SCIENCE IN CZECHOSLOVAKIA AND YUGOSLAVIA

A DISCUSSION on "Science in Czechoslovakia", arranged by the Society for Visiting Scientists, was held at the Society's House on February 1. Dr. Jan Masaryk was in the chair, and the speakers were: Prof. J. Bělehrádek, rector of the Charles University, Prague; Dr. J. Cisar, chargé d'affaires, Czechoslovak Embassy; Prof. E. G. Cox, University of Leeds; Dr. S. C. Dykes; Sir Alfred Egerton; Prof. A. Stampar, rector of the University of Zagreb; and Dr. Nora Wooster.

Dr. Cisar began the discussion by a brief historical outline of the scientific background of Czechoslovakia, during which he mentioned such great names as Kepler, Tycho Brahe, Comenius, who laid the foundations of educational science, Bolzano the mathematician, Purkyně, who coined the word 'protoplasm', Mendel, the founder of modern genetics, Doppler and Ernst Mach. Based on such traditions, modern Czech science has maintained a good international average, which it is hoped would soon be regained and even surpassed. He left it to Prof. Bělehrádek, who spent the war years under Nazi police supervision, and finally in a concentration camp, to describe the terrible years of Nazi occupation: the closing down of all university buildings as well as the technical colleges and schools, which were the real centres of scientific research; the imprisonment of thousands of Czech intellectuals and students; and the execution of a number of scientific men and student leaders. All scientific activity was strictly forbidden, and any attempt to teach science was considered as sabotage; laboratories were taken over by professors from the German University in Prague; clinics and hospitals were put under German direction. Prof. Bělehrádek's own Department of General Biology at the medical faculty was transformed into an Anstalt für Rassenhygiene. Couples intending to marry were examined, measured, weighed and photographed here, and their 'racial' characters determined.

The disorganisation of Czechoslovak science is deep. It is the result of six years of complete cessation of research activities, complete isolation from the outer world, with no possibility of obtaining journals and books from abroad; grave material damage to many laboratories, and the dismantling and removal to Germany of much valuable apparatus. The situation is further complicated by a serious depletion of academic personnel, and by the greatest influx of students ever experienced. There are to-day 52,000 students at the universities and technical and related schools in Czechoslovakia, out of a population one third the size of that of Great Britain. In Prague alone, there are 3,000 first-year medical students, and 2,000 more in Brno, Bratislava and Královĕ. Lecturing, practical work and examination absorb the whole time and energy of the teaching staff; dance halls have to be hired for lecturing to the huge classes of students, and practical demonstration is reduced to a minimum. Under such conditions, very little research can be done.

The Czech Government has set up a central planning office in Prague, which is considering these problems; the organisation of scientific research is an important part of its programme. The Office has begun its work, fully aware of the difficulties and the years of hard work ahead, but with a great deal of courage and optimism.

Dr. Stampar, rector of the University of Zagreb (now vice-chairman of the Security Council of the United Nations Organisation), painted a picture of Yugoslovak science not very different from that of Czechoslovakia: wanton destruction of libraries, of laboratories, complete isolation and cessation of work under the mixed domination of Germans and quislings, and a mortality of 10 per cent of the population (and higher still for students) in the struggle for freedom. Yet the liberation has brought the same influx of new students, all eager to learn and work. Cinemas and public halls have been taken over for lecturing, 30,000 students now attending. Their spirit is remarkable; they are orgarising clubs, dining-rooms and dormitories; they help in the repair work of the buildings; they cut wood to heat the lecture halls and laboratories; they have traced much stolen equipment. But here, too, there is a terrible shortage of staff, books and equipment, and it will need all their courage and determination, as well as considerable help from the Allies, to re-organise scientific life.

The other speakers, Sir Alfred Egerton, Dr. Nora Wooster, Prof. E. G. Cox and Dr. Dykes, who had recently visited Czechoslovakia, all stressed the terrible sense of isolation from which scientific workers there are suffering, and their eagerness and urgent need to re-establish contacts. The lack of scientific literature cannot be sufficiently emphasized, and it is hoped that anyone who can will send books, reprints or scientific journals to help fill the gap. Exchange of scientific men will also be of enormous value in helping to re-establish the key position of fundamental research. Owing to economic necessity, the tendency has been towards technological problems, and this, as well as the fact that the younger students have inevitably been infected with Nazi ideology, has tended to discourage a truly scientific outlook.

With reference to Prof. Heyrovský's important work on the polarograph, a suggestion was made that its manufacturers should subsidize research on the subject in Czechoslovakia. (Only one firm had paid any royalties so far to Prof. Heyrovský, and that was a Swedish firm.)

The chairman, Dr. J. Masaryk, wound up the discussion with a brief allusion to the political difficulties which had faced his country after the liberation. He concluded with these words: "Help us to free our souls and the soul of our national genius".

CHROMATOGRAPHIC ANALYSIS

A MEETING of the Physical Methods Group of the Society of Public Analysts and Other Analytical Chemists was held on February 26 to discuss "Chromatographic Analysis". Four papers were read, two dealing with principles, and two with applications of the method to analytical problems.

Mr. F. A. Robinson described Tswett's classical experiment, in which the pigments of green leaves were separated from one another by pouring a petroleum ether extract of the leaves on to a column of calcium carbonate, and 'developing' with fresh solvent. The method has since been applied not only to the separation of many other coloured substances but also to the separation of numerous colourless substances; but, whereas the position of coloured constituents on a column is self-evident, various

devices have to be employed to indicate the position of each colourless component. These include inspection of the column in ultra-violet light, painting the extruded column with a suitable reagent, chromatography of coloured derivatives and addition to the mixture of a dyestuff with the same adsorption affinity as one of the components.

The relation between structure and adsorption affinity, the principles to be used in selecting adsorbents and eluants, and the methods in use for the standardization of adsorbents were briefly described. Reference was also made to fluid chromatography, in which solvents of progressively increasing eluant power are run through the column in succession, thus eluting the constituents one after another, in the order of increasing adsorption affinities. Tiselius' use of *schlieren* boundaries for indicating the removal of components from charcoal chromatograms was described and also Tiselius' 'displacement chromatography', in which solutions of substances such as ephedrine, with high adsorption affinities, are added to the eluant to displace strongly held components of a mixture.

The chromatographic principle has also been applied to the separation of substances by methods not dependent on adsorption. Thus basic or acidic substances can often be separated by ion exchange on columns of zeolite, or amberlite resins or on columns of alumina containing adsorbed sodium or hydrogen ions. Partition chromatography is the name given to a method of separating substances by virtue of their relative partition coefficients on columns of silica gel or other substances capable of absorbing water. Inorganic ions have been separated on columns of specific organic reagents such as 8-hydroxy quinoline. Finally, a brief account was given of the theories put forward to explain chromatographic separation.

"Partition Chromatography" was dealt with in greater detail by Dr. R. L. M. Synge who, in collaboration with Dr. A. J. P. Martin, devised the technique in 1941. The bands produced in adsorption chromatography generally have diffuse rear edges or, more rarely, diffuse 'fronts', owing to the non-linear nature of the adsorption isotherms. The distribution of solutes between two liquid phases, however, gives rise to linear distribution isotherms, and it was considered possible that chromatograms on powdered silica gel saturated with the aqueous phase of a chloroform-water mixture would give sharp bands when developed with chloroform. This expectation was realized, and the method has since been used extensively, although it is limited to the separation of substances of relatively low molecular size and the results are frequently complicated by adsorption on the silica gel, which tends to make the bands diffuse. Among the most important applications of this method are the separation of amino-acids and their derivatives, peptides, fatty acids and methylated sugars. Instead of silica gel, starch and filter paper have also been used for the identification of amino-acids and peptides; filter paper has the advantage that only minute amounts of material are required.

An important modification of the original method is the use of buffered solutions in place of an aqueous solution for saturating the silica gel; this was of particular value in the purification of the penicillins. It is known that the partition coefficient depends on the contribution of all the groups in the molecule irrespective of their geometrical arrangements, whereas these are of great importance in adsorption. It may therefore be concluded that partition chromatography is best for the separation of fatty acids, for example, and adsorption chromatography for the separation of *o*-, *m*-, and *p*-isomers. Association and ionization may result in distortion of the distribution isotherms and, in such instances, the bands will tend to be diffuse. The effect of ionization can be controlled by using buffered solutions, so that the ratio of un-ionized to ionized acid is maintained constant. This not only leads to sharper bands, but also enables substances to be separated which in the un-ionized form travel down the column too quickly or which have similar partition coefficients in the un-ionized state but differ in *p*K.

Mr. K. A. Williams discussed "Chromatography in the Analysis of Fatty Oils". Selective adsorption of the constituents of a mixture depends on the relative affinities of adsorbent and solvent for the solutes, and chromatographic adsorption may be regarded as the result of a competition between them, other solutes, however, influencing the relative degrees of attraction. The first applications of chromatography to the analysis of oils was made with the unsaponifiable constituents, when it was shown that the adsorption of the carotenes on magnesium oxide was correlated with their degree of unsaturation and conjugation; the presence of hydroxyl groups increased the adsorption affinity. The hydrocarbon constituents of the unsaponifiable matter of oils are not adsorbed on a column of alumina, whereas unsaturated alcohols tend to collect towards the bottom of the column, sterols one-third of the way down, xanthophylls somewhat higher up and saturated alcohols at the top. When linseed oil is chromatographed on alumina, fractions containing 7, 6, 5 and 4 double bonds per molecule are obtained, the more unsaturated glycerides being adsorbed at the top and the less unsaturated at the bottom of the column. The constituents of a mixture of fatty acids, however, are adsorbed in the reverse order, the more saturated acids at the top and the less saturated at the bottom. This reversal is understandable if adsorption affinity is regarded as due to the algebraic sum of the positive polarity due to hydroxyl or carboxyl groups and the negative polarity of the double bonds. Of the simple chromatographic methods now available for use in commercial analysis, the following were described: the removal of free fatty acids from fat by alumina; the estimation of hydrocarbons in vegetable and animal oils; the estimation of carotene, xanthophylls and vitamin A in unsaponifiable matter; and the estimation of oxidized fatty acids.

"Some Applications of Chromatographic Analysis in Industry" was the title of the paper presented by Dr. F. R. Cropper. He described the method used for preparing and standardizing activated alumina, now available in Great Britain at a reasonable price, and discussed a number of its applications. It has proved of great value in separating anthraquinone derivatives from one another and in studying the constitution of competitive dyestuffs. It has also been used for the detection and estimation of fluorescent compounds, such as anthracene, in intractable materials like tar and pitch. An acid-washed alumina was used for studying the breakdown products of thiobarbituric acids; and magnesium carbonate columns proved satisfactory for investigating compounds that formed lakes with alumina.

Filter paper has found extensive application in testing the quality of dyestuffs intermediates. A solution of the substance to be tested is diazotized

and coupled, or simply coupled, with a suitable diazo reagent, and dropped on to the centre of a filter paper placed between glass plates. On development, concentric rings are formed, and the intensity of the colour due to the impurity is compared with that given by a standard. It is possible that filter paper partition chromatography may have similar applications, but these have not yet been adequately explored. Dr. Cropper illustrated many of these applications by means of demonstrations and exhibits.

A lively discussion ensued, in which many additional points were made. One speaker said that although unsaturated glycerides could be separated nto groups, as described by Mr. Williams, it has not been found possible to isolate each individual species chromatographically, as had been hoped. Reference was also made to Urey's separation of the isotopes of lithium on a column of adsorbent 30 ft. long. Several speakers referred to the need for further investigation into the chromatographic separation of inorganic substances, which in many ways is less satisfactory than the separation of organic substances ; the zones often overlap and extremely dilute solutions have to be used. Ion-exchange columns also suffer from the disadvantage that the zones run into one another, and the components cannot be separated merely by cutting the column. It was suggested that displacement chromatography may overcome this difficulty and give purer fractions. A modification of the filter-paper method described by Dr. Cropper was mentioned in which a thin layer of adsorbent is placed between two glass plates and used in the same way. Another speaker advocated the use of silica gel for adsorption, but stressed the importance of using a very finely divided powder ; others said they had found silica gel to be unsatisfactory. Questions were also asked about the possibility of isolating the colouring matter of jams and of cigarette tobacco by means of chromatography. The question, "What *is* light petrol ?" caused some amusement, until it was explained that 'light petrol' was not what it used to be, and nowadays frequently contains aromatic hydrocarbons which may well upset the equilibrium of the chromatogram—and possibly that of the chromatographer as well.

WAR-TIME CIVILIAN CONSUMPTION OF GOODS

COMPARISONS of respective sacrifices in a common cause can never tell the full tale ; but in such situations as that exemplified by the recent statements on food policy, it is expedient that the facts should be agreed and put on record. The report to the Combined Production and Resources Board from a special Combined Committee on Non-Food Consumption Levels, entitled "The Impact of the War on Civilian Consumption in the United Kingdom, the United States and Canada"*, deserves to be read by a far wider circle than those economists and statisticians or other specialists to whom the data tabulated in the appendixes, which occupy the greater part of the report, may be primarily of interest. The summary alone is well designed to facilitate that fuller understanding by each country of the circumstances and accomplishments of the others, which it is rightly assumed is essential to a combined approach to their common problems. In ten chapters covering in turn changing consumption levels and patterns, food, alcoholic beverages and tobacco, clothing, housing, fuel and electricity, household goods, other personal effects, amusements and reading matter, transportation and communication, and miscellaneous services, the report provides plenty of objective measurements on a basis affording fair comparisons.

Some of the comparisons are striking. In the United Kingdom, aggregate *per capita* purchases of consumer goods and services, valued at pre-war prices, decrease 15–20 per cent from 1939 to 1941–43, whereas in Canada and the United States they were 10–15 per cent higher than in 1939, in which year the physical volume *per capita* of consumer purchases was probably 10–20 per cent lower in the United Kingdom than in the United States. Moreover, in important categories of consumption, consumer purchases decreased in the United Kingdom and increased in the United States and Canada. Both limited imports and the overall shortage of labour were important factors in the United Kingdom declines. At pre-war prices, consumption of food per head increased in the United States and Canada, and decreased in the United Kingdom, but nutrient standards were in general maintained with substantial readjustments of diet. Again, not only did purchases of civilian clothing and household soft goods, etc., increase in the United States and in Canada and decrease in the United Kingdom, but also these decreased purchases include those required to cover damage and destruction by enemy attack ; this quite apart from the effect of the long-continued low level of such purchases leading to consumers' wardrobes and linen closets including by 1943 and 1944 a large proportion of items that even by war-time standards in the United States and Canada would be classed as worn out.

Some types of consumer purchases declined and a few groups increased in all three countries, and in some categories such as amusements, railway travel and communication services, it was not possible to separate civilian purchases from purchases by members of the Armed Forces ; and in so far as there is reason to believe that the average serviceman's expenditure on these items was considerably above that of the average civilian, the increases in purchases per head overstate the true change in civilian consumption, particularly in the United Kingdom, where the number of troops was proportionately larger.

Generally, the impact of the War on consumption in the United States and in Canada came later ; and its effects on consumption were more gradual and less severe than in the United Kingdom, where the war effort absorbed a major fraction of national resources nearly a year earlier than in Canada and a year and a half earlier than in the United States. In 1943 and 1944, war production represented about half the total gross product in the United Kingdom and Canada and about 40–45 per cent in the United States. The war products of the three countries were to some extent complementary : the United Kingdom had a considerably higher—about 30 per cent in 1944—proportion of its man-power in the Armed Forces and was enabled to do so partly because of the contributions of food, raw materials and munitions from Canada and the United States. In all three countries, additions to the stock of non-war buildings and capital equipment ceased, many capital goods

* London : H.M.S.O., 1945. 2*s*. 6*d*. net.