Molluscs

Chapter 16
Phylum Mollusca

- Phylum Mollusca includes snails and slugs, oysters and clams, and octopuses and squids.
Phylum Mollusca

- Molluscs have a mesoderm lined body cavity – a **coelom**.
- They are **protostomes** – mouth first and 3 layers
  - **Body Cavity**
Phylum Mollusca

• Molluscs evolved in the sea and most molluscs are still marine.
  – Some gastropods and bivalves inhabit freshwater.
  – A few gastropods (slugs & snails) are terrestrial.
Mollusc Body Plan

• All molluscs have three main parts:
  – A mantle – gills and protective shell over the visceral mass.
  – A head-foot region – movement and attachment
  – A visceral mass – digestive, circulatory, respiratory and reproductive organs.
Mollusc Body Plan

• Most molluscs have separate sexes with gonads located in the visceral mass.
Shells

- When present, the calcareous **shell** is secreted by the **mantle** and is lined by it. It has 3 layers:
  - **Periostracum** – outer organic layer helps to protect inner layers.
  - **Prismatic layer** – densely packed calcium carbonate.
  - **Nacreous layer** – protein lining secreted continuously by the mantle – forms pearls in some.
Shell Structure & Formation

- Shell
- Periostracum
- Prismatic layer
- Nacre
- Mantle
- Outer mantle epithelium
- Mantle folds
- New periostracum
- A
A Pearl Among the Swine
Mantle Cavity

• The space between the mantle and the visceral mass is called the **mantle cavity**.
  – The respiratory organs (gills or lungs) are generally housed here.
Head-Foot Region

- Most molluscs have well developed head ends with sensory structures including photosensory receptors that may be simple light detectors or complex eyes (cephalopods).
The **radula** is a rasping protrusible feeding structure found in most molluscs (not bivalves).

- Ribbon-like membrane with row of tiny teeth.
Head-Foot Region

• The **radula** in action:

  – [http://www.youtube.com/watch?v=mLVDwlrsq5U](http://www.youtube.com/watch?v=mLVDwlrsq5U)
Head-Foot Region

- The **foot** of a mollusc may be adapted for locomotion, attachment, or both.
Visceral Mass

• All the organs
• Many molluscs have an **open circulatory system** with a pumping heart, blood vessels and blood sinuses.
• Most cephalopods have a **closed circulatory system** with a heart, blood vessels and capillaries.
• Heart is located in pericardial cavity.
Visceral Mass
Mollusc Reproduction & Development

• Indirect development
  – Larval stages
  – Trochophore larva
    • Free swimming, ciliated, shell formation begins
  – Veliger larva
    • Free swimming, ciliated velum forms,
    • Shell/body torsion occurs
  – Spat
    • Metamorphic form between veliger and juvenile
    • Shell elaborates
Trochophore Larva

Apical tuft of cilia

Band of cilia (prototroch)

Mouth

Mesoderm

Anus
Gastropod Veliger Larva

- **Mouth**
- **Velia**
- **Shell**
Major Mollusc Classes

- **Four major classes of molluscs:**
  - **Class Gastropoda** – snails & slugs
  - **Class Bivalvia** – clams, mussels, oysters
  - **Class Cephalopoda** – octopus & squid
  - **Class Polyplacophora** – the chitons
Class Gastropoda

- **Gastropoda** is the largest of the molluscan classes.
  - 75,000 named species.
  - Include snails, slugs, sea hares, sea slugs, sea butterflies.
  - Marine, freshwater, terrestrial.
    - Benthic or pelagic
Class Gastropoda

- Twisting process called **torsion** that occurs during larval stage, the visceral mass is asymmetrical not bilateral.
Class Gastropoda

- The shell of a gastropod is always one piece – **univalve** – and may be coiled or uncoiled.
  - Shells may coil to the right or left – this is genetically controlled.
  - Columella is the central axis of shell and the snail is attached to.
Class Gastropoda

- Blood contains **hemocyanin**.
- Two copper atoms that reversibly bind a single oxygen molecule ($O_2$).
Class Gastropoda

- Many snails can withdraw into the shell and close it off with a thorny operculum.
Gastropod Feeding Habits

- Most gastropods are **herbivores** and feed by scraping algae off hard surfaces using the **radula**.
- Some are **scavengers** of dead organisms.
Gastropod Feeding Habits

• Some are carnivores and have a radula modified into a drill to bore through the shells of other molluscs. They use chemicals to soften the shell.
Gastropod Feeding Habits

• Snails in the genus *Conus* feed on fish, worms, and molluscs.
  – Highly modified radula used for prey capture.
  – They secrete a toxin that paralyzes their prey.
• Some are painful, even lethal, to humans.
Gastropod Feeding Habits

• Will “hibernate” during dry periods (estivation) when metabolism drops to almost nothing and their shells will be covered with protective mucous film when dried is called an epiphragm.
Internal Form and Function

- Respiration is done with Ctenidium (gills).
Internal Form and Function

• Pulmonates lack gills.
  – Have a highly vascular area in mantle that serves as lung.
  – Lung opens to outside by small opening, the pneumostome.
  – Aquatic pulmonates surface to expel a gas bubble and inhale by curling, thus forming a siphon.
Internal Form and Function

• Most have a single **nephridium** and well-developed circulatory and nervous systems.
• Sense organs include eyes, statocysts, tactile organs, and chemoreceptors.
• Eyes vary from simple photoreceptors to a complex eye with a lens and cornea.
• Style Sac at posterior end of the stomach, is ciliated and rotates to consume food into a string like mucus.
Major Groups of Gastropods

- **Prosobranchia** includes most marine snails and some freshwater and terrestrial gastropods.
  - Mantle cavity is anterior due to torsion.
  - Have one pair of tentacles, separate sexes, and usually an operculum.
Major Groups of Gastropods

- **Opisthobranchia** includes sea slugs, sea hares, sea butterflies, and canoe shells.
  - Most are marine, shallow-water.
  - Partial to complete detorsion - anus and gill(s) are displaced to right side.
  - Two pairs of tentacles, one pair modified to increase chemo-absorption.
  - Shell is reduced or absent.
  - **Cerata** instead of gills for respiration.
Marine Gastropods

Cowries
Marine Gastropods

Sea Hare – *Aplysia sp*
Marine Gastropods – Nudibranch (Sea Slug)
Major Groups of Gastropods

- **Pulmonata** includes land and most freshwater snails and slugs.
  - Aquatic species have one pair of tentacles.
  - Landforms have two pair of tentacles and the posterior pair has eyes.