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Regents Biology Laboratory Investigation

CLASSIFICATION OF FASTENERS

**Background Information**

Scientists are very organized people; they have a sort of systemic, all-consuming obsession to make sure that everything has a category. It’s not good enough to simply put all the animals together; scientists want to have all the animals with backbones in one group and those without in another. Within those groups, they want to know which have four legs and which give live birth and which make shells and…well, you get the point. They like to give everything a name.

The problem is, though, that there are so many ways to group living things. You could go by what they look like, but that might not always work out. For instance, zebras and horses look fairly similar in body structure but very different in color. Which characteristic would you use? And both porcupines and cacti have pointy bits, but one is a plant and one is an animal! Should they be grouped together?

Luckily for scientists, there is a much better way of grouping things than outward appearances. DNA is the basis for most classifications, because DNA can’t lie. An example will illustrate this point. While cacti and porcupines both have spikes, they’re made out of different materials. The spines of a cacti are really modified leaves (made out of cellulose and other carbohydrates), while the quills of a porcupine are really modified hairs (made mostly out of keratin, a protein). There are genes that code for each of these compounds, and by looking at the genes, it becomes readily apparent that porcupines and cacti are not very closely related. That is, they don’t share a lot of the same genes.

Keep in mind, though, that all living things are shaped by pressures in their environment. White-tailed deer have a coat that allows them to blend in to the woods. They didn’t get this coloration on accident, however. The deer with the best color match to their surroundings survived to pass on their genes to their offspring, and thus more deer were well-matched. Those that didn’t match very well were easy for predators to spot, and did not survive to pass on their genes. Just because there are also brown-colored birds doesn’t mean that deer and birds are closely related, though. We call this type of similarity an analogous trait; that is, the organisms look the same simply because they live in similar environments not because they are genetically similar. Same use but different source.

The opposite of this is a homologous trait. This is a trait, such as the appendages of many animals, that was present in the common ancestor even though it might be used for a different purpose in the present organism. Take legs as an example. Horses have several of the bones that correspond to our fingers fused into one large toe for ease in running. Dolphins have the same bones, but adapted for flippers. Birds and bats even have the same bones, but they, obviously, are used for flight. Same source, different use.

**Purpose**

The purpose of this lab is to help you better understand the various ways that scientists use to classify living things. You’ll see that while the appearance of certain organisms (in this case, different types of fasteners) might be helpful in helping you classify them, that it is not always the best thing to use.

**Materials**

PENCIL Various fasteners

Extra blank paper

**Procedure**

PART I – CLASSIFY YOUR FASTENERS

1. Remove your fasteners from the container and examine them. You should look for similar characteristics and those that set them apart.

2. Group them into TWO major categories. Record what characteristics you used for grouping in table 1, and give each group a name. For example, you might have

3. Within each category, create two more categories and record them in the table as well.

4. Continue on down until you have each fastener in a group of its own.

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| **Group** | **Characteristics Used** |
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PART II – SHOW RELATIONSHIPS

One way that scientists show relationships between organisms is with a cladogram. A cladogram is much like a tree, in that it has a root and them some branches. There are some rules to follow, however:

1 . Each branch point (called a node) must have only two branches

2. Organisms that exist at the top of the cladogram are extant (still living)

3. Organisms that are listed below the top of the cladogram are extinct.

See figure 1 for an example. You can see that species A, B and C are all extant, while species D is extinct. Furthermore, you can count the number of nodes (branch points) that you have to go through to get from species to species to tell how closely related they are. To get from A to B, you have to go through only one node. To get from A to D, you need to pass three. Therefore, species A and B are more closely related than species A and D.

A

B

C

D

Your task is to turn the groups that you made in part I into a cladogram. This will involve some more information. You currently have the fasteners grouped based on their characteristics, but you’ll now have to show which groups h