

Taxonomy and Biodiversity

Which two species are most closely related?



THE QUESTION

What is a Panda?

Raccoon

Red Panda

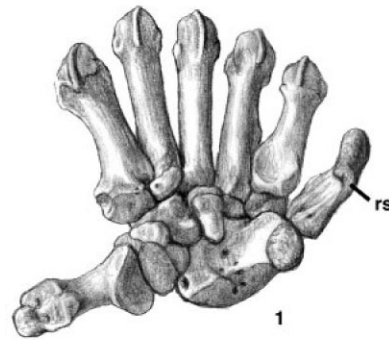
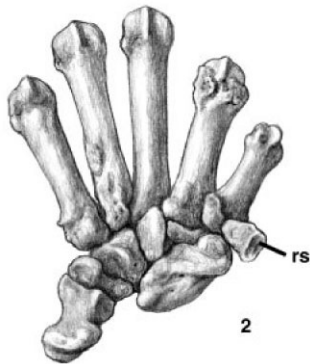
Panda

Bear



THE QUESTION

What is a Panda?



THE QUESTION

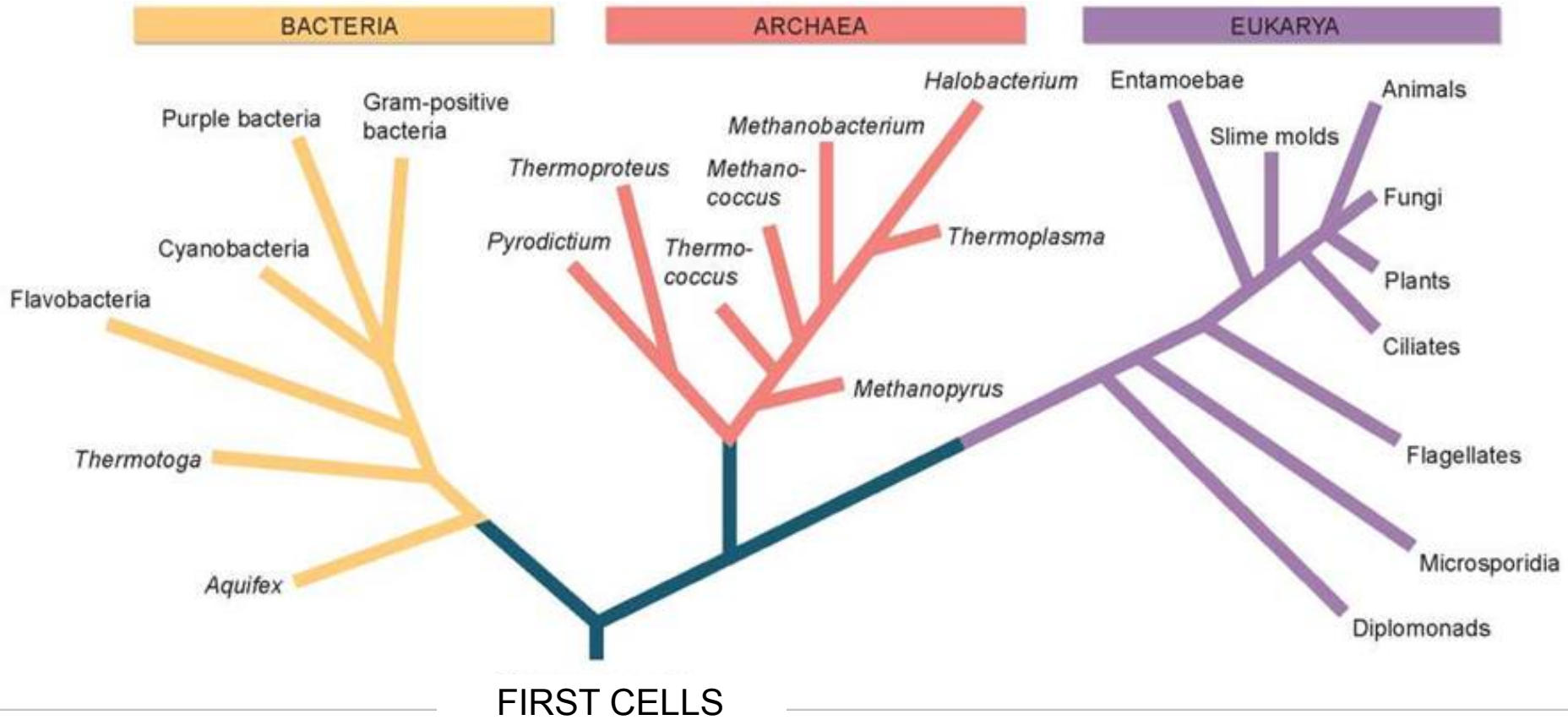
What is a Panda?



Taxonomy Part 1

Classification

THE 3 DOMAINS





*Carl Woese made an amazing discovery in biology...
Watch the short video clip as he relives his discovery.*

As you watch:

*1. Make note of why his discovery was so
important.*

*2. How are archaea fundamentally different
from other PROKARYOTIC cells.*



Domains

Three Domain system

- Eubacteria
 - PROKARYOTIC
 - No histone proteins
 - No introns in DNA (non coding regions)
 - Peptidoglycan cell wall
- Archaea
 - PROKARYOTIC
 - Histone-like proteins
 - Some introns
 - Non-Peptidoglycan cell wall
- Eukaryota
 - PROKARYOTIC
 - Histone proteins
 - Introns frequent
 - Non-Peptidoglycan cell wall (cellulose, chitin, etc)

Carolus Linnaeus



- Hey Swedish scientist/ naturalist
- Develop a hierarchical classification system (1753)
- Used **binomial nomenclature** to name each species

How do we classify organisms?

- Kingdom is the top level in categorizing
- There are 7 levels in total:

	Eg: housefly	Eg: human
K ingdom	Animalia	Animalia
P hylum	arthropod	chordata
C lass	insecta	mammalia
O rder	diptera	primates
F amily	muscidae	hominidae
G enus	<i>Musca</i>	<i>Homo</i>
S pecies	<i>domestica</i>	<i>sapiens</i>



Kingdom

Phylum

Class

Order

Family

Genus

Species

K P C O F G S

King Philp cut open five green snakes

Taxonomy and Natural Classification

- Species of the same taxa, will have a common ancestor!
 - eg... finches and warblers have a common ancestor while finches and flies do not
- Some species will appear similar, because of convergent evolution (eg. *Bees vs yellow jackets Hornets vs Wasps*) but should not be classified
- New species will be added by first classifying into higher taxa like kingdom, phylum, class, order...etc
- It allows prediction of characteristics of related species
 - eg. *similarities biochemically and physically in species of the same genus*



Hornet
(0.7 – 0.9 in)



Bee
(0.4 – 0.6 in)



Wasp
(0.4 – 0.7 in)

Taxonomy and Natural Classification

Kingdom:	Animalia	Kingdom:	Animalia	Kingdom:	Animalia
Phylum:	Arthropoda	Phylum:	Arthropoda	Phylum:	Arthropoda
Class:	Insecta	Class:	Insecta	Class:	Insecta
Order:	Hymenoptera	Order:	Hymenoptera	Order:	Hymenoptera
Family:	Vespidae	Family:	Apidae	Family:	Vespidae



Hornet
(0.7 – 0.9 in)



Bee
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Wasp
(0.4 – 0.7 in)

Binomial Nomenclature

- every living thing has its own name that includes ***Genus & species***
- ***Genus*** is given an upper case first letter
- the second name is the species (all lower case)
- *Italics* are used in print on documents

examples:

Name of the house fly: *Musca domestica*

Name of a beaver: *Castor canadensis*

Latin names often describe some feature about the organism

Which of the following are most closely related? Does classification reflect this?

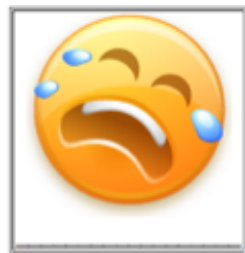


	Human	Chimp	Baboon
Kingdom	Animalia	Animalia	Animalia
phylum	chordata	chordata	chordata
class	mammalia	mammalia	mammalia
order	primates	primates	primates
family	hominidae	hominidae	Cercopithecidae
genus	<i>Homo</i>	<i>Pan</i>	<i>apio</i>
species	<i>sapiens</i>	<i>Troglodytes</i>	<i>anubis</i>

Six Kingdom

- Bacteria - E. Coli, Streptococcus
- Archaea- methanogens
- Protista - amoeba, paramecium, algae
- Fungi - mushrooms, mould
- Animal- insects, worms, fish, birds... etc
- Plant- mosses, ferns, trees... etc

1. Teeth visiblego to 2
 Teeth not visiblego to 4
2. Has a wide, toothy smileSmilus toothyus
 Is not smilinggo to 3
3. Visibly cryingSmilus dramaticus
 FrowningSmilus upsettus
4. Eyes are symmetrical go to 5
 Eyes not symmetricalgo to 8
5. Eyes shaped like hearts Smilus valentinus
 Eyes are shaped as ovalsgo to 6
6. Smiling, happy face Smilus traditionalis
 Not happy, frowning or othergo to 7
7. Mouth curved down, frowning Smilus saddus
 Mouth is a small circleSmilus suprisus
8. Has a pirate eye patchSmilus piratus
 Does not have eye patch go to 9
9. One eye is much larger than the other eye Smilus mutatus
 ...One eye is winkingSmilus winkus



USING A DICHOTOMOUS KEY

Many aquatic plants in aquariums in biology laboratories belong to one of these four genera:

- *Cabomba*
- *Ceratophyllum*
- *Elodea*
- *Myriophyllum*

All of these plants have cylindrical stems with whorls of leaves. The shape of four leaves is shown in the figure (below). A key can be used to identify which of the four genera a plant belongs to, if it is known to be in one of them.

1. Simple undivided leaves *Elodea*
Leaves forked or divided into segments 2
2. Leaves forked once or twice to form two or three segments *Ceratophyllum*
Leaves divided into more than four segments 3
3. Leaves divided up into many flattened segments *Cabomba*
Leaves divided into many filamentous segments *Myriophyllum*

Identification Using a Dichotomous Key

- » Key consists of numbered steps
- » Each step offers only **2** alternative characteristics that are all inclusive and mutually exclusive
- » Each step identifies the next step to go
- » Eventually the identification of the species will be reached

1. a. Does not have a distinct head.....Order Diptera (flies)
 b. Has a distinct headGo to 2
2. a. Has two or three tailsGo to 3
 b. Tail is absent.....Go to 4
3. a. Has two tails; two claws on footOrder Plecoptera
 (stoneflies)
 b. Has three tails; one claw onOrder Ephemeroptera
 (mayflies)
4. a. Prolegs with a claw at end of abdomenOrder Tricoptera
 (caddisflies)
 b. Prolegs absent; no hook.....Order Coleoptera
 (beetle larvae)

a



b

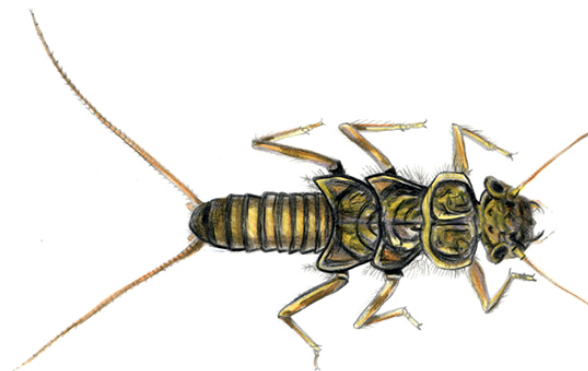
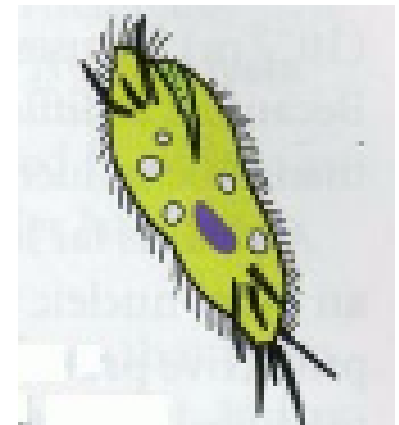
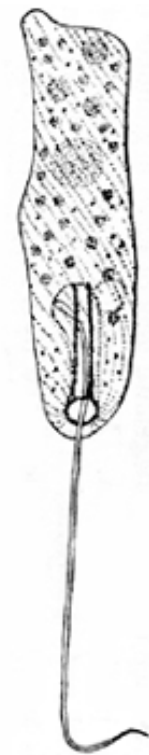


Table 2 Dichotomous Key for Protist Identification

1	(a) Cilia are present.	Go to 6
5	(b) Cilia are absent.	Go to 2
2	(a) Flagella are present.	Go to 4
	(b) Flagella are absent.	Go to 3
3	(a) Organism is asymmetrical and has pseudopodia.	<i>Amoeba</i>
	(b) Organism is spherical and has needlelike pseudopodia.	<i>Actinophrys</i>
4	(a) Organism has a single flagellum.	Go to 5
	(b) Organism has two or more flagella.	<i>Chilomonas</i>
5	(a) Organism has chloroplasts.	<i>Euglena</i>
	(b) Organism lacks chloroplasts.	<i>Paramecium</i>
6	(a) Cilia are present around entire body; no projections around body.	Go to 7
	(b) Cilia are present only around anterior opening; projections around body.	<i>Halteria</i>
7	(a) Organism is 200-350 μm long.	<i>Paramecium</i>
	(b) Organism is 500-800 μm long.	<i>Spirostomum</i>



Let's make our own Dichotomous Key

- How should we start to group the following?:



Remember...

- Only two choices per number
- Use clear characteristics (descriptive
- If you use size as a characteristic, you must reference something else

(eg., length is 3X as long as width;
less than 20 cm...)

Do NOT use ambiguous terms such as, “long”
“short” “wide” “big” “small”