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.