

Proteins & Miraculin, Teacher Resource

<p>Goals</p>	<ul style="list-style-type: none"> • Understand the structure and function of proteins in the human body. • Analyze the differences between various types of proteins. • Apply knowledge of protein structure and function to a hands-on experiment.
<p>Key Terms</p>	<ul style="list-style-type: none"> • Protein <ul style="list-style-type: none"> • Amino acids • Essential amino acids • Nonessential amino acids • Conditional amino acids • Antibody • Contractile protein • Enzyme • Hormonal protein • Structural protein • Storage protein • Transport protein • Glycoprotein
<p>Topic</p>	<p>Coverage</p>
<p>Introduction</p>	<p>Proteins are one of the most essential components of life, serving a wide variety of functions in the human body. They are made up of amino acids, which can range from the hundreds to thousands. Proteins contain nitrogen, carbon, oxygen, and hydrogen. In this unit, we will explore the structure and function of proteins, as well as the different types of proteins found in the human body.</p>
<p>What is protein?</p>	<p>Read the following & answer the questions below: They are responsible for the most critical roles in the body as well as the hardest working cells. Proteins are made up of amino acids that can range from the hundreds to thousands.</p> <ul style="list-style-type: none"> • Amino Acids: Molecules that aid in building proteins • Essential Amino Acids: Amino acids that must come from your food. Your body cannot create them • Nonessential Amino Acids: We can get these from food and our body can make them. • Conditional Amino Acids: Amino Acids that are not necessary unless we have an illness or stress <p>A protein is an organic compound deemed to be necessary for life. Proteins contain nitrogen, carbon, oxygen, and hydrogen.</p> <hr/> <ol style="list-style-type: none"> 1. What elements are in a protein? 2. What are the different types of proteins mentioned in the resource? List at least 3. 3. Explain the functions of enzymes in the body.



<p>What does protein do in our body?</p>	<p>The functions of proteins include creating antibodies, enzymes, being a messenger, structural component, transportation, and storage.</p>
<p>What kinds of proteins are there?</p>	<p>While there are thousands of proteins in the body, here are the most common ones.</p> <ol style="list-style-type: none"> 1. Antibody: fight against bacteria, viruses, and any foreign cells in the blood. With their ability to identify and immobilize these cells, they are best to aid the immune system. 2. Contractile: what allows us to have muscle contractions and movement. 3. Enzymes: All enzymes we have discovered in human life are proteins. Enzymes are just as important as proteins. Without them, we would not be able to live. Enzymes are responsible for building up and breaking down the substances needed for life. 4. Hormonal: travel through the body to help regulate and harmonize our bodily functions. Such functions include growth, testosterone, and cortisol. 5. Structural: upkeep and defend the structure of the body. This includes collagen which helps new cells grow, relieves joint pain, decreases bone loss, and reduces wrinkles. 6. Storage :specifically store extra amino acids and release them when the body is ready for them to be used. 7. Transport: simply transport or move molecules around the body.
<p>Protein vs Glycoprotein</p>	<p>As learned before a protein is made up of nitrogen, carbon, oxygen, and hydrogen. However there is another protein called a glycoprotein that is only made up of carbon, hydrogen, and oxygen. Glycoproteins are similar to normal proteins except they contain carbohydrates.</p> <p>What are the functions of glycoproteins?</p> <p>Glycoproteins can be found in the lipid bilayer of cell membranes. Glycoprotein's functions include collagen production, hormone regulation, alkaline phosphatase, and thyroid-stimulating hormones.</p>

Experiment

Analyzing the Properties of Miraculin

You are a scientist who has discovered a new protein in the West African fruit known as the Miracle Berry. This protein, called miraculin, has the unique ability to change the way we taste sour and bitter foods. You are eager to learn more about the properties of miraculin and its potential applications.

Go over each question with students:

1. What questions would you ask about the properties of miraculin, and why? Consider factors such as its chemical composition, interactions with taste receptors, and potential health benefits or risks.



2. What methods or techniques would you use to analyze the structure and function of miraculin? Consider both laboratory-based techniques (such as X-ray crystallography or mass spectrometry) and computational methods (such as molecular modeling or bioinformatics). What are the strengths and limitations of each approach?

Materials Needed:

- 2 spoons per student
- 2 slices of lemon or 1 teaspoon lemon juice per student
- 2 slices of grapefruit per student
- 3 drops of Tabasco per student
- 2-3 Salt & Vinegar chips per student
- 1 packet of ketchup per student
- 1 packet of yellow mustard per student
- 1 teaspoon of apple cider vinegar per student
- 1 mberry Freeze Dried Miracle Berry per student
- 1 paper plate per student

*You can also use a big bottle of ketchup and mustard to put some on their plates instead of packets. If you do not have these foods available, visit our website to see a list on best foods to try with mberry in our blog

Experiment Notes

While everyone will have different perceptions to taste with mberry, here are the normal changes:

Lemon	Lemonade
Grapefruit	Sugar covered grapefruit
Tabasco	Donut Glaze
Salt & Vinegar Chips	Sweet and Salty Snack, less bite
Ketchup	Sweet tomatoes
Mustard	Sweet mustard
ACV	Apple juice

Conclusion:

1. What are some observations you can conclude about the Miracle Berry based off of your experiment? **Students should be able to easily distinguish what the miracle berry does in the broad sense. They should also be able to begin to see that each person may have different experiences.**
2. Based on your understanding of the chemical properties of Miraculin and its interaction with taste receptors, how do you think Miraculin works at a cellular and molecular level? Explain your answer using information from the teacher's resource



and your experiment. **Miraculin binds tightly to our receptors and when acidic, bitter, or sweet is detected, the protein tricks our tongue and brain into sending sweet signals because it changes shape when it binds to your tongue (the binding tells your tongue and brain it is sweet) Here is the more scientific answer**

- Design an experiment to test the effects of Miraculin on a different food or beverage of your choice. Include a hypothesis, materials list, procedure, and expected results. How do you think the taste of the food or beverage will change after the introduction of Miraculin? What implications could this have for the food industry or for individuals with taste disorders? **This should aim to have students think beyond the food we have on our shelves now. To reach into their creative side to find possible solutions to others' problems.**

Topic	Coverage
<p>Begin to explain the Miracle Berry once students have completed the experiment</p> <p>Where can a glycoprotein be found?</p>	<p>Did you know that glycoproteins are not only found in our body but also in our foods? In West Africa, there is a fruit known as a Miracle Berry. This berry has a glycoprotein that can change your taste buds for about 30 minutes. This glycoprotein is different from the rest because it is the only one that changes bodily function. The flavor changing protein, Miraculin, attaches to your sour taste buds and makes you only taste sweet. Lemons turn into lemonade and grapefruit in pure sugar.</p>

Crossword Answer Key (Optional)

ACROSS

- [Conditional](#)
- [Protein](#)
- [Miracle Berry](#)
- [Structural](#)
- [Thyroid](#)
- [Amino](#)
- [Glycoprotein](#)
- [Antibody](#)
- [Miraculin](#)
- [Essential](#)

DOWN

- [Nonessential](#)
- [Transport](#)
- [Miraculin](#)
- [Protein](#)
- [Contractile](#)
- [Hormonal](#)
- [Storage](#)

