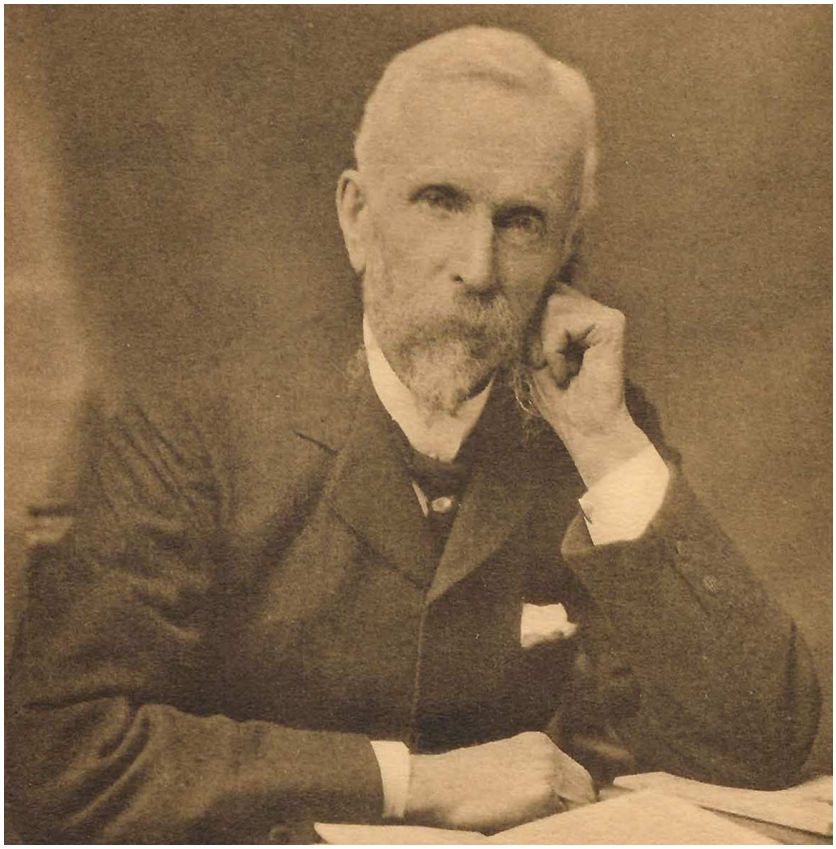
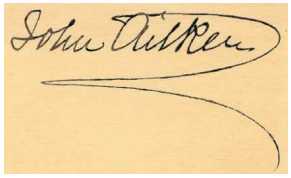
John Aitken
18 September 1839 – 14 NOVEMBER 1919





John Aitken

John Aitken highlighted the crucial role that microscopic particles play in the condensation of atmospheric water vapor in clouds and fogs. He achieved this through a series of experiments and observations using instrumentation he had designed and constructed to count atmospheric particles. He is remembered with the term Aitken nuclei.

John Aitken, the son of a lawyer, was born in Falkirk, Scotland on 18 September 1839. He was educated at the local grammar school and University of Glasgow. After graduating he intended to pursue a career in marine engineering and worked for five years in shipbuilding. Ill health forced him to abandon his chosen profession. He then began to study various natural phenomena and he transformed the drawing room in his house to a laboratory and workshop. His early training as an engineer proved invaluable in his scientific investigations.

His early papers dealt with such topics as “safety values (1867)”, “melting and regelation (sic) of ice (1872)”, “glacier motion (1873)” and “ocean circulation (1876-77)”. He began his research on condensation of water on airborne particles in 1875 and published his results from 1880 onwards. Based on his experiments he concluded: “(1) when water vapor condenses in the atmosphere, it always does so on some solid nucleus; (2) the dust particles in the air form the nuclei on which it condenses; (3) if there was no dust in the air there would be no fogs, no clouds, no mists, and probably no rain.”

Aitken designed and built the first apparatus to measure the number concentration of airborne particles. This involved making the particles visible by creating a supersaturation of water vapor through rapid expansion of the moistened air. Under these conditions each dust particle becomes a center of condensation, and grows into an easily visible drop. Aitken was not the first to create “clouds” in this manner. Prior to Aitken, Coulier (1875) recognized that under these conditions droplets are formed more readily in unfiltered than in filtered air, pointing to the importance of particles for 'nucleating' droplet growth. Yet Aitken was the first to use this principle to quantitatively assess the number concentration of airborne particles. Today most particle concentration counters work on this same principle.

Aitken continued to improve on this instrumental design from the first experimental form through to the Pocket Dust Counter. He began to study the meteorological and industrial (pollution) conditions influencing the formation of atmospheric particles and the role of locality, altitude, and prevailing winds. The dust counter was also used in his work on the “Evaporation of Musk and other Odorous Substances” where he investigated whether the odor from perfumes was solid or gaseous. The dust counter was also used to determine if the tail of Halley’s Comet was composed of solid or liquid particles. He measured dust levels before and after the coming of the comet in the West Highlands, a place he had earlier shown to be relatively clean. Simultaneous observations were made on sunset colors, haze, and atmospheric electricity. He concluded that there was no evidence that the Comet had introduced any measurable amount of dust into the atmosphere.

For many years he was unable to explain an increase in the number concentration at Kingairloch, a seaside resort. Eventually he discovered that the source of these particles was the foreshore under certain tide conditions and sunshine (1912). The hypothesis of gas-to-particle conversion was supported by a series laboratory observations.

In 1884, he concluded that the brilliant colors often seen in the sunset are due to the refraction of light by dust particles in the upper atmosphere. Aitken remarked that, on a few occasions, the sun had been observed to be a decidedly greenish color, whilst on others it appeared blue. He also obtained in expansion chamber experiments a succession of colors; first blue appeared, then green and yellow, and when the expansion was still further increased, the blue again returned to give place to a second green and yellow.

That same year Aitken began a long series of experiments on the measurement of air temperature. He showed how thermometers in a Stevenson screen would read too high on sunny days. The paper on this work was finished just days before he died. It was finally published in the Proceedings of the Royal Society of Edinburgh in 1921.

For his achievements, in various scientific domains, he received several honors including the Keith and Gunning Prizes from the Royal Society of Edinburgh and a Royal Medal from the Royal Society of London. He was awarded with an honorary doctorate from the University of Glasgow in 1889. He became a Fellow of the Royal Society of Edinburgh (1875) and a Fellow of the Royal Society of London in 1889. He died on November 14, 1919 and left the bulk of his estate for the benefit of the poor of Falkirk and to establish a temperance public house.

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