

# Phylogenetic Collection Lab

## Objectives

- to connect the diversity of organisms described in class with the real world.
- to connect particular phyla of organisms with their characteristic habitats.
- to compare & contrast organisms within the different phyla.
- to show that most of “nature” that you usually see belongs to only a few phyla.
- to have you look at the world in a different way.

## Assignment

Between now and your lab meeting during the week listed on the syllabus, each lab group (1 student minimum; 3 students **maximum**) must collect representatives of 16 different phyla. Groups may not share specimens.

**Note that you must have collected your specimens before this lab meeting!!!**

## Specifically:

1. Because different sources disagree on the definitions of several phyla, we have created a set of web pages with the “Official Bio 112 Phylum List”. Links to these pages can be found in the section of the On-Line Lab Manual for this lab. You can click on the name of each phylum to “Google” the name of that phylum; this will give you a set of links that can help you find samples of that phylum.
2. In lab during in the week of the lab, each group will present and discuss their collection.
3. In order to get credit for a particular phylum, you must bring in something that is clearly recognizable as a member of this phylum to show to your TA. It can be a whole organism or a piece of an organism, but it must be clearly recognizable as a member of that phylum. For example, a dog hair is clearly from a mammal (the only animals with hair) and since mammals are craniates, this is clearly a member of the phylum chordata. You can use a microscope to show your TA any microscopic samples.
4. **You** are responsible for defending the classification for your organism. If you have any doubt, check with your TA **in advance**. Bring any necessary supporting materials.
5. You can obtain samples from any source, including the supermarket, bait shop, florist, woods, etc.
6. In order to get credit, you must also specify where each of your samples came from. You must specify both geography (part of the world) and habitat. Note that, if you get your sample from other than its natural habitat (greenhouse, supermarket, etc.), you must specify where this organism originally came from. For example, if you include atlantic salmon that you got at Star Market, you’d have to say that it came from the north atlantic (geography) and from the open ocean (habitat).

7. Points for your collection will be given as follows (to a maximum of 60 points):
- to count as a member of a phylum:
    - your TA must be able to recognize it as a member of that phylum
    - you must specify where it came from (geography & habitat)
    - you must have a name for it (common or genus/species)

<u>Number of phyla</u>	<u>Points</u>
1 – 8	3 points each
9 – 12	4 points each
13 – 16	5 points each

This is a group effort for a group grade. All group members will receive the same grade.

**You must be prepared to defend your selections.** That is, it is up to you to prove to your TA that a particular organism is what you say it is and that it belongs in the phylum you say it is.

### Procedure

- You can get samples from anywhere. Some suggestions:
  - marshes near UMB
  - fish store
  - bait shop
  - the links on the course website for this lab can give other hints
  - a greenhouse (not the one at UMB or the Arnold Arboretum, though)
  - ethnic markets
  - in your house
  - off of the docks near UMB
  - supermarket
  - in your neighborhood
- You can consult any sources you need (you will need to consult outside sources).
  - the library
  - your TA
  - Brian White
- the WWW (I have put relevant links in the OLLM for this lab)
- You will need to preserve some of your specimens. You can try freezing, drying, or putting them in a mixture of 2 parts rubbing alcohol (isopropanol) to 1 part water (keep this in a tightly closed container!) and storing at room temperature.
- **All potentially dangerous specimens must be dead when brought into lab!!!** This includes anything that can bite (snakes, and other live animals), cause disease (bacteria, fungi, etc.), or cause an infestation (bedbugs, cockroaches, etc.). When in doubt, bring in a part of the organism (hair, skeleton, shell, etc) or be sure that it is dead.

**THIS WILL TAKE A LONG TIME; DON'T WAIT UNTIL THE LAST MINUTE!**

### In lab during the week listed on the syllabus:

- Each group should bring in their collection with the completed list as described below.
- Your TA will check off the various organisms and collect your lab reports for grading.
- Your TA will then go phylum by phylum and ask “does anyone have an ...”.
- The class will then discuss what they have found, where they found it, etc.
- The class will pick 10 different organisms from 10 different phyla and:
  - construct a table of their properties, as described later
  - make a phylogenetic tree of all (as best you can) the organisms. This tree will be based on the kingdom, phylum, etc for each organism.

**The 10 Organisms you have chosen to explore in detail:**

Write their names and a brief description below:

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

## **A) Describing the Organisms**

As a wrap-up of the course material (especially the Themes, Plants, and Animals material) and a review for the final exam, the class will discuss the answers to the following questions. These are based on the Themes, Plants, and Animals sections of the course. Write the numbers of the organisms from the previous page in the blanks as appropriate.

### **1) Life cycles**

a) Which of the *samples* you have contains:

- i) Sporophyte
- ii) Gametophyte
- iii) Gamete
- iv) Adult
- v) Spore
- vi) Seed
- vii) Diploid cells
- viii) Haploid cells

b) Which of the *organisms* in your collection includes the following anywhere in its *life cycle*?

- i) Sporophyte
- ii) Gametophyte
- iii) Gamete
- iv) Adult
- v) Spore
- vi) Seed
- vii) Diploid cells
- viii) Haploid cells

## 2) Nutrition

Complete the following table as best you can:

Organism	Carbon Source	Nitrogen Source	Energy Source
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

## 3) Miscellaneous details

- Which of the organisms have a flow-through digestive system?
- Which of the organisms have a nervous system?
- Which of the organisms have an excretory system?

#### **4) Size and Scale**

Which of the organisms have specializations required for life at larger than microscopic size? List the organisms and one different specialization for each.

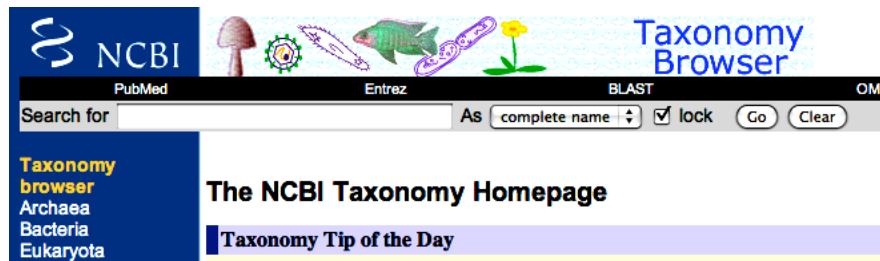
## B) Making the phylogenetic tree:

1) For each of the organisms in your class's collection that you can, you need to find its abbreviated taxonomic classification. This should include the levels of classification listed in *Campbell*:

- kingdom
- phylum
- class
- order
- family
- genus
- species

Since taxonomists disagree on some classification, it is important to use one single source for this information. We will use the Taxonomy Browser at the National Center for Biotechnology Information. Their website is: <http://www.ncbi.nlm.nih.gov/Taxonomy/>

When you go to that site, you will see:



**WARNING** Taxonomy is a field that is subject to lots of disagreement and debate. As a result, the names of phyla, orders, etc. on the NCBI site may be different from those we use in Bio 112 lectures and other labs. When there is a conflict, **always** use the names used in lecture and other labs when you are giving answers on an exam. In this lab, you should use the NCBI names, but **only for this lab**. Sorry for the confusion; welcome to the complex and contentious world of taxonomy...

2) Type the name of the organism into the "Search for" blank and click "Go". You might want to play around with some of the other choices under "complete name".

As an example, I typed in "harbor seal" and I got this:

NCBI Taxonomy Browser

Entrez PubMed Nucleotide Protein Genome

Search for  as  complete name  lock

Display  levels using filter:

Nucleotide  Nucleotide Core  Nucleotide EST  Nucleotide GSS  Protein  Structure  
 Genome Projects  Popset  SNP  3D Domains  Domains  GEO Data  
 UniGene  UniSTS  PubMed Central  Gene  HomoloGene  MapView  
 BLAST  TRACE  Taxonomy

**Lineage (full):** [root](#); [cellular organisms](#); [Eukaryota](#); [Fungi/Metazoa group](#); [Metazoa](#); [Eumetazoa](#); [B](#); [Gnathostomata](#); [Teleostomi](#); [Euteleostomi](#); [Sarcopterygii](#); [Tetrapoda](#); [Amniota](#); [Mammalia](#); [Theria](#)

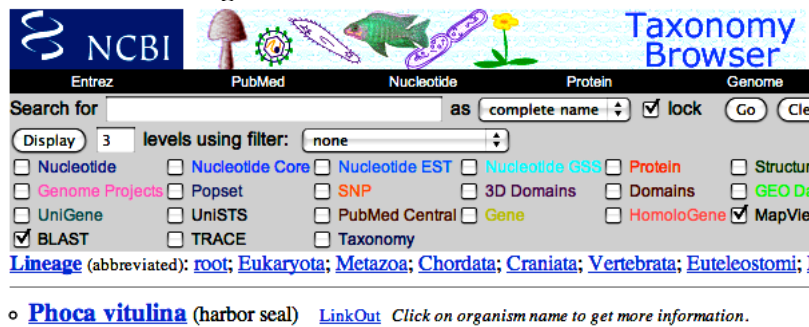
- [Phoca vitulina](#) (harbor seal) [LinkOut](#) *Click on organism name to get more information.*

This gives the full lineage for the harbor seal - this is too much information.



3) Click on the blue “[Lineage \(full\)](#)” link and it will change to “[Lineage \(abbreviated\)](#)” with many fewer entries.

You will see something like this:



This is more useful.

Note the line that says:

Lineage (abbreviated): root; Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia;

If you put the cursor over the terms, a little window will pop up showing the taxonomic level of that term. In this case, you’d get:

- Eukaryota - superkingdom (ignore this one)
- Metazoa - KINGDOM
- Chordata - PHYLUM
- Craniata - subphylum (ignore this one)
- Vertebrata - no rank (ignore this one)
- Euteleostomi - no rank (ignore this one)
- Mammalia - CLASS
- Eutheria - no rank (ignore this one)
- Laurasiatheria - superorder (ignore this one)
- Carnivora - ORDER
- Caniformia - suborder (ignore this one)
- Phocidae - FAMILY
- Phoca - GENUS

What about the species? Look down to where it says “Phoca vitulina” - the species is “vitulina”.

4) Use the kingdom, phylum, class, order, family, genus, and species to draw a phylogenetic tree of the organisms in your class using a format similar to that described on page MolPhyl-2. Label the branch points with the appropriate names.

**Phylogenetic Collection List:**

- The list of your collection will be due in lab during the week listed on the syllabus in your regular lab section.
- It must conform to the following format **exactly**:
  - 1) At the top, you should list your TA's name & section, and the names of all the group members.
  - 2) A table, in the following format, with your organisms listed. You may use the one on the following pages:

<u>TA checkoff</u>	<u>Sample #</u>	<u>Phylum</u>	<u>Page</u>	<u>Name</u>	<u>Where you found it</u>	<u>Where it lives</u>	
						<u>Geography</u>	<u>Habitat</u>
leave blank	same as on sample container or label	From On-line Lab Manual website	page in <i>Campbell</i> that describes this phylum (if listed in <i>Campbell</i> )	common name or genus, species name	(beach, market, etc.	where on <i>earth</i> it lives	what kind of environment it lives in

**Important Note:**

Not all of the categories of living things listed in *Campbell* are phyla. For example, on pages 671-673, *Campbell* lists "cnidarians" - this is a phylum - and "anthozoans" - not a phylum. Therefore, if you brought in an anthozoan and a hydrozoan, they would only count as *one* phylum since they are both members of the *same phylum* (cnidaria).

**Lab Report**

Lab reports are due to your TA during the week listed on the syllabus at your regular lab time. Your lab report will be worth 40 points. You should choose one phylum of organisms that was represented in your classmates' collections (it need not be a phylum that you brought in, but it must have been brought in by somebody). In a report of no more than 1-1.5 double-spaced pages, answer the following questions about the specimens of your phyla that you and/or your classmates brought in. Your report may only deal with organisms that were presented by you or your classmates.

1. Which organisms are you talking about in your report (a minimum of 3) and to which phylum do they belong?
2. What is similar about these organisms? Give six similarities. Be specific about body plan, habitat, etc.
3. What is different about these organisms and how do differences in their habitat, food source, 'life style', etc. explain these differences? Give 3 differences.
4. Using examples from the phylum you chose, explain 'what it takes to be a phylum'. That is: How *similar* must organisms be to be in the *same* phylum? How *different* must organisms be to be in *different* phyla?

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<u>TA</u> <u>checkoff</u>	<u>Sample #</u>	<u>Phylum</u>	<u>Page</u>	<u>Name</u>	<u>Where you</u> <u>found it</u>	<u>Where it lives</u>	
						<u>Geography</u>	<u>Habitat</u>
	1						
	2						
	3						
	4						
	5						
	6						

<u>TA</u> <u>checkoff</u>	<u>Sample #</u>	<u>Phylum</u>	<u>Page</u>	<u>Name</u>	<u>Where you</u> <u>found it</u>	<u>Where it lives</u>	
						<u>Geography</u>	<u>Habitat</u>
	7						
	8						
	9						
	10						
	11						
	12						

<u>TA</u> <u>checkoff</u>	<u>Sample #</u>	<u>Phylum</u>	<u>Page</u>	<u>Name</u>	<u>Where you</u> <u>found it</u>	<u>Where it lives</u>	
						<u>Geography</u>	<u>Habitat</u>
	13						
	14						
	15						
	16						