Topic 12

Basic principle:

While there is significant diversity of animal forms, for all animals, form is: (1) intimately tied to function, (2) acted upon by natural selection, and (3) constrained by physical laws.

Learning outcomes:

1) Explain what is meant by structure can provide clues to function; list examples
2) Identify the major levels of organization in living organisms, from the simplest to the most complex
3) Provide examples to show how each successive level of structural/functional organization displays novel emergent properties
4) Identify the body's four major tissue types and their roles; differentiate between specific examples of tissue types according to their anatomy and function
5) Compare and contrast the related functions of the endocrine and nervous systems
6) Discuss the significance of homeostasis, with particular emphasis on thermoregulation
7) Distinguish how negative feedback mechanisms regulate internal conditions

Vocabulary words:

1) Anatomy

Biological forms.

2) Collagen

The main structural protein of the various connective tissues in animals. As the main component of connective tissue, it is the most abundant protein in mammals.

3) Fiber

A thin and elongated cell.

4) Glial cell

Nourish, insulate, and replenish neurons. Modulate neuron functions.

5) Physiology

Biological functions.

6) Loose connective tissue

Most widespread tissue in vertebrates. Binds epithelia to underlying tissues and holds organs in place. Fibers are loosely woven. Adipose fat is a type of loose connective tissue.

7) Endocrine system

Signaling molecules (hormones) released into the bloodstream by endocrine cells. Hormone (signals) carried to locations in body. Slow, gradual changes.

8) Cell

The smallest structural and functional unit of life.

9) Adipose tissue

A type of loose connective tissue. Protects organs etc.

10) Hormone

Sent thru body by endocrine system as signals. Cells have receptors for specific hormones.

11) Tissue

Groups of cells with a similar appearance/common function. Tissues are organized into functional groups called organs.

12) Fibrous connective tissue

Dense with collagenous fibers. It is found in tendons (attach muscles to bones) and ligaments (bones to joints).

13) Homeostasis

Steady State. Maintenance of internal balance. Animals maintain a relatively constant internal environment even when the external environment changes significantly. Mammals: 37C, pH 0.1-7.4, and blood glucose 70-110 mg glucose/100 mL blood.

14) Organ

Different types of tissues are organized into function units. Groups of organs form systems.

15) Bone

Mineralized connective tissue. Osteoblasts form bones and osteoclasts eat away at them.

16) Regulators vs Conformers

Regulators:

An animal regulates for its environmental variables if it uses internal mechanisms to control internal changes in the face of external fluctuations. It can maintain its internal homeostasis through metabolism.

Conformers:

An animal is a conformer if it allows its internal conditions to change in response to an outside change in variables. Animals may conform to some external variables and regulate others.

17) Organ system

Groups of organs working together. Integumentary (skin, hair, nails, exocrine glands [sweat]), Skeletal, Nervous, Cardiovascular, Endocrine, Muscular, Digestive.

18) Cartilage

A tough, elastic, fibrous connective tissue.

19) Endotherm

Humans, mammals, birds. Warmed mostly by own metabolism. Some other reptiles, fish, etc. can do this (not many). Maintain internal temp (heating and cooling). Not mutually exclusive with ecothermy.

20) Novel emergent property

"The whole is greater than the composition of its parts." An organism becomes so complex that its parts have more functions that they do apart.

21) Blood

Loose connective tissue (cells suspended in a matrix). The interstitial fluid of vertebrates.

22) Ecotherm

Reptiles, fishes, amphibians, and most invertebrates. They gain their heat from external sources. Many ectotherms have high body temperatures than endotherms. Not mutually exclusive with endothermy.

****A poikilotherm is an organism whose internal temperature varies considerably. It is the opposite of a homeotherm, an organism which maintains thermal homeostasis.**

23) Epithelial tissue

Sheets of cells that cover the outside of the body and line organs. They function as barriers against pathogens, fluid loss, mechanical injury, etc.

24) Muscle tissue

Skeletal, Smooth, Cardiac. All made up of Actin and Myosin. Skeletal: Attached to bones by tendons (voluntary movement). Smooth: Digestive, urinary, bladder, arteries, internal organs. Cardiac: Contractile wall of heart (synchronization).

26) Thermoregulation

A process by which animals maintain their body temp within a normal range. Body temp outside the normal range can make enzymes less effective. Integumentary system is important here.
Insulation (hair, feathers, etc.). Circulatory Adaptations (blood flow from internal of body to near external-bring cold blood back in to be heated and bring blood from center of body to circulate near surface and let off heat)-Vasodilation (when too hot) and Vasoconstriction (when too cold).
Evaporation (panting, sweating, etc.). Behavior. Adjusting metabolic heat production.

27) Simple squamous epith.

A single layer of flat cells in contact with the basal lamina (basement membrane) of the epithelium. This type of epithelium is often permeable and occurs where small molecules pass quickly through membranes via filtration or diffusion. The lining of the mouth, lung alveoli and kidney tubules all are made of epithelial tissue. The lining of the blood and lymphatic vessels are of a specialized form of epithelium called endothelium.

28) Skeletal muscle

Attached to bones by tendons (voluntary movement). **Striat**ed muscle.

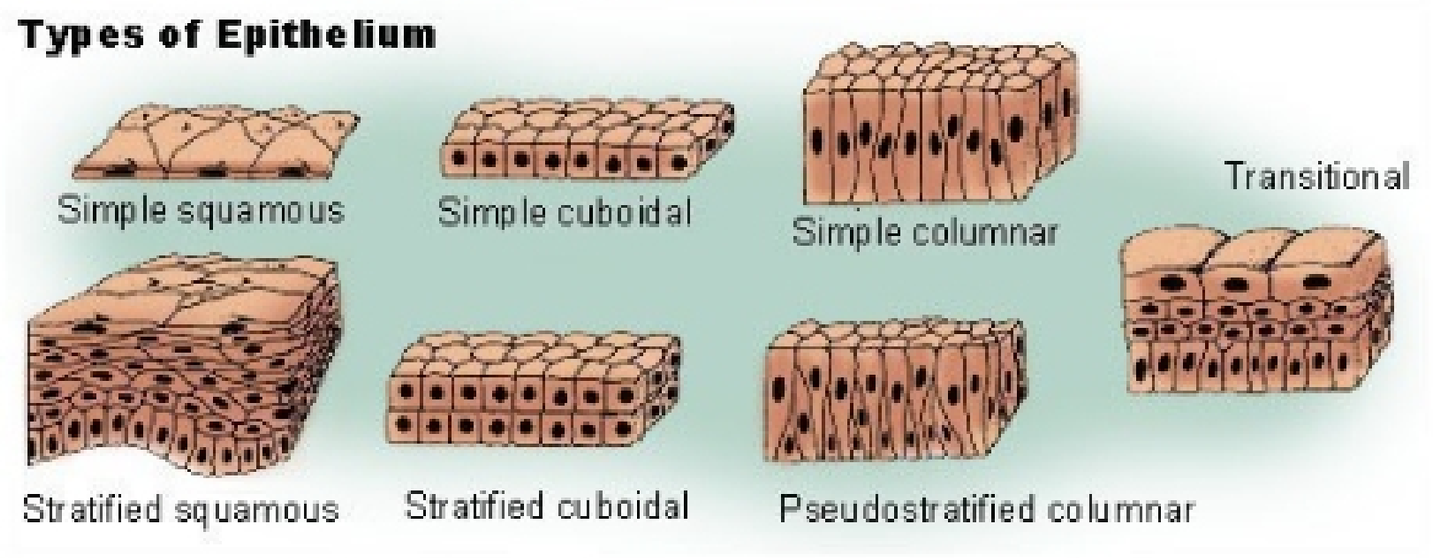
29) Vasodilation

The dilatation of blood vessels, which decreases blood pressure. Occurs under heat.

30) Stratified squamous epith.

Consists of squamous (flattened) epithelial cells arranged in layers upon a basal membrane.

Location: non-keratinized type forms the moist lining of the esophagus, mouth, and vagina; keratinized type forms the epidermis of the skin, a dry membrane.



31) Smooth muscle

Digestive, urinary, bladder, arteries, internal organs. Cardiac: Contractile wall of heart (synchronization).

32) Vasoconstriction

The constriction of blood vessels, which increases blood pressure. Occurs under cold conditions.

33) Connective tissue

Sparse population of cells scattered through an extracellular matrix. Holds tissues and organs in place. The matrix is generally a web of fibers embedded in liquid. Within the matrix are many cells called fibroblasts which secrete proteins and macrophages (engulf foreign particles and debris by phagocytosis).

34) Cardiac muscle

Cardiac: Contractile wall of heart (synchronization). Made of smooth muscle.

35) Countercurrent exchange

In many birds and mammals, reducing heat loss often relies on countercurrent exchange (the transfer of heat (or solutes) between fluids that are flowing in opposite direction). In occurs with arteries (from heart) and veins (back toward heart).

36) Fibroblast

A fibroblast is the most common type of cell found in connective tissue. These cells build bones.

37) Nervous tissue

Deals with info. Contain neurons (nerve cells) that transmit nerve impulses and support Glial Cells. Concentrated nervous tissue creates brain. Neurons: Dendrite-->Cell Body-->Axon-->Terminal-->Other Cells.

38) Hypothalamus

The sensors for thermoregulation are concentrated in the hypothalamus (brain region that also dictates circadian rhythms). A group of nerve cells functions as a thermostat and respond to temps outside the normal range and promote heat gain or loss. Based on feedback mechanisms for thermoregulation in humans mammals.

39) Matrix

Connective tissue is a sparse population of cells scattered through an extracellular matrix. Holds tissues and organs in place. The matrix is generally a web of fibers embedded in liquid. Within the