

# Nature of Dye

## Prepare a dye

Place two pieces of cochineal bug parts into the mortar. Crush the bug into a fine powder using the pestle. What does it look like?

Use the water dropper bottle to add three or four drops to the mortar and mix the solution using the pestle. How does it change?

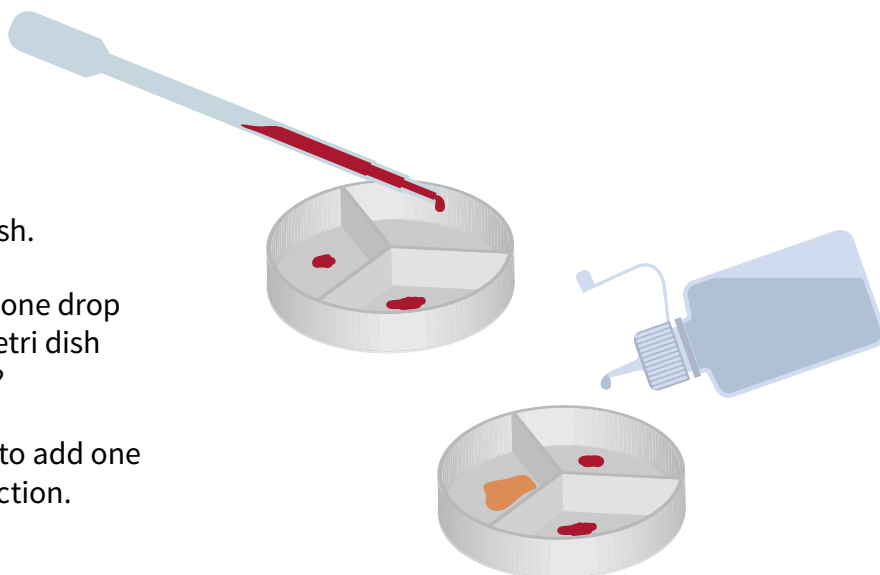


## Change the color

Use the pipette at your station to transfer one drop of your bug mixture (cochineal dye) from the mortar dish into each section of the 3-part petri dish.

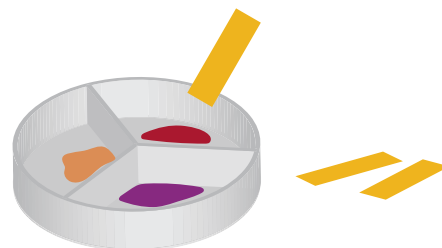
Use the vinegar dropper bottle to add one drop onto the cochineal dye in one of the petri dish sections. What changes do you notice?

Now, use the soda ash dropper bottle to add one drop onto a different cochineal dye section. What changes do you notice here?



## Test and experiment

Test the differences in the three dyes using strips of pH paper. How do the different dyes compare? Experiment by mixing the three dyes. You can retest the pH of your new mixture.



**Let's keep exploring!** Make a cochineal bookmark to take home! Dip a strip of watercolor paper into your dye samples to transfer the color. Or try using the pipette to add colors to the paper. How many shades of reds, oranges, and purples can you make?

# Chemists use tools to discover and make new things.

We made our own colorful dye out of crushed bugs and water! Adding an acid like vinegar or a base like soda ash changes the color of this dye by changing the pH. The shell of the cochineal (“koh-chin-eel”) bug includes a vibrant red chemical called *carminic acid*. Carminic acid is *pH-dependent*. For a more orange red, you can lower the pH (make it more acidic). To create a darker wine red or violet, you need to increase the pH (make it more basic).

Terms like “natural” and “artificial” on labels can be confusing. The cards show a range of products that use different ingredients to add color to food and cosmetics. Even though an ingredient like beet juice is a naturally occurring substance, it is considered an “artificial color” when added to a food deliberately for its color.



**The cochineal bug (*Dactylopius coccus*) is a scale insect that lives on cactuses from the the Southwestern United States to South America.**

## People shape the development and use of new materials and technologies.

Indigenous people, including Incas and Aztecs, in Central and South America were the first to discover ways to use cochineal bugs to make pigments that could color fabrics and other materials. This dye was once so highly prized that bags of the dried bugs were used as currency or as tribute. Spaniards, who colonized these areas, took the cochineal process back to Europe, and for a time cochineal was Mexico’s second-most valuable export after silver. Cochineal was used to dye the cloaks of Roman Catholic cardinals and to color jackets that gave British “redcoat” soldiers their nickname. Today, this rare and hard to cultivate dye is still used to color fabrics and food products around the world.



**Native peoples in Central and South America have developed a highly controlled and intricate set of practices to farm and collect cochineal insects for dye.**

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*Does it matter to you where a product comes from?*

*What about if it’s colored with natural or synthetic dye?*

*How do your values impact your choices?*