What is an animal?

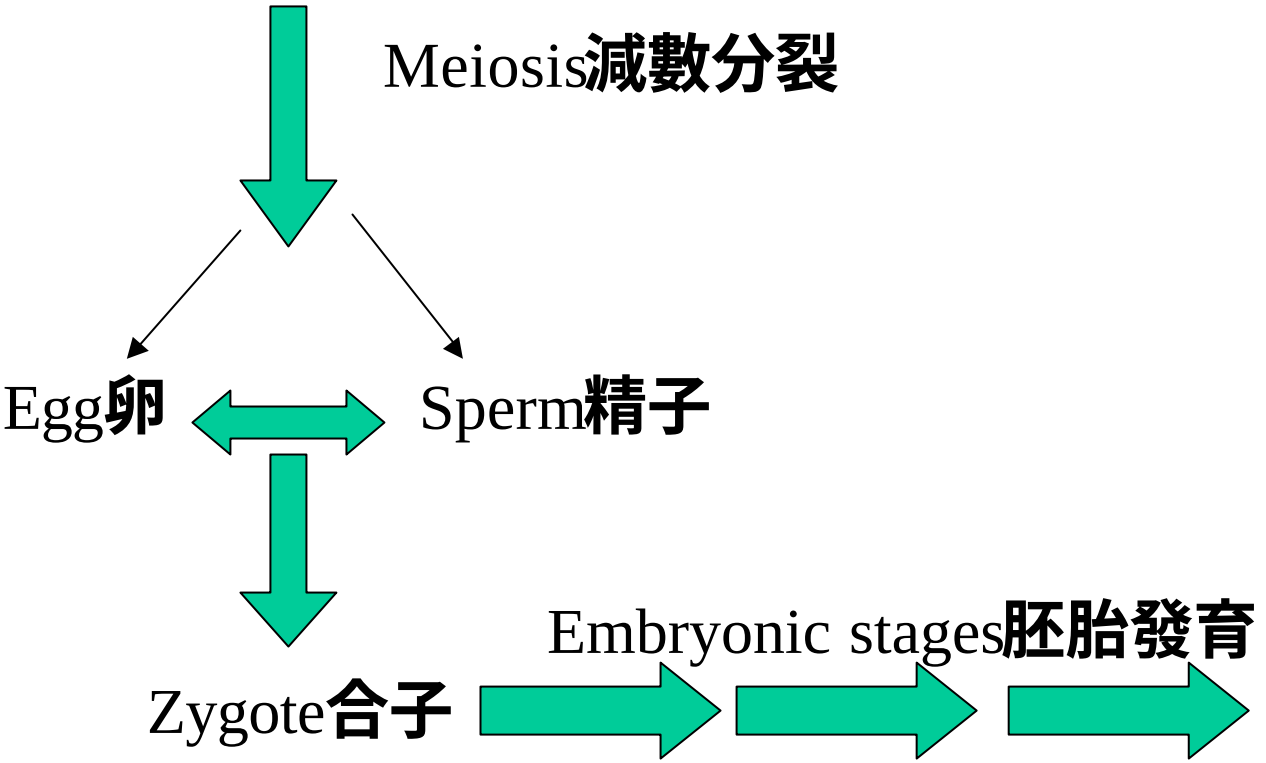
- multicellular**多細胞**
- Eukaryotes**真核生物**
- heterotrophic**異營性**
- most digest food inside their bodies**攝食性**
- sexual reproduction**有性生殖**
- diploid adult**成體為二倍體**
- embryonic stages**胚胎發育過程**

What is an animal?

- Glycogen storage**碳水化合物以肝糖形式儲存**
- lack cell walls**缺細胞壁**
- cell junctions:
  - tight junctions**緊密鍵結**
  - desmosomes**胞橋小體**
  - gap junctions**縫隙連接**
- Nervous and Muscle tissues**神經和肌肉組織**

Life cycle生活史

- Diploid adult二倍體成體



Life cycle生活史

- Zygote**合子** Cleavage（**卵裂**）→
- Blastula**囊胚**
- Gastrula**原腸胚** Gastrulation（**原腸化**）→
- larva**幼蟲** Metamorphosis（**變態過程**）→
- adult**成體**

What are the major evolutionary trends in animals?

- **Over evolutionary time, animals have increased in complexity**
- **Animal phyla show trends toward increasing cellular organization**
- **Body forms became symmetrical early in the evolutionary history of animals**
- **Cephalization increased over evolutionary time**
- **Body cavities arose in more-complex animals**
- **Segmentation first arose in annelid worms**
- **Digestive systems increased in complexity**

Trends in body symmetry

- Asymmetry: sponges
- Radial symmetry: cnidarians, some adult echinoderms
- bilateral symmetry: flatworms, mollusks, arthropods, larval echinoderms, chordates

Trends in body cavities

- No coelom: cnidarians, flatworms
- Pseudocoelom: roundworms
- True coelom: annelids, most more complex animals

Trends in digestive system

- Intracellular: Porifera (Sponges)
- Gastrovascular cavity: Cnidaria (Hydra, Anemones, Jellyfish), Platyhelminthes (flatworms),
- Separate mouth and anus: Nematoda (roundworms), most more complex animals

Trends in Nervous system

- **Absent: Porifera (Sponges)**
- **Nerve net: Cnidaria (Hydra, Anemones, Jellyfish),**
- **Head ganglia with longitudinal nerve cords: Platyhelminthes (flatworms),**
- **Head ganglia with dorsal and ventral nerve cords: roundworms,**
- **Head ganglia with paired ventral cords; ganglia in each segment: segmented worms, Arthropoda (insects, Arachnids, crustaceans)**
- **Well-developed brain in some cephalopods; several paired ganglia, nerve network in body wall: Mollusca (snail, clams, squid)**
- **Nerve ring and radial nerves; nerve network in skin: Echinodermata (sea stars, sea urchins)**
- **Well-developed brain; dorsal nerve cord: Chordata (vertebrates)**

Trends in support

- **Absent: Platyhelminthes (flatworms)**
- **Hydrostatic skeleton: Cnidaria (Hydra, Anemones, Jellyfish), Nematoda (roundworms), Annelida (segmented worms), Mollusca (snail, clams, squid)**
- **Endoskeleton of spicules: Porifera (Sponges)**
- **Endoskeleton of plates beneath outer skin: Echinodermata (sea stars, sea urchins)**
- **Exoskeleton: Arthropoda (insects, Arachnids, crustaceans)**
- **Endoskeleton of cartilage or bone: Chordata (vertebrates)**