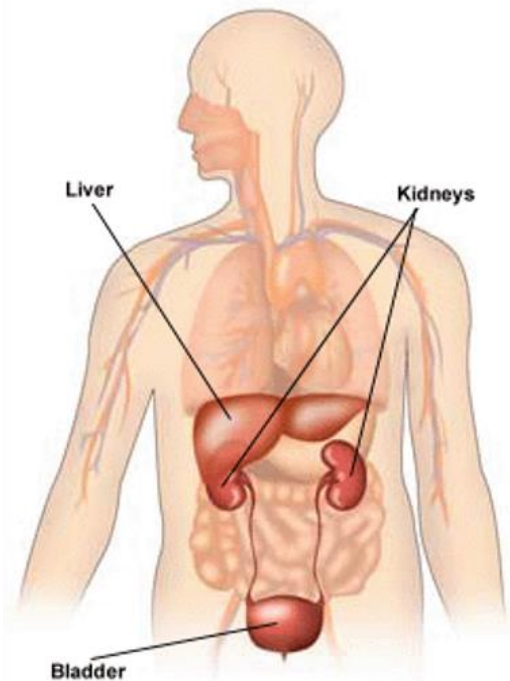


Kidneys and Dialysis

The kidneys are two bean-shaped organs, each about the size of a fist (NIH, 2014). They are located just below the rib cage, one on each side of the spine. Each day, the kidneys filter 180 L of fluid out of the blood – most of which is reabsorbed, together with all the nutrients that the body still needs, such as glucose and amino acids (Science in School, 2011). From the 180 L of fluid that they filter, the kidneys produce about 2 L of urine containing waste products such as urea, which is toxic to the body. The urine flows from the kidneys to the bladder through two thin tubes of muscle called ureters, one on each side of the bladder (NIH, 2014). The bladder stores urine. The muscles of the bladder wall remain relaxed while the bladder fills with urine. As the bladder fills to capacity, signals sent to the brain tell a person to find a toilet soon. When the bladder empties, urine flows out of the body through a tube called the urethra, located at the bottom of the bladder. In men the urethra is long, while in women it is short.

The kidneys are important because they keep the composition, or makeup, of the blood stable, which lets the body function (NIH, 2014). They prevent the buildup of wastes and extra fluid in the body. Kidneys also keep levels of electrolytes stable, such as sodium, potassium, and phosphate. They are responsible for making hormones that help regulate blood pressure, make red blood cells, and make bones stay strong.

The kidney is not one large filter. Each kidney is made up of about a million filtering units called nephrons (NIH, 2014). Each nephron filters a small amount of blood. The nephron includes a filter, called the glomerulus, and a tubule. The nephrons work through a two-step process. The glomerulus lets fluid and waste products pass through it; however, it prevents blood cells and large molecules, mostly proteins, from passing. The filtered fluid then passes through the tubule, which sends needed minerals back to the



http://publications.nigms.nih.gov/findings/feb04/lau_files/textmostly/slide7.html

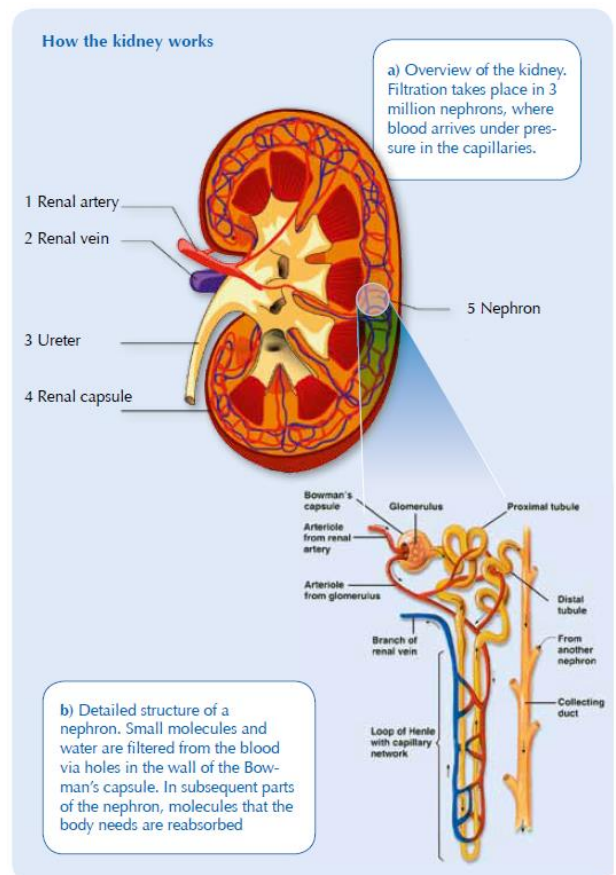


Image courtesy of Piotr Michal Jaworski; image source: Wikimedia Commons

Kidneys and Dialysis

bloodstream and removes wastes. The final product becomes urine.

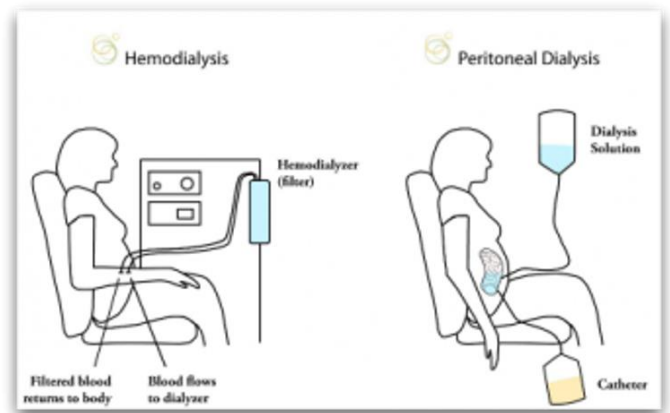
If a person's kidneys fail, death will follow in about four days because urea builds up and the body loses control of its water balance (Science in School, 2011). The person's life may be saved with the help of *dialysis*; this typically involves attending hospital three times a week. During dialysis, which takes about six to eight hours, the blood is taken from the patient's body in a tube and flows into a machine where it passes next to a filter called a dialysis membrane. A specialized dialysis solution flows on the other side of the membrane. The composition of this solution ensures that urea passes through the membrane from the blood into the dialysis fluid, but glucose and amino acids do not. The blood – minus urea – is then returned to the body.

Dialysis is a treatment to filter wastes and water from your blood, allowing people with kidney failure to feel better and continue doing the things they enjoy (National Kidney Disease Education Program, 2012). However, when many people think of dialysis, their fears can keep them from learning about this treatment. In fact, most people are surprised to find how well dialysis works and how much better they feel with treatment.

There are two types of dialysis, hemodialysis and peritoneal dialysis. In hemodialysis, your blood goes through a filter outside your body and the

clean blood is returned to the body (National Kidney Disease Education Program, 2012). Hemodialysis is usually done at a dialysis center three times a week, but it can also be done at home. Each session usually lasts between three and four hours.

Peritoneal dialysis uses the lining or peritoneum of your abdominal cavity (the space in your body that holds the stomach, intestines, and liver) to filter your blood (National Kidney Disease Education Program, 2012). It works by putting a special fluid into your abdomen that absorbs waste products from your blood as it passes through small blood vessels in the peritoneum. The fluid with the waste products is then drained away. Peritoneal dialysis is done at home. Many people choose to do this treatment at night, as they sleep.

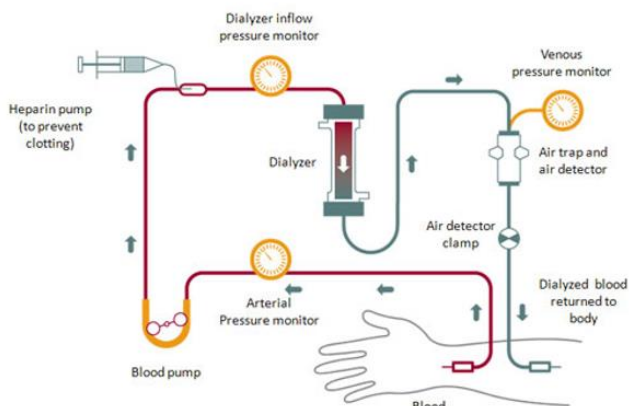


<http://www.renalventures.com/patients/treatment-options/peritoneal-dialysis/>

National Kidney Disease Education Program. (2012). "Dialysis". Retrieved from <http://nkdep.nih.gov/living/kidney-failure/dialysis.shtml>

NIH. (2014). "The Kidneys and How They Work". NIH Publication No. 14-3195. Retrieved from <http://kidney.niddk.nih.gov/kudiseases/pubs/yourkidneys/>

"Student worksheet 2: kidneys and dialysis". (2011). *Science in School*. Issue 21: Winter. Retrieved from www.scienceschool.org



<http://nkdep.nih.gov/living/kidney-failure/dialysis.shtml>

Kidneys and Dialysis

Close Reading Instructions:

1. Number the paragraphs before reading the article.
2. As you read, circle any vocabulary/key terms and words that are new to you.
3. Underline definitions of key terms found in the text. Underline explanations of processes.

Questions: Use the article and what you have learned about osmosis and diffusion to answer the following questions. Put your answers on a separate sheet of paper. Use complete sentences.

1. What are the functions of the kidney?
2. How does the kidney work like a filter?
3. Why do you think there are normally no plasma proteins in the urine even though they are in solution in the blood plasma?
4. Why are red blood cells and plasma proteins not removed from blood during dialysis?
5. What would happen if water were used as the dialysis fluid?
6. What is the difference between hemodialysis and peritoneal dialysis?
7. What advantages and disadvantages are there to undergoing hemodialysis to treat kidney failure? ____
8. What advantages and disadvantages are there to undergoing peritoneal dialysis to treat kidney failure?

The kidneys are almost as busy as the heart! They process 180 liters of blood per day and remove about 2 liters of waste per day. Over a lifetime that can really start to add up.

9. Based on the information given, how many liters of blood can the kidneys process in one year? Show your mathematical work and put a box around your answer.
10. How many liters of waste would the kidneys remove in one year? Show your mathematical work.
11. What if you lived to be one hundred years old? How many liters of blood will your kidneys have processed? Show your mathematical work and put a box around your answer.
12. If you lived to be one hundred years old, how many liters of waste will your kidneys have removed? Show your mathematical work and put a box around your answer.