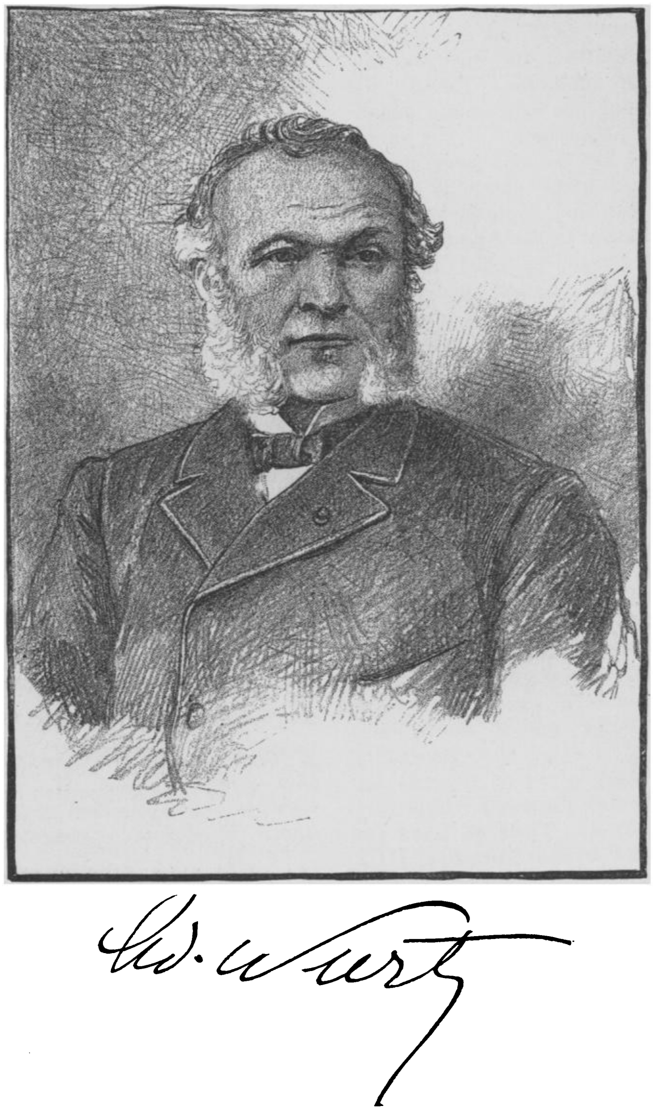
CHARLES ADOLPH WURTZ.

THE subject of this sketch, Charles Adolph Wurtz, who died on the 12th of May at Paris, was the chief representative in France of what is generally known as modern chemistry. He was born November 26, 1817, at Strassburg. Here he began his studies, and received the degree of doctor of medicine. Before his graduation in medicine, he was made assistant in the chemical department in the medical faculty; in 1845 he became assistant in Paris; in 1846 he was made chemical director of the School of art and manufactures; in 1851 he became professor in the Agronomic institution of Versailles; and in 1854, after the death of Orfila, he was elected professor of medical chemistry, taking upon himself the duties connected with the chair of pure chemistry, up to that time held by Dumas, and that of toxicology. In 1866 he was made dean of the medical faculty, — a position which he held until 1875, when he became professor of organic chemistry in the faculty of sciences.

Wurtz's contributions to chemistry are numerous and important. He is fairly entitled to be counted among those who have originated and developed the views which are now held by the majority of chemists. The two hypotheses which at the present day form the basis of speculation concerning chemical phenomena, are, 1°, the hypothesis of Avogadro, according to which equal volumes of all gases contain the same number of molecules; and, 2°, the valence hypothesis, according to which the elementary atoms differ among each other as regards the number of atoms of other elements which they can hold in combination. Thus we have the compounds represented by the formulas, HCl, H_2O, and H_3N, in which the atoms of chlorine, oxygen, and nitrogen are represented in combination with one, two, and three atoms of hydrogen respectively. Before these differences among the elements were recognized, the existence of various types of compounds was observed. In a vague sort of way, compounds were referred to this or that type: gradually, however, the idea of types became more definite, and then, undoubtedly, exerted a great influence on the development of chemistry; leading directly, as it did, to the conception of valence. The first important investigation of Wurtz had much to do with giving definiteness to the conception of types. In the paper containing the results of the investigation, he described certain compounds, which he regarded as ammonia, in which one of the parts of hydrogen was replaced by complex groups containing carbon and hydrogen; as, CH_3 (methyl) and C_2H_5 (ethyl). Representing ammonia as $N\left\{\begin{matrix}H\\H\\H\end{matrix}\right.$, the new substances can be represented thus, $N\left\{\begin{matrix}CH_3\\H\\H\end{matrix}\right.$, $N\left\{\begin{matrix}C_2H_5\\H\\H\end{matrix}\right.$, etc. It became clear that substances can be made which bear a very simple relation to ammonia; and a good experimental basis was furnished for referring these compounds to the ammonia type. In regard to this discovery, Kekulé, the distinguished German chemist, says, "The discovery of the bases corresponding to ammonia is indisputably the corner-stone of our present views."

It is an extremely interesting fact, that Liebig predicted the discovery ten years before it was made, in developing his views regarding the nature of the nitrogenous bases, the alkaloids; but the view that these bodies can be referred directly to ammonia in the sense in which Wurtz regarded them was not generally accepted by chemists until shortly after his discovery.

Another important investigation of Wurtz is that which led to the discovery of the so-called diatomic alcohols, the chief of which is glycol. Ordinary alcohol may be referred to the water type in the same way that Wurtz's bases are referred to the ammonia type; i.e., it may be regarded as water, $O\left\{\begin{matrix}H\\H\end{matrix}\right.$, in which one of the hydrogen atoms is replaced by the complex group, ethyl, C_2H_5. According to this view, which is founded upon experimental evidence, alcohol is represented by the formula, $O\left\{\begin{matrix}C_2H_5\\H\end{matrix}\right.$. In 1854 Berthelot's memoir on the fats and glycerine appeared. In this it was shown that glycerine acts in general like an alcohol, but that acids unite with it in three proportions. Wurtz suggested that just as ordinary alcohol may be regarded as derived from water as above indicated, glycerine may be regarded as derived from water as represented in the formula $O_3\left\{\begin{matrix}C_3H_5\\H_3\end{matrix}\right.$. In other words, ordinary alcohol is derived from water by the substitution of one group, C_2H_5, for one hydrogen atom in one molecule of water, $O\left\{\begin{matrix}H\\H\end{matrix}\right.$; whereas glycerine is derived from water by the substitution of one group, C_3H_5, for three atoms of hydrogen in three molecules of water, $O_3\left\{\begin{matrix}H_3\\H_3\end{matrix}\right.$. This led Wurtz to inquire whether, in a similar way, there might not be alcohols derived from two molecules of water, $O_2 \left\{ \begin{matrix} H_2 \\ H_2 \end{matrix} \right.$, by substituting some group for two hydrogen atoms. He soon discovered the first member of this group of bodies, viz., glycol, which he showed to be a compound intermediate between ordinary alcohol and glycerine. He represented it by the formula, $O_2 \left\{ \begin{matrix} C_2H_4 \\ H_2 \end{matrix} \right.$. Probably the most important result of this discovery was the fact that the attention of chemists was directed to the differences between the radicals C_2H_5 in ordinary alcohol, C_2H_4 in glycol, and C_3H_5 in glycerine. In the first the radical takes the place of one atom of hydrogen, in the second one radical replaces two atoms of hydrogen, and in the third the radical replaces three atoms of hydrogen. Here, then, in the polyatomic radicals, we have the beginning of the conception of valence. Just as radicals exist which can replace one, two, or three hydrogen atoms, so similar differences exist between the elements. Regarding the discovery of glycol, Ladenburg, in his 'Entwickelungsgeschichte der chemie,' says, "Seldom has the discovery of a single body exerted such an influence on the development of chemistry, seldom has a single compound given rise to such a series of beautiful and useful investigations, as glycol."



The ideas suggested by the investigations on the substituted ammonias and the polyatomic radicals were followed up by Wurtz and others, and the result is the chemistry of to-day. Wurtz has been an active participator in all important discussions regarding fundamental matters, and has ably and vigorously defended the modern views against the attacks of Berthelot, St. Claire Deville, and others in France. One of the last of these discussions was carried on only a few years ago. It pertained to the question whether Avogadro's hypothesis is valid or not. Many of the most prominent French chemists refuse to accept it, and, in defence of their position, tauntingly refer to two or three apparent exceptions. The particular case which gave rise to the discussion referred to is that of chloral hydrate. Wurtz claimed that the reason why this compound does not conform to the hypothesis is, that, when heated, it breaks up into water and chloral. This his opponents strenuously denied. Both sides introduced very delicate and skilful experiments; but, as is usually the case, no final conclusion was reached. Nevertheless, a large audience of chemists was interested and instructed by the discussion, and chemistry was benefited.

It would lead too far to attempt to give an account of all that Wurtz has done for chemistry. In addition to the epoch-making contributions mentioned, his synthesis of neurine, his methods for the synthesis of hydrocarbons and of the acids of carbon, his method for the transformation of sulphuric acids into phenols, and investigations on the condensation of aldehydes, are all worthy of much more than ordinary mention. He has also been a prolific writer of excellent books on chemistry, some of which are recognized as standards; and he has been an editor of journals of chemistry, his name being found at present on the title-pages of the *Annales de chimie et de physique* and the *Bulletin de la Société chimique*. The titles of his principal books are included in the following list: Sur l'insalubrité des résidues provenant des distilleries, 1859; Leçons de philosophie chimique, 1864; Traité élémentaire de chimie médicale, 1864–65; Leçons élémentaires de chimie moderne, 1866–68; the Dictionnaire de chimie pure et appliquée, which appeared in parts, beginning in 1868; Traité de chimie biologique, vol. i., 1880; and The atomic theory, one of the volumes of the International scientific series. His Elements of chemistry has been translated into English, and has reached a second edition in this country. His writings are clear, vigorous, and interesting. His fairness as a historian has been questioned; and it must be conceded that his enthusiasm occasionally led him to what calmer men are inclined to regard as incorrect judgment, expressed in strong language. One of his remarks, which naturally aroused the ire of the Germans, is the much-quoted phrase with which he introduced his dictionary: "La chimie est une science française: elle fut constituée par Lavoisier, d'immortelle mémoire."

In 1865, on the recommendation of the Academy of sciences, Wurtz was awarded the imperial biennial prize of twenty thousand francs. In 1867 he succeeded Pélouze as a member of the chemical section of the Academy of sciences. In 1878 he received the Faraday medal from the Royal society of England, on the occasion of his being invited to deliver the Faraday lecture before the English chemical society. In 1881 he was honored with an appointment as senator for life in the French senate.

Imperfect as this sketch is, it will at least serve to show that Wurtz occupied a commanding position among chemists of the present. His loss is a serious blow to science, and especially to the progress of chemistry in France. It will be hard to find a successor possessing his energy and ability. Dumas died a month ago, after having reached a good old age, and after he had ceased to work actively; and while, now that he is gone, we more clearly recognize his greatness, we can nevertheless more readily reconcile ourselves to his loss than to that of Wurtz, who seemed still to belong to the younger generation, capable of guiding others for years to come, and of adding to his former brilliant discoveries.

RESULTS OF DREDGINGS IN THE GULF-STREAM REGION BY THE U. S. FISH-COMMISSION.[1]

6. Evidences of the existence of light at great depths in the sea.

THE evidences of the presence of light and its quality and source at great depths are of much interest. At present very little experimental knowledge in regard to these questions is available. That light of some kind, and in considerable amount, actually exists at depths below two thousand fathoms, may be regarded as certain. This is shown by the presence of well-developed eyes in most of the fishes, all of the cephalopods, most of the decapod Crustacea, and in some species of other groups. In many of these animals, living in two thousand to three thousand fathoms, and even deeper than that, the eyes are relatively larger than in the allied shallow-water species; in others the eyes differ little, if any, in size and appearance, from the eyes of corresponding shallow-water forms; in certain other cases, especially among the lower tribes, the eyes are either rudimentary or wanting in groups of which the shallow-water representatives have eyes of some sort. This last condition is notable among the deep-water gastropods, which are mostly blind: but many of these are probably burrowing species; and it may be that the prevalent extreme softness of the ooze of the bottom, and the general burrowing habits, are connected directly with the absence or rudimentary condition of the eyes in many species belonging to different classes, including Crustacea and fishes. Such blind species usually have highly developed tactile organs to compensate for lack of vision.

Other important facts bearing directly, not only on the *existence*, but on the *quality*, of the light, are those connected with the coloration

[1] See *Science*, Nos. 16, 19, 27.