9-12 Food & Science Plant-based Proteins and Legumes

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Overview:

This lesson will challenge students to identify non-animal based proteins and their amino acids. Students will also explore how they can create complete proteins by adding complementary foods. Students will complete the lesson by cooking their own dish displaying a complete protein profile using legumes and another incomplete protein.

(Time Needed: 4-5 class periods with option to do additional cooking outside of class.)

Standards:

- FCS-FS-8. Students will discuss why proteins are important in food preparation and preservation.
    - Describe ways in which protein is used in food preparation.
    - Identify the essential and nonessential amino acids.
    - Compare and contrast complete and incomplete proteins.

Objectives:

- Students will identify protein options in the American diet.
- Students will list qualifications of a protein.
- Students will discover plant-based protein options with a focus on legumes and pulses.
- Students will learn the difference in essential and nonessential amino acids.
- Students will plan and create complete protein dishes or a complete protein meal plan by combining incomplete legume proteins with complementary foods.

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Materials:

- Protein Functions and Amino Acids: https://www.youtube.com/watch?v=tJtAw61bzsM
- What Are Complete Proteins, Incomplete Proteins, Essential Amino Acids, Non Essential Amino Acids: https://www.youtube.com/watch?v=652GrZpLkPs
- Adding Legumes to your Curriculum: https://www.cafemeetingplace.com/features/item/80-adding-legumes-to-your-curriculum
- Protein Flashcards: https://quizlet.com/15806357/hun1201-chapter-7-flash-cards/
- Global Pulse Confederation: http://iyp2016.org/resources/what-are-pulses
- Protein Hunt .pdf
- Medline: Amino Acids Overview
- Complete and Incomplete Protein Sources: https://www.builtlean.com/2012/10/03/complete-vs-incomplete-protein-sources/
- http://www.uen.org/Lessonplan/preview.cgi?LPid=1269
- Cookbooks or recipe websites featuring legumes
- http://www.consultant360.com/n411/articles/complementary-proteins-origins-and-recipes
- Meal prep – Students will have to create grocery lists, print recipes, and write lab steps prior to cooking. There is a lab planning sheet attached.
- Students must have also passed their food safety test.

Outline:

- Engage: Students will find protein sources in their current diets.
- Explore: Students will find additional types of proteins and determine if they are complete or incomplete. They will determine the amino acids missing if incomplete.
- Explain: Students will use legumes to create a complete protein meal or day meal plan and explain how each essential amino acid is included in the meal or day meal plan.
- Extend: Students can cook a complete protein meal featuring a legume to share with the class.

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Lesson Plan:

- Engage: Students are asked to write down all the protein foods they have eaten in the past week. This can be done as a chalk talk or on a sheet of paper. Encourage students to discuss what foods are good sources of proteins. Lead the discussion including questions: 1. “Do all proteins come from animals?” 2. “How do vegetarians eat adequate amounts of protein?” 3.” When and how often should we be eating protein?”

- Explore: Have students watch YouTube video on protein. Have them write down or add to the chalk talk protein sources not mentioned. Let them explore the Global Pulse Confederation website and discuss how people in countries around the world consume protein.

- Explain: Using the Medline: Amino Acids Overview, explain essential and nonessential/conditional amino acids (conditional amino acids are considered nonessential except in times of stress and illness when the body cannot adequately synthesize them). Using the BuiltLean article, explain the difference in complete and incomplete proteins and how to make incomplete proteins complete. Emphasize that complimentary proteins do not necessarily need to be eaten together at the same meal and that it’s important to eat a variety of healthy protein foods throughout the day. Have students brainstorm different meals that they have had, foods they eat throughout the day, or traditional foods in other cultures that enable a person to consume all the essential amino acids in one day. Use diagrams provided for a visual learners.

- Extend: Have students research a complete protein recipe or meal plan for the day using the consultant360 website or similar. Student should create a shopping list, research any cooking terms that are unfamiliar, and be able to explain how it creates the recipe is a complete protein meal using complimentary ingredients or how their day meal plan provides all essential amino acids. They can cook a recipe in class or at home for an extension.

- Evaluate:

Lab Evaluation Sheet						
Criteria	**Points**					
Plans complete: Each student undestands what they need to do	**10**					
Correct equipment used and safe handling of equipment: Taking special care in handling knives and blenders	**10**					
Cooperation Group helping each other: Fair distribution of roles	**10**					
Food Product: Tastes Good Looks good Every one in the group tries it	**30**					
Clean up: Counters clean Dishes cleaned and stored at the right place	**15**					
Followed directions: Did the assigned work for planning and lab work	**15**					
Time management: Used time well during class	**10**					

Supplementary Tables and Materials:

Table 1. Dietary Requirements for Amino Acids in Humans	
Essential	**Nonessential**
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

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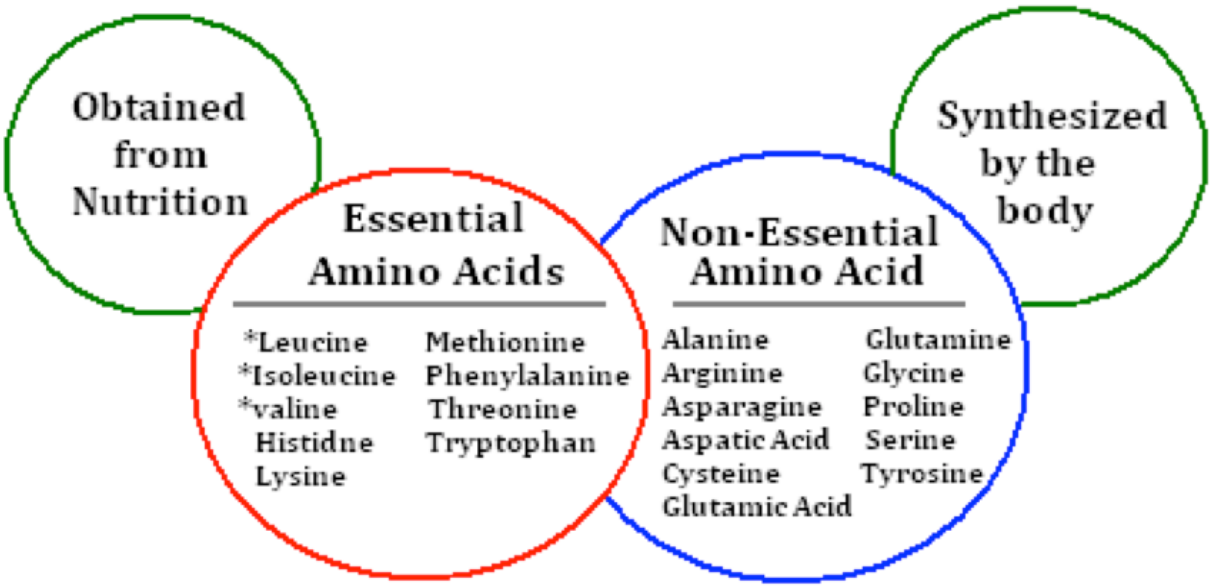

Amino acid in human body

Food	Limiting Amino Acid in Food	Complementary Foods
Beans	Methionine	Grains (rice), nuts, seeds
Grains (rice)	Lysine, threonine	Legumes (peas, lentils, peanuts…)
Nuts and seeds	Lysine	Legumes (peas, lentils, peanuts…)
Vegetables	Methionine	Grains, nuts. seeds
Corn	Tryptophan, lysine	Legumes (peas, lentils, peanuts…)