350 years since the birth of modern science - The Royal Society of London

This year, 2010, marks the 350th anniversary of the Royal Society of London. From small beginnings it pioneered experimental research, scientific publishing, the critical review of research papers, and advice offered to industry.

Its members, called "Fellows", which are elected for life by existing members, have included great minds such as Isaac Newton, Michael Faraday, Charles Darwin, Albert Einstein, Richard Feynman, Dorothy Hodgkin, Stephen Hawking and Tim Berners-Lee. The Royal Society laid the foundations of modern science.

The Society was born one weekend in November, 1660, when twelve men gathered at Gresham College in London to hear a young man called Christopher Wren give a talk on Astronomy. They decided it would be a good idea to form a society, an association, to assist and promote the accumulation of useful knowledge. In 1662 this became "The Royal Society of London for Improving Natural Knowledge", when it was granted a charter by King Charles II of England.

The Society has always tried to be independent of government and politics and its quest for knowledge became so valued internationally that scientific activities sponsored by the Society were deemed "off limits" during wartime. American warships left Captain James Cooke's 1776 expedition unmolested. English chemist, Humphry Davy, was allowed to travel freely on scientific business across Europe during the Napoleonic wars. In recent history, the Society refused to expel members who were citizens of enemy countries during either of the World Wars.

Polymaths and brilliant scientists

From the very beginning the Royal Society was focused on experimental research. Founder member, Irishman Robert Boyle, was fascinated by the invisible substance which surrounds us: the air. In pursuit of his investigation, Boyle devised a number of air pumps. Various creatures, ranging from birds to oysters, were placed in small glass vessels and then the air was pumped out while he observed and took notes about what happened (mostly, the animals died).

Boyle's writings are full of experiments. He reported both positive and negative results, and was unwilling to dream up theories to fit with his experiments. His best known legacy today is a definition of the physical law stating that the volume of a gas varies inversely to its pressure. This is known in the English speaking world as "Boyle's Law" and led to the invention of the steam engine. Boyle started life as a theologian and alchemist, and ended it as a physicist and founder of the science of chemistry.

Many of the early members were polymaths - people who are interested in a wide range of different subjects. Christopher Wren, the astronomer who gave the inaugural lecture to the society was also a mathematician, physicist and architect. He was later responsible for the design of London's St Paul's Cathedral. Earlier he had taken an interest in the circulation of the blood. He surgically removed the spleen of a dog to see if the animal would survive (it did).

345 years of publications

The group needed some means of making their observations public, so in 1665 they published the World's first scientific journal: "Philosophical Transactions", which has remained in continuous print until today. The first issue included articles on such diverse subjects as the improvement of lenses, the planet Jupiter, experiments on coldness, lead ore in Germany, whale fishing, silk worms, how to break rocks, a deformed calf, worms, and eclipses. Unusually, among scientific writings of the time, the journal was published in the English language instead of Latin, which made it accessible to a wider readership.

Today, the Royal Society publishes seven different journals which cover a broad spectrum of the life sciences, physical sciences and cross-disciplinary sciences. The archives of these journals are all available on the Internet, going back to the first edition in1665.

Publication in "Transactions" was open to all, including non-members. The writer did not have to be rich or famous, or even able to write in English. The only thing considered important was the quality of the science.

Sometimes research papers came from unusual sources. Tradesman and son of a Dutch basket-maker, Antonie van Leewenhoek, sent papers to the Royal Society which included fine and detailed drawings of tiny creatures he had seen through his home made microscope. The society was very sceptical about his observations at first and sent a team to Holland to investigate -an early example of critical review.

Leeuwenhoek was vindicated and was elected a Fellow of the Royal Society in 1680. Since he had no English, Latin, or high Dutch, he submitted his research papers in low Dutch, but this was not an impediment to their publication. Over a period of 50 years, starting when he was already past forty, Leeuwenhoek published over 200 papers describing microscopic objects. He was the first to see, draw, and describe a bacterium.

Towards the end of his life, he explained why he had been so diligent in this work:

". . . my work, which I've done for a long time, was not pursued in order to gain the praise I now enjoy, but chiefly from a craving after knowledge, which I notice resides in me more than in most other men. And therefore, whenever I found out anything remarkable, I have thought it my duty to put down my discovery on paper, so that all ingenious people might be informed thereof. "

Contributing directly to society

The reputation of the Society's expertise grew and it became a source of scientific advice to industry and Government. In 1815 a Committee in charge of coal mine safety in England approached Humphry Davy, a chemist and Fellow of the Society, for help in preventing lethal underground explosions ignited by the flames of miners' lamps.

Davy visited the mines and studied the situation for over three weeks. He then closeted himself in his laboratory almost without interruption for three months, carrying out experiments and issuing reports to the Royal Society. He analysed the properties of methane -the gas which was causing the explosions- and especially how it burned in the presence of air. He discovered that methane could either explode, or,

under different conditions, burn with a cool, blue flame.

On the basis of this knowledge he made a number of different safety lamp designs. The final design was both elegant and simple; a tube of wire mesh surrounded the naked flame of the lamp, conducting excess heat away, keeping the flame cool and safe. The lamp was soon in use all over Britain and Europe.

In addition to the safety lamp, Fellows and Foreign Members of the Royal Society have given us calculus, gravity, evolution, the electron, the double helix, the internet, penicillin, antiseptics, the jet engine, radar and a large part of the modern world (including Spam filtering and the atom bomb).

Although the Society is old and prestigious, it is not backward looking. Its mission in the 21st century is to "expand knowledge and further the role of science and engineering in making the world a better place".

Its 1503 members aim to achieve this by organising public meetings, lectures and exhibitions; providing scientific expertise in the filming of documentaries and radio programmes; funding research programmes and providing student bursaries; creating an international science policy for the UK; introducing initiatives to enhance the transfer of science to business; and increasing access to the best science internationally.

I think the twelve founder members would be pleased to hear that.

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