



Microfluidics: How to mix small amounts of liquids

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Macromixing (big)

Macromixing means mixing **big** quantities of items, such as making smoothies and cake/cookie batter in the kitchen.



People mix things every day of their lives.

- Drinks: Coffee/tea, sugar, and cream; Kool-Aid!
- Ice cream/milk and chocolate syrup
- Scientists mixing chemicals
- And, much more!



Micromixing (small)

What is *micro*?

'Micro' is a prefix in measurement units that means **very, very little**. One *micrometer* equals 0.00003937 inches. The average thickness of the human hair is 80 micrometers or 0.00314 inches.

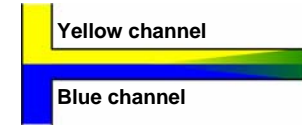


What is *microfluidics*?

Fluidics looks at all sorts of volumes of liquids. It could be as big as 2 liter soda bottle or 1 gallon milk jugs at the grocery store, or even fish aquarium tanks, which could be thousands of gallons! But, when we add *micro* to fluidics, then we talk about studying liquids of **very small** volumes – sometimes as small as a **few drops**. Microfluidics studies the behavior of fluids at the small scale (microscale). Microfluidics combines many fields of science and engineering, such as biology, chemistry, and physics.

Importance of micromixing

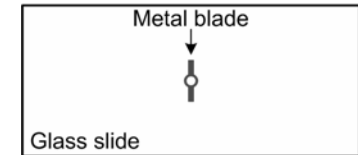
- Small amounts of liquids can be difficult to mix



- Make big things much smaller
- Make things go faster
- Use less power (less batteries)
- Reduce waste (save environment)
- Can help reduce cost (save \$\$\$!)
- You can carry the technology in your hand!

How to make a micromixer?

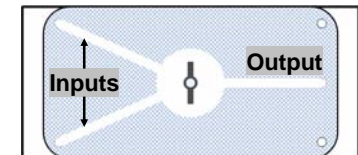
- A metal blade is put on top of a glass slide.



- A transparent plastic container is glued on top of the glass slide. The metal blade is *inside*.



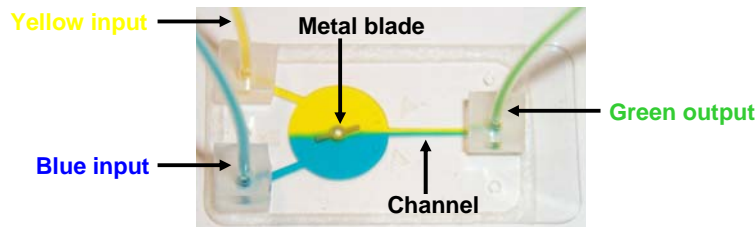
- The input and output channels (paths) for the liquids are made inside the plastic container.



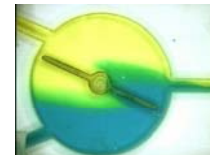
Ready for use!

Micromixer mixing two colored liquids

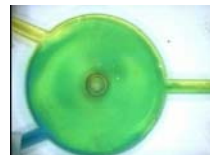
- Blue liquid comes into one channel; yellow liquid comes into the other channel.
- A rotating magnetic bar is used to move the metal blade.
- The metal blade rotates and mixes the liquids inside.
- The mixed liquid is green and flows through the output channel.



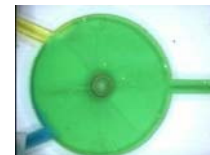
Time = 0 seconds



Time = 4 seconds



Time = 5 seconds



Time = 15 seconds