### Lecture 9 - Introduction to Phylogeny:

* Classifications of the biological hierarchy: Domain/Kingdom/Phylum/Class/Order/Family/Genus/Species.
* 3 Domains of life:
  + Bacteria: Single-celled prokaryotes.
  + Archaea: Single-celled prokaryotes.
  + Eukarya: Everything else.
* Phylogenetic tree: Shows evolutionary relationships, branches represent lineage and divergence.
* Evolutionary relationships: Determine common ancestors and lineage splits using phylogenetic trees.

### Lecture 10 - Inverts 1:

* Taxonomic biological hierarchy: Domain/Kingdom/Phylum/Class/Order/Family/Genus.
* Species: Group of organisms capable of interbreeding and producing fertile offspring.
* Importance of viruses: Control microbial populations and nutrient cycles.
* Marine vs. terrestrial food chains: Marine chains have more trophic levels, rely heavily on plankton.
* Animal: Multicellular, eukaryotic organisms that are heterotrophic.
* Animal symmetry:
  + Radial: Central axis (e.g., jellyfish).
  + Bilateral: Left and right mirror (e.g., humans).
  + Asymmetrical: No symmetry (e.g., sponges).
* Cephalization: Concentration of sensory organs and nerve cells at the front end, enhancing movement and response.

### Lecture 11 - Inverts 2:

* Lophotrochozoans: Group characterized by a feeding structure called lophophore and/or a larval stage called a trochophore.
* Flatworms: Bilateral symmetry, acoelomate, simple digestive system.
* Classes in Phylum Platyhelminthes:
  + Turbellaria: Free-living, regenerative abilities.
  + Trematoda: Flukes, live in internal organs, complex life cycles.
  + Cestoda: Tapeworms, live in intestines.
  + Monogenea: Ectoparasites, attach to external surfaces.
* Feeding:
  + Turbellarians: Pharynx, through mouth and throat.
  + Cestodes: Absorb nutrients through their skin.
* Life cycle of Schistosoma: Eggs -> Snails -> Humans.
* Rotifers: Microscopic, have organs, move using cilia, reproduce sexually or parthenogenetically.
* Nemertean proboscis: Used for hunting, everted from a cavity, muscular tube with a stylet.
* Sponge anatomy: Simple body plan with pores, canals, and chambers.
* Sponge cell types: Choanocytes, Amoebocytes, Pinacocytes.
* Sponge organization: Asconoid (simple), Syconoid (folded), Leuconoid (complex).
* Spicules: Structural elements made of silica or calcium carbonate.
* Cnidarian body plans: Polyp (sessile), Medusa (free-swimming).
* Jellyfish vs. sponges: Jellyfish have true tissues (eumetazoans), sponges do not (parazoans).
* Jellyfish sting: Cnidocytes contain nematocysts with coiled barbed thread and toxins, triggered by cnidocils.
* Schyphozoan lifecycle: Alternates between polyp and medusa stages.
* Classes of cnidarians: Hydrozoa, Scyphozoa, Cubozoa, Anthozoa.

### Lecture 12 - Inverts 3:

* Mollusc features: Mantle, radula, muscular foot.
* Polyplacophoran adaptations: Shell with eight plates, strong foot for clinging to rocks.
* Polyplacophoran anatomy: Dorsal shell, ventral foot, radula for feeding.
* Gastropod features: Torsion, coiled shell, diverse habitat.
* Bivalve anatomy: Two-part shell, filter feeders, no radula.
* Cephalopod anatomy: Tentacles, beak, complex eyes.
* Cephalopod defenses: Camouflage, ink, fast swimming, intelligence.
* Chromatophore: Pigment cell that allows color change.
* Mollusc locomotion:
  + Gastropods: Foot.
  + Cephalopods: Jet propulsion.
  + Bivalves: Burrowing.
* Mantle modifications:
  + Bivalves: Shell secretion.
  + Cephalopods: Siphons.
* Polychaete anatomy and locomotion: Segmented bodies, parapodia for movement.
* Polychaete types:
  + Errant: Mobile predators.
  + Sedentary: Tube-dwellers.

### Lecture 13 - Inverts 4:

* Ecdysis: Molting process in arthropods, crabs shed their exoskeleton.
* Tardigrade conditions: Moist environments, can survive extreme conditions.
* Feeding in nematodes: Use a muscular pharynx to ingest food.
* Nematodes as ecdysozoans: They molt their cuticle.
* Crustacean features: Exoskeleton, jointed appendages, two pairs of antennae.
* Lobsters vs. barnacles: Lobsters are mobile and predatory, barnacles are sessile filter feeders.
* Barnacle feeding: Attach to surfaces, use cirri to filter feed.
* Skeleton types:
  + Endoskeleton: Internal.
  + Exoskeleton: External.
  + Hydrostatic: Fluid-filled.
* Nature’s constraints: Evolutionary trade-offs, environmental changes, genetic constraints.

### Lecture 14 - Coastal Seas:

* Sea vs. ocean:
  + Sea: Smaller, partially enclosed by land, shallower.
  + Ocean: Larger, not enclosed by land, deeper.
* Rocky coast life:
  + Abiotic factors: Tides, wave action, temperature, salinity, sunlight.
  + Biotic factors: Predation, competition for space and food.
* Rocky coast creatures:
  + Barnacles: Cement to rocks.
  + Mussels: Use byssal threads.
  + Sea stars: Tube feet with suction cups.
  + Snails: Strong, muscular foot.
  + Chitons: Flattened bodies, strong foot.
* Mangroves:
  + Locations: Tropical/subtropical regions.
  + Importance: Protect shorelines, filter pollutants, provide habitat.
* Seagrass beds:
  + Locations: Shallow, salty, and brackish waters.
  + Importance: Provide habitat, stabilize sediments, support biodiversity.
* Coral reefs:
  + Formation: Coral larvae attach to submerged rocks.
  + Locations: Warm, shallow ocean waters.
  + Importance: Biodiversity hotspots, protect shorelines, support fisheries.
* Coral bleaching:
  + Process: Corals expel symbiotic algae due to stress, turn white.
  + Causes: Temperature changes, pollution, overexposure to sunlight.
  + Consequences: Loss of biodiversity, weakened coastal protection.
* Coral reef importance and perils:
  + Importance: Support marine life, protect coastlines, support tourism.
  + Perils: Climate change, pollution, overfishing.

### Lecture 15 - Open Seas:

* Pelagic realms:
  + Epipelagic zone: Surface to 200 meters.
  + Mesopelagic zone: 200 to 1,000 meters.
  + Bathypelagic zone: 1,000 to 4,000 meters.
  + Abyssopelagic zone: 4,000 to 6,000 meters.
  + Hadopelagic zone: 6,000 meters and deeper.
* Depth zone conditions and adaptations:
  + Epipelagic: Light, warm. Adaptations: streamlined bodies, countershading.
  + Mesopelagic: Dim light, cool. Adaptations: large eyes, bioluminescence.
  + Bathypelagic: No light, cold, high pressure. Adaptations: slow metabolism, bioluminescence, large mouths.
  + Abyssopelagic: Near freezing, high pressure. Adaptations: flexible bodies, reduced skeletons.
  + Hadopelagic: Extreme pressure, near freezing. Adaptations: specialized enzymes, proteins.
* Plankton and nekton:
  + Meroplankton: Temporary plankton (e.g., larvae of sea stars).
  + Holoplankton: Permanent plankton (e.g., copepods).
  + Ichthyoplankton: Fish eggs and larvae.
  + Nekton: Actively swimming organisms (e.g., fish, squid).
* Diel vertical migration:
  + What: Daily movement from deep to surface waters at night and back during the day.
  + How: Triggered by light changes, internal clocks.
  + Participants: Zooplankton, small fish, squid.
  + Importance: Avoid predators, access food, carbon cycling.
* Feeding on dispersed prey:
  + Filter feeding: Straining small particles (e.g., baleen whales).
  + Ambush predation: Lying in wait (e.g., anglerfish).
  + Active hunting: Pursuing prey (e.g., sharks).
  + Scavenging: Feeding on dead organisms (e.g., hagfish).
* Sargasso Sea:
  + Location: North Atlantic Ocean, bounded by currents.
  + Importance: Habitat for marine life, nursery for fish and turtles, supports endangered species, carbon sequestration.