

# VENOM!

a gallery lab experience at Arizona Science Center

## PRE-LAB ACTIVITY

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**Framing New Pathways to Medical Discovery for Families, Students and Teachers**

# Protein Bracelets

Pre-Lab Activity for Venom!

**Target Grades** 4<sup>th</sup> – 6<sup>th</sup> grade

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## Overview

In this 50 minute activity, students learn what a building block is and how amino acids are the building blocks of proteins. Additionally, students discover the many ways proteins are essential to our bodies. Using different colored pony beads (amino acids), students follow a series of directions to create a protein bracelet. Students may make one kind of several different proteins. They will see how each protein is unique, based on its different combination of beads. Students then speculate the potential consequences of not having a particular protein in our bodies.

## Concepts

Proteins are macromolecules made of amino acids.

There are 20 different types of amino acids which combine together to form different kinds of proteins.

Proteins perform many vital functions in our body.

## Listen for These Naïve Notions

The term “protein” may connote red meat.

They may confuse atoms and cells; molecules and atoms.

## Objectives

Students use beads (amino acids) to create a protein bracelet.

## Arizona Science Standards

### Grade 4

S1C2PO1

S1C3PO2

S1C4PO1

S1C2PO5

S1C3PO5

S1C4PO3

### Grade 5

S1C2PO1

S1C3PO1

S1C4PO3

S1C2PO5

S1C4PO1

**Grade 6**S1C2PO1  
S1C2PO5S1C3PO6  
S1C4PO3

S1C4PO5

**College and Career Ready ELA Standards****Grade 4**

SL.4.1

SL.4.3

L.4.4

**Grade 5**

SL.5.1

SL.5.3

L.5.4

**Grade 6**

SL.6.1

SL.6.4

L.6.4

**Learning Progressions****Basic Functions (3-5)****Deriving Energy from Food**

- From food, people obtain fuel and materials for body repair and growth.

**Basic Functions (6-8)****Deriving Energy from Food**

- For the body to use food for energy and building materials, the food must first be digested into molecules that are absorbed and transported to cells.

**Defense**

- Like other animals, human beings have body systems for obtaining and deriving energy from food and for defense, reproduction, and the coordination of body functions.
- Thinking about things as systems means looking for how every part relates to the others. The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes in the system as a whole.

**Modeling across topics such as matter and energy (Modeling is fore grounded)**

Across Grades 4 – 8

- Important aspects of understanding and engaging in using models, (constructing, critiquing, and revising models) as well as important aspects of the nature of models (understanding that models are tools for making predictions and explanations).

**Laboratory experiences in life sciences**

Grades 1 – 13

**Modeling is concerned with capturing key relations among ideas rather than surface appearance**

Grades K – 8

- We can learn about the world through modeling

**Arguments use reasoning to connect ideas and data**

Grades K – 8

- We can learn about the world through argument

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**Brief Background Information**

Proteins are made of small building blocks called **amino acids**.

Humans can make all but 8 amino acids in our bodies.

Humans acquire the 8 amino acids we do not make in our bodies by eating food.

When we eat animal or vegetable protein, our body breaks down the protein back into amino acids.

Once digested, the amino acids are then put back together to create new and different proteins the body needs to function.

You can think of the amino acids as beads on a bracelet. You could take the bracelet apart (eat) and put it back together, placing the beads in a different order to get a new bracelet (reassembly in the body).

Of all the molecules found in living organisms, proteins are the most important. Proteins carry out vital functions in every cell.

Without some very special proteins, called enzymes, the cells in our bodies would not be able to perform important chemical reactions fast enough to sustain life.

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**Setup****Time Frame**

50 minutes to conduct activity

## Materials

Each student will need:

- Pony Beads – (have 20 different colors and/or shapes available to represent each kind of amino acid )
- Jewelry Cord
- Markers/Crayons

**Note:** beads and jewelry cord may be purchased online at Kwik Crafts.

## Preparation

(85 minutes)

Based on the beads acquired, fill in the *List of Amino Acids and Bead Descriptions* sheet (15 minutes)

Make copies (15 minutes) of:

- *Types of Protein Bracelets* worksheet
- *List of Amino Acids and Descriptions* sheet (**filled in with bead descriptions**)

Organize Pony Beads for groups (30 minutes)

Cut jewelry cord into 12 inch sections (10 minutes)

Create example of a protein bracelet to show students (15 minutes)

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## Procedure

1. Ask students what they think of when they hear the words, **building block**? Ask them to give examples of what they think building blocks are. Using those examples, ask them what those building blocks create (for example, bricks could make a building, rocks could make a mountain, and pages could make a book).
2. Ask students what they know about protein. Accept all answers.
3. Inform students that proteins are important to our bodies for many reasons. Proteins are involved in almost everything cells do. For example, **enzymes** are proteins responsible for speeding up chemical reactions in our bodies, **hemoglobin** is the protein molecule in red blood cells that carries oxygen from the lungs to the body's tissues and returns carbon

dioxide from the tissues to the lungs, **collagen** is a protein responsible for providing structure and support to our bodies, and the immune system has a whole host of proteins that help protect our bodies from imbalance. Proteins can signal, link, and transport cell materials.

4. Inform students that proteins are made of building blocks called **amino acids**. Many amino acids linked together create a protein. There are 20 different kinds of amino acids, which, depending on how they are arranged, create many different types of proteins needed for our bodies to function.
5. Inform students that they will be creating a protein bracelet. They will string together beads, which represent different amino acids, together to form a protein.

**Note:** *Have your model bracelet ready so students can see what they are working to create.*

6. Inform students that because there are so many types of proteins, they have an opportunity to choose what kind of protein bracelet they would like to create, based on the descriptions provided. They may make the bracelet for themselves or may give it as a gift to someone they know. Ask students to read the various protein descriptions. While their bracelet will be about 20 beads long, it will be required to contain the core protein's specific order, which will be 7 beads long.
7. Ask students to read the protein descriptions and choose the protein they would like to make. Once they have chosen the protein, ask them to fill in the chart indicating the order of the 7 beads needed. Once they have done this, they may create their bracelet.
8. Students create their bracelets using the beads and jewelry cord. After proteins have been created, have students share their protein bracelet with the class.
9. Class Discussion: Why did you choose the protein you did? Was it easy or challenging to make the protein? What do you think would happen to our body if that protein did not exist?

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## Extended Background Information for Teachers



Proteins are polymers made up of linear chains of building blocks (monomers) called **amino acids**. Humans can manufacture (synthesize/make) all but 8 of them in our bodies. The rest are obtained through eating food. When we eat animal or vegetable protein, our body breaks down the protein back into amino acids. Once digested, the amino acids are put back together to create new and different proteins the body needs to function. You can think of the amino acids as beads on a bracelet. You could take the bracelet apart and put it back together in a different order to get a new bracelet.

Of all the molecules found in living organisms, proteins are the most important. Proteins are the biological workhorses that carry out vital functions in every cell. They may be enzymes, cellular structures, and antibodies. Proteins are used to support the skeleton, control senses, move muscles, send signals between cells, digest food, defend against infections and process emotions. Without proteins, the cells in our bodies would not be able to perform biochemical reactions fast enough to sustain life.

Chains of 50 amino acids are proteins called **peptides**, chains of 50-100 amino acids are proteins called **polypeptides**, and over 100 amino acids are simply called **proteins**. A number of hormones, antibiotics, antitumor agents and neurotransmitters are peptides .

In this activity, students are able to understand the relationship between amino acids and proteins by using different colored beads (amino acids) to create a bracelet (protein). They will also learn that different arrangements of amino acids create different kinds of proteins.

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### Vocabulary

**Atom** (/ˈatəm/): the basic unit of matter, sometimes described as building blocks.

**Amino Acid** (əˈmēnō / ˈasid/): building blocks of larger molecules called proteins. The amino acids are arranged like beads on a string. There are 21 common amino acids in proteins.

**Building Block** ( ): A basic element or part of something. Something small of which something bigger is made.

**Cell** (sel/): the smallest structural and functional unit of an organism

**Collagen** (/ˈkæləjən/): a protein responsible for providing structure and support to our bodies.

**Enzyme** (/ˈenzīm/): proteins responsible for speeding up chemical reactions in our bodies.

**Hemoglobin** (ˈhēmə,glōbin/): a protein molecule in red blood cells that carries oxygen from the lungs to the body's tissues and returns carbon dioxide from the tissues to the lungs

**Macromolecule** (/ˈmākro ˈmälə,kyool/): A very large molecule, such as a protein, consisting of many smaller structural units linked together.

**Molecule** (/ˈmälə,kyool/): a group of two or more atoms that stick together.

**Protein** (/ˈprō,tē(ə)n/): molecules made from tiny building blocks called amino acids, and are a vital part of all living things. They are part of everything that happens within cells. Their main function is to heal wounds, fight infection and build muscle.

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Name: \_\_\_\_\_

## Types of Protein Bracelets

### Action

Energetic **Enzymes** - These are proteins which catalyze (speed up) thousands of chemical reactions in our bodies. Make this bracelet if you need help making a decision or taking action in your life

Amino Acid	Asparagine	Histidine	Phenylalanine	Alanine	Isoleucine	Histidine	Asparagine
Bead Description							

### Support

Cool **Keratin** – These proteins provide structure to our hair and nails. Create this bracelet if you are in need of more structure in your life.

Amino Acid	Alanine	Serine	Phenylalanine	Threonine	Arginine	Glutamine	Glycine
Bead Description							

### Breath

Hip **Hemoglobin** – This protein is located in our red blood cells and helps transport oxygen throughout our body. Create this bracelet if you need to relax, breathe, and take care of yourself.

Amino Acid	Lysine	Isoleucine	Glutamine	Tyrosine	Arginine	Threonine	Proline
Bead Description							

### Health

Awesome **Antibodies** – This protein helps the body fight off disease. Create this bracelet if you are in need of better health.

Amino Acid	Asparagine	Histidine	Serine	Serine	Histidine	Histidine	Asparagine
Bead Description							

**Metabolism**

High-five **Hormones** – These proteins travel through our body and regulate metabolism. They are chemical messengers that transport a signal from one cell to another. Create this bracelet if you want better communication between yourself and others.

Amino Acid	Phenylalanine	Serine	Aspartic Acid	Cysteine	Glutamic Acid	Glutamic Acid	Valine
Bead Description							

**Strength**

Amazing **Actin** – This protein helps the muscles in our body contract and is important to body support. Create this protein if you need are in need of support.

Amino Acid	Threonine	Tyrosine	Tyrosine	Lysine	Proline	Methionine	Methionine
Bead Description							

## List of Amino Acids and Bead Descriptions

(Note: Bead descriptions will depend on what the educator determines to use, based on availability)

Alanine =	Glycine =	Leucine =	Serine =
Arginine =	Glutamine =	Lysine =	Threonine =
Asparagine =	Glutamic Acid =	Methionine =	Tryptophan =
Aspartic Acid =	Histidine =	Phenylalanine =	Tyrosine =
Cysteine =	Isoleucine =	Proline =	Valine =