dyes were "reactive" inasmuch as they form a covalent bond with the substrate during dyeing. Dyes were marked by high brilliance and good washing and peroxide fastness.

Dr J. E. Brenner (Du Pont International, Geneva) summarized a large area of new knowledge on the synthesis, properties and polymerization of perfluorocarbon epoxides. Cyclic and acyclic perfluoroolefines are converted to their epoxides by alkaline hydrogen peroxide at low temperatures. Hexafluoropropylene epoxide can also be prepared by an autoxidation process. It reacts with itself in the presence of fluoride ion to form dimers and high oligomers which have the general structure of substituted perfluoropolyethers terminating in an acyl fluoride group. The stabilized perfluoropolyethers are oils or low melting solids which have high thermal resistance both in air and vacuum.

Dr I. M. White (Royal Aircraft Establishment, Farnborough) spoke about a new range of perfluoroalkylene-linked aromatic polymers. Fluoroaliphatic iodides, aromatic halides and copper react together in aprotic polar solvents to form fluoroalkyl-substituted aromatic compounds. Thus units of $(CF_2)_X$-*m*-C_6H_4 were introduced into aromatic polymers to form polyimides and polyesters. These in particular formed a range of thermally very stable thermoplastic polyimides, some of which are soluble and may be cast into films.

An interesting applied chemistry paper was that presented by Dr G. T. Newbold (Fisons Ltd, Saffron Walden, Essex) on a novel class of pesticides. 2-Trifluoromethylbenzimidazoles have a number of biological activities of interest in the agricultural chemical field. Notable among the many members of the series synthesized are 4,5-dichloro-2-trifluoromethylbenzimidazole chloroflurazole, NC 3363, a post-emergent herbicide which controls broad leaf weeds in cereals, and 5,6-dichloro-1-phenoxycarbonyl-2-trifluoromethylbenzimidazole, fenazaflor, Lovozal, NC 5016, an orchard acaricide.

Glucose from Cellulose

from our Microbiology Correspondent

ALTHOUGH the numerous investigations of microbial breakdown of cellulose illustrate that many species can degrade the glucan at a rapid rate and to completion, cell-free extracts from these same species possess comparatively little of this activity. Indeed, *in vitro* enzyme digests depolymerize cellulose only slowly and, unless very low substrate concentrations are used, the hydrolysis is severely limited. This pattern of enzymatic digestion of cellulose may be contrasted with that of starch. The enzymatic hydrolysis of starch to glucose is a well proven commercial process with current production approaching half a million tons annually. In enzyme mediated starch digestion, the glucose level reaches about 30 to 40 per cent; in comparison, the release of glucose from cellulose by cell-free preparations rarely exceeds 5 per cent. It is unfortunate that the exploitation of a cellulase digestion has not been possible to date, particularly because cellulose is the most abundant natural product on this planet.

The recent brief report from the Natick Laboratories in Massachusetts of glucose production from modified native wood cellulose (Katz and Reese, *Appl. Microbiol.*, **16**, 419; 1968) is therefore most encouraging. Dr Reese and his colleagues have based their investigations on the observation made by Krupnova and Sharkov in Russia that wood cellulose, when milled at high temperatures, is readily hydrolysed by 10 per cent sulphuric acid. Katz and Reese milled the wood cellulose 'Solka Floc' for various times and at temperatures as high as 200° C and then tested its susceptibility to the cellulase produced by the fungus *Trichoderma viride*, an enzyme system which has been studied extensively at Natick. β-Glucosidase was also added to the digest. This second enzyme hydrolyses cellobiose which, if it accumulates in the reaction mixture, inhibits the cellulase. The conditions for producing the optimal cellulose susceptibility to the fungal enzyme were found to be a 30 min grinding period at 200° C; this procedure resulted in a suspension of 50 per cent solids (other modified celluloses produce about a 10 per cent suspension of solids). The thick cellulose suspensions, when incubated with *Trichoderma* cellulase (300 C_x units/ml.) and β-glucosidase, yielded glucose in concentrations greater than 30 per cent. The initial rate of glucose release was rapid but then fell gradually. The authors consider product inhibition and/or substrate heterogeneity are responsible for these kinetics and suggest that higher yields might be obtained if more violent milling was used during the preparation of the substrate. This preliminary study indicates the feasibility of producing glucose from cellulose enzymatically, but it remains to be seen whether or not the system can be scaled up to an economically viable process.

Instant Ribosomes

from our Molecular Biology Correspondent

THE reconstitution of functional ribosomes by mixing separated RNA and proteins is an experiment the feasibility of which one might well have been forgiven for doubting. It has now been achieved—at least with the 30*S* sub-unit from *E. coli*—by Traub and Nomura (*Proc. US Nat. Acad. Sci.*, **59**, 777; 1968). Earlier work by several groups of workers had shown that a substantial proportion of the total protein could be removed from ribosomes by exposure to high salt concentrations. The resulting particles or "cores" were inactive, but their function could be restored by replacing the dissociated proteins. Fractionation of these proteins into several groups led to the partial identification of the activities of particular fractions.

In the new experiments, the cores (23*S*) from 30*S* ribosomes were also stripped of their proteins by treatment with 8 M urea and 4 M lithium chloride. Recombination of the proteins with the 16*S* RNA occurred at 37° C (hardly at all at 0° C), and particles sedimenting at 30*S* were regained possessing practically the full activity of native ribosomes in cell-free systems with both poly-U and *f*2-phage RNA as messenger. Both the core protein and the more easily detached fraction are necessary for activity, and the order of mixing with the RNA is immaterial. That a high degree of specificity is involved in the recombination is shown by the inability of core proteins from the 50*S* particles to replace their counterparts from the 30*S* particle; and by the failure of recombination experiments when the RNA was degraded, and when RNA of the small sub-