Learning Goals
- Course objectives
- Course logistics

Introduction to Course
Presentation 1.1

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Purpose & Scope
- Initial knowledge and problem-solving skills
- For educators, scientists, practitioners
  - Guides: Mike, Neomi, Hugo are your safety net
  - links are on course home page (outside elearning)
- Scientific Content: 4 Parts
  - Part 1. Minds: Instinct & Intelligence
  - Part 2. Social: Living in Groups
  - Part 3. Mating: From Birth to Maturity
  - Part 4: Physical: Finding Food & Shelter

Objectives Q1.1
1. Participate regularly in dialogue
   - Clarify knowledge (chats in-class or on-line, field trip)
   - Strengthen communication skills (problem-solving)
2. Comprehend readings & lectures
   - Short-term: discover & remember fun facts & general concepts
   - Distinguish between folk psychology & scientific perspectives
3. Inquire about evidence to test scientific hypotheses
   - Inquiry activities: stimulate observation and critical thinking
   - Experiential learning to integrate concepts & examples
4. Apply general concepts to specific examples
   - Search scientific sources for examples relevant to you
   - Long term: prepare to answer 'in-the-spotlight' questions

Reasoning behind each objective:
- **Participate**: Communication is an important part of science and learning.
- **Comprehend**: Get information from readings and lecture into short term memory.
- **Inquire**: To build a concept map to be able to store and retrieve information in long-term memory; by asking and answering questions.
- **Apply**: To reinforce information in long term memory, apply the knowledge you have learned with experience.
### Grading tied to learning objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Assessment</th>
<th>Earn reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Comprehend</td>
<td>Assessment tool: weekly quizzes on reading assignment</td>
<td>10 @ 10 pts= 100</td>
</tr>
<tr>
<td>4. Apply</td>
<td>Discussion &amp; Assessment tools: Formative: BLOG discussions Summative: Final Exam</td>
<td>4 @ 7 pts = 28 pts 24 @3pts = 72 pts</td>
</tr>
</tbody>
</table>

This is how we will pace ourselves toward meeting the course objectives.

- We will engage in dialogue in class/chat, re. the study questions for the quiz and lectures,
- Read textbook pages assigned for each weekly unit and take the quiz on elearning. You may repeat quizzes twice at your own convenience during the week. Your grade will be averaged.
- Watch the 3 lecture presentations for each unit
- Observe and record behavior of animals viewed on video clips linked to Excel workbooks provided on CD rom.
- Practice short answers to spotlight questions by BLOG discussions for the comprehensive final

See links in the “getting started” folder on elearning

For teaching philosophy, visit the link to [meet the prof] near the howling wolf on the lower right corner of the course homepage (outside elearning)

http://people.tamu.edu/~j-packard/courses/wfsc422/MeetingDrPackard.html

See Syllabus

Problem Solving

Send a PS message with these four parts
1. Problem- “my view of this issue is…..”
2. Good Aspects- “despite this issue, it is good that…..”
3. Options- “possible solutions could be: (a)…. (b)…..”
4. Preferred Option- “option #b works best for me, because…”

Decide what type of problem
- Personal: safety net in case of need (no points awarded)
- Shared: points awarded for course upgrades that benefit all

1.1 Action Items

Go to the “Start here” folder
- Read the details on the [Syllabus]
- Read the [Schedule] and do the “Week 1” checklist
- Read [Technical Help] and [Resources] for problem-solving

Use the elearning tools
- Email tool: read and reply
- Chat tool: DE sections “eve chats”
- Discussion tool: introduce yourself; read/reply to BLOG1 question Q1.1
- Assessment tool: read assignment for Unit 1 and do quiz1
- Assignment tool: do A1 Participate

Get to know your favorite guide

Mike (education perspective)
Neomi (scientific perspective)
Hugo (practical perspective)

TIP #1: use this tutorial as a "life vest" from the very beginning

This is your safety net if any problems arise. See links in the “getting started” folder

http://people.tamu.edu/~j-packard/courses/wfsc422/Documents/PS.pdf

By next lecture, your job is to complete these action items.

We will have action items at the end of each presentation, to break the lecture into “learnable chunks”
Learning Goals
• Myths- Folk Psychology
• Scientific fore-fathers

Scientific thinking is shaped by the people who have done the research. The founding fathers of ethology were interested in zoology and natural history. This differentiates “ethological perspectives” from the “psychology perspectives” you might find in a course on animal behavior in the psychology department.

Our understanding of behavior shapes and is shaped by our experiences
• Most of us start with Folk Psychology words to explain our experiences with our pets
• Science challenges us to examine our underlying mental models
• Are we projecting our own assumptions on others?
• How would I test the match between reality and my mental model?

What is Folk Psychology?
¬ A reflection of our own minds (Lorenz 1973)
¬ Explaining behavior in terms of
  ▪ Desires- the dog “wants”
  ▪ Beliefs- the dog “thinks”
  ▪ Emotions- the dog “feels”
¬ Not a scientific perspective (what is the evidence?)
  ▪ Test it!- how do I know what you feel?
  ▪ Mental models- personal experience varies

Scientific Perspective: Helps us...
¬ Move beyond Folk Psychology (FP)-toward a more scientific mindset
¬ Test which of our “mental models” best match reality
¬ Increase understanding from 4 “angles of view”
  ▪ How? (Cause & Development)
  ▪ Why? (Evolution & Function)
¬ Understand our explanations for behavior are reflections of the questions we ask: myth (FP) or science (CDEF)?

• Pioneers in the science of ethology provided guidelines
• Shared mental models- how would we agree on what is the best model?
• Test it! The scientific method goes beyond personal experience to shared experience. Science provides rules that we use to agree on what is valid in the experience of more than just one person.
We introduce here the shorthand for Folk Psychology (FP) and scientific perspectives (CDEF) For more elaboration, look at links under “getting started”.
Before the 1970’s- European & American Schools
1. European Schools: ethologists were curious naturalists; observations and field experiments; Nobel prize awarded in 1973
   * Pioneering studies- moving beyond folk psychology
   * Basis for the scientific study of behavior
   * Tinbergen & Lorenz more well-known
   * Critique: Halliday (1996) does not mention von Frisch

2. American: funding related to the war effort; labs
   * Critics of the European school
   * Concern about “Social Darwinism”
   * More to follow (effects of modern technology)

Konrad Lorenz- imprinting in geese (CD); comparison of species-typical behaviors in waterfowl (EF)

I had the distinct pleasure of learning from him as an undergraduate intern on his research project at the Max Plank Institute in Germany

Niko Tinbergen-

Good friend of Lorenz until they were distanced by WWII. He tested the hypotheses that Lorenz proposed.
These are the four questions that Tinbergen defined as basic to all biology. Ethology fits within this framework.

Critique: Halliday only mentions three of these four. Can you identify which one he left out? (pg. 9)

Source: Tinbergen (1952) see links to concept map

http://people.tamu.edu/~j-packard/scienceinaction/concepts.pdf

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1. **neuro-ethologists** (motivational system: nerves/hormones)
   - Robert Hinde- hormones & brooding in canaries
   - Daniel Lehrman- hormones and dove courtship

2. **comparative psychologists** (CE);
   - Don Dewberry- copulatory behavior in rodent species
   - Tolman - how do different species open puzzle boxes?
   - Harry Harlow – social development of infant monkeys?

3.1 **behaviorists (learning: stimulus + reward => response)** (C)
   - B.F. Skinner- lab rats in operant conditioning boxes

3.2 **cognitive ethologists** (PC, UE)
   - Donald Griffin- bat use of sonar, animal thinking
   - Penny Patterson- sign language in gorillas (lab)
   - Irene Pepperberg- thinking abilities of parrots (lab)
   - Karen Pryor- clicker training in applied behavior

4. **Behavioral ecologists & field biologists**
   - E.O. Wilson- ant colonies- why do individuals cooperate?
   - Jeanne Altmann- mothering in baboons; techniques
   - Diane Fossey- gorillas, Jane Goodall- chimpanzees, wild dogs, Craig Packer- lions, Tim Caro - cheetahs

**TIP:** to post replies to the Discussion Questions, use the “Discussion Tool” in elearning (top menu bar, or direct link in the Learning Module for each unit)
Learning Goals
• Proximate Cause & Development
• Ultimate Function & Evolution

Basic Questions: How? Why?
Presentation 1.3

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Learning Goals
• Proximate Cause & Development
• Ultimate Function & Evolution

Concept Map = Conceptual Framework
AB=CDEF => Animal Behavior = Cause + Development + Evolution + Function

HOW- Proximate
- at the individual level in the hierarchy of Biology
- Analogous to a telephoto lens- “zoom in”

WHY- ultimate
- at the population level in the hierarchy of Biology
- Analogous to wide-angle lens- “zoom out”

CAUSE differs from DEVELOPMENT because it is more a snapshot (in contrast to a video of change over time)
- CAUSE: Snapshot- static pattern (stimulus/response/state)
- DEVELOPMENT: Video- dynamic change (maturation w/ age)

“How” Questions- Proximate
Q1.4 Cause?
• Stimulus/response
• Internal state (mood)
• External context (cues, rewards)

Q1.5 Development?
• Maturation (change with age)
• Nature/nurture (genotype/phenotype)
• Instinct/learning (heritability of traits)
Concept Map

Function is more like a snapshot, Evolution more like a video
- Function: Snapshot-static pattern (which genotypes have higher fitness at a point in time?)
- Evolution: Video-dynamic change (phylogenetic history of species, convergent, divergent)

“Why” Questions- Ultimate

Q1.6 Evolution?
- Convergent (different branches become more similar)
- Divergent (similar branches become more different)
- Ancestral vs. derived traits (trunk vs. stems)

Q1.7 Function?
- Those genotypes that survive better...
- Those genotypes that reproduce better...
- % of genotypes changes between generations

Ultimate is scientific word for the Why? Category of questions
- Refers to gene pools: population level of biology (groups of individuals that interbreed)
- Tinbergen: “What is the survival value of a particular behavior?” (c.f. Halliday 1994:9)- function
- There was also a fourth question: What is the phylogenetic history of a behavior? - evolution

Evolution- like the phylogenetic tree- over thousands to millions of years
- Convergent (similar- the branches come together)
- Divergent (different- the branches grow apart)
- Ancestral vs. derived traits (trunk vs. stems)

Function- from one generation to the next
- Those genotypes that survive better than others in the gene pool
- Those genotypes that reproduce better than others in the gene pool
- % of genotypes changes between generations
Slide 6

**Similarities: Review and elaboration**

- **HOW?** Proximate (individuals, genotypes)
  - Cause & Development
  - “Close-up lens” on individuals

- **WHY?** Ultimate (populations, gene pools)
  - Evolution & Function
  - “Wide-angle lens” on populations

So in review, C&D are both similar because they apply to individuals (genotypes within them).

E & F are similar because they apply to populations (Gene pools).

Slide 7

**Pattern is a “Snapshot”: Tinbergen’s basic questions**

<table>
<thead>
<tr>
<th>Analogy AB=CD</th>
<th>Pattern “Snapshot”</th>
<th>Process “Video”</th>
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<tbody>
<tr>
<td>HOW? Close-up lens</td>
<td>C: How does the stimulus cause a response?</td>
<td>D: How do responses change with age?</td>
</tr>
<tr>
<td>WHY? Wide-angle lens</td>
<td>F: Why might the environment influence the fitness of genotypes with this behavior?</td>
<td>E: Why has this behavior changed during evolutionary history?</td>
</tr>
</tbody>
</table>

Cause and function are more like a snapshot.

Causes: pattern of behavior in individuals
Function: fitness of genotypes in populations

Slide 8

**Process is a “Video”: Tinbergen’s basic questions**

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</table>

Development and evolution are more like a video.

Development: change in individuals
Evolution: change in species
Differences: Review and elaboration:

- Pattern “snapshot”
  - **HOW**: Proximate Cause “close-up lens on individuals”
  - **WHY**: Ultimate Function “wide-angle lens on populations”

- Process “video”
  - **HOW**: Proximate Development “close-up lens on a lifetime”
  - **WHY**: Ultimate Function “wide-angle lens on geological eras”

Cause differs from Development, because it is more like a snapshot than a video in the lifetime of a maturing individual.

Function differs from Evolution, because it is more like a snapshot rather than a video of the evolutionary history of a species.

### Review Concept Map - Scientific Perspective is CDEF

<table>
<thead>
<tr>
<th>Analogy</th>
<th>Animal Behavior</th>
<th>AB=CDEF</th>
<th>SNAPSHOT</th>
<th>VIDEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW?</td>
<td>Close-up lens</td>
<td>CAUSE</td>
<td>Shorter slice in time</td>
<td>Longer period of time</td>
</tr>
<tr>
<td></td>
<td>Proximate</td>
<td></td>
<td>Static pattern</td>
<td>Process of change</td>
</tr>
<tr>
<td>genotype</td>
<td></td>
<td>DEVELOPMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHY?</td>
<td>Wide-angle lens</td>
<td>FUNCTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ultimate Gene pool</td>
<td>EVOLUTION</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example from assigned reading Halliday (1994)

Anemone fish are protected by the stinging venom of the anemones and chase off other fish that might otherwise harm the anemones.

How might this have evolved?

Search for recent sources using http://scholar.google.com

Sources: (Hattori 2012, Hines & Pawlik 2012)
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Apply concepts - defense action of anemone fish

<table>
<thead>
<tr>
<th>Analogy AB=CDEF</th>
<th>Pattern “Snapshot”</th>
<th>Process “Video”</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW? Close-up individuals</td>
<td>C: Stimulus-predatory fish invading an anemone</td>
<td>D: young males chase; presence of a female inhibits growth of small fish; when female is removed, male gonads change to female</td>
</tr>
<tr>
<td>WHY? Wide-angle lens on populations</td>
<td>F: Cause-reduced predation on larval fish</td>
<td>E: divergent-ancestral species did not tolerate sting of anemones; derived species have a thick mucous protection</td>
</tr>
</tbody>
</table>

CAUSE
- Stimulus: anemone
- Response: enter tentacles

DEVELOPMENT
- Instinctive response – hard wired in genotype

EVOLUTION
- Diverged- other fish are punished by the toxins in the anemone

FUNCTION
- Hypothesis A: Symbiosis: Those fish that were tolerant of anemone were protected & got food; co-evolution of anemones- benefit because wrasse chase off other fish
- Hypothesis B: Comensal: Fish benefit from anemone, but the anemone is neither hurt nor harmed by the fish

Groupers come to a “cleaning station” on the reef and wrasse remove debris from their mouths

Putting this all together is like detective work, find the missing information from recent sources (Adam 2012)

To find this source on Web of Science, search for: “Mutualistic cleaner fish initiate trait-mediated indirect interactions by influencing the behaviour of coral predators”

(TIP: Web of Science is a search engine on http://library.tamu.edu)

Slide 13

Apply concepts to another example- cleaner wrasse

SOURCE: (Turner 1994: 108)

Groupers come to a “cleaning station” on the reef and wrasse remove debris from their mouths

Putting this all together is like detective work, find the missing information from recent sources (Adam 2012)

To find this source on Web of Science, search for: “Mutualistic cleaner fish initiate trait-mediated indirect interactions by influencing the behaviour of coral predators”

(TIP: Web of Science is a search engine on http://library.tamu.edu)

CAUSE
- Stimulus: large fish
- Response: approach & eat particles of skin & other debris

DEVELOPMENT
- Instinctive- initial approach
- Learned- where the large fish “hang out” for cleaning

EVOLUTION
- Divergent: cleaner wrasse diverged from other wrasse that do not show this behavior
- Convergent: cleaner shrimp show similar behavior

FUNCTION
- Those genotypes that cleaned, got more food and contributed more genotypes to the next generation than those that did not clean

Slide 14

Concept Map- cleaning behavior of wrasse

<table>
<thead>
<tr>
<th>Analogy AB=CDEF</th>
<th>Snapshot</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW? Close-up lens on individuals</td>
<td>C: stimulus - food particles in the mouth of parrot fish; response - entering &amp; feeding</td>
<td>D: nature- occurs in all ages and all individuals; nurture- they learn the location of where to expect to find parrot fish</td>
</tr>
<tr>
<td>WHY? Wide-angle lens on populations</td>
<td>F: effect-cleaner genotype survived and reproduced better Cause- better nutrition</td>
<td>E: divergent-ancestral species did not clean; derived species coevolved with parrot fish</td>
</tr>
</tbody>
</table>

CAUSE
- Stimulus: large fish
- Response: approach & eat particles of skin & other debris

DEVELOPMENT
- Instinctive- initial approach
- Learned- where the large fish “hang out” for cleaning

EVOLUTION
- Divergent: cleaner wrasse diverged from other wrasse that do not show this behavior
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FUNCTION
- Those genotypes that cleaned, got more food and contributed more genotypes to the next generation than those that did not clean
Take home message: Tinbergen’s basic questions

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<td>C: How does stimulus cause response?</td>
<td>D: How do responses change with age?</td>
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<tr>
<td><strong>WHY? Wide-angle lens</strong></td>
<td>F: Why might the environment influence the fitness of genotypes with this behavior?</td>
<td>E: Why has this behavior changed during evolutionary history?</td>
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</tbody>
</table>

We have reviewed the four major questions of ethologists and illustrated how they apply to three behavioral traits. This is to help develop your conceptual map that will be a foundation for learning in the rest of the course. It is the bottom line learning goal. Even if you forget all the details, if you have mastered the concept map by the end of the course, the effort will be worthwhile. It is basic to biological science in our modern society.

1.3 Action Items: apply concepts to examples

- **Prepare your answers for Q1.4 - Q1.7**
  - Halliday (1994): e.g. use the index to find pages for "anemone fish" "cleaner fish"
  - Dugatkin (2002): e.g. use index to find pages for "Tinbergen N" "ethology"
  - search for scientific sources on Web of Science (TIP: see [Technical Help] link)
  - choose another example more relevant to you (from textbook or other source)
  - read on BLOG Q1.4 - Q1.7 about the variety of examples others chose
  - practice critical thinking "where's the evidence behind the myth?"
  - TIP: for help with these concepts, read the tutorial linked to your guide’s webpage

- **OPTIONAL: chat &/or BLOG to earn participation points**
  - volunteer to chat about your answer to a question (you choose from Q1.1 - Q1.7)
  - post a comment to BLOG to get feedback about your answer (any time before Part 1 review session)
  - Dialogue on BLOG to help someone else practice critical thinking skills
  - TIP: read [Evaluation Criteria] link to clarify how to earn points on chat & BLOG

Elaboration on the example of Tinbergen’s sticklebacks

Want to learn more?
Example: Stickleback fish stimulus/response

Females have silver belly (eggs), males have red belly (testosterone).

Males display “head down” or chase other males, they do a zig zag dance in front of females. Females follow male and lay in the male’s nest. He fertilizes the eggs in the nest.


Q1.4 How? Proximate Cause

- **Proximate (genotype)**
  - How individuals respond to a stimulus
  - How genotypes differ in responses
  - Analogy: close-up lens on individuals
- **Cause: A static “pattern” (short slice in time)**
  - One maturational stage:
    - How different stimuli cause different responses
    - How responses to the same stimulus differ with internal state
  - Analogy: snapshot of one developmental stage in a lifetime

I recommend memorizing this information to help you distinguish between these four questions.

Q1.4 Tinbergen’s experiment- Proximate Cause

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Test model</th>
<th>Internal state of male stickleback</th>
<th>Male response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male rival</td>
<td>red underneath</td>
<td>Testosterone</td>
<td>Head down display</td>
</tr>
<tr>
<td>Gravid female</td>
<td>Silver underneath</td>
<td>Testosterone</td>
<td>Zig-zag dance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Castrated- no testosterone</td>
<td>No response</td>
</tr>
</tbody>
</table>

FP for “internal state” is mood or emotion; the evidence that a male has high testosterone is the red belly.

To test his hypothesis, Tinbergen tested whether males respond to “stick models” with the appropriate color. They did. This is evidence the fish do not “know” it is a female. They simply respond to the color. Adult males that do not have high testosterone, due to experimental castration, do not respond in the same way.

Tinbergen watched a male do a head down display in response to a red mail truck outside the window!
Q1.5 How? Proximate Development

- **Proximate (genotype)**
  - How individuals respond to a stimulus
  - Analogy: close-up lens on individuals

- **Development: dynamic “process” of change**
  - How response to the same stimulus changes with age during several stages of maturation
  - Nature/nurture: how environment influences expression of genes
  - Analogy: VIDEO of the timelines of individual lives


As testosterone increases with age, the coloration of male sticklebacks increases. This is a developmental change which is highly heritable, suggesting it is controlled by genes turning on at a particular stage of ontogeny.

It also re-occurs with the season, testosterone increases with long days in the spring, and decreases in the fall.

Behavior of males changes with age, caused by the change in testosterone levels with maturation.

Q1.6 Why? Ultimate Evolution

- Ultimate (gene pool)
  - Why genotypes vary among populations
  - Analogy: wide-angle lens on populations

- Evolution: dynamic “process” of change
  - Why species changed over phylogenetic history
    - Cause: changes in the environment (e.g., glacial eras)
    - Effect: divergence, convergence, phylogenetic inertia
  - Analogy: VIDEO camera on the timeline of one species


Q1.6 Example - Ultimate Evolution

<table>
<thead>
<tr>
<th>Genus of stickleback</th>
<th>Divergent Traits</th>
<th>Environmental Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancestral - Autorhynchus</td>
<td>No zig-zag dance Eggs laid on plants</td>
<td>Marine Fewer egg predators?</td>
</tr>
<tr>
<td>Derived - Gasterosteus</td>
<td>Zig-zag dance Eggs laid in nest</td>
<td>Freshwater More egg predators?</td>
</tr>
</tbody>
</table>

Q1.7 Why? Ultimate Function

- Ultimate (gene-pool)
  - Why genotypes vary among populations
  - Analogy: wide-angle lens on populations

- Function: static “pattern” (short slice in time)
  - Why some genotypes are more fit than others
    - Cause: “match” to the environment at that point in time
    - Effect: contribute higher % to gene pool of the next generation
  - Analogy: SNAPSHOT of one generation

Memorize!
### Q1.7 Example - Ultimate Function

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Which is more fit and why?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zig-zag dance</strong></td>
<td>More fit - increase % If dancers attracted more females (and got more copulations), then the % of this genotype would have increased in the gene pool of the population in the next generation.</td>
</tr>
<tr>
<td><strong>No dance</strong></td>
<td>Less fit – decrease % If dancers were less attractive to females, then fewer copies of this genotype would have been passed on to the next generation of the gene pool, and the % would have declined.</td>
</tr>
</tbody>
</table>

NOTE: this is a mental model based on the effect of the environment on the % genotypes in the population; it is worded in terms of the past, so would be considered scientific.

RED FLAG: if it was worded in terms of the best design for the future or for the survival of the species, then it would be Folk Psychology (because it implies the species wants to survive; we have no evidence for a whole species having a desire). To say the species wants to survive is projecting human anthropomorphism onto other species.

### Integrate concepts as applied to the zig-zag dance trait

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<tr>
<td><strong>AB = CDEF</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>HOW? Close-up lens on individuals</strong></td>
<td>C: mature males dance in response to the stimulus of a silver belly</td>
<td>D: dancing increases with maturational changes in testosterone</td>
</tr>
<tr>
<td><strong>WHY? Wide-angle lens on populations</strong></td>
<td>F: those genotypes that danced, were more likely to have attracted more females and protected more offspring, so they would have contributed more genes to the gene pool of the next generation</td>
<td>E: divergent- Ancestral marine species laid eggs on plants, no dance; Derived freshwater species made a nest, danced, &amp; defended nest from predators</td>
</tr>
</tbody>
</table>

Putting this all together is like detective work, find the missing information from recent sources.