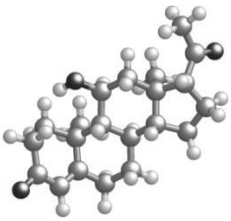

Chem!stry

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Date: …… **/** …… **/** ……

Once Your Blood was Dinosaur Urine

The History of a Water Molecule

Traveller: Water.
Origin: A comet, smashed into Earth.
Destination: This piece of paper.
Duration: Four billion years.

Water's journey began four billion years ago when Earth's hellish, dry and volcanic surface was being pummelled by a relentless rain of comets and asteroids. Molecules of water trapped inside them spread across the surface of our planet, and 700 million violent years later, Earth's dry rock had been transformed into the familiar blue marble.

As temperatures rose, a water molecule was swept with billions more into a vast oceanic river that slowly made its way from one pole to the other. For millions of years, one molecule skirted continents, nudged the sea floor, helped to dissolve rocks and transport gases. It crossed the equator hundreds of thousands of times. It found itself at the surface of the sea, was warmed by the sun, rose high into the atmosphere and fell to the ground in a raindrop. It seeped through cracks and became stuck in an underground layer of permeable rock, where it remained for centuries. Eventually, as all water does, it found its way back to the ocean.

From 3.8 billion years ago, a new deviation became possible from its usual route cycling around the oceans and atmosphere: inside living cells, keeping them alive.

And so, around 150 million years ago, our water molecule finds itself in a lake on what will eventually become one of the great plains of North America. A brontosaurus cranes its neck down for a drink. The water rolls around the beast's digestive system and is absorbed into its blood. Now it can perform the most important role Earth has found for it – enabling the basic chemistry of life.

In concert with other water molecules, it forces DNA, proteins and cell membranes into the correct shape to function. It helps carry oxygen to the dinosaur's brain and shuffles electricity around a heart cell. For a week it moves around the dinosaur's body, but the game is up once it reaches the animal's kidneys. The molecule is expelled in urine, taking with it some of the brontosaurus's waste. It sinks through the ground and, like so many times before, finds its way through cracks and fissures and streams back to the oceans.

In subsequent millennia, our molecule finds its way into a whale's brain, and Antarctic ice sheet, a glass of water and a human heart. Later, it waters a pine tree. It sits for decades in the cellulose fibres of the tree's heartwood before the pine is felled and turned into pulp. The water molecule stays in place as the pulp goes through chemical reactions, manipulations and dryings until it finds itself locked inside a sheet of paper. That paper is printed with ink. It is cut, folded and stapled. The water molecule sits, motionless, at the end of a sentence, this very one.

Alok Jha, Your Blood Was Once Dinosaur Urine, *New Scientist*, 14th November 2015, page 31.