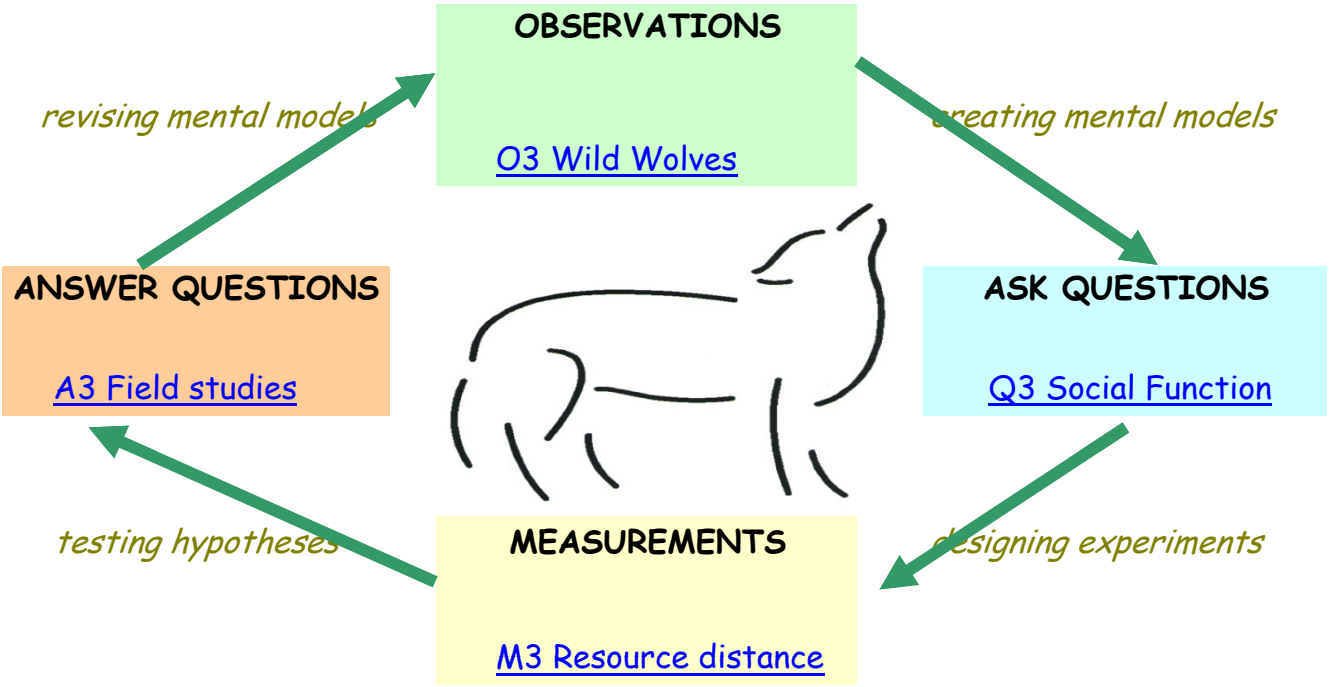
SCIENCE IN ACTION!

Nature's Partners: predators, prey & you

Wolf Inquiry Activity

Module 3. Wolf & Prey Partnerships



GENERAL LEARNING GOAL: Experience the nature of scientific inquiry

SPECIFIC OBJECTIVES FOR MODULE 3

3.1 Based on observations in the field, develop testable hypotheses about how social structure influences the sharing of food within wild wolf famllies.

3.2 Measure "resource distance" to test hypotheses about how social structure is related to food sharing in wild wolf families.

3.3 Evaluate the evidence about the adaptive function of food sharing, in ecosystems with abundance of large prey and scarcity of small prey.

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O3 Wild wolves- sharing prey in a family

STEP 1 Choose two video clips about a wild wolf family, which show behaviors related to sharing food. When you make your choice, consider whether you have sufficient information about the social structure of the wolf family in each video. In the column "VIDEO". Write the source information for each video in a separate box (bright green).**SAVE**. *OPTION: use clips 14-16 from the link to background information*

STEP 2 Observe the first video clip and write general notes on what happened in the box provided (white). Focus on the body language that influences how each member of the family gains access to the food item. Repeat for the second video clip. **SAVE**

STEP 3 Evaluate your notes from Step 2, to distinguish among observation (fact), inference (interpretation) and questions (see box below). Annotate your notes: underline observation place quotes around inferences; and insert question marks**SAVE**.

VIDEO	GENERAL NOTES ON WHAT HAPPENED

CODE	CATEGORY	DEFINITION	EXAMPLE
under-line	**Observation** (direct evidence)	what I actually saw, heard, smelled, or otherwise sensed about the animal anc its environment	junior wolves tucked their tails between their legs and pawed then licked the face of the senior wolf; he muzzled them when they got too close
"quotes"	**Inference** (indirect evidence)	what I (or others) think about what I observed; my underlying mental model	I think the juniors were offspring of the senior, probably from a litter the previous year
?	**Question**	what I'm curious to learn more about, to better understand what I observed; my hypothesis about cause/effect	I wonder if the juniors got to eat after the senior left the carcass

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Q3 Social function of conflict over access to prey

STEP 1 Discuss the meaning of the words "Structure" and "Function" as they are used in Folk Psychology. Contrast this meaning with the way ethologists use the words in terms of genotypes (read the box at the bottom of the page and the links provided on the Module 3 webpage) . Answer question #1 below**SAV**E *OPTION: Discuss how structure and function apply equally to behaviors as they do to examples of anatomy, as you have learned in other biology classes. Explore how genotypes control hormonal mechanisms underlying behavior as well as skeletal growth underlying anatomy.*

STEP 2 Analyze your notes from several observations of wild wolves sharing both large and small prey carcasses (O3). Answer questions #2 & #3 below. **SAV**E

STEP 3 Synthesize what you have learned about how social structure influences food sharing in the wild wolf families, and answer Question #4. **SAVE**. *OPTION: You may refer back to the systems charts that you examined for captive wolves. Discuss whether one chart fits all wolf families or if there is likely to be variation in wild families related to the age of the parents and cycles of scarcity in prey.*

STEP 4 Use what you have learned to write two testable hypotheses about the function of wild wolf packs. Discuss what evidence you would need to test your hypotheses. Answer Question #5**SAVE**

Question 1: In your own words, why is the meaning of "function" in ethology different than the meaning of "purpose" as used in folk psychology? (TIP: explain why genes are important)

My answer:

Question 2: What social behaviors cause junior wolves to stay away from a large prey carcass defended by a senior (parent)?

My answer:

Question 3: What social behaviors result in junior wolves gaining access to prey (large and small) caught by their seniors (parents)?

My answer:

Question 4:	How does the size of the prey and the age of juniors (pups) influence food sharing between seniors and juniors in wild wolf families?
My answer :	

Question 5:	In cycles of small prey surplus and scarcity, what is the function of the social structure of a wolf family? (TIP: think of questions you may answer by collecting data from videos you watched)	
Alternative Hypotheses	My Hypothesis:	Evidence I would need to test this hypothesis:
Example	In times of small prey scarcity, juniors that beg from seniors at a large prey carcass are likely to survive better.	(1) both juniors and seniors gain equal access to the prey carcass, juniors just wait until seniors are full, (2) juniors that beg and get some food are more likely to survive than those that disperse and go hungry, (3) tendency to beg is highly heritable
H1		
H2		

CONCEPT	MEANING	EXAMPLE
Structure	How something is put together; the pieces of a system and how they are related to each other; the boxes and arrows inside the "black box" of a system diagram.	In a wolf's jaw, there are 6 incisors, 2 canine teeth, 8 premolars and 4 molars. Half are on each side of the jaw, arranged from front to back in the order listed.
Function	How the structure influences the survival and reproduction of an individual's genotype, as compared to other genotypes in the population; the input and output arrows outside the "black box" of a system diagram	Better nutrition is correlated with better survival and reproduction.A variety of shapes of teeth help wolves catch and eat both small and large prey; canine teeth help hang on to prey during the kill, the incisors help pluck fur and feathers off the skin, the premolars help chew meat, and the molars help break bones; all resulting in more options and better nutrition during cycles of prey scarcity.

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M3 Measure resource distance

STEP 1 Choose one video clip that is about 2 minutes long, showing interactions of a family of wolves sharing food after a successful hunt. watch it an identify the seniors and juniors by name. For example, in clip 16 the 4 white wolves in the arctic Ellesmere Pack would be named "FATHER", "MOTHER", "JUNIOR", "BUBBA" *OPTIONS: View the clip provided or the whole video "White wolves". Discuss the features that are useful for identifying each individual and how you would know which were the juniors and seniors in a family. Discuss when you would use the name "father" rather than "senior male" or "alpha male".*

STEP 2 Start the video and let it play until you see more than one wolf in the frame then pause the video. Decide which of the wolves you named are close enough to the carcass to feed on it. For each wolf in the chart below, write a "yes" or "no" in the first line of the chart. **SAVE**

STEP 3 Play the video for 30 seconds then pause it again; fill out the next empty row of the table; repeat until the video is finished. **SAVE**

STEP 4 Count the number of boxes with "yes" in the column for each wolf and answer Questions A-C. **SAVE**

Time counter	**FATHER**	**MOTHER**	**JUNIOR**	**BUBBA**
0 sec				
30 sec				
60 sec				
90 sec				
120 sec				
Calculated "yes" Count:	0	0	0	0

Question A:	What was the "yes" count for FATHER?	What was the "yes" count for MOTHER?	What was the "yes" count for JUNIOR?	What was the "yes" count for BUBBA?
My "yes" Count:				

Question B:	**Which individual(s) had the least access to the carcass?**
My answer:	

Question C:	**Based on this evidence, which of the hypotheses from Q3 can you reject as "not a good model" (explain)?**
My answer:	

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A3 Field studies- social systems and food webs

STEP 1 Choose a source to read about the function of wolves in the food web of a particular ecosytem. Answer Questions #1 & 2. **SAVE**. *OPTIONS: Follow the links on the Module 3 webpage. Search the links provided on the Background Information page. Within your collaborative learning group, compare notes from different ecosystems, some with large prey and some with small prey. Discuss the evidence that the available prey cycles through periods of scarcity and surplus in dynamic ecosystems. Discuss the analogy of temperature cycling above and below the setting of a thermostat.*

STEP 2 Analyze how the size of the prey influences the wolf social system in the ecosystem described in your source. To do this, you will need to synthesize information from your source, O3, Q3 and M3. Think about whether a junior wolf is likely to stay with the family if begging is not successful because the prey is too small to share. Think about whether a junior would be more likely to be successful hunting alone in an ecosystem with a surplus of small prey compared to an ecosystem with only large prey. Think about whether the number of families in a population would increase under conditions where more juniors disperse from their parents' families and find mates of their own. Answer questions 3 & 4.**SAVE**. *OPTIONS: View the presentation linked to the Module 3 webpage. Discuss your answer with others in your collaborative learning group. Revise as needed to paraphrase witihout plagiarism.*

STEP 3 Analyze the adaptive function of switching from begging to hunting. To do this, you will need to think about what happens when a junior wolf goes hungry and what this means for survival and reproduction of individual genotypes. Answer questions 5 & 6.**SAVE.** *OPTION: View the presentation linked to the Module 3 webpage. Discuss your answer with others in your collaborative learning group. Is the junior more likely to die inside or outside the family group? Is it more likely to reproduce inside or outside the family? Is "switching" behavior likely to be a heritable genotype, or simply a phenotype? (see below)*

STEP 4 Apply the concepts you have learned in this activity, to answer four basic questions about one behavior, food begging. A systems table is provided for you to organize your thoughts. Notice that the rows are about wolves at two levels of the system: individuals (in families) and populations (families in neighborhoods). Notice that the columns are two time frames: short-term (snapshot) and long-term (videc Answer questions C, D, E & F in the Systems Table. Note that there is more than one good answer to these questions. The best answers are logical and based on evidence.**SAVE**. *OPTION: View the presentation linked to the Module 3 webpage. Discuss your answer with others in your collaborative learning group. Revise as needed while staying clear of plagiarism.*

Question 1: **What is your source of information about wolves in a food web?**

My source:

Question 2: **What prey do wolves hunt in the food web described in the source you chose? Do they hunt only small, only large, or switch between small and large prey?**

My answer:

Question 3: **How is the size of the prey likely to influence the size of wolf families?**

My answer:

Question 4: **How is the size of wolf families likely to influence the social structure of a wolf population?**

My answer:

Question 5: **Why is it an adaptive function for junior wolves to remain with their family group in ecosystems with many large bodied prey and no small bodied prey?**

My answer:

Question 6: **In environments with more small bodied prey than large bodied prey, why is it an adaptive function for junior wolves to switch from food begging to hunting on their own?**

My answer:

SYSTEMS TABLE	SYSTEM (snapshot)	CHANGE IN THE SYSTEM (video)
INDIVIDUAL LEVEL OF SYSTEM	C. STRUCTURE: How does the size of the prey influence whether a wolf switches from food begging to hunting?	D. DEVELOPMENT: How do genetic instinct and learned experience interact in shaping the food begging behavior of of individual wolves as they mature?
wolves in a family group (proximate)		
POPULATION LEVEL OF SYSTEM	F. FUNCTION: Why would a genotype for switching increase in populations where the food web is complex (both large and small prey)?	E. EVOLUTION: Why have dogs diverged genetically from wolves in the behavior of switching between food begging and hunting? Or have they?
family groups in one population, such as Ellesmere Island (ultimate)		

CONCEPT	DEFINITION	EXAMPLE

phenotype	Expression of the genetic blueprint as it is influenced by the environment.	Dogs starved early in life are smaller as adults compared to well-fed siblings. The variation in body size is not heritable if the small adults produce pups of that grow to normal size when fed a good diet.
genotype	The genetic blueprint is the sum of all the genes, some of which may control the timing of when other genes are turned on and off during development..	Size varies between chihuahuas and great danes, as a result of genetic mutations. A well-fed chihuahua puppy will not grow up to be a great dane.
cause	stimulus/response: mechanisms of behavioral response to stimuli outside the body; modified by internal hormonal state and external context	In response to pups licking the muzzle, adult wolves instinctively regurgitate food. They are more likely to respond when the stomach is full, prolaction hormone is high and the context of a densite.
development	nature/nurture: heritability of changes in stimulus/response; interaction of instinct and learned experience; age-related changes due to maturation as controller genes turn hormonal systems on and off;	As pups grow larger, the posture during muzzle-licking behavior changes so the body mimics the action of a smaller pup. The pawing behavior becomes slow and exaggerated, without touching the senior wolf; appears in the context of de-escalation.
function	differential fitness of genotypes; those genotypes that better survive and reproduce, are the ones that increase in percentage between generations of a population, relative to other genotypes in the same population	Those genotypes that persisted in mimicking juvenile food begging behaviors would have been more likely to survive and reproduce than the genotypes that dispersed and were unsuccessful at hunting alone outside the family.
evolution	history of species; accumulation of many changes in genotypes result in divergence of a species from traits in the ancestral species	During domestication of dogs from wolf-like ancestors, humans selected the genotypes that retained juvenile behaviors into adulthood.

EVALUATION (optional to earn participation points)

What worked?	
What didn't work?	
Sugges-tions?	