Although concern about global atmospheric warming has intensified in recent decades, research into the greenhouse effect actually began in the 19th century. Fourier compared the influence of the atmosphere on temperature to the heating of a glass-covered bowl with an interior coated with black cork (1). He and other scientists such as Tyndall (2) and Langley (3) appreciated that without heat-absorbing gases in the atmosphere, the temperature on the ground would be considerably lower, making life as we know it impossible. However, in 1896 the Swedish scientist Svante Arrhenius was the first to make a quantitative link between changes in CO$_2$ concentration and climate (4). The centenary of the publication of his paper was celebrated at a recent workshop at the Royal Swedish Academy of Sciences (5).

Although he had a wide range of interests, Arrhenius is best known for his work on electrolytic dissociation, for which he received the Nobel prize in Chemistry in 1896 (6), and on the theory of reaction kinetics. In his work on the effect of CO$_2$ on global climate (4), Arrhenius made clever use of data provided by Langley (6), who had measured the emission spectrum of the moon for different lunar heights and seasons. This data allowed the calculation of the absorption coefficients of CO$_2$ and H$_2$O and of the total heat absorbed in the atmosphere of the Earth for a variety of CO$_2$ concentrations, as well as the corresponding temperature change.

After an estimated 10,000 to 100,000 calculations by hand (7), Arrhenius predicted a temperature rise of 5° to 6°C for a doubling of CO$_2$, not too different from recent estimates of 1.5° to 4.5°C (8). Arrhenius primarily ascribed changes in CO$_2$ levels to changes in volcanic activity and concluded that they could be the effect of solar variations. He noted, for example, that the temperature on the ground in the 9th memoir (1890), p. 193.


S. Arhennius, Nord. Tidskr. 14, 121 (1896).

G. S. Callendar, Quart. J. Royal Meteorol. Soc. 64, 223 (1938).


12. Exact values differ widely for different models.