

# *Invent the Squirt Gun and Micropipette!*

You have a Straw and a cup of water...



**Invent:**

\*\*As many ways as you can to move a drop of colored water from the cup to the tray

...then...

**Invent:**

\*\*The *Two-legged* Eye Dropper



...then, with the addition of the cotton swab...

**Invent:** \*\*The *Syringe*



...then using the plastic tip...

**Invent:** \*\* The *Squirt Gun!*



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You can't take the \$200 micropipette home, but you can improvise one!

Here's the puzzle:

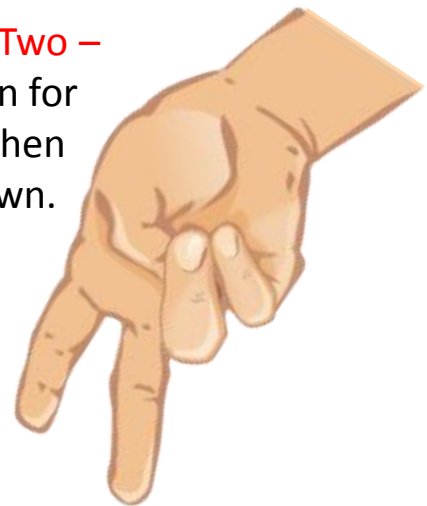
**First**, hand a straw to a person and say: "Given 30 seconds, invent as many ways as you can to move a drop of water from the cup to the tabletop, using the straw (without using your mouth)."

At the table, have a bunch of straws (small diameter works best), cups of colorful water, some 6 inch wooden Q-tips, and some blue micropipette tips. You'll need a sponge to clean up.

**Next**, invite the kids to share with each other the different ways they invented. Now, the second puzzle: say "If you haven't done so already, please invent the eyedropper." What is an eyedropper? Mmm: It's something of that you can squeeze to blow out air, and then you put the open end in water and release the part you squeezed, and that sucks water up into the eyedropper. Then you can move the eyedropper a few inches, and squeeze again to push out the liquid.

**Next**, if you haven't done so already, please invent the Two – legged Eyedropper." Signal this by making the finger sign for 2 (also known as the Churchill sign "V for Victory") and then turn your hand down so the two fingers are pointing down.

**Now**, watch to see if they can fold the straw in half. The fold pinches off the two "legs" of the straw and each leg can be an eye dropper



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"Now, with your straw and this wooden Q-tip, Invent the **Syringe**." Coax people to try putting the Q-tip in the straw, and using the Q-tip as a piston to draw water up into the straw.

Note: if people don't get good suction, ask them "Do you have a good seal? What does it take to make a good seal? What can you do to make the seal better between your Q-tip and the wall of the straw?"

Coax the people to try wetting their Q-tip's cotton head to make it swell and fit tighter.

"**Now** with your straw and Q-tip, add a blue tip and Invent the Squirt Gun."



They've improvised a micropipette that they can take home with them. They also take home the series of ingenuity puzzles, and for the rest of their lives, if they have a straw, they also have a two — legged eyedropper. Notice that while they've invented a tool that works, they have not yet investigated any ideas to explain how the tool works. This distinction between inventing tools and investigating ideas is for me a distinction between the main thrusts of engineering and of science. And Serendipity: "Next, take the blue tip off, and invent the whistle." (you can get a penny whistle sound by blowing across the open end of the straw, and sliding the Q-tip up and down.)