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**THERMOPHYSICAL  
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in thirteen volumes**

under the general editorship of  
**Y. S. TOULOUKIAN**, Director, Thermo-  
physical Properties Research Center, and  
**C. Y. HO**, Head of Data Tables Division,  
Thermophysical Properties Research Center,  
Purdue University, West Lafayette, Indiana.

Foreword by **EDWARD L. BRADY**, Associate  
Director for Information Programs, National  
Bureau of Standards.

For more than a decade, the Thermo-  
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**MEETINGS**

**Separation of Plant Particles**

Although much of what we know  
about plant (or animal) metabolism  
has been generated from studies with  
isolated subcellular structures such as  
chloroplasts, mitochondria, and ribo-  
somes, most investigators have had to  
accept a choice of either "preparative"  
amounts of crude suspensions or van-  
ishing by small quantities of pure par-  
ticles. Moreover, the intactness of iso-  
lated organelles has been a doubtful  
quality; most "chloroplast prepara-  
tions" have been "class II" chloro-  
plasts, a euphemism for stripped and  
swollen lamellae, devoid of stroma and  
limiting membrane. The discovery of  
peroxisomes has glaringly illuminated  
this unhappy state; for we suddenly  
find that peroxisomes, not chloroplasts,  
contain the catalase of green leaves,  
and that these same bodies, not mito-  
chondria, are the sites of fatty acid  
oxidation in fatty seedlings.

No one has been content with con-  
ventional methods of particle separa-  
tion and, with the new possibilities for  
relatively large-scale density gradient  
centrifugation in zonal rotors, we need  
no longer be limited by them. It is  
now possible, at least theoretically, to  
prepare biochemically useful quantities  
of all kinds of subcellular particles  
with defined sedimentation coefficients  
and equilibrium densities. In the future  
we should be able to specify that the  
particles in a chloroplast preparation  
have *S*-values of between 500 and 550  
kilosvedbergs and equilibrium densities  
between 1.100 and 1.105 g/cm<sup>3</sup>. Natu-  
rally, we should also demand ultrastruc-  
tural intactness.

Toward this end a Microsymposium  
on the Separation of Plant Particles  
was held at Oak Ridge, Tennessee,  
22-24 January 1970. The purpose of  
the meeting was to exchange practical  
and theoretical ideas on the separation  
of cellular, subcellular, and macro-  
molecular particles from plants. In  
order to describe the current state of  
the art in selected areas of particle  
separation independent of the immedi-  
ate application, a number of the invited  
speakers were concerned with animal  
or bacterial systems. The bias of the  
organizers—N. G. Anderson, R. C.  
Fuller, and myself—was revealed by  
the heavy emphasis on density gradient  
centrifugation in zonal rotors.

On the theoretical level, there was

a recurrent theme—the relatively large  
size and sectorial geometry of zonal  
rotors have increased the feasibility of  
and thus stimulated interest in the direct  
testing of physical and mathematical  
models of density gradient centrifuga-  
tion. S. P. Spragg (Birmingham, Eng-  
land) considered the design of gradients  
for optimizing resolution in which the  
volume (rather than the radial width)  
of a particle zone remains constant  
during sedimentation. Spragg asked if  
the diffusive flow of solute and solvent  
induced by a gradient must not set a  
lower and time-dependent limit on the  
volume of a particle zone. V. N. Schu-  
maker and B. Halsall (Los Angeles)  
described a simple model system for  
measuring zone broadening due to dif-  
fusion of the sample particles. Droplet  
sedimentation was eliminated by incor-  
porating a counter macromolecule in  
the underlying solution. Their proce-  
dure provides simple means of mea-  
suring diffusion coefficients and for  
evaluating additional factors that might  
influence zone broadening during sedi-  
mentation. H. W. Hsu (Oak Ridge  
and Knoxville) presented equations  
which predict particle behavior (posi-  
tion and instantaneous velocity) from  
the radial functions of gradient density  
and viscosity expressed as polynomials.  
His calculations should greatly facili-  
tate the calculation of apparent sedi-  
mentation coefficients in gradients of  
known composition.

In the area of centrifuge techniques  
and hardware, G. B. Cline (Birming-  
ham, Alabama) described recent de-  
velopments with the K-series of high-  
speed continuous-flow rotors. Cline's  
proposals for increasing resolution  
through the use of step gradients gen-  
erated considerable discussion. C. R.  
McEwen, E. T. Juhos, and R. W. Stal-  
lard (Palo Alto) discussed the prin-  
ciples and possibilities for continuous-  
flow fractionation with their elutriation  
rotor. Although the rotor is still in a  
developmental stage, its application to  
the fractionation of whole cell popula-  
tions will be watched very closely.  
D. A. Waters (Oak Ridge), speaking  
of the physical and metallurgical  
problems of rotor design, illustrated  
problems of stress limits of different  
rotor materials by cheerful references  
to "catastrophic self-disassembly."

The criteria for intactness and the  
special problems of membrane-bound  
particles were emphasized by three  
speakers. W. Laetch (Berkeley) de-  
scribed the different characteristics of  
chloroplasts in the parenchyma as con-

trasted with those in bundle sheaths of tropical grasses and other "Hatch-Slack" plants. N. E. Tolbert (East Lansing) outlined the metabolic activities of leaf peroxisomes and some of the problems in their isolation. W. D. Bonner (Philadelphia) reported highly intact mitochondria from white potato, but concluded that "God in his infinite wisdom meant that roots were not to be ground up." The consensus from numerous informal discussions was that difficult problems remained in the recovery of pure suspensions of completely intact chloroplasts, peroxisomes, and mitochondria.

The application of zonal centrifugation to the separation of specific particles was discussed by a number of speakers: bacterial "minicells" (W. Fisher, Oak Ridge), animal nuclei of different ploidy (C. A. Albrecht, Oak Ridge), continuous-flow harvesting and separation of intact from stripped chloroplasts (D. H. Brown, Oak Ridge), separation of mitochondria from de-repressed and repressed yeast (C. A. Price, New Brunswick), preparation of homogeneous viruses for vaccine production (J. L. Gerin, Bethesda; H. E. Bond, Bethesda), one-step fractionation of serum lipoproteins by density gradient flotation (M. Heimberg, Nashville), and separation of undegraded chromosomal DNA by reorienting gradient techniques (J. Lett, Fort Collins).

Among the most imaginative applications of particle separations was the proposed control of the Douglas fir tussock moth caterpillar through large-scale purification of the specific polyhedrosis virus in a K-type rotor (J. P. Breillatt, Oak Ridge).

The microsposium and two associated workshops were sponsored by the American Society of Plant Physiologists, the University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences, and the Molecular Anatomy Program of the Oak Ridge National Laboratory. Support was provided by these organizations plus the Division of Biology and Medicine of the U.S. Atomic Energy Commission, the International Equipment Company, and the Spinco Division of Beckman Instruments. The published proceedings of this microsposium will be available from the MAN Program, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

C. A. PRICE

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## Courses

**Experimental and Theoretical Analysis of Modern Characterization Methods Applied to Electronic Materials**, Cambridge, Mass., 27 July-7 August. This course will deal with the available methods and techniques (their potential and limitations) for the chemical and physical characterization of materials (for electronic applications, semiconductors, magnetics, dielectrics, and others). The principles of the various characterization techniques will be discussed as they relate to the determination of trace impurities, impurity heterogeneities, crystalline structure, lattice defects, electrical carriers, and surface configuration of specific classes of electronic materials. (Director of the Summer Session, Room E19-356, Massachusetts Institute of Technology, Cambridge 02139)

**Anthropology for College Teachers**, Boulder, Colo., 15 June-21 August. This summer institute is being offered for the 10th year and has been awarded a grant by the National Science Foundation. Is intended for 30 college and junior college teachers of anthropology whose formal training in the subject is weak. (Dr. A. J. Kelso, Director, Department of Anthropology, University of Colorado, Boulder 80302)

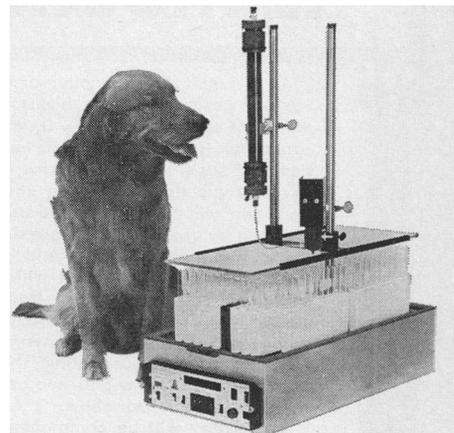
**Theory and Practice of the Analytical Ultracentrifuge; Advances in Macromolecular Characterization**, Woods Hole, Mass., 11-22 May. Material will include basic information, sedimentation velocity; boundary analysis; zonal and active enzyme sedimentation velocity, sedimentation equilibrium of enzymes, including paucidisperse systems; density gradient sedimentation equilibrium; and optical techniques. *Tuition*: \$400. (Dr. David Teller, Department of Biochemistry, University of Washington, Seattle 98105)

**Anatomy, Physiology, and Patient Care**, Charleston, S.C., 13 July-7 August. The course is designed to familiarize the engineer with the problems involved in the delivery of medical care. The opportunity to observe the activities of the emergency room, operating room, intensive care unit, and other areas of the hospital is provided. Limited to 40 participants. *Tuition*: \$500. (Mr. Thomas S. Hargest, Director, Engineering Development Section, Department of Surgery, Medical University of South Carolina, Charleston 29401)

**Polymers (Characterization, Morphology, and Structure-Property Relations)**, Houston, Tex., 4-8 May. *Fee*: \$300. (Mary B. Appleton, Office of Continuing Studies, P.O. Box 1892, Rice University, Houston, Tex. 77001)

**Practicum in Histology**, Boston, Mass., 24 May-5 June. An intensive program in histological techniques, including fixation, embedding, microtomy, staining, and autoradiography, is designed for doctoral level investigators. Highly recommended laboratory assistants will be considered. Limited to 12 students in order to insure maximum practical laboratory experience. (Dr. Clifford F. Youse, Director of Programs in Applied Science, Center for Continuing Education, Northeastern University, Boston, Mass. 02115)

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Salary: Dependent upon qualifications and experience.

Applications including curriculum vitae and names of two referees should be sent to Professor J. C. Conroy, Department Head, at the address above, no later than 1 May 1970.

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