Biotech Skills—Pipette by Numbers

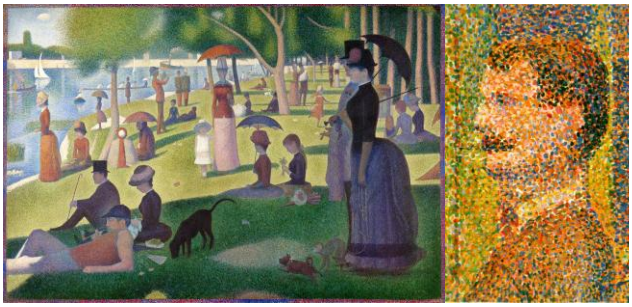
Be a scientist and practice a common skill used in biotechnology labs – micropipetting. Science and art also go hand-in-hand, so practice pipetting while painting an image!

Try this!

1. Pick up a 20uL (uL = microliter) micropipetter and attach a tip by firmly pushing a disposable tip onto the end of the micropipette
2. Select a numbered color (1-12) and draw up 20uL of paint into the micropipette tip (*using proper technique).
3. Find the corresponding number on the canvas and carefully deposit the paint on top of the number(s) (*using proper technique).
4. When finished, dispose of the used tip into the trash bucket and return the micropipette.
5. As more people add paint drops to the canvas, the mystery biotech image will be revealed!

What's going on?

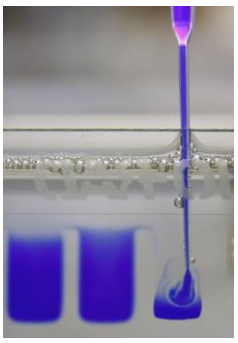
One of the most common techniques used in science laboratories is called micropipetting, which allows scientists to transfer very small and precise amounts of liquids. It is essential for scientists to conduct proper experiments while developing biotechnology products that can have fatal results if not done well. Just like any other profession, there are a set of techniques and protocols that every scientist follows in the lab to keep them and the public safe.



Example of pointillism in Georges Seurat's painting *A Sunday on La Grande Jatte and d*etail from Seurat's *La Parade de Cirque*. Wikimedia Commons

Though many don't see the connection between art and science, the fact is that they have long existed and developed collaboratively. This synergy was embodied in great thinkers like the legendary Leonardo Da Vinci and the renowned Chinese polymath Su Song. Artists have also been borrowing techniques and tools from biotechnology to produce pieces of art. Pipetting dots of paint to create a picture mimics a painting technique called **Pointillism.** This technique was made famous by artists Georges Seurat and Paul Signac in the 19th century.

How is this biotech?



Scientists use special tools and skills in the lab. The development of powerful tools in biotechnology has led to an explosion in our understanding of how organisms function, such as understanding genes and the factors controlling their expression. We have used the biological processes of microorganisms for more than 6,000 years to make useful food products, such as bread and cheese, and to preserve dairy products. Scientists use these skills in current research and examine ways in which these tools and techniques are being used in both research and in the development of medical learning. Common techniques include DNA extraction, PCR, and tissue culturing.

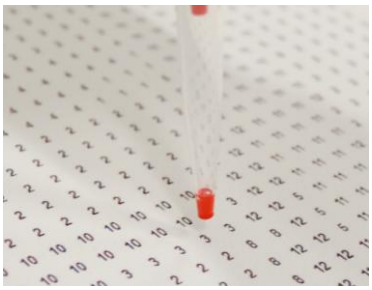
Left image, loading a sample into a gel electrophoresis well. By Blaz Nemec Wikimedia Commons CC-BY-SA-2.0

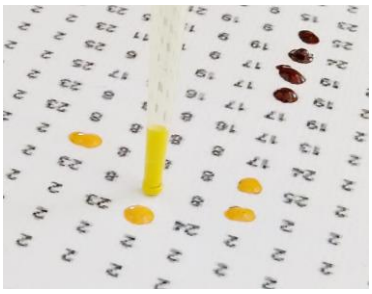
Visual Step-by-step Procedure

1. **Pick up a 20uL micropipette and attach a tip by gently pushing the tip onto the end of the micropipette. The tip should feel sealed around the end of the micropipette but still removable.**

2. **Select a numbered color and use the micropipette to draw up 20uL of paint into the micropipette tip**.
   Proper technique*: After attaching the tip, hold the pipette in your hand, positioning your thumb over the plunger. Gently push your thumb down on the button until it reaches the **first stop. While holding down the plunger, dip the tip of the pipette tip into the paint and then slowly release the plunger to draw up the precise amount of paint into the tip.

3. **Find the corresponding number on the canvas and carefully deposit the paint in one drop on top of the number.**
   Proper technique*: When ready to deposit the paint, position the tip over the number on the canvas with the tip barely touching the canvas. Using your thumb, slowly push down on the plunger to the **last stop. This will push as much as the paint out of the tip and into a single droplet on top of the number. If your hand is shaking, you can use your other hand to steady the pipette.





4. **When finished, dispose of the used tip into the trash bucket and return the micropipette.**

Biotech Skills—Pipette by Numbers Presenter Guide

Learning Objectives

1. Scientists use special tools and skills in the laboratory.

Materials

- 20x16 inch canvas with an image printed in numbers
- 2 x 20uL micropipettes
- Acrylic paint (combine to match the correct colors for each number)
- Color key
- 2 x 6-well tissue culture plates (a total of 12 wells) with the lids numbered 1-12
- Disposable wide-bore micropipette tips
- 10 x 50mL centrifuge tubes
- 12 x wooden stirrers for mixing paint
- Trash bucket (not provided)

Activity Diagram

Set-up

45 min – 1 hr

Program

Hours

Clean up

10 minutes

Notes to the presenter

SAFETY: Avoid ingesting the acrylic paint.

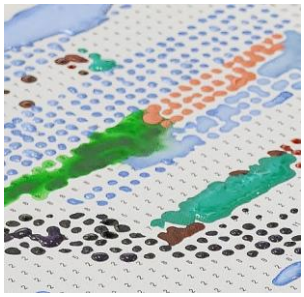
Before doing this activity: Mix the paints in 50mL centrifuge tubes and pour correct colors into numbered wells.

Tips:

- To prevent the paint clogging the micropipette, follow the proper techniques for using the micropipette and use wide bore tips. You may use other micropipettes besides the ones provided.
- If a tip becomes clogged, check the viscosity of the paint to make sure it has the consistency of syrup. If it is too thick, add small amounts of water to the paint until you reach the right consistency. Use a new tip and continue the activity.
- Make at least 25mL of each paint color in the 50mL centrifuge tube so that you can refill the wells throughout the activity with the same color. Use the color key to mix a combination of the acrylic paints provided + water to get as close to the color as possible.
- When adding paint onto the canvas, be careful not to deposit the drop too close to another drop of paint. The drops will merge, taking away from the pointillism style. This will depend on the paint viscosity (see above) and how much paint is deposited on each number (10-20 uL)

Correct paint viscosity and drop size.

Typically, a 20 uL micropipette can deposit enough paint for two drops (~10 uL/drop).



Incorrect paint viscosity and drop size.

The paint mixture has too much water, causing the paint drops to merge with surrounding paint.

Try not to deposit fresh drops directly next to each other.

Cleanup: Set the canvas somewhere safe to dry. Cover well plates and seal any paint containers to prevent the paint from drying out. Paint should last several days before drying completely. Dispose any used tips into the trash. Store the micropipettes, paint, unused pipette tips, and well plates away until future use.

Acrylic paint can be removed from skin with soap and water. However, avoid allowing acrylic paint to dry on clothes and treat material immediately to avoid stain.

Related Educational Resources

The World Biotech Tour website (www.worldbiotechtour.org/activities) contains additional resources to introduce visitors to biotechnology and the tools researchers use:

- Media include– *Pipette by Numbers* Activity and Presenter guide

Credits and Rights

The Pipette by Numbers is a signature activity developed by the North Carolina Museum of Natural Sciences in partnership with the Association of Science-Technology Centers for the World Biotech Tour.

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Images courtesy of the Association of Science-Technology Centers. 2015

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