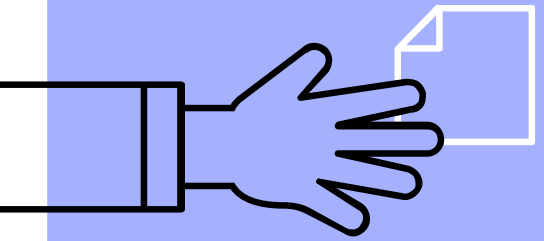
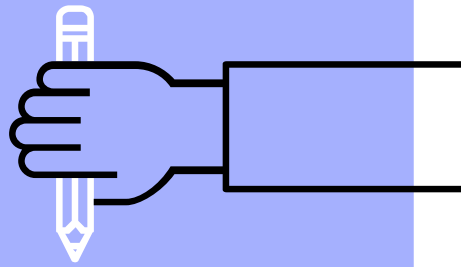


Icebreaker Question

Is cereal a soup?



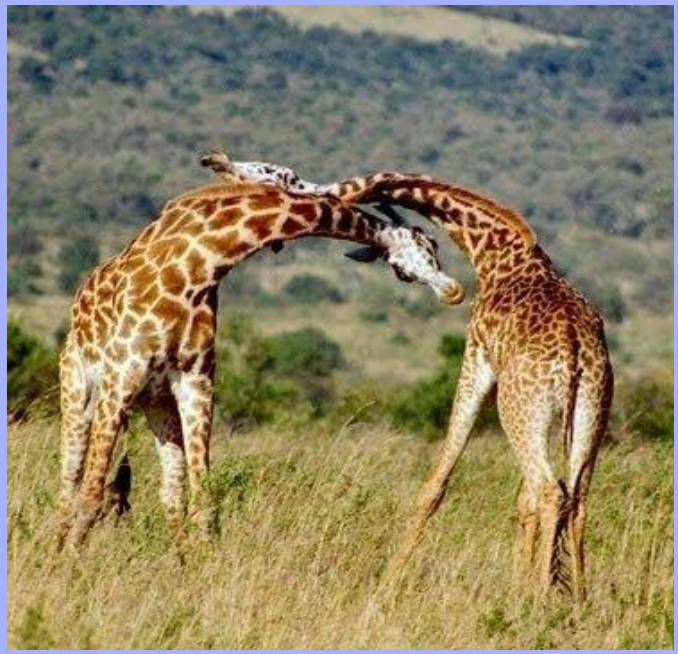




Recap

Previously, we learned...

- Neuroethology: questions about causation of animal behavior answered with neuroscience
- Behavior: observable action
- Researchers create hypotheses
  - Giraffes don't have long necks to reach high leaves on trees
  - Instead use necks to fight





“

Behavior *= giraffes have long necks*

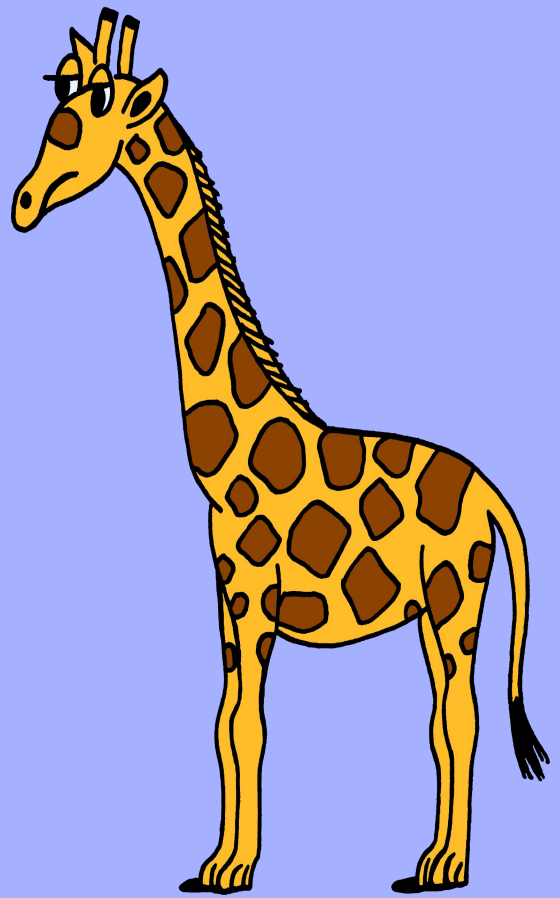
Why *does this behavior exist? (why is it caused)*

How *does this behavior exist? (how is it caused)*



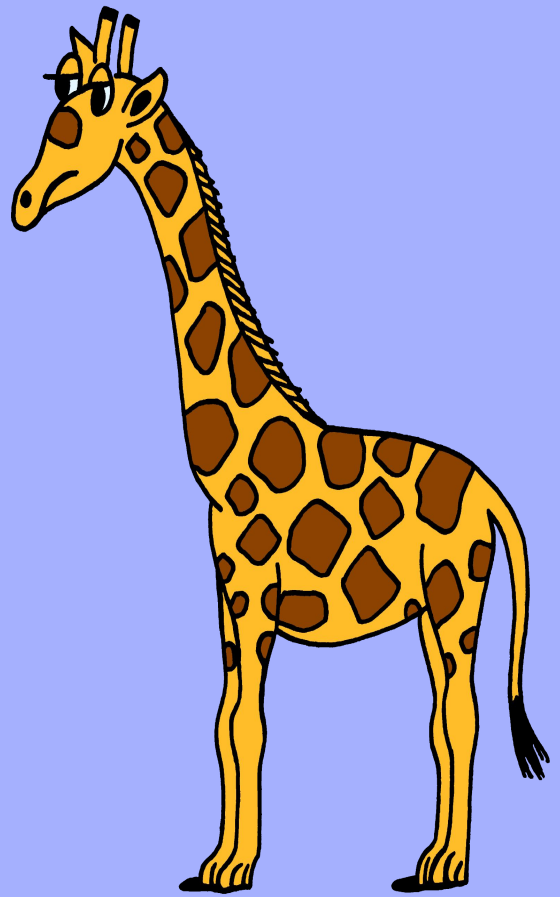
Tinbergen's 4 Levels of Analysis

Type	Level of Analysis
"How" Questions	1. Mechanisms - Physiological - Cognitive 2. Developmental (Ontogenetic) Processes - Development during the animal's lifetime
"Why" Questions	3. Function - Behavior exists because of its Effects on Fitness (i.e. enhances survival of the organism) 4. Evolutionary History - Traits exhibited today have a evolutionary history through the use of phylogeny and evolutionary trees



Tinbergen's 4 Levels of Analysis

There are 4 general types of answers to the question: "What causes animal A to exhibit behavior X?"	
(1) Mechanistic	How does it work physiologically? Or cognitively?
(2) Developmental (Ontogenetic)	How does it develop during an individual's lifetime? What are the roles of genes and learning?
(3) Function (Fitness Effects)	What is it for? Why is it maintained by natural selection?
(4) Evolutionary	What are its evolutionary origins / ancestral characteristics? How did it evolve over the history / lifetime of the species?





What causes the Emperor penguin to flap its wings underwater?

Ex) Emperor Penguins

What causes the Emperor penguin to flap its wings underwater?

Let's brainstorm! What could be a hypothesis based on a level of analysis?

Video link:

https://www.youtube.com/watch?v=A9mbCNs47FI





Hypotheses

(1) Mechanistic	
(2) Developmental (Ontogenetic)	
(3) Function (Fitness Effects)	
(4) Evolutionary	





Hypotheses

(1) Mechanistic	Muscle make the wings move
(2) Developmental (Ontogenetic)	
(3) Function (Fitness Effects)	
(4) Evolutionary	





Hypotheses

(1) Mechanistic	Muscle make the wings move
(2) Developmental (Ontogenetic)	The wings “flapping” movements are genetically determined.
(3) Function (Fitness Effects)	
(4) Evolutionary	





Hypotheses

(1) Mechanistic	Muscle make the wings move
(2) Developmental (Ontogenetic)	The wings “flapping” movements are genetically determined.
(3) Function (Fitness Effects)	Flapping keeps the penguin from drowning. It is necessary for fitness (survival).
(4) Evolutionary	





Hypotheses

(1) Mechanistic	Muscle make the wings move
(2) Developmental (Ontogenetic)	The wings “flapping” movements are genetically determined.
(3) Function (Fitness Effects)	Flapping keeps the penguin from drowning. It is necessary for fitness (survival).
(4) Evolutionary	Ancestors of penguins used these wings to fly. The emperor penguins acquired wings for underwater swimming from an ancestor who used to use to fly.

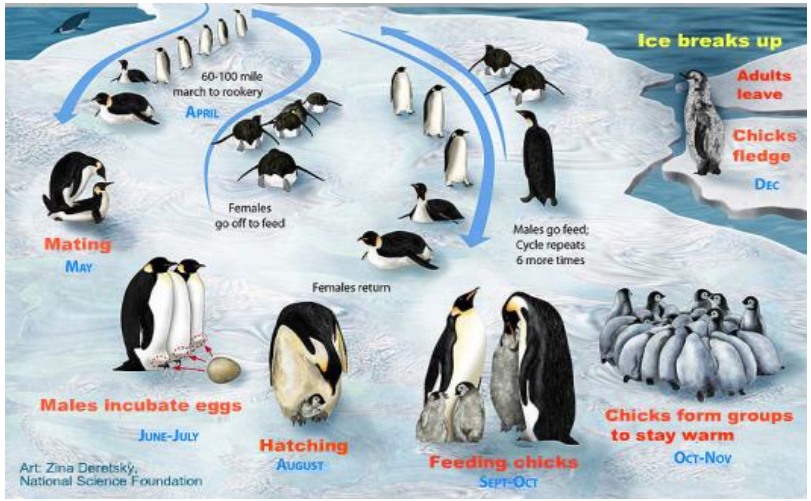




These different answers / hypotheses are <u>complementary</u> and <u>not mutually exclusive.</u>

An answer at one level of analysis does is not more important than an answer at another level (e.g. mechanisms are not more important than fitness effects, and vice versa).

A complete understanding of a behavior requires answers at all four levels of analysis!







In breakout rooms:

Watch the video of "romance" in the world of penguins and come up with hypotheses at each level of analysis (mechanistic, developmental, functional, evolutionary) to explain why they may be exhibiting certain behaviors to get a date!

Link:
https://www.youtube.com/watch?v=Azra2UV0wao

We will come back to the main room to discuss together afterwards!





Romance is in the air!


come at me bro

Main room discussion

What were some hypotheses your group discussed in breakout rooms?

What level of analysis (mechanical, developmental, functional, evolutionary) was your hypothesis?

Feel free to talk about any new thoughts that pop into your head!

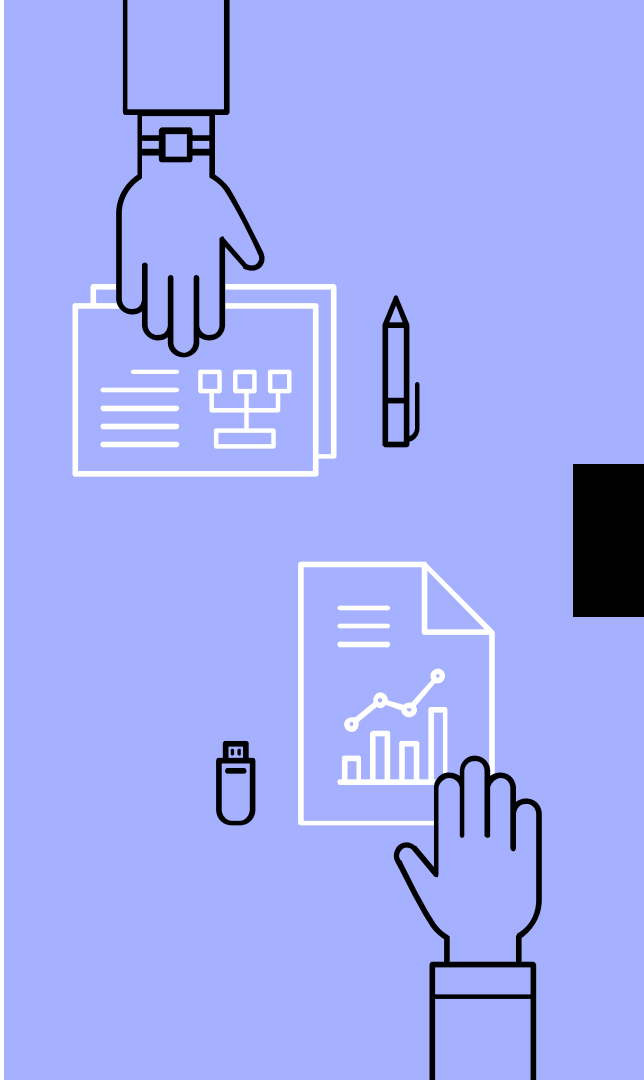


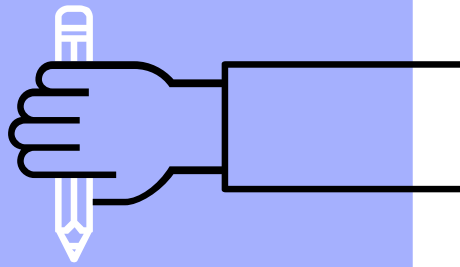


To be continued...

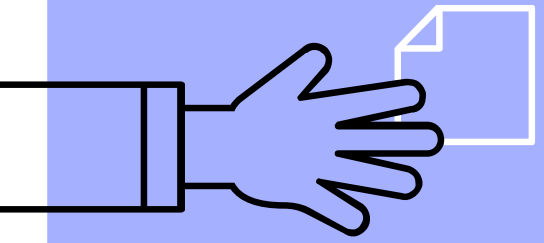
Next class:

- Examine real lab research projects
  - Learn what lab techniques are used for behavioral biology
  - Apply our learned skills to analyze a video of animal behavior!
- Intro to different types of bio labs at universities





End of Day 2



Any questions?
Please ask away!

Attendance Form