

Animal Structures and Functions

I. Classification of Animals

a. Body Symmetry

i. Radial

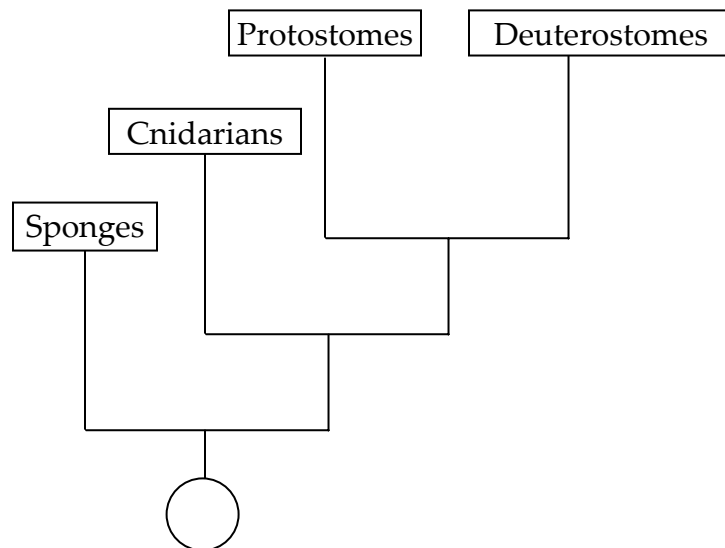
1. Circle
2. i.e. Starfish (Echinodermata)

ii. Bilateral

1. Half
2. i.e. Human (Vertebrate/Chordata)

iii. Classification

1. Animals



b. Body Cavity

i. Acoelomate

1. No enclosed body cavity
2. Only internal cavity: Digestive tract

ii. Pseudocoelomate

1. Fluid filled space in which body organs float

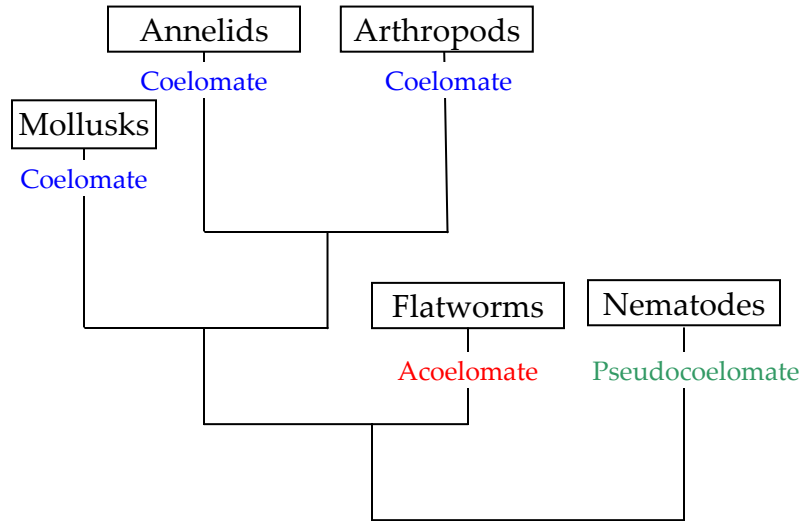
iii. Coelomate

1. Body cavity is lined with the Peritoneum
2. Organs are in pouches in the Peritoneum

c. Development Patterns

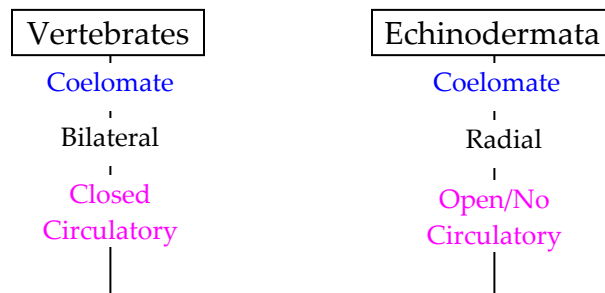
i. Protostome

1. Spiral cleavage
 - a. Initial stages
2. Mouth forms first
3. Embryo would not survive if one cell was missing



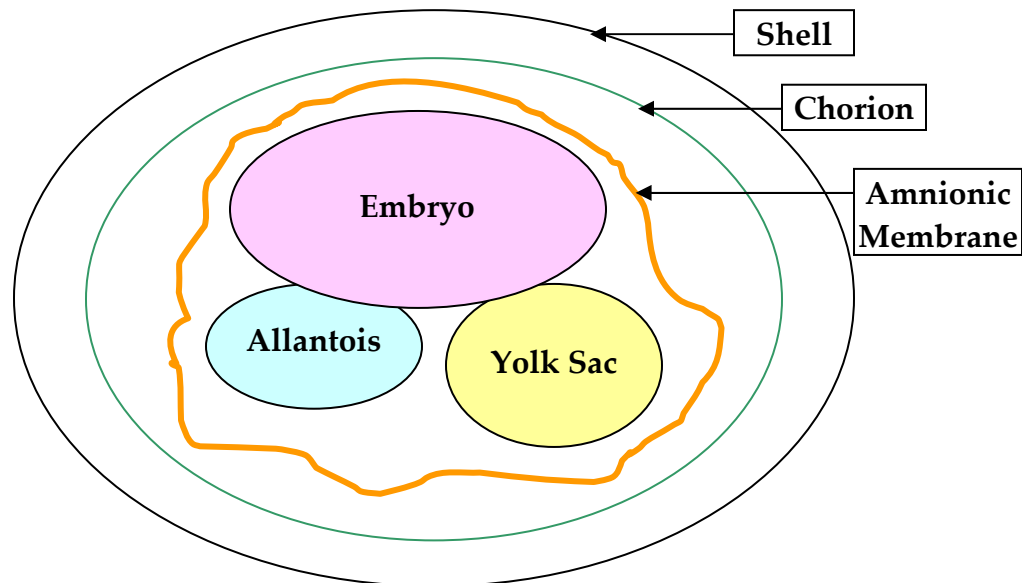
ii. Deuterostome

1. Radial cleavage
 - a. Initial stages
2. Anus forms first
3. Embryo could survive if one cell was missing
 - a. i.e. Twins
4. Coelomates
 - a. Fluid filled cavity



II. Classification of Vertebrates

- a. Chondrichthyes
 - i. Marine
 - ii. Sharks
 - iii. Rays
- b. Osteichthyes
 - i. Bony fish
 - ii. Marine/freshwater fish
- c. Amphibians
 - i. Breathe through lung or skin
 - ii. No scales
 - iii. No amnion or shell
- d. Reptiles
 - i. Scales
 - ii. Amniotic eggs
 - 1. allow embryo to survive on land without drying out



- | | |
|---------------------|--|
| 2. Shell: | Outer hard protective covering |
| 3. Chorion: | Permeable to gasses, not H ₂ O |
| 4. Amnion Membrane: | Surrounds and provides H ₂ O for the embryo |
| 5. Yolk Sac: | Provides nourishment for the embryo |
| 6. Allantois: | Stores Nitrogenous waste from embryo |

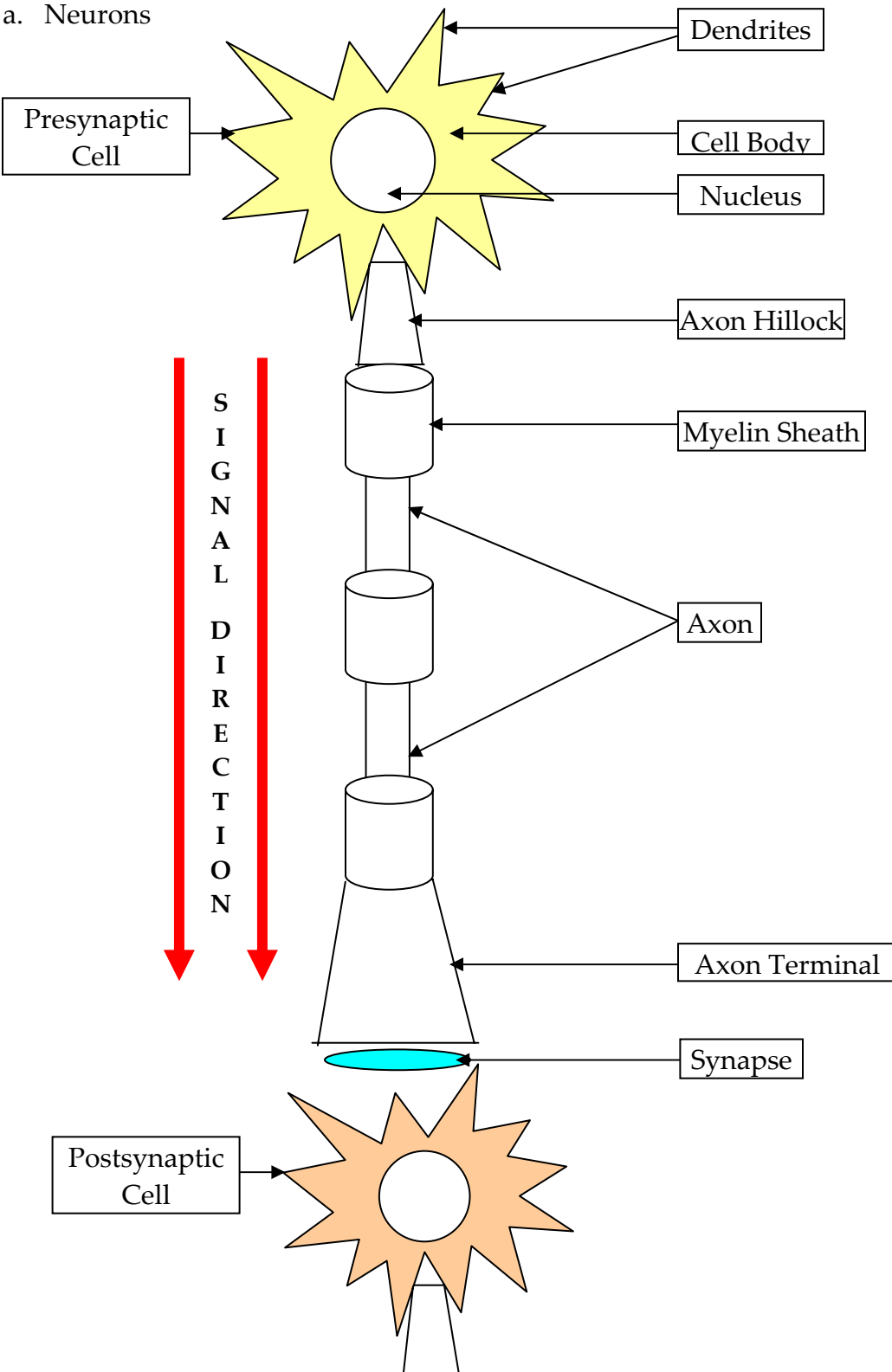
- e. Aves
 - i. Birds
 - ii. Amniotic eggs
- f. Mammals
 - i. Milk for young
 - ii. Hair

III. Immune System

- a. Non-specific Immunity
 - i. Skin
 - ii. Mucus Membrane
 - iii. Interferons
 - 1. Proteins that help prevent viral replication
 - iv. Macrophages
 - 1. Immune cells that eat bacteria
- b. Specific Immunity
 - i. Humoral Response
 - 1. **B-cells**
 - a. Antibodies bind to antigens
 - b. Helper T-cells release **Cytokines**
 - c. **Cytokines** encourage B-cells to reproduce
 - d. B-cells produce **Plasma Cells** (antibodies)
 - e. **Plasma Cells**
 - i. Inactivate antigens
 - ii. Some become memory cells for the next occurrence
 - ii. Cell-Mediated
 - 1. **T-cells**
 - a. Recognizes antigen in infected cell
 - b. Reproduces and replicates
 - c. Secretes **Perforin**
 - d. **Perforin** destroys the cell

IV. Nervous System

a. Neurons



- i. Cell Body: Houses the neuron's nucleus and organelles
- ii. Dendrites: Shorter extensions of the Cell body that receive signals from other neurons
- iii. Axon: Longer extension of the Cell body that transmits signals to other cells
- iv. Axon Hillock: Conical region of an axon where it joins the cell body
- v. Axon Terminal: End point of the axon – connecting to the synapse
- vi. Myelin Sheath: Layer enclosing the axon
 - a. Speeds up signal
- vii. Synapse: Site of communication between a synaptic terminal and another cell
- viii. Presynaptic Cell: Cell carrying/transferring the signal
- ix. Postsynaptic Cell: Cell receiving the signal

b. Transfer of Signal

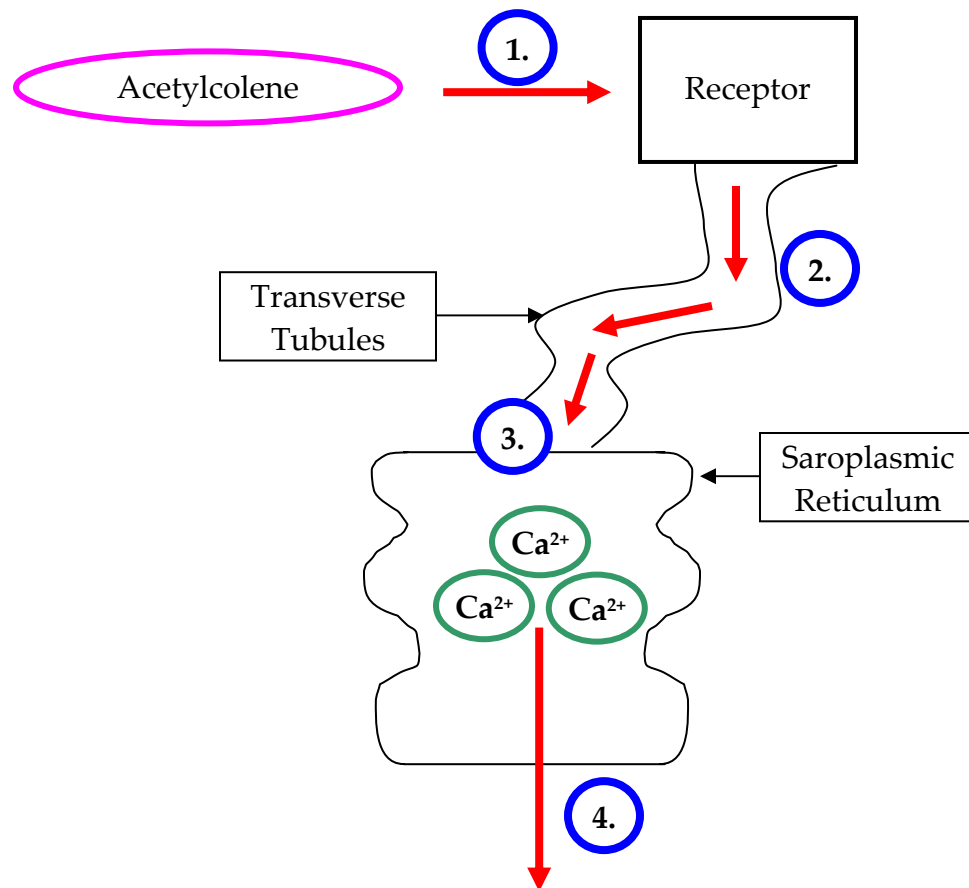
- i. Dendrites receive signal from neurotransmitter
- ii. Neuron has a charge of -70mV at rest
- iii. A chemical gated Sodium (Na^+) channel opens
- iv. Rush of Sodium (Na^+) causes the inside of the cell body to depolarize
- v. Voltage-gated Sodium (Na^+) channels open
- vi. Neuron has a charge of $+100\text{mV}$
- vii. Action potential is carried down the axon
- viii. Voltage-gated Potassium (K^+) channels open to balance charge
- ix. Neuron has a charge of -70mV
 - 1. Potassium (K^+) and Sodium (Na^+) are on the wrong sides
- x. Potassium (K^+) and Sodium (Na^+) pumps restore original -70mV
- xi. Calcium (Ca^{2+}) channels open in response to a positive charge
- xii. Neurotransmitter vesicle fuses with membrane and contents undergo exocytosis
- xiii. Neurotransmitter crosses synapse
- xiv. Neurotransmitter carries signal on to the dendrites on the next neuron

- c. Types of Nervous Systems
 - i. Central Nervous System
 - 1. Brain
 - 2. Spinal Chord
 - ii. Peripheral Nervous System
 - 1. Somatic (Voluntary)
 - 2. Autonomic (Involuntary)
 - a. Sympathetic
 - i. "Fight or Flight" Response
 - ii. Raise heart beat
 - iii. Raise heart rate
 - iv. Raise respiration
 - v. Constrict blood vessels
 - vi. Stop digestion
 - vii. Raise glucose levels in blood
 - viii. *STRESS*
 - b. Parasympathetic
 - i. Relaxing
 - ii. Back to Homeostasis
- d. Brain
 - i. Cerebrum
 - 1. Voluntary activities
 - a. Receive/Interpret
 - ii. Cerebellum
 - 1. Coordination
 - iii. Hypothalamus
 - 1. Homeostasis
 - iv. Medulla Oblongata
 - 1. Involuntary activities
 - a. Breathing

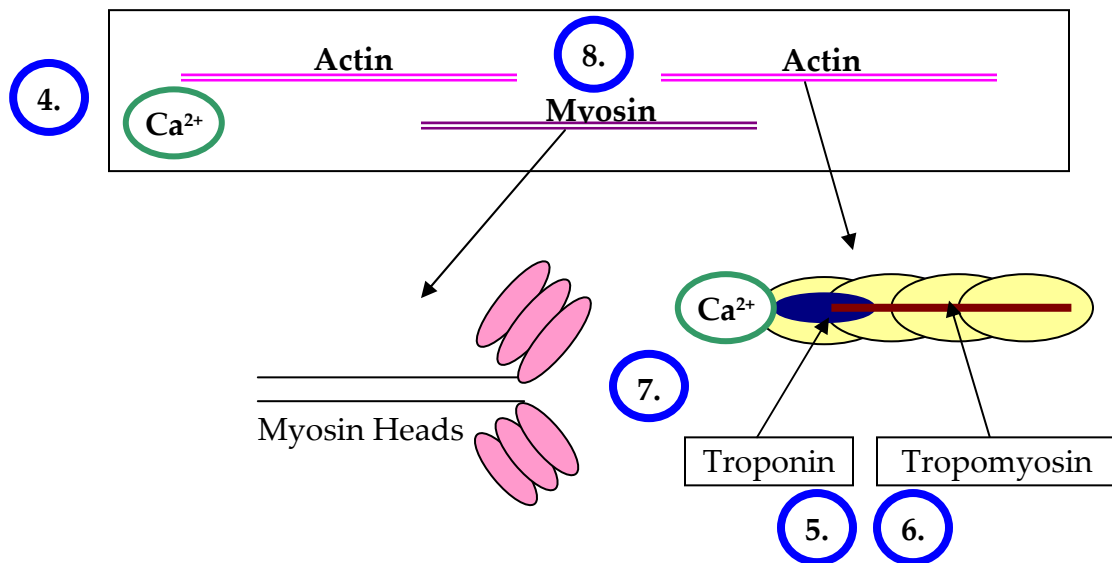
V. Muscle System

a. Neurotransmitter is **Acetylcolene**

- i. Bind to receptor
- ii. Receptor send signal through transverse tubules
- iii. Transverse tubules send signal to the Sarcoplasmic Reticulum
- iv. Sarcoplasmic Reticulum releases **Calcium (Ca^{2+})** into the muscle



- v. **Calcium (Ca^{2+})** binds to **Troponin** and moves **Troponin**
- vi. **Troponin** moves **Tropomyosin**
- vii. **Myosin** binds to **Actin**
- viii. **Myosin** and **Actin** move towards each other
 - 1. **Muscle gets shorter**
 - 2. **Muscle Contraction**



VI. Reflexes

- a. **Sensory Neuron** sends message to **Interneuron** in the Spinal Chord
- b. **Interneuron** sends message to the **Motor Neuron**
- c. **Motor Neuron** acts on the **Effector**

VII. Circadian Rhythms

- a. Purpose
 - i. Internal Clock
 - ii. Daily cycle of temperature, metabolic rate, etc.
- b. Behavior
 - i. Imprinting: First site
 - ii. Innate/Instinctive: Genetically programmed – Natural
 - iii. Learned: Over-time
 - 1. Habituation: Loss of old responses
 - 2. Conditioned: Associative (bell with food)
 - 3. Trial and Error: Repetitive trials
 - 4. Insight: Application of past experiences for a new situation