STUDY GUIDE - *Ch. 5.3 - Lipids are a diverse group of hydrophobic molecules.* **NAME:** _____

- **PHYSICALLY PRINT OUT this PDF and HANDWRITE (with a black or blue pen) your answers directly on this PDF.** *Typed or digitally-written work is **not** accepted. Do **not** answer questions on separate paper.*
- **Importantly, study guides are NOT GROUP PROJECTS!!!** *You, and you alone, are to answer the questions as you **read** your assigned textbook. You are **not** to share answers with other students. You are **not** to copy any answers from any other source, including the internet.*
- **Get in the habit of writing LEGIBLY, neatly, and in a medium-sized font.** *AP essay readers and I will skip grading anything that cannot be easily read so start perfecting your handwriting, and don't write so large you can't add all the relevant details and key elaborations in the space provided.*
- **SCAN physical documents in color and with good resolution. Then, upload your final work as PDFs to Archie.** *Avoid uploading dark, shaded, washed-out, sideways, or upside-down scans of homework. Keep completed physical study guides organized in your biology binder to use as future study and review tools.*
- **READ FOR UNDERSTANDING and not merely to complete an assignment.** ***First**, read a section quickly to get an overview of the topic covered. Then, read it a **second** time slowly, paraphrasing each paragraph **out loud** and analyzing every figure. Finally, read it a **third** time as you answer the study guide questions if assigned and start building your memory. Try to write answers out in your own words, when possible, and try to purposefully and accurately use all new terminology introduced.*

KEY CONCEPTS

- Lipids are a diverse group of **hydrophobic molecules** , different groups of lipids having different functions like storing energy, forming cell membranes, and chemical signaling within the multicellular organisms' bodies.
- Though a large biological molecule, lipids are not big enough to be considered macromolecules and so are **not considered polymers**.

1. a. **Lipids include fats, waxes, oils, phospholipids, and steroids.** What **characteristic** do all these share?

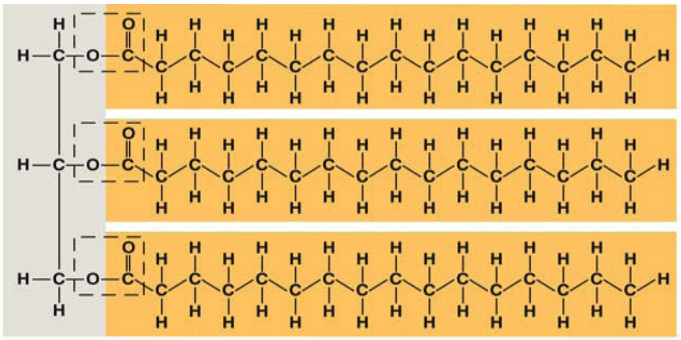
   b. What is the **molecular reason** for this key trait lipids have in common?

2. a. **Name AND describe the building blocks of a fat (a.k.a. a triacylglycerol or a triglyceride).**

      I. Name: _____
      Description:

      II. Name: _____
      Description:

   b. Label the four smaller molecules (monomers) that make up the fat on the illustration below?



c. Describe **how a fat is built**. Make sure your description includes not just a mention of the **1.** types of molecules and the **2.** chemistry involved, but also the **3.** specific functional groups on these molecules involved in the necessary chemical reactions and the **4.** products that have formed at the end of the chemical reactions.

d. On the fat illustration of question 2.b., label every **ester linkages** in the fat molecule as a result of the dehydration synthesis reactions that helped form the large biological molecule from its monomers.

3. a. **Compare** saturated and unsaturated **fatty acid**. **(Compare = In what ways are these two fatty acids SIMILAR)**

b. **Contrast** saturated and unsaturated **fatty acid**. **(Contrast = In what ways are these two fatty acids DIFFERENT -** *focus on their hydrogen atoms and carbon skeletons***)**

4. a. When a double bond exists between carbons in a carbon skeleton, that double bond can be a cis double bond or a trans double bond. *(Remember what you learned about geometric isomers - cis/trans isomers - in Ch.4).* What **type of double bond typically exists naturally in saturated fatty acids that are a part of saturated fats**?

b. Draw an **unsaturated fatty acid** that is **16** carbons long **AND** circle the element(s) in your drawing that make it unsaturated. *(Remember, fatty acids and fats are **not** the same thing: fatty acids are components of fats)*

c. Draw a **saturated fatty acid** that is **16** carbons long.

5. a. What are two examples of **natural saturated fats**?

   b. Study figure 5.10.a.. Why are **saturated fats typically solid at room temperature**?

   c. What are two examples of **natural unsaturated fats**?

   d. Study figure 5.10.b.. Why are **unsaturated fats typically liquid at room temperature**?

6. a. What changes in the atomic make up of **AND** in the shape of the "tails" in an unsaturated fat molecule when it gets **artificially hydrogenated** *(like hydrogenated unsaturated vegetable oil)*?

   b. What changes in an unsaturated fat molecule when it is converted by high heat or hydrogenation processes into a **trans fat**?

   c. FYI: **Hydrogenated oils** have been linked to cardiovascular disease such as **atherosclerosis** (the "hardening of arteries"), which involves the accumulation of lipid deposits (called **plaques**) on the inner walls of arteries. These plaques can break off producing dangerous embolisms that block blood flow in smaller arteries or veins.

   FYI: **Trans fats** have been linked to **coronary artery disease** (damage to the arteries that supply blood to the heart muscle) and maybe even to some **cancers**.

7. What are the **three main functions of fats in animals**?

   I.

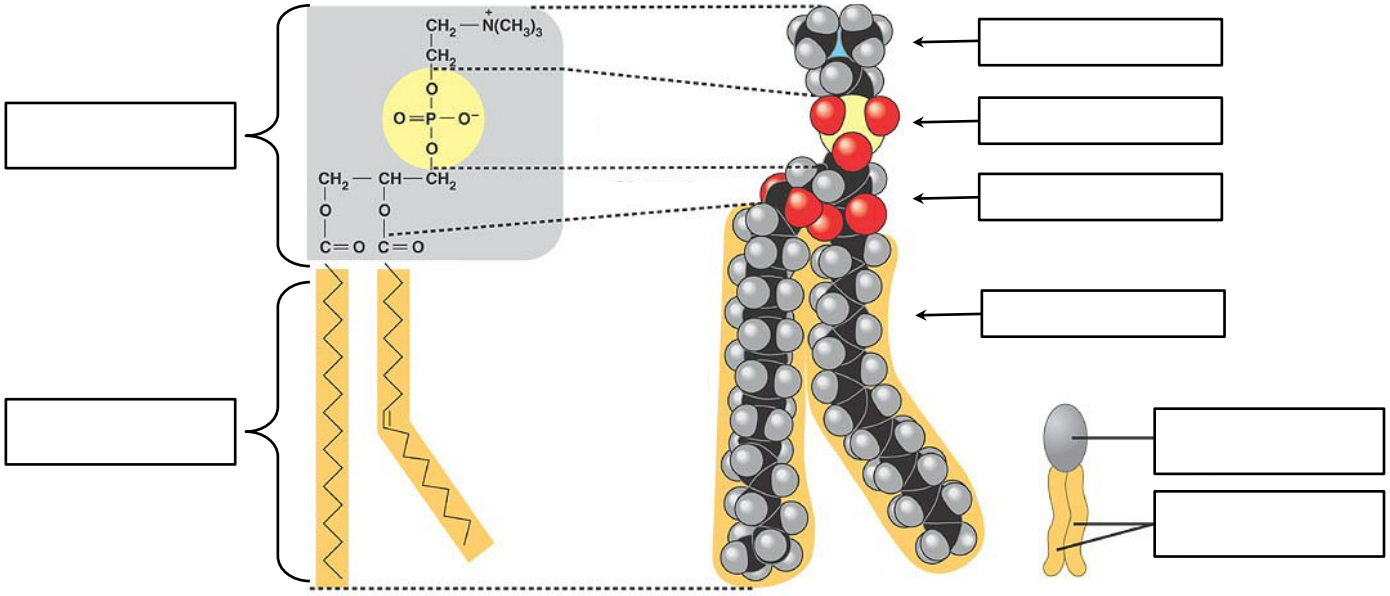
   II.

   III.

8. To review, if a fat is composed of 3 fatty acids and 1 glycerol molecules, how many water molecules must have been produced when the fat formed via dehydration synthesis reactions?

9. a. Now, let's take a look at another type of lipid, the phospholipid. Explain the **composition of a phospholipid**?

b. Label the phospholipid below



10. a. **Where do we find phospholipids in the cell**?

b. Different types of phospholipids exist. **Tails** can differ because they can either be made from saturated or from unsaturated fatty acids. How does one phospholipid's **head** group differ from that of another phospholipid?

c. How does a **phospholipid behave when added to an aqueous solution** (to water)? **WHY** does the head behave the way it does around water and **WHY** do the tails behave the way they do around water, exemplifying the theme of form fits function?

Behavior of heads of phospholipids =

Reason *(Remember those intermolecular forces from Ch.2)* **=**

Behavior of tails of phospholipids =

Reason *(Remember those intermolecular forces from Ch.2)* **=**

d. To summarize, a phospholipid has a glycerol attached to a phosphate group and two fatty acid chains. Now, make a large sketch the **phospholipid bilayer** structure of a plasma membrane *(include at least **10** phospholipids)*. Label the **1. hydrophilic heads, 2. hydrophobic tails, AND 3. locations of water.**

11. a. What is a **steroid**? *Think three hexagons and a doghouse :)*

b. How does one steroid **differ** from another?

12. a. Why is **cholesterol** such an **important** lipid (and specifically steroid) for humans?

I.

II.

b. Where do **animals get their cholesterol from**?

I.

II.

c. FYI: Cholesterol is essential. That said, high levels of cholesterol may also contribute to **atherosclerosis**.

13. Let's test your knowledge. Describe the difference in the structure of a triglyceride (fat) versus a phospholipid.

Triglyceride (fat) Structure =

Phospholipid Structure =

*(Check your answer to #13 by going to the **Ch.5.3 Concept Check Question #1** answer in Appendix A)*

14. Why are **human sex hormones considered lipids**? (P.S. Later, we will see that other types of hormones exist that are proteins, not lipids. Recall that hormones are signaling molecules that travel through the blood stream from the cell that makes them - endocrine cells - to the target cell elsewhere in the body).

*(Check your answer to #14 by going to the **Ch.5.3 Concept Check Question #2** answer in Appendix A)*

15. Suppose a membrane surrounded an oil droplet (instead of a aqueous solution) as it does in the cells of plant seeds and in some animal cells.

    a. **Describe** the form the membrane would take.

    b. **Explain** why you believe it will take the form you described.

*(Check your answer to #15 by going to the **Ch.5.3 Concept Check Question #3** answer in Appendix A)*