Title: Teeth Unit

Authors: Larry Hohl, L. C. Obourn High School, East Rochester, NY
Barbara Hendry, East Rochester Elementary School, East Rochester, NY
Revised and expanded by Florianna Blanton, Laurel Southard, and Sarah Hutchinson, CIBT, Cornell University, Ithaca, NY.

Appropriate Level: Grades 2-8

NYS Standards:
1-Analysis, Inquiry and Design: 1- Purpose of Scientific Inquiry: 1.1a, 1.3a; 2- Research plan, hypotheses: 2.1a, 2.3a,b; 3- Analysis of results: 3.1a, 3.2a, 3.4a; 3- Mathematics: 4-Modeling: 4.2, 4.3; 4- Living Environment: 3- Change over time: 3.1a, 3.2b.

Abstract: Students will investigate the characteristics of teeth and what teeth can tell about an animal’s lifestyle.
• Students will determine what kinds of teeth they have, and which teeth are used to eat which kinds of food.
• The unit will include a study of jaws from a carnivore, herbivore and omnivore. Based on the structure, students will hypothesize which jaw belongs to which type of animal.
• Students will sort and categorize 6-16 different animal teeth.
• Given information about what canines, incisors and molars are, students will identify which teeth are which and why. They will predict which teeth came from what animal.

Special Materials: CIBT Teeth Kit

Time Requirement: 12-14 class periods (without extensions)
Teacher Section Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State Learning Standards</td>
<td>3</td>
</tr>
<tr>
<td>CIBT Kit Contents</td>
<td>4</td>
</tr>
<tr>
<td>Sources and Additional Resources</td>
<td>4</td>
</tr>
<tr>
<td>Interdisciplinary Extensions</td>
<td>6</td>
</tr>
<tr>
<td>Introductory Activity: <em>What Do You Know?</em></td>
<td>8</td>
</tr>
<tr>
<td>Activity 1: <em>How Many Teeth Do I Have?</em></td>
<td>9</td>
</tr>
<tr>
<td>Activity 2: <em>Which Teeth Do You Use?</em></td>
<td>11</td>
</tr>
<tr>
<td>Activity 3: <em>What Did It Eat for Dinner?</em></td>
<td>13</td>
</tr>
<tr>
<td>Activity 4: <em>Oh, What Big Teeth You Have!</em></td>
<td>15</td>
</tr>
<tr>
<td>Activity 5 (Optional): <em>Tyrannosaurus Rex Teeth</em></td>
<td>18</td>
</tr>
<tr>
<td>Student Section</td>
<td>Attached</td>
</tr>
</tbody>
</table>
CIBT Teeth Unit
New York State Learning Standards

Standard 1: Analysis, Inquiry and Design

Key Idea 1: The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

1.1- The central purpose of scientific inquiry is to develop explanations of natural phenomena.
1.3- Develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed.

Key Idea 2: Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

2.1- Develop written plans for exploring phenomena or evaluating explanations guided by questions or proposed explanations they have helped to formulate.
2.3- Carry out their plans for exploring phenomena through direct observations and through the use of simple instruments that permit measurement of quantities, such as length, mass, volume, temperature and time.

Key Idea 3: The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.

3.1- Organize observations and measurements of objects and events through classification and the preparation of simple charts and tables.
3.4- Adjust their explanations and understandings of objects and events based on their findings and new ideas.

Standard 3: Mathematics

Key Idea 4: Modeling/Multiple representation – Students use mathematical modeling/multiple representation to provide a means of presenting, interpreting, communicating and connecting mathematical information and relationships.

4.2- Construct tables, charts and graphs to display and analyze real-world data.
4.3- Use multiple representations as tools to explain the operation of everyday procedures.

Standard 4: The Living Environment

Key Idea 3: Individual organisms and species change over time.

3.1- Describe how structures of plants and animals complement the environment of the plant or animal.
3.2- Observe that the differences within a species may give individuals an advantage in surviving and reproducing.
CIBT Kit Contents

The CIBT Teeth Unit Kit contains the following materials:

• 10 small mirrors
• 8 animal cards (laminated)
• Animal Jaws:
  o 1 cow jaw
  o 4 raccoon jaws
  o 4 coyote jaws
• 4 *Tyrannosaurus rex* fossil tooth rubber molds
• Animal Teeth labeled A-Q, five of each (available through Skulls Unlimited, www.skullsunlimited.com, 1-800-659-SKULL):
  o Bear canine  o Coyote molar
  o Beaver incisor  o Coyote canine
  o Beaver molar  o Coyote incisor
  o Bobcat canine  o Horse incisor
  o Bobcat incisor  o Horse molar
  o Bobcat molar  o Raccoon canine
  o Cow molar  o Raccoon molar
  o Cow incisor  o Raccoon incisor
• Teeth Books:
  o *Throw Your Tooth on the Roof: Tooth Traditions from Around the World* by Selby B. Beeler. May only be available in hardcover.
  o *Grandpa’s Teeth* by Rod Clement. Harper Collins Publishers, 1997. Find out where Grandpa’s lost teeth were.

Sources and Additional Resources

For Students:

• *Teeth, Tusks and Fangs* (Young Discovery Library) by Roger Dievart. Good source of information on physiology, uses, types and care of human and animal teeth, tusks and fangs. Third grade reading level.
• *Teeth and Tusks (Head to Tail)* by Theresa Greenway.
• *Dragon Teeth and Parrot Beaks: Even Creatures Brush Their Teeth* by Almute Grohmann.
For Students and Teachers:

*Dental and Skull Anatomy of Carnivores, Herbivores, and Omnivores

Dental Forensics: Teeth Impressions
http://www.cyberbee.com/whodunnit/teeth.html If students enjoy this activity, they may enjoy CIBT’s Forensics Odontology Kit and corresponding “I’ll Have a Bite” Lab!

*Differentiation of Teeth in Mammals
http://animaldiversity.org/collections/mammal_anatomy/kinds_of_teeth/ Insightful, thorough article on the different tooth types and their functions. Medium-high level reading; not appropriate for elementary students.

 Educator’s Guide to Oral Health
http://www.dentalcare.com/en-US/dental-education/lessonplancreator/lp-teaching-kids.aspx Crest and Oral-B’s Dental Education Program, including lesson plans, materials, games, and activities that would complement this unit if you are interested in teaching oral hygiene too.

Rat Teeth
http://www.ratbehavior.org/Teeth.htm Interesting, upper-level introduction to the teeth of rats. Their incisors never stop growing! Could be used in formulating an extension/research project.

Science Daily: T. rex’s Killer Smile Revealed
http://www.sciencedaily.com/releases/2012/03/120318100451.htm

Simple Steps to Better Dental Health

*Skull Science
http://www.dec.ny.gov/docs/wildlife_pdf/skullscience.pdf NYS DEC article explaining what students can learn from the skulls and teeth of an animal. Illustrated details about coyotes, beaver, and raccoons make a good homework reading or enrichment before Activity 4!

*Tales that Teeth Tell
http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1027&context=museummammalogy Excellent enrichment article detailing the structure and variety of teeth and differences in teeth due to diet. Middle-upper level reading.

*Tyrannosaurus rex: Everything You Need to Know About the King of the Dinosaurs
http://dinosaurs.about.com/od/dinosaurbasics/a/trexfacts.htm

University of California Museum of Paleontology. The Tyrant Lizards: The Tyrannosauridae,
http://www.ucmp.berkeley.edu/diapsids/saurischia/tyrannosauridae.html
Interdisciplinary Extensions

Mathematics

• Compare size of teeth and/or number of teeth from different animals. Make a graph or chart. For example, a whale shark has 7200 teeth, each about 3 mm big. The tusk from an old walrus can be 1 meter long. A dolphin has 80-104 teeth. An old elephant can have a 3-meter tusk that weighs 125 pounds.

• See Page 10 for graphing ideas…

Social Studies/History

• Investigate the history of the toothbrush, toothpaste, wooden teeth, toothpicks and other ways of dealing with teeth in the past.

Integrated Language Arts

• Investigate teeth folklore and legends. Read books about teeth traditions around the world. Have each student pick a tradition from a different country to tell about and find the country on a map.

Before students investigate teeth traditions around the world, have them try to think of some other ways to get rid of teeth that have fallen out. An excellent book is *Throw Your Tooth on the Roof: Tooth Traditions from Around the World* by Selby B. Beeler. Another book is *Tooth Tales: From Around the World* by Marlene Targ Brill.

• Write creative stories about a lost tooth or the tooth fairy.

• Read *How Rabbit Tricked Otter and Other Cherokee Animal Stories*, which includes a “why” or *pourquoi* story about why deer teeth are blunt. Have students write their own “why” stories about teeth.

• Read trade books about teeth. Some good examples include:
  
  o *A Quarter from the Tooth Fairy* (Hello Math Reader Level 3). A boy tries to spend his quarter but gets confused about the many different coins that equal twenty-five cents.
  
  o *The Tooth Fairy* (My First Reader) by Kirsten Hall
  
  o *Arthur’s Loose Tooth* by Lillian Hoban
  
  o *What Do Fairies Do With All Those Teeth?* by Michael Luppens. Lots of fun possibilities.
  
  o *Young Cam Jansen and the Lost Tooth* by David Adler. Cam uses her photographic memory to help a classmate find a lost tooth.
  
  o *The Tooth Book* by Dr. Seuss. Rhyming text and illustrations point out what animals have teeth, their uses and how to care for them.
**Introductory Activity: What Do You Know?**

**Time:** Approximately 20 minutes

**Purpose**
Find out what students already know about teeth and what questions they might have about teeth.

**Procedure**
1. Use semantic mapping to illustrate information students know already about teeth. (The map below was done using the computer program Inspiration and is used only as an illustration of what your students might come up with.)

   **Studying Teeth**

   ![Studying Teeth Diagram](image)

   - Size
   - Location
   - Shape
   - Color
   - Number of
   - Use
   - Tear
   - Cut
   - Grind
   - Importance of brushing teeth
   - Omnivores
   - Herbivores
   - Carnivores
   - Different animals

2. List questions students have about teeth, both their own and in different animals. (Mapping often contributes questions since students disagree about information on a subject.)
Activity 1: How Many Teeth Do I Have?

Time: Approximately 45 minutes.

Purpose

Students will explore their mouths and see if they can feel differences among their teeth. They will learn to identify canines, incisors and molars. Students will count their own teeth and graph class teeth data.

Materials

- Coffee Stirrers or Q-Tips
- Mirrors (one per group) (*)
- Antibacterial hand soap
- How Many Teeth? book (*)

(*) Materials included in the Tooth Kit

Procedure

1. Pass out the Activity 1 “How Many Teeth Do I Have?” Worksheet and have students read the introductory paragraph. Review this information as a class before proceeding; it will be used heavily throughout the lab. They will learn that:

   - **Incisors** specialize in cutting or snipping off pieces of food. They are broad and flat, with a narrow edge, and are located at the front of the mouth.
   - **Canines** rip and tear foods that might be tough; they also pierce and hold. Canines are located behind the incisors on both sides of the mouth.
   - **Molars** are large teeth with broad surfaces designed for crushing, grinding and chewing food. They can be found at the back of the mouth.

   The diagrams below show each of these tooth types from the side (the darker part is the root) and the top (the chewing surface).

   If you are working with older students, consider including pre-molars throughout the lab activities. Also known as bicuspid, these teeth are not present in primary dentition (they grown in once all “baby teeth” are lost). Pre-molars are a cross between canines and molars. They have sharp points for piercing and ripping, but they also have a broader surface for chewing and grinding.

2. After washing their hands with soap, direct students to determine the shapes of their teeth. Review the information on incisors, canines, and molars from their worksheet. Hand out mirrors and have them touch their teeth. There are no written questions for this section. Go around the room and ask them questions such as:

   - Do all your teeth feel the same?
   - What kinds of surfaces do you feel?
• How many different types of teeth can you feel?
• How many different tooth sizes can you feel?
• Where are the largest teeth located?
• Do some teeth feel flatter or duller than others?
• Do some teeth feel sharper than others?
• If so, where are they located?
• Why do you think you have different types of teeth?

3. Students will now **predict** how many teeth they have, and record on Table 1 on the worksheet. *They can also predict how many of each type of teeth they have (incisors, canines, molars), and upper/lower jaw count. If your students are less advanced, you can remove these rows from Table 1.*

4. Have students **read** the book *How Many Teeth?* by Paul Showers to confirm how many teeth children and adults have. They will record this data on Table 1.

5. Students will **count** how many teeth they have. They will record these numbers on Table 1 as well, so they can compare the predictions to observations. Using a mirror, and a coffee stirrer or Q-tip to touch each tooth as they count may help. Make sure each student records the information so they can graph data later on! *If working with middle or high school students, have elementary students count how many teeth older students have. Is it more or less? Why?*

6. **Class Discussion:** Collect data from all students about how many teeth they have. Direct students to raise their hand if they counted 15 teeth, then ask about 16 teeth, 17 teeth, etc. Record the results of the poll and announce to the class. Ask questions about the class data such as:
   • How many more students have 18 teeth than 16 teeth? (or similar questions)
   • What is the most common number of teeth?
   • Why do you think some students have more/less teeth?

*If desired, you can also ask students to graph how many teeth they have versus how old they are in months. You would need to break the class into groups of ~6-12, depending on ability level. Have students record each other’s ages and teeth counts. Two optional, modifiable worksheets are included for this activity (Activity 1 Optional Worksheets 1-2). The X-axis must be modified to suit your class’s ages.*

*Less advanced students can plot data points on a grid with age ranges and teeth counts (see Activity 1 Optional Worksheet 1). More advanced students can find the average teeth count for each age range (e.g. 18.7 teeth for students 102-104 months old) and make a bar graph (see Activity 1 Optional Worksheet 2). See if they can find any trends in number of teeth versus age, and why they think these might be (students lose “baby teeth” and re-grow them at various ages). This activity would be great with the help of high school students and their data!*  

*Other graphing possibilities for more advanced students include age vs. average number of canines, incisors, or molars; gender vs. number of canines, incisors, and molars. Different*
groups in the classroom could make different graphs and present to the whole class when finished.

7. Have students label a diagram of their mouth (Activity 1 Student Worksheets 3-4) showing which teeth are which. Answers are shown in the diagram at right. A diagram that includes a space for pre-molars is provided on page 8 of the Student Section for more advanced students.

8. Conclusion (and lead-in to next activity): When students have determined what kinds of teeth they have, see if they can use that information to hypothesize what humans would eat and which teeth might be used for which foods.

Activity 2: Which Teeth Do You Use?

Time: Approximately 45 minutes.

Purpose
Students will predict and investigate which kinds of teeth are used to eat different kinds of food.

Materials
- Food: bread, carrots, bananas (enough for each student to try each food)
- Optional food (for more trials): cookies, raisins, apples
- Mirrors (*)

(*) Materials included in the CIBT Tooth Kit

Procedure
1. Review Activity 1 by having students describe what each kind of tooth is used for:
   - Incisors: cutting
   - Canines: grasping, tearing, stabbing
   - Molars: crushing and grinding
   - Pre-molars: holding, crushing (add to Activity 2 Student Worksheet for more advanced students)

2. Have students predict which teeth they would use to eat bread, carrots and bananas. They must provide a reason why they chose a particular kind of tooth. They will record this information on the Activity 2: Which Teeth Do You Use? Student Worksheet.

3. Then instruct students to try eating each kind of food and help them figure out which teeth are being used. Are the same teeth used at the beginning, in the middle, and at the end of chewing? Having mirrors and a partner may help. The Answer Key is on the next page.

4. Have students predict what different kinds of teeth are used for other kinds of food (e.g. cookies, raisins, apples). If desired, repeat the predicting/eating/data recording process for these foods as well.

Optional Extension or Homework
If students have a dog or cat, have them observe it eating. Try to describe what kind of teeth it has and its jaw movement.
Activity 2 Student Worksheet ANSWER KEY

What are the three kinds of teeth that you have?
*Incisors, canines, and molars.*

Predictions
Which teeth would you use to eat bread? *Canines, molars*
Why? *Canines grasp and tear food, while molars crush and grind it.*

Which teeth would you use to eat carrots? *Incisors, molars*
Why? *Incisors slice off pieces of the carrots so molars can crush and grind the smaller pieces.*

Which teeth would you use to eat bananas? *Any or all teeth*
Why? *Bananas are soft enough to be bitten and chewed by any of the tooth types.*

Results
Now try eating the bread. Which teeth are used? *Incisors or Canines*
Are other teeth used as you continue or finish eating? *Molars*

Now try eating the carrots. Which teeth are used? *Incisors or Canines*
Are other teeth used as you continue or finish eating? *Molars*

Now try eating the banana. Which teeth are used? *Incisors or canines (most likely incisors)*
Are other teeth used as you continue or finish eating? *Probably molars*

Notice that different types of teeth take different actions (for example: tearing, stabbing, cutting, crushing, grinding) when you’re using them to eat. This is because each type of tooth has a specific purpose. *Any of the italicized answers are acceptable.*

What are incisors used for? *cutting, snipping, slicing*

What are canines used for? *grasping, tearing, stabbing, ripping, piercing, holding*

What are molars used for? *crushing, grinding, chewing*
Activity 3: *What Did It Eat for Dinner?*

**Time:** Approximately 45 minutes.

**Purpose**

Students will determine if a given jaw (or part of a jaw) is from a carnivore, herbivore or omnivore.

**Materials**

- Raccoon jaw replica “R” (*)
- Coyote jaw replica “C” (*)
- Cow jaw replica, unlabeled (*)

(*) Materials included in the Tooth Kit

**Procedure**

1. Jaws are labeled R (raccoon), C (coyote), or unlabeled (cow). *Don’t tell the students yet!* Make sure they have the [Activity 3: What Did It Eat For Dinner? Student Worksheet](#).
2. Instruct students to fill out the questions about animal diets at the top of the worksheet.
3. Help students fill in the data for the cow jaw column on their worksheet. We recommend using the cow jaw as an example, since it is unlabeled. They will determine which tooth is tallest, which is widest; and how many incisors, canines, and molars are present. *If you would like your class to practice metric measurement skills, you can modify the chart to include quantitative measurements instead of qualitative questions.*
4. Divide the class into groups of about four students. Give each group an “R” jaw and a “C” jaw. Allow some time for the students to study and compare the jaws. After filling out the data table, the group should be able to determine whether the animal was a carnivore, herbivore or omnivore—including a rationale for their choice. The Answer Key is on the next page.
5. After groups have examined both jaws, discuss as a class which jaws were which and the reasons why. Discuss the dentition of each jaw, especially the coyote’s prominent canines and tiny molars.

*With more advanced students, you can introduce the presence of the coyote’s carnassial tooth, a giveaway that it is a carnivore. Carnassial teeth (a.k.a. sectorial teeth) are large pre-molars/molars found in many carnivorous mammals, used for shearing flesh and bone in a scissor- or shear-like way. The fourth upper pre-molar and the first lower molar are carnassial teeth. Students can find these teeth on their cat or dog.*
<table>
<thead>
<tr>
<th>Jaw Characteristics</th>
<th>Cow</th>
<th>R</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallest type of tooth?</td>
<td>Molar</td>
<td>Canine</td>
<td>Canine</td>
</tr>
<tr>
<td>Widest type of tooth?</td>
<td>Molar</td>
<td>Molar</td>
<td>Molar (carnassial tooth)</td>
</tr>
<tr>
<td>How many incisors?</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>How many canines?</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>How many molars?</td>
<td>5</td>
<td>2 (+4 pre-molars)</td>
<td>3 (+4 pre-molars)</td>
</tr>
</tbody>
</table>

**Herbivore, carnivore, or omnivore?**

<table>
<thead>
<tr>
<th>Explain your choice.</th>
<th>Herbivore</th>
<th>Omnivore (raccoon)</th>
<th>Carnivore (coyote)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The molars are the tallest and widest type of tooth, indicating heavy use of these teeth for grinding plant material.</td>
<td>Molars are flatter, more uniform than those on Jaw C, indicating that the animal sometimes uses them for grinding plant material.</td>
<td>The long, sharp canine tooth and small, pointy molars indicate that this animal does most of its eating with the front teeth of its mouth.</td>
<td></td>
</tr>
</tbody>
</table>

**Optional Extension or Homework** Teeth Matching Game, [http://sciencekids.co.nz/teeth_eating.swf](http://sciencekids.co.nz/teeth_eating.swf). A fun animated game in which students match animals to their corresponding sets of teeth—helpful for tying together Activities 3 & 4. Elementary level.
Activity 4: Oh, What Big Teeth You Have!

Time: Approximately 90 minutes.

Purpose
Students will examine a group of animal teeth and sort them based on size, shape, function, and animal they likely belonged to. Students will be able to identify canines, incisors, molars, and their respective functions.

*** NOTE: This activity is sectioned into two different versions: one for less advanced students (approximately grades 2-5) and one for more advanced students (approximately grades 5-8). Decide ahead of time which procedure would suit your students best. ***

Materials
- Animal tooth replicas, 5 of each type; labeled A-Q (included in CIBT Kit)
- Metric rulers – required only for Advanced Version
- Calculators – required only for Advanced Version

Procedure
1. Divide students into groups of about four, making sure that each student has a copy of the Activity 4: Oh, What Big Teeth You Have! Worksheet.
2. Give each group a set of assorted teeth (including canines, molars and incisors) and a metric ruler.
3. Guide students in filling out Table 5 on their worksheets:
   A. The code letter of each tooth is on the bottom or root.
   B. Help students identify the top and bottom of each tooth as they sketch the teeth. The root (bottom) is usually the longer, darker part. This part of the tooth anchors it into the skull. There can be multiple roots on one tooth (note this in the next column). Molars typically have more roots than other tooth types, for stabilization during heavy use. The pointed, sharp & wedge-like, OR flat grinding surface is the top—the chewing surface.
   C. Students will then measure, in centimeters, the length (from root tip to crown of tooth) and width (from left to right) of each tooth, at its tallest or widest point. These measurements should be rounded to the nearest tenth (millimeter) and recorded in the next column.
   D. Next, students will use a calculator to divide the length by the width to come up with a “tooth index number” for the subsequent column.
   E. Students now determine if the chewing surface of the tooth (the top) is flat, pointed, or sharp & wedge-like. They can tell by looking and/or touching.
4. For the last column in Table 5, students will use the data they just collected in conjunction with the dichotomous key provided on page 9 (duplicated on the next page).
Tooth Types Dichotomous Key

1. The tooth has an index number below 2.7..............................................................Go to #2
   The tooth has an index number of 2.7 or above...................................................Go to #3

2. The chewing surface of the tooth is flat...............................................................Molar
   The chewing surface of the tooth is not flat..........................................................Go to #3

3. The tooth has one root.........................................................................................Go to #4
   The tooth has two or more roots..........................................................................Molar

4. The chewing surface of the tooth is pointed........................................................Canine
   The chewing surface of the tooth is sharp & wedge-like......................................Incisor

In general, students should find the following to be true:

- **Incisors**: higher index number (between 2.5-22.6), sharp & wedge-like chewing surface, one root
- **Canines**: range of index numbers (between 1.7-4.2), distinctly pointed chewing surface, one root
- **Molars**: lower index number (between 1.1-2.7), flat chewing surface, between one and four roots

See the key below to verify answers. Due to the differing nature of our specimens, all of the measurements below are APPROXIMATE! They are taken from only ONE set of teeth.

Table 5. Types of Teeth ANSWER KEY

<table>
<thead>
<tr>
<th>Tooth Code</th>
<th># of Roots</th>
<th>Length (cm)</th>
<th>Width (cm)</th>
<th>Tooth Index # (Length ÷ Width)</th>
<th>Chewing Surface: Flat, Pointed, or Sharp &amp; Wedge-Like?</th>
<th>Incisor, canine, or molar?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3-4</td>
<td>4.0</td>
<td>2.9</td>
<td>1.4</td>
<td>Flat</td>
<td>Molar</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>10.3</td>
<td>0.9</td>
<td>22.6</td>
<td>Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>2.6</td>
<td>1.9</td>
<td>1.4</td>
<td>Pointed</td>
<td>Molar</td>
</tr>
<tr>
<td>D</td>
<td>1</td>
<td>8.1</td>
<td>2.9</td>
<td>2.8</td>
<td>Pointed</td>
<td>Canine</td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>3.9</td>
<td>1.2</td>
<td>3.3</td>
<td>Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>3.3</td>
<td>1.8</td>
<td>1.8</td>
<td>Pointed</td>
<td>Canine</td>
</tr>
<tr>
<td>G</td>
<td>1</td>
<td>4.0</td>
<td>1.0</td>
<td>4.0</td>
<td>Pointed</td>
<td>Canine</td>
</tr>
<tr>
<td>H</td>
<td>2-3</td>
<td>1.7</td>
<td>1.5</td>
<td>1.1</td>
<td>Flat</td>
<td>Molar</td>
</tr>
<tr>
<td>I</td>
<td>1, 3-4</td>
<td>5.6</td>
<td>2.7</td>
<td>2.1</td>
<td>Pointed, Sharp &amp; Wedge-Like</td>
<td>Molar</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>2.0</td>
<td>0.7</td>
<td>2.9</td>
<td>Pointed, Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td>2.9</td>
<td>0.7</td>
<td>4.1</td>
<td>Pointed</td>
<td>Canine</td>
</tr>
<tr>
<td>L</td>
<td>1</td>
<td>0.8</td>
<td>0.3</td>
<td>2.7</td>
<td>Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
<tr>
<td>M</td>
<td>2-3</td>
<td>1.5</td>
<td>1.3</td>
<td>1.2</td>
<td>Flat, Pointed</td>
<td>Molar</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>2.4</td>
<td>0.9</td>
<td>2.7</td>
<td>Flat</td>
<td>Molar</td>
</tr>
<tr>
<td>P</td>
<td>1</td>
<td>1.5</td>
<td>0.5</td>
<td>3.0</td>
<td>Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
<tr>
<td>Q</td>
<td>1</td>
<td>7.1</td>
<td>1.6</td>
<td>4.4</td>
<td>Flat, Sharp &amp; Wedge-Like</td>
<td>Incisor</td>
</tr>
</tbody>
</table>
5. Now that the students know what kind of tooth each one is, they must find out who it came from! Page 12 of the Student Section gives a visual comparison between the seven different animals the CIBT teeth are from. The graphic from page 12 is duplicated below. If your students aren’t familiar with these animals, display the laminated Animal Cards from the CIBT Kit for reference.

Students will fill out Table 6 on page 13 with the tooth type, and which animal it came from. This builds on information from throughout the lab, and will probably be the most challenging part. Students will draw on their knowledge regarding dental differences between herbivores, carnivores, and omnivores from Activity 3, to make their best guess.

In the herbivorous species (i.e. cow, horse, beaver), molars and incisors will be well-developed, with canines duller and more incisor-like. Carnivores (i.e. coyote, bobcat) are likely to have small incisors and molars—and prominent, long, sharp, conical canines. Their molars may be surprisingly sharp and tiny. Omnivore (i.e. black bear, raccoon) dentition is the most ambiguous, but tends to resemble carnivore dentition more than that of herbivores.

Size/scale comparisons should also help—for instance, a heavy tooth that is 5 cm long probably did not come from a raccoon, because that is the smallest animal possible. Similarly, a tiny, 0.2 cm wide tooth probably did not come from a horse.

More likely, it is an incisor or molar from a small animal like the bobcat or raccoon.

Encourage students to think generally when making their decisions—they should try not to focus in on any one detail about the tooth. The final answers for Table 6 are at right:

<table>
<thead>
<tr>
<th>Tooth Code</th>
<th>Animal</th>
<th>Tooth Type (from Table 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cow</td>
<td>Molar</td>
</tr>
<tr>
<td>B</td>
<td>Beaver</td>
<td>Incisor</td>
</tr>
<tr>
<td>C</td>
<td>Coyote</td>
<td>Molar</td>
</tr>
<tr>
<td>D</td>
<td>Bear</td>
<td>Canine</td>
</tr>
<tr>
<td>E</td>
<td>Cow</td>
<td>Incisor</td>
</tr>
<tr>
<td>F</td>
<td>Bobcat</td>
<td>Canine</td>
</tr>
<tr>
<td>G</td>
<td>Coyote</td>
<td>Canine</td>
</tr>
<tr>
<td>H</td>
<td>Bobcat</td>
<td>Molar</td>
</tr>
<tr>
<td>I</td>
<td>Horse</td>
<td>Molar</td>
</tr>
<tr>
<td>J</td>
<td>Coyote</td>
<td>Incisor</td>
</tr>
<tr>
<td>K</td>
<td>Raccoon</td>
<td>Canine</td>
</tr>
<tr>
<td>L</td>
<td>Bobcat</td>
<td>Incisor</td>
</tr>
<tr>
<td>M</td>
<td>Raccoon</td>
<td>Molar</td>
</tr>
<tr>
<td>N</td>
<td>Beaver</td>
<td>Molar</td>
</tr>
<tr>
<td>P</td>
<td>Raccoon</td>
<td>Incisor</td>
</tr>
<tr>
<td>Q</td>
<td>Horse</td>
<td>Incisor</td>
</tr>
</tbody>
</table>

Table 6: Tooth Type and Animal It Came From ANSWER KEY
Activity 5: *Tyrannosaurus rex* Tooth (OPTIONAL)

**Time:** Approximately 45 minutes.

**Objective**
Students will use rubber molds and a casting medium to make their own replica of a fossil *T. rex* tooth.

**Materials**
- *Tyrannosaurus rex* tooth molds (*)
- Rubber bands to keep both halves of the mold together (*)
- Two finished example tooth casts: one with shoe polish, one plain (*)
- Casting medium (Perfect Cast, Plaster of Paris, etc.)
- Mixing cup
- Mixing utensil
- Water
- Nail file
- Shoe polish, clear nail polish (optional)

(*) Included in the CIBT Tooth Kit

**Procedure**
1. Hand out the Activity 5: *T. rex* Teeth Fact Sheet to students. Have them read through it, then discuss as a class in light of what they have learned throughout the Teeth Unit.
2. Cover the working area with newspaper or set up four disposable plates.
3. Fit the two pieces of the mold together in the correct position and secure them together with rubber bands. The kit includes four molds (eight halves).
4. Pour 2 ½ tablespoons of cool water (about 40 mL) into a plastic beaker or disposable cup.
5. Add approximately 6 tablespoons of casting medium (about 85 grams) to the plastic beaker/cup. Refer to the casting medium’s instructions for exact measurements. Begin stirring immediately until the mixture is evenly mixed and smooth. Tap the cup on the table for at least one minute to bring any bubbles in the mixture to the surface.
6. Fill the mold through the small hole on the top with the plaster mixture. If using a small beaker, you can pour from the spout. Otherwise you can use a small funnel or make a funnel folding half of a small disposable plate. Tap the mold slightly on the table. Tilt it in all directions to dislodge any air bubbles from the sides of the mold. Add more plaster as needed, until the mold is full.
7. **DO NOT** pour ANY extra casting mixture down the drain!!!
8. Extra plaster and the disposable cups should be thrown away in the trash. If you are using plastic beakers, clean with a wet paper towel and wash remaining leftover mixture with warm water. **Wash the mixing utensil before the mixture hardens.**

9. Let the filled mold sit undisturbed for at least 30 minutes or until the cast is warm and hard. The bottom of the mold might leak small drops of the mixture.

10. When the plaster is hard, carefully separate the sides of the mold and very carefully remove the cast. The cast might be slightly soft. This is a perfect replica of a genuine fossil.

11. Carefully break the funnel like projection at the top of the cast. File off any seam line where the two halves came together. Let the fossil dry completely.

12. You can finish the fossil with paint or stain in earth tones. Brown, solid shoe polish applied with a napkin works extremely well, but you can also use dark colored wood stains or even tea. After the shoe polish dries out, apply one coat or two of transparent nail polish. It gives the tooth a subdued, glossy finish, similar to a natural weathered bone.
How Many Teeth Do I Have?

In your mouth, you have at least three different types of teeth, all with different purposes. Other animals have these types of teeth too!

1. **Incisors** specialize in cutting or snipping off pieces of food. They are broad and flat, with a narrow edge, and are located at the front of the mouth.
2. **Canines** rip and tear tough foods; they also pierce and hold. Canines are located behind the incisors on both sides of the mouth.
3. **Molars** are large teeth with broad surfaces designed for crushing, grinding and chewing food. They can be found at the back of the mouth.

The diagrams below show each of these tooth types from the side (the darker part is the root) and the top (the chewing surface).

---

**Procedure**

1. **Getting to Know Your Teeth**

   Feel your teeth with your tongue. Using the diagram above to review the information on the different types of teeth that you have in your mouth.
   
   • Do all your teeth feel the same?
   • What kinds of surfaces do you feel?
   • How many different types of teeth can you feel?
   • How many different tooth sizes can you feel?
   • Where are the largest teeth located?
   • Do some teeth feel flatter or duller than others?
   • Do some teeth feel sharper than others?
   • If so, where are they located?
   • Why do you think you have different types of teeth?

   Now, **predict** how many of each tooth type you have (don’t count yet!). Write your predictions in the first column Table 1 below.

2. Next, **read** the book *How Many Teeth* by Paul Showers. Record the number of each type of tooth that the book says you have in the same table.
3. Now wash your hands with antibacterial soap. Use a mirror and work with a partner to count your teeth for the next section. You may want to use a coffee stirrer or Q-Tip (provided by your teacher) to help you count. Record your data in Table 1.

**Class Data**

Your teacher will now ask you how many teeth you counted and tell you how many teeth your classmates counted. Listen carefully in class so you can write down these answers:

- How many students have 20 teeth? __________
- How many students have 19 teeth? __________
- How many students have 18 teeth? __________
- How many students have 17 teeth? __________
- How many students have 16 teeth? __________
- How many students have 15 teeth? __________
- How many students have less than 15 teeth? __________

Use the next page to make a graph of this information.

---

**Table 1. Numbers of Teeth**

<table>
<thead>
<tr>
<th></th>
<th>Predicted Number</th>
<th>Number from How Many Teeth? Book</th>
<th>Counted Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incisors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower Jaw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Jaw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Optional Worksheet 1: Younger Students

How old are you in months? You can find out by using a calculator to multiply your age by 12, and then adding the number of months over your age that you are.

Fill out Table 2 below by asking your group members these questions:

<table>
<thead>
<tr>
<th>How old are you in months?</th>
<th>88</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many teeth do you have?</td>
<td>19</td>
</tr>
</tbody>
</table>

Now you will put a dot above the students’ age and next to their number of teeth on the graph below. The example from Table 2 is shown.

Can you find any trends in the number of teeth versus students’ age? If so, why do you think these may be?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
Optional Worksheet 2: Older Students (PAGE 1)

Fill out Table 2 below by asking your group members the following questions:

Table 2. Age in Months vs. Number of Teeth

<table>
<thead>
<tr>
<th>How old are you in months?</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How many teeth do you have?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now transfer your data to Table 3. You will need to find the AVERAGE number of teeth for each age range before filling it out. Use a separate sheet of paper for calculations.

Table 3. Age in Months vs. Average Number of Teeth

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Average Number of Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-122</td>
<td></td>
</tr>
<tr>
<td>123-125</td>
<td></td>
</tr>
<tr>
<td>126-128</td>
<td></td>
</tr>
<tr>
<td>129-131</td>
<td></td>
</tr>
<tr>
<td>132-134</td>
<td></td>
</tr>
<tr>
<td>135-137</td>
<td></td>
</tr>
<tr>
<td>138-140</td>
<td></td>
</tr>
<tr>
<td>141-143</td>
<td></td>
</tr>
</tbody>
</table>

Make a bar graph using the data from Table 3 on the next page.
Do you see any trends in the average number of teeth versus age range? If so, why do you think these might be?
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Title of Graph: ________________________________________________________________
Teeth Unit Activity 1: How Many Teeth Do I Have?

Student Worksheets

Name: __________________________

Label the following diagram of a mouth with canines, molars, and incisors:
FOR OLDER STUDENTS

Label the following diagram of a mouth with pre-molars, canines, incisors, and molars:
Which Teeth Do You Use?

What are the three kinds of teeth that you have?
_________________________, _______________________, and ________________________.

Predictions
Which teeth would you use to eat bread? _________________
Why?________________________________________________________________________

Which teeth would you use to eat carrots? _________________
Why?________________________________________________________________________

Which teeth would you use to eat bananas? _________________
Why?________________________________________________________________________

Results
Now try eating the bread. Which teeth are used? _________________
Are other teeth used as you continue or finish eating? _________________

Now try eating the carrots. Which teeth are used? _________________
Are other teeth used as you continue or finish eating? _________________

Now try eating the banana. Which teeth are used? _________________
Are other teeth used as you continue or finish eating? _________________

Notice that different types of teeth take different actions (for example: tearing, stabbing, cutting, crushing, grinding) when you’re using them to eat. This is because each type of tooth has a specific purpose.

What are incisors used for? ________________________________
What are canines used for? ________________________________
What are molars used for? ________________________________
What Did It Eat for Dinner?

Herbivores
What does an herbivore eat? ___________________
What kinds of teeth would an herbivore use the most? ___________________
Name two animals that are herbivores: __________________, __________________

Carnivores
What does a carnivore eat? ___________________
What kinds of teeth would a carnivore use the most? ___________________
Name two animals that are carnivores: __________________, __________________

Omnivores
What does an omnivore eat? __________________
What kinds of teeth would an omnivore use? ______________________________________
Name two animals that are omnivores: __________________, __________________

Your teacher will demonstrate how to answer the questions in Table 4 below using a cow jaw. Follow along and fill in the information in the first column. When your group receives two jaws from two different species labeled “R” and “C,” answer the questions in Table 4 to determine whether each animal was an herbivore, carnivore, or omnivore.

Table 4. Jaw Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Cow</th>
<th>R</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tallest type of tooth?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widest type of tooth?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many incisors?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many canines?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How many molars?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Herbivore, carnivore, or omnivore?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Explain your choice.</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Oh, What Big Teeth You Have!

Each tooth your teacher gave you has a code letter on the bottom, which you will enter in the first column to identify it. Fill out Table 5 below, using a metric ruler to measure the teeth in centimeters (cm). “Length” means from root tip to the top; “Width” means from left to right. Measure each tooth at its tallest or widest point, and round answers to the nearest tenth. **Once you have gathered all the information, fill in the last column using the dichotomous key on the next page.**

**Table 5. Types of Teeth**

<table>
<thead>
<tr>
<th>Tooth Code</th>
<th>Drawing Label top and root(s)</th>
<th># of Roots</th>
<th>Length (cm)</th>
<th>Width (cm)</th>
<th>Tooth Index # (Length ÷ Width)</th>
<th>Chewing Surface: Flat, Pointed, or Sharp &amp; Wedge-Like?</th>
<th>Incisor, canine, or molar?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tooth Types Dichotomous Key

1. The tooth has an index number below 2.7…………………………………………….Go to #2
   The tooth has an index number of 2.7 or above……………………………………….Go to #3

2. The chewing surface of the tooth is flat…………………………………………….Molar
   The chewing surface of the tooth is not flat…………………………………………..Go to #3

3. The tooth has one root…………………………………………………………………Go to #4
   The tooth has two or more roots………………………………………………………Molar

4. The chewing surface of the tooth is pointed……………………………………………Canine
   The chewing surface of the tooth is sharp & wedge-like……………………………..Incisor

Whose Tooth Was It?

Now that we know what kind of tooth each one is, we must figure out who it came from! There are seven different animals that these teeth could be from. Use the guide below to help you decide which animal each tooth came from. Write your answers on Table 6, on the next page.

Cow
Average Mass: 450-1100 kg
Diet: Herbivore

Horse
Average Mass: 380-1000 kg
Diet: Herbivore

Black Bear
Average Mass: 68-113 kg
Diet: Omnivore

Beaver
Average Mass: 20 kg
Diet: Herbivore

Coyote
Average Mass: 7-21 kg
Diet: Carnivore

Bobcat
Average Mass: 10-15 kg
Diet: Carnivore

Raccoon
Average Mass: 5-9 kg
Diet: Omnivore
Use the graphic on page 12 along with your knowledge of teeth in carnivores, herbivores, and omnivores to fill out Table 6 to the best of your abilities. (HINT: remember Activity 3!)

**Table 6: Tooth Type and Animal It Came From**

<table>
<thead>
<tr>
<th>Tooth Code</th>
<th>Animal</th>
<th>Tooth Type (from Table 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Tyrannosaurus rex
Teeth Fact Sheet

• The *Tyrannosaurus rex*, a carnivorous dinosaur that lived 68-66 million years ago, crushed its prey—bones and all—with over 60 strong teeth and powerful, four-foot wide jaws.

• Its teeth were about the size and shape of bananas (Figure 1), although some teeth grew up to four feet long. It had great variation in the sizes and shapes of its teeth.

  Figure 1. *T. rex* teeth compared to a human hand.

• The teeth had serrated edges, used to tear flesh (Figure 2). They were periodically shed and re-grown.

  Figure 2. Serrated edges on *T. rex’s* tooth.

• The *T. rex* could bite with three times the force of a Great White Shark, 15 times the force of an African lion, and 77 times the force of an adult human!

• *T. rex* never flossed its teeth, so pieces of rotten, bacteria-infested meat would get stuck between them. If its prey escaped, it would almost certainly die of infection from the bite.

• *T. rex’s* front teeth gripped and pulled, while the teeth along the side of the jaw punctured and tore flesh (Figure 3). The teeth at the back of the mouth sliced and diced chunks of prey, and also forced food to the back of the throat.

  Figure 3. *T. rex* using its strong front teeth to grip and pull apart its prey (a Triceratops).