entropy of solution of ions can be explained on the basis of alterations in the structure of the water. I venture to assert that the fruitfulness of such an approach is far from being exhausted.

For a long while we were satisfied with the classification of liquids into normal liquids, polar liquids and fused salt solutions. It became evident, however, that the mere fact of dipole moment was inadequate to account for solubility relations. We find, on the one hand, that iodine dissolves in chloroform, which is polar, and in carbon tetrachloride, which is non-polar, to give approximately regular solutions in both cases. Again, naphthalene, with zero dipole moment, dissolves in nitrobenzene, with a very large moment, to give an almost perfect solution. The polar character of the nitrobenzene causes little or no tendency for it to associate with itself rather than with the non-polar solute. We find, moreover, that although solubility in water has usually been regarded as proportional merely to the polar character of the substance in question, dipole moment alone is actually a very misleading guide. A striking illustration of this is given in Table II.

TABLE II
SOLUBILITY OF LIQUIDS IN WATER, 20°

	Per cent.	$\mu \times 10^{18}$
Benzene	0.06	0.
Nitrobenzene	0.19	4.19
Aniline	3.49	1.51
Phenol	8.2	1.70
Ethyl iodide	0.40	1.66
Ethyl alcohol	∞	1.70
Propyl chloride	0.27	2.0
Propyl iodide	0.11	1.6
Propyl alcohol	∞	1.7
Water	...	1.85

We see that the solubilities of benzene and its three substitution products in water do not at all follow their dipole moments. These solubilities do, however, accord with the amount of hydrogen bond formation that may be expected in solutions of water with aniline and phenol, respectively. A similar difference exists between ethyl and propyl halides and alcohols. It is the ability of the hydroxyl of the alcohol or the phenol or the amino group in aniline to enter more or less into the structure of the water which accounts for their solubility. The structure of ice is an open, continuous structure, like that of trydimite, and contains no permanent individual molecules. The structure of water at lower temperature is the same, more or less broken down by thermal agitation. Hydroxyl containing substances such as the alcohols are similar except for the fact that the substituted groups diminish the number of hydrogen bonds. The profound difference between liquids containing ordinary dipoles, such as acetone and chlorobenzene and liquids containing hydroxyl, such as the alcohols, is illustrated in Fig. 6 showing the alteration in molar polarization when mixed with varying amounts of an inert solvent. The carboxyl group of organic acids, however, allows two molecules of the acid to form a closed ring so that the polymerization is limited to a double molecule. This molecule may, except in extreme dilutions, behave as a constituent of regular solutions.

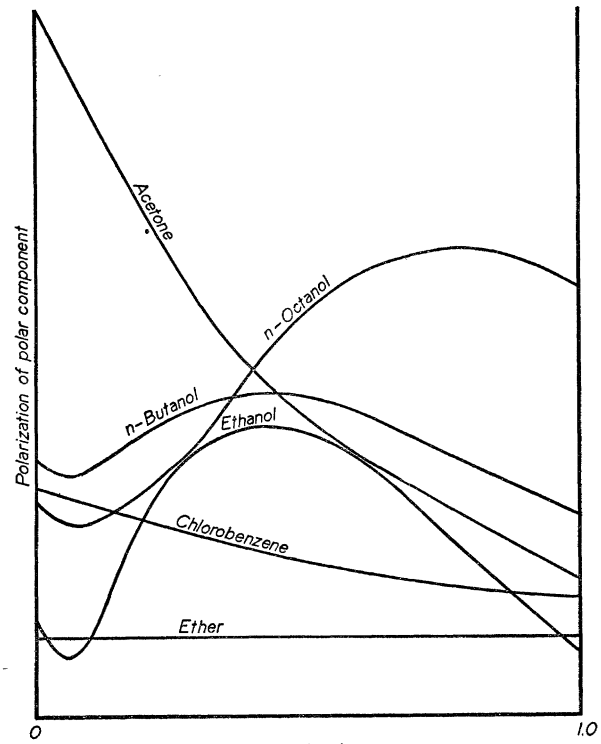

FIG. 6. Variation of molar polarization with concentration.

OBITUARY

DAVID TODD

WITH the passing of David Todd, on June 1 in Lynchburg, Virginia, at the age of 84, Amherst College lost another of the distinguished group of professors who added much to its prestige around the beginning of the century. The names of Tyler, Emerson, Olds, Loomis, Todd and the others were well known and respected both within and without the walls; and the last named of these was likely to receive the vote of the graduating class as the best known of all.

David Todd was born on March 19, 1855, in Lake Ridge, New York, the son of Sereno Edwards and

Rhoda Peck Todd, and a descendant of Johnathan Edwards. He enrolled in Columbia College, New York, in 1870, and entered Amherst College in 1873, where he received the A.B. degree in 1875, with membership in Phi Beta Kappa. He received the honorary Ph.D. degree from Washington and Jefferson College in 1888. After an absence of six years, in which he served under Simon Newcomb at the U. S. Naval Observatory in Washington, he returned to Amherst, in 1881, to take the new chair of astronomy. He was appointed professor of astronomy in 1892; he also served as secretary of the faculty of the college from 1891 to 1909, and was professor of astronomy and higher mathematics in Smith College from 1882 to 1887. He became professor emeritus in 1920.

More than a hundred technical and popular articles were contributed by Dr. Todd to various periodicals; they relate to solar eclipse problems, the solar parallax as derived from the transit of Venus, the orbits of the four bright satellites of Jupiter, the search for a transneptunian planet and other subjects. He contributed to Webster's Dictionary and to the Encyclopaedia Britannica. His best-known book is the "New Astronomy," first published in 1897, which has gone into many editions and is translated into Hungarian, Turkish and Chinese. He was a fellow of the American Association for the Advancement of Science, a member of the American Astronomical Society, the Washington Philosophical Society, the Astronomische Gesellschaft and honorary fellow of the Sociedad Geografica de Lima, Peru. He designed and supervised the construction of the Observatory of Smith College, and was instrumental in procuring funds to build the Amherst College Observatory, completed under his supervision in 1905, and to equip it with the excellent 18-inch refracting telescope by the Clarks.

Dr. Todd's interest in solar eclipses led him to many parts of the world. He was in charge of the National Academy of Sciences expedition to Japan in 1887, the U. S. Scientific Expedition to West Africa in 1889, and the Amherst expeditions to Japan in 1896, to Tripoli in 1900, to the Dutch East Indies in 1901, to Tripoli again in 1905 and to Russia in 1914. He invented an automatic device for photographing eclipses, and his misfortune with clouds on some of these occasions led to the keeping of meteorological records at selected stations for several years in advance of the eclipse. In addition, he was invited to direct the observations of the transit of Venus of 1882 at the Lick Observatory, then under construction on Mount Hamilton, California, and he cooperated with the astronomers of the Lowell Observatory in an expedition to Chile to photograph the planet Mars around the favorable opposition of 1907.

Dr. Todd's hobby was aviation, beginning as early as the 1880's. He took part in a number of balloon flights. He was founder member of the Aero Club of America, a member of the Board of the National Advisory Association of Aeronautics and of the Board of Governors of the Aerial League of America. In 1908, he founded at Amherst one of the first college aviation clubs, the Amherst Aero Club, the forerunner of the present Amherst College Flying Club.

Dr. Todd married Mabel Loomis, in 1879, who died in 1932. He is survived by his daughter, Mrs. W. V. Bingham.

ROBERT H. BAKER

HARVARD OBSERVATORY

RECENT DEATHS

DR. CHARLES ADDISON ELLIOTT, professor of medicine at the Medical School of Northwestern University, chief of the medical service of Passavant Hospital, Chicago, died on June 26 at the age of sixty-six years.

DR. HARRY VICTOR ATKINSON, professor of physiology and pharmacology at the School of the Medical Sciences of the University of South Dakota, died suddenly on May 7 at the age of fifty-two years.

GUY PINNER, chief engineer of the American Cyanamid Company, died on June 26 at the age of fifty-one years.

EMMA SAREPTA YULE, pioneer in educational work in Juneau, Alaska, and in the Philippines and for fifteen years editor of the *Philippine Agriculturist*, died in Los Angeles on April 16.

PROFESSOR HARRY HUNTINGTON BARNUM, head of the department of mathematics at Robert College, Istanbul, Turkey, has died at the age of sixty-one years. He had been a member of the college faculty for thirty-nine years.

SCIENTIFIC EVENTS

EXCHANGE OF VISITS BETWEEN THE ROYAL SOCIETY AND THE KAISER WILHELM GESELLSCHAFT

IN the autumn of 1938, following a suggestion of the president of the Kaiser Wilhelm Gesellschaft, arrangements were made by the president of the Royal Society of London, Sir William Bragg, and representatives of the Kaiser Wilhelm Gesellschaft, for an exchange of visits between these two bodies. The Kaiser Wilhelm Gesellschaft, founded in 1911 at the suggestion of the Kaiser Wilhelm II, has at its aim the encouragement of the natural and human sciences, primarily by establishing and maintaining research institutes for natural science in Germany.