Lesson Plan: Exploring Molecules

**General Description**
This activity is designed to teach the process of science and emphasize the importance of asking questions, begin to teach course content without any assumed background, and allow a discussion leader to establish rapport with his/her students.

**Objectives**
- Students will ask basic questions (how, why, what, where, when) about molecules that are related to many biological processes.
- Students will perceive themselves as engaged in the process of science by way of asking questions in the learning activity.
- Students will become familiar with the topics that will be covered in L112.
- Students will be motivated to participate in a learning process.
- Students will learn the names of discussion leader and fellow peers in the discussion section.

**Concepts**
fundamental biological molecules and introductory chemistry

**Time**
about 30 minutes

**Prerequisite Skills**
Basic familiarity with various classes of biological molecules.

**Materials**
Bag of laminated molecules
Optional student handout (list of molecules)
**UTI Instructions: Exploring Molecules**

**Introduction:**
In this activity, students will review basic biological molecules by playing the common game “20 Questions”. In “20 Questions”, individuals attempt to guess their partner’s object (in this case molecule) by asking questions that can only be answered by “yes” or “no”. Students practice asking questions and learn the general characteristics of various classes of biological molecules.

**Procedure:**
Introduce yourself to the class. Explain to the students that they will participate in a couple of activities, including one similar to “20 Questions”, and that, because asking questions is an important aspect of biology, this activity is designed to get them to start thinking like biologists. Have each student extract a molecule card from the bag. They should look at the molecule, but keep it secret from other students.

Start the students on “20 Questions”. They should pair up to guess their partner’s molecule. Have student keep track of how many questions they ask and what questions are particularly informative. After two minutes or so, have students switch roles or partners. Continue for three or four rounds.

Recollect the students’ attention. Ask the students what kinds of questions they asked when trying to determine the identity of their partner’s molecule. Focus attention in particular on questions that were the most informative – that is, the questions that led the individual to guess correctly. Write as many student questions on the board as possible.

Ask students if they can see any natural groupings to the questions they identified. Use the students’ words. Most of the questions asked can probably be divided into natural categories: structure, composition, possibly function. Describe how their understanding of biological molecules will be strengthened by examining the categories that these questions reveal.

If time remains, instruct students to break into groups according to the similarities of their molecules. Do not provide guidance on what types of characters should be used to assess similarity—allow the students to choose on their own. When groups of similar organisms have been assembled, have each group explain to the class how they determined that their molecules were similar. Ask students to describe what the implications of the similarities of their molecules are. If there is time, have the students repeat the grouping by similarity activity, this time focusing on a different characteristic than they used before. Are the groups different than before? Debrief as you see fit.
Pre-Activity Worksheet: Exploring Molecules

General Description
In the activity you will do this week during your learning/discussion group, you will be examining unique characteristics of biological molecules. In order to be prepared for this activity, complete this worksheet.

Reading
Browse the “Structure and Function of Macromolecules” chapter in your text. Pay particular attention to the figures in this chapter.

Definitions
Write a definition of the following words. Use your text, textbook glossary, and your previous knowledge to create the best definition possible. Remember to connect your definitions to biological molecules.

1) macromolecule

2) polymer (and monomer)

3) polypeptide

4) phospholipid

Questions
Answer the following questions. You will explore your answers to these questions in-depth during learning/discussion group.

1) What proportion of the molecules in your body do you think contain nitrogen (N)? Provide the rationale for your estimate.

2) What is the most important class of biological molecule? Defend your answer.

3) Name two chemical features that differentiate carbohydrates and proteins.
Exploring Molecules

Below is the list of all molecules included in the activity. This list is not a complete list of important biological molecules. One strategy to increase your understanding of these molecules would be to organize them by various criteria. How do the groupings differ based on what criteria you have used?

galactose  carbon dioxide
glucose  saturated fat
fructose  cholesterol
glucose (chitin)  cortisol
deoxyribose  structure
water  adenine
ribose  guanine
sucrose  uracil
cellulose  cytosine
molecular oxygen  carbon dioxide
galactose  thymine
lactate  NADH
glucose  NAD+
fructose  isoleucine

formaldehyde  FAD
deoxyribose  cAMP
fructose  ATP
celloses  G3P

acrolein  pyruvate
glycine  chlorophyll a
alanine  dopamine
unsaturated fat  epinephrine
valine  starch
leucine  progesterone
methionine  steroid general
proline  nucleotide general
tryptophan  phospholipid
serine  ribose
threonine  maltose
maltose  cysteine

ethanol  acetyl CoA
tyrosine  lysine
asparagine  GTP

arginine  testosterone

histidine  glutamic acid
phenylalanine  maltose
Individual Accountability: Exploring Molecules

Demonstrate your new understanding of biological molecules by answering the following question:

Name three features or characteristics of molecules that could be used to classify an unknown molecule. In one or two sentences per feature, describe how these features would differentiate among proteins, carbohydrates, nucleic acids, and lipids.