# Rise and Fall of the Plum Pudding

One of the great all-time questions is ‘what are things made of?’. Most answers have come down on the side of having a set of basic building blocks to make everything. Initially this was investigated by philosophers, then alchemists and then chemists. It took physicists to sort it out!

I’m sure you’ve heard of one of the earliest models we know about. Everything was made of some combination of four elements – earth, air, fire and water. This had the benefit of only having a few building blocks and had connections between properties and contents.

The next major model was the periodic table of the chemist Mendeleev. All matter was made up of atoms, with one type of atom per element (eg. iron, oxygen). Over 100 elements have been identified – a huge number for them to be basic building blocks!

Take a piece of gold. Keep cutting it into smaller pieces. It each lump will still be gold. Eventually, it was thought, you would get to a point where you couldn't cut it up any more. The Ancient Greek word 'atomos' (meaning 'uncut') was used to refer to such small lumps of an element. The word means 'indivisible' - these small lumps were thought to be fundamental.

However it was discovered by physicists that electrons came from inside atoms. That meant that atoms must be made of something else. The hunt was on.

In the early 20th century Rutherford studied the Plum Pudding Model of JJ Thompson. This held that the negative electrons were held in a positive 'batter'. He set some of his students, Geiger and Marsden, to test this.

In 1909 they fired alpha particles at gold foil. They recorded where they came out. The results surprised everyone. Most of the alpha particles went straight through. This showed that the gold was mostly made of empty space! Some were reflected through small angles. A few bounced almost straight back. This showed that there was something small and dense inside the gold.

From these observations the nuclear model of the atom was invented. It had the electrons orbiting a central nucleus, a bit like planets round the Sun.

Other scientists started to ask what the nucleus was made of. They studied it and discovered protons and neutrons. It was found that very atom of a particular element had the same number of protons. This meant that everything physical was made up of just three types of particle - protons, neutrons and electrons. That was very neat and beautiful. The physicists handed back to the chemists and let them get on with bothering moles.