Corinthic. It reads as follows:—"The eclipse of the sun was witnessed on board the Oceanic Company's steamer *Corinthic,* 480 miles south-west of Hobart. Totality lasted from 2h. 50m. to 2h. 54m. The corona was unexpectedly structureless, being equally distributed round the circumference. There were no prominences, rays, plumes, or streamers. The chromosphere was dark red and of exceptional depth."

WILLIAM J. S. LOCKYER.

SIR WILLIAM HUGGINS, K.C.B., O.M., F.R.S.

ONE of the pioneers of the new era of astronomy opened by the application of the spectroscope and photographic plate to celestial bodies has just passed into silence, and though the memorial formed by his works remains with us, no new block can be added or detail elaborated by the hand of its builder. It is not given to many men of science to have their scientific careers associated so closely with new developments as was that of Sir William Huggins, whose death on May 13, at eighty-six years of age, we regret to record. It may almost be said that he was present at the birth of celestial spectroscopy; when he commenced his work nearly fifty years ago, he had a virgin field of study before him, so that "nearly every observation revealed a new fact, and almost every night's work was red-lettered by some discovery." It was inevitable that some lines laid down in this early survey required modification as more exact instruments and methods became avail able, but the observations served their purpose in showing that new regions awaited exploration, and Sir William Huggins lived to lead investigators into the realm thus gained for science, and to stimulate a new generation to study it in detail.

In 1901, a year after Sir William Huggins had been elected president of the Royal Society, an appreciative account of his work was given by Prof. Kayser in these columns as a contribution to our series of "Scientific Worthies." He was then seventy-seven years of age, and had crowned the edifice of his scientific publications by the production of a sumptuous "Atlas of Representative Stellar Spectra." In 1902 his achievements received the highest official recognition by the bestowal upon him of the Order of Merit. While president of the Royal Society from 1900 to 1905, he delivered four addresses in the course of which he described some of the work which the society has done, and is doing, for the nation. Selections from these addresses, with a short history of the Royal Society, were published in volume form in 1906, and the subjects with which they deal were thus brought under the attention of a wider public than that present at the anniversary meetings at which they were delivered. Two of the addresses were concerned mainly with scientific education, and the public interest excited by one of them led the Royal Society to appoint a committee to consider the subject and prepare a report, which was afterwards sent to the existing universities of the United Kingdom, with a resolution adopted by the president and council asking that steps be taken to "ensure that a knowledge of science is recognised in schools and elsewhere as an essential part of general education." It is a matter for regret that this manifesto, which was a sequel to Sir William Huggins's advocacy of the claims of science in modern life, led to no definite result. A fuller knowledge of the conditions at the public schools and universities, and greater precision in the recommendations of the committee, might have gained for him a place among educational reformers who see their causes triumphant.

There is no need now to refer in much detail to Sir William Huggins's activities in the domain of astrophysics, for his work was surveyed in the "Scientific Worthies" article mentioned already. He began his spectroscopic studies with Prof. W. A. Miller in 1864, by the examination of the spectra of a few stars, with particular reference to the identification of their chemical constituents. Nine or ten terrestrial elements were found to exist in the atmospheres of Betelgeuse and Aldebaran, and other elements were suspected. While carrying on these investigations, he submitted a planetary nebula in Draco, close to the pole of the ecliptic, to a spectroscopic examination, and found the spectrum to consist of three bright lines, the brightest of which—the characteristic nebular line—he believed to be coincident with a line due to nitrogen. This identification was afterwards disproved, but there remains to his credit the fact that he was the first to observe the bright-line radiation of some nebulæ.

Sir William Huggins was also the first to apply the Doppler-Fizeau principle to the measurement of radial velocities. He showed in 1867 that motion in the line of sight could be determined by measuring the displacement of spectrum lines in a star or other heavenly body; but though his work, and that to which it gave rise at the Royal Observatory, Greenwich, demonstrated the feasibility of the method, the results were too discordant to be of substantial service to science. Not until Vogel applied photography to the subject, about twenty years later, was real success achieved, and the value of the principle in astrophysical investigations realised.

Photography had been used by Sir William Huggins in cooperation with spectroscopy long before Vogel showed the precision with which radial velocities could be determined by its aid. He was probably the first to obtain a spectrograph of Sirius, in 1863, using a wet plate, though he failed to secure any impressions of lines in the record. After the invention of the gelatin dry plate, several years later, the attempt to secure photographs of stellar spectra was renewed, and success was attained. Using instruments placed at his disposal by the Royal Society, he photographed the ultra-violet series of hydrogen lines in the spectra of six "white stars," this being the first time the series had been revealed, either in terrestrial or celestial chemistry. It is a little surprising, therefore, that he did not anticipate Vogel in the application of photography to the determinations of radial velocities which have led to such valuable additions to our knowledge of binary systems and the gregarious movements of stars.

Not so much is known, perhaps, of Sir William Huggins's work in other astronomical directions as of that in celestial spectroscopy. With Prof. Stone, about 1870, he made some investigations with the object of measuring the heat received from stars, using a thermopile, and concluded that distinct indications of thermal effects due to stellar radiations were obtained; but the results are now known not to be trustworthy. Twenty years later, Prof. Boys, using his far more sensitive radiometer, was unable to find any definite effects from the brightest stars, and only when a more delicate radiometer was used by Prof. Nichols in conjunction with the great telescope at the Yerkes Observatory was it possible to secure distinct deflections due to radiation from stars like Vega and Arcturus.

Such revision as this of early observations is, we take it, a concomitant of scientific progress. However well an investigator may build, the iconoclast, with superior equipment and deeper knowledge of causes of weakness of conclusions, overthrows the edifice and erects his own pillar in its place. There is frequently little left of the original foundation, yet each structure represents an advance upon that which it supersedes. Sir William Huggins recorded in 1867 that he had detected the presence of water vapour in the atmosphere of Mars, and re-affirmed his observation later at his observatory at Tulse Hill, but critical inquiry afterwards showed that the conclusions had been drawn too hastily. While, however, those observations must be discarded, we have the recent investigations at Prof. Lowell's Flagstaff Observatory giving clear evidence of the presence of aqueous vapour in the Martian atmosphere. So, like a coral on its base, rises the living body of science upon the monument of past effort. Cemented upon the rock of nature, Sir William Huggins stretched out his hands toward the stars, and if a succeeding generation is able to examine the secrets of the heavens more closely than was possible in earlier days, let it remember the patient pioneer work required to form the base of the pinnacle from which observations can now be made.

R. A. G.

PROF. STANISLAO CANNIZZARO.

BY the death of Cannizzaro, another link between the chemistry of to-day and that of the mid-Victorian era has been broken—a link which perhaps more than any other served to connect two well-defined and sharply differentiated epochs in the history of nineteenth-century chemistry. Cannizzaro was not a great discoverer in the ordinary sense of that word; the number of his published researches is few, and the field of inquiry he cultivated comparatively restricted. His greatest discovery, indeed, was his own countryman, Amedeo Avogadro. The fundamental conception of Avogadro that the gaseous laws of chemical combination—the laws associated with the names of Dalton and Gay-Lussac—could be explained by the simple hypothesis that equal volumes of gases, under identical conditions of temperature and pressure, contain the same number of molecules was as the seed which fell upon stony ground. Even the efforts of Ampère—a man of far more influence in his generation—to cause it to fructify had no immediate effect. Berzelius, for a time, dimly apprehended the potentiality of the supposition, but he eventually lost his way under the blind guidance of dualism, and led Europe wrong for a quarter of a century. The German school, it is true, mainly under the direction of Gmelin, gradually shook itself free from dualism, but it wandered still further from the true faith, and by the middle of the nineteenth century chemical theory was utterly befogged, and its doctrine bristled with inconsistencies, contradictions, and anomalies.

Cannizzaro appeared at the psychological moment, as the phrase goes. In its effect, the publication, in 1858, of his "Summary of a Course of Chemical Philosophy" created a revolution in chemical thought hardly less momentous than that which followed the appearance of Dalton's "New System." The publication of a syllabus of a lecture course is a simple enough occurrence, and perhaps never before marked an epoch. But its effect in this case was instantaneous and profound. Cannizzaro demonstrated that the hypothesis of his forgotten countryman constituted the means of placing the most important of all chemical constants on a definable basis; it rendered our conceptions of atoms and molecules, atomic weights and equivalents, gaseous volumes and valency, and all that is associated with or consequent upon these conceptions, logical and consistent.

It is not too much to say that Cannizzaro's intervention at this time saved the position of the atomic theory. The early 'sixties of the last century were a period of much perturbation; there was then a sort of parting of the ways. Williamson laboured to stem the tide of infidelity, but many were unconverted, and some even hardened their hearts. We hear little or nothing to-day of the scepticism which was fashionable among the young bloods of fifty years ago. It is largely due to Cannizzaro that our faith has been strengthened and purified.

There is something dramatic in the circumstance that Cannizzaro should have passed away at the time that all Italy is celebrating the achievements of Garibaldi and his never-to-be-forgotten Thousand in effecting the establishment of Italian unity, a cause in which Cannizzaro had himself struggled and suffered, and in which he was destined to take a share in shaping to a successful issue.

Cannizzaro was born at Palermo in 1826, where his father was president of the High Court of Chancery. He was originally intended for medicine, but under the influence of Melloni he began the study of natural science, more particularly chemistry, under Piria, in whose laboratory he became *préparateur*. The revolution of 1848 found Cannizzaro in Messina, and the youth of twenty-two an officer of artillery and a member of the Sicilian Parliament. For nearly nine months the revolutionaries held out against Ferdinand's army, but Messina was eventually bombarded and sacked, and Cannizzaro and what remained of his band were driven to Taormina. With the disaster of Novara and the abdication of Charles Albert, the Sicilian movement collapsed; the insurgents retreated to Catania, and thence by Castrogiovanni to Palermo, where Cannizzaro succeeded in getting on board a Sicilian frigate, and in escaping to Marseilles. He was now almost destitute, but friends helped him to Paris, and, thanks to Cahours, he found a place in Chevreul's laboratory in the Jardin des Plantes, and began the study of the amines in conjunction with Cloëz. In 1851 he became professor of physical chemistry at Alessandria, in Piedmont, where he discovered benzyl alcohol and worked with Bertagnini on anisic alcohol. In 1855 he was elected to the chair of chemistry at Genoa, where he drew up the famous "Summary" of which mention has been made.

At this time the cause of Italian unity was in the ascendant, and by 1860, thanks to the affairs of Magenta and Solferino, the consolidation of Central Italy was complete. Sicily was once more ablaze, and before the middle of May Garibaldi and the "Mille" had effected its liberation. Cannizzaro immediately returned to Palermo, and threw himself into the work of organising the political future of the island and its relation to Italian unity. He then resumed his academic work at Genoa, but in the following year he was invited to the chair of chemistry at Palermo, where he remained ten years, taking an active share in the management of the University and serving for a time as rector.

In 1871 he was called to the University of Rome, and made a senator of the kingdom. As director of the Chemical Institute at Panisperma he gave, session after session, for nearly forty years, systematic courses of lectures on general and organic chemistry, and practically every Italian chemist of note now living passed through his laboratories and worked under his inspiration and direction.

Cannizzaro was a foreign member of many learned societies, and of nearly every academy in Europe. At the time of his death he was the oldest foreign member of the Chemical Society of London, having been elected in 1862. In 1872 he delivered the Faraday lecture to the society, giving a charming and graceful exposition of the genesis of the doctrine with