**Phylogenetic tree of the multicellular animals**

**Body symmetry**

- (a) Radial symmetry
  - Oral
  - Aboral

- (b) Bilateral symmetry
  - Dorsal
  - Ventral

**Early Development**

- Zygote
- Cleavage
- Eight-cell stage
- Blastula (hollow ball)
- Cross section of blastula
- Gastrulation
- Blastocoel
- Archenteron
- Ectoderm
- Endoderm
- Blastopore

**Phylogenetictree of themulticellular animals**
Sponges, Schwämme, Porifera

Sponges, the oldest animals?

Today 5 - 10'000 species
Sponge systematics

**Calcarea/Calcispongiae**
- Calcarea possess spicules composed of calcium carbonate
- Since lower Cambrium
- Most diverse during the Cretaceous
- Predominantly found in shallow waters
- Body sack-like with terminal osculum or bush-like
- Usually < 10 cm.
- White, sometimes brown or yellow.
- Often on rocks in shallow water.

**Hexactinellida**
- Glass sponges, are characterized by siliceous spicules with 6 rays.
- Ancient sponges.
- Rare in the Mediterranean sea.

**Demospongia**
- Most common sponges.
- All of the known freshwater poriferans are demosponges.
- Found in many different environments, from warm high-energy intertidal settings to quiet cold abyssal depths.
- Skeletons are composed of spongin fibers and/or siliceous spicules
- Variety of growth forms from encrusting sheets living beneath stones to branching stalks upright in the water column.
- All colors, forms and sizes.
- They tend to be large and only exhibit the leucon grade of organization.
Anatomy: The body of a sponge has two outer layers separated by an acellular (having no cells) gel layer called the mesohyl (also called the mesenchyme). In the gel layer are either spicules (supportive needles made of calcium carbonate) or spongins fibers (a flexible skeletal material made from protein). Sponges have neither tissues nor organs. Different sponges form different shapes, including tubes, fans, cups, cones, blobs, barrels, and crusts.

Choanocyte (= collar cells) line the inner cavity of the sponge. They have a sticky, funnel-shaped collar (that collects food particles and sperm) and a flagellum (moving water). The sponge obtains its nutrients and oxygen by processing flowing water using choanocytes.

Sponge types

- **Asconoid sponge**: Characterized by a central cavity (atrium) with openings (ostia) to the outside. The choanosome is centrally located.
- **Scleraxis sponge**: A type of asconoid sponge with spicules in the choanosome.
- **Skenospongia**: Sponges with an irregular structure, often with a central cavity (atrium) and a central choanosome.
- **Reticulactinea**: A type of sponge with a reticulated (net-like) skeleton.
- **Leuconoid sponge**: A type of sponge with a leuconoid (light-colored) skeleton.
- **Exhalant canal**: A canal that allows water to exit the sponge.
- **Inhalant canal**: A canal that allows water to enter the sponge.
SPONGE FEEDING

Sponges are filter feeders. Most sponges eat tiny, floating organic particles and plankton (incl. bacteria) that they filter from the water that flows through their body. Food is collected in specialized cells called choanocytes and brought to other cells by amoebocytes. Some sponges are carnivorous.

Reproduction

All sponges are capable of both sexual and asexual reproduction. Asexual reproduction occurs by the production of external buds that detach or remain to form colonies or internal buds called gemmules that form during unfavorable periods. Detached fragments (buds) are broken off by water currents and carried to another location, where the sponge will grow into a clone of the parent sponge. Gemmules are highly resistant to freezing, drying, etc. and develop only when favorable conditions return.

Most sponges are hermaphrodites. Fertilization is internal in most species; some released sperm randomly float to another sponge with the water current. Sperm that enter through the internal canals is caught by the collar cells (choanocytes), fertilization takes place inside the sponge. Eggs are retained in the mesohyl and fertilized by motile. Zygotes develop into flagellated larvae, which break loose and are carried away by water currents. The resulting tiny larva (a ball of cells with cilia on the outside) uses tiny cilia to propel itself through the water. The larva eventually settles on the sea floor, becomes sessile and grows into an adult.
Regeneration

Since sponges are so loosely organized, they have tremendous regenerative powers. New sponges readily form from broken or injured parts of old sponges!

Some local Calcarea

*Sycon* spec. (Wimper-, Kronenkalkschwamm)
- small, < 3cm
- 18 species

*Grantia compressa* (Beutelkalkschwamm)
- small, <5 cm
- collapses outside water!
- often on red algae
- in groups
Some local Demospongia

*Cliona* spec. (Bohorschwamm)
- forms crusts, often on shells
- yellowish

*Halichondria panicea* (Brotschwamm)
- forms crusts, with smooth surface and large craters
- up to 20 cm
- white, orange, yellow, green, brown

*Axinella* spec. (Fingerschwamm)
- branched, up to 25 cm
- gold, orange, rot
- common, hard substrate

More local Demospongia

*Suberites domuncula* (Korkschwamm)
- roundish, often with hermit crabs
- yellowish, orange, brown

*Suberites ficus* (Korkschwamm)
- roundish
- yellowish, orangen
Phylogenetic tree of the multicellular animals

Cnidaria (Nesseltiere, Cnidaires)

Hydrozoa

Scyphozoa (Quallen)

Craspedacusta,
Süsswasserqualle,
Méduse de l'eau douce.
bis 20 mm Durchmesser

Hydra sp. Süsswasserpolyp,
Hydre d'eau douce
Cnidaria (Nesseltiere, Cnidaires)
Basic anatomy

- radial symmetry with two poles (oral and aboral)
- with cnidocytes (Nesselzellen)
- often with alternate generations

Cnidaria reproduction
Hydrozoa life cycle with polyp and medusa stage
Cnidocytes (Nesselzellen)

- Tentacle
- Nematocyst
- Coiled thread
- Discharge of thread
- Prey
- Cnidocyte

- Ctenophora
- Scyphozoa
- Alcyonaria (Octocorals)
- Zoantharia (Hexacorals)
- Cnidaria
- Porifera
- Demospongia
- Calcarea

Other multicellular animals

+ polyp

+ medusa
Phylum Cnidaria - Class Hydrozoa

Hydrozoan life cycle usually includes both polyp and medusa. The polyp is usually small.

*Hydra spec.*
- freshwater

*Plumulariidae* - marine

Class Hydrozoa

*Physalia physalis* Siphonophora (Staatsquallen)
Phylum Cnidaria - Class Scyphozoa

Jellyfish (Schirmquallen)

- The medusa is the dominant form.
- Usually from 2-40 cm, (one species 1 meter with 10 meter tentacles!
- Mostly floating in the open ocean
- Mesoglea is thick and contains cells as well as fibers.
- Sense organs called rhopalia are on the margin of the umbrella. Each rhoparium contains a statocyst for balance, sensory pits and sometimes even simple light sensitive organs called ocelli.
- A structure called the manubrium (which contains the mouth) is usually drawn out to form four oral arms that are used in capturing and ingesting prey.
- The tentacles, manubrium and often the entire body surface are well supplied with nematocysts that can give painful stings.

Aurelia aurita, Ohrenqualle

The medusa of this species does alternate with an overwintering, seabed-dwelling polyp stage.

Phylum Cnidaria - Class Scyphozoa

Wurzelquallen, Rhizostomae

Rhizostoma pulmo

Cotylorhiza tuberculata

mit zooxanthellen
Phylum Cnidaria - Class Cubozoa
Box-jellyfish (Würfel- oder Feuerquallen)

- 16 species, characterized by cube-like (square) bells
- Distinguished from jellyfishes by the presence of four flattened, blade-like structures (pedalia) from which the tentacles are suspended
- Dangerous! (the Australian sea wasp (Chironex) with a width of approximately 25 cm can kill a person within minutes!
- Complex eyes
- Strong swimmers
- Mostly tropical

Carybdea marsupialis (Feuerquelle).
- Mediterranean Sea
- Body 2-4 cm,
- Tentacles up to 150 cm
- Dangerous!

Phylum Cnidaria - Class Anthozoa

Australian sea wasp (Chironex)

Carybdea marsupialis (Feuerquelle).
- Mediterranean Sea
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- Dangerous!
Phylum Cnidaria - Class Anthozoa
Zoantharia (Hexacorals): Seeanemonen (i.w.S.)

*Actinia equina* (Pferdeaktinie)

*Actinia fragacea* (Erdbeearktinie)

*Anemonia sulcata* (Wachsrose)

*Cereus pedunculatus* (Sonnenrose)

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Phylum Cnidaria - Class Anthozoa
Zoantharia (Hexacorals)

*Cladocora cespitosa* (Rasenkoralle)

*Madreporaria, Steinkorallen*
- meist koloniebildende Hexacorallia
- kompaktes Kalkskelett
- Skelett schützt Polypen und bildet Substrat

*Dendrophyllia cornigera*
The coral reef

Phylum Cnidaria - Class Anthozoa
Alcyonaria (Octocorals, “Soft-corals”)

- 8 gefiederte Tentakel  
- stets koloniebildend  
- Polypen durch Röhrensystem verbunden  
- im seichten Wasser selten  
- Gruppen:  
  - Stolonifera (Lederkorallen)  
  - Gorgonacea (Hornkorallen)  
  - Pennatulacea (Seefedern) (eher selten zu sehen im Mittelmeer)

Eunicella singularis (Gorgonacea)
Alcyonium acaule  
(Stolonifera)
Phylogenetictree of the multicellular animals

Phylum Ctenophora
Comb jellies (Rippenquallen)

Beroe ovata

Cestus veneris
bis 25 cm