

# **Water and the Ecology of Disease: Examples from Ghana and West Africa**

**Jonathan D. Mayer**

**Professor of Epidemiology and  
Geography;**

**Adjunct Professor of Medicine  
(Allergy and Infectious  
Diseases), Family Medicine, and  
Health Services**

# Disease Ecology

- **Considers roles of**
  - Agent-host interactions
  - Environment
  - Culture
  - Behavior
  - Population
- **Coincidence in time and space of agent and host**
- **Examples**

# **Role of Water in Infectious Diseases in W. Africa**

- **Many/most major infectious diseases have water component**
- **Waterborne**
- **Others directly tied to water and water quality**

# Waterborne

- **Infectious diarrheas**
  - Bacterial
  - Viral
  - Other pathogens
- **These are well known and well described, eg**
  - Periodic cholera outbreaks

# Water as Breeding Grounds or Habitat for Intermediate Hosts

- **Schistosomiasis**
- **Buruli ulcer (*M. ulcerans*)**
- **Onchocerciasis**
- **Malaria**

# Example of Volta River Dam

- Akosombo River dammed for hydropower
- Created largest human made lake in world
- Completed 1965
- Unanticipated health effects









# Changing Epidemiology of Schisto Post-Dam

- Tremendous increase up-river in lake
- Questionably greater increase downriver
- Also increases in malaria, onchocerciasis

# Schistosoma species

Major forms of human schistosomiasis caused by 5 species of water-borne trematodes, or blood flukes, called schistosomes

- **Urinary disease**
  - S. haematobium
  - S. intercalatum
- **Hepatic / Intestinal disease**
  - S. mansoni
  - S. japonicum
  - S. mekongi

# Schistosomiasis

- 200 million people infected
- 600 million people at risk of infection
- 11,000 deaths per year
- 1.7 million DALYs lost per year
- 85% of all schistosomiasis cases in sub-Saharan Africa
  - Yemen and Mindanao also highly endemic
- Endemic but low levels
  - North Africa, Middle East, Yangtze River basin in China, Mekong River in Laos and Cambodia, several islands in the Phillipines

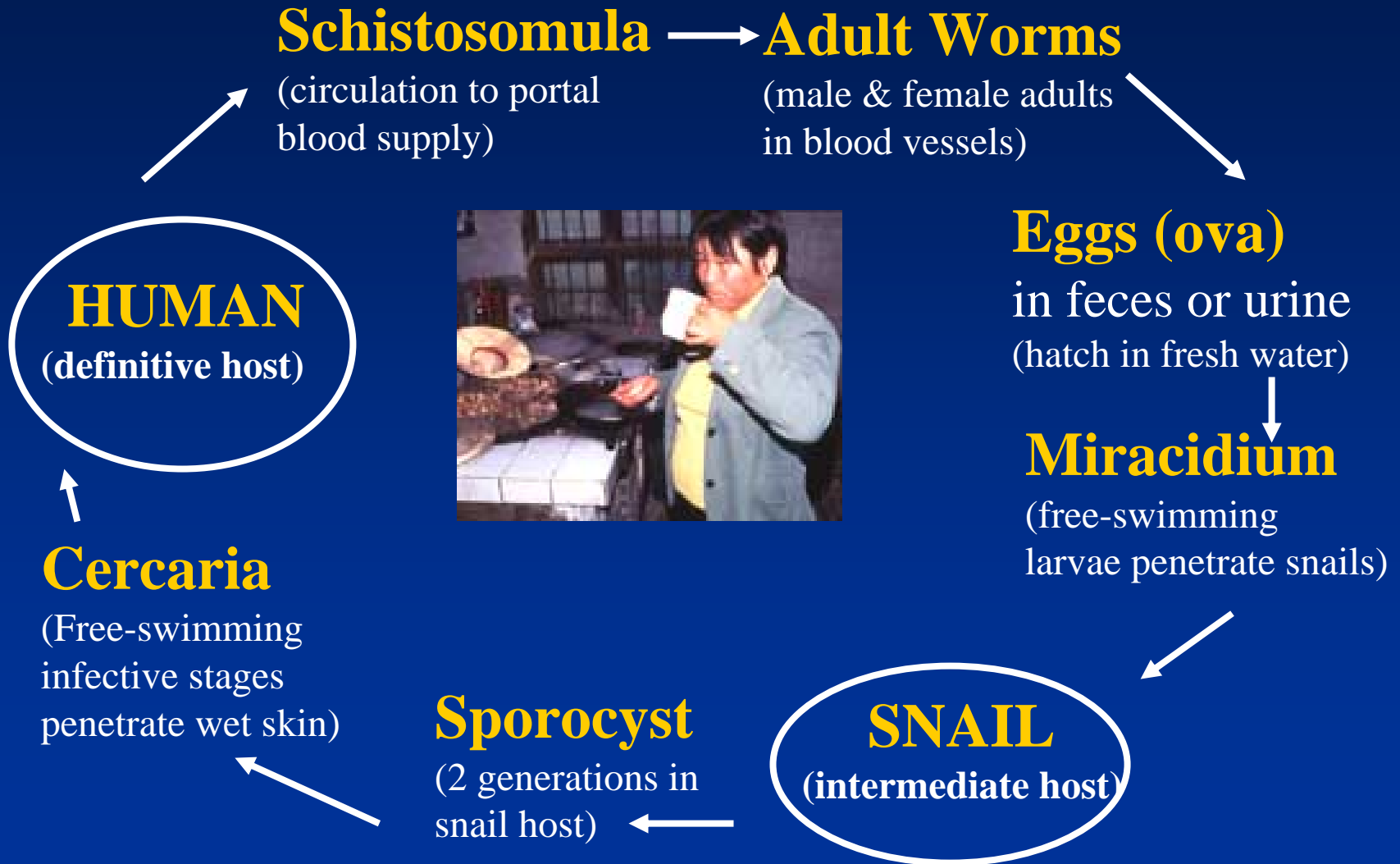
# Schistosomiasis

## Infections with *Schistosoma* species

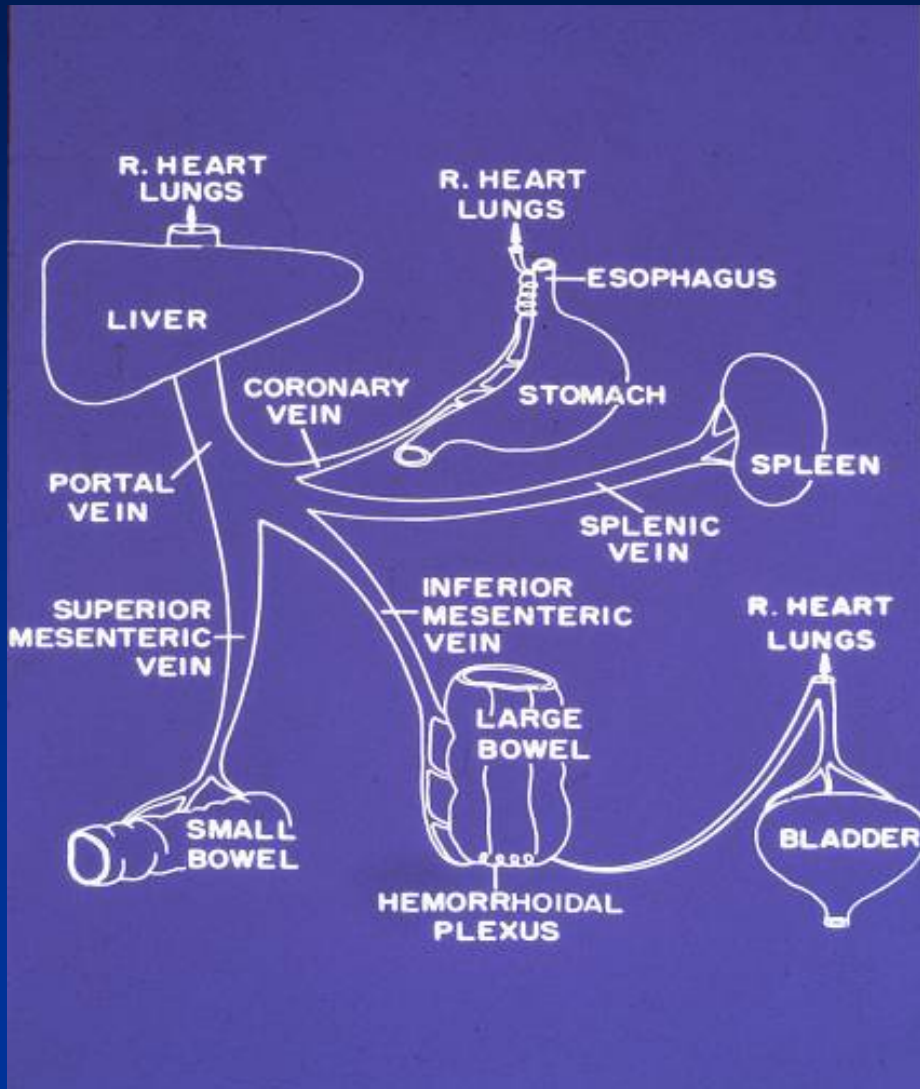
- Acute infection
- Incubation period
- Maturation, coupling, production of eggs

Schistosomiasis disease is characterized by chronic inflammation and fibrosis around ectopic parasite eggs lodged in tissues of various internal organs.

# Detailed Schistosomiasis Life Cycle



# Migration of Mature Worm Pairs



- Mature worm pairs migrate to venules of bowel or bladder depending on species
- Females lay eggs daily
- Eggs pass through walls of end-organs to exit the body in stool or urine
- Some eggs are trapped in organ walls
- Some eggs are swept back in portal circulation to the liver

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# Buruli Ulcer

- **M ulcerans**
- **Endemic in Ghana, Benin, Togo, Nigeria, Cote d'Ivoire, Australia**
- **Ecology not fully known**
- **Associated with water**
- **Water insects may be intermediate host**
- **Surgery only cure**
  - **Anti mycobacterials usually not definitive**

# Current Work in Nima

- Largest slum in Accra
- 150,000 people on 6 km<sup>2</sup>
- Census has not been fully analyzed
- Health status unknown
  - Anecdotally poor







BLK  
135

E 314  
15

E 3







