Peas

1. **List vegetables included in the legume family. Research the nutrient data of at least five legumes, including the three different forms of peas (use Nutrition Facts labels from the Sensory Exploration activity on page 1).**

   - Legumes include: Green Bean, Split Pea, Yellow Pea, Green Pea, Snow Pea, Black-eyed Pea, Chickpea, Broad Bean, Lima Bean, Fava Bean, Navy Bean, Red Kidney Bean, Great Northern Bean, Pinto Bean, Adzuki Beans, Mung Beans, Soy Bean, Brown Lentil, Green Lentil, Red Lentil, Black Lentil.

   - Green peas, 1 cup: Calories 134, Protein 9 g, Total Fat 0.3 g, Saturated Fat 0.1 g, Carbohydrate 25 g, Vitamin A 955 IU, Vitamin C 23 mg, Calcium 43 mg, Iron 2.4 mg, Fiber 9 g

   1a. What are the key nutrients common among legumes?

   - Protein, fiber, carbohydrate, folate, potassium, iron, and magnesium.

   1b. What health benefits do these nutrients provide to the body?

   - *Protein:* Made of amino acids, proteins are essential parts of all living organisms and participate in every process within cells (e.g. proteins are enzymes, have structural or mechanical functions, they are important in cell signaling, immune responses, and the cell cycle).
   - *Fiber:* A diet high in fiber can reduce risk of developing diabetes and help lower blood cholesterol levels, and reduce risk of heart disease.
   - *Folate:* Helps produce and maintain new cells; important during periods of rapid cell division and growth such as infancy and pregnancy. Folate is needed to make DNA and RNA, prevents changes to DNA that may lead to cancer, and helps make normal red blood cells and prevent anemia.

- *Iron:* Essential for the regulation of cell growth and differentiation. A deficiency of iron can lead to anemia, limiting oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity.
- *Vitamin A:* Promotes healthy surface linings of the eyes and the respiratory, urinary, and intestinal tracts. When those linings break down, it becomes easier for bacteria to enter the body and cause infection. Vitamin A also helps the skin and mucous membranes function as a barrier to bacteria and viruses.

1c. What nutrient is comparatively higher in legumes than in other vegetables?

Protein.

1d. Develop a plan to eat at least three legumes each week.

Student answers will vary.

2. Lutein and zeaxanthin are two carotenoids found in peas. What are carotenoids and in which fruit and vegetable color groups are they found? What role do these carotenoids play in vision health? Draw a diagram of an eye and label the parts. Highlight the eye parts that benefit most from carotenoids. Share findings with peers.

Answers will vary by grade level.

Sample lower grade level response:

- Carotenoids: Fat-soluble phytochemicals with a vitamin A-like structure and strong antioxidant and other potentially protective properties; associated with reduced risk of several chronic health disorders including some forms of cancer, heart disease and eye degeneration.
  - Sources: many fruit and vegetables, especially yellow/orange and dark green leafy produce, such as pumpkin, sweet potatoes, carrots, kale, and spinach.

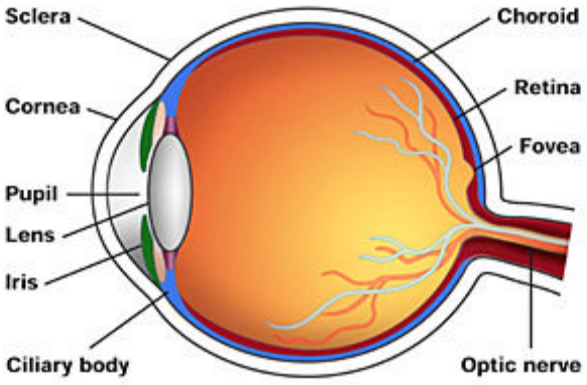
- Carotenoids are found primarily in the yellow/orange fruit and vegetable color group. Fruits and vegetables in the red and green color groups may also contain carotenoids.

Sample upper grade level response:

- Carotenoids are organic pigments that are naturally occurring in plants and some other photosynthetic organisms like algae, some types of fungus and some bacteria.
- There are over 600 known carotenoids; they are split into two classes, xanthophylls and carotenes.
- Carotenoids are characterized by a large (35-40 carbon atoms) polyene chain, sometimes terminated by rings.
- Carotenoids with molecules containing oxygen, such as lutein and zeaxanthin, are known as xanthophylls.
- The un-oxidized (oxygen free) carotenoids, such as alpha-carotene, betacarotene and lycopene, are known as carotenes.
- Their color, ranging from pale yellow to bright orange to deep red, is directly linked to their structure.
- Xanthophylls are often yellow. The double carbon-carbon bonds interact with each other in a process called conjugation, which allows electrons in the molecule to move freely across these areas of the molecule. As the number of double bonds increases, electrons associated with conjugated systems have more room to move and require less energy to change states. This causes the range of energies of light absorbed by the molecule to decrease. As more frequencies of light are absorbed from the short end of the visible spectrum, the compounds acquire an increasingly red appearance.
- Lutein: A carotenoid that concentrates in the macula of the eye. Lutein in foods may prevent age-related eye disease and may also reduce the risk of heart disease and protect against certain cancers.
  - Sources: green leafy vegetables like collard greens, spinach, and kale.
- Zeaxanthin: A carotenoid with antioxidant power that is deposited in the eye's macular region. Zeaxanthin may help prevent age-related eye disease and certain cancers.
  - Sources: green leafy vegetables and yellow/orange fruit and vegetables such as spinach, kale, collard greens, corn, tangerines, and nectarines.

- Beta-carotene: An antioxidant and precursor to vitamin A, a nutrient important for vision, immune function, and skin and bone health.
  - Sources: yellow/orange and dark green leafy vegetables.
- Lycopene: A carotenoid that is a potential antioxidant and may help prevent heart disease and reduce the risk for many cancers, especially prostate cancer.
  - Sources: red fruit and vegetables such as tomatoes and cooked tomato products, watermelon, and red peppers.
- Carotenoids role in vision health:
  - Lutein and its related compound zeaxanthin are highly concentrated in the macula, providing a yellow color known as the macular pigment (MP).The macular pigment protects the macula from the damaging photo-oxidative effects of blue light.
  - The retina also benefits indirectly from carotenoids (beta-carotene) because beta-carotene can be split to form one or two molecules of retinol (Vitamin A). Other carotenoids can be converted to Vitamin A, but it is very inefficient. Over 100 million cells reside in the retina, and each contains about 30 million molecules of Vitamin A-containing visual pigments.

SAMPLE EYE DIAGRAMS:



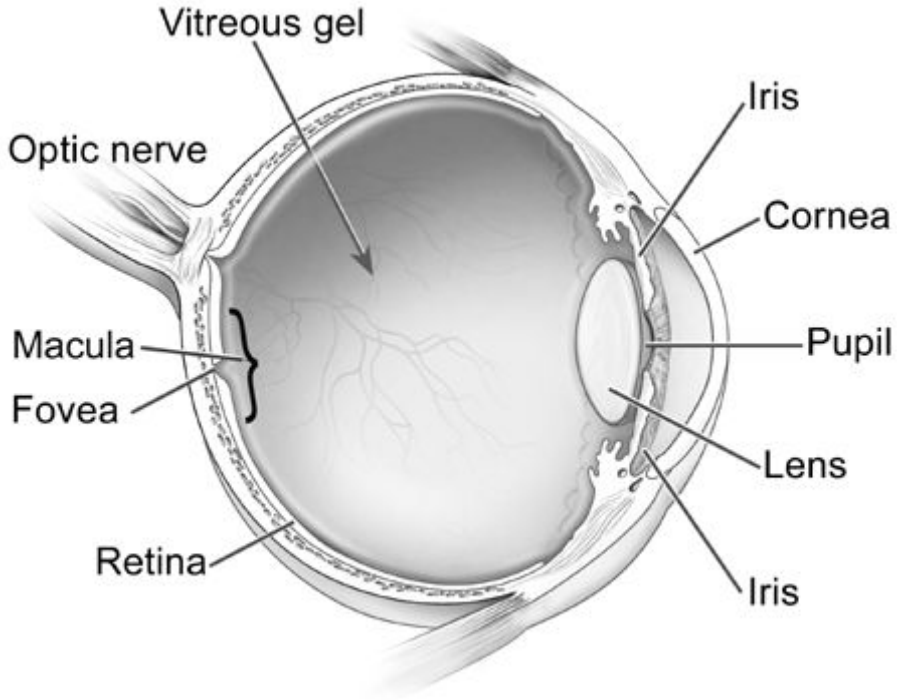


Image Sources:
www.nei.nih.gov/health/eyediagram/eyeimages3.asp
www.healthyeyes.org.uk/uploads/pics/Eye-1.jpg

3. What impact do leguminous plants have on soil? What is nitrogen-fixing? Describe its role in agriculture.

- Legumes are known for their ability to fix atmospheric nitrogen to replenish soil and its nutrients.
- Farmers use legumes in a crop rotation to help replenish soil that has been depleted of nitrogen. This helps to reduce fertilizer costs.

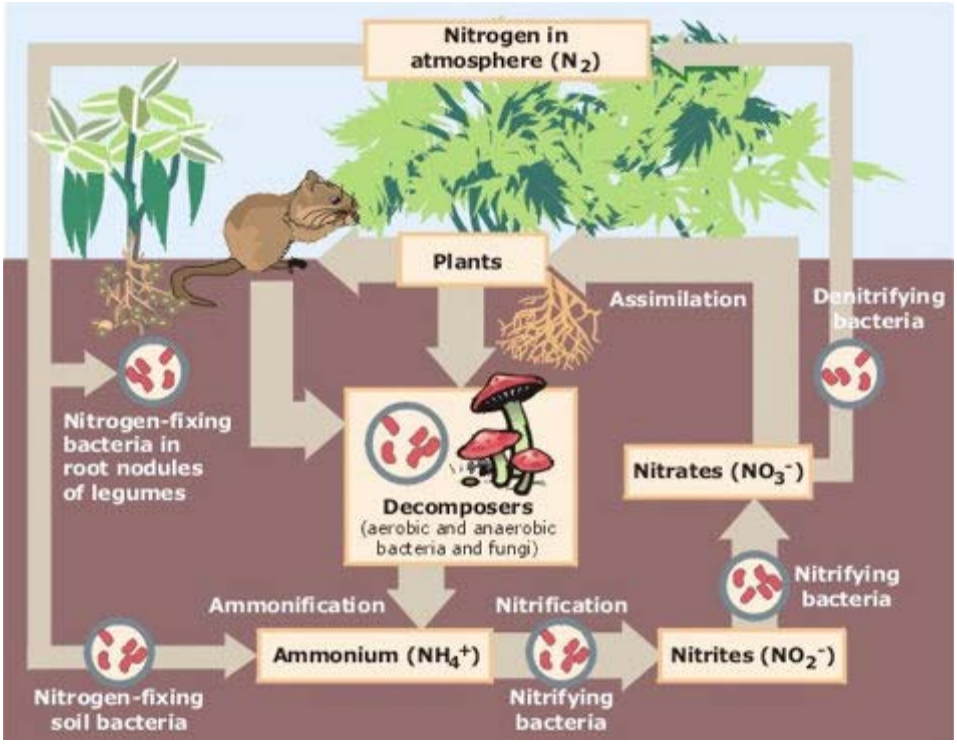


Image Source: http://en.wikipedia.org/wiki/Image:Nitrogen_Cycle.jpg

Sources:
University of Michigan Health System, November 2006.
www.med.umich.edu/umim/clinical/pyramid/legumes.htm
http://food.oregonstate.edu
http://aggie-horticulture.tamu.edu
www.nei.nih.gov/health/eyediagram/eyeimages3.asp, www.healthyeyes.org.uk/uploads/pics/eye-1.jpg
www.carotenoidsociety.org/carotenoids/fcarotenoids.html
www.luteininfo.com/eye
Richter, Henry J., *Dr. Richter's Fresh Produce Guide*, Try-Foods International, Inc., 2005, pg. 4.
Whitney and Rolfes, *Understanding Nutrition 10th ed.*, Thomson Wadsworth, 2005.

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