Internal Systems

- Digestive - obtain and assimilate food, remove waste products
- Excretory - remove nitrogenous waste products, involved in internal chemical and water balance
- Respiratory - obtain oxygen and removal of carbon dioxide

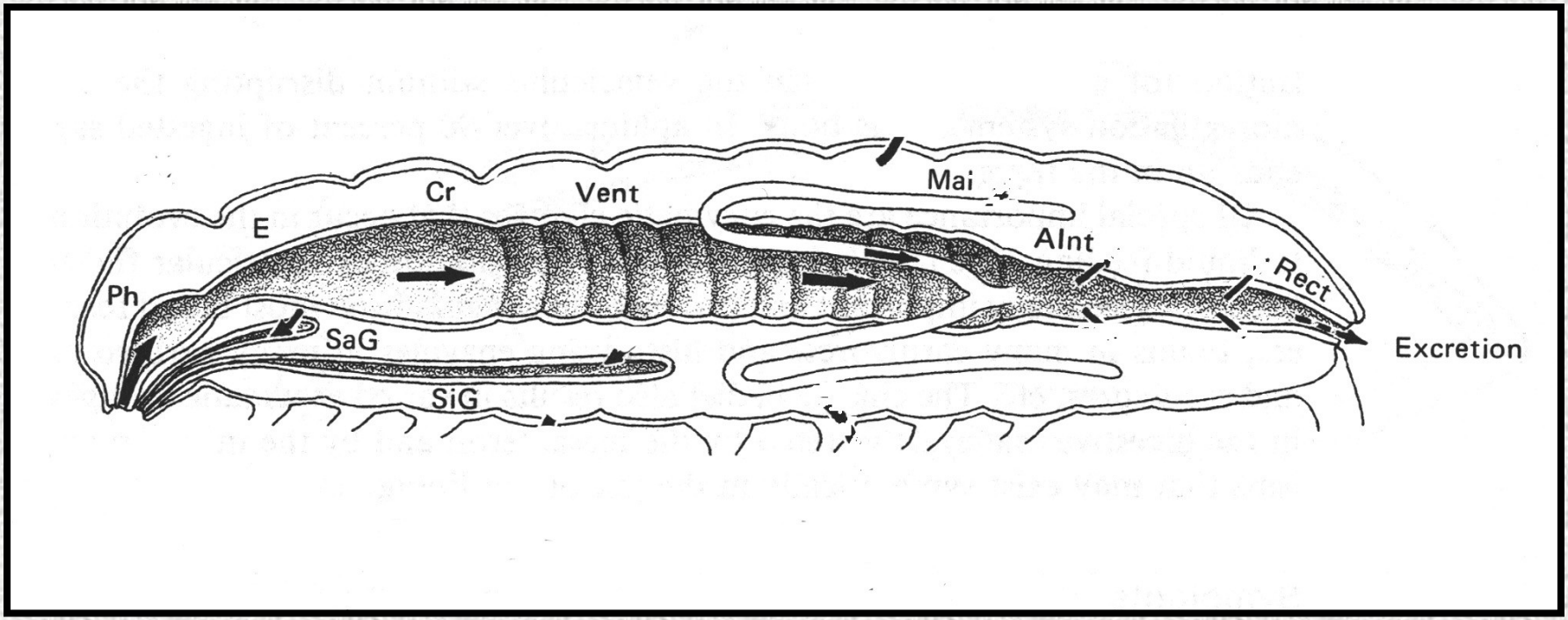
Internal Systems

- Muscular - “movement,” internally and through the environment
- Circulatory - transportation of items throughout the body, wound healing, storage
- Nervous - system of communication between stimuli and the organism

Internal Systems

- Reproductive - procreation
- Endocrine - growth, reproduction, “change,” internal communication

The Insect Digestive System



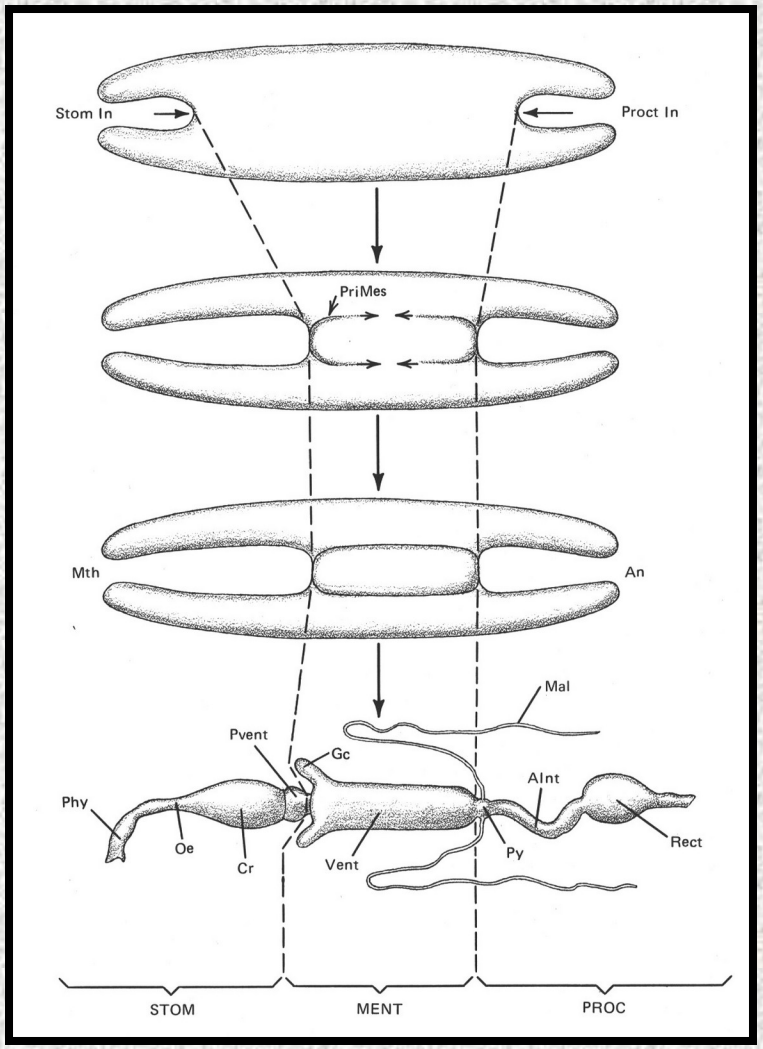
Functions of the digestive tract

- Ingestion - process of feeding, taking food into the body
  - Remember different types of mouthparts?
- Digestion - breakdown of “food” into a form that can be assimilated by the body

Functions of the digestive tract

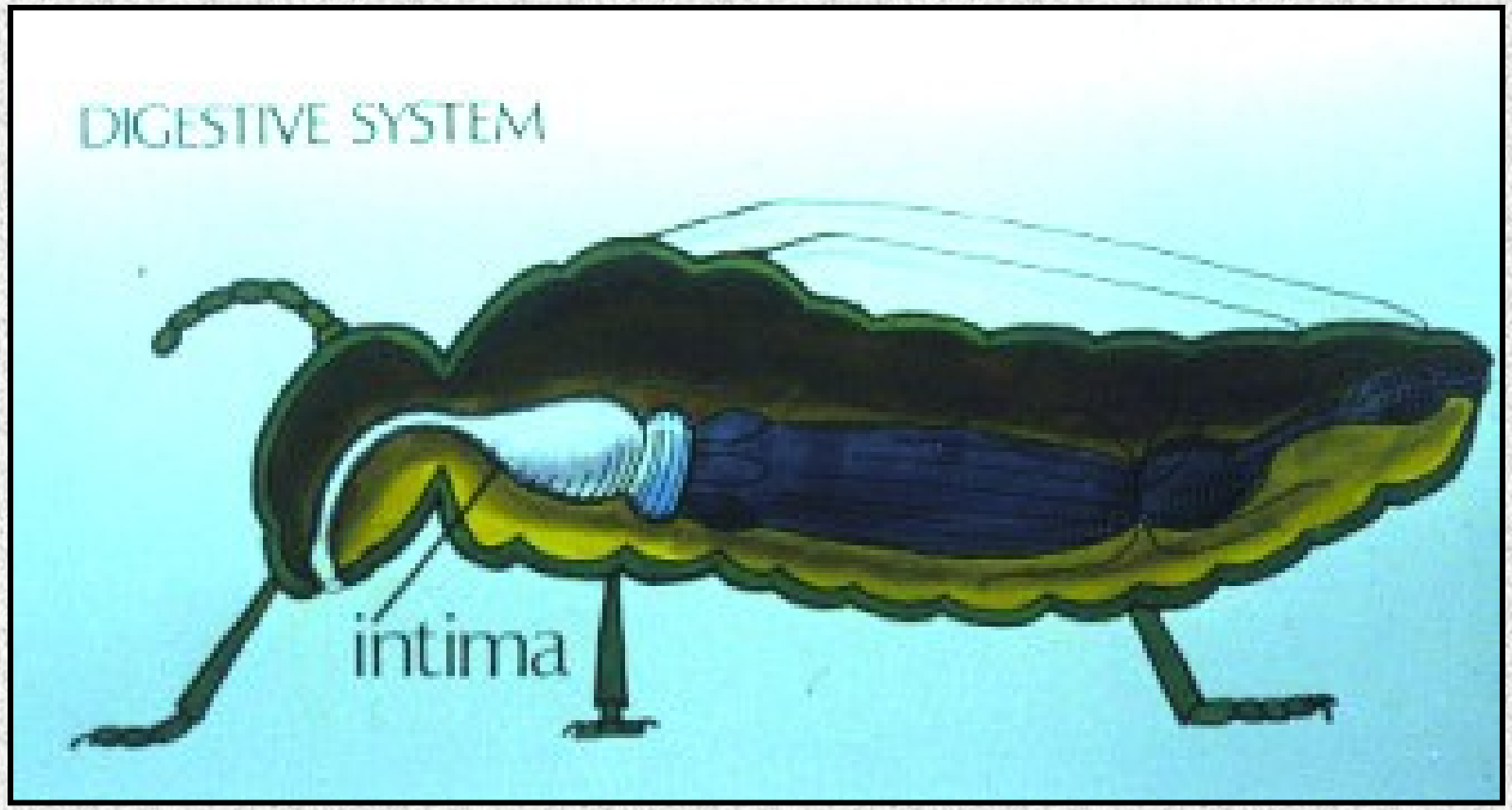
- Absorption - passage of digested food molecules from the digestive tract to the blood and body cavity
- Egestion - elimination of undigested food waste from the body

The Insect Digestive System

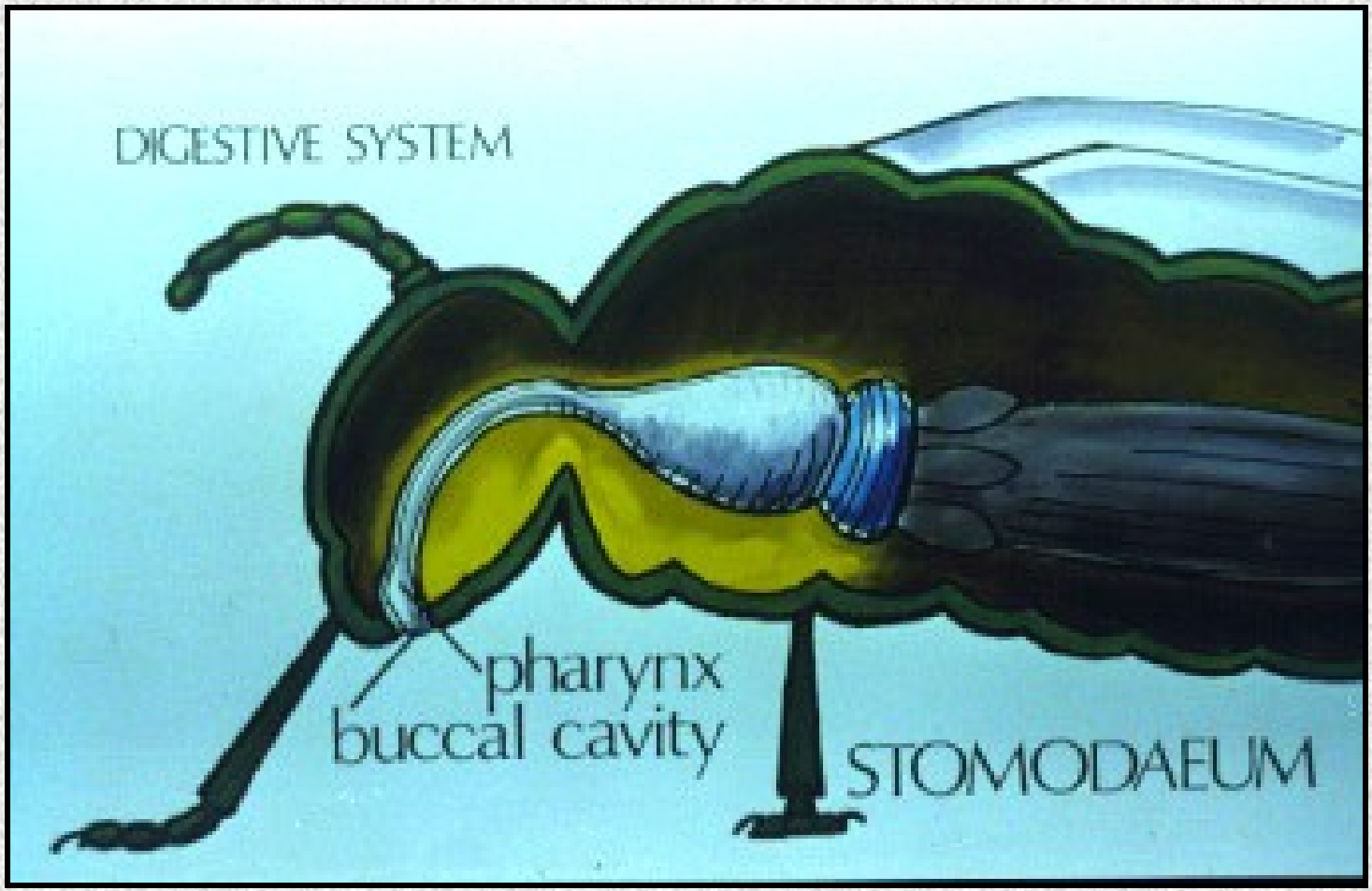


Insects and People
Internal Morphology

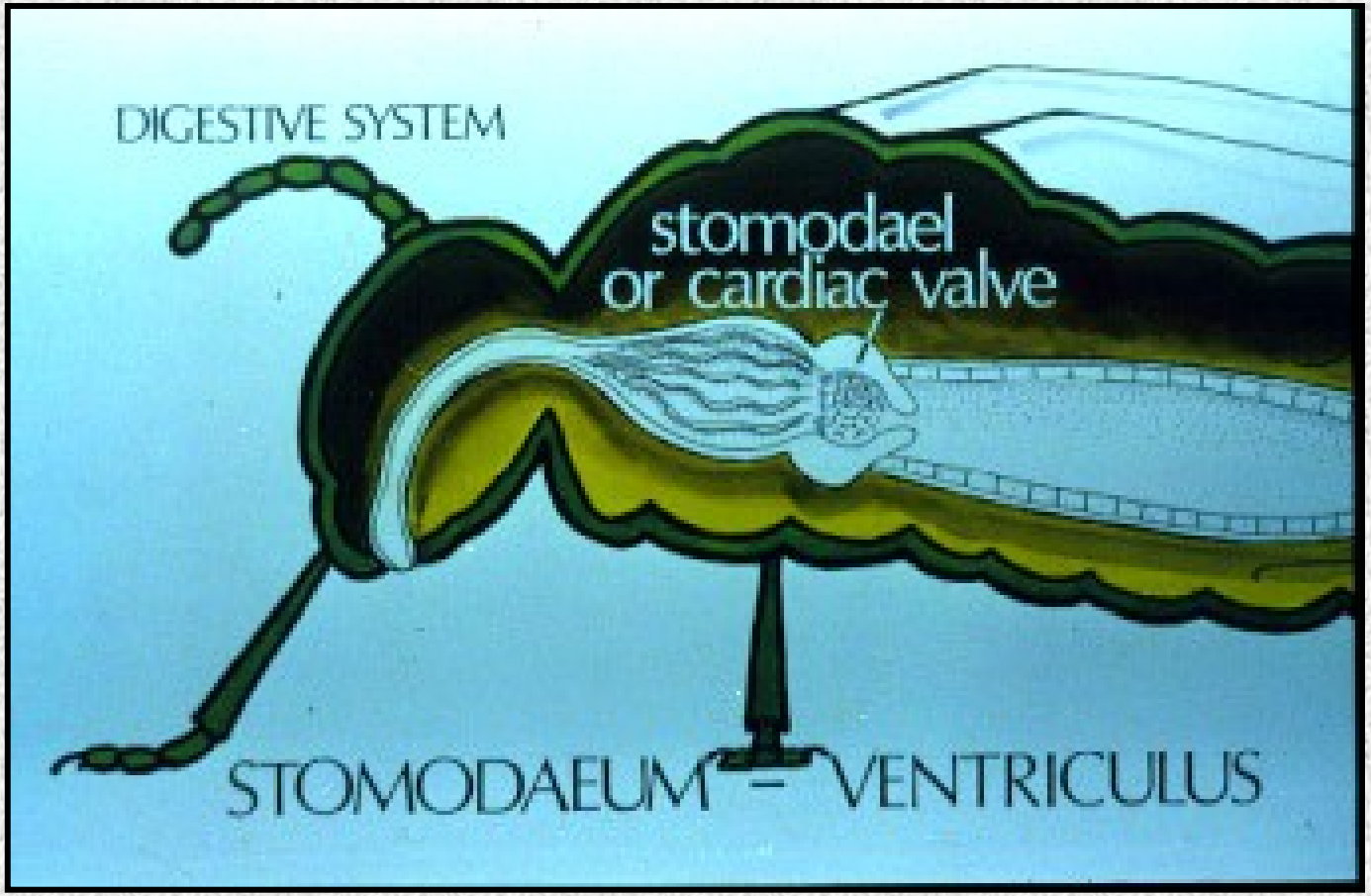
The Insect Digestive System
Foregut



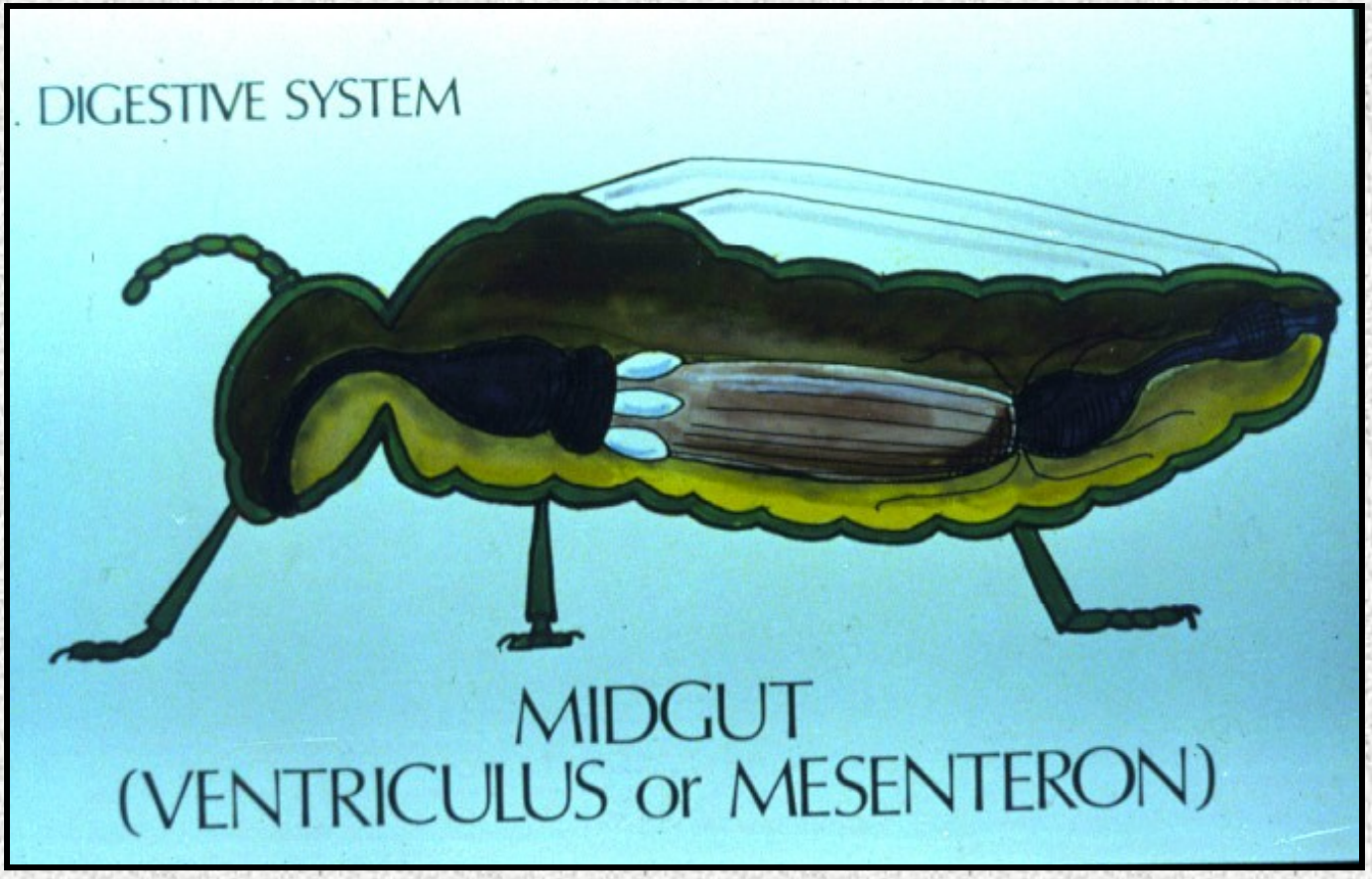
The Insect Digestive System
Foregut



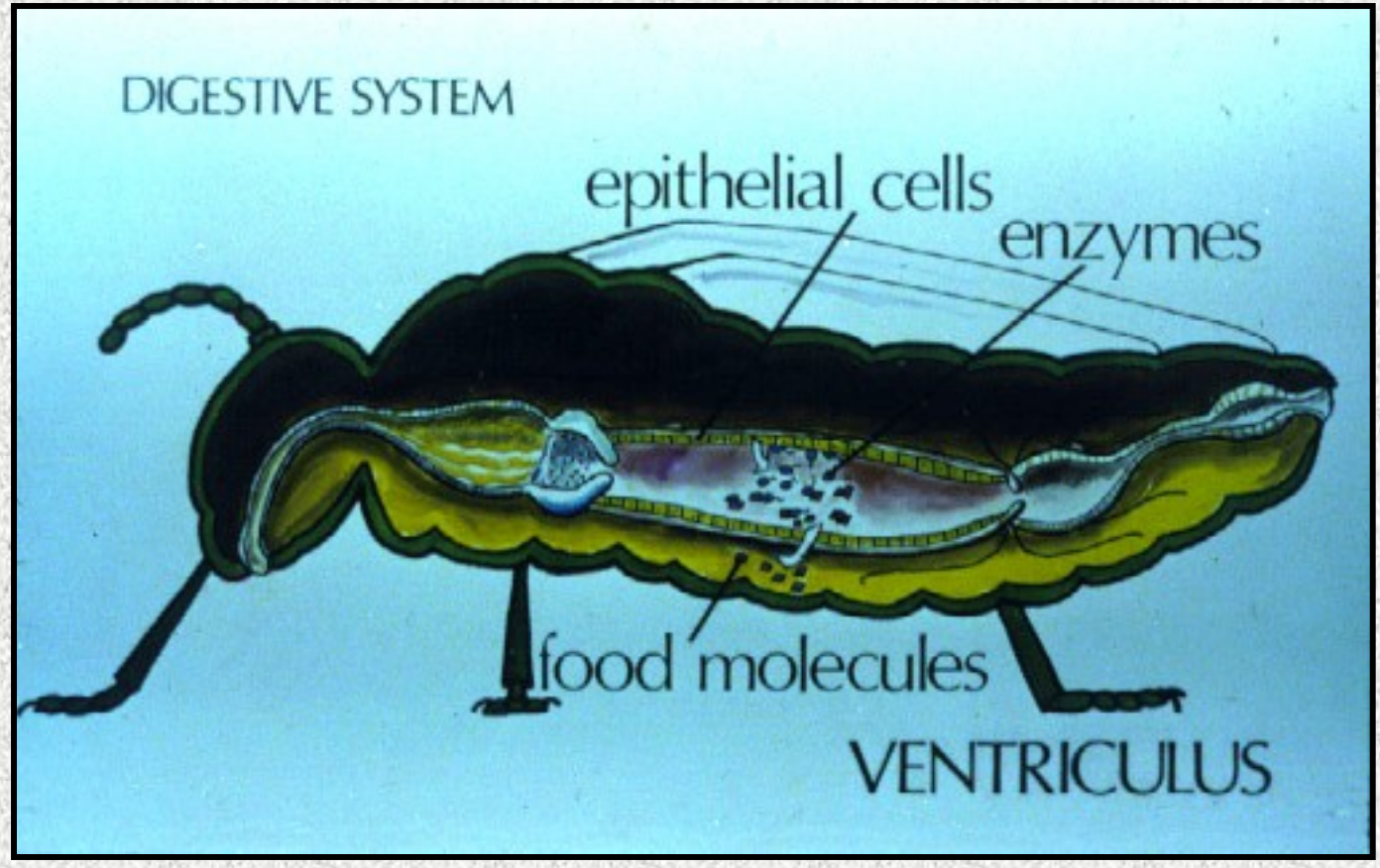
The Insect Digestive System
Foregut - Midgut



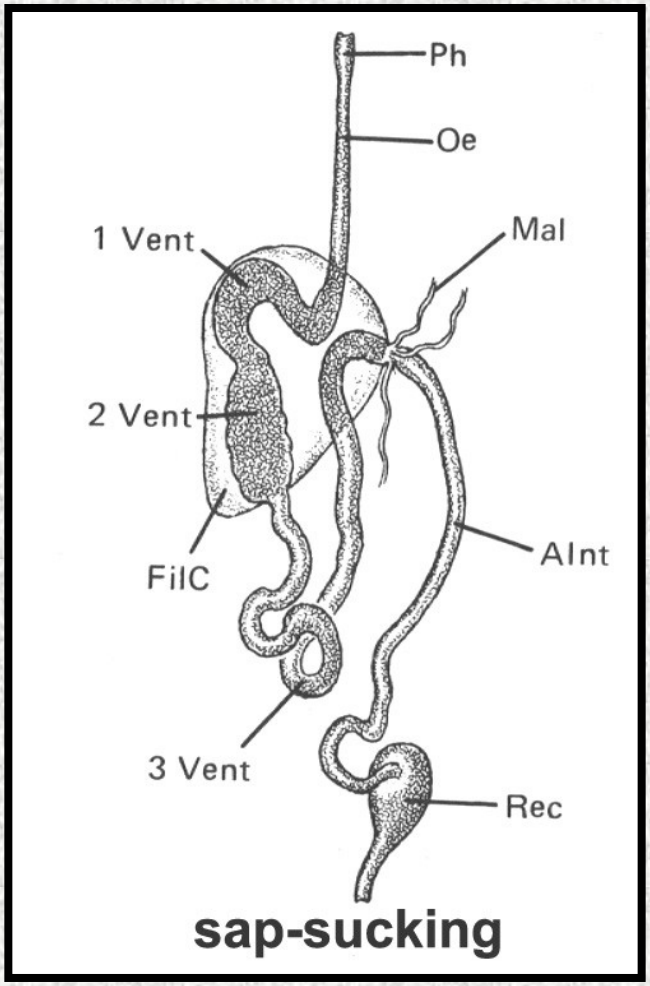
The Insect Digestive System
Midgut



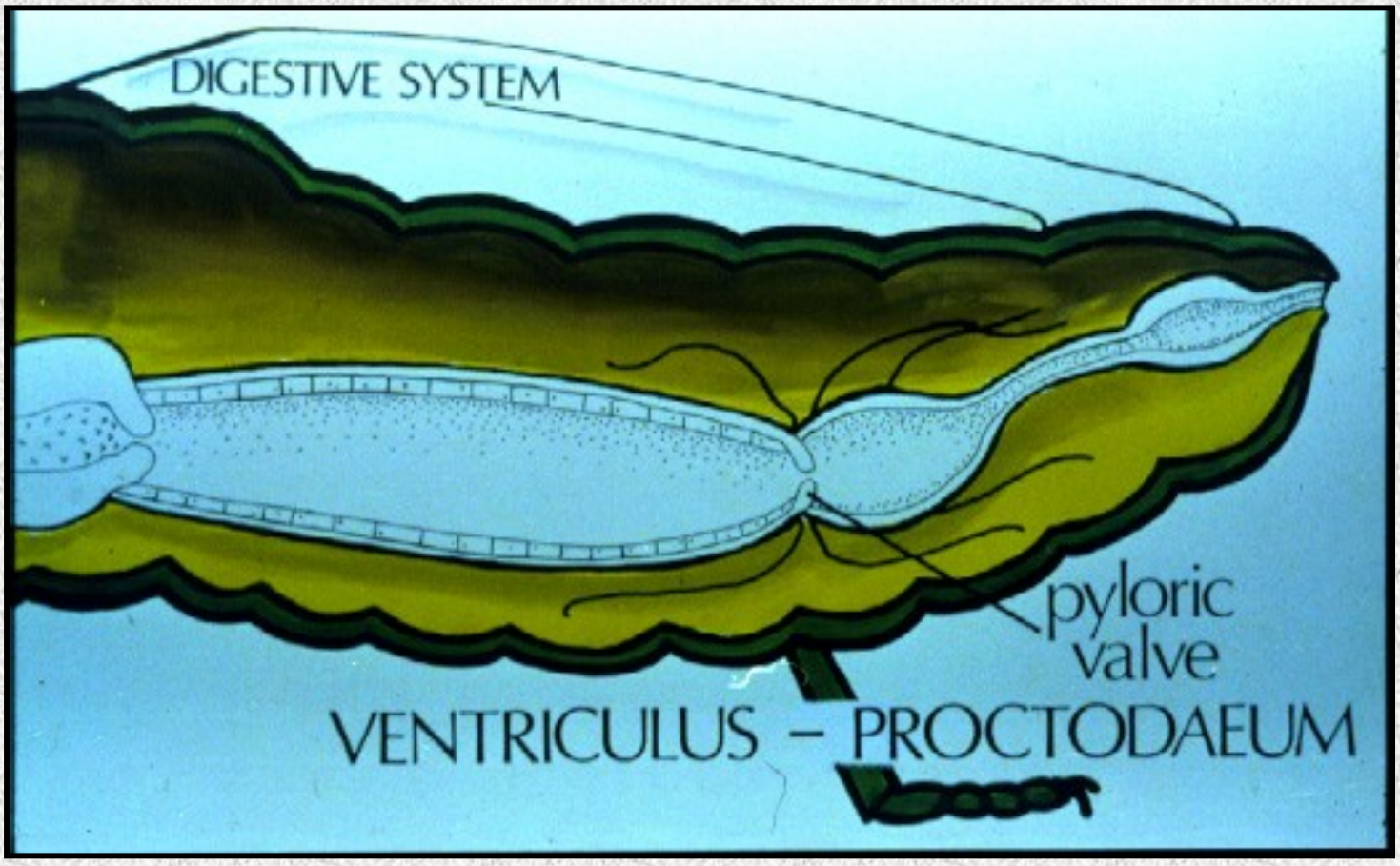
The Insect Digestive System
Midgut



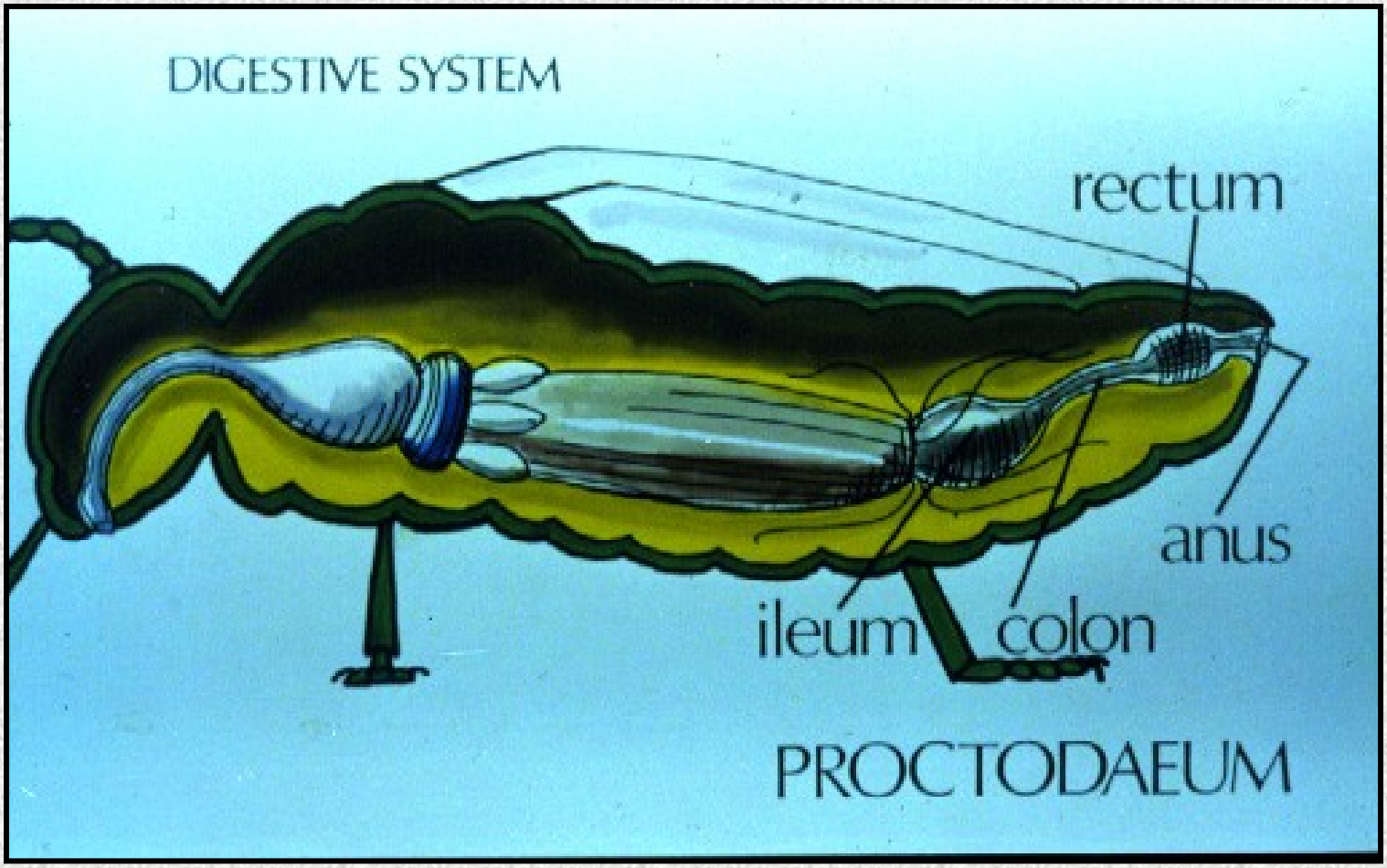
The Insect Digestive System
Midgut - variation



The Insect Digestive System
Midgut - Hindgut



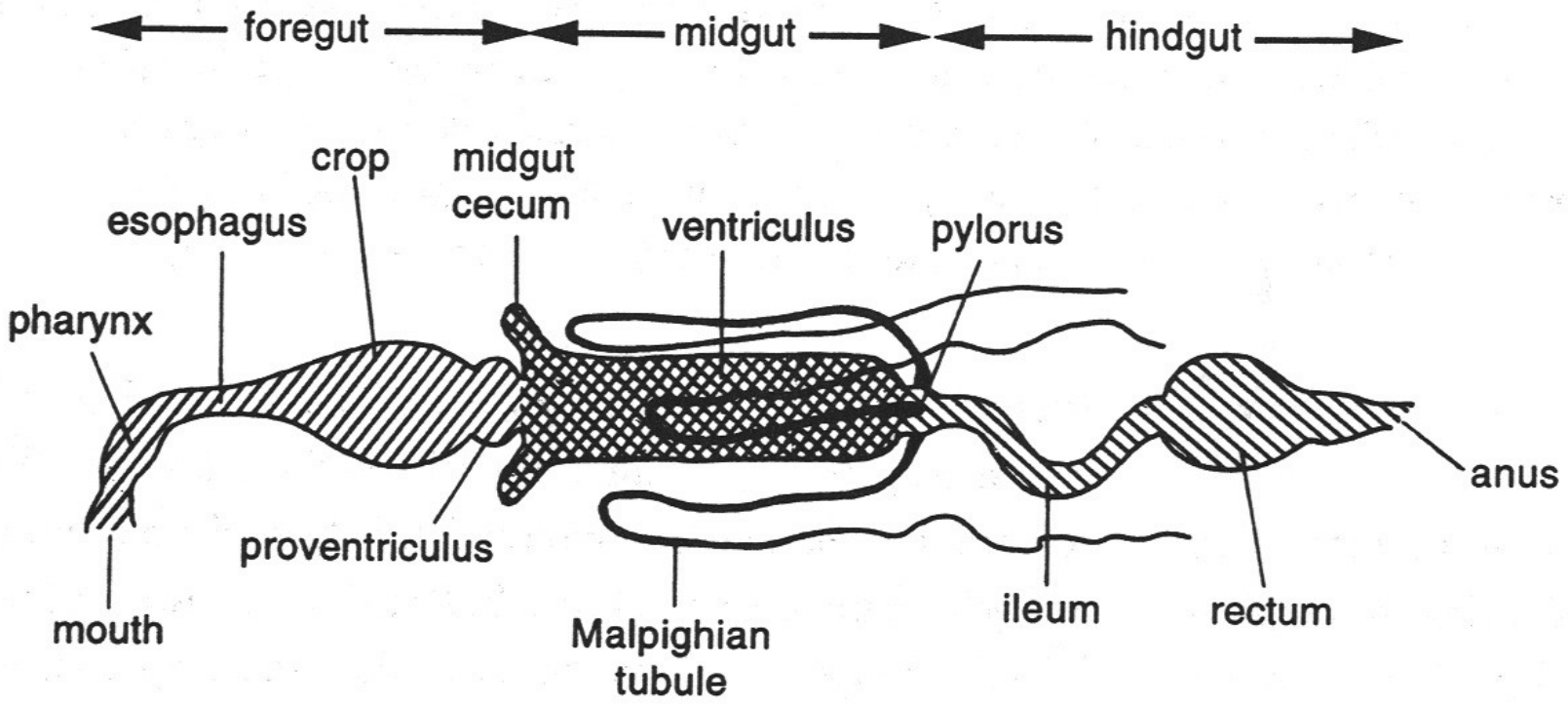
The Insect Digestive System
Hindgut



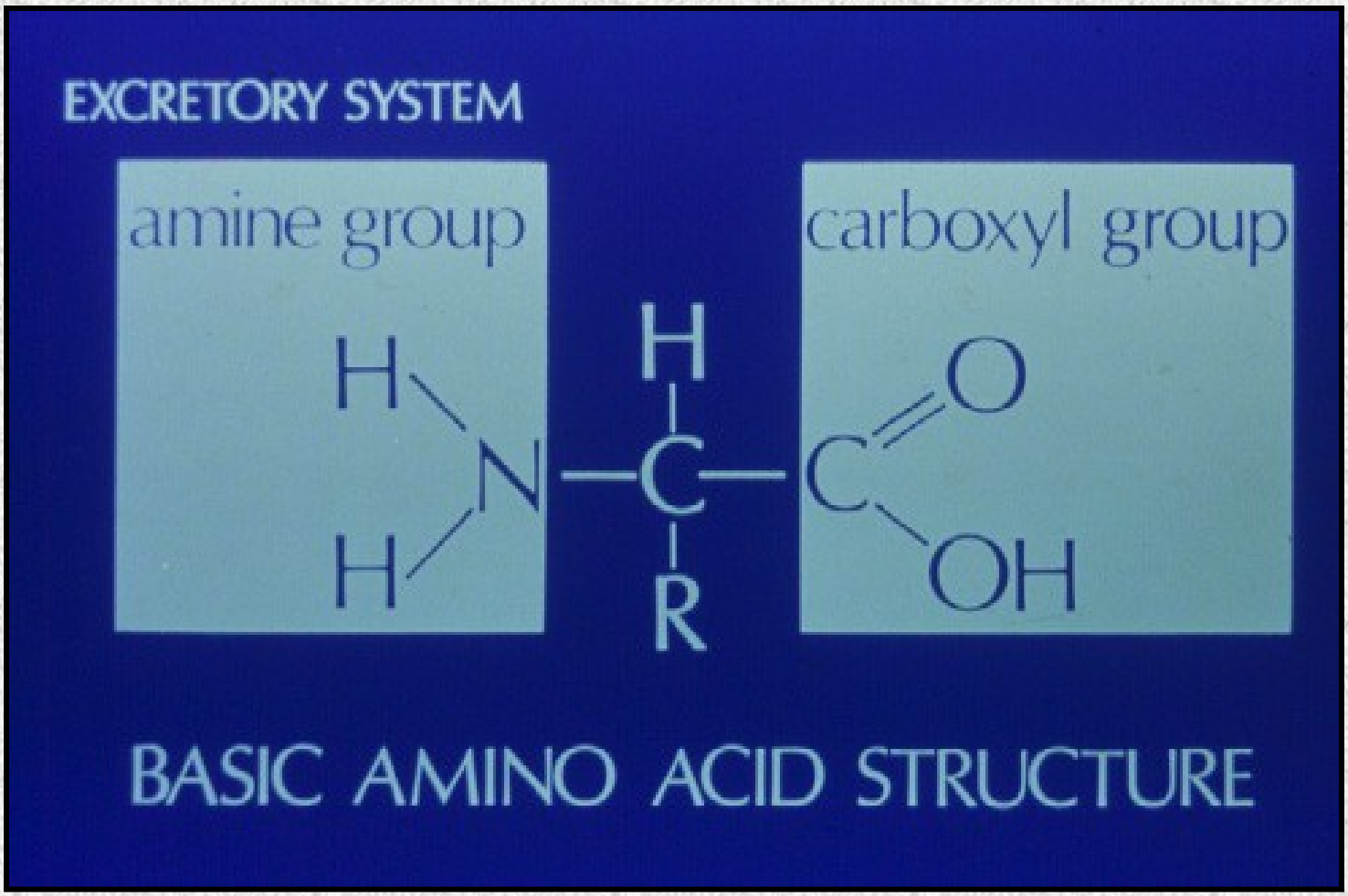
The Insect Excretory System

- Elimination of nitrogenous waste products
- Regulation of water and ionic balance
- The Malpighian Tubules

The Insect Excretory System



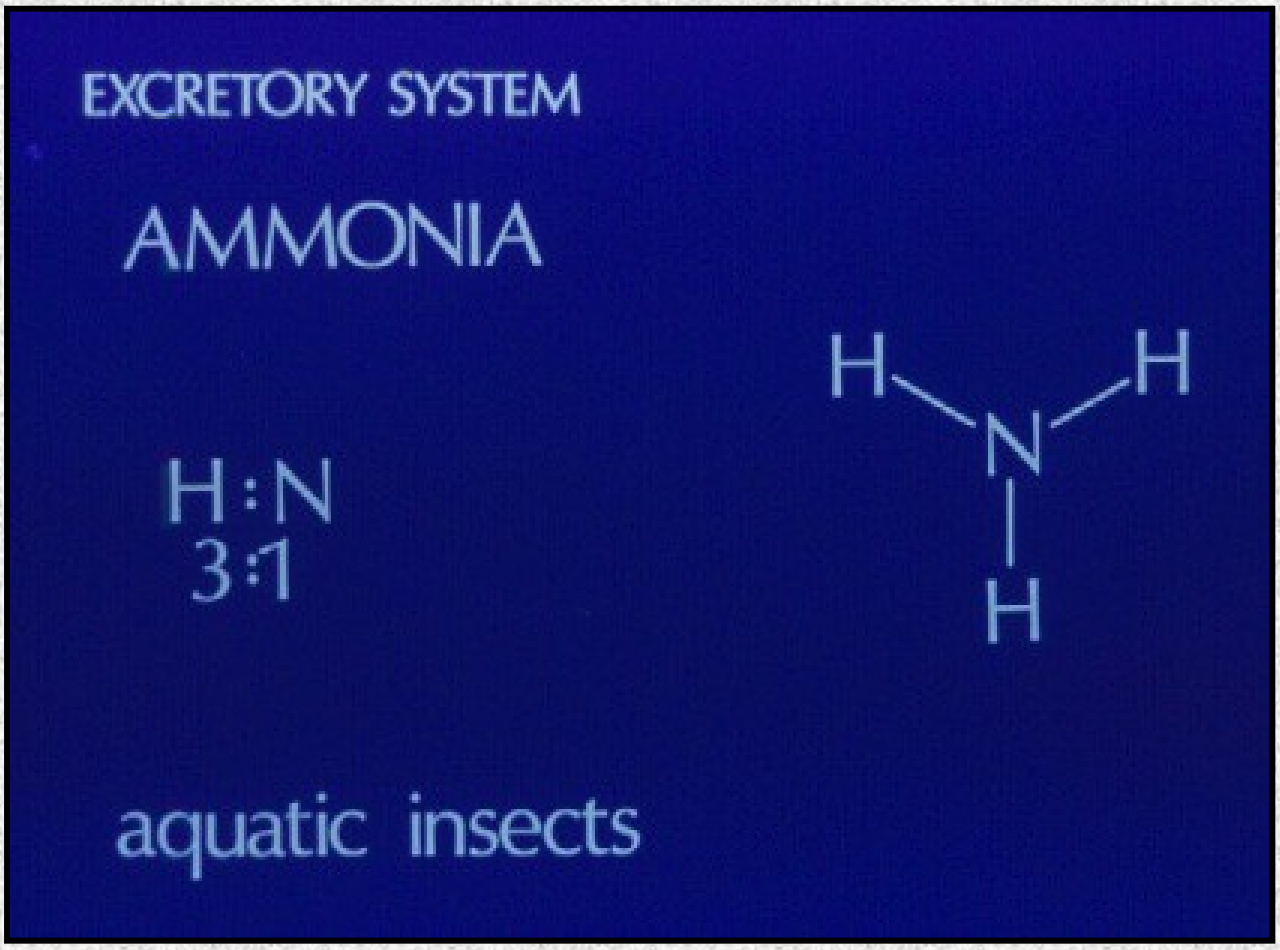
The Excretory System



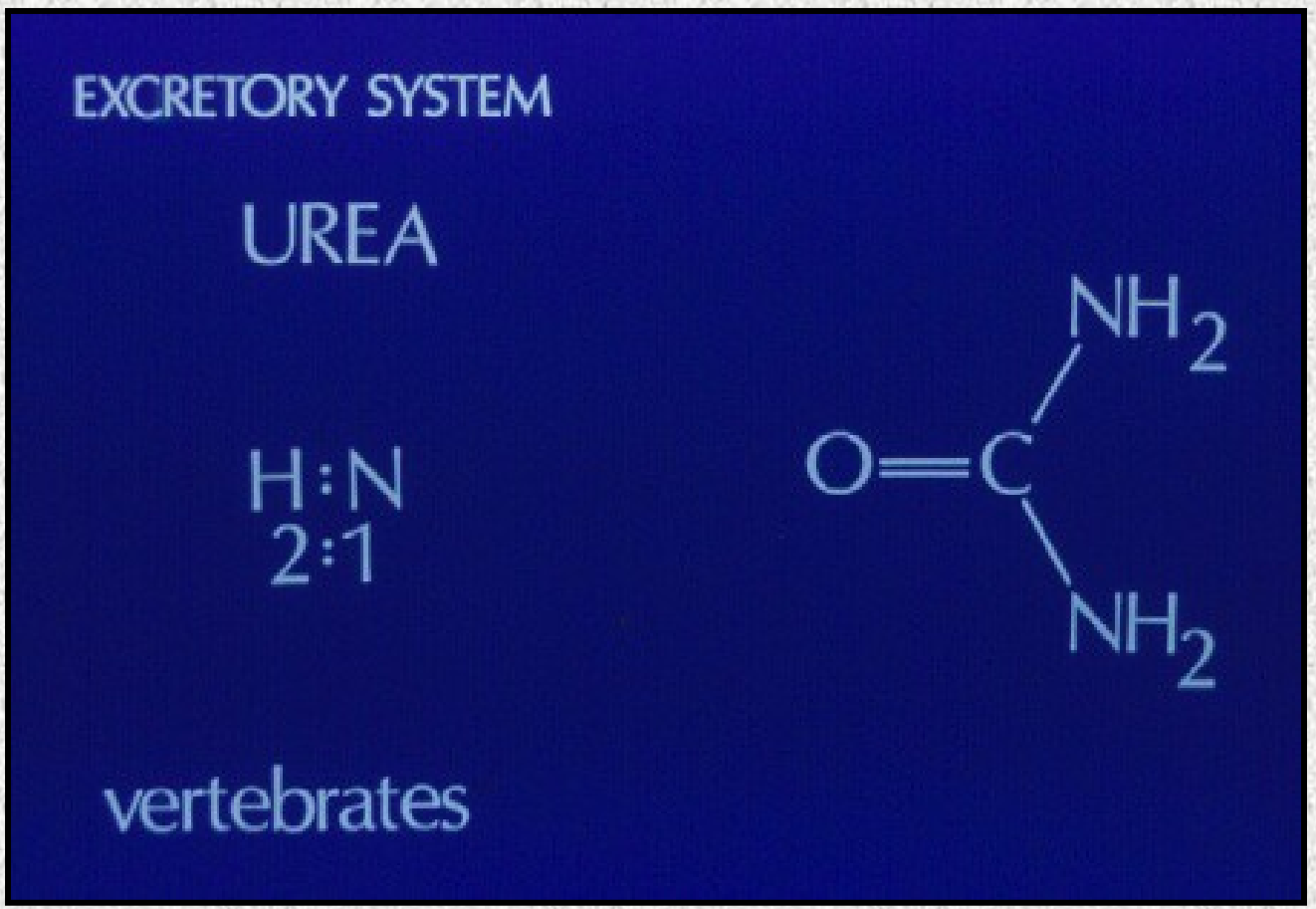
The Excretory System

- Excretory product = amine group + hydrogen (from water)
- Three products found in animals
  - Ammonia - easy to produce but toxic
  - Urea - not as easy to produce, not as toxic
  - Uric Acid - difficult to produce, not toxic

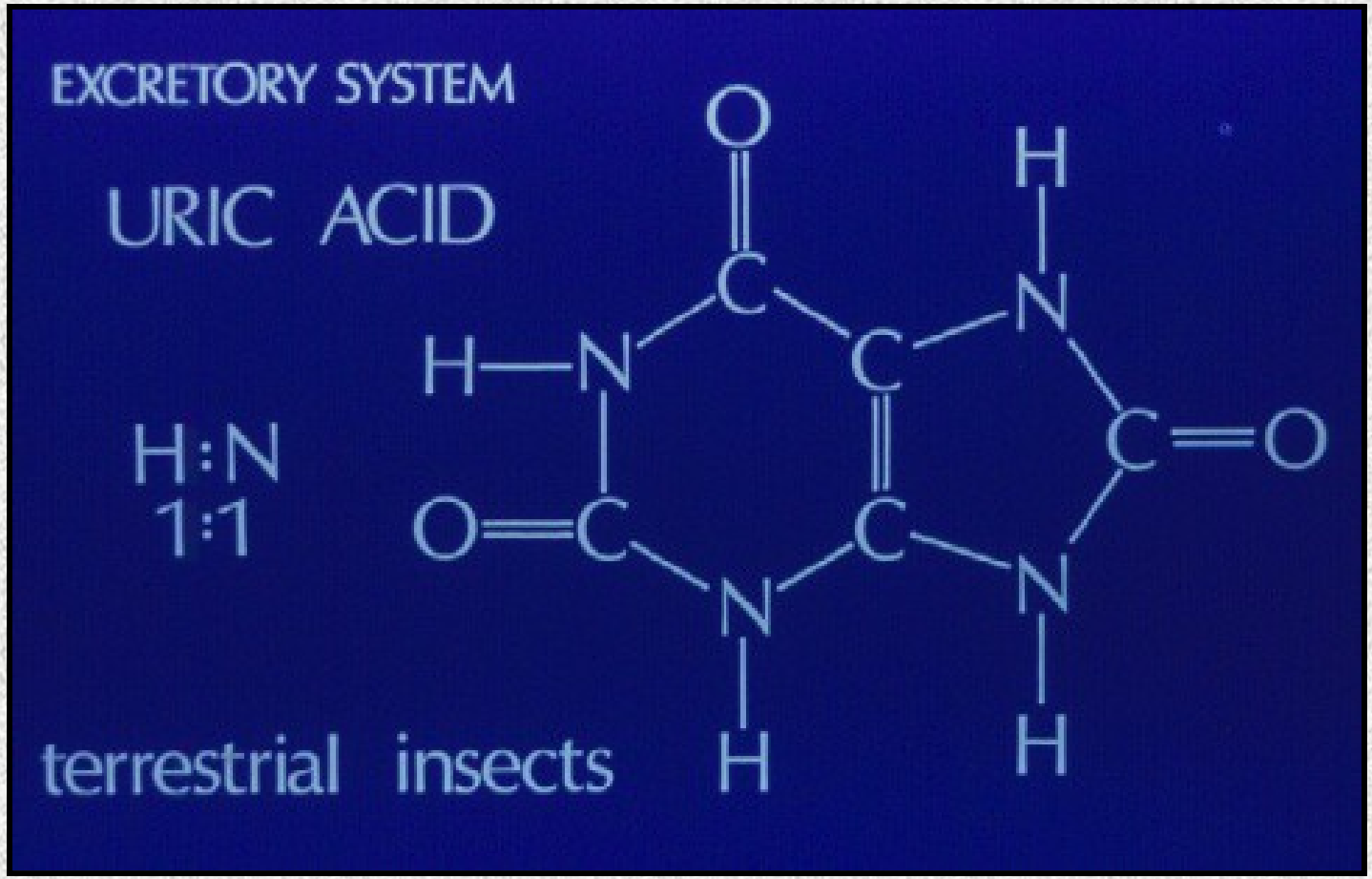
Ammonia - Excretion in small insects in moist environments



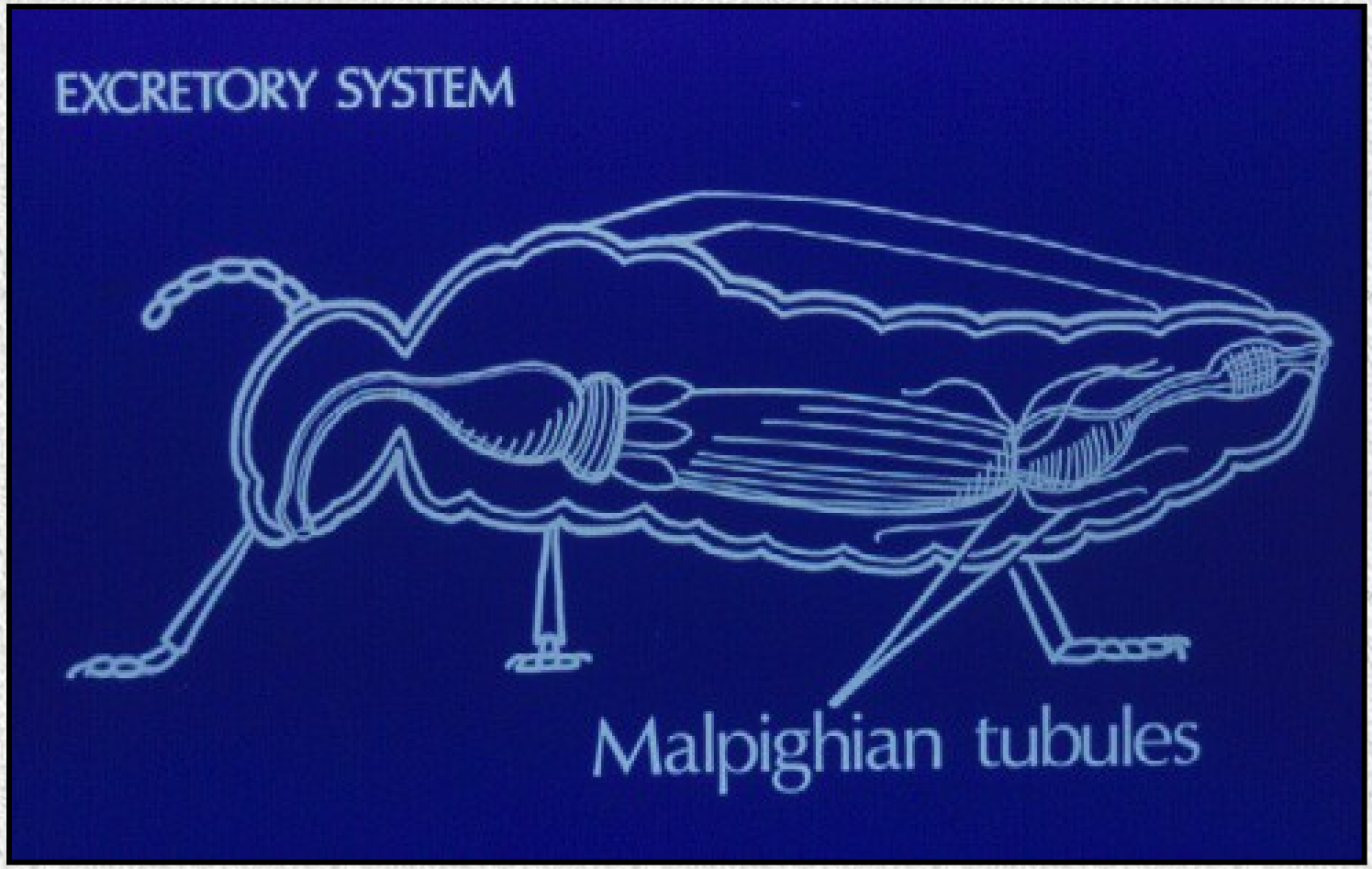
Urea - Most Vertebrates



Uric Acid - Most Terrestrial Insects



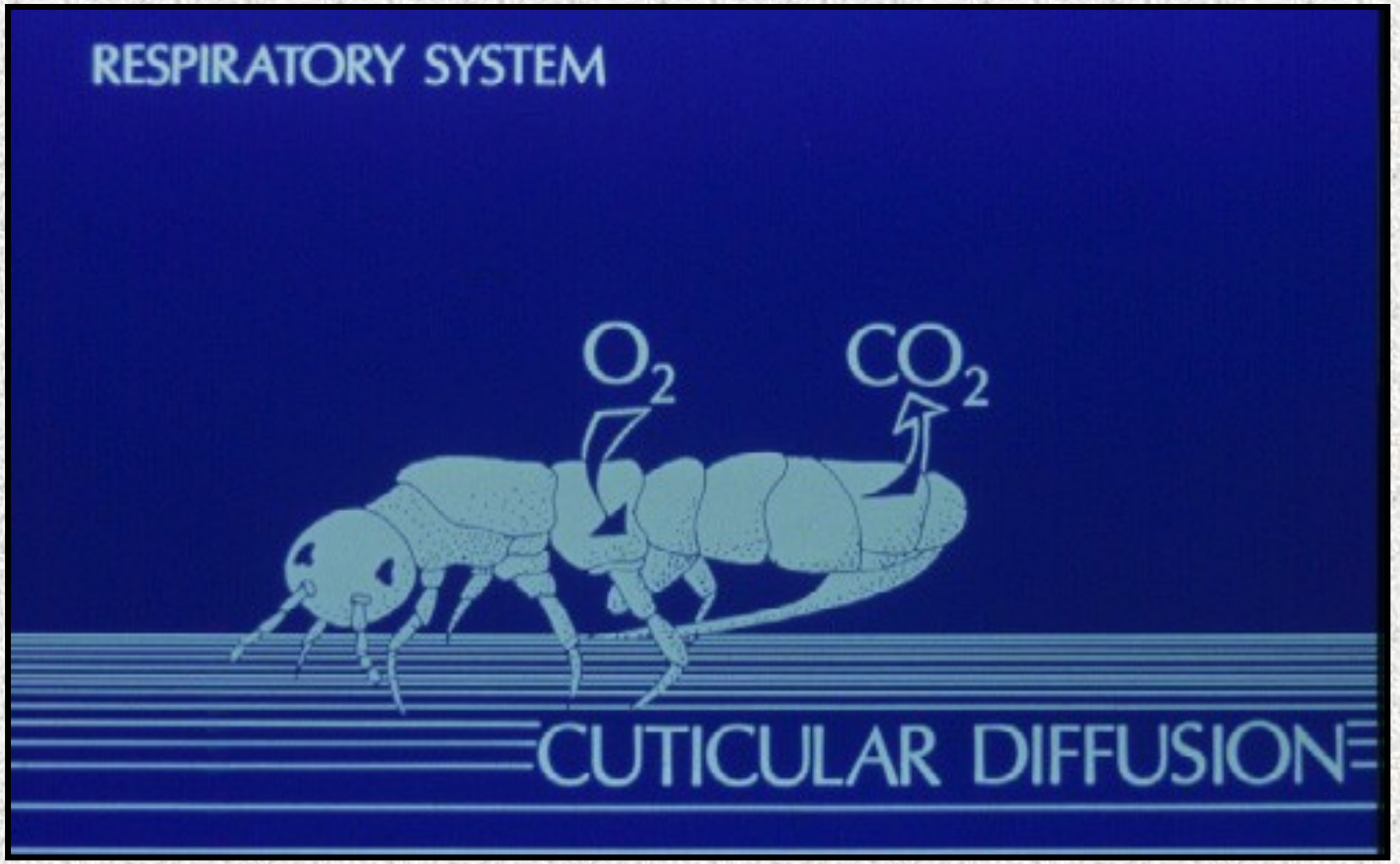
Malphigian Tubules



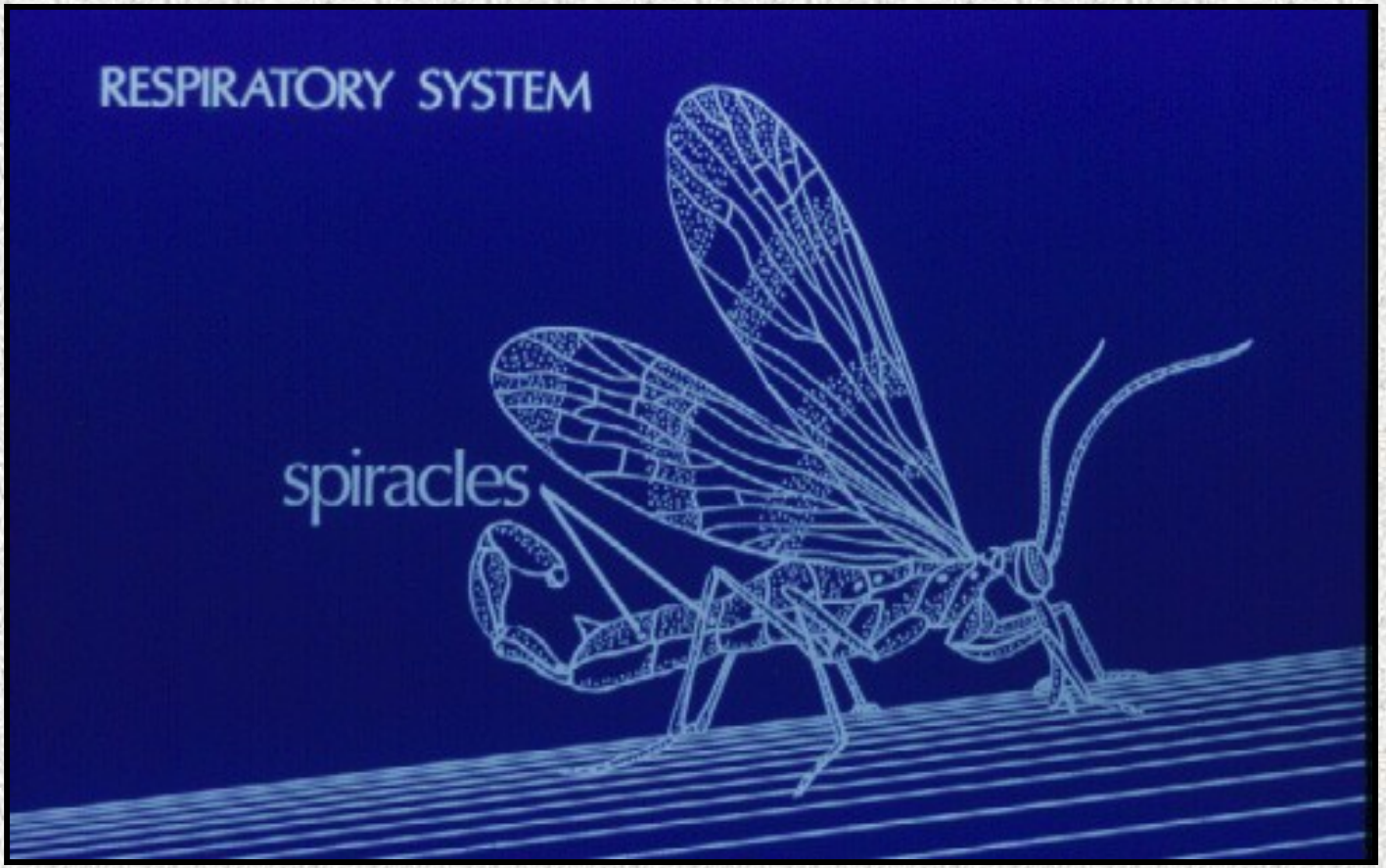
The Insect Respiratory System

- As all animals, insects need Oxygen
- As all animals, insects need to rid themselves of Carbon Dioxide
- Insects do not transport oxygen through the circulatory system!

The Insect Respiratory System Option - small and moist

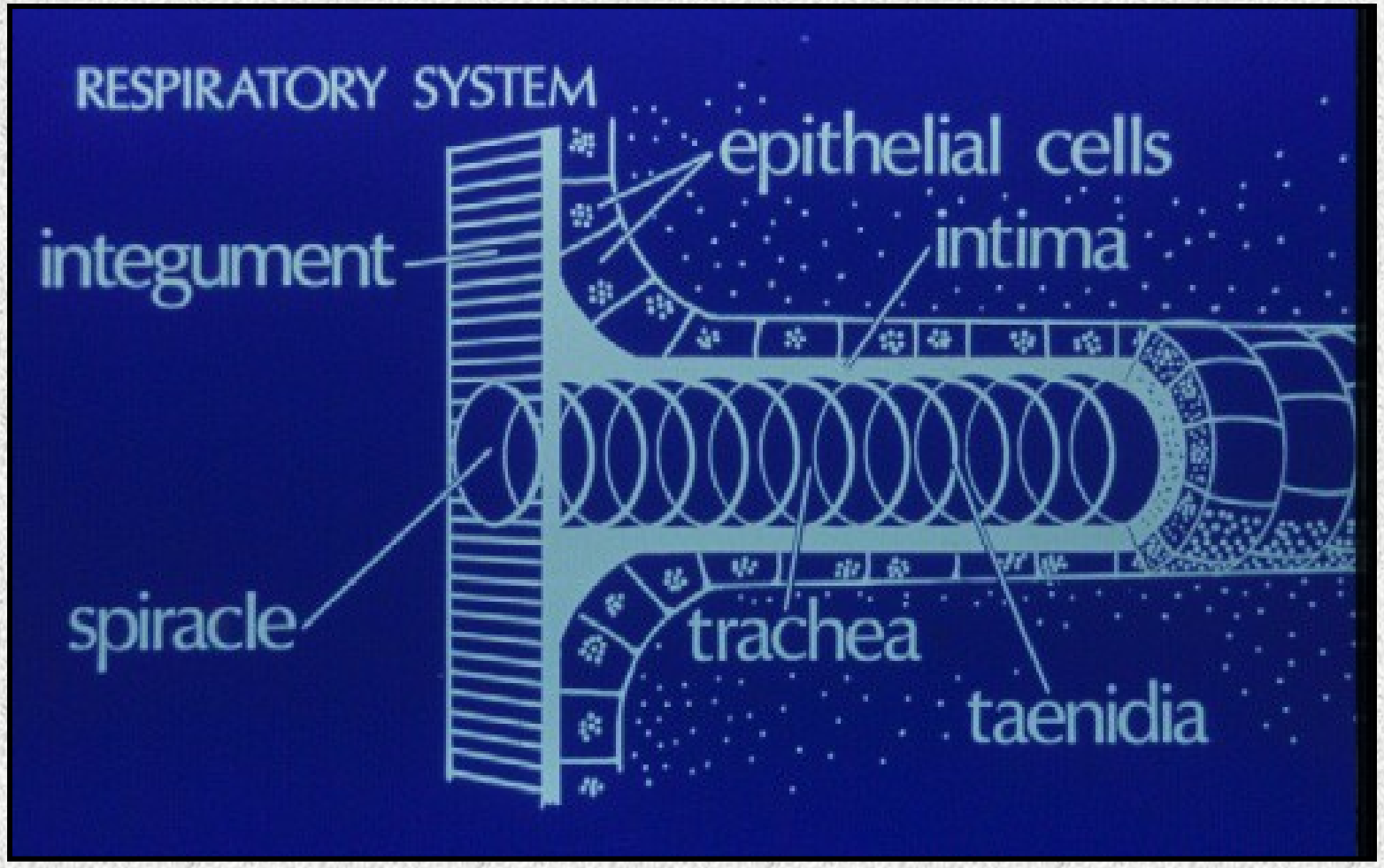


The Insect Respiratory System
Tracheal System - Spiracles

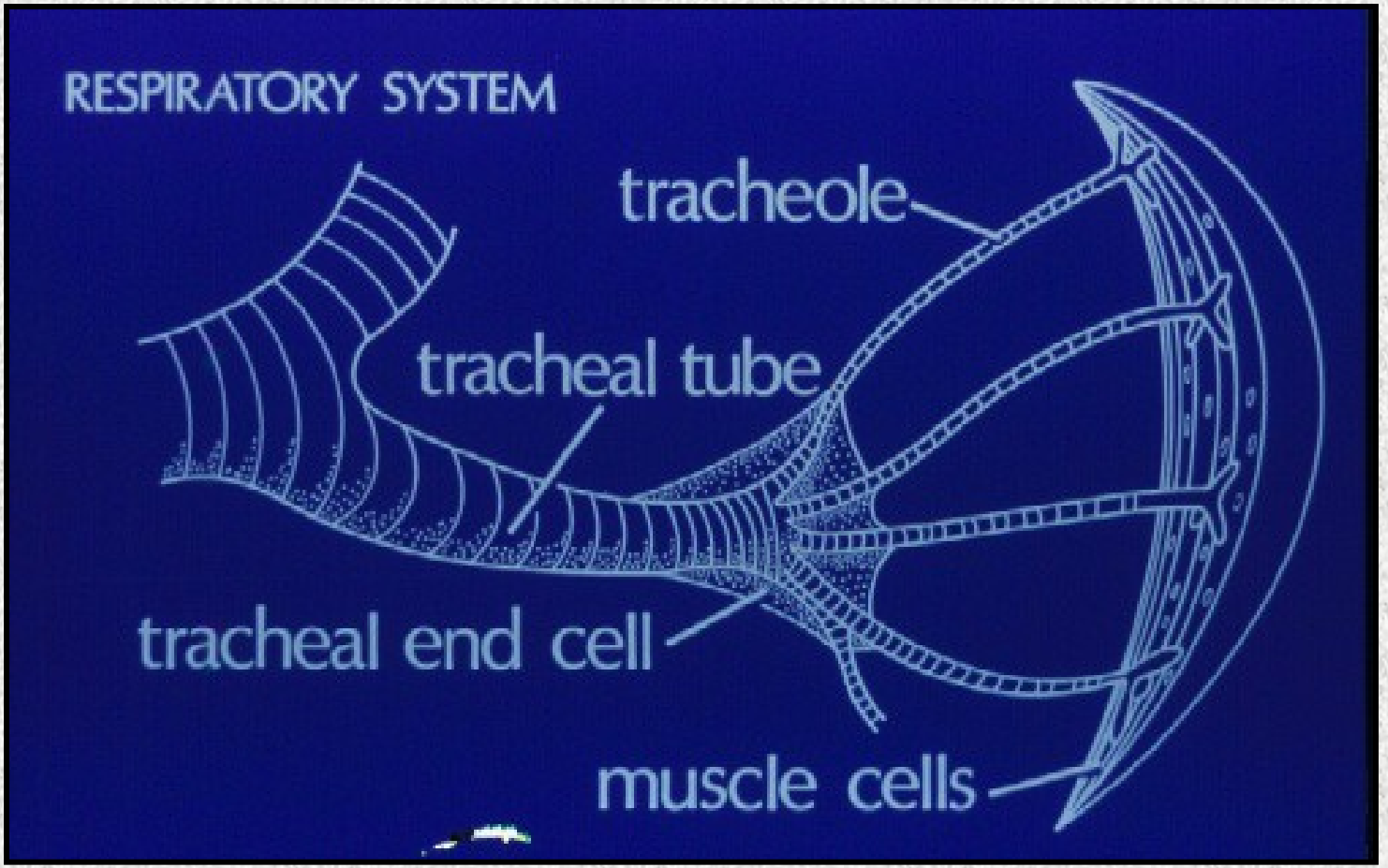


The Insect Respiratory System Spiracles

The Insect Respiratory System

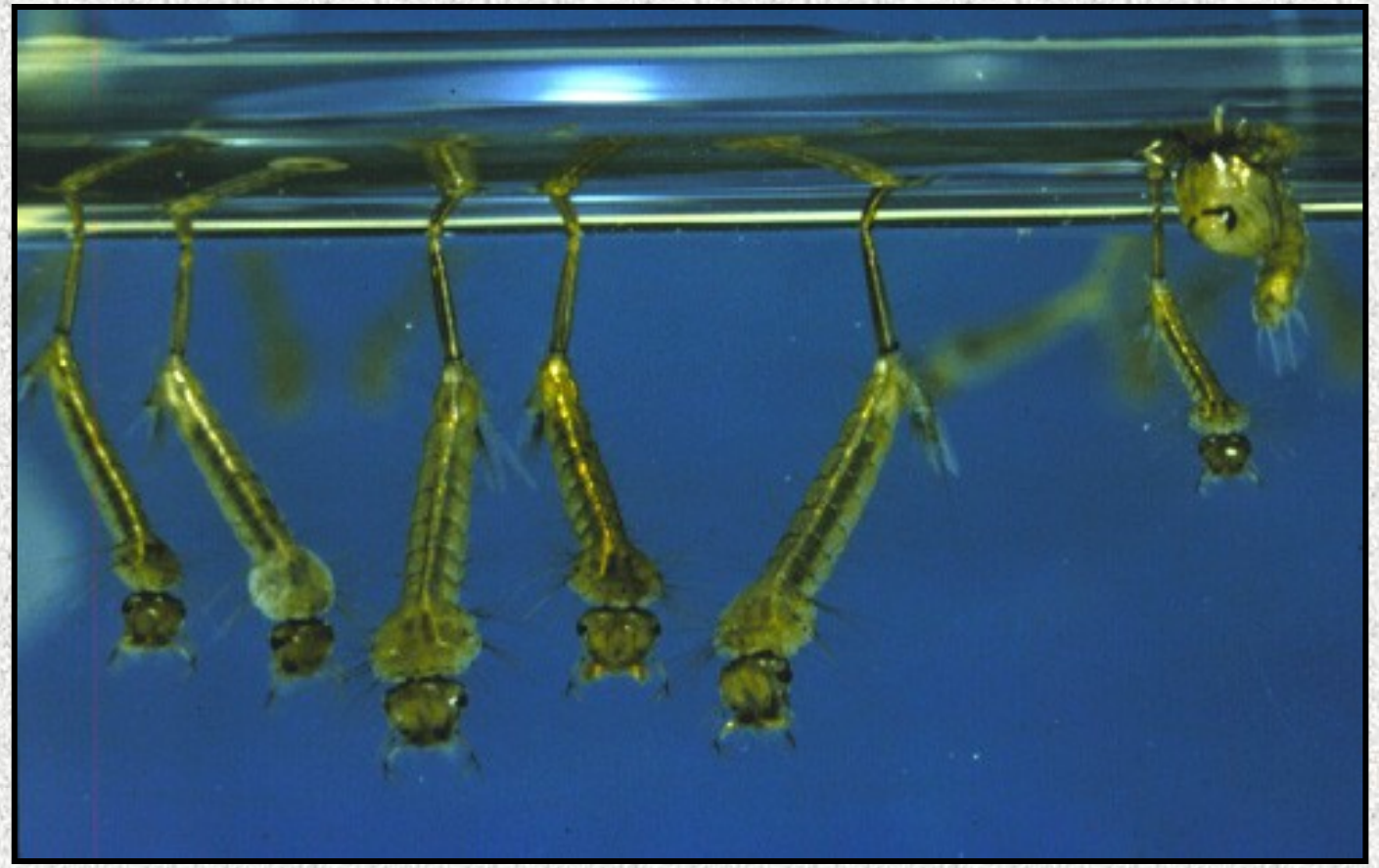


The Insect Respiratory System

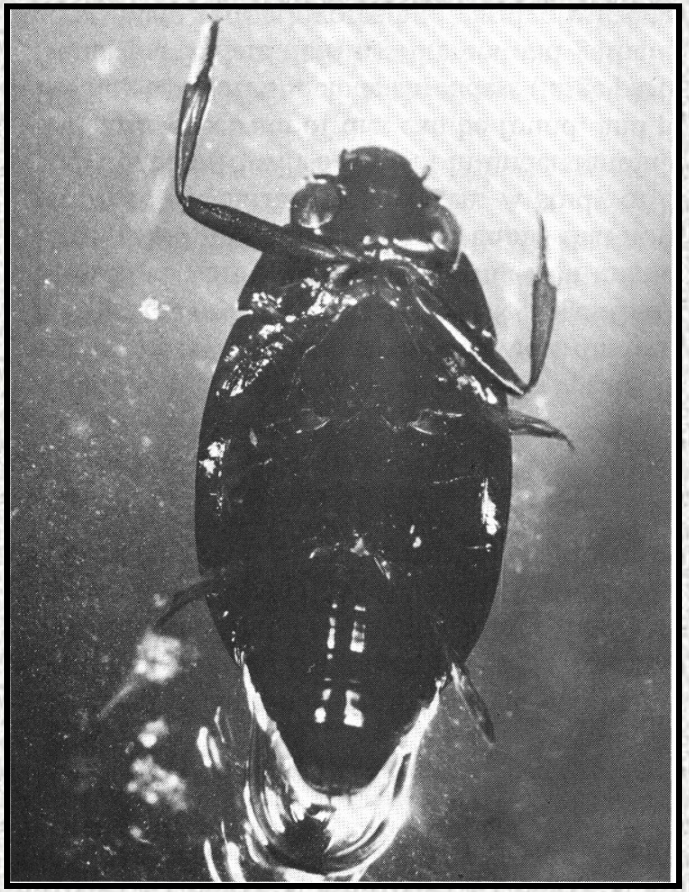


The Insect Respiratory System
Aquatic Insects - Gills

The Insect Respiratory System
Aquatic Insects - Spiracular Tube



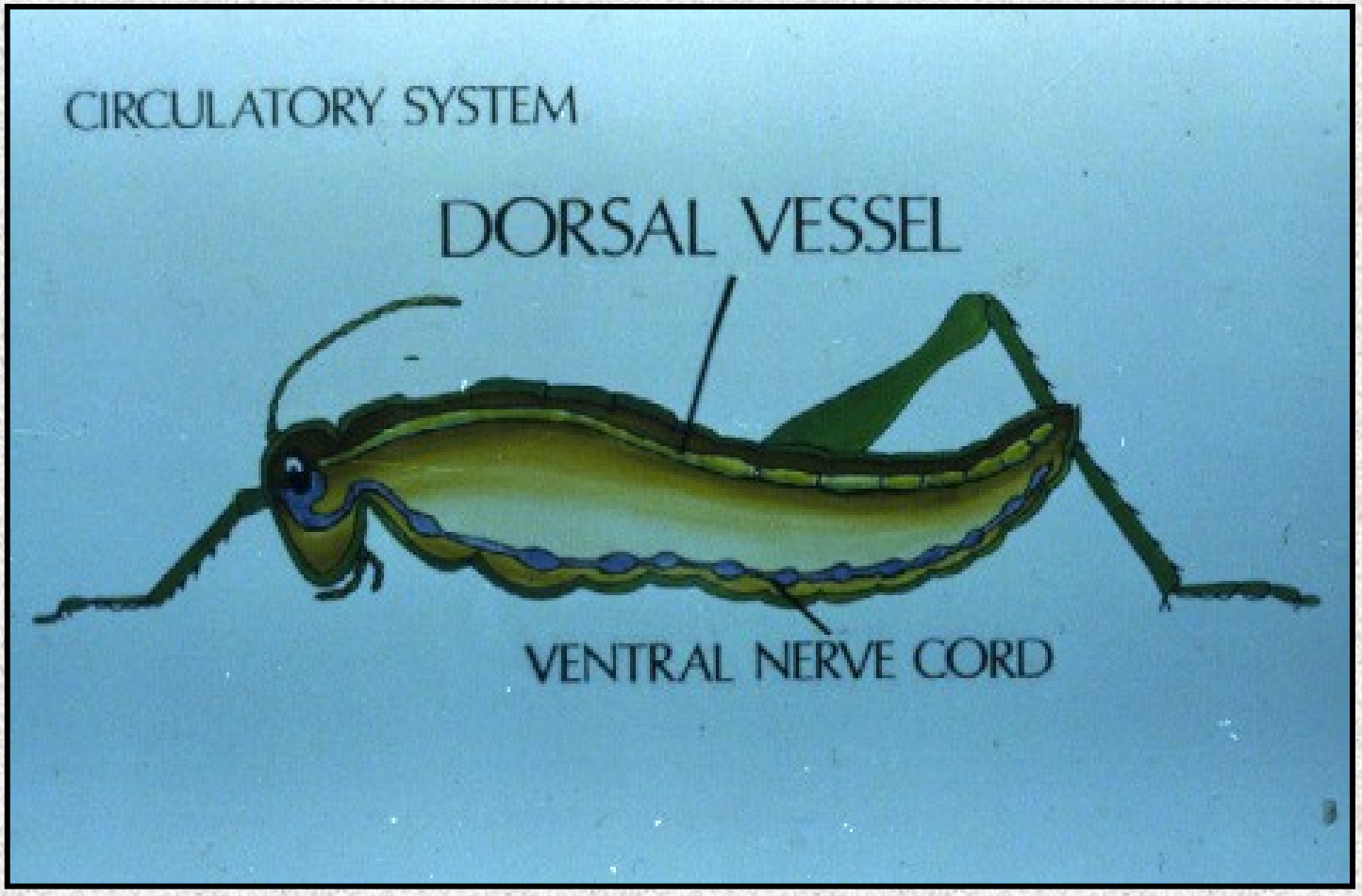
The Insect Respiratory System
Aquatic Insects - Plastrons



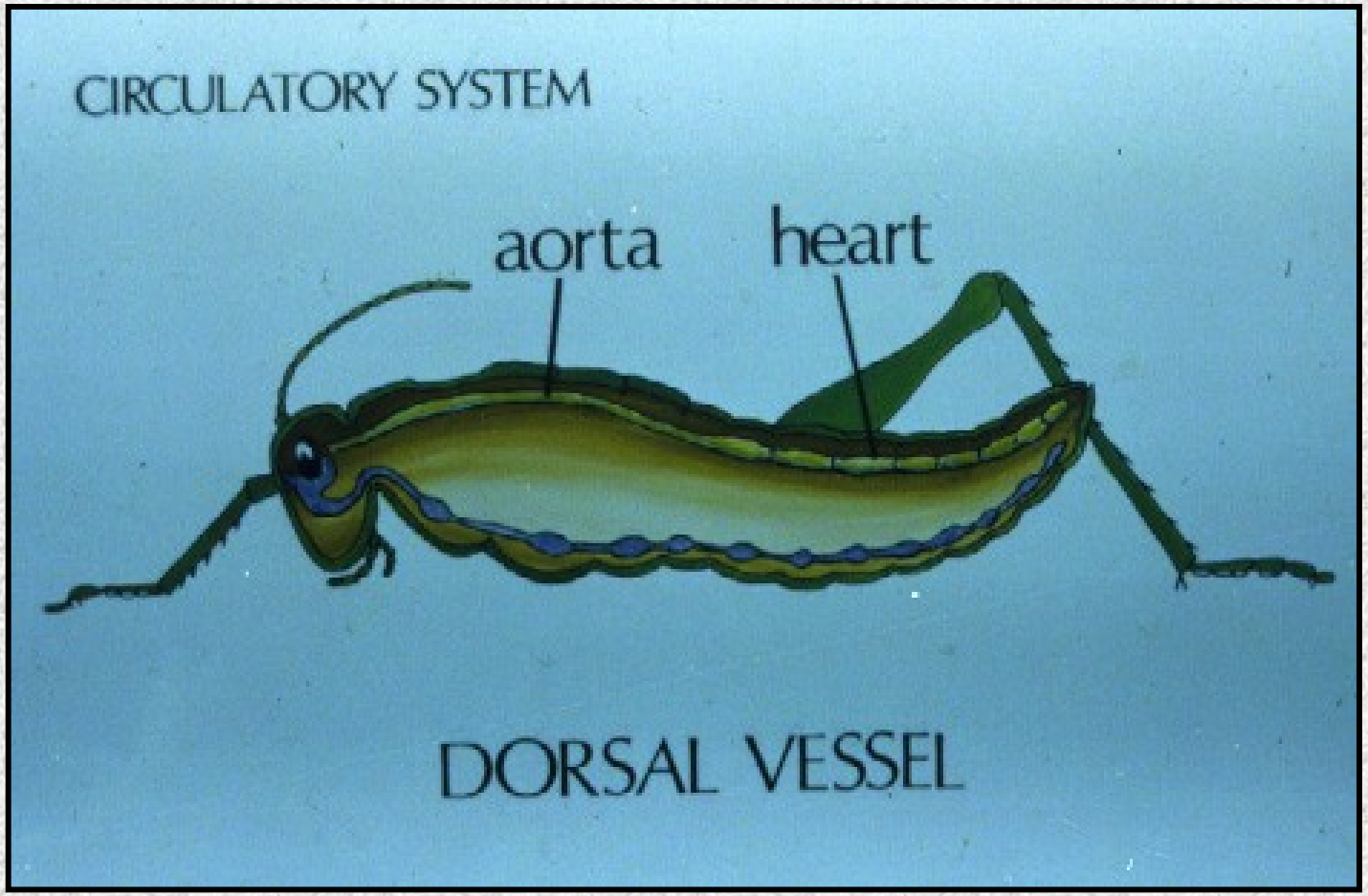
The Insect Circulatory System

- Not significantly involved in the movement of oxygen and carbon dioxide through body
- Movement of “information” throughout the body
- Important in storage,

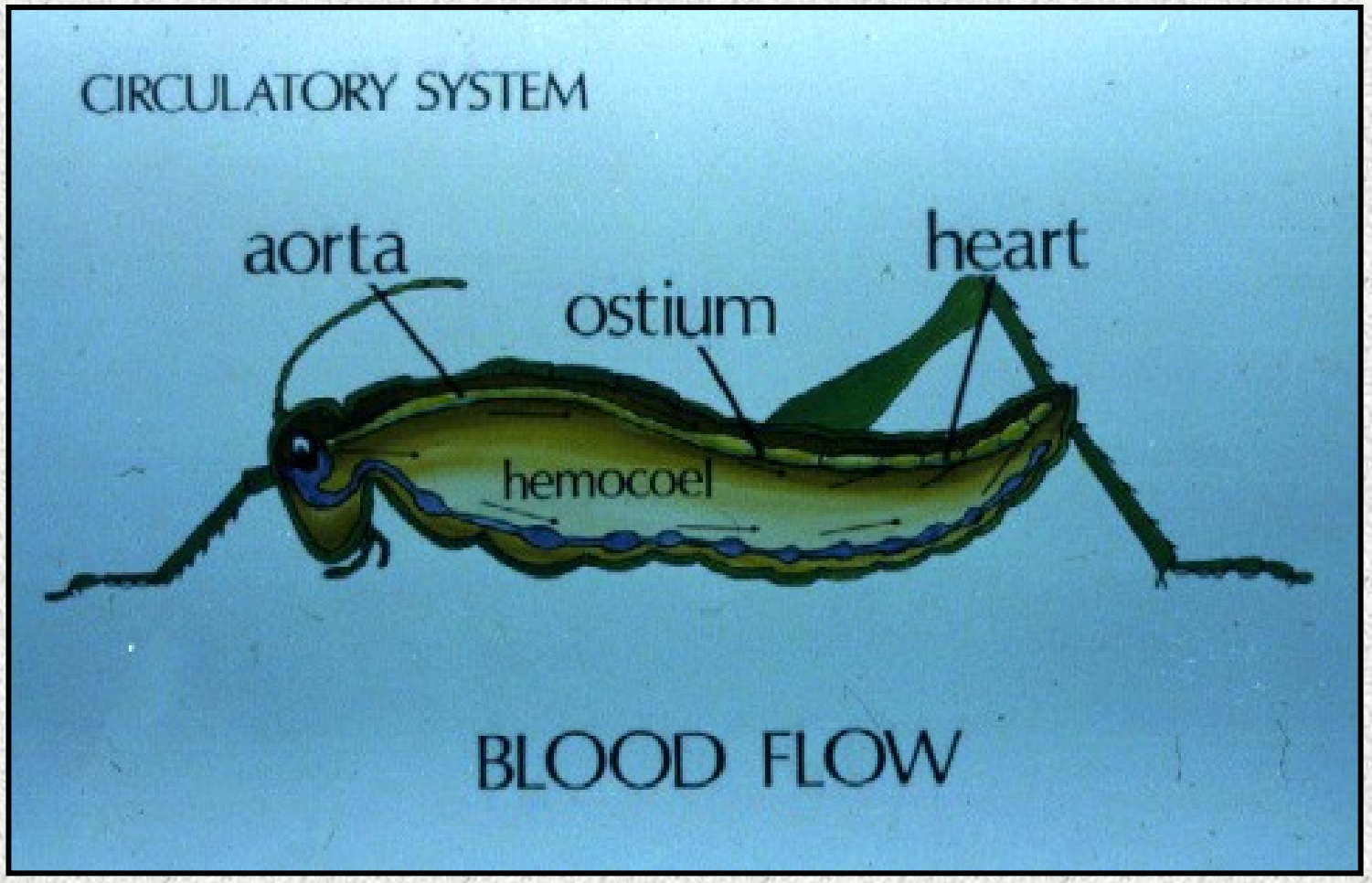
The Insect Circulatory System



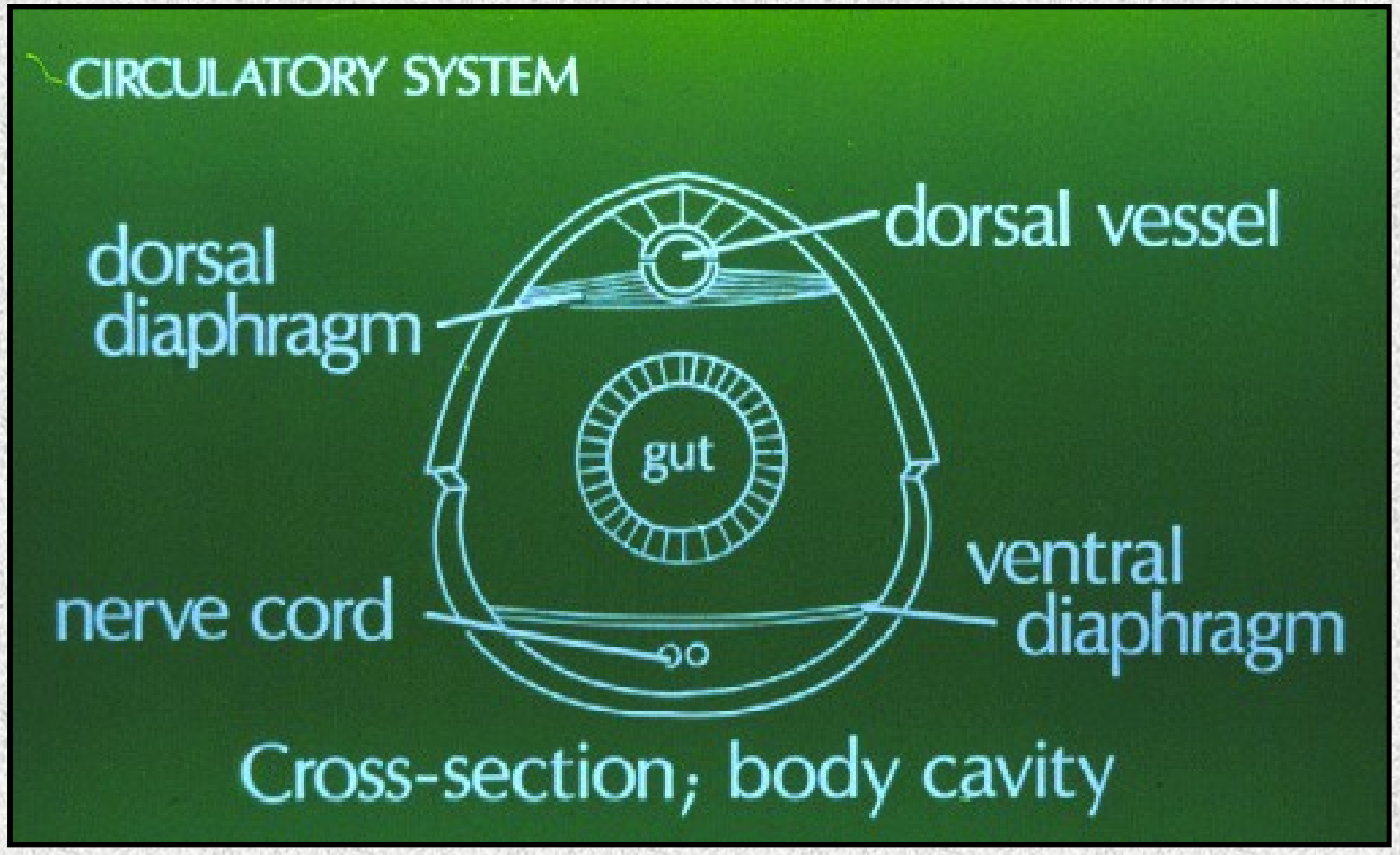
The Insect Circulatory System



The Insect Circulatory System



The Insect Circulatory System



The Insect Circulatory System

- Hemolymph = insect “blood”
  - Hemocytes
    - “blood” cells serving various functions
  - H_2O (water)
  - Inorganic ions
  - Organic molecules

Hemolymph Functions

- Transport
  - Nutrients
  - Waste products
  - Hormones
- Storage
  - Water
  - Ions
- Hydraulic Function
  - Internal pressure

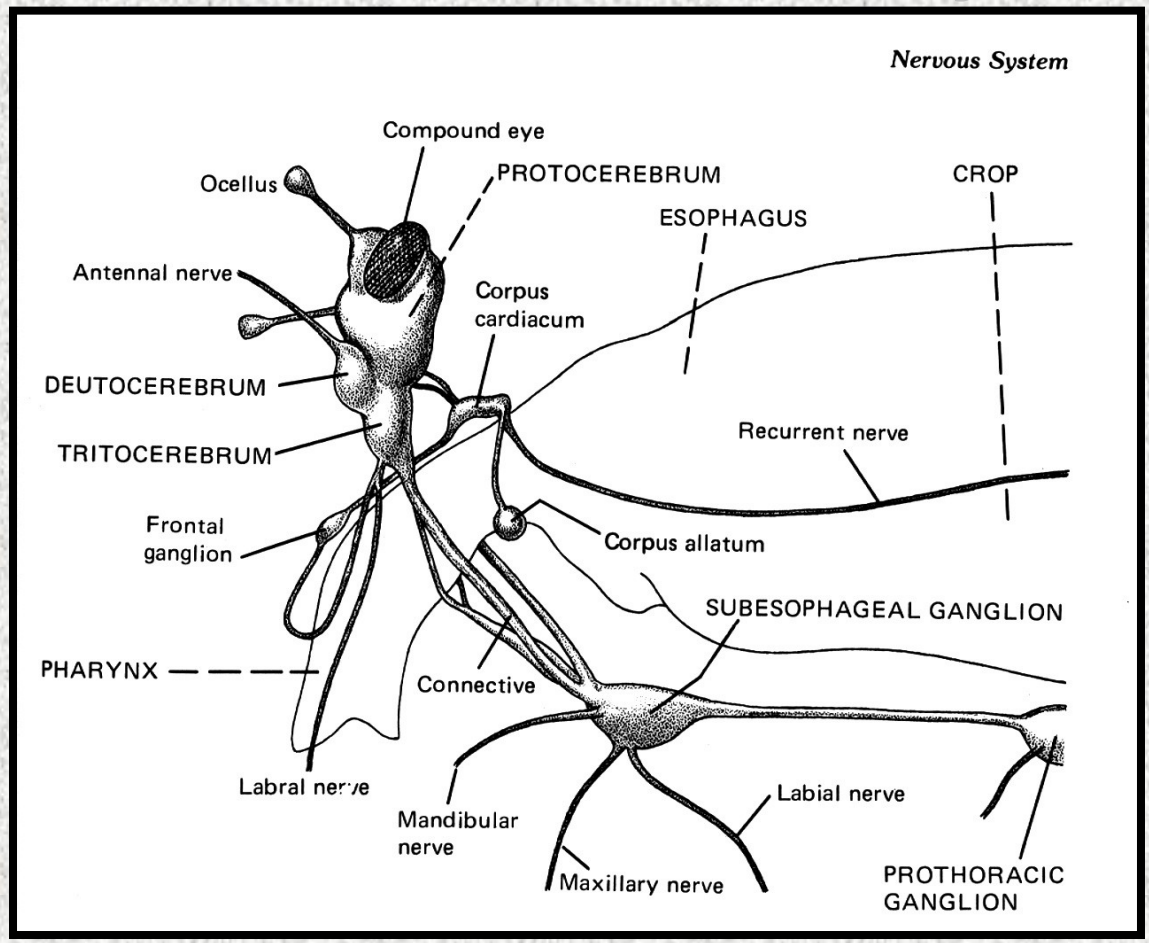
Remember

Insect Blood does not contain hemoglobin. It does not transport oxygen!

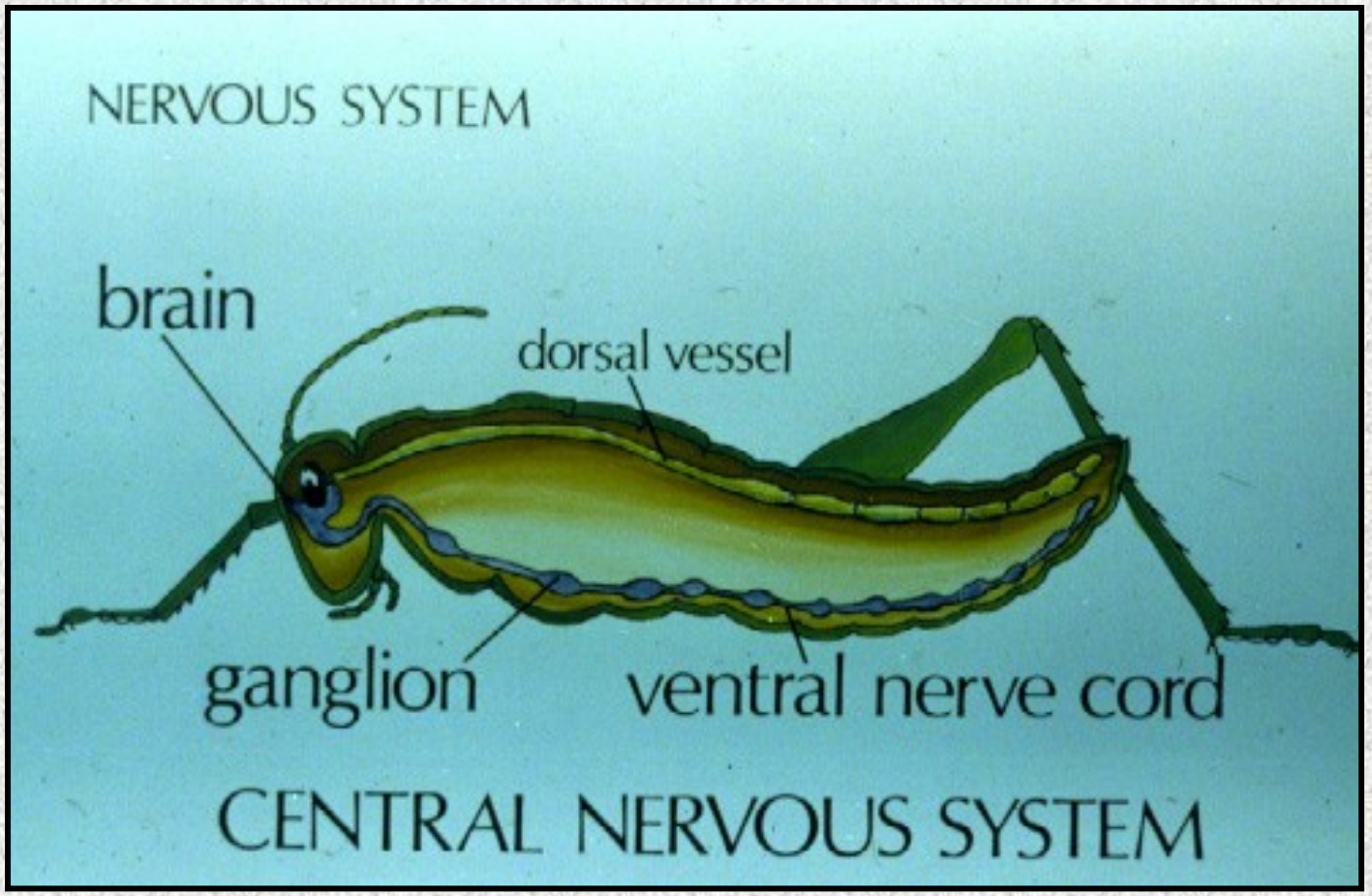
Some Hemocyte Functions

- Phagocytosis
- Coagulation
- Wound Healing
- Encapsulation

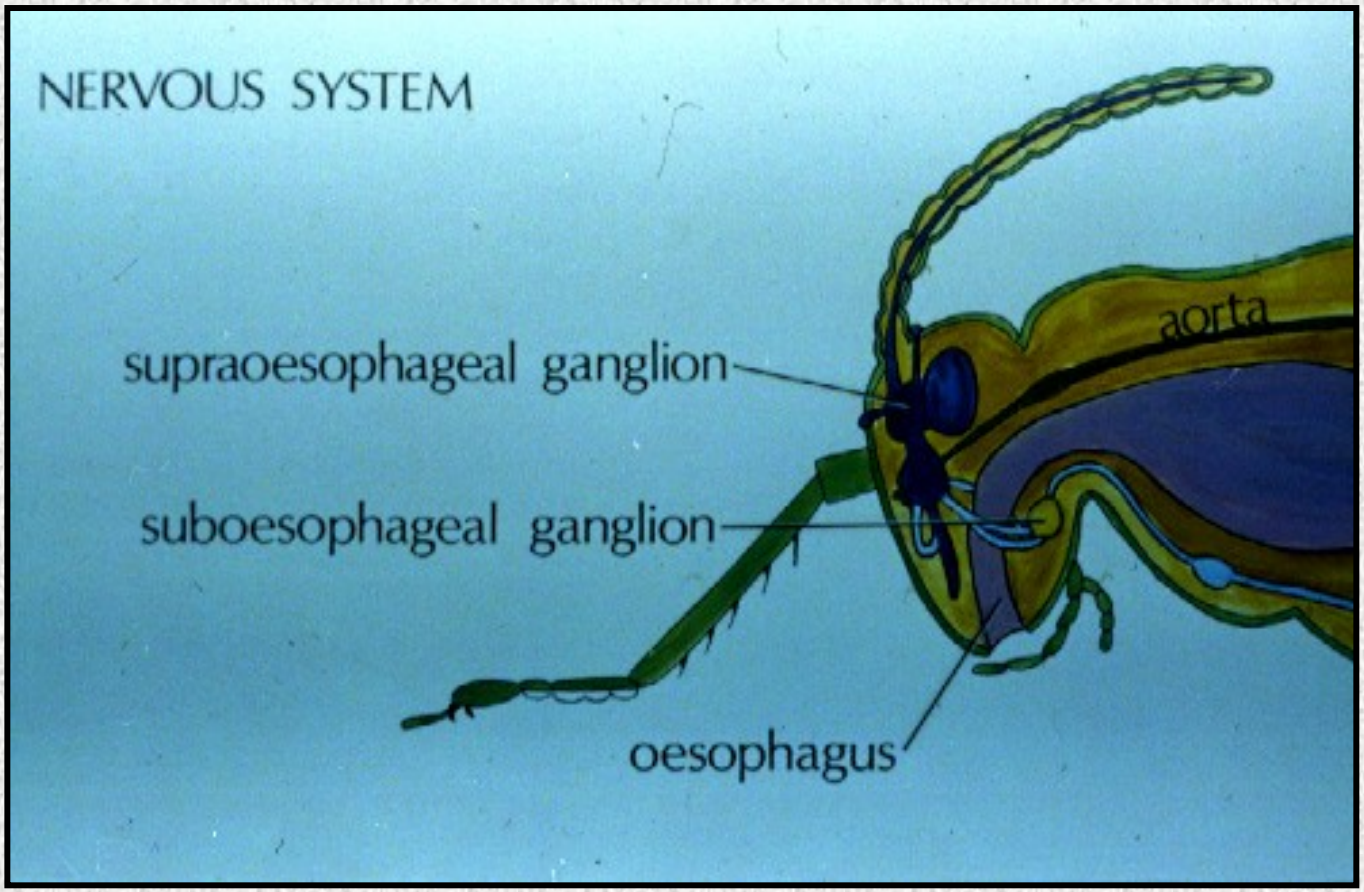
The Insect Nervous System



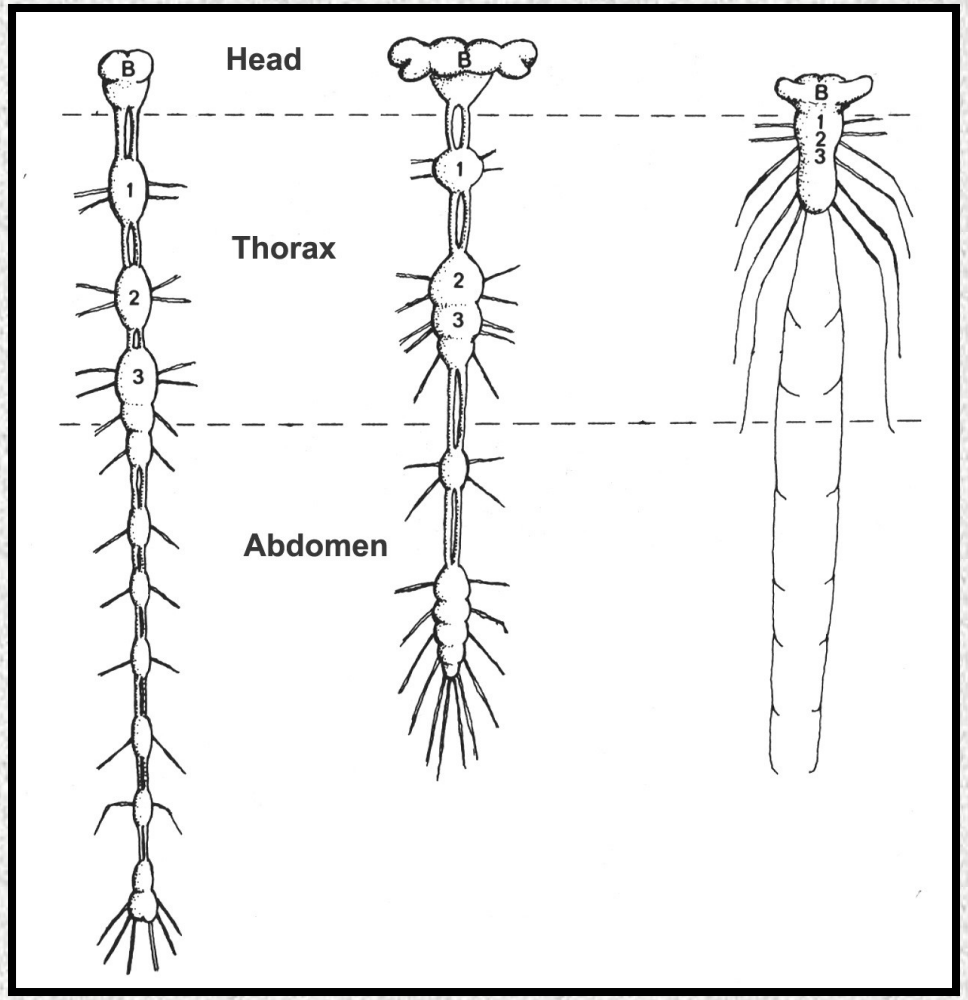
The Central Nervous System



The Central Nervous System

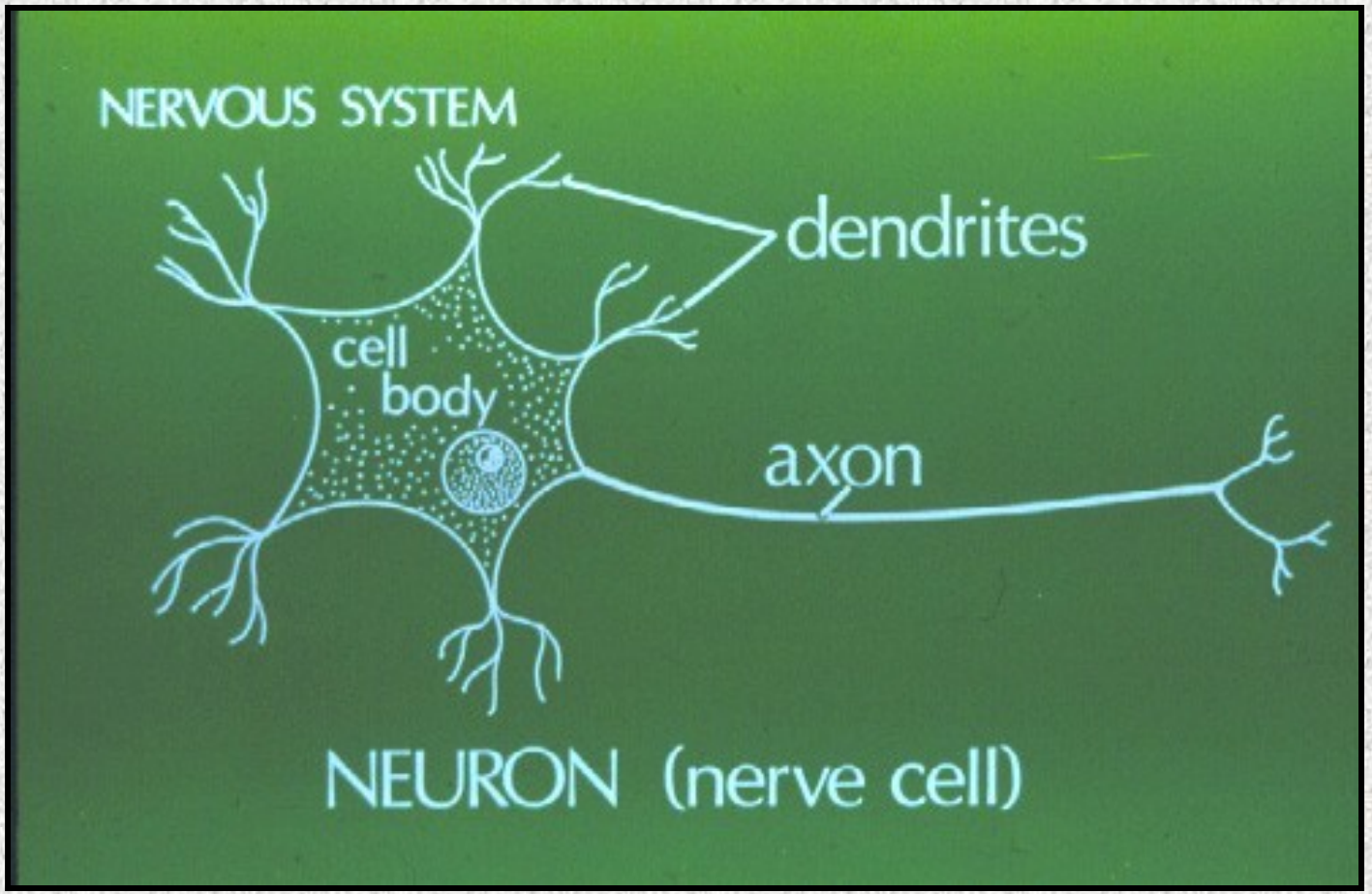


The Peripheral Nervous System



Insects and People
Internal Morphology

Neurons - Nerve Cells



Neuron Types

- Sensory
  - Associated with sensory structures
- Motor
  - Associated with muscles and glands
- Association
  - Witin CNS

The Nervous System