NEWS AND VIEWS

Accelerator Rebuilt

THE Brookhaven National Laboratory is planning what amounts to a rebuilding of the 33 GeV proton synchrotron which has been operating there for the past four years. This unique operation is being carried out not because anybody is dissatisfied with the way in which the big machine is operating—far from it—but because it is expected that rebuilding will increase twenty-fold the yield of energetic particles. The whole operation will be spread out over a period of five years, and will cost more than $40 million—a sum which exceeds the cost of the original machine but which is entirely justified by even the simplest cost–benefit analysis.

The refurbishing of the accelerator will consist of three separate steps. First, a more powerful energy source will be installed, and a new source of fast protons will be added. These operations will not interrupt the use made of the machine, but will increase the yield of fast particles, partly by increasing the beam intensity and partly because the cycle time will be reduced. The last phase of the operation will, however, entail that the accelerator should be put out of action for a year. The object during this stage of the operation will be to equip the accelerator with magnets the field strength of which can be adjusted sensitively during each cycle of operation so as to control the position of the proton beam. In such a way, it will be possible to provide each of several experimental arrangements around the machine with a supply of fast particles more accurately tailored to their needs. Not the least of the problems that will have to be tackled is the provision of extra shielding. In the course of doing this, the earth which at present covers the trench will have to be removed and the concrete covering strengthened so as to support a greater weight.

In Europe, the timetable laid down by the CERN council for decisions on the 300 GeV machine is unfolding slowly. At a meeting to be held in Geneva on June 16, the council will be given more information about the proposed design and reports on the nine sites which are being considered for it. This will allow governments to spend the summer deciding for themselves how enthusiastic they are for the project so that, by September, they will be able to choose a short list of three sites at a special council meeting. A final decision will not be made until December, but the months immediately ahead are ones in which governments wishing to play host to the big proton accelerator will have to state their claims and match them with generosity. France is known to be particularly keen.

Power Production

THE rapid increase of the production of natural gas and nuclear electricity is the most striking feature of a survey of energy production and consumption in the OECD area which has now been published (*Basic Statistics of Energy*, 1951–65, OECD and agents, 30*s*.). Although the production of nuclear electricity was only 1 per cent of the total electricity production in the OECD area at the end of the survey period, it has been doubling every two years for much of the past decade. Thus nuclear electricity production amounted to $0{\cdot}1 \times 10^9$ kWh in 1956, $0{\cdot}5 \times 10^9$ kWh in 1958, $2{\cdot}9 \times 10^9$ kWh in 1960, $6{\cdot}7 \times 10^9$ kWh in 1962 and $23{\cdot}9 \times 10^9$ kWh in 1965. So far, most of the production of electricity from nuclear power stations has been in the United States and the United Kingdom. Electricity production as a whole continues to increase throughout the OECD area at a rate which amounts to doubling every decade. Thus total production increased from $1{,}201 \times 10^9$ kWh in 1955 to $2{,}376 \times 10^9$ kWh a decade later. Apart from the rapid increase of nuclear production in the past decade, the most pronounced change has been the production of electricity from petroleum—63×10^9 kWh in 1955 and 257×10^9 kWh in 1965.

The production of natural gas in the OECD area has more than doubled since the beginning of the period of this survey. In 1951, the area as a whole produced 580×10^9 m^3 of natural gas, mostly in the United States. By the end of the fifties, production had increased to just under $1{,}000 \times 10^9$ m^3, and there has since been a sustained growth of production, with $1{,}271 \times 10^9$ m^3 in 1965. Evidently there will be a still further growth of natural gas production if the British Gas Council is able to exploit the North Sea as thoroughly as it seeks to do in the years immediately ahead. The National Coal Board in Britain, anxious as it is about the prospect of a steadily dwindling market for its product, will no doubt find some comfort in a compilation of statistics which shows that coal consumption is declining steadily elsewhere than in Britain.

Exhibiting the Future

Montreal, May

WORLD'S fairs are traditionally concerned with progress, and that which opened here a few days ago under the banner EXPO 67 is no exception. With the exception of the Barbados pavilion, which is given over mostly to serving drinks to the multitudes looking for somewhere to sit and rest, most of the sixty-odd national exhibitions are designed to show how quickly the future is turning into the present in different parts of the world. So it is natural that there should be two space capsules—one Russian and one from the United States—with the scars still left by the re-entry process. It is also natural that there should be several artificial panoramas of the Moon, Venus and the Solar System scattered about the exhibition site, though the surprise here is chiefly that people should be as interested as they are in what may fairly be called artists' impressions of what these distant places look like.

This, however, is merely the frosting on the cake. The exhibition has been provided with a number of themes which are sober enough, and all of which depend on the slogan "Man and his World" which also happens to be the title of a book by M. Antoine de Saint-Exupéry. There is, for example, a quite remarkable

collection of pictures borrowed from art galleries in Europe and North America, interspersed with sculpture much of which has been borrowed from egyptologists and other students of the past. There is also a striking piece of modern building in which 158 living apartments have been assembled out of prefabricated concrete boxes, which are piled on top of each other with some of the informal abandon of toy building bricks. This synthetic village has something in common with many of the old casbahs in North Africa, but is also plainly a place made with modern concrete. It is hard to see how those who trudge around will fail to be persuaded that there is no necessary incompatibility between modern building methods and the idiosyncratic tendencies of real people. A great many will wish that they could settle permanently in what the fair calls Habitat.

The exuberance which runs through this and other parts of the exhibition is infectious, and the American pavilion has been properly applauded for its gaiety and wit. This is why it is particularly disappointing that the most ponderous parts of the whole exhibition are those which embody the fair's own scientific exhibition. Where the rest of the exhibition works mostly by subtle suggestion, the scientists are unfortunately too often didactic. Panoramas abound. There is a darkened structure filled with lighted tubes and packages in which visitors can stand to be instructed in the workings of what purports to be a living cell, but the chances are that the commentary will not mean much to those who have neglected to mug up on mitochondria in advance. The live (or partly living) preparations of *Euglena* under half a dozen microscopes are better value. The elaborate model of the human brain is a model-maker's triumph but such that here again a brief course of private study will be necessary if people are to get much from it. The physical sciences may be easier to come to grips with, chiefly because there are real things to show, though here again the visitor who is not also a specialist will have to dig hard for a few pieces of understanding. What seems to have happened is that the organizers have designed a splendid kind of science museum—the sort of place to which people can return and browse—and that they have somehow failed to epitomize and to communicate a sense of how research has helped and is helping to transform the quality of life. To say this is not to complain, for they have done a splendid job of exposition which is disappointing chiefly because there is so much elsewhere that sparkles.

Thrombosis and the Pill

THE report of the Platt sub-committee to the Medical Research Council will undoubtedly cause some heart-searching among scrupulous doctors ("Risk of Thromboembolic Disease in Women Taking Oral Contraceptives", *Brit. Med. J.*, ii, 355, 1967). The committee's conclusion carries the case against the "pill" a stage further than other such reports have done in the past; the report states that "there can be no reasonable doubt that some types of thromboembolic disorder are associated with the use of oral contraceptives". On the other hand, the qualifications of this conclusion are almost as important as the conclusion itself. The risk involved is small—indeed, some very pretty statistical manoeuvres were necessary before any conclusions could be reached from the small number of thromboembolic episodes available for study. The risk of thromboembolic disorder in women taking the pill is roughly twice that facing an equivalent set of women who are not pregnant and not taking oral contraceptives. On the other hand, the risk facing women who are pregnant is about twice that due to oral contraceptives. The report estimates that oral contraceptives may have caused about twenty deaths from venous thrombosis and pulmonary embolism in 1966. There is no firm evidence of any connexion between oral contraceptives and cerebrovascular disease, although such a connexion may exist.

Oral contraceptives, in one form or another, have clearly come to stay, and the report is unlikely to cause an important decrease in the number of women using these preparations. What is clear, however, is that doctors are likely to be more cautious in prescribing the pill to women with a history of venous thrombosis. More research is needed to clarify which women are likely to suffer from the effects of oral contraceptives, and the work now in progress on low-dose oral contraceptives is likely to be pushed forward faster.

Information for Biologists

INFORMATION problems in the biological sciences are now being studied by the recently formed Committee on Biological Information. The new committee, set up as a result of a conference on communication in the Biological Sciences, has representatives from the institute, Aslib, and the Biological Council. Its members are Miss P. I. Edwards, B. J. Perry and L. Wilson (Aslib), C. Pettit, A. G. A. Pickford and A. B. Standfast (Biological Council), and E. O. Pearson, P. C. Williams and H. V. Wyatt (Institute of Biology).

At a preliminary meeting attended by an observer from the Office of Scientific and Technical Information, a broad plan of attack was agreed. By a combination of working parties, research projects and small informal conferences the following problems will be investigated: the burial and attempted resurrection of the information in theses; the usefulness of the *Style Manual for Biological Journals*; reprint and copyright problems; the form of abbreviated titles for journals; the ranking of journals into primary, secondary, or mixed publications; the lack of training in library and literature usage in university courses, and the general ignorance of the ways in which biologists actually get hold of their information. These problems have yet to be given an order of priority. Liaison is being established with the Conference of Editors of European Biological Journals and with the U.S. Council for Biological Information. Biologists with bright ideas—or complaints—about the present situation are invited to write to the Secretary of the Committee, at the Institute of Biology, 41 Queen's Gate, London, S.W.7.

Encouraging Spin-off

THE Ministry of Technology is to make another attempt to convince industry that the work supported in government laboratories is useful to it. The ministry is

collaborating with another organization—the Institute of Physics and the Physical Society—in organizing a conference on the contribution of the government laboratories to industrial physics. The conference will be held in Harrogate from June 7 to 9, when the industrialists will hear fifteen papers from scientists in government laboratories and will discuss ways of overcoming obstacles to the use of new technology and ways in which exploitation can be assisted. Finally, there will be a discussion on making innovation pay.

The papers will include contributions on explosive forming, material processing by glow discharge beams, friction welding, the use of reinforced plastics in large structures, laser holography, computer aids to engineering design, and optics as an aid to industry. These could all help British industry, but the feeling persists that the companies who need the help most are least likely to attend. The companies that do attend, on the other hand, will probably know it already, from literature sources.

More Space for Research

BRITISH space science is a recent development, so young that its grand old men are barely middle aged. Most of them were on hand last week when Dr. F. E. Jones of Mullard, Ltd., opened the first outstation of the Department of Physics at University College, London, which has been involved in British space research since the very beginning. The new laboratory, which will be directed by Professor R. L. F. Boyd, is at Holmbury House, a fine country house once visited by Gladstone and bought for University College as a gift from the Mullard Company.

The laboratory, appropriately called the Mullard Space Science Laboratory, will be concerned with the design of experiments to be flown in rockets and satellites. There are a number of ways in which these can be launched: solid fuel Skylark rockets can be fired to a height of about 300 km from the Woomera range in Australia; ESRO rockets are also available, flying from Kiruna in Sweden or from Sardinia, and the admirable NASA co-operative arrangements allow a number of experiments to be flown from Cape Kennedy or from the Western Test Range in California. The newer satellites, such as the NASA orbiting solar observatory, offer great increases in payload, greater electrical power and improved calibration. The newest and smallest vehicle is the Petrel rocket now being developed by the Atomic Weapons Research Establishment at Aldermaston for production by Bristol Aerojet. This will enable cut-price soundings to be made from the new range at South Uist in the Hebrides.

Perhaps surprisingly, then, there are plenty of opportunities to fly well designed experiments. If there is a great emphasis on careful design, it is because a mistake can cost three years work and perhaps £50,000; not much by NASA standards, but a great deal to University College, whose grant from the Science Research Council has been about £150,000 per annum. (Last week it was announced that in the next three years the S.R.C. will be providing a further £509,000.) The laboratory is now working on experiments for eight satellites and more than thirty rockets; these will include new work in ultra-violet astronomy, as well as the more familiar British work on the ionosphere.

Infra-red Astronomy

ON May 1 and 2 the Royal Society organized a Discussion Meeting on the relatively new subject of infra-red astronomy. As with other wavelength ranges that have recently been opened up in astronomy, the infra-red has provided many surprises, and reports of these were among the highlights of the meeting. The first day was devoted to the Moon, planets and stars.

Drs. Salisbury, Menzel and Goetz described their various measurements on the temperature distribution of the lunar surface. One controversial question was the existence of hot spots which might indicate volcanic activity on the Moon: Dr. Low has observed a hot spot at 20 microns, but other observers working at 8–14 microns have been unable to detect it. Mr. Saslaw discussed the chemistry of Jupiter's upper atmosphere and how organic molecules produced there by photochemical reactions would affect Jupiter's infra-red emission. He emphasized the need for further laboratory measurements of important reaction cross-sections. Dr. Solomon examined the infra-red opacity of the Venus atmosphere caused by pressure-induced absorption bands. In order to explain the surprisingly high surface temperature of Venus by a greenhouse effect, carbon dioxide must dominate the atmosphere unless the total pressure is higher than is currently believed.

The most exciting new infra-red observation at the meeting was reported by Dr. Low. He has found a diffuse region, probably behind the Orion nebula, the observed infra-red emission of which at 20 microns is greater than that of any other object in the sky. The object has an average temperature of about 100° K but becomes brighter toward the centre. If it is associated with the Orion nebula, it would have a diameter of about 20,000 astronomical units, a luminosity of about a million suns, and a mass greater than about a thousand $M_\odot$. How can this be explained? Dr. Cameron suggested a turbulent gas cloud of 1,000 $M_\odot$ in which about 500 stars are just beginning to form. An alternative interpretation offered by Dr. Harwit is that of a large dust cloud surrounding only a few young stars in a later and much brighter phase than the stars described by Dr. Cameron. It may be possible to distinguish between these models by making millimetre radio observations.

The second day was concerned with extended galactic objects such as nebulae and dust clouds, with extragalactic objects and finally with observational techniques. Professor Osterbrock outlined his calculations on line emission in the infra-red from H II regions and planetary nebulae. He hoped that future observations would disprove his predictions so that his rather doubtful assumptions could be modified accordingly. Dr. Peebles described his exciting speculations about young galaxies. He estimated that they had passed through a very bright phase at a time in the past corresponding to a red-shift relative to us in the range 10 to 30. Most of their emission would then be shifted into the infra-red and be spread over a patch of about 15 seconds of arc, because of the magnifying gravita-

tional action of space–time. Dr. Peebles estimated that these patches might be observable, and later Dr. Low agreed that he should be able to detect the predicted surface brightness.

Quasars also came in for their share of attention. Drs. Davies, Sciama and Low surveyed the present position and future prospects. 3*C* 273 is unique among quasars so far studied in that it emits more energy in the infra-red than at all other wavelengths combined. The mechanism is probably synchrotron radiation, although many problems remain. The highlight of this part of the meeting was the report of the success of Dr. Braccesi of Bologna, who has discovered many possible quasi-stellar objects from their strong infra-red intensity in the I filter at 0·9 microns. This strong intensity occurs for quasars with a red-shift exceeding about unity, and arises from their strong intrinsic ultra-violet emission which is red-shifted into the infra-red. A telegram from Dr. Braccesi received just before the meeting announced that Dr. Lynds has obtained spectra of three of these candidates and has confirmed that two of them are indeed quasars. If this rate of success can be maintained the number of known quasars should soon increase from hundreds to thousands.

Fertilization and Protein Synthesis

from a Correspondent in Cell Biology

IMMEDIATELY after the fertilization of amphibian and sea urchin egg cells, protein synthesis is controlled at the level of translation. Unfertilized eggs contain large amounts of *m*RNA but have a low rate of protein synthesis. Fertilization causes a complex series of changes in the metabolic activity of these cells including a great increase in the rate of protein synthesis in the absence of synthesis of new RNA molecules. Alternative hypotheses proposed to explain this post-fertilization activation of protein synthesis involve either structural changes in egg cell ribosomes caused by proteolytic activity, the synthesis of factors regulating *m*RNA translation, the presence of inhibitors of protein synthesis in egg cell cytoplasm, or the activation of energy dependent processes regulating *m*RNA attachment to ribosomes.

Stavy and Gross (*Proc. U.S. Nat. Acad. Sci.*, **57**, 735; 1967) report interesting new experiments designed to distinguish between these possibilities. They isolated subcellular fractions from sea urchin eggs and developing embryos (spp. *Lytechinus pictus*), compared their ability to synthesize protein *in vitro*, and found that unfertilized eggs contain functional ribosomes, are not deficient in essential stimulatory factors, and do not contain inhibitors of protein synthesis. Consequently Stavy and Gross attribute the low rate of protein synthesis in unfertilized eggs to the inaccessibility of *m*RNA, which until fertilization is masked and, they claim, contained in a heavy particulate fraction.

Epel (*Proc. U.S. Nat. Acad. Sci.*, **57**, 899; 1967) reports that the increase in rate of protein synthesis in this species of sea urchin is a relatively late response to fertilization. It does not begin until about 8 minutes after fertilization and is preceded by the breakdown of the cortical granules in the egg cell cytoplasm that results in the lowering of the external *p*H, an increase in oxygen consumption of the cells and a transient increase in protease activity. Thus the post-fertilization burst of oxygen consumption cannot result from the energy demands of increased protein synthesis. Epel has also shown that unfertilized eggs convert amino-acids into compounds not involved in protein synthesis and the rate of this catabolism increases after fertilization. He concludes that activation of protein synthesis after fertilization is not solely caused by increased protease activity but may well involve energy dependent attachment of *m*RNA to ribosomes; this agrees with the ideas of Stavy and Gross.

Because egg cells contain enormously large stocks of *m*RNA it is of great interest to know the function and fate of these molecules. Crippa *et al.* (*Proc. U.S. Nat. Acad. Sci.*, **57**, 885; 1967) used the RNA–DNA hydridization technique to determine the fate of the egg cell *m*RNA. They find that 65 per cent of the species of *m*RNA molecules made during oogenesis in the amphibian *Xenopus* are present both in unfertilized eggs and the midblastula embryo, when there are 500–2,000 cells. During the 1½–2 hour period separating the midblastula from the late blastula stages, however, 28 per cent of the egg cell *m*RNA species suddenly disappear. It is at this critical time before the onset of gastrulation that the rate of *m*RNA synthesis in the nuclei of the blastula greatly increases.

Microbiology and Space Exploration

from a Correspondent in Microbiology

THE unrelenting pressure of space exploration has caused rapid developments in certain areas of microbiological technology. Some indication of the diversity and implications of this research is shown by a series of papers at the current meeting of the American Society for Microbiology in New York (*Bact. Proc.*, **67**, 15; 1967). Two problems which require immediate appraisal are those of the microbial contamination of outer space and the population dynamics of the indigenous microflora of crew members. It is now evident that spacecraft must be assembled under ultra-clean conditions to maintain low contamination levels, and planetary quarantine restraints require that all planetary landers be sterilized by dry heat. The computed microbiological burden of a typical Mars probe/lander has been established as being between 10^5 and 10^9, depending on assembly conditions. Effective decontamination operations include a flight acceptance heat cycle and the use of ethylene oxide treatment cycles. Similarly, designs which reduce the extent of mated areas on space hardware are also found to diminish contamination.

Critical features of heat sterilization schemes are the decimal reduction times (*D*-values) and temperature coefficients ($Q_{\triangle t}$) appropriate to the type of contamination incurred. Because spores are an important source of contamination, it is imperative to define the *D*-value and $Q_{\triangle t}$ as functions of both temperature and water activity. For example, I. J. Pflug and K. I. Fox reported to the meeting that the *D*-value decreases with increasing water activity at high temperatures, whereas at intermediate temperatures the *D*-value first increases and then falls as the water activity increases. The development and microbiological evaluation of a glove box analogue of an assembly/sterilizer were described by J. J. Shull. This three-

chamber analogue comprises facilities for ethylene oxide treatment, and steam and dry heat sterilization. The operational efficacy of the analogue was tested with controls of high bacterial spore densities on stainless steel strips which were employed during the aseptic assembly, testing and repair of simulated spacecraft components. Complete sterilization of controls and electronic devices seeded with spores make assembly/sterilizer layouts important in this context. As a requirement for this type of study a host of new microbiological methods is being developed for purposes such as the counting of viable organisms inside and on the surface of solids, non-cultural estimation of viable and non-viable organisms and the automatic counting and identification of colonies.

It is of great importance to establish what changes occur in the indigenous microflora of flight crews. H. O. Wheeler and his colleagues have followed the changes resulting from space missions made by Gemini crew members. The results indicate a simplification of the indigenous microflora of the personnel and, while there was a decrease in the types of organisms, total numbers rose. Similar population changes occurred on the space hardware. Of major concern is the finding that a transfer of micro-organisms took place between crew members. Various suggestions have been made on how best to maintain the balance of the astronaut's microflora, but schemes involving the seeding of food or the atmosphere with selected micro-organisms, direct implantation of the contents of a "normal" human internal flora into the subjects, or the use of antibiotics to control microbial populations are all fraught with various degrees of danger. Probably the wisest approach at this juncture is to attempt to develop a communal microflora among the flight crew before the mission with the aim of establishing specific antibodies so that any cross-infection during the mission will provide only a minimal hazard.

This kind of work, in addition to finding answers to its own specific problems, is contributing to a broadening of the science of applied microbiology. In particular the microbiological problems of closed environments inhabited by man are now better appreciated and, together with developments in decontamination and sterilization, should be directly applicable to many hospital and industrial needs.

Money for Sociologists

THE Social Science Research Council has now published a list of the grants awarded for research in the social sciences since October 1966. The grants cover 43 subjects, and amount to £206,162 for new projects and £22,223 as supplementary support for existing ones.

The largest grant of all (£33,367) goes to Professor A. H. Potter at the University of Essex for the establishment of a social survey data bank. Dr. A. S. King at Essex is studying political leaders' conceptions of the electorate, and Mr. D. G. Harper at the London School of Economics is working on group functioning and jury deliberation. At the Department of Psychology at Keele, Dr. J. Hartley is investigating the factors which affect the efficiency of learning from programmed instruction. Mr. A. Silbertson of the Department of Applied Economics at Cambridge has contrived to get two grants; one for an analysis of patent statistics, and another for a survey of the economic impact of the British patent system. Dr. M. N. Clark at Edinburgh has £2,000 to study European Communism and the Common Market, while Professor J. P. Mackintosh at Strathclyde has the widest subject of all—the British Parliament—and £4,035 to enable him to study it. At least one of the grants should bring concrete benefits: Professors Dosser, Peacock and Wiseman at the Institute of Social and Economic Research are working on the tax problems of Britain's entry into the Common Market.

Proteins for Seeing

from a Correspondent in Molecular Biology

THE chemical events which underlie bleaching and regeneration of the rod pigment, rhodopsin, have been defined in a series of remarkable researches by Wald and his associates. Yoshizawa and Wald have now examined the behaviour of the cone pigment, iodopsin, which is responsible for bright-light (and colour) vision (*Nature*, **214**, 566; 1967). Iodopsin contains as chromophore the same 11-*cis* retinal (vitamin A_1 aldehyde) as in rhodopsin, bound to the protein cone opsin. The process of bleaching consists of photoisomerization of the retinal to the all-*trans* form (a change from an L-shaped to a linear configuration), followed by its dissociation from the protein, through a series of intermediates which were individually characterized by "freezing" the reaction at low temperatures. Iodopsin is now found to behave similarly in outline, but to show some fascinating differences in detail.

As in the rhodopsin system the first step, and the only one—triggered by light—is the isomerization of the retinal, which remains bound to the protein in the product, prelumi-iodopsin. This intermediate can be stabilized at −195°, and its formation is accompanied by a large red-shift in the absorption maximum, because of the modification of the chromophore; it is supposed that the protein is conformationally unchanged at this stage. This step is fully reversible in a manner previously encountered only in rhodopsin and a few organic dye systems: on irradiation near the absorption maximum of the prelumi-rhodopsin the retinal reverts to the 11-*cis* form and iodopsin is regenerated. In general an equilibrium mixture is formed, according to the proportions of the irradiating light absorbed by the two components. In the rhodopsin system, warming by stages in the dark leads to a succession of products, in all but the last of which the all-*trans* retinal remains attached to the opsin. On warming prelumi-iodopsin, on the other hand, iodopsin is regenerated, that is the retinal is re-isomerized in the dark to the 11-*cis* form. In order to form the next product in the bleaching sequence, lumi-iodopsin, intense irradiation at a wavelength at which the starting material absorbs much more than the product is necessary. This reaction, too, can be photochemically reversed. In the dark, an increase of temperature then leads to the bleaching of the lumi-iodopsin through two meta-iodopsins, each of which is characterized by a distinctive absorption maximum.

Clearly the prelumi-iodopsin is a highly unstable molecule. The protein conformation is evidently stabilized by its specific ligand, 11-*cis* retinal, and the system may therefore adjust in two directions: either the retinal may re-isomerize to the form which stabil-

izes the conformation, or the conformation itself may adjust, and the protein finally shed the retinal (which is attached by a weak Schiff-base linkage, as well as a non-covalent fit). The difference between the cone and rod systems lies then in the greater relative stability of the initial protein conformation in the former, so that the re-isomerization reaction has the lower activation energy. It should be noted that the changes which come after the iodopsin to prelumi-iodopsin conversion must reflect conformational states of the protein, and indeed some changes in terms of accessible side chains were established by Wald and co-workers in the rhodopsin intermediates. The nature of the conformation changes during bleaching and regeneration of the retinal pigments is an unexplored field. A start, however, has been made by the use of optical rotatory dispersion (Kito and Takezaki, *Nature*, **211**, 197; 1966), which suggests that rhodopsin may suffer a loss in α-helix content during bleaching. Circular dichroism measurements (Crescitelli *et al.*, *Proc. U.S. Nat. Acad. Sci.*, **56**, 1729; 1966) are consistent with this result.

Electron Spin Resonance

from B. A. Thrush

THE reactive intermediates in chemical reactions can be studied by electron spin resonance, and this application of E.S.R. was discussed at a meeting at the Royal Society on May 4. Dr. W. A. Waters, who organized the meeting, started by pointing out that the species detected in this way were often less reactive secondary species, and that kinetic studies of such systems are only just beginning. As well as detecting species, E.S.R. can be used to provide structural information such as bond lengths from spectra of diatomic molecules—Dr. A. Carrington said that for these species Stark modulation had some advantages over magnetic field modulation. Diatomic radicals normally have a few electric dipole transitions, but, as Dr. Carrington pointed out, non-linear polyatomics would show much weaker magnetic dipole transitions with many lines; 10^6, say, for nitrogen dioxide.

Professor T. M. Sugden described the sources of error in E.S.R. studies of gas reactions; Russian workers, he said, use the hydrogen–oxygen reaction as a source of atoms and radicals while others prefer discharge-flow systems. Dr. B. A. Thrush said that in the reactions $O+C_2H_2$ and $H+C_2H_4$, the rate constants agreed well with those determined in other ways. By sampling the microwave absorption at fixed times after repeated flashes while the magnetic field is slowly varied, Dr. T. M. Wilmshurst reported that he has been able to detect a transient radical in the flash photolysis of benzophenone solutions. Professor R. O. C. Norman discussed the free radicals produced by the attack of hydroxyl radicals on various molecules; in their subsequent reactions, heterolytic processes dominate homolytic ones.

E.S.R. can also be used to study both the radicals involved in polymer degradation and those present in the early stages of radical polymerization. The hindering of rotation in the polymer radical explains the proportion of isotactic and syndiotactic polymerization, as Dr. H. Fischer showed. In addition, E.S.R. can be used to study biological materials, particularly those containing metal atoms. For instance, it might prove possible to distinguish between radical and hydrogen transfer mechanisms for oxidation and reduction processes.

The New Chromatography

MR. C. G. SCOTT writes:

From discussions at the annual general meeting of the Gas Chromatography Discussion Group of the Institute of Petroleum Hydrocarbon Research Group (held at the Royal Institution on April 28, 1967), and from some of the papers presented at the symposium which followed, it is evident that the gas chromatographic techniques will soon make an impact on other chromatographic systems, some of which have seen little change in technique since their introduction long before the advent of gas chromatography.

R. J. Maggs reviewed recent studies in liquid–liquid chromatography in which the column dimensions, support materials, sample sizes and detection systems and—equally important—the scientific approach used by the experimentalists were those used previously in gas chromatography. In this short period of development a scheme for the determination of absolute retention values has also been proposed and verified. This research must inevitably lead to the production of highly efficient automated instruments for the separation of thermally labile and high molecular weight samples.

At the symposium, T. Cotgreave also described liquid and thin-layer chromatography with flame-ionization detection. In his first scheme, the problems encountered while investigating systems for removal of liquid mobile phase from the effluent from liquid–solid and liquid–liquid columns and for introduction of the sample to the detector were reviewed. A rotating disk system was finally adopted. In his second scheme, components separated on a thin-layer chromatoplate are sequentially volatilized (or pyrolysed) off the plate and swept by a stream of inert gas into the detector to yield a recorder trace of near symmetrical peaks. A trace for separated lubricating oil antioxidants was shown.

Components such as steroids which are difficult to handle by gas chromatography can be made more tractable by conversion to trimethyl silyl ether derivatives. B. S. Thomas described work done in collaboration with D. R. M. Walton on the quantitative separation and preparation of the traces of steroids present in urine and blood. They made use of the special sensitivity of the electron capture detector towards organic halides by the preparation of chlorodimethyl silyl ethers, and now derivatives containing other halogens are being investigated.

The deliberations of an Institute of Petroleum Sub-Panel which attempted to specify a standard gas chromatographic method of analysis suitable for reference use were discussed. G. R. Primavesi indicated that the problem of defining a criterion relating the degree of resolution of two partially resolved peaks to meet given reproducibility requirements had not been satisfactorily solved for the non-Gaussian peaks sometimes encountered in practice. Another member of the Panel, F. Snelson, commented on a computer approach to the problem.

Parliament in Britain

Select Committee

THE Central Electricity Generating Board must be sorry that it abandoned competitive tendering when it placed the order for Hinkley *B* nuclear power station. Since then people have hardly stopped talking about it. The Select Committee on Science and Technology had another go at Mr. Stanley Brown of the C.E.G.B. on May 4. Atomic Power Construction, he said, had been fully stretched at the time, building Dungeness *B*, and Nuclear Design and Construction was not ready to put in a tender. The Nuclear Power Group, on the other hand, was well placed, and the "exceptional" step was taken of directly negotiating a contract with it and, as Mr. Brown put it, "evolving to a price". It was true, he said, that A.P.C. had put in a lower estimate, and that the start of building had been delayed by one year by the reluctance of the Ministry of Power to give approval for the capital expenditure, but even so it was not possible to take the A.P.C. bid seriously.

In any case, Mr. Brown added, conventional estimates were grossly misleading—prices given without the discipline of building the station were worthless. The A.P.C. claim—£81 per kilowatt against the N.P.G. price of £87—was, he implied, shrewd public relations rather than hard financial bargaining. A.P.C. had not put in such a startling bid for Hunterston *B*.

Mr. Brown made some interesting claims for the availability of British nuclear stations. Excluding Trawsfynydd (which seems to have suffered one disaster after another), British stations are available 63 per cent of the time in their first year, against 46 per cent for stations in the U.S., and 85 per cent of the time in their fifth year, against 56 per cent in the U.S. The very high cost of outage (the times during which stations are out of service) showed how important this was.

Turnkey contracts would go, Mr. Brown thought; indeed, the C.E.G.B. had contemplated abandoning them for the A.G.R. programme, but had decided against it. The Dungeness *B* appraisal had established the facts about the boiling water reactor, he said, and since the Dungeness contract tenders for B.W.R.s had not been sought. Despite the Hinkley affair, Mr. Brown repeated the belief of the C.E.G.B. that competition is valuable, and could not be provided solely by the distant threat of American companies. All future stations, he said firmly, would be put out to tender.

Data Processing

WHEN the Post Office (Data Processing Service) Bill received its second reading (*Nature*, **214**, 553; 1967), Dr. J. Bray said that the Post Office was securing a return of 12–40 per cent on its existing computer installations. He saw no likelihood whatever of a monopoly situation developing in the use of computers or in the provision of computer services. On the contrary, keen competition with small and active private bureaux was probable. (Debate, May 3.)

Nuclear Power

LORD BESWICK, Parliamentary Under-Secretary of State for Commonwealth Affairs, said that comparisons of unit generating costs by Mr. Duncan Burn in his book *The Political Economy of Nuclear Energy* (*Nature*, **214**, 547; 1967) were vitiated by failure to ensure strict comparability both in the financial and operating conditions and in the physical environment of the station. Lord Beswick added that in this country a life of 20 years was assumed for the generating station and a load factor of 75 per cent, against the 30 year life and 85 per cent load factor assumed in the United States. On the U.S. basis, even the last few stations built under the Magnox programme would be producing cheaper electricity than their coal-fired contemporaries. (Statement, House of Lords, May 4.)

Antarctic Treaty

THE Antarctic Treaty Bill, which received its second reading in the House of Lords on the motion of the Bishop of Norwich, is intended to give effect to the measures for the conservation of Antarctic flora and fauna which the twelve Antarctic Treaty governments approved at a consultative meeting in Brussels in 1964. Clause 1 prohibits without a permit the killing, injuring, molesting or taking of native birds or mammals and is designed primarily for the protection of six species of seal and four species of penguin, as well as ten species of birds which fly and nest in the Antarctic, particularly the shags, petrels, gulls, terns and skuas. Under Clause 4 the Secretary of State would be able to issue permits to allow animals to be taken to provide specimens for scientific research for zoos and museums and will be authorized to delegate his powers in this respect to the Director of the British Antarctic Survey and also to leaders of the British Antarctic Survey stations and of other British expeditions. (Debate, House of Lords, May 1.)

Statistics

THE Fourth Report from the Estimates Committee and the Ninth Special Report from the Estimates Committee relating to Government Statistical Services were debated by the House of Commons. Generally the reports were welcomed by the House, particularly the recommendations for improving the career prospects and standing of statisticians in Government service, for standardization and for a comprehensive public guide to official and semi-official statistics. Mr. P. Shore, Joint Under Secretary of State for Economic Affairs, admitted the need for more statistical information and said that while there were in April 1967 251 established posts for statisticians, compared with 169 at the end of 1964, 52 were unfilled: adequate trained manpower was essential for most of the changes and improvements the Government sought to make in the statistical service, and efforts were being made to encourage recruitment by schemes such as the cadet statistician scheme for postgraduate training and a bursary scheme under which suitable people were sent to a university for a professional course. On the collection of key statistics Mr. Shore said that there must be an end to the present situation which made it difficult to relate information collected by the Board of Trade with that collected by the Minister of Labour; this was a key objective in improving Government statistics. He referred to the importance of the Family Expenditure Survey and said that this year it was hoped to survey 10,000 homes. They were also trying to bring together earnings figures for wages and salaries and to compile sub-regional as well as regional earnings figures. The reports and the debate, he said, marked the beginning of a sustained drive to improve our statistical services for both Government and industry. (Debate, May 4.)