Magnificent molecules

Vitamin C

Simon Cotton *looks at the molecule that improved the health of disease-ridden sailors*

A cure for colds?

© SHUTTERSTOCK

Linus Pauling, winner of Nobel prizes for both chemistry and peace, was convinced that taking large doses of vitamin C would stop people getting the common cold, however this is still to be proven.

Do you enjoy everything about Christmas except for the brussels sprouts? Of course you might have heard people saying that these vegetables are high in vitamin C. You might be sick of people saying that's why you should eat them. But be aware that the 'eat no fruit or veg for a year' experiment has already been done, and it wasn't pretty.

Dietary deficiencies

It was in the early 15th century that the experiment first began, although participation was not exactly voluntary. Explorers and traders began to undertake huge voyages to every corner of the globe, and sailors now spent longer and longer periods at sea. Their diets were confined to things that lasted for months, not days – meaning very little fruit or vegetables, a lot of salted meat and biscuits, and a serious lack of vitamins.

Vitamin deficiency can cause all sorts of health trouble, but the sailors' biggest problem was scurvy. Its gruesome symptoms began with general lethargy, before developing into spotted skin, rotten gums, bleeding from open wounds and eventually death.

All was cloaked in mystery until 1747, when James Lind proved that scurvy could be prevented by adding citrus fruit to the diet. The British authorities were slow to act on this, and it was only in the 1790s that daily rations of lemon juice were introduced for all sailors. The improvement in health was immediate, and this stood the Royal Navy in good stead for the fierce battles of the Napoleonic Wars. This was the reason why British sailors (and eventually Brits in general) acquired the nickname 'Limeys'.

© SHUTTERSTOCK

Ignorance

Over a century would pass before the effects of vitamin C were understood at the molecular level. In the late 1920s, a Hungarian named Albert Szent-Györgyi was studying antioxidants, and was convinced that a compound he isolated from cattle was the scourge of scurvy, so to speak. He knew its chemical formula, $C_6H_8O_6$, but wasn't sure of its structure. When he first submitted research on this new chemical for publishing, he called it 'ignose', a candid admission of ignorance that is certainly to be admired. Predictably, the editor wasn't happy with this, and asked him for another name, so Szent-Györgyi suggested going a step further with 'godnose'! In the end, however, he grudgingly accepted the editor's more mundane suggestion of hexuronic acid.

Szent-Györgyi's research team found they could obtain hexuronic acid from paprika, a cornerstone of Hungarian cooking, and sent samples to Norman Haworth, a professor of chemistry at the University of Birmingham. Haworth was an expert on the chemistry of carbohydrates, and had succeeded in deducing the structures of many of them.

Nobel prizes

Through some elegant chemistry, Haworth and his research group soon worked out the structure of the molecule. A pioneering x-ray diffraction study by Gordon Cox (also at Birmingham) confirmed Haworth's structure.

Glen King at the University of Pittsburgh carried out tests on guinea pigs with hexuronic acid in 1932 and showed it was indeed the molecule that prevented scurvy. Szent-Györgyi and Haworth were both to share Nobel prizes in 1937, Haworth the prize for chemistry and Szent-Györgyi the prize for physiology or medicine.

We now know that a shortage of vitamin C affects the synthesis of collagen, the main constituent of connective tissue. It is involved in the production of neurotransmitters like dopamine and adrenaline, and also mops up free radicals, protecting cells against damage.

The Latin noun for scurvy is *scorbutus*, leading to the adjective scorbutic. In honour of its anti-scorbutic properties, Szent-Györgyi and Haworth renamed hexuronic acid as ascorbic acid, the name by which we know vitamin C today.

Whatever you call it, this humble molecule plays a huge role in the body, so the next time you contemplate going on a year-long biscuit binge, remember the vitamin C!