

What We Know

- Many products of bodily metabolism are [waste](#) products that the body does not need or cannot use.
- The three organ systems that indirectly help to remove toxins from the body are:
 - [Respiratory System](#) - removes toxic gases and volatile chemicals from the body
 - [Integumentary System](#) - can remove toxins through sweating
 - [Digestive System](#) - eliminates toxins taken in by eating or drinking through feces
- The two organs with the biggest roles in detoxification are the [liver](#) and [kidneys](#)
- Liver
 - The liver is unique because blood flows [into](#) the organ from the gut.
 - The two steps that the liver takes to detoxification are
 - When [Kupffer cells](#) engulf/eat sludge trapped in the small spaces between cells
 - When Kupffer cells add materials to a chemical to make it non-harmful, a process called [conjugation](#)
- Kidneys
 - Blood goes from the liver to the heart and then to the [kidneys](#).

- Kidneys regulate the balance of [water](#), [minerals](#), and [salts](#) in the body
- About [150](#) liters of blood are pumped through the kidney every day.
- Blood flows into the kidney through the [renal artery](#) and leaves through the [renal vein](#).
- Each filtering unit in the kidney is called a [nephron](#).
- The [glomerulus](#) is a cluster of small blood vessels that allow small molecules of waste and fluid pass through them into the tubule.
- Water, minerals, and nutrients are [reabsorbed](#) from the tubule into the blood.
- Urine travels from the kidney through the [ureter](#) to the [bladder](#) where it is stored. Then when urine is ready to leave the body, it exits through the [urethra](#).

How We Know

- Kidney Function
 - Medical technicians examine urine through a procedure called [urinalysis](#) to look for any abnormalities. Diseases that can be detected by this method include:
 - [Diabetes](#)
 - [Kidney stones](#)
 - [Chronic urinary tract infections](#)
 - The three ways we analyze urine are:
 - [Unmagnified/macroscopic](#): check for amount, color, clarity
 - [Chemical analysis](#): check for acidity, density, amount of protein, glucose, ketones, nitrites, and white blood cells.
 - [Magnified/microscopic](#): check for crystals, squamous cells, bacteria, and other large objects
 - A small amount of urine could indicate that the kidneys (are/[are not](#)) filtering blood well.
 - The presence of [white blood cells](#) in urine could indicate infection of the kidneys, bladder, or other parts of the urinary tract.

●

- Liver Function

- We can tell a lot about the liver by observing it:
 - Large [veins](#) come into the liver from the gut
 - Blood flows past single rows of liver cells
 - The path of flow exposes blood to many [phagocytic](#) cells
- We can also tell a lot about the liver by seeing how the chemical contents of blood change between entering and exiting the liver. The liver:
 - Makes [urea](#), a protein waste product
 - Makes [bile](#), which is released to from the gallbladder and makes fat easier to digest in the intestines
 - Removes low density lipids and adds high density lipids to blood, protecting against [hardening of the arteries](#)
 - Converts and [detoxifies](#) many drugs and toxins
- A symptom of poor liver function is yellowing of the skin and eyes, called [jaundice](#), as well as prolonged bleeding, and swelling and hardening of the liver.
- The most common causes of liver damage are [alcohol abuse](#) and [viral hepatitis](#)

Common Hazards

- [Hepatitis](#) is irritation/inflammation of the liver and can end up resulting in the death of liver cells and eventual replacement with scar tissue ([cirrhosis](#)).
 - Causes of hepatitis include
 - Excessive [drug](#) or [alcohol](#) consumption
 - Viruses
 - Our own [immune](#) system
 - There are six different hepatitis viruses.
 - Hepatitis A - ([does](#)/does not) have a vaccine. Spread by [feces](#) of infected person.
 - Hepatitis B - ([does](#)/does not) have a vaccine. Spread by [blood](#) and [bodily fluids](#) from infected person.
 - Hepatitis C - (does/[does not](#)) have a vaccine. Spread by [blood](#) and [bodily fluids](#) from infected person.
 - Hepatitis D - (does/[does not](#)) have a vaccine. Spread by [blood](#) and [bodily fluids](#) from infected person. Only occurs in presence of Hepatitis [B](#) infection
 - Hepatitis E - (does/[does not](#)) have a vaccine. Spread by [feces](#) of infected person.
- Heavy metals like [cadmium](#), [mercury](#), [lead](#), and [chromium](#) are toxic to the kidneys and cause damage to the liver.

- Lead

- List 4 sources of lead exposure:

- [Old paint](#)
 - [Old pipes](#)
 - [Contaminated water](#)
 - [Batteries](#)
 - [Industrial processes](#)
 - [Leaded gasoline](#)
 - [Cosmetics](#)
 - [Toys](#)
 - [Containers made of metal](#)

- [Children](#) are most susceptible to the effects of lead.

- Mercury

- The kidneys [concentrate](#) mercury
 - Mercury [bioaccumulates](#) in food chains (it accumulates in organisms that eat other organisms that contain mercury). For example, eating large quantities of contaminated fish or shellfish can lead to mercury toxicity.

- Cadmium

- Cadmium damages kidney [tubules](#) (also causes [anemia](#) and [bone and mineral](#) loss)
 - Cadmium reacts with [proteins](#) and accumulates in the kidneys.

- Chromium
 - Chromium-[3](#) is an essential dietary requirement for humans, and is found in vegetables, fruits, meats, grains, and yeast
 - Chromium-[6](#) is toxic and can be found in the environment but is also produced by [industrial](#) processes.
 - Chromium is [reabsorbed](#) by tubule cells and becomes very [concentrated](#). It can also become corrosive and cause kidney failure.
- Free Radicals
 - Name 3 external sources of free radicals
 - [Pollution](#)
 - [Cigarette smoke](#)
 - [X-rays](#)
 - [Ozone](#)
 - [Industrial chemicals](#)
 - [Medication](#)
 - Free radicals can be both [toxic](#) and [beneficial](#)
 - At excessive levels, free radicals can damage cell parts like the [cell membrane](#) and [DNA](#).