

Bay Area Scientists in Schools Presentation Plan

Lesson Name True Blood, True Science

Presenter(s) Scientists from Bayer Healthcare

CA Science Standards Connections: 5th Grade, Life Science

5-LS-2. Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. As a basis for understanding this concept:

- a. Students know many multicellular organisms have specialized structures to support the transport of materials.
- b. Students know how blood circulates through the heart chambers, lungs, and body and how carbon dioxide (CO₂) and oxygen (O₂) are exchanged in the lungs and tissues.

Next Generation Science Standards Connections: 4th Grade, Life Science

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <p>Develop a model to describe phenomena. (4-PS4-2) Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)</p>	<p>LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)</p>	<p>Systems and System Models A system can be described in terms of its components and their interactions. (5-LS2-1)</p>

Common Core Standards:

ELA/Literacy:

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

Mathematics:

MP.2 Reason abstractly and quantitatively.

FOSS Connections:

3rd Grade Module: *Structures of Life*
Investigation 4: *Human Body*

5th Grade Module: *Living Systems*
Investigation 3: *Transport Systems*



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Teaser:

Scientists from Bayer Healthcare will talk about blood and why you need it through interactive activities. We'll talk about some of the major functions of blood and then identify the 4 main components of blood: plasma, red blood cells, white blood cells, and platelets. Then, we'll split up the class into 4 stations to go little more into depth about these things.

Objectives:

During this lesson students will...

- ...make observations about blood smears and use critical thinking skills to match them to the appropriate answer
- ...make a model of blood that will demonstrate the 4 components of blood

By the end, students should ...

- ...be able to name the 4 main components of blood.
- ...understand that blood transports oxygen, nutrients, and waste throughout your body.
- ...understand that white blood cells help protect your body from diseases.
- ...learn that you get iron from certain foods and iron is an important for red blood cells to transport oxygen and carbon dioxide.

Vocabulary/Definitions:

3 – 6 important (new) words

- **Red Blood Cells**– Transports oxygen throughout your body using iron.
- **White Blood Cells**– Defend the body against infectious disease.
- **Platelets**– Type of blood cells responsible for blood clotting so that you don't lose all your blood when you get a cut or scrape.
- **Plasma** – liquid component of blood has some blood clotting factors.
- **Iron** – A type of metal that red blood cells use to transport oxygen. You can detect iron in certain cereals by using magnets and in blood using a chemical called luminol.
- **Luminol** – A chemical used by forensic scientists as an indicator to detect iron in blood. It will glow blue when there is iron present.

Materials:

What will you bring with you?

- Magnetic Cereal Demo (neodymium magnets, cereal flakes, tray, water)
- Luminol Demo (Fake Blood, Flashlight, Paper Towel, Gloves, Luminol Spray-mix immediately before lesson)
- Blood Detective Game Cards (Blood Cell Images, Worksheets)
- Blood Model Materials

What should students have ready (pencils, paper, scissors)?

Curious Minds!

Classroom Set-up:

- For the introduction, have students seated at their desks so that they can all see and hear the presenters.
- Students will be split into 4 groups for the hands-on stations.
- This lesson requires access to water!

Classroom Visit

1. Personal Introduction: ___5min___ Minutes

We are scientists from Bayer Healthcare.

Have each volunteer say their name, a little about themselves, and what they do at Bayer. Feel free to talk about why you got into science, what you love about it, etc.

i.e. Some of us work in manufacturing to make the medicine and get it to doctors and pharmacies so they can give it to the people who are sick. Some of us are in quality control, we check to make sure that the medicine is made correctly and packaged correctly after it's made so that it gets to you safely.

Topic Introduction: ___10min___ Minutes

Today we're going to talk about blood.

What does blood do for your body? Why do you need it? (*Give students a chance to raise their hands. This will help to find out what they already know.*) What would happen if you lost all your blood?

Blood is important for MANY different reasons, and we're going to talk about a couple of those today.

1. Transport – blood runs everywhere throughout your body so it is able to transport different things to different parts of your body. *For example:*
 - a. Oxygen: Everybody take a deep breath. What did you just breathe in? *oxygen*. Every time you take a breath, you inhale oxygen. Your blood captures this oxygen and transports it throughout your body. You need oxygen to survive – to move your muscles, to digest your food, to think, etc.
 - b. Nutrients: Blood also transports nutrients to different parts of your body. So the nutrients you get from the food you eat end up in the blood where they are then carried somewhere else.
2. Protection
 - a. Injury: Who has ever cut themselves or had a scrape? Did you just keep bleeding or did the bleeding stop? When you injure yourself, your blood is able to form what we call a "clot" at the area where we were injured, and

this stops the bleeding. *You could talk a little about hemophilia here if you wanted to.*

- b. Infection: Sometimes germs (bacteria, viruses, etc.) are able to get into your body (through a cut, or when you inhale). Your blood is able to help fight off infection from these germs to keep you from getting sick.

There are several components in blood that help carry out these functions. Component means that these are the different parts that make up your blood. There are lots of things in blood, but we are going to focus on 4 major ones:

1. Red Blood Cells – These cells transport oxygen around your body.
2. White Blood Cells – These cells help fight infection, like we talked about a minute ago.
3. Platelets – Platelets are like really small cells, actually pieces of cells, that help with blood clotting. So if you have a cut or a scrape, the platelets will clump together near the cut to form a “clot” so that you will stop bleeding.
4. Plasma – this is the liquid part of your blood. If it is separated from all the other parts of blood, it is kind of yellow in color. The plasma carries around all the other parts of the blood (cells, platelets, etc.)

These components, other than plasma, are all microscopic – anyone know what that means? *If no one has the correct answer you can tell them what it means.* So, if you look at blood all you see is red, right? But if you look under a microscope you can actually see some of these parts, like the red and white blood cells.

Ok, now we’re going to break into 4 groups so that you can rotate through 4 different activity stations. *List each activity on the board while saying it out loud to the students. Write them in the order that you want them to rotate, and tell the students out loud the order in which they will rotate. The teacher can help you break the students into groups.*

2. Learning Experience(s):

8 minutes per station

Station 1: Magnetic Cereal

Materials:

- 2 trays with water
- cereal flakes
- 2 neodymium magnets
- 1 cup for waste

Set-up: Place a little bit of water in each of the shallow trays. Don’t walk around with trays filled with water as they are easily spilled. It works better to fill a cup with water and then fill the tray.

What comes to mind when you hear the word iron? Do you think we have iron in our bodies? In this cereal?

This cereal actually does have **iron** in it, which your blood needs to transport oxygen to all your muscles and your brain (which needs a lot of oxygen too!)

These magnets that I have here are called neodymium magnets and they are really strong magnets. If the cereal does in fact have iron in it, do you think it will be attracted to the magnet?

Demonstrate with a flake of cereal and the magnet. You should be able to get the cereal to follow the magnet if you move it slowly and keep the magnet close to the cereal.

Give each student a turn to practice moving the cereal. 2 students can go at the same time, one at each tray. Try to keep the students from putting both magnets in the same tray because they will stick together and it will be difficult to pull them apart!

While each student takes a turn moving the cereal, here are some discussion ideas:

Anemia is a condition where your blood doesn't have enough red blood cells to transport oxygen. You might become anemic if you don't have enough iron in your diet.

What other foods are rich in iron? Red meat, eggs, leafy green vegetables (spinach, broccoli, peas, string beans, kale, chard), seafood (tuna, shrimp, clams, oysters), dried beans, tofu.

We have enough iron in our bodies to make 2 small nails!

If time allows, you can let 2 students at a time race each other, seeing how fast they can move the cereal.

Station 2: Blood Detective Game

Materials: laminated cards – one set of text, one set of pictures

Set-up: Lay out the cards on a flat surface. You can have all the pictures on one side and all the text cards on the other, or you can mix them up.

If you are running this station it would be a good idea to look through all the cards first to make sure you are familiar with the material.

You can have the kids work together as a group or split into two groups. If you split them, give each group half the cards and then switch after a few minutes. Have the students take turns reading a card aloud to the group and then have them work together to find the matching picture card. If there is still time left over, you can split the cards and have two groups race to match up their cards the fastest.

Station 3: Luminol Demonstration

Set-up & Materials:

- Luminol Solution – *the solution is only good for a few hours so don't mix it too far in advance! If there is powder in your luminol bottle, fill the whole thing with water. The powder solution must sit for 30min before it is ready. If you are using the tablets, only fill to the designated line (125mL). Tablets are in packets of 2 – you must use BOTH tablets. Tablets only take a few minutes to dissolve and then they are good to go!*
- Fake Blood Solution,
- Q-tips,
- Small sheets of paper (have the student get a piece of scrap paper if you run out)
- Box (for darkness)

NOTE: *Luminol can be dangerous if inhaled or on skin. When demonstrating for students make sure the nozzle is pointed away from anyone's face and clothing. Tell the students not to spray themselves or each other with the luminol. Please see attached safety instructions for details.*

Who has heard that your blood has iron in it? There is iron in your red blood cells which actually helps them to be able to transport oxygen. Because your blood contains iron, you can do some really cool experiments.

In this station you're going to see an example of chemiluminescence. This is when a reaction between two chemicals emits light (glows). For example, have you ever worn or seen a glow stick before?

Here, we have some fake blood in this bottle. This is what we call a model – the blood looks and acts like real blood so you can study it like you would real blood, but it is NOT real blood.

In this bottle we have a chemical called luminol. When we mix luminol with blood, the iron in the blood reacts with the luminol and glows in the dark!

Take a Q-tip and a piece of paper – write or draw something on your paper (*remind them not to draw/write anything inappropriate*). When you're finished, let me know – you'll put your paper in the box and spray luminol on it to see what happens.

Give each student a chance to put their paper in the box and spray with luminol. They only need a few sprays – if they use too much it will get runny and the box will start getting too wet.

If there is time, ask the students if they remember why the reaction occurs (iron in blood) and what we call these type of chemical reactions (chemiluminescence).

Station 4: Blood Model

Materials:

- Cheerios
- Marshmallows
- Purple Glitter
- Water
- Yellow & Red food coloring
- Jar
- Laminated pictures of blood components

Start with a jar about half-full of water. Let a student add a few drops of yellow food dye. This is the **plasma**! Remind the students what the plasma does.

Add red food dye to a sandwich bag full of cheerios (this should be enough for all 4 groups). Mix it around. (You can let the kids do this). Let each student add a small handful of cheerios to the jar. The water should turn red! These are the **red blood cells**. Remind them what the RBCs do. Add about 10 marshmallows (each student can add one or two). These are the **white blood cells** – point out how there are far fewer WBCs than RBCs. In real blood the ratios is 600 RBCs: 40 platelets: 1 WBCs. Have a student add ~1/2 tsp. of purple glitter. These are the **platelets**. Now your blood is complete! Close the jar and let the students pass it around. Ask them to not shake it but they can turn it slowly.

3. Wrap-up: Sharing Experiences

 5min Minutes

Ask the students if they remember the components of blood. Call on students to give you the answers. Ask if they remember any of the important functions of blood. If they have trouble remembering, reiterate the answers for them (use the board!) Ask students what their favorite part of the lesson was and why.

4. Connections & Close:

 5min Minutes



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Ask if students have any questions about blood, what it's like to be a scientist, etc.

**Total 50 – 60
Minutes**

Follow-up – After Presentation

*Suggest students write a letter explaining “How we learned about _____?”
List or attach examples of activities, websites, connections for additional learning.
Attach worksheets, hand-outs, visuals used in classroom presentation.*

Supplemental Information & Discussion Topics

Have you ever seen X-Men? Do you remember when Magneto was able to make people move because the iron of their blood is attracted to magnets.

Are some foods with iron better than others?

Food has two types of iron — heme iron and non-heme iron. Heme iron is found in meat, fish and poultry, and is the form of iron that is most readily absorbed from your stomach and taken up into your body after you eat it. Non-heme iron is found in plant foods as well as meat. Foods with non-heme iron are still good to eat, but the iron contained in these foods won't be absorbed as completely as heme iron. You absorb up to 30 percent of heme iron, found only in animal tissues (meat, poultry, and fish). You absorb 2-10 percent of non-heme iron, found in plant foods as well as meat. Eating meat generally boost your iron levels far more than eating non-heme iron. When you eat heme iron with other sources of non-heme iron, the iron is more completely absorbed. Foods high in vitamin C, like tomatoes, citrus fruits and red, yellow and orange peppers can also help with the absorption of non-heme iron.

Do you remember which of the blood cells transport oxygen? (Red Blood Cells)
Your brain uses 25% of the oxygen you inhale.

Your muscles need a lot of oxygen, especially when you exercise. **Your working muscles can take oxygen out of the blood three times as well as your resting muscles.** Your body has several ways to increase the flow of oxygen-rich blood to working muscle:

- increased local blood flow to the working muscle (warm up before running a race)
- diversion of blood flow from nonessential organs to the working muscle (don't eat a big meal before exercising)
- increased flow of blood from the heart (cardiac output)
- increased rate and depth of breathing (take deeper breaths rather than quick shallow ones)
- increased unloading of oxygen from hemoglobin in working muscle

What if you had more red blood cells than normal? This would mean that more oxygen could get to your muscles and faster. One Olympic track and field gold medalist from Finland named Lasse Viren was known for blood doping, meaning that he would collect his own blood for a few weeks before a race. Then, right before the race he would give himself a blood transfusion with that blood that he collected. Because your red blood cells are constantly dying and while your body makes more, the number of red blood cells in your body stays fairly constant. But, if you get a blood transfusion, you will have more blood cells than normal. This made Lasse Viren an exceptional runner. Blood doping was made illegal in 1986.



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Iron Rich Foods

The amount and type of iron in your diet is important. Some iron-rich foods are:

Meat & Eggs

- Beef
- Lamb
- Ham
- Turkey
- Chicken
- Veal
- Pork
- Dried beef
- Liver
- Liverwurst
- Eggs (any style)

Seafood

- Shrimp
- Clams
- Scallops
- Oysters
- Tuna
- Sardines
- Haddock
- Mackerel

Vegetables

- Spinach
- Sweet potatoes
- Peas
- Broccoli
- String beans
- Beet greens
- Dandelion greens
- Collards
- Kale
- Chard

Bread & Cereals

- White bread (enriched)
- Whole wheat bread
- Enriched pasta
- Wheat products
- Bran cereals
- Corn meal
- Oat cereal
- Cream of Wheat
- Rye bread
- Enriched rice

Fruit

- Strawberries
- Watermelon
- Raisins
- Dates
- Figs
- Prunes
- Prune juice
- Dried apricots
- Dried peaches

Beans & Other Foods

- Tofu
- Beans (kidney, garbanzo, or white, canned)
- Tomato products (e.g., paste)
- Dried peas
- Dried beans
- Lentils
- Instant breakfast
- Corn syrup
- Maple syrup
- Molasses

Section 1 Chemical Product and Company Information

Innovating Science[®] by Aldon Corporation
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221 Rochester Street
 Avon, NY 14414-9409
 (585) 226-6177

CHEMTREC 24 Hour Emergency
 Phone Number (800) 424-9300
 For laboratory use only.
 Not for drug, food or household use.

Product LUMINOL REAGENT

Synonyms None assigned.

Section 2 Hazards Identification

This substance or mixture has not been classified as hazardous according to the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals.

Signal word: WARNING

Pictograms: GHS07 / GHS08

Target organs: None known



GHS Classification:

Eye irritant (Category 2A)

Acute toxicity (Category 4)

Reproductive (Category 2)

GHS Label information: Hazard statement(s):

H302: Harmful if swallowed.

H319: Causes serious eye irritation.

H361d: Suspected of damaging the unborn child.

Precautionary statement(s):

P201: Obtain special instructions before use.

P202: Do not handle until all safety precautions have been read and understood.

P264: Wash hands thoroughly after handling.

P270: Do not eat, drink or smoke when using this product.

P280: Wear protective gloves/protective clothing/eye protection/face protection.

P301+P330+P312: IF SWALLOWED: Rinse mouth. Call a POISON CENTER or doctor/physician if you feel unwell.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P308+P313: IF exposed or concerned: Get medical advice/attention.

P337+P313: If eye irritation persists: Get medical advice/attention

P405: Store locked up.

P501: Dispose of contents/container to a licensed chemical disposal agency in accordance with all local, state and federal regulations.

Ca Prop 65 - This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%	EINECS
Sodium carbonate, monohydrate	5968-11-6	86.5%	207-838-8 (as anhydrous)
Sodium perborate, tetrahydrate	10486-00-7	12.1%	239-172-9 (as anhydrous)
Luminol	521-31-3	0.7%	208-309-4

Section 4 First Aid Measures

INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person.

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

EYE CONTACT: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention.

SKIN ABSORPTION: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention.

Section 5 Fire Fighting Measures

Suitable Extinguishing Media: Use any media suitable for extinguishing supporting fire.

Protective Actions for Fire-fighters: In fire conditions, wear a NIOSH/MSHA-approved self-contained breathing apparatus and full protective gear. Use water spray to keep fire-exposed containers cool.

Specific Hazards: During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Section 6 Accidental Release Measures

Personal Precautions: Evacuate personnel to safe area. Use proper personal protective equipment as indicated in Section 8. Provide adequate ventilation.

Environmental Precautions: Avoid runoff into storm sewers and ditches which lead to waterways.

Containment and Cleanup: Sweep or vacuum up and place in a suitable container for proper disposal. Wash spill area with soap and water.