

An Irishman's Diary

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MANY READERS will know that this year marks the 150th anniversary of the publication of Darwin's *On the Origin of Species*. Another breakthrough occurred in science that fateful year, this one with an Irish connection. The discovery attracted much less attention than Darwin's theory of evolution at the time, but it has become one of the hottest topics in science today.

In July 1859, the Irish physicist John Tyndall, one of the great scientists of the 19th century, established that certain atmospheric gases absorb heat quite strongly. This innocuous-sounding discovery was established over a few short weeks, but it provided the solution to one of the great riddles of science: the "greenhouse effect".

The greenhouse effect was first proposed by the French polymath Joseph Fourier, almost a century before Tyndall's experiments. Fourier had wondered how the Earth maintains its warm temperature, and he speculated that while heat from the sun passes easily through our atmosphere on the way to Earth, heat radiated outwards by the warm Earth must somehow be trapped in the atmosphere. The hypothesis was highly controversial, as it was widely assumed that gases are transparent to heat.

Tyndall, a fierce proponent of the new experimental method of science, devised a series of simple experiments to test Fourier's hypothesis.

Working in the dusty basement of the Royal Institution in London in the summer of 1859, he soon established that, while most gases are indeed transparent to light and heat, some gases – carbon dioxide and water vapour in particular – can absorb heat energy at certain wavelengths. As traces of each gas were known to exist in the Earth's atmosphere, the puzzle of the Earth's temperature was solved.

How did an Irish scientist come to make such an important discovery? John Tyndall was born in Leighlinbridge, Co Carlow in 1820, the son of an RIC officer and land agent. On completing his schooling under renowned local teacher John Conwill, he started his professional career as a surveyor for the Ordnance Survey of Ireland. He was soon transferred to a position with the Ordnance Survey in Lancashire, England, but became interested in the new experimental sciences of physics and chemistry emerging in Germany. He moved to Germany in 1848 to study under the famous experimentalist Robert Bunsen at the University of Marburg, returning to England with a PhD in experimental science in 1851. By 1853, he had been appointed professor of natural philosophy at the Royal Institution, a position previously held by the renowned scientist Micheal Faraday.

Tyndall remained at the Royal Institution for the rest of his career, making important discoveries in diverse areas of science, from magnetism to optics, from the physics of sound to the behaviour of bacteria.

He is probably best known for "Tyndall scattering", the first scientific explanation for why the sky is blue. A keen mountaineer, he became interested in the science of glaciers and made several important discoveries concerning their behaviour. He became extremely well-known in Victorian England as a public communicator of science and member of the X Club, an influential group of prominent scientists who defended evolution and other scientific theories from the strict religious beliefs of some.

Tyndall's verification of the greenhouse effect was accepted by the scientific establishment, but not regarded as a matter of vital importance. He and his colleagues were aware of the output of Victorian England's

factory chimneys, but no one drew a link between this pollution and the greenhouse effect.

Today, the situation is radically different. In the last few decades, evidence has emerged that the average temperature of the Earth and its oceans has been gradually rising since the industrial revolution.

Despite many uncertainties, the scientific consensus is that this global warming is associated with an increase in carbon dioxide in the atmosphere, an increase that has been produced by human activities such as industry and transport. The discovery has led to concerted international efforts to agree on targets for reducing carbon emissions worldwide, a process that is only just beginning.

What would Tyndall make of today's climate problems? Like most scientists of his era, he would probably find it difficult to grasp that humans could have such a global effect on nature. On the other hand, he would be greatly depressed by the shrinking of his beloved glaciers.

Above all, he would be astonished to find that, of all the scientific discoveries he made, the work he did in the summer of 1859 has become a major preoccupation of 21st century science.

Today, the work of this great Irish scientist is commemorated by the annual Tyndall lecture of the Institute of Physics, the Tyndall Centre for Climate Change Research in the UK, the Tyndall National Institute in Cork, Mount Tyndall in California and the Tyndall glacier in Chile.

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