to the overall appearance of the molecule comes now from Lake and Beeman (*J. Mol. Biol.*, **31**, 115; 1968). They have measured X-ray scattering at low angles from yeast transfer RNA in aqueous solution. The scattering profile depends on the distribution of matter within the solute molecule, and it is possible to calculate the scattering for given models for the tertiary structure with considerable precision. Starting from a "cloverleaf" arrangement, containing four paired segments, Lake and Beeman are able to assert that the limbs are not splayed out; the tRNA is in fact a compact and disymmetric structure, and a good fit between experiment and theory can be achieved if the arms are packed tightly together. The best fit is for a two up - two down configuration, but three up and one down is not excluded. Granted the original "cloverleaf", therefore, this work must be seen as a considerable step towards a picture of the molecule.

No such working model exists as yet for the 5S RNA. An attempt at characterizing the secondary structure has been made by Boedtker and Kelling (*Biochem. Biophys. Res. Commun.*, **29**, 758; 1967). They have shown the existence of a considerable degree of base-pairing by demonstrating that the structure collapses when treated with formaldehyde. The absence of any significant ionic strength dependence of the sedimentation coefficient indicates that there is in fact a rigid tertiary structure. Measurements of ultraviolet hypochromicity in the native state, by comparison with that in the formaldehyde-treated material, have been used to obtain a limiting value for the extent of base-pairing. For reasonable values of mean hypochromicity for paired and unpaired RNA chains, it is found that some 60 per cent or more of the bases are paired.

Zonal Centrifugation

from a Correspondent

MORE than 200 people attended the British Biophysical Society meeting on zonal centrifugation on January 26, organized by Professor P. Alexander at the Chester Beatty Research Institute Laboratories at Sutton. Professor D. E. Hughes in his opening remarks described the development of the zonal centrifuge as a major breakthrough in the separation of biological material. One of the major fields of study in contemporary biological science is the relationship between function and structure. In order to study this it is necessary to obtain sub-cellular components in as pure a state as possible. The old method of differential centrifugation produced very impure fractions, while the introduction of separation by density gradient centrifugation in swinging bucket rotors improved the quality of the fraction at the cost of greatly reduced yield. With zonal centrifugation using rotors with capacities of up to 1,700 ml., it is possible to obtain fractions in quantities sufficient for almost any analytical procedure.

Dr N. Anderson of Oak Ridge who, with his co-workers, has been responsible for the development of the zonal centrifuge, started the proceedings with a major contribution entitled "Recent Advances in Zonal Centrifugation". This paper, lasting nearly an hour, was delivered with expertise and humour. He described a number of interesting modifications in technique which can be applied to zonal centrifugation

and which considerably extend its potential. Among the successful applications so far is the production of highly purified viral vaccines using a flow-through rotor to process 1 to 2 litres per hour of culture medium. One of the latest developments at Oak Ridge is a new generation of rotors, the "K" series, capable of handling four or five times the quantities of the present "B" series.

The following papers were each concerned with the isolation of one or more components from disintegrates of biological material. The overall impression was that the workers had achieved a degree of resolution and reproducibility not obtainable with any other method. Dr J. Hastings (Chester Beatty Research Institute) described the separation of different species of RNA using the B XV titanium rotor.

Dr C. D. Birnie and Dr Harvey (Imperial Cancer Research Fund) then showed some excellent separations of polysomes, ribosomes and ribosomal sub-units. In the afternoon session, together with Miss S. M. Fox, these authors also described the use of the continuous flow rotor for the isolation of viruses.

During the luncheon break, demonstrations of A, B XIV and B XV rotor systems were given by MSE of Crawley, England. The afternoon session was opened by Dr R. G. Wallis (Microbiological Research Establishment), who described a simple containment device for use in conjunction with the zonal centrifuge for the isolation of non-pathogenic viruses.

The complex problem of the isolation of cytomembrane and plasma membrane fragments from liver homogenates was dealt with by Dr E. Reid, Mr R. H. Hinton and Mr J. T. R. Fitzsimons (University of Surrey), and this was followed by a paper on "The Separation of Mitochondria and Lysosomes" by Mr G. C. Hartman and Mr R. H. Hinton.

Dr D. Lloyd (University College of South Wales and Monmouthshire), using the A rotor, showed that the zonal centrifugation of a fraction rich in mitochondria resulted in the mitochondria separating into fractions having different metabolic properties but appearing as a broad band on the zonal profile. Dr A. P. Mathias (University College, London) showed what degree of separation of nuclei could be achieved using the A rotor. Using low speeds of the order of 600 r.p.m., he had separated diploid and tetraploid nuclei from rat liver.

The final paper by P. J. G. Avis, Dr C. Dean, Dr A. Driedger and Dr L. Hamilton (Chester Beatty Research Institute) dealt with the separation of disintegrates of *Micrococcus radiodurans* using the B IV rotor. A novel feature was the lysing of the bacterial cells within the rotor to avoid excessive shearing of the DNA during the introduction of the sample through the rotating seal.

This was the first meeting to be held in this country devoted entirely to the technique of zonal centrifugation and drew one of the highest attendances for a meeting organized by the society.

Lactose Repressor

from our Cell Biology Correspondent

THE isolation at Harvard University of the lactose operon and λ -phage repressors by Gilbert and Müller-Hill and Ptashne has made possible fundamental experiments to detect how genetic repressors act at the