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Biology 1306/1406 – Modern Concepts in Bioscience II
Week of April 19th, 2021

Hey everyone, I hope that the semester is going well for everyone. Only two more weeks until finals, y'all are ALMOST THERE ☺. You can do this!!

Keywords: Reproduction, Osmoregulation, Excretion, Nephron, Succession, Ecosystems

Our Group Tutoring sessions will be every Thursday from 7:00-8:00 PM. You can reserve a spot at https://baylor.edu/tutoring. I hope to see you there!

This week in Biology 1306, we will be covering Campbell Chapters ch 44, 46 and 55

Osmoregulation and Excretion : Campbell chapter 44

Osmoregulation is achieved by actively pumping solute in and out of cells to move water passively. There are two ways to maintain water balance: **Osmoconformance** and **Osmoregulation.** Most invertebrates are osmoconformers and all osmoconformers are marine animals. Here are a few definitions to be familiar with:

Osmoregulation: active transport of solutes to passively move water
Osmoconformer: does not transport solute, takes on the conditions of the external environment (isosmotic with its surroundings) **ALL OSMOCONFORMERS ARE MARINE ANIMALS**
Osmoregulator: will actively move solute to create a new ideal environment for the organism
Stenohaline: organism that cannot tolerate changes in external osmolarity
Euryhaline: organism that can survive large changes in osmolarity (ex. Salmon)

Animals face different challenges related to osmolarity and therefore regulate differently:

Marine animals' main issue is water loss due to higher solute concentration in their environment, so they excrete **urine with a high concentration of salt** and very little water. **Land Animals** face the same issue, instead worrying dehydration. They **convert NH3 to urea** prior to excretion as a way to conserve water. **Freshwater Animals** face the opposite problem. Due to the higher concentration of salts in their bodies, as compared to their outside environments, they are worried about water gain. Thus, they take in salt through their gills and **excrete large amounts of very dilute urine**.

THE MAIN PURPOSE OF EXCRETION IS TO ELIMINATE NITROGEN WASTE

Fish eliminate nitrogen in the form of **Ammonia** because it is highly soluble in water, but it is also highly toxic. **Mammals, amphibians, sharks and some fish** eliminate **Urea**. Though it is not as soluble as ammonia, it helps prevent water loss in terrestrial animals. **Birds, insects, and reptiles excrete Uric Acid.** Though it requires much more energy to process, it is much less toxic and thus will not poison an organism while it is still growing inside an egg. **The form of nitrogen waste excreted will always match its function!!!**

Diverse Excretory Systems are Variations on a tubular theme:

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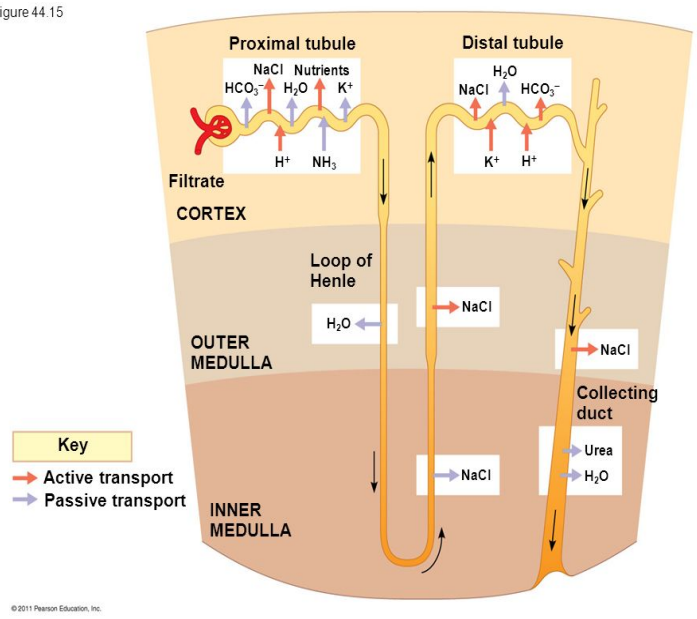
Protonephridia- seen in flatworms which lack a body cavity. Cellular units called **flame bulbs** cap the ends of the protonephridia and each bulb has tubule projections covered in cilia which beat water and solutes from the interstitial fluid before excreting it (purely osmoregulatory)
Metanephridia- seen in earthworms where each segment gathers its own wastes and excretes it through holes in the skin
Malpighian Tubules- seen in insects and arthropods; Out pockets dump nitrogenous wastes into the digestive system to be excreted. Some of the salts are reabsorbed in the rectum

Nephrons are the functional unit of the Kidney.

There are 5 steps in the nephron process. It is important to remember that we discuss "in" and "out" in relation to the filtrate, not the body.

1. Blood is filtered and filtrate is pushed out of the **Glomerulus** and into **Bowman's Capsule**
2. In the **proximal tubule**, H+ is actively transported in, NaCl and nutrients actively out, NH3 passively in, and water, K+, and HCO3 out
3. Next the filtrate enters the **Loop of Henle,** where 90% of reabsorption happens
   a. **Descending:** water is transported out passively
   b. **Ascending:** the vessel is impermeable to water and NaCl is actively transported out to re-establish the concentration gradient in the kidney
4. Then the K+ and H+ are actively transported in, NaCl and HCO3 actively out, and water passively out at the **Distal Tubule**
5. Finally, the filtrate reaches the **Collecting Duct**, the most important position for finalizing the filtrate. The collecting duct can be regulated by a couple of hormones
   a. **Anti-Diuretic Hormone (ADH)-** makes the collecting duct permeable to water, causing water to be reabsorbed into the body (OUT of filtrate)
   b. RAAS- acts similarly, increasing the Collecting Duct's permeability to water thus increasing blood volume



Animal Reproduction: Campbell chapter 46

Animal reproduction can fall into two categories: sexual reproduction and asexual reproduction.

First, let's start with some definitions:

Sexual Reproduction- (haploid) male and female and gametes fuse to form a diploid, 2n, zygote
- Creates the possibility of competition between gametes

Asexual Reproduction- creation of offspring without the fusion of gametes
- Sex reversal and **hermaphroditism**-being both male and female, can make this possible
- **Parthenogenesis-** the production of embryos without sperm fertilization can power asexual reproduction as well

Fertilization- can occur externally or internally
- **External Fertilization-** sperm and egg are both released outside of the body to form a zygote

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- **Internal Fertilization-** sperm fertilize the egg inside of the female reproductive system
    - Often found in animals who produce few offspring ex. Humans, bears and lions
    - Often found in animals who participate in parental care of offspring
- Fertilization requires timing of reproductive cycles: sperm must be released at a time when an egg is available to be fertilized. This timing can be influenced by pheromones, mating rituals, and cues from the external environment

Gonads- produce gametes

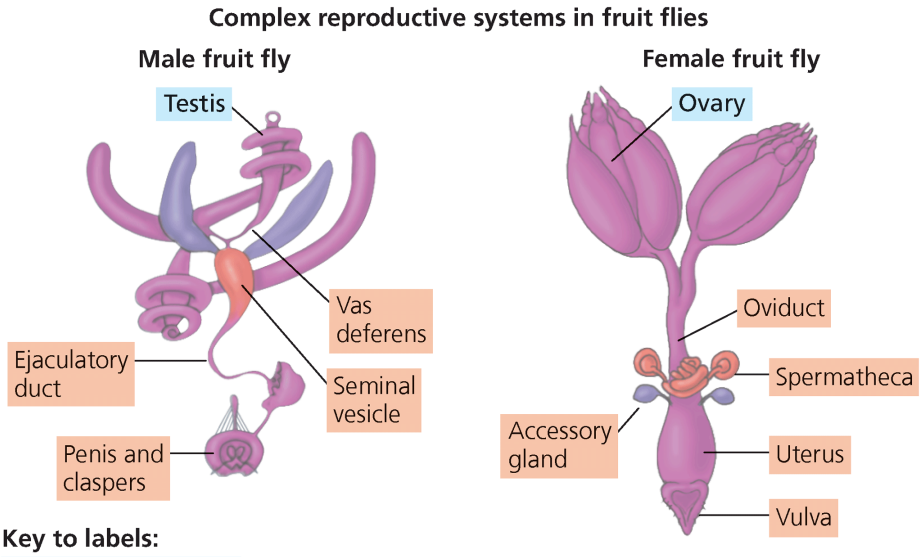
Reproductive systems have varying levels of complexity:

Male fruit fly anatomy includes:

- **Testis-** creates sperm
- **Vas Deferens-** brings sperm to seminal vesicle
- **Seminal Vesicle-** seminal fluid is added to sperm
- **Ejaculatory Duct-** carries semen to penis
- **Penis and Claspers**

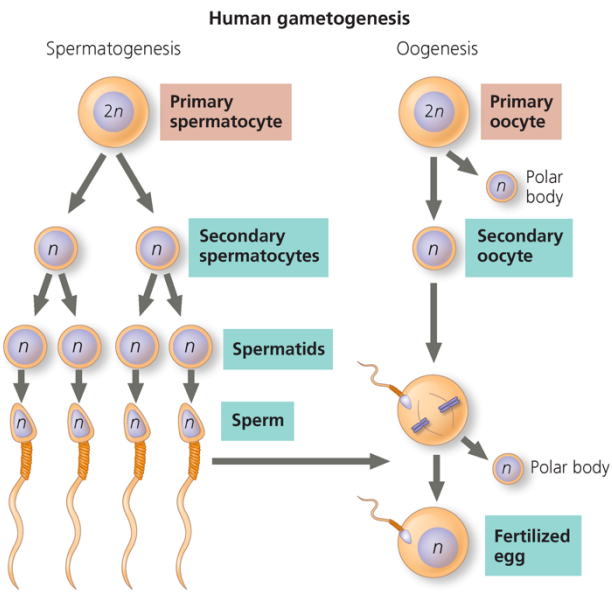
Female fruit fly anatomy includes:

- **Ovary-** creates ovum
- **Oviduct-** carries egg to Uterus
- **Uterus-** egg is fertilized here
- **Spermatheca-**
- **Accessory Gland-**



Check out this video to learn about human reproductive anatomy. It is more detailed than what you need to know, but a good resource.

Male: https://www.youtube.com/watch?v=RhBS9ANCVL8
Female: https://www.youtube.com/watch?v=LPvqphgIYXE



To learn about spermatogenesis, and oogenesis check out this video: https://www.youtube.com/watch?v=vonVty4kTuc

Ecosystems and Restoration Ecology – Campbell chapter 55

Ecosystems consist of all of the biotic and abiotic factors in an area. Within an ecosystem, there is a **flow of energy** from the sun, to the heat that is eventually lost to the environment. Throughout this process, detailed below, energy is conserved. Similarly, the chemical elements that enter and leave an ecosystem are conserved according to the law of conservation of mass. How

much energy is available at each trophic level is determined by:

Net primary production: the energy accumulated in plant biomass
Production efficiency: the efficiency of turning chemical energy into biomass at each level of the food chain; how effectively energy level is maintained
Trophic Efficiency: the percentage of energy that is transferred from one trophic level to the next in a food chain; this is usually 10%
- For example, when a lion eats a gazelle, the lion is only going to get 10% of the energy held in the gazelle's organic matter

Finally, we will briefly touch on the concept of ecological succession:

Ecological Succession: a sequence of changes in community composition following a disturbance. Succession can be PRIMARY or SECONDARY.

Primary Succession: this occurs when no soil or any other substrate exists, and therefore it must be created. Examples are volcanic islands and moraines left by glaciers melting
Secondary Succession: this occurs when soil or any other substrate exists, but it cannot support life (no nutrients). Examples include agricultural fields that have been exploited and abandoned, and areas that have burned.

Study Tips:

*** Review all vocabulary in each chapter and make sure you understand what the terms mean***

That's all folks.

If you have any questions, feel free to reach out to the tutoring center or use the link at the top of the resource to make a Microsoft Teams appointment.