

# Water of Life

In a list of lousy ways to go, dying of thirst is right up there.

That's because your brain, your heart, your muscles, and many organs are more than 70 percent water. Your lungs, more than 80 percent. Even bones are nearly one-third water.

Our bodies are essentially big water balloons, using water in every part, for every function.

Water carries oxygen and nutrients into cells, and carries waste away.

It helps regulate body temperature through sweating.

It cushions joints, the brain, the spinal cord, and babies in the womb.

Water lubricates your eyes, mouth, and mucous membranes. It allows the kidneys, liver, and intestines to flush out waste.

And it's the main ingredient in blood.

All this means that as you lose water, pretty much everything suffers. The biggest problem is shrinkage of the brain cells.

At just 2 percent water loss, your cognitive function declines. At 3 to 4 percent, you'd begin to experience headaches, which would get worse till 5 to 8 percent, when you'd get dizzy and fatigued.

If your level falls to 10 percent, you could become severely confused and even have a seizure.

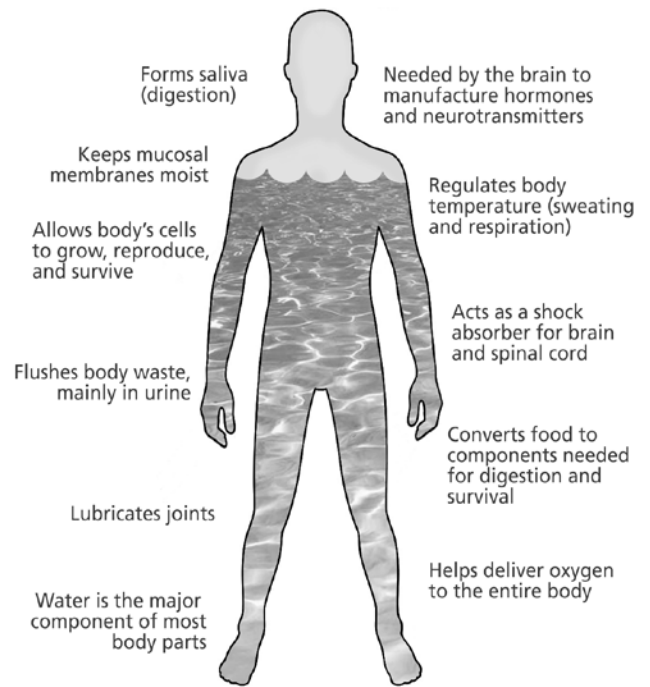
Somewhere between 15 and 25 percent water loss, you'd become unconscious.

And finally, your brain shrinks enough to disconnect from the skull.

Not pleasant at all.

The cure, though, is simple. Stay well hydrated. In our bodies, as on our planet, water is precious.

## What Does Water do for You?



Water makes up about 60 percent of your body and helps these physical functions.

Credit: USGS



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# Background: Water of Life

**Synopsis:** Water is so essential to life that scientists have never discovered an organism that can live without it. People have lived for up to six weeks without food, but without water most people can only last a few days. How does water keep us alive?

- Adult human bodies are made up of about 55–60 percent water by volume.
    - Our lungs are about 83 percent water.
    - Our muscles and kidneys are 79 percent water.
    - Our brain and heart are 73 percent water.
    - Our skin contains 64 percent water.
    - Our bones seem pretty solid, but even they are 31 percent water.
  - The percentage of water in our bodies changes as we grow and depends on body type.
    - When we are born, we are about 78 percent water.
    - At 1 year of age, we are about 65 percent water.
    - Adult male bodies, on average, are 60 percent water; adult female bodies average 55 percent water because they are built to have more body fat (for reproductive reasons) than males.
      - Because fatty tissue holds less water than lean tissue, thin individuals have higher proportions of water than heavy individuals.
  - Our bodies use water in all cells, organs, and tissues for many essential functions.
    - It is vital to the life of every cell because it functions as a solvent, transmitting oxygen and nutrients into cells and wastes out of cells through membranes.
    - It helps regulate our internal body temperature by sweating and respiration.
      - Most plants are 85–90 percent water, so they are even more sensitive than humans to higher temperatures and drier conditions.
    - Water acts as a lubricant and cushion for your joints and as a shock absorber for the brain, spinal cord, and fetuses.
    - Water keeps the tissues in the body hydrated, helping to retain optimum levels of moisture in your eyes, nose, and mouth, as well as in your mucous membranes.
  - Digestion depends on enzymes dissolved in watery saliva to start the process of breaking down food and liquid.
  - Nutrients like carbohydrates and proteins are metabolized and transported by water in the bloodstream, making them accessible to cells.
  - The kidneys, liver, and intestines use water to help flush out waste.
  - Water is necessary for the brain to produce hormones and neurotransmitters.
- We tend to take water for granted because it is all around us, but its unique and extraordinary chemical properties make it vital for life.
- Water is made up of an oxygen atom bonded to two hydrogen atoms in a special way that makes each molecule act like a small magnet.
    - The hydrogen atoms align themselves at one end of the molecule, creating a positive side that attracts ions or atoms with a negative charge; since these atoms have an extra electron to spare, they are eager to attach to this side.
    - When hydrogen ions spin in the same direction, the molecule is called ortho-water; if they spin in opposite directions, para-water. Even such tiny differences can impact reaction rates.
    - The side of the molecule with the oxygen atom is negatively charged and entices positively charged ions or atoms looking for extra electrons to latch on to this side.
  - Because it is bipolar—having opposite charges on opposite ends—water can dissolve almost anything. It is known as the “universal solvent.”
  - Water molecules are cohesive; they are attracted to each other, with their lowest energy state occurring when surrounded by other water molecules in a water droplet. This property gives water its surface tension, which is critical for transporting fluids in the body.



## References: Water of Life

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Fact Sheet:  
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# Background: Water of Life

- Water molecules are adhesive; they are attracted to other materials, which is why water droplets stick to surfaces like windows and leaves.
- Water has a very high specific heat—you have to add a lot of energy to raise the temperature by a few degrees.
- Because the solid form of water, ice, is less dense than liquid water, it floats. That's a lucky thing for us—if it sank, it would never melt under the blanket of water and our polar oceans would fill up with ice, disrupting marine life and global currents.
- Water can exist as solid, liquid, and gas within the range of temperatures common at Earth's surface.
  - Water is liquid for a seemingly narrow temperature range, from 32 to 212°F (or 0 to 100°C).
    - Compared to other liquids, though, water actually has a very large liquid range. If you add salt to make a brine, the freezing point can drop to -50°F. If you add pressure, the boiling point can increase.
  - Biochemical reactions need liquid water to dissolve molecules, to support chemical reactions, and to transport metabolites and nutrients, whether at the cellular or planetary level.
  - Liquid water has the unique capability to bend enzymes into the 3D shapes they must assume to catalyze chemical reactions.
  - All life on Earth uses membranes to absorb beneficial materials dissolved in water through cell walls, while preventing other possibly toxic substances from entering cells.
- Humans must maintain a water balance—loss offset by intake—or dehydration can occur.
  - Adult females need about 2.2 liters of water per day, and adult males need about 3 liters per day. These amounts can vary depending on your health, activity, and climate.
  - We take water in by drinking and eating, and we lose it by perspiration, excretion, and respiration.
  - Each day, an average person loses a quart of water by perspiring and breathing, and one to three more quarts through excretion.
    - If it is hot and dry, or if the person is experiencing physical exertion or health issues, the volume of water loss goes up.
  - At just 1–2 percent water loss, cognitive performance is impaired; 3–4 percent water loss causes thirst and headaches; and 5–8 percent causes fatigue and dizziness. Physical and mental difficulties like purple fingernails, seizures, and severe confusion occur at 10 percent. And 15–25 percent water loss causes death.
  - Severe dehydration leads to deadly symptoms.
    - Cells shrink as water is pulled from all cells in the body into the bloodstream.
    - The biggest problem is shrinkage of the brain cells, which causes confusion, coma, and eventually rupture of blood vessels that connect the brain to the cranium.
    - Kidneys that normally remove waste products from our blood shut down, causing toxic buildup.
    - As blood volume declines, other organs also fail



Drink water to stay hydrated.

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## References: Water of Life