Inventions come from mistakes

What do matches and X-rays have in common? Apparently nothing, but instead they are both inventions which came about by chance, i.e. the result of what in English is called serendipity. The word serendipity comes from Serendip, the ancient Arabic name for Ceylon (now Sri Lanka), and was coined in 1754 by the English writer Horace Walpole who, inspired by reading the Persian fable "The Three Princes of Serendip", used the term serendipity in a letter written to a friend. The fable narrates the adventures of the three protagonist princes who continue to discover things that they were not in the least looking for by chance. Serendipity, therefore, indicates the good fortune of making unexpected and fortunate discoveries by accident while searching for something else.

Coming back to the matches and X-rays, we can say that the world of science is the quintessential paradise of serendipity. There are, in fact, many scientific discoveries which took place by chance that have significantly changed our lives. It seems incredible, but it is estimated that between 30 and 50% of scientific discoveries come about by "accident", by chance or even due to errors. Chance, however, is not enough! The scientist or inventor, in fact, must have an open mind without preconceived ideas, prepared to identify and understand the importance of the unexpected incident and to use it constructively. Let's discover some of these accidental inventions which, in one way or another, have changed our world.

It doesn't take much to set things alight

The English chemist and pharmacist John Walker discovered the match by accident in 1826. While he was shaking a mixture of chemicals based on antimony sulphide, potassium chlorate, rubber and starch, he noticed that a small drop of the compound had dried on a wooden stick: when he tried to scrape it off it let off a spark! Walker called his accidental invention "friction light". The first matches were then put on the market by Samuel Jones with the name of Lucifers!

From that moment on everyone was able to carry a flame with them and light lamps and fires when needed, just as the Italian term "fiammifero" indicates, from the Latin flammifer "that brings, gives, or produces flame", consisting of flamma - flame - and - fer - bring.

Mauveine

In 1856, chemistry student William Perkins was trying to make an artificial quinine to treat malaria, but instead obtained a muddy residue of tar. While he was cleaning the glassware, he realised that the blackish residue erroneously obtained, if dissolved with alcohol, gave rise to a purple colouration. The young chemist, at just 18 years of age, had, the first to do so in the world, run into mauveine, a dye that could be used to dye fabrics. Mauveine represents the first synthetic dye. Perkin patented his discovery and took advantage of the new product in the textile industry. It became popular when Queen Victoria wore a silk dress dyed with mauveine at the Great London Exhibition in 1862.

That's funny!

Alexander Fleming (1881-1955) was certainly not lacking in serendipity. In fact, he had two stokes of luck that in 1929 led to the discovery of penicillin, the first antibiotic used in the medical field. The first important discovery of Fleming dates back to 1922. In those years he was a researcher in the laboratory of Sir Almroth Wright. One day, instead of staying home to cure a nagging cold, he decided to go to the laboratory all the same. He took his nasal secretions and put them on a plate used to cultivate bacteria, to see if they developed any germs. The next day, while he was analysing the bacteria colonies which had grown, a tear accidentally fell onto the culture plate. Fleming noticed the disappearance of the bacteria at the point where the tear had fallen and thus discovered lysozyme, an enzyme normally present in tears that can destroy bacteria due to lysis. Fleming tried to use the lysozyme to treat infectious diseases, but this enzyme is active against bacteria that rarely give rise to disorders and almost never cause diseases. A few years later, more precisely in 1929, chance again came to the aid of the Scottish scientist. That day, Fleming had decided to take a vacation. He left forgetting in his lab some Petri dishes, which he should have thrown away, in which he had sown colonies of Staphylococcus aureus. On his return, picking up the capsules, he exclaimed "That's funny...", thus
expressing all his amazement at noticing that one Petri capsule no longer contained the Staphylococcus aureus colonies. What had happened? The plate had been accidentally contaminated by a green mould that had caused the death of the Staphylococcus colonies. He conducted some experiments and saw that the mould belonged to the Penicillium notatum genus and produced a substance, which he called penicillin, able to prevent the growth of bacteria. Fleming later declared: “If it had not been for my previous experience, I would have immediately thrown away the plate since it was contaminated, as many bacteriologists must have done before me. It is very likely that other researchers have seen the same changes in a culture that I observed but, in the absence of a particular interest in the natural antibacterial substances, the mouldy cultures were immediately thrown away. Instead of getting rid of the contaminated culture, I did some experiments”. For this discovery, Fleming won the Nobel Prize for medicine in 1945.

From radars to kitchens: the invention of the microwave oven

The microwave oven owes its invention to a chocolate bar that melted in the pocket of American engineer Percy Spencer while he was working in a laboratory in front of the magnetron (a particular valve used in radars able to generate microwaves) of a radar. Intrigued, he placed some grains of corn near the magnetron and noticed that, while the magnetron was working, the seeds popped, turning into popcorn. So he tried putting an egg and the egg exploded. Spencer concluded that the phenomena observed were due to the effect of the microwaves. In 1946, the microwave cooking process was patented and, in 1947, the first microwave oven for sale was built, the Radarange. It weighed 340 kg, was 1.80 metres high and generated a power of 3 kW (2 to 4 times the power of current ovens). At the beginning, given that it cost more than a car, the microwave oven was only sold to restaurants and food companies. In 1955, the first more economical model for the home was built.

Discover the neutron and not recognise it

Until 1932, it was believed that the atom consisted of a positively charged nucleus surrounded by negative electrons in a sufficient number to make the atom electrically neutral. For nearly twelve years, however, some physicists had suspected that there was a third atomic particle inside the nucleus which, unlike the proton and the electron, had a neutral charge. The fact that it was a neutral particle, however, complicated its discovery, because in those days almost all experimental techniques measured charged particles. On 18 January 1932, Frédéric and Irène Joliot Curie (daughter of Pierre and Marie Curie) bombarded polonium atoms with alpha particles, directing the "rebound" radiation (consisting of gamma rays, i.e. photons, the particles that make up light) to a layer of paraffin. They discovered that the paraffin bombarded by the "rebound" radiation emitted protons. But something was not quite right. The photons constituting the radiation should have been able at most to expel electrons, particles of very small mass, and not protons, particles with a mass 1830 times greater than that of an electron. Their experiment was more or less like throwing a ball weighing half a kilogram at a car and seeing it move at great speed. How was it possible? The Joliot Curie couple assumed that the photons possessed infinitely high energy. In reality the two French scientists had for the first time come across the neutron without recognising it: the polonium, in addition to the gamma rays, had in fact emitted other particles, invisible to the instruments of the time, which, as already mentioned above, only detected charged particles. On becoming aware of what Joliot Curie couple had done, James Chadwick (1891-1974) repeated their experiment and described the new particle, which he called the neutron. For this "discovery", he won the Nobel Prize in 1935.

X-rays, an accidental discovery

In the evening of 8 November 1895, Wilhelm Röntgen was, as always, in his laboratory at the University of Wurzburg in Bavaria, tinkering with a cathode ray tube. Also that evening he had turned off the laboratory lights and wrapped the tube in a piece of black cardboard, so that the light could not filter through. All of a sudden, he noticed that another piece of paper on the table, covered with a platinum and barium salt, had become luminous. The physicist immediately thought that the fluorescence was caused by the emission of invisible, unknown rays from the tube, which, because of their unknown nature, he called X-rays. Röntgen exposed other objects to the beam of those newly-discovered rays and saw that their image remained imprinted on a photographic plate. He also called his wife, Anna Bertha Ludwig, to the
laboratory and made her hold her hand between the tube and the plate... the two were flabbergasted when they saw the skeleton of the hand, complete with wedding ring, engraved on the plate! That was the first X-ray in history. Röntgen never patented his discovery to make it fully public. For his rays he was awarded the Nobel Prize for Physics in 1901.