

Learning About Cell Membranes Through Inclusive Language

Subject / Discipline: Science/Biology/Chemistry

Grade Level: 9-12

Unit/Lesson New Jersey Student Learning Standards Bases on Next Generation Science:

Scientific Practices:

- 2. Developing and using models
- 4. Analyzing and interpreting data
- 8. Obtaining, evaluating, and communicating information

Cross Cutting Concepts:

- 1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- 6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

Core Idea LS1: From Molecules to Organisms: Structures and Processes

HS-LS1.A: Structure and Function

Scientific Investigations Use a Variety of Methods

HS-LS1.3 Scientific inquiry is characterized by logical thinking, precision, open-mindedness, and objectivity.

Brief Summary of Cultural Competencies Related to the Unit/Lesson

Does this lesson relate to and/or is inclusive of accurate histories, representation, contributions of:
LGBTQ community

What makes this lesson culturally relevant?

LGBTQ+ rights and concepts are currently at the forefront of both social and political discussions, and yet less than 1 in 5 students seem to be taught with any positive LGBTQ+ representation in any form in pedagogy (Kosciw, Greytak, Palmer, & Boesen, 2013). In fact, in 28 states it is still legal for employers to discriminate against someone for their sexual or gender identity (Human Rights Campaign, 2018). Therefore, there is a real need to integrate positive representation into our curricula.

The goal of this lesson is to incorporate positive LGBTQ+ language to make the classroom a more inclusive environment. The lesson uses the teaching of the structural components of the cell membrane to teach and reinforce appropriate language, while addressing and redefining outdated attitudes or assumptions about sex, gender, and expression (Lesbian, Gay, Bisexual, and Transgender Equity Center, n.d.)

Reference:

Human Rights Campaign (2018). Retrieved from <https://www.hrc.org/state-maps/employment>

Kosciw, J., Greytak, E., Palmer, N., Boesen, M. (2013). GLSEN's 2013 National School Climate Survey. Retrieved from https://www.glsen.org/sites/default/files/2013%20National%20School%20Climate%20Survey%20Full%20Report_0.pdf

Lesbian, Gay, Bisexual, and Transgender Equity Center. (n.d.) Good Practiced: Inclusive Language. University of Maryland. Retrieved from <https://lgbt.umd.edu/good-practices-inclusive-language>

Lesson Overview:

Essential Question(s)	How does structure relate to function? How can we use data to draw conclusions? What do effective problem solvers do when they get stuck? What is the value of inclusivity?
Enduring Understanding(s)	Scientists use information collect data, analyze and interpret evidence, and solve problems to develop accurate conclusions.
Potential Misconceptions:	Using outdated or hurtful language means we are not being inclusive. As students work though the parts of the POGIL, the teacher will periodically stop at specific points to go over answers to help scaffold learning and knowledge. This will also aid in addressing misunderstandings and appropriate vocabulary between concepts of sex, gender and the need for inclusive language.

Learning Plan, Experiences, Instruction and Learning Activities:

	The Teacher will... Run off photocopies of prepared activity. They should walk around the room and help address misunderstandings. As prepared, the activity suggests that teachers do the activities in sections (parts 1-5) and address parts and answers to help with this.
W What is expected? List the intentional learning objectives on the board	Students will be able to: - work in small collaborative groups and use the concept on the POGIL (Process Oriented Guided Inquiry Learning) activity - use problem solving skills and collaborations to work through concepts and vocabulary. - use inquiry and 2D models to discover molecular and cellular structures to link structure to function in a variety of ways (i.e. spatial, verbal, logical, & social) - use logical thinking and open-mindedness to draw accurate and socially appropriate conclusions. <i>Today we will be working on...</i> Learning about cell membranes while exploring inclusive language
H How will we hook (Introduce this to) the students? Activate thinking	Link to Engagement Hook/Do Now: What is a lipid? Where do you get them from? Why are these important in the human body? Have students answer these questions in their notebooks (2 min.)

Consider the language you will use to introduce the lesson	Think-pair-share: Share your answer with the person sitting next to you. Are there similarities? Are there differences? (2 min.) <i>You are really beginning to understand the idea that lipids are acquired by eating. They have many different roles in the human body. Today, we're going to dig deeper with a new focus. This focus will be about the structure of specific lipids, and how they relate to function. We will link this knowledge to inclusive LGBTQ + language.</i> Goal of the lesson: The created activity will focus on learning about lipids and cell membrane structure, while incorporating inclusive LGBTQ + language into the lesson.
E What equipment, resources, or materials are needed?	You will need to copy the Learning About Cell Membranes Through Inclusive Language POGIL packet (included below).
R How will we rethink or revise our thinking throughout the lesson? - What learning is confirmed? - What misconceptions are uncovered? - What is your new thinking?	Students are learning about structure and function through inquiry-based questions. They will link images with structure and interpret function. As students work through the parts of the POGIL, the teacher will periodically stop at specific points to go over answers to help scaffold learning and knowledge. This will also aid in addressing misunderstandings of concepts and appropriate vocabulary. Students use logical problem solving and collaboration to reflect on structure and function and apply this skill to any other concept. Learning is confirmed when questions are answered on the POGIL and revisions are made. In this way, students are getting feedback to their answers and misconceptions to learn in a positive manner. The assumption that everyone is cisgender can manifest itself in the form of misgendering (The Trevor Project, 2019). This can occur when a person is referred to by the incorrect pronouns or other gendered terms. This is why including pronouns when introducing oneself is the first step toward respecting people's gender identity and working against cisnormativity (The Trevor Project, 2019). By doing this you help to ensure a more welcoming space for people of all genders. References: The Trevor Project. (2019). Trans + gender identify. Retrieved from https://www.thetrevorproject.org/trvr_support_center/trans-gender-identity/
E How will students self-evaluate and reflect on their learning?	- Instant feedback is given as answers are gone over and discussed in class, part by part. - Collaborative group discussion and peer feedback is given in group work. - Problem solving takes place while strengthening social interactions and socially inclusive language, and justification is given.

T How will we tailor learning to varied needs, interests, and learning styles?	• The learning is taking place in groups. Each group member could have a role if needed, and groups can be hand-picked by the teacher to have groups with students with different skill sets. • Students work together to interpret 2D models and collaborate to come up with answers. • Spatial, verbal, logical, & social learning styles are incorporated into the lesson.
O How will we organize the sequence of learning during the lesson?	Scaffold the Instruction 1. Model: Teachers can hold up a model or show a model of a cell membrane, and the structure and function of this organelle will be further explored in the activity. GIF link: https://gfycat.com/hopefulcolorlessafricanmolesnake 1. Guided Practice Students will work through parts 1-4 in the activity. 1. Independent Practice Students will work on understanding inclusive language. 2. Extension Extension: There are other components and molecules that make up the phospholipid bilayer. Research at least 3 more molecules. Describe their structures and functions in the cell membrane. Your lab group will create a 3D model of the phospholipid bilayer, including both saturated fatty acids and unsaturated fatty acids in the phospholipid, cholesterol, and your groups 3 more molecules.

Check for Understanding

(Formative evidence such as conferencing, group Q/A, teacher observation, exit-slip, etc.)	A suggestion here would be the CAT (classroom assessment techniques): Ask students at the end of the activity: with a Ticket-Out-The-Door: 1. Name two molecules that require fatty acids in their structural make-up: 2. Name two kinds of fatty acids: 3. What is the difference between a trans-fatty acid and a cis-fatty acid: 4. Why is working against cisnormativity important? This will give the teacher time and feedback on need for re-teaching topics. (this is provided in the lesson plan).
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Performance Task/Project: (attach rubric)	• Goal: Your Group Task is to research and pick 3 more structural components/molecules that are found in the phospholipid bilayer. Report their structure and function. Build a 3D model of the phospholipid bilayer, including both saturated fatty acids and unsaturated fatty acids in the phospholipid, cholesterol, and your group's 3 more molecules. • Rubric is provided with attached documents.
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Cross Cutting Concepts:

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

Core Idea LS1: From Molecules to Organisms: Structures and Processes

HS-LS1.A: Structure and Function

Scientific Investigations Use a Variety of Methods

HS-LS1.3 Scientific inquiry is characterized by logical thinking, precision, open-mindedness, objectivity.

Students will be able to:

- work in small collaborative groups and use the concept on the POGIL (Process Oriented Guided Inquiry Learning) activity
- use problem solving skills and collaborations to work through concepts and vocabulary.
- use inquiry and 2D models to discover molecular structure, cellular structures, to link structure to function in a variety of ways (i.e. spatial, verbal, logical, & social).
- use logical thinking and open-mindedness to draw accurate and socially appropriate conclusions.
- Create 3D model of the cell membrane.

Scaffold the Instruction

- **Hook/Do Now:** What is a lipid? Where do you get them from? Why are these important in the human body? Have students answer these questions in their notebooks (2 min.)
- **Think-pair-share:** Share your answer with the person sitting next to you. Are there similarities? Are there differences? (2 min.)
- **Goal of the lesson:** The created activity will focus on learning about lipids and cell membrane structure while incorporating inclusive LGBTQ + language into the lesson.
 1. Model:
Teachers can hold up a model, or show a model of a cell membrane, and explain the structure and function of this organelle will be further explored in the activity. GIF link:
<https://gfycat.com/hopefulcolorlessafricanmolesnake>
 2. Guided Practice
Students will work in small groups through parts 1-4 in the activity.
 3. Independent Practice

Students will work on understanding inclusive language.

4. Extension

There are other components and molecules that make up the phospholipid bilayer. Research at least 3 more molecules. Describe their structures and function in the cell membrane. Your lab group will create a 3D model of the phospholipid bilayer, including both saturated fatty acids and unsaturated fatty acids in the phospholipid, cholesterol, and your groups 3 more molecules.

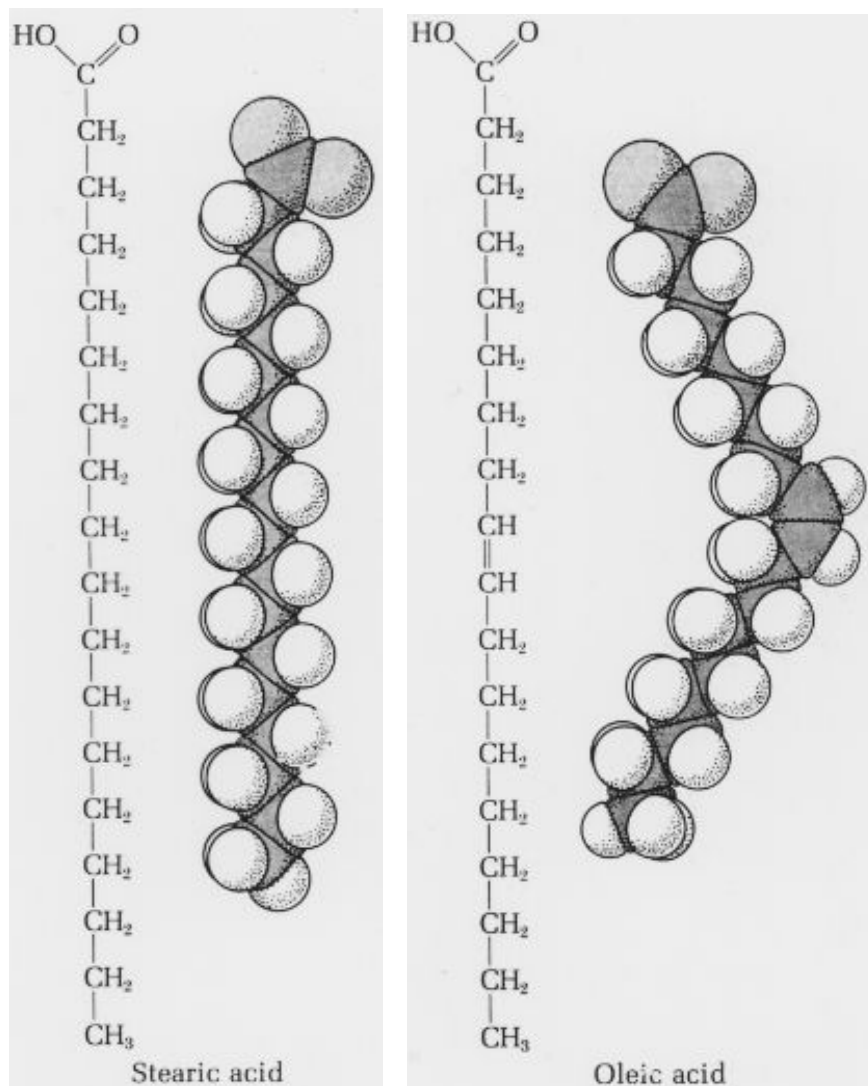
Learning About Cell Membranes Through Inclusive Language POGIL

This activity will take you through different kinds of lipids and their structural components. In your groups, work through each section in parts. You will start with Part 1 and work until it says stop. At this point your instructor will go over the concepts to ensure your understanding. Only after this point will you move forward to move through the parts in sequential order. Make sure to stop at each place where indicated.

PART 1:

Here are two different fatty acid structures that your lab group should look at:

Figure 1.



(Serianni, 2017).

1. Based on this image, what are some common elements that that all fatty acids share?

2. Based on this image, what is the difference in the structure of these molecules?

- Types of bonds = _____
- Shape of the molecule = _____

3. Stearic acid is said to be a saturated fatty acid. What do you think it is saturated with?

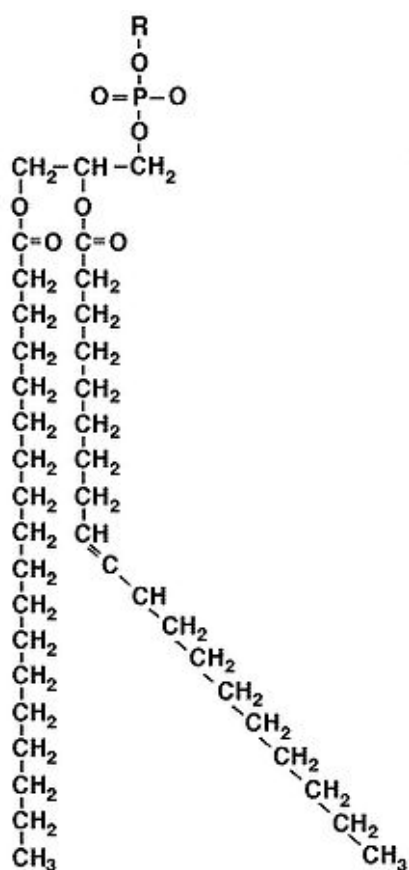
4. Oleic acid is said to be an unsaturated fatty acid. Why do you think that is?



PART 2:

Fatty acids are found as components in phospholipids. An image of a phospholipid is shown below:

Figure 2.



5. The term phospholipid can be broken down into 2 root words. What part of the molecule does the root word “phospho” come from?

6. The “lipid” portion of the molecule comes from the fatty acids in the structure. How many fatty acids are there in this molecule?

7. There is one fatty acid that is saturated and one fatty acid that is unsaturated in **Figure 2**. Circle the unsaturated fatty acid and put a box around the saturated fatty acid. How did you know which was which?

Water is polar and has a partially negative oxygen and a partially positive hydrogen. The partially positive hydrogens in water are attracted to partially negative oxygen in other molecules.

8. Water attracts other molecules that have oxygen atoms in their make-up. This section is hydrophilic, or water loving. Which section of this phospholipid would be attracted to water?

(“Phospholipid structure,” 2019).

9. Water is repelled by molecules that do not possess exposed oxygen atoms. This section would be hydrophobic, or water fearing? Which section of this phospholipid would not be attracted to water?

Look at the image provided on the right, Figure 3. This a cartoon representation of a phospholipid:

10. Label the hydrophilic “head” region on this image:

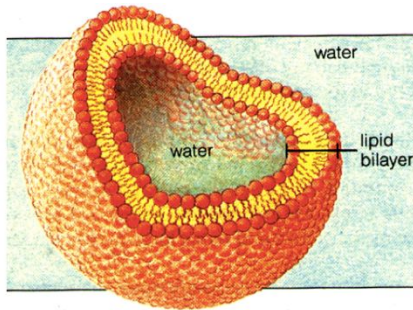
11. Label the hydrophobic “tail” region on this image:

Figure 3.



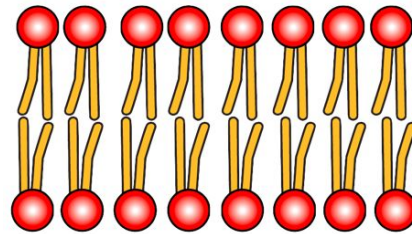
Figure 4.

Phospholipids makes up a cell membrane:



(“Phospholipids,” 2014).

If one looks at a cross section of the membrane, the phospholipids orient themselves in a Phospholipid bilayer:



(“02phospholipi-bila,” n.d.)

12. Think about what the prefix “bi” means. Why might this structure be called the phospholipid bilayer?



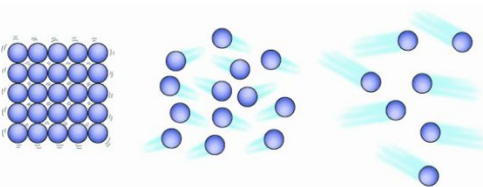
PART 3:

Fatty acids are used to build larger lipids, such as phospholipids and fats like triglycerides. Triglycerides have 3 fatty acids as part of their structure. All lipids are hydrophobic because they are composed mainly of carbon and hydrogen bonds.

Figure 5.

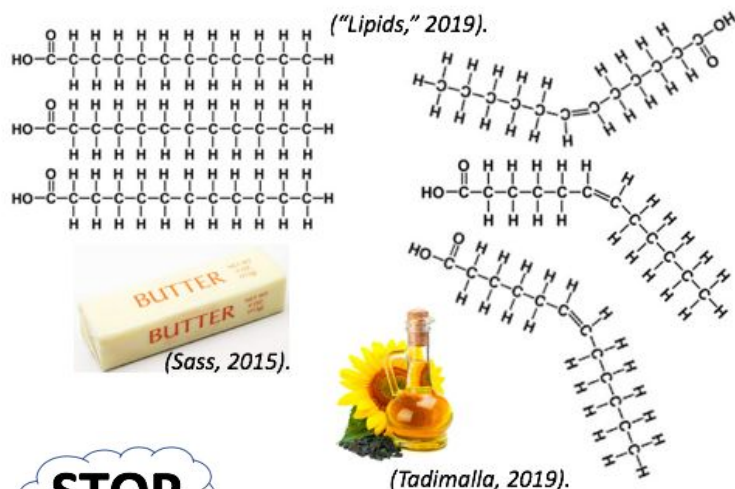
Kinetic molecule model:

Solid Liquid Gas



(Gall, 2019).

3 Saturated Fatty Acids Together & 3 Unsaturated Fatty Acids Together:



13. Based on **Figure 5.**, what would you suggest is the reason for saturated fats being solid at room temperature (i.e. butter)?

14. Based on this, what would you suggest is the reason for unsaturated fats being liquids at room temperature (i.e. olive oil)?

STOP

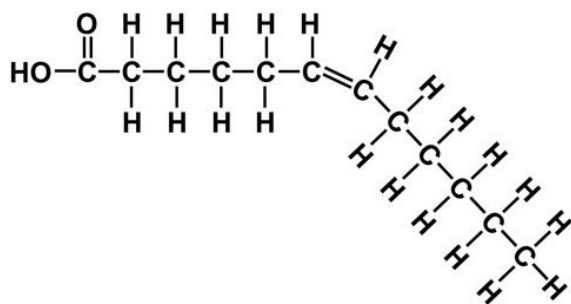
PART 4:

A diet high in saturated fats has been linked to higher levels of low-density lipoprotein (LDL or "bad cholesterol"). These have been linked to clogged arteries and, therefore, heart disease (American Heart Association, 2019). Since this link was made, food manufacturers shifted to using more unsaturated fats in their prepared products. The issue with that was that unsaturated fats spoiled quickly. Therefore, to solve this problem and extend the shelf life of their products, food manufacturers began putting unsaturated fats through a process called hydrogenation. This chemically changes the structure of unsaturated fats to add in hydrogen to make them more like solid saturated fats, which makes them last longer and can be more appealing to consumers. For example, if you have ever had natural peanut butter, it has oils floating on top. This is different from many brand-name peanut butters, which rely on hydrogenated fats. The process of hydrogenation creates a type of fat called trans-fat. Processed or packaged foods like doughnuts, chips, cookies, and fried foods are all high in trans-fat. When consumed, the body had no means of metabolizing these molecules, therefore, they act in the body in a similar way as do saturated fats.

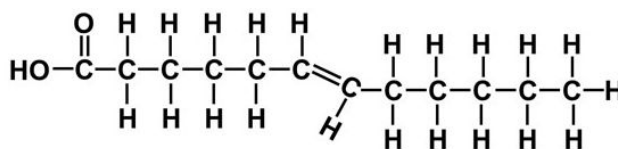
Now let's look at two different kinds of unsaturated fatty acids in the image below.

Figure 6.

Unsaturated Fatty
(like Linoleic acid found in vegetable oil)



Unsaturated Fatty
(like trans-Linoleic acid found in some margarine)



"Lipids," (2019).

Look at the double bond found on each of the molecules.

15. Linoleic acid has a cis-double bond. Where are the hydrogens located at the cis-double bond in the Linoleic acid?

16. Trans-Linoleic acid has a trans-double bond. Where are the hydrogens located at the trans-double bond in the trans-Linoleic acid?

A **cis** configuration means that the two hydrogen atoms are next to each other, or on the same side of the chain on the double bond. A trans configuration means that hydrogen atoms are on opposite side of each other on the double bond.

We can apply these prefixes “cis” and “trans” to gender. In most cases "**sex**" refers to the biological categories like genetic differences, chromosomes, and genitalia to differentiate between male and female. This is usually based on the “body.” This, however, forgets to include people who are intersex (people who might have physical characteristics that are not exclusively male or female. In the past, intersex individuals as hermaphrodites, but this is no longer an appropriate term to use (Clemets, 2018). "**Gender**" is harder to define, but it can refer to an individual's concept of themselves, or how they view themselves. This is about self-identity. “Cis” and “trans” gender are terms used to describe how they integrate their sex and gender.

17. What do you think is the difference between biological sex and gender identity:

18. Based on the activity, what do you think **Cisgender** Means?

19. Based on the activity, what do you think **Transgender** Means?

When sex and gender match, people are considered **binary** (man or woman) or cisgender (Clemets, 2018). When sex and gender do not match, people can be considered **non-binary** (**genderqueer** or **transgender** or **agender** (those who see no associating with gender)) (Gender Spectrum, 2019). Someone who is **Transgender** might not feel that their gender identity – meaning, their own personal sense of what their gender is – matches the gender assigned at birth (The Trevor Project, 2019).

20. People who identify as cisgender have their gender identity match their biological sex. In the United States, it is generally assumed that a person’s sex matches their gender identity. This assumption is called **cisnormativity**. Can you think of an instance or an example where this might not be the case?

“**Genderqueer** and **gender non-conforming** identities describe someone whose gender expression is, or seems to be, different from their assigned gender role. Usually, **genderqueer** and **gender non-conforming** people avoid gender-specific pronouns like “she/her” and “he/him,” and use more neutral pronouns instead, such as “they/them.”

The assumption that everyone is cisgender can manifest itself in the form of misgendering (The Trevor Project, 2019). This can occur when a person is referred to by the incorrect pronouns or other gendered terms. This is why including pronouns when introducing oneself is the first step toward respecting people’s gender identity and working against **cisnormativity** (The Trevor Project, 2019). By doing this you help to ensure a more welcoming space for people of all genders.

It’s important to note that not all **genderqueer** or **gender non-conforming** people identify as **transgender**, even though they fall under the umbrella of diverse gender identities” (The Trevor Project, 2019). Furthermore, “The term “**transgender**” should only be used as an adjective and never as a noun. For example: you may say: My friend is “transgender” - but you would not want to say that they are “a transgender” or that they are “tansgendered.” Also, the term “Transgendered” is grammatically incorrect. Offensive words include: tranny, transvestite, she-male, he/she, lady man, shim, “it,” or transsexual (The Trevor Project, 2019). These words should never be used in any circumstance.

21. What is gender expression?

22. How can making assumptions about someone’s gender be hurtful to that person?

23. How can you personally help to be inclusive for all different people? State at least 2 ideas or actions that you can start doing:

Ticket-Out-Of-The-Door

1. Name two molecules that require fatty acids in their structural make-up:



2. Name two kinds of fatty acids:

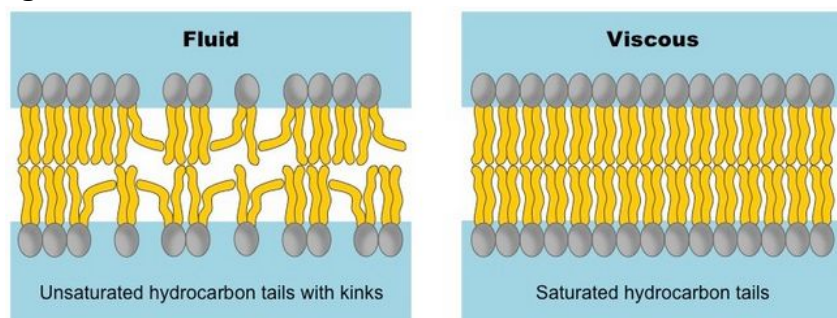
3. What is the difference between a trans-fatty acid and a cis-fatty acid?

4. Why is working against cisnormativity important?

Extension:

Look at the image of the phospholipid layers below:

Figure 7.



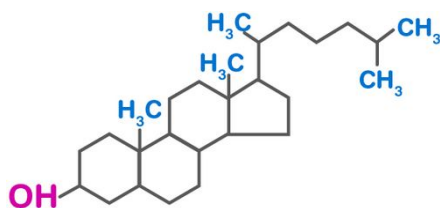
(Chemistry, 2019).

In general, cell membranes need to stay permeable for substances like carbon dioxide (CO₂) and oxygen (O₂) to diffuse across. On the right-hand side, the membrane is mostly made up of straight (i.e. saturated and/or trans) fatty acids, which create a more rigid and viscous membrane. Generally, this makes diffusion and cell-to-cell communication more difficult. However, in other cases this could be an adaptive strategy for survival. For example, in certain plants at high temperatures, they can decrease the amount of unsaturated fatty acids, thereby making the cell membrane less fluid and more stable (Zheng, Tian, Zhang, Tao, & Li, 2011). On the left-hand side, the membrane contains more unsaturated fatty acids (i.e. in the cis conformation). The bend or the kink in the cis-fatty acids keeps the molecules further apart and behaving more like a fluid rather than a solid. Remember that cells can, to some level, control the fluidity of their membranes. For example, when the temperatures drop, plant cells can increase the amount of unsaturated fats in the membranes and make it even more fluid (Zheng, Tian, Zhang, Tao, & Li, 2011).

There are other molecules in the phospholipid bilayer. One of these molecules is cholesterol. Check out the images below:

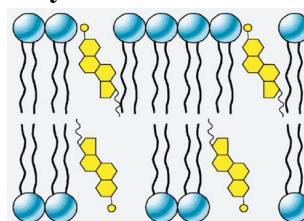
Figure 8.

Structure of Cholesterol:



(BYJU's, n.d.)

Phospholipid Bilayer with Embedded Cholesterol:



(Plasma Membrane, n.d.).

Apply what you know about the hydrophobic and hydrophilic sections of phospholipids to this cholesterol molecule.

24. Which section would be hydrophobic: _____

25. Which section would be hydrophilic: _____

26. Based on the last two answers and **Figure 8.**, explain how cholesterol would arrange itself the way it does in the phospholipid bilayer. Use the terms hydrophilic and hydrophobic in your explanation.

27. Based on **Figure 7.** And **Figure 8.** Is the phospholipid bilayer more fluid or more viscous? Justify your reasoning.

Extension: There are other components and molecules that make up the cell membrane. Research at least 3 more molecules. Describe their structures and functions in the cell membrane. Your lab group will create a 3D model of the phospholipid bilayer, including both saturated fatty acids and unsaturated fatty acids in the phospholipid, cholesterol, and your groups 3 more molecules.

Rubric: 3D Model Extension:

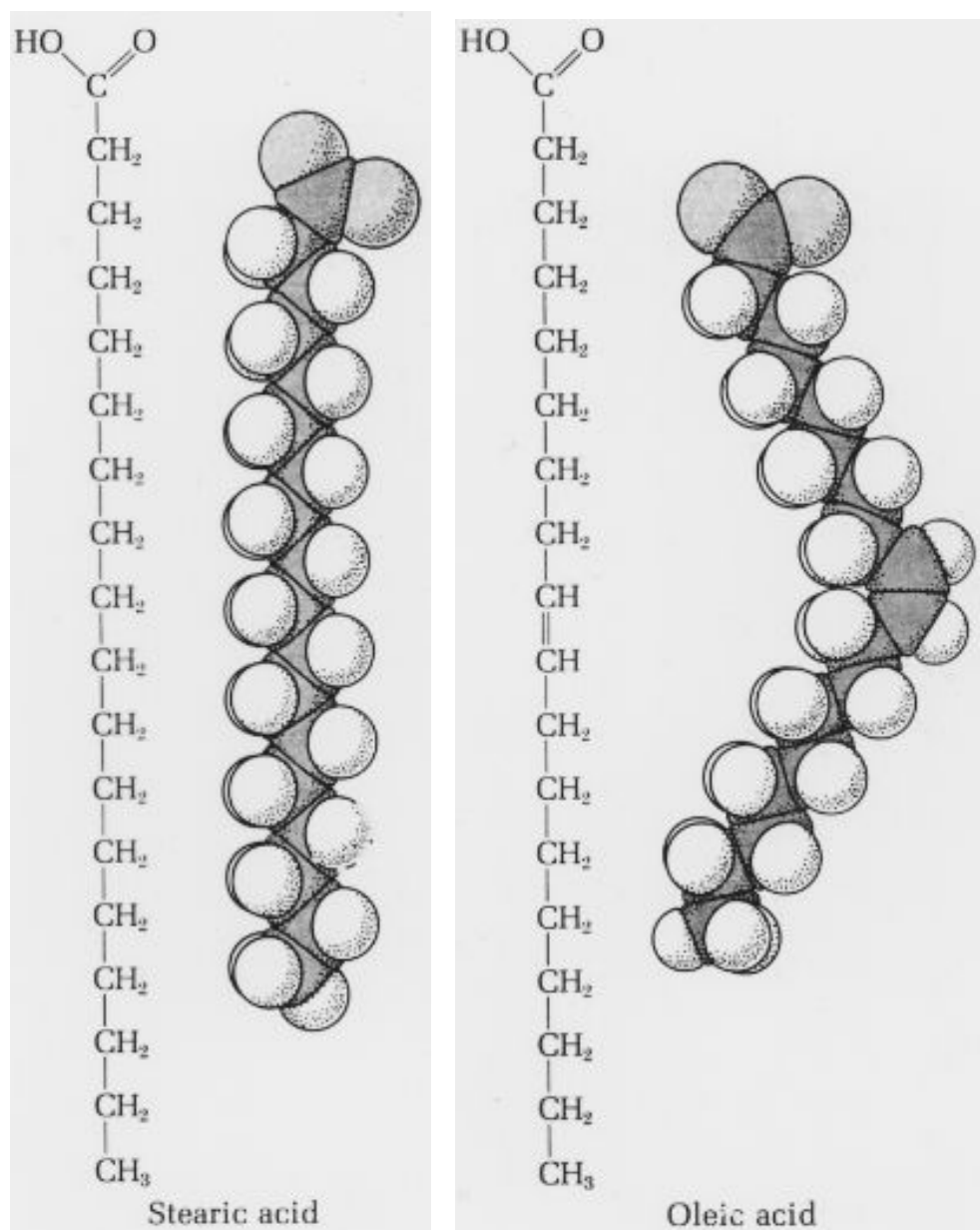
Categories	Level 1 – Expert	Level 2 – Meets	Level 3: Emerging	Level 4: Beginning
Model Accuracy				
Required Components:	<i>All</i> components are represented	<i>Most</i> components are represented	<i>Some</i> components are represented	<i>No</i> components are represented
Accuracy:	<i>All</i> components are accurately represented with appropriate labels	<i>Most</i> components are accurately represented with appropriate labels	<i>Some</i> components are accurately represented with appropriate labels	<i>No</i> components are accurately represented with appropriate labels
Used processing skills:	With <i>high degree</i> effectiveness	With <i>considerable</i> effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness
Model Creativity				
Uses critical and creative thinking process:	With <i>high degree</i> effectiveness	With <i>considerable</i> effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness
Application				
Research component:	With <i>high degree</i> effectiveness	With <i>considerable</i> effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness
Applies knowledge and skills in familiar contexts:	With <i>high degree</i> effectiveness	With <i>considerable</i> effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness
Transfers knowledge and skills to new contexts:	With <i>high degree</i> effectiveness	With <i>considerable</i> effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness

Makes connections within and between various contexts:	With <i>high degree</i> effectiveness	With <i>considerable</i> Effectiveness	With <i>limited</i> effectiveness	With <i>little to no</i> effectiveness
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Adapted from the Escape Room Project Assessment Rubric Retrieved from http://www.newlearnerlab.com/uploads/3/1/9/7/31973521/escape_room_project_rubric.pdf

ANSWERS:

Here are two different fatty acid structures that your lab group should look:



Serianni, A. (2017).

1. Based on this image what is the common structure that all fatty acids share?

Carbon, Hydrogen, Oxygen

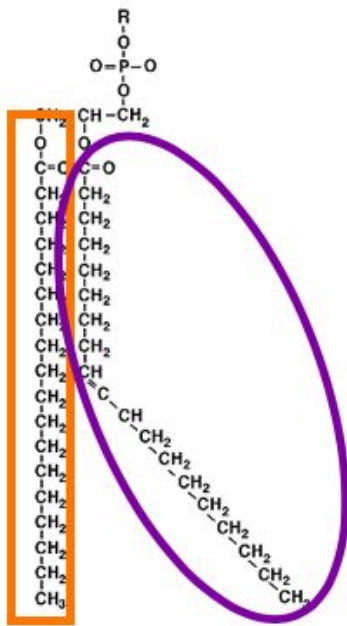
2. Based on this image, what is the difference in the structure of these molecules?

- **Types of Bonds** = Stearic acid has many single bonds while oleic acid one double bond
- **Shape of molecules** = Stearic acid is straight while oleic acid is kinked

3. Stearic acid is said to be a saturated fatty acid. What do you think it is saturated with?
Hydrogen

4. Oleic acid is said to be an unsaturated fatty acid. Why do you think that is?
The double bond takes away 2 possible Hydrogens from bonding.

Fatty acids are found as components in phospholipids. An image of a phospholipid is shown below:



5. The term phospholipid can be broken down into 2 root words. What part of the molecule does this root word “phospho” come from?
Phosphate head

6. The lipid portion of the molecule comes from the fatty acids in the structure. How many fatty acids are there in this molecule?
2

7. There is one fatty acid that is saturated and one fatty acid that is unsaturated. Circle the unsaturated fatty acid and put a box around the saturated fatty acid. How do you know which was which?

(“Phospholipid structure,” 2019).

1 saturated fatty acid (left) because there are only single bonds while there is one unsaturated fatty acid (right) because it has a double bond which makes the molecule kink

Water is polar and has a partially negative oxygen and a partially positive hydrogen. The partial positive hydrogen in water are attracted to partial negative oxygen in other molecules.

8. Water likes other molecules that have exposed oxygen atoms in their make-up. Which section of this phospholipid would be attracted to water (hydrophilic)?
Phosphate head

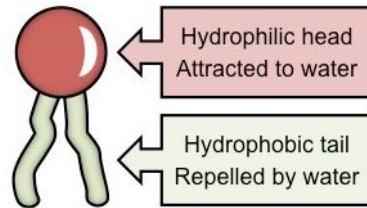
9. Water is repelled by molecules that do not possess exposed oxygen atoms. Which section of this phospholipid would not be attracted to water (hydrophobic)?

Both fatty acids because they are made up of hydrocarbon chains (with CH_2 and CH_3 groups)

Look at the image provided. This is a cartoon representation of a phospholipid:

10. Label the hydrophilic “head” region on this image:

11. Label the hydrophobic “tail” region on this image:

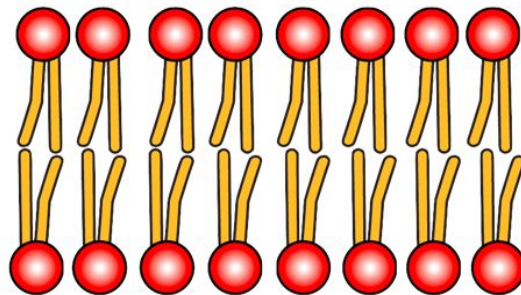
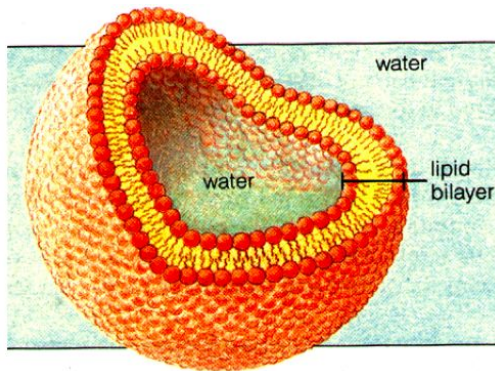


(BioNinja, "n.d.).

Figure 4.

Phospholipids make up a cell membrane:

If one looks at a cross section of the membrane, the phospholipids orient themselves in a Phospholipid bilayer.



(“Phospholipids,” 2014).

(“02phospholipi-bila,” n.d.)

12. Think about what the prefix “bi” means. Why might this structure be called the phospholipid bilayer?

There are 2 (bi meaning 2 or both) layers of phospholipid molecules that make the cell membrane.

PART 3:

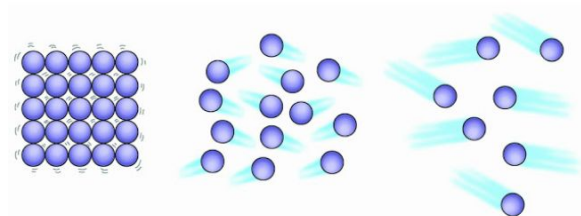
Fatty acids are used to build larger lipids, such as phospholipids and fats like triglycerides. Triglycerides have 3 fatty acids as part of their structure. All lipids are hydrophobic because they are composed mainly of carbon and hydrogen bonds.

Figure 5.

Kinetic molecule model:

Saturated Fats Together:

Unsaturated Fats Together:

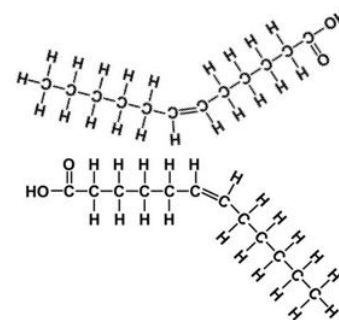
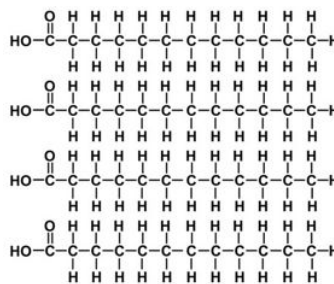


Solid

Liquid

Gas

(Gall, 2019).



“Lipids,” (2019).

13. Based off of this, what would you suggest is the reason for saturated fats being solid at room temperature (i.e. butter)?

They can fit closer together behaving molecularly more like a solid.

14. Based off of this, what would you suggest is the reason for unsaturated fats are liquids at room temperature (i.e. olive oil)?

because of the kink with the double bond, these molecules cannot fit as closely therefore they are acting more like liquids.

PART 4:

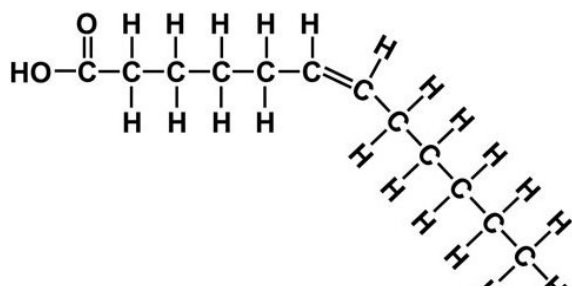
A diet high in saturated fats has been linked to higher levels of low-density lipoprotein (LDL or “bad cholesterol”). These have been linked to clogged arteries and therefore heart disease (American Heart Association, 2019). Since this link was made, food manufacturers shifted to using more unsaturated fats in their prepared products. The issue with that was that unsaturated fats spoiled quickly. Therefore, to solve this problem, and extend the shelf life of their products, food manufacturers began putting unsaturated fats through a process called hydrogenation. This chemically changes the structure of unsaturated fats to add in hydrogen to make them more like solid saturated fats, which makes them last longer, and can be more appealing to consumers. For example, if you have ever had natural peanut butter it has oils floating on top. This is different from many brand name peanut butter which rely on hydrogenated fats. The process of hydrogenation creates a type of fat called trans-fat. Processed or packaged foods like doughnuts, chips, cookies, and fried foods are all high in trans-fat. When consumed, the body had no means of metabolizing these molecules, therefore, they act in the body in a similar way as do saturated fats.

Now let’s look at two different kinds of unsaturated fatty acids in the image below.

Figure 6.

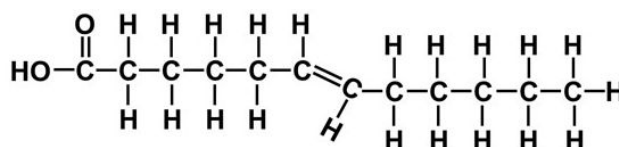
Unsaturated Fatty

(like Linoleic acid found in vegetable oil)



Unsaturated Fatty

(like trans-Linoleic acid found in some margarine)



"Lipids," (2019).

Look at the double bond found on each molecule:

15. Linoleic acid has a cis double bond. Where are the hydrogens located at the cis double bond in the Linoleic acid?

Same side

16. Trans-Linoleic acid has a trans double bond. Where are the hydrogens located at the trans double bond in the trans-Linoleic acid?

Across the double bond (on opposite sides)

A **cis** configuration means that the two hydrogen atoms are next to each other, or on the same side of the chain on the double bond. A **trans** configuration means that hydrogen atoms are on opposite side of each other on the double bond.

We can apply these prefixes "cis" and "trans" to gender. In most cases "**sex**" refers to the biological categories like genetic differences, chromosomes, and genitalia to differentiate between male and female. This is usually based on the "body." This, however, forgets to include people who are intersex (people who might have physical characteristics that are not exclusively male or female. In the past, intersex individuals as hermaphrodites, but this is no longer an appropriate term to use (Clemets, 2018). "**Gender**" is harder to define, but it can refer to an individual's concept of themselves, or how they view themselves. This is about self-identity. "Cis" and "trans" gender are terms used to describe how they integrate their sex and gender.

17. What do you think is the difference between biology sex and gender identity:

In most cases "**sex**" refers to the biological categories like genetic differences, chromosomes, and genitalia to differentiate between male and female. This is usually based on "body." This, however, forgets to include people who are intersex (people who might have characteristics that are not exclusively male or female. Please note the term hermaphrodite is not appropriate to use) (Clemets, 2018). "**Gender**" is harder to define, but it can refer to an individual's concept of themselves, or how they view themselves. This is about self-identity. When sex and gender match people are considered binary (man or woman) or cisgender (Clemets, 2018). When sex and gender do not match people can be considered non-binary (genderqueer or transgender or agender – or see no associating with gender) (Gender Spectrum, 2019).

18. Base on the activity, what do you think Cisgender Means?

"Same gender" which means a person whose personal identity and gender identification matches with their birth sex.

19. Base on the activity, what do you think Transgender Means?

"Across gender" which means a person whose personal identity and gender identification does not match with their birth sex.

When sex and gender match people are considered **binary** (man or woman) or cisgender (Clemets, 2018). When sex and gender do not match, people can be considered **non-binary** (**genderqueer** or

transgender or **agender** (those who see no associating with gender)) (Gender Spectrum, 2019). Someone who is **Transgender** might not feel that their gender identity – meaning, their own personal sense of what their gender is – matches the gender assigned at birth (The Trevor Project, 2019).

20. People who identify as cisgender have their gender identity match their biological sex. In the United States, it is generally assumed that a person's sex matches their gender identity. This assumption is cisnormativity. Can you think of an instance or an example where this might not be the case?

Someone who is non-binary: Remember - The assumption that everyone is cisgender can manifest itself in the form of misgendering (The Trevor Project, 2019). This can occur when a person is referred to by the incorrect pronouns or other gendered terms. This is why including pronouns when introducing oneself is the first step toward respecting people's gender identity and working against **cisnormativity** (The Trevor Project, 2019). By doing this you help to ensure a more welcoming space for people of all genders.

“Genderqueer and gender non-conforming identities describe someone whose gender expression is, or seems to be, different from their assigned gender role. Usually, **genderqueer** and **gender non-conforming** people avoid gender-specific pronouns like “she/her” and “he/him,” and use more neutral pronouns instead, “they/them.”

The assumption that everyone is cisgender can manifest itself in the form of misgendering (The Trevor Project, 2019). This can occur when a person is referred to by the incorrect pronouns or other gendered terms. This is why including pronouns when introducing oneself is the first step toward respecting people's gender identity and working against **cisnormativity** (The Trevor Project, 2019). By doing this you help to ensure a more welcoming space for people of all genders.

It's important to note that not all **genderqueer** or **gender non-conforming** people identify as **transgender**, even though they fall under the umbrella of diverse gender identities” (The Trevor Project, 2019). Furthermore, “The term “**transgender**” should only be used as an adjective and never as a noun. For example: you may say: My friend is “transgender” - but you would not want to say that they are “a transgender” or that they are “tansgendered.” Also, the term “Transgendered” is grammatically incorrect. Offensive words include: tranny, transvestite, she-male, he/she, lady man, shim, “it,” or transsexual (The Trevor Project, 2019). These words should never be used in any circumstance.

21. What is gender expression?

Gender expression is typically shown through mannerisms, clothing, and hairstyle, mannerisms (GLSEN, 2019). This is a social component since it is a way that we can communicate our gender to others (Gender Spectrum, 2019).

22. How can assuming someone's gender be hurtful to someone?

“It is a privilege to not have to worry about which pronoun someone is going to use for you based on how they perceive your gender. If you have this privilege, yet fail to respect someone else's gender identity, it is not only disrespectful and hurtful, but also oppressive” (Lesbian, Gay, Bisexual, Transgender, Queer, Plus Resource Center of the University of Wisconsin-Milwaukee, 2019).

23. So how can you personally help to include inclusion for all different people? State at least 2 ideas or actions that you can start doing:

Pronouns are related to gender identity. Someone who identifies as a woman may use pronouns like she/her/hers. However, one should not assume someone's gender identity based on gender expression. By introducing yourself with your personal pronoun you are providing an opportunity for someone else to share their pronoun(s), and you are telling them that you are not assuming their gender identity based on appearance (GLSEN, 2019). Again, including pronouns is a first step toward respecting people's gender identity.

Ticket-Out-Of-The-Door

1. Name two molecules that require fatty acids in their structural make-up.

Fatty acids and fats (like triglycerides)

2. Name two kinds of fatty acids:

Saturated and unsaturated

3. What is the difference between a trans-fatty acid and a cis-fatty acid:

trans-fatty acids have the hydrogens across from each other (on the opposite side) and a cis-fatty acids have the hydrogens on the same side as the double bond.

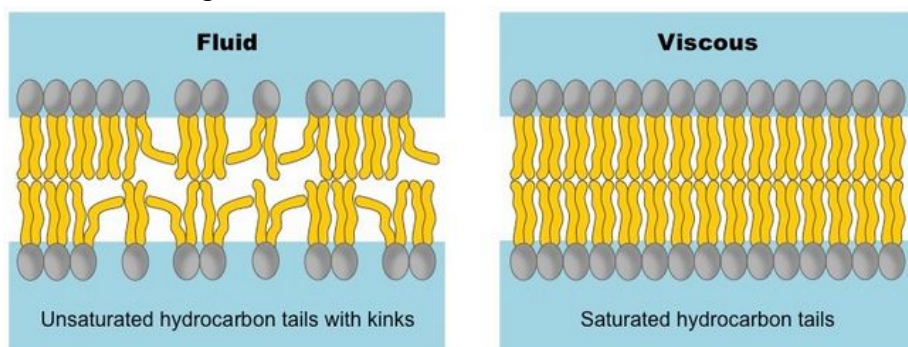
4. Why is working against cisnormativity important?

this is the first step toward respecting people's gender identity and creating safe spaces for all.

Extension:

Look at the image of the phospholipid layers below:

Look at the image below:



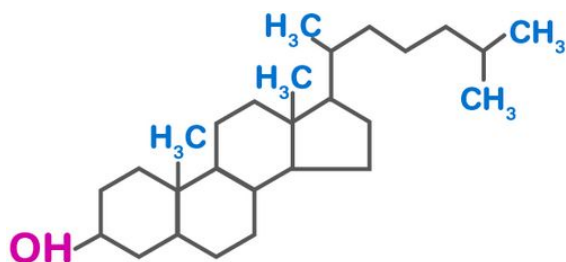
(Chemistry, 2019).

In general, cell membranes need to stay fluid for substances like CO_2 and O_2 to diffuse across. On the right-hand side the membrane is mostly made up of straight (i.e. saturated and/or trans) fatty acids, which create a more rigid and viscous membrane. Generally, this makes diffusion and cell to cell communication more difficult. However, in other cases this could be an adaptive strategy for survival. For example, in certain plants, at high temperatures, they can decrease the amount of unsaturated fatty acids, thereby making the cell membrane less fluid and more stable (Zheng, Tian, Zhang, Tao, & Li, 2011). On the left-hand side, the membrane contains more unsaturated fatty acids (i.e. in the cis conformation). The bend or the kink in the cis-fatty acids keeps the molecules further apart and behaving more like a fluid rather than a solid. Remember that cells can, to some level, control the fluidity of their membranes. For example, when the temperatures drop, plant cells can increase the amount of unsaturated fats in the membranes and make it even more fluid (Zheng, Tian, Zhang, Tao, & Li, 2011).

There are other molecules in the phospholipid bilayer. One of these molecules is cholesterol. Check out the images below:

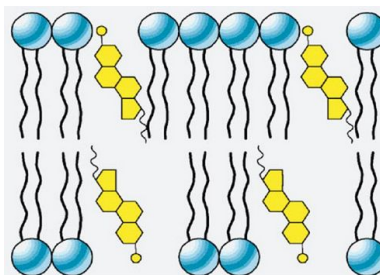
Figure 8.

Structure of Cholesterol:



(BYJU's, n.d.)

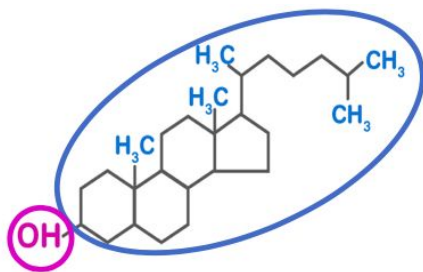
Phospholipid Bilayer with Embedded Cholesterol:



(Plasma Membrane, n.d.).

Apply what you know about the hydrophobic and hydrophilic sections of phospholipids to this cholesterol molecule.

24. Which section would be **hydrophobic**:



25. Which section would be **hydrophilic**:

26. Based on the last two answers, and *Figure 8.*, explain how cholesterol would arrange itself the way it does in the phospholipid bilayer. Use the terms **hydrophilic** and **hydrophobic** in your explanation. the hydrophilic section of the cholesterol will orient itself by the hydrophilic sections of the phospholipid heads, while hydrophobic sections of the cholesterol will orient itself within the hydrophobic phospholipid tails.

27. Based on *Figure 7.* And *Figure 8.* Is the phospholipid bilayer more fluid or more viscous?

Cholesterol serves the same purpose as the kinks from the fatty acids. The keeps cholesterol keeps the molecules further apart and allows the phospholipids to behaving more like a fluid rather than a solid.

Extension: There are other components and molecules that make up the cell membrane. Research at least 3 more molecules. Describe their structures and function in the cell membrane. Your lab group will create a 3D model of the phospholipid bilayer, including both saturated fatty acids and unsaturated fatty acids in the phospholipid, cholesterol, and your groups 3 more molecules.

References:

- American Heart Association. (2019). Saturated fats. Retrieved from <https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/fats/saturated-fats>
- BioNinja. (n.d.). Phospholipid Bilayer. Retrieved from <https://ib.bioninja.com.au/standard-level/topic-1-cell-biology/13-membrane-structure/phospholipid-bilayer.html>
- BYJU's. (n.d.) Cholesterol formula. Retrieved from <https://byjus.com/cholesterol-formula/>
- Clemets, KC. (2018). What's the difference between sex and gender. Retrieved from <https://www.medicalnewstoday.com/articles/232363.php>
- Chemistry, (2019). What makes trans fats more harmful than saturated ones? Retrieved from <https://chemistry.stackexchange.com/questions/60735/what-makes-trans-fats-more-harmful-than-saturated-ones>
- Escape Room Project Assessment Rubric. (n.d.). Retrieved from http://www.newlearnerlab.com/uploads/3/1/9/7/31973521/escape_room_project_rubric.pdf
- Gall, M. (2019). Molecular Model. Retrieved from <http://lookgoodandstudyhard.blogspot.com/2015/12/physics-unit-4-simple-kinetic-molecular.html>
- Gender Spectrum. (2019). Understanding Gender. Retrieved from <https://www.genderspectrum.org/quick-links/understanding-gender/>
- GLSEN (2019). Pronouns: A resource for educators. Retrieved from <https://www.glsen.org/activity/pronouns-resource-educators>
- Lesbian, Gay, Bisexual, Transgender, Queer, Plus Resource Center of the University of Wisconsin-Milwaukee. (2019). Why is it important to respect people's pronouns? Retrieved from https://uwm.edu/lgbtrc/qa_faqs/why-is-it-important-to-respect-peoples-pronouns/
- Lipids. (2019). Retrieved from <https://dlc.dcccd.edu/biology1-3/lipids>
- 02phospholipi-bila. (n.d.) Retrieved from <http://www.sciencemusicvideos.com/wp-content/uploads/2014/10/>
- “Phospholipids.” (2014). Retrieved from <http://biology4alevel.blogspot.com/2014/08/10-lipids.html>
- Phospholipid structure. (2019). Retrieved from <https://bioeng01.wixsite.com/bmeresources/single-post/2016/10/22/Phospholipid-structure>
- Plasma Membrane. (n.d.) Retrieved from https://plantcellbiology.masters.grkraj.org/html/Plant_Cellular_Structures3-Plasma_membrane.htm
- Sass, C. (2015). Is butter bad for you? What you should know. Retrieved from <https://www.health.com/heart-disease/is-butter-bad-for-you-what-you-should-know>

Serianni, A. (2017). Chemistry 420 - Principles of Biochemistry. University of Notre Dame. Retrieved from <https://www3.nd.edu/~aseriann/satunsatfa.html>

Tadimalla, R. (2019). 7 Amazing benefits of sunflower oil. Retrieved from <https://www.stylecraze.com/articles/best-benefits-of-sunflower-oil-for-skin-hair-and-health/>

The Trevor Project. (2019). Trans + gender identify. Retrieved from https://www.thetrevorproject.org/trvr_support_center/trans-gender-identity/

Zheng, G., Tian, B., Zhang, F., Tao, F., Li, W. (2011). Plant adaptation to frequent alterations between high and low temperatures: Remodeling of membrane lipids and maintenance of unsaturated levels. *Plan Cell Environ.* 34(9). Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3980542/>

Personal Bio:

I graduated from Providence College with a B.A. in Biology. Therefore, I started my teaching career teaching Biology at South River High School as an alternate-route candidate. I worked there for 4 years and received tenure. In 2007, I received a job offer from Princeton High School. Over the years, I have taught various courses like Ecology, Biology I, Biology II. I have now been at Princeton HS for around 11 years, and I am currently teaching Accelerated and AP level Biology. During that time, I also earned my MA in Teacher Leadership from Rowan University, and I am working on my second masters at the American College of Education.

Best,

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