

# Meetings

## Research and Training in Biomaterials

Research and training in the important and rapidly developing field of biomaterials was the subject of a conference held in Chicago on 5 and 6 April 1968. The complexity and sophistication of the supramolecular and histological structure of biological tissues poses not only a problem to scientists studying biomaterials, but also poses a challenge to biomaterials engineers working to synthesize new materials for use in medicine. These artificial materials should be considered in the context of a closer analysis of the biological tissues.

The important roles of membranes in biological systems was discussed by E. Leonard (Columbia University). These membranes act as anticonvectants, antishrink structures, and diffusion controls. The requirement for biologically compatible material for synthesis of artificial membrane systems is difficult to satisfy because of the high surface to volume structures into which the membranes are formed. J. Bougas (Boston University) reviewed the history of metal implants for heart valves; he discussed developments in the use of titanium and other commercial alloys for surgical materials and mentioned new composite structures fabricated of metals and polymers together. F. Leonard (Walter Reed Army Medical Center) described studies on homologous alpha-cyanoacrylate monomers which polymerize on site to form wound coverings. E. Greener (Northwestern University) discussed the large-scale requirements for biomaterials in the dental health industry. For example, there are now about 100,000 dentists using about 300 to 400 million dollars worth of dental materials and disposables annually. Dental decay occurs in about 97 percent of the American population, and there are about 700 million untreated caries lesions (cavities)—that is, an average of about four per person.

G. Bugliarello (Carnegie-Mellon Uni-

versity) discussed the complexity of blood as a fluid biomaterial having many phases. Mechanical factors lead to advanced rheological definitions which are further complicated by boundary layer phenomena. E. Salkovitz (University of Pittsburgh) discussed the properties of bone as a biological material and indicated that its complexity is seen when the many hierarchical levels of histological structure are studied. For example, the basic properties of osteons (microscopic elements in bone) reveal the importance of non-homogenous and nonisotropic factors that must be considered in any analysis of mechanical properties of bone. K. Keller (University of Minnesota) discussed mass transport phenomena in the circulatory system. He stressed the importance of scaling considerations, such as the "Peclet Number" which relates convective to diffusional velocities. A. Rubin (Cornell University) discussed the structure of collagen in relation to its uses in tubular membranes for artificial kidneys and transparent membranes for artificial corneas.

J. Dickson (NIGMS) defined the interests of the NIH bioengineering and biomaterials divisions. This included basic research in physical biology, engineering development of applications for medical care, and social engineering involved in the delivery of health services for the population of this country.

Centers for biomaterials research should be established in crucial areas, for example, near industry. Standards need to be established; a scientific group must be able to provide scientific grounds for the authorization and control of new materials for medical uses. These centers might also be subsidized for small-scale production of important new biomaterials, not yet commercially feasible on an industrial scale. Training programs for developing adequate manpower resources, especially crucial at the doctoral level, are needed. The fact that ten times more biomaterial scientists (250) are needed than can be produced (30) within the next 5 years

indicates the priority that should be assigned to these programs. Cooperation between government, industry, and universities is essential for the success of biomaterials research and training.

The conference was supported by the National Institute of General Medical Sciences, the University of Illinois, the Presbyterian-St. Luke's Hospital, and the Whittaker Corporation. A summary of the conference proceedings is scheduled for publication by Plenum Press, with the title "Biomaterials."

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## Calendar of Events

### National Meetings

#### February

2-7. American Soc. for **Testing and Materials**, Denver, Colo. (T. A. Marshall, Jr., The Society, 1916 Race St., Philadelphia, Pa. 19103)

3-5. American College of **Surgeons**, Omaha, Neb. (Communications Div., 55 E. Erie St., Chicago, Ill. 60611)

3-6. American **Physical Soc.**, New York, N.Y. (D. W. Havens, Columbia Univ., New York 10027)

3-6. American Assoc. of **Physics Teachers**, New York, N.Y. (M. W. Zemansky, The Association, 335 E. 45 St., New York 10017)

5-6. **Sanitary Engineering Conf.**, 11th, Urbana, Ill. (J. H. Austin, 3230 Civil Engineering Bldg., Univ. of Illinois, Urbana 61801)

5-7. American Acad. of **Occupational Medicine**, Boston, Mass. (B. D. Dinman, Inst. of Industrial Medicine, Univ. of Michigan Medical Center, W 5634, Ann Arbor 48104)

5-8. American **Educational Research Assoc.**, Los Angeles, Calif. (R. A. Dersheimer, The Association, 1126 16th St., NW, Washington, D.C. 20036)

10-11. **Industrial Electronics and Control Instrumentation**, Washington, D.C. (H. P. Kalmus, Harry Diamond Labs., Dept. of Army, Washington, D.C. 20438, or E. Mittelman, 549 W. Washington Blvd., Chicago, Ill. 60606)

10-11. **Transducer Symp.**, Washington, D.C. (E. Mittelman, 549 W. Washington Blvd., Chicago, Ill. 60606)

10-13. **Weed Science Soc. of America**, Las Vegas, Nev. (F. A. Holmes, E. I. du Pont de Nemours & Co., 701 Welch Rd., Palo Alto, Calif. 94304)

11-13. **Aerospace and Electronics Systems**, Los Angeles, Calif. (R. W. Gregory, Northrop Nortronics, Palos Verdes Peninsula, Calif.)

12-14. **Chemical Marketing Research**

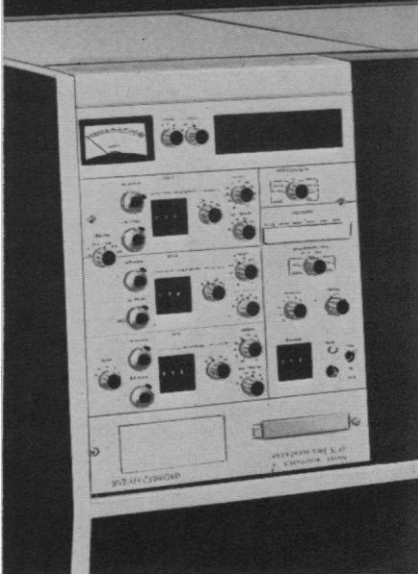
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14-15. American **Psychopathological** Assoc., 59th, New York, N.Y. (M. Fink, New York Medical College, 5 E. 102 St., New York 10029)

16-20. Soc. of **Economic Geologists**, Washington, D.C. (R. A. Laurence, P.O. Box 1549, Knoxville, Tenn. 37901)

16-20. American Inst. of **Mining, Metallurgical, and Petroleum Engineers**, 98th, Washington, D.C. (W. V. O'Connell, Public Relations, The Institute, 345 E. 47 St., New York 10017)

18-20. **Biophysical** Soc., Toronto, Ont., Canada. (W. A. Brodsky, Univ. of Louisville, Reynolds Bldg., Louisville, Ky. 40208)

18-22. American College of **Radiology**, Atlanta, Ga. (W. C. Stronach, 20 N. Wacker Dr., Chicago, Ill. 60606)

19-21. **Solid State Circuits** Conf., Philadelphia, Pa. (Office of Technical Activities, Inst. of Electrical and Electronics Engineers, 345 E. 47 St., New York 10017)

20-22. **Catalysis** Soc., 1st North American mtg., Atlantic City, N.J. (J. H. Sinfelt, Central Basic Research Lab., Esso Research and Engineering Co., P.O. Box 45, Linden, N.J. 07036)

20-22. Central **Surgical** Assoc., Chicago, Ill. (V. L. Williams, 1325 S. Grand Blvd., St. Louis, Mo. 63104)

23-28. Intersociety Committee on **Pathology**, Los Angeles, Calif. (O. Neibel, CAP, 230 N. Michigan Ave., Chicago, Ill. 60601)

26-2. American College of **Cardiology**, New York, N.Y. (W.D. Nelligan, 9650 Rockville Pike, Bethesda, Md. 20014)

27-1. **Experimental Nuclear Magnetic Resonance** Conf., 10th, Pittsburgh, Pa. (J. M. Anderson, Dept. of Chemistry and Chemical Engineering, Univ. of Illinois, Urbana 61801)

27-1. American **Physical** Soc., St. Louis, Mo. (W. W. Havens, Jr., The Society, 335 E. 45 St., New York 10017)

### March

1-7. American **Concrete** Inst., 65th, Chicago, Ill. (The Institute, 22400 W. Seven Mile Rd., Detroit, Mich. 48219)

2-7. Pittsburgh Conf. on **Analytical Chemistry and Applied Spectroscopy**, Inc., 20th, Cleveland, Ohio. (W. M. Hickam, 1969 Pittsburgh Conf., Westinghouse Research Labs., Pittsburgh, Pa. 15235)

3-5. National Conf. on **Underwater Technology**, 3rd, San Diego, Calif. (J. T. Quirk, Ocean Engineering Div., U.S. Naval Civil Engineering Lab., Port Huemene, Calif. 93041)

3-6. American Assoc. of **Junior Colleges**, Education Material and Equipment Exposition, Atlanta, Ga. (American Junior College Exposition, P.O. Box 1016, Alexandria, Va. 22313)

3-7. Symposium on **Arthritis and Related Disorders**, New York, N.Y. (Office of the Recorder, New York Univ. Post-Graduate Medical School, 550 First Ave., New York 10016)

4-6. National **Space** Mtg. of the Inst. of Navigation, Houston, Tex. (R. H. Battin, M.I.T. Instrumentation Lab., 75



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4-7. **Offshore Exploration Conf.**, 4th, San Diego, Calif. (OECON IV, P.O. Box 88, Palos Verdes Estates, Calif. 90274)

5-7. **Fundamental Cancer Research**, 23rd symp., Houston, Tex. (D. E. Anderson, Univ. of Texas, M. D. Anderson Hospital and Tumor Inst., Houston)

5-7. **Particle Accelerator Conf.**, Washington, D.C. (E. H. Eisenhower, Center for Radiation Research, Natl. Bureau of Standards, Washington, D.C. 20234)

9-11. **American Assoc. of Pathologists and Bacteriologists**, San Francisco, Calif. (K. M. Brinkhous, Dept. of Pathology, Univ. of North Carolina, School of Medicine, Chapel Hill 27514)

9-14. **American Soc. of Photogrammetry**, Washington, D.C. (G. L. Loelkes, 8608 Cherry Valley Lane, Alexandria, Va. 22309)

10-12. **Flight Test, Simulation, and Support Conf.**, 3rd., Houston, Tex. (J. C. McLane, Jr., Structures and Mechanics Div., Engineering and Development Directorate, NASA Manned Spacecraft Center, Houston 77058)

10-12. **Society of Toxicology**, Williamsburg, Va. (J. F. Borzelleca, Dept. of Pharmacology, Medical College of Virginia, Richmond 23219)

10-13. **Conference on Electric Fields in the Magnetosphere**, Houston, Tex. (J. W. Freeman, Jr., Dept. of Space Science, Rice Univ., P.O. Box 1892, Houston 77001)

10-13. **American Nuclear Soc.**, Idaho Falls, Idaho. (J. E. Kunze, General Electric Co., P.O. Box 2147, Idaho Falls 83401)

10-14. **National Assoc. of Corrosion Engineers**, 25th, Houston, Tex. (Publication Director, 980 M & M Bldg., No. 1, Main St., Houston)

11-14. **Optical Soc. of America**, San Diego, Calif. (M. E. Warga, The Society, 2100 Pennsylvania Ave., NW, Washington, D.C. 20037)

13-14. **Symposium on Automated, High-Resolution Analyses in the Clinical Lab.**, Oak Ridge, Tenn. (Oak Ridge Natl. Lab., P.O. Box X, Oak Ridge 37830)

13-15. **Conference on Nuclear Isospin**, 2nd, Asilomar, Calif. (S. D. Bloom, Lawrence Radiation Lab., P.O. Box 808, Livermore, Calif. 94550)

14-15. **American Burn Assoc.**, Atlanta, Ga. (J. A. Boswick, Cook County Hospital, 1835 W. Harrison, Chicago, Ill. 60612)

15-19. **American Acad. of Allergy**, Bal Harbour, Fla. (J. O. Kelly, 756 N. Milwaukee St., Milwaukee, Wis. 53202)

16-20. **American Inst. of Chemical Engineers**, 64th, New Orleans, La. (R. M. Persell, U.S. Dept. of Agriculture, Southern Utilization R&D Div., Box 19687, New Orleans 70119)

16-20. **American Soc. of Mechanical Engineers**, Cleveland, Ohio. (The Society, 345 E. 47 St., New York 10017)

18-19. **Central States Section of the Combustion Inst.**, Minneapolis, Minn. (B. Schukraft, Inst. of Gas Technology, 3424 S. State St., Chicago, Ill. 60616)

20-22. **American Acad. of Facial Plastic and Reconstructive Surgery**, New Orleans, La. (J. R. Anderson, 111 Tulane Ave., New Orleans 70112)

23-29. **American Crystallographic**



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24-25. **Laser Safety** Conf. and Workshops, 2nd, Cincinnati, Ohio. (L. Goldman, Laser Lab., Children's Hospital Research Foundation of the Medical Center of the Univ. of Cincinnati, Cincinnati 45229)

24-27. American **Physical** Soc., Philadelphia, Pa. (W. W. Havens, Jr., The Society, 335 E. 45 St., New York 10017)

24-28. **Desalination: Methods and Applications**, Berkeley, Calif. (Continuing Education in Engineering, Univ. Extension, Univ. of California, 2223 Fulton St., Berkeley 94720)

25-27. American **Laryngological, Rhinological and Otological** Soc., Inc., New Orleans, La. (V. R. Alfaro, 917 20th St., NW, Washington, D.C. 20006)

26-28. National **Business Aircraft** Mfg. and Engineering Display, Wichita, Kan. (A. J. Favata, SAE Headquarters, 2 Pennsylvania Plaza, New York 10001)

26-28. Symposium on the **Engineering Aspects of Magnetohydrodynamics**, 10th, Cambridge, Mass. (J. Klepeis, Arrangements Committee, Avco Everett Research Lab., 2385 Revere Beach Parkway, Everett, Mass. 02149)

26-28. **George H. Hudson** Symp., 4th, Plattsburgh, N.Y. (M. H. Tourin, State Univ. College of Arts and Sciences, Plattsburgh 12901)

27-28. **Technical Writing** Inst., Lubbock, Tex. (M. Miles, Technical Writing Inst., Dept. of English, Texas Technological College, Lubbock 79409)

28-29. American **Otological** Soc., Inc., New Orleans, La. (W. H. Bradley, 1100 E. Genesee St., Syracuse, N.Y.)

28-30. American **Psychosomatic** Soc., Inc., 26th, Cincinnati, Ohio. (H. Weiner, 265 Nassau Rd., Roosevelt, N.Y. 11575)

30-2. American **Orthopsychiatric** Assoc., New York, N.Y. (M. F. Langer, Room 1313, 1790 Broadway, New York 10019)

31-2. **Advances in Water Quality Improvement**—Physical and Chemical Processes, Austin, Tex. (Center for Research in Water Resources, Univ. of Texas, Rt. 4, Box 189, Austin 78757)

31-2. **Metals Engineering** Conf., Washington, D.C. (R. J. Cepluch, Hartford Steam Boiler Inspection and Insurance Co., 56 Prospect St., Hartford, Conn. 06102)

31-2. American Assoc. of **Thoracic Surgery**, San Francisco, Calif. (T. B. Ferguson, Suite 311, 7730 Carondelet Ave., St. Louis, Mo. 63110)

#### International and Foreign Meetings

##### February

18-21. International **Oceanological Equipment and Services** Exhibition, Brighton, England. (BPS Exhibitions Ltd., Oceanology International 69, 6 London Street, London, W.2)

19-21. International **Solid-State Circuits** Conf., Philadelphia, Pa. (J. H. Wuorinen, Bell Telephone Labs., Murray Hill, N.J. 07971)

23-27. Pan American Congr. for **Psychoanalysis**, 4th, New York, N.Y. (H. Montessori, Intern. Psychoanalytical As-



soc., 2B Prins Hendriklaan, Amsterdam Z, Netherlands)

27-28. Congress of Intern. Inst. for **Sugar Beet Research**, 32nd, Brussels, Belgium. (The Institute, 150 rue Beauduin, Tirlemont, Belgium)

#### March

2-6. International Soc. of **Anesthesia Research**, 43rd, Bal Harbour, Fla. (B. B. Sankey, 3645 Warrensville Center Rd., Cleveland, Ohio 44122)

3-6. Symposium on **Protein Structure and Function**, St. Marguerite, P.Q., Canada. (T. H. G. Michael, Chemistry Inst. of Canada, 151 Slater St., Ottawa 4, Ont.)

7-12. International Acad. of **Pathology**, 58th, San Francisco, Calif. (P. K. Mostofi, % Armed Forces Inst. of Pathology, Washington, D.C. 20305)

9-11. International Conf. and Exposition on **Urban Transportation**, Pittsburgh Pa. (Pittsburgh Urban Transit Council, 945 Union Trust Bldg., Pittsburgh 15219)

9-22. International Postgraduate Congr. for **Practical Medicine**, Daves, Switzerland. (W. Brune, Kongressburo der Bundesärztekammer, Haedenkampstr. 1 5000 Koln-Lindenthal, Germany)

10-12. International Conf. on **Urban Transportation**, 4th, Pittsburgh, Pa. (G. R. Schaefer, WABCO Mass Transit Center, Westinghouse Air Brake Co., Pittsburgh)

12-13. Conference on **Safety on Construction Site**, London, England. (Institution of Civil Engineers, Great George St., London, S.W.1)

17-18. International Symp. of **High-speed Testing: The Rheology of Solids**, Boston, Mass. (R. H. Supnik, % Plas-Tech Equipment Corp., 4 Mercer Rd., Natick, Mass. 01760)

20-23. International Assoc. for **Dental Research**, 47th, Houston, Tex. (A. D. Frechette, 211 E. Chicago Ave., Chicago, Ill. 60611)

24-27. International Convention of Inst. of **Electrical and Electronics Engineers**, New York, N.Y. (The Convention, 345 E. 47 St., New York 10017)

25-28. **Autoclaved Building Products**, 2nd intern. symp., Hanover, Germany. (Secretary, Second Intern. Symp. 1969, "Haus der Kalksandstein-industrie," Postfach 66, 3 Hanover-Herrenhausen)

25-28. **Liquefied Natural Gas**, London, England. (Conference Dept., Inst. of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.1)

27-28. International Congr. for **Heating, Ventilating, Air Conditioning**, 19th, Frankfurt am Main, Germany. (S. Ausschuss, Kongress für Heizung, Luftung, Klimatechnik, Kongressburo, Königstr. 5, 4 Dusseldorf 1, Germany)

31-4. International Symp. on **Concrete Bridge Design**, 2nd, Chicago, Ill. (American Concrete Inst., P.O. Box 4754, Redford Sta., 22400 W. Seven Mile Rd., Detroit, Mich. 48219)

#### April

7-11. Federation of European **Biochemical Societies**, 6th, Madrid, Spain. (Secretariat, Centro de Investigaciones Biológicas, Velazquez, 144, Madrid 6)

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8-11. International Symp. on **Laboratory Animals**, Washington, D.C. (B. F. Hill, Charles River Breeding Labs., Inc., Wilmington, Mass.)

9-12. **British Medical Assoc.**, clinical mtg., Valletta, Malta. (British Medical Assoc. House, Tavistock Sq., London, W.C.1, England)

14-17. **Cleft Palate**, intern. congr., Houston, Tex. (B. J. McWilliams, Cleft Palate Research Center, Univ. of Pittsburgh, 313 Salk Hall, Pittsburgh, Pa. 15213)

15-17. **Civil Engineering Problems of the South Wales Valleys**, Cardiff, England. (Institution of Civil Engineers, Great George St., London, S.W.1, England)

15-18. International **Magnetics Conf.**, Amsterdam, Netherlands. (T. Holtwijk, Philips Research Labs., Eindhoven, Netherlands)

17-18. British Inst. of **Radiology**, London, England. (British Inst. of Radiology, 32 Welbeck St., London, W.1)

19-27. Yugoslav Seminar and Exhibition of **Regulation, Measuring and Automation-Jurema** 1969, 14th, Zagreb. (Jurema, Unska U1, P.O.B. 123, Zagreb)

21-23. Canadian Inst. of **Mining and Metallurgy**, 71st, Montreal, Canada. (Executive Director, The Institute, Suite 906, 1117 St. Catherine St. W., Montreal 2, P.Q.)

21-25. **Switching Techniques for Telecommunication Networks**, London, England. (Conference Dept., Institution of Electrical Engineers, London, W.C.2)

21-26. Canadian **Pulp and Paper Assoc.**, 10th, Vancouver, B.C. (W. K. Voss, Ontario Paper Co. Ltd., Thorold, Ont.)

22-25. **Cotton Textile Research**, 1st intern. symp., Paris, France. (Institut Textile de France, 23 rue des Abondances, 92, Boulogne, France)

22-29. **Hydrology of Deltas**, intern. symp., Bucharest, Rumania. (A. I. Johnson, Water Resources Div., U.S. Geological Survey, Federal Center, Denver, Colo. 80225)

28-2. Symposium on **Radiation-Induced Carcinogenesis**, Athens, Greece. (R. N. Mukherjee, Unit of Radiation Biology, Intern. Atomic Energy Agency, Karntner Ring 11-13, A-1010 Vienna, Austria)

#### May

5-8. **Instrumentation in Aerospace Simulation Facilities**, 3rd intern. congr., Farmingdale, N.Y. (C. R. Spitzer, MS-236, NASA Langley Research Center, Hampton, Va. 23365)

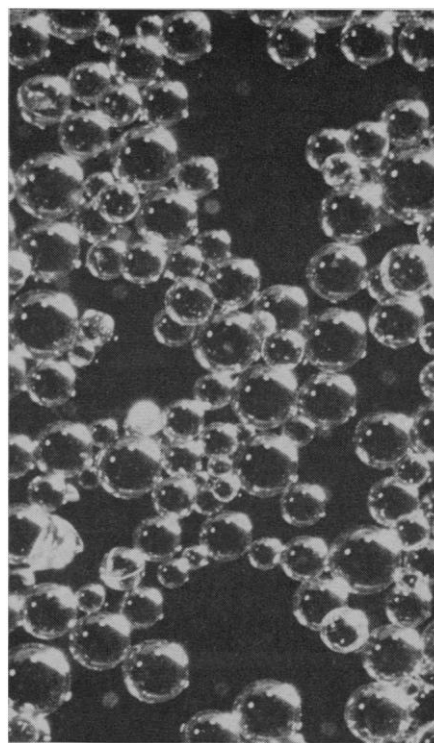
5-8. International **Microwave Symp.**, Dallas, Tex. (J. B. Horton, MS 905, Texas Instrument Co., Box 5012, Dallas 75222)

5-9. Commonwealth **Mining and Metallurgical Congr.**, 9th, London, England. (Congress Secretary, Commonwealth Council of Mining and Metallurgical Institutions, 44 Portland Pl., London, W.1, England)

6-8. **Nuclear Electronics Symp.**, Ispra, Italy. (L. Stanchi, C.C.R. Euratom, 21020 Ispra)

6-8. **Power Thyristors and Their Applications**, London, England. (Conference Dept., Institution of Electrical Engineers, Savoy Pl., London, W.C.2, England)

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