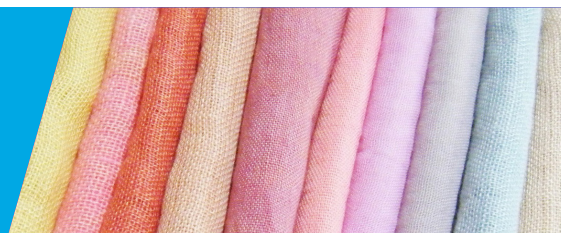


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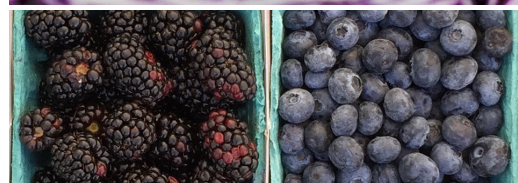
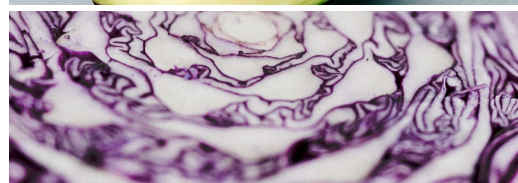
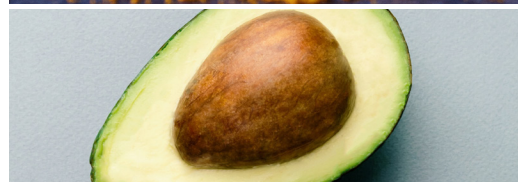
NATURAL TIE-DYE



Natural dyeing is a tradition that has been practiced for time immemorial. Indigenous chemists and natural dye specialists have mastered techniques for extracting colors, or pigments, from plants and minerals and using these pigments to dye natural fibers, such as cotton, linen, and wool. Learn how to make your own natural dyes using foods found in your kitchen!

MATERIALS

- Raw materials for natural dyes: beets, yellow onion skin, red onion skins, spinach, black tea, turmeric, avocado pits and skins, red cabbage, blueberries, and/or blackberries
- **Optional (use with adult supervision):** Knife and cutting board
- Two pots
- Strainer
- Clean white 100% cotton fabric (e.g. t-shirt, bandanna, socks, or pillowcase)
- Salt
- Measuring cup
- Tongs
- Rubber bands (the thicker the better)
- Large shallow dish or rimmed baking tray
- Kitchen baster or large spoon
- Sealable plastic bag or airtight container
- **Optional:** Rubber or plastic gloves
- **Optional:** Clear glass or bowl (optional)
- **Optional (for older students):** Lemon juice
- **Optional (for older students):** Baking soda



Experiment continued on next page...



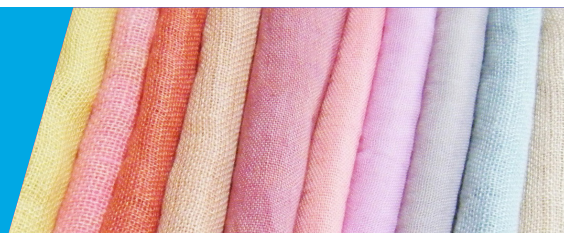
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NATURAL TIE-DYE



PROCEDURE

MAKE THE DYES:

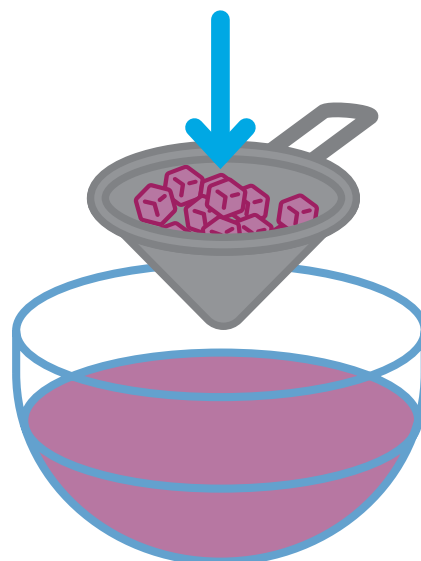
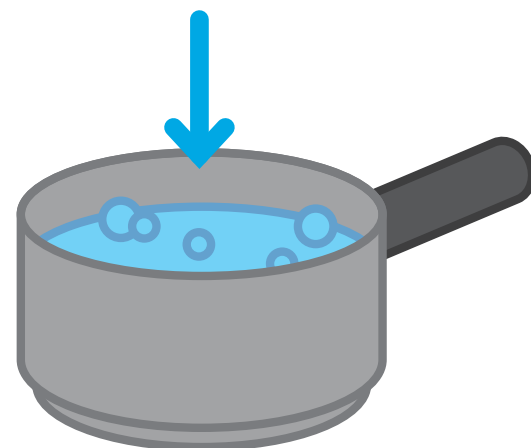
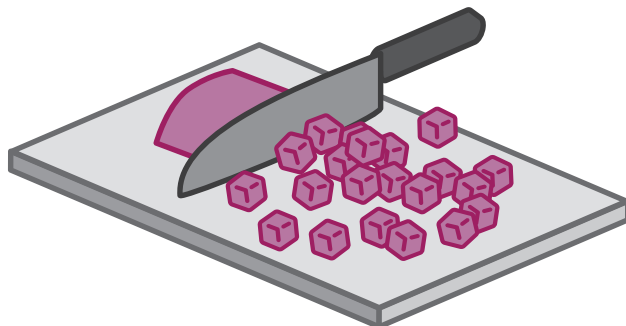
- Cut large fruits or vegetables into small pieces.
- Place raw dye material in a pot (one type of raw materials per pot) and cover with water. For best results, use one part raw materials to two parts water.
- Heat water until near boiling (but not actually boiling) and simmer for 1 hour.

TIP: For a deeper color, leave raw materials to cool in the pot and soak overnight (12-24 hours).

- Strain out raw materials and reserve dye liquid.

PREPARE THE FABRIC:

- Before dyeing, prepare fabric using a fixative solution. To make fixative solution, dissolve $\frac{1}{2}$ cup salt in 8 cups water in a pot. Place fabric into the salted water and simmer on stovetop or hot plate for about an hour. This will help prevent dye from washing out of fabric later.
- Remove fabric from water using tongs and allow fabric to cool. Gently squeeze out excess salted water (be careful, water may be hot).

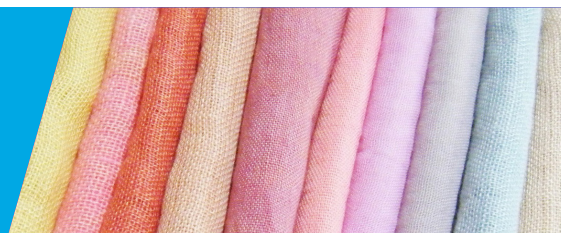


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NATURAL TIE-DYE



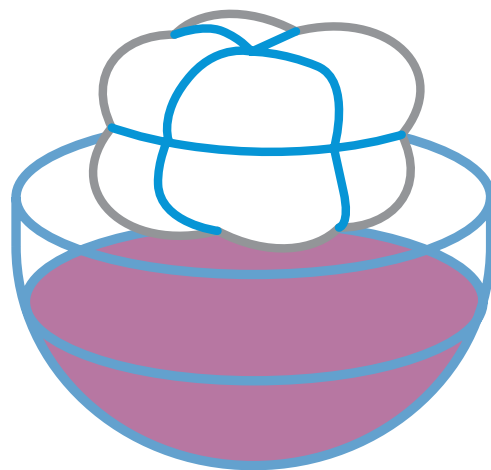
PROCEDURE

DYE THE FABRIC:

- Roll damp t-shirt or fabric into a ball, not too tight.
- Wrap several rubber bands around it to hold it in a ball
- Place still-damp ball in large shallow dish or on a rimmed baking tray. Use kitchen baster or large spoon to apply dye to fabric. If using multiple colors, apply each color to different portions of the fabric, following your own design. Be sure to completely cover all side of fabric with dye. **Be careful not to splash dye on the clothes you are wearing!**

TIPS: For fuller saturation of designs with one solid color, soak fabric in liquid dye for 1 hour. Wear gloves to prevent dye from staining hands.

- Seal fabric in plastic bag or airtight container to keep damp while dye sets for 6-8 hours or overnight.
- After dye has set, rinse fabric in cold water until water runs clear. Remove rubber bands and lay flat to dry.
- To wash, cold wash separately on a delicate cycle with a mild detergent, or hand wash. Tumble dry on low or hang to dry in shade.



Experiment continued on next page...



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NATURAL TIE-DYE



TRY THIS

- Try a different fabric scrunching and rubber banding technique. How does your technique affect the dyed pattern?
- Many factors can affect how well certain dye pigments transfer and stay in natural fibers. How does using vinegar-based fixative (1 part vinegar to 4 parts water) affect the dye job? How do different dye setting times affect the color vibrancy? Do some natural dyes change color when exposed to direct sunlight? Try different dyeing techniques and compare your results.
- Many native plants can also be used to make natural dyes. Check out this resource guide from the U.S. Forest Service to learn more about native plants used for dyes in your area. When foraging for wild plants, follow the 1 in 20 rule: only take one if you can see 20 other good plants of the same kind.

DID YOU KNOW?

Natural dye specialists need to understand the chemical properties of different dye pigments to prevent colors from fading over time. There are two important types of dyes: adjective dyes and substantive dyes.

Adjective dyes require a bonding material called a mordant (such as alum and tannic acid) to stop the dye from washing out of the fibers. The mordanting process is when fibers are treated with a metal salt solution to create a lasting bond between the fiber and the pigment.

Substantive dyes do not need a mordant because they are from plants that contain natural mordants, such as tannins. The pigment molecules of substantive dyes are water-soluble and can directly bond to natural fiber on their own.



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NATURAL TIE-DYE



K–2 GRADE EXPLORATION

Here are some questions you can explore together:

- Look closely at the raw dye materials before boiling them in water. What colors do you see?
- After straining the solids from the liquid dye, what do you notice about the colors of the raw dye materials now? Pour some of the liquid dye into a clear glass or bowl to observe it more closely. What color words would you use to describe the dye? What color do you think it will dye the fabric?
- After you tie up your fabric and dye it, make a prediction about what the pattern will look like.
- Look at the color and pattern of your finished tie dye: Is it similar to or different than what you predicted? How so? Can you tell where the rubber bands were placed? What would you try differently next time?



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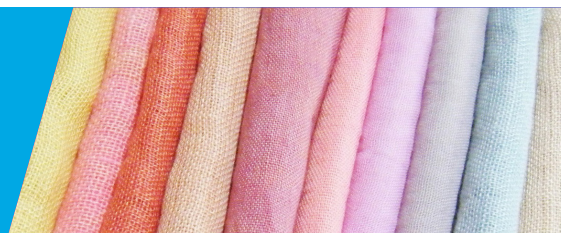
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NATURAL TIE-DYE



3–5 GRADE EXPLORATION

Make observations about the transfer of natural dyes from the raw materials to the fabric. Record your observations in the table below, or in your science notebook.

- Look closely at the raw dye materials before boiling them in water. What colors do you see? After straining the solids from the liquid dye, what do you notice about the colors of the raw dye materials now?
- Carefully take a sample of the liquid dye after simmering the raw plant materials for 20 minutes. Pour the sample into a clear glass or bowl to observe it more closely. What color words would you use to describe the dye? Repeat again after 1 hour. What do you notice about the color now?
- Observe the color of the fabric immediately after dyeing. Compare the color after the dye has had time to set and the fabric has been rinsed in cold water. How does the color change during the dyeing and rinsing process?

Raw materials used for dye: _____

Color(s) of raw plant material before boiling	Color(s) of raw plant material after boiling
Color of liquid dye after 20 minutes	Color of liquid dye after 1 hour
Color of fabric after immediately after dyeing	Color(s) of raw plant material before boiling

Other observations:



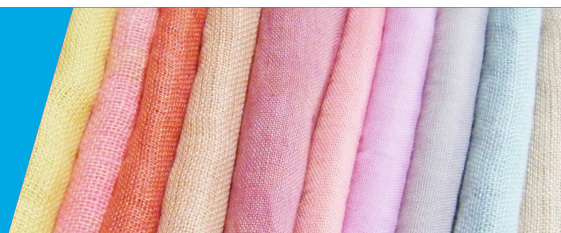
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NATURAL TIE-DYE



6–8 GRADE EXPLORATION

Explore the following questions and record your answers in your science notebook.

Some natural dyes are pH sensitive. This means that they change color when exposed to an acid (like lemon juice) or a base (like baking soda). Test the pH sensitivity of your natural dye:

- After making your liquid dye, take a sample and divide it evenly into three clear glasses or bowls.
- Add lemon juice to one sample portion and stir.
- Add baking soda to another sample portion and stir until dissolved.
- Leave one sample portion untreated.
- Observe for any color change and record your observations in the chart below, or in your science notebook.

Dye treated with acid (lemon juice)	Dye treated with base (baking soda)	Untreated dye

- If your dye is pH sensitive, how can you use the application of acids and/or bases to affect the color of your dyed fabric? Try out different dyeing techniques and make notes on your process. What technique would you recommend for someone else to try?



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