



Bringing Soybeans to the Table

Lesson Plan

Nebraska AFNR:

Standard 9: Students will demonstrate competence in knowledge of the food science industry.

- Benchmark 9.1: Evaluate how different foods affect the human body and its physical and cellular processes.

Nebraska Science Standards:

SC12.3.1.a: Students will... Identify the complex molecules that make up living organisms.

SC12.3.3: Students will describe, on a molecular level, the cycling of matter and the flow of energy between organisms and their environment.

Objectives:

- The student will understand the nutrient breakdown of soybeans and the necessity of essential amino acids.
- The student will compare and contrast different types of protein sources and their ability to be used in the human body.
- The student will create a complete meal plan that uses soybeans as a protein source.

Additional Enrichment Resources or Source Files:

- HHMI BioInteractive is a collection of free, science education resources
<https://www.hhmi.org/biointeractive>

Soybean Nutrients

Soybeans may be small, but they are packed with nutrients! The number one nutrient in soybeans is protein – one cup of raw soybeans can have up to 68 grams of protein. The U.S. Food and Drug Administration notes that soybeans are classified as a complete protein, meaning that they have a significant amount of the essential amino acids necessary for human growth and development.

Our body requires amino acids to build the proteins that create both the physical and physiological expression of the genes coded on our DNA. Many of these small molecules our body can create by reorganizing chemical elements we consume. However, some amino acids our body cannot create and we must consume in their final chemical form. The amino acids we cannot create are called essential amino acids.

There are 23 amino acids that our ribosomes use to create proteins in each of our cells. Nine of these amino acids the human body cannot create and we must ingest in their completed chemical form. Soybean protein contains all nine of these essential amino acids.





For any living thing to function, each cell in the organism must function appropriately. The key to a cell knowing what to look like and how to function is based on the proteins made within the cell. Our DNA carries the code that makes these proteins. Sequences of DNA, called genes, are turned on or off in different types of cells. The genes that are on will go through the process of transcription and translation.

Transcription will use the enzymes DNA helicase to open the double strand of DNA at a specific sequence and DNA polymerase will transcribe the DNA code into complimentary, single stranded, mRNA. During translation a ribosome attaches to the mRNA and reads it in small segments of three nitrogen base pairs called codons. The codon signals for a complimentary anticodon molecule. Attached to each anticodon is an amino acid. The ribosome sets the amino acids next to each other and bonds them together. A complete chain of these amino acids is called a protein and will give the cell its form and function. This entire process, from gene to protein, is called protein synthesis.

For a basic introduction of transcription, watch the following short video from the Howard Hugh's Medical Institute:

<https://www.hhmi.org/biointeractive/dna-transcription-basic-detail>

For a basic introduction of translation, watch the following short video from the Howard Hugh's Medical Institute:

<https://www.hhmi.org/biointeractive/translation-basic-detail>

The Human Body & Protein

Proteins are the molecule that gives a body structure and the ability to function. Some specific examples of proteins in the body include:

- Structural proteins – these provide support for our body, for example the base protein that builds all muscle is called myosin
- Enzymes are proteins that help with biochemical processes, for example the one of the enzymes that helps break down proteins in food is called pepsin
- Antibodies are proteins that help remove foreign materials from our body which cause infection
- Hormone proteins facilitate body functions, like insulin that controls blood sugar levels
- Transport proteins move molecules around the body, for example hemoglobin found in blood cells transports oxygen throughout the body.

All different types of proteins working together is what allows any organism to live and function.





Bringing it to the Table

We know that soybeans, because they contain essential amino acids, can be a part of a well-balanced diet. Soybeans are available in many different forms, both raw and processed.

1. Students will research different soybean products for human consumption, and create a meal plan that contains soybeans as part of a balanced diet.
 - a. For diet recommendations, refer to the USDA My Plate website: <http://www.choosemyplate.gov/>.
 2. Students will present their meal plans to the class.
 3. Optional Lesson Extension: Students will vote on the top meal plan, and prepare the meal in class to share.
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