

FSC 111

CLASSIFICATION OF LIVING THINGS (ORGANISMS)

BY

DR. ADEBAYO OGUNKANMI.
(Cell Biology and Genetics Department)

Lecture 1

What is an Organism?

An organism is generally referred to any living thing. More specifically any thing that has “cells”. E.g. single celled bacteria - largest redwood tree or Blue Whale.

Classification is the branch of biology that names and groups organisms according to their characteristics and evolutionary history.

Why classify things?

- Going to a mall to get some new clothes.
- Where would you go?

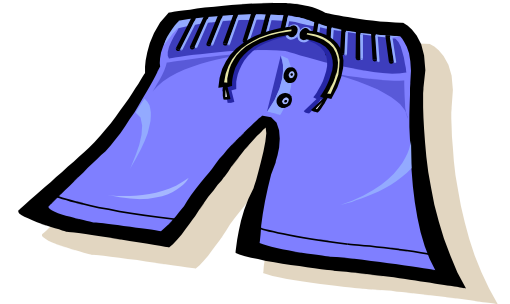


How is a mall organized?

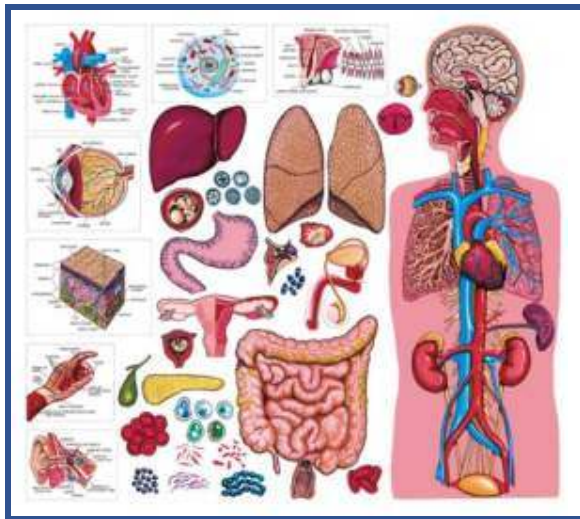
- Food Court
- Big Department Stores
- Specialty Clothing Stores
- Jewelry Stores
- Electronics Stores
- Shoe Stores
- Toy Stores
- Kiosks



- Can you imagine if the mall was just like one below?
- How long would it take you to locate your demand?



Here are some things that scientists classify or organize:

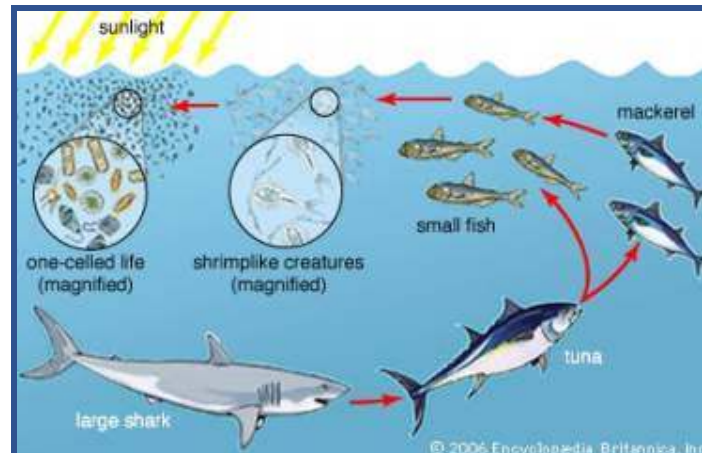


- The human body

Periodic Table of the Elements

1 H 1.008																	18 Ar 39.948																														
2 He 4.003																	19 K 39.098	20 Ca 40.078																													
3 Li 6.941	4 Be 9.012															21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80																
11 Na 22.990	12 Mg 24.305															37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98.906	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.91	54 Xe 131.29														
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.88	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80	37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98.906	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.91	54 Xe 131.29												
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc 98.906	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.91	54 Xe 131.29	55 Cs 132.91	56 Ba 137.33	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 144.91	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97													
55 Cs 132.91	56 Ba 137.33	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 144.91	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222	87 Fr 223	88 Ra 226	89 Ac 227	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 244.06	95 Am 243.06	96 Cm 247.07	97 Bk 247.07	98 Cf 251.08	99 Es 252.08	100 Fm 257.10	101 Md 258.10	102 Lr 262.11
57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 144.91	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.05	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po 209	85 At 210	86 Rn 222	87 Fr 223	88 Ra 226	89 Ac 227	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 244.06	95 Am 243.06	96 Cm 247.07	97 Bk 247.07	98 Cf 251.08	99 Es 252.08	100 Fm 257.10	101 Md 258.10	102 Lr 262.11		

- The elements



- Interactions in Ecosystems

Scientists also Classify Living Organisms

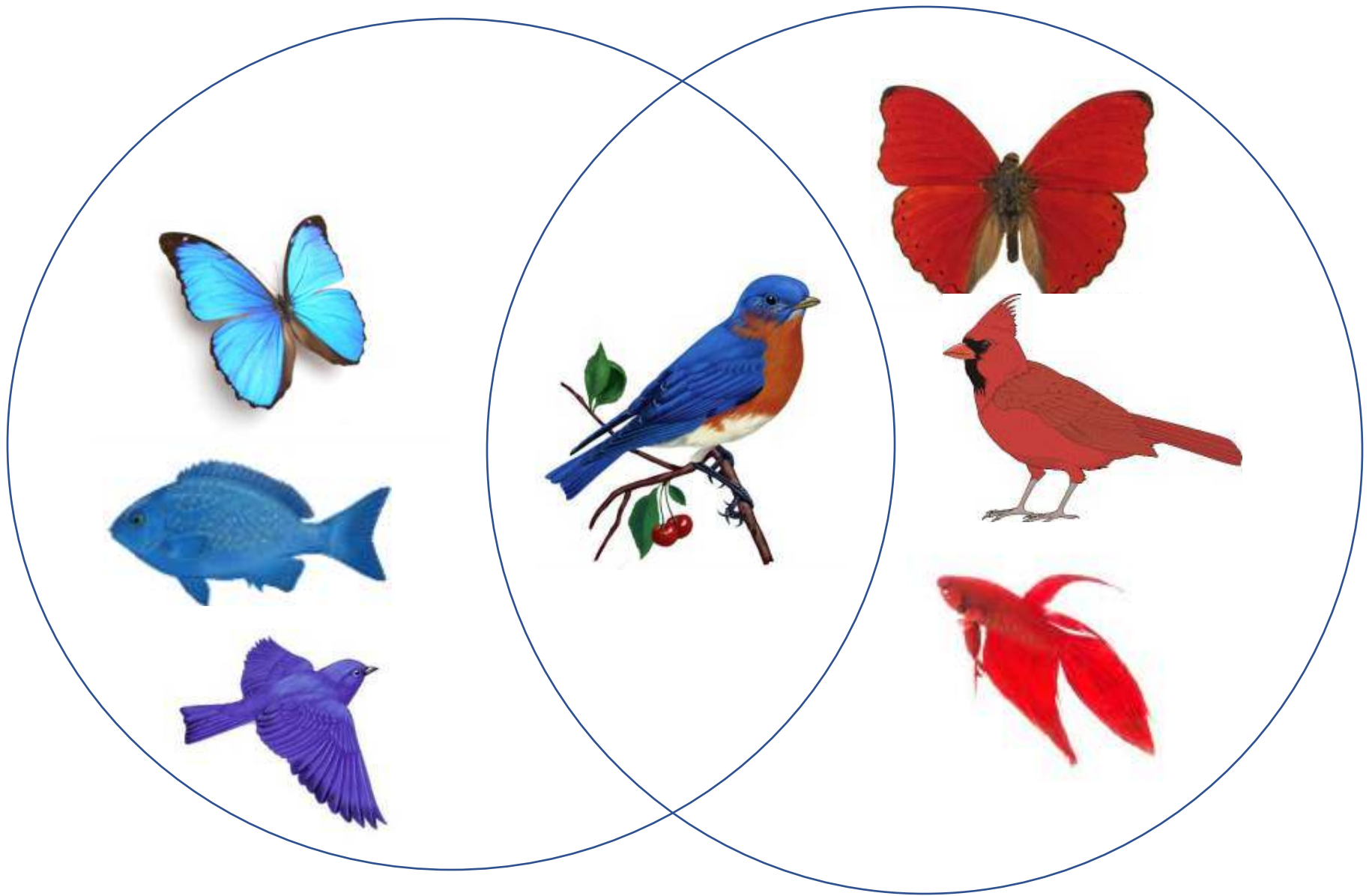


- How could you classify these living things?

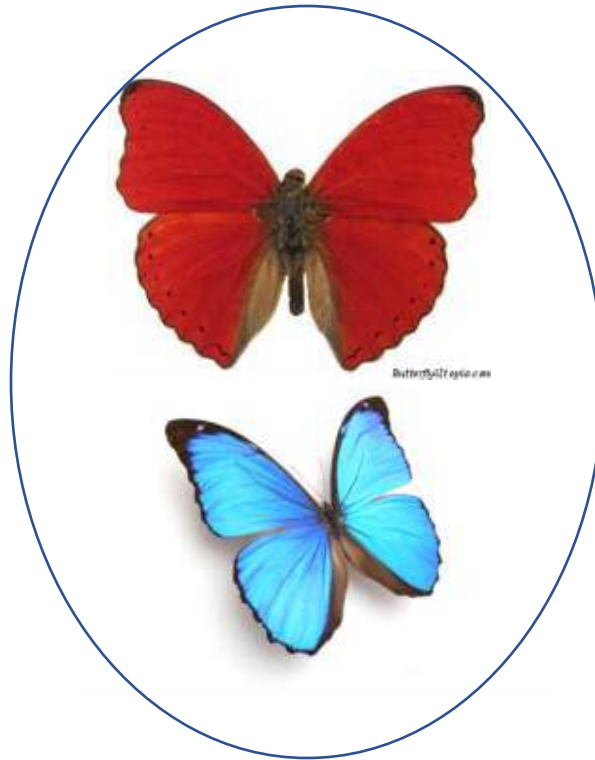
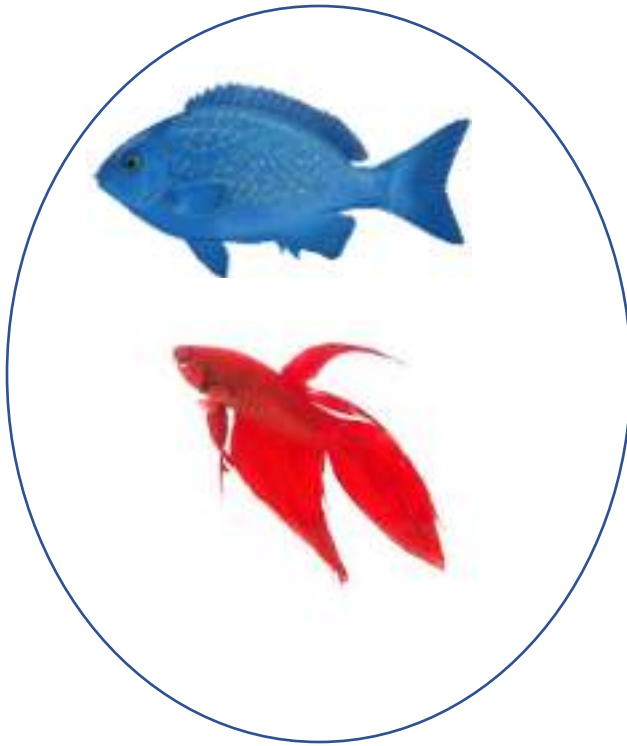
Quick, organize these living things into groups:



Did you do it like this?



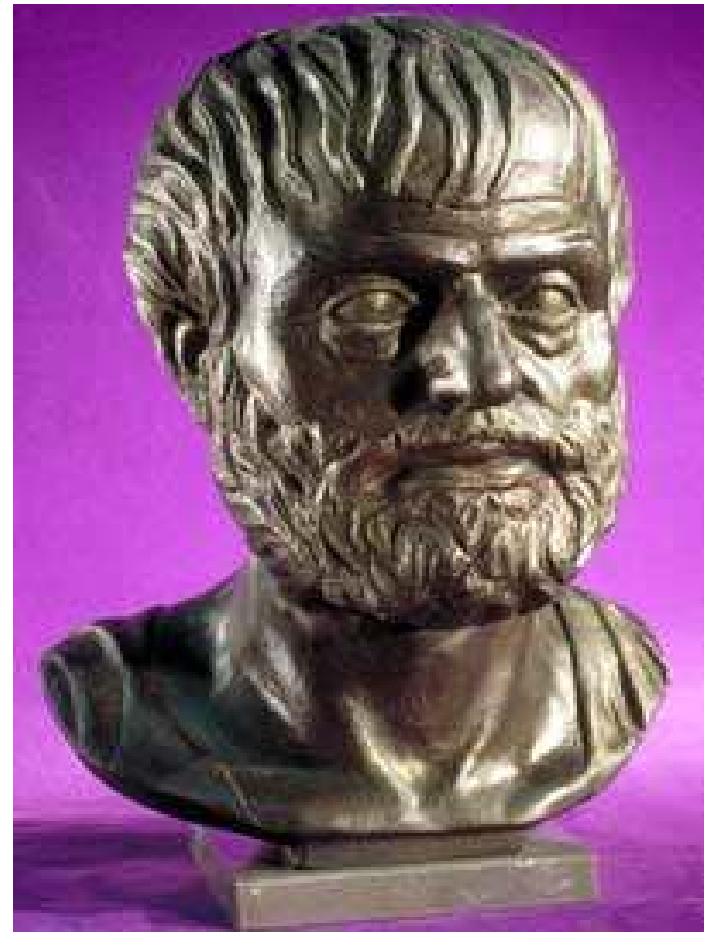
Or this?



Are there any other ways to group these living things?

History of Classification: Early System of Classification

- **Classification/Taxonomy** is the branch of biology that names and groups organisms according to their characteristics and evolutionary history.
- Organisms were first classified more than 2,000 years ago by the **Greek philosopher Aristotle**.



Early classification systems: Aristotle

- Plants: into three categories based on the **differences in their stems.**



Animal: Land dwellers,



water dwellers,



air dwellers

Modern System Hierarchy: Seven Levels of Organization

- Established a simple system for classifying and naming organisms.
- Developed a Hierarchy (a ranking system) for classifying organisms
- He was called “father” of modern taxonomy.



Carolus Linnaeus mid-1700

Modern System Hierarchy-Seven Levels of Organization

- **Linnaeus used an organisms morphology (form and structure), to categorize organisms.**
- **He first divided all organisms into two Kingdoms,**
- **Plantae & Animalia**
(Plants) (Animals).

Modern System - Seven Levels of Organization

- **Modern System:**

- Each kingdom (plant and animal) was divided into a phylum* (division for plants)
- Each phylum into a smaller groups called class.
- Each class was divided into an order.
- Each order was divided into family (families).
- Each family was divided into a genus (plural-genera)
- Each genus was divided into a species. (scientific name)

Levels of Classification

- Remember:
- King Philip Came Over For Grandma's Soup.
- **Kings Play Cards On Fat Green Stools**
- Kids Prefer Candy Over Fresh Green Salad

Kingdom

Phylum

Class

Order

Family

Genus

Species

Classification so far

- Scientists estimate that there are between **3 million** and **100 million** species of organisms on Earth.
- **Taxonomists**--biologists who specialize in identifying and classifying life on our planet--have named approximately **1.7 million** species so far.
- Each year, about **13,000** **new species** are added to the list of known organisms.
- So, how do scientists **classify** (organize) all these millions of species?

Classification

- Classification is the grouping of things together on the basis of the **features they have in common.**

Taxonomy

- The study of the classification of living organisms including its principles, practice and rules, is known as taxonomy.
- Based on similarities and dissimilarities among organisms
- It is a descriptive science based on variation and form of morphological characters
- Darwin: puts in species relatedness and evolution in classification

Types of Classification

1. Artificial classification

Grouping of organisms for the purposes of convenience such as grouping people according to their morphological characters e.g heights, where they live or their size

Which part of the plant is used for classification?



Collect information about what you see:

What are the characteristics of individual plant parts?



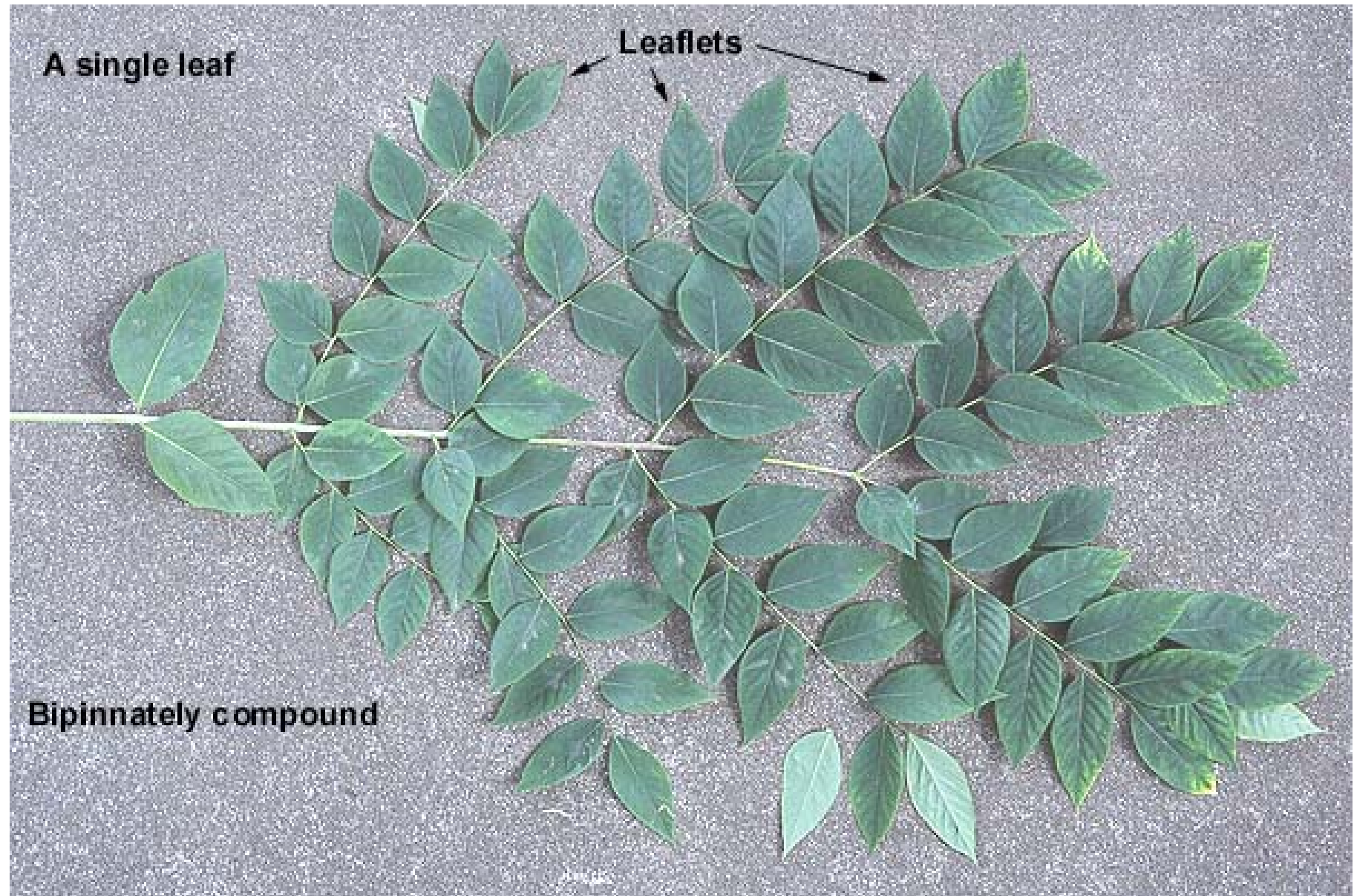
Leaf type-simple leaf



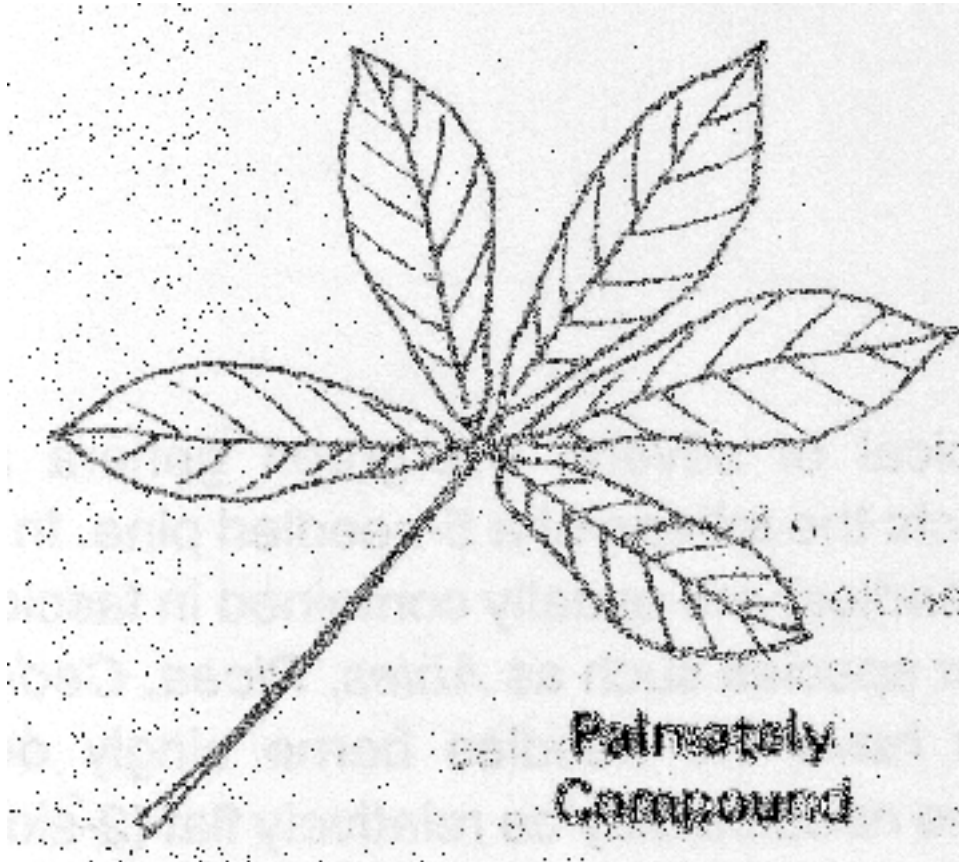
Leaf type-pinnately compound



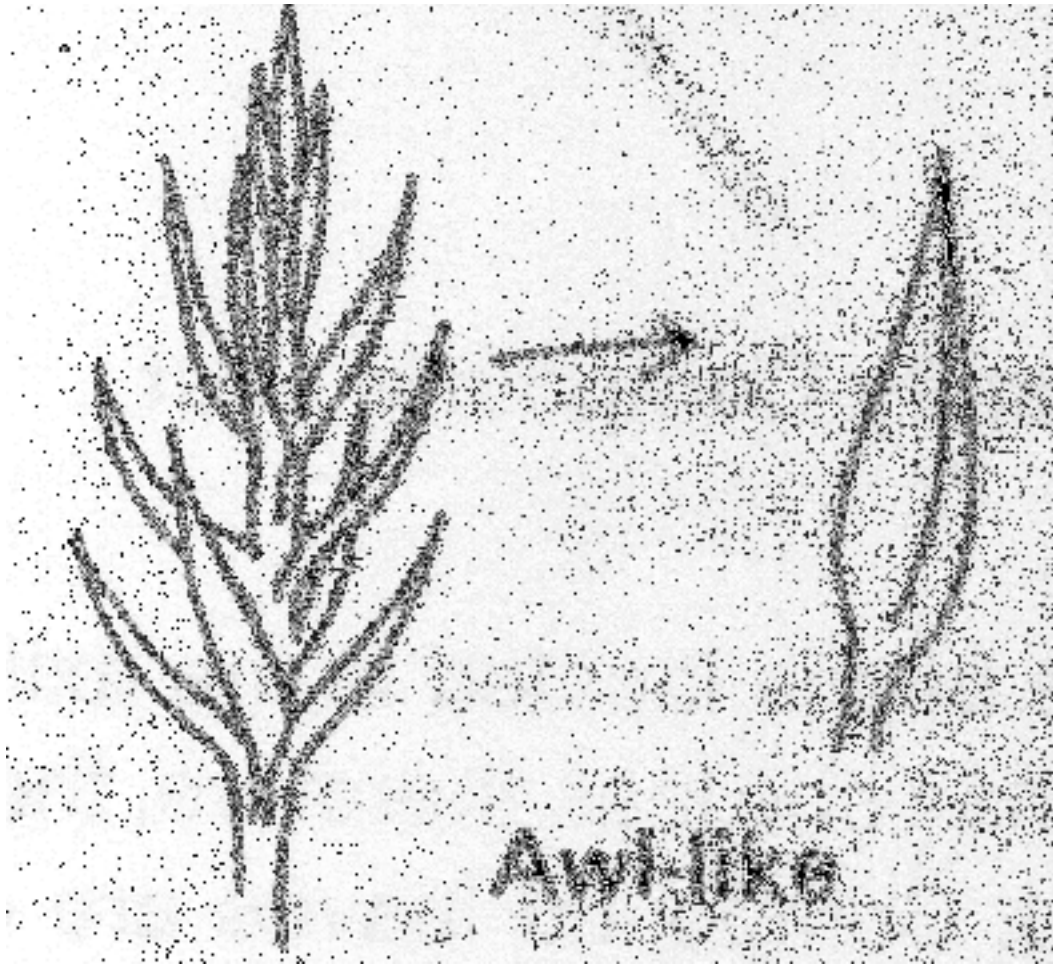
Leaf type



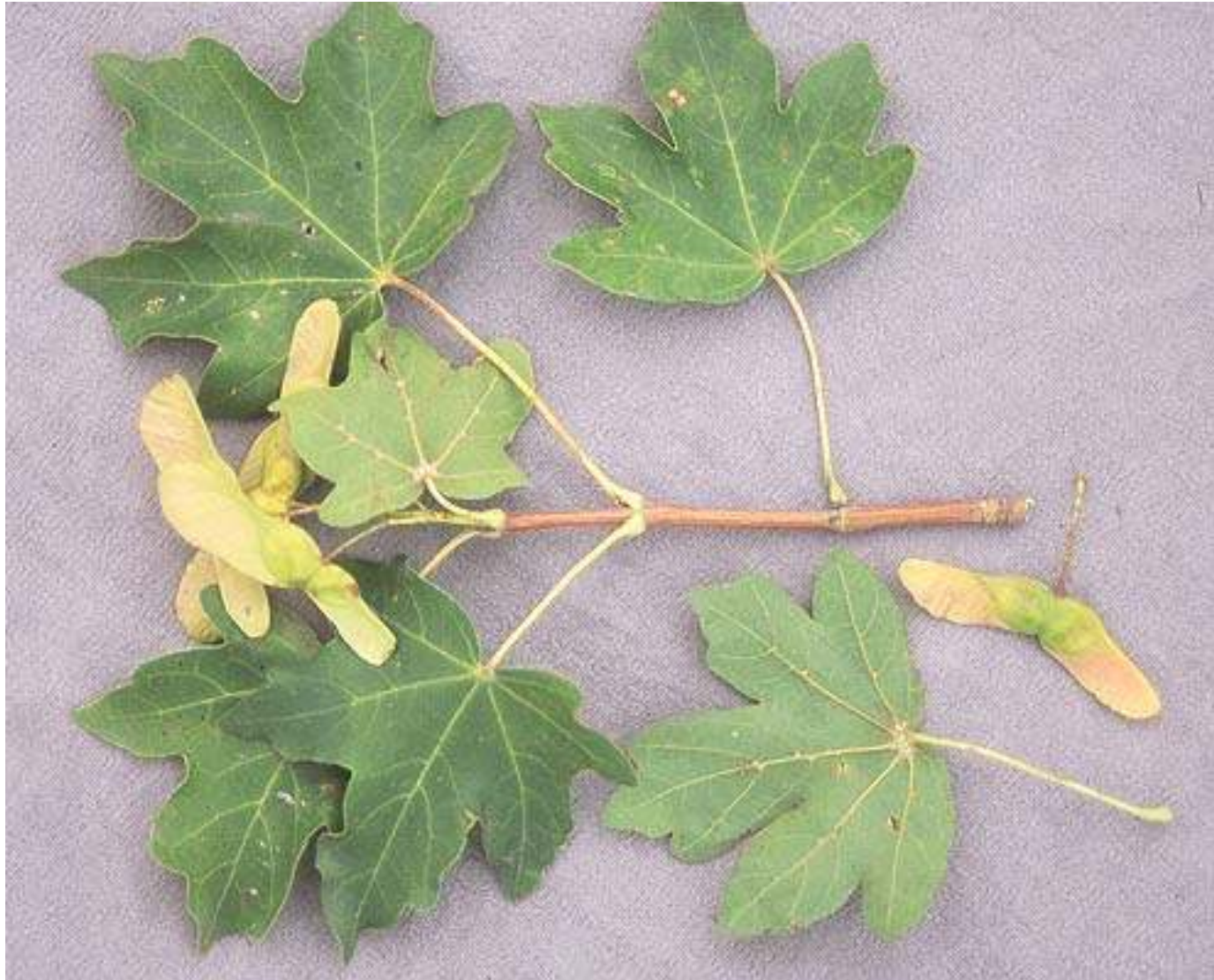
Leaf type



Leaf type



Leaf Arrangement



Leaf Arrangement



Leaf margins





Bark



spines



Types of Classification

2 Natural classification

Attempt to group organism according to their natural relationships.

More evidence than artificial classification such as similarity of embryology, morphology, physiology, anatomy, cell structure and behaviour.

Taxa

- Refer to a **series of groups** arranged in hierarchy.
- Each group '**taxon**' contains organisms sharing some basic features indicating that they have **a common ancestry**.
- There are seven main taxa: **kingdom, phylum, class, order, family, genus, and species**.

Taxa

- Listed in descending order of size such that the **kingdom is the largest** and most inclusive containing many organisms with the fewest features in common, whereas the **lowest or exclusive taxon is the species**.
- Each **taxon** can also have **subgroups** such as super-, sub-, infra etc.

Classification of Humans

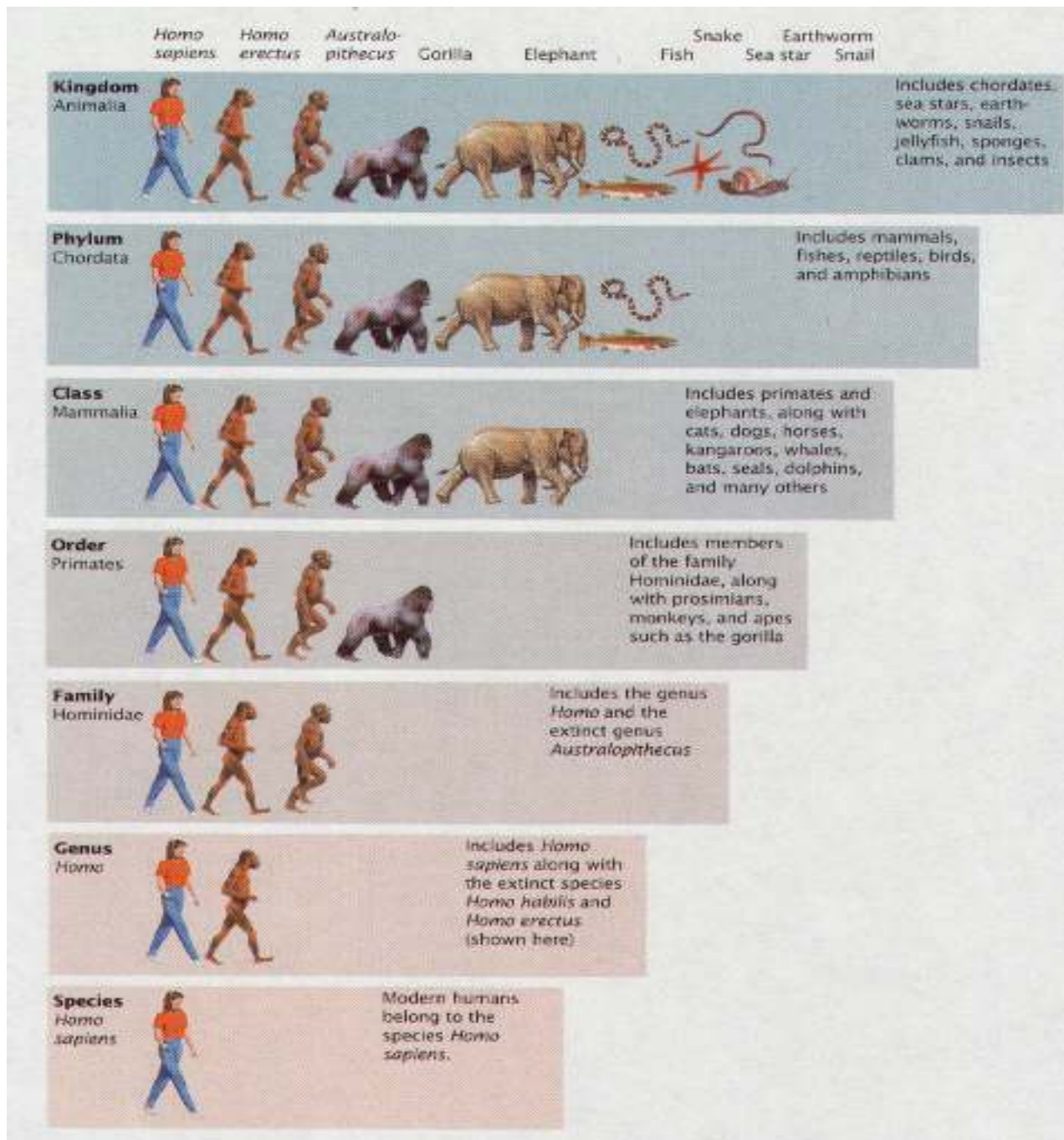
- Kingdom: **Animalia**
- Phylum: **Chordata**
- Sub Phylum: **Vertebrata**
- Class: **Mammalia**
- Order: **Primates**
- Family: **Hominidae**
- Genus: **Homo**
- Species: **sapiens**

Reasons for Humans classification

- Kingdom: Multicellular/heterotrophic
- Phylum: Dorsal nerve/Chord/skeleton
- Sub Phylum: Notochord instead of vertebral column
- Class: Warm blooded/hairy/young ones such milk

Reasons for Humans classification

- Order: Tree dweller/grasping hand free with 5 digits
- Family: Bipedal/man-like apes
- Genus: Closely related
- Species: Sparse body hair/ highly developed brain



Classification of Modern Humans

Kingdom Animalia



Phylum Chordata



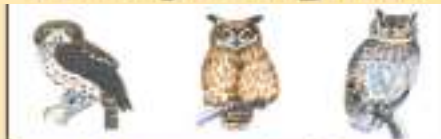
Class Aves



Order Strigiformes



Family Strigidae



Genus *Bubo*



Species *Bubo virginianus*



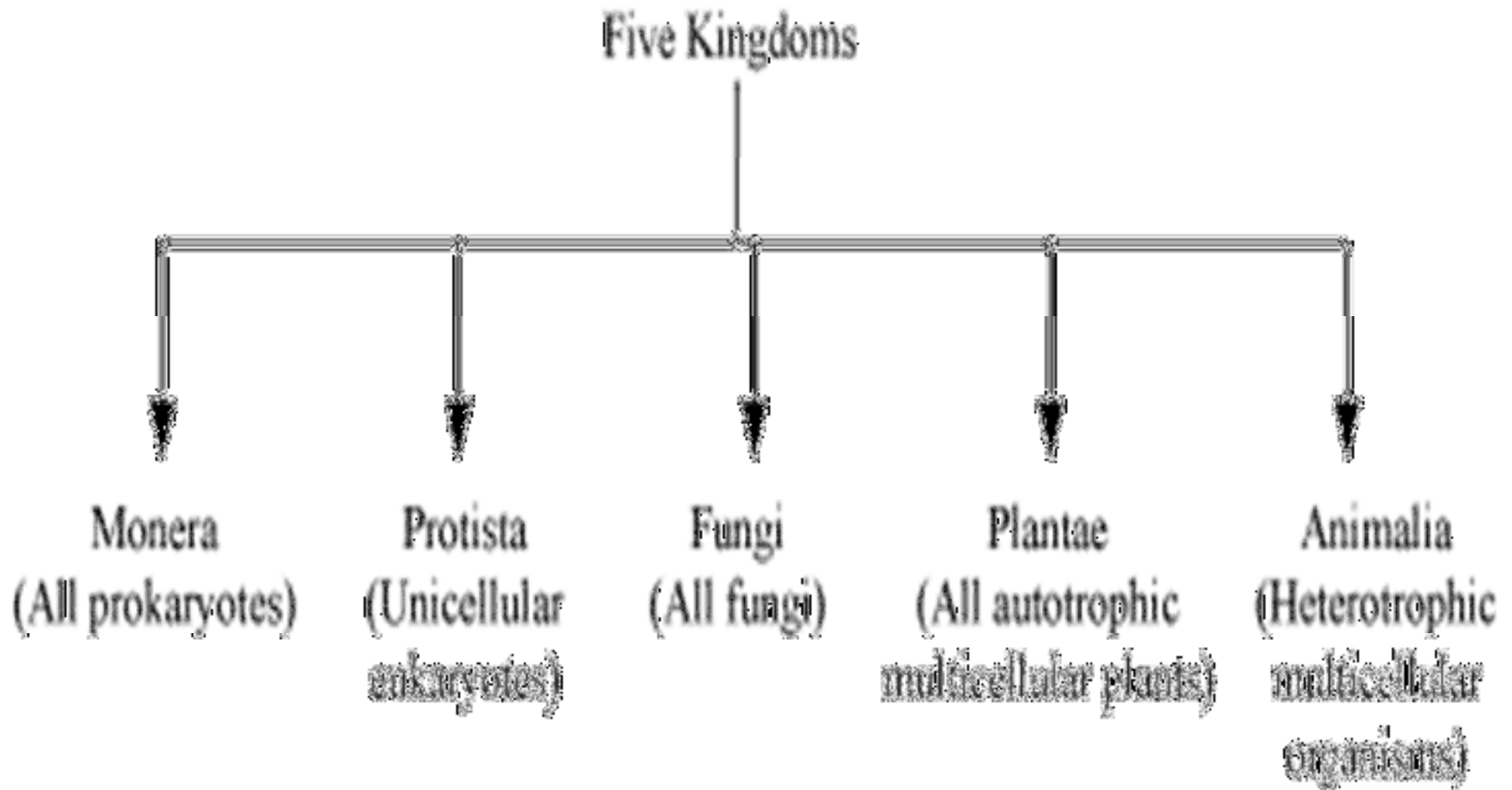
Lecture 2: Diversity of Life

According to **Margolis and Schwartz**

There are **5** major Kingdoms of Living Organisms

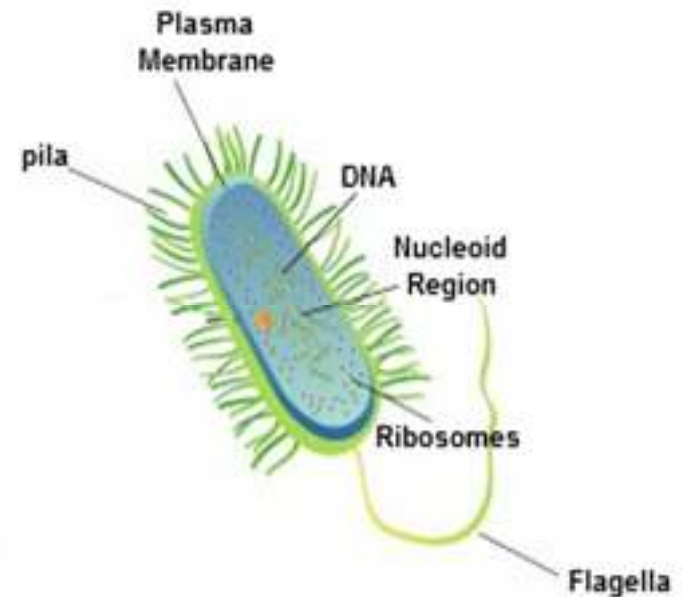
- **Kingdom**

Diversity of life



Kingdom: Monera: (ARCHAEBACTERIA and EUBACTERIA)

- Contain all **Prokaryotic** organisms eg bacteria
- Microscopic and Single celled creatures
- No bound organelles
- Found in wide range of habitats
 - **Lactobacillus** (found in food decay)
 - **Diplococcus** (Feed on other organisms)
 - **Rhizobium** (Mutualistic)

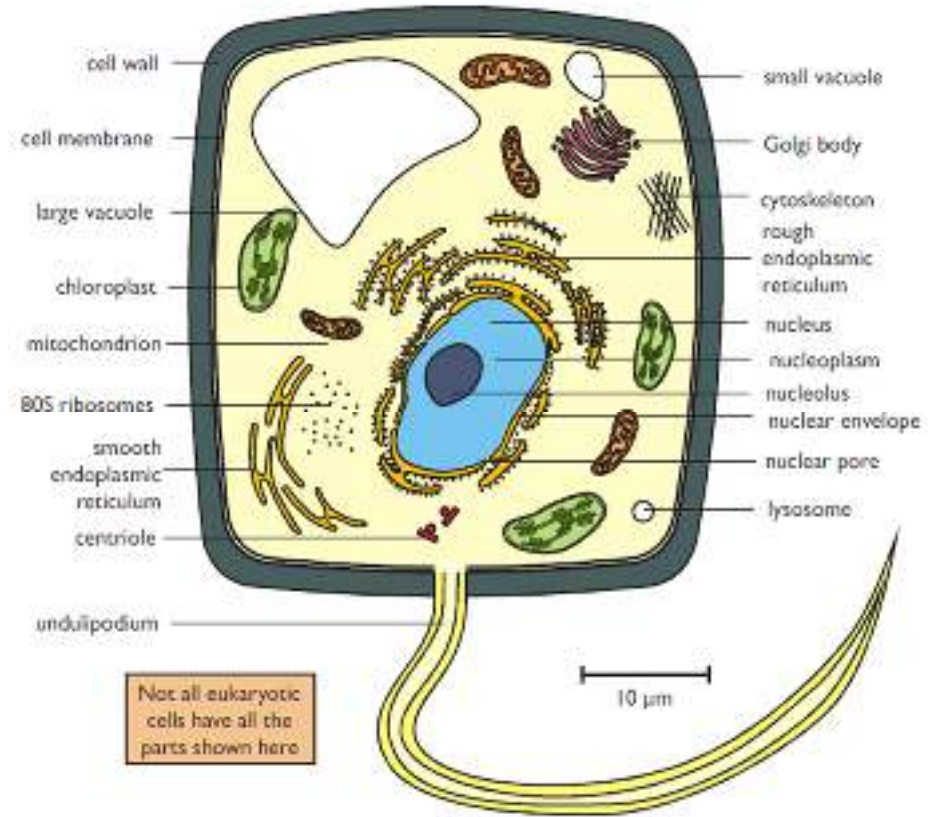


Kingdom: Protista

- Eukaryotic

- Possess bound organelles
- Single celled organism

eg Protozoans (Amoeba and Paramecium)
Seaweeds and Algae (Photosynthetic)



Kingdom: **Plantae**

- Multicellular with **cellulose cell wall** eg
 - Simple plants (Mosses and Ferns)



PLANTS

No vascular system

**Mosses,
Liverworts,
Hornworts**

Vascular system

Seedless Plants
(reproduce by spores)

**Ferns, Horsetails,
Club Mosses**

Seed Plants
(reproduce by seeds)

Gymnosperms
("naked seeds")

**Conifers
Cycads
Gingkoes**

Angiosperms
(flowers, seeds
enclosed in fruit)

Flowering Plants



- Complex flowering plants (Angiosperm) Photosynthesize their food and non motile



Kingdom **Animalia**

- Multicellular
- Heterotrophic
- Motile and ingest food eg
 - **Simple creatures (worms)**
 - **Complex creatures (Fish, Insect, Amphibian, Reptiles, Mammals)**



- **Jelly Fish**

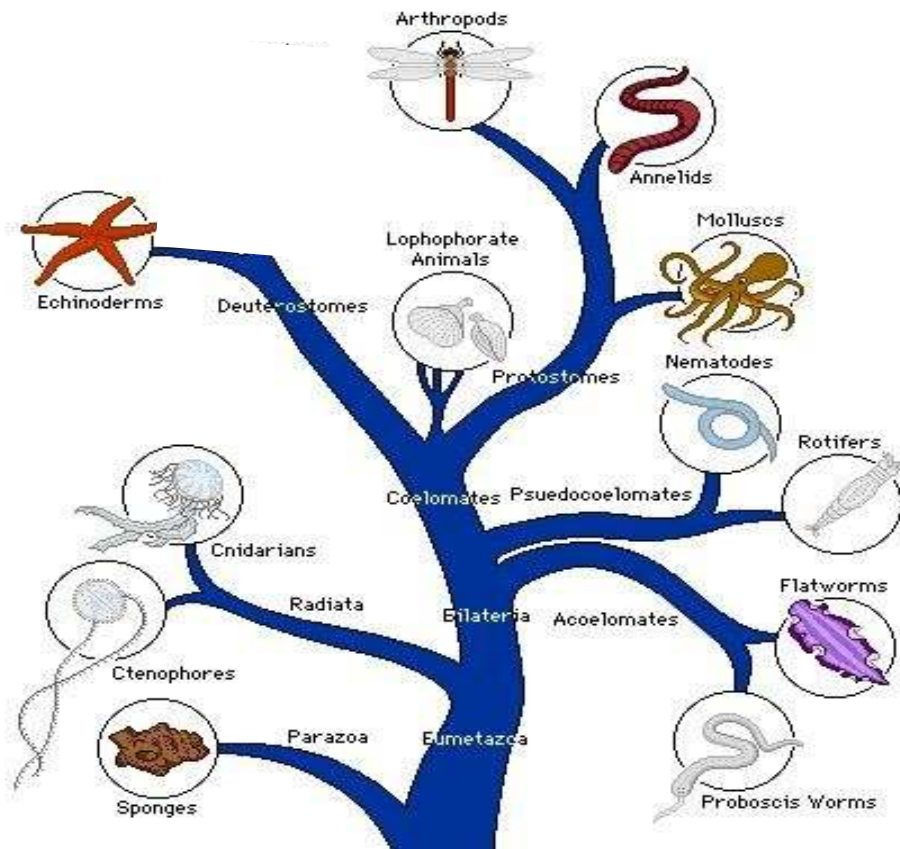


ANIMALS

Invertebrates
(no backbone)



Vertebrates
(backbone)



Animals with backbones



Fish



Birds



Reptile



Amphibians



Mammals

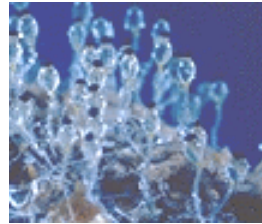
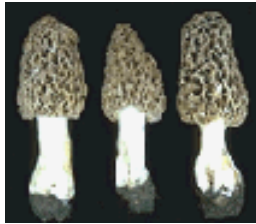
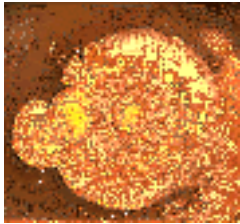


Kingdom: **Fungi**

- Heterotrophic
- Non Motile
- Extracellular digestion
- Sometimes feed on **decay materials**



FUNGI



Fungi sometimes look like plants, but they're not!

Fungi can't do photosynthesis, because they don't have chloroplasts; they get their nutrients from the organic material they live in.

- ❖ **Decomposers**, like mushrooms, feed on dead organic material.
- ❖ Some fungi **feed on living organisms**, such as plants, animals and even other fungi. This causes diseases and infections in these organisms (like athlete's foot and ringworm in humans).
- ❖ Some fungi live as **symbiotic partners with algae**. The result: lichen

Other differences from plants:

- fungi don't have roots, they have a mycelium
- fungi's cell walls are made of chitin, not cellulose.

FUNGI

Binomial Nomenclature

Nomenclature

- Biological nomenclature is based on **binomial system** devised by **Carl Linnaeus (1707-78)**.
- In this system each organism has a scientific name consisting of **two words in Latin**.

History of Plant Nomenclature

Nomenclature means naming of organisms

- Dates back to 200 B.C. to China and Egypt
- Greeks and Romans classified plants into 4 groups
 - herbs
 - undershrubs
 - shrubs
 - trees



Binomial System of Nomenclature

- Before 1753 Names were composed of 3 or more words eg
- *Salix pumila angustifolia altera* (Willow plant)
- system developed by **Carl Von Linne or Linnaeus** used to methodically classify and name the whole of the natural world
- His Book: Species Plantarum (1753)
- system still in use today

Botanical nomenclature

- language is mainly **Latin with Greek** and some other languages
- these are “**dead languages**” whose words and meanings will likely change little over time

The names of plants

- The scientific name for a plant consists of two words:

1. Genus or generic name e.g.

Oryza

2. Specific epithet e.g. *sativa*

Rice (*Oryza sativa*)

Carpinus caroliniana



- By using the binomial system of nomenclature, plant names are the same in all languages!
- Every plant has a “first and last name” where the last name is written first.

The **genus** is usually a **noun**, **capitalized** and can serve to describe one of the following:

- a plants appearance-*Hemerocallis* (day and beauty)
- supposed medicinal qualities- *Pulmonaria* (lungwort)
- resemblance to body parts-*Hepatica* (liver)
- honors a person by using their name – *Vigna* (Vigna – former director of Piza)

Specific epithet

- the second word in a scientific plant name, **not capitalized** and usually **an adjective** used to describe size, color, leaf shape, growth habit, origin of the plant or to commemorate a person.

The specific epithet can give us hints about the plant:

- *Cotoneaster horizontalis*
- *Coreopsis gigantea*
- *Cistus x purpureus*
- *Securidaca longepedunculata*
- *Erythrina senegalensis*
- *Eugenia uniflora*
- *Commofora africana*
- *Arachis hypogea*

Species

- the **basis** of the binomial system of nomenclature
- a population of individuals within a genus that are capable of **interbreeding**

Writing plant names correctly

- scientific names should always be **underlined or in italics**
- the genus is **capitalized**, the specific epithet is not
- the name is only complete if it is followed by the name of the **person who first described or named it**

For example: Red Oak

Quercus rubra Linnaeus

or

Quercus rubra L.

Quercus rubra or *Quercus rubra*



Plant species can be divided more specifically into:

- a cultivar
- variety
- hybrid
- form

Cultivar

- “Cultivated variety” or horticultural variety
- plants within a species that have been selected especially for a particular characteristic and are propagated, usually asexually to continue this trait(growth habit, flower, fruitless)

Cultivar names

written in plain text, capitalized and set off by single quotes, e.g.

Viburnum opulus 'Roseum'

Viburnum opulus cv. Roseum

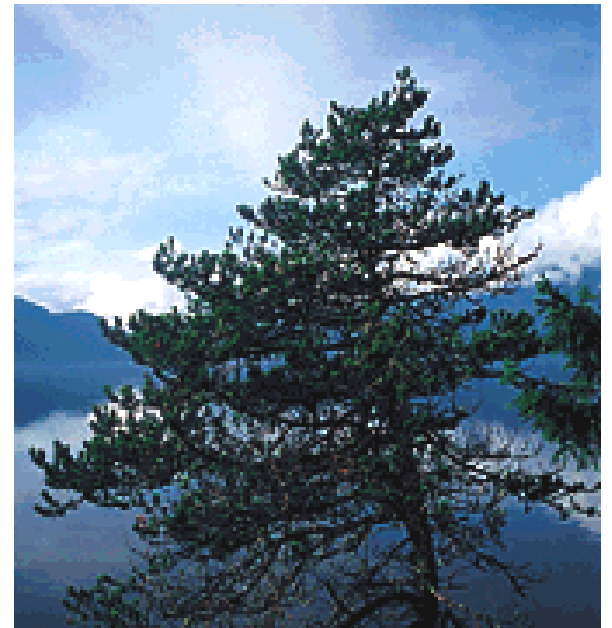


Variety

- botanical or wild variety
- a group of plants intermediate between species and form and usually associated with inheritable differences.
- They are recognized as distinct populations breeding true to type

Variety names

- written in lowercase and italicized or underlined
- e.g. *Pinus contorta* var. *contorta* Shore Pine
- *Pinus contorta* var. *latifolia* Lodgepole Pine



Hybrid

- two closely related but distinct species will be interbred to form a hybrid
- are often sterile and produce no seed or fruit

Hybrid names

- written in lowercase and italicized or underlined
- an “x” is placed between the genus and hybrid epithet

Platanus occidentalis crossed with *Platanus orientalis*



Plantanus x acerifolia



Naming exercises

- What is the name of these plants

Can you name these plants?



What about this?



Ok, is this *Theobroma cacao*?



??????????



Exercise

What are these crops?

1. *Vigna unguicalata*
2. *V. unguiculata*
3. *V. unguiculata subsp unguiculata*
4. *V. unguiculata cv-gr unguiculata*
5. *V. unguiculata var. testilis*

Answers

1. *Species*
2. *Species*
3. *subspecies*
4. *cultivar group*
5. *variety*