

Animal Nutrition

I. Evolutionary Adaptations to Diets

Dichotomous keys are used for identification. The identification is based on a series of questions, each with two possible answers (*di-* = two). After answering each question, the investigator is directed to another question until the organism is identified.

We'll use the dichotomous key below to identify the skulls of several different mammals. The features we'll examine are an important part of nutrient acquisition for these animals.

Teeth

Mammalian teeth are classified as incisors, canines, premolars and molars.

Incisors – most anterior teeth

May vary in shape and size

May be missing in some mammals

Canine teeth – posterior to incisors

May be absent in some mammals, commonly herbivores

Can be very sharp in carnivores

Premolars – posterior to canines

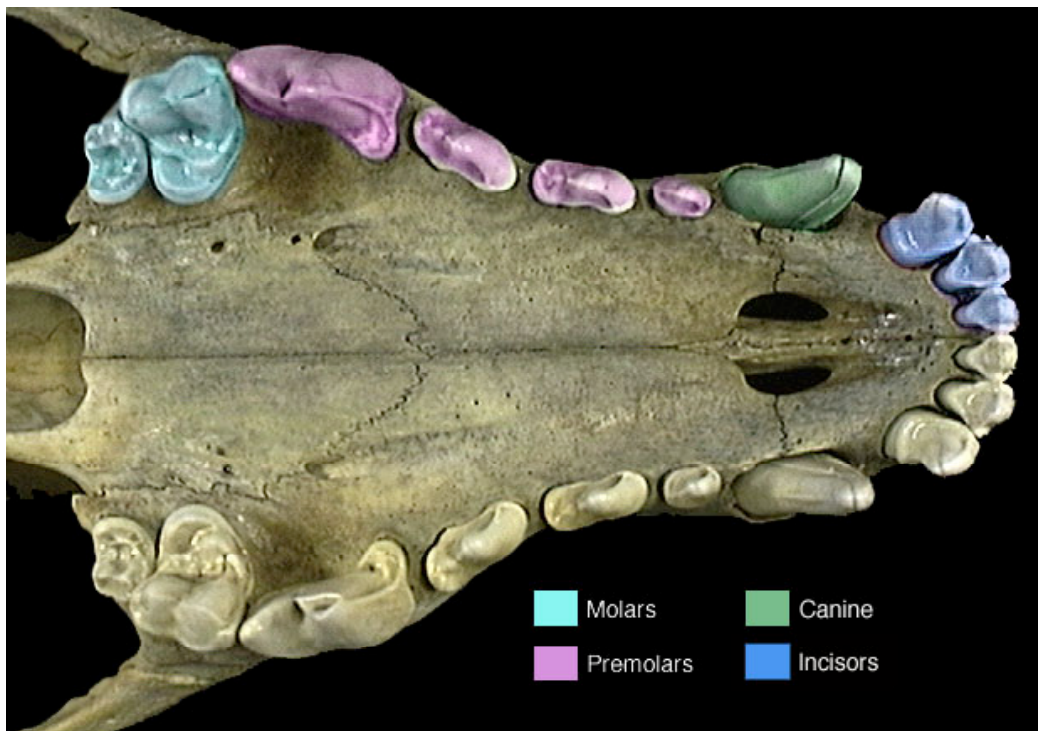
Vary in shape and size

Herbivores: premolars are very broad and flat like molars

Carnivores: premolars can be sharp, although always smaller than canines

Molars – most posterior teeth

Broader and flatter than premolars, but can still vary in shape and size



Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond, and T. A. Dewey. 2006. The Animal Diversity Web (online). <http://animaldiversity.org>

Diastema

A diastema is a gap between teeth. Many herbivores have lost teeth (usually the canine teeth) through their evolution and have a diastema between their incisors and premolars.

Sagittal crest

The sagittal crest is a bony ridge running lengthwise along the top of the skull. It serves as an attachment point for the temporalis muscles, which are important muscles for chewing. It is associated with animals that rely on powerful biting and clenching of their teeth as a part of their hunting strategy.

Diet

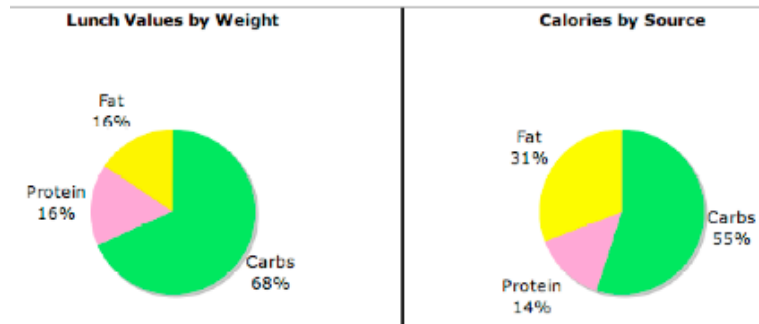
Animal diets can be generally classified into three categories: carnivore, herbivore and omnivore. Carnivores feed on other animals and herbivores feed on plants, while omnivores feed on both. However, many animals do not fit perfectly in the carnivore/herbivore classifications. Some animals have a primarily carnivorous diet, but feed on plants occasionally. Other animals may have a primarily herbivorous diet, but feed on the occasional insect. An animal who regularly feeds on both plants and other animals is an omnivore.

Dichotomous Key to Identify Mammalian Skulls – Mammal (*Genus*)

1a. Incisors on the upper jaw.....	2
1b. No incisors on the upper jaw.....	Sheep (<i>Ovis</i>)
2a. Canines present between incisors and premolars.....	4
2b. Diastema replaces canines between incisors and premolars.....	3
3a. Lower incisors are approximately the same length as upper incisors.....	Rabbit (<i>Sylvilagus</i>)
3b. Lower incisors are longer than upper incisors.....	Beaver (<i>Castor</i>)
4a. Canines are over 5 cm in length.....	Grizzly bear (<i>Ursus</i>)
4b. Canines are less than 5 cm in length.....	5
5a. Presence of a sagittal crest.....	6
5b. Absence of a sagittal crest.....	Human (<i>Homo</i>)
6a. Incisors are sharp.....	7
6b. Incisors are flattened.....	8
7a. There are 3 incisors on the lower jaw.....	Coyote (<i>Canis</i>)
7b. There are 2 incisors on the lower jaw.....	Sea Otter (<i>Enhydra</i>)
8a. Eyes are forward facing.....	Gorilla (<i>Gorilla</i>)
8b. Eyes face out to side.....	Horse (<i>Equus</i>)

Use this information to fill in the tables and answer the questions in your lab report.

II. Pie4Lunch: a Diet Analysis Spreadsheet



Pre-Lab

On the day you will attend the lab session of this course please bring the following:

1. Your lunch; nothing special, just what you would usually have as your midday meal. If your lab is a morning session, you can bring that day's lunch or the previous day's lunch.
2. The Nutrition Facts portion of any and all labels from food and beverage containers that held the parts of your meal. If you bring something that doesn't have such a label (e.g. an apple or homemade soup), you can probably find equivalent information online (There are links in the Nutrition Lab Worksheet.)
3. A list of everything you ate after you had lunch the previous day together with Nutrition Facts for what you consumed. Including today's lunch data this will provide a 24-hour snapshot of your food input. (A four-day food diary that included part of a weekend would give a better picture of your diet. Your instructor may assign this as a follow-up exercise.)

A. The Nutrient Content of Your Lunch

1. Form a team of two or three students and get a laptop computer.
2. Find the Excel file called **Nutrition Lab Worksheet** either on the computer or download a copy from the Bio110 website.
3. Open **Nutrition Lab Worksheet** file (an Excel worksheet.) Tour the two tabbed sections of the spreadsheet: Pie for Lunch and Resources. **You should only change or enter values in tan-colored cells in the Pie for Lunch worksheet.**
4. From the File menu select "Save as..." renaming the spreadsheet "**RachelRay.xls**" but use your name instead of Rachel's. In this new copy of the spreadsheet you will record the foods you have eaten and their nutrient values. You should delete the sample meal (oatmeal, raisins, butter and milk) and record your own meal in those spaces. Each team member should have an individual file for this purpose.
5. If you have a food item for which there is no Nutrition Facts label, or if you want to know about a nutrient not included on a particular label, try some of the links on the **Resources sheet**. The website www.calorieking.com will probably be the most useful. You can enter any food and you will get an estimate of the nutrient content.
6. Notice that Nutrition Facts labels typically cite the amounts of many micronutrients (minerals and vitamins) as percentages of a recommended amount, but some online databases cite actual units, like milligrams, micrograms, or IU (International Units). To convert the units to percentages for entry in Pie4Lunch,

- use the converter in cell AM6 of the Pie for Lunch worksheet.
7. Once you have entered nutrient values for your lunch, compare the resulting “pies” and discuss what you notice within your group.
 8. Continue entering nutrient values for the other two meals (last night’s dinner and today’s breakfast) and take another look at your totals, percentages, “pies,” and the column chart for individual nutrients.
 9. On the Macronutrient Dietary Analysis chart and the Micronutrient Dietary Analysis chart, check where your values are relative to the Recommended Daily Values. Consider why any score might be below 100%. Cite as many as reasons as you can.
 10. Some scores might exceed 100%. Might that be a problem? Before assuming that your diet is unhealthy (which it might be), consider whether there may be problems with any of the assumptions that this examination is built upon.
 11. Save the document and print it out or email it to yourself to print out later.

B. Limitations!

1. Organize your food selections for a presentation for the class with a basic food plan for the week and an addendum that adjusts the types and quantities of foods needed if you had to take into consideration one of the following limitations:
 - a. a dry desert or cold mountain environment instead of moist tropical one;
 - b. there is no refrigeration;
 - c. members of the group are diabetic or vegan;
 - d. members of the group have hypertension (high blood pressure);
 - e. members of the group have religious limits on what they eat;
 - f. members of the group prefer eating Asian, or Mexican, or other ethnic food.
 - g. there is no way to cook food.

Are there members of your team who have information resources about any of these?

2. Be prepared to make an oral presentation of your group’s solution to the Case of Survivor: Tobacco Caye. The presentation could include a computer presentation.
3. Copy-and-paste the three graphs from the Pie4Lunch sheet into a Microsoft Word document. E-mail that document to your own e-mail address. (If you don’t use Word at home, print the Word document as a PDF and e-mail the PDF to yourself.)
4. Write a brief report that includes your Case Analysis, a summary of the 7-day diet that your group assembled, and the graphs of your own individual 24-hour diet together with an interpretation of what the three graphs show and what they might mean about your food intake during that 24 hours. Bring the report to next lab.

C. What needs to be in your emergency kit?

Addition individual project: plan the food portion of a home emergency kit to provide for nutritional needs of your household during an emergency (four days for earthquake; at least six weeks for a lethal avian flu pandemic). Besides the total amount of food needed, how would a 6-week food cache differ from a 4-day food cache?

Name _____

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1. Record the skull number and the type of mammal below.

Skull Number	Mammal

2. Look carefully at the tooth shape and arrangement on each skull. Based on what you see, construct a hypothesis about what kind of diet each mammal has.

Mammal	Hypothesized Diet (carnivore, herbivore or omnivore)
Sheep (<i>Ovis</i>)	
Horse (<i>Equus</i>)	
Rabbit (<i>Sylvilagus</i>)	
Beaver (<i>Castor</i>)	
Grizzly Bear (<i>Ursus</i>)	
Sea Otter (<i>Enhydra</i>)	
Human (<i>Homo</i>)	
Coyote (<i>Canis</i>)	
Gorilla (<i>Gorilla</i>)	

II. Pie4Lunch: a Diet Analysis Spreadsheet

1. Once you have entered nutrient values for your lunch, compare the resulting “pies” and discuss what you notice within your group. How are your two pies different? What would make for a “good” pie? How does your pie compare to others at your table?

2. If your lunch seems high (or low) in some regard, how might you have assembled a lunch that was just as appetizing to you but lower (or higher) in the area of concern?

3. Discuss with your team any possibilities or limitations you see with making changes in future food choices after viewing the nutritional status of your recent selections. Do one or more members of your team have a 24-hour diet that actually meets the recommended guidelines?

4. If not, could you combine foods from more than one team member’s list that would fully meet the guidelines? Or will you need to make appropriate substitutions? You may use online resources to find nutritional facts about other food choices.

5. Does the composite list of foods sound appetizing? Could you eat it for every day for a week on a tropical island? How will you vary it providing good nutrition for a week?