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Library Research Award

Reflective Essay

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I became a neuroscience major because theoretical explanations rarely satisfied my curiosity. Psychology tells me that encoded memories can be transferred from short to long term storage, but it cannot explain the biological basis of memory, nor the molecular processes regulating it. When assigned a biology research project in English 299, my interest in a mechanistic explanation for memory prompted me to ask: what impact does local protein synthesis in neuronal dendrites have on the neuron, and how does this inform our understanding of synaptic plasticity and memory?

Being new to scientific academic research, I reached out to the UW's Biology Subject Librarian, Sally Pine. My initial research strategy was to familiarize myself with my topic through review articles, which Sally suggested I look for on Web of Science. Recognizing my lack of experience, she also gave me a crash course in effective researching, including database selection, use of keywords, filtering search results, and citation managers. I owe much gratitude to Sally for by her advice, I consistently refined my results to articles and review papers published post-2000, both for the purpose of maintaining accuracy and relevancy as well as fitting my technical, modern research topic.

Utilizing my newfound research skills, I unearthed "Local Translational Control in Dendrites and Its Role in Long-Term Synaptic Plasticity"(Sutton and Schuman 2005), a review paper which synthesizes the last 60 years of research on this topic. I was intrigued that nearly

half the paper addresses gaps in knowledge and began to doubt whether enough evidence existed to meaningfully, comprehensively explore my research question. My professor, Sarah Ghasedi, echoed my concerns, at which point I was faced with a daunting thought: is my research question even feasible?

At the core of my question, I realized, was a biological pathway that starts with local protein synthesis in the dendrites and ends with memory formation. The feasibility of my research question thus rested on how effectively I could reconstruct this pathway given the available evidence, so I decided to shift my focus away from review articles and toward research papers. I also subdivided my research question into more manageable sub-questions that accounted for different parts of this biological pathway: how does local protein synthesis in dendrites work? What proteins are locally synthesized? How do they function within the neuron? How does this function impact synaptic plasticity? What is the connection between synaptic plasticity and memory, and how does a certain protein's role in synaptic plasticity inform memory formation?

Research to answer these questions represented the bulk of my investigation; to answer them, I relied heavily on keywords and snowballing. Through using quotation marks and the "AND" search command (for example, "local protein synthesis" AND dendrites), I searched only for resources using these key phrases in conjunction, narrowing my results to papers of smaller scope and relevant to each sub-question. Furthermore, I utilized the review papers I had already found as source hotbeds, identifying a relevant study and following the citation rabbit hole down to niche research (I was told this technique is called "snowballing").

Nevertheless, the scientific papers I discovered were dense, complex, and addressed research that didn't perfectly fit the subcategories I had established. Growing frustrated, I decided that another reevaluation - possibly of both research question and approach - was in order. Concerning research strategy, the more fruitful approach might be to think of my topic as a staircase instead of a linear pathway. Allowing related evidence to collectively support a conclusion circumnavigated my problem of finding evidence that "perfectly" fit my sub-questions, yet still achieved a cohesive biological explanation. Through this approach, my research question was in fact feasible, but I could not ignore the plethora of unanswered questions I discovered in this field. I chose to work this second point into my investigation, resulting in the final question: What role does local protein synthesis in neuronal dendrites play in synaptic plasticity and memory, and what questions remain unanswered regarding this biological mechanism?

After this adjustment, my research became more interconnected and harmonious. For instance, though I could not find a "perfect" standalone answer for the sub-question "how can a locally synthesized protein impact synaptic plasticity?", my discovery of first: a normally synthesized protein that greatly impacts plasticity (Henley and Wilkinson 2013), second: a locally synthesized lipid that impacts plasticity (Younts et al. 2016), and third: a locally synthesized protein that impacts plasticity on some level (Benson 1997), gave me confidence to conclude that locally synthesized proteins have the potential to play significant roles in synaptic plasticity. If evidence was allowed to build upon itself, advantageous overlap emerged. However, evidence gaps that needed to be bridged constituted my final hurdle.

I made such leaps through my own interpretations of the evidence, surprised to feel sentiments of uncertainty and guilt as a result. As an undergraduate, who was I to make conjectures about concepts far exceeding my expertise? When I asked Sally Pine to review my conjectures, our resulting exchange gave me confidence in my own voice. Sally called science a conversation, noting that my intense feelings of imposter syndrome do not reflect my inherent value as a fresh mind, brimming with new ideas and creativity.

If science is indeed a conversation, the main method of conversing, I realized, is research. Ironically, my research topic – full of uncertainty and questions – showcased science as a cycle of inquiry, evidence collection and evaluation, much like what my own investigation had become. The thought that research is a spark which renews this cycle, not the strict, inaccessible notion fueling my fear of contributing incorrect, silly ideas, changed how I considered my own discipline. Not only have I learned and had the opportunity to practice my database and research skills, which are deeply applicable to my future professional career, but the challenges of answering my research question and connecting evidence reinforced the value of reevaluating a problem from multiple angles. Along with the novel sense of place and identity that it helped me construct within the scientific community, this research experience has fostered my growth into a more cognizant, confident scholar.

Works Cited

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