ment, particularly those using laser heating, appeared to have special advantages for the study of a wide range of chemical reactions.

The discussions of the second day (organized by R. H. Eisenhardt and K. K. Lonberg-Holm) were divided into three major areas: liquid-liquid quenching, tissue-freeze quenching, and rapid sampling. Under the topic of liquid-liquid quenching was included the subject of the rapid freezing of liquid jets upon being squirted into a cold immiscible liquid (R. C. Bray, G. Palmer, and H. Beinert) and upon being aimed directly into a second jet of cold liquid (M. Sangster). A number of the problems inherent in these methods were discussed; some items noted were the estimation of quenching time and the possible difficulty in stopping intermolecular reactions or reactions with protons or gaseous species which might occur in the frozen state. Bray, Palmer, and Beinert have already employed cold quenching in EPR and in reflectance spectroscopy studies of enzyme kinetics. The quenching time available with current mixers and freezing techniques is approximately 10 msec. It was concluded that under most circumstances intermolecular reactions can be satisfactorily quenched at −180°C. The desirability of carrying out parallel studies by direct physical measurement and by quenching was pointed out.

Some of the artifacts which may be caused by a variety of chemical quenching methods were touched upon with particular reference to liver tissue (T. H. Bücher), yeast cells (T. Savioja), and *Chlorella* (J. A. Bassham). In the case of *Chlorella* and also in mouse ascites tumor cells alcohol quenching was found to be very convenient, but it could not be demonstrated that the quenching time was less than 200 msec. Much shorter quenching times can be demonstrated in whole yeast cells when TCA is employed (J. K. Miettinen). Acid or alkali are eminently suited for use as quenching agents when simple enzyme solutions are used (H. Gutfreund) and seem to require less than 1 msec if the reaction is not heavily buffered.

The rapid freezing of muscles in varying states of contraction was discussed by D. F. Cain and by W. F. H. M. Mommaerts. Cain, using Freon 13 to −180°C, reports that a 1-sec time interval is required to reach −55°C with 2 mm^3 of tissue. Mommaerts gives the same time interval for cooling a 150-mg sartorius muscle. It is suggested, however, that 80 to 90 percent of the mass passes through ice crystal formation within 50 msec or less.

Metabolite assays on quickly frozen samples of liver were described by Bücher. This technique involves not only the quick freezing method but also the complete analysis of small slices of frozen tissues carried out at −25°C. The results suggest that these methods are necessary to maintain the metabolite pattern in general and the nucleotide concentration values in particular.

A number of methods for withdrawing samples from transient or steady state metabolic systems were presented. Lonberg-Holm described a rotating stopcock type sampler and a newer "aspirator" type sampler which has been used to take aliquots from ascites tumor suspensions at 0.7-second intervals after glucose feeding. Eisenhardt described a constant, aliquot "single drop" type sampler which was built to study transients in mitochondrial metabolism and which permits sampling at 0.3-second intervals, 0.5 or 0.8 second after a substrate is added to the reaction. This latter sampler could be adapted to a completely automatic mode of operation which would permit an experiment to be programmed ahead of time. Miettinen described three types of apparatus developed for the study of phosphorus assimilation in yeast—a magnetic valve type sampler, a multiple mixer flow apparatus, and a syringe type injector for quenching samples shortly after substrate addition. A more complex sampler employing syringes was also described by V. Moses. This latter device, together with the magnetic valve equipped reaction chambers described by Bassham and by M. Klingenberg, may be more suited to the investigation of the steady state or of slow metabolic changes than of rapid transient changes. Klingenberg also reported a novel, rapid filtration technique involving zonal centrifugation.

To study really rapid reactions by chemical means (by taking samples at less than 200 msec intervals), it appears at present to be necessary to employ a "quenching type" or multiple mixer type flow apparatus. The disadvantage in such a method is that only one sample may be obtained from each run and biological material may not remain in the same state for a period of time long enough for an experiment. Gutfreund has used a quenching type flow apparatus to study the kinetics of several enzyme systems and has been able to get good agreement with results obtained from the stopped flow technique.

The proceedings of this conference were published by Academic Press on 15 November in a volume entitled *Rapid Mixing and Sampling Techniques in Biochemistry*.

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Forthcoming Events

January

3–10. **High Energy Physics**, 3rd annual symp., Inst. of Mathematical Sciences, Madras, India. (R. Vasudevan, Inst. of Mathematical Sciences, Madras 20)

5–7. **Glass Formation, Phase Equilibria, Nucleation and Crystal Growth**, symp., Sheffield, England. (D. Hawksworth, Soc. of Glass Technology, Thorton, 20 Hallam Gate Rd., Sheffield 10)

5–8. **Solid State Physics**, 2nd annual conf., H. H. Wills Physics Laboratory, University of Bristol, England. (Administrative Assistant, Inst. of Physics and Physical Soc., 47, Belgrave Sq., London S.W.1)

6–8. **Industrial Electronics and Control Instrumentation**, 13th annual conf., Philadelphia, Pa. (E. Weiss, Sun Oil Co., Marcus Hook, Pa.)

6–9. **Psychopharmacological** Conf., Czechoslovak Medical Soc., Psychiatry Section, Jesenik Spa. (M. Vojtechovsky, Budejovicka 800, Pavilion A1, Prague, Czechoslovakia)

8–9. **Orthopaedic** Research Society, New York, N.Y. (R. A. Calandruccio, 869 Madison Ave., Memphis, Tenn.)

9–14. American Acad. of **Orthopedic Surgeons**, annual, New York, N.Y. (H. K. Hart, AAOS, 29 E. Madison, Chicago 2, Ill.)

10–16. The **New Science**, symp., Colorado Springs, Colo. (F. A. Sondermann, Colorado College, Colorado Springs)

11–14. **Civilian and Military Uses of Aerospace**, conf., New York, N.Y. (I. B. Laskowitz, New York Acad. of Sciences, 2 E. 63 St., New York)

12–14. **Reliability and Quality Control,**

symp., Miami, Fla. (H. D. Hulme, Westinghouse R&D Center, Bldg. 601-1346, Churchill Boro, Pittsburgh, Pa.)

12–15. **Crustacea**, symp., Cochin, India. (Marine Biological Assoc. of India, Marine Fisheries P.O., Mandapam Camp, S. India)

14. American **Genetic** Assoc., Washington, D.C. (W. R. Singleton, Biology Bldg., Univ. of Virginia, Charlottesville)

18–20. **Solar Radiation Simulation**, intern. conf., Los Angeles, Calif. (H. F. Sander, Inst. of Environmental Science, 34 S. Main St., Mount Prospect, Ill.)

19. American Inst. of **Mining, Metallurgical**, and **Petroleum** Engineers, Metallurgical Soc., 7th mechanical working conf., Pittsburgh, Pa. (R. W. Shearman, Secretary, Metallurgical Soc. of AIME, 345 E. 47 St., New York 10017)

19. **Cor Pulmonale**, New York Heart Assoc., New York, N.Y. (NYHA, 10 Columbus Circle, New York 10019)

19–20. **Die Design and Press Tooling** Conf., American Soc. of Tool and Manufacturing Engineers, Hartford, Conn. (M. Zapico, Asst. Conf. Director, ASTME, 10700 Puritan Ave., Detroit 38, Mich.)

20–22. **Instrumentation**, College Station, Tex. (P. T. Eubank, Chemical Engineering Dept., Texas A&M Univ., College Station)

20–23. National Soc. of **Professional Engineers**, New Orleans, La. (P. H. Robbins, 2029 K St., NW, Washington, D.C.)

22. **Bibliographical** Soc. of America, New York, N.Y. (Mrs. H. C. Ralph, P.O. Box 397, Grand Central Station, New York 10017)

22–1. **Earthquake Engineering**, 3rd world conf., Auckland and Wellington, New Zealand. (Administrative Secretary, Third World Conf. on Earthquake Engineering, P.O. Box 5180, Wellington)

22–23. **Blood**, annual symp., Detroit, Mich. (W. H. Seegers, Dept. of Physiology and Pharmacology, Wayne State Univ. College of Medicine, Detroit)

22–23. **Hydrocarbon Analysis,** symp., American Soc. for Testing and Materials, Houston, Tex. (ASTM, 1916 Race St., Philadelphia 3, Pa.)

25–26. **Fundamental Phenomena in the Material Sciences**, 3rd annual symp., Boston, Mass. (D. B. Fay, Ilikon Corp., Natick Industrial Centre, Natick, Mass.)

25–26. **Viruses of Laboratory Rodents**, symp., Atlanta, Ga. (R. Holdenried, Natl. Cancer Inst., NIH, Bethesda, Md. 20014)

25–27. American Inst. of **Aeronautics and Astronautics**, New York, N.Y. (J. Bidwell, AIAA, 1290 Avenue of the Americas, New York 10019)

25–28. American **Meteorological** Soc., annual, New York, N.Y. (K. Spengler, AMS, 45 Beacon St., Boston 8, Mass.)

25–28. American Society of **Heating, Refrigerating and Air-Conditioning Engineers**, Chicago, Ill. (R. C. Cross, 345 E. 47 St., New York 10017)

25–28. Modern Methods of **Analytical Chemistry**, 18th annual intern. symp., Baton Rouge, La. (P. W. West, Dept. of Chemistry, Louisiana State Univ., Baton Rouge)

25–28. **Cardiovascular Diseases**, 2nd natl. conf., Washington, D.C. (C. H. Maxwell, 9650 Wisconsin Ave., NW, Washington, D.C. 20014)

25–29. American **Mathematical** Soc., Denver, Colo. (G. L. Walker, AMS, 190 Hope St., Providence, R.I.)