Name: _____ Date: _____

Skills Practice: Science Reading Comprehension

Learning goals
After completing this activity, you will be able to …

- Apply information that you read in a scientific source.
- Determine appropriate tests of scientific explanations.
- Evaluate the merit of a scientific explanation.

Reading comprehension, application, and evaluation
Professional scientists publish their findings in journals so other scientists can replicate the findings and evaluate their reasoning and methods. These articles are read for many different reasons. Some people read the articles for the information. Other scientists read articles with an eye toward extending the results in their own research, while other scientists may read an article with an eye toward evaluating the plausibility and reliability of the authors' claims.

Try your own hand at reading a scientific article with a critical eye. Read the article given on the next page and answer the questions below it.

Veins Are Not Blue

Abstract: Human tissue was tested with different colors to determine that veins do not reflect blue light more than other light. An alternative explanation for the apparent color of veins is provided.

Fortunately, it is no longer common to read the old myth that oxygen-poor blood in the veins is blue. It is well known that oxygen-poor blood is in fact a dull, dark red. What accounts, then, for the blueness of veins for fair-skinned people?

Earth's atmosphere scatters light. Since blue light scatters more easily than red, yellow, or green, we see the sky as blue. Similarly, the tissue lying immediately under the epidermis (the outermost layer of skin) is translucent and scatters light. This scattering causes some light to be ejected from the skin. Thus, the appearance of skin is determined by what light is ejected by these subsurface layers.

Therefore, the natural explanation for the color of veins is that a vein changes the absorption/scattering properties of skin so that we see mostly blue light coming from the vein. This account suggests veins are blue for reasons similar to the blueness of the sky. The chemical properties of the near-surface tissue causes more blue light to be scattered back than other colors just as atmospheric particles in the air preferentially scatter blue light.

To test this account, we shined light of different colors on a sample of forearms from fair-skinned volunteers. We observed that red light was scattered significantly more than blue light. Based on the relative scattering of red, green, and blue light, one would expect veins to appear a reddish, dull grey (or mauve taupe).

Further measurements give support to a different explanation. It is well known that the human brain takes into account not just the colors it sees but the contrast it sees between one color and another. We submit that the color of human veins is a type of optical illusion caused by the significant contrast in red light scattered from nearby skin versus skin directly above the vein. The table below summarizes our data:

Color	Percent scattered by skin above vein	Percent scattered by skin near vein but not directly above it	Contrast
Red	37	49	12
Green	28	32	5
Blue	29	34	5

In short, it is not a simple abundance of blue light that causes veins to appear blue, but rather the relative depression of red light compared to nearby skin. Thus, even though the skin above the vein scatters red light and other long-wavelength colors better than it does green or blue light, the human brain perceives the region as blue because it is not as red as the background (non-veined) skin.

1. Apply the information given in the table to answer the following questions:

   A. Does a vein increase or decrease the amount of light scattered by the skin? _____

   B. Justify your answer: _____

   _____

   C. Does oxygen-poor blood absorb light more or less than the tissue near a vein?

   Explain your reasoning: _____

   D. Connect your answer to part C to the fact that oxygen-poor blood is very dark.

   _____

2. The authors could have proposed their explanation even if veins scattered more blue light than red light. Why does the information in the fourth paragraph under the abstract make their explanation more plausible?

   _____

   _____

3. Why did the scientists use several volunteers instead of just one? _____

   _____

4. **Evaluate:** Do you believe the explanation given is plausible? Why or Why not?

   _____

   _____

5. **Challenge:** Propose an experiment you could run to test their explanation fairly:

   _____

   _____

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