PHYLUM ANNELIDA
GENERAL CHARACTERISTICS AND CLASSIFICATION

SEMESTER – II
ZOO CC203
UNIT-1

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Phylum Annelida

General characteristic and classification

General characteristic

• Annelida are mostly aquatic; marine or freshwater, some terrestrial, burrowing or living in tubes, sedentary or free living. Some are commensal and parasitic also.

• Body triploblastic, bilaterally symmetrical, elongated and vermiform.

• Body *metamERICALLY SEGMENTED*: externally by transverse grooves and internally by septa into a number of division: each division is called a segment, metamere or somite.

• Organ-system grade of body organisation.

• Outer covering of the body is *cuticle* secreted by underlying epidermis.

• Body wall is contractile, consisting of an outer epidermis, circular and longitudinal muscles.

• Appendages when present are unjointed.

• Locomotory organs are segmented arranged paired *setae* or *chaetae* in most of the cases.

• Presence of the true *schizocoELous COELOM* usually divided into a large number of compartments by intersegmental septa.
External structures of the earthworm, *Lumbricus terrestris*.
Development of Metameric, Coelomic Spaces in Annelids.

(a) A solid mesodermal mass separates ectoderm and endoderm in early embryological stages. (b) Two cavities in each segment form from the mesoderm splitting on each side of the endoderm (schizocoelous coelom formation). (c) These cavities spread in all directions. Enlargement of the coelomic sacs leaves a thin layer of mesoderm applied against the outer body wall (the parietal peritoneum) and the gut tract (the visceral peritoneum), and dorsal and ventral mesenteries form. Anterior and posterior expansion of the coelom in adjacent segments forms the double-membraned septum that separates annelid metameres.
Annelid body plan.
*Nereis virens* (A–D) and *Nereis diversicolor* (E) are errant polychaetes. **A.** Anterior end, with pharynx everted. **B.** External structure. **C.** Posterior end. **D.** Generalized transverse section through region of the intestine. **E.** In this photo of a live *N. diversicolor*, note the well-defined segments, the lobed parapodia, and the prostomium with tentacles in the upper center.
• Alimentary canal is tube like, complete, extending from mouth to anus.
• Respiration occurs through general body surface, in some cases by gills also.
• Blood vascular system is **closed** type, blood is red due to presence of **haemoglobin** or **erythrocruorin** found dissolve in plasma.
• Excretion by segmentally arranged **nephridia** which usually communicate the coelom to exterior.
• Nervous system with a pair of cerebral ganglia, the **brain** and a double nerve cord having segmentally arranged ganglia.
• The tactile organs, taste buds, statocysts, photoreceptor cells and eyes are the receptor organs.
• Usually **monoecious**, i.e, hermaphrodite: dioecious or unisexual forms also present.
• Development **direct** in monoecious forms but **indirect** in dioecious forms.
• A free swimming **trochophore** larval stage is characteristic in case of indirect development while in others this stage is passed during the development.
• Asexual reproduction also occurs in some forms.
Earthworm Structure. Lateral view of the internal structures in the anterior segments of an earthworm. A single complete septum is shown.
Circulatory System of a Polychaete

Cross section through the body and a parapodium. In the closed circulatory system shown here, blood passes posterior to anterior in the dorsal vessel and anterior to posterior in the ventral vessel. The direction of blood flow is indicated by black arrows. Capillary beds interconnect dorsal and ventral vessels.
Annelid Nervous System

(a) Connectives link suprapharyngeal and subpharyngeal ganglia. Segmental ganglia and lateral nerves occur along the length of the worm. (b) Cross section of the ventral nerve cord, showing giant fibers.
Polychaete Development

(a) Trochophore. (b) A later planktonic larva, showing the development of body segments. As more segments develop, the larva settles to the substrate. (c) Juvenile worm.
Classification of Annelida

1. Similar rings or segments—Metameres or somites; Homonomous metamermism
2. Development of true coelom
3. Neprhridia is well developed
4. Capable of complete regeneration
5. Cephalisation firstly appeared
6. Mesoderm is not solid
7. Polychaete and oligochaete term given by Grube (1851)
8. Pair appendages are not jointed
9. Only group which uses chaetae as locomotory organ
10. The phylum Annelida was established by Lamark (1801)

4 Classes

- Polychaeta
  1. All marine
  2. Somites are many
  3. Clitellum is absent
  2 Orders

- Oligochaeta
  1. Mostly terrestrial without parapodia
  2. Clitellum is present
  3. Testes anterior to ovary
  3 Orders

- Hirudinea
  1. Freshwater and marine
  2. Setae, parapodia and tentacles are absent
  3. Fixed number of segments (33)
  4 Orders

- Archiannelida
  1. Exclusively marine
  2. Setae and parapedia are generally absent
  3. External segmentation is not well marked
  4. Trochophore larva
  5. For example, Polygordius

4 Classes

- Errantia
  1. Numerous and similar somites
  2. For example, Nereis

- Sedentaria
  1. Dissimilar somites and parapodia
  2. For example, Chaetopterus

- Plesiopora
  1. For example, Naïs, Tubifex

- Opisthopora
  1. For example, Pheretima

- Prosopora
  1. For example, Lumbricus

4 Classes

- Acanthobellida
  1. For example, Acanthobella

- Rhyndobellida
  1. For example, Glossiphonia

- Gnathobellida
  1. For example, Hirudo
CLASS 1. POLYCHAETA

• Polychaeta are **marine** and **carnivorous**.
• Body is elongated and segmented
• Head consist of **prostomium** and **peristomium** and bears eyes tentacles, cirri and palps, etc.
• **Setae are numerous** and are borne up on lateral prominences of the body wall known as **parapodia**.
• **Clitellum** is absent.
• Highly **vascularized gills** are present in most large-sized polychaetes used for gas exchanged.
• Cirri or branchiae or both may be present for respiration.
• Coelom is spacious usually divided by intersegmental septa.
• Alimentary canal is provided with an eversible buccal region and protrusible pharynx.
• Excretory organs are segmentally paired nephridia.
• **Sexes separate**, fertilization external ,free swimming larval stage **trochophore**.
• Asexual reproduction by lateral budding.
ORDER 1. ERRANTIA

• Free swimming, often pelagic, while some living in tubes.
• All body segments are similar except at anterior and posterior ends.
• Parapodia, provided with cirri are equally developed throughout.
• Head with distinct prostomium which is provided with eyes, tentacles and palps.
• Pharynx is usually prostrusible and armed with chitinous jaws and teeth.

Examples: *Nereis*, *Aphrodite*, *Glycera*, *Polynoe*, *Syllis*. 
ORDER 2. SEDENTARIA

- Burrowing and tube dwelling forms.
- Body is divisible into two or more regions with unlike segments and parapodia.
- Head is small or much modified, without eyes and tentacles, prostomium indistinct.
- Pharynx is non-protrusible devoid of jaws or teeth.
- Gills or branchiae, when present, localized to the anterior segments.
- Feeding on plankton or organic detritus.

Examples: Chaetopterus, Terebella, Sabella, Arenicola, Serpula, Amphitrite, Spirorbis.
CLASS 2. OLIGOCHAETA

- Mostly terrestrial or some freshwater forms.
- Body with conspicuous external and internal segmentation.
- Distinct head, eyes and tentacles are absent.
- **Parapodia** and **cirri** are absent.
- **Setae** are usually arranged segmentally.
- **Clitellum** is usually present.
- Usually no **respiratory organs** except a few species (e.g., *Dero, Branchiura*) which possess true gills. Gas exchange takes place by diffusion through the moist body wall.
- Pharynx is not eversible and without jaws.
- Excretory system **metanephridial type**.
- **Brain** simple type with ventral nerve cords.
- **Hermaphrodite**, i.e. sexes united.
- Fertilization occurs externally.
- Asexual reproduction usually common in freshwater species.
- **Development** is **direct** and takes place within **coccons** secreted by clitellum; **no free larval stage**.
ORDER 1. TUBIFICIDA / PLESIOPORA / ARCHIOLIGOCHAETA

- Mostly freshwater forms.
- Body consist of few segments.
- Setae are present in bundles with two or more setae.
- Gizzard is poorly developed, non muscular or absent.
- Clitellum is simpler, consist of single layer of cells and situated far forwards.
- Eye spots are frequently present.
- Male reproductive openings (gonophore) lie in front of the female reproductive openings (gonophore).
- One pair of testes followed by a pair of ovaries.
- Reproduction asexual and sexual.

Examples: *Tubifex, Aelosoma, Nais, Dero.*
ORDER 2. OPISTHOPHORA / NEOOLIGOCHAETA / HAPLOTAXIDA

• Usually terrestrial, aquatic or semiterrestrial forms.
• Body is large and largely segmented.
• Setae are arranged in lumbricine manner.
• Gizzard is well developed.
• Clitellum is composed of two or more layers of cells and never begins before twelfth segment.
• Female genital apertures (gonophore) are always on the fourteenth segment and the male pore lies a few segments behind them.
• Vasa deferentia are elongated extending over the three or four segments.
• Eye spots are never developed.
• Reproduction sexual. Asexual reproduction is not known.

Examples: *Pheretima, Eutypheus, Megascolex, Lumbricus, Megacolides.*
ORDER 2. PROSOPORA / LUMBRICULIDA

• Usually freshwater forms.
• 4 pairs *setae* in each segment.
• **Clitellum** consists of a single celled layer.
• Male and female gonophore in the clitellum.
• Male pores anterior to female pores.
• Examples : *Lumbriculus*, *Rhynchelmis*, *Stylocolex*
CLASS 3. HIRUDINEA

• Mostly ectoparasitic and freshwater forms, while few are marine feeding upon fishes and other animals.
• Body is elongated usually flattened dorsoventrally or cylindrical.
• Body consist of definite number of segments, trunk consists of 21 segments with preclitellar region, clitellum and post clitterell regions. Each segment breaks up into 2 to 4 rings or annuli.
• Parapodia and setae are absent.
• Body is provided with an anterior and a posterior **sucker**, both situated ventrally.
• Mouth opens on the ventral surface in the anterior sucker, while anus opens dorsal to the posterior sucker.
• Coelom generally reduced by the presence of connective tissue, called **botryoidal tissue**, and muscles.
• Both sinuses and muscular blood vessels present.
• Excretory organ include segmentally arranged 10 to 17 pairs of **metanephridia**.
• **Hermaphrodite**, i.e., sexes united; reproduction sexual.
• Asexual reproduction is not known.
• Fertilization is internal.
• Eggs are usually laid in **coccons**.
• Development is direct without free swimming larval stage.
ORDER 1. ACANTHOBDELLIDA

- Mostly parasitic on the fins of salmon fishes.
- Body comprises thirty segments only.
- Anterior sucker is absent but posterior sucker is well developed and composed of four segments.
- Anterior five segments are provided with double rows of setae.
- **Proboscis** is short.
- Body cavity is spacious and incompletely divided by septa.
- Vascular system consist of dorsal and ventral vessel.
- Nephridial opening situated on the surface between the segments.
- Acanthobdellida forms a connecting link between Oligochaeta and Hirudinea.

Example: *Acanthobdellida*.
ORDER 2. RHYNCHOBDELLIDA

- Parasites on snails, frogs and fishes, marine and freshwater form.
- Each typical body segments consist of 3, 6 or 12 rings.
- Mouth is small median aperture situated in the anterior sucker.
- Proboscis is prostrusible.
- **Jaws** are absent.
- Blood is colourless.
- Coelom is reduced to sinuses without botryoidal tissues.
- All are aquatic, **ectoparasites** of both invertebrates and vertebrates in fresh-water and marine habitats.
- Examples: *Pontobdella* (*parasite on other aquatic vertebrates*), *Glossiphonia* (*parasite on aquatic snails*), *Ozobranchus* (*parasite on turtles and crocodiles*), *Branchellion, Piscicola*. 
ORDER 3. GNATHOBDELLIDA / ARHYNCHOBDDELLIDA

• Freshwater and terrestrial forms.
• Each typical body segment consist of five rings or annuli.
• **Anterior sucker** with three jaws, one median dorsal and two ventro-lateral.
• Proboscis is absent
• Blood is red colored.
• **Botryoidal tissue** present.

Examples: *Hirudo, Haemopis, Hirudinaria, Herpobdella.*
CLASS 4. ARCHIANNELIDA

• Exclusively marine forms.
• Body elongated and worm-like.
• Setae and parapodia are usually absent.
• External segmentation is slightly marked by faint, while internal segmentation is marked by coelomic septa.
• Prostomium bears two or three tentacles.
• Unisexual or hermaphrodite.
• Larva is typical trochophore.

Examples: Polygordius, Protodrillus, Nerilla, Saccocirrus.