

## Owls in Trees

Many species of birds signal to one other with brightly colored feathers. Plumage is an important way for birds to identify other members of their own species, which is necessary for finding a mate and establishing territorial boundaries. It's also a valuable tool for evolutionary biologists trying to sort birds into phylogenetic trees, because birds with similar plumage are often (but not always!) related.

Nocturnal birds can't see each other well, so they identify themselves and others by ear instead of by their feathers. Should evolutionary biologists sort these birds the way the birds themselves do – by sound – or should we infer relatedness by looking at plumage and body shape?

In this lesson, we will investigate this question by exploring the appearance and the calls of ten U.S. owls.

### Part One: Calls

#### Step 1: Make observations.

In pairs or small groups, listen to the following owl calls on a computer with RavenViewer installed. As you listen to each call and watch the spectrogram, write down your observations about the call. It may help to make a sketch of it. Is it long or short? Does it have a regular rhythm or does it seem randomly spaced? Does it remind you of a sound you know? Does it go up or down in pitch? Discuss and take notes on all the calls.

1: <http://macaulaylibrary.org/audio/ravenViewer.do?id=112622>

2: <http://macaulaylibrary.org/audio/ravenViewer.do?id=20427>

3: <http://macaulaylibrary.org/audio/ravenViewer.do?id=9435>

4: <http://macaulaylibrary.org/audio/ravenViewer.do?id=125364>

5: <http://macaulaylibrary.org/audio/ravenViewer.do?id=8339>

6: <http://macaulaylibrary.org/audio/ravenViewer.do?id=45181>

7: <http://macaulaylibrary.org/audio/ravenViewer.do?id=8319>

8: <http://macaulaylibrary.org/audio/ravenViewer.do?id=4543>

9: <http://macaulaylibrary.org/audio/ravenViewer.do?id=111096>

10: <http://macaulaylibrary.org/audio/ravenViewer.do?id=22874>

Step 2: Classify the calls.

Sort the calls into groups by similarity. As you do so, discuss the criteria you're using to assign them to groups. Make a list of these characteristics.

Formalize your list into a table with at least three characteristics, where each characteristic is shared by at least two owls. In the table, write down whether each owl shares each particular characteristic (Yes/No).

You may add lines to this table if you have more characters.

<b>Character</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>

Step 3: Make a tree.

In the space below, draw a rooted phylogenetic tree of all the owls. Group them by the shared characters you decided on above. Mark the transition of each character on the tree. At the root of the tree, write down the character state of the ancestral owl.

Step 4: Present your tree.

Your instructor will ask a representative from each group to sketch the tree on the board, with the owl numbers and character transitions marked. As a class, we will discuss the different choices the groups made.

## Part Two: Morphology

### Step 1: Classify the owls.

Your instructor will hand out pictures of the same ten owls whose calls you listened to in Part One. In your group, discuss the owls and group them by how you think they're related. As before, decide on characters and make a table with the owls scored for each character.

You may add lines to this table if you have more characters.

Character	1	2	3	4	5	6	7	8	9	10

### Step 2: Make a tree.

In the space below, draw a rooted phylogenetic tree of all the owls. Group them by the shared characters you decided on above. Mark the transition of each character on the tree. At the root of the tree, write down the character state of the ancestral owl.

### Step 3: Present your tree.

Have a different representative from your group sketch the tree on the board, with the owl numbers and character transitions marked. As a class, we will discuss the different choices the groups made.

### Part Three: Analysis and Conclusions

Answer these questions on a separate piece of paper.

1. Your instructor will hand out a key that gives you the names of the owls in the pictures and on the list of calls. On each tree that your group created, write down the species names for all ten owls. Compare the two trees that your group created. How are they similar? How are they different?
2. Was there more agreement between groups on how to classify the owls when everyone used calls or when everyone used plumage?
3. Why do you think that was?
4. What disagreements arose in your group as you discussed how to classify the owls? Would you have come up with different trees if you had used different characters to classify the owls?
5. Based on your findings, do you think calls or appearance are better characters to use for classifying nocturnal birds? What makes a good character?
6. Your instructor will hand out a phylogenetic tree of the owls that is based on the sequence of one mitochondrial gene and one nuclear gene. Which of your group's trees agrees better with the DNA tree? Why do you think that is?
7. Owls, like all animals, have many genes, and the DNA phylogenetic tree uses only two because of technical limitations. Earlier DNA trees that used only one gene differed somewhat from the one you were given. How do you think estimates of the owl DNA phylogeny will change in the future as we sequence more genes?
8. What can calls and plumage tell you about the owls that DNA cannot?