Unit 2: Biodiversity

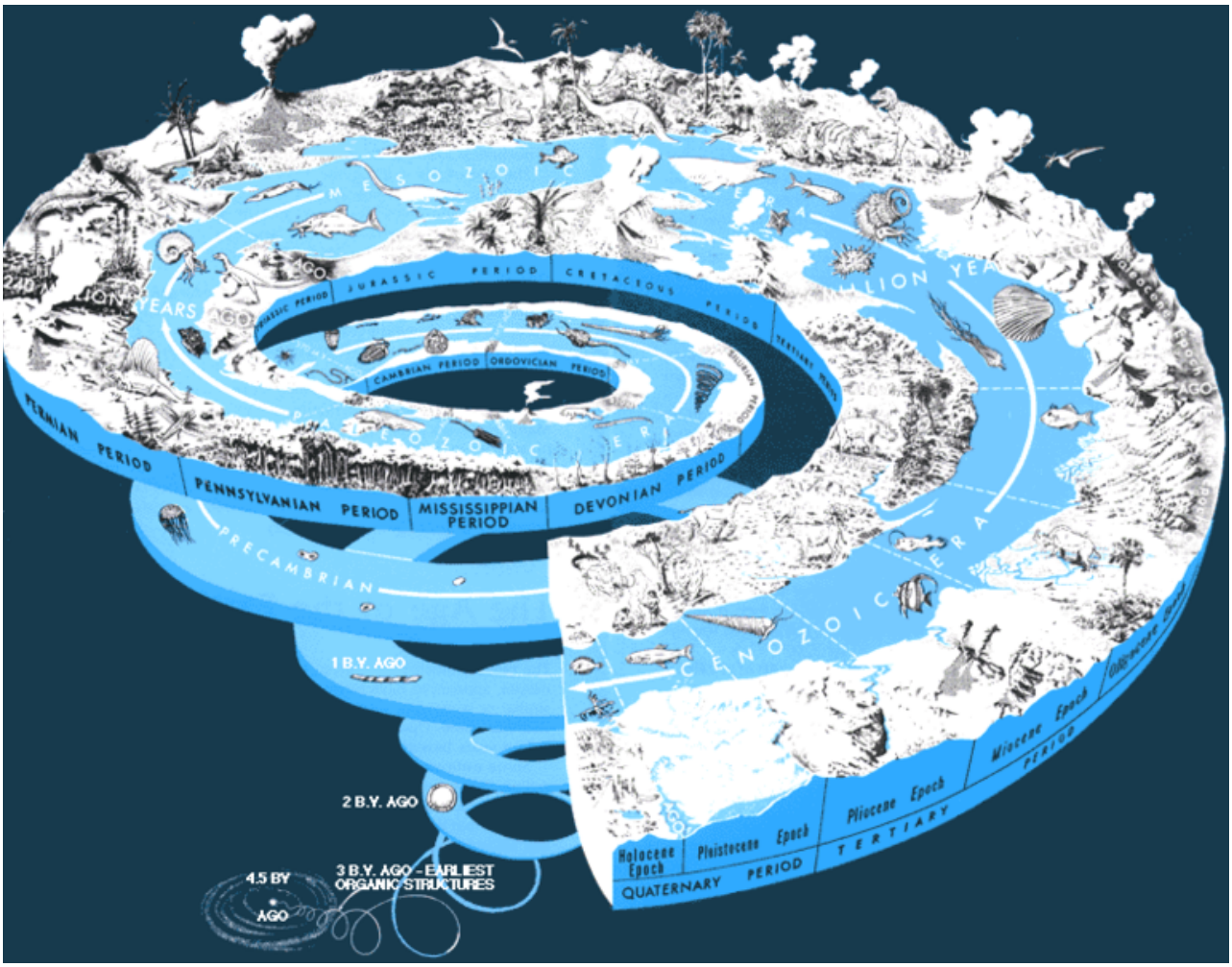
- Biodiversity – The diversity of life. All the different kinds of living things.

http://www.youtube.com/watch?v=N5ssjM2Fjuc

What is Alive? P.104

What is Alive? P.104

- Characteristics include:
    - Has cells.
    - It has a metabolism (chemical reactions that help keep it alive).
    - It needs water.
    - It makes organic molecules (molecules which have a lot of C, H, N and O).
    - It reproduces with inheritance (characteristics can be passed on).
    - It can adapt.


MESOZOIC ERA
JURASSIC PERIOD
CRETACEOUS PERIOD
TRIASSIC PERIOD
TERTIARY PERIOD
CAMBRIAN PERIOD
ORDOVICIAN PERIOD
PALEOZOIC ERA
PERMIAN PERIOD
PENNSYLVANIAN PERIOD
MISSISSIPPIAN PERIOD
DEVONIAN PERIOD
PRECAMBRIAN
1 B.Y. AGO
2 B.Y. AGO
4.5 BY AGO
3 B.Y. AGO - EARLIEST ORGANIC STRUCTURES
CENOZOIC ERA
Holocene Epoch
Pleistocene Epoch
QUATERNARY PERIOD
Pliocene Epoch
Miocene Epoch
TERTIARY PERIOD

Classification of Organisms

- Classification – A method of organizing things.

- E.g. music can be classified as rock, jazz or classical.

- Why are classification systems important?

1. Makes communication between scientists easier
2. Establishes connections between related organisms
3. Makes identification easier

Classification of Organisms

- Originally classification systems were broad and arbitrary.

E.g. Things were once classified as an animal, vegetable or mineral. Very vague categories.

- Classification could also be very subjective.
- E.g. weeds vs. non-weeds. What a person called a weed depended only on what plants they liked.

Classification of Organisms

- Scientists then needed some formal method to classify organisms that was specific and objective.
- The system that is now used involves seven major categories:

Kingdom
Phylum (Division)
Class
Order
Family
Genus
Species

King **P**hilip **C**ame **O**ver **F**or **G**oose **S**tew

http://www.youtube.com/watch?v=kKwOlAqQoLk

Classification of Organisms

- Example 1: Beaver

Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Rodentia
Family	Castoridae
Genus	*Castor*
Species	*canadenis*

Classification of Organisms

Example 2: black spruce

Kingdom	Plantae
Division	Coniferophyta
Clas	Pinopsida
Orde	Pinales
Family	Pinaceae
Genu	*Picea*
Species	*mariana*

Review

Classification of Organisms

- Classification – A method of organizing things.

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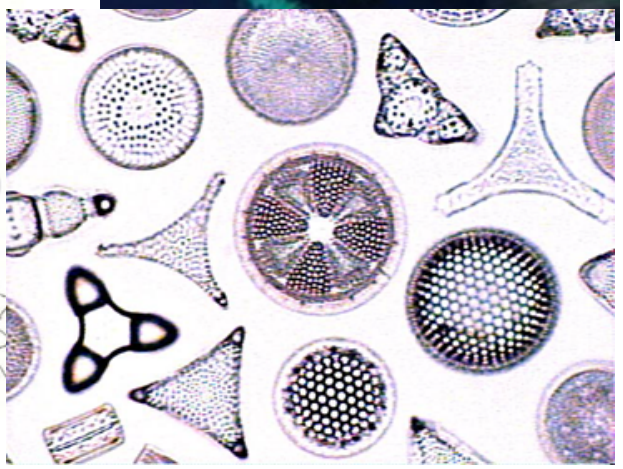
Domains

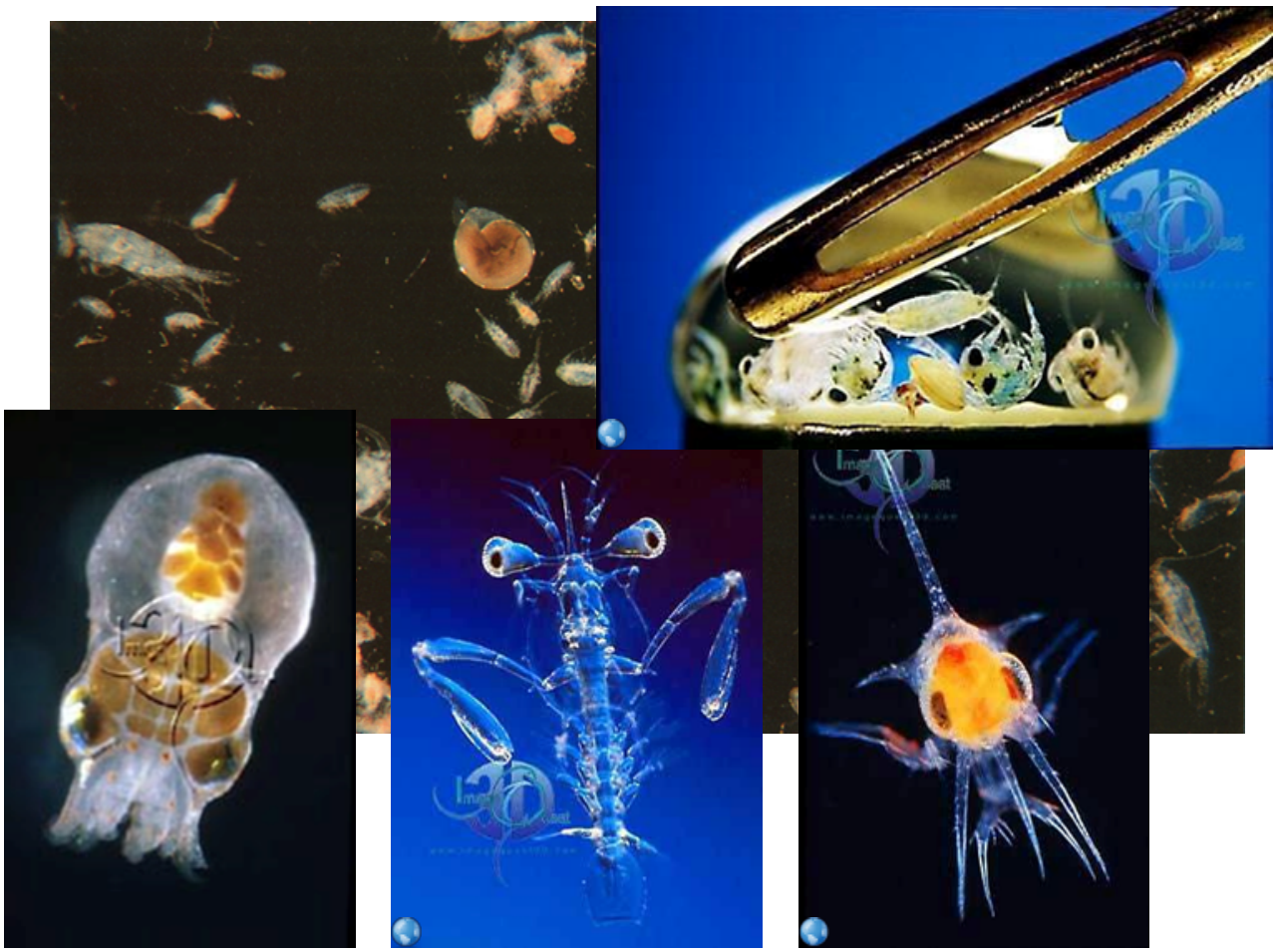
- The Archaea were once classified as Bacteria.
- Recently analysis of the DNA of these two groups revealed how different they really are.
- To emphasize the dramatic difference a new classification level was invented above Kingdom.
- There are 3 Domains:
  1. Archaea
  2. Bacteria
  3. Eukaryota

Kingdoms

- There are 6 Kingdoms
  1. Archaea
  2. Bacteria
  3. Plantae
  4. Animalia
  5. Fungi
  6. Protista – Mostly single celled eukaryotic organisms. They can be similar to plants (algae), fungi or animals.


TASTE AND ODOR ALGAE
ASTERIONELLA
ANABAENA
UROGLENOPSIS
HYDRODICTYON
EUGLENA
MALLOMONAS
PERIDINIUM
STAURASTRUM
GERATIUM
DINOBRYON
TABELLARIA
PANDORINA
VOLVOX
EUNOTIA
Standard Methods for Examination of Water and WasteWater
PLATE I





Genus & Species

- In the past organisms have sometimes been given names arbitrarily.
- **Vernacular names** – names that have no obvious relevance. E.g. daddy long legs.
- **Descriptive names** – names based on some physical characteristic. E.g. black bear.
- Although descriptive names can be useful, they can vary from place to place and between languages.

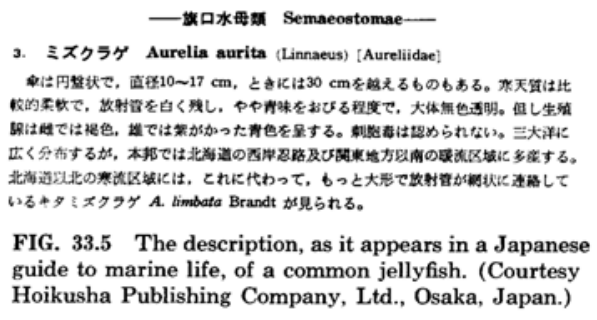
Genus & Species

- In the late 1700s **Carolus Linnaeus** developed a binomial system of classification.
- This is now referred to as an organism's scientific name.
- Scientific names consist of the genus and species of that organism.
- Both of these names are ALWAYS written in italics or are underlined.
- The genus always begins with a capital letter and the species always with a lower case letter.

Genus & Species

- E.g. Homo sapiens
- The name is also always written in Latin, because:

1. It reduces racial bias because the language is not used by any country currently.
2. It is a dead language so the meaning of the words do not change over time.
3. It makes it easy to identify an organism in text regardless of the language.

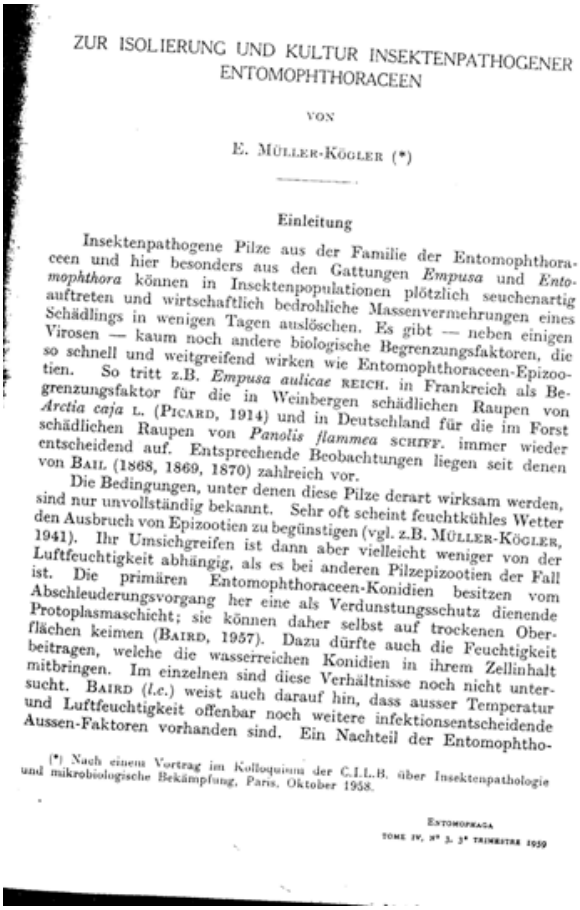


——旗口水母類 Semaeostomae——

3. ミズクラゲ **Aurelia aurita** (Linnaeus) [Aureliidae]

傘は円盤状で，直径10～17 cm，ときには30 cmを越えるものもある。傘天質は比較的柔軟で，放射管を白く残し，やや青味をおびる程度で，大体無色透明。但し生殖腺は雌では褐色，雄では紫がかった青色を呈する。刺胞毒は認められない。三大洋に広く分布するが，本邦では北海道の西岸忍路及び関東地方以南の暖流区域に多産する。北海道以北の寒流区域には，これに代わって，もっと大形で放射管が網状に連絡しているキタミズクラゲ *A. limbata* Brandt が見られる。

FIG. 33.5 The description, as it appears in a Japanese guide to marine life, of a common jellyfish. (Courtesy Hoikusha Publishing Company, Ltd., Osaka, Japan.)



ZUR ISOLIERUNG UND KULTUR INSEKTENPATHOGENER ENTOMOPHTHORACEEN

VON

E. MÜLLER-KÖGLER (*)

Einleitung

Insektenpathogene Pilze aus der Familie der Entomophthoraceen und hier besonders aus den Gattungen *Empusa* und *Entomophthora* können in Insektenpopulationen plötzlich seuchenartig auftreten und wirtschaftlich bedrohliche Massenvermehrungen eines Schädlings in wenigen Tagen auslöschen. Es gibt — neben einigen Virosen — kaum noch andere biologische Begrenzungsfaktoren, die so schnell und weitgreifend wirken wie Entomophthoraceen-Epizootien. So tritt z.B. *Empusa aulicae* REICH. in Frankreich als Begrenzungsfaktor für die in Weinbergen schädlichen Raupen von *Arctia caja* L. (PICARD, 1914) und in Deutschland für die im Forst schädlichen Raupen von *Panolis flammea* SCHIFF. immer wieder entscheidend auf. Entsprechende Beobachtungen liegen seit denen von BAIL (1868, 1869, 1870) zahlreich vor.

Die Bedingungen, unter denen diese Pilze derart wirksam werden, sind nur unvollständig bekannt. Sehr oft scheint feuchtkühles Wetter den Ausbruch von Epizootien zu begünstigen (vgl. z.B. MÜLLER-KÖGLER, 1941). Ihr Umsichgreifen ist dann aber vielleicht weniger von der Luftfeuchtigkeit abhängig, als es bei anderen Pilzepizootien der Fall ist. Die primären Entomophthoraceen-Konidien besitzen vom Abschleuderungsvorgang her eine als Verdunstungsschutz dienende Protoplasmaschicht; sie können daher selbst auf trockenen Oberflächen keimen (BAIRD, 1957). Dazu dürfte auch die Feuchtigkeit beitragen, welche die wasserreichen Konidien in ihrem Zellinhalt mitbringen. Im einzelnen sind diese Verhältnisse noch nicht untersucht. BAIRD (*l.c.*) weist auch darauf hin, dass ausser Temperatur und Luftfeuchtigkeit offenbar noch weitere infektionsentscheidende Aussen-Faktoren vorhanden sind. Ein Nachteil der Entomophtho-

(*) Nach einem Vortrag im Kolloquium der C.I.L.B. über Insektenpathologie und mikrobiologische Bekämpfung, Paris, Oktober 1958.

ENTOMOPHAGA
TOME IV, N° 3, 3e TRIMESTRE 1959

Odd Names

Gammaracanthuskytodermogammarus loricatobaicalensis, Dybowski 1926
(amphipod; at 50 characters, the longest binomial)

Ia io, Thomas 1902
(Chinese bat; the shortest binomial, probably the only all-vowel binomial)

Ytu brutus Spangler, 1980 (water beetle)

Ba humbugi Solem, 1983 (snail) from Fiji.

Colon rectum Hatch, 1933 (beetle)

Pison eu Menke, 1988 (sphecid wasp)

Genus & Species

- When referring to an organism, scientist ALWAYS write both the genus and species name.
- Although there may be other organisms with the same genus or species name, there are none with the same genus AND species name together.
- E.g. Felis domesticus refers to the house cat and only the house cat.
- Felis concolor refers to the mountain lion only.

How Organisms are Classified p.113-116

- **Taxon**– Classification group (e.g. kingdom, class, etc.)

- Closely related organisms are put into the same taxon.

- Organisms become more similar as you go down the classification scheme.

E.g. all the organisms in the same genus are much more similar than all the organisms in the same domain.

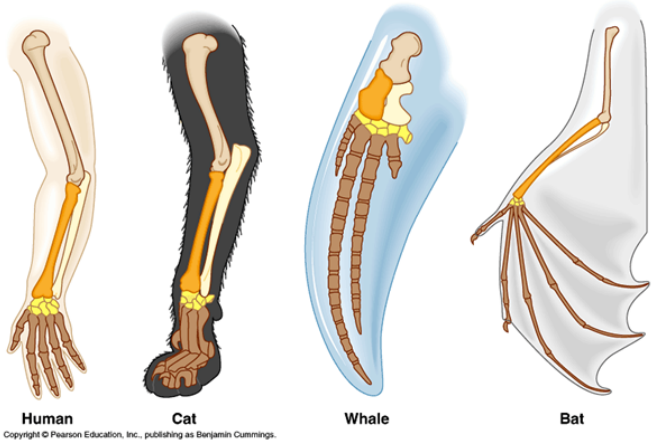
- Determining how similar organisms are, is done with evidence from several sources:

How Organisms are Classified

1. Morphology – The physical characteristics of organisms.

Organisms that are closely related should look similar.

E.g. reptiles and mammals are related because they have 4 legs.



How Organisms are Classified

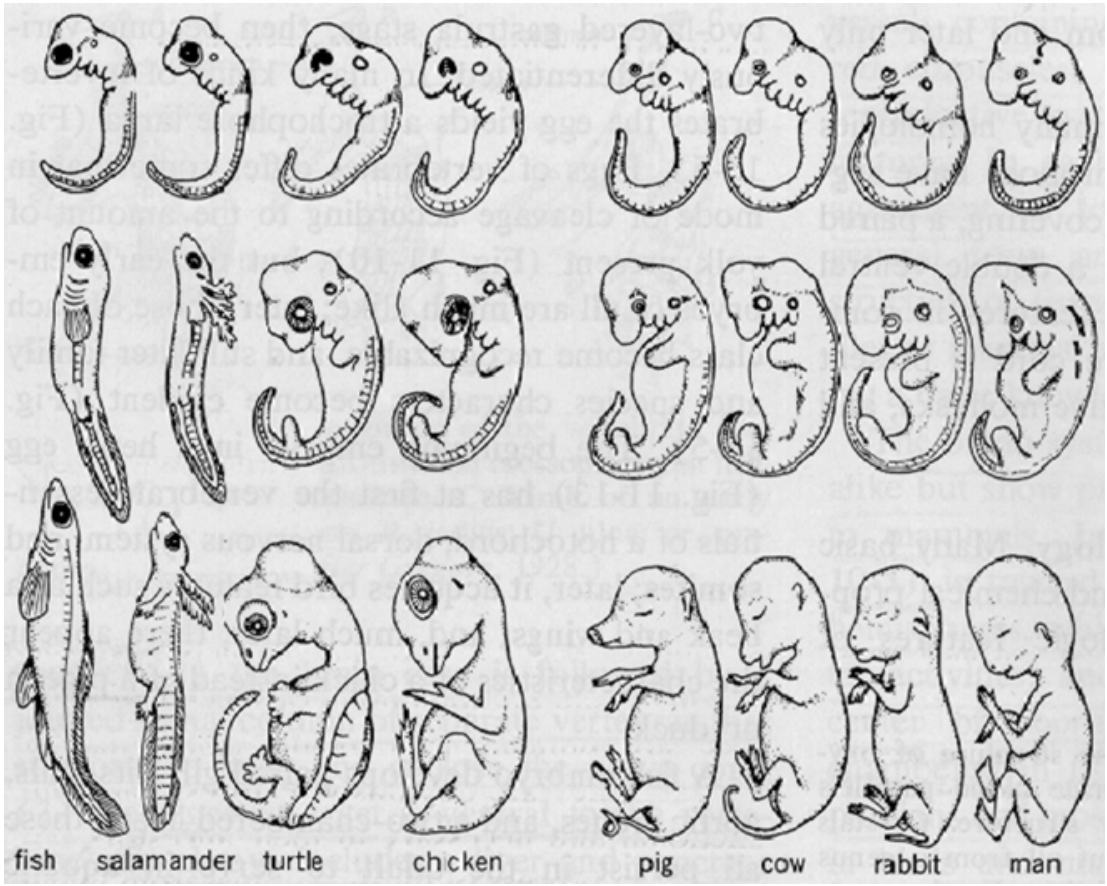
2. **Behaviour** – organisms that are closely related should have similar behaviour.

E.g. All honeybees are soci

How Organisms are Classified

3. **Similar development** – Related organisms look similar as the embryo develops.

E.g. humans are related to fish because they have similar looking embryos.



How Organisms are Classified

4. **Fossils** – Provide evidence that taxons that look different today are actually related.

How closely related organisms are is determined with the help of radioactive dating of rocks.

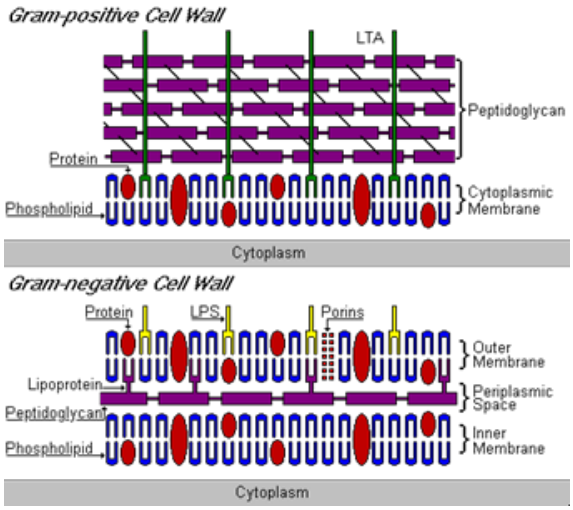
As time passes atoms become less radioactive, so old rocks should not be very radioactive.

E.g. Archaeopteryx is an extinct genus of bird that has many characteristics similar to reptiles.

How Organisms are Classified

5. **Cell structure** – These are most similar in related organisms.

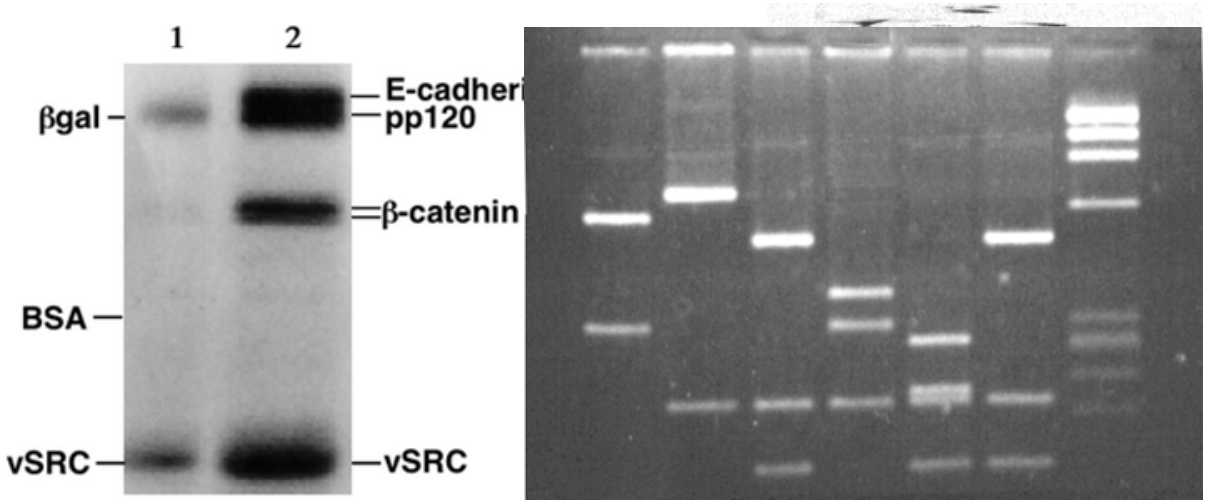
E.g. Bacteria can be divided into two groups based on the structure of their cell wall.



How Organisms are Classified

6. **Biochemical similarities** – Related organisms have similar proteins and DNA.

Protein structure and DNA can be used to determine how similar two organisms are.



Review

- **Classifying**

1. **Morphology** – The physical characteristics of organisms.
2. **Behaviour** – organisms that are closely related should have similar behaviour.
3. **Similar development** – Related organisms look similar as the embryo develops.
4. **Fossils** – Provide evidence that taxons that look different today are actually related.
5. **Cell structure** – These are most similar in related organisms.
6. **Biochemical similarities** – Related organisms have similar proteins and DNA.

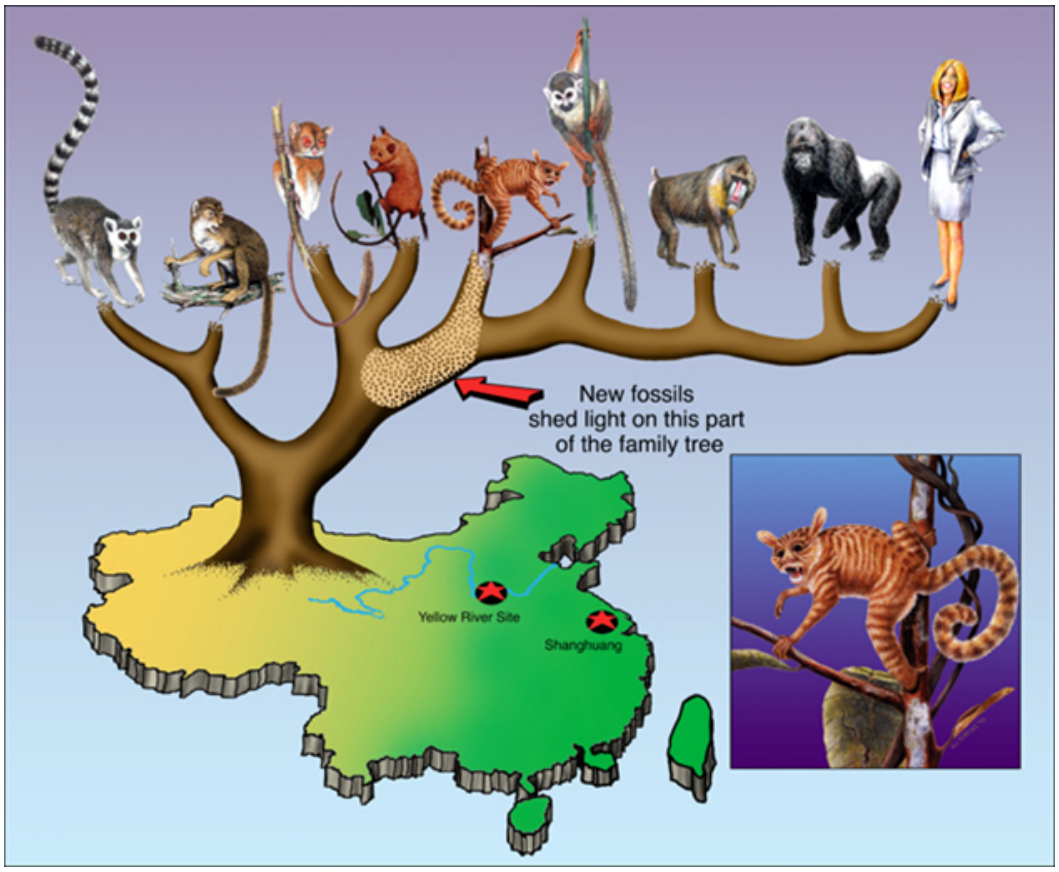
Phylogeny p.116-121

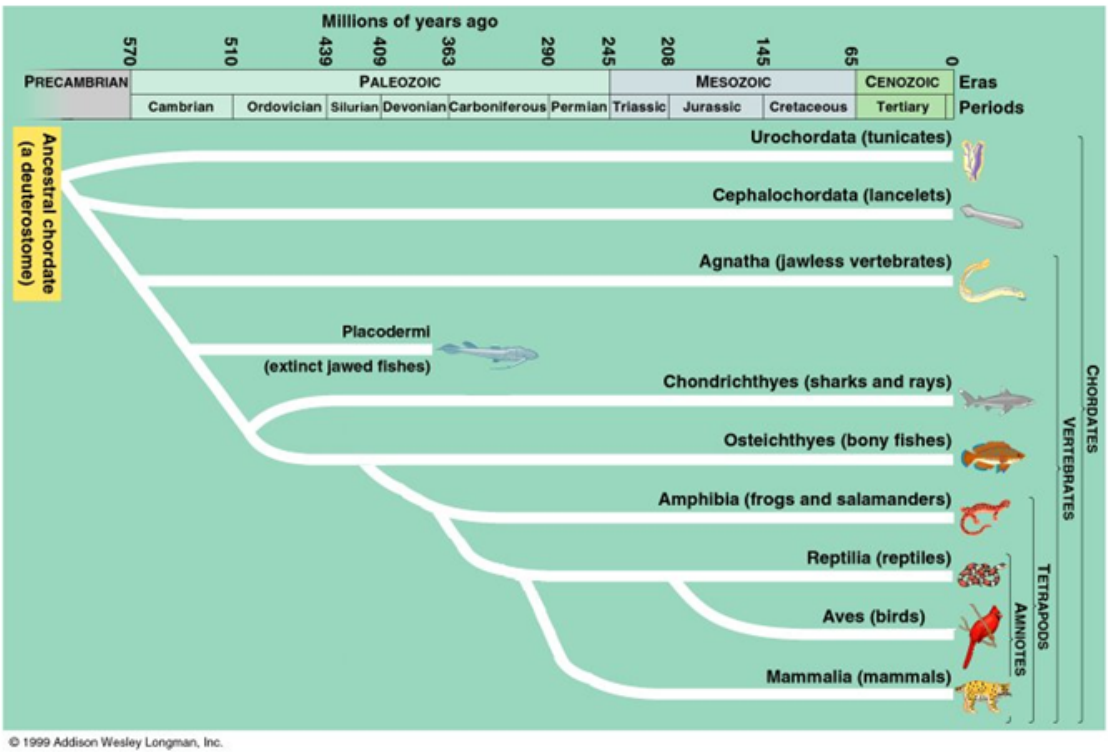
- **Phylogeny** – The evolutionary history of an organism.

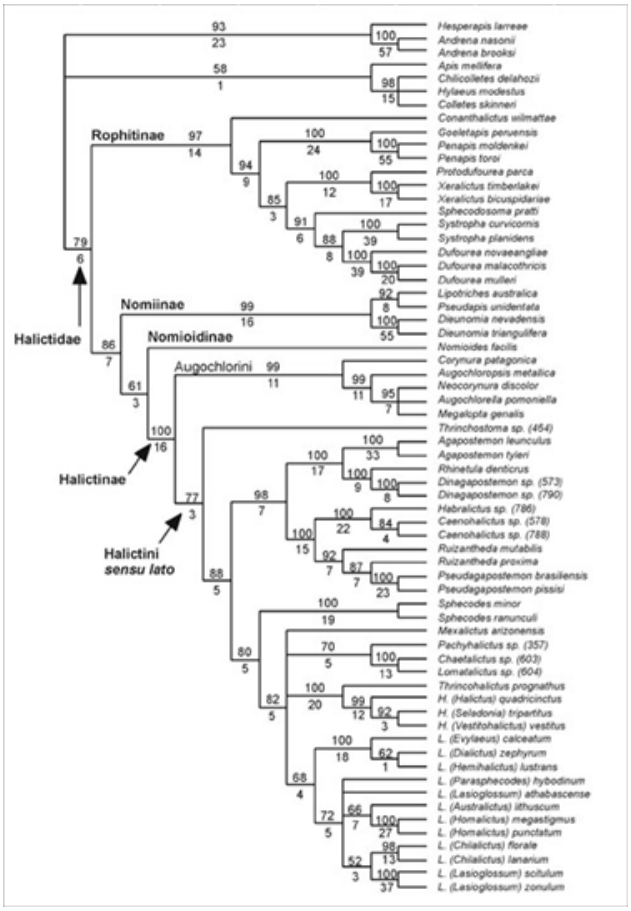
- The evidence used to classify organisms is also used to make phylogenies.

- **Phylogenetic tree** – A diagram that shows a phylogeny.

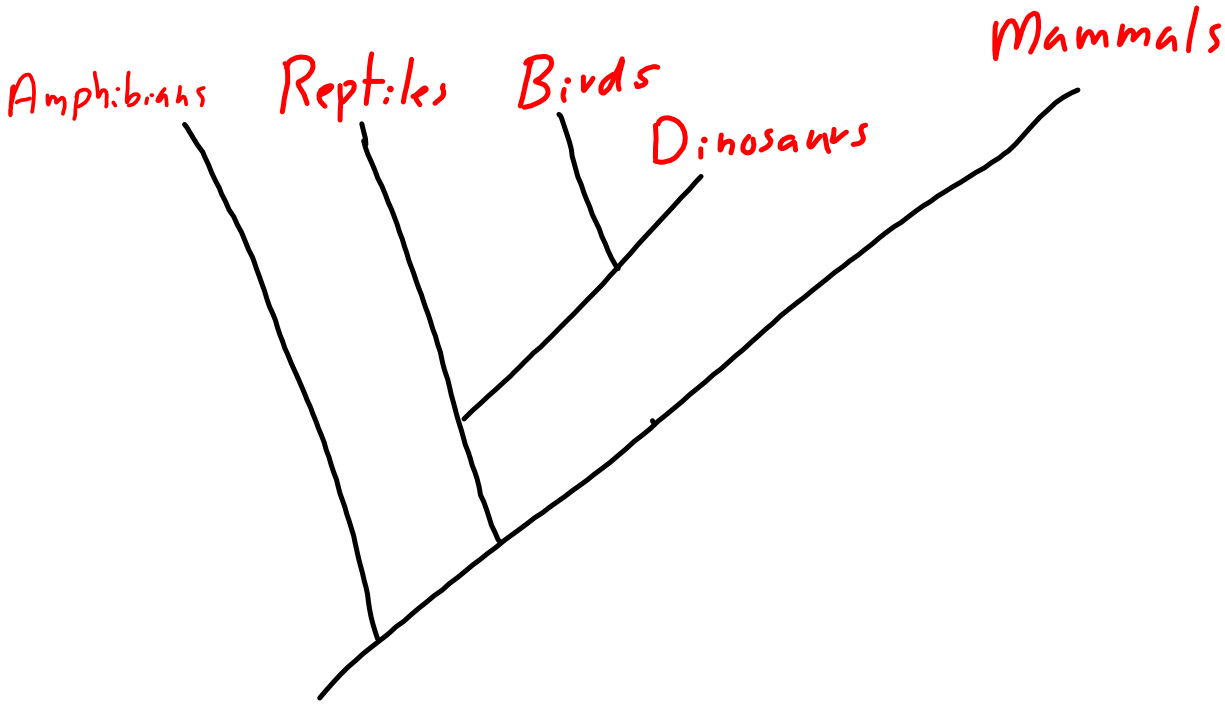
- Some trees present a lot of information (e.g. a cladogram) , some very little.




Millions of years ago
570
510
439
409
363
290
245
208
145
65
0
PRECAMBRIAN
PALEOZOIC
MESOZOIC
CENOZOIC
Eras
Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
Tertiary
Periods
Ancestral chordate (a deuterostome)
Urochordata (tunicates)
Cephalochordata (lancelets)
Agnatha (jawless vertebrates)
Placodermi
(extinct jawed fishes)
Chondrichthyes (sharks and rays)
Osteichthyes (bony fishes)
Amphibia (frogs and salamanders)
Reptilia (reptiles)
Aves (birds)
Mammalia (mammals)
CHORDATES
VERTEBRATES
TETRAPODS
AMNIOTES
© 1999 Addison Wesley Longman, Inc.


Hesperapis larreae
Andrena nasonii
Andrena brooksi
Apis mellifera
Chilicolletes deliahozii
Hylaeus modestus
Colletes skinneri
Conanthalictus wilmattae
Goeletapis peruensis
Penapis moldenkei
Penapis toroi
Protodufourea parca
Xeralictus timberlakei
Xeralictus bicuspidariae
Sphecodosoma pratti
Systropha curvicornis
Systropha planidens
Dufourea novaeangliae
Dufourea malacothricis
Dufourea mulleri
Lipotriches australica
Pseudapis unidentata
Dieunomia nevadensis
Dieunomia triangulifera
Nomioides facilis
Corynura patagonica
Augochloropsis metallica
Neocorynura discolor
Augochlorella pomoniella
Megalopta genalis
Thrinchostoma sp. (464)
Agapostemon leunculus
Agapostemon tyleri
Rhinetula denticrus
Dinagapostemon sp. (573)
Dinagapostemon sp. (790)
Habralictus sp. (786)
Caenohalictus sp. (578)
Caenohalictus sp. (788)
Ruizantheda mutabilis
Ruizantheda proxima
Pseudagapostemon brasiliensis
Pseudagapostemon pissisi
Sphecodes minor
Sphecodes ranunculi
Mexalictus arizonensis
Pachyhalictus sp. (357)
Chaetalictus sp. (603)
Lomatalictus sp. (604)
Thrincohalictus prognathus
H. (Halictus) quadricinctus
H. (Seladonia) tripartitus
H. (Vestitohalictus) vestitus
L. (Evylaeus) calceatum
L. (Dialictus) zephyrum
L. (Hemihalictus) lustrans
L. (Parasphecodes) hybodinum
L. (Lasioglossum) athabascense
L. (Australictus) lithuscum
L. (Homalictus) megastigmus
L. (Homalictus) punctatum
L. (Chilalictus) florale
L. (Chilalictus) lanarium
L. (Lasioglossum) scitulum
L. (Lasioglossum) zonulum
Rophitinae
Nomiinae
Nomioidinae
Augochlorini
Halictidae
Halictinae
Halictini
sensu lato

Tetrapoda Tree



Phylogeny

- Phylogenetics is a very important part of biology:

1. It points to new areas for research (i.e. which plants may produce useful drugs).

2. It also provides information on organisms we currently know little about (i.e. which bees are social).

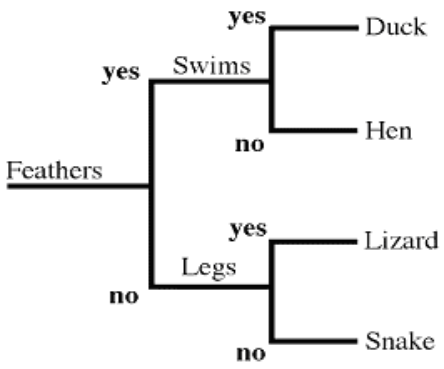
Dichotomous Keys

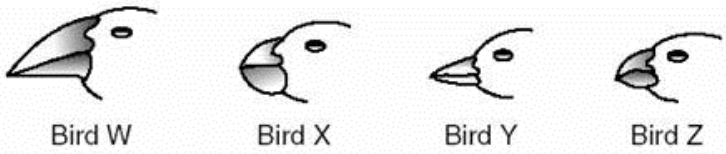
- Once an organism is classified, it is important that other scientists can easily find the name of that organism.

- This is most often done with **dichotomous keys**.

- These are a series of steps, in groups of two, which present the reader with a choice.

- The choice is usually two opposite characteristics.
  - When the reader is done, they come out with one particular species or taxon.





Dichotomous Key to Representative Birds	
1. a. The beak is relatively long and slender	*Certhidea*
b. The beak is relatively stout and heavy	go to 2
2. a. The bottom surface of the lower beak is flat and straight	*Geospiza*
b. The bottom surface of the lower beak is curved	go to 3
3. a. The lower edge of the upper beak has a distinct bend	*Camarhynchus*
b. The lower edge of the upper beak is mostly flat	*Platyspiza*

Dichotomous Keys

- An example of a good dichotomous key couplet is:

1. a) Leg is black…..2
   b) Leg is white….5

- This is good because it presents the user with options that are clearly one or the other.
- An example of a poor couplet is:

1. a) Organism is big…2
   b) Organism is small…5

- This leaves the reader thinking what is big or small. And it is particularly bad if you have nothing to compare your organism with.

Biology 2201
Monster Dichotomous key

- Make a dichotomous key for the following monsters.
- Make sure that each option you create divides the remaining monsters into two groups.
- Each option should have only two choices.