

RECENT LOW-TEMPERATURE RESEARCH AT THE IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

THE fourth meeting of the Low Temperature Group of the Physical Society was held on May 15 in the Department of Chemical Engineering and Applied Chemistry, Imperial College, when the work of the Department in the field of low-temperature technology was described and the laboratories and equipment were open to inspection by members of the Group. The head of the Department, Sir Alfred Egerton (who is also chairman of the Low Temperature Group), describing the origin of his interest in low-temperature technology, said that in a country where petrol is not indigenous, as much use as possible should be made of the hydrocarbon methane, which can be made available in unlimited quantities from coal. One use that is feasible is as a fuel for internal combustion engines. The best way to carry methane on motor-vehicles is as a liquid in vacuum-jacketed tanks, at approximately atmospheric pressure and normal boiling point, -161.4°C .

During the War a variety of problems connected with this subject were attacked and solved, to the point where it would have been possible, if required, to produce cheap liquid methane on a large scale and to provide motor-vehicles with reliable equipment which would permit the use of either petrol or liquid methane, according to which was available. The cost of liquid methane from coal gases would not be so low as that of petrol, but it could be competitive with other liquid fuels produced from coal. In some countries where natural gas or waste vegetation are sources of methane, the liquid could be produced at quite a low cost.

The work at the Imperial College included the design and construction of a pilot methane liquefier and a liquid methane rectifying-column, the design of vacuum-jacketed vehicle tanks and of equipment for feeding the liquid to the engine, and tests on engine performance and wear. In addition, numerous laboratory investigations were carried out on the vapour-liquid phase equilibria of mixtures containing methane; the heat transfer coefficients of methane and other gases under forced convection at low temperatures; the measurement of thermal conductivities of insulating materials at low temperatures; the measurement of heat radiation from various metal surfaces from the point of view of their incorporation in vacuum-jacketed vessels; the solubilities in water of methane, carbon dioxide, and their mixtures under pressure, and the fire-hazards attendant upon the use of liquid methane on vehicles.

With the end of the War and the end of restrictions on the Department's activities, the scope of the work was extended. A laboratory liquid-air plant utilizing Freon-12 as a pre-cooling fluid has been designed and is now being constructed. A method of purifying gases from small quantities of condensable constituents by the injection of a stream of cold pure gas is being tried out, and experiments are in progress to determine the factors influencing the adhesion of frozen particles to tube walls. Both these investigations derive from the general problem of the purification of industrial gases prior to liquefaction. An apparatus has been constructed for the determination of the latent heat of vaporization of binary mixtures at low

temperatures and pressures above atmospheric; and an investigation is in progress on the properties of lubricants at low temperatures.

Calculations and experiments have been made on the extraction by refrigeration of olefines and methane from coal or coke-oven gases, the first being of use in chemical synthesis, the second in the form of liquid, as a thermal reservoir to meet peak loads on town-gas undertakings. The methane would be extracted and stored as liquid at periods of low demand, and re-gasified to enrich water gas at periods of high demand.

The experimental work of the Department was exhibited to the Low Temperature Group, and the various activities were discussed in greater detail in the course of short addresses given by Sir Alfred Egerton, Prof. D. M. Newitt, Mr. M. Pearce and Dr. T. A. Hall, on the storage of liquefied gases, on the unexplored regions of the temperature-entropy diagram, and on the purification and separation of constituents of coal and coke-oven gas by liquefaction.

IMPORTANCE OF TAXONOMY

IN the course of his final presidential address to the Linnean Society on May 24, Mr. A. D. Cotton took occasion to emphasize the importance of taxonomy and the need of securing additional workers in this branch of biology.

Speaking of the distribution of the *Dendrosenecios* on the equatorial mountains of Africa, he said it was the impossibility of reconciling the records of the species on Kilimanjaro and on other mountains which led him to take up the study of the group. Many records existed in systematic literature; and ecologists and others used these records for their field work and in their published papers. When he came to study them he was confronted by a state of affairs only too familiar to all experienced taxonomists. Except where new species are concerned, no record, whether in floristic or ecological literature, could be accepted at its face value. This casts no reflexion on the botanists of the past. The fact illustrates the slow growth and evolution of a difficult branch of botanical science and demonstrates the imperative need for further taxonomic research and of a more intensive type.

Mr. Cotton does not maintain that the classification he has prepared is perfect or final, because much more field work is necessary; but with the aid of as much co-operation as possible in the field and by examination of all herbarium material extant, it is believed to be reasonably correct.

The Linnean Society is the one Society which, from its inception to this day, has cared for general taxonomy, and at the present time, when the subject tends to be overshadowed by other branches of biology, the Linnean Society has never shrunk from bearing the very heavy expense of publication of systematic papers even to the serious depletion of its funds. Systematic papers are not usually suitable for reading at meetings but are prepared for use and for reference. They have a permanent value not often attained by other papers. The Society aims at being broad in its interests, but one of its principal functions is the publication of such papers for the benefit of botanists and zoologists throughout the world. Taxonomic work and its publication is, in fact, in large measure, essentially a service.

There is no doubt that the standard of taxonomy needs to be raised aloft. Looking back over a period of twenty years, during which he has been in charge of a great systematic institution, Mr. Cotton has become acutely conscious of the need of recruits to this branch of biology. Unless such recruits be forthcoming, and in considerable numbers, the immense floras and faunas of the world can never be properly understood. Only those who have worked with such world floras and faunas have any conception of their magnitude and their riches in genera and species.

Ecology and cytology naturally make a strong appeal also to the present-day student not only on account of their intrinsic interest but also because of their suitability for short-term research and research theses: but their very interest and glamour is apt to lead to the less exciting, more exacting, but all-important work of taxonomy being passed by. It may even fall into disrepute among those who do not realize the value of taxonomy, or who think only in terms of nineteenth-century systematics. Mr. Cotton therefore appealed to the young biologist to consider seriously the claims of this branch of science. There can be no question of the need for a greater number of professional taxonomists. The flora or handbook which the ecologist or economic botanist demands when he takes up a Colonial appointment can only be prepared after years of patient labour in a systematic institution, while more fortunate colleagues who carry out researches on such subjects as physiology and genetics require correctly named material or they may find their results at variance with those of other workers.

Mr. Cotton pointed out that this emphasis on the importance of taxonomy was not made on account of personal preference but from a sense of responsibility and a desire to serve the interests of biologists as a whole.

METHODS AND RESULTS OF NUTRITION SURVEYS

IN October 1944, the Nutrition Society set up a Standing Advisory Committee "for co-ordination of methods of survey in liberated territories". Advantage was taken of the fact that there was in Britain at that time a large number of scientific workers from enemy-occupied countries, and three representative panels were set up to report on: (1) laboratory methods; (2) clinical methods; (3) methods of survey of food consumption.

Certainly some agreement on terminology, methods of investigation and ways of presenting results is badly needed, particularly for the first two. As things stand, it is difficult to compare one person's findings with another's, with any assurance that the measurements made do, in fact, provide a true basis for comparison.

Two of the three panels (the first and the third) presented reports in August 1945*. It would be very valuable if the Nutrition Society would now add a short note on the experiences since gained by investigators while putting the recommendations

* Standing Advisory Committee for Co-ordination of Methods of Survey in Liberated Territories. Recommendations with Regard to Methods of Investigation of Nutrition. Pp. 67. Dietary Panel: Methods for Dietary Survey. Pp. 23. (London: Bureau of Nutrition Surveys, London Hospital, E.1, 1945.)

into practice. Has any modification been required, and if so, what? Have any other techniques been evolved or found more practicable?

Choice of method for any investigation is inevitably limited by the facilities available. The Laboratory Methods Panel has recognized this and has limited its recommendations accordingly. Estimations of haemoglobin and of proteins in plasma or serum are dealt with very fully, and tests of vitamin C status are described; but comment on "the assessment of level of nutrition with regard to B-vitamins" is limited to a short description of the principles and relevant literature, since "the biochemical evaluation of the nutritional status of the B-vitamins requires elaborate equipment and special chemicals".

It appears that the main difficulties in reaching any uniformity of meaning in past surveys have been due to: (1) differences in methods used; (2) differences in assumptions on which calculations were based; (3) differences in standards used; (4) personal factors; (5) errors in instruments; (6) differences in methods of expressing results.

Accordingly, among the recommendations made, the Panel suggests: (1) that apparatus used should be standardized; (2) that results should be expressed in absolute units and in the decimal system; (3) that methods in which subjective errors may be large should be avoided.

In addition to critical reviews of estimation methods mentioned above, there are "general recommendations with regard to taking samples of blood" and a detailed table putting together the results of a very large number of surveys dealing with haemoglobin-levels, all of which had been conducted under conditions meeting with the requirements of the Panel. Other tables set out results of surveys showing protein levels in serum or plasma in healthy persons and under conditions of nutritional oedema.

The report ends with details of working methods and a "comparison of results obtained by various methods with those obtained by measurement with other methods used as standards". A list of references is included.

The Food Consumption Panel had a problem of a different nature to face. Provided facilities are available, laboratory investigators have a straightforward job; but dietary surveys are always complicated by the fact that collection of data for analysis depends to a very large extent on obtaining full co-operation from the individuals being surveyed. At the best of times this is difficult to ensure; under the unsettled conditions immediately following liberation of enemy-occupied countries, it must have been still more difficult. Where there are food shortages and the inevitable 'black market', investigators must necessarily be regarded with suspicion, if not with fear. In territories where the administration is in the hands of strangers, the local population is usually inclined to blame them for all difficulties and shortages, and investigators belonging to such an administration may find it virtually impossible to establish the necessary confidence.

The Panel recognized that such difficulties would exist, and it is stated that "investigators should be provided with letters of authority and preferably with a photograph. Arrangements should be made with the local burgomaster and police to establish the credentials of each investigator and ensure her protection if necessary." It would be interesting to know how this has worked out in practice; my own experience is that the more informal and unofficial