IMAGINE TRYING TO live in a world dominated by dihydrogen oxide, a compound that has no taste or smell and is so variable in its properties that it is generally benign but at other times swiftly lethal. Depending on its state, it can scald you or freeze you. In the presence of certain organic molecules it can form carbonic acids so nasty that they can strip the leaves from trees and eat the faces off statuary. In bulk, when agitated, it can strike with a fury that no human edifice could withstand. Even for those who have learned to live with it, it is an often murderous substance. We call it water.

Water is everywhere. A potato is 80 percent water, a cow 74 percent, a bacterium 75 percent. A tomato, at 95 percent, is little *but* water. Even humans are 65 percent water, making us more liquid than solid by a margin of almost two to one. Water is strange stuff. It is formless and transparent, and yet we long to be beside it. It has no taste and yet we love the taste of it. We will travel great distances and pay small fortunes to see it in sunshine. And even though we know it is dangerous and drowns tens of thousands of people every year, we can't wait to frolic in it.

Because water is so ubiquitous we tend to overlook what an extraordinary substance it is. Almost nothing about it can be used to make reliable predictions about the properties of other liquids and vice versa. If you knew nothing of water and based your assumptions on the behavior of compounds most chemically akin to it—hydrogen selenide or hydrogen sulphide notably—you would expect it to boil at minus 135 degrees Fahrenheit and to be a gas at room temperature.

Most liquids when chilled contract by about 10 percent. Water does too, but only down to a point. Once it is within whispering distance of freezing, it begins—perversely, beguilingly, extremely improbably—to expand. By the time it is solid, it is almost a tenth more voluminous than it was before. Because it expands, ice floats on water—"an utterly bizarre property," according to John Gribbin. If it lacked this splendid waywardness, ice would sink, and lakes and oceans would freeze from the bottom up. Without surface ice to hold heat in, the water's warmth would radiate away, leaving it even chillier and creating yet more ice. Soon even the oceans would freeze and almost certainly stay that way for a very long time, probably forever—hardly the conditions to nurture life. Thankfully for us, water seems unaware of the rules of chemistry or laws of physics.

Everyone knows that water's chemical formula is H_2O, which means that it consists of one largish oxygen atom with two smaller hydrogen atoms attached to it. The hydrogen atoms cling fiercely to their oxygen host, but also make casual bonds with other water molecules. The nature of a water molecule means that it engages in a kind of dance with other water molecules, briefly pairing and then moving on, like the ever-changing partners in a quadrille, to use Robert Kunzig's nice phrase. A glass of water may not appear terribly lively, but every molecule in it is changing partners billions of times a second. That's why water molecules stick together to form bodies like puddles and lakes, but not so tightly that they can't be easily separated as when, for instance, you dive into a pool of them. At any given moment only 15 percent of them are actually touching.

In one sense the bond is very strong—it is why water molecules can flow uphill when siphoned and why water droplets on a car hood show such a singular determination to bead with their partners. It is also why water has surface tension. The molecules at the surface are attracted more powerfully to the like molecules beneath and beside them than to the air molecules above. This creates a sort of membrane strong enough to support insects and skipping stones. It is what gives the sting to a belly flop.

I hardly need point out that we would be lost without it. Deprived of water, the human body rapidly falls apart. Within days, the lips vanish "as if amputated, the gums blacken, the nose withers to half its length, and the skin so contracts around the eyes as to prevent blinking." Water is so vital to us that it is easy to overlook that all but the smallest fraction of the water on Earth is poisonous to us—deadly poisonous—because of the salts within it.

We need salt to live, but only in very small amounts, and seawater contains way more—about seventy times more—salt than we can safely metabolize. A typical liter of seawater will contain only about 2.5 teaspoons of common salt—the kind we sprinkle on food—but much larger amounts of other elements, compounds, and other dissolved solids, which are collectively known as salts. The proportions of these salts and minerals in our tissues is uncannily similar to seawater—we sweat and cry seawater, as Margulis and Sagan have put it—but curiously we cannot tolerate them as an input. Take a lot of salt into your body and your metabolism very quickly goes into crisis. From every cell, water molecules rush off like so many volunteer firemen to try to dilute and carry off the sudden intake of salt. This leaves the cells dangerously short of the water they need to carry out their normal functions. They become, in a word, dehydrated. In extreme situations, dehydration will lead to seizures, unconsciousness, and brain damage. Meanwhile, the overworked blood cells carry the salt to the kidneys, which eventually become overwhelmed and shut down. Without functioning kidneys you die. That is why we don't drink seawater.

There are 320 million cubic miles of water on Earth and that is all we're ever going to get. The system is closed: practically speaking, nothing can be added or subtracted. The water you drink has been around doing its job since the Earth was young. By 3.8 billion years ago, the oceans had (at least more or less) achieved their present volumes.