Saltwater Language:
Making Sense of Ourselves Through the Science and Art of Marine Invertebrates

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Abstract

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Saltwater Language: Making Sense of Ourselves Through the Science and Art of Marine Invertebrates is an "undisciplined" project entangling the biology of four marine invertebrates (sea stars, crabs, barnacles, and octopuses) with a wide array of genre-crossing literatures featuring those real and figurative marine invertebrates to explore the question: what does it mean to be human? Though the question is large, and certainly not static, the impetus to separate being human from being animal via the messy character traits of consciousness, reasoning, morality, and free will is examined.

I argue that marine invertebrates, the spineless, faceless, *queer*, biblically "teeming things" that deny any easy categorization of what it means to be "animal," challenge the stability of human *Othering* and by default, challenge the stability of the traits defining what it means to be human. Marine invertebrates shatter the spell of essentialist thinking, requiring a deeper, interior inquiry and binding relations with the natural world. Each chapter traces the real and fantastical representations of a particular marine invertebrate to elucidate the innumerable threads woven together, defining the unending process of becoming human.

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Dedication

In the Jewish tradition, there are 613 mitzvot (commandments) to follow as a path to better yourself and the world. The 613th mitzvah states that all Jewish people should at one time in their life contribute to writing the Torah, thus continuing the tradition of learning, teaching, developing, and self-reflecting. This dissertation, in my own way, observes that tradition.

PREFACE
THE FAIRY TALE OF BEING HUMAN

What does it mean to be human? That is a large question to ask and a question without an answer, or rather, too many answers, none of which wholly satisfy the curiosity driving the question or the curiosity of understanding human beings as both a solitary species and also an animal, related to other animals. Humanity has positioned itself as a replica of the divine, at least in Western civilization, gifted with a sense of self-awareness, reasoning, right and wrong, and free will, primed to name and manage other animals. So perhaps a better question to ask is: Why is there an impulse to define being human at all? Why would knowing who or what a human is, and is not, better prepare us for living in the natural world?

I ask these questions from a 21st century perspective, with the luxury of combing through documented histories of global cultures, philosophical enchantments, artistic movements, scientific discoveries, and shifting political tides. Now is the time to rethink the question of what it means to be human after the world experienced a global pandemic, COVID-19, hypothesized to be a bat-borne virus effectively transferred to humans.[1] Though this is not the first instance of a virus hopping from an animal to a human, the distance covered by the virus does call for reflection upon changes to the animal-human or human-animal interface brought on by environmental disruption. If COVID-19 reintroduced the need for self-isolation to curb the spread of the virus, it also punctuated the reality that nothing exists in isolation. This sentiment is echoed by the words of 19th century American naturalist John Muir, who is credited for initiating the drive to institute a National Park System, and writes, “When we try to pick out anything by

[1]Arinjay Banerjee, et. al. “Bats and Coronaviruses,” *Viruses*, vol. 11, no. 41, 2019, pp. 1-15.

itself, we find it hitched to everything else in the Universe."[2] There is a profound stickiness to life (and its abiotic relations).

That calls for associative thinking. Therefore, to illustrate associative thinking, I am emboldened to associate the novelty of a bat-borne global pandemic with the philosophical conceptual problem of assessing individual conscious awareness posed by 20th century American philosopher Thomas Nagel in his essay, "What Is It Like to Be a Bat?".[3] The tangibility of the virus, for which the bat acts as a physical vector (consequently rendering humans into vectors) and turning to the bat as a model to illustrate the elusiveness of articulating how an individual creature senses the world, in my mind, elucidates the inconstancy of abstract traits that are used to mediate the material world and the consequent relations produced between self and world. Nagel argues that the "subjective character of experience" of any individual cannot be captured or quantified, nor can the quality of something be objectively and universally felt. There is no specific way to unequivocally claim how something *is*. It *is* a multitude of *things* based wholly on the attitude of the beholder. Nagel rejects the principle that everything can be reduced to material *stuff* by noting that how things appear and how they really are, never meet; nor are the ways in which a particular creature is conscious of itself accessible to other creatures. Nagel proposes that a bat, and by default all species, have their own special awareness of what it's like to be that species (*Umwelt* is a term regularly used to specify the unique perception of *being in the world* of each creature, coined by theorist Jakob von Uexküll). Hence, it is impossible to reduce the lived reality of the bat and its sensory experiences to the conceptualization of the bat via the outlook of another species.

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[2]John Muir. *My First Summer in the Sierra*, Houghton Mifflin, 1911, p. 110.

[3]Thomas Nagel. "What Is It Like to Be a Bat," *The Philosophical Review*, vol. 83, no. 4, 1974, pp. 435-450. Nagel admittedly selected a bat because it is a mammal closely related to humans yet appears utterly "*alien*" to human sensibilities.

Human relations with animals are historically complicated and contradictory, and culturally coded. Animals have always participated in shaping human lives and humans have "communicated their significance by dancing, sculpting, performing, imagining, narrating and thinking them"[4] on a global stage. From the discovery of a 45,000-year-old cave painting of a wild pig on the Indonesian island Sulawesi, to the oral tales of how animals came to be in the world communicated by Aboriginal Australians, the oldest known living people on Earth, to the advent of the scientific study of creatures established by Aristotle's *Historia Animalium* documenting the physiology and behavior of an array of animals, a fascination with animals has a long history. That fascination expanded to the popularization of attaching meaning and moral lessons to brightly colored real and fantastical "beasts" glossing the pages of medieval natural history texts, to the "exotic" and hybrid species described and catalogued by Renaissance naturalists, and to the collection of species displayed in curiosity cabinets compliments of 19th century explorers. Animals offered a portal to consider the place of humans in the animal world. They also engaged humanity in a game of tug-of-war, simultaneously pulling humanity closer and pushing humanity further from recognizing its *animality*.

Yet, in Western Civilization, the response has been to establish humans as the control group to distinguish themselves from other animals. This attitude aligns with the claim of Aristotle that "man alone stands erect in accordance with his god-like nature and essence"[5] by virtue of walking upright. By Aristotle's reasoning, *Homo sapiens* are inherently associated with the capacity to think. The abstract quality of *thinking* in particular ways and its associative counterparts, namely, consciousness, reasoning, morality and free will, are positioned against *othering* animals who are *like* us. Making sense of the animal world inadvertently drew people to

[4]Paul Shepard. *The Others: How Animals Made Us Human*, Island Press, 1996, p. 11.
[5]Aristotle. *De Partibus Animalium*, Trans. William Ogle, Oxford University Press, 1912, p. 686.

compare and consequently create ways to distinguish themselves from their animal natures. Again, animals became the focal point by which to conceive of and navigate the natural world, and simultaneously to locate humanity outside those boundaries. But focusing on mirroring has led to fetishizing animals seen as "like" us. For example, while theorist Donna Haraway contends that "We polish an animal mirror to look for ourselves,"[6] I question what animals are reflective and which are not, as well as which specter of the human the animal speculatively possesses. My project aims, in some respect, to shatter "mirror-gazing" by asking, in the vein of 20th philosopher Gaston Bachelard who argues that objectivity is as impossible as is an impartial subject, against whom do we look at ourselves?

In my inquiry, I foreground marine invertebrates (specifically sea stars, crabs, barnacles, and octopuses) to divert the conversation from a focus on reflection to one of deeper internalization. Despite their *uncharismatic* designation and murky presence, marine invertebrates comprise approximately 92% of life in the oceans and are vital players in maintaining integral functions of complex ecosystems. Marine invertebrates, with an uncanny wateriness, whose histories extend over 500 million years and signify the earliest appearance of animals on Earth, have crept, crawled, or anchored themselves in literature, art, traditional medicine, magic, and popular culture to reveal the wateriness of being human. It is precisely their *oddity*, that is, their lack of any resemblance to humans, that casts them as irreducibly real and yet perpetually figurative characters to interrogate the stability of the self-assigned abstract traits delineating what it means to be human. Because they are so unlike *us*, they fracture the inclination to compare or contrast. Perhaps because of the fact that they occupied the lowest rung

[6] Donna Haraway. "Animal Sociology and a Natural Economy of the Body Politic, Part II, The Past is the Contested Zone: Human Nature and Theories of Production and Reproduction, Primate Behavior," *Signs,* vol. 44, no. 1, 1978, p. 37.

on Aristotle's *Scala Naturae*[7] (Great Chain of Being), marine invertebrates (with the exception of octopuses) remain outcasts, not included in the National Animal Welfare Act governing the treatment of animals for the purposes of advancing knowledge. In that respect, they evoke a self-awareness that is messier than that found by petting a dog, as advocated by theorist Donna Haraway (*When Species Meet*) or the shame felt by philosopher Jacques Derrida in standing naked before his cat (*The Animal That Therefore I Am*). For that reason, I focus on the particular biologies of individual creatures, namely barnacles, sea stars, crabs, and octopuses, and connect a specific biological trait to a particular literature that makes use of that creature to represent human relations with the world.

Almost nothing about the biology of marine invertebrates can be likened to human beings. Their physical bodies are marked by hard outer shells, roundness, or a multitude of legs. Their behaviors evoke shudders; using feathery feet to capture food, extending the stomach outside the body to capture prey, walking sideways, and mimicking the environment are some of the acts that startle spectators. Marine invertebrates seem other-worldly; therefore, they are prime candidates to unsettle our tendency to be "in the world like water in water"[8] as if we could steer all of nature on a designed course. Therefore, I concentrate on the biology of sea stars, crabs, barnacles, and octopuses, and their representation in eclectic literatures outside the confines of a select time and place, to explore the reliability of the abstract qualities pinned to the definition of being human (qualities historically refused to animals).

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[7]The *Scala Naturae* positioned animals on a ladder based on the expression of "spirit" over matter. "Spirit" referred to the ability to act, reason, move, and communicate and was predicated on the animal's physiology and behavior.
[8]Qtd. in Mathew Calarco, *Animal Philosophy: Essential Readings in Continental Thought*, Continuum, 2004, p. 34. The quote is originally attributed to 20th century French philosopher Georges Bataille, *Theory of Religion*, Zone, 1992.

Mine is an "undisciplined" interdisciplinary experiment entangling numerous threads in response to claims made by material, ecocritical, and post-human theorists that the human is always already comprised of the material flow of agencies. That material flow assumes, or ignores, the aforementioned abstract qualities associated with being human, therefore, I focus on seeing associatively rather than reflectively. I can articulate what I mean with a personal childhood memory of dissecting "Kermit" the frog in my 6th grade biology class. With a scalpel in one hand and the sticky frog in my other, my mind wandered to the pollywogs I had collected from the creek behind my house, swimming inside the pink plastic bucket I had scooped them into with hopes of being able to witness the magical moment when they would somehow turn into frogs. I was inspired by the fairy tale "The Frog Prince" where the frog transforms into a prince after receiving a kiss from a princess, though I knew on one level that the story was just a fantastical way to teach a moral lesson on the fallibility of judging the world based on appearances and on another level, was made aware that anything can suddenly, and without warning, change into something else. In addition, I knew that many frogs were associated with other-worldly powers because of the presence of a hallucinogenic substance on their skin (bufotoxin). Licking the skin of the frog would trick the mind; this is part of why they were associated with witches and evil spirits, though the toxin was successfully used medicinally to treat human infections. In order to understand how we inhabit the world of the frog, including the transfer of its properties into magical beliefs and scientific facts, it is necessary to embrace a multidisciplinary approach. It is necessary to consider the mechanisms by which we transfer the properties of the frog to the physical and imaginative human world.

My associative thinking is an attempt to write at one and the same time inside and outside academic circles, finding ways to assemble them together (Theorist Bruno Latour would insist on

it). My ideal audience includes academics engaged in ecocriticism as well as citizen humanists and citizen scientists interested in and involved with promoting human-nature connections on numerous levels. In the spirit of public scholarship, I have to "push" the work in the world. Therefore, I aim to communicate to an audience that need not have professional expertise in either the humanities or the sciences, and yet be eager to participate in mapping a world where we continuously listen to other voices (however silent) and see other points of view (whatever the focus). In roping together initially disparate elements, I explore an emerging humanity immersed in a struggle to identify itself as part of the mysterious and fluid natural world. I trust an audience does exist and will join me.

Chapter One: Consciousness

Sea Stars: Seeing One's Self and Knowing That One Is Seeing

Sea stars poetically connect heaven and Earth. But in reality, it is the imperfection of the human eye that makes the gaseous balls of stars in the sky appear to have points and the human eye that transfers that vision onto the disk-like bodies of sea stars and their appended arms. Sea stars do not have a face, though they have a mouth on the underside of their body and an eye on each of their, mostly pentaradial, arms. These crayon-colored icons of tidepools who wear the moniker of *keystone* species (an architectural term referring to the essential piece holding a structure together) are indiscriminate carnivores, communicating by sending and receiving invisible chemical signals travelling through water, producing toxins to ward off predators, and if they happen to lose an arm to a predator, or the forces of nature, they regenerate that arm. If the arm contains part of the central nervous system, it can create a whole new other sea star. Yet for all that, sea stars lack a brain.

For this reason, sea stars challenge intuitive perceptions of what it means to possess consciousness (also referred to as a soul), defined as self-awareness in processing one's internal and external world. Consciousness lends an illusion of a unified self, with respect to the existence of the unconscious as an active, though silent, negotiator of human thought and action. In addition, the imagination is activated by the same part of the brain that records experience and memory. Therefore, what it means to be aware cannot fully be determined. In following sea stars represented in literatures themed by the pursuit of self-discovery, I underscore how proprietary claims to consciousness/soul stumble in the rush of the immense outside world.

Chapter Two: Reasoning

Crabs: The Logic of Meandering

The *logical* mind conjures the crab as a menacing creature. Yet the descriptive adjective "menacing," is founded upon feeling. The word is suggestive. Because crabs are notably the earliest creature to venture from sea to land, they are metaphorically aligned with conquerors taking possession of a foreign territory armed with weapons, in this case claws; strategic planning, in this case walking sideways; and subterfuge, in this case the act of moulting, which leaves the impression of a larger army presence.

Crabs are notoriously associated with deception. To call someone "crabby" alludes to a lack of trust in that person, as well as implying that the person is quick to anger, thus impetuous. They are also equated with the notion of shiftiness since the constellation Cancer heralds the coming of winter in the northern hemisphere and summer in the southern hemisphere, disrupting daylight. Though besmirched by their biological traits, crabs exhibit sophisticated social relations. They defy what we expect from them, or rather, the ideas we append upon them.

Therefore, their traits act as an entrance point to interrogate the stability of claiming reasoning as a reliable trait; a trait historically appended on humanity as being the only "rational animal," first stated by Aristotle. In looking at real and figurative depictions of crabs in literatures that evoke their image in order to illustrate the frailty of human reasoning, I question the reliability of reasoning as a tool for rationalizing what it means to be human.

Chapter Three: Morality

Barnacles: Upside Down Sensibilities and What If Right Were Wrong

Barnacles are one of the oldest living creatures and though they are readily available to anyone walking along any shore, I have often had to convince those traipsing through tidepools that barnacles are indeed living creatures. What astonishes the *swashbucklers* anxiously balancing themselves on the quicksand of low tide at five o'clock in the morning is that barnacles are close cousins to crabs. Other marvelous facts about barnacles include feeding and breathing with their feet and, for the majority of species, a hermaphroditic sexual orientation; ironically, for being both sexes, barnacles have the longest penis relative to body size in all of the animal kingdom. Barnacles are also unique in that their life cycles have two distinct phases: a free-swimming planktonic phase and a sessile, permanently "stuck forever in place" phase. Their intimate bond with the substrate they call home supports their entire livelihood.

Their weathered-beaten exterior and tenacious hold onto their support base has metaphorically associated them with seasoned sailors (old salts). Barnacles are discombobulating. They have legs that don't mobilize; they basically stand on their head and their fate is tied to whatever base bears their weight. Their *bizarre* biology and mode of living is where I launch a query into the soundness of sticking to the trait of morality as a substantive

measure of *being* human. Humanity has historically situated itself apart from other creatures on the basis of a self-professed moral rectitude, routinely founded on the ability to exercise self-control and follow the prescribed order of right and wrong. In looking at the ways in which barnacles are represented in texts featuring characters grappling with the phenomenon of nature versus nurture in establishing who is and is not human, the veracity of morality as a stable mode of measurement is questioned.

Chapter Four: Free Will

Octopuses: The Freedom to be Anything and Adapt

Horror movies feature octopuses as fiercely determined "monsters" intent on collapsing built environments and savagely attacking people with Medusa-like spindly arms or a beak-like mouth hidden underneath a bulbous body. Despite their ferocious reputation, octopuses are lauded by scientists as intelligent creatures with astonishing abilities to solve problems and retain memories. Their agile minds are equally matched by an inordinate strength for such a soft body (they are fantastically credited with sinking grand sailing ships) and the ability to mimic their environment, including its varied denizens. Octopuses display an ability to make choices, as well as the ability to learn. That is one reason why they acted as a favorite metaphor employed by ancient Greeks in advising their progeny to copy the law of the land. A contemporary of Aristotle, Clearchus of Soli writes, "My son, my excellent Amphilocus/Copy the shrew device of the polypus/And make yourself as like as possible to those/ Whose land you chance to visit."[9]

The marvelous ability to learn by observing, to act, to change at will is surprising for a solitary creature like the octopus. Such behavior motivates inquiry into the nature of free will.

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[9]Qtd. in Henry Lee. *The Octopus; or the Devil-Fish of Fiction and Fact*, Chapman and Hall, 1875, p. 30.

The independent nature of the octopus invites contemplation on the notion of being free to choose how to act. That agency, historically assigned to humanity alone, may also well be a chimera, as nature dictates its own will, the human mind reputedly has a mind of its own, and the imposition of social order and responsibility also contribute to the fickleness of free will. By focusing on the representation of octopuses in fiction and fact, I focus on the ways in which the uncanny traits of the octopus raise questions regarding the reliability of the claims of self-possession, self-actualization, and self-movement; the freedom to choose.

INTRODUCTION

Most animals, especially simple ones such as those of which I write, have a sweet will of their own, and will not be forced, even in the slightest degrees to do what their masters wish.

John Harper, *The Sea-Side and Aquarium, or Anecdote and Gossip on Marine Zoology*

"Boys and girls, something special!" Mrs. Terwilliger would call out to us and a gaggle of rainboot clad children would huddle together to spy upon a sea star nestled in a canopy of barnacles or a blue-spotted yellow sea slug slowly slithering across streamers of green algae. An environmental force, Mrs. Terwilliger taught us to find brightly colored rubbery or calcium fortified bodies hidden under rocks and "not to poke anything" as she gallantly led us on a crusade to learn how specific creatures made a living cooperating and combatting with one another in a tidepool. In her quintessential straw hat, Mrs. Terwilliger taught us to pay attention and take pleasure in it, which also meant freeing ourselves to wade in the water and sometimes stumble and outright fall into a tangle of seaweed without being afraid of the "critters" who were minding their own business. Marine invertebrates were serious business, though her natural excitement when talking about this creature or that one was infectious; detailing what they ate, who they relied upon, who their enemies were, and their distinct role in the give and take relations of tidepool life, or what both biologists and fiction writers refer to as a microcosm of the world. No one was immune to the charms of Mrs. Terwilliger. Even former Commander-in-Chief, President Ronald Reagan, flapped his arms like "Mr. Eagle" along with Mrs. Terwilliger while honoring her for her tireless role as an inspiring naturalist (and there is video to prove it).[10]

The term "invertebrate" was coined by 18th century naturalist and evolutionary scientist Jean Baptiste Lamarck,[11] while he combed through and separated the variety of species that were

[10]See website: http://www.marinnostalgia.org/portfolio/elizabeth-terwilliger/.

[11]In a lecture presented by Jean Baptiste Lamarck at the Museé National d'Histoire Naturelle, Paris, France in 1803, he stated: "Relative to the animal kingdom, we should chiefly devote our attention to the invertebrate animal,

first divided and organized into two groups of organisms, *Insecta* and *Vermes* (worms), by 18th century Swedish naturalist Carolus Linnaeus (Carl von Linné). Crowned the Father of Taxonomy, Linnaeus was responsible for developing a system of naming species according to shared traits and pooled all sea creatures lacking a spine (creatures without a backbone) into its own special grouping. According to the Oxford English Dictionary, the word "invert" has been in use since the 1500's and is defined in conjunction with verbs that connote some kind of chaos: "to subvert; to upset; to transform; and outside in." The word retains, even today, the sentiment of a kind of shiftiness. The word "invert" suggests something awry, and the residue remains. It is not so far-fetched to align marine invertebrates with the notion of deceptiveness considering some were long mistaken for plants and their faceless, geometrically challenging bodies evoke the feeling of some kind of other-worldliness. The strangeness of their varied shapes and habits, coupled with the ability to withstand temporarily living in the air, makes the attempt to anthropomorphize marine invertebrates particularly fussy.

They also resist any kind of domestication tried out by the debut of parlor room aquariums in 19th century, Western middle-upper-class homes swept-up in the popular hobby of collecting and displaying live and dried specimens from the seashore. Aquariums brought the sea into the living room. It became a center piece of the home, a marvel that mesmerized and terrified spectators witnessing asexual reproduction up close, regeneration of lost parts, cleverly calculated escapes, and the general oddity of ways of feeding and breathing. As author Rebecca Stott writes, "For the naturalist, the marine or freshwater aquarium provided a constantly

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because their multiplicity in nature, the singular diversity of their systems of organization, and of their means of multiplication,…, show us much better than the higher animals, the true course of nature, and the means which she has used and still unceasingly employs to give existence to all the living bodies of which we have knowledge." Qtd. *Theories for Everything: An Illustrated History of Science* by John Langone, Bruce Stutz, and Andrea Gianopoulos, National Geographic, 2006, p. 261.

changing, glass fronted theater of bizarre and exotic bodies, moving, metamorphosing, interacting, and breeding in sensational ways,"[12] presenting a veritable circus where the peculiar voices its very real existence. These "misfit" animals exuded something diabolical to the human mind, and consequently, inverted the gaze, forcing humanity to look inward to question the impetus behind that response. Marine invertebrates were animals and not animals, and consequently, challenged how humanity comprehended its own being and not being animal. There is no obvious stewardship for them; no protests to shed a light on the plight of barnacles. Their *animal* existence does not seem real, but they are exhibited in literature and art to represent human behavior and thought. Because they do not quite fit the category of "animal" and we lack the ability to participate in one another's worlds, they cannot be categorized as lacking something, and consequently, they awaken us to our own "strangeness." The fantasy of what makes us human fractures when we consider the biology of these creatures and the ways they are culturally and artistically represented because we feel that we share next to nothing with these creatures.

In efforts to contain marine invertebrates, they were rendered into art pieces. The intricate insides and outsides of these eccentric creatures were delicately drawn to convey the integrity of evolution by 19th century biologist Ernst Haeckel, famed for merging science and art in his series of books titled *Art Forms in Nature*. The precision with which Haeckel rendered the ridges and spines of each individual creature is matched by the fragility of glass replicas of marine invertebrates created by the 19th century father and son team Leopold and Rudolph Blaschka, now housed at Cornell University. Some of the specimens immortalized in glass contain secrets of the sea's ancient past as the search to locate living representatives was undertaken by marine

[12]Rebecca Stott. "Through a Glass Darkly: Aquarium Colonies and Nineteenth-Century Narratives of Marine Monstrosity." *Gothic Studies*, vol. 2, no. 3, 2000, p. 307.

biologist Drew Harvell, whose multi-award-winning film *Fragile Legacy*, spotlighting her adventures in tracking down living organisms replicated in translucent glass, also captures the elusive stability of both life and its representation.

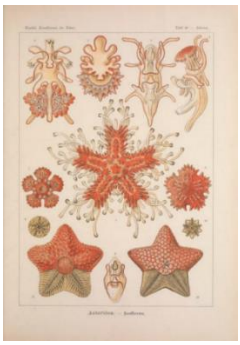

Figure 1: Ernst Haeckel, Asteridea, *Kunstformen der Natur* (*Art Forms in Nature*) 1899-1904, Courtesy of the Biodiversity Heritage Library.

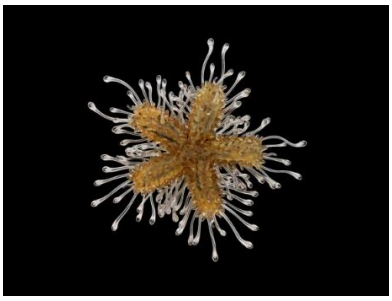

Figure 2: Leopold and Rudolf Blaschka, *Asterias rubens*, 1888, Courtesy of Guido Mocafico, Natural History Museum of Ireland.

Real and Imaginative Spaces

Tidepools are real and imaginative in-between spaces-neither all sea, nor all land-offering refuge to an assortment of interdependent invertebrate species. Characterized by moon-like depressions allowing sea water to pool when the gravitational pull of the moon drags the waters to the open sea, tidepools reveal an immensity of life found in a puddle. While some creatures are ablaze in fantastic color, others are as gray and brown as the rocks that support them. Some move with slow plodding steps, while others anchor themselves and are confused for flowers because their tentacle-like *petals* bloom with the flow of water, quietly curling into a tight ball when the water recedes. For scientists, tidepools are referred to as ecotones, the *defined*

transition space in between two specified niches; essentially, a space where species otherwise relegated to one precise area are given an opportunity to meet and consequently change as a result of that interaction. For tidepool storytellers, ecotones present themselves as metaphors for identities in flux and for examining socially constructed belief systems. It is a space we can walk into, breathe air, and get personal with creatures completely unlike us.

Marine invertebrates are quite different from mammals. The fact that they do not birth live young, don't parent offspring, and lack a discernable face stifles any immediate, intimate connection. It is because of their uncharacteristic animality that they resist being *othered* by us. Yet, according to the theory of evolution, we are inhabited by these strange creatures who bring attention to the creatively complex "trying-out" of biological life and consequently how life forms are organized according to an established hierarchical order. Because marine invertebrates maintain a space outside of our control, they elicit an examination of the stability of the abstract categories we have comfortably assumed distinguish humans from animals. Those categories, namely consciousness, reasoning, morality and free will, occupy a contentious and paradoxical space in both the sciences and humanities.

Though these traits are both quantified and qualified by distinct disciplines, they are imprinted in our minds as innate to humans alone and have been historically used as a means to *other* ourselves from animals who in some way may remind us of ourselves. That is not possible with marine invertebrates. Marine invertebrates collapse that "spine" of categories with their "spinelessness." I am not looking at marine invertebrates to trace back our animal origins, nor necessarily our relations, though they are there. Rather, I look at marine invertebrates to question the qualities we have unquestionably and systemically relied upon to record and represent ourselves as arbiters of the natural world. In short, through the scientific study of marine

invertebrates and the ways in which they have been represented in art and literature, I argue that we are confronted with the exotic, irreducible complexity of life that cannot be contained by fluid, arbitrary traits. Here, I defer to scholar Gary Handwerk, who phrases it best and captures my starting point for following marine invertebrates as a path to re-think how we compass ourselves in the natural world, *unanchoring* us from essentialist thinking: "Go outside of, and get over, ourselves."

Marine invertebrates are among the first life forms on Earth and have a long history. Their biology and habits were first officially documented by Aristotle, dubbed the Father of Marine Biology, and the span of time and space they occupy is one reason why this project is haunted by an ahistorical approach. Marine invertebrates alter our vision, and their ancient existence draws us to look deeper. The looking asks us to imagine why we seek to calculate the incalculable. We are also invited to ask why the traits we use to distinguish our humanity are contentious both within and across disciplines. Marine invertebrates call upon us to plunge into our humanity, calling on us to face our own "oddity." It is precisely their *uncanniness* that calls us back to us. They direct our gaze to our own *uncanniness* and entangle us in play, fluidity, mutability, or rather, our *unrecuperated* uncanniness.

My chapters detail the biology of sea stars, crabs, barnacles, and octopuses, and metaphorically position those biological traits against various literatures featuring these same marine invertebrates, literally or figuratively, in an effort to reexamine how we understand what it means to be human. In other words, I present a view of humanity as an ecotone; entangled with the world in more ways than we realize or yet know. What I am considering is how the biology of these creature offer an opening to evaluate how humanity has systematically related to the world as something exterior to itself. To take this risk, I break with traditional models that cloak

animals with only allegorical value and I write for more than one audience. In this venture I borrow from the words of marine biologist Rachel Carson, famed for exposing the effusive dangers of pesticides in her book *Silent Spring*, "To sense this world of waters known to the creatures of the sea we must shed our human perceptions of length and breadth and time and place."[13] Therefore, for now, I organize the chapters according to a particular species and divide each chapter according to the distinct biological properties of that species. I associate a distinct biological property of the creature with a particular literary text because, at this time, it is the only way I can perceive the life of this work. The collection of texts I incorporate in this dissertation come from multiple genres to address my interest in reaching an audience within and without academia, and to speak to my overarching intent to confront the compulsion to measure ourselves by abstractions.

For years we have attempted to remove ourselves from our *baser* animal qualities with the belief that we possessed consciousness, reasoning, morality, and free will not afforded, by our measure, to other animals. Looking at animals more like us provided a space to concede to the fact that "yes, we are animals, but not that kind of animal." Since it was difficult to completely dismiss ourselves as animals, we recuperated by *othering* those animals and empowering ourselves with distance via uncontestable, intangible traits. These traits were studied by Animal Studies scholars calling to "blur" the boundaries between humans and animals, arguing that animals also possess these intangible traits in their own right. However, the abstraction is a distraction. The fallibility of the traits themselves and how they impoverish our understanding of what it means to ecologically participate with the natural world in ecologically sound ways demands attention. It is when we are in relations with marine invertebrates, which

[13]Rachel Carson. "Undersea," *The Atlantic Monthly*, 1937, p. 63.

we cannot *other* any more than their own physical features already accomplish, and in contact with their "uncharismatic" faceless *weirdness*, that we retreat into ourselves. They act as a surface to go deeper.

Though marine invertebrates are not typical ambassadors for flagship animal rights causes or totemic animals, they have the potential for making us think about our humanness in radically different ways. Their multi-stage life cycles and expansive dealings with a wide array of diverse species that drive their adaptive behaviors, contribute to challenging our perspectives. In the words of ecologist and author Paul Shepard, "Personal identity is not so much a matter of disentangling the self or 'the human' from nature as it is a farrago of selected correspondences in which aspects of the self are projected into the dense, external world where they are discovered among a variety of animals who are both similar to and different from us."[14] Our biology is intertwined with all kinds of life forms, as are our dependencies on the interconnected relations between marine creatures and their environments in maintaining a functioning ecosystem. Ultimately, we are "strangely composed of animals who flesh out our being, a diverse zoology of the self"[15] communicating the fact that we are a product of layered histories. Marine invertebrates remind us that we are coded with all kinds of life and exist in a perpetual state of transformation.

In looking at the biological properties of marine invertebrates to open communication between our evolutionary drives and our cultural identities, a new kind of language for understanding difference emerges. For example, barnacles, which are nicknamed "sticky little creatures" and "crusty fouler," secrete a fast-drying glue so they can quickly latch onto a variety of animate and inanimate objects. They are often maligned as pests for compromising the

[14]Paul Shepard. *The Others: How Animals Made Us Human*, Island Press, 1996, p. 86.
[15]Ibid. p. 80.

integrity (fouling) of their selected host substrate. That characterization appeared in the traditional folk song “Barnacle Bill the Sailor,” which makes use of the barnacle to represent a true “old salt” eternally bound with the sea. The song narrates a cautionary tale to be leery of Barnacle Bill who, with unrelenting “stickiness,” campaigns a fair young maiden to engage in sexual intercourse and abandon staid moral virtues. Sea chanties were often erotically charged and taboo in subject matter, and a catalyst for building comradery among a “motley crew” of men cramped together in tight spaces for long periods of time, and whose presence on land was immediately signaled by their manner of walking (brought on by a shift of equilibrium in moving from a fluid world to a “stable” one). Barnacles represent rugged, salt-soaked resilience, coarseness and tenacity but are also used as a metaphor to depict sailors as stuck in a state of waywardness that can easily seep into genteel society and degrade moral codes of civilization. On the surface, it is easy to oversimplify the traits of these creatures. Though we may at times anthropomorphize them, we are actually embodying their physical traits to express an attitude that demands introspection.

The traits of marine invertebrates are often manipulated and become *Procrustean*, as noted by the ways crabs are inscribed with the character trait of unadulterated anger. A “crabby” person bears the epithet of being ill-tempered as well as a miser. This stereotype is perpetuated by Eugene H. Krabs, an animated cartoon character in *Sponge Bob Square Pants.* This show has been on the air for over twenty-one years and is the creation of marine science educator Stephen Hillenburg, who authored an unpublished textbook, titled *The Intertidal Zone,* for his students. The show integrates the unique character traits distinguishing marine species with human social customs to shake our perspectives. In effect, the use of fiction as a tool to engage in otherwise taboo subjects brings out truths otherwise buried below the depths. In the case of Eugene H.

Krabs, owner of Krusty Krab restaurant, an undesirable character who appears to be obsessed with money, is nonetheless a devoted and generous single father to his daughter Pearl, a sperm-whale living amidst a group of invertebrates. Turning to an animated cartoon series aimed at children, with a cast of marine invertebrates who speak, wear clothes, and have jobs to discuss how marine invertebrates engage our thinking about our own lives does appear silly. But, in playing with our perception of their relations, we are able to look interiorly. Eugene H. Krabs and Pearl immerse us in a natural culture of interspecies relations where symbiosis works, as well as the viability of single fathers as caregivers.

Of Curiosity and Wonder

In tidepools, we move among fantastical creatures and learn to listen otherwise. In the cacophony of noise, our senses and understanding of the natural world are tested. But how can we truly capture these other voices? Filmmaker David Gatten foregrounds the call to listen differently by submersing unspooled rolls of film taped to a crab pot into the Atlantic Ocean to record how the sea *speaks*. He collected a series of exposures which he titled, "What the Water Said." The film recorded random streaks, flecks from anonymous creatures, and energetic noisy static in layer after layer of overlapping, unmediated interactions. We experience something outside a human way of communicating and become immersed in an understanding that fully *defining* ourselves, and the world, via our voices alone is untenable.

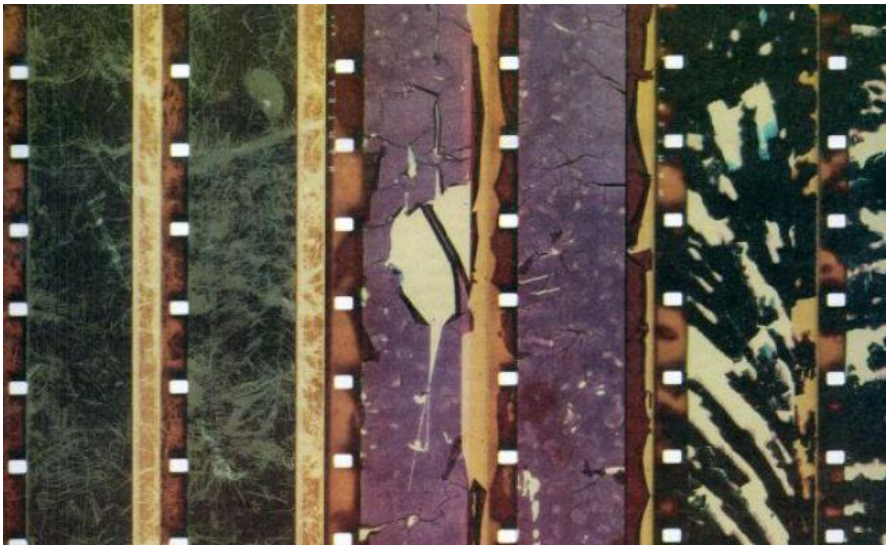

Figure 3: David Gatten, “What the Waters Said,” Nos. 1-3, davidgattenfilm.com.

Here we see the exposed film that is captured by life. Rather than an image of life, life creates the image. How we interact with and what we *feel* about the image reflects our instinct to explain what we don’t know as a way to cope with what we don’t know. The first question that comes to mind is “What is it?” and next our minds work to wrangle a meaning. That grappling makes us aware that the meaning remains opaque. The life striking the film continues to baffle us. If these supposed simple creatures continue to remain mysterious, we too must be shrouded in a mystery that labels cannot illuminate and we have to ask, “What are we?” Marine invertebrates provide one portal to foster that question. Though they seem innocuous life forms resigned to be studied as mere specimens, marine invertebrates are not simply wonders to behold long enough to decipher; rather, they inspire curiosity. Curiosity confuses as much as it reveals, even though it also makes use of standardized scientific practices of collection, observation, theorizing, and experimentation. Scourged by wits of the Enlightenment as an aimless prying into things of no concern, curiosity was at one time reviled as a rebellious venture. Eventually, curiosity made its way into the world of prominent scientists who merged their method of practice with the world of mystics, magicians, and astrologists in their quest to make the

invisible visible. At the same historical period when *curiosity* held a reputation for promoting the unhinged and unbound, *wonder* was attached to the heavenly realm and a reverence for docile faith. The two words seem interchangeable, but curiosity pushes boundaries. Curiosity evokes a desire to probe deeper, whereas wonder aligns itself with sublime tendencies to conquer the "strange" and strip away its awesomeness. Wonder is associated with a drive to overpower the "object" that holds us and reduce its unwieldy stature to something manageable. Curiosity encourages contradictions. It inspires a meeting with that which makes us uneasy precisely because we sense something we cannot quite fathom. Curiosity promotes a connection with fluidity as expressed by famed 20th century French philosopher of science Gaston Bachelard who writes, "a body dedicated to water is a being in flux. He dies every minute; something of his substance is constantly falling away."[16] Bachelard also writes of the difference between looking at oneself reflected in the fluid depths of water, as opposed to the flatness of a mirror, using Narcissus as an example to illustrate the desire to get closer to one's complete self.

Curiosity is particularly triggered by intertidal species. It grows as we continue to learn more about these creatures, aware that their entirety cannot be fully captured, and that they remain apparitions. They are not typically regarded as pets or companions, like cats or dogs, with whom we converse and by whom we expect to be understood. We are hard-pressed to consider a sea star, a crab, a barnacle, or an octopus as a potential "stand-in" for humanness, even though the more we learn about them, the more we realize that the delineations of humanness are not reserved for us alone. Marine invertebrates demonstrate an intentionality beyond what can strictly be defined as pure instinct. It is a surprise to most non-scientists to discover that marine invertebrates experience pain, show emotion, make decisions, and communicate. But marine

[16]Gaston Bachelard. *Water and Dreams: An Essay on the Imagination of Matter*, Trans. Edith R. Farrell, Pegasus Foundation, 2006, p. 6.

invertebrates spark something in our imagination. They move us beyond thinking of them as animals towards whom we should feel obligated. They seem independent of our meddling. Furthermore, they are mesmerizing. In their presence we are captured by their powerfully challenging forms and modes of living, capturing the marvelous knottiness of life itself.

An Awakening

Those field trips to Point Reyes National Seashore, Marin County, California took my fellow elementary students and me into a mysterious world of epic proportion. Its tangible liquidity slipping through our hands mingled with all kinds of creatures slithering, side-tracking, or hydro-lifting their bodies to crawl across a substrate, evoking an attraction both eerie and captivating; a place simultaneously real and surreal, turned inside out. We were not just learning about it; we were in it. A tidepool and the creatures living in its *in-between* condition inspires exploration. It offers an encyclopedia of alluring, colorful, solitary and clumped together beings whose transformative powers have the potential to rewrite old narratives. With their geometrically skewed shapes and failure to be included on the list of "charismatic megafauna," marine invertebrates redefine the debate on the existence of an animal/human divide, directing our sights, instead, on how these creatures draw us into their complexity and, ultimately, our own as well. These remarkably perplexing beings rekindle the briny sea swirling in our blood, sweat, and tears which makes our contact with them intimately and peculiarly interiorized. They do not possess the traits readily delegating them as "metonymical human being(s)" to quote philosopher Claude Leví-Strauss, and therefore they turn our gaze inward.

Our natural draw to the sea and its creatures induces a kind of uncanny unraveling. The intrigue of life's beginnings and the ghosting of the sea in our bodies and minds is of interest to

both scientific inquiry and poetic appeal. The bold return of land mammals back home to the sea, perhaps due to a beckoning siren call, caught the interest of many paleontologists, while the call to abandon the shackles of modern life and return to the sea also found form in poetic verse extolling the virtues to be gained from walking along wave-beaten shores. The transition from water to land and then land to water appealed to popular science authors like Richard Ellis in his book *Aquagenesis* and Carl Zimmer in his book *At the Water's Edge: Macroevolution and the Transformation of Life*, who track the successful transformations particular animals underwent to return to the sea after their initial dispersal to their associated residences, and the phenomenon of readapting limbs, vision, and means of communication necessary to maneuver life in a liquid medium. Through fossil records, the two authors reconciled past and present, binding them together. Zimmer writes, "The line that divides water and air is a barrier that has particularly fascinated biologists for over two thousand years."[17] Zimmer also discusses how fossils act like an arrow directing movement from sea to land and land to sea, telling a surprising story of adaptation and transition. Collecting the bits and pieces of shards to create a picture led to an understanding that "Life doesn't proceed from one point to another-like the cladograms that represent it, it forks and radiates."[18] Even our biology has twists and turns that we can't quite configure into one solid piece.

The back-and-forth evolutionary motion also led paleontologists Mark and Dianna McMenamin to develop their theory of Hypersea—a theory founded upon the concept of symbiosis. The theory hypothesizes that land animals are more than "relict sea-water, but rather a new type of sea-like environment."[19] The argument claims that land animals carry the signature

[17]Carl Zimmer. *At the Water's Edge: Macroevolution and the Transformation of Life*, The Free Press, 1998, p. 6.
[18]Ibid. p. 200.
[19]Mark McMenamin and Dianna McMenamin. "Hypersea and the Land Ecosystem," *Biosystems*, vol. 31, no. 2-3, 1993, p. 145.

of the sea within their bodies and that sea promotes the exchange of nutrients in the body. Essentially, land animals cultivated an inner sea-like environment akin to the flow of nutrients raised from the depths of the sea to the surface in a process known as upwelling to successfully colonize land. The theory focuses on the "fact that on land so many species of organisms are capable of thriving in the body fluids of other organisms. Additional species are virtually packed inside or on top of one another."[20] Our lineage and physiology continue to unravel, and the strands show us that our knowledge of ourselves continuously shifts.

Accompanying Mrs. Terwilliger and bending over or squatting to inspect creatures whose bright array of colors startled both bystander and would-be predator as intended, though most steadfastly remained glued to a specific spot prepared to batten-down the hatches until the tidewaters steadily advanced, we found ourselves in a fantastical world. Here we entered an essential abyss momentarily available for us to trespass. Breathing is not a problem in a tidepool. We are spared the load of a scuba tank precisely calibrated with just the right amount of compressed nitrogen, oxygen and smaller, yet hardly trivial elements to simulate our natural atmosphere. But everything else about you changes as you walk into an otherwise prohibited world. You experience a heavy silence interrupted only by the sinking of boots into sand that appears firm yet acts like a liquid and pulls you into what feels like the center of the earth with an immediate and immense force.

The in-between space of tidepools and their denizens captured the attention of author John Steinbeck who beckons us to see ourselves as part of a wider mystical universe, and writes, "It is advisable to look from the tidepool to the stars and then back to the tidepool again."[21] Steinbeck suspends us in between the heavens and the waters, awakening us to the magic of life.

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[20]Ibid. p. 151.
[21]John Steinbeck. *The Log from the Sea of Cortez,* Penguin Books, 1951, p. 178.

Since we are essentially made of stardust and primordial life presumably began in the ocean, it is sound advice to suspend ourselves between these two worlds as an invitation to see ourselves as part of the cosmic whole. The uncanniness of our own being strikes us. This sentiment asks us to shift our sights, much like what occurred during the Victorian Age with its professed attraction to the shore, abetted by doctors' orders to take the "bath" for one's "health." As a defense against being accused of moral depravity for leisurely wasting time, visitors to the shore devoted their time to scouring tidepools for *funny* creatures to dry and display in curiosity cabinets as proof of "God's" wondrous creativity. The Victorian Age was also a time riddled with an explosion of scientific and technological advances appearing to *defy* the laws of nature, rousing feelings of excitement and unease. The microscope, the telescope, and other inventions profoundly affected how humanity experienced and imagined itself; influenced as well by everyday parlor conversations revolving around the nature of evolution and the overwhelming surge of new species dredged up from the ocean's layers once presumed to be devoid of life. Victorian author Mary Ann Evans, writing under the pen name George Eliot to free her novels from gender stereotypes, writes of her adventures climbing over tidepool rocks in search of sea anemones and uses that experience to reflect on the inefficiency of human sight to accurately witness itself in the world. In her essay "Recollections of Ilfracombe, 1856,"[22] she writes, "It is characteristic enough of the wide difference there is between having eyes and seeing…" calling attention to our inability to completely comprehend what is before our eyes or our vision of ourselves. With that sentiment, we are guided to question how we impose our point of view on nature, or its creatures, and ultimately, orchestrate ways to keep those creatures in check. In shining a light on

[22]George Eliot. "Recollections of Ilfracombe, 1856," *The Journals of George Eliot*, Cambridge University Press, 1998, p. 264.

multiple ways of looking, we are also invited to reflect on our participatory blindness in determining what categories we use to impress a particular point of view.

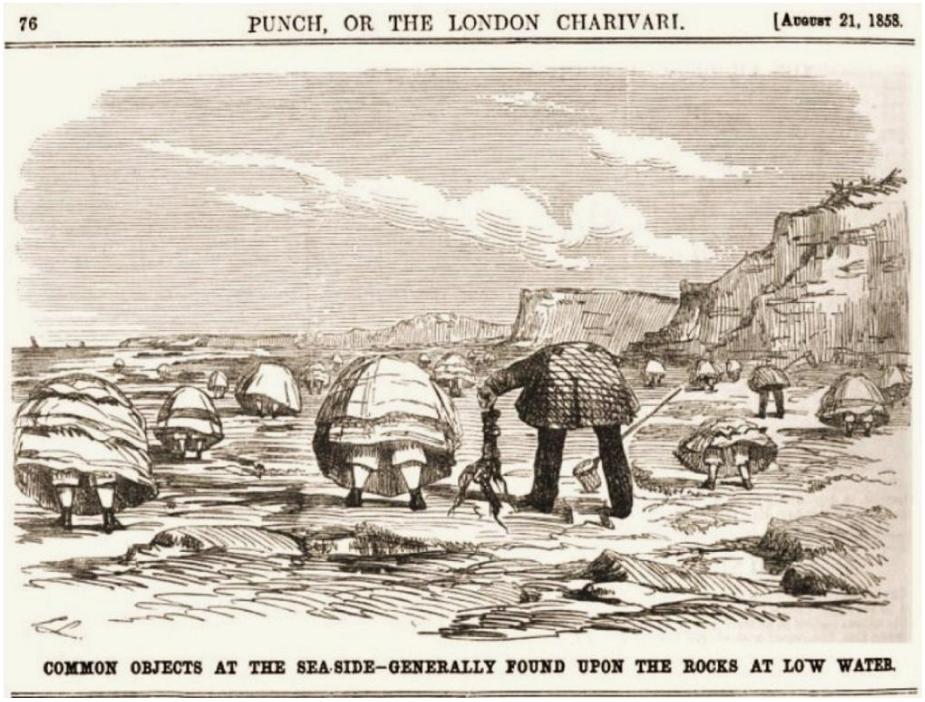

Figure 4: John Leech, "Common Objects at the Seaside-Generally Found Upon the Rocks at Low Water" *Punch's Almanack*, vol. 35, 1858. Courtesy of University of Pennsylvania, The Online Books Page.

Tidepools are engrossing. The illusion of an invincible ecosystem pristinely populated with an abundant collection of diverse species is countered by the reality of a fragile, unpredictable world subject to stochastic fluctuations in temperature, salinity, oxygen load or pH determining the acidity of the water. Any one of these factors has the effect of destabilizing the biochemistry of organisms and biological functions such as what an organism eats, when the organism chooses to reproduce and who moves in and out, otherwise known as recruitment. Small changes are monumental but, in a world dominated by flux, stasis is not utopic. Tidepool denizens are astutely aware of what we would consider minute changes. In a tidepool, balance is

essential to survival and creatures have to adapt to unpredictable situations that spontaneously or gradually present themselves.

Without fail, our seaside excursions would end in a stillness uncharacteristic of grade schoolers as we watched the incoming tide resume its protective cover over sea creatures that awoke irrepressible feelings of joy within us and made us keen observers. Mrs. Terwilliger invited us into this world and shared it with us. With a tone befitting a fairy godmother charged with dispelling wisdom and warning, she explained how marine invertebrates had their skeletons sort of inside out and that that is why they were mostly hard on the outside while we were mostly soft. They were not like Mr. Fox and Mrs. Fox whose still life figures kept company with Mr. and Mrs. Mole on a shelf, along with her taxidermic zoo of wide-eyed animals, in a van assuming the role of a roaming makeshift classroom. Mrs. Terwilliger gave us an awareness and appreciation for individual creatures and their uniqueness, “like all of us,” she would say, and we needed to respect their place so they could continue to grow, mature and change. She guided us to realize we too would grow, and mature, and change. That was a lot of responsibility, but the fact that it was bestowed upon us by Mrs. Terwilliger imbued the task with high honor. More than a teacher, and certainly more than a tour guide, she took our thoughts and feelings to a place beyond picture books. She encouraged us to think about ourselves as part of something larger, and over time, as more than we imagined. Mrs. Terwilliger passed in 2006, though her legacy continues in countless students she encouraged to “sniff the salt air” or to patiently observe sea anemones sway in time with the current.

The Animal Question

Despite their intense geometric beauty, sea stars, crabs, barnacles, and octopuses do not readily appear before us in our day to day lives, and rarely enter our thoughts. They do not appear on lists of sentient creatures whose eyes implore us to have compassion and appreciation of their method of parenting. Marine invertebrates appear to be purely physical beings, driven to eat, escape predators, hide, or release sex gametes carelessly into the water column. They do not have a recognizable face, four limbs and are often referred to in writing as "uncharismatic" creatures. Their charms do not lie in being like us-we cannot maintain a steady reflection in their countenance-and how apropos, since they live in an in-between world of water and air, at times mobile in a mobile element and at times statuesquely still. It is virtually impossible to assess the moods or thoughts of marine invertebrates, though we may try. However, we rely on marine invertebrates though we may not be fully aware of that dependence. We need them to perform a myriad of unceremonious roles necessary to maintain a fragile oceanic ecosystem. We exploit them for their ability to produce antibiotics, anti-cancer, and anti-inflammatory chemicals we then synthesize to develop medicines. We seem to only see them when they perform in a freakishly and frightening show like the sudden melting of limbs of sea stars symptomatic of the Densovirus, aptly nicknamed "Wasting Away Disease."

Yet these invertebrates challenge us to think about the kinds of human/animal/world distinctions we make and why we make them. They also make their way from scientific literature to popular literature adorning bookstore shelves; notably, *The Soul of the Octopus* by Sy Montgomery, who invites audiences to meet eight unique octopuses, all with distinct personalities. In an interview with *National Geographic* magazine, Montgomery states, "It's possible to have an octopus care about you, to choose your company," and confessed her own

attachment to each octopus she spent considerable time getting to know.[23] Imagine knowing an octopus can recognize you and decide if you are worthy of being liked. There is a desire to know these creatures as much as is possible, as countless Western amateur naturalists and natural historians made collecting, studying, trading, and displaying marine invertebrates a fashion during the 19th century. Some fortunate enough to own a microscope were able to peer further into "God's" secret language, fancying they were ancient alchemists searching for the deeply hidden secret residing within. Londoners in particular displayed a penchant for seashore gathering. Partly due to the advent of cheap train travel affording an escape from the congestion of crowded city streets cocooned in a permanent shroud of black fog, the seashore became a place to be revitalized both physically and spiritually, and an opportunity to be a part of the experience of a microcosm of the world. It was acceptable to ply oneself towards the study of "God's world" and reflect on the splendor of it all, while mentally calculating the postage needed to mail a particular specimen across the country to be studied and settled in a well-admired, leather-bound book.

These strange, marvelous creatures - a barnacle that stands on its head kicking food into its mouth; a sea star with five eyes each strategically placed on the underside of a respective arm; a crab with eight legs and two claws used for defense, eating, and attracting mates; and an octopus that mimics its world and possesses eight brains - all share a tidepool home. Of all creatures to be "otherized" or "edged out," they would most logically fit into those categories. The word "queer" appears frequently as an adjective describing these creatures. Yet rather than simply being "othered" by human beings, they are the ones doing the "othering." Their presence in our lives and in art impacts how we process our own humanity. In the words of the eclectic

[23]Interview of Sy Montgomery by Simon Worral. *National Geographic*, June 10, 2015.

20th century biologist J.B.S. Haldane, reputed for routinely conducting experiments on himself to test the capacities of being human, "life is queerer than we suppose."

It is their lack of resemblance to us, their unknowability, their *bizarre* shapes or means of reproduction, such as the hermaphroditic barnacle with a penis recorded to stretch out approximately eight times its body length to mate; or the sea star that can voluntarily lose a limb and if it contains part of the nerve ring, and given enough time, will produce a clone; or the crab that sheds its outer skeleton and exposes its complete insides until it grows a new protective shell; or the male octopus that dies immediately after inserting its specialized sperm filled arm into the female, while the female dies soon after the eggs she meticulously cleans hatch, which creates the possibility that this class of creatures might mediate our own identity and relations with the natural world at a moment in history when we badly need such things.

Their role as both real and imagined creatures in literature does not center on answering the human/animal question. Rather, they function as a catalyst for thinking about our own complexity within and without social and cultural boundaries. Unlike *Animal Farm* where a group of ordinary farm animals attempting to gain their freedom stage a coup to end the reign of their human overlords, recite the sing-song mantra, "four legs good, two legs bad" and proceed to learn to read and write, marine invertebrates, other than crabs and octopuses featured in eco-horror films, are not villains in a plot line to eliminate humanity. The "animal question" has a long history and many voices. Fundamentally, the animal question interrogates the legitimacy of framing human beings separate from the animal category simply because human beings express the ability to use language or specialized tools or for any *other* reason. Though we are reminded of our own *animal* beginnings still in existence by the theory of life's entanglement put forth by Charles Darwin and inclusion as the genus *Homo* in the categorical list of species lined out by

Carolus Linnaeus, language, and by extension reasoning, conspire to instill in us prejudices in favor of an upright stature and a singular mode of species cognition. In the first edition of *Systema Naturae* (1735) Linnaeus included the Latin phrase, "Nosce te ipsum" (know thyself) next to the category *Homo*. Whether a statement of fact or a call to action, the sentiment remains open-ended. Knowing one's self or getting to know one's self acted as the base for situating humanity beyond its animal relations. Yet what that entailed remained shadowy as Darwin professed that "the lower animals, like man, feel pleasure and pain, happiness and misery,"[24] while sea creatures retained a reputation of inconceivable "monsters." Sea monsters were real reminders of life's boundlessness. The belief that we came from the sea, and may well return, was not novel to modernity. This is prominent in the narrative history of merfolk, from the Babylonian sea-god known as Ea from 5000 BCE to the Syrian fertility goddess Atargatis from 1000 BCE who drowns herself and turns into a mermaid after accidentally causing the death of her husband; the 19th century tale "The Little Mermaid" by Hans Christian Andersen, where a mermaid exchanges her voice and tail for legs with the aid of a sea witch, and communicates via the expression of her eyes and the art of dance; and the display of the "FeeJee (Fiji) Mermaid," in reality, a monkey torso sewn to a fish tail, by 19th century circus showman P.T. Barnum. The mermaid embodies the lurking thoughts expressed by playwright William Shakespeare, "We know what we are, but we know not what we may be," speaking of the potential for the transformation of physical forms and by default, the attached notion of a spirit appended to that form.

If we seem detached from marine invertebrates, it is an illusion. If we are to believe evolution, we are inhabited by them. They evoke other feelings not found in *companion* animals

[24]Charles Darwin. *The Descent of Man, and Selection in Relation to Sex*, Routledge, 1992, p. 448.

or mammals we know through zoos or wildlife documentaries. In a provocatively personal essay, philosopher Jacques Derrida writes about feeling ashamed for being naked in front of his cat. In his essay titled, "The Animal that Therefore I Am," Derrida appears baffled by the shame, at first, and then proceeds to reassure himself of the naturalness of nakedness. I have to wonder how Derrida would feel appearing naked before an octopus who may very well respond by showing Derrida exactly how he is perceived by another creature. The octopus mimics its environment and Derrida would be looking at his own nakedness reflected back, guided to think about the *costumes* we cloak ourselves with to hide our own, internal nakedness. The lingering truth is that animals that are more like us that we can train and command, that birth live young and recognize familial relations, are actually more readily "othered" precisely for those very reasons. It is both a deflection from confronting what it means to be human and a creeping sensation that those animals most like us will, and often do, rebel in some fashion; whether it is not listening to our pleas for "Rover" to drop the ball or the extreme case when a performing whale trapped in a pool meant to substitute for the wild, open sea turns on its trainer. With invertebrates, we never expect them to fully comprehend or to obey us in the first place.

Basic aspects of human culture are revealed in the ways animals fit into our lives according to psychologist Hal Herzog in *Some We Love, Some We Hate, Some We Eat: Why It's So Hard to Think Straight About Animals*. Posing questions such as who has a better life, the chicken on the dinner plate or the one people bet on to win a fight, Herzog does not shy away from the gritty side of how animals are used for sport, entertainment, and food. Whether we term them biblical, cultural, or just plain "yucky," we assign animals their place, so we agree, at least within particular cultures, on those we describe as cute, playful, or smart, as opposed to those which make us shudder. Studies on animal behavior and physiology, despite the wonders they

reveal, spotlight our visceral responses to particular animals as well as our inherently assumed exceptionalism. They give us a sense of control. Animal studies scholar Akira Mizuta Lippit believes human beings are attracted to particular animals because they see themselves represented in them. In *Electric Animal: Toward a Rhetoric of Wildlife*, he writes, "Human beings find the animals' look familiar because they recognize themselves in this look; they find themselves caught in the act of looking at themselves…as if in a mirror."[25] We see ourselves in them and comfortably take on the dominant role of deciding their fate. Taking on this responsibility is one way of subduing the horror evoked by the reflection in the look of an animal.

Invertebrates, perhaps, offer an alternative path, one more in keeping, potentially at least, with the interconnectedness of all living entities. Although few humanist scholars have taken to writing about marine invertebrates, the field is opening and one of the first to take the plunge is Eva Hayward. She immerses herself in aquariums, particularly among jellyfish and sea stars, and speaks about the human struggle to contain itself when human beings are instead fluid, uncontrolled, ethereal beings. She watches jellyfish undulate in an aquarium and writes, "[We] experience a vibratory, percussive, expressive, improvisation of becoming more than ourselves."[26] These creatures do something that moves a wide array of people in ways that does not fit the category of anthropomorphism. Through these creatures, ideas of boundaries are challenged. Progenitors of all other forms of life, it is odd to label marine invertebrates as simple creatures because they do not comply with our own measures of complexity; namely, the possession of language, reasoning ability, or use of tools.

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[25]Akira Mizuta Lippit. *Electric Animal: Toward a Rhetoric of Wildlife*, University of Minnesota Press, 2000, p. 173.
[26]Eva Hayward. "Sensational Jellyfish: Aquarium Affects and the Matter of Immersion," *A Journal of Feminist Cultural Studies*, vol. 23, no. 3, 2012, p. 186.

It is probably safe to assume that marine invertebrates were not included in Noah's ark. They were not considered rescuable or needing to be rescued from a shipwrecked world and their absence can be construed as part of another wreckage to be swept away. Their mesmerizing beauty and perplexing physical shapes seemingly defy physics. They are not what we associate with the word *animal*. The very word that links us to them lacks an ability to capture marine invertebrates. Acute attention to marine invertebrates may have risen due to real fears of "devolving" into "lower forms" heightened by the publication *On the Origin of Species* by Charles Darwin, although talk of species relatedness and evolution circulated long before its release. The idea that people could revert to some presumed "monstrous" state prompted a more intense study of marine invertebrates, including what they ate, how they reproduced, how they communicated, how they interacted, as well as the inner workings of their anatomy.

My "undisciplined" dissertation situates itself at the edge of the sea, a liminal site where sea and land meet, at a boundary that does not stay put. And that, to my mind, gives me license to borrow from any and all disciplines to explore ways in which marine invertebrates shape our sense of self. I discuss the unique biological features of sea stars, crabs, barnacles, and octopuses and connect those distinct biological features of each species with a literature making use of that species to question the limits and very definition of humanness. We connect with the unconventional friendship of Ishmael, glued barnacle-like to the tattooed cannibal Queequeg in *Moby Dick*, travel with the seafarer Odysseus possessed by Poseidon-like octopus in *The Odyssey*; with oral tales of Aboriginal people where people regenerate into sea stars; with a dog named Crab who reconfigures the logistics of logical relations in *The Two Gentleman of Verona*; and with an inversion of the meaning of being toxic and toxicity in the science fiction novel

Starfish by Peter Watts, among other texts. All my selected texts draw upon the unfathomable, disorienting depths of ourselves, our relations, and our own particular place in the natural world.

Marine invertebrates have historically been seen as signifiers of transmutation. They were marked with sensationalism and speculation by all the periodicals, science journals, and travel writing highlighting these species as the pinnacle to discovering the mysteries of life's origins, while at the same time ascribing to them the idea of inhuman monstrosity, which also seeped into perceptions of cultures altogether different from European and American standards. The expression of turning inside out, breaking apart, and all kinds of bodily contortions frightened and exhilarated a public already captivated by mutable and permeable bodies. Through reading literature featuring marine invertebrates, we enter a space of transformation which undermines stasis as it celebrates change, continuously rendering what was once familiar into something strange and what was strange into something familiar. As the cartoon by John Leech depicts a speared octopus brought into the home aquarium strategically placed between the window and hearth, the spectacle of life is one to display and embrace. That discovery, I argue, directs us to address the liquid nature of the qualities we have historically relied upon to measure ourselves and mediate the natural world. We can do better.

Figure 5: John Leech, "Valuable Addition to the Aquarium," *Punch's Almanack,* vol. 38, 1860. Courtesy of University of Pennsylvania, The Online Books Page.

CHAPTER ONE: CONSCIOUSNESS

Sea Stars: Seeing One's Self and Knowing That One Is Seeing

Introduction

> He loves me, he doesn't love my bowels, if they showed him my appendix in a glass he wouldn't recognize it, he's always feeling me, but if they put the glass in his hands he wouldn't touch it, he wouldn't think, 'that's hers,' you ought to love all of somebody, the esophagus, the liver, the intestines. Maybe we don't love them because we aren't used to them, but if we saw them the way we saw our hands and arms maybe we'd love them; the starfish must love each other better than we do.
>
> Jean Paul Sartre, *The Wall: (Intimacy) and Other Stories*

A spiny, purple sea star stretches its five limbs around a water-soaked rock in a tight embrace. But, at low tide, it is not likely a rogue wave will knock it off its dais and send it spinning into the surf. Nonetheless, in a world always in motion, dislodgement and dispersal into a vast watery expanse is very real and scientists are invested in understanding the physiological response of sea stars to "seasonal changes in wave exposure"[27] and how sea stars adjust to fluctuating environmental conditions in order to keep a strong hold on the substrate supporting them. Protecting themselves against elemental forces from the outside world does not include prodding by the hands of eight-year-olds intermittently pressing light index fingers to their rough calcareous skin. It is undeniable that the bright color and absolute stillness of the sea star attracted the attention of an excited group of children stepping into the magical unveiling of low

[27]C.D.G. Harley, et al. "Local- and Regional-Scale Effects of Wave Exposure, Thermal Stress, and Absolute versus Effective Shore Level on Patterns of Intertidal Zonation," *Limnology and Oceanography*, vol. 48, no. 4, 2003, p. 1498.

tide. I gently pick up the sea star from its perch and turn it on its eyes and stomach, and we stare at the rows of tube feet "kicking" in the air with the energy supplied by the flow of sea water circulating through its body. Because we perceive our bodies to be independent of our environments, it is uncanny to realize that sea water animates sea stars and acts like "blood," even while knowing that our own salty tears, sweat and blood story our aquatic origins.

Sea stars perform all their life functions via an intricate water vascular system. Breathing, moving, prying open shells of bivalves, such as mussels, to get to the meaty insides and expelling waste are all possible because of a highly sophisticated network of canals circulating sea water throughout the entire body of the sea star. As the sea water stored inside the sea star gets pumped into the "squishy" row of feet causing them to sway to and fro in mesmerizing rhythm, the kids also begin to wiggle their own hands in excited communion, accompanied by exclamations, "They look like worms" and "It's like a caterpillar," to wrap their minds around the fact that a circular creature could be just as locomotive as any linear creature already familiar to them. "How does it know where it's going?" asked a young boy. I replied, "It senses its world through smell, for one, and it has eyes at the end of each arm. That is how sea stars see the world." Then a young girl asked, "It won't go in circles?" with genuine concern that the sea star lives in constant *dizzying* danger. "No," I replied, "The sea star coordinates all its feet to work together to lift itself up and move. It is called hydraulic power. The hydraulic tube feet of sea stars fill and empty with sea water to supply the necessary pressure to make their way over rough terrain and to steady the weight of their bodies." The kids nod with a sense of relief.

The tube feet supporting sea stars are designed to adjust to the contours of the coasts they call home. Sea stars respond to shifting environmental conditions through the mechanism known as phenotypic plasticity, defined as a change in behavior or biology of an organism in response

to shifts in environmental conditions. To cope with fluctuations in their environments, sea stars intentionally change the physical characteristics of their bodies to meet the demands of their world, including the force of waves or the steady flux of species they encounter. For example, sea stars living on sandy shores are distinguished by their pointed tube feet equipped to navigate across uneven sediment, whereas sea stars living on rocky shores are distinguished by suckered tube feet designed to keep a hold on wave-beaten rocks whose surfaces are often pockmarked with depressions.[28] Research has also shown that sea stars even change their body shape to contend with the pressure of water; sea stars in wave-exposed shores have narrower and lighter arms than those on protected shores to secure them from lift and drag forces. Survival depends on the ability of sea stars to physically respond to environmental conditions, and "Such plastic changes in body shape represent a unique method by which sea stars adapt to spatial, seasonal and possibly short-term variation in flow conditions."[29] That plasticity leads to questions, such as how sea stars anticipate changes in their environments and how quickly they are able to respond to those changes. Another aspect to evaluate includes the affect sea star plasticity has on other species.

I place the sea star on its hard, calcareous side and we watch it right itself. In righting itself, several arms reach out for solid ground and "plant" their tube feet to establish dominance. The leading ray, the one who gains control, coaxes the other arms to somersault over the entire body. If the sea star is missing rays, preference for righting leans in the direction opposite the lost ray or rays. Righting behavior is not an easy feat, and, on average, a sea star takes between

[28]The ability to modify body shape also has implications for modifying genetics and speciation. Anurag A. Agrawal. "Ecology-Phenotypic Plasticity in the Interactions and Evolution of Species," *Science*, vol. 294, no. 5541, 2001, pp. 321–326.

[29]Kurtis Hayne and Richard Palmer. "Intertidal sea stars (*Pisaster ochraceus*) alter body shape in response to wave action," *The Journal of Experimental Biology*, vol. 216, (Pt. 9), 2013, p. 1717.

two to four minutes to self-correct its position. The timing appears to us to be inconsiderably short, yet it can be an eternity for a slow-moving sea star accustomed to living amongst numerous predators. Righting behavior is crucial in the life of a sea star and various studies evaluating sea star fitness and ability to contend with stress concentrate on recording the measure of time it takes for a sea star to flip itself from its back side to its front side. Their slow moving, high visibility profile makes us think they should not have survived, though they have a deep history going back approximately 500 million years.

How the sea star senses itself in its world inspires serious thought on the nature of self-awareness or consciousness. Self-awareness or consciousness, synonymous with inner essence or the soul, has historically been attributed to humanity alone. Yet, the concept of the soul is abstract, difficult to pin down, though pinned with the synonyms of reason, mind, essence, and sentience, as well as oscillating between *existence* as a material substance residing in some part of the body or an ethereal aspect circulating in the self (I will use the word soul throughout the essay and assume all its synonyms embedded). It is an abstract, intangible trait and arguably, a sense of self is subject to disappear when in the midst of an ecstatic moment. It is a ghostly figure, unseen but *felt*. In looking at the biology of sea stars, specifically their ability to regenerate lost limbs, communicate via chemosensory signals, see with five eyes, and protect themselves against predators via the production of toxins, in conjunction with literatures that use sea stars as characters for navigating humanity's gaze inward, I explore how the concept of the soul, the immaterial, inherent dimension of being human, is contentious and reveals a longing to feel connected with the natural world and in turn to feel significant. The literature I examine includes the story "Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms" from the oral tradition of Aborigine culture, where a human metamorphizes into a

sea star as punishment for deceiving a fellow friend;" the 20th century nature-writing essay "The Star Thrower" by anthropologist, author, and poet Loren Eiseley who recuperates from the existential angst of alienation by saving sea stars from suffocating in the sand; 19th century imaginative science writings by naturalist Philip Henry Goose who dives into the secret language of sea stars to imagine a deeper self in communion with creation; and the 20th century science fiction novel *Starfish* authored by marine biologist Peter Watts where sea stars inspire reconfiguration of *toxicity* in altered bodies.

There is a magnetism to sea stars whose unique presence inspires thinking about the nature of belonging with the world. That belonging demands immersion and interaction, noted by author John Steinbeck who directs his sight to sea stars as models for living. He writes, "The true biologist deals with life, with teeming boisterous life and learns something from it, learns that the first rule of life is living. The dry balls [those enclosed in their own walls] cannot possibly learn a thing every starfish knows in the core of his soul and in the vesicles between his rays."[30] Steinbeck mocks the staunch belief that sealing one's self in a laboratory, dissecting the network of neurons firing within and across regions of the brain, will provide answers to questions of the soul/consciousness/self-awareness. His call to step outside the self illuminates the reality that isolating one's self from experience and from being shaped by the world, limits both being in the world and moving with it. Steinbeck anoints the sea star with an innate vitality, while calling attention to the limiting laboratory existence of a humanity trapped inside an interior first-person view shut out from the rest of the world.

The concept of the soul boasts a long, complicated, contentious history. It has been dismantled and reimagined throughout the ages, yet unequivocally assumed to be the keystone

[30]John Steinbeck. *The Log from the Sea of Cortez,* Penguin Books, 1986, p. 29.

piece delineating what it is to be human and what separates humans from animals. The soul, in all its configurations, stands for the undefinable human. Yet, in all its configurations, there is no definitive assurance that the soul exists at all. We take the soul for granted because humanity has documented itself under a spell of its own making. We are sentient beings, but we are not the only ones. And in observing ourselves through the biology of sea stars we can profoundly, and humbly, consider our soul as a paradoxical, self-referential current moving towards integrating us in an oceanic existence[31] and not hovering above it.

According to the Barnhart Dictionary of Etymology, the word soul comes from Proto-Germanic *saiwalō* meaning "coming from the sea, belonging to the sea" in reference to the belief that the soul *resides* in the sea before it is born and after it dies. Consequently, our ensouled selves are as fluid as the sea if we look to writings about the nature of the soul by Western and Eastern philosophers. Discussion of the soul's physical or not physical being, its being as thought and feeling, especially in light of modern science informing us that our brain compartmentalizes our senses and those fragmented pieces stumble about to make us specifically us, continues to befuddle what it means to be aware of one's self. Or, in the sentiment of 4th century philosopher Aurelius Augustine, "I myself am my soul," and that indivisible truth sufficiently addresses the existence of the whole individual. The association of the soul as an indestructible, enduring force, that in all its swirling definitions "supposes, thinks, and knows," as argued by Aristotle, and is uniquely one of a kind, despite contradictions or inconsistencies, acts as an invisible part of humanity that binds humanity with an invisible creative spirit. The idea of soul nourishes the conceptualization of an essence of a self that is irreducible and true, hence, unchanging. The

[31]Writer Romain Rolland first used the phrase "oceanic feeling" in a letter penned to psychologist Sigmund Freud in 1927 in reference to a mystical, spiritual feeling of being one with the universe and a mystical view of the mind.

individual, then, is perfect, and the substrate of the self is linked to a self-awareness that portends to permanence.

The intertwining of body and soul suggests that the soul/self-awareness/consciousness is dependent on a body. The premise rests on an unchanging body and what it *feels* to be a part of the body, experiencing that body, is both inexplicable and fluid. The problem of consciousness, as philosophers phrase it, is that consciousness may or may not be purely physical. Therefore, a change in physical form raises questions about the nature of consciousness and sea stars evoke such inquiry. Sea stars counter the premise that biology is static, and by default, if bodily forms shift and change, as they do, then what is the essence of the thing comes into question. Embedded in that question is whether consciousness can be explained in physical terms or demands another kind of explanation if it can be explained at all. The physical conundrum of sea stars models the ongoing inquiry into the materiality of soul/self-awareness/consciousness. Sea stars are exceptional in starting life as bilateral symmetric larvae and developing into pentaradial symmetry as adults; a shape we recognize as belonging exclusively to sea stars and their relatives in the phylum Echinodermata. The discovery of a primitive sea star fossil, *Helicocystis moroccoensis*, confirms that the body pattern of sea stars began with bilateral symmetry in the embryonic stage and then developed into the common pentaradial form. This new discovery, according to the research, also presents "a novel and unexpected mix of echinoderm features,"[32] leading researchers to wonder what motivated the change in symmetry and what types of external forces played a role. Peering into the process of a sea star's development, magnified by the microscope, also raises the philosophical and biological question: When is a human being recognized as human? This question is enlarged by the fact that both sea stars and human beings

[32]Andrew Smith. "Cambrian Spiral-plated Echinoderms from Gondwana Reveal the Earliest Pentaradial Body Plan," Proceedings of Royal Society, *Biological Sciences*, vol. 280, no. 1765, 2013, pp. 1-6.

belong to the deuterostome taxon meaning "second mouth" because the mouth develops secondary to the anus. In that respect, we learn we have a physiological connection to a creature completely removed from how we physically recognize ourselves. It takes a magnifying lens to show us what is invisible to the naked eye, and in magnifying our physical relations, we can open our thinking towards the invisible qualities we entangle ourselves with to think of ourselves as more than physical, more than mortal, and more than part of a collective genus.

It seems impossible to grasp that we share 70% of our genetic code with sea stars. And, since genes makeup the ingredients structuring our brains, our biological proximity exists despite the fact that sea stars have no central nervous system that is recognized as a brain. Sea stars have eyes, yet no discernable face and a double stomach that acts as both a weapon and digestive tool; where the cardiac stomach protrudes from the body, penetrates into the closed shell of a prey, and then transfers the catch to the pyloric stomach where digestion occurs. This unique manner of eating caught Aristotle's attention as he details in *Historia Animalia*, "The star-fish is naturally so warm that whatever it lays hold of is found, when suddenly taken away from the animal, to have undergone a process like boiling."[33] Essentially, the sea star digests quickly, but a sense of urgency is felt in the translated word "warm," though unbeknownst to Aristotle, the proteins controlling the retraction of the stomach are evolutionarily related to the proteins regulating anxiety and arousal in human beings.[34] There is a mechanistic component involved in the expression of an uncontrolled feeling.

The odd connection between digestion in sea stars and arousal in human beings informs us of the possibility that perhaps we are not entirely aware of our own responses, nor if they are

[33]Aristotle. *Historia Animalium*, Trans. D'Arcy Wentworth Thompson, Book V, Ch. XIII, 1910, p. 548.
[34]Dean C. Semmens, et. al. "Discovery of a Novel Neurophysin-Associated Neuropeptide that Triggers Cardiac Stomach Contraction and Retraction in Starfish," *Journal of Experimental Biology*, vol. 216, (Pt. 21), 2013, pp. 4047-4053.

physical or imagined. Just like the soul can be perceived as being either connected to the body or separate from it, and can experience itself outside of its own awareness, as in sexual relations, we can look to sea stars to grapple with sexual expression. Sexual expression crosses biological and social arenas and is a topic that provoked anxiety in 19th century Western audiences when they learned that sea stars selectively reproduce both asexually and sexually. Sea stars can either autotomize a limb to clone a replica sea star or release gametes into the water column to fertilize. The unusual regenerative ability of sea stars attracted the attention of feminist scholar Eva Hayward, who focuses on sea star asexual reproduction to remove the stamp of deviance imprinted on the various expressions of human sexuality. Hayward turns to sea stars in the song "The Cripple and the Starfish"[35] written and performed by Antony and the Johnsons, whose repeated chorus "I'll grow back like a Starfish" bolsters her own "materialization" as a trans-gendered person plunged into a fluid process of "the body's multiplicities, its vicissitudes." Hayward wonders if sea stars "might provide me (and maybe others) some prefixial lessons or guides through language, metaphor and other tropological terrains (sic)" to question what is instituted as inherently good or inherently bad, otherwise labeled *harmonious* in relation to soul as part of the cosmic laws of nature and the body as a vessel carrying the laws of nature. The stirring up of sea stars in Hayward's mind drives her argument for the pliant nature of individuality; ultimately, the pliant nature of a soul although it often stands for the *perfection* of the self.

Contact with "starfish" brings Hayward into contact with the "roots in oneself (sic)" and her transsexuality as "an identity that bleeds and is cut" in a lived, unmeasurable body. Hayward

[35] Eva Hayward combines transgender studies and animal studies through a lexical lens and her essay, "More Lessons from a Starfish: Prefixial Flesh and Transpeciated Selves" in *Women's Studies Quarterly*, vol. 36, no. 3&4, 2008, pp. 64-85.

does not specifically refer to brittle stars in her writing, and technically brittle stars are not classified as "true" sea stars because their madreporite (the sieve that takes in water) is on the underside of their bodies (oral surface). But the genus *Gorgoncephalus*, which translates from the Greek as "dreadful" or "terrible" head, strikes a chord with Hayward's discussion of sexual identity. Brittle stars are playfully referred to as "serpent stars," alluding to the mythical figure Medusa, a member of the Gorgon family and a daughter of the sea. Medusa was a beautiful mortal who was cursed by Athena and turned into a monster with writhing snakes in place of her once flowing locks of hair (Athena was jealous of Medusa's beauty and angry at the desecration of her temple when Medusa was raped by the sea god Poseidon). Furthermore, anyone who set eyes on Medusa would immediately turn to stone. In opposition to the horror of ossification, marine biologist Rachel Carson inverts the monstrous into an uncanny attractiveness, describing the "snaky-locked" brittle star with its "maze of curling tendrils" as a figure of "beauty, grace, and elegance."[36] Carson connects us with brittle stars with a language of motion in the vein of Aristotle's conception of the soul as the aspect of the living being that is the cause of movement, and exists in varying degrees in all life. Yet, the aesthetically descriptive words Carson employs to enliven the virtues of the brittle star are as abstract, and subjective, as the concept of soul.

Similarly, 19th century naturalist Alexander Agassiz, (son of Louis Agassiz and credited for founding the study of glaciology), responds associatively to the manner in which the brittle star makes its way from place to place by shape shifting. Agassiz imagines the brittle star morphing into a network of climbing plant tendrils and ultimately into the image of a house: "In moving, the animal lifts itself on the extreme end of these branches, standing as it were on tiptoe, so that the ramifications of the arms form a kind of trellis-work all around it, reaching to the

[36]Rachel Carson. *The Edge of the Sea*, Houghton Mifflin, 1955, p. 225.

ground, while the disk forms a roof."[37] In the keen observation of the brittle star, Agassiz connects the idea of temporariness with permanence; linking movement with the concreteness of the body. The idea of a body as a house resonates with the belief that the body houses the soul that enlivens it. Yet, the description illustrates that the body takes on various shapes.

The soul is historically perceived as a conduit to join humanity with the divine and sea stars "house" some of the myths binding humanity with the other-worldly. Myths act as a means to story the social order with a cosmic one. Connecting the everyday with the supernatural reveals a desire to see the self as more than a physical entity and regenerate a relationship with a natural world. Regeneration in sea stars acted as a physical force connecting the real with the imaginative, connoting supernatural relations. Restorative power is historically associated with Isis, the ancient Egypt goddess, worshipped for her role as protector of seafarers who traversed the Red Sea and for possessing the power of healing and rebirth. She is linked specifically with sea stars because she restored her husband/brother Osiris from the dead, sewing all his dismembered parts together. In Roman mythology, the goddess Venus is Isis' counterpart. Born of the sea, Venus is often depicted holding a sea star symbolizing fertility and love. In a way that Hayward would appreciate, Venus' sexuality was fluid; she embraced male and female, mortal and immortal lovers, and by association, sea stars also evoke erotic undertones of ambiguity, since sea stars do not display an obvious gender. Venus derives from the Latin *venus* meaning love and *venenum* meaning potion or charm, ironically binding the emotional change of state with the idea of *madness* expressed by the release of specific hormones when we are in love or lust, and thus, offers a rationale for what would otherwise be pushed to the border as irrational

[37]Elizabeth Cabot Agassiz and Alexander Agassiz. *Seaside Studies in Natural History*, James R. Osgood and Company, 1871, p. 117.

behavior.[38] In Christian symbolism, the mortal Virgin Mary is referred to as the Star of the Sea (*Stella Maris)*[39] and is revered for giving birth to Jesus Christ, the son of God, through Immaculate Conception; much like sea star self-regeneration. Sea stars also make an appearance on totem poles of the North American Coastal Indian Haida tribe who respect the sea star for its strength and associate the sea star with immortality because of its ability to regenerate lost limbs. While these myths are wrought with mysticism, they also illustrate a universal phenomenon of turning to sea stars to close the secret distance between self and mysteries of the world.

Sea stars remind us of an ancestral past before the existence of human beings and the ways in which humanity conspires to know itself in a world it consequently shapes and is reciprocally shaped by in turn. The notion of being shaped by invisible, abiotic forces is presented in the parable "The Legend of the Starfish" published in the 19th century American periodical *Maine Farmer*. Blending moral lesson with a "just-so" explanation of how animals came to be, and with the added allure of the timeless quality characteristic of fairytales, the parable begins "Many, many years ago" to situate both a measured time and no time at all, an age when "the oceans were very large, and the dry land exceedingly small" to capture the biblical authority of Genesis. In this world, "a new star was born, and he had an entirely different nature from all the others" to inform us of his outcast position. The star lived "high up in the heavens" and felt unsuited to his place amongst the other stars. He lamented that he was not part of either the "family of the Lion, of the Crab, of the Dog, and so on" as opposed to being a member of the Fish family. Seeking to correct him, his fellow stars reasoned that "all families in

[38]Anthropologist Helen Fisher categorizes romantic love as lust, attraction, and attachment in her book *Why We Love: The Nature and Chemistry of Romantic Love* where each is characterized by the distinct activation of specific hormones in the brain.

[39]It is believed that the moniker "Star of the Sea" may have been a result of a translation error from the Hebrew words star מאור (ma'or) and the verb אור ('or) meaning to shine for the name Miriam.

the great heavens were equal." The Queen Lady of the Fish warned him that if he continued to insist on wishing to change his nature, he would be banished; in other words, he would become extinct. This sentiment played on reigning insecurities about individual significance in the world and fear of going "backwards" on the evolutionary scale; a backwardness made apparent by the physicality of the body. After one year, the star still refused to accept his lineage as a Fish. Suddenly, a voice from the dark whispered, "Thou who hast always despised the family of the Fishes shall become one in reality!" and the star was hurled through space towards Earth. And now, "the Star-fish may often be seen on the sea-shores, among the crevices of rocks, alone and deserted sadly gazing upwards to its old home and friends." The "Star-fish" desired to be more than he was, to be significant in his mind. He fell prey to the categorization of life and as a consequence for decrying his own kind in favor of a more favorable family, he was cut from the family and from the entire collective. However, the fall was, in a curious way, a triumph as well. Now, at the edge of sea, we find sea stars are top predators, holding the title of "keystone species," structuring the kinds and number of species living within its ecosystem, and influencing the behavior and shape of other species; in essence performing the tasks of structuring a world.[40] The fate of the Star-fish embodies the call of author John Steinbeck who writes, "It is advisable to look from the tidepool to the stars and then back to the tidepool again."[41] There is an invisible connection between all material life, though we may not feel it or

[40]The term keystone comes from architectural design and refers to the stronghold piece maintaining the integrity of an entire structure. Without it, the entire structure would be dramatically altered. Sea stars gained the metaphorical moniker "keystone species" as a result of the field work by revolutionary marine biologist Robert Paine, who was a pioneer in bringing the "laboratory" into the natural world. He carefully removed sea stars from their rocky homes off the coast of Washington state and assessed how ecosystems cope with the question: What happens when an important species is removed from our environment? Sea stars are generalist predators and the removal of sea stars resulted in the exponential increase of mussels bundled together like bouquets with their byssal thread stems planted into rocks. As keystone species, sea stars actively manage the continual diversification of species residing in wave-beaten and wave- protected shores, and also influence the size and shell density of other species.

[41]John Steinbeck. *Sea of Cortez*, Penguin Classics, 1951, p. 178.

be aware of it, and a pull to be more than we are, though the cause may not be known. Our biological limitations may indeed be the reason we cannot comprehend consciousness and its ties to our physical being as well as to the world at large.

Sea stars act as chimerical clones of the sky, thereby symbolically binding our cosmic origins with our aquatic.[42] Nor is this just a conceit reserved for poets. Marine biologist Rachel Carson fosters connection between heaven and earth in *The Edge of the Sea*. Carson draws our attention to the twinkling of the sand caused by an "astral image" which soon fades "like a star disappearing in mist." That ghostly departure is accompanied by the gliding movement of a starfish disappearing under a rock.[43] Mingling stars in the sky with stars in the sea, Carson pictures a sea star in communication with its spiritual counterpart or apparition of itself. Blending the mystical with the earthly also appealed to 19th century naturalist Edward Forbes, pioneer of the study of biogeography and author of an encyclopedic text, *A History of British Star-fishes and Other Animals of the Class Echinodermata*, which merged the real and fantastical. Combining whimsical vignettes and line drawings such as an angel with arms crossed in self-embrace gliding over a dark ocean illuminated by one radiant sea star, a mother and child merfolk playing catch with a sea star, and illustrations of a mischievous elflike sprite playing a flute for two dancing sea stars, or the same elf mightily pulling a sea star away from the clasp of a clam, Forbes creates a fantastical world connecting the real with the supernatural. Forbes also

[42]Our collective relations with the natural world occupied the mind of 18th and 19th century naturalist, explorer, philosopher, and artist Alexander von Humboldt who titled his observations of the natural world *Cosmos* to capture the collapse of time and space: "[to] live in both past and present time, gathering all around us all that Nature has produced in various climes, bringing us into communication with all the peoples on Earth." Relations between the stars and their Earthly counterparts also occupied the minds and writings of many ancient Greek philosophers who observed nature, contemplated the shape of the universe, and wrote about the place of humanity in the world. The word *kosmos* is used to describe the order, beauty, and harmony inherent in nature, of which humanity is a part. The term was introduced by the Greek philosopher and mathematician Pythagoras, who stressed that all animate life was related and that human souls were immortal and transmigrated into animal forms after death

[43] Rachel Carson. *The Edge of the Sea*, Houghton Mifflin, 1955, p. 140.

pushes us to conceptualize our being in this world as also part of the cosmos, far reaching what we can comprehend, when he references the poem "The Pelican Island" by19th century Scottish poet James Montgomery: "The heavens were thronged with constellations, and the seas strown with their images."[44] Constellations create a mythology out of the visible. The far-away twinkling of lights sends our minds to the gods once believed to be integrated in our everyday lives. The stars in the sky and the sea contain the mysteries of the world we long to connect with, a connection we name the soul.

Figure 6: Edward Forbes, *A History of British Star-fishes, and Other Animals of the Class Echinodermata*, 1841. Courtesy of the Biodiversity Heritage Library.

Affiliating sea stars with the divine demonstrates a desire to be more than the boundary of tendons, muscles, and bones coiled together to form a body always in the process of decay. To be human is to be encased in a body that deteriorates, that quarrels with itself, and arguably clinging to an illusory form; the body is finite and temporary. If human beings are, according to Judeo-

[44] Edward Forbes. *A History of British Starfishes, and Other Animals of the Class Echinodermata*, J. Van Voorst, 1841, p. 72.

Christian belief, made in the image of "God" and the pinnacle of creation, how can we accept that we are susceptible to disease, decay, and death, and may indeed just be a mutation?

The connection between human beings as "God's" double is presented in the intended "futuristic" short novel *The Arms of the Starfish* by Madeleine L'Engle (author of the famed novel *A Wrinkle in Time*), whose plot centers on translating the regenerative abilities of sea stars onto human beings and the battle between the forces of good, who see the value of all of humanity, and the forces of evil, who discriminately believe only a select elite are worthy recipients of the restorative potion. The novel blends theology and science fiction to explore the broad theme of recognizing good and evil, and choosing sides, turning to sea stars to trawl through the process of restoring one's sense of self. In the novel, the metaphor and actuality of sea star regeneration inspires a letting go of one's self in order to reclaim one's self as part of the triumph of good over evil. We are introduced to Adam, which according to Judeo-Christian tradition, is the progenitor of all of humanity, created from mud and brought to life by the breath of God, bestowed with the power to name all the creatures. He is a student of marine biology who is on his way to an island off the coast of Portugal for a summer internship with marine biologist Dr. Calvin O'Keefe, who is working on a secret project to translate the regenerative abilities in sea stars to human beings. Dr. O'Keefe's work is safe-guarded by two trusted friends, clergyman Canon John Tallis and government official Joshua Archer, a name which means salvation, and is also associated with self-realization. Adam assumes he will be assisting Dr. O'Keefe to maintain the aquariums of sea stars and collect data on their regenerative properties. He is not certain if he can trust Dr. O'Keefe, who has already experimented on the indigenous people of Portugal and on a dolphin, and finds himself lured by business mogul Typhon Cutter (whose name refers to the monstrous son of Gaia and the underworld), along with his daughter Kali (the name of the Hindu goddess of death, change

and time), who try to convince Adam that Dr. O'Keefe is seeking fame and power rather than the well-being of all of humanity. Typhon Cutter is championed by Dr. Eliphaz Ball, whom Adam misconstrues as Baal, a Semitic reference to "false deities."

Adam does not trust himself to know who to trust, but alone in the lab, communing with sea stars, he leans on the biology of sea stars and the science behind regenerative abilities to think about the nature of being human. In conversation with Dr. O'Keefe on the perplexing nature of divergence, that is, why it is that we came from the same family as sea stars, yet "we chose to develop in different directions" and why that answer is not available to us, Adam offers the belief that human beings are defined by "free will and making choices and stuff."[45] Just like a sea star knows if it "feels that an arm is being hurt or threatened in any way, he drops it and grows another"[46] in an act of free will to repossess itself. Adam connects the sea star's ability to interpret its world as an opening to see himself as part of larger cosmic forces. Dr. O'Keefe informs Adam that energizing regenerative abilities in human beings calls for tracing back two thousand years of history to determine when "we've gone off" and "lost something of inestimable value"[47] that could have belonged to humanity, thus recovering what was once familiar. In that evolutionary course, Adam wonders if humanity veered off in an "imperfect" direction on the path to becoming human and if sea star regeneration will put humanity back on course.[48]

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[45]Madeleine L'Engle. *The Arm of the Starfish,* Ariel Books, 1965, p. 111.
[46]Ibid. p. 110.
[47]Ibid. p. 132.
[48]Research on the sea star *Luidia foliolata* intimates that "Because of the close evolutionary relationship and developmental similarities between echinoderms and vertebrates, sea star larvae may provide insights into the mechanism underlying regeneration in other deuterostomes, including humans." Michael Vickery, et. al. "Utilization of a Novel Deuterostome Model for the Study of Generation Genetics: Molecular Cloning of Genes that are Differently Expressed During the Early Stages of Larvae Sea Star Regeneration," *Gene*, vol. 262, no. 1-2, 2001, pp. 73-80.

Dr. O'Keefe acknowledges the struggle of searching for the *invisible* defining the self and affirms that each person has their own "*isness*," a phrase coined by L'Engle to champion the idea of self as a regenerative force, continuously adding new dimensions.[49] Through sea stars, we are made aware of the culmination of experiences, of biological and sociological pasts belonging to us and to others, that illuminate the complexity of all species. As Dr. O'Keefe informs Adam, "In this tank, we started two months ago, but you can see that the starfish is going to grow, that life is going to win."[50] For L'Engle, sea star regeneration directs attention to powers of good and powers of evil residing within, and the unique position of humans to be innately aware of the position to gravitate towards a particular sensibility of right and wrong. Adam is warned, "If unscrupulous men got hold of this it would be like letting loose the power of the atom for devastation, for death instead of life. The tiniest thing in the world is the heart of the atom, and yet it's the most powerful. What we are learning from the starfish is just as powerful, and like the core of the atom, can be either destructive or creative."[51] In Adam, the choice to ascend or to fall is liberating, like our star from the Fish family. We also are introduced to the idea that our own mattering is intimately tied to the mattering of other species, whether we believe in the soul or not, our fates are wound together.

Yet, for all our fascination with the sea stars, we have a history of pinning them into an aesthetic, anaesthetized existence, failing to respect their separate, meaningful lives. The hobby of collecting and exhibiting sea stars was prominent during the naturalist craze erupting in the

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[49]Madeleine L'Engle articulates her vision of self in *A Circle of Quiet*, Farrar, Straus, and Giroux, 1972, p. 11: "I haven't defined a self, nor do I want to. A self is not something static tied up in a pretty parcel and handed to a child, finished and complete. A self is always becoming. *Being* does mean becoming, but we run so fast that it is only when we seem to stop-as sitting on the rock at the brook- that we are aware of our own *isness*, of being. But certainly, that is not static, for this awareness of being is always a way of moving from the selfish self- the self-image- and towards the real. Who am I, then? Who are you?".

[50]Madeleine L'Engle. *The Arm of the Starfish*, Ariel Books, 1965, p. 111.

[51]Ibid. pp. 110-111.

western world in the 19th century. Sea stars found themselves prized specimens in the invention of the home aquarium or dried, proudly labeled and mounted in curiosity cabinets furnishing respectable parlors. Writing of the aquarium phenomenon, 19th century author Arthur M. Edwards, maintained that "a parlor is hardly considered furnished without one" and praised the inherent value of aquariums to "amuse and instruct the children," stressing the multilayered role aquariums filled to enrapture the mind.[52] Sea stars also stamped their imprint in home décor and reams of wallpaper lining the living spaces of upper-class society. Sea star inspired décor appealed to the desire for symmetry and order, that is, to manage the unruly natural world, especially creatures that defied the category of animal. This ability to arrange sea stars otherwise offered a respite from the anxiety they aroused. Probing into their world and rendering them in art was much like probing into our own existence. It made room for real and abstract thinking about the overall connective patterns organizing life and how to capitalize on that knowledge for understanding ourselves in profound ways.

Viewing sea stars encased behind the glass of aquariums gives a false impression of sea stars as solitary creatures because we seldom, if ever, witnessed sea stars socializing. But studies, and the advantage of time lapse photography, have shown that sea stars do indeed engage in intricate social relations. Marine Biologist Don Wobber, intrigued by the mysterious lives of sea stars, recorded deep sea and tidepool sea stars for over thirty years and found that sea stars do indeed interact with one another.[53] Describing their posturing as "statuesque poses," his hypothesis suggests that sea stars fight for dominance, using their arms to wrestle one another.

[52]Arthur M. Edwards. *Life Beneath the Waters; or, The Aquarium in America*, H. Bailliere, 1858, p. 21.
[53]Don R. Wobber. "Agonism in Asteroids," *The Biological Bulletin (Lancaster)*, vol. 148, no. 3, 1975, pp. 483–496.

His studies also showed that sea stars demonstrate "home field" advantage, essentially, the sea star that feels at home and is most familiar with the territory usually wins the bout.

The unexpected complexity of the social life of sea stars expanded awareness of the delicate negotiations connecting species with one another. The social capital of "home" marks the boundary between belonging and being uprooted. Being at home in one's self is a theme driving the work of Chicana poet Lorna Dee Cervantes, who is taken in by sea stars. Cervantes calls on us to realize we apprehend ourselves when we least expect it, in uncensored moments, and in doing so, consider how we seek relief in idea of a soul which joins the whole body, in all its feeling and thoughts, so that pain, for instance, is not always located in the physical body or where we imagine we experience it. In the poem "Starfish," Cervantes takes us on a stroll by the shore to witness sea stars strewn like "splayed hands," a metaphor alluding to the ways in which hand gestures reveal thoughts and feelings, linked with idea of openness and availability. The unnamed speakers approach the sea stars, whose bodies act as host to dead, inert *life*. She writes of the burden carried by the sea stars, decorated with the remnants of the lives of others, "As if they had created terrariums with their bodies/On purpose; adding sprigs of seaweed, seashells/White feathers, eel bones, miniature Mussels, a fish jaw." The speakers also participate in fashioning the sea stars into scenes of life and death, arranging and rearranging, picking up and leaving behind, creating an exhibit. Life and death intertwine into one, inseparable existence.

Loss and recovery permeate through the poem as Cervantes contextualizes the burdens of being subject and object, visible and invisible, and the union of life and death for a forgotten or no longer imaginable cause:

We touched them,
Surprised to find them soft, pliant, almost
Living in their attitudes. We would dry them, arrange them,
Form seascapes, geodesics…We gathered what we could

In the approaching darkness. Then we left hundreds of
Thousands of flawless five-fingered specimens sprawled
Along the beach as far as we could see, all massed
Together: little martyrs, soldiers, artless suicides
In lifelong liberation from the sea. So many
Splayed hands, the tide shoveled in.

The "flawless" sea stars are selectively inscribed with an air of innocence, perfect in just being, though they carry death and evoke death. That "flawless" nature of sea stars left behind exposes the fallibility of all life that sacrifices itself for both a loss and a gain. The insinuation that death is real and unfathomable, violent and nonsensical, is painted by the scene of sea stars likened to human hands. The body of the sea stars are transposed into a part of the human body, pointing to the parts that make up the whole and the inexplicable contraction and expansion of the significance of those parts.

Environmental essayist Barbara Hurd also finds herself immersed in sea stars reflecting on the interconnectedness of life. Admittedly engrossed by "edge species" as embodiment of "transitions and diversity and abundance," Hurd sets her sights on sea stars to suspend her audience between the cosmos and the sea. In an essay titled "Sea Stars: A Galaxy at Our Feet" published as a blog for *Orion* magazine,[54] Hurd transports her readers back and forth between sky and sea, reminding them that they are made of stardust, and that the "stars in the dark overhead and here a spiny constellation over rocks" are tethered, as are we, to a cosmic self. Hurd holds one sea star with missing limbs in the palm of her hand and watches the "Hundreds of slender tubes wriggle like antennae, only these aren't sense organs; they're feet, and what they're searching for isn't food or enemy or mate, but something to cling to, any firm surface that can anchor them and end this futile flailing at the air." Hurd is focused on the reaching out

[54]Orion Magazine. https://orionmagazine.org/articles/sea stars a galaxy at our feet/.

for stability, perhaps unaware that sea stars sense the world through their feet and communicate from every part of themselves to every part. Hurd concentrates on the idea of loss; in the case of the sea star, a loss of limbs, which it can regenerate, and a loss of footing, which is always precarious. But these sea stars continue "unburdened by notions of heroism or sacrifice, or even consciousness," because they absorb their losses. Hurd likens the loss of limbs to amputees who experience the "phantom pain" of a part no longer visible or responsive, though the "tingling or short stabs" make its presence felt, almost comforting. What is there, or not there, is tricky.

Similarly, Hurd connects the body and mind through analogy of those who were born without a limb, yet "sometimes feel what was never there and experience physically, what others of us know psychologically- a need to confirm what we feel but can't see." Hurd continues to shuttle between sea stars on the shore to the stars above, to the "whirling constellations" generating animals, myths, and legends. She equates the "worlds we'll probably never see" to the sea stars like a "galaxy spread out at our feet" beckoning us to acknowledge "what lies broken and hungry inside us all." The thousands of sea stars "about to disappear underwater…. misshapen maybe and less visible" are still present and evoke a "ghostly presence…of wanting" which is to embrace the loss as real, but not entirely gone. She unites mind and body, evoking the madness of Herman Melville's Captain Ahab from *Moby Dick* as a sorry creature obsessed with chasing down the white whale who stole his leg, though, in the depth of his soul, Ahab is chasing down the inscrutability of life. Ahab's unrelenting pursuit of "whiteness" and all forms of nature's whiteness, discussed in the chapter "The Whiteness of the Whale," can never be satisfied. Such a pure, isolated entity is unrealistic. Ahab twines us in a thought experiment of parts and wholes as both unfathomable. Whiteness presents itself as real and symbolic, interchanged with notions of "God," good/evil, and the entire universe as both innocent and

ferocious, as is humanity. Hurd empathizes with Ahab, admitting, “Oh, Ahab, I often think; if you could have hunted with less vengeance and fewer absolutes, might the whale have someday returned to you what it took so long ago, so violently?” The question positions Ahab consumed by a physical loss that affected his mind, leaving him beside himself, or rather, out of his self, and with a longing to reconnect. Ultimately, Hurd inspires a continuous search for the missing parts. Foraging for herself on the shore and reflecting on the physical struggle of sea stars to survive in a world where they cannibalize one another, and adapt, as well as the cosmic relations they engender, Hurd pulls us into an awareness of our desire to matter and a nostalgic desire for deeper relations.

The connective tissue in the literature I present is a longing, and striving, for significance. This paper draws upon and combines varied disciplines to illuminate the journey of the “soul” through time and space, and its many interpretations, presented via contemplation of sea stars. The soul does not, and has not, stayed put, yet it remains the point of discussion in deliberating what is human and non-human, namely, what, other than our biology, connects us to this world. What we assert via first person perspective is under scrutiny as we face what it means to be aware, to be conscious, reason, and the evolution of the soul, or being ensouled. To ask, as philosopher John Locke does in grappling with the contradictory notions of being “self-possessed or divinely owned, “What am I,” is unanswerable. However, it is important to ask the question and sea stars, who are not fish, open a space for that inquiry.

Regeneration: Renewing the Inner Other Creatures Within

Regeneration in sea stars refers to the regrowth of lost rays (arms) as a response to predation, an unstable habitat, or autotomy.[55] It is also a method of asexual reproduction. If a sea star willingly loses a ray and that ray retains part of the nerve ring, it can regenerate into an entirely new sea star. But the loss of a ray is serious and impacts essential functions like locomotion, feeding and sexual reproduction, therefore, energy allotted to regrowth is necessary, though expensive. Regeneration of sea star limbs fascinated naturalists throughout generations. Helen Dean King, whose 1898 Bryn Mawr College experiments on the manner in which the sea star *Asterias vulgaris* "repeats" itself, that is, regenerates, cites that the first proclamation of sea star regeneration, though not observed or experimentally derived, came from Welsh naturalist Edward Lhuyd in 1703.[56] The notion of "being again" and creating one's own genesis is appealing. It effuses the sense of the immortal, as well as the infinite. According to King, the first documented experiments of sea star generation were conducted by German naturalist Reamur in 1742, later replicated by French naturalist Charles Bonnet in 1764. Recent discovery that sea star larvae are able to completely regenerate missing body parts, tissues, and organs engages thinking along the scope of self-creation, and what is eternal. An organism in its infant stage of development that is capable of regenerating itself demonstrates the power of one species to utilize its genes to its advantage. In this case, sea star regeneration-associated protease (srap) guides understanding of evolutionary characteristics that tie physiology with morphology and with environments. It is as if the cells determine their own fate, signaling to one another to restore some loss to make the species whole. One can imagine the cell sensing its own ghost and

[55]Before what is now labeled the Mesozoic era, predators were not as prevalent in the ocean, therefore, abiotic factors were the most likely culprits of arm loss in sea stars and may have been the catalyst for the development of regeneration.
[56]The sea star genus *Luidia* is named after Edward Lhuyd.

taking control to reincarnate itself. One study set out to discover the inner workings for recreating a lost part of the self in a sea star and found that a "mixed population of progenitor cells"[57] contribute to that replacement. In simple terms, cells that can differentiate into different types of cells, originating from various organs are recruited to produce a new arm.[58] The uncanny nature of being "repeatable" or fundamentally new, seemingly anoints a creature as both alive and dead at the same time.

Two types of regenerative processes are currently known: morphallaxis and epimorphosis. In morphallaxis, pre-existing cells differentiate to replace missing parts. In epimorphosis, new cells are created to begin the process of wound healing and eventual regeneration. However, recent evidence indicates that these two processes largely overlap, and, in many cases, both contribute to the overall regenerative processes.[59] Further studies indicate that "cells from mixed origin are recruited from more distant sources of stem progenitor cells in sea stars."[60] Those cells begin the process of healing and proliferation to set regeneration in motion. In animating itself, the vital principles of life and the mechanism of life intersect.

The instructions for regeneration, and for the entire development of all species is held in what are called homeobox genes (Hox). These genes are responsible for bringing together different types of cells at just the right time and place to oversee the mechanisms of "re-generating" by telling the cells where, when, and how to operate. Hox genes are notably

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[57] Bodil Hernroth, et al. "Possibility of Mixed Type Progenitor Cells in Sea Star Arm Regeneration," *Journal of Experimental Zoology, Molecular and Developmental Evolution*, vol. 314B, no. 6, 2010, pp. 457-468.

[58]French naturalist Georges Cuvier, credited for shaping Charles Darwin's idea of natural selection, although he believed that species were formed after other species were wiped out by catastrophic events, also studied regeneration in sea stars, which he discusses in *Tableus élémentaire de l'historie naturelle des animaux* (1797). It was followed by the writing of naturalist Jean Baptiste Cuvier, who did not support species extinction, in *Historie naturelle des animaux sand vertebres* (1818).

[59]Yousra Ben Khadra, et. al. "Regrowth, Morphogenesis, and Differentiation During Starfish Arm Regeneration," *Wound Repair and Regenerations*, vol. 23, no. 4, 2015, pp. 623-634.

[60]Bodil Hernroth, et.al. "Possibility of Mixed Progenitor Cells in Sea Star Arm Regeneration," *Journal of Experimental Zoology: Molecular Development and Evolutions*, vol. 314B, no. 6, 2010, p. 465.

conserved throughout every mapped animal and plant species, meaning they maintain a visible presence; they have existed for a long time and before species divergence, signaling relatedness among species. Recent research on sea star regeneration has found "The expression pattern of Hox genes, that is, the Hox code, is one of the most relevant sources of evidence by which to trace in space and time the emergence of major evolutionary novelties."[61] Hox genes code for the development of all life and thus offer evidence of a continued genetic kinship between species. Studies indicate that Hox genes laid the foundation for the production of specialized cells leading to cascading signals for organizing and orienting cells into tissues and organs.

In an imaginative feat, one can read Charles Darwin's "descent with modification," a term describing connectedness of all beings, as an act of regeneration, defined as the action of bringing into renewed existence, restoration, and rebirth. Regeneration is an act of transformation and made familiar to us via tales of enchantment. A wealth of myths, stories, and fables from around the world evidence the shared enchantment with the possibility of changing our shape via the aid of some magical elixir. The fantastical hope to be again, to realize ourselves differently is universal, yet, what is taken for granted is that our souls will move along with us. The soul apparently transfers unscathed. Transformation can be a reward or a form of punishment, either a realization of a true self or a physical mark of a transgression. It is an external display of an internal deceit. Myths serve to instruct people of the consequences of breached relations with the natural world, or a social order, and a drive to restore balance, but also elucidating the reality that boundaries are flexible.

Transformations also shore up an unknowability of the matter (spirit) inhabiting everything. That unknowability raises awareness that life is a process of forfeiting things in

[61]Bruno David and Rich Mooi. "How Hox genes can shed light on the place of echinoderms among the deuterostomes." *EvoDevo*, vol. 5, no. 1, 2014, p. 22.

response to a disturbance or to keep continuity between life forms and the outside world. Aboriginal people are known for keeping the oldest myths in the world and their myths are how they know their world. The oldest living known people, Aboriginal Australians, whose existence dates back approximately 60,000 years follow a belief known as *The Dreaming*, *Dreamtime*, or *The Law* a term meaning "originating from eternity."[62] *The Dreaming* refers to the entire act of creation when the ancestors gave shape to the seascapes and landscapes, the rocks and the trees, the scars on the mountain and bend of a river and gave life to all living creatures. According to anthropologist W.E.H. Stanner, "Dreaming is many things in one. Among them a kind of narrative of things that once happened, a kind of character of things that still happen, and a logos or principle of order transcending everything significant for Aboriginal Man…It is also a cosmology, an account or theory of how what was created became an ordered system."[63] Because *The Dreaming* draws out the blueprint for all of life, it is also referred to by the Aborigines as *Law*. In the *Dreamtime,* Aborigine Bill Neidjie states: "we are connected with the total self-regenerative pattern of nature."[64] In that belief, all humanity reflects all other species. Everything cycles and is repeated and resides in everything and everyone; all animate and inanimate life are intertwined in an ongoing process of being and transforming. Everything is and is not.

The Dreaming was first coined by anthropologist Francis Gillen in 1896 to describe the spiritual worldview held by the Arunta tribe based in Central Australia. The original word from which the *Dreaming* was translated is *alcheringa*, which scholars suggest means eternal or uncreated. Late in the 20th century, anthropologist W.E.H. Stanner revitalized interest in

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[62]*Altijira ngambakala* translates as "to dream" and "eternal" signaling infinite occurrence of all possible things.
[63]W.E.H. Stanner. *White Man Got No Dreaming: Essays 1938-1973*, Australian University Press, 1979, p. 28.
[64] Qtd. in "Dreamtime Law: Australian Aborigine Philosophy," *Between the Species*, Michael W. Fox, vol. 3, no. 2, 1987, Article 9, p. 81.

Aboriginal culture and dedicated his work to help Aborigines reclaim their selfhood as indigenous people, calling attention to the fact that *The Dreaming* consists of "a complex of meanings" which he elucidated to the best of his understanding as a texture of the world enriched by conscious, supernatural beings presiding over a natural world. Ancestral Beings reshaped the natural world from an already existent, amorphous mass of clay and water. Stanner describes *The Dreaming* as "many things in one," and the "other side of this side," combining both the real and mystical. *The Dreaming* is of all time and all at once when the ancestors roamed the world and laid down the blueprint for all life and non-life, culled under the sentiment, "everywhen," a term coined by Stanner. The term "everywhen" embraces an *ahistoricity* where all things exist all at once without beginning or end. Stanner distinguishes Aboriginal life as an ever-present, felt experience between self and the Ancestors: "Aboriginal mind makes contact-thinks it makes contact-with whatever mystery connects *The Dreaming* and the Here-and-Now,"[65] mobilizing the real and spiritual world as one. Nothing can disrupt this belief and "nothing is nothing."

Ethnographers who study Aborigine culture admit to the slipperiness of the *Dreaming* because of the wide array of diverse Aboriginal tribal and language groups spread across Australia. But each tribal group shares a belief that all of nature and events in nature are entangled with the spiritual. Each tribe understands a distinct version of *The Dreaming* shrouding the entirety of all existence with an indelible sacredness. The Law of the Ancestors is encoded and guarded by Aborigines because they are aware that the spirits are aware and know all that is happening on Earth. This regeneration-resurrection is explained through the concept of pattern thinking. One indigenous Aborigine, Kwaymullina, a member of the Bailgu and Njamal people,

[65]W.E.H. Stanner. *White Man Got No Dreaming*, Australian National University Press, 1979, p. 24.

explains how the markings found on species, landscapes, and the elements of Earth indicate an interwoven world, both present and evolving:

> Imagine a pattern. This pattern is stable, but not fixed. Think of it in as many dimensions as you like-but it has more than three. This pattern has many threads of many colors, and every thread is connected to, and has a relationship with, all of the others. The individual threads are every shape of life. Some-like human, kangaroo, paperbark- are known to western science as 'alive'; others like rock, would be called 'non-living.' But rock is there, just the same. Human is there too, though it is neither the most nor the least important thread- it is one among many, equal with the others. The pattern made by the whole is in each thread, and all the threads together make the whole. Stand close to the pattern and you can focus on a single thread; stand a little further back and you can see how that thread connects to others; stand further back still and you can see it all, and it is only once you see it all that you can recognize the pattern of the whole in every individual thread. The whole is more than its parts, and the whole is in all its parts. This is the pattern that the ancestors made. It is life, creation spirit, and it exists in country.[66]

This is reminiscent of the debates on the nature of the soul in relation to defining an individual in past, present, or future time. If everything is the same substance, then the same energy is in everything. In unraveling patterns of *The Dreaming*, real events, spiritual awareness, and knowledge of social order and morality combine to make the world and its inhabitants. Aboriginal thinking is not "this is mine" but "this is me." The "this is me" way of thinking permeates through the stories of *The Dreaming* and arguably reflects the sentience of all things bound by a shared origin. Every person, animal, plant, and inanimate object are bound together into a "oneness" that is inseparable because "to threaten a man's shadow is to threaten him."[67] This is an intuitive truth combining the tangible and intangible aspects of the individual.

Because *Dreamtime* stories were transmitted orally and shared among the various language groups on the island, there are many renditions of the *Dreamtime Tales*. Stories of *The Dreaming* vary between tribes and though the stories contain similar plots, each maintains a unique trait to illustrate a special significance for the particularities of the tribe and region. One

[66]Ibid. p. 371.
[67]Ibid. p. 25.

such story involves a sea star and a whale. It is a story of regeneration where the actions of humans resulted in their change of form; each character is rebirthed as a sea creature marked with distinct physical features to remind them of their behavior and its implication in a greater chain of being. With direct, unembellished style of translating an oral story into writing, the tale of the sea star and whale is known by many titles, two of which are "The Whale Man and His Canoe," written down and published in the book *Gadi Mirrabooka: Australian Aboriginal Tales from the Dreaming* and "Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms," written down and published in *Some Myths and Legends of the Australian Aboriginals*. Each tale is believed to date back approximately 7,000 years because the underlying premise stresses the need to travel across the ocean to what is now Australia because of rising water levels and a lack of resources.[68]

In each tale, we are told that the animals we are familiar with were once humans. The Whale Man was a described as a "big fella" in "The Whale Man and His Canoe" and "the biggest of all men" in "Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms." In each tale Whale Man possessed a canoe that would allow the men to travel in the wildest of storms, yet he was selfish and would not allow anyone to use his canoe. Whale Man maintained a "strict guard over the canoe and would not leave it alone for a moment" ("Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms"), so the other men devised a plan to trick Whale Man and steal his canoe. It was arranged that Starfish Man would visit Whale Man under the pretense of removing sea lice from his head. Starfish Man plied Whale Man with funny stories to keep his mind occupied, occasionally tapping his hand on a piece of bark to assure Whale Man that his canoe was safely tied down. Meanwhile, the other

[68]Patrick D. Nunn and Nicholas J. Reid. "Aboriginal Memories of Inundation of the Australian Coast Dating from More Than 7000 Years Ago," *Australian Geographer*, vol. 47, no. 1, 2016, pp. 11-47.

Animal-Men steal the canoe and set off across the ocean. When the Whale Man "grew tired of his friend's attention and storytelling" ("Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms") he rose to find his canoe was gone and he realizes he has been tricked. The Whale Man grew angry and he "pounded the Starfish Man until he fell senseless onto the rock, from which he slid onto the sand. There he lies to this day, all squashed out in the water" ("The Whale Man and His Canoe"), but not before Starfish Man was able to land one tremendous blow to Whale Man that resulted in opening a hole in Whale Man's head.

In the other version of the story, Whale Man "beat the starfish unmercifully" and "made great ragged cuts in the faithless creature" and that is why the starfish has a "very ragged appearance, and always hides himself in the sand" ("Why the Whale Spouts, the Starfish is Ragged, and the Native Bear has Strong Arms"), but native bear (Koala Man) managed to row to land before Whale Man, who dove into the water, could catch them. As for Whale Man, he swam out to retrieve his canoe, to no avail, and can be seen still circling around Australia "spouting water through the hole in his head, made by the Starfish Man when they fought that day, way back in the Dreamtime,"[69] pining for his lost canoe. Other versions of the tale relay that the island off of Australia was formed from the canoe that was pushed back out to sea and sunk. And though their friendship ended, both whale and sea star reunite in the sea, giving credence to one Aboriginal belief that law is in the sea, claimed by Aborigine Kenneth Jacobs, "We do not carry it [the law] around in a book. It is in the sea. That is why things happen when you do wrong things. That sea, it knows."[70] Both Starfish Man and Whale Man were transformed from men

[69]Ibid. p. 54.
[70] Qtd. in Vickie Grieves, "Aboriginal Spirituality: A Baseline for Indigenous Knowledges Development in Australia," *The Canadian Journal of Native Studies*, vol. 28, no. 2, 2008, p. 371.

into animals, bearing the history of their past selves, indicating that all creatures are on a horizontal plane and physical forms do not append hierarchy.

There is an "otherness" to us that eludes us. Sea-Star Man volunteered to trick Whale Man, although he professed to be his best friend, demonstrating that relations are complex and not solely chivalrous. The self is in constant negotiations with itself, and the world, acting and reacting, and even caught off guard. The transformation signifies a permanent impermanence, a liquidity, to every being (and thing) and nothing escapes. Though Sea Star Man is a trickster whose motivations are ambiguous, he illustrates the fact that every being and thing is a ghost of some other being or thing, and exterior appearances are just a memory of something else.

According to Stanner, stories provide a foundation for Aborigines to take their place within "an indefinite ancient past"[71] and are not estranged from the past, such that customs also include the belief that reality is informed by the fantastical and shadows. Sea Star Man was transformed into a sea star to illustrate that the entire world is our uncanny double. The materiality of Sea Star Man and his alter ego, the actual sea star, communicate the instability of form, hence, the instability of reserving the presence of a soul for one creature alone. Sea Star Man is decried as a "faithless creature" who "betrays" his friend Whale Man, yet it is inconstancy and fickleness that spawns new forms from existing ones, showing a connectiveness. Neither Sea Star Man nor Whale Man are estranged from themselves, rather they reveal other parts of themselves. The regeneration is a physical reminder of the interwoven nature of all things and that the soul, consciousness, self-awareness, and all its forms, are regenerated in everything.

[71]Ibid. p. 30.

Vision: Seeing the Light in the Shadows Within

Sea stars see. A compound eye similar to those found in clams designed to detect rapid movement rests on a modified tube foot on the bottom tip of each ray. Though the image formed is not sharp, sea stars are able to lift their rays and bend the tip to take in their surroundings. The fact that sea stars have eyes was first documented in 1780,[72] but only recent studies have discovered a unique purpose for development of those eyes; namely, a navigation tool for way finding, specifically finding the way back home. Feeding and mating take place at home and if a sea star is dislodged and carried away, orienting itself in order to go back is crucial. Marine biologists Anders Garm and Dan-Eric Nilsson were among the first investigators of the use of vision in sea stars and concluded that, "Given their ecology and close association with coral reefs, it seems likely that they use visual cues to discriminate reef structures from the open sea in order to navigate towards their preferred habitat."[73] Only sea stars with intact eyes were able to navigate their way back home, although experiments indicate that sea stars successfully use vision to orient themselves back home only if they have travelled a short distance, specifically one meter.[74]

Site location does not appear to select for sea stars with or without eyes as experiments showed that twelve separate species of sea stars from shallow to deep Greenland waters were all found to have eyes.[75] In a constantly mobile space characterized by continuous change, eyes add another layer of security, especially as ambient light declines the deeper the descent into the sea.

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[72]J.E. Smith. "On the Nervous System of the Starfish *Marthasterias glacialis*," *Philosophical Transactions of the Royal Society of London*, vol. 227, no. 542, 1937, pp. 111–173.
[73]Anders Garm and Dan-Eric Nilsson. "Visual Navigation in the Starfish. First evidence for the use of vision and eyes in starfish," *Proceedings of the Royal Society, London B*. vol. 281, no. 1777, 2014, p. 1.
[74]Ibid. p. 4.
[75]Marie Helene Birk, et al. "Deep-sea Starfish Have Well Developed Eyes in the Dark," *Proceedings of the Royal Society Biological Sciences*, vol. 285, no. 1872, 2018, pp. 1-9.

Visual guidance in sea stars remains a mystery in terms of truly knowing the extent of their full capabilities and we have yet to know the complexity of their sense organs, but we do know that selection for eyes in sea stars is energetically expensive to produce. The protein known as PAX 6 regulates the expression of vision and the structure of eyes in a wide array of species and "displays obvious similarities across the animal kingdom, and this has been taken as evidence that the last common ancestor of all animals already had eyes."[76] Visual information processed by the brain allows the sea star to monitor what is happening and consequently monitor how it will respond.

Sea stars filter out smaller objects and focus on contrasts between large objects and the water, thereby tuning out distractions. This is aided by physiology and morphology, that is, the biological structure and shape of the sea stars' eyes. The low visual acuity and low speed at which an image forms and is translated by the nervous system, according to the behavioral analysis of the leading researchers in this field suggests that the hypothesis that sea stars primarily see to "ensure that they do not move away from the reef"[77] is plausible. Vision also serves to counteract the effects of "multidirectional currents and omnipresent chemical cues"[78] swirling in the water. In a world where it is easy to lose one's bearings, where the line between being a predator or a prey is faint, vision supplies an extra measure of security.

The sea star's attachment to home, along with their fascinating mannerisms, captured the attention of 17th century naturalist Georgius Everhardus Rumphius, who studied the natural flora and fauna of Indonesia and published his findings in *The Ambonese Curiosity Cabinet*. He

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[76]Michael Land and Dans-Eric Nilsson. *Animal Eyes*, Halico, 2012, p. 7.
[77]Anders Garm and Dan-Eric Nilsson. "Visual Navigation in the Starfish. First evidence for the use of vision and eyes in starfish," *Proc. R. Soc. London B.* vol. 281, no. 1777, 2014, p. 7.
[78]Robert Sigl, et. al. "The Role of Vision for Navigation in the Crown-Of-Thorns Sea Star, *Ancanthaster planci*," *Scientific Reports*, vol. 6, no. 30834, 2016, p. 1.

writes, “when they [sea stars] see thunder storms approaching, grab hold of many small stones with their legs, looking to weigh themselves down, or hold themselves down as if with anchors, so they will not be tossed back and forth by the waves.”[79] Rumphius was projecting his interpretation onto sea stars; however, in consideration of the fact that their homes are responsible for their fitness, namely, feeding and reproduction, it is reasonable to assume sea stars willfully cling to the place they know.

Knowing and its associate, learning, is often correlated with vision. According to the creative experiments conducted by 19th century physiologist William Preyer, sea stars have the capacity to learn. Preyer rigged all manners of contraptions to imprison sea stars in various Houdini-style traps, using all manners of restraints, and documented the variability of novel arm combinations sea stars worked out until they successfully achieved freedom. Preyer believed that sea stars were “intelligent” and able to “improve through experience,”[80] leading to the hypotheses that their nervous system underwent changes as they learned. Preyer was fixated by the notion of connections and speculated on whether or not there existed a connection between the brain and the soul. That inspired his experiments on the ability of sea stars to purposefully “see” their way out of a situation. A similar interest captured 19th century biologist Carus Sterne, who published an essay titled “Five Souls with But a Single Thought: The Psychological Life of the Starfish.” Sterne marvels at the fact that each ray of a sea star possess its own nervous system, its own “brain,” so “that the psychical and mental guidance of these animals is entrusted to a board of five members who possess, it is true, sentient communication with each other, but

[79]Georgius Everhardus Rumphius. *The Ambonese Curiosity Cabinet*, Yale University Press, 1999, p. 68.
[80]Qtd. R. J. Herrnstein. “Nature as Nurture: Behaviorism and the Instinct Doctrine,” *Behavior and Philosophy*, vol. 26, no. 1, 1998, p. 98. The original writings of William Preyer are in German.

act without the intermediation of a presiding officer."[81] He notes the acrobatic precision that each ray exhibits as well as their ability, and willingness, to relinquish control to other rays, and writes, "we were here confronted with a five-fold Siamese monster as it were, in which five separate persons were brought mentally under the same guidance or where five minds had to pull, simultaneously, one rope."[82] He continues to rely on literary references to articulate the connection between biology of a species and essence of a species. An essence of self-awareness is elucidated by the "wonderful fact that a starfish which fastens its arms to everything possible never seizes its own arm and thus, like Moliere's miser, in its visit to its oyster beds never catches itself for a thief."[83] The insinuation here is that the sea star has an essence of itself which is more than meets the eye. Expounding on the tenacious determination of sea stars, Sterne likens sea stars to the fictional, invincible, adventuresome character Baron Munchausen, remarkable for accomplishing impossible feats, who Sterne admiringly states is able to "pull one's self out of a swamp by the tops of one's boots,"[84] praising sea stars for their tenaciousness, and remarkable feats that defy expectations to demonstrate its ability to know itself in its environment.

Those sea star experiments influenced the thinking of early 20th century zoologist and eugenicist Herbert Spencer Jennings, who writes: "When the established truth that the behavior of the lower organisms is specially characterized by variability and changeability is recognized, we shall have fewer dogmatic statements as to the precise limitations of these animals and as to what they are *forced* to do under certain outward conditions."[85] His own observations

[81]Carus Sterne. "Five Souls with But a Single Thought: The Psychological Life of the Starfish," *The Monist*, vol. 1, no. 2, 1891, p. 249.
[82]Ibid. p. 249.
[83]Ibid. p. 249.
[84]Ibid. p. 249.
[85]Herbert Spencer Jennings. *Behavior of the Starfish Asterias Forreri de Loroil*, University Press, 1907, p. 152.

documented that sea stars do not move randomly and he argues that instinct is an overarching general term that is imprecise in relation to the capabilities of sea stars and what is yet unknown about them.

Impressed by their decision-making capabilities, Jennings marveled that "The starfish is not hampered by any consideration of anterior and posterior; it may move with any one of its rays in the lead so that its possibilities as to variation and direction of locomotion are really unlimited."[86] The sea star seems prepared for all that nature presents. With their five rays, each of which can take the lead of the whole animal through maneuvers of tube feet extension, attachment, withdrawal, twisting and stepping, they coordinate towards a goal. This is the lesson that Jennings concludes as he sums up the value of his research: "Perhaps the most important thing developed in this paper is the demonstration of the variability, modification, unity, and adaptiveness in the main features of the behavior of the starfish."[87] With that, he rebukes the idea that sea stars are merely reflex organisms, especially noting the fact that sea stars live in a highly variable, unpredictable fluid environment.

Seeing puts things in perspective. Of course, to see in a physical sense is the ability to form a picture of the world in the "mind's eye." The eye is directly linked to the brain to form uninterrupted pictures of the world. But, for the simplicity of just stating there is a line connecting our eyes to our brains, we are still learning more and more about the human brain we still know very little about. In fact, our brain informs our vision, telling us what to pay attention to as a product of stored knowledge, and is divided into two aspects: orientation and discovery. Using "orientation attention," our eyes keep us from walking into objects and out of harm's way, as much as we are willing to believe what we see or are alert enough to react. In order to

[86]Ibid. p. 155.
[87]Ibid. p. 183.

understand what we don't quite have a full picture of or just catch at the corner of our eye, we rely on "discover attention" to recall blueprints of a similar experience; seeing a replica that draws our interest to uncanny remembrances.

Seeing is often used synonymously with enlightenment, as eyes inform the brain, thus connected to the notion of reason and arbiter of the senses. Therefore, to see is to make sense of the world. How humanity envisions itself in the world, either a part of or apart from, elucidates the struggle to see from various perspectives. Even Charles Darwin admits being fascinated and afraid of the power of the eye and writes in a letter to his friend Asa Gray (regarded as the Father of Botany), "The eye to this day gives me a cold shudder, but when I think of the fine known gradations, my reason tells me I ought to conquer the cold shudder."[88] Darwin was uneasy about the ways in which the eye developed to limit light and distance, adjust for light, and to fill in what is beyond sight. A similar feeling befell anthropologist, scientist, essayist, and poet Loren Eiseley who professed, "One does not meet oneself until one catches the reflection from an eye other than human."[89] We do not know if it is because that eye is more inquisitive or honest that Eiseley obtains a clearer picture of himself, but we can imagine that the eye of another creature internalizes Eiseley's gaze. In another essay, Eiseley's exuberance for the development of the eye as a product of the meeting ground between the abiotic and biotic is seen in this homage: "A billion years have gone into the making of that eye; the water and the salt and the vapors of the sun have built it; things that squirmed in the tide silts have derived it."[90] Eiseley employs those eyes, born in the "simplest" of creatures to be passed on to more "complex" creatures, to look for himself and bring himself back to the world.

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[88]Charles Darwin. Darwin Correspondence Project, DCP-LETT 2701, Letter to Asa Gray, February 8/9, 1860.
[89]Loren Eiseley. "The Star Thrower," *The Unexpected Universe*, Harcourt, Brace, and World, 1969, p. 16.
[90]Loren Eiseley. "The Great Deeps," *Immense Journey*, Random House, 1957, p. 45.

Eiseley dedicated his life to digging up pieces of past lives embedded in stone tombs, and in the process, became a "fugitive" from the aseptic approach of merely putting back together the bones of being human. He embraced science but felt there was more to humanity than objective truths or mere biological relations and turned to what he called the "concealed essay" to dredge up the spark of life. His writings display a vision to embody the world of the alchemist who is able to see through an object, excavate its essence, and illuminate the shadow within. In reaching out for a belonging, Eiseley seeks to see himself as more than an illusion; more than just a fleeting form and a whirring of gears animated by electrons. In many of his writings, Eiesely alludes to the evolutionary journey of all species, including humanity, through time and form, and the projection of all life in other life, as a desire to affirm that life can be a collection of selves. Though his convictions waver, he maintains faith in the power of insight. It is through an experience with sea stars, presented in the semi-autobiographical essay "The Star Thrower," that Eiseley contemplates the "miraculous unexpectedness" of humanity in the world despite our "statistical impossibility," and that the soul, known or not, yearns and struggles to affirm our connections. In saving sea stars from suffocating in the sand, Eiseley is able to find himself and accept the contentious, push and pull relations creating life.

Marine invertebrates were not strangers to Eiseley. His autobiography *All the Strange Hours* reminisces on the world he created after reading *The Home Aquarium: How to Care For It* by Eugene Smith and built his own aquarium out of glass and wood and populated it with "local invertebrates." He refers to the book as a "hidden teacher" and in applying the lessons, he realizes, "one learns unconsciously about ecological balance." He marvels at our biological existence, though he feels estranged by it and longs for something he cannot see. In "The Star

Thrower," Loren Eiseley shipwrecks himself, spent and desiccated, on the shores of Costabel,[91] wandering the coast alone, separated from the world and hiding behind dark-lensed glasses. His connection to the world had been deadened by narrowing his view through the "objective" lens of science. In turn, he laughs at the local resident who, in a matter-of-fact tone, states that her father "reads a goose bone for the weather."[92] Nursing primitive beliefs are preposterous to Eiseley, further dislocating him from an imaginative space, as he withdraws from the world. Detached and alienated from the world after years spent documenting death to attempt to piece together and articulate the path leading to the development of humanity, Eiseley finds himself a fugitive from the living.

His place of refuge becomes a rocky intertidal shore described as a war zone "littered with the debris of life" where shell seekers ravage the living and the dead to fill cooking pots or decorate window sills. Surrounded by death, he repeatedly likens himself to "an eye in a skull" bereft of individual will or of *being*. In telling his personal story, Eiseley, seeks to recuperate the natural history of being human amidst the natural history of all other species, not to form a kinship, entirely, but to revitalize the mystery of being, innervate the surprise of being alive and become enchanted with the unusual condition of being human as an ongoing story. In seeing sea stars, and their struggle for life, Eiseley reconciles a double vision of science and humanities, where the soul can be both the thoughts of the mind and the unknowable, and in turn, electrifying the invisible which keeps us hopeful, and accepts the illusiveness and elusiveness of being

[91]In a letter to a friend, Loren Eiseley remarked that he "picked up the name Costabel "by listening to a sea shell on what has been called the coast of illusion" (qtd. *Loren Eiseley*, by Andrew Angyal, Twayne Publishers, 1983, p. 81).
[92]According to the 1980 "Old Farmer's Almanac" a goose bone left to dry on a windowsill would either turn white, purple, or blue, based on the amount of dietary fatty oil the bird had stored, indicating the preparations the bird had made in anticipation of the severity of a coming winter.

human. He longs to accept what he knows to be the reality of all species "climbing in or climbing out of the world," as a movement of elements rather than death.

On the shores of Costabel, Eiseley stumbles upon sea stars struggling to breathe after a storm stranded them on shore, suffocating in the sand, soon to be scooped up by eager locals and tourists. At the beginning of the essay, Eiseley sees himself as desiccated and drained of physical substance, continuously referring to himself as "an eye glaring in the skull." He writes that with the "same eye, some have said, science looks upon the world" to wonder how it is that he is suspended between a world of facts he observes and a world of riddles and puzzles that do not call for a solution. Leaving those riddles and puzzles in pieces illustrates how the idea of a soul acts as a defense mechanism to protect humanity from being a mere shadow. Eiseley seeks to unite light and shadow, rather than delineating them as good and bad respectively, writing, "Huge shadows leaped triumphantly after every blinding illumination." He is keenly affected by a desire to believe in a dimension of his self that is beyond observation, beyond sight.[93] Yet, he presents himself as a man stripped to bare minerals, the calcium and collage making up the skeleton, he continues to link himself with death, likening himself to "an eye like a pharos light," in reference to the lighthouse in Alexandria, Egypt, dedicated to Poseidon, Greek god of the Sea, which in contrast to its intended purpose of guiding seafarers to safety, drew them into the shallows to their watery graves. The eye keeps him from seeing beyond what is tangible, yet also informs him that sight is deceptive.

Before he encounters the star thrower, every eye he encountered was one of futility and endings. His "pharos" searching eye pauses before the sand-bleared "dark-lensed eyes" of an octopus, and he is consumed by a sun shining with "an ominous red glare amidst the tumbling

[93]Writer Richard E. Wentz describes Loren Eiseley as "a contemplative who gazed into and *through* the otherness of reality" in his article, "The American Spirituality of Loren Eiseley," *Christian Century*, vol. 14, 1984, p. 432.

blackness of the clouds." Pressuring himself to maintain an objective view of life under the scorching eye of the sun, he suddenly spies a "gigantic rainbow of incredible perfection" where the "supernatural had touched hesitantly, for an instant, upon the natural" and the "star thrower" standing at the foot of the rainbow, "unconscious of his position" and "gazing fixedly at something in the sand. Eiseley approaches the "star thrower" and asks him if he is a collector. The "star thrower" answers, "The stars throw well. One can help them,"[94] assuring him that each star had a fighting chance to live, and humanity has an inherent impetus to be part of the creative lives of other creatures, despite the fact that the "sea rejects its offspring" as the surf "casts them repeatedly back upon shore." The "star thrower" and his conviction captivated Eiseley's watchful eye, beckoning Eiseley to participate: "He looked full at me with a faint question kindling in his eyes, which seemed to take on the far depths of the sea."[95] Eiseley longs to join him, but hesitates, returning to the eye embedded in his isolating world view.

The "terrible eye" with its indifference and the "cold, world-shriveling eye" circling inside Eiseley pull him away, though he stops and turns to look at the star thrower continue with his quixotic quest to return each living sea star back to sea. His reasoning self could not see beyond the futility of life and death or accept the balance of positioning an eye to science and an eye to the interior mystery of the self, even though he yearns to integrate the two. Eyes feature prominently in Eiseley's writings and demonstrate his working toward unifying a vision of self as both a physical specimen and an ambiguous jumble of inconstant, unconscious feelings. Eiseley retreats from the sea stars and star thrower, but the haunting specter of the eye taunting his resolve to identify with the dead rather than the living pulls at him in his dreams. The eye

[94]In biblical Hebrew there is not a defined term for the word "color." The Hebrew word for eye ("ayin," ויע) is used instead. The rainbow honored bond reflects the covenant between God, Noah, and all humanity and all species after the Flood in Judeo-Christian beliefs resurging the convening of supernatural and natural.
[95]Loren Eiseley. "The Star Thrower," *Unexpected Universe*, Harcourt, Brace, and World, 1969, p. 72.

draws him inward to contemplate the distinction, and worth, of "every individuality" and toward celebrating rather than mourning the fact that evolutionists "saw life rushing outward from an unknown center" evidenced by the "reptile under the lifted feathers of the bird." In a dream, he is met with a "turning eye within the skull" that then becomes "conscious of another eye that searched it with equal penetration from the shadows of the room" which is the first time we see two eyes paired together. The self-observing eye transforms into the eye of the "dead cephalopod" and continues transforming into the "beaten, bloodshot eye of an animal from somewhere within my childhood experience" and lastly, into the eye that saw through him with a vision which had already "absorbed whatever terror lay in that abyss," the eye of his deaf and mute mother whose inability to communicate shut her off from the world. These eyes direct Eiseley to rekindle the figure of the alchemist who sees spirit in matter.

Sea stars surfaced memories and insight. He opens his eyes to feel and believe in the magic of the self: "Deep-hidden in the human psyche there is a similar injunction, no longer having to do with the longevity of the body but, rather, a plea to wait upon some transcendent lesson preparing in the mind itself." He draws himself out of himself in order to see himself again. He joins subjective and objective being, a theme he continues in "The Golden Alphabet," with the warning, "if we fail to use both pairs of spectacles equally, our view of ourselves and of the world is apt to be distorted, since we can never see completely without the use of both."[96] He also writes of the eye of "God" inhabiting life, and, by default, life must reflect "God," saying in "The Long Loneliness" that "It is as though man and porpoise were each part of the same great eye which yearns to look both outward on eternity and inward to the sea's heart."[97] It is this

[96] Loren Eiseley. "The Golden Alphabet," *The Unexpected Universe*, Harcourt, Brace, and World, 1969, p. 125.
[97] Loren Eiseley. "The Long Loneliness," *The Star Thrower*, Harvest Book, Harcourt Inc., 1978, p. 43.

ecstatic, hypnotic release from a mechanistic view of his self to an abyssal self without absolutes that brings him to the personal.

Haloed by the series of eyes, Eiseley sets out to join the star thrower. With a newly resurrected sense of self, Eiseley sees the infinite disguises of nature as enticing, writing, "I flung myself as forfeit, for the first time, into some unknown dimension of existence." He becomes "part of the rainbow;" "another thrower" attached to the world, and aware that, "The fate of man is to be the ever recurrent, reproachful Eye floating upon night and solitude. The world cannot be said to exist save by the interposition of that inward eye; an eye various and not under restraints to be apprehended from what is vulgarly called the natural."[98] No longer paralyzed by the reality of the elusiveness of form, Eiseley sees himself as belonging to the struggle, and not alone.

Sea stars changed his outlook and the "eye turned and turned," guiding him to the "great many-hued rainbow" where he finds himself a "modern" who "reads goose bones for the weather of his soul."[99] He sculpted a new perspective that exceeds the measurement presented by the "encrusted eye in the stone [that] speaks to us of undeviating sunlight" and exceeds the "calculating planner" within to welcome the "trickster" character of nature, and, conversely, in himself. Admitting that a "kind of maleficent primordial power persists in the mind as well as in the wandering dust storms of the exterior world" where he and all of humanity emerge. He is a "whirlwind" of comingling molecules, and more, contented with the relationship between the universe and humanity as immeasurable, as he states, "The nothing had miraculously gazed upon the nothing and was not content." The eye mediates his thoughts and is "one of nature's infinite disguises," he muses as he moves away from viewing *being* as an "inchoate void." Eiseley ecstatically turns from a short-term view to a long-term view: "As the spinning galactic clouds

[98]Loren Eiseley. "The Star Thrower," *Unexpected Universe*, Harcourt, Brace, and World, 1969, p. 88.
[99]Ibid. p. 77.

hurl stars at worlds across the night, so life equally impelled by the centrifugal powers lurking in the germ cell, scatters the splintered radiance of consciousness and sends it prowling and contending through the thickets of the world."[100] No longer a distant spectator, he feels himself a part of the "circle of perfection" inseparable from it all. He tells the star thrower, "Call me another thrower." In naming himself, he enters the circulation of life on "an infinitely gigantic scale" that looms beyond sight. He ends the experience:

> I picked up a star whose tube feet ventured timidly among my fingers while, like a true star, it cried soundlessly for life. I saw it with an unaccustomed clarity and cast far out. With it, I flung myself as forfeit, for the first time, into some unknown dimension of existence. From Darwin's tangled bank of unceasing struggle, selfishness, death, had arisen, incomprehensibly, the thrower who loves not man, but life. It was a subtle cleft in nature before which biological thinking had faltered.[101]

His eye-opening encounter shifted his point of view. He envisions his "mattering" as part of an indivisible movement with a colorful cast of participants, all of whom participate in his unknown being and becoming.

Chemosensory: Communicating with the Microcosm Within

Sea stars communicate with one another, with other species, and with their surroundings. Through specialized tube feet located at the tips of their arms,[102] sea stars read, and respond to, the flow of "infochemicals" emanating from every animate being, as well as emitting their own presence to would-be predators. They produce their own frequencies founded on olfactory reception. Through an evolutionary need, sea stars developed an *invisible* to the naked eye form

[100]Ibid. p. 79.
[101]Ibid. p. 96.
[102]Marine Biologist Jelle Atema specializes in chemical ecology/chemosensory signals and how they travel in water, as well as how particular species take advantage of smelling their world and found that sea stars typically raise their "arms" above the substrate they rest on to detect "ambient overhead odour." Atema also concentrates on the problems of detection due to ways in which odour travels and obstacles present, which he summarizes in "Aquatic odour dispersal fields: opportunities and limits of detection, communication, and navigation" in the text *Chemical Ecology in Aquatic Systems*, ed. Christer Brönmark and Lars-Anders Hansson, Oxford University Press, 2012.

of communication to connect them to other sea stars and with other species. Their relations with their environment and all their life functions rely on the ability to soak in the invisible stream of chemical signals, the unspoken language of the creatures of the sea. Sea stars produce and release complex arrays of chemical compounds arranged and bonded into unique molecules which continuously "speak" of their aliveness. These molecules tether diverse species together in vital bonds, influence social behavior, and contribute to morphological changes, affecting all types of ecological interactions. Being chemically literate, translated as the ability to understand the signals wafting and circulating in the currents, also determines when sea stars mate. Specific olfactory information signals sea stars to release gametes and sperm into the water column to fertilize, and also what to eat, and where they live. It also determines whom they come into contact with and who comes into contact with them, which, in a strange twist in evolutionarily terms, impacts the shape of other species. It is a language of perception which a sea star deciphers to gain access to the rumblings of the invisible within the visible. Like alchemists who understand that within each living and non-living being there rests a hidden essence aching to be excavated, sea stars sense the invisible essence in other creatures via the invisible emission of chemicals.

The language of sea stars fascinated evolutionary biologist George J. Romanes,[103] a close friend to Charles Darwin and one of the first scientists to record observations of chemosensory

[103]George J. Romanes documents the observations from his crafted, behaviorally-motivated experiments on sea stars, "Observations on the Physiology of Echinodermata," *Zoological Journal of the Linnean Society*, vol. 17, no. 99, 1883, pp. 131-137: "Selecting one individual and putting it in a large dish which was filled with sea-water, I found that I could at pleasure lead the starfish in any direction I chose by holding a morsel of crab an inch or two from the end of one of its rays, and continuously withdrawing the food as the starfish continually approached it. Moreover, I could at any time reverse the direction of advance by transferring the food to the opposite side of an animal and holding it for a short time near the tip of a ray. Thus, I could entertain no doubt that starfish have a well-developed sense of smell, which enables them quickly and accurately to perceive the direction from which the odour of food is coming, provided that the distance of such food as I have named is not more than a few inches from the animal."

behavior. He wrote, "I found that the sense of smell occurs in Star-fish, though it is not localized, being in fact distributed equally over the whole of the ventral surface of the animal, to the exclusion, however, of the dorsal."[104] And because of the sense of smell, along with the witnessed "acrobatic" and "righting" behavior exhibited, which are "strongly suggestive of true powers of perception," Romanes hypothesized that sea stars intentionally orient their behavior with respect to past experiences. Hence, he attests he is "justified in attributing to these animals' faint powers of memory (as distinguished from the association of ideas),"[105] where memory is defined as a "dim idea of an absent object or experience."[106] Romanes claims that sea stars remember and track past experiences when they encounter a new experience and have to figure out their next move. Associating the sense of smell with storage of experiences for creatures that have no central brain revolutionized thinking about the mysterious world of other creatures.

Plumes, patches, and trails of chemical stimuli all represent the irregular randomness of dispersal. The language of that dispersal relays information. For example, mussels, the primary prey of sea stars, secrete a molecule known as KEYSTONEin which is important to building their immune system and formation of the shell; that same molecule attracts sea star predation. Essentially, mussels secrete a language attractive to sea stars. According to the research, "KEYSTONEin has become exploited by sea stars as an honest and predictable contact chemical cue for prey identification."[107] All chemicals contain their own fingerprint, so wading through a world in constant buzz demands that sea stars become attuned to both the quality of the compound mixture, referred to as "spectral contrast" and the quantity of the compound mixture,

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[104]George J. Romanes, *Mental Evolution in Animals, with a Posthumous Essay on Instinct by Charles Darwin*, Keegan Paul, Trench & Co., 1883, p. 348.
[105]Ibid. p. 348.
[106]Ibid. p. 153.
[107]Richard Zimmer, et al. "Keystone Predation and Molecule of Keystone Significance." *Ecology*, vol. 98, no. 6, 2017, pp. 1710-1721.

referred to as "dynamic contrast." The terms were invented by marine biologist Jelle Atema, who specializes in chemosensory biology, to understand how marine species extract useful information from those with whom they share their world. According to his research, chemosensory cues influence how sea stars coordinate their rays to move as a unit towards or away from a scent. Sea stars rely on physical mechanisms of diffusion, turbulence, and current to receive unique chemical profiles belonging to specific organisms, objects, or just the sea. Sea stars orient towards distinct odors and "change leading ray multiple times during their approach to the source"[108] and, since sea stars do not have a central brain, the leading ray shifts control to the "ray receiving the stronger odor stimulation."[109] Chemical signals have "no direction" and are basically aimless and variable, as noted by Atema. The "unlimited possibilities," combined with the physics of odor dispersal, "results in unpredictable signal intermittency,"[110] in part because odor dispersal can collide with other odors or objects and the fact that water is not a homogenous mixture. Atema observed that sea stars "typically raise their arms to detect ambient overhead odour"[111] to minimize interference and contend with the water's boundary layers. Distinguishing odors is crucial to understanding the world around them, therefore, filtering compounds translates into action. A sea star is bombarded with a shower of signals to track and "integrates odour information to derive stable concentration gradients for navigation"[112] as it interprets them to determine a course to follow.

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[108]Jonathan Dale. "Coordination of Chemosensory Orientation in the Starfish *Asterias forbesi*," *Marine and Freshwater Behavior and Physiology*, vol. 32, no. 1, 1999, p. 57.
[109]Ibid. p. 65.
[110]Jelle Atema. "Aquatic Odour Dispersal Fields: Opportunities and Limits of Detection, Communication, and Navigation." *Chemical Ecology in Aquatic Systems*, Eds. Christer Brönmark and Lars-Anders Hansson, Oxford University Press, 2012, p. 12.
[111]Ibid. p. 12.
[112]Ibid. p. 13.

Reading invisible messages flowing in the sea allows sea stars opportunity to exploit resources. Not all creatures read the same way and a heightened "vocabulary" provides an advantage for sea stars, who are generalist predators. Their circular shape is an advantage as research indicates "radially symmetrical invertebrates receive chemical cues from all directions equally well."[113] Sea stars live in a complex and ever-changing ecosystem, surrounded by the flow of "natural effluents" and mediated by, or disrupted by, natural and unnatural barriers, both physical and chemical. Through contact and attenuation to exact chemical cues, they wade through the chatter to enter an invisible world where they comprehend the message necessary for their survival, and ultimately the influence they have on other species, as studies indicate chemical cues also "stimulate the production of prey morphologies that inhibit predation,"[114] such as stronger shells. Other responses include migration of species to higher levels in the intertidal zone. Research indicates that there are "vital links between stimulus production/transmission and behavior, and between individual behavior and large-scale dynamics in the abundance and spatial/temporal distributions of organisms."[115] Therefore, it is prudent to read the waters.

Chemosensory research has made us aware of a world that was present, yet absent from sight or any other written record, and invisible to the naked eye. It bent the space of perception and awakened us to a world we can get closer to knowing as we learn more and more about what we cannot see; it is an entrance into a world of secrets where processes of life are carried out in imaginative ways. This hidden world attracted 19th century seaside western naturalists, who

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[113]Reid Brewer and Brenda Konar. "Chemosensory Responses and Foraging Behavior of the Sea Star *Pycnopodia helianthoides*," *Marine Biology*, vol. 147, no. 3, 2005, p. 794.
[114]Lee B. Kats and Lawrence M. Dill. "The Scent of Death: Chemosensory Assessment of Predation Risk by Prey Animals." *Écoscience*, vol. 5, no. 3, 1998, p. 362.
[115]Richard K. Zimmer and Cheryl Ann Butman. "Chemical Signaling Processes in the Marine Environment," *Biological Bulletin*, vol. 198, no. 2, 2000, p. 177.

viewed the scientific study of sea creatures as a means to dive into the secret language of an invisible creator, and consequently the hidden language swirling inside humanity. In an era demarcated by inventions and discoveries[116] in the field of chemistry, a desire to "talk" with the divine, and discover the presence of the divine within, occupied naturalists, notably Phillip Henry Gosse, who popularized the keeping of in-home aquariums,[117] as well as the use of the microscope to scrutinize the makings of life. As a naturalist, Gosse worked outside the framework of strict science. As he argues, "There are more ways than one of studying natural history. There is Dr. Dryasdust's way; which consists of mere accuracy of definition as harsh and dry as the skin and bone in the museum where it is studied. There is the field observer's way; the careful and conscientious accumulation and record of facts bearing on the life-history of the creatures; statistics as fresh and bright as the forest or meadow where they are gathered in the dewy morning. And there is the poet's way; who looks at nature through a glass peculiarly his own; the aesthetic aspect, which deals not with statistics, but with the emotions of the human mind-surprise, wonder, terror, revulsion, admiration, love, desire."[118] The microscope connects Gosse with himself as part of a cosmology that propels him inward and outward. The microscopic lens acts as an "inner eye" to draw him into a new language of being that is incommunicable, but speaks, and is perceived via invisible relations.

The realm of "subvisibilia" connotes an entire existence "unseen by the unassisted eye." Gosse marvels at the power of the microscope to uncover the "myriad wonders of creation" and the poetry of being human. In the first page of his book, *Evenings at the Microscope, or,*

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[116]The atomic theory, the discovery of approximately thirty chemical elements, the relationships of the periodic table, the birth of organic chemistry, oceanography, physiology, and realization of the cell as the basic living unit were some of the discoveries made in the 19th century.

[117]Phillip Henry Gosse did not invent the aquarium, though he is credited for ushering its presence into the parlors of British society. Non-discriminating in his collection of specimens, Gosse's aquarium housed an eclectic array of species from various shores without concern to the natural habitat and zonation of tide pools.

[118]Philip Henry Gosse. *The Romance of Natural History*, Gould and Lincoln, 1862, p. 3.

Researches Amongst the Minuter Organs and Forms of Animal Life, Gosse presents the microscope as the portal to an unfamiliar world, that unravels further and further to larger and larger unknowns, "Like the work of some mighty genie of Oriental fable, the brazen tube is the key that unlocks a world of wonder and beauty before invisible, which one who has once gazed upon it, can never forget, and never cease to admire."[119] Gosse referred to the microscope as "wonder-showing tube" acting as the interface to discover the secret language of creation, and by proxy, the invisible existence of the soul, made known by looking inside sea stars.[120]

Gosse dissected sea stars and placed them under the microscope, where he probed the elements that made their visible forms: "The substance of which the spines are composed is best seen by crushing the calcareous spines into fragments affords the experienced naturalist, on being presented with the minutest fragment of solid substance, would, by testing it with his microscope, be able at once to affirm with certainty, whether it had belonged to an Echinoderm or not."[121] Gosse dedicated his life to the study of marine invertebrates at sea, at home, and under the scope. He took the sea stars apart and put them back together in his mind, creating a vision of them via the bits and pieces that made them whole. Having spent a year observing life at the edge of the sea, he became attracted by their beauty and their tenacity for self-preservation, enchanted by the "Scores of this pretty Star are exposed, clinging to the wet sides and roofs of the dark passages by means of their sucker-feet," and "Add to this, that the animal is in the habit

[119]Philip Henry Gosse. *Evenings at the Microscope, or, Researches Among the Minuter Organs and Forms of Animal Life*, D. Appletone and Company, 1860, p. v.
[120]Catherine Wilson writes of the history of the microscope as a tool of visualization that resulted in a "new view" in *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, 1995.
[121]Philip Henry Gosse. *An Evening at the Microscope, or Researches Among the Minuter Organs and Forms of Animal Life*. D. Appleton and Company, 1860, p. 319.

of very frequently turning up the tip of one or other of its rays, when the range of vision would take in the zenith,"[122] as if the sea star was aware of its existence outside the existence of others.

Figure 7: Philip Henry Gosse and M. & N. Hanhart, lithographer. *The Aquarium: An Unveiling of the Wonders of the Deep Sea*. John Van Voorst, 1854.

The natural world of the shore, the artificial world of the home aquarium, and the eye of the microscope excited self-examination of the incorporeally individual soul.[123] The microscope focused the material and immaterial into one. In a two-fold counter-intuitive turn, the microscope penetrated through with an illuminating light to peer into the life-building parts of the whole, inspiring reflection on the existence of an invisible self. Gosse associated the study of marine invertebrates with a deeper connection to the divine, thus, an alertness to the uncontainable and indeterminate. The microscopic view of sea stars' insides made naturalists aware that the essence of life was mired in the intricate processes carried out by cells and their constituent parts and at the same time gave evidence of a divine force, sparking thinking about the intricate, interwoven artistry- the mosaic patchwork of all beings- glued onto one canvas. Access to an invisible language aroused intense feeling of interspecies relations. Naturalists such as Gosse and his contemporaries moved back and forth between observations of life at the edge of the sea shore, the glass frame of the home aquarium, and the lens of the microscope, where sensational

[122]Philip Henry Gosse. *A Year at the Shore*, Alexander Strahan, 1865, pp. 174-175.

[123]Philip Henry Gosse expressed the power of the sea and its creatures to evoke unbound relations in the first page of his text *The Ocean* (1854) with the words "Standing on some promontory where the eye roams far out upon the unbounded ocean, the soul expands, and we conceive a nobler idea of the majesty of God."

creatures, believed to be the progenitors of categorically "advanced" species, performed their "theatrics" of living for an audience, inadvertently offering a stage to contemplate the nature of life in all its many uncanny forms.

It was the microscope that made the familiar unfamiliar and acted as an infinite lens producing an image of a deeply present inner self outside the measurable realm. It was a tool for drawing out the invisible elements of life and focused an intense examination of the "unseen." It also offered a means to reconcile science with spirituality and an opening to believe in an unobserved essence via an observable record. Specimens placed under lens of the microscope were continuously broken apart and put back together, sparking conceptualization of the self beyond sight, with an ineffable language all its own. The real and the speculative blurred together and the soul, the essence, the sentience, or the consciousness of the individual, synonymously difficult to capture, earned legitimacy. The seen and unseen turned worlds inside out, rendering the real presence of ungraspable, unavailable truths. Author Lynn Gamwell cites the microscopic visibility of sea creatures previously bereft from view as the tool providing a new vocabulary for 19th century artists. The artists turned to "pictures of sea creatures invisible to the naked eye" to "symbolize the insights into dreams and fantasies issuing from the asylum and consulting room" and of its power to imagine more, as "shapes and colors inspired the imagination, and also heightened sensation of being surrounded by unseen nefarious forces."[124] The microscope provided a scope for the self to be more than meets the eye.

All manners of publications on the magic power of the microscope to draw the public into a reflective mood lined the shelves of 19th century bookstores. One of the firsts includes *The Wonders of the Microscope; or, An Explanation of the Wisdom of the Creator, in Objects*

[124]Lynn Gamwell. "Beyond the Visible: Microscopy, Nature, and Art," *Science*, vol. 299, no. 5603, 2003, pp. 49-50.

Comparatively Minute; Adapted to the Understanding of the Young Persons (Anonymous, 1806). It asserted, "it [the microscope] improves the faculties, exalts the comprehension, and multiplies the means of happiness, and should, therefore, be rendered the means of exciting in our breasts emotions of gratitude to that great and good Being to whom we are indebted for life, and all its various sources of enjoyment."[125] The author extolls the use of the microscope to get to the intricacy of the divine, with an underlying reference to the fact that individuals are made in the image of the divine, and contain the divine, or the soul, within. As the author exults, "The works of nature are no less admirable for their variety than for their beauty! Even in such things as appear the most alike, a strict examination will discover differences beyond all human conception."[126] The author proceeds to illustrate the power of the microscope to distort our understanding of the world, of meaning itself, proclaiming that outward appearances are tamed poses protecting the solitary truth of the soul, "The finest writing, such as the Lord's prayer in the compass of a silver penny, when examined by a microscope is shapeless, uncouth, and barbarous, as if written in the coarsest characters."[127] The formless, wild, and outside the scope of civilization is communicated in the magnitude of what is invisible to the naked eye.

The microscope illuminated the particulars while still retaining a vision of the whole specimen, placing past and present, living and dead, into one and rousing reflective awareness of what speaks to us from within us. The us hidden though present is made known to us through what is commonly assigned to the soul-searching question "Who am I?" as the text within a text was shrunk beyond sight. The microscope opened a passage into strange realities, and as a result, inspired reflective inquiry into an *interiority* reaching beyond our nearsightedness. Amateur

[125]Anonymous. *The Wonders of the Microscope; or, An Explanation of the Wisdom of the Creator, in Objects Comparatively Minute; Adapted to the Understanding of the Young Persons*, Tabart and Co., 1806?, pp. 2-3.
[126]Ibid. p. 23.
[127]Ibid. p. 112.

naturalist and author George Henry Lewes writes of the microscope's power to pull him deep into the myriad of paradoxes residing within creatures and describes it as a tool which "brings us into the very homes and haunts of life"[128] noting of the pedicellaria (defensive projections of sea stars) that "when magnified it looks like a pair of pincers."[129] Just like the knobs of a microscope work to focus or distort vision, we are made aware that outward appearances fail to objectively classify all that exists to speak of the self. Lewes also rhapsodized on the infectious hold of the microscope on his waking and dreaming moments, confessing, "The hours I spent thus, fled like minutes, and left behind them traces as of years, so crowded were they with facts new and strange, or, if not absolutely new, yet new in their definiteness, and in the thoughts they suggested. I could not look at anything intently, but that chance was that some play of light would transform itself into the image of a mollusc or a polyp. THE THINGS I HAVE SEEN IN TAPIOCA PUDDING…!"[130] The microscopic view of marine invertebrates provided a stage for thinking of the whole nature of shared existence, the strangeness of life, and to become illuminated by the swarming, envelopment of living.

Other writers stressed how the observational precision offered by the microscope provided a check on possible excesses of direct self-observation leading to self-absorption. Naturalist and author Charles Kingsley affirmed that knowing the world through the lens of nature indelibly links us in a world that "becomes transparent." The divine world captivated Gosse and Kingsley, both devoted to uncovering the language of God, and by default, the intangible aspect of being human. Kingsley specifically advocated for the study of nature as a fact-based, worthy enterprise, imperative for preventing the imagination from "being thrown

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[128]George Henry Lewes. *Seaside Studies at Ilfracombe, Tenby, The Sicily Isles, and Jersey*, Blackwood and Sons, 1860, p. 58.
[129]Ibid. p. 432.
[130]Ibid. pp. 35-36.

inward, and producing a mental fever, diseasing itself…by feeding on its own…morbid feelings" and to avoid "heating the brain or exciting the passions." [131] It was the peering into concealed worlds spiraling beyond sight, the hidden nooks and crevices of sea creatures through the light of the microscope, which inspired better-grounded imaginative speculations about the essence, the soul, the consciousness, of the individual.

The paradox of the microscope lies in its capacity for revealing an interconnectedness between species while simultaneously engaging provocative feelings of being more than what is seen. The world of appearance was not to be trusted. In fact, reliance on what is made visible to the eye adopted an air of suspicion. In the anonymous text, *How to Live in London; or, the Metropolitan Microscope and Stranger's Guide* (1828), the reader is guided on a tour of the "specimens" of London, namely, the types of charlatans and criminal assortments marking particular regions, where humanity is taxonomically parceled into groupings using the methods of classification found in natural history and a microscopic aesthetic. The book begins with a warning to pay attention to what lies beneath the wayward flocks cloaked behind a veneer of respectability. These observations are all vouched for by two gentlemen who are "known" in society and in order to infiltrate the underside of life, voluntarily sought out the company of the "ill-reputed" in order to "obtain their secrets" and expose their "attack on the souls" of unsuspecting innocents. The world of appearances was unreliable. The text penetrated through superficiality to expose charlatans, but also initiated the public into imagining an inner truth present in all individuals and outside the scope of visibility. The authors promise to reveal life as it really is behind the façade and "various deceptions" and "From the most ludicrous scene,

[131]Charles Kingsley. "How to Study Natural History," *Kingsley, Scientific Lectures*, 1853, p. 294.

knowledge of life and of human nature may be extracted."[132] They direct us to scrutinize what we see and look closer at things, turning the focus to our interiority.

Every part of the organism brought into view under the light of the microscope gave way to more mysteries and conceptualization of what is missing, what remains unseen. In observing the sea star in its natural habitat, Gosse focuses on the economy of features fit for the biology of living, noting the function of its body parts as "amply sufficient for its needs." From its habit of movement and behavior, he surmised that the sea star is "probably conscious of the difference between light and darkness and may also discern the sudden approach of any object,"[133] drawing attention to individual perception and reaction. Gosse was engrossed with the ability to observe and in *The Aquarium: An Unveiling of the Wonders of the Deep*, he admires the ways in which sea stars, "wind their flexible bodies, now and then turning back a ray, from which the pellucid suckers are seen stretching and sprawling; and as they mount the glass, not only can their hues be admired, but the exquisite structure of their spines, and the mechanism of their suckers, can be studied at leisure." He notes how sea stars intentionally move about the tank by "gliding motion produced by the attachment and shifting of hundreds of sucker feet, which are protruded at will."[134] Hypnotized by their coordinated control of every physical aspect of themselves, the sea stars evoked a poetic reverie for the mysteries shrouding the definition of life, eminently found through the lens of the microscope where Gosse expounds on an "unspeakable" creator who guides our questioning of our very selves in producing the wealth of dazzling creatures whose complexity is often overlooked. He writes, "To us invisible, or dimly seen. *In these thy lowest*

[132]Anonymous. *How to Live in London; or, The Metropolitan Microscope and Stranger's Guide*, Joseph Smith, 1828, p. xi.
[133]Philip Henry Gosse. *A Year at the Shore*, Alexander Strahan, 1865, p. 176.
[134]Philip Henry Gosse. *The Aquarium: An Unveiling of the Wonders of the Deep*, John van Voorst, 1854, pp. 56-57.

works; yet, these declare, Thy goodness beyond thought, and power divine."[135] The very existence of these creatures provokes thinking of a material and imaginative self that is bound to all other creatures.

What is available for observation at the highest degree of magnification evokes a sense of something intelligibly intangible. Observation of the vitality of sea creatures populating tide pools and observation of their inner workings inspired a reverence for the divine and a reflection of the vitality of the individual concentrated in the deeply centered communion with the natural world, "Surely when a Christian naturalist examines more recondite anatomy, not of the human body merely, but of any, even the lowest forms of animal being, he is constrained to say with the Psalmist, 'I will praise Thee; for all is fearfully and wonderfully made: marvelous are thy works, and that my soul knoweth right well.'"[136] We are imprinted by a soul we cannot see, and through a lack of sight, detect our sense of self in imaginative proportions. It is in seeing the invisible makeup of sea stars, and other "low" creatures, that excites Gosse and surfaces real and imaginative bonds with a world always unfolding in both plain sight and with hidden machinations.

Toxicity: Unnatural Natural Sensibility

Saponins are foamy, soap-like, water soluble molecules produced by sea stars that elicit avoidance responses in other species and, at times, the death of other species. The first recorded instance of saponin poisoning was documented by 19th century naturalist Charles Parker. He witnessed the death of his beloved cats, one half-grown who fell violently ill and died and the

[135]Philip Henry Gosse. *Evenings at the Microscope or, Researches Among the Minuter Organs and Forms of Animal Life*, D. Appletone and Company, 1860, p. 477.
[136]Philip Henry Gosse. *A Naturalist's Rambles on the Devonshire Coast*, John Van Voorst, 1853, p. 54.

other full-grown who "suddenly began to scream piteously" and "soon became unable to walk or stand, and died" after both ate a "fine specimen of the Sun-star" he had brought home to study.[137] Spanning the entire body of the sea star, found in every organ, including the tube feet, the mystery of saponins is that their chemical composition and concentrations differ from species to species, and from organ to organ. These natural "toxins" produced to ward off predators are characterized by their chemical diversity. Each organ of a sea star has its own "saponin" identity designed to protect the sea stars' most vulnerable body parts. Imaging technology shows that saponin distributions particularly differs between the "soft underside and hard topside" in relation to the type of defense demanded, bacterial or predatory, suggesting sea stars "face different external aggressions on both sides,"[138] and have evolved measures to address those threats.

Sea star saponins evolved as a self-defense mechanism to compensate for slowness and an "awkward" five directional, permanently splayed resting position that makes movement a coordinated feat of cooperation. For humanity, uncovering the properties of saponins and understanding their structural diversity has led to learning how saponins inhibit cancer cells from dividing and proliferating. Testing the ways in which saponins work within the human body tells us how the properties of one species can flow into the properties of another species, to borrow from alchemical imagery, as we learn of the value of "molecules [that] are of high interest due to their hemolytic, cytotoxic, antibacterial, anti-fungal, antivirus, and anti-tumor properties."[139] In some ways, we look to the products of nature to help perfect or repair the human body deemed "toxic," just as alchemists believed nature was always in the process of perfecting itself.

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[137]Charles Parker. "Poisonous Qualities of the Starfish," *The Zoologist,* 1881, pp. 214-215.
[138]Marie Demeyer, et. al. "Inter-and-intra Organ Spatial Distribuition of Sea Star Saponins by MALOI Imaging," *Analytical and Bioanalytical Chemistry*, vol. 407, no. 29, 2016, p. 8822.
[139] Ibid. p. 8822.

Saponins fulfill several important biological functions for sea stars, yet they remain a mystery. Only recently have research studies on the chemical composition of saponins shown that each organ in a sea star contains its own diverse distribution of type and quantity of saponins and that the molecular structure of saponins varies between sea star species. Studies on the composition of saponins analyze the varying mixture isolated from specific body parts to record the heterogeneity of components in each body part and amongst species.[140] Saponins have their own distinct signature. Because saponins are difficult to isolate, associating a particular saponin with a particular behavior remains speculative. Saponins are metabolically costly to produce, taking energy away from strengthening other organs, such as vital reproductive organs, reminding us that for all our impressions of sea stars as predators, they are also prey. The integrity of the toxins communicates the strength of sea stars. In that regard, toxins evoke examination of how toxicity is evaluated.

The word toxin evokes imagery of brews, elixirs, and potions, notably artifacts of *witchery*; conjuring images of deep black cauldrons bubbling with a mixture of animal, plant, and sometimes human parts, congealing into a potent liquid with curative or transformative power. For the most part, history has conditioned us to register the idea of poison when we come across the word "toxin." It is apropos to follow that line of thought, considering that the first recorded law criminalizing poisoning, scribed in Roman law, known as the *Lex Cornelia*, traces back to 82 BC.[141] Toxic substances altered behavior or appearance and were associated with the dark arts. The dark arts flowed into the alchemical arts, eventually laying the foundation for

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[140]Marie Demeyer, et. al. "Molecular Diversity and Body Distribution of Saponins in the Sea Star *Asterias rubens* by Mass Spectrometry," *Comparative Biochemistry and Physiology, Part B*, vol. 168, 2014, pp. 1-11.

[141]Though history documents varied ways in which "toxins" naturally occurring in minerals and plants were used for medicinal purposes, hunting, and even make-up, the formal study of toxins, toxicology, had its beginnings in the 19th century Mathieu Joseph Bonaventure Orfila authored the book *Triate de Toxicologie* (1814), which classified toxins into categories based on effect, and is credited for founding the science of toxicology which he primarily used in forensic studies to produce visible proof that poison was the culprit in a murder.

chemistry. The practice of alchemy engaged practitioners in the laboratory study of chemical processes, the study of diseases, and esoteric mysticism, religion, and philosophy. In a generalized quest for self-making, "God" making, and gold making, the underlying premise of alchemy was that each object held a secret, hidden aspect and yet, at the same time, that the properties of one thing can flow into another. Alchemy professes that nothing exists in its final stage, and the natural world is not meticulous, ordered, and fixed, as is presumed. Through the lens of alchemy, "toxin" becomes metaphor for self-making, for reincarnation in different form; essentially for the essence of the self to surface.[142]

Those possibilities, approached as exotic and unknown, should not be frightening, according to the prescription of Paracelsus, 16th century physician and alchemist.[143] Synthesizing biblical scripture with cosmological revelations and a science of trial and error, he professed that uncertainty and unpredictability are an organic, natural part of the complexities shared by living and non-living entities, like Adam made from tangible, material dust and intangible, metaphysical energy of the cosmos, and God, begetting all of humankind, who ultimately return to dust. Alchemy, according to interpretation of Paracelsus, discloses that "...invisible and imponderable things, such as the cosmic ether, the light producing power of the sun, the vital power of plants and animals, thought, memory, imagination, will, psychological influences affecting the state of the mind or producing a sudden change of feeling and other things too

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[142]"Nature being the Universe, is one, and its origin can only be one eternal Unity. It is an organism in which all natural things harmonise and sympathise with each other. It is the Macrocosm. Everything is the product of one universal creative effort; the Macrocosm and man (the Microcosm) are one. They are one constellation, one influence, one breath, one harmony, one time, one metal, one fruit" (qtd. in *The Life of Philippus Theophrastus Bombast of Hohenheim Known by the name Paracelsus*, Franz Hartmann, 1887, p. 47).

[143]"The anatomy of man is twofold. One aspect of it may be known by dissecting the body, so as to find out the position of its bones, muscles, and veins, &c.; but this is the least important. The other is more important and means to introduce a new life into the organism, to see the transmutations taking place therein, to know what the blood is, and what kind of sulphur, salt, and mercury (energy, substance, and mind) it contains" (qtd. in The Life of *Philippus Theophrastus Bombast of Hohenheim Known by the name Paracelsus* by Franz Hartmann, 1887, p. 175).

numerous to mention, are nevertheless facts, and exist… ."[144] Unbound by visible form, the bramble of energies characterizing alchemical arts and biological processes intertwine, each in its own way, erupting in some other measurable, active form. Paracelsus believed that human beings were a microcosm of the entire world, containing every possible being inside.

According to alchemical teachings, we are infused with the same elements of the stars, and because of that, we carry the soul of the universe within us. That connection with extremes attracted anthropologist Stefan Helmreich who turned his attention to studying life at extremes, specifically microbes residing in deep sea hydrothermal vents. His work explores how their ancient presence established the primeval lineage of all forms of life and argues for an examination of "conditioning situations" on forms of life who "experience themselves as subjects" and their unique "embodiment of nature."[145] Helmreich seeks to invert the idea of extreme into one of "multi-naturalism" to acknowledge that "different organisms summon different 'natures' even as they share the enterprise of being alive." He asks us to explore the interconnected and symbiotic nature of life on the edge, altogether unmoored and unanchored.

The idea that some amalgamation of abiotic elements is capable of, or rather responsible for spearheading the charge for uncanny forms of life invites skepticism, yet it is not science fiction when we are taught to accept a swirling array of chemicals and rocks intertwining to give birth to a living Earth and a continued process of development. Tracing the chemical and physical changes Earth underwent to form oceans and produce oxygen, reminds us of the fact that Earth, this abiotic thing, performed the greatest alchemy in birthing life; life that evolved to occupy specific niches with their distinct ecologies and relations. Thinking with the Earth takes

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[144]Franz Hartmann. *The Life of Philippus Theophrastus Bombast of Hohenheim Known by the name Paracelsus,* 1887, p. vi.
[145]Stefan Helmreich. "Extraterrestrial Relativism." *Anthropological Quarterly*, vol. 85, no. 4, 2012, pp. 1125-1140.

us back to face the fact that Earth was once uninhabitable for human beings and some parts still remain uninhabitable without the aid of some technology. Ocean depths remain uninhabitable to humans, though they are now hailed for their significant role in mixing together the primordial elemental ingredients which generated the beginning of life. Specifically, hydrothermal vents are credited for initiating the "spark of life" setting all life in motion.

Hydrothermal vents revealed a new domain of chemistry operating on planet Earth. Research into hydrothermal vents and the origin of life has discovered that the sulphide-based ecosystems are "primordial environments that are reminiscent of early Earth, with reactive gases, dissolved elements, and thermal and chemical gradients that operate over spatial scales of centimeters to meters."[146] They support complex microorganisms known as chemoautotrophs capable of converting chemical elements into biomass, that is, renewable source of energy. The diversity of life forms making a living in hydrothermal vents also fuel other species who dine on those life forms, creating symbiotic relations. A variety of species absorb or take in chemical nutrients from hydrothermal vents and are dependent on them for essential synthesis of proteins. Understanding of these hydrothermal vents has turned the focus from available sunlight as dominant factor in the investigation for life on other planets to a focus on hydrothermal circulation indicative of a geologically alive planet. Such thinking leads to reclassifying what constitutes life as these surreal creatures seep into the here and now.

The intimate connection between environments and life forms confuses our understanding of life forms as independent beings. It is a confusion that suggests a different perspective to the kinds of toxic narrative typically characterized as science fiction. Toxic narratives present a world actively engaged or coming out of some catastrophe that overhauled

[146]John Baross, et. al. "Hydrothermal Vents and the Origin of Life," *Nature Reviews*, vol. 6, no. 11, 2008, pp. 805-814.

normal life. Some technological or biological act, either human-made or a shift in the natural world, initiated a drastically changed world and we are made familiar with it. Yet these narratives might be seen in a more positive light as well, where what we witness is an adaptation of life. Toxic environments are relative to the types of organisms that can and cannot live in such conditions and toxins produced by organisms, while protecting the organism itself, can also act as a life force for other organisms. Carbon dioxide comes to mind. Humans expel it as a toxic by-product of oxygenating the body and plants absorb it to create oxygen. Such a reality would be the product of a science fiction novel where the inverse was true, and oxygen was toxic to life forms.

Stefan Helmreich discusses the similarities between life in extreme locales and possibility of life forms in his essay "Extraterrestrial Relativism" beginning with a reference to the science fiction novel *Starfish* by Peter Watts. Likening the Antarctic research stations to outer space research stations situates us in understanding the estrangement of the novel's setting, Helmreich looks at the ways in which life at extremes enlightens humanity on the imagining, and overturning, the boundaries of life. *Starfish* is a science fiction novel set in a time where the world is under threat of dwindling energy reserves and the only solution is to mine the ocean depths for energy from hydrothermal vents. The novel takes place in deep sea hydrothermal vents where the composition of life is stretched, where aquatic cyborgs are "working at the limits of categories and phenomena." The people selected for this job are society's outcasts, whose own personal traumas inscribed them with resilience. They all agree to biochemically and mechanically alter their bodies to live and work in the dark abyss inside and outside an underwater marine station (named Beebe station after marine biologist William Beebe, the first man to descend over 3,000 feet underwater in a submersible, 1934). Conditions in this deep

abyss are labeled “extreme” and would otherwise be toxic to humans had they not been engineered to live in those conditions.

The chemical composition and physical pressure, and certainly perpetual darkness, fosters its own kind of life forms, but not human ones. These self-characterized misfits of Earth modify their internal and external body parts to inhabit a place too harsh to support human life. In a place toxic to human life, they adapt themselves to its demands, in effect, becoming toxic, or what biologists call “extremophiles” to describe and utilize the life forms that thrive, literally “lovers” of environments situated on the edge. Selected because of their acutely measured tolerance to “stress, confinement, prolonged isolation, chronic physical danger, that sort of thing,”[147] they are deemed “immune” to human emotion, therefore, it is fitting that they live in a cold, dark expanse. Transformed to be either less human or more human, the cast of characters jig-sawed into “other-than-human” are collectively known as “Rifters.” The name “Rifters” is meant to convey a merging with the hydrothermal vents they monitor. The term is associated with a crack in an otherwise unblemished space. The group represents a “crack” in what would be considered human. Yet, it is those “cracks,” those lives deemed “toxic” to the evolutionary chain or who find themselves in an environment that does not support their “toxicness,” who can branch out to form new life reflective of the life-creating forces of the hydrothermal vents. This is true as the “Rifters” realize they can and do self-modify their biochemical properties, adjusting their calcium levels, and as a result, gain what can be construed as telepathic awareness of each other and all the organisms living in the abyss. Their minds and bodies would be deemed compromised by the laws governing another ecosystem, but in the deep ocean, they are

[147]Peter Watts. *Starfish*, Tor Books, 1999, p. 45.

reimagined, and ultimately, are able to relate with their world and one another in more profoundly intimate ways.

For these Rifters, their newly "poisoned" bodies open them up to realizing their humanity; it is a means to recuperate belonging in the world. They come to view their new existence as dynamic and purposeful, giving them a sense of worth. In testing their bodies, they turn into "bio-objects"[148] and invert what it means to be human. The main character, Lenie Clarke, acclimates quickly to her machine-like body, noting, "It takes a conscious effort to feel the machines lurking where her left lung used to be." She is no longer aware of the plastic and metal inside of her, breathing for her, and she still feels the "memory of what it was to be fully human, and mistake that ghost for honest sensation."[149] Adapting to their "machine-like, chemically altered" bodies, which they later self-modify to access a deeper consciousness and telepathic powers, they Frankenstein themselves into entirely new beings. A process that is translated into sea stars as we witness Lenie grafting together parts from different sea stars to form one completely new, viable species. The Rifters do not realize that in mining the deep ocean, they have contacted an ancient microbe programmed to attach itself to other life forms and take the path of evolution in another direction. However, the Grid Authority, overseers of the energy mining project, are aware of the dangers presented if the microbe reaches land; a threat made real only if the crew of Beebe station return (although none have inclination to ever leave their ocean life), therefore the Authority releases a nuclear bomb to explode Beebe Station and everyone inside.

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[148]Bio-object is a term coined by Peter Dabrock to confront the taken-for-granted distinctions delineating living from non-living, artificial from natural, and subject from object. He argues that the bio-objects challenge how we qualify life according to presiding societal laws. Bio-objects are ambiguous in their strange familiarity, yet difference, from an acceptably known form. Read more in "A Prisoner to 'Bio-Objects': New Challenges at the Interface of Science, Technology, and Society," *Systems and Systematic Biology*, vol. 7, no. 1, 2013, pp. 1-6.

[149]Peter Watts. *Starfish*, Tor Books, 1999, p. 19.

For these "toxic" humans living in Beebe station, life in the abyss is the norm. Each character quickly adapts to the ocean, preferring to continuously remain zipped up in their specialized scuba "skins" and they are always wearing "white corneal caps" to completely shield their eyes. Gradually each character begins to spend the majority of their time outside the station in the ocean, even sleeping in its complete darkness. Living in the deepest ocean, the characters encounter fish of monstrous size, although they were informed that the fish in that part of the ocean are quite small.[150] Yet the size is irrelevant in consideration of the fact that these fish are lacking in calcium to build their bones, consequently making them brittle and easy to break. This is because the fish have been invaded by a bacterial microbe enlarging their bodies but are incapable of manipulating the chemical requirements to support such a large body. While the fish appear frightening, the reality is they do not have the strength to overpower the Rifters. When the Rifters self-regulate their biochemistry, which they refer to as "induced isometrics," the fish no longer sense the presence of the Rifters.

The rewriting/rewiring of human beings fuses the Rifters with the sea and its life forms rather than outside of it. This is a life envisioned by famed marine biologist Jacques Cousteau who yearns for a time when the world is populated with *Homo aquaticus*, human beings capable of living freely in the ocean because of surgical or biological alteration. In a speech to an audience at the World Congress on Underwater Activities in London, England, 1963, Cousteau proclaimed, "I think there will be a conscious and deliberate evolution of *Homo aquaticus*, spurred by human intelligence rather than the slow blind natural adaptation of species. We are now moving toward an alteration of human anatomy to give man almost unlimited freedom

[150]Microbes in the deep ocean actively coordinate complex food webs and fuel nutrient cycles affecting an entire ecosystem.

underwater."[151] Humans are defective until they are able to skillfully apply ingenuity to return to the liquid world which birthed them, according to Cousteau's perspective. The monstrous, the *toxic horror*, remains in continuing to remain human.

The Rifters are endowed with a special oceanic sentience. In what is probably the millionth time that Lenie drops into the ocean through the cylinder porthole, the feeling of sensing herself beyond herself, outside her body, never dissipates. She describes the sensual sensation as "the ocean rushing into her, cold and unstoppable like a lover. At 4˚ C the Pacific slides through the plumbing in her chest, anesthetizing the parts of her that can still feel"[152] and she is released into its embrace where she can discard human vulnerability. The feeling is accentuated when the Rifters begin to "fine tune" their components, bypassing the self-adjusting mechanisms coded into their initial programming. They transform according to the demands of their environment and as a result are themselves strengthened by its unknowable vastness. Lenie reflects on this in her determination to patch up wounded, yet living sea stars and fuses "bits and pieces together at all angles" to produce a "crawling Gordian knot, some pieces red, some purple, some white" to create new beings. Although the newly born sea stars are not "normal," having "extra limbs, asymmetrically grafted" rendering a body that "lurches" and is "perpetually unstable," as it moves and clings to rocks, they live.

The viability of the sea stars and the viability of the Rifters coincide. The Rifters calibrate their own lives, as illustrated by the sea stars Lenie puts back together. That act of creation discombobulates the authorial figure, Dr. Scanlon, sent down from the Grid Authority to psychoanalyze the Rifters. In watching Lenie stitch together sea stars, which Scanlon calls a "real monster," he cannot hide his disgust at the defiance of physics and at Lenie's visible

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[151]Qtd. in Brad Matsen, *Jacques Cousteau: The Sea King*, Pantheon, 2009, pp. 160-161.
[152]Peter Watts. *Starfish*, Tor Book, 1999, p. 107.

pleasure. Lenie informs him that sea stars have a "really primitive immune system, so there's no tissue rejection problems to speak of. It makes them easier to fix if something goes wrong with them."[153] The reconfiguration of sea stars is attractive to Lenie who sees the beauty in the possibilities of reconfiguring one's self, in opposition to Dr. Scanlon's view that the sea stars are ugly and the Rifters are unsound. Where Lenie sees hope and perseverance, Dr. Scanlon notices the "Filaments of parasitic fungus" that "trail from ragged seams, not quite healed. Extra limbs, asymmetrically grafted, catch on rocks; the body lurches, perceptibly unstable."[154] As the "pet monster squirms in slow motion, trying to right itself" Lenie senses that Dr. Scanlon is disturbed by the Rifters, as much as he is disturbed by the sea stars. He refers to them as "vampires" and reports that Lenie has developed a "mutilation neurosis" because of her fascination with broken creatures. However, it is Lenie who makes Scanlon realize he is just as broken, as all life is essentially broken, in process of becoming.

Lenie fully realizes that she is more than the physical parts that construct her being when she questions the chemical compound labeled "True Happiness" that she comes across in a book that claims to be the answer to "fixing" humanity. We enter her mind as she imagines the chemical compound speaking to her, "You've been solved, it says. You're mechanical. Chemicals and electricity. Everything you are, every dream, every action, it all comes down to a charge of voltage somewhere, -or a-what did she say- a tricyclic with four side chains."[155] If that were true, Lenie insists, everyone would be "fixed" and that is not true. She realizes she is more than just a form. Like the sea stars she puts back together with borrowed parts, she is something altogether different that still works, that is necessary, and that feels, experiences, and perceives

[153]Ibid. p. 199.
[154]Ibid. p. 199.
[155]Ibid. p. 41.

herself and the outside world in non-physical ways. If that is her soul, then all creatures have one.

By tinkering with the protective mechanisms meant to contain their "humanity" the Rifters become more connected with the ocean, and along with that, become attuned to infinite physical and psychological selves. They truly belong to it without barriers as one of the Rifters exclaims, "It's really kind of…well, beautiful, in a way. Even the monsters once you get to know 'em. We're all beautiful."[156] They understand that life is malleable, and consequently, "toxic" is relative. Adaptability and interconnectedness permeate through every aspect of the Rifters. Rather than an apocalyptic depiction of toxicity, *Starfish* paradoxically brings our attention to reconfigure how we understand what it means to be human, especially when that human is both familiar and unfamiliar, flesh and machine. The human that creates unease because it is perceived as a threat, in truth, creates awareness of adaptation, changing form, to meet the changes in environments. Nature is not static, and therefore, as part of nature, neither is humanity, therefore, toxicity becomes a means of renewal and rejuvenation. The novel ends with Lenie, alive and alone, as she "swims down and east, towards her own resurrection."[157] She is alive and intact, reclaiming her belonging.

[156]Ibid. p. 113.
[157]Ibid. p. 366.

CHAPTER TWO: REASONING

Crabs: The Logic of Meandering

> What is the pattern that connects the crab to the lobster and the primrose to the orchid, and all of them to me and me to you?
>
> Gregory Bateson, *Mind and Nature*

Moving side to side with a "sea-leg" stance to keep from stepping on the geometrically challenging rocks speared with the headstones of limpets, barnacles, and mussels, we crept carefully through the tide pool until someone screamed, "There's a crab!" Everyone immediately raised one foot off the ground, quickly placed it back down and raised the other, certain they were going to have their toes cut off by claws inflated with Herculean strength capable of slicing through heavy-duty rubber boots. We turned towards the crab running sideways while its eyes remained fixed straight at us. I, and a group of eight-year-olds, struggled to keep a steady gaze on this creature whose rapid zigzagging movements were dizzying. We all admittedly had the sensation that we were moving; and though we were standing still, we were the ones forced to regain our bearings. "Doesn't it know which way it's going?" a concerned girl asked. "Yes, it knows," I replied as the crab slipped beneath a rock and disappeared from sight.

Crabs maintain an enduring strangeness. With claws instead of hands, a sideways walk that is counter-productive to the conservation of energy or the most direct route, and a growth process dependent on sloughing off an outer shell, exposing soft insides, the physiological make-up of crabs suggests that they are "off-kilter." The flat, circular body of the crab, supported by eight legs, lends the impression of an experiment gone awry. It is not unusual to instinctively shudder when spying a crab scamper from one place to another. The dizzying traits of crabs draw

attention to the unwieldiness of nature, by human standards, in designing reasonable modes of living. Crabs frightfully disrupt what the human mind construes as logical, which is why their waywardness inspires inquiry into the nature of reasoning. The instability of reasoning is presented by the fickle attitude shown towards crabs. If we encounter them in the *wild,* we panic, but when we find ourselves standing before a tank piled high with crabs strategically displayed at the fish counter under a sign reading, "Fresh Crabs: $20 Each," our attitudes shift. Reasoning deals with attitudes.

Sound reasoning relies on recalling past knowledge and, in application, the ability to assess whether the past is compatible with the present and future. Reasoning demands we become soothsayers in our own lives. Indeed, reasoning is akin to doubt, a constant act of admitting and discarding select "knowledge" to securely fasten a belief or override a belief. Scholars continue to disagree on the reason for the evolution of reasoning. While one camp argues that reasoning evolved as a means to protect one's reputation rather than a process to seek out truth, another camp argues that reasoning evolved to foster cooperation necessary to successfully live among social groups. Cooperation relies upon the critical skill of *mindreading*; a silent monitoring of speech and behavior of others and the ability to use that stored information to predict future behavior. That power to draw inferences from abstract expressions interested evolutionary theorist Charles Darwin. He praises the superiority of human reasoning in *The Descent of Man*, writing, "Of all the faculties of the human mind, it will, I presume, be admitted that reason stands at the summit,"[158] although the faculty of reasoning is itself contentious.[159]

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[158]Charles Darwin. *The Descent of Man and Selection in Relation to Sex*, John Murray, 1882, p. 75.

[159]Reading people's expressions and translating them into language to produce a repertoire of signs mimics the logic of syllogisms. A syllogism is a method of reasoning linking two separate premises together to draw a conclusion. The basic tenet of syllogisms follows the pattern: if a=b and b=c, then a=c. The simplified logic scheme tricks us into accepting a conclusion because it shares aspects with already held beliefs (On a personal note, there is a syllogism named Barbara. It is so named because the name Barbara contains three exact vowels signifying that the

Reasoning is not entirely logical; it receives input from the senses, the imagination, memory, desire, instinct, feeling, hope, and can be as meandering as the locomotive zigzag of crabs. Reasoning is apothecarial, spectacular, open-ended, and a guessing game. In truth, the human mind can imagine beyond the knowledge it holds, hypothesize a multitude of outcomes, and follow a path fulfilling the promise of wishful, or magical, thinking. Reasoning is contrary; therefore, I examine the nature of reasoning as a substantive measure of what it means to be human using the biology of crabs and literature featuring the representation of crabs. The *illogical* makeup of crabs, with claws in place of "hands," sideways walking, and shedding a protective shell to expose a fleshy body renders them apt figures to question the nature of reasoning. I examine a figurative crab featured in the play *The Two Gentlemen of Verona* by William Shakespeare, who names the one and only dog to appear in any of his plays Crab to reveal the façade of class-based customs and the meaning of true friendship; the fantastical crab in *The Crab that Played with the Sea* by Rudyard Kipling, where a magical crab controls the tides and interrogates the tension between "human" laws and the laws of nature; and the play *The Condemned of Altona* by Jean Paul Sartre, where imaginary crabs act as future arbiters of a human history mired in violence.

As iconic tidepool species, crabs are familiar to us, spellbinding, but contact with them in their natural habitat tends to elicit an instinctive recoil response. Crabs straddle land and sea, evoking an eerie sensation that they transcend boundaries. True crabs, so classified by their short tails and small abdomens, belong to the larger phylum Arthropoda, Subphylum Crustacean, order

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syllogism contains two premises and one conclusion). Syllogisms expose the slipperiness of our minds, adept at simultaneously entertaining possible and impossible scenarios all at once. Reasoning is touted as a super power elevating us above the realm of animals, yet reasoning is faulty. Our reasoning engages both intuitive reactions and learned behaviors, triggering continuous attitude adjustments and self-canceling points of view. We unassumingly follow a trend that scholars have labeled "my-side-bias" and "makes-sense epistemology" where we assert conclusions which readily conform to already held beliefs.

Decapoda, and consists of almost 7,000 named species with over a 200-million-year history. The diversity of crabs is so extensive that scientist Ling Ming Tsang[160] developed a relationship tree to determine the degree of relatedness between species. The tree documents the rate of diversification; an approximation of when a crab species split off from the main arterial trunk into its own separate branch. Eking out a living is tough in a tide pool, and competition and shifts in habitats play a part in driving diversification. Because the body plan of crabs is favorable to every habitat and there is a "correlation between the body form and ecology, with protective and locomotory behaviors as examples,"[161] the crab is an ideal model for studying Earth's past.

True crabs live everywhere. Salt, brackish, and fresh water provide welcoming homes to crabs. One crab species, *Birgus latro*, nicknamed the coconut crab, as well as the robber crab because of its reputation for "stealing" knick-knacks from people, can climb trees. Though they range in shape and size, crabs are popularly recognized for a body plan consisting of ten legs divided into a pair of pincers known as chelipeds and four pairs of "walking" legs interchangeably used for grabbing food, digging, prying open shells, and warding off attacks. Crabs disorient predators (and most people) with their set of independently acting limbs which also lend them their signature sideways scutter. Adding to the perplexity of the crab's method of locomotion is the fact that crabs shed their outer skeletons in order to grow. In a process known as moulting, crabs discard their protective shell and are temporarily "naked" as they wait for their new shell to form. Because their gills and eye sockets remain intact during the moulting process, the empty shells standing like stationary sentinels give the impression that the crab is both eerily alive and magnanimously still.

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[160]Ling Ming Tsang, et. al. "Evolutionary History of True Crabs (Crustacea: Decapoda: Brachyura) and the Origin of Freshwater Crabs," *Molecular Biology and Evolution*, vol. 31, no. 5, 2014, pp. 1173–1187.
[161]Joanna M. Wolfe, et. al. "How to Become a Crab: Phenotypic Constraints on a Recurring Body Plan," *BioEssays*, vol. 43, no. 5, 2021, p. e210020.

Naturally equipped with a set of weapons, armor, and a “shifty” or “crooked” way of walking, these curious creatures are perplexing. Consequently, crabs symbolically act as a warning against going astray from accepted social customs. In Aesop’s short fable, “The Crab and Its Mother,” a mother crab asks her son why he walks one-sided and reprimands him for not choosing to walk straight as it is “more becoming.” The young son agrees and expresses a willingness to walk straight if the mother would only set the example. The mother tries and fails. From a biological perspective, mother and son ask us to consider the ways in which traits and behaviors are transferred genetically through long chains of evolutionary lines and what could break such a chain. From a sociological perspective, the fable asks us to study the social mores dictating behavior and how social constructs change over time and space. In keeping with social conventions, natural and *unnatural* behaviors are continuously scrutinized, and what is relegated to the public or private arena is monitored.

Undoubtedly, choices are often a matter of selecting the most desirable probable outcome out of an infinite number of what-if scenarios. Available choices are organized by the number and variety of scenarios imagined, however, the ability to address one’s mental state (theory of mind) is not always available. Without dispute, deciding whether to “fit-in” or “rebel” does not follow a logical path. Straying from the norm finds a place in the play *The Duchess of Malfi* by Renaissance playwright John Webster who turns to the out of the ordinary way crabs walk to center the normalization of gender roles. At the time, women were characterized as erratic, ill-equipped to reason and prone to waywardness of mind (scatter brain), and by association, their bodies, and therefore, prohibited from governing their own lives. Webster introduces the picture of a crab to call gender roles into question. In one scene, the Duke of Ferdinand reprimands his sister, the Duchess of Malfi, for failing to adhere to class consciousness and her station as a

woman. The Duke questions the reasoning capabilities of the Duchess because she violates moral standards by transgressing from her own "kind," claiming she is "like the irregular crab/ which though 't goes backward, thinks that it goes right/ Because it goes its own way." To go backward meant to go against reason and invoking the image of the side-stepping crab added an association of recklessness. The Duchess of Malfi is deemed unfit for failing to fit with the collective reasoning of society, though her only crime was to love someone beneath her class standing. By succumbing to sexually charged emotions, and willing to lose her royal standing, the Duchess of Malfi traces the tension between thinking with the heart or mind, or, as the saying goes, "not thinking straight."

The association between crabs and intractableness continues to invite introspection through its appearance in the Jātaka tales of India. These tales safe keep the records of everyday life and are the nation's oldest collection of stories, dating between 300 BCE and 400 ACE. The Jātaka tales include the various adventures of Bodhisattva who becomes enlightened and reborn as Buddha. One aspect of the tales is to bring attention to the fact that reasoning is enlightened by processes outside conscious consciousness. Though the tales are allegorical, the dual casting of a crab as both a villain and a hero underlines the ways in which reasoning undergoes revision to fit the situation. The figure of the crab oscillates between a force of unmitigated violence and a force of justice in tales intended to instruct humanity about karma, a term referring to the foundations of cause and effect.

In "The Giant Crab and the Elephant" we find a giant crab living alone in a large lake. When other animals make their way to the communal drink, the crab grips the leg of the unsuspecting animal, dragging it underwater. One day, the Bodhisattva, taking the form of an elephant, informs his wife and family that they are going to the lake. While the elephants fill up

with water, the giant crab takes hold of the Bodhisattva. The Bodhisattva cried aloud, "Gold-clawed creature with projecting eyes, Lake-bred, hairless, clad in bony shell has caught me! Here my woeful cries, Mate! Don't leave me-for you love me so well." His mate vows to remain by his side and begs the crab to release her husband. Enchanted by her pleas, the crab releases the Bodhisattva, but rather than receiving a reward, is instead trampled to death. The crab is punished for assuming there would be no consequences for his attitude (though the crab must also eat). Meanwhile, the elephant is praised for ridding the world of a "monster" who lacks familial relations, lives on the edge of "civilization," and is the only one of its kind. Though the crab is moved by the display of loyalty to release the Bodhisattva, his past behavior is not absolved. The past cannot be escaped, nor is it possible to unequivocally predict how the world will contend with a past that erupts with unforeseeable transformations in the future.

In another story, a crab echoes the reality of an inherent order in the natural world. The story of the "Crane and the Crab" features a crane that offers to transport fish to a separate lake where the food is more plentiful. After tricking the fish into entering his mouth, and eating them one by one, the crane, still hungry, set his sight on the crab. The crab does not trust the crane; however, he agrees to be flown to the new lake if he can wrap his claws around the crane's neck for support. During the flight, when the crane reveals his plan to eat the crab, the crab threatens to snap the crane's neck if they do not land safely. The surprised crane lands the crab on the lake and is immediately beheaded. While there are moral lessons to be learned in considering where to place trust and why, a more profoundly deeper analysis questions the nature of subjectivity in cases where all individuals act deceptively, or rather, when nature takes its course. The crane may never have predicted that outcome, and the crab may not have premeditated the murder, yet the reciprocity gives satisfaction. The crab is just a crab, and the crane is just a crane, but the

assumption is that the public should side with the crab because intuition tells us that is "right," even if it is difficult to articulate why. The tacit comradery with the crab for using its wit to outwit the crane, incidentally, elucidates the reality that the natural world is in constant negotiation, and loss is a natural part of those relations.

In a complex world, where everything is uncertain, choices reflect a person's state of mind. Psychologists label personally driven decision making as "optimistically biased beliefs." The argument holds that the right kind of distortion advances outlook and beliefs, while the wrong kind creates confusion and a "stick to it" attitude. One example is shown in a Chinese folktale that turns to the "cunning" character of the crab to illustrate the arbitrary nature of taking sides. In "The Proud Fox and the Crab,"[162] a fox who prides himself on his four legs in comparison to the "many feet" of the crab, regards the crab as a "stupid creature" for his inability to run fast despite his numerous legs. In response, the crab challenges the fox to a race, to which the fox agrees, acquiescing to having its tail tied down, eliminating any advantage. Unbeknownst to the fox, the crab takes hold of his tail. At the ready, the fox ran with all his might, panting for breath. When the fox finally stopped, there stood the crab alongside him. The crab's cunningness outwitted the fox because the fox failed to read between the lines; his positive illusions blinded him. The crab cheated; however, the delight of his victory is undeniable; deflating another's grandiose sense of self reveals the absurdity of ranking creatures whose unique traits clandestinely contribute to the development of particular traits in other creatures.

The pull of the nonsensical animates the flow of reason and is the backbone of the trial-and-error approach animating human relationships with the natural world. Trial-and-error characterizes the discoveries of Emperor Shen Nung of China (28th century BCE), author of *The*

[162]Mary Hayes Davies. *Chinese Fables and Folk Stories,* American Book Company, 1908.

Shen Nong Ben Cao Jing, translated into English as *The Divine Farmer's Materia Medica Classic*, who, according to mythology, had a transparent stomach so that everything he ingested was visible to the outside world. Emperor Shen Nung was engrossed with the natural world and often experimented on himself to assess the effects of particular herbs and animal parts in order to discover their hidden medicinal properties. A proponent of nature-inspired medicine, Emperor Shen Nung proclaimed that the Chinese Mitten Crab, *Eriocheir sinensis*, possessed a cold nature and salty flavor that was especially powerful for treating "evil qi in the chest, bound heat pain, deviated mouth and eyes, and swollen face."[163] Having a cold nature was associated with a formidable, impenetrable presence and salt was heralded as *prima materia*, a substance endowed with all the secrets of nature. Emperor Shen Nung also credits the crab shell for its ability to "staunch bleeding and dissipate stasis, resolve toxin and disperse swelling."[164] Because the crab was perceived as "cold" and hard, he reasoned that human illness was a matter of relieving the body of pent-up emotions, releasing it from toxicity. For Emperor Shen Nung, the natural world was ordered into two categories: cure or poison. Every natural element had the power to heal or harm. This cause and effect thinking led to experimenting with combinations of elements, intrinsically binding his reasoning with instinct; what felt "right" determined what was added into the cauldron. Ironically, Emperor Shen Nung is rumored to have died from eating a poisoned flower and failed to follow through with an antidote fast enough to save his life.

Emperor Shen Nung believed that the crab's appearance bespoke of its character, understandably so since crabs evoke images of staunch warriors ready to engage in battle. They are impenetrable with their "hard parts on the outside and the soft fleshy part inside;" a feature

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[163]Emperor Shen Nung. *The Divine Farmer's Material Medica Classic*, Trans. Yang Shou-zhong, Blue Poppy Press, Inc., 2008, p. 126.
[164]Ed. Xinjian Yan, et. al. *Traditional Chinese Medicines: Molecular Structures, Natural Resources, and Applications*, Ashgate, 1999.

Aristotle found worthy of documenting in *Historia Animalia* because it is a trait that turns expectations of life inside-out. The significant oddity of crabs also attracted Pliny the Elder, a 1st century Greek naturalist and philosopher who wove fantasy and fact in documenting animals of the natural world in his thirty-seven-volume set titled *Naturalis Historia*. In book thirty-two, passage nineteen, Pliny writes of the use of crabs as an antidote for poison, claiming "fresh river-crabs ponded and taken in water, or their ash preserved, are good for all poisons" and defers to the higher occult powers to substantiate his claims. He professes that "The magi indeed assert that if ten crabs with a handful of basil are tied together, all the scorpions of the district will collect to the spot, and to those wounded by scorpions, they apply with basil either crabs themselves or else their ash."[165] Pliny also assures "no antidote for snake bites is as good as crabs; that pigs, when bitten cure themselves by taking crabs as food." Whether the claim is purely conjecture or if Pliny observed, or merely heard about, these remedies, draws attention to what makes an account credible. The use of crabs as a curative against the venom of other creatures does spin reasoning about the natural world into a commodifying enterprise.

There are limits to understanding the reasons guiding behaviors and behaviors are often rationalized after the fact, working backwards from the effect to the cause. This is a magical thinking and crabs have a long, deep association with magic. The *Papyri Graecae Magicae*, a collection of spells and potions curated from ancient Greece and Egypt, spanning from the 2nd century BCE to 5th century ACE documents the use of crabs as familiars due to a belief that crabs stood at the crossroads of real and supernatural forces. Crabs held court as protective charms whose waiving claws attracted the spirits, elucidating the permeable boundaries that linked both the material and spiritual world. Therefore, crabs were main ingredients in creating

[165]Pliny the Elder. *Naturalis Historia*, Trans. John Bostock, Henry G. Bohn, 1855, p. 497.

potent potions. One spell concentrating on the power of crabs calls for crab parts to release its power: "And crab claws/sage, rose and pits for you."[166] A claw aimed at the heavens summoning supernatural forces beyond sight dramatizes the desire to imagine and engage the invisible, betraying an attachment to deeply embedded superstitions. History accounts for a wide acceptance of other realms and beings invisible to the eye, merely because it is felt to be true or because science cannot explain that it is not. The crab beckons humanity to consider a world where magic *crawls* everywhere. With crabs as a vehicle of both the real and imagined, they open a portal to introspection. They provoke us to reflect on the ways in which human reasoning takes the mind beyond what it knows to be unilaterally true and why it is possible to accept absence as proof of presence.

The alchemical arts aptly proport the presence of absence. Accordingly, crabs permeate the study of alchemical arts, a practice predicated on the belief that all things, and all beings, have a hidden true essence buried deep inside, aching to be seen. The alchemical arts reason that the true purpose of an object or being aspires to be liberated, which is possible by accessing the inner life. Inadvertently, the proposition of alchemy is that all living creatures and all material things are living in a condition of in-between and once their secrets are made available, all will be settled. By that reasoning, we operate in a world we do not fully comprehend, nor are we fully part of, because we are not privy to all of its existence. Because the moulting properties of crabs endeared them as agents of change, crabs are model specimens for ennobling the transformative potential of all beings. Crabs captivated alchemists, notably Zosimos,[167] a Greco-Egyptian who lived during the 4th century. Acclaimed as the Father of Alchemy, and the first alchemist to authorize his writings by signing them with his real name, one of his professional roles was to

[166]Ed. Hans Dieter Betz. *The Greek a Magical Papyri in Translation*, The University of Chicago Press, 1992.
[167]Of note is the fact that *Zosimos* became the adopted genus name of many known crab species.

collect and interpret alchemical recipes for their authenticity; a difficult feat dependent on repeating experiments perfectly and determining the equitable *closeness* of the results. Zosimos aimed to uncover the essential purity of things. His "Formula of the Crab" presents a series of line drawn images, with the fifth resembling a crab. Each drawing presented a complex litany of meaning, intended to provide the clues to get at the mysterious life embedded in everything. Indeed, if there is something other dwelling inside that has potential to radically other the body and mind, and is simultaneously there and not there, then nothing neatly resides with absolute certainty.

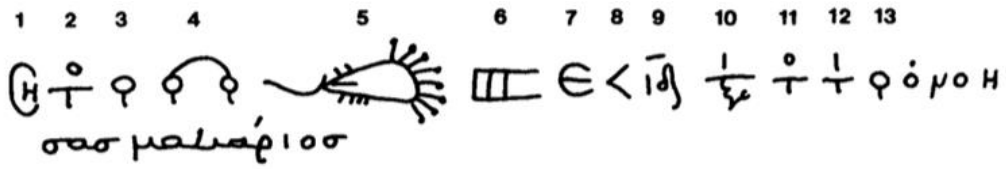

Figure 8: Zosimos, "Formula of the Crab," Marcellin Berthelot, *Collection des anciens alchemistes grecs*, Georges Steinheil, 1888, vol. 1.

Renaissance alchemists, most notably, Theophrastus Bombastus von Hohenheim (1493-1541), who gave himself the name Paracelsus, believed all living and non-living beings contained trapped properties, did not believe that the inner body and outer body were separate, and that all life and non-life were bound together in mutual exchange. Paracelsus believed all things in the natural world were inseparable and is famous for claiming that "all things are poison; it just depends on the dose." Of crabs, Paracelsus writes in a chapter titled "The Vertues of the Crab-fish Cancer":

> IN the foresaid fish Cancer have been found many other Vertues; it hath an excellent cooling faculty, and it is good against St. Anthonies fire, if you presse the juice out of the toes of it, and anoint the place with this juice: you may also make an oyntment with this juice, very good against all sorts of burnings or scaldings, viz. by fire, or water, or pitch, or fat things, &c. The Ancients never found a better remedy then this against any

> burnings. This oyntment is also good against inflamed, eating sores; and if it be annointed upon the temples of the head, it very much helpeth those extraordinary pains of the head, which almost distracts people, It helpeth also that inflamation called the Rose, and the heat of ulcers.[168]

Paracelsus visualized the world and everything in it as an uninterrupted whole and that the "balm" of the body, the bones, flesh, tissues, veins, congeal as one and communicate with one another. Therefore, any external remedy was already inextricably bound with the body. The level headed, cool, composed nature of the crab caused Paracelsus to reflect on the body's susceptibility to disease and illness, which inevitably extends into the mind. Illness affects focus, and thus, reasoning. Therefore, to be of sound mind and body is a serious concern as it is evident that both could easily dissipate.

The contract between mind and body attracted natural scientists and artists of the Renaissance, stimulated by the world of plants and animals they documented and illustrated in books of *beasts* known as bestiaries. Crabs were a favorite subject in these books combining taxonomic encyclopedic accounts with symbolic, fantastical meaning. Artist Leonardo da Vinci drew "Studies of Crabs" to supposedly "work out" humanity's natural proclivity for violence. Scholar and naturalist Conrad Gessner included a crab in a published a four-volume encyclopedic series *Historia animalium* (1551-1558) a venerated, first of its kind rendering of both real and fantastical species, complete with life-like illustrations to give the impression of truth. His crab had a *human* face, feeding prevailing anxieties about the origins and direction of humanity. Gessner also dabbled in alchemy and wrote, "The juice of crabs mixed with honey, is useful to those who have dropsy" and "An ointment made of ashes or a crab's shell, with honey,

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[168]*Paracelsus His Dispensatory and Chirurgery. the Dispensatory Contains the Choisest of His Physical Remedies. and all that can be Desired of His Chirurgery, You have in the Treatises of Wounds, Ulcers, and Aposthumes*. Faithfully Englished, by W.D. London, Printed by T.M. for Philip Chetwind, and are to be sold by Stationers, 1656.

cureth the king's evil" along with crab remedies to "lift the spirits." Crabs reinforced the reality of human vulnerability in both body and mind, as well as the reliance on the marvelous versatility of the natural world to mediate that permeability. The competence of the body and mind is shaky and demands acute vigilance. This thinking seeped into the writings and illustrations of another Renaissance scholar and naturalist, Joachim Camerarius the Younger, whose own four-volume series on animals and plants, *Symbola et emblemata* (1604), showcases a crab holding the world on its back with the motto: "Miraris cancri dorso consurgere mundum. Desine: Sic hodie vertiture orbis iter," translated as, "Are you surprised to see the world on a crab's back? Give it up! That is the way the world is nowadays" expressing the impossible feat of truly reasoning with a world that holds us up rather than the other way around. Human beings can observe and speculate, enact, and revise, as new knowledge becomes available, laugh at prior beliefs without reckoning that new ones will face the same fate. It is simple to see the world humans create, rather than how the world creates us, and crabs awaken humanity to looking inward.

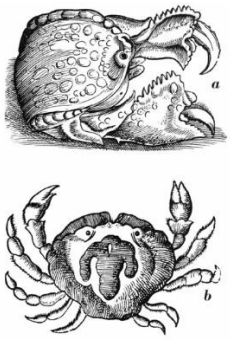

Figure 9: Conrad Gessner, *Historia animalium*, Tigvri, 1558.

Figure 10: Joachim Camerarius the Younger, *Symbola et emblemata*, Nürnberg, 1604.

In keeping with its alchemical reputation, crabs also graced the occult, in particular, astrology. The summer solstice begins in the sign of the crab (Cancer), and as the length of daylight increased, people's way of life shifted. This shift was recorded by the earliest book on astrology, *The Astronomica*, written in 1st century ACE by Marcus Manilius. Book four of the five book series depicts the crab as a beacon of prosperity binding shores together: "Shining at the hinge of the year by the blazing turning point which when recalled the Sun rounds in his course on high, the crab occupied a joint of heaven and bends back the length of the day. Of a grasping spirit and unwilling to give itself in service, the crab distributes many kinds of gain and skill in making profits; he enables a man to carry his investment of foreign merchandise from city to city and, with an eye on steep rises in the price of corn, to risk his money, upon such winds; to sell the world's produce to the world, to establish commercial ties between so many unknown lands to search out under foreign skies fresh sources of gain, and from the high price of his goods to amass sudden wealth."[169] The sign of the crab inspired exploration and adventure, as

[169]Manilius. *Astronomica Book 4*, Ed. and trans. G. P. Gold, Loeb Classical Library, Harvard University Press, 1977, p. 235.

longer daylight hours spawned an invitation to enter the unknown and unfamiliar; an opportunity to make contact with other worlds and be transformed. Pursuing the arc of the crab inspired people to chart unknown seas and untether themselves to test their fortunes. The sign of Cancer occurs from June 21st to July 21st and first documented by the Sumerians (the earliest known civilization) around 3000 BCE, coincides with the rush of female river crabs (Potamon species) onto land to scavenge for food. The Sumerians referred to the Potamon crabs as "allul" meaning "deceptive digger."

In addition to signifying a change in light, the crab also occupies a place as a mythological warrior. According to Greek mythology, the goddess Hera sent the crab to attack Hercules in his battle against the Hydra. The crab latched onto Hercules' toe, refused to let go, and was crushed to death. For his loyalty, Hera rewarded the crab by permanently placing him among the stars as the astrological sign of Cancer. Looking to the stars for understanding the wonders of the world occupied William Parsons, 3rd Earl of Rosse, who named his telescopically aided observance of a supernova explosion in 1840 "The Crab Nebula" (The first recorded sighting of the supernova was in 1054 by astronomers in China, who referred to the bright light as a "guest star"). The naming illustrates how reactive we are, making connections in our minds that then register in the minds of others. The pop-up idea of the crab that came to mind as the first reaction to seeing the "Crab Nebula" is not easily shaken and the mind then works to justify that initial response. Those judgments are often instantaneous and hard to shake, which inspired the motto *Festina lente*, translated as "Make haste quickly," adopted by Augustus Caesar, the first Roman Emperor, and stamped onto a coin bearing his image on one side and the image of a crab holding a butterfly on the other. Biographers note that Augustus Caesar believed good leadership was a product of a well-trained leader who spent time deliberating, thoroughly

weighing all paths, rather than making rash decisions. But we do often act impulsively and are quick to apply and stick with immediate first impressions.

Figure 11: Coin of Emperor Augustus Caesar, Numismatica Ars Classica, The Ernst Ploil Collection of Roman Coins.

Crabs continued to act as a unifying symbol binding the natural and supernatural world in the *Heike monogatari* tales from Japan. The tales are grouped under the category *Kaidan*, a popular form of storytelling that incorporates strange and unusual phenomenon into real events. Variants of *Heike monogatari* tales narrating Japan's Gempei War (1180-1185), a civil war between the Heike clan (also known as Taira) and the Genji clan (also known as Minamoto), combine fact and fantasy to describe the collapse of a monarch-centered society to the establishment of shogun military regime. One sea battle, Battle of Dannoura (1185), recounts the immortalization of slain Heike samurai warriors. According to the tale, the souls of the slain Heike samurai warriors were reincarnated in the form of the crab *Heikeposis japonica*, a native Japanese crab whose carapace resembles a fierce samurai mask.

Figure 12: *Heikeia japonica* crab and superimposed Samurai Kubuki print, Utagawa Toyokuni Ill, public domain.

While the face-like image on the carapace of the crab is an aberration, the reality is that the lines on the shell are connection points for ligaments and tissues. Evolutionary biologist Julian Huxley (grandson of Thomas Huxley, nicknamed “Darwin’s Bulldog” for his staunch support of his close friend and ally Charles Darwin) proposed that the proliferation of this particular crab was a result of respect, if not superstition, by Japanese fishermen. Huxley surmised that natural selection favored the increasing population growth of *Heikeposis japonica* because the crabs, when caught, were thrown back into the sea, whereas other crabs were collected and shipped to market. This respect preserved the species, though the *Heikeposis japonica* species were considered too small to be a worthy meal. The spectral dimension ascribed to these crabs reminds us that we look for patterns as much as we invent them to aid us in rationalizing the external world that we are both a part of and apart from, while we wander the globe identifying and documenting its multitude of species. But it is the pull to believe in the improbable, or the ridiculous, that reminds us that reasoning is fluid. It is also an example of the

mind striving to seek patterns, or make sense of patterns (abstractions), to render the world more to human likeness, available to order.

Ascribing supernatural powers to crabs also colored the water-based culture of the Moche People (circa 100 BCE – 800 CE) of coastal Peru. Settled in the north coast of Peru in thriving fishing communities, the Moche People were also farmers with advanced irrigation systems. Water and flooding were part of their everyday world. The Moche People witnessed their beaches seasonally strewn with crabs from the *Grapsidae* family escaping the suffocating warm waters of El Niño. Though they had domesticated their own world, the natural world remained a mystery, and the importance of honoring a natural world that provided for them was commemorated in art. Pottery, ceramics, tapestry, and metalwork were the means by which the Moche People communicated their connection to the supernatural and natural world. Crabs were prominently represented because they straddled two realms, land and sea, and embodied both a solid and fluid existence, imbuing them with magical, transformative powers. The Moche People equated the legs of the crab with rays of the sun, and coincidentally, the carapace of the *Grapsidae* family of shore crabs appear to bear the image of a sun.

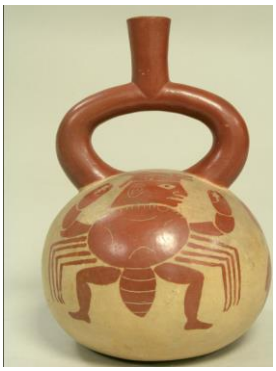

Figure 13: Bottle Crab Deity, 2nd-4th century ACE, Gift of Nathan Cummings, Metropolitan Museum of Art.

Commemorating crabs in art pointed to the significance of water in their lives as well as the transient nature of the world. The crabs symbolize a reality where the world is unpredictable despite our machinations to create structure and order. Rain, floods, droughts, and severe weather shaped their everyday lives, and the Moche People represented the wash of environmental phenomena in art to appease the gods, and to demonstrate faith. Connecting with the creative powers of the gods also finds its place in the naming species. Naming demonstrates acknowledgement of the unique character of a creature and signals connection. One example stems from famed 18th century naturalist Carolus Linneaus, credited with discovering the crab species fondly called "Sally Lightfoot" (*Grapsus grapsus*), named for its sprite, rapid scamper that embodies the definition of the verb "sally" as "a sudden charge out of a besieged place against the enemy." Charles Darwin was the first to record detailed observations of "Sally Lightfoot" during his four-year *Beagle* journey around the world, but it was John Steinbeck who wrote of his personal encounter with "Sally Lightfoot" in the style of a romantic novel. In *The Log of the Sea of Cortez*, Steinbeck writes of his enchantment with Sally Lightfoot: "The very name they are called by reflects the delight of the name. These little crabs, with brilliant cloisonné carapaces, walk on their tiptoes. They have remarkable eyes and an extremely fast reaction time. They are able to run in any one of four directions; but more than this, perhaps because of their rapid reaction time, they read the mind of their hunter."[170] Steinbeck is hypnotized by the vibrant colors and agility of these crabs, and he equates their quickness with "telepathic" powers. Steinbeck makes sense of the crab via a mindreading of his own; illustrating how the mind defaults to spontaneous inferential reasoning in order to understand the world.

[170]John Steinbeck. *The Log of the Sea of Cortez*, The Viking Press, 1951, p. 53.

The mind tricks itself to get a grip on its own meanderings. A ready-made mind arranges complexity into simplicity to function. One coping mechanism is to make a caricature of the real, characterizing the genre of horror movies. The 1957 pulp fiction horror film “Attack of the Crab Monsters” directed by Roger Corman takes place on a remote island in the Pacific Ocean where a group of scientists disappeared without a trace and a new group of scientists are dispatched on an expedition to find out what happened. What the scientists do not know is that the missing scientists were devoured by a pair of radioactively mutated giant crabs. The crabs absorbed the minds of the scientists and are now able to communicate telepathically using their voices. Because of the mutation to their cell structure, these crabs are incapable of being killed by conventional weapons, and, consequently, a battle of wits between man and crab ensues. Though humanity prevails, human hubris is spotlighted when already weaponized creatures, the clawed-crabs, draw attention to the short-sightedness of human invention and the perpetual cycle of problem-solution.

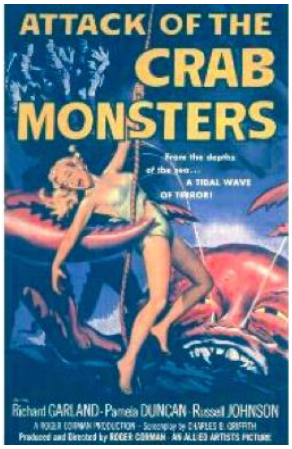

Figure 14: “Attack of the Crab Monsters,” Allied Artists, 1957.

With the “clickety-clack” of their claws snapping open and shut, the horror of being severed by one of those claws seems very real. The alterity of crabs leads directly to this conclusion: that if humans mess with the natural world, the consequences will be dire. Turning

nature into something monstrous became its own genre, aptly labeled eco-horror. The genre plays with the mind's inability to accept that it can be mastered by another creature or the abiotic world. In a series of interviews with 20th century English pulp fiction writer Guy N. Smith,[171] best known for his series of crabs run amok novels befitting the eco-horror genre, he challenges us to reflect on our expectations of a world that is wild, despite our efforts to tame it, and nonchalantly affirms, "As for violence, what do you expect from the Crabs?"[172] Beginning with *Night of the Crabs* the plot lines of each book centers around crabs exposed to radiation which grow to a disproportionate size, and are intent on eradicating humankind. The series expands to the titles *Killer Crabs*, *The Origin of Crabs*, *Crabs on the Rampage*, *Crab's Moon*, *Crabs: The Human Sacrifice*, *Killer Crabs: The Return*, *Crabs' Fury*, *Crab's Omnibus*, and 21st century release, *The Charnel Caves: A Crab's Novel* where the remaining experimented upon crabs return and begin to proliferate in caves beneath the English shoreline. Each book cover emphasizes a large crab claw poised for attack and a tag line calling for complete annihilation of the crabs if humankind has any chance for survival. The problem-solution approach dismisses fault, refusing to acknowledge that "thinking" fails to encompass all possibilities. Instead, attention is placed on the erratic, menacing crabs that have become "murderous machines." The solution is founded on recovery and returning to a "normal" state, where humanity faces the dangers of "playing god" and are also made aware that it is impossible to foresee, or control, the course of events set in motion.

[171]All interviews can be read on the official website www.guynsmith.com.
[172]Interview of Guy N. Smith by Booksquawk, October 31, 2014.

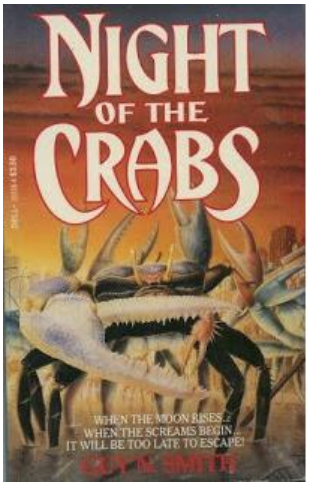

Figure 15: Guy N. Smith, *Night of the Crabs*, New English Library, 1976.

Though it is easy to dismiss unease provoked by a crab invasion as idle fiction, a group of paleontologists discovered a ninety-five-million-year-old fossil of a crab they named *Callichimaera perplexa*, which means "perplexing, beautiful chimera," projecting awe and uncertainty for life's constant twists. The adult crab has swimming legs and other features similar to those found in an earlier specie. Javier Luque, lead researcher on the excavation, contends that this crab "blurs the boundaries of how a crab is defined."[173] In this statement, the question, "What makes a crab a crab?" is prominent. It is a question that launches a series of other questions in a continuous unravelling of what is known and what is speculated, and how even those categories are upended. Discovering a crab described as "the platypus of the crab world" contributes to that categorical uncertainty.

Figure 16: Javier Luque with *Callichimaera perplexa*. Photo Credit: Daniel Ocampo.

[173]Javier Luque, et. al. "Exceptional preservation of mid-Cretaceous Marine Arthropods and the Evolution of Novel Forms via Heterochrony," *Science Advances*, vol. 5, no. 4, 2019, p. eeav3875.

Crabs are perplexing and they continue to astound researchers with their behavior. Another mystifying crab is the Pom-Pom Crab, also known as the Boxer Crab, so named because its claws are gloved by sea anemones it uses as both a defensive tool and to capture prey. These crabs have short, pointed claws adapted to maintain a hold on sea anemones. Thanks to the stinging cells of sea anemones, crabs are protected from predators. In addition, crabs have the advantage of benefitting from eating the food captured by sea anemones. In return, sea anemones become mobile and gain greater access to food stores, oxygenation, and opportunities for asexual reproduction. This mutual relationship was first noted by Karl August Marten Möbius in an 1880 study[174] and further developed by James Edwin Duerden in a published study titled "On the Habits and Reactions of Crabs Bearing Actinians in Their Claws."[175] He concludes, "It is very evident that the actinians by means of the threads of their stinging cells are able to assist the crab in securing its prey, for which the actinian has the advantage of being carried from one place to another, and by this means is brought into touch with more animals which serve them as food." This strange alliance between crabs and sea anemones illustrates how symbiotic bonds contribute to the success of species. In reflecting on this relationship, we weigh the gains and losses of this cooperative transaction, and the open-ended nature of cooperation we coordinate to obtain a desired goal. Cooperation is a game, and each participant guesses the extent to which the other will go to keep or break the commitment.

More than one hundred years later biologist Yisrael Schnytzer[176] resurrected the study and found that if a crab somehow managed to lose one sea anemone, it would approach another

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[174]Karl August Martens Möbius. *Beiträge Zur Meeresfauna Der Insel Mauritius Und Der Seychellen*, Verlag Der Gutmann'schen Buchhandlung (Otto Enslin), 1880.
[175]James Edwin Duerden. *On the Habits and Reactions of Crabs Bearing Actinians in Their Claws*, Undetermined, 1906.
[176]Yisrael Schnytzer, et. al. "Boxer Crabs Induce Asexual Reproduction of Their Associated Sea Anemones by Splitting and Intraspecific Theft," *Peer Journal*, vol. 5, 2017, e2954.

crab with the intention to steal its sea anemone. Rather than a duel to the death, Schnytzer notes that the thief, in this case the crab lacking his own sea anemone, only has thievery in mind. Another strategy the crab uses if it loses a sea anemone is to split the one remaining sea anemone in half to replace the loss. Schnytzer commented that "splitting" behavior is one way that the sea anemone asexually reproduces. In negotiating a symbiotic life, the claws evolved to meet the physical demands of maintaining that partnership. The study is revolutionary, but there is a historical record of crabs using tools to achieve a goal. Second century Greek poet Oppian wrote a five-volume poem on fishing titled *Halieutica* where he espouses the clever thinking of the crab in securing access to an oyster's meaty inside. He writes: "And one who observes a Crab among the mossy ledges will praise and admire him for his cunning art. The Crab on the other hand takes a pebble from the beach and, moving sideways, carries it clutched in its sharp claws. Stealthily he draws near and puts the stone in the middle of the Oyster. Then he sits by and makes a pleasant feast."[177] Oppian anthropomorphizes the crab and grants it the powers of deliberate thinking in conquering the clamped-up oyster. Remarkably, when a creature so unlike us demonstrates calculated thought, or what we perceive as calculated, we are placed in the position of reconsidering what distinguishes reason from instinct.

Improvisation is a distinguishing character trait of reasoning and instinct. Improvisation elucidates the fact that we are always adjusting, and satire surfaces the idiosyncrasies of reasoning. The satire of Charles Dickens and numerous popular magazines of the 19th century featured the crab to illustrate the slipperiness of reasoning. Using a familiar, conversational tone in an article titled "Crabs" published in his own weekly magazine *Household Words*, Dickens writes of the crab as an endearing creature who also graces the world of myth, medicine, and the

[177]Oppian. *Halieutica*. *Book Two*, Loeb Classical Library, 1928, p. 297.

dinner plate. Crabs occupy a diverse array or roles, and Dickens laughs at that medley. First, he satirizes the mindlessness of physical battle by defending the crabs' "penchant" for bouts with one another: "When a crab fights, it is always on a personal question: to resent an insult or to defend himself from assault."[178] He continues the joke by associating the crab's jousting claws with the revered history of chivalry, honoring knights for their virtuous commitment to wage a battle in the name of honor, and argues, "who can tell what may have been the amount of provocation that had led to this hostile demonstration? There may have been a lady in the case; which, considering that crabs are arrayed like knights-errant, always in full panoply, is not by any means improbable."[179] Dickens pokes fun at the ways in which the human imagination is as quirky as the crab itself, invariably in the ways that humanity scrutinizes the past with its mind in the present.

Dickens continues the parody by praising the "cultivated taste" of the crab for demonstrating a love of music and juxtaposes that with the cultivated taste of a person who enjoys crabs seasoned with lime juice. He then concentrates on the leakage of language to express reason when language is riddled with problems. The irony of approving crabs as a meal while showing repulsion at the idea of eating a spider, its closest relative, illuminates the inconstancy of labeling. Labels, order, classification, and language are as shifty as crabs, and Dickens exploits that in his novel *Hard Times*. Amidst fears of industry acting as a de-evolutionary force on humanity, Dickens describes the workers "like the lower creatures of the sea shore, only hand and stomachs" and later as "shouldering and trampling and pressing one another to death" as they fall prey to a mechanized life. Dickens uses the imagery of crabs to depict humanity as mindless, unsociable creatures.

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[178]Charles Dickens. "Crabs,*" Household Words*, vol. 10, no. 237, 1854, p. 178.
[179]Ibid. p. 178.

Crabs refuse our attempts to exorcise ourselves from our baser instincts. This is profoundly felt during the 19th century when the general public was made aware of their lowly evolutionary relations. That knowledge spurred an uncanny fascination with unlikely relatives brought into the home after a seaside excursion and "domesticated" in saltwater aquariums decorating upper-middle class parlors. Crabs brought to light the anxiety of being human as John Harper writes in *The Sea-side and Aquarium; or, Anecdote and Gossip on Main Zoology* that he had to place a crab in "solitary confinement" for its aggressive behavior towards its tank mates, though he fails to prevent a "general massacre." Harper is perplexed by the crab's indifference and is disturbed by the crab's expression of "surprise and indignation" which was "evident, if not from his face, at least by his actions." Hoping for a show of remorse from the crab, which never materializes, Harper seeks to maintain a level head, choosing to believe that "the late disaster was not so much due to the depravity of Crab-nature in general, as to some extraordinary moral perversion exhibited by an individual."[180] His response to the crab's instinct conveys a latent fear of succumbing to one's inner animalistic presence.

A series of articles on crabs published in a wide array of magazines from the 19th century fixate on crabs as a mirror into humanity's interior. One article titled "Crabs," published in *The Albion: A Journal of News, Politics, and Literature* in 1854, expresses a "wish to speak of their [crabs] moral and personal attributes" and proceeds to psychoanalyze the crab, in contradictory language, illustrating that much of what we know is conjecture from multiple stories. The author claims the crab has a "subtle intellect" and that the "crab's career affords strong evidence of his being generally under the influence of an *arrière pensèe,*" translated as a concealed thought or intention. The crab reminds us that we too zigzag along a circuitous route, testing the terrain and

[180]John Harper. *The Sea-side and Aquarium; or, Anecdote and Gossip on Main Zoology*, William P. Nimmo, 1858, p. 71.

the weight it can hold. The author then asks a rhetorical question, “If the crab had not something out of the common in him, is it likely that the learned astronomers would have placed him so conspicuously in the zodiac?” and follows with the affirmation, “There is not a part of the globe of which he is not an esteemed inhabitant” and why the crab is revered for its “many occult virtues” and its principle roles in the “pharmacopeia of the middle ages.” The magical aura placed upon the crab animates our view of ourselves as sorcerers, appointed with highly specialized minds to figure out the secrets of the world.

The article “The Crab” from *Forrester’s Boys’ and Girls’ Magazine, and Fireside Companion* published in 1856 praises the resilience of crabs such that if crabs find themselves “confined in the pot or basket in which they have been caught, for months together, without any food other than that which is collected from sea water,” they will live. Despite its tenacious grip on life, the crab also demonstrates self-destructive tendencies, shown by the fact that the crab, considerably “being irritated” by its own claw, proceeds to grab it and crack it open. Yet, when the crab became aware of its wound, “it cast off the piece in the usual place but continued its hold with the great claw a long time afterwards.” The behavior of the crab, participating in its own destruction, is disconcerting. It maintains its composure in hanging on to its own flesh only recently torn from its own body by its own claws, evoking both fascination and shudders.

In June 1877, the monthly magazine *The Sanitarian* printed an anonymous piece titled “Crabs” using the character traits of the crab to metaphorically stand for “anti-progressive ideas.” The author notes that in addition to walking backwards, indicating regressive tendencies, the crab “clings to anything which is thrust at him with a grip which nothing on earth can sever, and the human crab sticks to old, exploded theories and notions which ought to have been forgotten long ago.” The article describes the crab as provocative, seeking out violence in their “warlike”

crusade and "the human crab is doubly so" in vengeance. The metaphor calls out our erratic negotiations with our own kind, and suggests that if reasoning were stable, we would all see in the same way.

The periodical *Once A Week* published an article "The Crab" in 1878, by an author named as "Young Philosopher" rather than using his real name, George Manville Fenn, a prolific 19th century English novelist who contributed to the periodical *All the Year Round* published by Charles Dickens. The article describes the crab as something out of the norm, yet that which is out of the norm becomes compared and categorized according to something known: "This wonderful freak of nature has been variously called by naturalists a fish, and a vegetable, and possess the advantage of being called which you please, proof is shown in the Latin, where, if you inquire within whether you may call a crab a fish, you find you cancer (can sir)." This play with phonetics continues as Fenn calls attention to the logic of not spelling crab with the letter "k," though you can eat it with a "knife." He follows with the ways in which species are scientifically catalogued yet are endearingly pinned with nicknames like the "snub crab" likened to "cross old women" or the "carpenter crab" so called because of a penchant for "holding together boards which refuse to be married with nails." In reality, carpenter crabs have sharp claws able to cut through wood, though have yet to build anything. Fenn's crab takes residence everywhere, finding its way to the constellations and the dinner plate, often mistaken for crab apples, or the "original apple bitten by Eve" bestowing knowledge. He concludes his story with another bite at language use, insinuating that we are more instinct driven than we recognize and our use of language may not be the most direct line between two points: "The way to dress a crab is in oil and vinegar, and pepper…These clothes are hard to keep, so the custom is not to put them on, like jackets or trousers, but to open him, shake them up, and pop them in." The use of

dress to convey two kinds of covering, seasoning food and covering up nakedness, shows that puns are often necessary tools, indeed tricks, to expose a truth in a more meaningful way.

Truth is subjective. Interestingly, crabs appear in the Bible as forbidden food and a warning against cultivating a "crab mentality" represented in the story of Jacob grasping for the foot of his twin, Esau, to usurp the position of first born. The phrase "crab mentality" is associated with the idea of dragging someone down. That may be why crabs found themselves the subject of an article titled "Crabs" in the *New York Evangelist*.[181] Writer Sarah Cooper narrates the life history of crabs and uses crabs as a metaphor for disorientation: "At the first glance we can scarcely tell which is the head. Walking as they do, forward, backwards, and even sideways, with equal case, it seems as if they too might be slightly puzzled about their formation, and so, not stopping to decide which part is intended to go foremost, they dart off on a venture, and in the oddest manner possible." The crab here acts as a warning against acting rashly or impetuously; associated with the "painful and perilous" molting process. This is a sentiment expressed in another article titled "Crabs" published in the periodical *The Youth's Companion* in 1889, describing crabs: "Crabs, like other of the lower animals, have sources of knowledge which, to human view, seem very mysterious, if not absolutely inscrutable." The inscrutability of the natural world continuously challenges ways of knowing.

The topic of crabs did not escape the attention of *Hardware Dealer's Magazine*.[182] One article prominently displays its title "CRABS" in large bold letters over the image of a crab with large claws projecting from the page. Roy F. Soule points out the astonishing features of crabs, such as their eyes concentrating like "spotlights" with unwavering focus. Crabs are not distracted. Obstacles are climbed over without thought. After emphasizing the admired character

[181]Sarah Cooper. "Crabs," *New York Evangelist,* vol. 55, no. 5, January 31, 1844, p. 6.
[182]Roy F. Soule. "Crabs," *Hardware Dealer's Magazine,* vol. 68, no. 2, August 1927, p. 23.

traits of crabs as "the greatest side steppers in the world" and "natural scrappers," Soule concludes by asking the audience to reflect on what it means to call a person a crab. Under the subheading "He's a Crab" Soule asks us to think about how the idea of a crab, a creature who eats its own kind, feeds off the unpalatable organs of other creatures, and walks sideways, became a moniker to describe a human who is considered to be a grouch. Soule concludes his encyclopedic account with the remark, "Real human crabs are scarce. Many try to create the impression that they are hard shelled," noting that humanity is not impermeable. He concludes with the fact that crabs have a "rather vigorous way of tearing one another apart," as a commentary on the fallibility of reasoning to see a common humanity when blinded by desire.

Claws: Loyalty and Loss

Claws are the signature mark of crabs. While some crabs have dimorphic claws, a large claw designed for strength and a smaller claw designed for quick motion, others have monomorphic claws of the same size and strength.[183] Because claws perform varied tasks, their strength and maneuverability are closely linked with fitness, and are brandished like swords, warning predators to keep a distance. Charles Darwin admired this unique feature of crabs and equated claws with a sign of fidelity. Darwin writes of the sacrifice of the "hard-shelled crab [that] always stands sentinel to prevent the sea insects from injuring their companions" and while on duty will "boldly meet the foe" yet when off-duty, "shows great timidity, and is very expeditious in effecting his escape from his enemies."[184] For Darwin, crabs stand as pillars of

[183]G. J. Vermeij. "Patterns in Crab Claw Size: The Geography of Crushing," *Systematic Zoology*, vol. 26, no. 2, 1977, pp. 138-151.
[184]Anonymous. "The Crab." *Forrester's Boys' and Girls' Magazine, and Fireside Companion*, December 1, 1856.

loyalty and wisdom, ready to defend the life of their fellow creatures, prudent in choosing when to retreat.

Claws are a product of predator/prey relationships. Both predator and prey unknowingly and unwittingly participate in a back-and-forth exchange that continuously shapes the other. Predator-prey relationships, that is, the dynamics of species and interspecies interactions, influence the shape, size, and variation of claws. Differences in the power and agility of claws directly correlates with the diversity of life forms crabs come into contact with regularly. What they eat fashions their appearance and functional properties. Maintaining a versatile diet promotes their ability to adjust to the speed or *hardness* of prey. The time it takes to capture or break into a prey has a reciprocal effect on claw morphology, and consequently a trickle-down effect in the ecological role played by the crabs as managers of complex food webs.

Research on intra-species difference in claw morphology shows that "the strong response of crab claw morphometry to environmentally induced diet variations is an important mechanism in successful adaptation of crab species to inhabit differing habitats."[185] In predator-prey relations, a natural "arms race" occurs, and the dexterity of the claw impacts the chances of survival. Researchers evaluating the power of a crab's claw discovered it is capable of generating a crushing force up to eight hundred Newtons. This power is assessed when crabs defend their territories against hostile take-over. A crab must stand ready to fight to protect its home and surrounding hunting grounds from poaching by other crabs. This fact is borne by a reality that these indiscriminate carnivores have no qualms about resorting to cannibalism.

Claws are paramount in all aspects of a crab's life. One function of the claws which does not readily come to mind, though it is of unequivocal importance, is the role they play in

[185]Ana Silva, et. al. "Variation in Crab Claw Morphology and Diet Across Contrasting Inter-tidal Habitats," *Marine Ecology*, vol. 38, no. 1, 2017, p. e12374-n/a.

attracting a mate. More than just weapons, claws are tools for communication. Claws signal to related conspecifics, as well as other non-related species, and produce a network of messages. Specifically, claws facilitate female attraction and female choice. Whether or not a crab has the opportunity to pass on its genes depends on the size of the large claw and the effectiveness in showing off a high rate of waving. The ability to demonstrate agility, endurance, and stamina corresponds with signaling health and virility, all important for ensuring reproductive success and main selling points in attracting females. Although energetically costly to produce, a large claw is also more effective in deterring other would-be suitors from competing for the attention of a female.

Claw waving displays vary among species. In addition, waving engages the whole body. The posture of the crab, the action of the smaller claw, the movement of the legs, and the pattern of walking all contribute to the process. The mosaic repertoire of displays spotlights the uniqueness of each individual, while also securing species recognition. Like attracts like and storing a rich catalogue of identifying markers reduces the chance of mistaken identity. Crab waving is of interest to crab researchers because those subjective measures of attractiveness provide information regarding the crab's retention of particular physical and behavioral traits. Fiddler crabs comprise the majority of studies on claw waving displays and the major claw of fiddler crabs holds as much as 50% of its total body weight. These crabs live all over the world and their nickname comes from their manner of eating. As deposit feeders, they scoop up sediment and scrape the material across their mouths to sift out food, resembling a bow moving across the body of a fiddle.

One revolutionary study investigated the quantitative appraisal of crab waving in the fiddler crab and resulting mating success. The study recorded the patters of "interspecific waving

variation" governing communication strategies.[186] The study found that the rate of waving, or waving velocity, is affected by recognition from a member of the same species and females show a preference for crabs who wave with higher intensity. In a natural setting, as opposed to laboratory conditions, researchers showed females preferred higher wave rate over claw size.[187] Timing in lifting and lowering the claw was the main focal point of the quantitative study, although other factors, such as position of the claw, contributed to female preference. The position of vertical movement of the claw relative to the position of the crab's body, either directly in front of the crab or to the side, also contributed to female preference. A novel "more circular 'come hither motion'" motion observed in *Uca beebei* attracted more attention.

Courtship between males and females is intricate. A female will approach a male and the show begins with "high intensity waving in which he unflexes his large claws, raising and lowering it several times. Along with the waving of the large claw, the male also raises and lowers his small claw as well as one or two of his walking legs."[188] The ritual translates into a demonstration of control and composure, and thus, an ability to protect. While female choice drives signaling displays in males, females must nonetheless be on alert for false advertising. Since displays are energetically draining, males may "fakeout" a female to expedite the mating process. Females must keep a fine eye on the "individual signals of a male's multiple displays in order to identify which of the signals could potentially convey information about the male's

[186]Daniela M. Perez. "The Evolution of Waving Displays in Fiddler Crabs (*Uca* species, Crustacea and Ocypodidae)," *Biological Journal of Linnean Society*, vol. 106, no. 2, 2012, pp. 307-315.
[187]Sophia Callander, et. al. "The Effect of Claw Size and Wave Rate on Female Choice in Fiddler Crabs," *Japan Ethiology Society*, vol. 30, no. 1, 2012, pp. 151-155.
[188]Minoru Murai and Patricia R.Y. Blackwell. "More Signaling for Earlier Mating: Conspicuous Male Claw Waving in the Fiddler Crab *Uca perplexa*," *Animal Behavior*, vol. 70, no. 5, 2005, pp. 1093-1097.

condition or quality."[189] The repertoire of claw-waving displays is vast, and females must be judicious in order to detect deception.

Mate choice drives the propagation of genes and competition drives the selection process. Crabs are alert to intruders and must be ready to bout. But the crab does not always fight alone. A larger crab will engage in bouts to protect the territory of smaller crabs as well, and the smaller crabs may lend a hand. In what constitutes a type of mutualism between larger crabs and smaller crabs, the larger crabs fight to protect the smaller crabs and the smaller crabs withdraw from participating in courtship rituals. Whereas the larger crab will protect the territory of smaller crabs, smaller crabs will refrain from competing for females, and consequently, remain small. For larger crabs, though the battle may not always prove victorious, "the immediate cost of helping to retain a small, familiar neighbor is less than that of negotiating territory boundaries with a larger replacement neighbor."[190] Therefore, it is wise to keep the neighbor you know, the one which does not pose a threat.

The crab is an anomaly. With claws that serve as tools to defend others and to also attract mates, crabs require the mind to balance the logical and the marvelous, the rational and irrational, all at once. Their inscrutability captivated playwright William Shakespeare who weaves together the idea and image of crabs, either the fruit or the sea creature, indistinguishably in several plays. The word "crab" interchangeably refers to either a sour apple causing the face to pucker like a fish or the peevish marine crustacean snapping at intruders to cause frantic scurrying. Ironically, both types of crabs were popular snacks for the lower classes attending the

[189]Fumio Takeshita, et. al. "Multimodal Signaling in Fiddler Crabs: Waving to Attract Mates is Condition-Dependent but Other Sexual Signals are Not," *Behavioral Ecology and Sociobiology*, vol. 72, no. 140, 2018, pp. 1-10.
[190]Jessica Bolton, et. al. "Even Weak Males Help Their Neighbors: Defense Coalitions in a Fiddler Crab," *Ethiology: International Journal of Behavioral Biology*, vol. 117, no. 11, 2011, pp. 1027-1030.

open-air Elizabethan theaters.[191] The ambiguity between crab-apple and crab-crustacean is never fully resolved, though it is apparent that the reference to the crustacean is understood in Hamlet's taunting of Polonius, "for yourself, sir, shall grow old as I am, if, like a crab, you could go backwards." Polonius responds to himself, "Though this be madness, yet there is method in it" (II.ii.197-203).[192] While Hamlet appears to have lost his mind, he nevertheless makes sense. Polonius is confused and cannot fathom if Hamlet is sane or not.[193] Hamlet leans on the non-linear crab to disrupt the unadulterated association between age and wisdom.

The Renaissance tied wisdom to relations between friends.[194] Renaissance essayist Michel de Montaigne,[195] whom Shakespeare borrowed from generously, likened friendship to an unspoken, invisible bond stretched beyond any limits. Friendship extended social obligations to absurd proportions and the words spoken between friends cemented that bond. Shakespeare parodies friendship and language in the duplicitous friendship displayed by the two gentlemen Valentine and Proteus, and the loyal, incommunicable friendship between Launce, servant to Proteus, and his dog Crab[196] in the play *The Two Gentlemen of Verona*. Though the friendship

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[191]Julian Bowsher and Pat Miller. *The Rose and the Globe: Playhouses in Shakespeare's Bankside, Southwark*, Museum of London Archaeology, 2009.

[192]William Shakespeare. *Hamlet*, Yale University Press, 2003.

[193]In the same scene, Hamlet mocks humanity's self-assigned role as the paramount of reason, stating, "What a piece of work is man! How noble in reason! How infinite in faculties. In form and moving how express and admirable! In action how like an angle! In apprehension how like a god! The beauty of the world, the paragon of animals! And yet to me what is this quintessence of dust?" (II. ii. 293-298).

[194]The Renaissance is marked by a revival of classical thinking and borrowed from the classical ideas of Socrates, Plato, and Aristotle, who divided friendship into three distinguishing types in *Ethics*, and reserved the category of utility for "old, crabbed men."

[195]In an essay titled "On Friendship" Montaigne writes: "But in the friendship I speak of, they mix and work themselves into one piece, with so universal a mixture, that there is not more sign of the seam by which they were first conjoined. If a man should importune me to give a reason why I love him, I find it could not otherwise be expressed, than by making answer: because it was he, because it was I. There is, beyond all that I am able to say, I know not what inexplicable and fated power that brought on this union." Montaigne emphasizes that true friendship is seamless, tethered by an unspoken understanding that breaks the bounds of language, which does not need language, knotting the pair in extrasensory communion.

[196]The image of dogs was also prevalent in paintings and as emblems upon grave sites, signifying ideals of fidelity and faithfulness, as well as serving as signs of intuition and perseverance. Read the article, "The Dog in the Humanist's Study" by Patrik Reuterswärd in the journal *Konsthistorisk*.

between Launce and Crab is satirical, the irony of Launce endangering his life to safekeep a dog, whereas the two gentlemen figuratively bout with one another's trust, calls on us to question the ease with which social bonds dissolve in favor of the favor of a mate. Valentine and Proteus quickly abandon their friendship, along with the abandonment of reason, when they find themselves in the throes of love. Familiars since birth, the two share a special intimacy, but at the very beginning of the play we are immediately introduced to a rift in their relationship with Valentine's imminent departure from Verona to Milan to fulfill his duty to travel and become enlightened, thus off "To see the wonders of the world abroad" (I.i.6). Valentine derides Proteus for his want of stasis and warns Proteus that his mind will wither away if he tethers himself to the hearth: "Home-keeping youth have ever homely wits" (I.i.1). Valentine criticizes Proteus for being lovestruck with Julia, and equates emotion with an absence of self-control, stating Proteus is "yoked by a fool," which has dulled his reasoning. Valentine later becomes lovestruck with Silvia and becomes dull-witted himself. Aware that Silvia's father, the Duke of Milan, has selected another suitor for Silvia, Valentine rejects any code of morality and plans to flee with Silvia. However, he is betrayed by Proteus, in whom he confided, and consequently is banished from Milan into the woods, where he joins a band of outlaws and becomes their leader.

We expect Valentine and Proteus to support each other, yet they both abandon the other for their own pursuits. Sick with love, Proteus admits he is discombobulated and incapable of discourse:

> Thou, Julia, thou hast metamorphosed me,
> Made me neglect my studies, lose my time
> War with good counsel, set the world at naught;
> Made wit with musing weak, heart sick with thought (I.i.65-70).

Lovestruck Proteus detaches himself from humanity and readily abandons the intellectual world. His "wit by folly vanquished," Proteus can only envision himself cast through the eyes of Julia. But, true to his shape-shifting oceanic namesake, he quickly changes his mind and forsakes Julia after meeting Silvia, who "hath dazzled" his reason. Proteus is impervious to Valentine's professed love for Silvia, nor does he care that the two had already secretly betrothed themselves to the other. And, though Proteus acknowledges his "erring love," he continues to scheme against Valentine. The word "reason" continuously applied to Proteus satirizes the belief that reasoning is automatically associated with class. Proteus admits his self-centeredness and hides behind the mask of status, betraying Valentine's trust and competing for Silvia's affection. Proteus places his desires above the demands of social cooperation, admitting, "I to myself am dearer than a friend" (II.iv.23) and at the end of the play confesses that to be human is to pretend. He exclaims, "O heaven, were man/But constant, he were perfect. That one error/Fills him with faults" (V.iv.109-111), drawing attention to the tempestuous nature of being human. Proteus performs the role of friend yet is duplicitous.

In opposition to Proteus, the selfless, passionate devotion of Launce for Crab defines the meaning of friendship and reciprocal relations with the natural world. Though Crab is not a literal crab, the interspecies bond between Launce and Crab indicates that real bonds supersede social laws. Launce protects Crab at all costs, even to his own physical self, without reciprocity. His selflessness undermines the expectations of reward which reason dictates. While Crab is certainly a dog, his appearance in the play is always associated with water. The reason for naming the only dog to appear in any of Shakespeare's plays Crab is not known, though the prevailing view of crabs at the time was something indeterminate, bewitching even, and antisocial. Crab exhibits all these qualities. However, it is Launce's unwavering, unconditional,

and “unreasonable” love for Crab over the years that creates a distinctly fluid but real connection. Launce and Crab appear on stage when they are taking their leave, along with Proteus, from Verona to join Valentine in Milan:

> I think Crab my dog be the sourest-natured dog that lives: my mother Weeping, my father wailing, my sister crying, our maid howling, our cat wringing her hands, and all our house in great perplexity, yet did not this cruel-hearted cur shed one tear. He is a stone, a very pebble-stone, and has no more pity in him than a dog (II.iii.5-10).

Crab is a dog, expected to not be a dog, and then likened to a dog for failing to not act like a dog. Crab sheds no tears when he and Lance are about to embark on a journey across the sea. Crab is a dog, and therefore, presumably devoid of emotions. Yet dissociating him from his lack of “crocodile tears” in this case mocks the sincerity demanded from others. Launce then reconstructs the episode of his leaving home, substituting an object for each member of his family. He becomes Crab. Shoes stand in for mother and father. A staff stands in for his sister. His hat becomes Nan the maid. Launce then cries, “I am the dog. No, the dog is himself, and I am the dog. O, the dog is me, and I am myself. Ay, so, so.” (II.iii.21). In this confused speech where Launce and Crab are interchangeable and people become objects, Launce fumbles to position who is who and what is what, demonstrating that language fails to keep logical categories where they “belong.” In the shape shifting soliloquy, Launce and Crab become one another’s double, breaking the human-animal divide, and orienting the audience towards a shared creaturely existence.

Launce plays with the fluidity of language and contrasts language with rational order. The metaphor of the tide providing both formidable and favorable opportunities to leave one’s place is one example of the slippery wateriness of language. When Launce makes his way to the docks, commanded to make haste lest he lose the tide, Launce responds to the comment by

referencing his (un)tethered connection with Crab, “It is no matter if the tied were lost, for it is the unkindest tied that ever any man tied” (II.iii.35-37). Launce’s cunning use of the word “tied” for “tide” reflects the binding affection he holds for a dog and sustains, despite the lack of emotion demonstrated by Crab. It is their watery relations that keeps Launce afloat. Cinching himself to Crab gives him purpose that does not ebb and flow like the tide, emblematic of the friendship between Valentine and Proteus, who use language to jeer, jibe, and fool the other. There is a long watery history between Launce and Crab, beginning with Crab’s birth, as he recalls, “one that I brought up of a puppy; one that I saved from drowning when there or four of his blind brothers and sisters went to it. I have taught him even as one would say precisely, ‘Thus I would teach a dog.’” (IV.iv.4). Launce risks his life to save Crab and when Crab steals a “capon’s leg” from Silvia’s plate and then proceeds to urinate under the table, another watery sign, Launce offers himself in place of Crab to bear the punishment. Launce reprimands Crab for urinating under the table with rhetorical questions that assumes Crab to be human: “Did I not bid thee still mark me and do as I do? When didst thou see me heave up my leg and make water against a gentlewoman’s farthingale? Didst thou ever see me do such a trick?” (IV.iv.37). These questions foreground the fact that reason compels people to hide natural inclinations for the sake of public acceptance, and earning public acceptance comes from following social norms. Launce dispels those norms by casting himself as Crab in his own play. There is a relation between Launce and Crab that challenges what is acceptable, erupting the distillation of the tame from the wild in human behavior and taking notice of Crab-inspired truths.

Launce continuously reminds us that Crab is a dog, effectively drawing the audience to take note of the differences between Launce’s openness and the deceptive, double-talk between Valentine and Proteus. Lance confronts the gentlemen threatening to punish Crab by ridiculing

the reasoning capacity of a person who resorts to violence to teach another species a human lesson: "Friend…You mean to whip the dog?" and reproaches the man for not being able to reason well, "You do him the more wrong." Launce takes the blame for Crab's misdeeds, "Twas I did the thing you wot of" and offers himself to bear the whip. Crab publicly humiliates the court, remains unperturbed, and upends the promiscuous veneer of honor and status by evoking a human response, and a violent one at that. Launce also cites the many times he sacrificed his own life and reputation in safe-keeping Crab from being punished for being a dog and following his instinct, "I'll be sworn I have sat in the stocks for puddings he hath stolen; otherwise, he had been executed. I have stood on the pillory for geese he hath killed; otherwise he had sufferd for 't" (IV.iv.28). Launce rattles the Renaissance definition of friendship, collapsing the expectation of reciprocity and erecting an incorruptible authentic relation in its place. By sacrificing himself for Crab, Launce publicly demonstrates the irrational impetus to put on a show of warning for others who fail to abide by the boundaries of being human, the public punishment displays the audacity of failing to display self-control.

We know Launce holds Crab in high esteem even when others would dismiss Crab as a "cur," meaning a rogue or rascal, though Crab never strays from his identity. Rather, it is Valentine and Proteus who act like "curs" in their deception. Launce sees Crab as an equal and defends Crab's worthiness to Proteus who sends Launce to gift Silvia a lap dog as a token of love.[197] Because the lap dog was stolen from him in the market place, Launce generously gifts Crab to Sylvia instead. Launce prizes Crab and forthrightly claims Crab is "as big as ten of yours and therefore the gift the greater," (IV.iv.55) mocking Proteus for thinking one dog noble and

[197]The popularity of lap dogs as fashion accessories for the aristocratic crowd also served a purpose in keeping the laps and feet of young ladies warm.

another a scoundrel based on appearance yet fails to see the irony of Launce's convictions. Launce decries Proteus' disregard for Crab and thinks Proteus a fool for his means of measuring worth. Proteus berates Launce for prizing Crab over a show dog, ironically, Proteus is the "mongrel" who sees himself as the better suitor to Silvia.

Launce does not engage in posturing and does not lose his status as "human" by turning himself into a dog. His lack of pretense illustrates an unsevered bond with what is natural. Therefore, his natural friendship does not require peace keeping platitudes. That is not the case for Valentine and Proteus. Their friendship is a transaction and to restore an established order, Valentine relies on the language of business to negotiate a truce, "I receive thee honest" (V.iv.78) and Proteus responds by offering his "hearty sorrow" as "sufficient ransom for offence" (V.iv.74-75) reiterating that their friendship, once tested, has failed. Both agree to maintain the ruse and Valentine cements the deal by accepting Proteus' words, closing with the line, "then I am paid" (V.iv.78). The way they demonstrate friendship reveals the ways in which they think about themselves as isolated individuals whose self-interest shadows the community. It is Proteus and Valentine who cross the lines of friendship and loyalty, who put on a public face and hide a private one, while Launce and Crab tell the truth.

Walking Sideways: The Ebb and Flow of Human-World Laws

Aristotle writes that desire and thought motivate every living being to move. In *On the Gait of Animals*, he argues that movement, characterized as a change of state, is a result of mental activity. For Aristotle, movement is a deliberate act and more than just a series of nerve impulses circulating through the body. He was intrigued by propulsion in general and by the unique, disk-like body of the crab. Aristotle described the crab as a circle without beginning or end, equipped with "many leading feet" and "its side equivalent to a hinder part," so that its

entire body moves "obliquely." The crab depends on coordinating all its limbs, as Aristotle notes, "because otherwise the limbs that were still would have got in the way of those that were moving"[198] and the crab would tumble. For crabs, precision is necessary to prevent entanglement between the five pairs of legs (four walking pairs and one pair of claws) attached at a 90-degree angle to a spherical body. The crab's fine-tuned motor skills and keen ability to refine its steps according to its environment led Aristotle to designate locomotion as the essence of an animal.

Crabs are unique in walking sideways. Their manner of walking, though, is metaphorically associated with something perverse and sinister, purportedly hiding some nefarious purpose. That purpose is to disorient predators. Forward walking was once the norm for crabs, but the evolutionary transition to sideways walking provided them with the ability to escape predators approaching from any direction. Crabs rely on the rhythmic push and pull of muscle groups to regulate the alternating slack and tension that carries the entire body. The muscles bear the burden of weight shifting and balance to maintain a steady footing in both static and fluid environments. Quick maneuvering is essential for crabs. They depend on a fast recovery in fluctuating substrates and need to change direction at an instant. Therefore, the legs of the crab alternate functioning between a leading side and a trailing side. Each leg has seven distinct segments and because the "knees" of the crab are jointed sideways, the crab is able to scuttle rapidly to the left or right with plenty of leg room and agility. The crab rarely walks forward or backward, though it can, but does maintain a forward focused gaze as its legs, often poetically described as a ballet dancer on point shoes, elevate the body and carry it across the stage. This acute control of body is described as a "sixth sense."[199]

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[198]Aristotle. *On the Gait of Animals*. Trans. A.S.L. Farquharson, Infomotions Inc., 2000, p. 17.
[199]Carl P. Spirito, et. al. "Nervous Control of Walking in the Crab *Cardisoma guanhumi*," *Zoologie Physiologie*, vol. 76, no. 1, 1972, pp. 1-15.

With ascribed extrasensory perception, crabs navigate on both dry and wet substrates, shifting their gait to balance on rugged rocks encrusted with shelled creatures. The instability of substrates poses a danger and the potential to slip is real. The crab must constantly adjust its center of mass to compensate for the diversity of textures. Adjusting and readjusting the center of mass requires a change in speed that calls for acceleration and deceleration with respect to the terrain. In addition, the shift from water to air poses discrete challenges for crabs. The viscosity of water is much higher than that of air. Consequently, the drag forces acting on the crab's ability to mobilize in water are more challenging than on land. Yet, the crab's dexterity and skill enabled arthropods to claim the title of the first sea creatures to "invade" land. This claim is evidenced by the discovery of an arthropod fossil dating back 450 million years.[200] One theory hypothesizes that direct contact with the sea floor, that is, bottom walking, gave crabs an advantage to successfully transition between worlds.

In order to maneuver between land and sea, crabs shift power between their legs. Studies indicate that "By pushing laterally, legs create a more robust gait that can be passively self-stabilizing as the animal changes speed, moves over uneven ground, or is knocked askew by uneven terrain, a gust of wind, or a would-be predator. Species with sprawled postures can actively alter course by changing orientation of forces generated by a single leg!"[201] This biomechanical control provides an advantage for crabs to quickly shift gears as the earth beneath their feet suddenly changes. A crab's gait is defined by speed. Low-speed locomotion is described by an "inverted pendulum gait" and high-speed locomotion is described by a "bouncing gait." The inverted pendulum reflects the exchange of energy between actual

[200]A. J. Jeram, et. al. "Land Animals in the Silurian: Arachnids and Myriapods from Shropshire, England," *Science*, vol. 250, no. 4981, 1990, pp. 658-661.
[201]Michael Dickinson, et. al. "How Animals Move: An Integrative View," *Science,* vol. 288, no. 5463, 2000, pp. 100-106.

movement and the gravitational forces acting on the body's center of mass. It is as if the crab is vaulting over its own legs. A bouncing gait, according to biologist Claire Farley, a specialist in animal locomotion, resembles "legs [behaving] like compliant strings" if one imagines the motion of a pogo stick. A crab's walking life is always a process of exchange innervated by the outside environment and a constant struggle to prevent itself from overturning. There is an intimate connection between crabs, the ground beneath their feet and the air or water surrounding them.[202] Inescapably, crabs must be quick on their feet in order to move in a world that is always in motion.

The unusual sideways gait inspired writers to use the crab as a symbol for crookedness and deceit. Moving sideways was associated with going against what was "right" and regarded as a blatant attack on social norms. To "go sideways" became a euphemism for going against reason. One example is found in the comedic play *Peace* by the 5th century BCE Greek playwright Aristophanes, which centers around the Peloponnesian War (431-404 BCE) between the Greek city-states of Sparta and Athens. The gods, tired of the senseless battles between the states, abandoned their thrones on Mount Olympus, leaving War to reign and Peace incarcerated. The main character, the farmer Trygaeus, takes it upon himself to reason with the gods and rides up to Mount Olympus on a dung beetle, rescuing Peace. Although the play promotes a return to an idyllic agrarian life, Aristophanes parodies the logic of using war as a tool for financial gains. He turns to the crisscross movement of the crab to chastise human folly, whose penchant for violence results in alienation from one another and the natural world. He writes, "You will never

[202]Andrès G. Vidal-Gadea, et. al. "The Evolutionary Transition to Sideways-Walking Gaits in Brachyurans Was Accompanied by a Reduction in the Number of Motor Neurons Innervating Proximal Leg Musculature," *Arthropod Structure & Development,* vol. 42, no. 6, 2013, pp. 443-454.

make the crab walk straight," using the biology of the crab to chastise humanity's reluctance to change course despite insufferable loss.

Negotiating the place of humanity as "rational animals"[203] in the natural world inspired the writing of late-Victorian author Rudyard Kipling, famed for *The Jungle Book*, a tale that features a boy raised by animals, and reflects the anxieties of degradation and environmental collapse at that time.[204] Kipling wrote at a time when both the havoc of human-made and natural disasters sparked fears about sustainability of life on Earth. That fear was exacerbated by the influx of technological inventions destabilizing connections with the natural and spiritual world.

The world had a beginning; therefore, it was logical to believe it would have an end, and Kipling sparked the idea that the world, and by default humanity, was not eternal and indeed mutable. In mingling animals, humanity, and the divine into one space, Kipling confronts the logic of erecting an uncompromising space between humanity and the outside world. Kipling turns to a crab to discuss how humanity moves about recklessly in the world because they exist in a state of in-between; neither absolute "god" or animal. He draws upon his fascination with the natural world and animals, including the crab, in stitching together the imaginative and the real. In his story "The Crab that Played with the Sea," from the collection of *Just So Stories*,[205]

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[203] The catalyst for questioning what it means to be rational began with the widely and commonly accepted premise that Aristotle labeled "man" a "rational animal." The label inspired psychologists and authors to attest that label, citing the fact that human beings act impulsively and make decisions with bias. Psychologists Steven Stitch writes in the article "Could Man Be an Irrational Animal?" (1985) that human reasoning is systematically flawed and people regularly "invoke inferential and judgmental strategies ranging from the merely invalid to the genuinely bizarre" (p. 115).

[204]The Late-Victorian period inverted the evolutionary ideas of Charles Darwin into the theory of Social Darwinism, and the invention of eugenics, a term coined by Francis Galton, cousin to Charles Darwin, in *Hereditary Genius* (1869), advocating for individual responsibility in breeding more resilient and intelligent human beings.

[205]Kipling remarked that he selected the title *Just So Stories* to illustrate that though we may gather knowledge on how the world works, we cannot create it; some things are just beyond us. They are magic. The term just-so-story has been adopted by evolutionary biologists and sociobiologists to examine the complexity of human development. Kipling's statement that his best work was inspired by an energy outside his conscious self, which he referred to as his "Daemon" in his autobiography, *Something of Myself: for My Friends, Known and Unknown*, Pickle Partners Publishing, contributes to discussions concerning if we are in control of our own minds or just act instinctively.

famed for exploring the intersection between childhood and adulthood, Kipling takes us on a guided tour of knowledge gathering and knowledge creating to rattle a rationalizing partnership with "God;"[206] a relationship that places humanity on equal footing simply because the first human, Adam, was tasked with classifying the natural world.

As in many of the *Just So Stories*, in "The Crab that Played with the Sea," is set in a magical place in the "High and Far-Off Times" before the world came into existence. The audience is introduced to the Eldest Magician busy with putting the world in order. The magician calls out to all the animals and assigns each of them a specific "play" and that play translates into the diverse topographies of the world. The idea of "play" refers to the co-creative act of world building, which excludes Man in this story. This is made clear by the magician who "breathes" a life-giving force to the ground the elephants stomp upon to create the Himalayan Mountains, to the grass the cows chew to create the deserts, to the dams the beavers build to form Florida's Everglades, and to the sand the turtles scoop with their flippers to create the Malayan Archipelago. Everyone has a role in creating the world with the exception of humankind.

During the exhaustive process of passing down instructions to each animal, Man, also referred to as the son of Adam to signal he is part of a divine lineage, and his "little girl-daughter," approach the Eldest Magician. Man declares himself "too wise for this play" but instructs the magician to make all the animals obedient to him. Man separates himself by virtue of his intellect, but his insistence on making the animals subservient communicates an unsettling truth of being a "species" with limitations.[207] Though Man asserts that his *creatureliness* lies

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[206]Avivah Gottlieb Zornberg writes in *The Beginning of Desire: Reflections on Genesis* (1995) that "all animal life on earth is described as crawling" and represents animals as irrational, swarming beings without will and leaves Adam the only "image of verticality" to naturally "rule over the world."

[207]Cataloging and categorizing animal and plant life grounded 19th century citizens struggling to cope with the theory of natural selection and the precarious nature of life. The ephemeral reality of species was enforced by naturalist Georges Cuvier who was the first to espouse the theory of species extinction along with his argument that the world itself is subject to cataclysmic upheaval.

outside the constraints of simply being an animal, he must convince himself that animals lack such a mind, and thus, can be programmed to obey. Meanwhile, the crab Pau Amma, "scuttled off sideways and stepped into the sea," refusing to accept the magician's ruling or Man's declared supremacy, mumbling to himself, "I will play my play in the deep waters, and I will never be obedient to this son of Adam."[208] Kipling uses the side-stepping nature of the crab to show humanity that any creature can escape its maker, implicating humanity in a realization that any animal, ourselves included, can become a "Daemon"[209]at any moment. We are also challenged with the idea that reasoning is species specific, and it is wishful thinking to believe humans reason with an unequivocal understanding of the machinations of the world or that the world is permanent and irreversible.

When the Eldest Magician set out to admire the play of the animals, Man complained of the sea's disobedience. He tells the Eldest Magician that once a day the sea creeps in and inundate his house and once a night the sea withdraws, leaving nothing but mud and a stranded canoe in its wake. Unaware of this "play," the Eldest Magician, accompanied by the Man and little girl-daughter, boarded the canoe to find out who was playing with the sea. Once they discovered Pau Amma was responsible for moving the sea back and forth, causing the "little fish to die" and the legs of the Elephants to become all "muddy," the magician admitted he could not stop the crab's "play" because he had escaped at the "very beginning." Both the magician and Man face the reality that classifying and categorizing the world does not make the world static. The world is always personal, and Man is porous and vulnerable to the ways of the outside world despite arguments to the contrary.

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[208]Rudyard Kipling. *Just So Stories*, Doubleday Page & Company, 1902, p. 180.
[209]Rudyard Kipling uses the word "Daemon" in his autobiography *Something of Myself: For My Friends, Known and Unknown* (1937) to articulate the magical, transcendent, other conscious realm that enters him as he writes.

The magician and Man confront Pau Amma, and the crab pleads ignorance to his part in moving the tides. He is unaware of the "havoc" he wreaks and defends himself by citing that he is only scavenging for food: "Once a day and once a night I go out to look for my food. Once a day and once a night I return," and the unintended consequences are not his responsibility. Yet, when told that his daily scavenging disrupted the peace between water and land, leaving "all the beaches of all the islands left bare" only to be later drowned, he took pride in his perceived influence on everyone's life. Pau Amma swelled up at this news and responded, "I did not know I was so important. Henceforward, I will go out seven time a day, and the waters shall never be still."[210] Pau Amma, elated with his newly discovered power, waves his legs to "stir up the sea."

In order to teach Pau Amma that his powers are not as far-reaching as he assumes, the magician strips the shell from Pau Amma's back. Ashamed and afraid, Pau Amma pleads with the magician to restore him back to normal. The magician tells Pau Amma that if he stops "playing with the sea," he will receive his shell back eleven months of the year and shrink in size so as to be able to hide in the crevices of rocks. The Man promises to gift Pau Amma with the ability to live on both land and sea if he stops "playing with the sea" and the little girl-daughter promises to gift Pau Amma her little golden scissors which were "very sharp and strong." Both Man and the Eldest Magician, as well as the little girl-daughter, bribe Pau Amma to bend to their will. Much like "The Giant Crab and the Elephant" in the Jātaka tales, every creature is in constant negotiation with others. A permanent sense of law and order does not exist, particularly in a world full of marvel. Pau Amma teaches Man that there is a magic beyond magic, binding the entire world. Side-stepping the natural world is a pretense, leaving Man high and dry and soaking wet.

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[210]Rudyard Kipling. *Just So Stories*, Doubleday Page & Company, 1902, p. 192.

As the three make their way back home, Man grumbles at having to work to paddle home now that the tide no longer exists. The Magician calls the man lazy, decrees that all his descendants will be lazy, and tells the Fisherman on the Moon to let down his fishing line and pull them home. The Man responds, "If I am to be lazy all my days, let the sea work for me twice a day for ever. That will save paddling."[211] When the crab played with the tide, and the water encroaches upon his life, Man peeved, grumbles to the magician to restore order. However, when he realizes another use for the tides, he wishes for its return. He repeats patterns of history and twists the narrative to fit the scale and dimension of his imagined hierarchy over living beings. Kipling's attitude towards humanity was ambiguous, but he remained certain that humanity, because of its unchanging nature, would continue to repeat its mistakes. Thus, Man is reminded of his position to accept, as illustrated in the picture of the crab holding up the world in the drawings of Joachim Camerarius, that humanity is always in the process of renegotiating its place in the world that holds it up.

The crab brought the tides to the attention of Man, but Man angers at the crab's power over him. It is when Man realized another use value for the tides, one that was advantageous to him, that his perspective changes and he no longer views the tide as order gone awry. Though the conclusion is the same, the predicates have changed, that is, what moves the tides. We are left with the knowledge that we reason differently; we err in our logic. This may be due to inattention or memory, though that places cognitive competence on trial. In the end, Pau Amma forces Man to realize he is as reactive as reflective in reasoning; and the natural world is always surprising.

[211]Ibid. p. 195.

Moulting: Removing the Cover of History

Moulting is a cyclical process where crabs cast off their exoskeleton (carapace) in order to grow. During the process, crabs are inside-out; naked and temporarily exposed to the harsh realities of environmental forces and more vulnerable to predation, with only the support of a liquid skeleton for protection. It is a complex process that involves chemical, physiological, and behavioral changes. Fishermen used to refer to crabs preparing for moulting or having just undergone the moulting process as "Granny Crabs" due to their bitter taste and discolored shells. The fishermen thought that moulting crabs were diseased and would kill those crabs to prevent the presumed disease from spreading. What the fishermen did not understand was that the process of moulting follows a series of precise phases enabling the crab to absorb the necessary ions and secrete the necessary tissues to build a new exoskeleton shell.

Moulting also captured the imagination of second century Greek poet Oppian, whose five-volume heroic-epic poem *Halieutica, or Fishing* includes vignettes about all the animals of the sea and represents moulting as a rite of passage. Oppian writes, "…when they [crabs] feel the violence of the rending shell, rush everywhere in their desire for food, that the separation of the slough may be easier when they have sated themselves. But when the sheath is rent and slips off, then at first, they lie idly stretched upon the sands, mindful neither of food nor of aught else, thinking to be numbered with the dead and to breathe warm breath no more, and they tremble for their new-grown tender hide."[212] Oppian appears to be impressed by what he perceives to be the crab's mixture of determination and hope, taken in by what he infers to be the crab's sense of mortality.

[212]Oppian. *Halieutica, or Fishing*, Loeb Classical Library, 1928, Book 1, p. 235.

The crab's exoskeleton, primarily made of chitin, a calcium-based flexible and hardy substance, protects the crab from the pressures of pounding water and the sun's heat. It also bears the mechanical load of barnacles and other critters making their home upon the crab's back. Albeit a sturdy casing, the carapace, nonetheless, does not provide the crab with invincible powers and is vulnerable to fracture and stress, potentially exposing the crab's inside to the outside. Beneath the carapace, four distinct skin layers are organized into coiled tubes, referred to as Bouligand[213] structure, which efficiently transports the necessary nutrients to build a new exoskeleton once the old one has been shed. The moulting process, though regulated, is precarious. Despite the higher risk of death, the payoff of growth and reproductive opportunity outweighs the cost. However, if the moulting cycle is not successful, the crab will die.

Moulting is stimulated by a moulting hormone ecdysteroid produced by the Y-organ located in the fused, anterior part of the head and body portion of the arthropods, commonly known as the cephalothorax. The Y-organ is suppressed by the moulting inhibiting hormone produced by the X-organ/sinus gland complex located in the eyestalks of the crab. If the eyestalks are removed from the crab, uncontrolled moulting will result; often referred to as precocious moulting. Moulting cannot happen without a synthesis of chemicals, one of which comes from the outside world: cholesterol. Cholesterol obtained from food is a necessary element for the Y-organ to synthesize the steroid hormone ecdysteroid. Consequently, the role of the X-organ is to hinder synthesis of ecdysteroid hormone. If the Y-organ is damaged or deteriorates, and fails to produce ecdysteroid hormone, or if the Y-organ remains productive but the X-organ overproduces moult inhibiting hormone to suppress growth, the crab ceases to grow.

[213]Bouligand structure refers to the arrangement of molecules into a twisted shape stemming from one point and is prominent in the biological makeup of many organisms.

Marine biologist Charles Zeleny, a pioneer in the study of moulting in crustaceans, accidentally discovered that removing the eye stalk of the fiddler crab accelerated molting. This discovery inspired him to concentrate his studies on the correlation between the rate of moulting and impaired physical condition. Zeleny wondered what, if anything, would create a sense of urgency in crabs, causing them to expedite the moulting process. He found that "the member of the series with the greater injury moult more rapidly than those of the series with the lesser injury."[214] Zeleny hypothesized that vulnerability spurred crustaceans to speed up regeneration of lost limbs, and consequently, moulting. *Need* was the key word selected by Zeleny to explain the cost and benefit associated with extreme energy necessary for rapid regeneration or moulting.

Moutling is not instantaneous. Early studies in moulting divided the process into distinct phases or stages: hard, pillans (also known as peeling stage), about to moult, newly moulted, soft and paper shell.[215] The stages pertain to the "hardness," of the shell. In 1939, marine biologist Pierre Drach, focused his study on the moulting cycle of crustaceans, subdividing the process into five distinctive stages still applied. Drach classified the stages of the moult cycle to reflect the changing physiological conditions crustaceans experience prior, during, and after final shedding of the exoskeleton. Using the properties of texture and rigidity of the exoskeleton as a signpost for each moulting stage, Drach designated the stages as newly moulted, recently moulted, intermoult, premoult, and finally, ecdysis, the actual act of moulting where the carapace of the shell splits and the crab backwards away from its former hard shell. Each stage also reflects the preparation the crab undergoes; most notably, the absorption of salt water necessary to break free from its case. During the process of moulting, the crab inflates itself with water and

[214]Charles Zeleny. "The Relation of the Degree of Injury to the Rate of Regeneration," *Journal of Experimental Zoology*, vol. 2, no. 1, 1905, pp. 346-369.
[215]J. Percy Baumberger and J.M.D. Olmsted. "Changes in the osmotic Pressure and Water Content of Crabs During the Molt Cycle," *Journal of Physiology and Zoology*, vol. 1, no. 4, 1928, pp. 531-544.

resembles an animal with a hydrostatic skeleton, a flexible skeleton found in sea stars and jellyfish. Once dependent on a stiff skeleton to locomote, the crab must temporarily depend on a fluid skeleton. The shift from exoskeleton to hydrostatic skeleton and back to an exoskeleton induces great stress and demands acute physiological control to prevent deformation. Although the body of the crab is not compartmentalized, the crab is able to control each limb independently, even if the claws are not as effective for defense. Crabs, and other crustaceans, are the only creatures that fundamentally shift from one skeletal support form to another and are forced to adapt to a new type of support system lacking in strength and mechanical abilities.

Many scientists further divide moulting into passive and active phases. The passive phase characterizes the period of water intake, while the active phase characterizes the physical extraction of the crab from its carapace. Though passive implies lack of control, studies show "an animal can prolong or even interrupt the passive phase when disturbed by a potential predator, or as is occasionally seen in the case of male crabs, when mating behavior is preferred."[216] The passive phase is described as a "swelling" and because of the cannibalistic tendencies of crabs, the crab will tend to hide itself under a stone or burrow in the sand during this phase. During this phase the crab will also reabsorb the calcium carbonate from its old shell into its body and then secrete the necessary enzyme to separate the shell from the body. The active phase is likened to giving birth because of the series of contractions. Once molting begins, it must proceed to its finale. Otherwise, the crab will perish. Water temperature fluctuation, overcrowding, and food availability are some of the outside factors impacting the active phase,

[216]Markus K. Philippen, et. al. "Ecdysis of Decapod Crustaceans is Associated with a Dramatic Release of Crustacean Cardioactive Peptide into the Haemolymph," *The Journal of Experimental Biology*, vol. 203, (Pt. 3), 2000, pp. 521-536.

as well as internal determining factors such as energy demands to regenerate a lost or injured appendage and production of eggs for future mating.

Moulting dictates more than just growth. In addition to numerous physiological changes a crab undergoes during moulting, it is often, though not exclusively, synchronized with reproduction. In addition to reaching reproductive maturity as a result of moulting, often before a new shell hardens, crabs are driven to reproduce, overriding the danger of serious injury made more apparent by a fragile body. A female crab in the process of moulting may be held by a male crab during the entire moulting process and thus gain extra protection. In females, the moulting cycle can also initiate production of eggs for fertilization. Though growth and reproduction are two independent functions, they are both mediated by the eyestalks; that is, the X-organ/sinus complex commanding molt inhibiting hormone and the gonad inhibiting hormone. If the X-organ/sinus complex is severed, a female crab will produce eggs without constraint. In addition, the ecdysteroid hormone produced by the Y-organ also functions in developing female sexual organs and production of eggs. It is necessary for a crab to balance an allocation of hormones between growth and reproduction to preserve the function of both.

Pressures such as temperature fluctuation, salinity, and availability of food influence the timing of shedding the old shell and replacing it with a new one. Other “unnatural” pressures, including quantities of pesticides or petroleum waste, also influence timing of moulting. These disturbances elicit a deliberate response from the crab to either initiate or suspend moulting until conditions are more suitable. Crabs read environmental conditions for optimal survival for both themselves and potential offspring. Internal and external environmental conditions mediate two life-determining events, and the cycle of growth and reproduction fluctuates. Therefore, time and timing govern a crab’s life. In time, as a crab continues growing, moult and reproductive cycles

take longer and longer. More time is needed to grow back parts and gather resources for the next interval. All the physiological functions involved in moulting and reproduction must coordinate. The rate at which the Y-organ synthesizes the complex chemicals to begin the moulting process, leading to a series of physiological changes, including atrophy of the claws, influences the rate at which a crab moults. This also tells us that any changes in chemical makeup of oceans or food stores may disrupt the crab's natural life process and the crab's ability to tolerate, and adapt to, those disruptions. We can evaluate environmental conditions based on the crab's ability to synthesize necessary hormones for growth and reproduction.

Moulting, once perceived as an interruption in the "normal" life of the crab, crucially binds the intrinsic and extrinsic factors working in unison to assure the crab's ability to grow and reproduce. While some species follow a linear course aligning reproduction with being the right size, the width of the body and the body weight itself are dominant factors in the crab's allocation of energy resources producing eggs or sperm. This decision also impacts duration of the moult cycle. Both processes take a physiological toll on a crab reliant upon stored energy reserves to activate the necessary hormones to communicate with their respective organs in order to initiate change. A crab depends on stored reserves to prepare for reproduction and those reserves need to be replenished. The moulting process requires energy, and the transformative process does not always succeed, but without it, crabs will not grow. The crab processes cues from its nervous system as well as external cues such as environmental stress and crowding, in determining if moulting is viable. How the crab processes internal and external stimuli to determine if conditions favor moulting or not continues to interest scientists. The "Crab Lab" established by Don Mykles of Colorado State University attempts to tackle that question and

studies the mechanism behind the genes responsible for activating and repressing the moulting process and the extent of outside influences.

Moulting is an inside-out and outside-in process. It involves stripping away some part of the self in hopes for a larger life. It is a metaphor that attracted author Jean-Paul Sartre[217] who places crabs into his fictional works, including *The Condemned of Altona*, to expose human capacity to justify condemning other humans. Sartre explores what it means to be "authentically human" when human beings continuously practice the art of self-deceit, which he called "bad faith."[218] The complexity of "bad faith" is summed up by the belief that human beings deceive themselves into believing that they do not have choices in life, preventing themselves from having to make a choice. Humanity is always under a spell of its own making in order to avoid the freedom to choose. The principle of "bad faith extends to the ways in which people convince themselves to play a role. Sartre writes, "I am what I am not, and am not what I am," alluding to God's statement to Moses, "I am that I am" to indicate that God, and by proxy, humanity made in God's image, is elusive. It is that elusiveness that allows humanity to wear several masks and reason the legitimacy of those masks.

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[217]Crabs were prominent in the life of Jean-Paul Sartre, and he includes the dominating presence of crabs in his life in his autobiography *The Words*. In recalling his first encounter with crabs, Sartre writes of a memory of riding on a train, flipping through the pages of the *Hachette Almanac* and resting upon "a drawing that was enough to make one's hair stand on end…a long gnarled claw came out of the water, took hold of a drunkard, and dragged him to the bottom" and continues with the confession, "I was afraid of the water, afraid of crabs…" (p. 94). Crabs returned to Sartre's psyche after he experimented with the hallucinogenic drug mescaline, whose side effects includes the resurfacing of primate childhood fears. Sartre discusses how he saw crabs everywhere and that the crabs were following him. In an interview with John Gerassi published in the book *Talking with Sartre: Conversations and Debates*, Sartre admits of crabs, "I always knew they weren't there…but they served an important purpose. They were a warning that my life was not right" (pp. 90-91).

[218]The phrase "bad faith" translated from the French, *mauvais foi,* was coined by philosopher and writer Jean Paul Sartre to represent the fact that we have choice and freedom and the attempt to escape that prevents our ability to access our authentic selves. Discussion of "bad faith" permeates throughout *Being and Nothingness* (1958).

Sartre turns to crabs to plunge into the question of human reasoning powers in asking the question "Is that me?"[219] That is the question Franz Gerlach of *The Condemned of Altona*[220] continuously faces while entombed in the attic of his ancestral family home. Franz lives a solitary existence, removed from time. His single room contains a photograph of Adolf Hitler and does not have a clock or a calendar. He busies himself recording his justification of his role as the "Butcher of Smolensk" for the Nazi regime on spools of tapes he continuously rewinds, erases and fast forwards. In telling and retelling his story, his memories, into a tape recorder, confessing and retracting his crimes, Franz exposes the tenuous hold reason maintains in a mind balancing both reality and hallucination.[221]

The entire play *The Condemned of Altona* takes place in a period of one week and the setting is confined to the mansion of the Gerlach family, presided over by the father, whom the children refer to as Old Hindenburg, in a nod to Paul von Hindenburg, a World War I German commander who refused to concede defeat. The father built a large ship building empire and sold off parts of the family estate to the Nazi regime to construct concentration camps. The eldest son Franz, groomed to take over the family business, becomes a ruthless Nazi soldier, trapped by his own crimes against humanity. After witnessing the loss of humanity in the Jewish prisoners, whose "eyes" indicated a relinquished humanity and of the murder of a prisoner he helped escape, he became part of a dehumanizing regime. After the war, Franz sequestered himself in the attic, conversing with a tribunal of crabs who he believed would rule over the thirtieth century. Franz refuses to believe that Germany remains prosperous, despite its crimes against

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[219]In *Being and Nothingness*, Sartre writes, "There are indeed many precautions to imprison a man in what he is, as if we lived in perpetual fear that he might escape from it, that he might break away and suddenly elude his condition" (Trans. Hazel E. Barnes, Citadel Press, 2001, p. 102).

[220]Jean-Paul Sartre. *The Condemned of Altona*, Trans. Sylvia and George Leeson, Borzoi Books, 1961.

[221]Of interest, the word hallucination derives from the Latin "alucinari" meaning "to wander mentally" and was introduced by 17th century physician Sir Thomas Browne to associate unrealistic, delusional visions of the mind with depraved thinking.

humanity, and lives in his own mind, with the occasional visits from his sister Leni and his sister-in-law Johanna; Leni supports Franz's delusions and keeps up the nationalist German illusion, whereas Johanna breaks the mirage and presents Franz with the truth along with a watch to bring him back to the present.

Franz lives in condition of dead time. He remains in the attic, living in a world he calls a "window," controlling what does and does not enter. Franz's window world is "the day in reverse" made of "ether" and "It records the slightest breath. All history is engraved on it from the beginning of time up to this snap of my fingers."[222] History becomes an object to look at from an outside perspective. Franz removes himself from the world and loses all power to reason. Trapped in his mind, he only really speaks to imaginary crabs that he claims are the only remaining inhabitants of the thirtieth century in charge of judging humanity. Shut away from the outside world, Franz plays and replays his monologues preserved in spools of tapes, talking over his own voice, questioning himself, as he exclaims, "I didn't mean to say that, but who's speaking" Not a word of truth. I can't stand that voice anymore. It's dead. For God's sake, stop it! Stop It! You're driving me mad… ."[223] In rationalizing his past, he is haunted by the stark reality that he cannot simply shed his participatory role, nor can he maneuver language to extradite him from his participation in Hitler's scheme. He turns to crabs rather than admit he had a choice in joining the Nazi regime. It is uncertain as to whether or not Franz is of sound mind and body, presented as he is in "wearing a tatted uniform, and his skin shows through the tears" as he begins walking on all fours, imitating a crab. He selectively pleads his case to crabs, seeking to make sense of it himself, but loses himself even more as his rationalization falls apart.

[222]Jean-Paul Sartre. *The Condemned of Altona*, Trans. Sylvia and George Leeson, Borzoi Books, 1961, p. 64.
[223]Ibid. pp. 59-60.

Crabs provide an outlet for Franz to move within an unpredictable and erratic mind. Franz excuses his behavior, reasoning that he is trapped by circumstances. In order to recuperate his lost self, he pretends time does not exist and surrenders his life to the judgment of imaginary crabs. By refusing to accept Germany's prosperity after the war and refusing to accept that, he has no freedom because his life never belonged to him, Franz turns reasoning into a people pleasing affair. His belief that humanity will perish, and crabs will govern the world reveals an inability to recover the logic that motivated him to align with the Nazis. The "inhuman" crabs, Franz cries, will deliberate what it means to be human:

> Real men, good and handsome, on all the balconies of the centuries. When I was crawling in the yard, I thought I heard them saying, 'What's that, brother?' And that…was me. I, the Crab. Well, I said no, men won't judge my time. What will they be, after all? The sons of our sons. Are brats allowed to condemn their grandfathers? I turned the tables, and I cried: 'Here is man; after me, the deluge, after the deluge, *you*, the Crabs!' All unmasked! The balconies swarming with Arthropods. You must know that the human race started off on the wrong foot, but I put the lid on its fabulous ill-fortune by handing over its mortal remains to the Court of the Crustaceans.[224]

Throughout, Franz slips in and out of real time and past time, historical truths and narrative truths, to place himself in and out of humanity, both on trial for creating himself and exonerated for being created. Appealing to crabs as earth-bound and "god-like" creatures, Franz faces humanity's position of being in-between, a story that is always changing, as he satirizes the sacredness of history, sarcastically challenging its veracity, stating, "If you change a single comma, nothing will be left" and turns to crabs as non-human outsiders to come to terms with an objective truth that may not exist.

Franz conjures a creature antipodal to human beings to reason and *unreason* between who he appears to be and how he sees himself. He pulls at the fragile threads of humanity ensnared in a system of law and order, twisted in inside-out and outside-in due processes that

[224]Ibid. pp. 132-133.

"reasonable doubt" cannot protect. Franz's speech to the crabs mixes personal pronouns, acting as defense attorney and perpetrator all at once, and destabilizing what is and is not trustworthy:

> Masked inhabitants of the ceiling, your attention, please! Masked inhabitants of the ceilings, your attention please! They are lying to you. Listen to the plea of mankind: 'We were betrayed by our deeds. By our words, by our lousy lives!' Decapods, I bear witness that they didn't think what they were saying and that they didn't do what they wished. We plead not guilty. And, above all, don't condemn on the basis of statements, even signed statements. Dear listeners, my century was a rummage sale in which the liquidation of the human species was decided upon in high places. Centuries, I shall tell you how my century tasted, and you will acquit the accused. To hell with the facts; I leave them to the false witnesses. I leave to them the relevant causes and the fundamental reasons. This was how it tasted.[225]

His attempts to come to some truth collapses into a perpetual state of in-between, noted by the placard he places on a table when he retreats to the bathroom adjoining his one-room cell, which reads, "Back at 12 o'clock," meshing together day and night.[226] The in-between reflects his inability to make a choice and abide by his choices. Franz asserts that life is always in a state of in-between despite donning the armor of objectivity, as he tells the crabs, "You've chose to wear shells Bravo! Farewell, nakedness! But why have you kept your eyes? That was the ugliest thing about us. Eh? Why?"[227] The attention to the eyes demonstrates an inability to "unsee" himself, and an unwillingness to see himself. Franz continues to fixate on the metaphor of seeing, of bearing witness, to destabilize the existence of impartial, consistent, infinite, and unprejudiced truth: "One alone speaks the truth: the shattered Titan, the eyewitness, the ageless, regular, secular… ."[228] A truth no one can claim as he listens to himself and speaks above the recording, does not recognize himself, claims that the person is "dead," and states, "I'll have to begin

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[225]Ibid. p. 58.
[226]Fun fact: *Twelve O'clock High* is a book, translated into film, written by two Hollywood screenwriters, Beirne Lay Jr. and Sy Bartlett, who were both English Air Force Officers commissioned to bomb Nazi Germany in 1943. The phrase "twelve o'clock high" refers to the position of an enemy plane relative to one's own reference sight.
[227]Ibid. p. 59.
[228]Ibid. p. 58.

again." He dissociates himself from the world, locking himself up in a self-contained space to purge his complicit involvement in the Nazi cause, and struggles to see himself as someone else to continue to live with himself. His illusory vision of himself breaks when he envisions himself other than who he truly is; a person gratified by the dehumanization of others.

Insanity, or pretending at insanity, is the only means by which Franz can be honest. Franz lives in between reason and unreason, at the cusp of day and night, as he informs the crabs that "It has been midnight for twenty years this century. It's not very easy to keep your eyes open at midnight"[229] reiterating that what he sees and tells is only a perception of his mind. Our eyes do not present accurate recordings to our minds and the outside world is rearranged by the inside. He assures himself that the verdict of the crabs will be reasonable because "They'll have different bodies and, therefore, different ideas. What ideas, eh? What? Can you grasp the importance of my task and its exceptional difficulty? I am defending you before the judges which I haven't the pleasure of knowing. You drop a word here to the judge, and it tumbles down the centuries" but laments the failure of language to accurately portray him, as he wonders, "What will it mean up there? Do you know I sometimes say white when I mean black?"[230] Sartre believes that there is nothing "objective" about us. If that is the case, there is no definitive truth that we can reason with in justifying ourselves to ourselves and others.

In the end, the father confesses to Franz, "Tell your Court of Crabs that I alone am guilty-of everything." Franz responds, "That's what I wanted to hear you say"[231] after learning his father had known he was the "Butcher of Smolensk." Franz imprisoned himself, "making speeches to Crabs" in a frenzied attempt at exoneration, but the truth was always there despite

[229]Ibid. p. 72.
[230]Ibid. p. 65.
[231]Ibid. p. 172.

his unawareness. He needed his father to admit complicity in roping Franz into believing that it was "vitally necessary" to obey (or disobey) those in power. Franz repeats his version of the truth until it entirely slips away, and he faces the brute force of humanity rationalizing its inhumanity. He leaves one final recording as he and his father drive to their deaths. Franz returns to the "eyes" metaphor as an inaccurate reference point in his final confession, "The century might have been a good one had not man been watched from time immemorial by the cruel enemy who had sworn to destroy him, that hairless, evil, flesh-eating beast- man himself. One and one make one- there's our mystery. The beast was hiding, and suddenly, we surprised his look deep in the eyes of our neighbors. I struck. A man fell, and in his dying eyes I saw the beast still living-myself."[232] Franz concludes his "opus magnum" recordings with the conscious realization that reasoning is entirely wound in a personal dimension and that "everything will be dead-eyes, judges, time."[233] In striving to achieve a distance from himself and reflecting upon his past, Franz objectifies himself. The fear of being dehumanized, of being nothing but a body subject to control by other bodies, reveals the reality of all beings. By deciding to end his life, Franz reclaims it, and in a personal moulting process turns the hard shell of history inside-out.

[232]Ibid. p. 178.
[233]Ibid. p. 178.

CHAPTER THREE: MORALITY

Barnacles: Upside Down Sensibilities and What If Right Were Wrong

Introduction

To have got the whole Barnacle family together would have been impossible for two reasons. Firstly, because no building could have held all the members and connections of that illustrious house. Secondly, because wherever there was a square yard of ground in British occupation under the sun or moon, with a public post upon it, sticking to that post was a Barnacle. No intrepid navigator could plant a flag-staff upon any spot of earth, and take possession of it in the British name, but to that spot of earth, so soon as the discovery was known, the Circumlocution Office sent out a Barnacle and a dispatch-box. Thus the Barnacles were all over the world, in every direction−dispatch-boxing the compass.

Charles Dickens, *Little Dorrit*

"Is it alive?" asked the girl as her finger reached out to touch the closed beak of a barnacle nestled upon an otherwise inconspicuous grey rock that, compliments of a significantly low tide, momentarily loomed like the Rock of Gibraltar. "Yes," I responded, though its weathered granite-like shell camouflaged its *aliveness*. They looked more like miniature mountains jetting from the surface of the moon than living organisms that eat, breathe, and reproduce. When I informed the group of eight-year-olds huddled together around the newly nicknamed "barnacle rock" that barnacle cement is the strongest substance produced by any aquatic creature, their eyes swelled with a mixture of doubt and curiosity, eager to test out the fact for themselves. "Let's see, let's see," they eagerly begged. A few daringly, though hesitantly, placed slim thumbs and forefingers around the armored plates in an effort to wrench a barnacle loose. Their eyes were pinched tight with the innocent hope of proving themselves the

rightful heir to some legendary kingdom reminiscent of mythic King Arthur, the only person worthy of extracting the sword Excalibur from the tight embrace of a rock. No one succeeded. We assume that our lives are separated from barnacles because there is nothing about them that reminds us of ourselves. These non-anthropomorphized creatures, whose place in the popular imagination is veritably non-existent, do not readily come to mind as viable candidates for introspection. They are not animals we normally interact with on any level nor are they main characters in popular wildlife documentaries, though they are credited with inspiring the theory of evolution. Ironically, despite their swarm-like aggregation on substrates, they are virtually invisible, and, from my experience as a tide-pool guide leading children, young adults, and adults into an exposed sea, the question of whether or not barnacles are actually living beings is common. Their appearance insinuates that they are perpetuating a façade. They question our ability to discern between things. In reading through literatures that include barnacles, both literally and figuratively, they notably draw attention to the flaws of equating outward appearances (façade) with a moral sense, propelling me to consider how the biological traits of transformation, permanent stickiness, upside-down feeding and breathing, as well as hermaphroditic sexuality attends to, or can guide a rethinking of, the substantive nature of the abstract quality of morality reserved to distinguish humanity. Through the paradox of living as free-living larvae, metamorphizing into a stuck in place creature standing on its head, feeding and breathing by kicking its legs out, and is both male and female, I turn to the biology of barnacles as a portal to examine the verisimilitude of the moral sense in defining what it means to be human. Barnacles situated in such watery fictional texts as *The Tempest* by William Shakespeare, where we are challenged by nature-nurture debates authoring who rightfully belongs and knows the natural world; *Moby Dick; or The Whale* by Herman Melville, where we

connect with a schoolteacher whose unlikely attachment to a cannibal restructures his perceptions of civilized society; *Little Dorrit* by Charles Dickens, where the Barnacle family of government officials symbolizes the general swindling practiced by a society enamored with illusion; and *The Adventures of Arthur Gordon Pym* by Edgar Alan Poe, where we see an indistinguishing mirroring of *good* and *evil* upsetting the ability to separate one from the other, broach the question of morality as a viable measure to separate humanity from the workings of the natural world.

Throughout the ages, the concept of morality has been bandied about as a measure of a person's worth, and often associated with qualifiers of virtue, honor, justice, and duty. Moral cognition arguably represents a "break with our animal past," though marine invertebrates are not the animals referenced in that sentiment. By associating the distinct processes of metamorphoses, settlement, feeding and breathing, and hermaphroditism in barnacles with the ways in which fictional characters turn to barnacles, both real and representative, to face their conceptualization of the world, the fortitude of *moral reasoning* is examined. Morality is a sticky term that is hard to settle and is animated by eclectic elements, including intuition, instinct, brain chemistry, sympathy, reasoning, free will, and societal norms. Charles Darwin credits sociability as the cause for the development of moral reasoning, writing that we are beholden to "that short but imperious word *ought*, so full of high significance,"[234] though whether morality expresses itself as altruism for sake of kinship or selfishness for sake of self-preservation remains an ongoing debate. The process by which the brain "adjudicates between morality and immorality is still unclear."[235] Moral thinking prefaces humanity with a *higher consciousness* to judge what is

[234]Charles Darwin. *The Descent of Man, and Selection in Relation to Sex*, Princeton University Press, 1981, p. 871.
[235]Christopher M. Filley, et. al. "Morality and the Brain: The Right Hemisphere and Doing Right," *Cognitive Behavioral Neurology*, vol. 33, no. 4, 2020, p. 304.

profitable for one's self and others, or consequently, to sacrifice what is profitable for the self for the sake of others. However, it is impossible to frame honor/dishonor, good/evil or right/wrong as exact, static, transparently clear, universal, or real. Time and place mediate moral codes and moral codes are also influenced by "emotional states of others, empathy, predictions of the consequences of possible options, integration of competing values, and cognizance of the competing normative values of a community."[236] There is an assumption that we are conscious moral beings, yet our moral decisions are excited by competing factions of the brain and research from "neuropsychological and neuroimaging studies showed that a person can be shifted more toward utilitarian or deontological judgments by disruption or damage to ventromedial prefrontal cortex (vmPFC) or dorsolateral prefrontal cortex (dlPFC) functioning, respectively."[237]

Cognitive science examines the discrete influence of each "section" of the brain involved in decision making and studies indicate that a "shared neural circuitry for moral and non-moral decisions implies that many phenomena pertaining to the latter will also manifest in the former."[238] Therefore, it is natural to be skeptical of our fragile moral credentials. Morality may just be a "collective illusion foisted upon us by our genes" in the words of 20th century philosopher of biology, Michael Ruse. Ruse paints morality to be a mechanical tool pawned on us by evolution in order to cope with the competition and conflict inherent in living in a natural world popularly described as "red in tooth and claw." One way to recuperate from nature's *meanness* was to institute a boundary between the tame and the wild or register those creatures living in the condition of in-between with the potential to be converted from a condition of savagery to one of civility.

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[236]Ibid. p. 304.
[237]Clare Kelly and Redmond O'Connell. "Can Neuroscience Change the Way We View Morality?," *Neuron*, vol. 108, no. 4, 2020, p. 604.
[238]Ibid. p. 604.

Taking a barnacle view of the world would upend us. It would require us to imagine standing on our heads and kicking out our legs to capture food and breathe, while under the protective cover of the sea. But, at low tide, when the water recedes, barnacles are exposed to the desiccating effects of air, which can be fatal. For the sake of saving their lives, they shut the portal (operculum) of their shell-homes and tuck themselves safely inside their calcium walls. Then they wait until the water returns, signaling it is safe to open the portal and fan out their legs to sweep the surf. We are related to these stationary creatures, these "swords" connecting us to a time before human existence. Over 1200 catalogued species of barnacles dating back 440 million years, reaching from the edge of the sea to deep hydrothermal vents, have been described. Though we as a species are separated from them by millions of years of evolutionary history, the glue that barnacles secrete to permanently secure them to their selected substrates contains the same enzymes as those that cause human red blood cells to clot. Because they are sessile all their adult life, barnacles are keenly aware of the pressures presented by environmental forces that can dislodge them or by predators scavenging for a meal. In selecting a home, barnacles have to listen to the water and read its signs. Therefore, barnacles are programmed to choose wisely. From a barnacle's perspective, suitable substrates come in many forms: whales, fallen tree limbs, or rocks are notorious habitats for a barnacle to spend its lifetime of five to ten years, barring an untimely demise caused by natural forces or trampling feet. Other factors barnacles must concern themselves with in securing their survival include water acidity, salinity, and temperature, all of which affect the flow of water; a force barnacles depend upon to bring them food. All these factors occupy the barnacle in the search for a suitable home where the competition for space is intense and community is a matter of life and death. There is safety in numbers and the density of a group statistically sways the probability of being eaten. Furthermore, aggregation promotes

reproductive opportunities due to the increased availability of mates. Although barnacles can self-fertilize due to the benefit of being hermaphroditic, gene exchange is more profitable for coping with life's fluctuations. The hermaphroditic sexuality of barnacles was discovered by Charles Darwin and disturbed 19th century audiences fearful that a burgeoning amoral world was creeping in on their understanding of how the world *is* and what it *ought* to be. The refusal of barnacles to follow a "separate sphere" mode of gender assignment caused anxiety and disrupted presumed evolutionary *truths*.

As we see them, barnacles appear to be permanently cocooned in an egg-like shell. But because their entire body undergoes significant morphological changes in the larvae stages, they eluded classification and deceived naturalists for many years. Moving from a free-living larvae form into a sedentary existence, barnacles undergo a complex process of metamorphosis where organs and appendages are gained and lost. At first, classification placed barnacles as part of the mollusk family claiming clams, oysters, and mussels as kin. Later discovery of their larvae stages led 19th century naturalist John Vaughan Thompson to describe barnacles as "strangely altered shrimp" and move them into the crustacean family, claiming crabs, lobsters, and shrimp as kin. Classification traces relations among species and the discovery of the barnacles' true family ancestry was confirmed by Thompson: "On the Cirripedes or Barnacles, demonstrating their deceptive character, the extraordinary metamorphosis they undergo and the class of animals to which they indisputably belong,"[239] that of crustacean. Thompson also equated the complexity of the barnacle with the presence of a divine Creator, and claimed, "we recognize the operations of Superior intelligence…in the peculiar structure of these curious and interesting animals."[240] In

[239]John Vaughan Thompson. "On the cirripedes, or barnacles; demonstrating their deceptive character; the extraordinary metamorphosis they undergo, and the class of animals to which they indisputably belong," *Zoological Researches*, Cork Publishing, vol. 3, 1830, p. 69.
[240]Ibid. p. 70.

surrendering to the mysterious divine to comfortably accept the confounding features of the barnacle as God's intention, the unease of life's direction glaringly loomed.

Barnacles rattled the ability to make sense of life, especially since Charles Darwin remarked that even their core parts fail to stay put and little by little "character after character fails and blends away by insensible degrees."[241] Most descriptions could not resist giving the barnacle solitary membership as an unparalleled organism: either God's joke or God's omen. Naturalist Louis Agassiz, (credited with development of glacial theory explaining how extinction was caused by a Great Ice Age), described barnacles as if they were circus performers—contortionists causing audiences to shudder uneasily at the body's capacity to twist itself into fantastical proportions. Though the written source is unknown, Agassiz is widely credited as stating, "The barnacle is a shrimp-like animal standing on its head in a limestone house and kicking food into its mouth with its feet," conjuring an image of an unclassifiable creature acrobatically entertaining and frightfully misgiving.

These crusty, hardened, weather-beaten, stoic creatures occupied eight years of Charles Darwin's life and claim fame as the catalyst for Darwin's development of the theory of natural selection. Darwin meticulously scrutinized barnacles with acute precision to the point of writing: "I hate the Barnacle as no man ever did before, not even a Sailor in a slow-moving ship,"[242] conflating the weight of inscrutable barnacles on his mind to the drag force barnacles induce, preventing ships from making headway. Barnacles got in the way and interrupted "smooth sailing" by creating friction between the wooden planks and the salty sea. That friction animates the fact that the laws of nature apply their own causality on us. Barnacles also marked the bodies

[241]Charles Darwin. *A Monograph on the Sub-Class Cirripedia with Figures of All Species*, J. Cramer, vol. 2, 1854, p. 242.
[242]Charles Darwin. Darwin Correspondence Project. DCP-LETT 1489, Letter to W.D. Fox, October 24, 1852.

of sailors who defied the smooth governance of law and order aboard the ship. They inscribed many a 19th century sailor with indelible scars when any of the men dared to transgress the authority of the captain or the *brotherhood of the sea*. In a practice known as keeling or keelhauling, sailors who defied the *brotherhood of the sea* found themselves tied to the masthead and thrown overboard to bear the cuts of the ship's barnacles on their bodies. Keeling was also rumored to be part of the Neptune Ceremony, an initiation ritual for greenhorn sailors who were elevated to "salt" status when they crossed the Equator. The rite of passage ceremony honored those who betrothed their lives to the sea and the motley crew of people aboard, also rendering the ship a microcosm of the world.

Though Charles Darwin was not alive to witness advances in neuroscience as it applied to morality, he championed an evolutionary basis for morality in humans, and was influenced by the writings of philosopher Davide Hume, theologian William Paley, naturalist Alexander von Humboldt, and numerous other naturalists. Darwin ventures into a discussion of the development of the moral sense in *The Descent of Man, and Selection in Relation to Sex*, distinguishing its magnitude in the distinguishing humanity, writing, "I fully subscribe to the judgment of those writers who fully maintain that of all the differences between man and the lower animals, the moral sense or conscience is the most important. This sense…is summed up by that short but imperious word *ought*, so full of high significance. It is the most noble of all the attributes of man leading him without a moment's hesitation to risk his life for that of a fellow-creature; or after due deliberation, impelled simply by the deep feeling of right or duty, to sacrifice it in some great cause."[243] The paradox situates morality as a trait elevating humanity from reflexive impulses, but also that humanity is beholden to act outside the pull of self-preservation for the

[243]Charles Darwin. *The Descent of Man, and Selection in Relation to Sex*, Princeton University Press, 1981, p. 871.

sake of public opinion. Here morality, though ambiguous, acts as an adaptation to secure some kind of significance in the face of nature's indifference, or as argued by Thomas Henry Huxley, nicknamed "Darwin's Bulldog" because of his staunch support of the theory of evolution, morality is "man's nature within nature." Darwin contends that morality transcends animal instincts but is also bound to social mores. He believes that behaviors are imprinted in the mind according to the favorability of the outcome, arguing, "For each individual would have an inward sense of possessing a certain stronger or more enduring instincts, and others less strong or enduring; so that there would often be a struggle which impulse should be followed; and satisfaction or dissatisfaction would be felt, as past impressions were compared during their incessant passage through the mind. In this case an inward monitor would tell the animal that it would have been better to have followed the one impulse rather than the other. The one ought to have been followed: the one would have been right and the other wrong."[244] Therefore, though impossible to replicate one's self at the time of the experience, the theory implies that developing a moral compass is a process of evaluating and re-evaluating an experience. That begs the question of whether or not there are "mind-independent" facts objectively navigating moral behavior and how pervasive a role memory plays.

The moral sense is a process of collecting and discarding particular modes of conduct. That impetus to stabilize a moral sense catapults morality into the realm of reason. Both morality and reasoning occupied the public conscience from antiquity to modern times. The shared interest in the question of morality and what make a species special flourished during the 19th century. The study of nature, and natural law, during the 19th century was intensified by the flood of natural seaside history books extolling the wisdom to be gained in unraveling the mysteries of

[244]Ibid. pp. 73-74.

marine creatures emblematic of the mysterious powers of divine creation. The score of books detailing the intricate biology of such wondrously strange creatures also attracted fiction writers who turned to the seashore as a place to recuperate "moral" relations with "God's mysteries" and "perfections" via observations of life working in harmony, with purpose, and with lessons to impart. Stories became the perfect vehicle to transmit moral lessons and synchronize the parts of the brain binding language, emotion, memory, and imagination with socializing behavior. Just as the "barnacle rock" set the group of young eight-year-olds on a hero's journey, Louisa May Alcott, famed for penning *Little Women*, blends the mythical world of mermaids with barnacles in her short story "Mermaids"[245] to impart a moral lesson that loneliness and absence of self-worth are brought about by impetuous, selfish desires to live outside the structure of civilized society. Mermaids are fabled creatures, half-human/half-fish whose place in the literary imagination was often that of the missing link between animals and humans, and, in relations with sailors, reputed temptresses who lured them into a watery death. In this story, we enter a quasi-magical sea swirling with mortality, mutability, and a union with cosmic forces; a sea where mermaids idly play and metamorphosize into barnacles when it is time for them to die.

The main character Nelly, a young girl who yearns to be a "sea-gull, or a fish, or a mermaid" swimming in the open sea, and "not have to stay on this stupid dry land all day"[246] subject to her mother's list of dos and don'ts, expresses her desire to shed her skin. The Seagull King heard her wish to be free from being "good" and Nelly immediately found herself transformed into a mermaid among other mermaids who spent their days seeking pleasure, without knowing love or goodness. After some time, Nelly lamented that there was no one to

[245] Louisa May Scott. "Mermaids," *Lulu's Library*, vol. 2, Little, Brown, and Company, 1837.
[246]Ibid. p. 174.

"love her, or care if she was good, or wish to make her better when she was selfish or angry"[247] leaving Nelly adrift and bereft. Nelly cried that the merfolk had no "minds" (sense of morality) and because the moon and sea were their parents, their lives were associated with the pull of the erratic. She chides the mermaids for being content with their primitive delights, telling them, "You haven't any minds, and don't think much or care to know things. I do, and I want to learn a little or make someone happy if I can,"[248] desirous of recognition for her unique individuality and therefore, relevance. They gleefully exclaim, "We have no souls, and don't trouble about being good," and "We sing and swim and eat and sleep; is that not enough to make us happy?"[249] until the end of their lives when all merfolk, according to Father Barnacle, would become "stone up" as "they called their queer way of dying."[250] The metamorphosis from mermaid to barnacle, a movement from an in-between fantastical creature to a "lowly" real one, upsets Nelly's beliefs in reward and punishment.

The change from merfolk to barnacle denotes nature's chimerical entanglement. It also serves to warn human audiences that a lack of morality leads to a boundary-flouting existence. Yet, it is Father Barnacle that imparts scientific lessons to Nelly and reveals that the underlying foundation for following a moral order is a desire to be noticed. Morality is a measure of promoting social norms as Nelly eclipses mermaids and barnacles for human beings who "wish to be good and wise and happy." Nelly feels insignificant because the care-free mermaids who live impulsively do not entertain a desire to be other than part of the flow of nature. Nelly seeks

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[247]Ibid. p. 177.
[248]Ibid. p. 180.
[249]Ibid. p. 180.
[250]Charles Dickens published a literary and mythic account of mermaids in an article titled "Mermaids" published in the periodical *All Year Round*, June 20, 1885. In the piece, Dickens discusses how sea-dugongs were perceived to be mermaids by sailors spent by too much sun and too much salt and too much time isolated in the middle of the sea. Dickens alludes to the influence the idea of mermaids had on biblical literature, such as the story of Lilith, Adam's first wife in Hebrew lore, equating female beauty with sorcery and magic which defied natural order.

the advice of "wise old Barnacle and asked him what she should do to be a child again." He encourages Nelly to open herself to the unadulterated charm of the dynamic sea rather than "fret for that very dry land in which we see no beauty,"[251] and to adopt a wider perspective on the immense trajectories of life. Father Barnacle does reassure Nelly that at some unbeknownst time the King Seagull will appear, meanwhile he educates Nelly on the varied, pulsating interconnected "interesting histories" of the ocean through "wise lessons in tides and stars, and the mysteries of the great ocean!" and its ever-rising marvels. Nelly learns about the magnificent interplay of forces colliding together to create an imaginatively real world but fails to see beyond the surface. Though Father Barnacle educates her on the vast interplay of known and unknown forces churning together in an amazing creative space, and Nelly is enchanted by "such wonderful stories" populated with "interesting histories of sea flowers, fishes, and monsters," she devotes herself to teach "the cruel sharks, the ugly octopus, and the lazy snails to be kinder and more industrious."[252] The descriptive traits imprinted upon these creatures are produced by fear of not fitting into prescriptive boundaries. The traits Nelly imposes upon the sea creatures drowns the knowledge imparted by the barnacle. Nelly steadfastly continues to be *good*, which "kept her busy" and pacified her fear of being accused of idleness, a stamp of moral recklessness. It is the fear of lacking purpose and being anonymous that motivates Nelly. Initially desirous to join the mermaids and rid herself from following a scripted life, Nelly is unsettled by the idea of impermanence and fading into a "material immortality" where heaven does not exist for those who are "good." Nelly's mind was wound up with the dread of being forgotten, and she vowed to never be "naughty" again or to be the same "wilful one who ran away," as an admission she longed to be seen (unlike the mermaids who hide from people and have no heart).

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[251] Louisa May Scott. "Mermaids," *Lulu's Library*, vol. 2, Little, Brown, and Company, 1837, p. 196.
[252]Ibid. p. 197.

A moral code of conduct engrossed 19th century naturalists who worked to reconcile the strangeness of the sea's creatures with their spiritual beliefs in a purposeful God. Traipsing through tide-pools turned into a documentation of God's creation, marketed as morally righteous because it actively engaged public participation in a concentrated effort to know God's world, consequently evoking reverence for industrious hard work. Linking the incredible array of God's fantastically complex creatures eking out a harsh living with a human campaign to stifle the propensity for complacency, distinguished naturalist and fiction writer Charles Kingsley. He writes that the moral character of the naturalist must be like the "knights of old" celebrating the manners and honor of a chivalric code. Knights were men of discipline safeguarding the kingdom from intrusion by outside waywardness and Kingsley argues that "the kingdom of Nature, like the kingdom of heaven, must be taken by violence, and that only to those who knock long and earnestly does the great mother open the doors of her sanctuary."[253] Immersing one's self in the sea and learning its secrets fortified a connection between humanity and the divine, and warded off the avarice of "melancholy, testiness, and pride, and all the passions that make men see only what they wish to see."[254] Only those who successfully commit themselves to praising and protecting the sanctity of *God's* creation, and understand their responsibility as a proxy for *God*, are inscribed with a moral sense. In turning to a "cousin" of the barnacle, Kingsley metaphorically alludes to the necessity of obeying a moral code to exorcise the pull of the wild from humanity. He turns to the process of metamorphosis as a metaphor to acknowledge a natural desire to explore innate desires and the value of choosing to abide by unadulterated rules. Kingsley paints a picture of a philandering lackadaisical free-swimming larvae that soon realizes the appeal of becoming an enterprising creature, "having sown its wild oats, it settled

[253]Charles Kingsley. *Glaucus; or The Wonders of the Shore*, Ticknor and Fields, 1855, p. 44.
[254]Ibid. p. 44.

down in life, built itself a good stone house, and became a landowner."[255] The vagrant, vagabond barnacle redeems itself by establishing roots and working the land, contributing to the economy of fashioning the world into something of use and which has a purpose. The *accidental* and *uncontrollable* self is traded for a promise of a fertile, replenishable self. In a sense, the meandering (messy) self has to be brought into "right living."

Such thinking animates neuroscientific and social research on the ways in which "deviance in social interactions, transgression of group norms, and identification with shared interests are often seen as defining moral and immoral behavior."[256] Public scrutiny instills the desire to cooperate and gain public esteem or to revoke affiliation with particularly "unseemly" publics; in both cases, public testimony competes with private conscience. Scientists continue to test the brain to "understand why and when different types of interventions aiming to regulate moral people's moral behavior are likely to be successful or unsuccessful"[257] especially in consideration of our capacity to imitate or mirror behavior (mirror neurons), that is, to adapt. Framing the biology of barnacles to acknowledge the reality of natural urges in need of temperance admits that human nature is subdued for the sake of society, while simultaneously providing space to slip and recover.

Adaptation is an integral part of a barnacle's life. It is difficult to anticipate change, countered by the fact that change is an elusive enterprise, leaching out conscious and unconscious physical and mental responses. Charles Darwin made us keenly aware that the self is open to revision, as he states in a correspondence letter to geologist Charles Lyell, "Our

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[255]Ibid. p. 118.
[256]Naomi Ellemers and Félice van Nunspeet. "Neuroscience and the Social Origins of Moral Behavior: How Neural Underpinnings of Social Categorization and Conformity Affect Everyday Moral and Immoral Behavior," *Current Directions in Psychological Science*, vol. 29, no. 5, 2020, p. 514.
[257]Ibid. p. 514.

ancestor was an animal that breathed water, had a swim bladder, a great swimming tail, an imperfect skull & undoubtedly a hermaphrodite! Here is a perfect genealogy for mankind."[258] This letter was written well after Darwin studied one hundred and fifty-three mostly hermaphroditic barnacle species, beginning with the barnacle he named "Mr. Arthrobalanus," which he studied during his five-year voyage aboard the *HMS Beagle*.

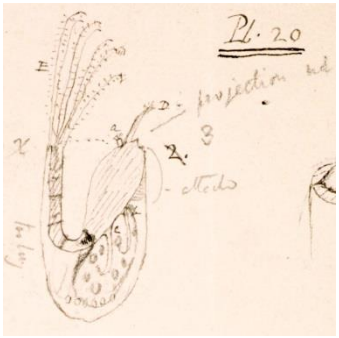

Figure 17: "Mr. Arthrobalanus," Cambridge University Library, The Darwin Correspondence Project, 29.3: 72.

Time spent on barnacles "pushed the frontiers of the known world" according to the concluding chapter "The Universe in a Barnacle Shell" in *Darwin and the Barnacle* by Rebecca Stott. The barnacle opened Darwin's perception about species, their origins, and their relations. Stott writes, "Barnacles had shown him that it was almost impossible to mark a line where a variation with species stopped and where distinct species began−nature produced no such lines of absolute demarcation."[259] The ebb and flow of traits supplants permanence and challenges the legitimacy of both concrete and abstract traits. We are wobbly.

Barnacles challenge the ways in which life is measured in general, and in doing so, in my mind, draw attention to the efforts made to reconcile a shadowy existence into a substantive one. Being human is a temporal narrative tempered by temporal traits that cannot capture the

[258]Charles Darwin. Darwin Correspondence Project. DCP-LETT 2647, Letter to Charles Lyell, January 10, 1860.
[259]Rebecca Stott. *Darwin and the Barnacle*, W.W. Norton and Company, 2003, pp. 241-242.

irreducible complexity of life, as Darwin elucidates in thinking on barnacles: "Barnacles in some sense, eyes and locomotion, are lower, but then so much more complicated, that they may be considered higher."[260] Their vision and movement are poor in comparison to other creatures, but their over-all biology distinguishes them as advanced creatures. Their intricate biology inspired scientists to use barnacles to tell "dead" time. The well-documented complex life processes barnacles undergo as they develop, essentially their life history, piloted forensic scientists to incorporate a knowledge of growth rate in barnacles in determining Post Mortem Submersion Interval (PMSI), the amount of time dead bodies spent in the water.[261] Barnacles act as objective truth-tellers. They are also worldly story tellers. They tell stories about oceans past and the whales that travelled through oceans eons ago. Oxygen isotopes, basic variants of elemental oxygen, collect in the shells of barnacles as they accompany whales along migration routes. Because oxygen isotopes vary from ocean to ocean, it is a key element to deciphering climate change, and also revealing any shifts in the physiology or behavior of particular whale species.

Paleontologist J.S. Killingley first proposed the theory of tracking whale migrations through oxygen variations coded in "epizoic barnacles."[262] In essence, the whale is monitored via the measurement of a non-living element, oxygen, and the story is told and recorded by a barnacle. Barnacles archive other species, geographies, and climates in their sea-formed shells. It is a continuum recognized by Charles Darwin, who writes, "the skin of the whale has been mistaken by some authors for parts of the Cirripede!".[263] The idea of interconnected life attracted

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[260]Charles Darwin. Darwin Correspondence Project. DAR 72: 117-119.
[261]For further reading: "Time of submergence using aquatic invertebrate succession and decomposition changes" by Niki R. Hobischak, et. al., *Journal of Forensic Science*; "Evaluation of float time of a corpse found in a marine environment using barnacle *Lepas anatifera*" by Paola A. Magni, et. al., *Forensic Science International*.
[262] J.S. Killingley. "Migrations of California Grey Whales Tracked by Oxygen-18 Variations in their Epizoic Barnacles" *Science*, vol. 207, no. 4432, 1980, p. 759.
[263] Charles Darwin. *A Monograph on the Sub-Class Cirripedia with Figures of All Species*, J. Cramer, vol. 2, 1854, p. 401.

marine anthropologist Stefan Helmreich, who studies life in hydrothermal sea vents, and writes, "Life materializes as a network phenomenon linking the microscopic to the macroscopic, bacteria to the biosphere, genes to the globe,"[264] whereby it is only the elusive aspect of time and imperceptible movements that prevent us from seeing all those relations. The theory coincides with that of biologist Lynn Margulis who argues that life succeeds because of symbiotic, cooperative acts, rather than competitive, aggressive ones. The long-term effects of symbiotic relations are witnessed by the developments of new biological organs and behaviors. Arguably, those symbiotic relations served as a catalyst for a biological *morality* promoting the success and reproductive capacity of species. Morality offers a protective shield from the harsh material reality that the natural world has secrets of its own.

Philosopher J.B.S. Haldane, developer of population genetics, the study of the conditions influencing the appearance of genes in a select group, linked human beings and marine invertebrates via a shared system of reproduction, namely the meeting of egg and sperm. Returning to "salt-water beginnings" charts a course for his discussion on human-animal connections. Haldane takes on the persona of a "philosophical barnacle" in his essay "Possible Worlds" to show that human existence is "queerer than we can suppose" and that human beings are fixed to a present, thereby, very much like a barnacle, limited by what can be "swept into their arms" and "what is before their eyes." Writing in a manner reminiscent of Plato's "Allegory of the Cave" where distinctions between reality and shadows blur and asserting that "Man is after all only a little freer than a barnacle," Haldane challenges the ways in which humanity distances itself from questioning its evolutionary existence, preferring to maintain an illusion of separation from its *animalistic* nature. Haldane compares barnacles to human beings to illustrate

[264]Stefan Helmreich. *Alien Ocean*, University of California Press, 2009, p. ix.

the "fairly rigid" constraints humanity imposes on itself, in part because of physical limitations, and in part because of prescribed attitudes of "human" behavior and thought. Haldane tells us that human perspective is not out of the realm of the unruly and out of place. He emphasizes survival as the prime mover of species' history and reiterates that we will never fully comprehend the process, as he concludes, "But I do not feel that any of us know enough about the possible kinds of being and thought, to make it worthwhile taking any of our metaphysical systems very much more seriously than those at which a thinking barnacle may arrive."[265] Haldane's sentiment that humanity is always in a condition of incompleteness, incapable of fully knowing itself, and in a perpetual state of becoming. Therefore, to claim at knowing one's self actually diminishes the self, as does presenting morality as stable marker.

The insecurity of life's trajectory saturates the genre of science fiction. In general, the genre is prefaced by some major cataclysmic event that maroons humanity in a threatened state. In such a world, the struggle to restore order results in a willful amnesia of the cause of the current dystopia, despite the fact that the new "toxic" world reveals that we are not inseparable from the world and not immune from contamination. These issues of environmental exile and experiencing our humanity otherwise make themselves known in the short story "Barnacle Bill the Spacer" by science fiction writer Lucius Shepard. In this narrative, we find a group of select individuals (health was associated with moral aptitude) living aboard the spaceship *Solitaire*, hovering over a polluted Earth corrupted by waste and greed, and plagued by a lawless state of anarchy. The spaceship serves as a temporary refuge until another Earth-like planet can be located to colonize. Only the strong and vital were invited to colonize *Solitaire*, with the exception of Barnacle Bill. His real name was William Stamey, and he was the illegitimate son

[265]J.B.S. Haldane. "Possible Worlds," *Possible Worlds,* Transaction Publishers, 2009, p. 280.

born to a government employee who was allowed to live despite his mental deficiencies. He is regarded as an evolutionary misfit; a fouling organism, as his name implies. Because he ostensibly stole a place on *Solitaire*, Barnacle Bill is continuously afraid for his life, and he is relegated to the position of space janitor responsible for scrubbing away the barnacles attached to the outer shell of the spaceship. Ironically, it was later discovered that the excrement of the barnacles served a purpose in strengthening the integrity of the outer shell of the ship.

Barnacle Bill is not a likeable character. We do not readily sympathize with him. He is described as being simultaneously a boy and a man, who at thirty-two years of age, shambled about "unkempt" and holding a paper bag filled with candy and pornographic material. He is relentlessly tormented by others who see him as a reminder of all the waste they left behind on Earth, and family members and friends who were denied permission to board *Solitaire*. Barnacle Bill had one friend and protector, the security officer John who polices the ship to prevent the anarchist group governing Earth, known as the Strange Magnificence, from gaining entrance. The Strange Magnificence indiscriminately support every cause dedicated to toppling down any semblance of order. Their entire structure, if there was one, was nihilism, and they "had no moral or philosophical problem with anything because according to them the ultimate morality was a work-in-progress."[266] They notoriously evoke allusions to ghosts and gothic horror to shake confidence in people and betray any semblance of stability.

To keep Barnacle Bill in check, the political body of the ship implanted him with a computer chip, Mister C, to monitor his behavior and guide him towards a right course of action; assuring him that "good deeds are always good" even though Mister C "doesn't always help" and sometimes "does not know stuff."[267] Barnacle Bill was aware that he was a misfit and fretted

[266]Lucius Shepard. "Barnacle Bill the Spacer," *Barnacle Bill the Spacer and Other Stories*, Millenium, 1997, p. 33.
[267]Ibid. p. 17.

that he would be killed if he did not prove his worth, telling John, "Less I do something good, *really* good, they gonna kill me."[268] He kept to himself and immersed himself in studying barnacles, the "variously coloured" barnacles streaked with "metallic shades of red, green, gold and silver" based on the "nature of the substrate and their nutrient sources," which became his reason for living. Barnacles inspire Barnacle Bill to do something worthwhile to show the chosen inhabitants of *Solitaire* that he is worthy. Barnacle Bill felt he had to prove his value and that human value is not intrinsic, rather, founded on use value for others.

The ship was doomed from the beginning as a majority of the lucky inhabitants were merely there because of the good fortune of knowing the right person. Yet, by John's admission, they "came to perceive [themselves] as the common people's last, best hope, and each successive failure struck at our hearts and left us so crucially dismayed, [they] developed astonishing talents for self-destruction,"[269] and simply ignored their participation in propagating the "horror and chaos of Earth." The delusion of their "worth" inspired the inhabitants to think of themselves as ideal beings, however, the reality of their pretense overpowered their ability to see the real internal fractures aboard *Solitaire*.

Barnacle Bill tended to the barnacles like a "gardener" despite the fact that others saw barnacles as "mindless things, incapable of any activity more sophisticated than obeying the basic urges of feeding and reproduction."[270] The barnacles responded to Barnacle Bill and would "wobble about him like strange pets, bumping against his faceplate and sometimes settling on him briefly….making it appear that he was wearing jewelled rosettes on his back and shoulders."[271] It was as if the barnacles sensed something in Barnacle Bill that put them at ease,

[268]Ibid. p. 16.
[269]Ibid. p. 16.
[270]Ibid. p. 30.
[271]Ibid. p. 31.

despite the fact that he was spraying them with oxygen so that they would detach from the ship. It was because of the barnacles that John reevaluated his feelings about Bill. Intrigued by Bill's devotion to the barnacles, John began to read about them. In his studies of their behavior, he realizes, "The most profound thing I discovered, however, had nothing to do with barnacles, or rather had only peripherally to do with them, and was essentially a rediscovery, a reawakening of my wonderment at the bleak majesty surrounding us."[272] The study of barnacles transport John into an existential aliveness; he comingles with the vast unknown and rather than an immense emptiness, finds an overwhelming authenticity. He claims that the barnacles "rekindled the embers of [his] soul" and he felt as if he could feel the "entire blast and spin of creation" inside of him. The radical unknowability of life overwhelms him and simultaneously awakens an other-worldly connection with it all.

Although Barnacle Bill was not privy to the level of corruption aboard the space station, that led to its eventual implosion, he was the first to notice that the barnacles, in a complete reversal of their survival instinct, were purposefully detaching themselves. Bill assumed the migration was a sign of a "personal apocalypse" and though John did not agree, he went back to the literature on barnacles, noted that by detaching themselves from the station, the barnacles were "placing their fate in the hands of God." John admits there is no way of judging the reason for the mass exodus but assumes "it would appear that they must be terrified of something, otherwise, they would stay where they were."[273] The barnacles deliberately detached themselves, at great risk to their survival, rather than remaining in a place where they sensed imminent doom. Ultimately, Barnacle Bill and John escape in a spacecraft before *Solitaire* explodes. Their entanglement with barnacles secured their own escape. John comes to terms with the fact that life

[272]Ibid. p. 31.
[273]Ibid. p. 47.

is a dystopic condition, riddled with "compulsions and corruptions." He realizes that law and order are a ruse to ward off a reality of the "raw, and the deformed, and the ugly, the miserable miracles of our days, the unalloyed baseness of existence"[274] and in order to really live, we have to see the beautiful necessity of the *oddities*. Barnacles provide an impetus for John to question the reliability of labeling people good or bad and accept the "dismal frailty" of a utilitarian moral sense. Looking into ourselves with barnacles as a guide, we become ostensibly less familiar to ourselves, yet more available to enlarging our vision of ourselves, and seeing the myriad of threads binding us, and the world, together.

Metamorphosis: A Permanent Temporal Creaturely and Self-Made Self

Metamorphosis is a process of transformation. What begins as one thing changes in form and function to become something else; it is a shape-shifting act. Cells come together, organs are developed, and new forms replace old ones to prepare the organism to support itself in its environment. Through a series of six physiologically monumental moults, barnacle larvae transform legs, eyes, nervous system (brain), and their entire torso (thorax), shifting from a life as a drifter into a determined, purpose-oriented cyprid scouting for a perfect resting place, and finally into a sedentary full-formed barnacle adult.

After internal fertilization, the barnacle emerges with "three pairs of jerking limbs, the swimming power of which is quickly lost, and a single eye."[275] The physical prowess of the larvae at this nauplius phase, equipped with a median eye, propels it towards plankton-rich waters to obtain the necessary nourishment to prepare for the impending changes. The nauplius reconfigures itself in a series of six distinct stages before transitioning to the cyprid phase where

[274]Ibid. p. 47.
[275]Edward Heron-Allen. *Barnacles in Nature and Myth*, Oxford University Press, 1928, p. 6.

the focal point is to scout and select a permanent home. It is exponentially important enough that in this phase the cyprid fasts. The cyprid depends upon energy reserves stored in the nauplius phase, referred to as Cyprid Major Protein, to mediate successful metamorphosis.

Each successive change the barnacle undergoes prepares it to cope with its environments. The passing of phases captivated the imagination of Rebecca Stott who writes, "This fabulous story about the body of a water creature and how it had come to exist out of unimaginable eons of time-this story of valves and apertures and anal orifices shaping in deep time-was this so very different from a fairy tale… ."[276] equating the fantastical reality of this ancient creature with timeless stories of epic and supernatural proportion. The victorious barnacle does transform into a distinguished being as its anterior limbs turn into antennae with suckers to secrete adhesive glue cementing the cyprid to its selected substrate and another pair of eyes develops to complement the already existing single median eye. In the cyprid stage, the brain is well-developed and its "nervous system must sort and process input from various sense organs and coordinate an appropriate behavioral response."[277] Though it is difficult to fully understand the sophisticated workings of the cyprid nervous system, the investment in developing acute sensory organs suggests a complex nervous system is at play.

The success of the nauplius determines the success of the cyprid to become fully competent, equipped to attend with the pressures of an external world in constant motion. A contemporary of Charles Darwin, embryologist Karl Ernst von Baer, developed a universal law of embryonic development, identifying an animal's chances for success as the qualitative and quantitative measure of "morphological differentiation" animals undergo in becoming an adult.

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[276]Rebecca Stott. *Darwin and the Barnacle*, W.W. Norton and Company, 2003, p. 141.
[277]Paul J. Harrison and David C. Sandeman. "Morphology of the nervous System of the Barnacle Cypris Larva (*Balanus amphitrite* Darwin) revealed by Light and Electron Microscopy," *Biological Bulletin*, vol. 197, no. 2, 1999, p. 155.

Darwin used von Baer's work to tie development with ancestral origins, contributing to the demarcation between invertebrate and vertebrate species. Through barnacle larvae, Darwin worked through the concept of homologies, looking at how different species share similar parts and consequently lose parts as they develop, in order to determine evolutionary relationships. In examining barnacles, Darwin advanced his ideas on natural selection, writing in *Origin of Species*: "Thus, as I believe, natural selection will always succeed in the long run in reducing and saving every part of the organization, as soon as it is rendered superfluous, without by any means causing some other part to be largely developed in corresponding degree."[278] Though the "stickiness" aspect associated in barnacles makes us believe in an illusion of fixed, finite forms, we are consequently reminded that species evolve, that parts dissolve, and "natures" come and go.

Metamorphosis of each larval stage is a coordinated enterprise with the purpose of storing necessary energy to prepare to enter the cyprid phase. It is a "dynamic, environmentally dependent process that integrates ontogeny with habitat."[279] In a fluid habitat where larvae are mistaken for plankton, where outside forces such as nutrient rich water and temperature influence the metamorphic process, and where time is truly of the essence, the sea holds a dual role as both stage and actor. In turn, the internal cues of barnacles must synch with external cues to secure the highest chance for survival. Swimming "legs" change into walking "legs" to feel the environment and test its stability before sending anchor signals to commit. Further adjustment to the body occurs as the cyprid "blob" continues to contort its body, shed its outer skin, and proceeds to lose its compound eyes. Through a relatively fast sequence of six stages

[278] Charles Darwin. *Origin of Species*, 1st edition, John Murray Publishers, 1859, p. 148.
[279]Arga Chandrashekar Anil, et. al. "Larval development, sensory mechanisms, and physiological adaptations in acorn barnacles with special reference to *Balanus amphitrite." Journal of Experimental Marine Biology and Zoology*, vol. 392, no. 1, 2010, p. 91.

compressed into a constrained time frame, approximately thirty-two hours for those settling in the upper tidal zones where desiccation is a real threat, barnacles transform into their recognizable form, protected by calcified shell plates, ready to feast and mate.

Darwin concentrated on barnacle metamorphosis to illustrate the complex process of evolution. He emphasizes the import of change and its elemental foundation in making the "best" model, writing that "larva can show the common affinity of disparate adult forms (the law of embryonic resemblance); the ancient forms resemble the embryo; that the barnacles emerged in the Mesozoic era; that very diverse forms of males and females are included in the same species; that the loss of organs from larva to adult is a response to a selection pressure in a settled existence; that homologous organs are adapted for other uses; and that useless organs are lost to save energy"[280] like an alchemist coaxing out the buried, true essence of a thing. Darwin understood that outward appearances were deceptive and did not accurately portray the complexity of the organism or its relations with its environments. In his diary entry dated January 8, 1835, he referred to the barnacle as an "ill-formed little monster." Darwin was not fully aware of the intricacies of its "reduced and modified"[281] nervous system as a result of metamorphosis or the "remarkable processes of reduction and interconnection that take place in the peripheral nervous system throughout larval development,"[282] but he had a keen appreciation for its elusiveness. A so called "monster" evades classification since it remains open to other transformations.

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[280]Charles Darwin, *Origin of Species*, 1st edition, John Murray Publishers, 1859, p. 441.
[281]Paul Kalke, Thomas Frase, and Stefan Richter. "From Swimming Towards Sessility in Two Metamorphoses-The Drastic Changes in Structure and Function of the Nervous System of the Bay Barnacle *Amphibalanus improvises* During Development," *Contributions to Zoology*, vol. 89, no. 3, 2020, p. 326.
[282]Ibid. p. 326.

That Nature could completely overturn itself and produce something opposite to its initial form exhilarated the minds of "naturalists" from the classical period onwards. The belief that everyone was vulnerable to shapeshifting led to the invention of myths to reconcile living in a world of unperceived dimensions where even interspecies procreation was possible. This was the case for the belief that the barnacle goose *Branta leucopsis* gave birth to barnacles; a myth that permeated the across the globe, on every continental shore, from the 11th until the beginning of the 19th century.[283] Of the numerous first person accounts accumulated, the underlying premise maintained that barnacles nestled on the limb of a tree and those that fell into the sea were reborn as barnacle geese, whereas those that fell to the ground, perished.[284] Metamorphosis was a matter of chance or destiny, no one knew, but what was foregrounded in people's minds was the role of the sea as alchemist, birthing a different life from existing life. Even the tales of *The Arabian Nights* celebrates the heroic Sinbad the Sailor who bore witness to the marvel of barnacle goose hatching, affirmed in the literature: "I saw a bird that cometh out of a sea-shell and hatch her chick on the surface of the water"[285] much like the birth of the goddess Aphrodite born from the mixing of the blood of the god Uranus and sea water. Sea water was the magic elixir that could produce gods and transform creatures.

[283]Gerald of Wales writes in his book *Topographia Hibernicae* (1186), "Bernacae […] are produced from fir timber tossed along the sea and are at first like gum. Afterwards they hang down by their beaks as if they were seaweed attached to the timber, and are surrounded by shells in order to grow more freely. Having thus in the process of time been clothed with a strong coat of feathers, they either fall into the water or fly freely away into the air. They derive their food and growth from the sap of the wood or from the sea, by a secret and most wonderful process of alimentation. I have frequently seen, with my own eyes, more than a thousand of these small birds, hanging down on the sea-shore from one piece of timber, enclosed in their shells and already formed. They do not breed and lay eggs like other birds, nor do they ever hatch any eggs, nor do they seem to build nests in any corner of the earth. Hence bishops and religious men in some parts of Ireland do not scruple to dine off these birds at the time of fasting, because they are not flesh nor born of flesh."

[284]Edward Heron-Allen. *Barnacles in Nature and in Myth*, Oxford University Press, 1928, p. 23.

[285]Ibid. p. 20.

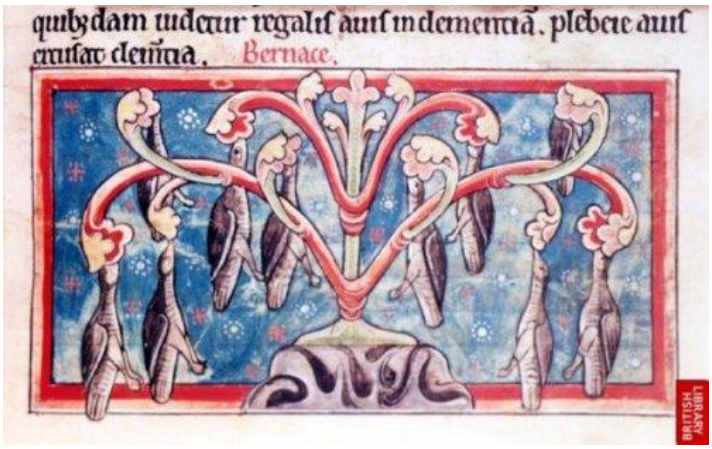

Figure 18: Barnacle Goose from Medieval Bestiary, British Library, Harley 4751.

Yet the prevalent belief that shelled animals lacked sense or intellect left people mystified as to how such a lowly creature could spawn a higher one. The debate even entered religious circles concerned about the feasibility of eating such a goose and its effects on moral constitution. The Barnacle Goose became an integral part of religious identity, ripening or spoiling a union with God. According to Jewish Law, compiled in the *Shulhan Arukh* by Joseph Caro (1488-1577), the Barnacle Goose was not Kosher and could not be consumed: "The kind of fowl which grow on trees and hang there by their beaks are forbidden by reason of being creeping things that crawl upon the earth."[286] Food had the power to change the structure and appearance of the body, hence, eating food prohibited by God would damage spiritual relations, and the physical appearance of bodies would act as evidence of transgression from a communal identity. For Catholics, the Barnacle Goose was permissible to eat during Lent because it was categorized as a fish and not born of flesh, and perhaps reminiscent of the significance of the fish as a symbol for Jesus Christ. The comingling of food with the nature of mind and body was preserved by the publication *Approved Directions for Health, Both Natural and Artificial* by Renaissance medical practitioner William Vaughan who argued that the body was transformed

[286]Qtd. Jacob Seide. "The Barnacle Goose Myth in Hebrew Literature of the Middle Ages," *Centaurus*, vol. 7, no. 2, 1961, p. 209.

by the place of development and by the food it ingested. You were your geography and where you lived and where you hailed from and what you ate were all attached and contributed to who you were and what you could become.[287] As a result, moral rectitude was demarcated by a person's place of origin and the flora and fauna of that region.

Yet, the Barnacle Goose stood contrary to all the laws of nature, shaking the hierarchical placement of species put forward by the philosophy of The Great Chain of Being or "Ladder of Being" conceived by Plato[288] and continued by Aristotle, situating sedentary creatures like barnacles on the lowest rung because they resided furthest from heaven, and elevating birds, because of their ability to soar the heavens, on top. The protean nature of life was exacerbated by the myth of barnacle geese. We were no longer able to truly claim our own permanence, made in God's image, and inscribed with a moral compass. We were, after all, another creature made up of other creatures: "Shortly, man is a Barnacle, a shining shell from the Tree of Life falling into the sea of human tribulations, and subject to stated frailties, subsequently by the grace of God endowed with wings and becoming a bird much favored by God the One and Three, he goes to heaven to be consoled with the food which the Souls of the Blessed enjoy there."[289] Human beings were left in the precarious position of either accepting the will of nature or working towards controlling the will of nature; fully aware that change does not have limits.

This kind of evolutionary thinking is characteristic of the Renaissance, which witnessed the theater of natural history staged by the flood of print books in the marketplace. Naturalists and reputedly keen observers of nature, like Conrad Gessner (*Historia Animalium,* 1551–1558)

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[287]In a travelogue essay, "New Division of the Earth," written by physician François Bernier in 1684, he argues that the water, the food, the quality of land and the air determined human physical traits. *History of Workshop Journal,* vol. 51, 2001, pp. 247-250.

[288] Plato engaged in the enterprise of investigating and classifying life and defined man as a "featherless biped."

[289]Edward Heron-Allen. *Barnacles in Nature and in Myth*, Oxford University Press, 1928, p. 72.

who professed that spontaneous generation from living and non-living beings was possible, and Ulisse Aldrovandi (*Ornithologiae*, 1599-1603) who supported the Barnacle Goose myth. Aldrovandi based his belief on the respected, eyewitnesses who faithfully reported to have seen Barnacle Geese being born and then swimming away. Both naturalists contributed to the grand narrative with detailed drawings of the birthing of Barnacle Geese to safeguard the premise with a veracity that placed imaginative art alongside the printed word. The unusual birth of Barnacle Geese also captivated their contemporary, playwright William Shakespeare[290] also an educated ornithologist, who alludes to the myth of the Barnacle Goose in his play *The Tempest* to wrestle with nature and nurture in harnessing the power to access life's blueprint.[291] The marvelous myth, inevitably, lost clout with the advance of evolutionary ideas rampantly circulating during the 19th century. Naturalist Oliver Goldsmith writes in the text *History of the Earth and Animated Nature: With Numerous Notes From the Works of the Most Distinguished British and Foreign Naturalist*: "It is scarcely necessary to combat the idle errors of this bird's being bred from a shell sticking to a ship's bottoms; it is well known to be hatched from an egg in the ordinary manner, and to differ in very few particulars from all the rest of its kind"[292] to dissipate anxiety born from species nonconforming to the laws of nature. But barnacles continued to stir humanity's preoccupation with their mutability, reminding us we were born of "dirt" according to Judeo-Christian beliefs and the beliefs of Aristotle, who was convinced that barnacles as well

[290]For an extensive list of animals William Shakespeare was familiar with, both real and fantastical, and which he wove into his plays, see *Natural History in Shakespeare's Time: Being Extracts Illustrative of the Subject as He Knew It* by Herbert West Seager, Elliot Stock Publishers, 1896.
[291]James Edmund Harting. *The Ornithology of Shakespeare*, Woodfall and Kinder, 1871.
[292]Ibid. p. 229.

as other "testaceans" were spontaneously generated from mud and those species whose mode of life was both terrestrial and marine were the intermediate forms leading to humanity.[293]

Barnacles communicated a reality that the organization of life is itself alive, bringing the inconstancy of form and function to the surface. The body's volatility seeped into the psyche of Renaissance audiences, animating the already popular nature/nurture debates. During a time marked by sea exploration, industrialization, growing population, and general upheaval of what was once certain, the need to recalibrate the human was very real. William Shakespeare took notice of the fantastical nature of the sea and its protean materiality with its ability to transform life and make everything murky. The sea was a space of disorientation and spawned a renegotiating of life as sailors turned field scientists, brought back rare specimens of all kinds, including people, from far-off, uncharted lands to exhibit in traveling circuses in what became a practice of "ethnological show business."[294] The uncanny resemblance of one creature to another, though from a totally far-off place, mixed with potentially off-putting features, shook people's perceptions of themselves. To recuperate, the status of being human was tied to what appeared to be virtuous, honorable, and true, essentially, moral traits specified by behavior and appearance. As such, world-making, the humanity of being human, was in the hands of both nature and humanity. That world-making erupted in the dissemination of a wealth of "moralistic"

[293]Charles Darwin was aware of the Barnacle Goose Myth as evidenced from a correspondence between him and the botanist Joseph Dalton Hooker. Charles Darwin writes to Hooker on October 6, 1848, "I have not lately done much in the species line, for I am becoming rapidly a complete Cirriped in my mind. I remember saying to you at Oxford…that I felt as if a Barnacle had never been created; I shall never be able, I fear, to say that again. Though I have done little about species, I have struck up a cordial correspondence with a first-rate man, the author of the articles on Ornamental Poultry (Edmund Saul Dixon) in Gardener's Chronicle." Darwin Correspondence Project, DCP-LETT 1202. Joseph Dalton Hooker responds on February 3, 1849, "what on Earth have Barnacles to do with ornamental poultry!-? except possibly 'mediate' the old fable of the geese." Darwin Correspondence Project, DCP-LETT-1220.

[294]Bernth Lindfors. "Ethnological Showbusiness: Footlighting the Dark Continent," *Freakery: Cultural Spectacles of the Extraordinary Body*, Rosemarie Garland Thomson, ed. New York University Press, 1996.

pamphlets to separate the status of the human from the wild spectrum of life pouring into England.[295]

William Shakespeare attends to that nature versus nurture debate in *The Tempest* via the symbolic tension between the intelligibility of an instinctual "magic" and a learned "magic" represented by the indigenous, shapeshifting, "nonhuman" Caliban and the book-touting, member of the royal court, Prospero. In the play, we are situated on an isolated, unnamed island, where we meet the *devilish* Caliban, son of the witch Sycorax, who was exiled to the island while pregnant. We also meet a spirit named Ariel who was formerly imprisoned in a pine tree for twelve years by Sycorax and after her death, was set free by the magic of Prospero, a former Duke of Milan, who, by his own admission, was so engrossed in his books, "And rapt in secret studies," he was derelict in his duties to his subjects. Prospero drowns himself in book learning, ironically vowing to "drown his books" at the end of the play, as if knowledge once acquired can be sunk, returning humanity to the state of nature; or simply disavowing the power of learning to retain its power. After years of pawning off his duties onto his brother Antonia, Prospero was stripped of his title and banished along with his daughter Miranda to the island some twelve years past. Prospero, with his learned magic (referred to as his "dark arts"), enslaves both Caliban and Ariel, and commands Ariel to create a storm to shipwreck Alonso, King of Naples, Antonio, the king's son Ferdinand, Trinculo the court jester, and an intoxicated butler, Stephano. Prospero separates the shipwrecked party and clouds their sense of truth to restore himself back into the royal household, while Caliban forms alliances with Trinculo and Stephano to regain

[295]A diverse array of pamphlets addressing a range of topics with the intent of reviving a humanist moral code flooded the market place. A collection of those pamphlets can be read in *The Elizabethan Pamphleteers*: *Popular Moralistic Pamphlets, 1580-1640* by Sandra Clark, Fairleigh Dickinson University Press, 1983.

control of the island. Everyone is disoriented and dislocated, questioning what is real and who is in command.

While Caliban and Prospero appear to be opposites, but they mirror one another, and barnacles illuminate their shared desire to crown themselves the legitimate overseer of the island. The two specific references to barnacles in the text shows the paradox between the reverence for nature/god's creativity and a disgust for a divine creativity connecting humanity to its auspicious beginnings. The magic of nature sires unique life-forms and the magic of knowledge categorizes those creatures according to a scale that approximates proximity to humanity. Knowledge of these creatures sires its own cycle of constructing and collapsing human bonds with its essential internal and external self; the stamp of being anything can change. During the Renaissance, humanity was perceived as superior in relation to the perceived inferiority of barnacles at the lowest end of the scale and apes at the highest, closest to imitating humanity. While it was easy to define "other" apes as inferior in relation to their human relatives, we do not share a physical resemblance with barnacles, though we have a kinship, so we are forced to look interiorly and assess the substantive nature of the qualities we claim afford us ruling status. When Caliban offers to bring Trinculo and Stephano "young scamels" (the word scamel refers to either a bird or fish in Shakespeare's Words and correlates with the Barnacle Goose Myth), he elevates the barnacle as a prize for reinstituting the natural order, namely, freeing Caliban from the mechanization of nature by Prospero's magic. Yet, when Trinculo and Stephano lollygag in their commitment to overthrow Prospero, Caliban warns them that they are all in danger of being turned into barnacles or apes if Prospero becomes aware of their plan before they execute it. The two different barnacles, serving as both a reward and a punishment, reveal that humanity profits from nature when the natural order is revered, and can equally become a victim when the natural order is altered.

Both Prospero and Caliban share the status of exile and estrangement, each stout in their claims to be the rightful heir of the island, and each stuck. Prospero is the "master of full poor cell" (I.ii.20), or rather a rock cave, and Caliban is also confined "In this hard rock" (I. ii.344), and both hurl insults at the other, painting a picture of the other's malice. Both human and other-worldly in their limitations and knowledge, Prospero and Caliban reflect the irascible nature of belonging in the natural world. Prospero is likened to a "god of power" whose book-smarts grant him "so potent Art" to civilize a world and bend it to his will. His book-smarts, or rather, his "rough magic," allow him to manipulate biotic and abiotic elements to his will. However, by his own admission, his obsession with the "liberal arts/those being all my study," estranged him from the world. He acknowledges that he did not burden his mind with his constituents, as he was wholly absorbed in mastering himself and by default mastering the natural world: "And to my state grew stranger, being transported/And rapt in secret studies." (I. ii.75-77). Prospero prided himself on "neglecting worldly ends, all dedicated/To closeness and the bettering of [his] mind" (I.ii.89-93), providing, from his perspective, a rational justification for manipulating rather than appreciating a transitory world and his own transformations.

As he turns everything into "strange stuff" and ministers every "sea change," Prospero justifies his egocentricity as a means of reinstituting a moral order. Thus, we witness Prospero manipulate Caliban and everyone else to admonish both wild nature and the false nature of bureaucracies. He uses enchantment to muddle everyone's minds, so they are not sure of themselves or their judgment; he turns everyone into a puppet, and he is the puppet master. Much like Nelly, from Louisa May Alcott's "Mermaids," who determines that her purpose in life is to instill a moral code into the sea creatures she deems lazy or cruel, Prospero condemns the world, including the "damned witch" Sycorax, for not seeing the import, and difference, of his magic to

lead humanity on a true path. Prospero lifts himself above the world by controlling nature, represented by Caliban, who embodies all the natural elements of the island, and Caliban's rebellion is to diminish knowledge into an illusion, by calling to burn Prospero's books. Prospero repeatedly describes Caliban as a devil, and, from Judeo-Christian literature, we understand that the devil is a creation of "God," therefore another image of "God":

> A devil, a born devil, on whose nature
> Nurture can never stick. On whom my pains,
> Humanely taken, all, all lost, quite lost,
> And, as with age, his body uglier grows,
> So his mind cankers. I will plague them all,
> Even to roaring. (IV.i.189-193)

Despite classifying him as the personification of evil, Prospero admits he is also part Caliban, claiming, "the thing of darkness/I acknowledge mine" (V.i.330), binding them together in unwary familiar strangeness. The slipperiness of their relations raises questions about origins and the nature of authorial separation of the self from the other when anything can become something else.

According to all the characters in *The* Tempest, Caliban is unclassifiable, although he is the one privy to the "qualities o'th'isle" is tuned in to all the "noises" of the isle and knows "where the crabs grow" and where the "jay's nest," where "The fresh springs, brine pits, barren place and fertile" (I.ii.405) and has wherewithal to provide "naught but brine" to drink and can decline to "show him/Where the quick freshes are" (III.ii.73-74). Caliban has the power to control everyone's life and yet is enslaved by Prospero, and his very being is questioned. Imposing one form on Caliban is impossible. It is uncertain whether he is a "man," a "fish,"[296] a "poor-john,"[297] a "strange

[296]Our fishy ancestry is acknowledged by our entombment in a watery womb until we are forced out into the world, as Kimberly C. Patton in *The Sea Can Wash Away All Evil* writes, "Fish until we emerge, we can extract oxygen from air easily only at birth after a full-term pregnancy." Columbia University Press, 2006, pp. 2-3.
[297]Poor John refers to low quality salt cod known for its notoriously bad smell.

fish" a "tortoise" a "monster" a "thing of darkness" or "not honour'd with a human shape," Caliban remains a wild progeny of untamed forces, and representative of a changeling,[298] identified with darkness and inscrutability. But the inability to be captured does not protect Caliban from transformation by nurture. Caliban is taught Prospero's language, which he aptly learns, and uses, despite the fact that he rebukes having learned it, claiming, "You taught me language, and my profit on't/ Is, I know how to curse. The red plague rid you/ For learning me your language" (I.ii.363-365). In appropriating language and disabusing its power, Caliban collapses book-smarts as the arbiter of moral standing, yet he recruits Trinculo and Stephano in a plan to seize Prospero's books, acknowledging that knowledge has the power to upset nature, and humanity, and influence its future course. Caliban informs them that the books are the source of power and instructs them to take the books and destroy them: "First to possess [Prospero's] books, for without them/He's but a sot, as I am, nor hath not/One spirit to command. They all do hate him/As rootedly as I. Burn but his books" (III.ii.86-90). Paradoxically, Caliban admits that knowledge has the power to make all things transient, as does nature, therefore, neither has complete control to bend the will; neither is good or bad.

Caliban's deep-rooted attachment to the island is reflected in his intimate relations with all of its creations. Caliban promises to gather "Young scamels (a form of barnacle) from the rock" (II.ii.162) for Trinculo and Stephano if they agree to overthrow a tyrant and set themselves up as the new rulers of the island. Barnacles act as catalyst to change authority, though, ironically, the authority is merely transferred. Caliban does not believe he can take command of the island without the support of two clowns. When Trinculo and Stephano fail to act quickly,

[298]Folklore suggests fairies would steal newborn babies and swap them for a changeling, a deformed, ill-tempered, and cantankerous creature who could not be controlled. The reality was that children born with diseases and fated to death frightened a public uncertain of the cause of that deformity or disease.

Caliban warns them that they are in danger of being transformed into barnacles by Prospero's magic: "We shall lose our time/And all be turn'd to barnacles or apes/With foreheads villainous low" (IV.i.246-257).[299] Barnacles bring attention to Caliban's position as a natural being engaged in give and take relations, but also, animate the reality that because Caliban is also subject to change, any type of authority is temporary.[300]

Barnacles are the catalyst for us to see, through the eyes of Caliban, the pulsating nature of evolution, culture, emotion, reasoning, and the deep natural history that humanity is bogged with as it conceptualizes itself. Caliban offers barnacles as a reward to return the island to a previous time and stamp out the intrusion of Prospero, but Caliban cannot erect a barrier or turn back time. He bases his logic on the premise of reciprocity, though he is aware that Trinculo and Stephano also have designs to profit from the island and exhibit him in a traveling circus show. In contrast to his skewed logic, Caliban also emotionally reasons that if he falters in stripping Prospero of his powers, he is at the mercy of becoming a barnacle, or ape, indicating he is not immune from the wide array of causally contributing pieces to his being. Both barnacle and ape rest on the same spectrum of thought as "lowly" and "evil" for being too far and too close to the appearance of being human.[301] Caliban is already an unstable mixture of many creatures, so the

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[299]Metaphorically, apes were affiliated with the nefarious manipulation of nature because of their proximity to human beings, and Shakespeare referred to apes, interchangeable with monkeys, baboons, and marmoset, in association with magic and sorcery, in many of his plays. Adolph Hans Shultz writes of the representation of primates in Renaissance Europe in *The Life of Primates*, as adhering to a universal pattern of association with vanity and unrestrained sense of self-importance.

[300]Caliban boasts of his ability to "snare the nimble marmoset" and when Prospero sets nature to attack him "like apes, that mow and chatter" Caliban evades them. Caliban also invokes the idea of monkeys to provoke strife between Trinculo and Stephano. When Ariel, under the command of Prospero, pretends to be the voice of the court jester Trinculo, and calls Caliban a liar, Caliban names Trinculo a "jesting monkey" which results in a brawl between Trinculo and Stephano.

[301] Shakespeare's prolific use of the word ape and its variants in numerous plays points to an experimentation with breaking boundaries between apes and humans. According to the lecture, "Rise of the Poet of the Apes" presented by Scott Maisano at the 40th annual Shakespeare Association of America Conference, April 2012, the ape in *Hamlet* "tries conclusions-that is, it gets intellectually curious, conducts experiments, and tests hypothesis." Sachi Sri Kantha, in "Subhuman Primates in Shakespeare's Oeuvre," *Current Science*, vol. 106, no. 4, 2014, presents a study

fact that he is worried about metamorphosizing into a barnacle, or ape, elucidates the fact that he is not immune to transformation.

Everyone and everything exist in a condition of change, hence, it is impossible to ascribe a moral code on a body that does not stay put. Anyone can at any time radically transform from a former self and lose membership from a group. Prospero cannot prevent Caliban's plotting and Caliban is beset upon by spectral dogs, plying his mind with fears. Caliban claims that Prospero's "art is of such power/It would control my dam's god Setebos/And make a vassal of him" (I.ii.371-373). Prospero has the power to capture nature's supernatural mysteries and turn them into a profitable servant. Each are deceived by the other. Sorcery and nature continuously spill over, revealing an uncertainty and unsettled admission that the version of one's self is more than what can be encountered.

The magic of nature and magic of knowledge cancel each other in the final act of Caliban and Prospero. Caliban seeks forgiveness for being so foolish as to worship two fools and Prospero abandons knowledge, promises to "drown [his] books" and is left bare: "Now my charms are all o'erthrown/ And what strengths I have's mine own" (Epilogue, 1-2). And in his exit, Prospero places himself at the mercy of the audience, though, while asking for a pardon, implicates the audience in the wishy-washy nature of morality, as he calls to them, "Let your indulgence set me free" (Epilogue, 20). Can we really believe that Caliban and Prospero come to their "senses" and no longer seek power, but rather, seek redemption from the outside world? Is it fair to assume that in playing out their schemes, each discovered they share a desire to recuperate some loss? Though an answer is not provided, there is an awareness that the world of nurture and the world of nature actively shape the other.

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of Shakespeare's use of primate related words in the various plays, including the slang "jacknapes" to express "contempt, endearment, imitativeness and sorcery."

Settlement: Bound to a Shared Fate

Chemical cues and water pressure communicate the right time and place for a cyprid, the last stage of the larvae form before a barnacle becomes a full adult, to settle. Cyprids cast a wide dispersal range and if they fail to settle down in a timely manner, their death is imminent. Time has many definitions, or rather, many forms of measurement, but for cyprids, time correlates with aging and there is only a brief thirteen-day period that can elapse between metamorphosis to the cyprid phase and permanent settlement into adulthood. Site selection is crucial because "a poor choice of surface will often result in death."[302] The more time the cyprid takes to determine its final resting place, the less discriminatory they may become in their selection process; risking a life resigned to low prime real estate. Cyprid larvae fast the entire time they are seeking a home, so the need to replenish stores of energy begins immediately after permanent settlement.

A cyprid must settle onto a substrate in order to survive and success of the settlement depends on its competence in listening to biological and environmental cues. Success also depends on the strength of the cyprid to swim up and down in the water column. Competence is based on intuition and perception. During this phase, the cyprid's eyes become large and compound, the better to see with, as it focuses on finding the *right* spot where food and mates are plentiful. It also enters a phase where "swimming, feeding and flotatory features [of the nauplii] are lost."[303] Cyprids also develop "jaw feet" to taste their world, testing the viability of a place. In scouting for a potential home, the cyprid uses attachment tools at the end of its antennae to "walk" across substrates feeling for discontinuities, evaluating the texture of the topography and the contours of the space, as well as assessing the rate of water flow via its sensitive sensilla

[302]Diego Maruzzo, et. al. "Metamorphosis in the Cirripede Crustacean *Balanus Amphitrite*," *PLoSONE* vol. 7, no. 5, 2012, p. e37408.
[303]Donald T. Anderson. *Barnacle: Structure, function, development, and evolution*, Chapman and Hall, 1994, p. 22.

(hairs). Acceptance or rejection of a surface determines if the barnacle will take "the passage from a pelagic way of life to a benthic way of life"[304] and textualize itself with the select substrate.

Once a site is selected, cyprids secrete indissoluble glue to cement them in place. That attachment process molds them into one being with their substrate, making it difficult to separate where one being begins and the other ends. Scientists at the National Oceanic and Atmospheric Association found that the average tensile strength of a barnacle, which is the amount of pressure it can withstand without changing its shape, is 5,000 pounds per square inch. This means their adhesive strength is 22-60 pounds per square inch. The complexity of proteins responsible for producing barnacle glue confirms the value of settlement for growth and reproductive success. Removing a barnacle from its "home" involves the severing of chemical bonds, thus tampering with both the stability and integrity of the barnacle. Darwin described the ritual of barnacle settlement as the closing of circle between self and substrate, merging with and "penetrating into, and even blending with the epidermis."[305] This is especially true when measuring post-settlement mortality as well as the success between settlement and recruitment. Recruitment is defined as the rate in which cyprids become sexually mature and join the adult world. Not surprisingly, barnacles on rocky shores demonstrate a preference for "cracks and pits" with ample room to grow after fertilization.[306]

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[304]Sebastiάn Rodriguez, et. al. "Settlement of Benthic Marine Invertebrates," *Marine Ecology Progress Series*, vol. 97, no. 2, 1993, pp. 193-207.
[305]Charles Darwin. *Monograph*, Ray Society, vol. 2, 1851, p. 35.
[306]Caroline Bell, et. al. "Barnacle Settlement on Rocky Shores: Substratum Preference and Epiobiosis on Mussels," *Journal of Experimental Marine Biology and Ecology*, vol. 473, 2015, p. 195.

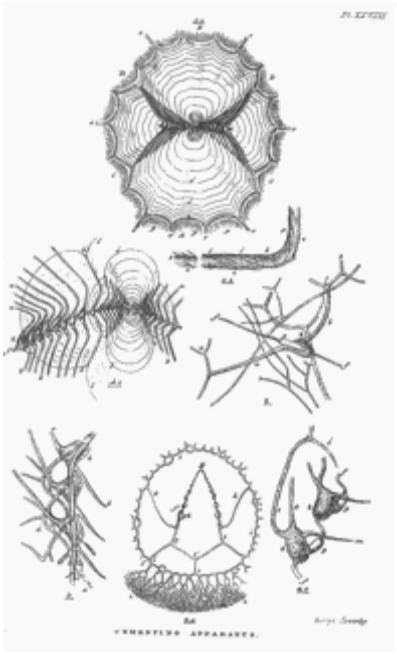

Figure 19: Cementing apparatus of barnacles from Charles Darwin, *Monograph*, Ray Society, 1854.

When a barnacle makes the ultimate decision to settle down and establish residence, it becomes an extension of whatever living or non-living being. The object of attachment and the barnacle mold together to become something new, each now part of the other, biologically, and metaphorically knotted in a shared "sea of brotherhood" experience of salt, surf, and sun. The bricolage of calcium carbonate, skin, wood, and other assortments of surfaces who boast barnacle familiars are fundamentally shaped by that attachment, and barnacles become symbiotic with their hosts, nourished by linked destinies. They dwell together and the fate that befalls one befalls the other. If the whale that barnacles attach to sinks, they sink with it. If the pier they climb splits from its base, they topple into the sea, set out to drift with the rhythm of a wave's crests and troughs.

Though it is often difficult to discern if the slate-colored, asymmetrical plates of a barnacle contain a living body inside, its knobby shell remains as an echo of its having been there. It leaves an indelible impression on the substrate that supports both conditions of being.

Undoubtedly, the perception of the integrity, the purity, of the substrate changes as a result of the *barnacling*. That *barnacling* metaphorically relates to the lives of a motley assemblage of seafarers attached (barnacled) to a wooden world. The hallowed brotherhood of deep-sea sailors of 19th century was one "betwixt and between selfhood" as they set up a space outside the conventions of society; they tested the waters, so to speak, experimenting with new modes of living. Regarded as "boundary organisms" tied together aboard a ship populated with an assortment of "renegades, castaways and cannibals" who travel beyond what landlubbers experience, sailors faced their own mortality on a daily basis. Their face-to-face encounters with the forces of nature and creatures of the sea, according to sailor and author Herman Melville, endowed them with a feeling of "nationaliz[ing] with the universe" and "fus[ing] into the universe of things."[307] They were one with the ship and sea. Sailors were immersed in the test of saltwater where every decision, every behavior, every close-quarter experiment, was felt by all; biology and beliefs coalesced, and novel ways of living emerged.

The sailors settled in a world in motion for many reasons, including that spoken by Ishmael in *Moby Dick*, "to be social with horror."[308]A desire to participate in the laboratory of what it means to be human lured men, and some women, whose social standing was more than the status of transient or outcast. Educated, "elite" university students took to the sea to develop physical strength and rebel against the debilitating, restrictiveness of land. Unwritten and written land-based codes of conduct washed away aboard the "wooden world" of seafaring as sailors settled into the freedom of bare life in a reeling sea. It was a place for a trying out of humanity. Personal accounts of self-expression were documented in sailor's diaries, known as logbooks,

[307]Herman Melville. *White-Jacket: or, The World in a Man-of-War*, Harper & Brothers, 1850.
[308]Philosopher Michel Foucault refers to ships as "heterotopic" spaces because they are real arenas where social norms could be "represented, contested, and inverted" beyond watchful, or rather reproachful, eyes. "Of Other Spaces," *Diacritics*, vol. 16, no. 1, 1986, p. 25.

detailing the mundane facts, such as the weather, along with uncensored pleasures of thought, feeling and occasional doodles. It is at sea where the uncanniness of being alive emerged—from eating foods reputed to infect the soul and diminish the human spirit to a provocative upheaval of rank and class— purged by the untraceable, unimaginable sea so that, as Herman Melville affirms, the sea is where "a fellow comes out. Salt water is like wine, in that respect."[309] The untamed, open sea demanded sailors be more than human, more sincere, more cosmopolitan, and more vulnerable as their very lives were inescapably bound with one another.

Through the backdrop of whaling,[310] *Moby-Dick; or The Whale* by Herman Melville weaves biology, chemistry, geology, meteorology, physics, natural history, and human history into one story. We are brought into the world of Jack Tars (common nickname for sailors because their hands were blackened from the tar used to repair leaks on ships) aboard the *Pequod*, who made contact with strange lands and strange peoples, brought those strange customs home to muddle the moral status knotting domestic and social life strung together by whale oil providing light and whale bones corseting women. These sailors exercised a mutual sense of duty to one another, well aware that their very lives depended on the sensibility of each individual to fearlessly, and willfully, submit to the well-being of the collective. And we come face to face with a "sea monster," the white sperm whale known as Moby Dick, who is hunted by a monomaniacal, revenge-driven captain Ahab, referred to as a "grand, ungodly, god-like man" hungry to usurp the powerful mysteries of nature. All this is narrated much like a sailor's log by

[309]A quote by Herman Melville stated in a letter written to friend and fellow author, critic, and publisher Evert Augustus Duyckinck on May 29, 1860, while aboard the *Meteor*, from the text *Some Personal Letters by Herman Melville and a Bibliography*, Ed. Meade Minnigerode, E.B. Hackett, The Brick Row Book Shop, 1922, p. 77.
[310]Whalers straddled to two worlds and unknowingly shifted the divide between human and animals. According to scholar Philip Armstrong in "Leviathan is a Skein of Networks: Translations of Nature and Culture in Moby Dick," *ELH*, vol. 71, no. 4, 2004, p. 1040, the whaler was "praised as a harbinger of American values and vilified for his immoral relationships with the 'innocent savages' of the Pacific" and both a "romantic adventurer into wild space and a prototype of the industrial laborer, farmer and meat processor" uncannily turning whales into oil to light the darkness and bones for ladies' corsets, canes, and umbrella handles, and more.

a humble school teacher turned sailor, who opens the novel with a self-introduction "Call me Ishmael," an adopted name from the *Old Testament* ironically signifying that he is a wanderer, without a permanent place. Ishmael intimately bonds with Queequeg, repeatedly referred to as a "noble savage," described as the tattooed, primitive, cannibalistic South Pacific Islander, a rightful son of a king, who hails from an uncharted island in the middle of the ocean.[311] Queequeg's contradictory identity illustrates that the world is always erupting and folding in on itself, creating and inspiring new ways of living. Therefore, ascribing a moral code to define being human falters as what is right and wrong continuously shifts with respect to people and place.

Besides the great white whale, the novel forefronts the natural world as a guide for humanity to discover itself against the "multitudinous, God-omnipresent, coral insects"[312] and the "inscrutability" of life. Every possible arrangement of life is expressed in the language of an incomprehensible infinite mingled with the imperceptible, microscopic labor of the "lowest" creatures which, according to Darwin, rise above the "art of man" in their ingenuity to build islands.[313] The fathomless arrangement of life, the invisible essence of a creative deity, and the plasticity of life over time collect to override the concept of human subjectivity. As Ishmael wanders about seeking to subdue the "drizzly November" pervading his sense of self, he sets out

[311]Novel interpretations of the novel exist in pictorial form. Artist and architect Frank Stella painted and built a series of works dedicated to each chapter of *Moby Dick*. The entire project, completed 1986-1997, pays tribute to the abstract aspect of the novel and its message, interpreted by Stella, as the "menace and danger of being alive." The text *Moby Dick in Pictures: One Drawing for Every Page* by Matt Kish illustrates the novel's words using ball point pen, crayon, and water color, among other tools on varied paper. The Board Book Series for infants created by Jack Wang and Holman Wang includes *Moby Dick* among its catalog of texts. In twelve pages of "needle-felted scenes and twelve child friendly vocabulary words" the classic voyage of the *Pequod* is rendered.

[312]Charles Darwin wrote extensively about corals and their contribution in developing reefs, ultimately, part of the geological formation of the continents studied by scientists in developing notions of *deep time*.

[313]Charles Darwin espouses on the ingenuity of coral polyps to triumph against the violence of the natural world by its sheer nature, and writes in *The Voyage of the Beagle* (1839), "Thus do we see the soft and gelatinous body of the polypus, through the agency of the vital laws, conquering the great mechanical power of the waves of an ocean, which neither the art of man, nor the inanimate works of nature could successfully resist." p. 485.

to sea, to a location without markers and with a language of its own. Ishmael seeks the fluidity of the sea to take him away from the market place of being human. On land, he is intangible and a mimic, as he states, "Methinks that what they call my shadow here on earth is my true substance. Methinks that at looking at things spiritual, we are too much like oysters observing the sun through the water, and thinking that thick water the thinnest of air"[314] decrying the self-effacement of humanity as it erodes away from its relations with the natural world. Disconnected from people, Ishmael is adrift, bereft of exterior and interior connections, as he finds himself "threadbare in coat, heart, body and brain." He aimlessly ambles through the "street stalls of earth" where the temporality of life is bartered. Death was the only reliable bill of sale he sought as he found himself "pausing before coffin warehouses and bringing up the rear of every funeral" and electing to take a room at The Spouter Inn owe by Peter Coffin. It is in the space of death that he betroths himself to Queequeg and begins the process of settling into a raw, unmediated life, a genuine life transcendent of moral prescriptions. When Ishmael *barnacles* to Queequeg in one "Wild… Watery…Unshored" existence, he makes himself available to the open-ended nature of unwieldy relations.

Barnacles bind ships, people, whales, and the cultural production of the natural world together in a shared evaluative position reflective of the ambivalent relations we maintain with our real selves and the outside world. The persistence of barnacles to change the story makes us aware of the naiveté associated with our inclinations to enlarge our own limited experiences and imprint those experiences onto a vast unknown. Through barnacles, we are attached to an ongoing debate on the nature of things, and ourselves, while "cherishing unwarranted prejudices."[315] Ishmael reconciles the contradictory nature of Queequeg as both a self-sacrificing

[314]Herman Melville. *Moby Dick, or The Whale*, Harper & Brothers, 1851, p. 36.
[315]Ibid. p. 34.

hero for humankind and an indifferent being without regard for even his own kind, describing Queequeg as "George Washington cannibalistically developed."[316]

In a world where immaterial winds overpower material things and people,[317]a world that shapes the wide stance of a sailor whose sea legs balance upon a moving surface, and a world that imposes itself on nature in the form of harpoon scars branded on the bodies of whales indicating their battles with humankind, scrimshaw carvings tattooed on whale teeth to make the experience of the sea into folkloric art, or log-books diligently kept by sailors hopeful of publishing, there is an uncanniness in being taken in by another form.[318] The *Pequod* in the novel *Moby Dick*, like any ship at the time, attracted all walks of life for all kinds of reasons. Some sailed to escape the monotony of an encroaching industrialization, others sought a wayward route

[316]Ibid. p. 45.

[317]Quantifying tides, winds, and currents turned ships into "floating observatory, temple of science" according to naval officer Matthew Fontaine Maury in *The Physical Geography of the Sea*, revered for accomplishing the phenomenal task "to collect the experience of every navigator as to the winds and currents of the ocean, to discuss his observations upon them, and then to present the world with the results on charts for the improvement of commerce and navigation."

[318]Settlement intertwines sea, ship, and sailor as a unit both in place and in motion. Often referred to as a nation unto itself, ships paradoxically were often manned and guided by men, and occasionally women, of numerous "nationalities" and wandering backgrounds, operating outside the laws of civilization. The sea beckoned those who longed for adventure, yearned to show courage, and in the Age of Sail, was a way to escape the confines of machine-regulated industrialization mechanizing the natural world. The sea was seen as last refuge for connecting with others and with nature. This was advocated by Harvard educated lawyer, Richard Henry Dana, who set sail for two years to recuperate from the strain of studying and published his travels under the title *Two Years Before the Mast* (1840). Dana proudly called himself a "son of Neptune" although he was sparred the initiation rituals associated with the Neptune ceremony commemorating a sailor's first crossing of the Equator. Presented as a rite of passage, cementing fraternal bonds after all, everyone's life was in the hands of everyone else, ceremonial practices included various forms. In some cases, a sailor was tied to a rope and thrown overboard where the barnacles on the hull of the ship pierced his body in a ritual known as keeling; some were forced to drink salt water or subjected to tar and feathering by the King Neptune, who was really a seasoned, old salt sailor dressed in costume signifying a godly connection with the sea. This ceremonial ritual affirmed real, primal, and spiritual connection with one another and with the sea. In his writings, Dana exclaimed, "We must come down from our height and leave our straight paths for the byways and low places in life, if we would learn the truths by strong contrasts; and in hovels, on forecastles, and among our outcasts in foreign lands, see what has been wrought upon our fellow creatures by accident, hardship, or vice" The reality of life aboard a ship was tedious, harsh, and dirty. Through log-diaries, sailors shared their personal feelings of life in close quarters, sharing intimacies, and ways in which the ship was home. After reading *Two Years Before the Mast*, Herman Melville penned a letter to Dana effusing on their shared bond as "strange and congenial feeling" and being "tied and welded to you by a Siamese link of affectionate sympathy" and "shock of recognition" finally signing the letter "a sea-brother." We recognize the uncanny mode of strange and familiar ties made possible by a shared, yet separate, sea experience.

to the prevalent ideology of Manifest Destiny calling for westward expansion, while others found the sea to be a refuge from the regimen of domestic life.[319] But, they were united as one entity where "all the individualities of the crew, this man's valor, that man's fear, guilt and guiltiness, all varieties were welded into oneness;"[320] creating a collection of "isolatoes," a term coined by Melville, to refer to a people and way of life at the edge of civilization, who hail from "all isles of the sea, and all the ends of the Earth," who live a life attached to natural laws; even in death, lost at sea, in a world otherwise reserved for creatures other than human.

Ishmael boards the *Pequod* in order to "see the world." He is anxious to escape the confines of land that arbitrarily separate and catalog life and signs his fate to a ship made-up of incongruities molded together-with both living and non-living parts-acting in unison and bearing the burden of each. It is described as such:

> They were one man, not thirty. For as one ship that held them all; though it was put together of all contrasting things-oak, and maple, and pine wood; iron, and pitch, and hemp-yet all these ran into each other in the one concrete hull, which shot on its way, both balanced and directed by the long central keel; even so, all the individualities of the crew, this man's valor, that man's fear; guilt and guiltiness, all varieties were welded into oneness, and were all directed to that fatal goal which Ahab their one lord and keel did point to.[321]

The ship is not innocent.[322]It is not an object devoid of a history or connections, and all the materials and all the personalities holding up the weight of its "weedy hull," likened to the

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[319] The ship itself is both "a self- sufficient narrative ecosystem" and "a radically heterogeneous space" or "world as ship." Emerging as a geological entity, the ship imposes a type of evolutionary course on its crew, as presented by another sailor-author Joseph Conrad, casting the ship as "a fragment detached from earth" and "intent on its own destiny" and "alive with the lives of those beings who trod her decks." Historian Margaret Creighton contributes to sentiment of detachment by writing of perceptions of sailors from the vantage point of land as: "their work was too erratic, their hands too soiled, their company too mixed, and their ships too far from home."

[320] Herman Melville. *Moby Dick, or The Whale*, Harper & Brothers, 1851, p. 548.

[321]Ibid. p. 406.

[322]For further discussion on the ways in which culture and industry bind together to shape the individual, read the *Dialectic of Enlightenment: Philosophical Fragments* by philosophers Theodor W. Adorno and Max Horkheimer. The authors write about the struggles of human nature and the ethics of normativity in a world governed by industry and the consequent dehumanization of the individual, and ultimately, a groundless system of morality.

"barnacled hulls of the leviathan" reveals the associations coursing through material and natural beings and the futility of pulling apart the particulars in a complex system. Nothing is purely one thing. After all, the *Pequod* is on a mission to hunt whales to extinction and ironically bears the name of an extinct Indian tribe. The chimerical configuration of the ship, and its metaphorical representation of crew, whale, and Ahab, draw attention to the objectification of living beings attached to a world that tugs and pulls at them, and which no one set of morals can be applied.

While aboard the schooner transporting them to the *Pequod*, Ishmael and Queequeg became the centerpiece of attention and ridicule. Queequeg notices a "young sapling mimicking him behind his back," a greenhorn, as newcomers to the life of sailing were called, completely inexperienced and sheltered, and more a landlubber contained by social constraints. Queequeg effortlessly flopped the young man off his feet and onto the planks. The captain soon after threatened to kill Queequeg but was interrupted by the swing of the main sail which had come undone, knocking the greenhorn into the sea. Queequeg deftly lassoed the sail back onto the mast, dove into the water, "took an instant's glance around him, and seeming to see just how matters were," resurfaced with the young man in tow, who was immediately resuscitated back to life. In an uproar of goodwill, all the men voted "Queequeg a noble trump, the captain begged his pardon" and Ishmael proclaims, "From that hour I clove to Queequeg like a barnacle, yea, till poor Queequeg took his last long dive." In a blink, Queequeg turns from physically schooling the young greenhorn for his insolent mimicry to saving his life without hesitation. And, as the "last long dive" foreshadows Queequeg's death, we also learn that it is Queequeg's coffin, which he had commissioned from the carpenter when he had a premonition of his own death, that buoys Ishmael after the *Pequod* sinks, drowning the entire crew.

Barnacles remain attached to the substrate, even after they die. The substrate always bears the weight and imprint of the barnacle.[323] Ishmael looks to the steadfast character of barnacles to express his attachment to the uncategorical Queequeg, who can unquestionably punish a person for ridiculing his behavior, arguably justifiable, and for reasons unknown, will risk his life to save that same person. Queequeg defies generalizations of cause or intent when it comes to moral behavior and Ishmael's union with him signifies a liberating commitment and openness to circumstance and chance. Their spectral union crumbles rigid understandings of right and wrong, pure and tainted, civilized and savage, and, instead, reveals the reality of a human nature that is all of that, and still unfolding. In this, and other hallowed unions between barnacles and their substrates, it is impossible to shore up a consensus on good and evil, sanity and madness, or to escape their resistance to be disentangled.

The barnacle bond is replicated in the "Monkey Rope" chapter where Ishmael and Queequeg are fastened together by a hemp rope like "inseparable twins." Queequeg balances on the body of the whale and dissects it into pieces while Ishmael stands on deck. Ishmael is well aware that "should poor Queequeg sink to rise no more, then, both usage and honor demanded, instead of cutting the cord, it should drag me down to his wake."[324] Ishmael no longer sees himself as a discrete individual, rather, he is a living part of Queequeg, and no longer who he once was or who he may become as he realizes, "So strongly and metaphysically did I conceive of my situation then, that while I earnestly watch his motions, I seemed distinctly to perceive that my own individuality was now merged in a joint stock company of two."[325] Ishmael turns to the

[323]Barnacles are perceived as "swarm" creatures because they are unidentifiable as individuals and are seen as one pack. Ideas of becoming imperceptible are further discussed in *A Thousand Plateaus: Capitalism and Schizophrenia* by Gilles Deleuze and Felix Guatarri.
[324]Herman Melville. *Moby Dick, or The Whale*, Harper & Brothers, 1851, p. 356.
[325]Ibid. p. 356.

metaphor of a formal business exchange to indicate that his transaction is ironically a union of life and death, a "humorously perilous business" based on blind trust and hope. Ishmael states, "I say, I saw that the situation of mine was the precise situation of every mortal that breathes; only, in most cases, he, one way or the other, has this Siamese connexion with a plurality of other mortals."[326] Ishmael is fully aware that he could act on self-interest and suffer beratement from the crew and consequent "earned" punishment, and that he could also lose his life. Ishmael is in a precarious situation with Queequeg. But that situation liberates him as well. Ishmael likens himself with the body of a settling barnacle becoming one with its substrate, as he muses while taking the watch on the masthead: "…the thickest watch-coat is no more a house than the unclad body; for as the soul is glued inside of its fleshy tabernacle, cannot freely move about in it, nor even move out of it, without running great risk of perishing; so a watch-coat is not so much of a house as it is a mere envelope, or additional skin encasing you."[327] Ishmael uses barnacle imagery to illustrate the fluid interaction of emotion, thought, and unmitigated external factors supporting and contradicting themselves, that are nonetheless, in some ways, all true.

The "mutual joint-stock" ties Ishmael to all kinds of relations. When Queequeg saves the greenhorn from drowning, Ishmael embodies Queequeg, imagining that imagining that Queegqueg thinks "It's a mutual joint-stock world in all meridians. We cannibals must help these Christians."[328] Ishmael uses the language of invisible geographical lines that divide the globe and economic exchange to position Queequeg's perspective as more enlightened to the interconnected, invisible settling of all life. Ishmael continues, "Men may seem detestable as joint-stock companies and nations; knaves, fools, and murderers there may be; men may have

[326]Ibid. p. 356.
[327]Ibid. p. 120.
[328]Ibid. p. 53.

mean and meagre faces; but man, in the ideal, is so noble and sparkling, such a grand and glowing creature, that over any ignominious blemish in him all his fellows should run to throw their costliest robes."[329] There is a maelstrom in humanity and when it sucks in everything in its path, there remains something undeniably natural that resists being known. And, as Ishmael concludes that our mysterious selves remain intact by "our divine equality" to a mysterious God, we are also related to all of nature and all of life. This is a sentiment he continuously discovers in every instance of settling in with the crew, and the world, notably in the business of squeezing the spermaceti lumps from whale into liquid, when in a moment of ecstasy, Ishmael cries to himself, "let us all squeeze ourselves into each other; let us all squeeze ourselves universally into the very milk and sperm of kindness."[330] Ishmael invokes the primal elements symbolic of new birth to announce his rebirth, namely, his settling into an open life.

Underway at sea, Ishmael's barnacle attachments extend to his musings upon a "less erroneous picture of whales" painted by Ambroise Louise Garnery and coming into direct contact with a captured right whale anointed sovereign of the seas by the crown of barnacles resting on its head. The description of Garnery's whale scene shows a boat drawing "alongside the barnacled flank of a large running Right Whale, that rolls his black weedy bulk in the sea like some rocky moss-slide from the Patagonian cliffs"[331] with a plume of water erupting from its spout and a flock of birds "pecking at the small crabs, shell-fish, and other sea candies and maccaroni." Subsequently, Ishmael comes face to face with a Right Whale strapped to the side of the boat, whom Ishmael describes as a "Stoic," a reference to ancient philosophers who maintained a practice of moral idealism governed by reason which human beings can follow if

[329]Ibid. p. 92.
[330]Ibid. p. 305.
[331]Ibid. p. 198.

they are virtuous.[332] The Right Whale, adorned by a swath of barnacles that the Greenlanders refer to as a crown and others a bonnet, is described by Ishmael with symbols of land-based nature; a "green barnacled thing" that appears like "the trunk of some huge oak, with a bird's nest in its crotch." Despite the fact that this whale was bestowed with royal powers, he was simultaneously quantified as a prized commodity that would yield some "500 gallons of oil and more."[333] Through barnacles, Ishmael appraises the paradox of relations between self and world, working to make sense of the knots. He becomes a stakeholder in his own life as part of a shared mystery, profitable or otherwise, but stretches beyond the false front of a moral contract between himself and the world. He begins his journey filled with "hypos" that overpowers him that it "requires a strong moral principle to prevent [him] from deliberately stepping into the street and methodically knocking people's hats off"[334] and ends his journey relieved of that pressure.

Barnacles compel us to reflect on the symbiotic reality of life which continues to unfold. While the Right Whale is "blemished" by barnacles, and the Sperm Whale maintains a smooth, clean skin, we are confronted with the fact that we cannot rely on qualitative, external features, or an act, to argue that humanity is defined by its moral sense. Especially, as barnacles show us, our conception of the whale as an island or a part of a monstrous ocean, signals a concert of

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[332]Melville borrowed heavily from naturalist writings on whales to compose *Moby Dick*. Naturalist Dr. Frederick Bennett wrote in *Narrative of a Whaling Voyage Round the Globe from the Year 1833-1836, Comparing Sketches of Polynesia, California, the Indian Archipelago, Etc. with an Account of Southern Whales, the Sperm Whale Fishery, and the Natural History of the Climates Visited*, "the True Whale [right whale] of the South…has its body encrusted with barnacles and other parasites, often to the extents of resembling a rugged rock." The journal of sailor Robert Weir, *Journal Aboard the Clara Bell, 1855-1858*, contains a passage showing unaffectionate admonishment for a "dirty mammal" whose nose is marked by barnacles and he also writes: "And when you see a whale just rising out of water it has the appearance of a rock, the barnacles are enormous-as much as two inches deep-the boys often roast them and eat them the same as oysters." Whales themselves were also mistaken for islands according to lore. One legend has 6th century monk St. Brendan camping on the back of a black, treeless island that suddenly began to move frightening the monks into leaving their food behind. Seventeenth-century text *Historia Animalium* by naturalist Conrad Gessner introduces the "Devil Whale" whose rough skin resembles a rocky shore, leading hapless sailors to drown when they camped upon its back.

[333]Herman Melville. *Moby Dick, or The Whale*, Harper & Brothers, 1851, p. 246.

[334]Ibid. p. 3.

accident, incident, and frame of mind. When the *Pequod* sinks under the charge of Moby Dick, and Ishmael is the sole survivor, barnacled to Queequeg's coffin, oddly ignored by sharks and sea-hawks, he refers to himself as an "orphan" released from societal norms, where anything is possible.

Figure 20: St. Brendan, *Manuscriptum translationis germanicae,* ca. 1460, Biodiversity Heritage Library.

Figure 21: "The Devil Whale," Conrad Gessner, *Historia Animalium,* 1604, Biodiversity Heritage Library.

Feeding and Breathing: The Visible Invisibility of Performance

Barnacles are sessile creatures and depend on the flow of currents to supply them with a stream of food. As suspension feeders, or filter feeders, barnacles open the door (operculum) of their shell-housed bodies, and stretch out their cirri, or "curled feet," (hence their namesake classification in the class Cirripedia) to sift for food from the surrounding waters. Actively beating or passively extended cirri act like a sieve collecting vagrant diatoms, plankton, larvae, and other food stores drifting or swimming in time with the currents. Barnacles rely on the sea to

bring them food and reciprocate by cleaning the sea. The sweeping back and forth of barnacle cirri led marine biologist Rachel Carson to poetically describe the mechanism of feeding as a ritual performance: "Barnacles open their shells and begin a rhythmic sifting of the water."[335] For barnacles, environmental factors influence behaviors and numerous studies indicate temperature and water flow govern the display of "beating behaviors" ranging from length of cirri extension to length of exposure time.

Feeding well also demands an ability to cope with the flow of the external world. To adjust to fluctuating conditions, barnacles developed an ability to change the shape of their cirri to respond to the constant changes experienced in a hydrodynamic medium. This process is known as phenotypic plasticity. Cirri from barnacles in exposed sites where wave forces are more pronounced develop more robust cirri to withstand the pressure, whereas cirri from barnacles in sheltered sites are spindlier since they are less prone to contend with the pressure of heavy water. Though not a universal character trait in all barnacle species, "In environments exposed to heavy waves, the rami of the cirri are shorter and stouter, and are likely more resistant to damage. In calmer environments, cirri are longer and thinner, providing a greater surface area for particular capture."[336] But nothing exists in isolation, and wave action is influenced by changes in temperature and salinity, which in turn impacts water viscosity, the internal resistance or stickiness of water that increases or reduces the rate of flow. To adjust to the shift in viscosity, some cirri will behave like a paddle, allowing water to flow around the perimeter of the cirri, as it captures food.

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[335]Rachel Carson. "Undersea," *Atlantic Monthly*, 1937, p. 64.
[336]Maureen Vo, et. al. "The Fluid Dynamics of *Balanus glandula* Barnacles: Adaptations to Sheltered and Exposed Habitats," *Journal of Biomechanics*, vol. 71, 2018, p. 235.

The diversity of their habitat selection also makes barnacles ideal organisms for studying timing in phenotypic plasticity. In a moving environment where quiet waters quickly become noisy, scientists wonder where the breaking point lies; specifically, at what point does water become significant in motivating changes to the size and shape of cirri. One study found that "barnacles change leg length almost twice as fast when moved from an exposed shore to a protected shore (28 days) than when moved in the opposite direction (57 days)"[337] demonstrating the inherent flexibility inherited through natural laws to adjust to the demands of a changing environment.

The cirri fan out to capture prey or snare plankton in "a continuous rhythm of partial furling and re-extension, with pauses in the extended position."[338] The angle the cirri orient towards, the beat rate, and time spent gathering food all work in synchronicity with wave action. Barnacle biologist Donald T. Anderson writes of the important connection binding evolutionary forces and environmental factors in producing the varied appearance of cirri necessary for creatures "encased in a cumbrous protective box."[339] Because they are stuck in one place and occupy different zones in aquatic environments, barnacles act as living *biomonitors* of ecological conditions. Barnacles are keystone creatures in measuring levels of trace metals present in aquatic ecosystems because they accumulate contaminants via their feeding process. While barnacles rely on receptors to recognize food from non-food, feeding on specific proteins and ions, and do their best to avoid ingesting toxic material that can potentially cause neurological damage, accumulation of toxic material is unavoidable.

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[337]Christopher J. Neufeld. "Barnacle Appendage Plasticity: Asymmetrical Response Time-Lags, Developmental Mechanics and Seasonal Variation," *Journal of Experimental Marine Biology and Ecology*, vol. 429, 2013, p. 23.
[338]Donald T. Anderson. *Barnacles: Structure, Function, Development, and Evolution*, Chapman & Hall, 1994, p. 33.
[339]Ibid. p. 39.

Cirri are more than just a food gathering apparatus; they also act as lungs. Their curled feet breathe. Breathing depends on the exchange of dissolved materials between the barnacle and its environment and gills located in the "curled feet" exchange gases with the surrounding water. The same connection to water temperature and flow determines the rhythmic beat of the cirri that exhibit a distinct "respiratory pumping beat" behavior to meet their oxygen needs. In respiration, actively beating cirri work to disrupt boundary layers of water to increase oxygen uptake and passively beating cirri expand surface area to also increase oxygen uptake. This is especially valuable when the behavior of water itself is volatile.

Permanently imprisoned in self-made shells, barnacles rely on their environments for basic needs, but also actively adapt to the situation. They survive because of the competency of their legs to interpret the world circulating around them and filter through the refuse and junk, taking in what they need and expelling the waste. In their "upside-down" position with their legs kicking out, they thrive. A "thinking barnacle" corresponds to its environment. This intimacy lends itself to philosophizing on the interdependent, symbiotic relations navigating their lives. Barnacles are vital residents in oceanic ecosystems. They are primary consumers of detritus, thereby filtering the waste for other organisms. Therefore, they are more than self-encased creatures mindlessly scooping food into their mouths; they participate in an exchange process that is mutually beneficial. This spectacular creature attracted 19th century novelist Charles Dickens to include the Barnacle family as individual characters in his novel *Little Dorrit*.[340] The novel is difficult to capture with one sweeping plot line. However, its collection of sub-plots

[340]Dickens originally intended to title the novel *Nobody's Fault* to condemn bureaucracies for their abuse of power, as well as societies for blindly or willfully complying with a system for their own interests. Dickens did publish an article in *Household Words* titled, "Nobody, Somebody, and Everybody" decrying both as feeding of the other, labeling "Nobody" as the "great irresponsible, guilty, wicked, blind giant of this time. Charles Dickens. "Nobody, Somebody, and Everybody," *Household Words*, August 30, 1856, no. 336, p. 146.

spirals together with the Barnacle family at its loci. The Barnacle family represent the ongoing exchange between individuals and institutions to challenge our assessments of who is blameless or blameworthy. Though the multitude of characters occupy different class strata, they are consciously and subconsciously wound together in artful deception. Every character is wound up in some kind of deception, duping others and themselves and turned upside down by the fast-talking Barnacle family.

Charles Dickens was familiar with the barnacle study of Charles Darwin, which he references in the essay, "Sea Gardens" published in his weekly periodical *Household Words*. Dickens describes barnacles as drab creatures that lack any exceptional or noteworthy trait, using the adjectives "droll, dry, dead scurf, almost akin to lichens" and utterly bizarre in unparalleled ways, as he refers to barnacles as "strange creatures indeed are these *balani*, and stranger still are some of the habitats in which they are found."[341] Dickens then asks audiences to imagine themselves possessed by an external force that beckons them to sway their arms in the air at a set time: "Suppose your two arms were run into one above your head, and your ten fingers were split into twenty-one sickle-like feathers; suppose, moreover, you were shut up within the closed valves of a conical shell, and had to get a meal every twelve hours by plying this feeding machinery as actively as possible during a few minutes of high tide."[342] In drawing attention to the way in which barnacles are prisoners, Dickens directs audiences to take stock of behaviors, motivations, coping mechanisms, and responses to imprisoning forces. It is apropos to the novel *Little Dorrit* whose characters are marked by a "prison taint."

We meet Little Dorrit who was born in Marshalsea debtor's prison to William Dorrit, who anoints himself with the title "Father of the Marshalsea," to maintain the illusion of living in

[341]Charles Dickens. "Sea Gardens," *Household Words*, September 27, 1856, no. 340, p. 244.
[342]Ibid. p. 244.

an ordered society, though preferring the security offered by prison life. Little Dorrit encourages the charade and upholds the illusion by keeping him ignorant of the fact that she has a job; the thought of Little Dorrit having to work to pay for the family's upkeep would debase his social standing and would be regarded as morally reprehensible. We also meet Arthur Clennam, a middle-class businessman who describes himself as a "nobody" with desires to be "somebody" in the world, though he admittedly confesses he has no will of his own. He embarks on a quest to discover why the Dorrit family has been imprisoned for over twenty-five years, and in turn, learns of his own family's role in the incarceration of the Dorrit family and the inheritance his family had secretly deprived them from receiving. Everyone's lives intersect with the litany of Barnacles who govern the Circumlocution Office, a conspicuous government institution "neatly epitomizing the administration of most of the public affairs," squeezing cohesiveness and anomie together to support their "little, tight, little island."

Each individual Barnacle participates in upholding the ruse of a moral status quo. Each Barnacle member specializes in circular reasoning and successfully turn everyone's convictions upside-down. When Ferdinand Barnacle explains the role of the Circumlocution Office to Arthur Clennam, he emphasizes that the general public fails to separate reality from imagination, and consequently, collapse a functioning society. He states, "Believe me, Mr. Clennam, our place is not a wicked Giant to be charged at full tilt; but, only a windmill showing you, as it grinds immense quantities of chaff, which way the country wind blows."[343] The allusion to Don Quixote charging at windmills, which he perceives to be ferocious giants, alludes to the fallibility of the mind to feed on its own illusions. Because humanity reacts to situations first with a gut instinct before thought takes over, contending with contradictions becomes a scale to weigh

[343]Charles Dickens. *Little Dorrit*, Chapman & Hall, 1857, p. 845.

wants versus *oughts*. In churning out the grain that feeds the country and keeps it in motion, the Barnacle family exposes the reality that moral codes are an invention, intended to maintain appearances and keep society functioning.

Ferdinand Barnacle speaks of morality as an exchange. In casual conversation, Ferdinand Barnacle jokingly refers to the dual face of justice where good and evil are both undisguised and camouflaged, and the absurdity of applying a standard moral code when the same crime committed by two different people can be arbitrarily rewarded or punished. Ferdinand Barnacle brings attention to the inadequacy of being impartial when it comes to assessing others via a sonnet he recites at a party:

> Since laws were made for every degree,
> To curb vice in others as well as me,
> I wonder we ha'n't better company,
> Upon Tyburn Tree![344]

Tyburn Tree is a reference to the gallows, a site of public executions where criminals were hung for the amusement of large crowds of spectators. Embedded in the sonnet is the reality that we are navigated by inherent biases, instincts, societal restraints, and cultural values when we evaluate moral standing.[345] In that regard, Ferdinand Barnacle and the Barnacle clan hold a mirror to the world. That mirror reflects every individual as a confusion of truths, amidst the roles they play to keep their identity from totally deteriorating. The Barnacle family models that duality of order and disorder entangling reason and emotion. The union of reason and emotion often results in an unresolvable stand-off as witnessed by the association between the Barnacles and the nation: "Either the nation was under a load of obligation to the Barnacles, or the Barnacles were under a load of obligation to the nation. It was not quite unanimously settled

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[344]Ibid. p. 637.

[345]This resembles "The Veneer Theory" presented by Frans de Waal *(Primates and Philosophers: How Morality Evolved*, 2006) which argues that immoral human behavior is stamped with a veneer of morality by society.

which; the Barnacles having their opinion, the nation theirs."[346] The interminable teeter-tottering is unresolvable. The interdependent exchange between the Barnacles and the nation continues to perpetuate a "world turned upside down." The "general bamboozling air" of the Barnacle clan reflects the "foul water within the harbor" seeping into the city.

The Barnacle run the country under the motto "How not to do it." The motto begs the question: What is the right way? This question sparks an avalanche of further questions seeking answers for why something ought not to be done the way it is, how to do it otherwise, and why one decision outweighs all others. Is it presumptuous to assume that that the long-evolved foundation of instinct and impulse will motivate that decision in favor of a moral sense? That quandary is satirized by the symbiotic relationship of exchange between the Barnacles and the nation: "That what the Barnacles had to do was to stick to the national ship as long as it could. That to trim the ship, lighten the ship, clean the ship, would be to knock them off; that they could but be knocked off once; and that if the ship went down with them yet sticking to it, that was the ship's look out, and not theirs."[347] The Barnacles are beholden to the ship to provide stability, but the ship destabilizes personal autonomy in favor of one well-oiled machine. The ship assumes that its jury-rigging of individuals will, for the sake of self-preservation, as well as public opinion, result in a self-regulatory system exercising self-control. But such a system creates an environment of moral disengagement where the Barnacles are able to "baffle every endeavor to fasten responsibility anywhere."[348] Systems function because of cooperative measures, yet those interdependent relations are influenced by the situation and the values, beliefs, and motives orienting the individual to react and reason in a particular way. So, when even the "potent art of

[346]Charles Dickens. *Little Dorrit*, Chapman & Hall, 1857, p. 124.
[347]Ibid. p. 140.
[348]Ibid. p. 333.

Prospero himself would have failed in summoning the Barnacles from every speck of ocean and dry land on which there was nothing (except mischief) to be done, and anything to be pocketed, it was perfectly feasible to assemble a good many Barnacles,"[349] questioning who is the practitioner of "dark magic." The learned and practical awfulness of a society mired in its lies, feeding and breathing on deception, comes to light via the Barnacle family.

Via the channels of the Circumlocution Office, which the Barnacles refer to as a "school for gentlemen," a description purposefully directing attention to the image language creates to trigger our feelings, as well as animating the fact that we are influenced by the veneer of aesthetics and manners, we find an institution occupying two extremes: "a heavenly institution that had absolute right to do whatever it liked; or took refuge in total infidelity."[350] The duplicitous nature of the Barnacles exposes our tendencies to see what we want to see and failing to see another reality of something good hidden behind a shady surface, or the opposite, something shady underneath a shiny veneer. This is evidenced by the appearance and residence of Tite Barnacle, head of the Barnacle clan. Tite Barnacle lives on Mews Street, Grosvenor Square. Mews Street is in reality an alley of converted carriage houses and stables situated behind the mansions of Grosvenor Square. The address gave the impression of living in an elite neighborhood, though the actual residence is a barn. Dickens describes the damp, dingy, fecal stench of the house as "filled with a strong distillation of mews" where we find Tite Barnacle mummified in "folds of white cravat round his neck" and wound in "a coat buttoned up to inconvenience, a waistcoat buttoned up to inconvenience, an unwrinkled pair of trousers, a stiff pair of boots. He was altogether splendid, massive, overpowering, and impracticable"[351] and he

[349]Ibid. p. 458.
[350]Ibid. p. 124.
[351]Ibid. p. 280.

always "seemed to be sitting for his portrait to Sir Thomas Lawrence all the days of his life."[352] Tite Barnacle confuses our ability to evaluate reality because our inclinations lean towards what we see and what we are conditioned to believe. His attire is attractive but hides the fact that the clothes are cumbersome and dampen his ability to move. Even the footman that answers the door to Arthur Clennam is out of place in a home that is actually a stable.

Tite Barnacle informs Arthur that there are protocols to follow in requesting information and there are two kinds of publics in the world. One type of public follows orders and "approaches [the Circumlocution Office and its resident Barnacles] according to official forms." The other type of public "does not approach it according to the official forms" and consequently, "the Public has only itself to blame."[353] Paradoxically, in a later scene when Arthur is imprisoned for a bad investment, Ferdinand Barnacle informs him of the need for deception to keep the public content, "We must have humbug, we all like humbug, we couldn't get on without humbug. A little humbug and a groove, and everything goes on admirably, if you leave it alone,"[354] and the machinery continues. Ferdinand informs Arthur that pretense thrives because illusion feeds its flow.

Ultimately, Tite Barnacle sends Arthur back to the Circumlocution Office to speak with Barnacle Junior, Tite's son and second in command. Barnacle Junior is not an imposing figure, and forever losing his eyeglasses and fumbling for words to get Arthur to leave his office. He is likened to a new-born chick with "flat orbits to his eyes and such limp eyelids"[355] and visibly exasperated by the interruption. He is frazzled and agitated by Arthur and angered at his repetitive demand "to know." In the company of Barnacle Jr, Arthur asserts himself, while

[352]Ibid. p. 129.
[353]Ibid. p. 130.
[354]Ibid. p. 845.
[355]Ibid. p. 125.

Barnacle Junior frantically tries to send him away. Arthur feels confident that he is on his way to securing information, though Barnacle Junior just sent him to bother someone else. Arthur is sent from person to person and finally comes to the door of Number Four, a lowly level Barnacle, not even worthy of a name, who is described as the antithesis of Barnacle Junior, "a vivacious, well-looking, well-dressed, agreeable young fellow…but on the more sprightly side of the family,"[356] Arthur is the one taken aback and at a loss. Number four directly and repeatedly tells him, "You had better not bother yourself about it," though if he does want to bother, there are lots of forms to fill out that will be referred "right and left" and go nowhere. This lowly clerk who explicitly tells Arthur that the quest is futile, receives more respect from him than did Barnacle Junior, and Number Four is thanked for his "politeness."

The Barnacle family exposes a system that refuses to sift through the insincerity. The entire city follows the resolve "one must eat" as stated by the novel's pseudo-artist Henry Gowan. To keep the system flowing, nothing changes, and nobody speaks out. Ferdinand Barnacle tells Arthur that "people want to be left alone" and they "dislike and ridicule any invention" that endangers their vision of themselves. Ferdinand excuses himself by deflecting the blame onto others, stating, "We don't want to do it [floor people] but if men will be graveled, why-we can't help it."[357] The satire of the Barnacle family illuminates the reality that people have a choice to live in a prison of befuddlement or be free in honest relations.

Hermaphroditic: Good and Evil in One

Sexual expression is quite diverse in barnacles. Barnacles can be hermaphroditic with both male and female reproductive parts, androdiecious, simultaneously hermaphroditic with an

[356]Ibid. p. 134.
[357] Ibid. p. 580.

added “dwarf” male constituent, or dioecious, either male or female. For the hermaphroditic barnacle, sex allocation increases opportunity to mate and reproduce. A driving force of “adaptive sexual systems” in barnacles is the size of mating groups,[358] which is measured by the sparsity or density of barnacles settled on a particular substrate and the close contact between the shells of each individual. Charles Darwin was the first to notice barnacles display a wide array of sexual lifestyles. In a letter to geologist Charles Lyell, Darwin writes, “the other day I got the curious case of a unisexual, instead of a hermaphrodite, cirripede, in which the female had the common cirripedial character, & in two of the valves of her shell had two little pockets, in each of which she kept a little husband; I do not know of any other case where a female invariably has two husbands. Truly the schemes & wonders of nature are illimitable.”[359] Although instances of observed and documented self-fertilization have been rare, the possibility exists, conferring “reproductive assurance” to these anchored species. As species capable of producing either eggs or semen, the decision to make one or the other involves taking inventory of food sources as well as surveying the availability of mates. Other factors to consider are environmental stresses, such as intensity of wave action, exposure to air. Those factors determine if it is more profitable to act as a male or female, expending the energy to produce eggs or build a penis.

In the role of male, barnacles are distinguished by an “extensible copulatory organ” equipped with an innate “guidance system controlling location and penetration.” [360] A male penis can extend up to eight times the length of its body. Long, flexible penises allow for optimal mating opportunities, although danger is present, as the extended penis becomes vulnerable to

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[358]Yoichi Yusa, et. al. “Diverse, Continuous, and Plastic Sexual Systems in Barnacles,” *Integrative and Comparative Biology*, vol. 53, no. 4, 2013, p. 703.
[359]Charles Darwin. Darwin Correspondence Project. DCP-LETT 252, Letter to Charles Lyell, September 2, 1849.
[360]Donald T. Anderson, *Barnacles: Structure, Function, Development and Evolution*, Chapman and Hall Publishers, 1994, p. 128.

predation and crashing waves. Accordion-like, the range and musculature of the penis intimately allows the barnacle to extend its mating radius. And, because the penis is located between the feeding legs, allocating energy to reproduction reduces feeding efficiency.[361] The tradeoff for passing on genes may mean the barnacle has less energy to support itself.

To accomplish the task of finding a receptive mate, the barnacle uses its penis lined with specialized setae to probe the environment in search of a female with mature eggs ready to fertilize. Darwin extensively described the barnacle penis in 1854, but it was not until 1972 that the functional male was known to rely on hydrostatic pressure, whereby the pressure of the fluid inside the penis makes the penis rigid. The willing female responds to the advances of the male by momentarily resting the kicking legs and opening the shell door for the male to enter. A male begins the search for a mate by taking a full circle-circumference feel of the surrounding area regardless of the proximity of a functional female; this ritualized practice may be a sign of competitive strength. Competition also contributes to the adaptive plasticity of the penis. Studies indicate that barnacles in wave-exposed areas develop stronger and stouter penises as opposed to barnacles settled in wave-protected sites. The ocean shapes their reproductive success. And it is the ocean that eventually carries the released larvae to their final resting place. Wateriness defines their sexuality as much as it does their entire livelihood.

The choice to produce eggs also depends on the fitness of the barnacle as much as the environment, such as the availability of specific nutrients, specifically nitrogen,[362] necessary to produce eggs. In spending energy to produce eggs, fewer resources are allocated to other life-sustaining functions. Eggs occupy a large space inside the body, and are therefore, costly to

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[361]Waltraud Klepal, H. Barnes, and E. A. Munn. "The Morphology and Histology of the Cirripede Penis," *Journal of Experimental Marine Biology and Ecology*, vol. 10, no. 3, 1972, pp. 243-265.
[362]Lukas Schärer. "Tests of Sex Allocation Theory in Simultaneously Hermaphroditic Animals," *The Society for the Study of Evolution*, vol. 63, no. 6, 2009, p. 1383.

produce. For that reason, studies indicate that the size of barnacles is a determining factor for producing eggs and large females are more likely to succeed in attracting a mate. To insure optimal viable offspring to compensate for the costs of producing eggs, functional females are capable of being fertilized by more than one male. Sex allocation for females also takes into consideration the availability of males, that is, the intensity of male-male competition.

Hermaphroditism is unusual in the animal kingdom and its presence shook people's sensibilities as the wobbliness of life colored the domestic realm. Life's unwieldly crossings and the study of hermaphroditism animated the writings of Erasmus Darwin, grandfather to Charles Darwin, who published a two-volume publication, *Zoönomia or The Laws of Organic Life* (1794, 1796), arguing, "All warm-blooded animals derived from one living element. Cold-blooded animals, insects, worms, vegetables, derived also from the one living filament"[363] and "the present existence of breasts and nipples in all the males" meant that "mankind and quadrupeds were formerly in a hermaphroditic state;"[364] a startling statement that unnerved an anxious and religious audience who, though unflinchingly accepting of Adam's hermaphroditic birthing of Eve, were less prone to accept their own volatility.[365] Taking his evolutionary ideas further, Erasmus Darwin attributed sensation, movement, and degrees of mental activity to animals and plants, following the same classification criteria he used to describe traits of human beings. If humans, animals, and plants shared the qualities of independent thought and action, what would distinguish humanity?

Charles Darwin continued the comparative study of embryonic forms of humans and the lower animals, claiming, "that man descended from some less highly organized form. The

[363]Erasmus Darwin. *Zoönomia or The Laws of Organic Life*, J. Johnson, 1794, p. 505.
[364]Ibid. p. 53.
[365]Carolus Linnaeus (1707-1778) argued that new species were a result of hybrids of those originally created by God.

grounds upon which this conclusion rests will never be shaken, for the close similarity between man and the lower animals in embryonic development, as well as in the innumerable points of structure and constitution, both of high and of the most trifling importance, - the rudiments which he retains, and the abnormal reversions to which he is occasionally liable, - are facts which cannot be disputed. They have been long known, but until recently they told us nothing with respect to the origin of man."[366] Darwin viewed life as an ongoing experiment, a trying out of forms, making all character traits fungible. His study of barnacles led him to shed all his expectation of life, when he found "character after character fails and blends away by invisible degrees."[367] Fear of slippage between men and women, humans and animals, humans and plants, humans and machines, and life and death occupied trans-Atlantic minds[368] in a century stamped by technological and scientific invention and discovery, with the proliferation of newspapers, magazine and novels making the stirring up of uncertainty a lucrative business.[369] If character traits were fluid, then humanity was in need of some kind of reassurance of its own stability. According to Darwin, exhibiting control over impulse and emotion would separate humanity from other animals. Morality became as much an innovation as science as the public was made ill at ease by the explosion of novel life forms and their natural histories became widely publicized.[370]

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[366]Charles Darwin. "General Summary and Conclusion." *The Descent of Man*, Amherst, 1998, p. 629.
[367]Charles Darwin. *Monograph*, Ray Society, vol. 2, 1854, p. 242.
[368]American and English audiences were well accustomed to hybrid animals displayed live, preserved, or pieced together, in menageries, aquariums, traveling "freak" shows, and in various print mediums. See *Victorian Hybridities*: *Cultural Anxiety and Formal Innovation* by UC Knoepflmacher and Logan Browning.
[369]Cheap paper and printing created a paperback revolution spawning a new market in "dubious" material, fulfilling the public desire for mystery, mayhem, and rebellion, unwittingly made available and private by taking advantage of the postage rate set by Congress. See *Morality and the Mail in 19th Century America* by Wayne E. Fuller.
[370]Prescriptive writing intended to instruct the public on managing their domestic and public lives took hold during the 19th century, including "joke books" educating the public on what is acceptable humor. Establishing self-discipline and restraint demonstrated control over one's thoughts and actions. For an extended discussion on morality, see *Victorian American*, ed. by Daniel Walker Howe and Geoffrey Blodgett.

At a time when every aspect of life was teetering on the edge of being corrupted, consequently inferring that people were corruptible, protecting domestic spaces took primary concern. As a result, communities monitored their behaviors and that of others, and were highly attuned to any show of deviant behavior. To satiate a desire to explore independent modes of living, the public turned to the salacious adventures of fictional and real sea-faring expeditions detailed in print. Sea novels washed away fine distinctions between life and death; purity and passion; chaos and order; self and other, opening portals for reimagining morality that does not exclude the body from the mind. One such novel, *The Adventures of Arthur Gordon Pym* by Edgar Allan Poe, promising "mutiny", "atrocious butchery", "shipwreck", "horrible suffering", "famine", "capture", "massacre" and "incredible adventures and discoveries," questions the authenticity of a moral code when it is tempered by artificial separation of mind and body, especially when the mind and body are susceptible to twists and turns, or embrace a "mad freedom" to borrow a term from the philosopher Immanuel Kant, to condemn the moral depravity of barbarous societies. And it does so with the aid of barnacles.

We embark on a sea voyage with Arthur Gordon Pym from the docks of Nantucket to invented islands and the yet to be discovered South Pole.[371] This desire to go the "ends of the Earth" represents the drive to break away from boundaries and to be "expansive." In this nomadic life in a watery world where what is "civilized" is always in the making, moral sense is challenged by both human and animal, demonstrated in doubling of the plot and a spirit of *rationalization* that splits parallel incidents into one of moral superiority and inferiority. Barnacles appear at the apex to split the novel into two mirroring parts, reflecting the fallibility

[371]The majority of the novel is borrowed from Benjamin Morrell's *Narrative of Four Voyages*, J&J Harper, 1832. Edgar Allan Poe was also influenced by the Hollow Earth theory proposing that the inside of the Earth is hollow and can be accessed via entrances at either the north or south pole. This inner Earth was supposedly a replica of Eden.

of distinctly stating what is good and what is evil. Pym admittedly longs for "shipwreck and famine, death or captivity among barbarian hordes; of a lifetime dragged out in sorrow and tears, upon some gray and desolate rock, in an ocean unapproachable and unknown."[372] He desires to feel agony, to take his body to the extreme to find out who he is and what he is capable of doing. He is accompanied by mutineer turned ally, Dirk Peters, and we are placed in baffling situations where catastrophes turn out to be fortuitous and the reverse, good fortune, turns into disaster.

The novel is flooded with doubling, or hybridity. The many instances of hybridity call attention to the instability of moral perspective when the audience is confronted with repeated experiences and fail to see the same way twice. One hybridity is between Pym and his lifelong friend Augustus Barnard with whom he "shares intimate communion" seeping into a "partial interchange of character." Bernard engages Pym's imagination with wild stories of the sea, and though Pym is a novice sailor, is riled up to launch out to sea on midnight escapade aboard Pym's ship the *Ariel*, where Pym, the least experienced sailor, ends up saving both their lives. Unphased by the near-death experience, two later conspire to stow Pym away aboard the *Grampus*, captained by Augustus' father. The sea offers an escape from Pym's well-regulated world. He seeks to escape the constrictions of his "respectable" family, notably his grandfather Mr. Peterson, "an attorney in good practice" who had "speculated successfully in stocks" though it led to the failure of many banks and loss of people's life savings when a financial crisis struck in America. Another double-doubling is that of the mutineer Dirk Peters, whose name mirrors that of Mr. Peterson, and who held the important position of whale-line manager, before becoming a mutineer, and later an ally to Pym. In the first half of the novel Pym refers to Peters as "hybrid" and "half-breed" possessed by a singular undecipherable "ruling expression" of a

[372]Edgar Allan Poe. *The Adventures of Arthur Gordon Pym*, Harper & Brothers, 1838, p. 12.

man "convulsed with laughter" that upon "second glance makes one shudder as if the expression indicated the merriment of a demon."[373] In the second half of the novel, Peters is described as "white." The flip-flopping of descriptive traits paints moral judgment as something aesthetically motivated and emotionally driven. After mutiny and shipwreck, Pym and Peters are rescued by the hybrid *Jane Guy*, and repeat their adventures as they navigate towards the South Pole with a layover on the fictional island of Tsalal where everything and everyone is black and anything white is horrifyingly frightening to the natives. The horrifying, bloody events aboard the *Grampus* are paralleled in Tsalal.

Barnacles split the novel into two repeated (hybrid) journeys.[374] After suffering through entombment, adopting the identity of a corpse, participating in a bloody mutiny, engaging in cannibalism, and surviving a storm that overturned the *Grampus*, Pym finds himself sitting atop the upside-down ship, and discovered, "the whole bottom, from within two or three feet of the bends, as far as the keel, together with the keel itself, thickly covered with large barnacles, which proved to be excellent and highly nutritious food. Thus, in two important respects, that accident we had so greatly dreaded proved a benefit rather than an injury; it has opened to us a supply of provisions, which we could not have exhausted, using it moderately in a month; and it had greatly contributed to our comfort as regards position, we being much more at our ease, and in infinitely less danger, than before."[375] Barnacles revive Pym and cure him of his experiences, returning him to "well-regulated human intellect." The barnacles restore order in Pym's mind, and he absolves himself of any wrongdoing.

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[373]Ibid. p. 36.
[374]Edgar Allan Poe was rumored to be an amateur naturalist and translated the text *The Conchologists First Book on a System of Testaceous Malacology* written by French naturalist Georges Cuvier.
[375]Edgar Allan Poe. *The Adventures of Arthur Gordon Pym*, Harper & Brothers, 1838, p. 82.

Via the resuscitating barnacles, Pym seems to acquire selective amnesia. He is rejuvenated by the barnacles to go on another adventure after he and Peters are rescued by the *Jane Guy*, a doubling of male and female. Pym adopts the character of seasoned sailor and coerces Captain Guy, who loses his position to Pym, to head to the South Pole. Pym is emboldened by the barnacle feast and takes on the role of a learned naturalist yet applies a moral sense to a natural phenomenon. He claims to witness penguins and albatrosses nesting together in what he describes as a "bizarrely regulated geometry of the rookery" admiring their orderly pattern. The geometry acts a metaphor for the parallel worlds he experiences and fails to recognize as one.

In the first half of the novel, Pym receives a letter from Augustus while he is stowed away, hiding in the ship's bowels aboard the *Grampus*. Confusingly, the letter appears to be the same one that Pym had sent to his family, under the assumed hand of a family friend, calling for Pym to come visit, and in defiance of physical laws, has three sides. The letter had "several lines of the MS. in a large hand, and apparently in red ink" with close instruction to remain put, though Pym was delirious with hunger and sick from the smell of whale flesh staining the cargo hold. The note read, "blood-your life depends upon lying close," and Pym "formed a thousand surmises" as to the reason, but cannot solve the mystery, incapable of imagining that a commissioned whaling vessel would be vulnerable to mutiny. Before having read the note, Pym had, out of anger, torn it to shreds, and had to scramble to put the bits and pieces together to gain some semblance of information from it. The function of the letter was to inform Pym of the uprising of the ship, but Pym could not conceive that the crew would overthrow the authoritative powers of the captain. Ironically, Pym is a stowaway, indicating the captain is not fully aware of all the happenings aboard the ship.

In the second half of the novel, on the uncharted island of Tsalal, Pym is entombed in a cave, having separated from the group when a fissure in the mountain caught his attention and he ventured inside, fortuitously escaping the mutinous avalanche planned by the *Tsalalians* to bury the crew of the *Jane Guy*. In the cave, his eyes settle upon carvings made in stone that he attributes to the natural erosion, the work of nature, rather than believing that the "primitive" people of Tsalal could possibly have created a form of communication or history: "With a very slight exertion of the imagination, the left, or most northern of these indentures might have been taken for the intentional, although rude, representation of a human figure standing erect with outstretched arms. The rest of them bore also some little resemblance to alphabetical characters…"[376] but Pym dismisses such fancies as impossible, categorizing the *hieroglyphics* lacking the gravitas to pass for any kind of legitimate language. Pym does not even bother to imagine that the pictures signify language because he has already labeled the *Tsalalians* evil for their treachery, conveniently forgetting his own participation in the murder of the mutineers aboard the *Grampus*. Pym decries the *Tsalalians* as the "most wicked, hypocritical, vindictive, blood thirsty, and altogether fiendish race of men."[377] He creates a boundary between his experience aboard the *Grampus* and that in Tsalal, yet the doubling is inescapable.

Delineating animals as domestic and wild provides another instance of doubling. Trapped in the bowels of the *Grampus*, Pym dreams he is attacked by a monster with a "red throat" and awakens to find the "paws of some huge and real monster" with "white and ghastly fangs gleaming" sitting upon his chest. The beast turns out to be his "faithful follower and

[376]Ibid. p. 160.
[377]Ibid. p. 201.

friend," Tiger the Newfoundland (a breed of dog specifically trained to work on the water),[378] he had rescued from drowning as a puppy some seven years back and who was secretly brought on board by Bernard. Tiger is emblematic of domestic sanctity, a tame "inseparable companion" who in a "multitude of instances had given evidence of all the noble qualities for which we value the animal" reinforcing the idea that knowing and naming animals elevates human intellect. In parallel, while navigating towards the South Pole aboard the *Jane Guy*, the crew picks up the "carcass of a singular-looking land animal. It was three feet in length, and but six inches in height, with four very short legs, the feet armed with long claws of a brilliant scarlet, and resembling coral in substance. The body was covered with a straight silky hair, perfectly white. The tail was peaked like that of a rat, and about a foot and a half long. The head resembled a cat's with the exception of the ears- these were flopped like the ears of a dog. The teeth were of the same brilliant scarlet as the claws."[379] Pym is horrified by the creature whose resemblance to a dog fails to meet the idea of a dog because of the fact that it was outside Pym's own mindset. The animal is unclassifiable, and thus a beast that evokes disgust. It exists outside his social order, therefore, does not warrant consideration.

Reality and illusion in regard to self-image offers another lens into doubling. During the mutiny aboard the *Grampus*, Pym conspires to take back the ship by disguising himself as the corpse of Hartman Rogers, a sailor who had been poisoned by the "head mutineer." Dressed in Rogers' shirt, Pym ghosts his face with white chalk and "blotching it with blood." When Pym catches sight of his likeness in a "fragment of a looking glass" he finds himself "impressed with a sense of vague awe with my appearance" and the reality of the representation, that he was

[378]Seaman was the name of the Newfoundland dog accompanying Meriwether Lewis and William Clark on their Corps of Northwest Discovery tour from the Mississippi River to the Pacific Ocean, and one of the books Pym had been provided with while hiding in the hold of the Grampus is the "expedition of Lewis and Clark."
[379] Edgar Allan Poe. *The Narrative of Arthur Gordon Pym*, Harper & Brothers, 1838, p. 102.

"seized with a violent tremor, and could scarcely summon resolution to go on with [his] part" though he convinced himself to "act with decision." Pym sees his own inevitable other self and what he is capable of, and though momentarily overcome with disgust at his appearance, he proceeds to violently reclaim the ship. In a similar instance, Too-wit, Chief to the *Tsalalian* people, is invited to tour the *Jane Guy*, whereby he notices two mirrors placed on opposite sides of the cabin. Facing one mirror and with his back to the other, he looked at his "reflected self in the glass" and reacted so violently, Pym "thought the savage would go mad" and "upon turning short round to make a retreat, and beholding himself a second time in the opposite direction, I was afraid he would expire on the spot."[380] The reflection in the mirror turn both Pym and Too-Wit into "mad men" but from Pym's perspective, his behavior led to a restored order, whereas Too-Wit's behavior demonstrates an innate lack of order because of an inability to distinguish an image/illusion from the substantive, real person.

Dietary laws are another form of doubling. The *Grampus* was almost drowned by a storm, making it impossible to reach the store of food. Starving and delirious, Pym and the surviving three others are ready to face death when they are approached by a "hermaphroditic brig, of a Dutch build,"[381] zigzagging towards them with the determination of a drunken stagger. When the ship gets closer, they see a hybrid crew of "Twenty-five or thirty human bodies, among whom were several females, lay scattered about between the counter and the galley in the last and most loathsome state of putrefaction."[382] As they yelled out to the ship, their call was

[380]Ibid. p. 132.

[381]The Dutch ship refers to the 17th century golden age of shipping dominated by the Dutch East India Company. The myth of the *Flying Dutchman* has had many authors, the most prominent are Thomas More (1779-1852) and Sir Walter Scott (1771-1832) who write of the murder and piracy committed by the crew that banished them from ever reaching safe harbor and doomed them to sail the seas forever.

[382]Seafaring superstitions held that women were considered a liability, jeopardizing the sailors' concentration and were morally dangerous to the sanctity of domestic life.

answered by "something, from near the bowsprit of the stranger, so closely resembling the scream of a human voice that the nicest ear might have been startled and deceived" which turned out to be a seagull gorging on the face of a figure at the helm. The pecking motion made the smiling figure appear to be swaying to and fro with life, though the truth revealed a face "utterly naked." The startled gull flew off and dropped a morsel of flesh on the deck of the *Grampus* and the idea of cannibalism is seeded.[383] Pym enters the seagull's perspective, transgressing the taboo of cannibalism, and via democratic vote, elects to kill and eat a minor character who survives the mutiny. The effect of which appeased his "raging thirst" and he "devoured the body" in four days. Yet, in Tsalal, Pym is repulsed by the natives "greedily devouring" sea cucumbers plucked from the water in their raw state, and later when invited to feast with the tribe, the crew are offered a meal consisting of the "palpitating entrails of a special unknown animal" to which Pym and the crew of the *Jane Guy* react with a "rebellion of stomach." His prior cannibalism satiated his hunger and did not raise the level of visceral disgust he felt towards the traditional foods of the *Tsalalians*. He is physically sickened by the diet of the *Tsalalians* though his only comment after consuming a fellow human is to state that their hunger was abated for four days.

In the end, Pym leaves us in a blank state. He and Peters are swallowed by the sea as they float aimlessly in a stolen canoe, along with a captured *Tsalalian* native. Eventually, they glide into a chasm foregrounded by a mysterious, large "white shrouded figure." And the novel closes. Everything is absorbed by a blank canvas, swallowing Pym whole. There is no reflection on right and wrong, good and evil, as they dissolve together. The hybridity of the novel and Pym's lack of awareness of that hybridity illustrates that morality is a social convention that inhibits

[383]Seagulls were reputed to be gluttonous birds, indiscriminately devouring anything they happened upon, however putrid.

relations with a natural world that is “queerer” than we can imagine or ever truly discover.

CHAPTER FOUR: FREE WILL

Octopuses: The Freedom to be Anything and Adapt

> Adopt the disposition of the octopus, crafty in its convolutions, which takes on the appearance of whatever rock it has dealings with/At one moment follow along this way, but at the next change the color of your skin: you can be sure that cleverness proves better than inflexibility.
>
> Theognis, *Elegiac Poems*

"The rock has eyes," shouted the little boy in the bright orange coat circled by an equally bright blue stripe, pressing his index finger against the glass aquarium housing an octopus. "That rock is an octopus," I replied as we both stared at the rectangular pupil of the camouflaged octopus whose eyes resembled black slits painted onto sandstone rock. We wondered if *Umbrella* (the name written on the sign leaning against the enclosed tank) saw us and it certainly was unclear who was watching whom. In a tank full of sea-creatures both familiar and bizarre, the octopus appeared to us as the only one surveying both its world and ours. According to numerous claims by visitors to aquariums and those who have worked closely with octopuses, the uncanny feeling of being watched is a common phenomenon. We sensed that Umbrella saw something in us that we could not see in ourselves. Seeing and being seen locates us in the world. That sentiment intersects poetry and science via the expression and function of our eyes. The motto that the "eyes are a window to the soul" promises that looking directly into a person's eyes will reveal a true character and innermost intentions. Our eyes are part of our automatic nervous system and the first responders in detecting possible threats. But our eyes can deceive us as biology documents that our eyes are directly connected to our brain, and our brain is charged

with interpreting what we see to form a picture we can understand; therefore, what we see is not always what we think we see.

Our eyes give us away and navigate our being in the world. Eyes inform us and expose us, as do the eyes of octopuses, well adapted to detect constant movements. Octopuses process complex images by absorbing the light reflected by objects, as do humans. But there the similarity ends. Octopuses have square pupils that change shape to control how much light enters, whereas human beings have round pupils that change in size to control how much light enters. Though this may seem inconsequential, it has inspired researchers to question whether octopuses see color. That question was studied by biologist Alexander Stubbs and his father, astrophysicist Christopher Stubbs. Their research indicates that the shape of the pupil in octopuses, combined with the mechanism known as "chromatic aberration," the way in which the lens of the eye processes light, function in such a way that makes it possible for octopuses to recognize color. The evidence indicates that octopuses have "sacrificed overall acuity in favor of chromatic blurring, which we suggest here as a mechanism for spectral discrimination"[384] that enables octopuses to blend in with their surroundings.

Referred to as chameleons of the sea, octopuses have an evolutionary history that spans approximately 300 million years. Though they have existed through millennia, these soft-bodied, intelligent creatures maintain a captivating yet inimical reputation, associated with the peculiar and strange. Their being is summed up by the moniker appended to them, alluding to something sinister, both of and not of this world, namely, "devil-fish." The horror of inscrutable octopuses is patterned by their ability to instantaneously change skin color and texture, the fact that they

[384]Alexander L. Stubbs and Christopher W. Stubbs. "Spectral Discrimination in Color Blind Animals via Chromatic Aberration and Pupil Shape," *Proceedings of the National Academy of Sciences-PNAS*, vol. 113, no. 29, 2016, p. 8208.

possess three hearts, circulate copper-base blue blood, have a parrot-beak for a mouth, and eight extraordinarily strong, sucker-lined tentacles equipped for walking, swimming, grasping, and probing. Furthermore, the tentacles of the octopus act independently of one another and of the central brain. Each tentacle is a brain of its own. Two-thirds of the 500 million neurons governing reaction responses are located in the stretchable arms and are "capable of reflect withdrawal to a noxious stimulus without reference to the brain."[385] The octopus pulls itself together, working in sync with nine independently acting "brains," and still functions as one singular creature. They also eject coal-black liquid ink to distract potential predators and can adroitly squeeze into and out of all kinds of geometrically challenging spaces. They are seductively flexible and elusive. When we try to hold them in our minds, they escape.

The notion of breaking free from constraints characterizes the octopus. That intentionality rouses thinking about what it means to exercise free will. The question of free will crosses disciplines, combining neuroscience, psychology, philosophy, theology, and sociology. From these disciplines, the question of whether or not human beings are merely products of their genes and environments, morally responsible (or not) for behaviors, arises. The tension of human agency occupies the world of neuroscience as much as it occupies the world of social sciences, contending that free will guides moral decisions, and human beings are responsible for their behaviors if they could have acted otherwise.[386] The concept of free will challenges humanity to think cosmically, terrestrially, and *thallasologically*, as does the octopus with its extraordinary intelligence, the ability to alter its ribonucleic acid (RNA) to meet prevailing environmental conditions without disrupting its deoxyribonucleic acid (DNA), and its remarkable strength in

[385]Katherine Harmon. "Even Severed Octopus Arms Have Smart Moves," *Scientific American*, blog post, August 27, 2013.

[386]Philosopher Harry Frankfurt coined the phrase Principle of Alternate Possibilities in 1969, claiming that a person is morally responsible for any behavior if alternative choices exist, and a person could have done otherwise.

contrast to its soft body. With so many areas of study engaged in unravelling what does or does not constitute free will, and if free will even exists, it is extraordinary that for centuries, free will stood, and stands, as one pillar defining what it means to be human (separate from other animals). Our own colliding chemical configurations, evolutionary inheritance, belief in a higher power, societal influences, and personal experiences, swirl together to pose the question, "Are we free to act?" How attentive we are to this question is of interest in reckoning how we navigate and mediate the natural world. I approach the question through the biology of the octopus. The octopus takes the world in and refuses to stay put. It compels us to ask what it means to be self-possessed. In reading with octopuses via the study of the relationship between humans and gods in *The Odyssey* by Homer, the character of the individual in society in *Toilers of the Sea* by Victor Hugo, and the desire to test moral rectitude before the forces of nature in *The Octopus, or the Devil-Fish of Fiction and Fact* by Henry Lee along with other writings of the "Devil-Fish," I examine the paradoxical nature of free will and its stability in defining what it means to be human.

Decision making is synonymous with intentionality or desire and is also linked to free will. A multidimensional creature, like the octopus, with the intelligence of a "higher order" vertebrate commands attention to the belief in free will in a world that may or may not be deterministic; a world that influences us in invisible ways. We are possessed by a world that shapes us in indeterminate ways, including the development of our brains, as neuroscience argues that individuals are unable to entirely control the workings of the mind. Our thoughts exist beyond our own cognizance, exposing a certain lack of privacy over our emotions, reactions, and actions. Human beings are a process, a chain of causal events, an open system with the potential to have done otherwise but tethered to a history of prior events calling upon us

to admit, “I don’t know why I did that, yet I am fine with my action.” Recently, octopuses have officially entered into the conversation of free will. According to a statement published on July 7, 2012 by the Cambridge Declaration of Consciousness, an international group of neuroscientists meeting to evaluate and measure conscious experience in humans and non-humans, octopuses are included, for the first time, in the conversation: “Furthermore, neural circuits supporting behavioral/electrophysiological states of attentiveness, sleep and decision making appear to have arisen in evolution as early as the invertebrate radiation, being evident in insects and the cephalopod mollusks (e.g., octopus).”[387] The octopus is recognized as a sentient creature, fully aware and capable of experiencing its “internal state,” namely, it shows intention in its interactions. Studies also indicate that octopuses have memories and are known to actively like or dislike people.

It seems impossible to define an octopus as a single creature. Continuous with the outside world, octopuses appear to completely dispense with physical boundaries. Octopus scientist Martin J. Wells affirms the difficulty in describing a creature so irregular, whose movements “are not restricted as our own are, by the limitations imposed by a skeleton, and the animal adjusts to the surface over which it is travelling, seeming rather to flow from place to place than to move by discrete limb movements.”[388] The octopus dissolves the separation between itself and its outside environment. Naturalist Charles Darwin is also captivated by the elusive octopus, and writes, “I took several specimens of an Octopus, which possessed a most marvelous power of changing its colours; equaling any chameleon, & evidently accommodating the changes to the colour of the ground which it passed over-yellowish green, dark, brown & red were the

[387]The declaration was written by Phillip Low and presented at the Francis Crick Memorial Conference on Consciousness in Human and Non-Human Animals, University of Cambridge, June 7, 2021.
[388]Martin J. Wells. *Brains and Behavior in Cephalopods*, Stanford University Press, 1962, p. 6.

prevailing colours; this fact appears to be new, as far as I can find out."[389] The octopus left its mark on chapter one of *Voyage of the Beagle*, where Darwin writes of the octopuses' repertoire of disguises and confesses he sensed that the octopus was conscious of his presence: "various arts to escape detection by one individual, which seemed fully aware that I was watching it."[390] Darwin believes that the octopus is deliberately shape-shifting to undermine his presence of sight and mind.

The indecipherability of the octopus and its inaccessibility captured 20th century American poet Ogden Nash and moved him to evince his fascination with the creature in verse. Nash entangles us in a self-conscious desire to possess the same boundless independence and *God-like* eminence. The poem reads:

Tell me, O Octopus, I begs,
Is those things arms, or is they legs?
I marvel at thee; Octopus;
If I were thou, I'd call me, Us.

Nash is unable to definitively label body parts or connect them to a specific function. He also confuses subject-verb agreement, using the singular verb form "Is" to refer to the plural "arms" and "legs." In questioning the purpose and unity of the octopus, he falls short of waiting for an answer, possessed instead in admiring the undefined and unanswerable. He pleads with the octopus to confess its secret, as if the octopus is the only one privy to know, yet eagerly moves on to express awe with a creature whose being is unconstrained. He asserts that if he were an octopus, he would refer to himself as "Us" in keeping with the formal "thou," whose historical meaning in the English language connotes an intimate relation with God. In evoking a spiritual

[389]Charles Darwin. The Darwin Correspondence Project, DCP-LETT 171, Letter to John Stevens Henslow, May 18, 1832.
[390]Charles Darwin. *The Voyage of the Beagle*, Open Road Integrated Media, 2016, p. 13.

connection with attention to bodily forms, the evolution of life, and acceptable and unacceptable ways of being, the octopus acts as a guide in the quest to determine if we are free to determine who and what we are in this world. The question of free will disturbs scientists and philosophers who share in the exploration of the condition of existence.

How we move around the world, we argue, is up to us. The alternative is that we are "out of control," forced to override our own "minds" in what neuroscientist Benjamin Lipet terms "Free Won't." Lipet argues that we are under the influence of a mind we cannot fully access, ultimately at the whim of something "other" in charge of our behavior, our decisions, our responses. And the Houdini-like stories describing how octopuses accomplish daring feats of escape from barricaded aquariums begs the question of what it means to be a living being that thinks, feels, and decides to act.[391] The choices made by individuals is not so discrete, rather, they are a product of "hard wiring" as Lipet contends, or merely a stockpile of automatic responses. However, something is pulsating within and without that guides decision making, or as is often cited in psychology, one cannot act against one's self. Despite that contention, the legal system has successfully argued that particular chemicals in foods are viable culprits in transforming a person from a Dr. Jekyll into a Mr. Hyde, and arguably, that person cannot be held responsible for his or her actions. Free will either exists or it does not. Exploring the mystery yields more questions than resolutions. In that regard, free will is a ghostly element. It is an undiscernible, intangible non-substance, but one we assume makes us human. Through the

[391]Marine biologists Jacques Cousteau and Phillippe Diolé recount a friend's experience with an octopus in *Octopus and Squid, The Soft Intelligence* (Doubleday, 1973). They narrate the time when their friend Gilpatrick "brought an octopus home and put it in an aquarium, which he then covered with a heavy lid. A short time later, the aquarium was empty, and Gilpatrick found the octopus going through his library, book by book, turning the pages with its arm" (p. 33).

lens of the octopus, we are invited to ask ourselves if we are an *Us* rather than an *I*, and what such thinking means in relation to our being with the natural world.

Relations in the form of action and reaction to the natural world, and the octopus specifically, found a place in art. Ancient Greeks portrayed the octopus in pottery to connect with a threatening and unfathomable sea. Octopuses were prominently featured in pottery by the "sea people" of Minoan culture circa 2700-1500 BCE and Mycenaean culture circa 2000-1100 BCE. Both cultures independently developed the "Marine Style" or "Octopus Style." The majority of unearthed pottery artifacts feature an octopus with protruding, hypnotic eyes. The eyes were often drawn as a series of concentric circles with a prominent black pupil in the middle, dwarfing the size of the head and giving the eerie impression of following the observer. Though the octopuses were drawn in simple lines, their undulating arms suggested fluid movement. The pottery demonstrates a reverence for the octopus that frightens away dangers omnipresent in seafaring. Seafarers were accustomed to unpredictable seas and believed that paying homage to the octopus would show their respect for the supernatural. Octopuses continued to maintain a mystical hold on Greek thought, inspiring Aristotle to describe the octopus as "neat and thrifty in its habits" and observe that it was the "only mollusc that ventures onto dry land; it walks by preference on rough ground."[392] The octopus crosses boundaries and defies categorization. Whereas Aristotle concentrates on the ingenuity of the octopus, famed 2nd century Roman natural historian Pliny viewed the octopus as a malicious, murderous creature: "No animal is more savage in causing the death of man in the water, for it struggles with him by coiling round him and it swallows him with sucker-cups and drags him asunder."[393] Pliny

[392]Aristotle. *History of Animals*, Trans. D'Arcy Wentworth Thompson, Loeb Classic Library, 1911, Book IX, Part 37.
[393]Pliny the Elder. "The Natural History of Fishes," *Naturalis Historia*, Trans. John Bostock, Perseus Digital Library, 1855, Book IX, Chapter 2.

contributes to the reputation of this fearsome beast, writing the octopus as a conniving monster ready for battle, untethered by species categorization. In narrating the story of an octopus that snuck into a fish farm, Pliny recounts that the proprietors "felt they were pitted against something uncanny, for by its awful breath it also tormented the dogs, which it now scourged with the ends of its tentacles and now struck with its longer arms, which it used as clubs."[394] A level of sophisticated planning is ascribed to the octopus. Human, dog, and octopus wound together in a contest of brawn and wit in either a desire for something or a desire to control that desire.[395]

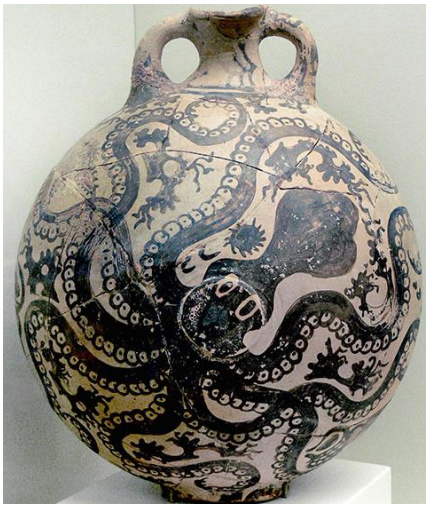

Figure 22: Octopus vase from Palaikastro, c. 1500 B.C.E., Archaeological Museum of Heraklion.

A preoccupation with the unbridled forces and unmatched forms of the octopus continued into the Renaissance with the work of 16th century Italian naturalist Ulisse Aldrovandi who filled a personal museum with over 8,000 illustrations of real and imaginary creatures and over 18,000

[394]Ibid. Chapter 2.
[395]American philosopher Susan Wolf coined the phrase "deep self view" to articulate that if one is responsible for one's actions, one is also responsible for the self that performs those actions.

specimens. His text *Monstrous Historia* represents a veritable museum, a catalogue of actual and fantastical life. In describing the octopus, Aldrovandi claimed its strength surpassed the eagle, its temper fiercer than a lion. The analogies assumes that with provocation, the octopus exceeds it nature. It's no wonder that through time, octopuses became synonymous with the kraken, a celebrated sea monster reputed to reside primarily in Scandinavia (arguably the idea of a sea monster resembling an octopus originated in Greek mythology with the legend of Scylla). The kraken reputedly drowned seafarers whose ambitions inspired them to leave the safety of dry land. In other parts of the world, the kraken was synonymous with "devil-fish," alluding to an evil spirit eliciting human beings to succumb to a longing to recklessly abandon their faculties. The circulating myths of the kraken/devil fish resonated with the fact that the sea could suddenly be rent by a spontaneous maelstrom, fantastically imagined as a bulbous horned-headed beast with a voracious appetite and a penchant for seeking out poor, unsuspecting souls, dragging them down into the depths. These superstitions remain, in some form, embedded in the psyche, and surface when light and shadows play with reality. A shift in perspective draws out a belief resting in the recess of the mind, a resting causal association meant to protect and instruct, and sticks regardless of its irrational tenor.

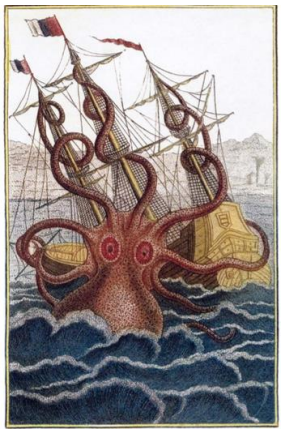

Figure 23: "Le Poulpe Colossal," Denys de Montfort, 1801.

While octopuses have their own ancient history, the 19th century encountered the octopus in novel ways. An octopus craze hit the world after Victor Hugo published *Toilers of the Sea* in 1866, featuring a wrestling match between the main character Gilliatt and an octopus. In the man versus beast contest of will, the stark truth of being at the mercy of natural hidden forces reveals itself. According to André Maurois in his biography *Victor Hugo and His World,* the octopus was the "talk of the day." It was common to find women parading along the seaside under the shade of large hats adorned with long, dangling, tentacle-like extensions. On March 31, 1866, the magazine *La vie parisienne* featured a line drawing of a woman fitted in a nautical themed dress with embroidered clam shells with anchors at the hem and a bodice with octopus eyes prominently placed at the breasts. The dress was also adorned with a flowing array of tentacle-like ribbons down the shoulders. The title of the drawing, "La toilette de la pieuvre" (Toilette of the Octopus), alludes to beauty rituals performed by women of the day.[396] In costuming themselves like the octopus, they were, in some ways, appropriating its undiluted, unparalleled existence. As octopuses eventually made their way into cuisine, the phrase, "everything has been octopusied" took on another dimension.

Figure 24: "The Toilette of the Octopus." *La Vie Parisienne,* 31 Mars 1866, Bibliotèque nationale de France.

[396]La Vie Parisienne, Moeurs Élégantes, Choses Du Jour, Fantaisies, Voyages, Théâtres, Musique, Modes / Par Marcellin, 31 Mars 1866.

Connecting with the octopus felt like crossing over into a whole other world; it was liberating. The enigmatic octopus bewitches the senses and dissolves boundaries. In 1869, amateur naturalist Lucie L. Hartt, the first woman to publish an article in the journal *The American Naturalist,* recounts her meeting with an octopus during an excursion to a tide pool. Hartt recalls the grip of the octopus on her arm, preventing any escape. After several minutes, the octopus relaxed its grip, leaving Hartt to wonder at the reason for its release, "I was never able to discover whether he was smitten with remorse and retired with amiable intentions, or whether he only yielded to the force of circumstances."[397] Hartt believed the octopus was self-aware, though she was unsure of its motivation as she followed the wobbly return of the octopus to its den, comparing its movement with that of a child taking its first steps. Though she writes of the "uncivil" octopus, unwilling to be "persuaded" to release its grip, until it was finally "convinced" that it must decide between gripping her arm or gripping the rocks, Hartt remains entranced. Not quite able to accept the idea of octopuses having a mind of their own, however, Hartt seems to be working towards shaking off the spell, attempting to distance herself from the thinking octopus, returning to the idea of how the body plan of the octopus is primed for efficient, rhythmic movement through water. Taking refuge in documenting its biology provides Hartt with perspective, though it highlights her own sensation of being physically and mentally overpowered by a strange "force." She is carried away, literally and figuratively, and wonders whether she was released out of guilt or necessity.

The idea of being hunted, and haunted, by an octopus tied together fact and fiction. The 19th century science fiction novel *Twenty Thousand Leagues Under the Sea,* an epic adventure story of man against nature or machine against nature, features an octopus attacking the famous

[397]Lucie Hartt. "A Chapter on Cuttle-Fishes," *The American Naturalist,* vol. 3, no. 5, 1869, pp. 257-261.

world-traveling Nautilus submarine on its cover. Though the octopus plays a minor role in the novel, the cover image centers on tentacles furling and unfurling with ferocious intensity. Two characters in the novel, Professor Aronnax, an esteemed professional naturalist, and Ned Land, a seasoned whaler, cannot "repress a gesture of disgust" at seeing the "monster" alongside the submarine, calling it a "freak of nature" with a "bird's beak" for a mouth. Of all the life forms discovered and recorded, only the octopus causes alarm, forcing the characters to lose themselves and give in to their feelings of angst. Verne's vision of the octopus borrows from the description of the kraken printed in *A Description of the Northern Peoples* by 16th century Catholic priest and naturalist Olaus Magnus, who describe the octopus as a "monster of the deep driven by gluttonous appetite and fear, the ill-nature of which eventually leads it to prey upon itself." Verne also includes a reference to the kraken glossing the pages of *The Natural History of Norway* by 18th century Lutheran bishop and naturalist Erik Pontoppidan, to add the element of credibility to his narrative. The idea of the octopus as a monster continued to circulate amongst renown naturalists in Verne's time and symbolizes a warning against falling prey to one's own wildness. It reflects the fear of a creeping force taking over one's very being, exposing that one is always already a stranger to one's self. Zoologist George Shaw, famed for being among one of the first scientists to publish an account of the platypus, was also gripped by the wanton octopus, reporting to the Royal Institute of London in 1809 that the octopus exhibits a "degree of strength" and "ferocity and violence." This unbridled power display also occupied 19th century naturalist Henry Lee. Moved by the octopus, Lee writes, "To have the long, cold, damp arms of an octopus writhing and twining about ones' wrist and hand and fastening its hundreds of sucking cups all over them, give a singularly uncomfortable sensation,"[398] as if

[398]Henry Lee. *The Octopus, or the Devil-Fish of Fiction and Fact*, Chapman and Hall, 1875, p. 44.

being swallowed. When possessed by a chimeric creature, we are left to consider our own chimerical being and the agency those individual and entangled parts maintain in governing our decisions and behaviors. The octopus could not escape its villainous reputation in the 20th century as author John Steinbeck describes the octopus in his novel *Cannery Row*, as a "creeping murderer," a scoundrel who refuses to reveal its true identity, "pretending now to be a bit of weed, now a rock, now a lump of decaying meat while its evil goat eyes watch coldly."[399] Steinbeck's writing reveals what appears to be annoyance towards a creature who seems to play with the mind. Steinbeck's animosity seems unwarranted and more of a reflection of his own apprehension of being prey to a mischievous (misfit) octopus.

One recourse to recovering self-control was to test one's physical prowess against the strength of the "rubbery" octopus. Octopus wrestling became a real craze and pitting one's strength and mind against a sea creature was a way to recuperate a sense of powerlessness. In 1949, *Mechanix Illustrated* published a short story, "Octopus Wrestling is My Hobby" by Wilmon Menard, detailing the popularity of young, thrill-seeking men traveling to Tahiti to test their resolve and resistance against the *monster*. These young men sought to prove their manhood by being social with a creature reminiscent of the mythological Medusa, famed for turning men into stone. Through the eyes of such thrill seekers, the octopus is described as a "devil" with a "hideous horned head." For the Tahitians, the octopus represented the "prowling ghost of the wicked god Tumuraifenua, who cast the natives into darkness by holding down the sky with its tentacles." Endowing the octopus with supernatural forces reveals an awareness of being under the spell of elusive cosmic forces, and the ghost imagery elucidates the fact that the

[399]John Steinbeck. *Cannery Row*, Viking Press, 1945, p. 25.

past always seeps into the present. Yet, in naming the cosmic force "wicked" the Tahitians acknowledge that forces beyond their understanding, or control, govern them.

Figure 25: *Skin Diver Magazine*, Hearst Magazines, July 1963. Courtesy of Tacoma Public Library.

The octopus continued to carry a "reign of terror" in its role as a monster, most notably in the 20th century novel *The Beast*, by the best-selling author of *Jaws,* Peter Benchley. The action takes place in a small Washington state fishing community that sells-out its environmental interests to commercial enterprises. As a punishment, the community is plagued by an octopus roaming the waters and drowning fisherman. While critics heralded the novel as a wake-up call for environmental consciousness, the run amok octopus, remaining unidentified until late in the novel, reminds the community of their position as subjects of nature. This sentiment is expressed by the main character Whip, who states, "Leave it alone and maybe it will go away." The story bears a resemblance to the science fiction novel *War of the Worlds* by H.G. Wells, who describes alien invaders on planet Earth as octopus-like, with "two large dark-colored eyes" and a "mass that framed them. The head of the thing was rounded, and had, one might say, a face." The frighteningly larger than life creature exacerbated the sense of a lack of self-control as the "whole creature heaved and pulsated convulsively" and its flailing arms appeared to fly wildly as one "tentacular appendage gripped the edge of the cylinder, another swayed in the air." This

description inspired the production of a litany of eco-horror films where the octopus, as a result of coming into contact with radioactive forces, turns into an enormous, insatiable killing machine. The 1955 film "It Came From Beneath the Sea" features a menacing octopus deliberately wreaking havoc throughout the human world, crushing buildings and decimating the artifacts of civilization. The trailer reads: "A tidal wave of terror engulfs the screen as a raging monster from the dawn of creation attacks the world of man" though admittedly the hydrogen bomb that births the super-octopus, messing with nature, is incapable of killing it.

Figure 26: "It Came From Beneath the Sea," Clover Productions, 1955.

Associating octopuses with "monsters" also appears in a report written by marine biologist William Beebe, famed for being the first person to descend 3,000 feet into the ocean in a bathysphere (a metal bubble tethered to a line affixed to a ship) in 1934. He described the octopus as having a "bulging mass" for a head with a "horrible absence of all other bodily parts which such an eyed creature should have-nothing more than eight horrid cup-covered snaky tentacles reaching out in front."[400] This discombobulated creature, sutured together like Frankenstein, makes us shiver, because it fails to find a counterpart on land and meets all the criteria of a mythological being. For Beebe, the octopus was a form without a form, parts that fail to produce something comprehensible. Classifying the creature as unclassifiable is not far-

[400]William Beebe. *Half a Mile Down*, Duell, Sloan, and Pearce, 1951, p. 69.

fetched considering the publication of a joint paper, "Causes of Cambrian Explosion-Terrestrial or Cosmic" published in the *Progress in Biophysics and Molecular Biology Journal*. Penned by a group of scientists, the paper argues that the octopus' unique ability to edit its expression of genes without affecting its foundational heredity material, its Deoxyribonucleic acid (DNA), makes it alien. Though the article was met with skepticism and some ridicule, the scientists believed that the complexity of the 33,000 protein-coding genes present in the octopus, along with the singular ability to edit the ways in which the gene is featured, most likely means that octopuses are "extraterrestrial imports to Earth." The premise that octopuses are out of this world questions evolution of all species and how relations impact being in the world. The scientists speculate: "Thus the probability that the cryopreserved Squid/Octopus eggs arrived in icy bolides several hundred million year ago should not be discounted as that would be a parsimonious cosmic explanation for the Octopus' sudden emergence on Earth ca. 270 million years ago."[401] Through the lens of an "alien" octopus, we are drawn into a reality that evolutionary origins, either scientific or spiritual, are unlocatable. Immersed in time wholly removed from our experience of time, we are faced with so much that is unknown, or not yet available to our minds, as fate, gods, the laws of physics, genes, and the environment mingle together in our grappling with ourselves.

Octopuses are often considered supernatural, aligned with immortal ancient gods. One example is found in a collection of short stories, *The Great Sea Horse*, written by a socialite and descendent of the first group of colonists in Massachusetts, Isabel Anderson. In her story, "Young Neptune," an anonymous narrator tells a young boy about a personal meeting with the great "God" of the sea while on a cruise to India. Neptune christens the women with splashes of

[401]Edward J. Steele, et. al. "Causes of Cambrian Explosion-Terrestrial or Cosmic," *Progress in Biophysics and Molecular Biology Journal*, vol. 136, 2018, p. 20.

water and dunks the men in tanks of water. The narrator then directs the young boy's attention to a statue of Neptune holding a three-pronged spear, claiming he was "brave and strong...and battled with the great octopus," and to the "cruel arm of the octopus curling about Neptune."[402] The mythological sea-god practicing a ritual associated with Christian baptisms, engaged in battle with a creature he supposedly holds command over illustrates the confusion of the compatibility debates prevalent in the discussions of free will and determinism. The conflation of magic with the belief in an omniscient, omnipotent, and omnipresent "God," along with the existence of a naturally malevolent creature, points to our drive to make sense of the unknown world acting upon us and our self-forming beliefs in determining our character.

Figure 27: Fountain of Neptune, Piazza Navona, Rome, Italy.

The more we contemplate the fantastical nature of octopuses, the more they challenge us to think about our own realities. Indeed, octopuses inspired the invention of virtual reality. Caspar Henderson, author of *The Book of Barely Imagined Beings*, documents a group of animals that inspired various human inventions, devoting one chapter to the octopus. Henderson quotes naturalists from ancient times to the 21st century, including author and inventor of virtual reality Jaron Lanier, who claims: "[Octopuses] taunt us with clues about the potential future of

[402]Isabel Anderson. "Young Neptune," *The Great Sea Horse*, Little, Brown, and Company, 1909.

our species…" and they "embody meaning"[403] by expressing themselves through their skin. A creature that expresses itself in this way leads Lanier to envision himself as an octopus avatar in his memoir *Dawn of the New Everything: Encounters with Reality and Virtual Reality*. Lanier writes that octopuses "evolved to be intelligent. They can not only morph, but morph wisely."[404] Octopuses are able to transform themselves into objects they never encountered, and would not encounter, in their natural habitats. Their response to something new or strange prompts an evaluation of attitudes and responses to a world we depend upon and a world in motion. A world in motion inspires fluid thinking. The octopus is a model candidate for that fluidity.

Researchers at the BioRobotics Institute at the Sculoa Supeperiore Sant'Anna in Pisa, Italy, led by Cecilia Laschi, built a flexible robot which they named, Octopus Integrating Project. A team of engineers and scientists mimicked the flexible capabilities of the octopus, replicating its agile movement by studying the hydrostatic muscular structure of octopus arms. Using "shape-memory alloys," elements that "remember" their shape and return to their original shape despite changes in temperature or volume, the team created springs that made it possible for arms to extend, contract, and grab. Soft robotics make it possible to explore unwieldly terrain such as that characterizing the sea. In designing the robot, Laschi explains, "We decided to follow the example of evolution and try to fashion arms that didn't require complex control inputs."[405] The robot maneuvered through unpredictable surfaces with great success. Octopuses reshape our thinking towards the unpredictable nature of humanity, as much as in environments. In fashioning robots to replicate movements of octopuses, we are reminded of our own flexibility;

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[403]Caspar Henderson. *The Book of Barely Imagined Beings: A 21st Century Bestiary*, University of Chicago Press, 2013, p. 235.
[404]Jaron Lanier. *Dawn of the New Everything: Encounters with Reality and Virtual Reality*, Henry Holt & Company, 2017, p. 295.
[405]IEEE Spectrum. https://spectrum.ieee.org, August 15, 2016.

that is, the plasticity of our brains to learn and shift within the constraints of our own potential. Consequently, if the brain is not static and subject to change, how much control a person holds becomes an important question.

Associating octopuses with machines is not a novel concept and has its foundation in the literature of the 19th century, a time reckoning with a rush of new industries and inventions. For 19th century naturalist Jules Michelet, the octopus is likened to a steam train. He describes the octopus as "a terrible machine, and like the steam engine, can load itself with vapor, overcharge itself with force, and so acquire such an incalculable power of elasticity that it can spring from the sea full upon a vessel."[406] The octopus is depicted as a storehouse of pent-up energy, ready to prey upon unsuspecting ships. It is indiscriminate in its violence, tearing up *old* world practices and drowning any opposition to progress or change. The machine metaphor also appeared in the realm of the political. Adolph Sutro, a champion of the working class, a successful businessman and proponent of planting trees and preserving nature, the 1894 mayor of San Francisco, California, decried the building of the railroad and equated it with the grip of the octopus. Sutro opposed construction of the Southern Pacific Railroad, stating in a public speech: "We are in the power of the railroad, which like slimy octopus holds us in its tentacles, crushing for the moment all elements of prosperity. You would rid yourselves of this vise-like grip? There is one way to do it: Follow me!"[407] The octopus stood as a symbol of unrelenting, out of control industry intent on dominating the public will.

The fear of being governed by machines resonated with people and the octopus became the symbol of that fear. Sutro's train was nicknamed the "Octopus," and it threatened to derail

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[406]Jules Michelet. *The Sea*, Rudd & Carleton, 1861, pp. 156-157.
[407]Paul Stangl. "Geographic and Discursive Wanderings of San Francisco's "Evil" Octopuses," *Interdisciplinary Literary Studies* vol. 18, no. 3, 2016, p. 343.

free market competition for farmers, though also reminding farmers of the regulatory cycles already determining when to harvest and when to sell. This nickname motivated author Frank Norris to title the first book of his fictional trilogy centered around the conflict between the world of farming and industry, *The Octopus* (1901). The epic struggle between farmers and railroad magnates took place against a backdrop of human rights. Norris writes of the institution and reality of the railroad terrorizing and debilitating the townspeople. His Octopus is ". . . the galloping monster, the terror of steel and steam, with its single eye, Cyclopean, red shooting from horizon to horizon . . . symbol of a vast power, huge, terrible, flinging the echo of its thunder over all the reaches of the valley, leaving blood and destruction in its path; the leviathan, with tentacles of steel clutching into the soil, the soulless Force, the iron-hearted Power, the monster, the Colossus, the Octopus."[408] Norris associates the train with an octopus throwing humanity into a tailspin. Humanity finds itself in the grip of an "Octopus" machine that rips through the land. They are paralyzed by its magnitude, as the main character, Presley, a poet, reveals at the end of the novel: "Men were naught, death was naught, life was naught; force only existed-force that brought men into the world, force that crowded them out of it to make way for the succeeding generation, force that made the wheat grow, force that garnered it from the soil to give place to the succeeding crop."[409] The inhuman train-an octopus with tentacles everywhere-in its blind indifference, collapsing time and space, forces us to confront what it means to be free in a world always colliding with itself.

[408]Frank Norris. *The Octopus*, Doubleday, Page & Company, 1903, p. 51.
[409]Ibid. p. 446.

Intelligence: Thinking and Reacting to the World

Octopuses are reputed to be the most intelligent invertebrate. Since they have nine independently acting brains located in eight tentacles and one central brain, they certainly are capable of solving complex problems. Intelligent creatures invent new behaviors to thrive in a fluctuating environment, and by that definition, octopuses demonstrate intelligence. Each of the eight individual tentacles contain two-thirds of the entirety of the total neurons housed in the body. Their extraordinary brain power is credited as the reason for the numerous reported cases of daredevil escapes from aquarium tanks. In fact, the brain of an octopus shares similar wave patterns with mammals, demonstrating a high capacity for diverse types of learning and storing knowledge. Furthermore, their highly organized nervous system affords them the ability to learn by sight and touch. The nervous system of an octopus is divided into three parts: the central brain, the optic lobes, and the peripheral nervous system. These divisions contribute to an understanding of the complexity of learning and memory associated with the octopus. Octopuses can learn to distinguish between shape, size, and orientation of an object and according to octopus researcher Martin J. Wells, "cephalopod behavior very commonly resembles that of vertebrates."[410] Wells showed that octopuses are able to differentiate between objects irrespective of their visual distance. Octopuses also learn to discern differences in shape. Wells used two separate shapes  and  with the same surface area to test his hypothesis that octopuses can count the number of corners to tell objects apart.

The functional components of the nervous system of the octopus also include the ability to recall experiences. Binyamin Hochner and Tal Shomrat study the neurophysiology of octopuses in relation to learning and memory and recognize an unusual "fan-out/fan-in"

[410]Martin J. Wells. *Brains and Behavior of Cephalopods*, Stanford University Press, 1962, Preface.

organizational structure of the octopus nervous system. A "fan-out/fan-in" organization of the nervous system refers to the information received and delivered to the brain and the consequent display of behavior. Hochner names this learning *embodied organization* in reference to the term "intelligent embodiment" applied to robotics. Robot behavior arises from an interplay of "dynamic physical and sensory interactions of the agent's materials, morphology and environment."[411] Since predation, habitat change, prey selection, and numerous disruptions affect the daily life of octopuses, their survival depends on quickly reading and responding to their surroundings.

One form of decision-making involves learning by observation. One of the first experiments of conditional learning involved teaching octopuses to avoid eating crabs with stinging sea anemones strapped to their backs. Physiologist and pioneer in the study of ways in which animals connect with their environments, Jakob von Uexküll conducted an octopus "learning" experiment in 1905 at Stazione Nazionale.[412] He starved octopuses for a period of fifteen days and then introduced crabs strapped with sea anemones into the tank. The octopuses quickly learned to avoid those crabs. Consequent experiments showed octopuses learn by tactility. Their brain compartmentalizes visual and tactile memory. Another experiment managed by Graziano Fiorito and Pietro Scotto[413] tested observational learning in octopuses and hypothesized that octopuses learn from watching one another perform complex tasks and are able to retain that knowledge for up to five days. Ability to emulate the activity performed by a conspecific entity indicates learning on an individual and social level, as well as the use of

[411] Binyamin Hochner. "An Embodied View of Octopus Neurobiology," *Current Biology*, vol. 22, no. 20, 2012, p. 887.
[412] A research station, located in the Bay of Naples, Ital, opened in 1873 dedicated solely to marine research.
[413]Graziano Fiorito and Pietro Scott. "Observational Learning in Octopus vulgaris," *Science*, vol. 256, no. 5056, 1992, pp. 545-547.

memory. Excitement surrounding connectedness of learning and memory directs attention to evolutionary convergence between octopuses and vertebrate brains. What this means is that human beings and octopuses are not far removed from one another. According to Hochner, we share ways of thinking: "The findings from recent electrophysiological studies in the octopus suggest that a convergent evolutionary process has led to the selection of similar networks and synaptic plasticity in evolutionarily very remote species that evolved to similar behavior and modes of life."[414] There is a thread that binds everything together and a reality that the thread can come undone, loosen, and take an unthought of course.

Although octopuses mostly keep to themselves, their nerve cells connect and communicate through the presence of proteins called protocadherins. Research indicates protocadherins are the reason why octopuses exhibit complex behavior. Protocadherins tell nerves how to tell one another apart as they develop. Scientists note that the purpose of protocadherins is to provide "name tags" for nerve cells. Once assumed to belong to species with backbones, human beings possess approximately 60 protocadherin proteins, recent mapping of the octopus genome reveals that octopuses have 168 protocadherin proteins. According to the research, "expression of protocadherins in octopuses' neural tissues is consistent with a central role of these genes in establishing and maintaining cephalopod nervous system organization as they do in vertebrates."[415] The presence of protocadherins produces the capacity to think and is instrumental in "establishing and maintaining cephalopod nervous system organization as they do in vertebrates." It is an advanced system despite the fact that their nerves are not covered by the myelin sheath responsible for transmitting signals quickly in the human nervous system. The

[414]Binyamin Hochner, et. al. "The Octopus: A Model for Comparative Analysis of the Evolution of Learning and Memory Mechanisms," *Biological Bulletin*, vol. 210, no. 3, 2006, p. 308.
[415]Caroline Albertin, et. al. "The Octopus Genome and its Evolution of Cephalopod Neural and Morphological Novelties," *Nature*, vol. 524, no. 7564, 2015, pp. 220-224.

diversity of protocadherin proteins provides octopuses with the tools to deal with a world in constant flux.

The presence of these proteins may account for the variability of behavior in octopuses. Psychologist and octopus researcher Jennifer Mather argues that the variability results in unique, individual personality. Mather's research reveals the ability of octopuses to "quickly habituate" to situations, suggesting "motivational differences among individuals and a complex base on which they act."[416] To act means making choices based on a collection of experiences. Other studies on octopus intelligence reveal a "lateralize allocation of brain function" linking specific brain areas with specific behavior. Essentially, octopuses actively designate particular brain activity towards achieving a particular goal.

Octopuses thrive because of an ability to think. Brainpower drives flexible behavioral responses and flexibility encourages positive learning. An example of positive learning is known as habituation where the octopus demonstrates the ability to change its response to a stimulant based on repeated, nonobtrusive contact with that stimulus. Scientists Peter Boyle and Paul Rodhouse argue that "a great deal of behavior of individual animals is conditioned by the past experience of that individual."[417] Octopuses remember. They remember individuals they meet during the course of their brief life. A study conducted by primary scientists Roland Anderson and Jennifer Mather at the Seattle Aquarium in Washington showed that octopuses respond to particular treatment and recognize individuals. The ability to process that information aids in

[416]Jennifer Mather. "To Boldly Go Where No Mollusc Has Gone Before: Personality, Play, Thinking, and Consciousness in Cephalopods," *American Malacological Society*, vol. 24, no. 1, 2008, p. 55.
[417]Peter Boyle and Paul Rodhouse. "Form and Function," *Cephalopods: Ecology and Fisheries*, Blackwell Science, 2005.

distinguishing threats from non-threats. The experimenters noted that octopuses would refuse to accept food from individuals they did not like and subject "annoying" people to a water bath.[418]

The individuality of octopuses is a product of their genes. Genes are the "basic physical and functional unit of heredity." They make us, us. Genes hold the instructions for building an organism. Genetic information follows a fixed path until it presents itself as a feature common to the species. Beginning with DNA, a storehouse of four distinct chemical bases, adenine, guanine, cytosine, and thymine, paired and distinctly ordered to create one unique organism, the genetic material is delivered to RNA, which then translates those messages into proteins; that is, an expression of particulars making-up an organism. What is remarkable about "recoding" at the level of RNA is that the changes are transient. Whereas DNA is limited in variation because only two alleles, genes inherited from both parents, result in biological expression of features, RNA is not. Due to demands of the environment, including predator populations, an "organism can choose to turn them on or off, providing phenotype flexibility, a quality that is particularly useful for environmental acclimation."[419] Revolutionary study into the genome of the octopus finds that the octopus is equipped to "recode codons and fine-tine protein function." Remodeling their genes exponentially increases their ability to survive in a changing world. This "morphological departure" allows octopuses to fully exploit their environments.

What this means for the octopus is that it does not mutate. The octopus suppresses its openness to change in order to gain another type of openness. It sacrifices new possibilities to retain select control. The ability to adjust to change is due to an ability to "create proteins that were not originally encoded in the DNA, allowing an organism to add new riffs to its basic

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[418]Roland Anderson, et. al. "Octopuses Recognize Individual Humans," *Journal of Applied Animal Welfare Science*, vol. 13, no. 3, 2010, pp. 261-272.
[419]Noa Liscovitch-Braver, et al. "Trade-off Between Transcription Plasticity and Genome Evolution in Cephalopod," *Cell*, vol. 169, no. 2, 2017, pp. 191-202.

genetic blueprint."[420] This ability affords the octopus a means to test "slightly different protein shapes and functions" and according to research, an octopus can recode "more than 60% of their RNA in spite of instructions received from DNA."[421] It appears that the octopus defies certain laws of nature and acts without constraints. Unresolved questions remain, such as when editing is "turned on" and under what circumstance. The ability to edit RNA also appears to be "an invention of the coleoid cephalopods"[422] and not prevalent in other mollusks. Because octopuses live in a wide range of ocean conditions, fine-tuning their insides means freedom to compensate for those conditions. Because of their strange, unique genome, popular science magazines casually refer to octopuses as "alien," including an article published with the headline, "Don't freak out, but scientists think octopuses 'might be aliens' after DNA study."[423] The word "alien" implies an octopus does not fit into any known life form on Earth.

The freedom to exist outside laws of nature and as part of the supernatural realm associated with octopuses caught the interest of the ancient Greeks, who were early in foregrounding the octopus as a fearsome inhabitant of the sea. The ancient Greeks were hypnotized with octopuses, as they appear in writings of numerous authors, philosophers, and naturalists. Pindar, a poet of the 5th century BCE, writes in his *Hymns*, "O son, make your mind most like the skin of the rocky sea creature;" Plutarch, a writer of the 1st century ACE, describes the octopus as "crafty." In the chapter "Whether Land or Sea Animals Are Cleverer" in *Moralia*, Plutarch presents the octopus as a thinking oriented creature: "But this same action on the part of the octopus is not an emotional response, but a deliberate change, since it uses this device to

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[420] Anna Di Cosmo, et. al. "*Octopus vulgaris*: An Alternative in Evolution," *Marine Organisms as Model Organisms in Biology and Medicine*, vol. 65, 2018, p. 585.
[421] Ibid. p. 585.
[422] "'Smart' Cephalopods Trade-off Genome for Prolific RNA Editing." *Space Daily*, April 12, 2017.
[423] http://home.bt.com/news/science-news/dont-freak-out-but-scientists-think-octopuses-might-be-aliens-after-dna-study-11363997587287. Accessed April 29, 2019.

escape what it fears and to capture what it feeds on: by this deceit it can both seize the latter, which does not try to escape, and avoid the former, which proceeds on its way."[424] The octopus is celebrated for its observant character; a trait the Greeks sought to emulate. They were also cognizant of the wily character of the octopus that kept even creatures on land at attention, as Aelian, a 2nd century ACE naturalist, writes in *De Natura Animalium*: "Mischief and craft plainly seem to us to be characteristic of this animal." This statement is in reference to a story of an octopus trespassing from water to land to steal fish from skillfully locked earthenware vessels. The octopus is also featured in *Halieutica*, a five-volume poem on the subject of marine life, written by Oppian, a 2nd century ACE poet. Oppian repeatedly references mythology and Homer's 8th BCE epic poems, *The Illiad* and *The Odyssey*, in describing the chaotic forces of the sea and the interactions between its diverse inhabitants. Of the octopus, Oppian writes:

> No one, I think, is ignorant of the craft of the Poulpes, which make themselves like in appearance to the rocks they embrace and entwine with their tentacles. By their deceits they easily mislead and escape fishers alike and stronger fishes. When a weaker fish meets them near at hand, straightaway they leap forth from their stony form and appear as veritable Poulpes and fishes, and by their craft contrive food and escape destruction. But in winter, they say, the Poulpes never travel over the waters of the sea; for they fear the fierce storms. But sitting down in their hollow chambers they cower and devour their own feet as if they were alien flesh. These feet, when they have glutted their owners, grow again; this gift, I ween, Poseidon has given them.[425]

Their own fatal appetites cannot end their lives, as they are closely associated with the sea-God Poseidon who has endowed them with a quasi-divine immortality. Octopuses occupy a liminal space, belonging to diverse worlds and "straddle or transgress two cultures at once, fully belonging to neither" according to historian of folklore Camilla Asplund Ingemark who traces

[424]Plutarch. *Moralia*, Trans. Harold Cherniss and W.C. Hembold, Harvard University Press, 1957, Volume XII, p. 359.
[425]Oppian. *Halieutica*, Trans. A.W. Mair, Harvard University Press, 1928, Book II, p. 305.

symbolism of octopuses in ancient writings.[426] The octopus intersects nature and culture, both in the world and outside of it.

Crossing boundaries while still tethered to the natural world, or rather the intervention of the gods, is also a character trait of Homer's hero Odysseus from the epic *The Odyssey*. The adventure epic follows Odysseus on his journey home to his wife and child after the final fall of Troy, while the sea and its children waylay him, delaying his homecoming for another ten years. In spite of Odysseus' professed desire to return home and reclaim his role as king, he is diverted by Poseidon's play and also by his own choices. As a result, he finds himself in situations marked by the loss of his own countrymen, forsaken from his home on the shores of Ithaca. As the mastermind of the Trojan Horse that signaled the end of a ten-year war, Odysseus is beloved for his quick wit. He is introduced in the *Odyssey* as a man "skilled in all ways of contending" by translator Robert Fitzgerald; a man "of many ways" by translator Richmond Lattimore; a man of "twists and turns" by translator Robert Fagles; and a "complicated man" by translator Emily Wilson. Each description pays homage to the Greek reverence for cunning intelligence, known as *metis*.[427] Scholars Marcel Detienne and Jean-Pierre Vernant define *metis* as a type of intelligence encompassing "a complex but very coherent body of mental attitudes and intellectual behavior which combine flair, wisdom, forethought, subtlety of mind, deception, resourcefulness, vigilance, opportunism, various skills, and experience acquired over the years."[428] Odysseus, we are told, is "clothed in all his wits and wiles," but is also the subject of divine provenance, caught in a tug-of-war between Zeus and Poseidon, who metaphorically turns

[426]Camilla Asplund Ingemark. "The Octopus in the Sewers: An Ancient Legend Analogue," *Journal of Folklore Research*, vol. 45, no. 2, 2008, pp. 145-170.
[427]*Metis* is also associated with foresight and the ability to anticipate all possible outcomes. It is associated with a type of flexibility akin to the notion of play, which calls for inventiveness and sudden change in plans.
[428] Marcel Detienne and Jean-Pierre Vernant. *Cunning Intelligence in Greek Culture and Society*, University of Chicago Press, 1991, p. 3.

Odysseus into an octopus, and in response, Odysseus is forced to don his former identity of "Nobody;" a name he first created to escape the clutches of Polyphemus, son of Poseidon.

On his way home from Troy, Poseidon shipwrecks Odysseus on the island ruled by the Kyklopês Polyphemus. Polyphemus sparingly eats members of Odysseus' crew until Odysseus gets him drunk and pierces his eye with a stake; initially saving himself from retribution by introducing himself as Nobody. Before he sails away, Odysseus, motivated by his own hubris and temporary loss of *metis*, reveals his true name. Polyphemus calls on his father to avenge him: "O hear me, lord, blue girdler of the islands, If I am thine indeed and thou art father: grant that Odysseus, raider of cities, never see his home."[429] Both Poseidon and Odysseus are then intertwined in a single shipwreck. Poseidon desires to restore his honor with the gods who orchestrated Odysseus' release without his counsel and from Odysseus himself whose self-proclaimed intelligence fails to show reverence for the sea. As a result, Odysseus' life is lost to him and is wielded by the wiles of Poseidon.

Cursed by Poseidon, Odysseus' mortality is tested by an "inhuman sea" until he is likened to an octopus and under the spell of Poseidon, returns to his identity as a "Nobody," forced to relive his past and face himself. After his bungling with Polyphemus, Odysseus' ship flails about caught in a perpetual cycle of landings and launches. He lands on the island of winds, Aeolus, receives a sealed bag of wind to steer him home, but mysteriously falls asleep (Poseidon's influence implied), presenting an opportunity for his crew to open the bag and drive them back. All the while, Odysseus assumes it is Zeus who endangers his life and causes the death of his men. Odysseus then sails to the island of man-eating giants, only to lose more ships, leaving his the only surviving vessel. He then lands on the island ruled by the sea-witch Kirke,

[429]Homer. *The Odyssey*, Trans. Robert Fitzgerald, Farrar, Strauss, and Giroux, 1998, Book Nine, p. 386, ln. 553-555.

where he separates himself from his crew, telling them that he needs to take "counsel with myself," revealing his lack of trust in them. Back at sea he encounters the six-headed, twelve-legged "monster" Scylla, the whirlpool Charybdis, and tempting sirens. All these encounters are intoxicating to varying degrees, presenting opportunities to enter into mind-altering states via a plant that induces forgetfulness, beastly horrors evoking paralyzing fear, emotional reverie causing loss of memory, and lastly, a promise of immortality and, ultimately, a loss of self. Ensnared by tumultuous seas and tormented by Poseidon, the "god who laps the land in water," Odysseus reckons with the degree of self-control he possesses. Though we only see Poseidon's direct intervention in Odysseus' life in Book Five, his presence is always there, and he remains "raging cold and rough against the brave king till he came ashore at last on his own land."[430] As soon as Poseidon learns that Odysseus, following seven years of bondage, was released from the island of Ogýgia, a place "girded by waves and located at the navel of the sea," ruled by the sea-nymph Kalypso, he splinters Odysseus' raft. Poseidon permanently stranded Odysseus on Ogýgia, presuming he would be incarcerated by the sea for the entirety of his life. That navel umbilical cord was intended to tie him to the center of nowhere forever. The seven years Odysseus spent in tears (his own saltwater waterfall) moved Athena to plea for his release, arguing to Zeus that one God (Poseidon) should not hold power over them all. Zeus consents, however, Poseidon argues that Odysseus still needs to suffer in order to teach him that he is not a mortal-God able to pick and choose whom to respect.

When Odysseus sets sail from Ogýgia, Poseidon drowns him in a wash of salt and Odysseus is flung onto a rock, a temporary home, but one that cannot keep him safe. Poseidon envelops him in a whirlpool, submerging his mind and body in the sea, making him realize how

[430]Ibid. p. 274, Book One, ln. 30-33.

little control he possesses: “Then the backwash hit him, ripping him under and far out. The octopus, when you drag one from his chamber, comes up with suckers full of tiny stones: Odysseus left the skin of his great hands torn on that rock-ledge as the wave submerged him.”[431] That is the only instance in which Poseidon, “he who makes earth tremble,” makes an actual appearance. Odysseus, octopus-like, is at the whim and mercy of the sea, or rather, Poseidon, and awakened to the fact that his life is a hodge-podge of conditional prophecies. Odysseus is “swollen from head to foot” and overflowing as “seawater gushed from his mouth and nostrils,” as he begins to swim to land. Poseidon’s sea and all its creatures challenge Odysseus’ self-reliance and his defiant assertion that his mortality creates his own world. In the mysterious sea, maneuvered by Poseidon, Odysseus realizes he cannot completely out-think the world.

Poseidon felt bereft of honor in the divine world as well as in the mortal world. The gods convene without him to orchestrate the fate of Odysseus, and thus, he seeks a homecoming of sorts, and to have his power reaffirmed. While Poseidon is bound by Zeus’ decree that Odysseus will arrive safely home in Ithaca, he is nonetheless free to continue to plague Odysseus’ mind. In the bits and pieces Odysseus leaves of himself on the rock, he is reminded that he was ripped from “home” and in all the predicaments in which he finds himself, he is always stripped of a part of himself. Odysseus, washed in Poseidon’s brine, is uncertain of himself and unsure of where to place his trust.

After being ripped from the rocks, Odysseus becomes literally and figuratively insecure. Clinging to the protective cloak gifted to him by Kalypso, he is told by the once mortal Ino now metamorphized into the sea nymph Leucothea, to discard it and instead tie himself in her veil. Odysseus is unable to decide until he is profoundly close to drowning, and feeling as if he has no

[431]Ibid. p. 340, Book Five, ln. 448-450.

other choice, wraps himself up in Leucothea's immortal veil. He lands naked upon the island of Scheria, whose king Alkínoös, is a grandson to Poseidon. Alkínoös' subjects, the Phaiàkians, are dedicated to seafaring and sanction the public meeting space, the *agora*, as "Poseidon's shrine." Odysseus is infused with the creaturely Poseidon and forced back into his prior condition of "Nobody." Arriving as a stranger at the palace, a minstrel begins to sing a song "of heroes whose great fame rang under heaven. The minstrel also sings of the clash between Odysseus and Akhilleus" and about adulterous lovers punished by all the gods for their deceit, with the exception of Poseidon who demands that the lovers be released from the chains that bound them together as punishment. Moved by the song, Odysseus (Nobody) reveals his name.

Odysseus begins to narrate his adventures at sea and, in repeating his narrative, is both free and imprisoned. In reliving his adventures, he is both subject and object, highlighting his tactical prowess to maneuver in a "winedark sea." It is Poseidon that causes Odysseus to see himself anew. The cycle of awareness and unawareness, making choices and having choices made for him, leaves Odysseus piecing himself together. He experiences himself in continuous flux, unwittingly possessed by Poseidon and still attempting to rekindle his *metis*. He blames his troubles on the "Earthshaker" who "wrecked and battered him" and is reminded that he is both a stranger to himself and to the world. Poseidon places him in a position to shape-shift, assuming the persona of a "great tactician" in the court of Alkínoös. In telling of his adventures, he omits and re-interprets, and unwittingly, sees himself differently.

Though Odysseus presents himself as a man of fortitude, his *Poseidon-adventures* resign him to a state of homelessness. Without a home, he remains a nobody on the move. Once Odysseus is assured that Alkínoös' subjects will ferry him home, Poseidon intervenes. This time he allows Odysseus to reach home but makes Odysseus the reason to punish Alkínoös and the

Phaiàkians for plying Odysseus with gifts and safe passage. Poseidon spies the returning home-bearing ship and “struck her into stone, rooted in stone” and returns back to sea. Odysseus can only shed anonymity and the fury of Poseidon by offering a sacrifice to him. Odysseus rallies against Poseidon’s “blows, gale winds and tons of sea” and tests his resolve, finally slacking their tension when Odysseus, following the prophecy he received from his journey to the underworld Hades, plants an oar in a city unfamiliar with the sea and “with burnt offerings to Poseidon of the Waters” *unanchors* himself.

Both Poseidon and Odysseus are tangled in a game of cause and effect that lacks direction. Both perceive their status to be threatened and, consequently, each believe they have to prove themselves to restore their place. Both are guided by a divine planning they cannot escape, though they respond within the limits impressed upon them. Poseidon drives Odysseus into the wild, unfathomable sea in order to teach Odysseus that he is not so clever, nor can he rely on the constancy of the world. The sea reminds Odysseus that his mortality is also associated with oblivion as he loses his fellow seafarers one by one because of his personal choices. Like the octopus tentacles embroidered with the symbolic pebbles of its home, Odysseus leaves pieces of himself everywhere as he clothes himself with disguises and lies of omission in order to keep some of his heroic claims intact. Finally, when paying respect to Poseidon by traveling to a land devoid of knowledge of the sea, Odysseus acknowledges that he does not live in a closed world of his own mind and making. In his return to a nameless, “Nobody” condition, Odysseus is positioned to look back on himself and his trials at sea to reimagine how to relate to a natural world other than conquering it.

Camouflage: Hiding and Revealing the Self

Octopuses are masters of disguise. They cloak themselves with their surroundings and the array of patterns and colors they assume seem limitless. In a flash, they take in the world around them and reflect it back. In addition to impersonating both the animate and inanimate, octopuses have the power to "cease to appear to exist at all" according to 19th century naturalist Abbott Thayer, a pioneer in the study of animal coloration. Abbott Thayer and his son Gerald Thayer studied the art of color in the natural world and published their findings in *Concealing Coloration in the Animal Kingdom,* with the intention to present "relations between animals' costumes and their environments," uniting natural history with artistic communication. Rapid color changes, or what they called "chameleonism," renders the property of color as alive as the animals that display them, as well as an important mechanism for illustrating how animals perceive and respond to their particular worlds."[432] Another response is to appear to be a shadow. Octopuses know they share their liquid world, and that other species pay close attention to any disturbance. One way to counter detection is to become a non-thing or to disappear ghost-like. To disappear is to become invisible and "Passing Cloud" is the name given to that optical illusion technique. Described as "a dark form on the dorsal surface, passing generally forward over the body," chromatophores, cells that produce color on the skin of the octopus expand and contract in less than a second so that a "cloud shaped figure appears to move along the skin surface in an anterior motion."[433] The ruse gives the impression of movement, though in actuality, the octopus remains stationary. As we observe such phenomena, drawn into a fluid world made even more fluid, we experience a constant state of motion and possibility.

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[432]Gerald Thayer. *Concealing Coloration in the Animal Kingdom*, Macmillan Press, 1909, p. 169.
[433]Jennifer Mather, et. al. "Apparent Movement in a Visual Display: The Passing Cloud in *Octopus cyanea*," *The Journal of Zoology*, vol. 263, no. 1, 2004, p. 89.

The power to "transform" one's self, or "other" one's self to represent something that is not recognizably "you," namely camouflage, is a unique product of the nervous system and common in octopuses. The freedom to imitate its environment has earned the octopus the reputation of being a "trickster" as noted by 20th century philosopher Roger Caillois, who believes that human judgement is predisposed to be seduced by specific "habits" of a creature or the associations humans make between the "habits" of the creature and their own experience. He writes, "The octopus presents itself to the attentive and unprejudiced eye as a slow, clumsy animal with poor defenses, but yet blessed with exceptional faculties of camouflage and intimidation. In turn, alga, sponge, rock, or fan, it has a vast repertoire of forms at its disposal. Its arms can fold beneath its abdomen or curl up above its head at will."[434] It becomes something else and its "symmetry wavers and disappears," keeping us off-guard. In his studies on the octopus, Caillois claims that "In any given context, whether myth, art, or personal fantasy, it [octopus] may have one or any number of unconscious roots."[435] Camouflage is a means of mimicking the natural (and cultural) world, bringing into question what is and is not a part of the octopus. That question was addressed by 19th century naturalist Jules Michelet who writes of the octopus as a non-substantive creature in *The Sea*. In the chapter "The Sea Rover (Poulpe)" he portrays the octopus as a permanent embryo, a gelatinous mass of indiscernibility, always "strange, caricatured, and almost ridiculous appearance" with the "magical strength of this mysterious lighting."[436] Illusion and instability define the octopus. Michelet treats this marine creature as if it were a cartoon, an impression of some fantasy of life, writing: "Thou art a mask rather than a being."[437] It is both real and not real.

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[434] Roger Caillois. "Logic of the Imagination," *Diogenese*, vol. 18, no. 69, 1970, p. 77.
[435] Ibid. p. 77.
[436]Jules Michelet. *The Sea*, Rudd & Carleton, 1861, pp. 155-156.
[437]Ibid. p. 159.

Masters of masquerade, octopuses obscure our ability to trust what we see. Their endless permutations suggests that something or some event in the outside world has caused these transformations. Aristotle was among the first to witness octopuses match the appearance of their surroundings, yet it was only in the 19th century that the mechanism for understanding how octopuses rapidly change skin color and skin texture was discovered. The first accurate description of the function of the neuromuscular organs responsible for the octopuses' ability to transform themselves, known as chromatophores, was presented by Giosuè Sangiovanni in 1819. A decade later, a colleague, Stefano Della Chiaje, discovered that radial muscles controlled chromatophores. Studies show that "cephalopod skin is a complex structure containing muscles which allow the skin morphology to vary from smooth to highly papillated, a surface layer of chromatophores and a deeper layer of iridophore and leucophore reflective cells."[438] Though it is still not universally determined whether or not octopuses are color blind, investigation has shown that leucophores and iridophores cells, themselves colorless, appear to reflect all wavelengths of light, granting octopuses greater ability to match their environment. These components are not randomly distributed and are spaced out to capture light and illuminate images. The versatility is astounding.

Chromatophores are neuromuscular organs innervated by voluntary, active nerves. In the center of each chromatophore lies a cell compartment with pigment granules. When the muscles contract, chromatophores expand, displaying an array of colors and patterns. Each species of octopus has its own unique pigment composition. The research of octopus scholar John B. Messenger informs us that an octopus can rapidly choose how to present itself. Because octopuses change at will and have polymorphic powers, they create illusions. These illusions

[438]John B. Messenger. "Cephalopod chromatophores: Neurobiology and Natural History," *Biological Reviews*, vol. 76, no. 4, 2001, pp. 473–528.

combine with posturing, a term describing the ways in which an octopus moves its arms and body to imitate features of the animal, plant, or object. That movement distracts "shape-oriented searches by potential predators." Because octopuses live in all oceans, their geographically specialized configurations of size and pigments of chromatophores distinguish various species.[439] Just as octopuses are not static and operate in real time, so do their predators and environments, enabling octopuses to store experiences for future interactions.

Octopus researcher Roger Hanlon writes of the remarkable ability octopuses possess to process and respond to complex visual stimuli. They are multidimensional creatures interacting within a multidimensional world. They coordinate a control of physical displays in a manner that demands constant resolution, stability of color displays, and independent bilateral control. Octopuses are capable of featuring one pattern and color on one side of the body and another distinctly different pattern and color on the other. These distinct expressions are categorized by Hanlon as uniform with minimal contrast variation, mottled with light and dark patches, or disrupted with differing shape, size, and arrangement of light and dark patches in an array of pattern selections. He observes that the magnitude of changes an octopus displays shift "with a speed and diversity unparalleled in the animal kingdom."[440] These marvelous changes reflect their own unique version of reality.

Hanlon recognizes the unique neural control allowing for "rapid change" and "fine-tuned optical diversity" as key contributors to fact that octopuses "can move where they wish and can adapt their body pattern to a staggering array of visual backgrounds."[441] This shows that octopuses are aware of their surroundings while the outside world plays a part in activating the

[439]Noam Josef and Nadav Shashar. "Camouflage in Benthic Octopuses: What Does It Teach Us," *Cephalopod Cognition*, Cambridge University Press, 2014, p. 181.
[440]Roger Hanlon and John B. Messenger. *Cephalopod Behavior*, Cambridge University Press, 2018, p. 45.
[441]Roger Hanlon. "Cephalopod Dynamic Camouflage," *Current Biology*, vol. 17, no. 11, 2007, pp. 400-404.

"optical malleability" of the octopus's skin. Further study indicates dynamic camouflage also acts as a means to communicate with conspecifics; that is, close relatives. This is accomplished through active control of the iridophores. Octopuses manage iridophores and can send hidden signals of polarized light through the chromatophores without alerting predators. Though humanity does not corporally participate in camouflage-driven predator-prey relations, Hanlon argues that attention to light and dimension influence art, photography, landscape, architecture, and "invisibility cloaks" of fiction. This type of "trickery" tells us that we can be duped into a departure from what we think is real, consequently affecting our decisions.

Understanding how this process works caught the attention of the zoologist and physicist team, Alexander Stubbs and Christopher Stubbs, who together designed a computational model looking into how a creature with a monochromatic view of the world is capable of mirroring that world. They hypothesize octopuses exploit image blurring through a mechanism of chromatic aberration whereby the "off-axis pupils of these animals can be understood as an adaptation that maximizes spectral information, even at the expense of image acuity."[442] Their research claims octopuses utilize chromatic blurring by changing pupil size in order to receive different color wavelengths and, in doing so, sacrifice visual sharpness, expanding their capacity to match their environment. It is still a theory. However, it provides a method for assessing choices octopuses make and which mechanisms govern those choices.

Octopuses are often represented as a biological and mechanical being, fusing together the antipodal concept of thought and thoughtlessness. They prompt reflection upon the mechanism acting according to, and bound by, an automated nature with no off switch. Thus, humanity resides in a suspended position-the paradox of a living being always in the process of change,

[442]Alexander Stubbs and Christopher Stubbs. "Spectral Discrimination in Color Blind Animals," *Proceedings of the National Academy of Sciences*, vol. 113, no. 29, 2016, pp. 8206-8211.

including death, and an inexhaustible lifeless machine-both suturing the world together. Equating the octopus to a train, as Jules Michelet describes it as "that terrible and living steam machine," conjures the octopus as a breathing, yet mindless entity, simultaneously autonomous and manipulated. Michelet continues his description of the octopus as "a perfect rainbow of changing colors, that come and go, shine, fade, dazzle and die" exemplifies its state of in-between the natural and unnatural. Its kaleidoscopic existence alarms, representing "dark forces of the abyss." These dark forces suggest that our simple straightforward existence is actually a mixture of deeply embedded evolutionary and cultural histories. We are placed in the position of accepting or denying natural forces; notably nature, time, and place, finding ourselves in a continuous cycle of shape shifting.

These issues present themselves in the novel *Toilers of the Sea* by Victor Hugo, including an epic battle between man and octopus.[443] The octopus, perceived as unclassifiable, becomes an unspoken metaphor describing the main character, Gilliatt. More profoundly, the unclassified octopus, linked to phantoms and vampires, exposes an inability to capture more than an ephemeral essence of being human. The monster always escapes. It occupies the space of the unventured, as Hugo writes, "The Possible is a terrible matrix. Monsters are mysterious in their concrete form. Portions of shade issue from the mass, and something within detaches itself, rolls, floats, condenses, borrows elements from the ambient darkness, becomes subject to unknown polarizations, assumes a kind of life, furnishes itself with some unimagined form from the obscurity, and with some terrible spirit from the miasma, and wanders ghostlike among living things."[444] In this mix of real and mythological dimensions the octopus may well represent

[443]Victor Hugo himself was synonymous with the plurality of the ocean. The Victor Hugo Museum on the *Place des Vosges*, France displays a letter addressed simply to "Mr. Hugo. The Ocean" delivered to him on Guernsey Island, in between England and France, during his self-imposed exile from Paris, France.
[444]Victor Hugo. *Toilers of the Sea*, Little, Brown, and Company, 1888, vol. 2, pp. 158-159.

Gilliatt, who models a piecing together of ephemeral parts, the will of nature and the civilizing of nature, to the perplexity of the resident islanders who rely upon to cure their ills, yet shun him for his ability to mediate the natural world.

The novel is set on the isolated island of Guernsey where longtime residents resist intrusion from the modern world and are troubled by the arrival of strangers and progress in the form of a steamboat, the *Durande*. The *Durande* is referred to as a "devil-fish" roaming the sea at will, disturbing its calm waters. The commandeer of that progress, long timer islander and entrepreneur Lethierry, is unexpectedly dispossessed of his prized vessel and offers the hand of his niece Déruchette in marriage to anyone who can retrieve it. Unbeknownst to Lethierry or the islanders, Clubin, the captain commissioned to sail the *Durande*, purposefully shipwrecks the steamboat, fakes his death, and swims away with money he was entrusted to retrieve from Lethierry's former business partner. However, due to foggy conditions, Clubin loses his bearings and unintendedly crashes on a pile of rocks five miles from shore. With no other choice but to swim the distance, he succumbs to the grip of the octopus and drowns.

The main character, Gilliatt, a man who, because of his unknown origins, is suspiciously referred to as *marcou*, meaning magical, and *cambion*, meaning a progeny of the devil. Described as a dreamer with the "faculty of a seer," Gilliatt cannot be easily contained. Both book-learned and intimately connected with the workings of the natural world, his diverse scope of knowledge both attracts and spooks the islanders. Arriving on the island as a toddler with his mother, whose origins were also suspicious, together they live in a "haunted house" where they "magically" cultivate a vibrant garden in salty soil. Though Gilliatt rarely speaks throughout the novel, he proves to be a skilled carpenter, sailor, mechanic, and blacksmith, able to mold material to take on a different life. He is also a kind of apothecary, earning him the reputation of

a sorcerer. Adding to his reputation as more-than-human, he is an expert swimmer who saves many others from a fate of drowning, including Déruchette's future husband, Ebenezer Caudry, a young priest who is also a foreigner to the island. Gilliatt's "witchcraft" cures people of common ills and extends to an understanding of the spread of infectious diseases as he redirects well water away from the run-off of animal waste. He reads signs of nature and is adept at catching fish while everyone else goes empty-handed. He is a paradox, a creature not of this world, wearing "sombre mask of the winds and of the sea." Hugo keeps Gilliatt a mystery, though informs us that Gilliatt harbors a hidden love for Déruchette, causing him to risk his life to salvage the *Durande* in hope of winning her hand in marriage.

Though successful, he relinquishes any claims to Déruchette after discovering she loves another, choosing instead to allow the sea to reclaim him. Gilliatt never reveals his thoughts or feelings to others and carefully cloaks himself in a solitary world, feeling misunderstood and misjudged. He is bound by, and on the periphery of, both the primitive natural and progressively inventive modern world. Whether life belongs to him oris susceptible to the will of others is articulated by the dismembering of, or camouflaging condition, of body and soul, as Hugo writes, "The human body might well be regarded as a mere show; it hides our reality, it darkens our light and our shadow. The soul is the reality. Strictly speaking, the human face is a mask. The true man is that which is below the man. If that being, which thus exists sheltered and secreted behind that illusion which we call the flesh, could be approached, more than a strange revelation would be made."[445] Gilliatt is portrayed as a "grotesque" figure, encompassing all the mysteries of creation, both good and evil, living in the here and now, as well as in dreams. He is

[445]Ibid. vol. 1, p. 59.

as unclassifiable as the sea; the exile space where he rescues the *Durande*, becomes aware of Clubin's death, renounces marriage to Déruchette, and where he chooses to end his life.

Gilliatt aligns himself with the sea in its "unexplored depths" and "living transparencies." He carries that known and unknown realm into a conscious/unconscious state of sleep, imagining himself indistinguishable from a visible/invisible, liquid formlessness. In his condition of awake/*unawakeness*, he "beholds around him strange manifestations of life-pale spectres, terrible or smiling, dismal phantoms, uncouth masks, unknown faces, hydra-headed monsters, undefined shapes, reflections of moonlight where there is no moon, vague fragments of monstrous forms."[446] In his dreams, he is encircled by the living dead and a mythological octopus, all shadows, emblematic of his own silence. The din within sounds itself in the wrenching out of something out of nothing; he acts and triumphs, whereas Clubin, a man of excessive glib, perishes in the arms of the same "blood-sucker." Though the sea's silence eventually swallows Gilliatt, it is, for him, becoming part of a creative force.

His triumph is consummated by his daring risk to mediate between the ravenous god-mocking hydra (octopus) of his dreams and the mechanically manipulated hydra of progress. The hydra of his dreams is transferred onto the *Durande*, which the islanders nickname "Devil-Boat" and "Devil-Fish," depicted as a "strange, undefined thing, a monstrous form which puffed and blew; a horrid machine which reared like a wild beast, and smoked like a volcano; a species of Hydra foaming among the breakers, and leaving behind a dense cloud; as it rushed on towards the town with a frightful beating of its fins, and a throat belching forth flame."[447] This "monster" upsets a way of life, promising to upend the island's comfortable stasis and false sense of

[446]Ibid. vol. 1, p. 40.
[447]Ibid. vol. 1, p. 62.

distance from the influence and will of the mainland. The *Durande* provides Gilliatt with the possibility of altering his own fate. Gilliatt accepts this mission, hoping to be seen by Déruchette.

Gilliatt starts out alone to rescue the *Durande*, inspired by the promise of marriage. After battling a hurricane, making use of every tool he has available to salvage the shipwrecked vessel, Gilliatt ironically also falls into the clutches of the very same octopus that drowned Clubin. The octopus latches its tentacles around Gilliatt, pulling him under water, and, according to Gilliatt, sucks on his flesh as if trying to drink him. He "looked at the monster; which seemed to look at him" and is transfixed by how alive the octopus presents itself despite its association with the non-real:

> These animals are indeed phantoms as much as monsters. They are proved and yet improbable. Their fate is to exist in spite of *à priori* reasonings. They are the amphibia of the shore which separates life from death. Their unreality makes their existence puzzling. They touch the frontier of man's domain and people the region of chimeras. We deny the possibility of the vampire, and the cephaloptera appears. Their swarming is a certainty which disconcerts our confidence. Optimism, which is nevertheless in the right, becomes silenced in their presence. They form the visible extremity of the dark circles. They mark the transition of our reality into another. They seem to belong to that commencement of terrible life which the dreamer sees confusedly through the loophole of the night.[448]

As a man of the sea, self-made in its liquidity, much aware of oscillating predator-prey relations, Gilliatt attests that "the sea is one and the same hydra" and the "ocean is Ceto.[449]" The octopus is both real and other-worldly, an emblem of an otherness that cannot be quarantined. Through its being, Gilliatt moves further into inward where the imagination and the real cannot be delineated or wholly understood. Life and death need not be separated in the brute struggle

[448]Ibid. vol, 2. p. 159.
[449]Ceto is a primordial sea goddess symbolic of the dangers of the sea.

between will and nature, or in a mutiny against fate or circumstance, or what Victor Hugo calls the "anankē of things."[450]

Entangled in a battle with the octopus, Gilliatt realizes his own condition of being an individual as well as part of the whole of nature and creation: "The hydra incorporates itself with the man; the man becomes one with the hydra. The spectre lies upon you: the tiger can only devour you; the devil-fish, horrible, sucks your life- blood away. He draws you to him, and into himself; while bound down, glued fast, powerless, you feel yourself gradually emptied into this horrible pouch, which is the monster itself."[451] Succumbing to the octopus, Gilliatt opens himself to a passion he had previously suppressed. This "concrete form of evil," the only creature he thought of in disparaging terms, aroused his desire to break from the shackles of suppressed emotions and gossip of the islanders. He has entered the lair of the octopus and emerged from the darkness, an underworld grotto oozing with the slimy, slippery, and sticky where he wrests the secret from the shapeless horror. We are as possessed by nature as much as we possess it, and Gilliatt embraces the cacophony of the tame and savage forces within and without.

The octopus directs Gilliatt to relocate himself. Defeating the octopus inspires Gilliatt and he successfully jerry-rigs the *Durande* together, returning to claim Déruchette as his bride. He entered into amazing, terrifying sea and the creatures it breeds, and in the process exits with the feeling that he is not bound by definitions. Nonetheless, Gilliatt is much defined by the natural world and constantly confronts the limits of being human, positioning him in a kind of permanent exile. His suicide is yet another change in form, clarifying an inherent imbalance in the scaled relations between the reassurance of control and primeval chaos. Like the dynamic sea and the octopus, Gilliatt is amorphous. He is part of an ironic reality where "All created things

[450]Anankē is the Greek goddess of inevitability and associated with the creation of the earth, heaven, and sea.
[451]Victor Hugo. *Toilers of the Sea*, Little, Brown, and Company, 1888, vol. 2, p. 158.

enter into and form the elements of other. To decay is to nourish. Such is the terrible law from which not even man himself escapes."[452] He is part of an evolving natural world, and as such, death is only the next step in an infinite series of changes.

Power: Tales of the "Devil-Fish" and Defiance of God-like Eminence

Octopuses have soft bodies yet are powerfully formidable. Their multi-purpose tentacles used for locomotion, hunting, feeling their environment, and manipulating objects, are also capable of suffocating the life out of any living being. The "monstrous" agility of each independent arm, writhing and grabbing, was also associated with imaginative descriptions of being possessed by the devil, pinning octopuses with yet another moniker, "devil-fish." Because the flexible tentacles lack rigid bone structures, the arms appear to supernaturally suspend in mid-air, defying gravity. In reality, the flexibility of the arms is due to its musculature. Each arm is controlled by complex motor control mechanisms.[453] Octopus arms operate via a collection of closely packed muscle fibers bundled under the operative force known as "muscular hydrostat." The muscles in the collection lack a rigid skeleton and rely on hydrostatic pressure to move and to provide support. Hydrostatic pressure is maintained at a constant volume to allow the arms to contract, expand, torque and bend.[454] The degree of movement has a geometry of its own. In moving objects or food from place to place, the octopus imitates a "vertebrate-like strategy, temporarily reconfiguring its arm into a stiffened, articulated, quasi-joint structure. This indicates

[452]Ibid. vol. 2, p. 160.
[453]Germàn Sumbre. "Control of Octopus Arm Extension by a Peripheral Motor Program," *Science*, vol. 293, no. 5536, 2001, pp. 1845-1848.
[454]William M. Kier. "The Musculature of Coleoid Cephalopod Arms and Tentacles," *Frontiers in Cell and Developmental Biology*, vol. 4, 2016, p. 10.

that an articulated limb may provide an optimal solution for achieving precise, point-to-point movements."[455] The octopus keeps it grip.

Research also shows that the arms of octopuses still function even if they are severed from the central brain. A study conducted by scholar Germàn Sumbre indicates that mechanical or electrical stimulation induces arm extension to arms severed from the brain connection.[456] The movements generated are nearly identical to normal connected arms. This ghostly apparition of movement, both attached and detached from a body, is exaggerated by suckers lining each arm. These sophisticated gripping mechanisms earned octopuses the name "mansuckers" by many fishermen. Octopuses rely on suckers to chemically and mechanically explore their environments. The round, concave suckers, or suction cups, lining each arm are divided into two parts: the visible, squishy part (the sides and edges) referred to as the infundibulum, and the central cavity, referred to as the acetabulum. A muscular base attaches the sucker to the arm providing it with the ability to rotate in any direction and elongate. The muscle fibers in the suckers contribute to the strength of the arms.

The arms and suckers provide the octopus with the ability to contend with unpredictable, uneven environments and predators. The muscles controlled by the network of nerve fibers dedicated to the "suckers" afford the octopus a "wide array of motor and proprioceptive functions."[457] Suckers are also essential tools for "tasting" and "feeling" the surroundings. The suckers operate by creating or releasing pressure to grab or let go, as the situation demands. Each sucker can lift approximately five pounds. Working together with approximately 280 suckers on

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[455]Germàn Sumbre. "Motor Control of Flexible Octopus Arms," *Nature*, vol. 433, no. 7026, 2005, p. 595.
[456] Germàn Sumbre. "Control of Octopus Arm Extension by a Peripheral Motor Program," *Science*, vol. 293, no. 5536, 2001, pp. 1845-1848.
[457] Hosain Bagheri, et. al. "New Insights on the Control and Function of Octopus Suckers," *Advanced Intelligent Systems*, vol. 2, no. 6, 2020, pp. 1900154-n/a.

each arm, they are capable of lifting a diverse array of heavy objects. The suckers do communicate with one another, but, since they act independently of the brain, the system is not perfect, and each arm may engage in a totally opposite action. Whether or not arms make "decisions" is still a mystery.

Suckers remain a formidable force. Attachment and detachment are a product of "negative pressures" created between the suckers and the object. The ability of an octopus to maintain a hold on something also depends on the surrounding water. Research shows that the tenacity of the grip depends on the "differential between the ambient pressure and the pressure of the water enclosed by the adhesive surface" and that "ambient pressure increases with depth," thus suckers have to be strong enough to adapt.[458] Further research shows that the suckers are rimmed with grooves that provide them with the extra suction required to create a seal on uneven surfaces. Conforming to the design of the object provides an advantage. Studies indicate that the "infundibulum can closely match the contour of a surface, and thereby provide a watertight seal."[459] The elasticity of the suckers are keenly adapted to adjust to the versatility of a fluid world.

The eight arms and thousands of suckers are capable of extraordinary feats, including weaving their ways into cramped spaces or suspending objects beyond their own body weight. Marine biologist Jim Cosgrove who has logged over thirty years in studying the octopus and admits that the first time he came up close to an octopus, "It was very much a fear fascination type of thing. I was not sure whether it was going to lunge out at me and suck the heart out of

[458]Andrew M. Smith. "Cephalopod Sucker Design and the Physical Limits to Negative Pressure," *The Journal of Experimental Biology*, vol. 199, (Pt. 4), 1996, p. 949.
[459]Francesca Tramacere, et. al. "Structure and Mechanical Properties of *Octopus vulgaris* Suckers," *The Journal of the Royal Society*, vol.11, no. 91, 2014, 20130816-n/a.

me."[460] The fear equates with feeling uncertain and hints at feeling exposed as an object, rather than a subject, of the natural world. The mingling of two seemingly antipodal feelings, horror and awe, points to the pleasure and repulsion of losing one's self to supernatural forces, or the devil. The devil coerces us to be our true self and liberation comes from shedding whatever shackles bind us from encountering our hidden selves.

Despite admonishing the idea of analogizing the octopus as the "devil," octopus scholar Frank W. Lane titles a chapter in his book *Kingdom of the Octopus*, "Danger." He writes that the octopus holds a reputation for being evil because of its "strange, repulsive appearance" and though the fictional stories of its unprovoked attacks on unsuspecting ships are "grossly exaggerated," the horns projecting from the head of the octopus evokes the image of the devil delighting in upsetting the world. The luridness of the sea itself contributed to that image. The primary character trait of the devil in all its incarnations, is one of disruption; holding a mirror for us to acknowledge our own limitations and desire to overcome them. More than a figure of rebellion, the devil also acts, or rather functions, as an interrogator of cosmic order and a reminder of the presence of inconceivable things in the world, ostensibly testing how well we know ourselves or allow ourselves to be known. The devil represents the obscurity of supernatural forces and is a symbol of a monster because its presence in our lives surfaces our undomesticated nature. Domesticated comes from the Latin, meaning to "dwell in a house" and the devil dwelling within us reminds us that the "house" of our mind and body possesses us. The devil is also famed for capriciousness, and, ultimately, embroils humanity in a tug of war between good and evil. Because the octopus is associated with something weird, sprawling, moist, unpleasant, diabolical, noxious, and other adjectives effusing something putrid, it is

[460]Quoted in ABC news piece "Mystery of the Sea: National Geographic Pursues the Giant Pacific Octopus," reported by John Berman and Michael Murray, April 19, 2010.

regarded as violent, and anything violent in nature has been historically aligned with the work of the devil.

The octopus/monster/devil-fish moniker conveys the feeling of personal disturbances. The devil creates doubt. It transports thinking towards the paradox of a world that is determined, mechanistic, created by "God" and simultaneously breaks that spell, making the world ours for the making, and by proxy, ourselves for the making. The devil reinforces the principles of free will and "un-free will" as both possible and impossible, real and imaginary. Reality and imagination shared a lifeblood when it came to describing the octopus as the devil-fish in the scientific and literary world. Naturalists and fiction writers both leaned towards language synonymous with the devil. Naturalist Baron Cuvier combines a removed, antiseptic approach with personal affect in *The Mollusca and Radiata* Cuvier, describing the swimming of octopuses in words befitting an exorcism: "swim with their head backwards, and crawl in all directions with the head beneath and the body above"[461] and being "remarkable for a peculiar and intensely black excretion, with which they darken the surrounding water when they wish to conceal themselves."[462] We are face to face with a creature whose body appears disarticulated and possesses the devil-like feature of vanishing amidst a black cloud into the ether. Cuvier concludes: "These animals are voracious and cruel"[463] as if the octopus intentionally and unremorsefully takes pleasure in violence.

This personification can indeed be read as a projection of either humanity's suppressed desire to express itself physically or praising the human spirit for the ability to realize or quell those desires. Naturalist Jules Michelet presents the octopus as a creature whose existence is

[461]Georges Cuvier. "Mollusca and Radiata," *The Animal Kingdom Arranged in Conformity with its Organization*, Printed for G.B. Whittaker, vol. 12, 1827, p. 6.
[462]Ibid. p. 6.
[463]Ibid. p. 7.

founded on its readiness to seduce a victim and ensnare that victim into a state of incapacitation: "To the mechanical power of its tenacious arms, which twine round and enchant its victims, add the magical strength of this mysterious lightning; add too, a vision, and a hearing of extraordinary power. You stand appalled."[464] Michelet warns us we are about to enter a "gloomier world-a world of strife and murder" as we come closer to the octopus. Michelet draws us deeper down into ourselves to dissect the mechanical configuration powering our movements and face the possible horror of our yet unrealized potential; acknowledging we are capable of things unknown, or repellant and some revolving prevents or promotes that potential.

The stamp of "devil-fish" grew over time and numerous magazine articles glossed their headlines with the moniker "devil-fish," animating anxieties about the ability to understand and manage the natural world. Those anxieties signaled a self-examination of the reality of free will to "fight the monsters" within and without. The power of the external world emerged in the monstrous power of the "formidable tentacles" lined with the "terrible armament of suckers" cited by Colonel Nicholas Pike in "The Octopus, or Devil-Fish" published in *Frank Leslie's Popular Monthly* in April 1891. Pike details all the "narrow escapes" he miraculously survived in his numerous encounters with the "killer," and his ill-prepared, without a "weapon to combat such a foe" presumably intent on taking his life. He felt threatened at each encounter, ill-equipped to defend himself, admittedly frightened at his lack of power, yet continued to return to sea, home of the octopus that births young "miniatures of the ferocious adults" ready to stick their "fangs into any object that presents itself." If the octopus is intentionally or mechanistically determined and the whole of nature operates under this prevue, Pike's reflection on his experiences provokes a self-examination of the drive to find ourselves in a fluid world populated

[464]Jules Michelet. *The Sea*, Rudd & Carleton, 1861, p. 156.

by writhing beasts and why we desire to meet them. How free we are presents itself in disrupting the assumption of who holds power and what is available to us to experience. The devil symbolized liberation, interrogating what it means to be a "free" human being. The sentiment was reiterated by the headline "A Devil-Fish Seizes a Boat" published in the *Seattle Telegraph,* February 28, 1892 (which made its way into a section in *The New York Times*), telling the story of two men who fought off an octopus that had attached itself to an oar of their boat with the intention to take occupancy. The octopus was reported as "striking wildly at the occupants" until one of the men cut the arm of the "monster" and it sank beneath the waves. The devil-fish forces us to confront our powers of perception and question what we believe and why we believe it, when the evidence before us fails to rise to the imaginative reliving of the event.

A litany of other articles echoed the sentiment of the octopus as the "devil" whose very breath was also the means of its locomotion; it takes in the world and exhales it back out, transformed. *Scientific American* presented a piece titled "The Devil Fish" in 1873 about the influence of mythology in coloring the perception of the octopus/devil fish, stating that it is "almost the only survivor of the world of the prodigies" dating back to ancient Greece. It connects us to a time when the world was a wild compilation of fact and fiction; the world was in a process of revealing itself and what was observed baffled the mind. Turning to the supernatural to explain cause and effect offered a means to protect one's self from nature's perplexing relations and our position within its constant changes. The magazine *Science, Invention and Discovery* published an article called "The Octopus" in 1875 citing numerous other magazine articles that published stories about the devil-fish, attempting to dismiss the myth of its monstrosity by writing of the utility of its biology. The audience is told of a nineteen-foot-long

specimen that is "entirely cartilaginous, tough, and pliant as leather, and very strong" with arms lined with hundreds of suckers, providing extraordinary power.

The allure of the octopus extended to the desire to taste it, perhaps ingest its power, as 19th century naturalist William Healey Dall, famous for his explorations of Alaska's interior, writes in "The Arms of the Octopus; or the Devil-Fish" published in *Science* in 1885. He speared an octopus and prepared it to be interned at the United States National Museum, but not before taking a bite: "Having heard octopi were eatable, and the flesh looking white and clean, we boiled some sections of the arms in salt water, but found them so tough and elastic that our teeth could not make the slight impression on them."[465] The creature aroused their appetites, literally, and figuratively, as eating is an intimate act engaging emotional and physical responses.
The octopus was an enigma. On one hand a delicacy, and on the other, an efficient machine. An example illustrating this is found in the prominent display of the octopus in the 1871 unveiling of the Crystal Palace Aquarium in London. The octopus was a prized feature and regarded as a "marvelous piece of mechanism well worth of study, and even imitation on, by engineers"[466] by then aquarist William Alford Lloyd, who also reported of his encounter with an octopus in an article published in Australia's newspaper the *Kapunda Herald and Northern Intelligencer* in 1872, titled "The Octopus-Devil-Fish-or Man-Sucker." The article quotes Lloyd's harrowing toss with the octopus: "In an instant the long arms were coiled 'round my hand, quick as the end of a driving-whip twists around a gig-shaft; the brute did not bite me-at least, if he had, I should have recollected it." The octopus is likened to a machine, a mechanical creation, moving without thought; operating mindlessly and efficiently to complete a task. Lloyd finds himself imagining

[465]William Healey Dall. "The Arms of the Octopus; or the Devil-Fish," *Science*, vol. 6, no. 145, 1885, p. 432.
[466]The Crystal Palace Foundation. www.crystalpalacefoundation.org.

the possibility of a physical altercation with the machine, proudly assuming that the victory would be his if matters had escalated.

Battles between unsuspecting people and octopuses continued to make headlines and appeared in diverse magazines. *National Geographic* got caught up in the "devil" craze as late as 1919, publishing an article titled "Devil-Fishing in the Gulf Stream" authored by John Oliver La Gorce, who describes his meeting with the octopus as reprehensible:

> In appearance the octopus is most repulsive, having a large, ugly head, a fierce-looking mouth, armed with a pair of powerful horny jaws, shaped much like a parrot's beak, topped with two diabolical eyes set close together, which are positively capable of sending forth a demonic glare when angered. The arms or tentacles are provided with rows of suckers, with which it clasps and clings to its prey with uncanny strength and quickness. As a rule, it will not give battle to a man unless angered or injured, but when challenged will fight to the last, doing its best to pull the object of its wrath beneath the surface of the waters.[467]

The octopus is depicted as a menacing creature. Here, we also see that "man" is yet another undesignated "object," in nature. *National Geographic* continued its coverage of the octopus in a 1935 article "Marauders of the Sea: Monsters & Midget Squid and Octopus, Etc." by Roy Waldo Miner, who describes the octopus as "one of the most gruesome marauders of the sea…squatting in a nestlike lair of boulders…the eight tapering arms sprawling in all directions, extending and contracting, clinging to the rocks with their powerful sucking disks, or undulating through crevices as they explore everything within reach" and ends with the octopus dragging down a hapless creature to its death. Time did nothing to erode the image of the octopus as a beast. In 1971, *National Geographic* published another article on the octopus, titled, "Shy Monster: The Octopus" by Gilbert Voss, who, for all his admiration wrote that the octopus "arouses distaste" and "seems a ghostly monstrosity as it flows stealthily along." The octopus evokes affective responses but also

[467]John Oliver La Gorce. "Devil-Fishing in the Gulf Stream," *The National Geographic Magazine*, vol. 35, no. 6, 1919, p. 476.

asks us to think about why its characteristics conjure imagery of ephemeral spirits and feelings of terror, or horror, towards a creature that is undeniably part of the natural world.

In time, Hollywood became enraptured by the "devil-fish." Octopuses appeared on Hollywood screens as exaggerated monsters.[468] Disney created one of the most infamous octopus-like "monster" villains; Ursula from "The Little Mermaid." While the original 19th century story by Hans Christian Anderson does not name or describe the character other than referring to her as a "sea-witch," Disney introduces audiences to a heavy-set, half human/half octopus brandishing long, black tentacles[469] that grab hold of other magically charged sea creatures to mix with her own blood and boil in a black cauldron, transforming Ariel, the Little Mermaid, into human form. Ursula's potion changes fates. However, when dealing with the devil, nothing is legitimate without a contract. In return for weaving a spell to turn Ariel into a human, Ursula demands some kind of physical bodily payment. Ariel agrees to sacrifice her voice in exchange for human legs. Symbolically, she relinquishes her ability to communicate via the process of making "sounds," but gains the ability to communicate via the movement of her legs, dancing to attract the love of Prince Eric, for whom she left the sea.

Ursula contracts Ariel in a play of free will. Ariel desires to be something "other" and Ursula is the slippery, writhing figure granting that wish with the full discharge of jet-black ink from her own body. Ariel's legs grant her an ability to move beyond the sea, to evolve and defy her maker; in essence, to gain control. But, Ursula, the bewitched, is never satisfied with the

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[468]The word monster derives from the Latin root *monere* meaning "to show or to warn." Whereas mythologist Joseph Campbell treats the monster as a universal metaphor for existential threat to life and symbolic of destructiveness, occupying literal and figurative spaces outside civilization, literary critic Jeffrey Jerome Cohen writes in *Monster Culture (Seven Theses)* of the desire evoked by the monster. The monster "attracts," and the monster presents safe expression and access to "fantasies of aggression, domination, and inversion."

[469]The slithering movement, reminiscent of Medusa's mesmerizing head of snakes, has been labeled "Bad Hair" and "Flamboyant" by many who study octopuses.

written conditions of the contract. There is always something unspoken, unthought of, and lurking. Ursula adopts Ariel's voice and uses it to seduce the prince, who believes the voice belongs to the woman who saved him from drowning. Power changes hands. Ursula's classification as an octopus, indiscriminately eating the bodies of shriveled merfolk who fail to abide by the contract, who injects a "fine print" in all her contracts-in this case, calling for Ariel to be her slave "for all eternity" if Prince Eric does not fall in love with her-directs the audience to consider constraints on free will, even as it is freely exercised.

Another famous octopus-like villain is Otto Octavius, otherwise known as Dr. Octopus, antagonist to Marvel Comic's hero, the Amazing Spiderman. Introduced by creator Stan Lee as a brilliant scientist, cunning inventor, committed to developing clean energy, Octavius created a set of artificially intelligent mechanical arms to assist him with experiments. A radioactive explosion permanently fused the arms to his body and because the "neural inhibitor chip" controlling the arms was destroyed, the arms took over and Dr. Octopus, the villain was born. Endowed with super strength, Dr. Octopus wreaks havoc in New York City, becoming more than human, more powerful, and explosive with evolutionary potential to survive an increasingly nuclearized world. Dr. Octopus stomps around the city, crushing everything in his path, out of control, forcing everyone but Spiderman to flee. Only another "radioactive" force, like Spiderman, could stop Dr. Octopus. These imaginative octopus-like creatures reveal a desire to be more, to transcend the boundaries of limited physical bodies, and that is ostensibly considered evil. The octopus-like villain represents free will "run wild" as Dr. Octopus uses telepathy to move each tentacle independently. However, the tentacles are sentient entities that compel Dr. Octopus to be "evil." It is as if Dr. Octopus has to be rescued from himself. Is this an example of a license to shirk responsibility and act without remorse?

The "queerness" of the octopus, its strength and ambiguous form, renders it disruptively monstrous. Octopuses became synonymous with the fictional kraken, now believed to be the giant squid. The *King's Mirror (Speculum Regale)*, an anonymous text written in the 12th century, presumably a dictation of the ideas of King Sverre of Norway, introduced the kraken in a chapter entitled "Marvels of the Icelandic Seas: Whales; The Kraken." Although the narrator admits to never having actually seen a kraken, and that encounters with the kraken are a rare occurrence, he reports: "It seems likely that there are but two in all the ocean and that these beget no offspring, for I believe it is always the same ones that appear."[470] Their presumed stasis reflects the desire to contain the world of monsters, to name it, and to prevent it from changing. The narrator informs the audience that those sightings of the "kraken" make it "appear more like an island than a fish" and, as if invincible, has never been caught or found dead on shore. It is always something other than what it really is, outside of time, as it never ages, and outside of space, as it circulates and turns from a living being into a static inanimate stretch of rock offering an illusion of shelter from tumultuous seas. In effect, the monster reflects our probing and searching for the possible.

Octopuses continued to maintain their status as monsters, made by a devil-mediated world, in the writing of Swedish Catholic priest and naturalist Olaus Magnus, creator of the *Carta Magna* (1539). In a wall size map of the Northern Sea, Magnus shows us fantastical sea monsters with protruding teeth, elongated snouts, clawed feet, and every conceivably frightening form of fleshy weaponry complete with a descriptive legend identifying and characterizing each monster occupying the majority of the space. Representing marine life as he and his contemporaries envisioned, the map features the kraken as a "creature with horrible horns and a

[470] *The King's Mirror*. Trans. Laurence Larson, *New York American-Scandinavian Foundation*, 1917, p. 125.

burning gaze" like the devil. The meeting of heavens and sea inspired "literary monsters" scholar Lindsay Starkey to describe the complexity of monsters foregrounding the map as "provocative, inciting passions, manifested in the fear they caused to surface along with the desire for sea adventure."[471] Notably, fear and desire merge when we imagine octopuses, portraying the anxiety of not being in control of ourselves and the longing to escape; illuminating the indeterminacy of both.[472]

Many sea creatures evoke a sense of terror, notably those that seduced sailors with distorted proportions. The kraken held a reputation for sinking ships into watery, immeasurable depths with its tangle of tentacles or by simply submerging itself to create a maelstrom. Imagining that the raw brutal strength of the kraken could deflate the power of ships and manipulate the ocean was awful and *awe-full*. Both frightful and sensational, the kraken held an allure for landlubbers whose lives were increasingly mechanized by civilizing processes. Magnus was intent on accessing the dark powers of nature, or in his words, "illuminating the secrets of nature" and writes of beguiling aspect of sea monsters to inspire thought provoking passions.[473] Linking passion with intellectual curiosity, positioned alongside sea monsters, combines the imaginative and rationale mind, fantasy and reality, with wonders such as monsters, and our own "monstrosity," driving us to act (or preventing us from acting).

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[471]Lindsay J. Starkey. "Why Sea Monsters Surround the Northern Lands: Olaus Magnus's Conception of Water," *Preternature*, vol. 6, no. 1, 2017, p. 31.

[472]Magnus is credited as establishing an agreed upon definition of monster as a creature at once frightening and exotic, so it elicits a uniquely intense "reaction." Starkey focuses on the word reaction as responsible for "making a monster a monster" highlighting the relationship between such a creature and human beings. Starkey conceptualizes this relationship as exciting "cognitive passion" perhaps interchanging knowing with emulating, however, Magnus writes of the persistence of the mystery of monsters. Referring to each creature as "monstra marina mirabilia" (marvelous marine monsters), Magnus divided each as either threatening, protective, as predictors of future events, and as commodities drawing people to the sea. For Magnus, these creatures acted as extensions of a world marked with vitality.

[473]Olaus Magnus. *A Description of the Northern Peoples*, 1555, Routledge, 1998, vol. 3, Chapter 7.

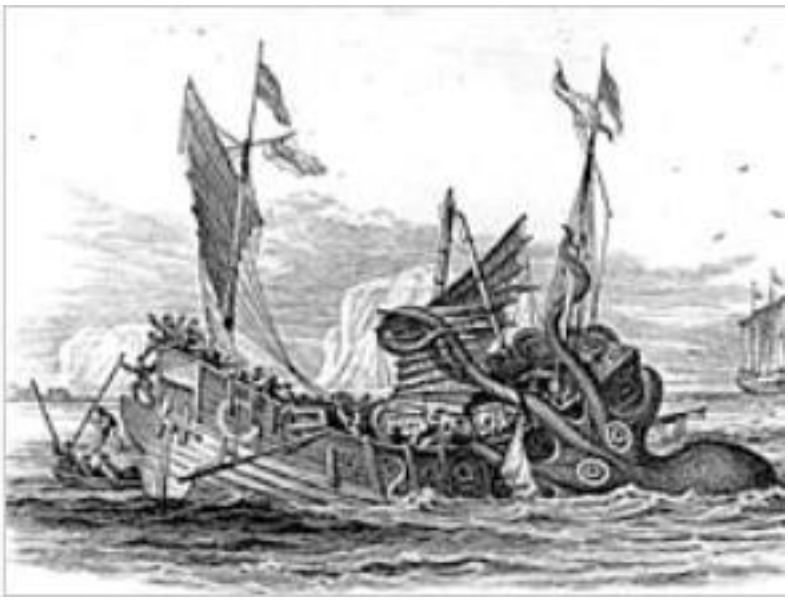

Figure 28: Pierre Denys de Montfort, "Poulpe Collosal," 1801. Courtesy of Biodiversity Heritage Library.

Norwegian bishop and naturalist Erik Pontoppidan extended the longevity of the kraken myth in his 18th century text, *The Natural History of Norway*.[474] Pontoppidan writes that the kraken is the world's largest creature and is often mistaken for "floating islands" rising from the ocean, luring sailors to rest their weary bodies. Describing the kraken as a monster which first appears like a "number of small islands, surrounded with something that floats and fluctuates like sea weeds" but soon metamorphize, he writes: "it seems these are the creature's arms," which left people insecure and untrusting of their powers of acuity or of nature's honesty. In this world of fantastical proportion, and shifts, it was natural to reflect on one's own potential to shape shift, and undoubtedly, the potential for neighbors to be other than what they appeared.

Despite exaggeration, tales of the kraken endured. Pontoppidan describes the kraken through a series of metaphors reinforcing the difficulty of capturing its essence, its spirit, its

[474]Carolus Linnaeus, anointed the father of taxonomy for creating a classification scheme for all species, participated in the Kraken craze. His first edition of *System Naturae* (1735) includes the entry *Microcosmus marinus*, for the kraken.

novelty, its ancientness, as he traces sightings and stories back in time from reputable, learned, prestigious figures in history and in society. From his collection of narratives, Pontoppidan assures an audience that the kraken "has never been known to do any great harm, except they have taken away the lives of those who consequently could not bring the tidings" [475] Pontoppidan implies it is a sign of disrespect and hubris for sailors to deny offerings to the kraken. Offerings are a sign of holding a creature in esteem, of recognizing its higher power, paying homage with the hope of bestowed favors, hence, becoming its child. It reflects a communication between species resulting in reciprocity. Essentially, a closing of the gap between the mortal and immortal presented by the arrival, the sighting, of the monster. Pontoppidan concludes his discussion on the kraken with a call to continue to add to the story. He attests to the existence of sea monsters and acknowledges that there is more to uncover.

French naturalist Pierre Denys de Montfort continued to propel the myth of the kraken well into the early 19th century. Known for aggrandizing mysteries into occult-like status, Denys de Montfort fostered even more curiosity about the existence of kraken/giant octopuses after a sperm whale was found to have an eight-foot tentacle in its stomach. Famed for painting the quintessential depiction of a giant octopus grasping the entire length of a sailing ship, *Colossal Octopus* (1801), Denys de Montfort also presents the octopus as a creature beyond the scope of the real in *The Natural History of Molluscs* (1801-2). Although Denys de Montfort was ridiculed for sensationalism and discredited as a naturalist for writing about a sea monster capable of sinking a ship, he did discover and identity twenty-five mollusk species. It is not unreasonable to be frightened by finding yourself in the arms of a creature able to "bend at one or many positions along their lengths, can shorten or extend, splay away from midline, and can also twist, rotating

[475]Erik Pontoppidan. *The Natural History of Norway*, A. Linde, 1755, p. 213.

around their own axis."[476] Using machine-like terminology to describe a creature that has the power to render you into a malleable object elucidates the feeling of being caught in a world of natural, physical laws that are invincible, as well as invisible, to which we are inherently bound. Once more, we are not certain if those laws are temporary or permanent.

Monsters also interested 19th century naturalist Henry Lee who writes of being on friendly and "familiar" terms with the octopus. He dedicates one entire book to the octopus, *The Octopus; The Devil-Fish of Fiction and of Fact* and also included a chapter on the octopus/hydra in *Sea Monsters Unmasked* and *Sea Fables Explained*. Mingling his own experiences housing octopuses and observing their behavior along with recorded historical accounts, Lee evokes the idea of determinism in defending the octopus as "a perfectly natural instinct inherited from his ancestors." Lee approaches the study of octopuses via the biological and the mythological, to display his paradoxical relationship as an objective observer as well as a path to self-discovery. Lee refutes the idea that the arms are weapons of "constriction, compression, or suffocation," and claims that the arms are "eight radiating, supple, tapering thongs," alluring and mesmerizing in their independent movements. He voluntarily presents his arm to a captive octopus, pretends to pull back on its grasp in order to test its suction powers, and nonchalantly compares the marks left by the suckers as no different than cupping one's arm with a glass tube. While the fiction accurately brings attention to the resident powers belonging to the "devil-fish," the malice ascribed to it is misplaced. The "holding-power" of the octopus is inarguable, but its intentionality is circumspect. Lee writes of an octopus kept at the Brighton Aquarium (England) "which used regularly every night to quit its tank, and make its way along the wall to another tank at some distance from it, in which were some young lump fishes. Day after day, one of

[476]Jennifer Mather. "The Cephalopod Specialties: Complex Nervous System, Learning, and Cognition," *Canadian Journal of Zoology*, vol. 91, no. 6, 2013, pp. 431-449.

these was missing, until, at last, the marauder was discovered. Many days elapsed, however, before he was detected, for after helping himself to, and devouring a young 'lump-sucker,' he demurely returned before daylight to his own quarters."[477] We are left to wonder if the octopus knew or suspected that its behavior would be classified as a crime. Lee calls on us to think about our behaviors and what constitutes natural versus unnatural as we classify them according to law, time, place, and circumstance.

In another text, *Sea Monsters Unmasked*, Lee begins with a chapter on "The Kraken." Emphasizing its historical presence around the world as well as its physiology, Lee admires the "holding power of its numerous suckers" and its immense strength, and if pitted against a human, doubts any person could "disengage himself under water by mere strength."[478] Though his intentions are to dispel the myth of the kraken, to curb superstitious aggrandizement of its mysterious existence through the ages, he remains impressed by their enormous size and their "clinging power," challenging the wherewithal of humanity to regain control. Recounting his own experience measuring one particular specimen brought to his lab, Lee confirms: "Here, then, in our midst, and to be seen by all who ask permission to inspect it, is, and has long been, a limb of a great cephalopod capable of upsetting a boat, or of hauling a man out of her, or of clutching one engaged in scraping a ship's side, and dragging him under water, as described by the old master mariner Magnus Dens."[479] We can make light of our fears and in doing so, acknowledge that they exist. However, those fears call upon us to ask: Are we in the clutches of a monster of our own making? In merging the actual with the make-believe, we reveal our awareness that the world is beyond our comprehension, always out of reach, and it is exhilarating. It holds us as

[477]Henry Lee. "The Lernean Hydra," *Sea Fables Explained*, William Clowes & Sons, 1883, p. 56.
[478]Henry Lee. "The Kraken," *Sea Monsters Unmasked*, William Clowes & Sons, 1883, p. 34.
[479]Ibid. p. 34.

much as we hold it, both in our body and mind. We act and are acted upon. In exchange, the impetus to keep going, to find out, compels the continual trial (and error) of being in the world and figuring out how to be with the world.

CODA: Why Look at Marine Invertebrates?

There have been many more low tides since my childhood field trips with Mrs. Terwilliger. But she always comes to mind when I observe a small, sandy finger gingerly touch the casing of a barnacle, caress the calcareous skin of a sea star, protectively curl inside its own hand at the sight of a crab, or point at the slithering arms of an octopus. Low tides never cease to captivate. It is impossible to not be captured by the agility of a crab tiptoeing over a rock jeweled with mussels or the spectacle of bright orange sea stars accessorizing an earthen rock. The unveiling of low tide is literally like stepping into another world. Anthropologist and author Loren Eiseley offers the adage "time-binding" to account for the uncanny sensation of being at home and not at home in this world awash with spineless creatures contorted in a wild array of shapes.

These *misfit* creatures straddling land and sea, lack discernable faces, cannot be tamed (or trained), and invert human inclination to "Other" other creatures. Invertebrates pull us into ourselves via the "sharp tang of non-human immensity" to quote Blue Humanities scholar Steve Mentz. What *humanizes* the human is *microscoped* by looking at creatures that do not look back, in whom we cannot find any resemblance, who resist othering any more than they are already othered by their own biology, and consequently magnify the soundness/unsoundness of the abstract character traits historically reserved for humanity alone. It is precisely the "lack" of *humanness* in marine invertebrates that collapses the vertical ladder cataloging life and reconfigures that ladder into a horizontal orientation, carrying the very small to the very large, on a flat line. The magnitude of life, or what Charles Darwin calls "grandeur," becomes *unscaled*, revealing itself in surprising ways. Marine invertebrates direct us to sense ourselves, and the world, otherwise. This is demonstrated by a group of global scientists who have taken up the call

to collecting soundscapes of "marine invertebrate sounds and choruses" to enhance understanding of ecological communities and "investigate the biodiversity and community of soniferous species, frequency and temporal niche positioning."[480] Marine invertebrates draw us into knowing the world, and our being with the world, in ever unfolding ways.

The value of marine invertebrates is deep. Ecologically, marine invertebrates are integral players in filtering the sea to maintain water quality, cycle nutrients through the water, engineer habitats, and host other species. Commercially, marine invertebrates contribute to the development of cosmetics and medicine, and economically, aquaculture is a thriving industry. Marine invertebrates ae also key informants of changes in the ocean's health due to pollution, acidification, deep sea mining, tourism, invasive species, and global warming. Biologist E. O. Wilson emphatically championed the value of invertebrates (ants specifically), stating, "If human beings were to disappear tomorrow, the world would go on with little change. But if invertebrates were to disappear, I doubt that the human species could last more than a few months."[481] Our dependence on them is cause for reflection.

Therefore, I ask the question, "What does it mean to be human?" in a time marked as the Anthropocene. While scholars continue to debate its beginnings, it is an epoch centering humanity as an exceptionally significant species in shaping Earth's biological systems. It is undeniable that our species, *Homo sapiens,* has influenced biodiversity and altered the composition of the planet, and that human history is intimately connected with natural history.[482] We are integrated in the process of give and take, though, arguably, our contributions have

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[480]Miles J.G. Parsons, et. al. "Sounding the Call for a Global Library of Underwater Biological Sound," *Frontiers in Ecology and Evolution*, vol. 10, no. 810156, 2022.
[481]E.O. Wilson. "The Little Things that Run the World (The importance and Conservation of Invertebrates)," *Conservation Biology*, vol. 1, no. 4, 1987, p. 345.
[482]For a synopsis on human driven climate change, see "The Climate of History: Four Theses," Dipesh Chakrabarty, *Critical Inquiry*, vol. 35, no. 2, 2009, pp. 197-222.

accelerated the process of change. Thus, in asking what it means to be human, and drawing upon scholarship of the ecocritics, materialists, and posthumanities, which seriously interrogates the relationship between humans and non-humans, questioning the "coherence" of human nature by stating that the human is always already permanently inhabited with the non-human, I specifically ask, "Why look at marine invertebrates?". I explicitly borrow the framing of the question from John Berger's essay, "Why Look at Animals?"[483] discussing the historical trajectory of edging animals away from a human centered world as a result of capitalistic ventures. Berger wonders, "What were the secrets of animal's likeness with, and unlikeness from man?" but neglects, as does most scholarship, to include marine invertebrates. Therefore, I redirect the spotlight to marine invertebrates because they are undoubtedly principal figures in maintaining ecosystems, yet do not accompany humans in literatures depicting friendships or act as an animal presence that represents "a way out" from animal identification.

I look at marine invertebrates as boundary-breaking creatures and as creatures who direct us to look at ourselves differently. After all, Charles Darwin argues that "from so simple a beginning, endless forms most beautiful and most wonderful have been, and are being evolved."[484] In reacquainting ourselves with marine invertebrates, we are invited to look at the spectacular primordial life personally connecting us to our material and ephemeral selves, and our communities. If the sinews of biology confirm our relations with all species, then every species has, in one sense or another, the abstract qualities of consciousness, reasoning, morality and free will, arguably conferred by biology and simultaneously cancelled by biology. Neither biology nor theorized concepts are exclusively contained.

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[483]John Berger. "Why Look at Animals?", *About Looking*, Writers and Readers, 1980, pp. 1-26.
[484]Charles Darwin. *On the Origin of Species*, John Murray, 1859, p. 425.

So what? How do we engage in a world in a way that does not remove us or exclude voices we cannot hear? In a symbiotic, posthuman world, there is not one answer. The world is sticky and pretending otherwise is catastrophic, as the Anthropocene reveals. Sticking to stickiness, at least, admits other sensibilities and creaturely perspectives beyond the confines of *terra firma*. In stickiness, we are immersed in water's viscosity, thus, if we continue to stay with the belief that the sea breeds monsters, then we have to fabulously include ourselves in that category. And that may be the liberating act needed. Sea monsters also hold a recognizable human form, notably mermaids and mermen, illuminating ineffable watery ties, supported by the wealth of water origin myths sprung from cultures around the world. We are creatures of the sea. And the sea, and its creatures, are all agents mixed up with all other biotic and abiotic forces.

Marine invertebrates release the tension between an ancient past and an apocalyptic future by awakening our shared fate. Through marine invertebrates we can reframe how we understand ourselves as part of the world in all its splayed, clawed, upside-down, or head-footed ways. We have a lot to learn from the first life forms on Earth. Since we cannot take over their perspective, we cannot stamp our sense of hearing, tasting, touching, seeing, and smelling to speak for them. In the end, marine invertebrates turn us inside out to elevate our senses and look within and without. What is means to be human, therefore, means more than can be statically contained.

Incorporating the biology of species that caused such a stir in the imagination, and inspired the theory of evolution, as well as raising anxieties concerning the intimate proximity of body parts, with the world history of fables, legends, myths, and stories making use of marine invertebrates to wrestle with their humanity, excites sensibilities. Foregrounding the biology of marine invertebrates directs attention to the ways in which human biology became associated

with abstract character traits to emphasize difference. A focus on biology also illuminates the desire to be more than just a body. Therefore, biology became the basis for assigning consciousness, reason, morality and free will. Standing upright became inextricably linked with metaphysical traits and paradoxically, separated humanity from connections with "bare life." I turn to biology as a path to engage systemically, or associatively, to return to the sea, despite the reality, as noted by Steve Mentz, that we cannot live there. My response is that the sea lives in *us,* and the sea makes *us* possible. Finally, if Jacques Derrida still stands naked before his cat and wonders why he feels shame, I invite him to enter the sea and wonder why he does not.

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