



Kidney Dialysis

Teacher information

Summary:

Students create a mini-model of a dialysis machine. They observe which substances diffuse from the bloodstream into the fluid in the dialysis machine. They determine what substances should be added to the dialysis fluid to maintain homeostasis.

Core concepts:

- The processes of diffusion and active transport are important in the movement of materials in living organisms.
- To maintain homeostasis the internal environment must be kept stable - within normal limits that are favorable for cell activities.
- Homeostasis in an organism is constantly threatened. Failure to respond effectively can result in disease or death.

Class time required:

Two 40-minute class period + homework

Teacher preparation:

Each student will need:

- 1 *Kidney Dialysis*
- 1 color *Hemodialysis* and *Peritoneal Dialysis* (Consider laminating this for reuse)
- Safety goggles

Each team of students will need:

- Wide bore dropper with tip cut off
- 9 inch length of "Serpent Skin" tubing or dialysis tubing. "Serpent Skin" can be ordered from Educational Innovations (Catalog # SM-200):
www.teachersource.com/BiologyLifeScience/LifeScience/SerpentSkinTubing.aspx
- 10 oz. tall form clear plastic cup
- 15 ml conical tube or test tube labeled "Simulated Red Blood Cells" – add 1-2 ml of red glitter or red seed beads
- 1.5 ml microtube labeled "Glucose" – fill with 1 ml BAKING SODA (not glucose)

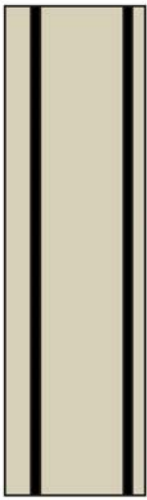
- 1.5 ml microtube labeled “Simulated Urea” – fill with 0.5 ml yellow food color and 0.5 ml water
- 1.5 ml microtube labeled “Protein” – fill with 1 ml BAKING SODA (not protein)
- 1 small paper packet of salt
- 1 small plastic bag labeled “Test Paper” - fill this bag with:
 - 1 strip of chromatography paper (white paper)
 - 1 strip of 6-8 narrow range pH paper (orange paper)
 - 1 strip of RED litmus paper (pink paper)

During Class:

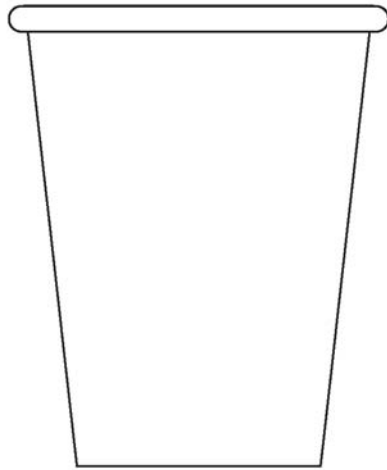
1. Group students into lab teams of 2-4 students.
2. Distribute to each student.
 - 1 copy of *Kidney Dialysis*
 - 1 color copy of *Hemodialysis and Peritoneal Dialysis*
3. Read *The Introduction* aloud to the entire class.
4. Ask students to work with their team members to complete the *Kidney Dialysis* activity.
5. Optional: Ask teams (or the class) to make a list of what they know about kidney dialysis and what questions they have about dialysis. Consider inviting a dialysis patient, nurse from a dialysis center, or nephrologist to visit and answer the students’ questions.

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Quick Guide:



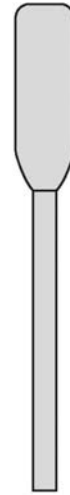
Dialysis Tubing



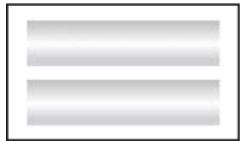
Cup



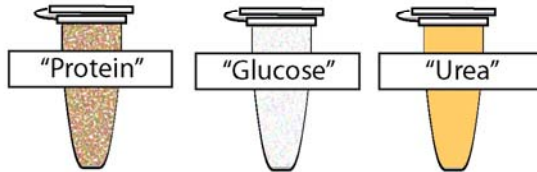
Simulated Red Blood Cells



Dropper



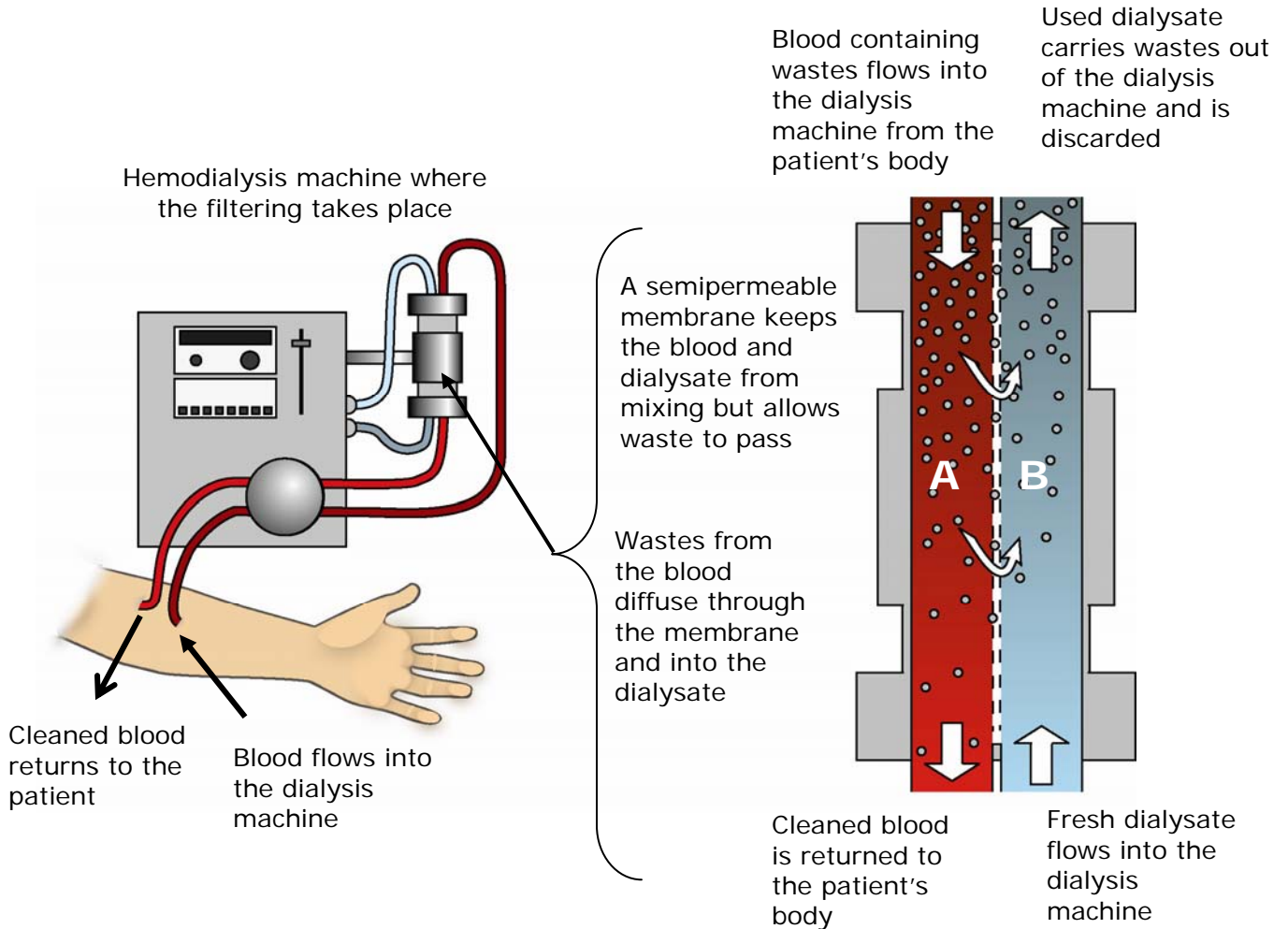
Salt



"Protein," "Glucose" and "Salt" Test Papers

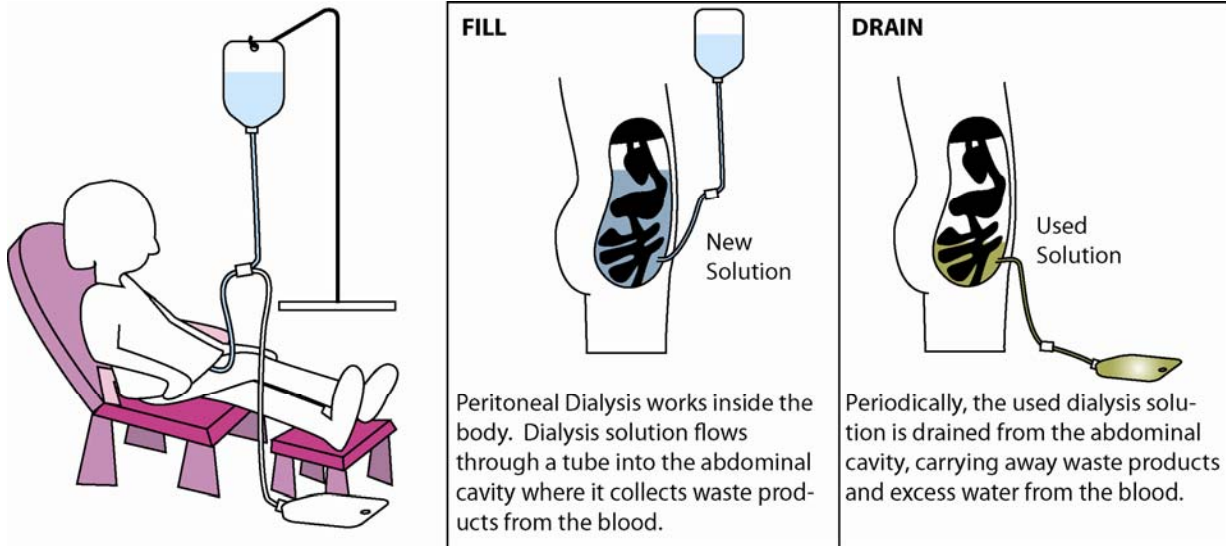
Hemodialysis

Patients who have severe problems with their kidneys need a dialysis machine to remove harmful substances from their blood. The dialysis machine has one area **(A)** containing the patient's blood and another area **(B)** containing a fluid called dialysate. These two areas are separated by a semipermeable membrane through which small molecules can diffuse. Small waste products such as urea diffuse out of the blood and into the dialysate. The dialysate that flows out of the machine is then discarded.



Peritoneal Dialysis

In peritoneal dialysis, the patient's own peritoneum (lining of the abdominal cavity) is used instead of a dialysis membrane. A sterile plastic tube is inserted into the abdominal cavity, and a solution of glucose (a form of sugar) and salts is periodically injected to fill the abdominal cavity. The fluid comes into contact with delicate blood vessels in the peritoneum. Wastes from the blood diffuse through the membrane of the peritoneum into the dialysis fluid. The used dialysis liquid is periodically drained and replaced with a fresh solution.



No one type of dialysis is best for everyone. Each type has pros and cons that patients will need to evaluate as they make their decision. Hemodialysis must be done by trained health professionals who can watch for any problems such as low blood pressure, blood clots, and bloodstream infections. But, it needs to be done at a hospital or dialysis center on a fairly set schedule. Peritoneal dialysis can be done at home or any clean place and patients can do it by themselves. It must be done every day of the week and may increase the risks for infection of the peritoneum.