Introduction: Origins of Behavior

1. Have each student tell their university, department, what their thesis research is and what their interest is in foraging ecology of herbivores.
2. Go through syllabus
3. Focus of class is foraging behavior, especially diet selection - have students divide into groups of 3 or 4 and come up with as many answers to the following question as they can.

Why do animals choose the diets they do?

(nutrition, availability, learning, nothing else, toxic, easy to get, safe, post-ingestive feedbacks)

Come together as a class and make a list on the board.
How might these reasons be classified?

Evolution/instinct/nature vs. learning/experience/nurture
Ultimate/large scale/long term vs. proximate/small scale/short term
Ontogeny vs. phylogeny

When trying to explain a "cause" or "why something happens" Aristotle gave 4 types

1. Formal—a chair is like it is because the blueprint called for it
2. Material—a chair is like it is because of the characteristics of the wood it is made of
3. Efficient - a chair is like it is because of the behavior of the carpenter who built it (causation, mechanism)
4. Final - a chair is like it is because the carpenter desired a comfortable seat (function - teleological)

Similarly, Tinbergen (1963) gave 4 reasons a behavior might occur that overlap with Aristotle's "causes"
**Why do starlings sing the songs they do?**

1. Development (Ontogeny)-proximate

   *Starlings sing a song because they have learned it from their parents*

2. Evolutionary history (phylogeny)

   *Complex songs of starlings evolved from simpler ancestral calls*

3. Causation (mechanism) -- proximate

   *Starlings sing because increasing daylength triggers changes in hormone levels in the body*

4. Functional (explains final outcome or survival mechanism) -- ultimate

   *Starlings sing to attract mates for breeding*

Actual behaviors derive from dependent interactions of genes and environments -- a combination of genetic code and in utero and ex utero experiences.

**Natural selection:**

1. individuals differ in morphology, physiology and behavior
2. some of these differences are derived from different genes obtained from parents
3. organisms have a huge ability to reproduce, producing more offspring than can survive, thus there is competition for scarce resources
4. some variants (best competitors) will leave more offspring, those that are most adapted and best able to survive and reproduce

Therefore, there are many different kinds of answers to why animals choose the diets they do, and because diet selection is a complex topic, it is important to explore and understand it from all different scales and angles. We will begin the semester talking about the functional or evolutionary basis
for foraging behavior and then talk about the mechanics and learning aspects.
Diet selection:  What is it?  How do you measure it?

To do:  Power point on use, avail, selection, requirement
    Slides from bruce, video, preference analysis, selection analysis from
    Mark

1. Have students work in groups to determine specifically how to answer the
   following research questions. Include study design, methods, and analysis.

A. Mountain goats were introduced into the Rocky Mountains of Colorado in the
   early part of this century. Since then, mountain goat populations have expanded,
   whereas the native Rocky Mountain bighorn sheep populations have declined. Your
   supervisor at Colorado Division of Wildlife would like to know if these two species
   are potentially competing for habitats. She would specifically like you to determine
   if there is any dietary overlap between the two species. (U)

B. Using 2 different aversive conditioning techniques, you have attempted to teach
   cattle not to eat a poisonous plant. In your field test, you wish to determine how
   much of this plant was eaten by cattle that had undergone each treatment. Explain
   how you will compare your methods. (U)

C. You have just been hired as the manager of a state-owned property, on
   which hunting pheasants is the most popular public activity. You would like
   to provide natural food that will keep the pheasant population high as
   possible. How would you determine which native plants to encourage on this
   property? (R)

D. Populations of pygmy rabbits have been declining for the last few decades, and
   are now are listed as endangered in Washington. State wildlife managers would like
   to know whether sagebrush alone meets the pygmy rabbit’s requirements for
   protein and energy. What techniques will you use to answer this question? (R)

E. Ranchers in south Texas often use mixed grazing strategies in which goats,
   sheep, and cattle all occupy the same rangeland. To better manage their rangelands
   and herds, the Rancher’s Association is funding you to determine if goats, sheep,
   and cattle use different foods within the rangeland because of differences in size
   and digestive anatomy. What procedures will you include in your study plan?

F. Dr. Launchbaugh has spent 5 years developing a breed of sheep that carries
   genes that predispose sheep to eat sagebrush. She has completed preference
   trials in the lab, but now wants to do a field test at the sheep research station to
determine whether her new breed actually select sagebrush in their diet more than do regular sheep. What methods would she use to determine this? (S)

G. Sexual dimorphism is common among Cervidae (the deer family). Males are typically larger than females, and thus have larger mouths, longer legs, and other anatomical differences that may influence habitat selection. You have just been accepted as a Master’s student in Scotland to determine if male and female red deer select different foods. What procedures will you include in your study plan? (S)

Diet use (Diet composition, food habits)—What an animal eats

Diet selection—an animal’s choice among food items available (use/availability)

Diet preference—choice of one food over the other, without regard to whether one is available or not. (assumes equal availability of all types)

Dietary requirement—foods or constituents needed to survive or reproduce (relates to fitness value).

Palatability?

How do you measure use?

1. Direct observation
2. Esophageal fistula, esophageal ligature
3. Post-ingestive analysis
   a. Crop
   b. Rumen/stomach/intestines/cecum
      i. Dissection
      ii. emetic
   c. Feces
4. Remains
   a. Browse surveys
   b. Den or nests
5. Exclosures
How do you measure availability?

What is available? CAG vs. new growth, accessibility (how high, snow depth), what diameter? Plant sampling, litter collection, browse diameter

How do you measure selection?
Is a particular food item used more frequently than expected by chance given its availability in the habitat?

Compare % use and % availability
Ratio is a crude index to selection
Use/Avail < 1, avoided
Use/avail > 1, selected
Use/avail = 1 used in proportion to availability

How do you measure preference?

How do you measure requirements?

Protein
Minerals
Energy
  Digestion, metabolism
Minerals
Vitamins
Toxins - how well can handle?