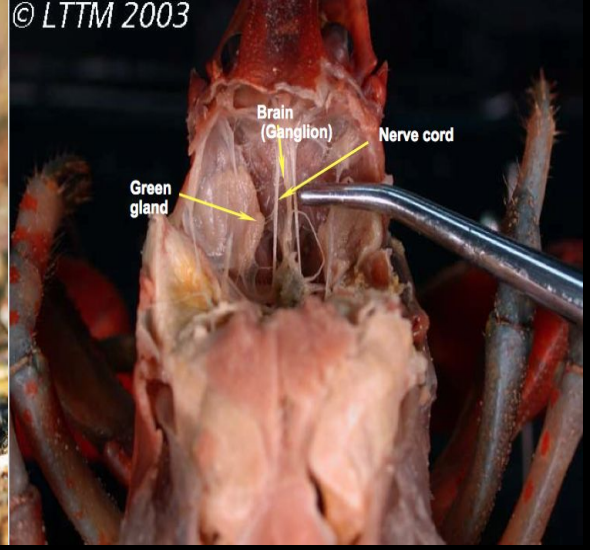
Brian Bevel
Mckayla Connor
Cheyenne Welker
Colton Brooks

Crustaceans

- Nervous and Sensory Systems
- Reproduction, Life Cycles, and Endocrine Functions
- Molting and Ecdysis
- Other Endocrine Systems
- Feeding Habits
- Gastric Mill
- Hormonal Control of the Ecdysis Cycle

Nervous and Sensory Systems

- *The brain is a pair of supraesophageal ganglia that supplies nerves to the two pair of antennae.*
- *The double ventral nerve cord has a pair of ganglia for each segment and nerves serving the appendages,muscles,and other parts.*
- *The largest sense organs of crayfish are the eyes and statocytes. Chemical senses of taste and smell are found in receptors on the antennae,mouthparts, and other places.*
- *Eyes in many crustaceans are compound, composed of many photoreceptor units called ammatida.*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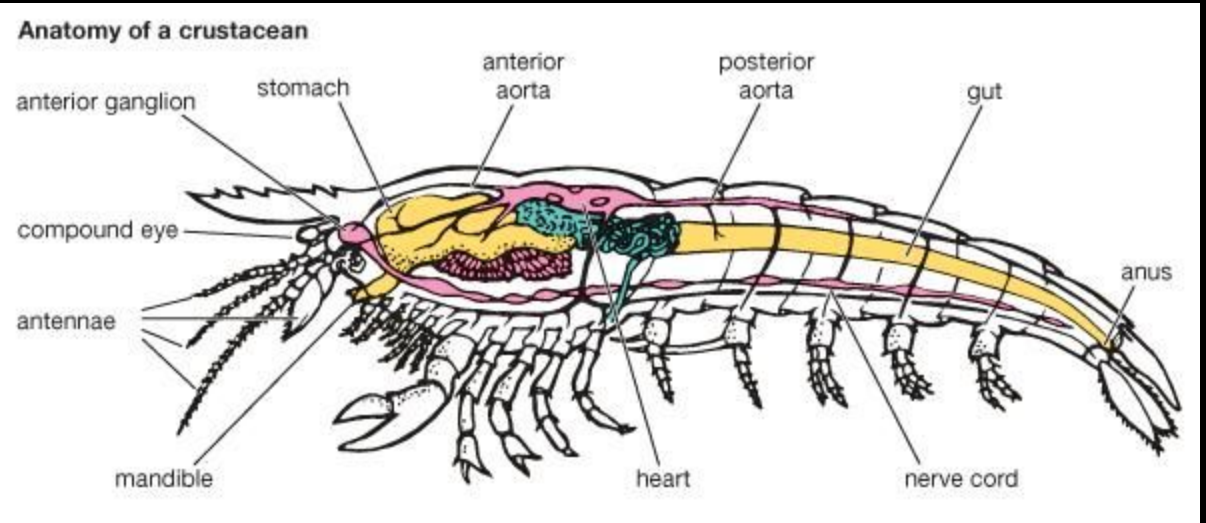
Brain
(Ganglion)
Nerve cord
Green
gland


Anatomy of a crustacean
anterior ganglion
stomach
anterior
aorta
posterior
aorta
gut
compound eye
antennae
anus
mandible
heart
nerve cord

Reproduction, Life Cycles, and Endocrine Function

- Most Crustaceans have separate sexes
- Barnacles are monoecious but generally practice cross-fertilization
- Most Crustaceans brood their eggs
- Crayfishes have direct development, and have no larvae form
- Change from larva to adult is metamorphosis
- The ancestral and most widely occurring larva in Crustacea is the nauplius
- Nauplii only have three pairs of appendages
    - Uniramous first antennules
    - biramous antennae
    - biramous mandibles
- Appendages and segments are added through series of molts

Molting and Ecdysis

The physiological process of making a larger cuticle, or shedding of the outer layer.

- Cuticle - underlying epidermis
- epicuticle - thin layer of lipid-impregnated protein
- procuticle - chitin-protein layer
- exocuticle - beneath the epicuticle and contains protein, calcium salts, and chitin
- endocuticle - composed of a principal layer
- principal layer - contains more chitin less protein, heavily calcified, and uncalcified membranous layer
- membranous layer - thin layer of chitin and protein
- gastroliths - mineral accretion

Other Endocrine Systems

- Eyestalks produce a hormone that aids in color changing
- If the eyestalks are removed, the hormones are gone, and two significant consequences occur
  - Molting speeds up
  - Loss of ability to change body color
- Androgenic glands- stimulates male expression and they only occur in males
  - When implanted in a female, her ovaries turn into testes and begin to create sperm.
  - At the next molt her appendages begin to aquire male traits
    - Ex: size and color of claws
  - Females don't posess any organs similar to these glands, however their ovries secrete 1-2 hormones to influence sexual characteristics.
- Other hormones are secreted in crustaceans such as a substance secreted by the eyestalks that regulates blood sugar

Feeding Habits

- Feeding habits vary amongst different crustaceans.
  - Many can change their habits due to environment and food availability.
- They have different mouthparts
  - Mandibles and maxillae-ingestion
  - Maxillipeds-hold and crush food
  - Walking legs (mainly chelipeds)- aid in food capture in predatory crustaceans
- Majority are predatory, although some are suspension feeders or scavengers
  - Suspension feeders
    - Use their legs(covered in setae) to sweep currents of water containing food particles over the setae
      - Ex: fairy shrimp and water fleas
  - Scavengers
    - Eat dead animal and plant matter

Gastric mill

- Crayfish have a two part stomach
  - The fist part contains a **gastric mill,** which is an area where small particles of food are ground up further into smaller particles by 3 calcareous teeth.
  - The second part of the stomach is a filter of setae, where the fine paricles of food pass through, and nutrients are absorbed.
  - Food then passes into the intestine for chemical digestion.

Hormonal Control of the Ecdysis Cycle

- Ecdysis is hormonally controlled
- Often initiated by environmental stimuli percieved by the central nervous system
    - Day length
    - Temperature
    - Humidity
    - Or combination of environmental signals
- The signal from the central nervous system decreases production of a molt-inhibiting hormone by the X-organ
- The X-organ is a group of neurosecretory cells in the medulla terminalis of the brain

Hormonal Control of the Ecdysis Cycle

- The hormone is carried in axons of the X-organ to the sinus gland, in the eyestalk, where it is released into the hemolymph
- A drop in level of molt-inhibiting hormone promotes release of a molting hormone from the Y-organs (lie beneath the epidermis near the adductor muscles of the mandibles)
- Homologous to prothoracic glands of insects
- Action of molting hormone is to initiate processes leading to ecdysis
- Once initiated the cycle proceeds automatically