**Materials:**

* Dialyzers (2)
* Dialyzer tubing(2 sets)
* Extra tubing for the heater (6-8 feet Masterflex large, 12 feet Masterflex small)
* Two pumps
* Two heaters
* Two containers (one with Urea water and one with normal water)
* Two containers for collecting dialyzer outlets of “dialysate” and “blood”

This lab is similar to the PBL lab in the sense that students design parts of it themselves, and they are trying to optimize the system. The following elements of the cart will already be set up, the pumps, the heaters and the containers with “blood” and “dialysate.” The container of Urea water should have an initial concentration of about 200 mg/dL and a total volume of five liters. This value is the largest recorded value for urea in patient blood, and the average human has five liters of blood. This value should be recorded so urea removal values can be tested.

Students will be provided with up to three dialyzers, tubing to correspond to each of those dialyzers, containers for “blood” and “dialysate” outlet streams, and tubing to run through the heaters. There is an example video that students can reference when building their systems if they need assistance.

If students use up all of their “blood” they can be provided with up to 10 more liters of “blood” at the same initial concentration. These are human lives they are dealing with, so the supply of blood is not endless in this short experimental time window.

The heating system for the “dialysate” will not yet be set up, but the system for the “blood” will be. In the final design the “blood” holding tank will be replaced with tubes leading to and coming from the patient's body. Two sizes of Masterflex tubing will be provided. The thicker tubing will connect the initial fluid holding containers to the tubing that is within the heater, and the thinner tubing will be inside the heater. The thinner tubing is connected to the thinner tubing with ring clamps or tubing connectors. The thinner tubing should be at least 2.5 feet long.

To set this up connect the large tubing to the outlet spigot of the “blood” container. Then connect the other end of this tube to the end of the thinner tubing. If using ring clamps the inner tube must be inserted into the larger tubing and the ring clamp tightened to prevent leaking. The thin tube is then fed through the heater and connected to additional thicker tubing in the same manner as before. This thicker tubing is then fed through the pump and into the top of the “blood” container so it will not be pulled out.

This “blood” running through one of the heaters should be allowed to reach 37 degrees Celsius. This will imitate the temperature of human blood during dialysis. The heater that the “blood” runs through should be set to 38-40 degrees Celsius. This will allow the “blood” to reach a temperature between 34-37 degrees Celsius. Using the pump let the “blood” run through the loop at 300 rpm for 10 minutes, or until it feels warm to the touch. The system is now prepared for students to use.