

A mathematical equation, just a string of symbols scribbled on a page, can be more powerful than you can possibly imagine. Newton's equations of motion took us to the moon. Schrodinger's equation, the foundation of quantum mechanics describes the chemical properties of everything around you.

These equations are so useful because they are tools for making incredibly accurate predictions, leading to some of the greatest achievements of human kind. Unfortunately though, in many complex situations solving these equations is too hard. For instance, we would like to predict whether or not two molecules dissolved in water will bind together, but using Schrodinger's equation to do this can be beyond the powers of even the hugest supercomputer.

This is a massive problem because this attraction of molecules in water like two people drawn to each other across a crowded room, is the fundamental mechanism by which your body operates. It's also how most medical drugs work, this means we have to rely on trial and error to find new ones, resulting in thousands of untreatable diseases.

We need to find approximate equations that are easier to solve. To do this we should follow the advice of Newton, who said: "Truth is ever to be found in the simplicity, and not in the multiplicity and confusion of things." Schrodinger followed this advice to discover his equation by focussing on describing the properties of a single hydrogen atom the simplest possible element.

The simplest possible part of the human body is salt water. It's so simple because in water salt breaks apart into perfect tiny spheres called ions such as sodium and chloride. These ions are not just simple though, they're also vital for life. They carry electrical charge, just like a balloon that's been rubbed against the carpet, and can therefore create electricity. It's the flow of ions in and out your cells causes your muscles to flex and carries the electrical signals in your brain that makes up your consciousness.

If we take the sodium ion from table salt and its two closest relatives. Lithium and potassium. Because they're so simple we might expect these three different ions to behave the same way, but they don't at all. In fact Lithium is somehow an effective treatment for depression. This used to be an ingredient in 7up by the way hence the up as well as their slogan: "taking the ouch out of grouch." At the other extreme is potassium a component used in the lethal injection.

In my research I discovered a set of equations that can successfully predict whether or not an ion will bind to another ion or to a simple surface. This incredibly exciting, as we might be able to use the same equations to predict the binding of more complex molecules, and hopefully one day use a set of scribbles on a page to design molecules that can help save lives. That is why understanding Salt water is simply vital.