Left and Right – The Mathematics of Chirality

Professor Goriely entertained the audience with an enthralling journey into the relevance of asymmetry at the molecular level.

Why do 90% of snail shells coil to the right (and given that left-handers find getting-it-together with right-handers somewhat tricky how does the species manage to maintain its population frequency)? Or perhaps genetics has little to do with it and it is all down to the way biological materials produce and react to physical forces?

Right-handed? Left-handed? That labelling is a convention for a start, and it is one that it took scientists some time on which to agree - causing a century of descriptive confusion – even Carl Linnaeus contradicted himself. We do know that chirality (as it is known to scientists) is hugely important. Three of the four fundamental forces of physics do not care whether things twist one way or the other, but the "weak" force which controls radioactivity certainly does - it only works with particles twisting left-handed (unless you are dealing with anti-matter, when everything goes to the right). Why? We do not know - but at the deepest level the universe is definitely left handed.

Professor Goriely is interested in how handedness at different physical scales interacts and controls the way biological systems work. Some 3 billion plus years ago life chose to work with molecules with a certain chirality - it was probably an accident, though we do not really know. As a result, however, DNA helixes always twist to the right (like a normal cork-screw), some protein fibres always twist to the left (such as keratin - a biological structural material) and that may explain why fibres giving stiffness to some plant stems twist to the right. These are helical springs which just happen to be made out of proteins and though they behave just like metallic springs in many ways Nature turns out to have used them in ways that have only recently been recognised by engineers as better than their own designs.

The fascination of this excellent talk came from seeing how mathematics gives a completely different insight into the way biological organisms are the way they are. It is not all down to natural selection - sometimes it is just down to the way that springy materials have to behave given that they have a built-in twist predetermined by an accidental choice three or four billion years ago.