lishing. Furthermore, many of these problems could be handled with but little equipment and at small expense. Why not start the student on such problems and give him a chance at learning research methods before graduation?

To be sure, such problems do not extend our knowledge of scientific laws, and so it might not be proper to call it scientific research. Instead, they are a study in finding what laws apply to particular cases in which we are interested. It is technical research rather than scientific. But it is just as truly research and uses the same methods, but the subject-matter is more in line with the age of the student.

To try to put such problems into the college course does not seem practical. One difficulty is the difference in the ability of the student and the professor to handle the problem. The professor would want the results and would see that they were obtained promptly, in this way reducing the research practically to the position of present-day laboratory experiments.

I would, therefore, suggest that the student go into the industry for his first experience at research, to some place where the results of his work would be appreciated from a financial as well as from an educational standpoint, and where he can obtain results on his own initiative that are worth publishing. As he sees the need for more general courses in various subjects, he can take these up with more interest than would be possible without his research practice.

Several advertisements have appeared recently in SCIENCE for a boy to do exactly this, but so far not a single reply has been received, not even a request for further particulars. What can be the reason? Do all parents feel that the college is the only place to study research? Or possibly they do not want their sons to go into research work? Do they feel that no business firm would take on a young boy for such purposes, and so there must be some hidden deceit about the advertisement? Is the fact that the boy receives pay instead of having to pay for it the obstacle? Or what is the reason that not a single person has been sufficiently interested to inquire about it?

A. W. FORBES

WORCESTER, MASS.

REACTIONS OF CARBON DISULFIDE WITH ALDEHYDES

IN the presence of metallic sodium, carbon disulfide condenses with bodies containing "active" hydrogen to give unstable dithio acids. The reaction has been applied to compounds which contain the group

$$-\overset{O}{\overset{\|}{C}}H \quad \text{or} \quad -\overset{O}{\overset{\|}{C}}-\overset{H}{\overset{|}{C}}-$$

(aldehydes, ketones, esters, salts of organic acids) and is probably general for all substances capable of aldol condensation.

Aldehydes yield α-keto dithio acids, with ketones ethers of dithio acids are produced; ethyl formate reacts irregularly, giving sulfo-methane dicarboxylic acid. The new dithio acids have only been studied through their salts, etc.; the free acids are very unstable and have so far not been isolated.

Further work will extend the study of this reaction to other types of substances which undergo aldol condensation, and will report the preparation of the esters of the new dithio acids, which appear to be stable.

E. WERTHEIM

UNIVERSITY OF ARKANSAS

SCIENTIFIC AND INDUSTRIAL RESEARCH[1]

THE Report of the Committee of the Privy Council for Scientific and Industrial Research for 1922–23 shows the far-reaching importance of the work carried on under the auspices of this committee. The civil departments concerned in public administration, it is noted, are making larger use of the machinery now existing for the scientific attack upon problems that affect them. As part of the policy of coordination, periodic conferences have been held between representatives of the Department of Scientific and Industrial Research, the Development Commission and the Medical Research Council, at which the biological secretary of the Royal Society has been present. These conferences, the report states, have provided valuable opportunities for the consideration of such matters as the responsibility for the conduct of investigations at borderlines, the possibility of cooperative action in the conduct of investigations in which more than one of these departments may be interested, and the continuance of research work which has developed in such a way as to bring it outside the scope of the fund originally aiding it. These discussions have helped to define the common problems of human and animal disease, and have emphasized the interdependence of biological and physical research. They have driven home to the committee the conviction that a national policy in research, complex though it might be and directed by diverse and suitably designed organs, must be conceived and implemented as a unity. A series of conferences were held during the year with the management of the British Empire Exhibition, and a departmental committee was appointed to consider how science and the application of science to industries could best be represented. It was agreed with the exhibition authorities that they should ap-

[1] *The British Medical Journal.*

point a small committee, nominated by the Royal Society, to assume responsibility for the organization of the central scientific exhibit, and a larger committee, acting on behalf of the research associations, to deal with the general organization of sectional scientific exhibits. With regard to the plea that was made in last year's report that a vigorous search for new knowledge and the more effective application of science to industrial processes offered a potent means of reestablishing our country and maintaining its population, it is recorded with satisfaction that in December, 1922, an act with a similar end in view was passed in France, creating a national office for scientific and industrial researches and invention in connection with the Ministry of Public Instruction. The report includes a summary of the work of the various research boards and committees of the Department of Scientific and Industrial Research. At the National Physical Laboratory, in addition to the researches which it necessarily undertakes in the discharge of its primary functions as the custodian of national standards, with a view to the improvement of measurements of all kinds, including those relating to standards of quality, much research work of a general character is carried out. It includes researches involving continuous observations over a very extended period of time, and researches requiring the use of exceptionally expensive equipment or other special facilities—for example, work at very high voltages or at very low temperatures. The Food Investigation Board dealt with varied problems affecting fruit, meat, fish and eggs; many of these have been noted in our columns. Among new investigations which are being carried on are the design of a commercial gas store for fruit, the growth and respiration of fungi under various conditions, the study of vegetables in transit from producer to market, the autolysis of meat and of fish, the bacteriology of fish and the freezing point of eggs in relation to the risk of overcooling. A report from the Oxygen Committee, shortly to be published, contains descriptions of the improvement of the known method of handling liquid oxygen and liquid air on a practical commercial scale; of these methods the committe has been principally concerned with the development of the double-walled vacuum vessel as a container. Among the other boards and committees carrying on different branches of research work are the Fuel Research Board, the Geological Survey Board, the Radio Research Board, the Physics, Chemistry, and Engineering Coordinating Research Boards, the Fabrics Coordinating Research Committee, the Adhesives Research Committee and the Lubrication Research Committee. During the academic year 1922–23 the committee made 403 grants to research workers and students in training; of these 252 were allowances to students to enable them to take advantage of the facilities offered by various universities and colleges or other research institutions, 38 were personal grants to research workers to undertake independent research or to act as scientific assistants to other investigators, and 14 were grants to scientific workers to enable them to employ laboratory assistants or to purchase equipment; the total expenditure on these grants was £50,000. The total expenditure of the committee during the financial year was £497,549, of which £264,493 came directly from the Exchequer, while £89,608 represents fees for tests and special investigations for outside bodies, and repayments from the service departments.

SPECIAL ARTICLES

GELS AND THEORY OF ADSORPTION*

THIS paper is not to give a summary of the theories that have appeared on adsorption. Time nor patience would permit such a presentation. On the contrary, the speaker, with due consideration for all theories thus far advanced, is going to present a point of view which is in harmony with the experimental facts which have been found out at the University of Maryland during the past three years.

Before beginning our work, I felt that the hypothesis, which said that the electrical charge on the colloid was due to the adsorbed ion, was the most general. You all know that this point of view arose from Hardy's work, but was first clearly presented by Bredig. Helmholtz's double layer theory was another way of accounting for the electrical charge. Furthermore, you are all familiar with Freundlich's assumption of adsorbed ions and Michael's idea of surface molecules being dissociated.

After reviewing the great amount of work on adsorption, it seemed to me that we did not need more theories on adsorption until more fundamental work was done, in order to prove the falsity or truth of the theories already in print.

Our work was started on silica gel and you all know that this gel is negative with respect to water. We assumed that this negative charge was due to the Helmholtz double layer and, according to Hardy's work, we had reason to believe that if the hydrogen ion concentration was decreased, the negative charge on the gel would increase, and similarly, if you increase the hydrogen ion concentration the gel would assume a less negative charge until it would assume a positive charge when the pH had fallen below 7. The Helmholtz theory also assumes that a charge of a particular sign can not exist without one of oppo-

* Read before the Chemistry Section of the American Association for the Advancement of Science at the Boston Meeting on December 28, 1922.