RAFT IDEAS

Topics: Anatomy, Circulatory System

Materials List

- ✓ Thin plastic bag that can be sealed (e.g., zip sandwich bag)
- ✓ Thick white paint or equal (white fabric paint will work)
- ✓ Red permanent marker
- ✓ Black background material
- ✓ Piece of white paper
- ✓ Purple & red paper
- ✓ Translucent material such as a section of a "whitish" plastic liquid container
- ✓ Tape

This activity can be used to teach:
Next Generation Science:

- Body structures and systems (Life Science, Grade 4, 1-1; Middle School, 1-3)
- Senses (Life Science, Grade 4, 1-2; Middle School, 1-8)
- Light reflecting from objects/entering eye (Grade 4, Physical Science 4-2),
- Waves are reflected, absorbed/ transmitted (Middle School, Physical Science 4-2)

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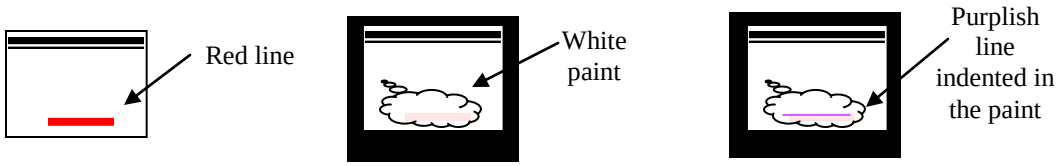
Red Blood looks "Blue"?

Why do veins filled with red blood look bluish?



Seeing can be deceiving! Model how a person's blood can look bluish in the wrist veins and address the misconceptions that have been created to explain this paradox.

Assembly

1. Cut about an 8 cm (3") wide flat strip from a translucent material such as a plastic milk bottle. Cut a 3 mm (1/8") strip from a piece of purple paper.
2. Place the purple strip on the red paper and cover the strip with the translucent material.
3. With a permanent red marker make a line about 5 cm (2") long by 1 cm (3/8") wide near the bottom of a thin plastic bag, on one side, as shown above.
4. Allow the red ink to dry completely. Flip the bag over.
5. Open the bag and add enough white paint to cover the surrounding area over the red line, so the line can not be seen, but do not fill the bag with paint, see above.
6. Seal the bag. Place the bag, red line side downward onto a black binder cover or other material with a dark surface. Tape the top of the bag to the dark surface.

Note that some white paints may work better than others to make the red line underneath look bluish or purplish. Try a different thick, white substance if needed.

To Do and Notice

1. Note the purple strip looks more bluish when the background color is reddish.
2. Move the white paint in the bag by pressing and sliding fingers to manipulate the paint so as to completely cover the red line from view.
3. Gently press on the bag with a finger in a stroking manner to gradually thin the paint layer over the red line. Note the color when the red line can just be perceived through the white paint.
4. Slip white paper under the line, between the bag and the dark surface. Does the color of the line as seen through the bag and the paint appear to change?
5. Compare the colors noted in steps 3 and 4 to the actual color of the line by flipping the bag over to see the actual red line.
6. Repeat step 2 and then repeat steps 3 and 4 but use a fingernail instead to create a very thin line while gradually thinning the layer of white paint above the red line.

The Science Behind the Activity

The paradox of reddish colored blood looking bluish is due to how the different colors (wavelengths) of light are absorbed and reflected by the blood, the veins and the skin when a vein is at certain depth below the surface of the skin. The color of the surrounding skin plays an important part in the illusion of blood appearing bluish. Light colored skin does not absorb much of the white light making skin appear whitish-red depending on how much melanin is present. Blood reflects some red light giving blood a reddish coloration. A vein without a skin covering will absorb all the blue light, so even though only about 1/4 of the red light is reflected from the blood in

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the vein appears red, such as the veins visible in the white of the eye.

If a vein is about 0.5 mm (~5/32") below the surface of the skin, less red and even less blue light will be absorbed. The effect is to make the blood appear purplish. By pressing on the white paint in the bag, a thin enough layer of white paint can be created to mimic this effect, creating the perception of a purplish line rather than the actual bright red color of the line that is drawn on the bag.

A vein at the proper depth will appear bluish even though slightly more red light than blue light is being reflected. The key factor is that the surrounding skin reflects more red light than blue light. Color perception is strongly influenced by the background color. If a purple strip is placed on a red background the purple strip will appear bluish, as shown in the first step of the **To Do and Notice**.

Combining both effects produces the bluish color we perceive when looking at veins filled with reddish blood that are located at the proper depth below the surface of the skin.

Arteries have thicker walls than veins as the blood in the arteries is at higher pressures due to the blood being pushed by the beating heart. Also the arteries tend to be in a more protected location farther below the surface of the skin while veins can be seen near the surface of the skin, which aids dissipating excess heat from the body. If arteries were thin walled and near the surface of the skin then the arteries filled with oxygenated blood would also look bluish!

In reality bright red oxygenated blood, which has about a 95% oxygen saturation level, becomes a dark red or maroon color when deoxygenated. Deoxygenated does not mean without any oxygen as deoxygenated blood still has about a 75% oxygen saturation level.

A common misconception says veins look bluish because the blood in the veins is bluish due to a lack of oxygen in the blood, which is not true. This misconception is unintentionally supported by the anatomy charts that use the colors red and blue to distinguish the arteries, with oxygenated blood, from the veins, containing deoxygenated blood. To explain why the "blue" blood appears red in a cut another misconception was created saying that the "blue" blood turns red outside the body due to the contact of the "blue" blood with the oxygen in the air. Another incorrect misconception created to support the first misconception!

Taking it Further

Students could survey friends and family by asking, "What color is the blood in the veins?" and "Why do veins look blue?"

Web Resources (Visit www.raft.net/raft-idea?isid=575 for more resources!)

- Scientific research - http://www.imt.liu.se/edu/courses/TBMT36/pdf/blue.pdf

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