presence or absence of a Q branch it is possible to determine whether the vibration is parallel to the axis of least inertia or not, but this requires high dispersion in infra-red measurements. Analogies from other systems with approximately equal energy quanta can also be used for associating modes of vibration with particular lines.

Mr. C. N. Hinshelwood described experiments on the decomposition of molecules in which the rate of decomposition varies with the pressure in a complex manner. Analysis of the results indicates that several modes of decomposition are possible, different modes predominating in different regions of pressure. The decomposition products are apparently the same in each case. This indicates alternative modes of vibration in the molecule and a possible line of attack on structural problems from kinetic experiments.

Obituary

Prof. G. Embden

BY the death on July 25 last of Gustav Embden, professor of chemical physiology in the University of Frankfort-on-Main, science has suffered a very severe loss; one of the most inspiring teachers and workers has passed away at the height of his successful activity.

Gustav Embden was born in 1874 in Hamburg, of a distinguished family; he studied medicine in Freiburg and Strasbourg, where the personal influence of Hofmeister and of his own lifelong friend Bethe brought him (after a few years at Zurich with Gaule and Hoeber, and later in Frankfort with Paul Ehrlich) into the field of physiological and biochemical research. In Hofmeister's biochemical laboratory at Strasbourg, where he worked while he was a member of the staff of Ewald's physiological laboratory, he started the work on intermediary metabolism which occupied him throughout his life.

In 1904 Embden went to Frankfort as head of the chemical laboratory of the city hospital, and in 1909 this laboratory was developed, as were so many laboratories in German hospitals, into a well-equipped and excellent institution with much greater facilities for work than the average university laboratory at that time. As the head of this institute, Embden became in 1914 professor of "vegetative Physiologie" in the University, a position which was founded then: the name implies the physiology of chemical function in the animal body.

Embden's early papers dealt with a number of questions which were investigated by the liver perfusion method, greatly improved in his hands; with the formation of sugar in isolated liver, of sugar from amino acids, of aceto-acetic acid, and of acetone from fatty acids, and from amino acids, of amino acids out of nitrogen-free bodies, and with the formation and disappearance of lactic acid in the liver. He was probably the first to indicate that glucose can be formed from lactic acid and that these two substances are convertible into one another in either direction in the animal body: this idea has been developed into one of the most important in the chemical physiology of muscular activity.

From 1912 onwards the work of Embden and his school was concentrated on muscle chemistry. The discovery by Harden and Young of the rôle of phosphates in alcoholic fermentation led Embden to the idea that, in the glycolysis of animal tissues also, phosphoric esters of carbohydrates must take part as intermediaries; this idea, put forward for the first time by Embden, finally proved, after a long and chequered history, to be correct. It was Embden himself, after twenty years, who brought this idea to a successful conclusion a few months before his death in a paper published early in 1933, in which he traced out the path of the intermediary processes in glycolysis; his scheme is most important for the further development of our ideas on glycolysis both in animals and in yeast cells.

The history of Embden's work on the intermediary rôle of phosphates in glycolysis is a dramatic one indeed: whole groups of laborious papers sometimes appeared as wholly erroneous because of experimental or theoretical mistakes or misinterpretation: sometimes, however, conclusions of his, already abandoned by himself or discredited by others, had to be revived. Embden's idea that a diphosphoric ester of hexose is an intermediary compound in lactic acid formation from glycogen in muscle tissue was finally proved to be correct, after this idea had for years been deserted by the author himself, and another ester, a hexose monophosphate, had been supposed by him to be the 'lactacidogen'. His idea that lactic acid formation is not the chemical change immediately connected with muscular contraction, and that this body is formed after contraction is over, also proved correct; and the strong opposition to this idea, which was held on very good experimental grounds by Hill and Meyerhof, had to be withdrawn when contraction without lactic acid formation was discovered by Lundsgaard, and when new experimental work by Embden and Lehnartz and by Meyerhof demonstrated beyond doubt the existence of delayed lactic acid formation after a muscle twitch.

The following important results of Embden's work on the chemistry of muscle must be quoted: the discovery of the occurrence in muscle of hexose monophosphoric ester (the Embden ester); the formation of Harden and Young's diphosphoric ester in muscle pulp in the presence of fluoride; the action of mineral ions on the changes in muscle pulp; the discovery of adenylic acid in this and other tissues. Embden first recognised that this latter compound is the precursor of the long-known inosinic acid in muscle, and this led him to his

observations of ammonia formation in muscle; he also recognised that the adenylic acid of muscle is different from the adenylic acid of Jones and Kennedy, occurring in yeast nucleic acid. The discoveries of the vasomotor and cardiac action of adenylic acid by Szent Györgyi and Drury, and of adenosinetriphosphoric acid and its rôle as co-enzyme of muscle glycolysis and yeast fermentation, are consequences of Embden's discovery. In addition, the work on muscle permeability and its alleged change during activity, the results of which are still matters of controversy, was started by Embden.

Embden's later work was abundantly referred to in Sir Frederick Gowland Hopkins's presidential address before the British Association meeting at Leicester on September 6 (NATURE, 132, 381, Sept. 9, 1933) and in Dr. Otto Meyerhof's lecture delivered last July at Cambridge (NATURE, 133, 337, Sept. 2 and 373, Sept. 9, 1933). Although others (Neuberg, Nielson) had nearly obtained these results, and although Meyerhof had reached them almost at the same time, the discovery by Embden of phosphoglyceric acid and of its changes in muscle pulp, the realisation of the mechanism of glycolysis, of the rôle of glyceryl phosphate and of pyruvic acid, of the mechanism of lactic acid formation, of its inhibition by fluoride and by iodoacetic acid, will probably be regarded as among the most inspired accomplishments of biochemical thought.

Embden was, to use the phrase employed by Ostwald and Smoluchowski, a romantic explorer: very bold ideas, arising sometimes before, sometimes after his observations, gave him a picture of the process, sometimes down to minute particulars, and this picture was then tested by ample experimental work, not always careful and critical enough but always very fertile and leading to further experiments and consequences. Much of this work and many of his results have been swept away by the further development of research: others, however, have become outstanding facts and ideas in biochemistry. Not only his friends—and they were many—but also those who, like the present writer, have had frequent and even bitter controversy with him, will consider Gustav Embden as a very great biologist, whose keen temperament and uncommon power of grasping the ultimate facts, and whose strenuous work have been stimulating and enlightening factors in the recent development of biochemistry.

He died too soon and at an unhappy time in the history of science in Germany; he had not, however, himself to submit to the hardships and difficulties which were experienced by many of his colleagues.

J. K. PARNAS.

M. EMILE MEYERSON

WE regret to record the death, which occurred on December 4, of M. Emile Meyerson. Many British philosophers knew the hospitable apartment of the Rue Clément Marot, in Paris, where he used to receive his intimate friends. There was an air of sadness about him, for he suffered much ill-health and physical pain. Emile Meyerson seemed to know everything and everybody. It could scarcely be otherwise, when one remembers that he was born at Lublin in Poland in 1859, studied chemistry in Germany before going to France, where he worked at first as a journalist with the Agence Havas and as a director of Jewish charities. From his vast experience of men and things, he drew the material with which he built up his philosophy, for he owned no master and created a method suited to his purpose.

During the past twenty years, Emile Meyerson has given us a series of brilliant books in which he expounds his views with a conviction backed by an amazing wealth of historical and scientific knowledge. His first work, "Identité et Réalité", which has been translated into English, then "L'Explication dans les Sciences" (Payot, Paris, 1921) and "La Déduction Relativiste" (Payot, Paris, 1922), and finally "Du Cheminement de la Pensée" (3 vols., Alcan, Paris, 1931), develop the same theme, that the object of science is not to formulate new laws only, but also to attempt an explanation of Nature. So that his purpose was less to create a new system than to trace and examine the processes of the mind in his search for truth through the sciences. To discover that a certain effect has a certain cause is to identify them ultimately. That is why physics, for example, is dominated by the principle of inertia and the principle of conservation of energy, which eliminate the heterogeneous in favour of the homogeneous. There are many obstacles in the way, however, like Carnot's principle. Yet these irrationals should not stop the forward movement of the mind: it is only in the constant attempt of the mind to reduce the irrational to the rational that science finds its justification.

Emile Meyerson did not wish to go any further. The wider issues of metaphysics are beyond the compass of his philosophy, though he was distinctly a realist as he believed in the existence of the 'thing' which supports the whole structure of science. Nevertheless, no future interpretation of science will be able to avoid negotiating the arguments produced and elaborated by Meyerson. In this respect his philosophical work has a universal importance and will prove to be an everlasting shrine to his memory.

T. GREENWOOD.

We regret to announce the following deaths:

Dr. F. L. Chase, assistant astronomer at the Yale Observatory from 1890 until 1910 and acting director from 1910 until 1913, known for his work on stellar parallax and proper motion, on November 8, aged sixty-eight years.

Mr. J. Humphrey, formerly editor of the *Pharmaceutical Journal*, president of the British Pharmaceutical Conference in 1910, who had a large share in the compilation of the British Pharmaceutical Codex, on December 8, aged seventy-one years.