Junkyard Digestion

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Editor's notes:

Website URLs listed in this resource were current as of publication, but may now be obsolete. If you know of a replacement URL, please suggest it in the resource's "Comments" section http://www.apsarchive.org/resource.cfm?submissionID=384.

The APS encourages teachers to give students a copy of the "ABC" (Appropriate, Beneficial, Caring) rules for use of animals in the classroom, to discuss the rules, and to ask students to sign the "ABC" rules contract (see References). Also, teachers should have a plan for short term care of the animals (with supporting references for appropriate care guidelines) and for disposal or long-term care of all classroom organisms.

Teachers should carefully review any stimulus or environmental change for an animal being used in experiments or observations before students are allowed to use that stimulus. This is especially important if the stimulus could cause pain or distress to the organism. Teachers may be able to identify a less stressful stimulus for the students to use in their experiment.

Although mammals provide excellent opportunities for observational studies, they require particular care in terms of handling and may cause allergic reactions in some students. The teacher should check local and state guidelines before using mammals in the classroom.

Disclaimer:

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Junkyard Digestion

Teacher Section

Purpose	Build a working model of the digestive tract in order to investigate the structure and function of digestive organs.
Objectives	The student will be able to: Define the structure and function of digestive organs. Design a logical system. Assess problems and practice problem-solving skills. Write a scientific proposal for materials and approvals.
Grade Level	Designed for grades 10 and up.
National Science Education Standards Alignment	K-12: Unifying Concepts and Processes Systems, order and organization Evidence, models, explanation Form and function Grades 9-12: Science as Inquiry Abilities necessary to do scientific inquiry. Life Science Matter, energy, and organization in living systems Science and Technology Abilities of technological design Science in Personal and Social Perspectives Personal and community health - diseases
Time Required	The entire unit will take approximately 3 to 4 days on the block. On a regular schedule plan for a full week to seven days depending on your depth of expansion. (See Unit Outline for Suggestions)
Materials	KWL Chart Student Parameter Handout Internet Research Sheet Junkyard Digestion Evaluation Form pH indicator (might be needed for some groups) Basic tools (hammer, wire cutters, glue gun, depends upon class needs) Food (input into system) Camera to record group projects (optional)
Safety	Instruct the students on safe use of the tools.

Including All Students

One interesting idea would be to arrange all girl and all boy groups. This may erase gender role stereotyping in the groups and ensure equal participation.

Students with special needs may need to be grouped with individuals who can help them with the assignment.

Consider modalities when arranging groups. Typically, the more varied the group is in modalities the more success it has. Try to make sure that the tactile learners and visual learners are not all grouped together but rather spread out among the groups.

In classes where projects are not normal procedure, it may be beneficial to provide roles to each student. For example, a group may consist of recorders, researchers, and builders. This approach works well to get all students involved in the project.

An extension to include underrepresented students would be to use a varied diet in some of the models. For example, students could choose their own diet from their culture to use instead of what is suggested in the handout.

Unit Outline Suggestion

1. Start the KWL Chart (What you Know, What you Want to know, and What you Learned). Cover what you know and want to know at this stage.
2. Present the students with the *Parameters* handout. This supplies them with the list of organs, rules (energy, materials, food), and what should be included in their written proposal.
3. Do Internet research for information about the digestive system. Textbooks and the library may be substituted for or supplemental to the Internet research. Allow a minimum of one full day for research.
4. Submit Written Proposal for teacher approval.
5. Build models. Allow at least one full period on the block or two on regular school schedule for construction.
6. Peer evaluation time – offer suggestions and hypotheses.
7. Test Models (Allow half a period to a full period)
8. Evaluate End Products using the grading rubric.
9. Allow students to assess their problems and fix them before the final test.
10. Re-test models for final evaluation. (Performance Based Assessment)
11. Return to KWL Chart and complete the What you Learned section.

Questions to Ask Along the Way

What do you know about the digestive system?

How does your system filter water and waste?

How do the materials you are using simulate digestive organs and their function?

What did you learn from your research?

How can you make your model more effective?

Traditional Schedule Outline

Day One: KWL Chart and Discussion
Student Parameter Handouts and Questions
Begin Internet Research (if time allows)
Day Two: Internet Research Time
Begin Brainstorming for Materials and Design
Start on Written Proposal
Day Three: Written Proposal Due by End of Class
(You could have an activity like a worksheet to reinforce their research on organ functions for groups who finish early.)
Day Four: Begin Building of Models in Class
(Plan for this to take the entire hour.)
Day Five: Finish Building
Peer Evaluation Time
Begin Testing (if time allows)
Day Six: Testing and Evaluation
Assessment of Problems
Day Seven: Re-test
Return to KWL Chart
Expansion Time or Alternative Evaluation Time

Preparation and Procedure

Students will build a model of the digestive system out of used goods and trash. The model must actually work in that it digests food and produces an end product.
The activity is done in cooperative groups of approximately 3 to 5 students. Groups may be arranged or chosen by the students. See the Including All Students section for additional grouping ideas.
The food used in the models may be varied (one of each food group), simple like a can of baked beans, or one fat, one carbohydrate, and one protein. See the Including All Students section for an idea for involving underrepresented students.
See the student handouts for specific rules, organs, and the evaluation criteria.
If the Internet is not available at your school, contact the National Institute of Health and ask them for their pamphlet "*Your Digestive System and How It Works*." See the Resources section for more information.
The model will not move by itself or look like an actual digestive system. Students will supply the energy moving the food and the model will be more functional than attractive.
All the numerical points on the handouts can be adjusted to meet your needs.
This activity works well by just letting the students discover the information instead of lecturing. However, the suggested outline may be changed to meet your needs.

Suggestions for Assessment	Write a story of the life of your breakfast through the digestive system. A traditional multiple choice, fill in the blank, or essay test.
Extensions	Research digestive system disorders. Nutrition unit studying the effects of diet on the digestive system. Include a section on food from different cultures in your nutrition study.
References & Resources	www.ccfa.org/weekly/wkly911.htm www.niddk.nih.gov/health/digest/pubs/digesyst/newdiges.htm NIH: (301) 654-3810 (phone) or (301) 907-8906 (fax)

Junkyard Digestive System Parameters

Goal: Create a working model of the digestive tract from household materials.

Rules:

1. Model must include mouth, epiglottis, esophagus, stomach, liver, pancreas, gallbladder, colon, jejunum, ileum, duodenum, and anus. Also, some form of digestive enzyme must be present at the stages of the mouth, stomach, liver, and pancreas.
2. All materials used must be straight from a group member's household. Absolutely no new material may be purchased for this project without approval from the teacher. This request for new materials must be submitted in your written proposal.
3. Model must be able to pass the test, which is putting a cup of a mixture of food sources into your model for digestion. Your model must produce some sort of semi-digested end product. Your group's end product will be collected and measured as an evaluation of your digestive system model.
4. A written plan must be submitted before any construction may begin. This plan needs to include *a list of members, list of materials, a detailed diagram, an overall plan, and any special requests*.
   The overall digestive system must be outlined in detail including all of these items before approval will be given.
5. All parts of the system must be labeled.
6. The model will not look identical to a true digestive system; rather it will function like a digestive system.
7. Both mechanical and chemical digestion must be demonstrated in some manner. The model does not have to move on its own. This means that human hands will supply most of the movement. However, the entire process of mechanical digestion may not solely include mashing the substance with your hands.
8. Only 12 ounces of water are legal to use in your system to chase the food down.
9. Group participation is a must and will be taken into account during grading.

Internet Research Worksheet

Use the web sites listed below to answer the questions.

www.ccfa.org/weekly/wkly911.htm

www.niddk.nih.gov/health/digest/pubs/digesyst/newdiges.htm

1. What is the purpose of the digestive system?

2. What are the jobs of your different digestive system organs (liver, pancreas, gallbladder, stomach, and intestines) and how is your digestive system arranged?

3. What is the difference between mechanical and chemical digestion? What chemicals are present in the digestive system?

4. What are the sections of the intestines called in the digestive system?

Junkyard Digestion Evaluation Form

Written Proposal (25 Points Total)
- list of members (5 points)
- list of materials (10 points)
- diagram (10 points)
- overall plan (5 points)

Model Design (35 Points Total)
- Completion of all Parts (15 points)
- Labeling (5 points)
- Overall Design and Engineering (15 points)

Group Participation (5 Points Total)

End Product (35 Points Total)

Excellent (30 to 35 Points)	Good (20 to 29 Points)	Average (10 to 19 Points)	Poor (0 to 9 Points)
Product is solid and filtered well. The end product has obviously been processed and does not resemble the original input of food. The amount is also appropriate for the amount of food put into the system. No improvements are necessary in your digestive system.	Product is mostly solid and filtered. The end product appears to be mostly processed and does not resemble the original input of food to a large extent. The amount is for the most part appropriate for the amount of food put into the system. Only fine-tuning is necessary in your digestive system before further testing is conducted.	Product is fairly solid and filtered. The end product still resembles the original input of food to a large extent, yet some processing is apparent. The amount of end product is a little too large for the amount of food put into the system. The system needs a few problems worked out before further testing may be conducted.	Product is runny and not filtered well. The product resembles the original input of food and does not appear as if any processing has been completed. The amount is too large for the original input of food. The model needs to be rebuilt before further test may be conducted.

KWL

What I *Know*
What I *Want* to Know
What I *Learned*

_____ Name
_____ Period

Topic of Discussion:		
What I *Know* about	What I *Want* to know about	What I *Learned* about