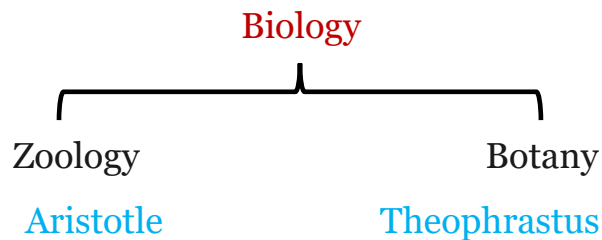


Unit-1: Introduction to Biology

What is biology?

- ❖ It is derived from Greek words; bio means life and logy means study i.e. study of living things and their vital processes.
- ❖ Biology is the study of all living things. The major groups of living things are archaeon, bacterium, protist, fungus, plants & animals i.e. biology studies their structure, function, distribution, evolution, and taxonomy.



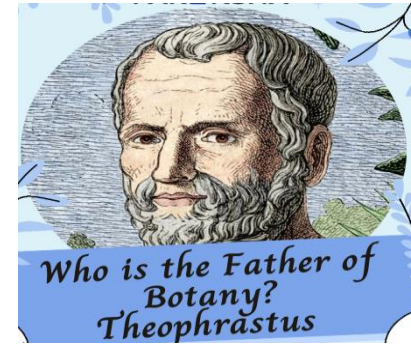
Wrote Book: *Historia Animalia*

Plantarum

Historia



Aristotle
The Father of
Biology



Who is the Father of
Botany?
Theophrastus



Archaeo



Bacterium



Protist



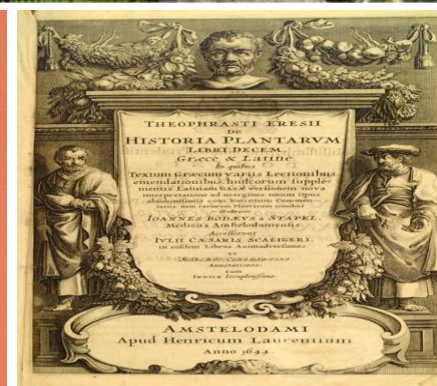
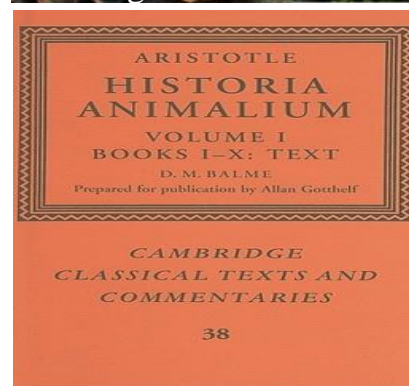
Fungus



Plant

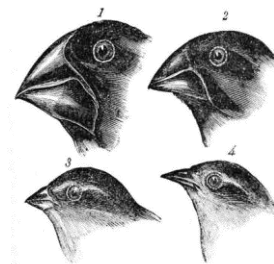
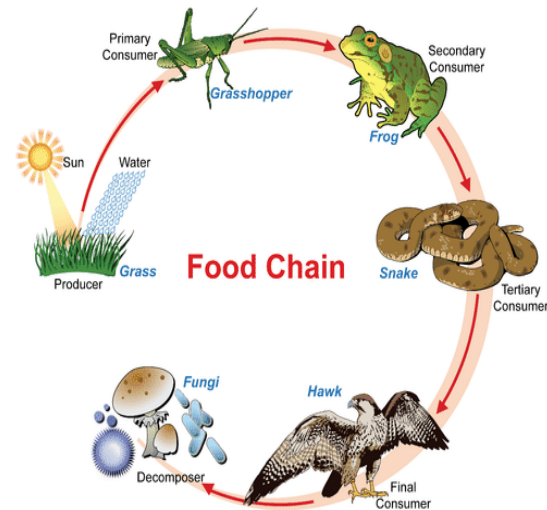
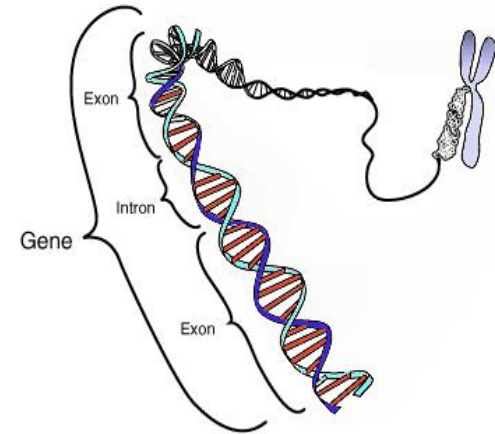


Animal

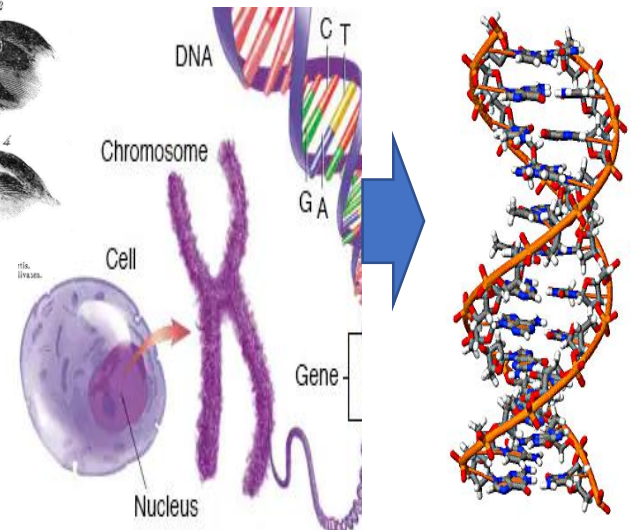


Basic principles of biology:

- Cells are the basic building blocks of life.
- Genes are responsible for passing traits from parents to their offspring.
- The diversity of various species on Earth is because of evolution by natural selection.
- Living beings possess the ability to transform energy.



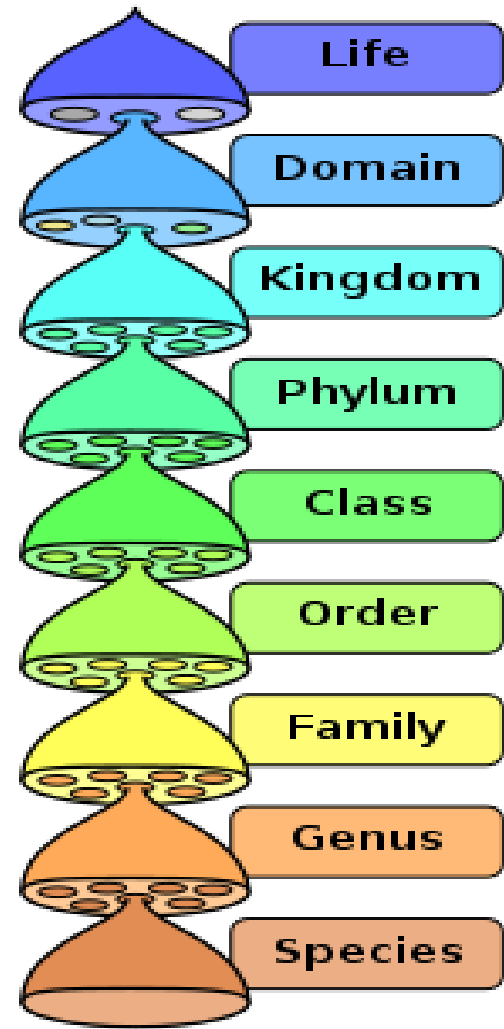
DARWIN'S FINCHES



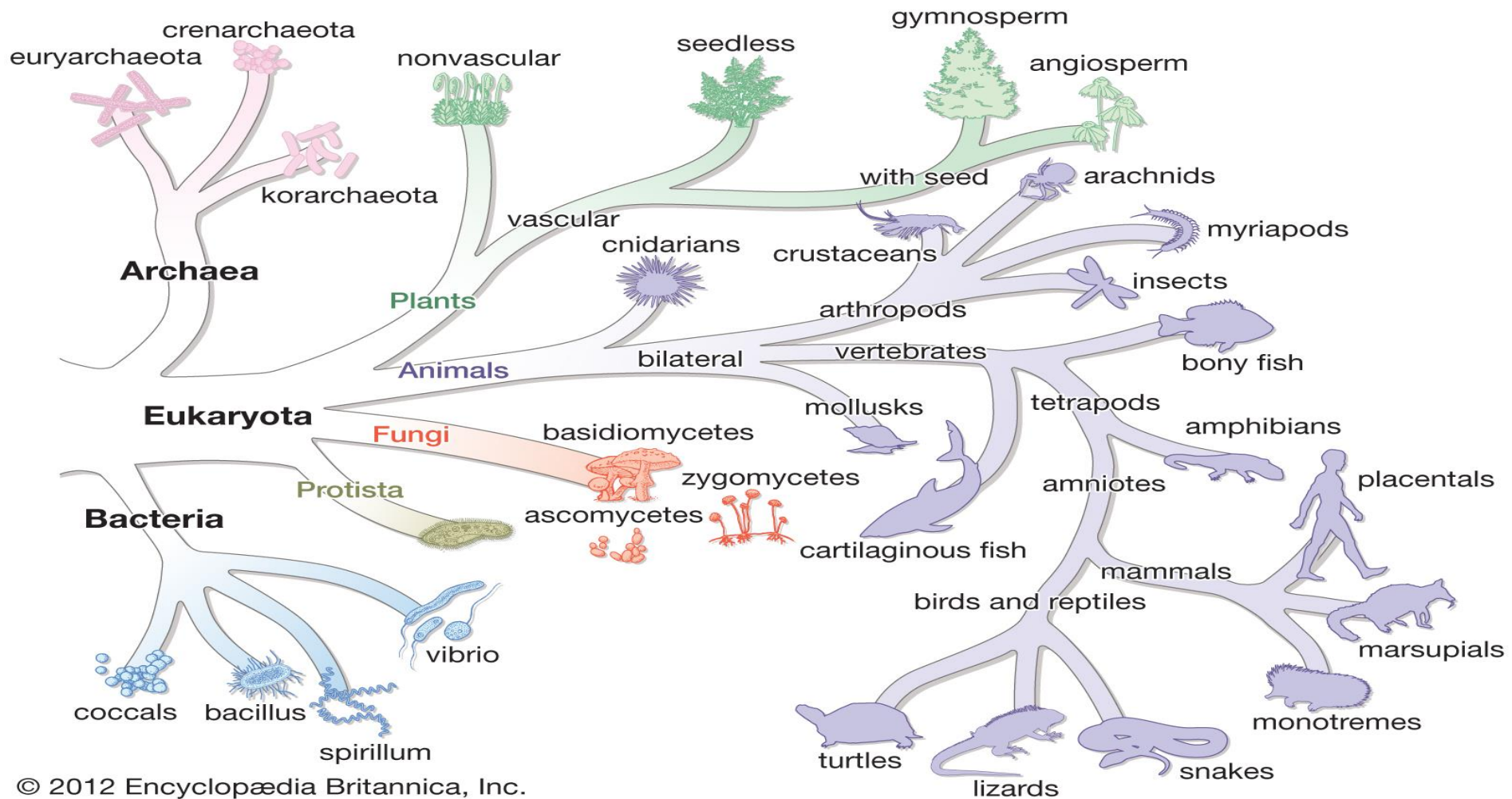
How genetic traits are inherited

Biological classification:

- It is the scientific procedure of arranging the organisms in a hierarchical series of groups and sub-groups on the basis of their similarities and dissimilarities.
- Other well-known ranks in descending order of size are life, domain, kingdom, phylum, order, family, genus, and species, with class fitting between phylum and order.
- In biological taxonomy, a domain, is the highest taxonomic rank of organisms in the three-domain system of taxonomy. According to this system, the tree of life consists of three domains: Archaea, Bacteria, and Eukarya.
- A species is the basic unit of classification and a taxonomic rank of an organism, as well as a unit of biodiversity.

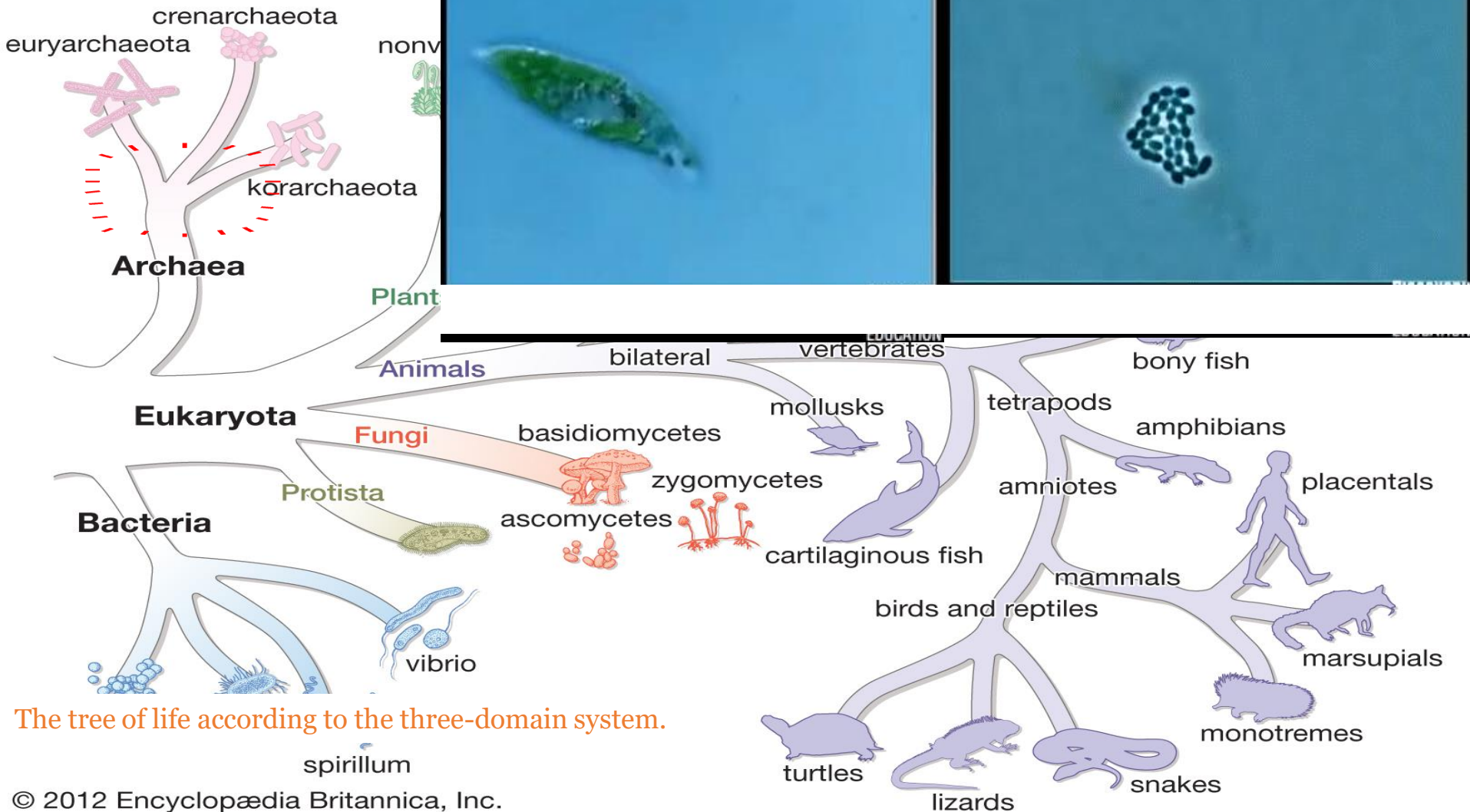


Biological classification: Three-domain system

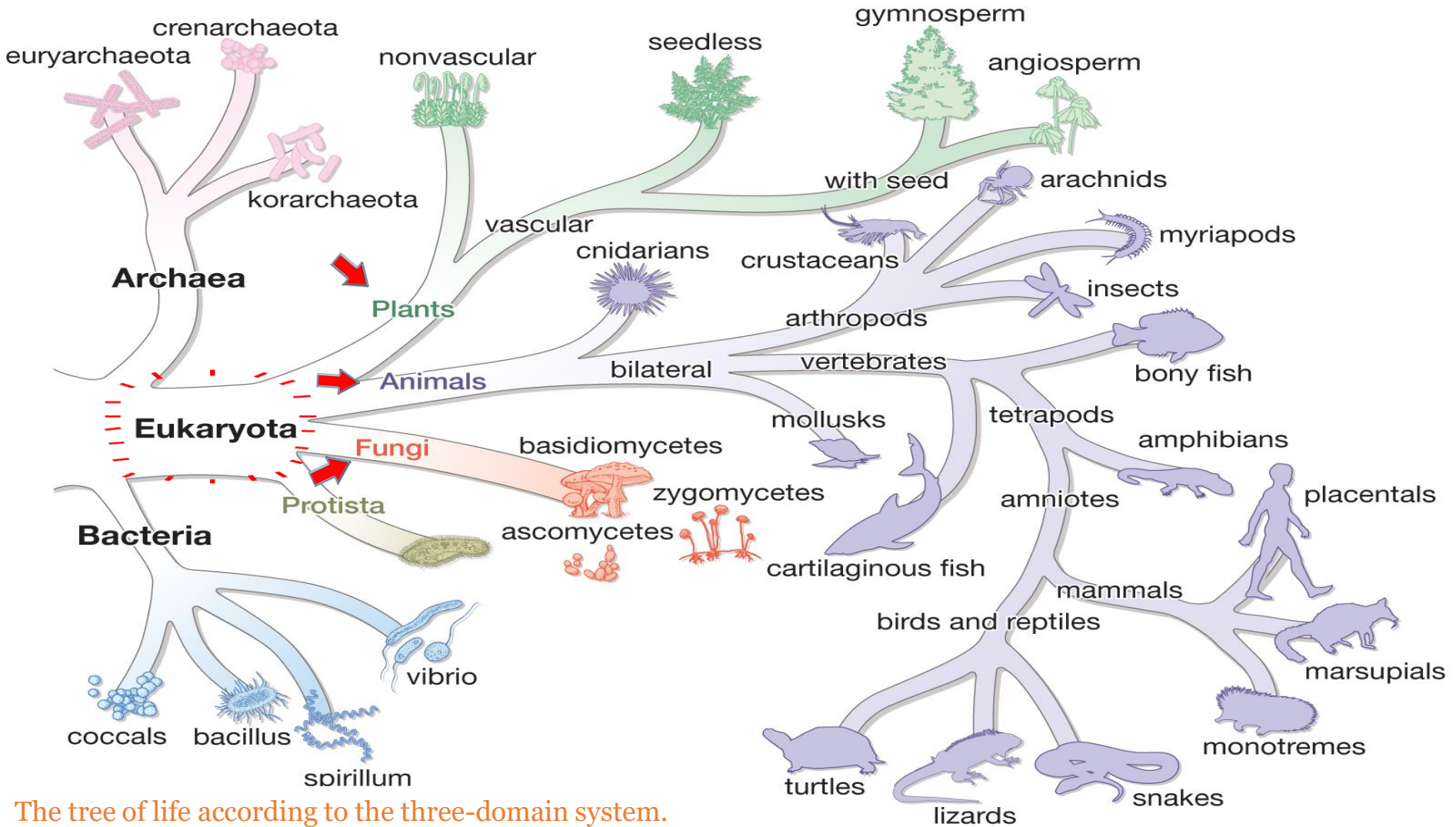


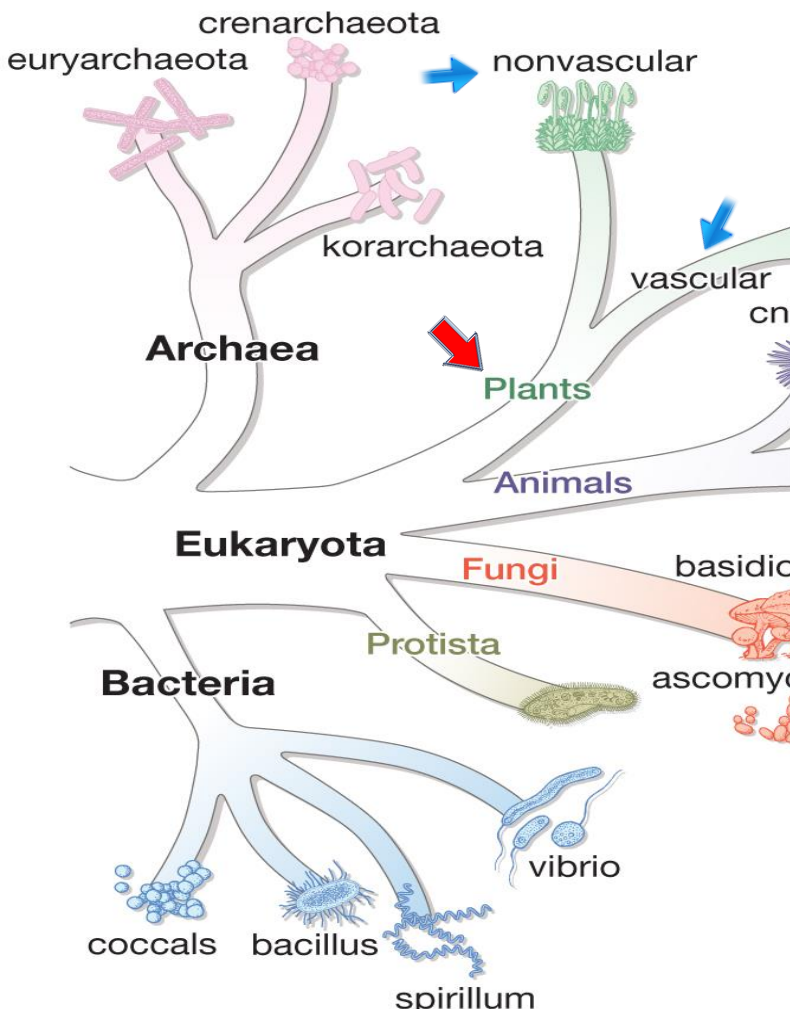
The tree of life according to the three-domain system.

Archaea can be spherical, rod, spiral, lobed, rectangular or irregular in shape are a primitive group of slow-growing microorganisms that also are present in the human gut.



The tree of life according to the three-domain system.





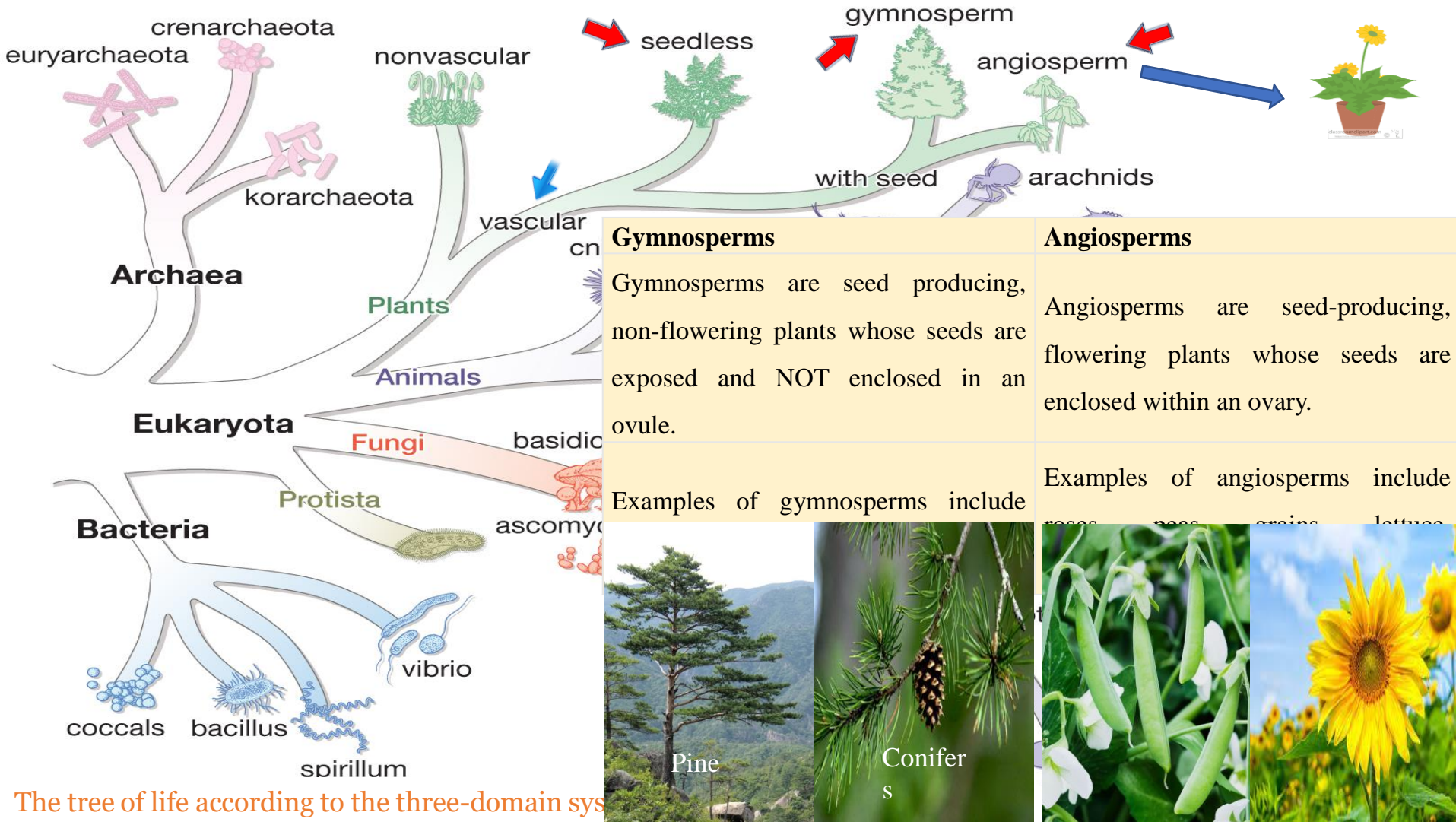
Differences Between Vascular and Non-vascular plants



- The main difference between vascular and non-vascular plants is that vascular plants contain a specialized **xylem and phloem tissues** for the transportation of water and foods, while non-vascular plants do not contain specialized vascular tissues for transport.
- Vascular plants are known as higher plants while non-vascular plants are known as lower plants.
- Vascular plants become tall due to the structural support gained from its lignified xylem. Non-vascular plants grow on the surface of the ground or on tree trunks.
- Vascular plants may be Seedless, gymnosperm & angiosperm.

turtles
lizards
snakes

The tree of life according to the three-domain system.



The tree of life according to the three-domain system

Classification of Plant

No vascular system (bryophytes)

Mosses, Liverworts,
Hornworts

Vascular system

Seedless Plants (reproduce by spores)

Ferns, Horsetails, Club Mosses

Seed Plants (reproduce by seeds)

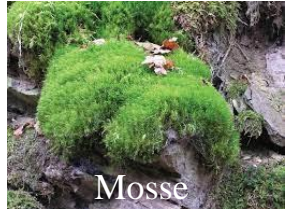
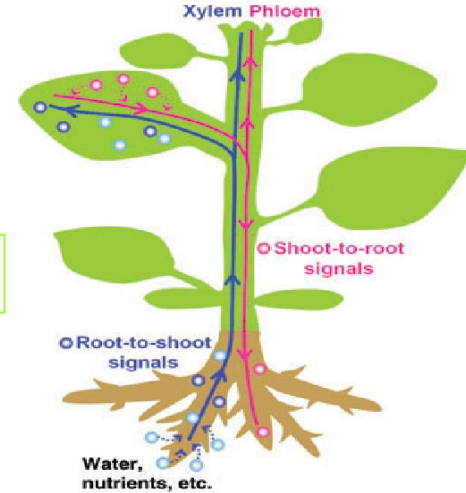
Gymnosperms
("naked seeds")

Conifers
Cycads
Gingkoes

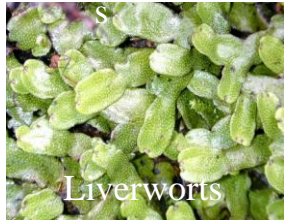
Angiosperms (flowers,
seeds enclosed in fruit)



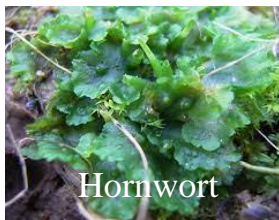
Flowering Plants



Mosse



Liverworts



Hornwort



Ferns



Horsetails



Club Mosses



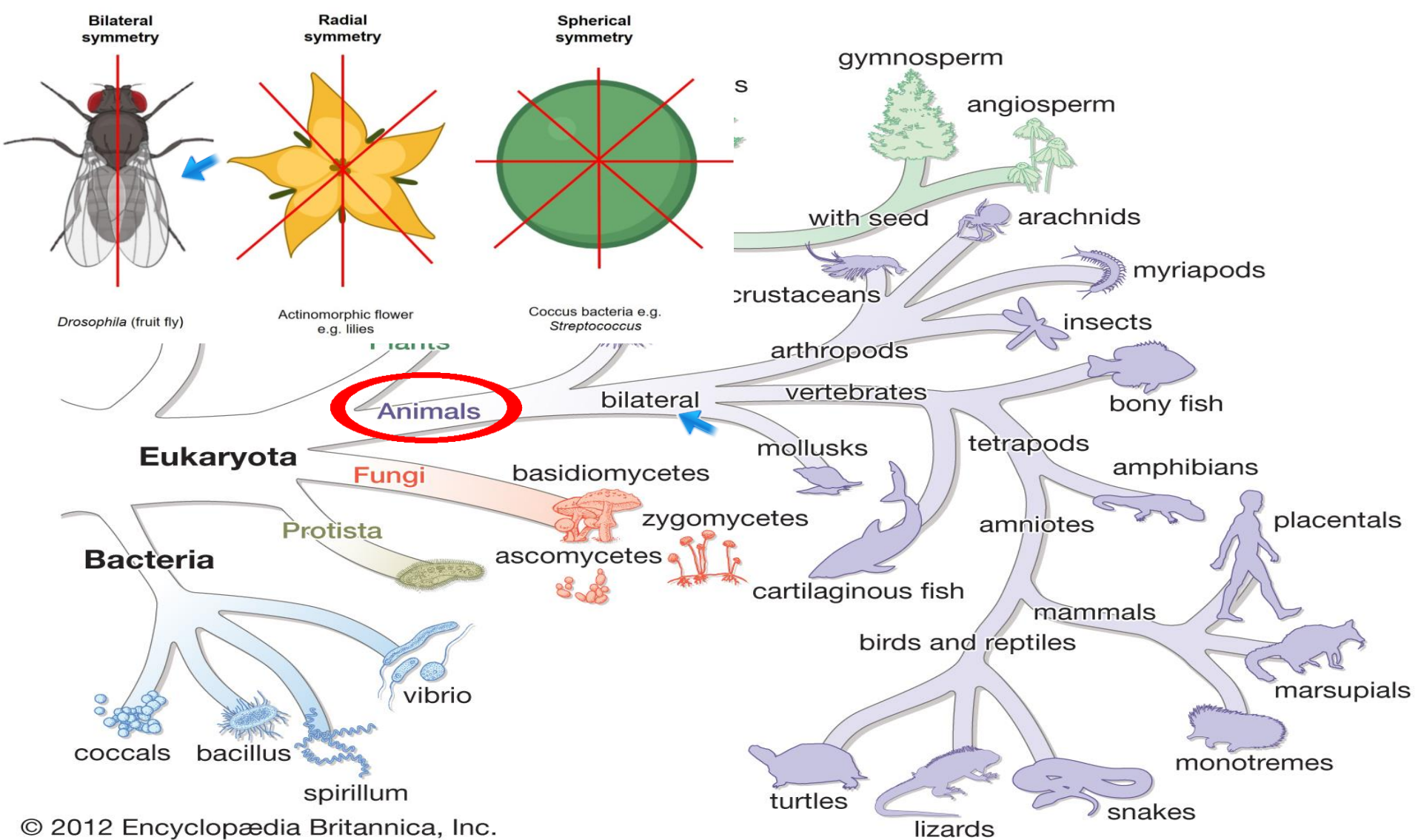
Conifer



Cycads



Gingkoe

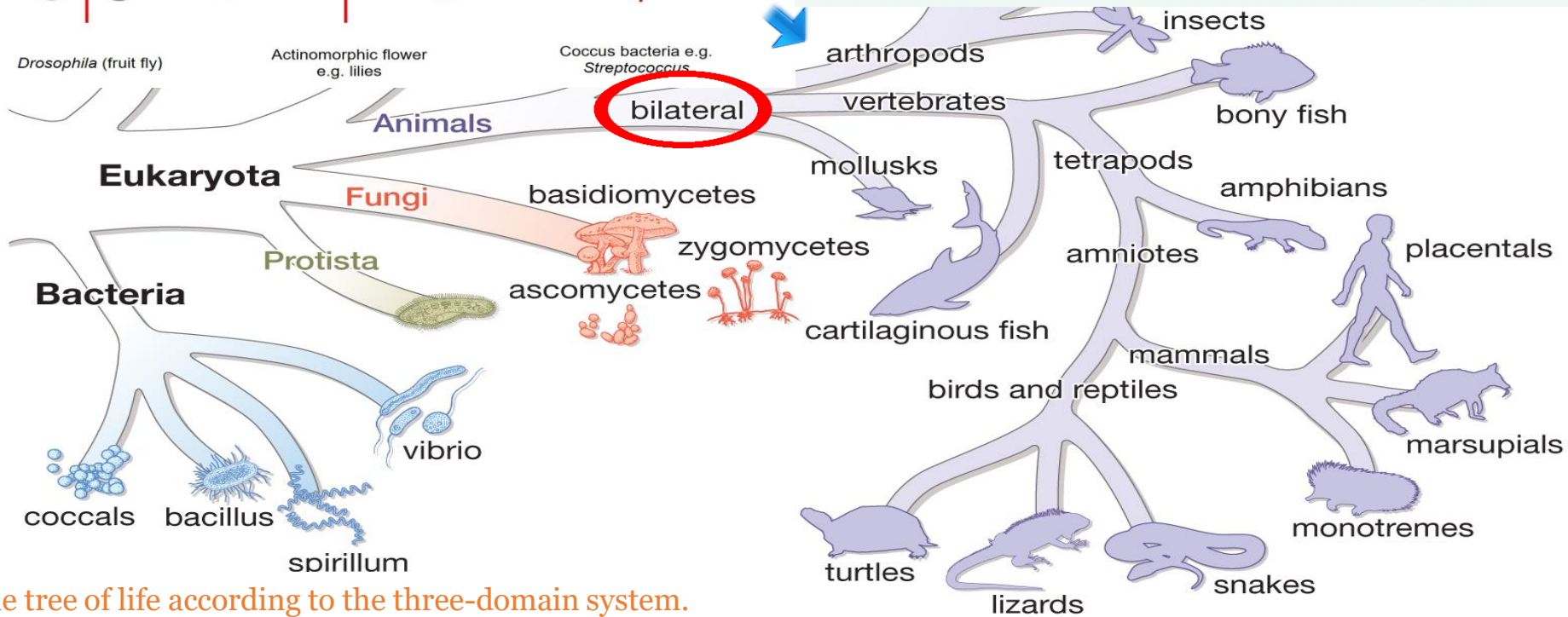
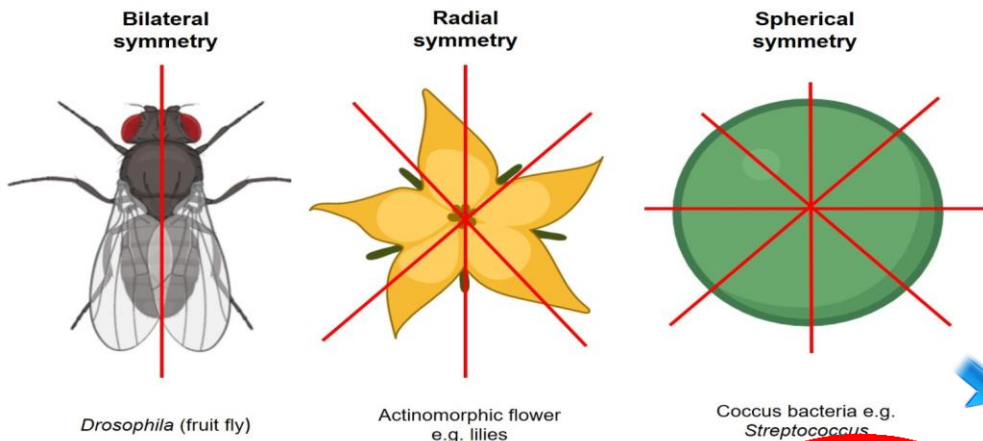


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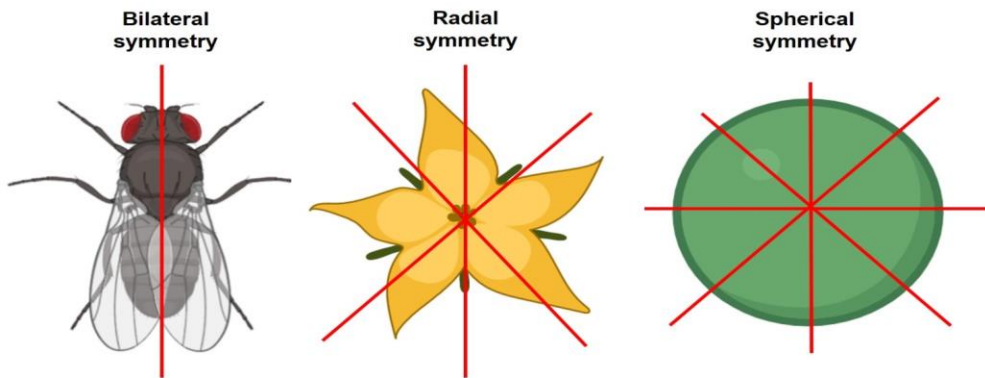
The tree of life according to the three-domain system.

In Radial every plane passing through the center divides the body into two equal halves is known as radial symmetry.

Bilateral symmetry: Body symmetry is described as the ability to split the body into two identical halves.



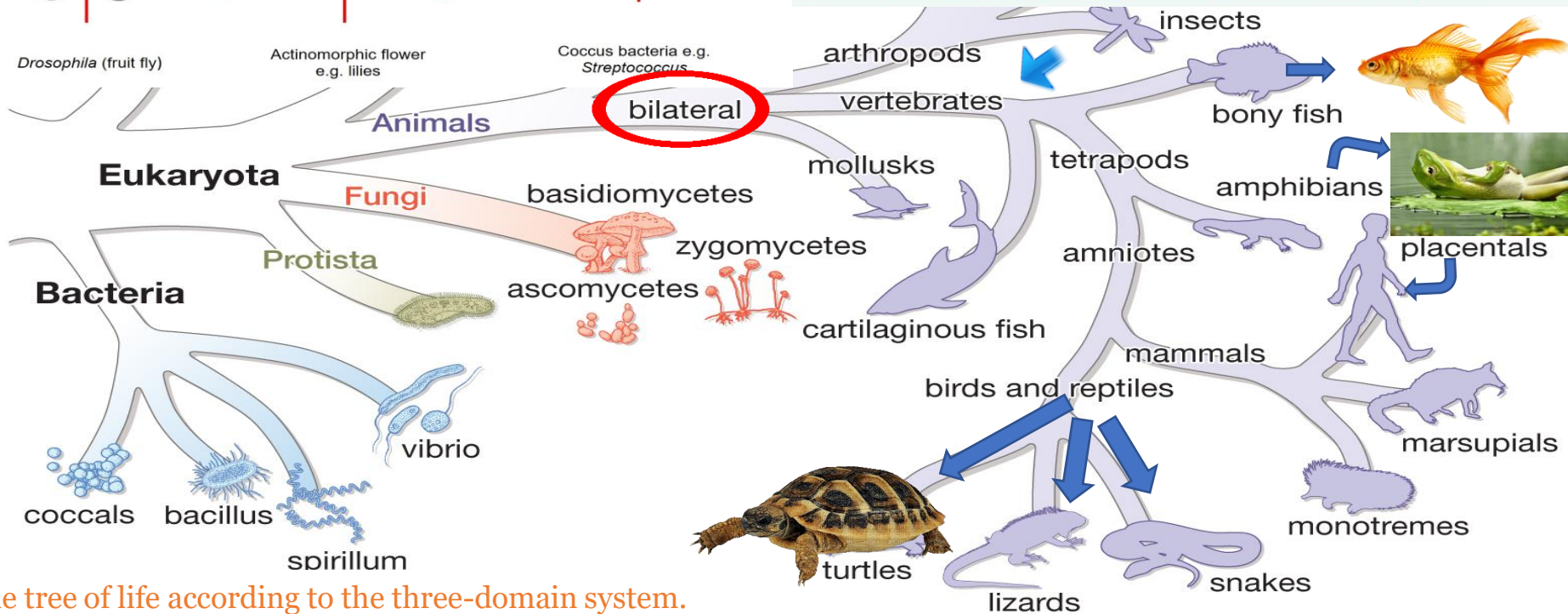
The tree of life according to the three-domain system.



Drosophila (fruit fly)

Actinomorphic flower
e.g. lilies

Coccus bacteria e.g.
Streptococcus

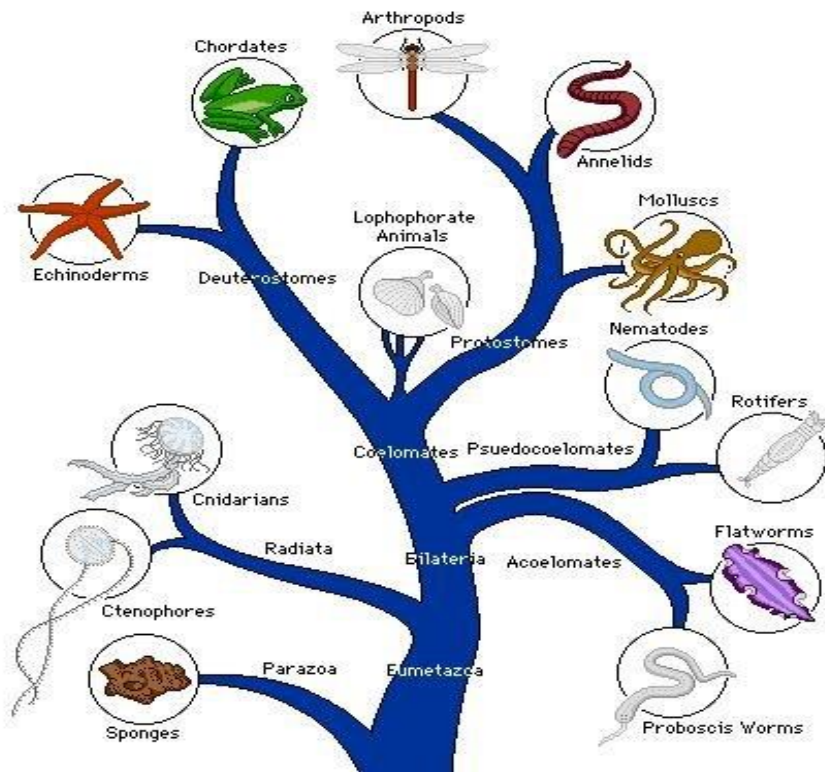


The tree of life according to the three-domain system.

Classification of Animals

Invertebrates (no backbone)

- Generally, their body size is smaller than vertebrates.
- They do not possess a backbone, not an internal skeleton.



Vertebrates (backbone)

- Generally, their body size is larger than invertebrates.
- They possess a backbone and an internal skeleton.

Animals with backbones



Fish



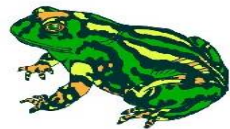
Mammals



Reptile

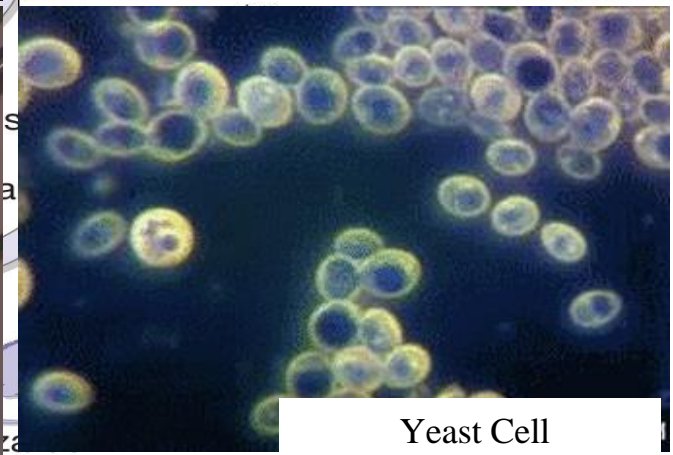


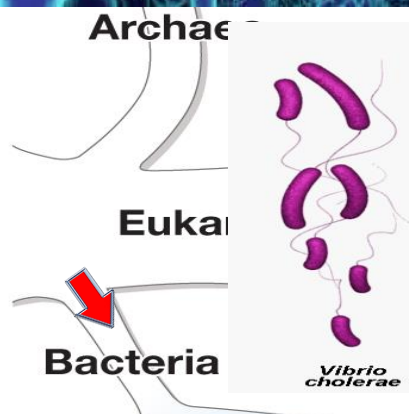
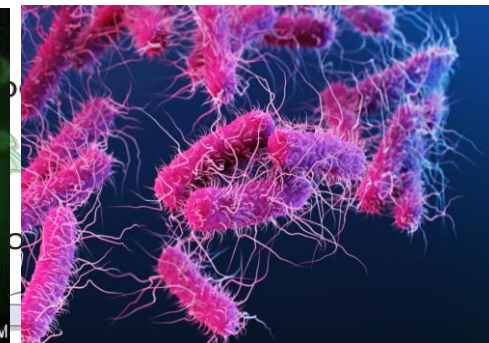
Birds



Amphibians

Fungi: a plant that is not green and does not have leaves or flowers (mushroom), or that is like a wet powder and grows on old wood or food, walls, etc. The cell walls of fungi **contain chitin**, which is a hard substance also found in the exoskeletons of insects and arthropods such as crustaceans. **They do not contain cellulose, which commonly makes up plant cell walls.**





A bacterium called *Vibrio cholerae* causes cholera infection. The deadly effects of the disease are the result of a toxin the bacteria produces in the small intestine. The toxin causes the body to secrete enormous amounts of water, leading to diarrhea and a rapid loss of fluids and salts (electrolytes).



Bacterial Leaf Spot Disease



Skin Infection



Common human diseases

```
graph TD; A[Common human diseases] --> B[Bacterial diseases]; A --> C[Viral diseases]; A --> D[Fungal diseases]; A --> E[Protozoan diseases]; A --> F[Helminthic diseases]; B --> B1[Dysentery]; B --> B2[Plague]; B --> B3[Diphtheria]; B --> B4[Cholera]; B --> B5[Typhoid]; B --> B6[Pneumonia]; C --> C1[Common cold]; C --> C2[Mumps]; C --> C3[Measles]; C --> C4[Viral hepatitis]; C --> C5[Dengue fever]; C --> C6[Chikungunya]; C --> C7[Chicken pox]; C --> C8[Poliomyelitis]; D --> D1[Candidiasis]; D --> D2[Athlete's foot]; E --> E1[Malaria]; E --> E2[Amoebiasis]; E --> E3[African sleeping sickness]; E --> E4[Kala-azar]; F --> F1[Ascariasis]; F --> F2[Filariasis];
```

Bacterial diseases

- Dysentery
- Plague
- Diphtheria
- Cholera
- Typhoid
- Pneumonia

Viral diseases

- Common cold
- Mumps
- Measles
- Viral hepatitis
- Dengue fever
- Chikungunya
- Chicken pox
- Poliomyelitis

Fungal diseases

- Candidiasis
- Athlete's foot

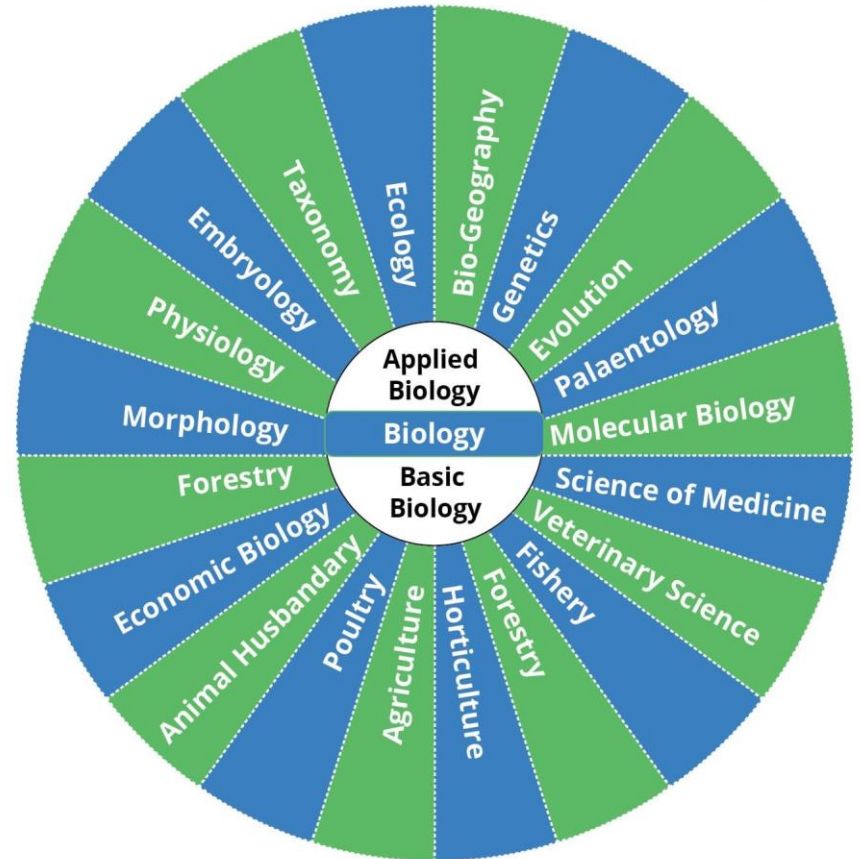
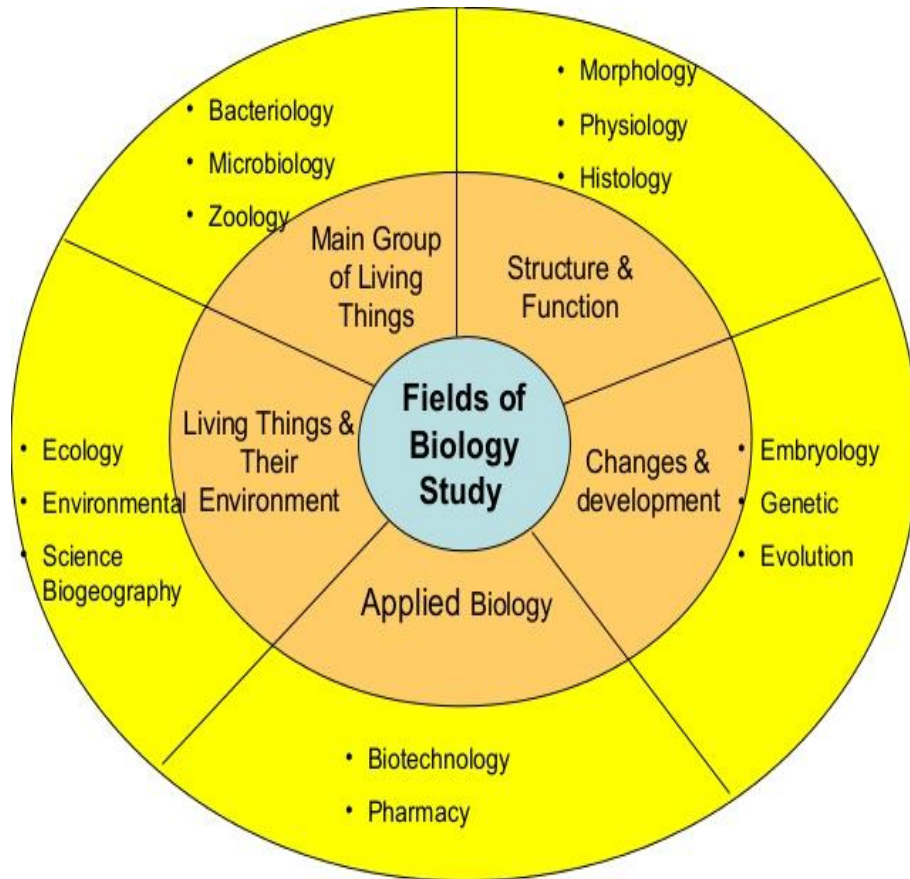
Protozoan diseases

- Malaria
- Amoebiasis
- African sleeping sickness
- Kala-azar

Helminthic diseases

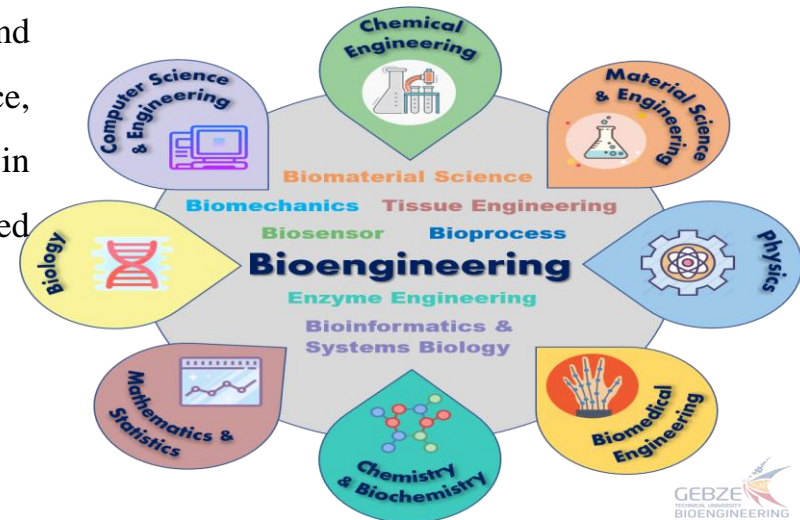
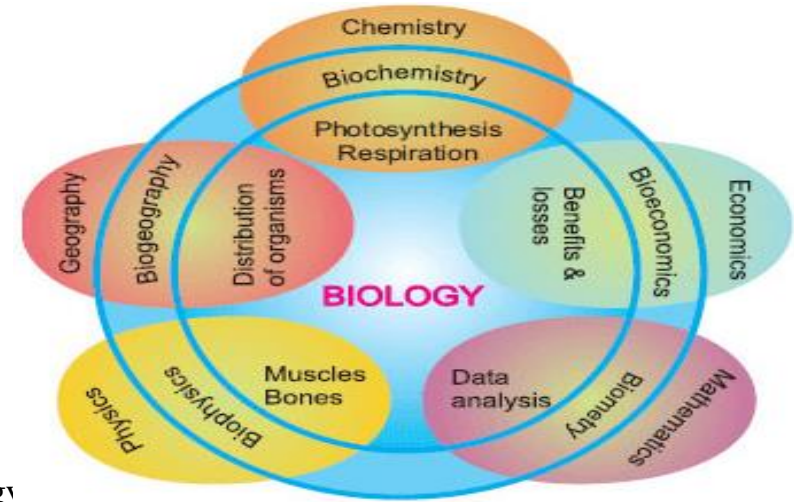
- Ascariasis
- Filariasis

Others Branches of Biology



BIOENGINEERING: BIOLOGY FOR ENGINEERS- NEED OF ERA

- ❖ It is a branch of science that seeks solutions for problems in biological systems with an interdisciplinary approach by combining basic sciences such as physics, chemistry, mathematics with engineering *i.e.* it is a discipline that applies engineering principles of design & analysis to biological systems & biomedical technologies.
- ❖ Students in bioengineering are trained in fundamentals of both biology and engineering, which may include elements of electrical and mechanical engineering, computer science, materials science, chemistry, and biology. This breadth allows students to specialize in their areas of interest and collaborate widely with researchers in allied fields.
- ❖ Bioengineering graduates are employed by a variety of institutions, including medical device manufacturers, pharmaceutical companies, regulatory agencies and medical research institutions.



Application of Biomedical Engineering



Robotic surgery



Artificial heart



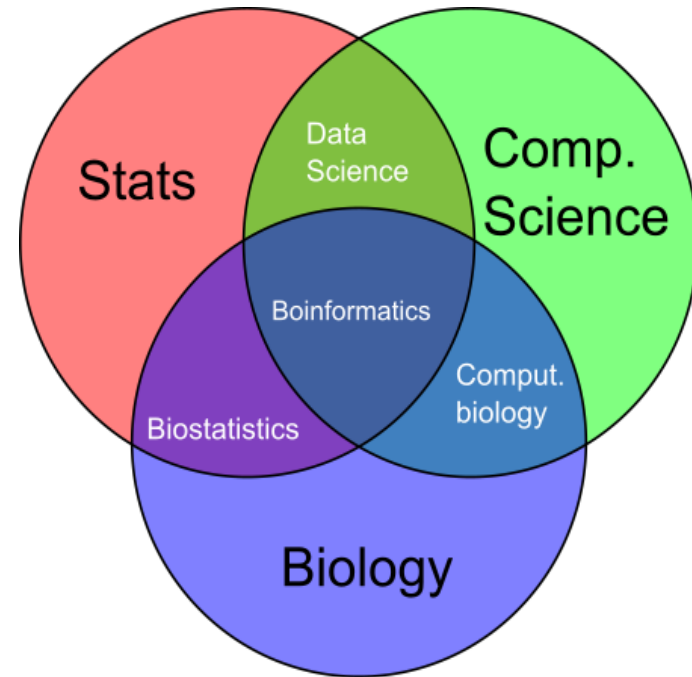
Artificial
limb



Artificial organs

Bioinformatics:

- It is an emerging interdisciplinary field that develops methods and software tools for understanding biological data.
- As an interdisciplinary field of science, bioinformatics combines computer science, statistics, mathematics, and engineering to analyze and interpret biological data.
- Current biological and medical labs use methods that produce extremely large data sets, which cannot be analyzed by hand - for instance sequencing human genomes. Therefore, modern biological and medical research and development cannot be done without bioinformatics.
- In addition, bioinformatics plays an important role in biomedical research. Research work in the area of genetic diseases and medical genomics is rapidly increasing and the future of personalized medicine depends on bioinformatics approaches.



List of bioinformatics software:

Software	Description
<u>AMPHORA</u>	<u>Metagenomics</u> analysis software
FastPCR	FastPCR is an integrated tool for PCR primers or probe design, in silico PCR, oligonucleotide assembly and analyses, alignment & repeat searching".
<u>BLAST</u>	Algorithm and program for comparing primary biological sequence information, including DNA and protein sequences.
Primer3	It is a freely available online software for designing primers and probe from a DNA sequence. It's a very popular software due to availability of several parameters to design primers with high specificity and accuracy.
<u>EMBOSS</u>	Suite of packages for sequencing, searching.
<u>Click2Drug</u>	"Click2Drug contains a comprehensive list of computer-aided drug design (CADD) software, databases and web services. These tools are classified according to their application field, trying to cover the whole drug design pipeline".
RaptorX	efficient protein structure prediction server that predicts the secondary & 3D protein structure. it also predicts solvent accessibility & disordered regions
<u>SOPMA</u>	Its an online protein Secondary structure prediction tool
<u>Glimmer</u>	Glimmer (Gene Locator and Interpolated Markov ModelER) is a system for finding genes in microbial DNA, especially the genomes of bacteria, archaea, and viruses.

Quiz

Q1. The word biology is derived from

- A. Greek B. Latin C. Both D. German

Q2. Father of Zoology and Botany were.

- A. Aristotle & Theophrastus respectively.
B. Theophrastus & Aristotle respectively
C. Aristotle & Fleming respectively
D. None

Q3. Father of Biology & Zoology were

- A. Aristotle & Theophrastus
B. Theophrastus & Aristotle
C. Aristotle & Aristotle
D. Theophrastus & Aristotle

Quiz

Q4. The Book written by Aristotle is

- A. *Historia Animalia* B. *Historia Plantarum* C. Both D. None

Q5. The Book written by Theophrastus is

- A. *Historia Animalia* B. *Historia Plantarum* C. Both D. None

Q6. Which of the following statements are CORRECTS?

- A. Biology is the study of few living things.
- B. The major groups of living things are only archaeon, bacterium, plant & animal.
- C. Biology studies their structure, function ONLY.
- D. None

7. 10% law of energy transfer in a food chain is given by

- A. Schimper
- B. Elton
- C. Haeckel
- D. Lindemann

8. Which of the following organisms can be found in extreme saline conditions?

- A. Eubacteria
- B. Archaeobacteria
- C. Cyanobacteria
- D. Mycobacteria

9. Smallest taxon of classification is _____.

- A. Kingdom
- B. Family
- C. Variety
- D. Species

10. Turtle is _____.

- A. Plant
- B. Fungi
- C. Vertebrate
- D. Invertebrates

Unit-1

The End