

# Topic 05

Zoology

# Learning Objectives

**At the end of this module, students will be able to:**

- Describe zoology in terms of the life sciences.
- Interpret selected animal phylogenetic relationships.
- Describe ways animals reproduce offspring.
- Contrast meiosis from mitosis
- Recognize trophic levels and the energy pyramid

# Outline

- a. Zoology overview
- b. Animal characteristics
- c. Animal phylogeny
- d. Animal reproduction
- e. Animal trophic levels

# Definition

## **Zoology**

Zoology is the scientific study of the behavior, structure, physiology, classification, and distribution of animals.

It encompasses all aspects of scientific knowledge about animals. Zoology is broken into many branches because there many ways to study animals.

# Definition

## **Phylogenetic Tree**

It is a diagram representing the evolution and relationships among living organisms. The diagram illustrates how different species evolved from a series of common ancestors.

Sometimes the phylogenetic tree is called the “Tree of Life” or a “Dendrogram.”

# Definition

## **Trophic Levels**

Trophic levels each of several hierarchical levels in an ecosystem, comprising organisms that share the same function in the food chain and the same nutritional relationship to the primary sources of energy.

05.a

# Zoology history

**350** *bce*

Animal observations

**1600's**

European university studies

**1800's**

Microscope

**1859**

Natural Selection published

**1860**

DNA discovered

**1962**

Double helix discovered

**2008**

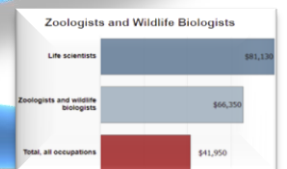
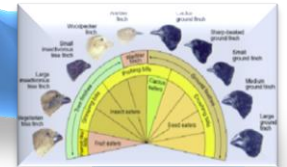
Genome sequencing of cancer

**2014**

Genetic fingerprinting

**2020**

Current employment



05.a

# Zoology overview

## **Special Expertise**

Comparative anatomy

Animal physiology

Ethology

Entomology

Invertebrate zoology

Vertebrate zoology

Soil zoology

Mammalogy

Biological anthropology

Palaeontology

## **Human Issues**

Malnutrition

AIDS: HIV/AIDS

Malaria

Air pollution

Displacement

## **Wildlife Issues**

Endangered species

Recognition

Disease controls

Animal health



05.a

# Zoology overview

**Zoologists study issues** like endangered species, impacts of viruses, disease control, animal behavior and human displacement.

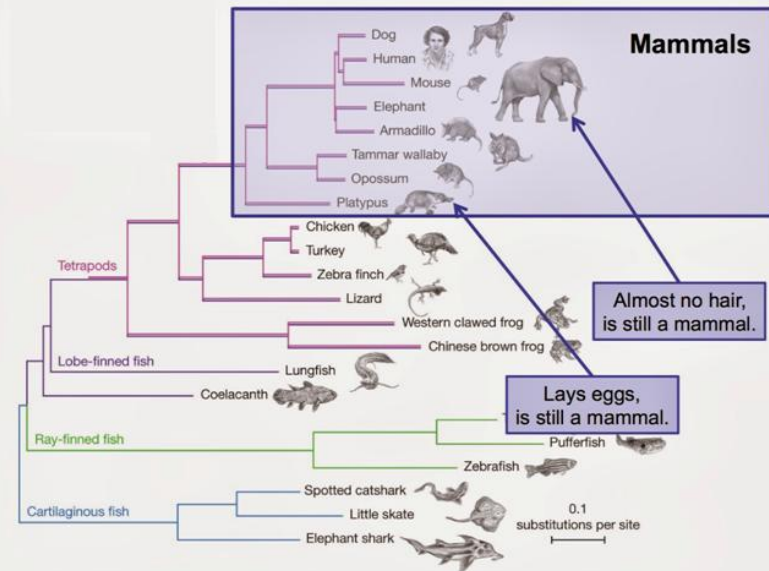
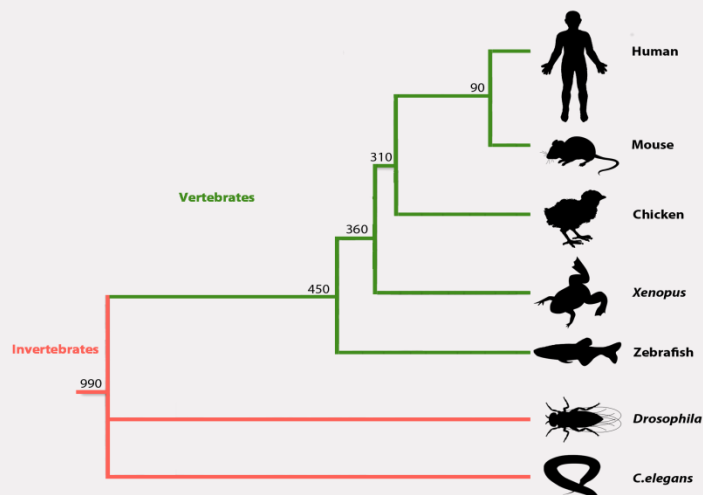


05.b

# Animal Characteristics

## Characteristics of animals:

1. all animals eat other organisms
2. all animals move
3. all animals are multicellular



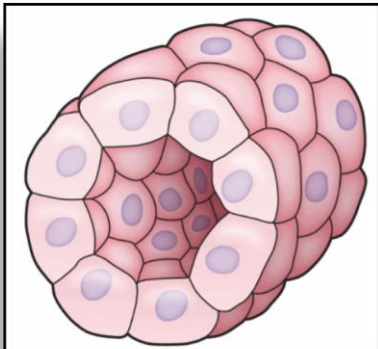
05.b

# Animal Characteristics

## Distinctions of animals:

1. defined tissues vs. undefined tissues
2. radial symmetry vs. bilateral symmetry
3. protostomes vs. deuterostomes
4. molting vs. growth of skeletal elements

### Tissue



### Symmetry



### Blastopore



### Growth

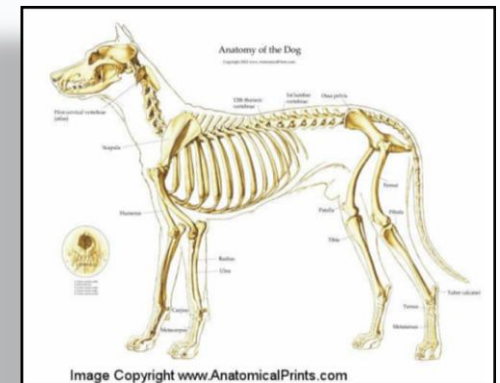


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05.b

# Animal Characteristics

**Tissue:** defined vs. undefined

**Example:** humans vs. sponges



defined



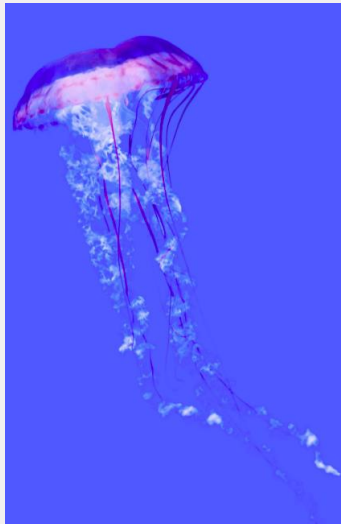
undefined

05.b

# Animal Characteristics

**Symmetry:** radial vs. bilateral

**Example:** jellyfish vs. butterfly



radial



bilateral



05.b

# Animal Characteristics

## Blastopore: protostomes vs. deuterostomes

This happens during the embryonic stage. A dent forms in one side of the embryo. This dent (blastopore) deepens to become the stomach (archenteron).

### Example: insects vs. birds

Note: In 2016 a new phylum, Xenacoelomorpha was identified and named. The phylum are free-living, parasitic, and symbiotic. They are small flat-like worms found in marine and brackish water environments.



mouth develops first



anus develops first

05.b

# Animal Characteristics

**Growth:** molting vs. skeletal elements

**Example:** snakes vs. dogs



molting



skeletal growth

05.c

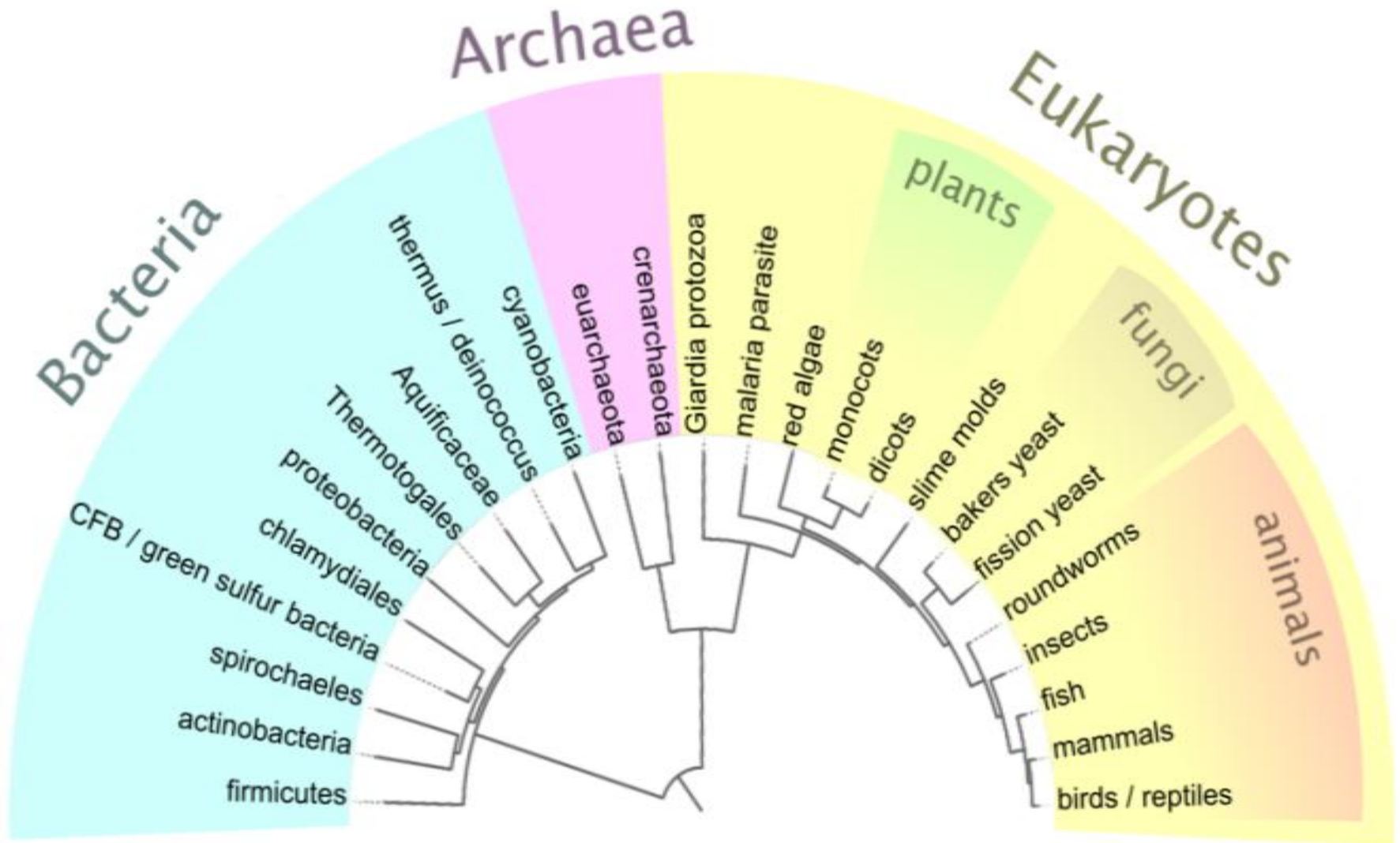
# Animal Phylogeny

- A phylogenetic tree is a diagram that represents evolutionary relationships among organisms.
- Phylogenetic trees are hypotheses, not definitive facts.
- The pattern of branching reflects how species or other groups evolved from a series of common ancestors.
- Two species are more closely related if they have a more recent common ancestor
- Species are less related with less recent common ancestors.
- Phylogenetic trees can be drawn in various equivalent styles.
- Rotating a tree about its branch points doesn't change the information it carries.



05.c

# Animal Phylogeny



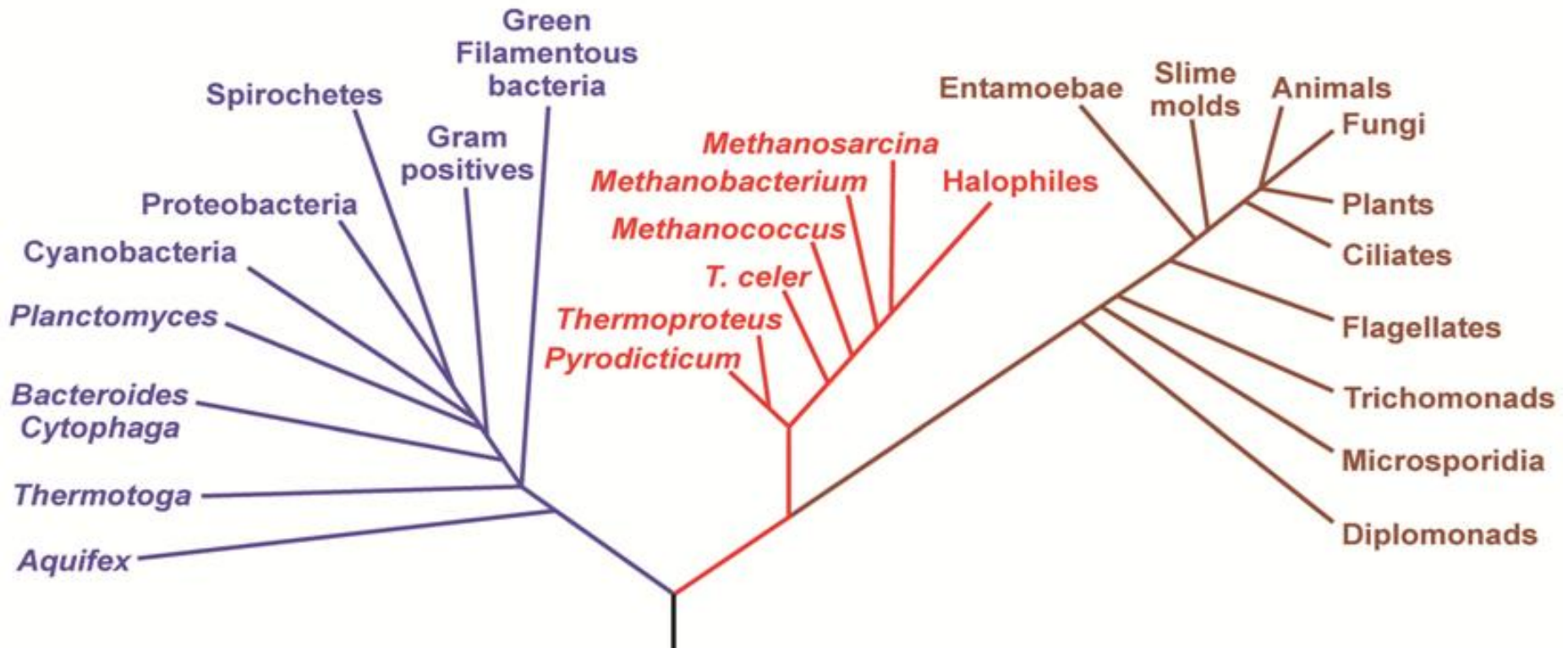
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# Animal Phylogeny

## Bacteria

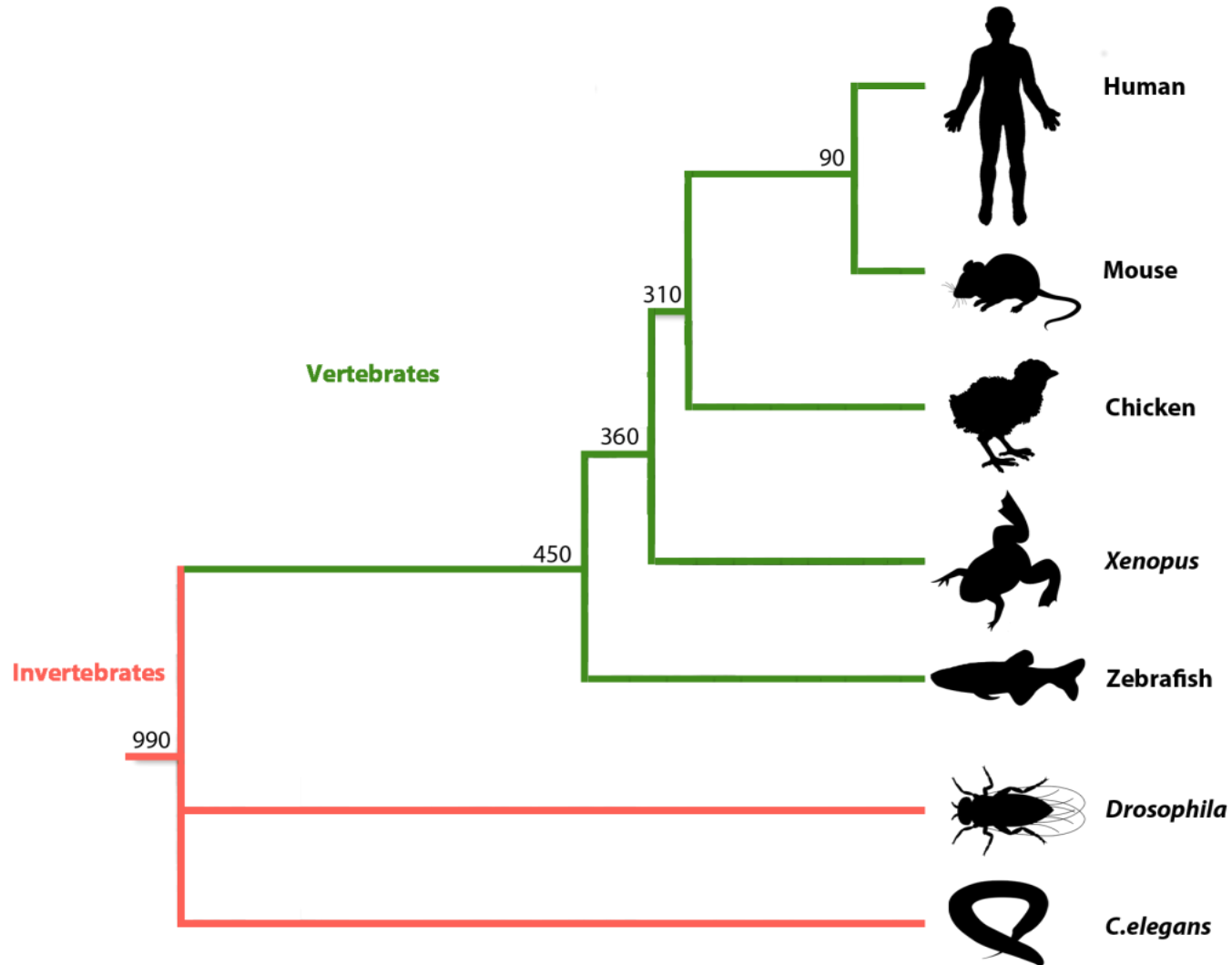
## Archaea

## Eukaryota



05.c

# Animal Phylogeny



# Animal Phylogeny

## BINOMIAL NOMENCLATURE



- It is a method of giving each species a name consisting of two words.
- The first name is generic name which is the name of genus and second name is the name of species, i.e. specific name.
- Genus name is written by capital letter and species name is written by small letter.
- Both names should be underlined or should be written in italic form.

Genus species  
G. species

05.c

# Animal Phylogeny

## Domestic Dog

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Canidae  
Genus: Canis  
Species: *C. lupus*  
Subspecies: *C. l. familiaris*

## Wolf

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Canidae  
Genus: Canis  
Species: *C. lupus*

## Coyote

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Canidae  
Genus: Canis  
Species: *C. latrans*

### Domestic dogs

Temporal range: At least 14,200 years ago – present<sup>[1]</sup>



### Wolf

Temporal range: Middle Pleistocene–present (810,000–0 years BP)<sup>[1]</sup>



### Coyote

Temporal range: Middle Pleistocene – present (0.74–0.85 Ma)<sup>[1]</sup>





05.c

# Animal Phylogeny

## Domestic Cat

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Felidae  
Genus: Felis  
Species: F. catus



## Lion

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Felidae  
Genus: Panthera  
Species: P. leo



## Tiger

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Carnivora  
Family: Felidae  
Genus: Panthera  
Species: P. tigris



05.c

# Animal Phylogeny

## Asian Elephant

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Proboscidea  
Family: Elephantidae  
Genus: Elephas  
Species: E. maximus

## African Elephant

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Proboscidea  
Family: Elephantidae  
Genus: Loxodonta  
Species: L. africana

## Hippopotamus

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Artiodactyla  
Family: Hippopotamidae  
Genus: Hippopotamus  
Species: H. amphibius

Asian elephant



African bush elephant



Hippopotamus



05.c

# Animal Phylogeny

## Killer Whale

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Artiodactyla  
Family: Delphinidae  
Genus: Orcinus  
Species: O. orca

## Common Dolphin

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Artiodactyla  
Family: Delphinidae  
Genus: Delphinus  
Species: D. capensis

## Porpoise

Kingdom: Animalia  
Phylum: Chordata  
Class: Mammalia  
Order: Artiodactyla  
Family: Phocoenidae  
Genus: Phocoena  
Species: P. phocoena

Killer whale



Long-beaked common dolphin



Harbor porpoise





05.c

# Animal Phylogeny

## Catfish

Kingdom: Animalia  
Phylum: Chordata  
Class: Actinopterygii  
Order: Siluriformes  
Family: Siluridae  
Genus: Silurus  
Species: *S. glanis*

## Pink Salmon

Kingdom: Animalia  
Phylum: Chordata  
Class: Actinopterygii  
Order: Salmoniformes  
Family: Salmonidae  
Genus: *Oncorhynchus*  
Species: *O. gorbuscha*

## Largemouth Bass

Kingdom: Animalia  
Phylum: Chordata  
Class: Actinopterygii  
Order: Perciformes  
Family: Centrarchidae  
Genus: *Micropterus*  
Species: *M. salmoides*

Wels catfish



Pink salmon



Largemouth bass



05.c

# Animal Phylogeny

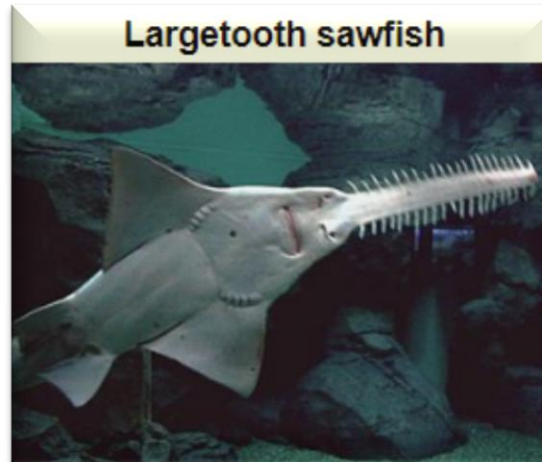
## Striped Panray

Kingdom: Animalia  
Phylum: Chordata  
Class: Chondrichthyes  
Order: Rhinopristiformes  
Family: Zanobatidae  
Genus: Zanobatus  
Species: *Z. schoenleinii*



## Largetooth Sawfish

Kingdom: Animalia  
Phylum: Chordata  
Class: Chondrichthyes  
Order: Rhinopristiformes  
Family: Pristidae  
Genus: *Pristis*  
Species: *P. pristis*



## Thresher Shark

Kingdom: Animalia  
Phylum: Chordata  
Class: Chondrichthyes  
Order: Lamniformes  
Family: Alopiidae  
Genus: *Alopias*  
Species: *A. vulpinus*



05.d

# Animal Reproduction

## Reproduction

**Sexual** a haploid gamete combines with another resulting in a diploid organism.

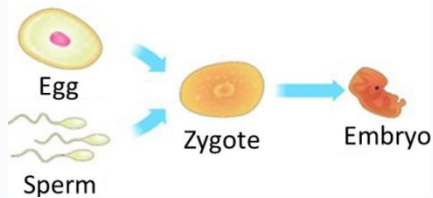
**Asexual** reproduction not involving the fusion of gametes.

sexual

Asexual "virgin birth"

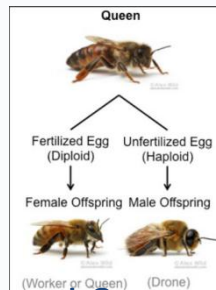
asexual propagules

### Sexual



Diploid organisms

### Cyclical parthenogenesis



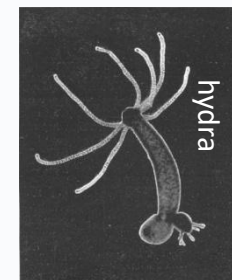
Sexual & asexual

### Constant parthenogenesis



All female (clones)

### Polyembryony



Budding

05.d

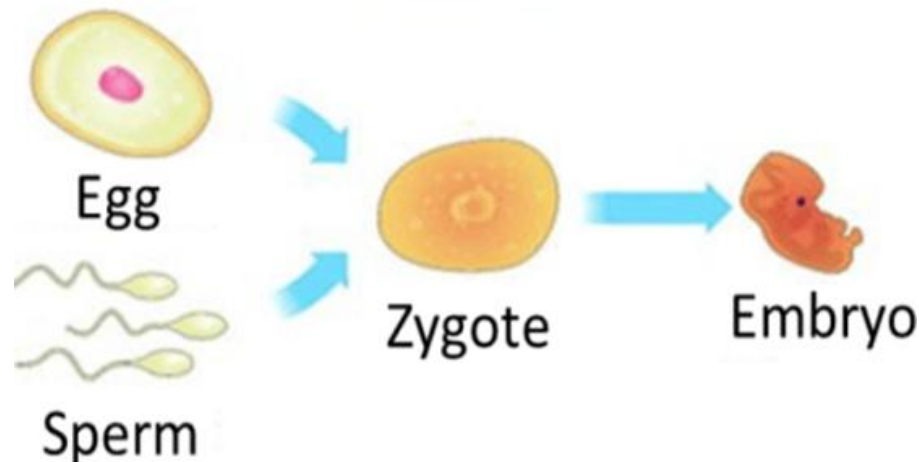
# Animal Reproduction

## Sexual Reproduction (Meiosis)

Meiosis involves cell division. The only cells that go through meiosis are gametes, or sex cells (sperm in men and eggs in women).

Meiosis is needed for sexual reproduction, Each cycle of meiosis creates four daughter cells with exactly half the number of chromosomes as the parent cell.

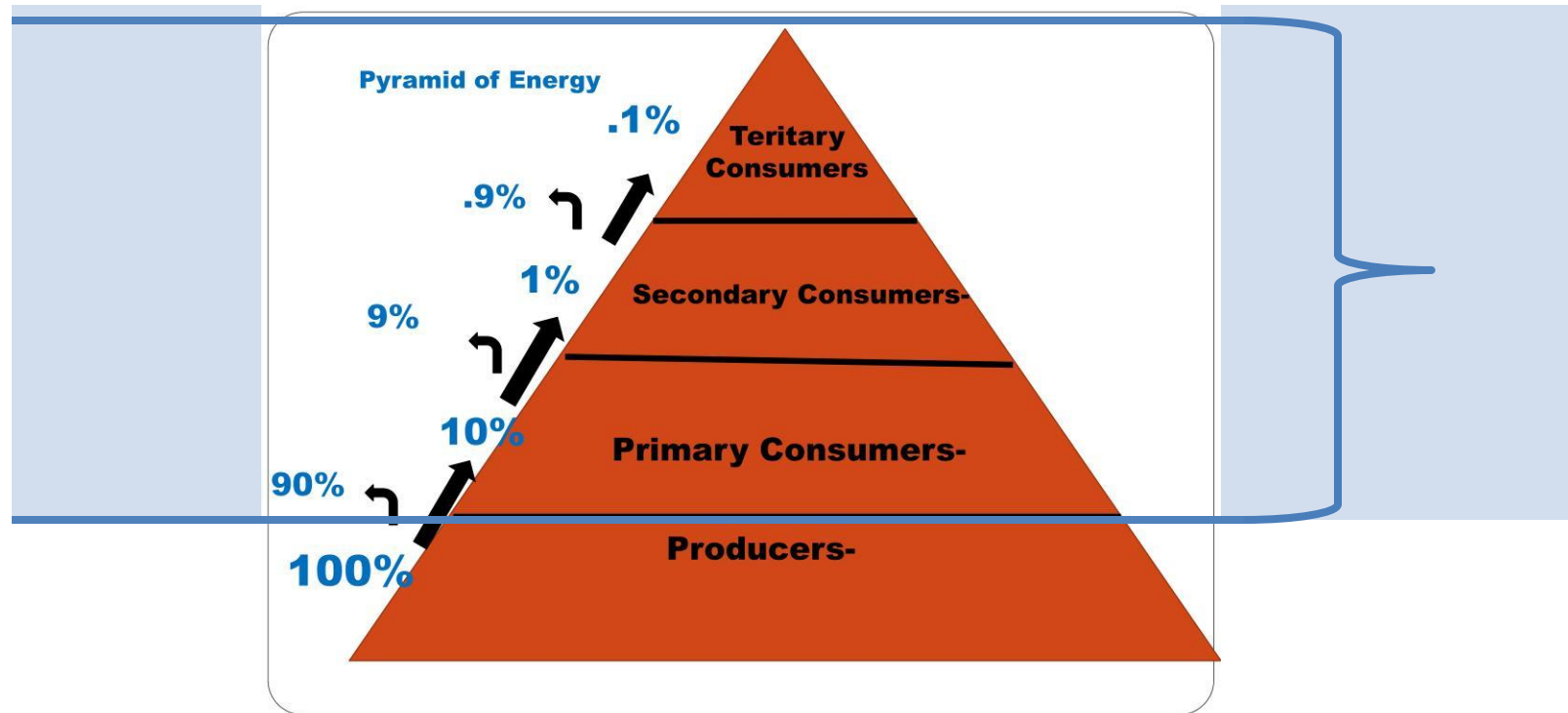
During fertilization, two daughter cells (one from each organism reproducing) will combine to create an embryo with a full set of chromosomes.



05.e

# Trophic Levels

**Trophic levels are related to food chain (web)**

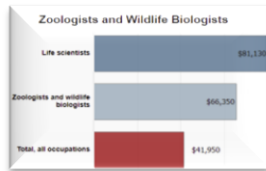
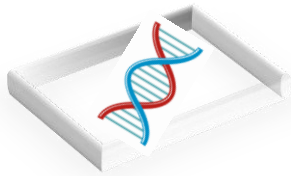


# Summary

Expertise

Issues

Zoology overview



Animal characteristics

## Characteristics of animals:

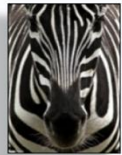
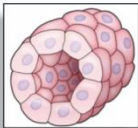
1. all animals eat other organisms
2. all animals move
3. all animals are multicellular

Tissue

Symmetry

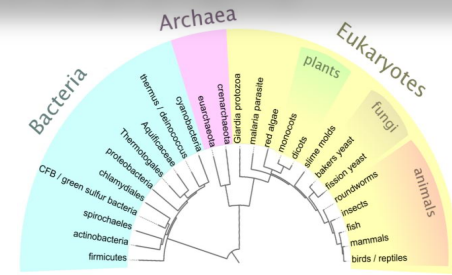
Blastopore

Growth

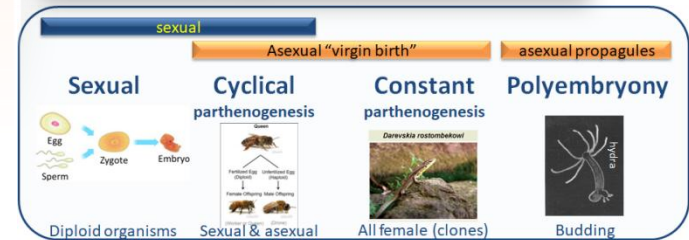


Kingdom  
Phylum  
Class  
Order  
Family  
Genus  
Species

Animal phylogeny



Animal reproduction



Animal trophic levels



# Check

**At the end of this module, students will be able to:**

- Describe zoology in terms of the life sciences.
- Interpret selected animal phylogenetic relationships.
- Describe ways animals reproduce offspring.
- Contrast meiosis from mitosis
- Recognize trophic levels and the energy pyramid