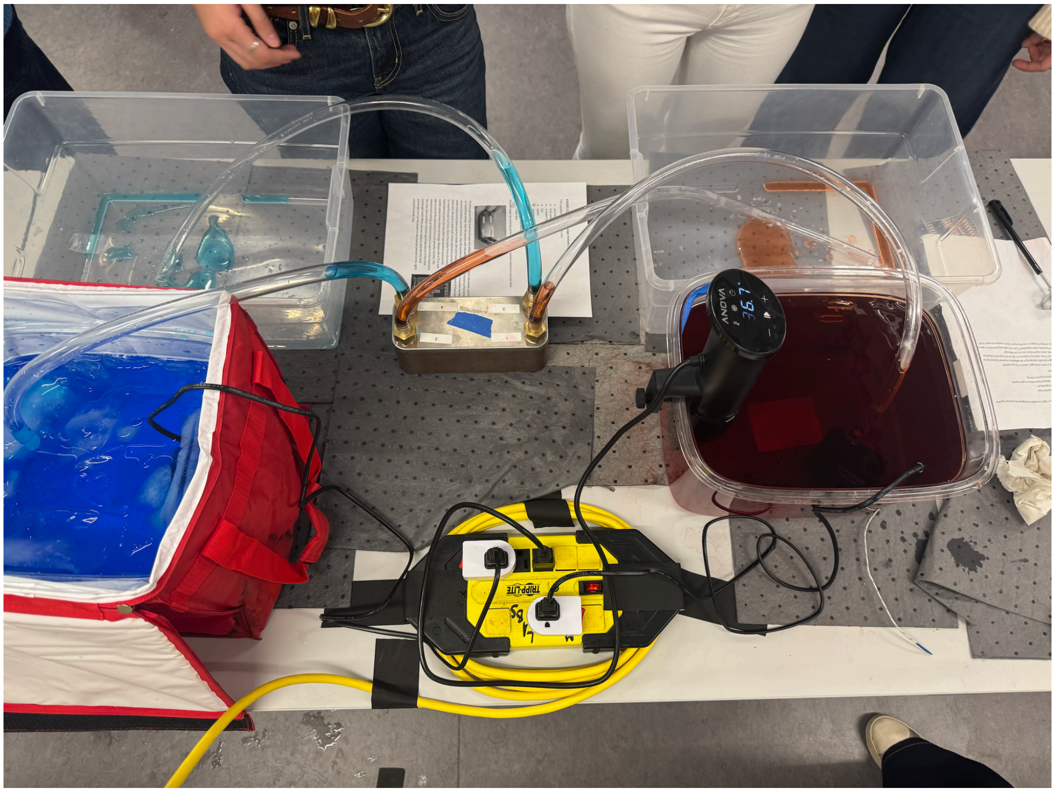
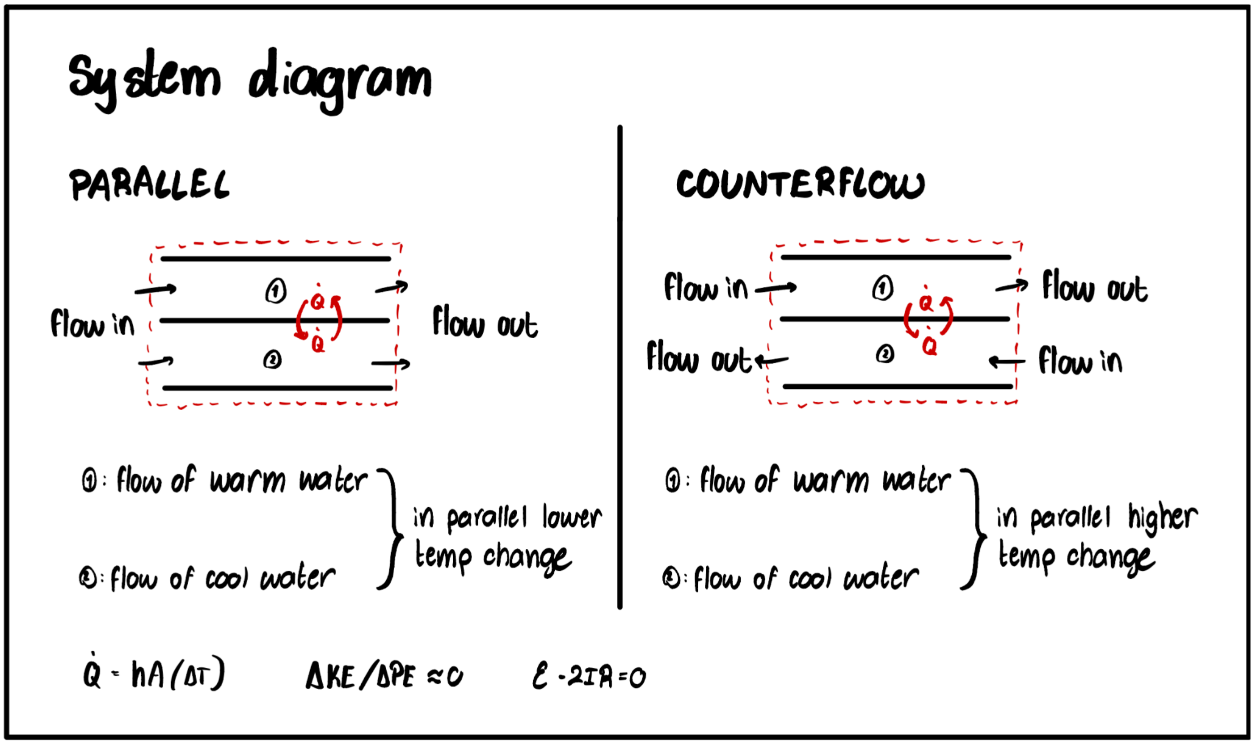
Heat Exchanger Lab Report

Sofia Savoia
(Worked with: Katherine Krishtope, Kate Collard, Charlotte Huber, Katie Moskal)



The device included two containers of liquid water and two empty containers. One included ice cold water with ice cubes, placed in a refrigerating bag around it to keep it cool, the cold reservoir. The other, the hot reservoir, contained warm water, warmed up by an immersion heating device. Each of the water baths were also colored with food coloring to differentiate the two, with the cold bath having blue coloring added and the hot water having red coloring. Each of these containers have a water pump inside of them connected to tubes that are then linked to a heat exchanger. The heat exchanger is connected to two other tubes that each rest in one of the two empty containers. The setup is connected to power through the pumps which is what allows the liquids to flow through the tubes, into the heat exchangers, and out into the empty containers.

The way the system works, in general, is that the hot and cold water will be pumped into their respective tubes at the same time in order to reach the heat exchanger in unison. Once they have entered the heat exchanger, the liquids will transfer heat between each other (without mixing) through the conductive material and be spit back out at different temperatures than where they initially started. The cold liquid will be warmer than it was before and the warmer liquid will be cooler than it was before.



We tried a few different changes, compared to the original parallel flow, in the setup of the experiment including the following: counterflow, a hotter reservoir in parallel, and pinching the tube that carries the warm water. Our data shows the following:

Experiment	**Temp of cold water before interacting with heat exchanger (celcius)**	**Temp of cold water after interacting with heat exchanger (celcius)**	**Temp of hot water before interacting with heat exchanger (celcius)**	**Temp of hot water after interacting with heat exchanger (celcius)**
Parallel	4.0	23.6	43.1	27.3
Counterflow	6.3	28.1	43.1	23.0
Parallel with hotter hot water	4.0	23.0	50.0	30.0
Pinched tube (containing hot water)	9.6	24.9	42.4	26.5

From these results we can see the following:

- Parallel: When touching the heat exchanger, the left side of the heat exchanger (2 and 4) is much warmer compared to the right side (1 and 3). These results make sense as that is where the warm water is flowing.

- Counterflow: In this scenario we noticed something very strange where the initially warmer water became colder than the initially cold water, and the initially cold water became hotter than the originally hot water. This can only happen with counter flow
- Parallel with hotter hot water: Here we can see that the colder water actually gets colder than it does in regular parallel flow by the end, which doesn’t seem right but is probably due to experimental error.
- Pinched tube (containing hot water): In this case we can see that the temperature change in the cold water is less than that in parallel, which makes sense as the flow of warm water was restricted.