Three Really Stupid Ideas About Parasitism

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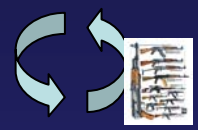

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SI#3. The fundamental Darwinian principles can explain the diversity of reproductive anatomy in trematodes (cestodes, nematodes, etc.).

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Parasites of *Peromyscus maniculatus* (arthropods; 1973-1976)

- ***Hystrichopsylla dippiei***
- ***Stenoponia americana***
- ***Meringis parkeri***
- ***Epitedia stanfordi***
- ***Catallagia decipiens***
- ***Anomiopsyllus nudatus***
- ***Rhadinopsylla sectilis***
- ***Peromyscopsylla hamifer***
- ***Peromyscopsylla hesperomys***
- ***Dactylopsylla ignota***
- ***Orchopeas neotomae***
- ***Orchopeas leucopus***
- ***Malaraeus sinomus***
- ***Malaraeus telchinus***
- ***Malaraeus euphorbi***
- ***Megabothris abantis***
- ***Monopsyllus wagneri***
- ***Monopsyllus eumolpi***
- ***Cuterebra fontinella***
- ***Dermacentor occidentalis***
- ***Anomiopsyllus fascicalifornicus***
- ***Opisodasys keeni***
- ***Meringis cummingi***
- ***Neotrombicula brennani***
- ***Chatia setosa***
- ***Euschoengastia velata***
- ***Euschoengastia oregonensis***
- ***Comatacarus americanus***
- ***Dermacarus jonesi***
- ***Odontacarus villosus***
- ***Xenodontacarus plumosus***
- ***Catallagia mahesoni***
- ***Catallagia sculleni***
- ***Phalacropsylla allos***

(I count 34 scientific names on this list.)

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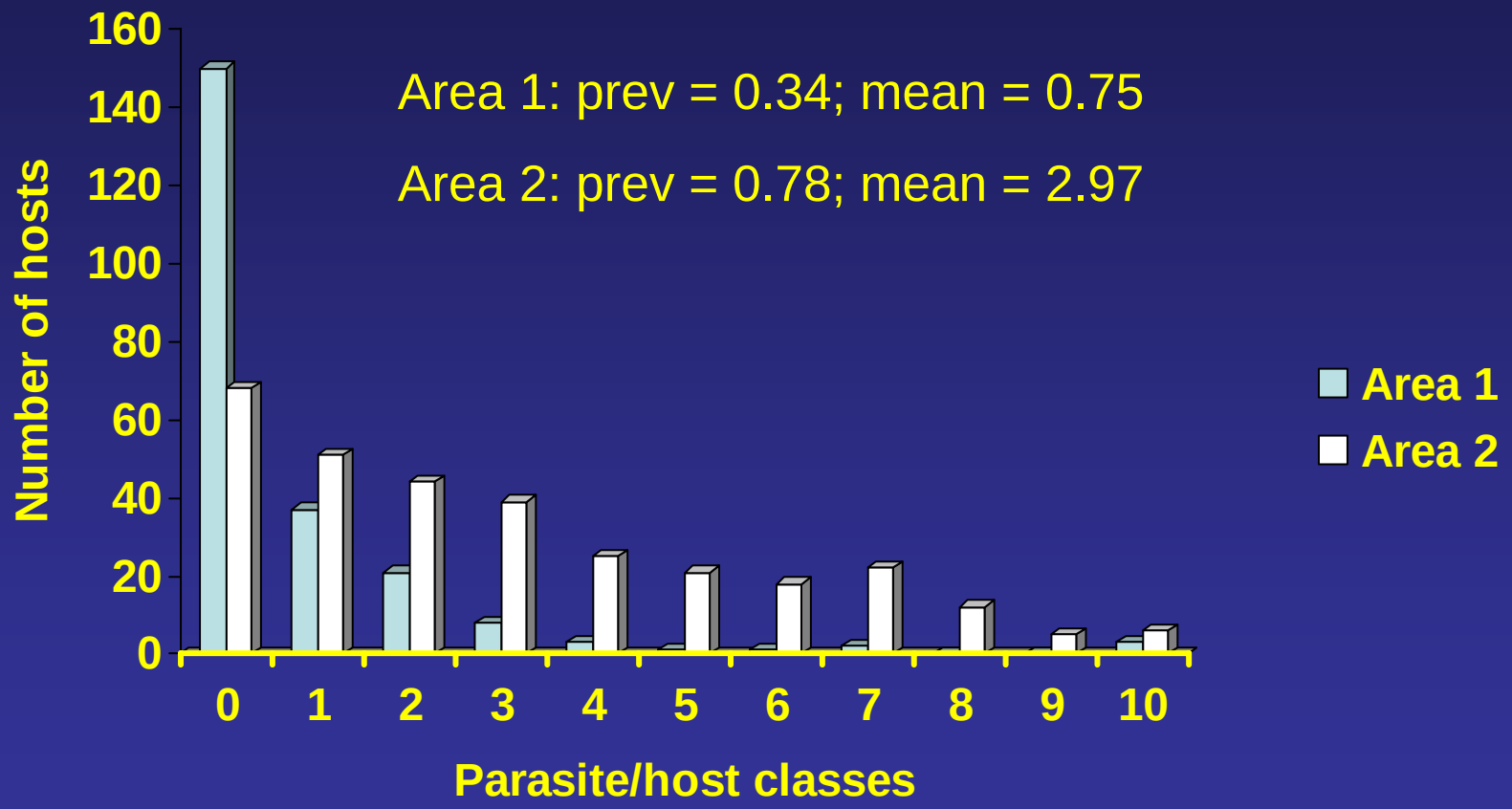
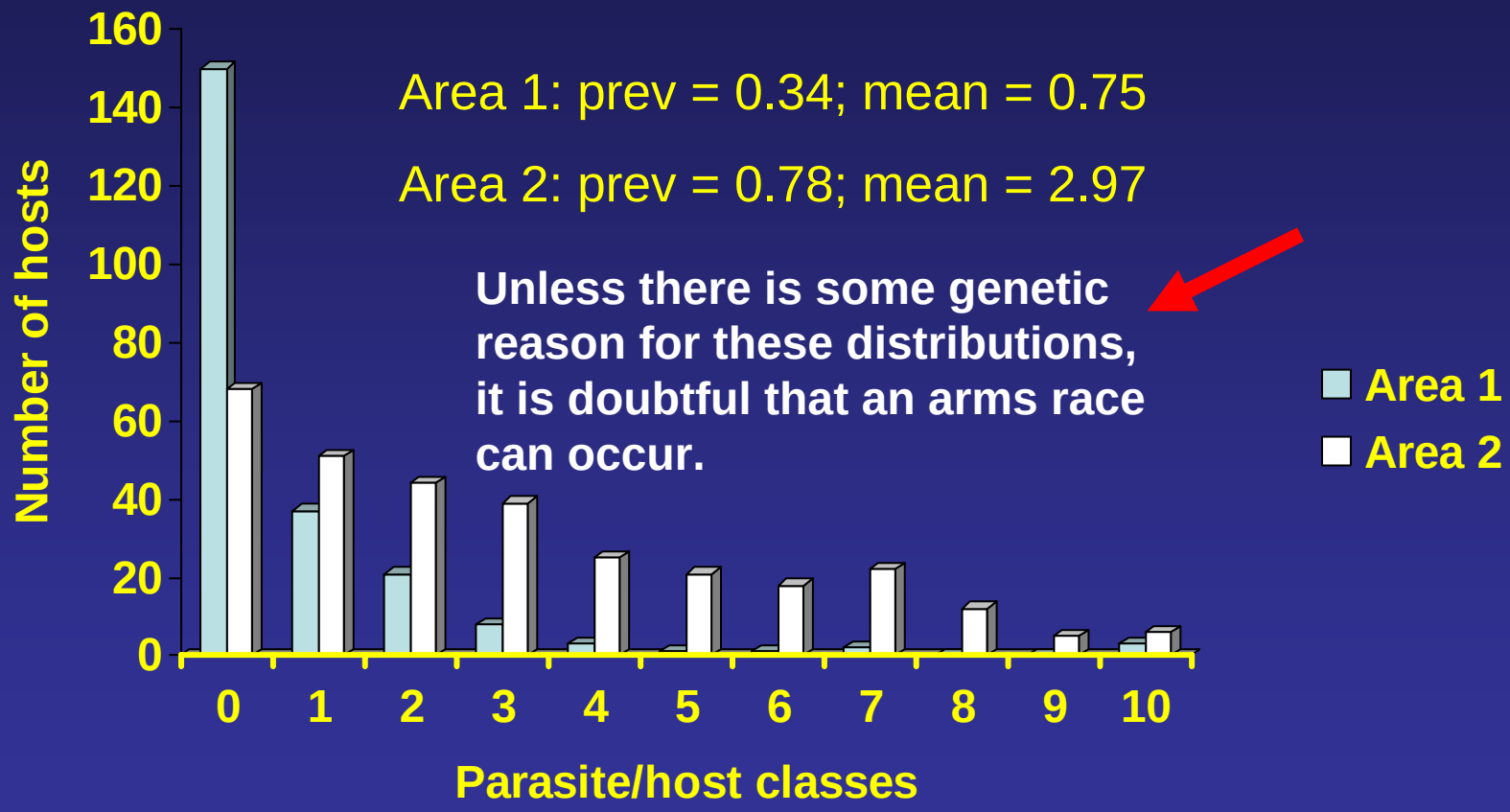
Remember: these parasites are only the ectos.

Public Health Statistics: Typical macroparasite population distribution



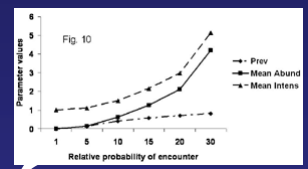
However →

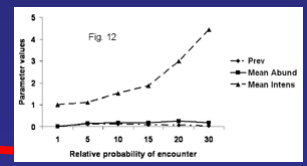
Public Health Statistics: Typical macroparasite population distribution



(To my knowledge, a genetic explanation for such distributions has never been clearly demonstrated for any host-parasite system that has ever been studied.)

PROBABILITY OF INFECTION





TIME-SPACE

SI#1. There is an evolutionary arms race between hosts and parasites.

- Which parasite(s)?
- Do any of them act in concert?
- If so, which ones?
- What, exactly, is evolving?
- Can you measure the relative impact of parasites on fitness and if so is that impact enough to drive genetic change in the host?

Can you measure the relative impact of parasites on fitness and if so is that impact enough to drive genetic change in the host?

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A Field Biologist's Intuitive Relative Fitness Risk Table for *Peromyscus maniculatus*:

Owls

Bullsnakes

Coyotes

Rattlesnakes

Annual fluctuations in seed supply

Really bad winters

Other mice

All parasites combined

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And, all this interaction is taking place out in nature instead of in the lab.

You've got to be kidding!

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SI#2. You can actually study the effects of parasitism on a single species of really common animal out in the wild.

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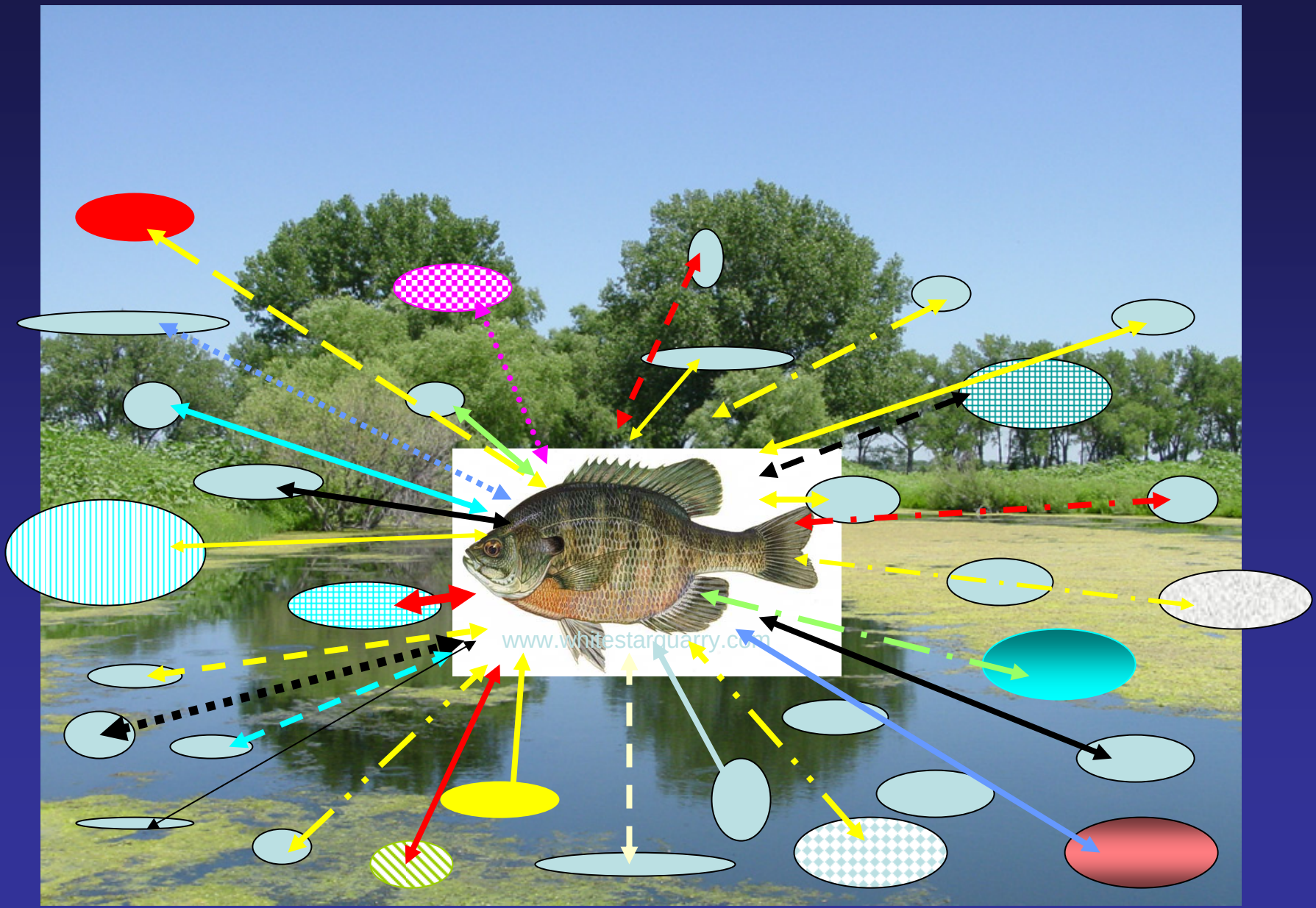
Dunwoody Pond; Keith County, Nebraska

Parasites of *Lepomis macrochirus*, Reported 1973-77

- *Crepidostomum cornutum*
- *Leuceruthrus micropteri*
- *Proterometra macrostoma*
- *Lerneaea cyprinacea*
- *Leptorhynchoides thecatus*
- *Pomphorhynchus bulbocollii*
- *Acanthocephalus jacksoni*
- *Posthodiplostomum minimum*
- *Homalometron armatum*
- *Neoechnorhynchus cylindratus*
- *Proteocephalus ambloplitus*
- *Bothriocephalus claviceps*
- *Spinitectus carolini*
- *Argulus flavescens*
- *Illinobdella moorei*
- *Myzobdella moorei*
- *Clinostomum marginatum*
- *Eustrongylides* sp
- *Epistylus* sp.
- *Actinocleidus fergusoni*
- *Actinocleidus oculatus*
- *Cleidodiscus nematocirrus*
- *Cleidodiscus robustus*
- *Urocleidus acer*
- *Urocleidus biramosus*
- *Urocleidus dispar*
- *Urocleidus ferox*
- *Urocleidus variabilis*
- *Urocleidus furcatus*
- *Argulus maculosus*
- *Ergasilus arthrosis*
- *Ergasilus caeruleus*
- *Ergasilus centrarchidarum*
- *Ergasilus lizae*
- *Ergasilus tenax*
- *Contracaecum* sp.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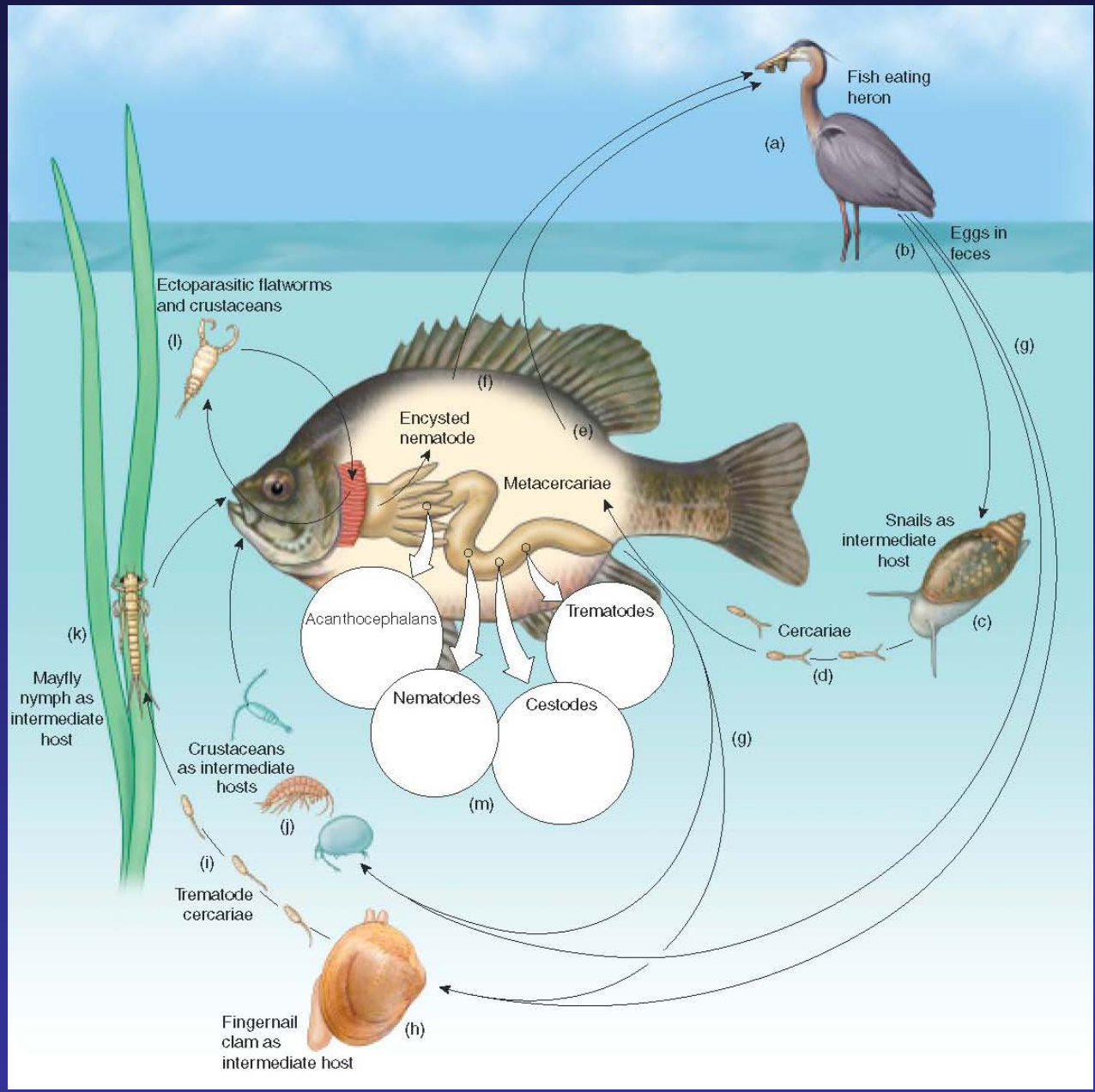


Bill Ober drawing for Fig, 2.4 in Foundations, 8th Ed.

THE CENTRAL QUESTIONS:

- How do I design the experiments to actually test hypotheses about the effects of parasitism in populations of wild vertebrates?
- To what extent would the principles established by any such study be applicable to parasitism in general?
- What do the answers to these questions tell us about the fundamental nature of [our] science?

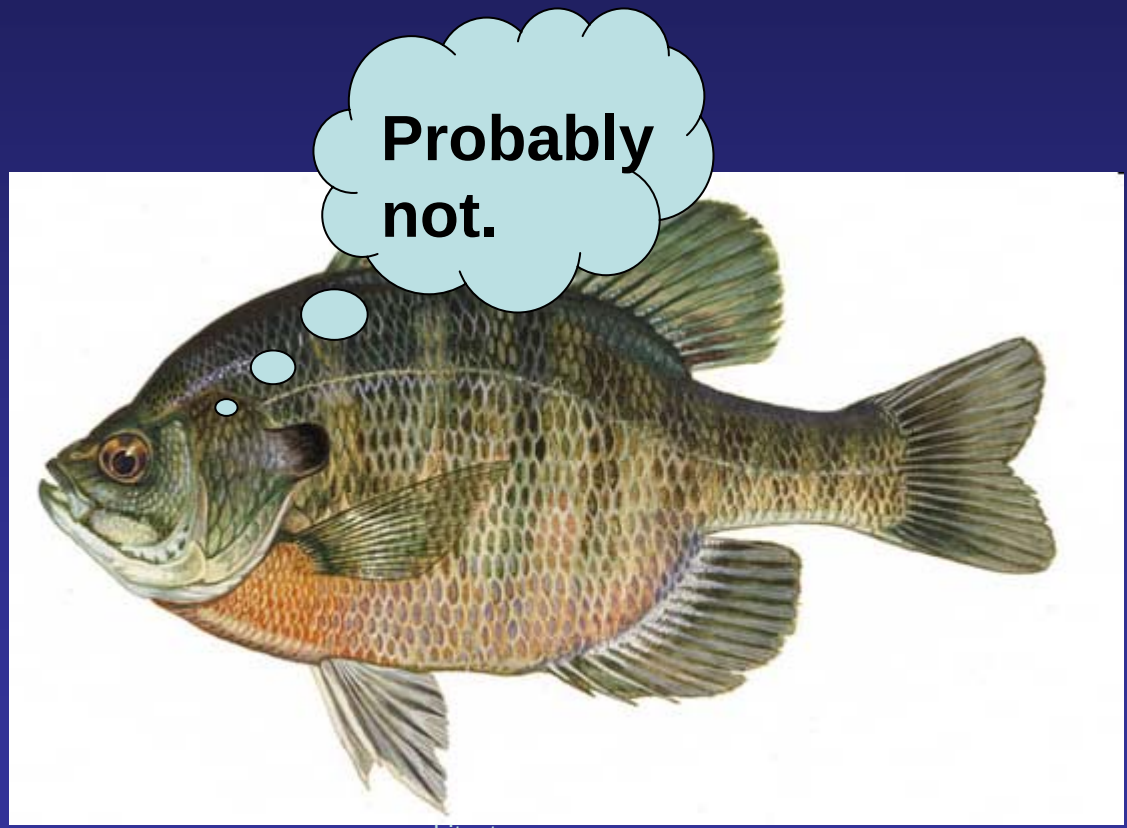
A Minimal List of “To Do” Items:

1. Find large semi-replicate populations of bluegills in semi-similar regional settings.
2. Determine the “wild type” health parameters in all these populations (the cliff swallow model).
3. Separate your replicate populations into statistically relevant groups.
4. Remove the parasites, one by one, from “treatment” groups and repeat (2).

A Minimal List of "To Do" Items (cont'd):

4. Then start removing parasite species in all possible combinations, keeping all the other parasite species populations statistically stable (5 parasite species = 30 such studies).
5. Ensure that all external factors are kept constant (e.g. heron visits, etc.)
6. Find places where all the unstudied parasites are and repeat (1) through (5)

Can you actually study the effects of parasitism on a single species of really common animal out in the wild?



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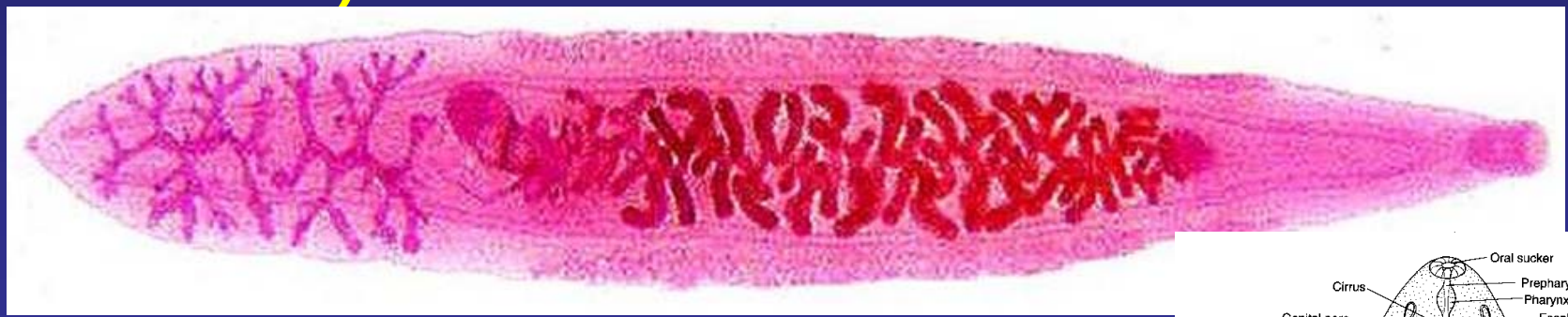
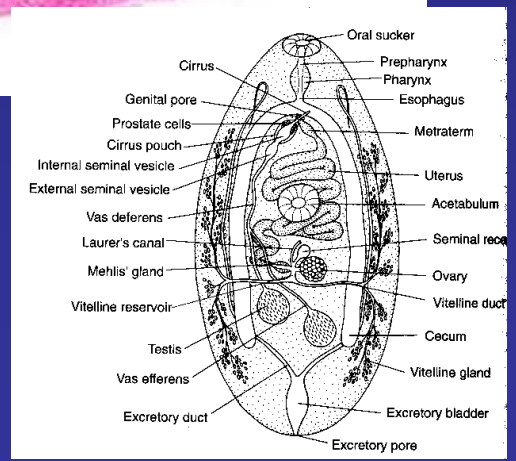
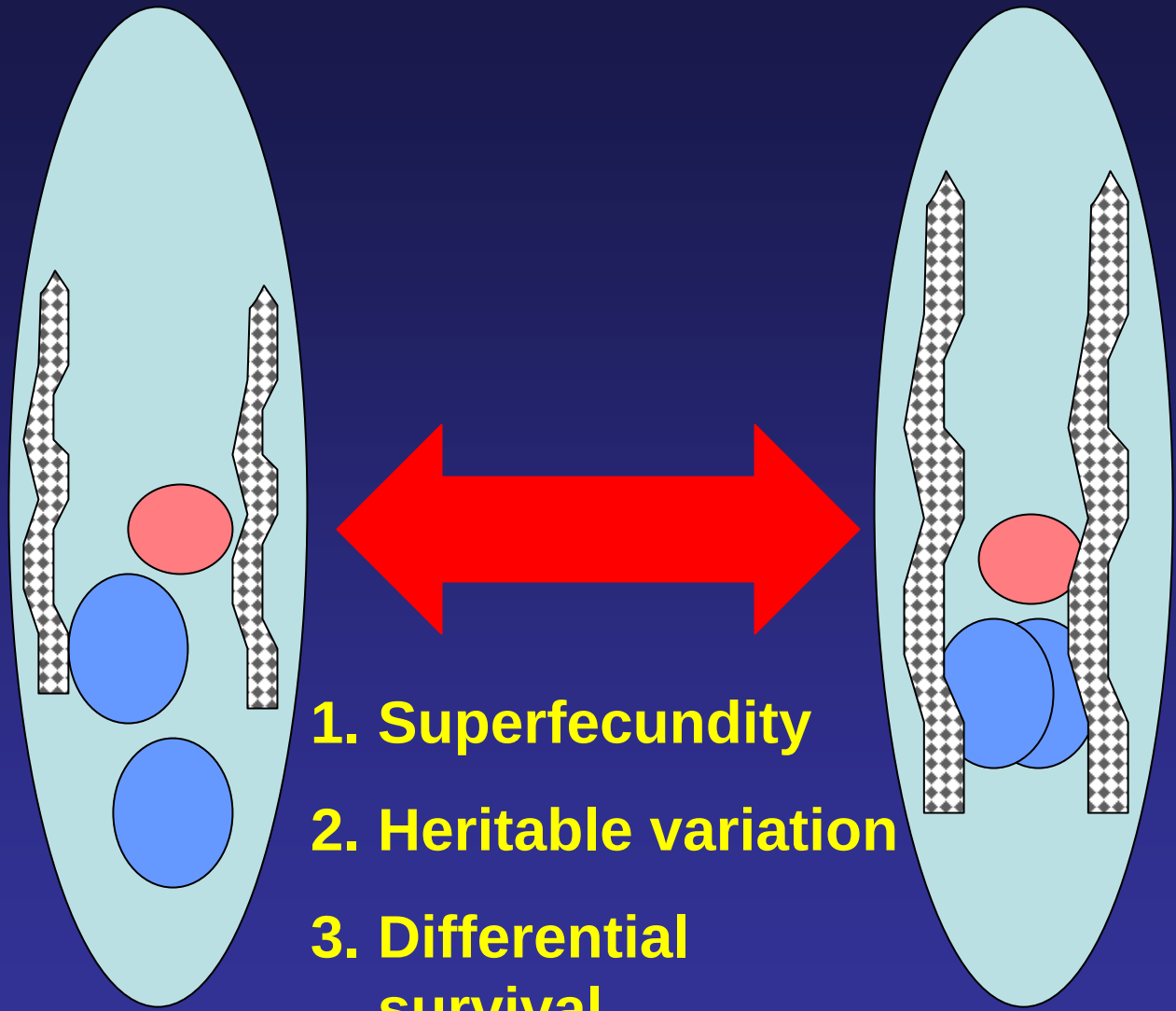
SI#3. The fundamental Darwinian principles can explain the diversity of reproductive anatomy in trematodes (cestodes, nematodes, etc.).





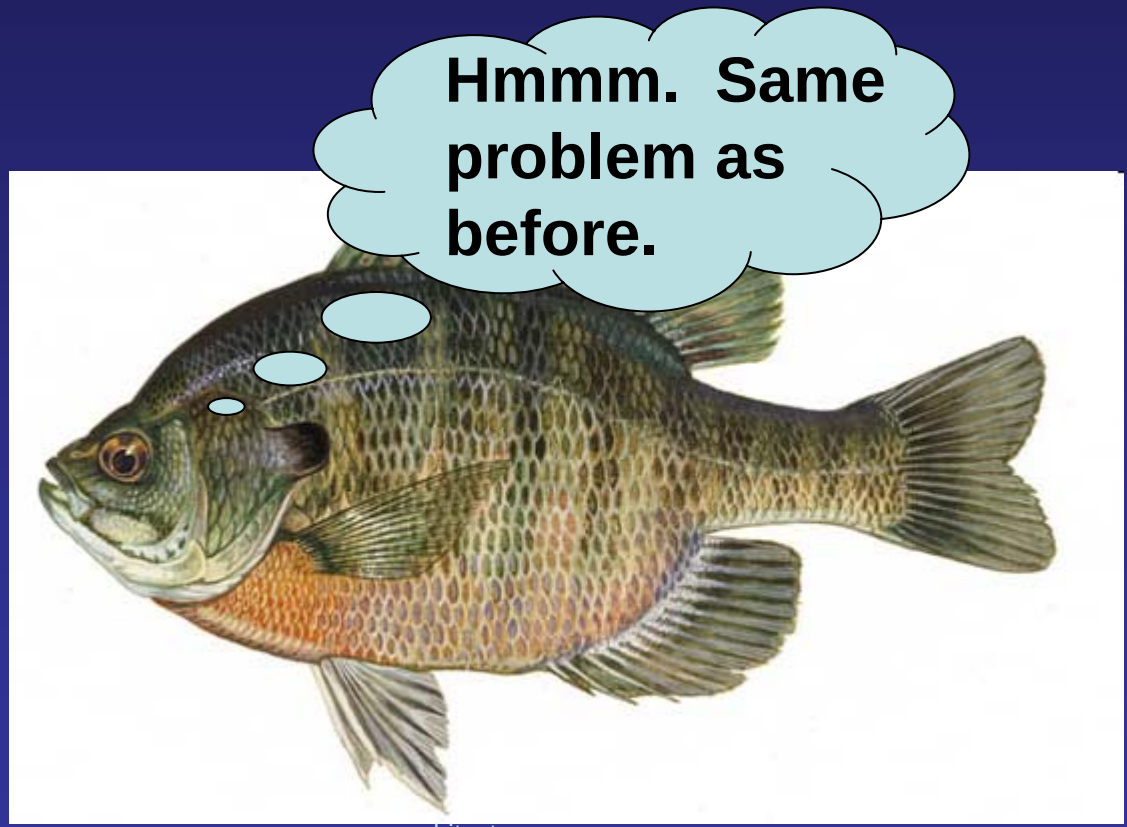


1. Superfecundity
2. Heritable variation
3. Differential survival

Conditions necessary for Darwinian selection for testis position

- More adult trematodes produced than can survive in all available hosts and infection sites to which they have access.
- Testis position must be inherited.
- The slightest change in testis position must be of survival advantage to worms (all other survival factors rendered inconsequential)

Can fundamental Darwinian principles account for internal structural diversity in trematodes?



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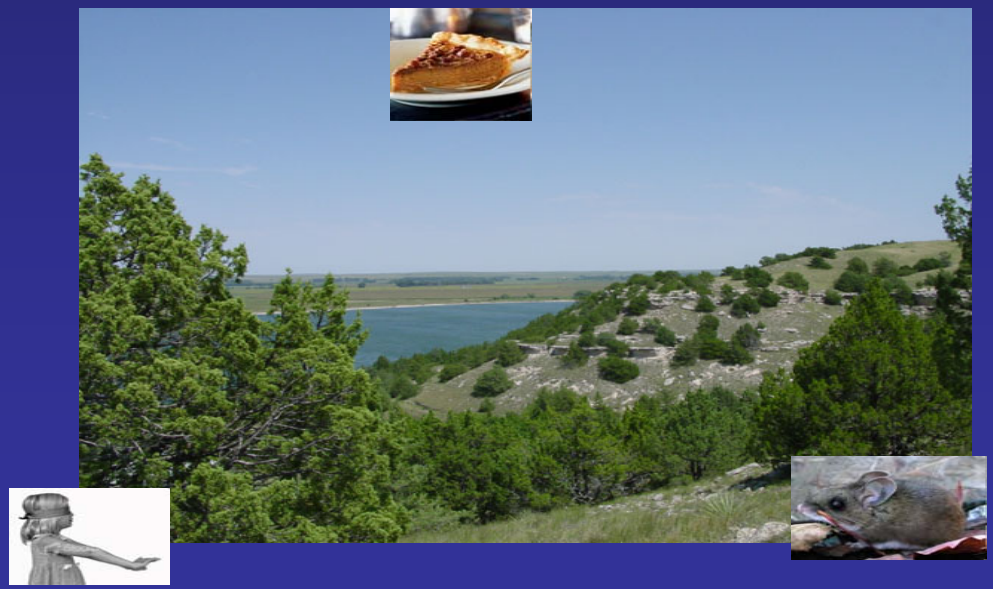
So, where do really stupid ideas come from?

The origin of stupid ideas about the most common way of life on Earth:

- Ignorance
- Transfer of the human experience to the natural world



“The natural world need not be logical in any obvious way. Science does not consist of imposing our reason on the world but rather reducing our preconceptions to the point that the world imposes its logic on us. This is very difficult indeed, involving a minimalization of our ego while maintaining our full powers of observation and receptivity. The capacity to perform this feat is what the teacher of science attempts to foster in the student. No one succeeds completely.”

--L. Slobodkin (from *Simplicity and Complexity in Games of the Intellect*)