

## Biology 1306/1406 – Modern Concepts in Bioscience II

### Hello and welcome to the weekly resources for BIO-1306/1406 - Biology 2

This week is Week 13 of class, and typically in this week of the semester, your professors are covering the topics below. If you do not see the topics your particular section of class is learning this week, please take a look at other weekly resources listed on our website for additional topics throughout the semester.

We also invite you to look at the group tutoring chart on our website to see if this course has a group tutoring session offered this semester.

If you have any questions about these study guides, group tutoring sessions, private 30 minute tutoring appointments, the Baylor Tutoring YouTube channel, or any tutoring services we offer, please visit our website [www.baylor.edu/tutoring](http://www.baylor.edu/tutoring) or call our drop in center during open business hours (M-Th 9am-8pm on class days at 254-710-4135).

**Keywords:** Miller and Urey Experiment, Early Life on Earth, Origin of Species, Osmoregulation and Excretion, Kidney

### Topic of the Week:

This week in Biology 1306, we will be covering The Origin of Species, History of Life on Earth, and Osmoregulation and Excretion.  
Campbell Chapters 24, 25 and 44.

#### **The Origin of Species, Macroevolution; History of Life on Earth- Campbell chapters 24, 25**

**Macroevolution** describes how species evolve. According to the **Biological Species Concept**, members of a **Species** can interbreed and form viable, fertile offspring. When species become **Reproductively Isolated** and can no longer interbreed, **Speciation**, or two new species arising from one, can occur. Reproductive Isolation can be either Prezygotic, or before the creation of a zygote, or Postzygotic, after the creation of a zygote.

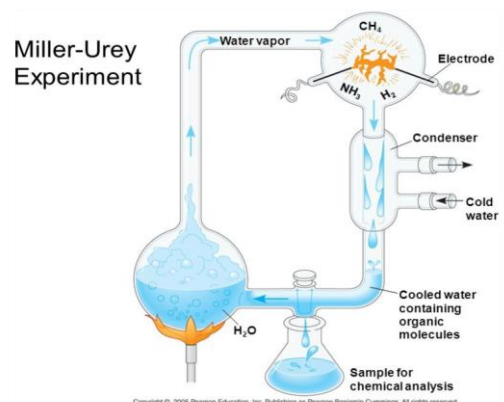
**Prezygotic Isolating Mechanisms** include: Behavioral Isolation, Mechanical Isolation, Habitat Isolation, Temporal Isolation, and Genetic Isolation

**Postzygotic Isolating Mechanisms** include: Hybrid breakdown, Reduced hybrid fertility, and Reduced hybrid viability

• **Allopatric Speciation** occurs when members of a population are kept **APART** by a geographic barrier; **Sympatric isolation** occurs when the members of a population are not geographically isolated and are in the **SAME** area

Chemical and physical processes, along with natural selection, made the origin of life possible on early Earth. In their experiment, **Miller and Urey** found that organic compounds, or biotic molecules, could be synthesized from abiotic factors. This led to the theory that life originated near Alkaline

**Hydrothermal Ocean Vents**. The first organic macromolecules



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.

thought to be synthesized near these ocean vents are **RNA Polymers**. This is due to the fact that RNA Polymers will self-generate if monomers are present. These early molecules were packaged into **Protocells**, or droplets with membranes that maintain an internal chemistry different than that of the surroundings. From these protocells came single celled organisms and eventually multicellular organisms who later colonized land. Once on land, the rise and fall of dominant groups reflects **plate tectonics**, which can cause allopatric speciation, **mass extinctions**, like at the end of the **Permian** period, and adaptive radiation following a mass extinction where the survivors of the extinction adapt into important ecological niches.

### **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 NH<sub>3</sub> 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:**

**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

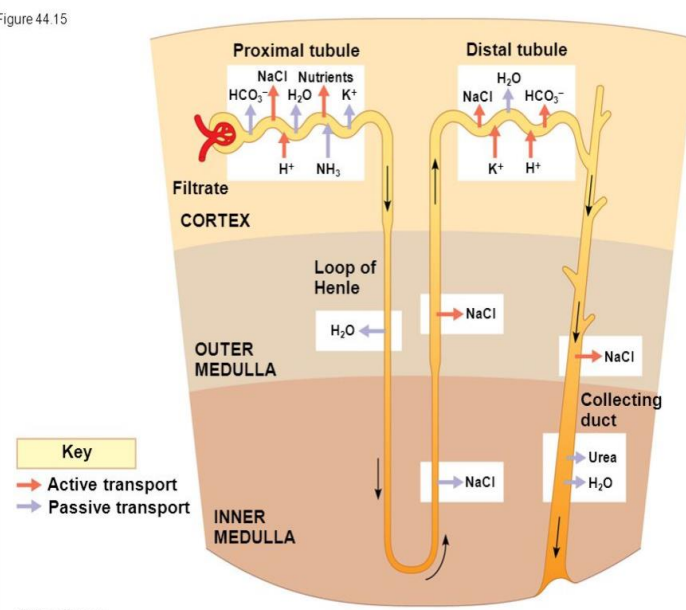
**Nephrons are the functional unit of the Kidney.** There are 5 steps in the nephron process. It is



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,  $NH_3$  passively in, and water,  $K^+$ , and  $HCO_3^-$  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  $HCO_3^-$  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

Figure 44.15



### CHECK YOUR LEARNING

1. What was the product in the Miller-Urey Experiment?
2. What is the main purpose of excretion?
3. What is the difference between allopatric and sympatric speciation?

### THINGS YOU MAY STRUGGLE WITH

1. Vocabulary! These chapters are all about memorization. Make sure that you can differentiate between the similar concepts presented by your professor.
2. The Hardy Weinberg Experiment: Check out this video starting at 5:29 <https://www.youtube.com/watch?v=NNijmxsKGbc&t=318s>
3. The structure and function of a nephron. Draw! Draw! Draw! The more you draw the structure, the more familiar it will be.

### 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 an appointment.**

Answers:

1. Organic compounds synthesized from abiotic/inorganic factors.
2. To excrete nitrogen waste.
3. Allopatric speciation occurs when members of a population are Apart. Sympatric speciation occurs when members of a population are in the Same environment.

All diagrams, tables, and external information is property of Campbell Biology and Pearson Education Inc.