Pathology of the Syrian Hamster

Progress in Experimental Tumor Research

Vol. 16


S. Karger • Basel • München • Paris • London • New York • Sydney

Symposium on Hamster Pathology held at the Museum of Science, Boston, Mass., November 18-20, 1970
Pathology of the Syrian Hamster


With 279 figures and 53 tables

S. Karger • Basel • München • Paris • London • New York • Sydney • 1972

Progress in Experimental Tumor Research

Vol. 1: XVI+476 p., 166 fig., 44 tab., 1 cpl., 1960
Vol. 2: XIV+386 p., 220 fig., 48 tab., 1961
Vol. 4: XII+320 p., 169 fig., 41 tab., 1964
Vol. 5: XII+308 p., 85 fig., 48 tab., 1964
Vol. 6: XII+340 p., 45 fig., 34 tab., 1965
Vol. 7: VIII+352 p., 43 fig., 26 tab., 1965
Vol. 8: VI+297 p., 93 fig., 36 tab., 1966
Vol. 9: X+341 p., 85 fig., 25 tab., 1967
Vol. 10: X+293 p., 40 fig., 15 tab., 1968
Vol. 11: XII+496 p., 92 fig., 73 tab., 1 cpl., 1969
Vol. 14: Inhibition of Carcinogenesis, X+241 p., 34 fig., 20 tab., 1971
Vol. 15: Plant Tumor Research. X+235 p., 32 fig., 2 tab., 1972

S. Karger • Basel • München • Paris • London • New York • Sydney
Arnold-Böcklin-Strasse 25, CH-4000 Basel 11 (Switzerland)
Table of Contents
List of Participants VII
Dedication XII
Editor's Foreword XIII

History, Husbandry, General Pathology

Yerganian, G. (Boston, Mass.): History and Cytogenetics of Hamsters 2
Slater, G. M. (Newfield, N.J.): The Care and Feeding of the Syrian Hamster 42
Chesterman, F. C. (London): Background Pathology in a Colony of Golden Hamsters 50
Homburger, F. (Cambridge, Mass.): Disease Models in Syrian Hamsters 69
Friedell, G. H. and Bannon, P. D. (Worcester, Mass.): Experimental Studies of Anemia in Golden Hamsters 87
Stewart, H. L. (Bethesda, Md.): Cancer and Comparative Pathology (After-Dinner Speech) 142

Oncology, Toxicology

Homburger, F. (Cambridge, Mass.): Chemical Carcinogenesis in Syrian Hamsters 152
Shubik, P. (Omaha, Nebr.): The Use of the Syrian Golden Hamster in Chronic Toxicity Testing 176
Nettesheim, P. (Oak Ridge, Tenn.): Respiratory Carcinogenesis Studies with the Syrian Golden Hamster: A Review 185
Kirkman, H. (Stanford, Calif.): Hormone-Related Tumors in Syrian Hamsters 201

Table of Contents VI
Cardiovascular and Pulmonary Pathology

Gertz, E. W. (Boston, Mass.) : Cardiomyopathic Syrian Hamster : A Possible Model of Human Disease 242
Abelmann, W. H.; Jeffrey, F. E. and Wagner, R. (Boston, Mass.): Circulatory Dynamics in Heart Failure of Syrian Hamsters 261
Caulfield, J. B. (Boston, Mass.): Striated Muscle Lesions in Dystrophic Hamsters 274
Kleinerman, J. (Cleveland, Ohio): Some Aspects of Pulmonary Pathology in the Syrian Hamster 287
Frenkel, J. K. (Kansas City, Kans.): Dissecting Aneurysms of the Aorta, and Pancreatic Islet Cell Hyperplasia with Diabetes in Corticosteroid- and Chlorothiazide-Treated Hamsters 300

Infections and Immunity

Frenkel, J. K. (Kansas City, Kans.): Infection and Immunity in Hamsters 326
Handler, A. H. (Boston, Mass.): Studies of Cardiac Allografts in Syrian Hamsters 368
Greenblatt, M. (Omaha, Nebr.): Hamster Cheek Pouch Chamber: Homograft Studies of Normal and Neoplastic Tissues 380

Virology

Toolan, H. W. (Bennington, Vt.): The Parvoviruses 410
Chesterman, F. C. ; Harvey, J. J. ; Branca, M. ; Phillips, D. E. H. ; Hallowes, R. C. and Bassin, R. H. (Harrow): Tumors and Other Lesions Induced by Murine Sarcoma Viruses 426
Eddy, B. E. (Bethesda, Md.): Viral Infectivity or Oncogenicity Due to Viruses in Hamsters 454
Berman, L. D. and Black, P. H. (Boston, Mass.): Morphologic Reflections of Viral Genome Activity in Viral Oncogenesis of Hamsters 497

Dental Pathology

Shklar, G. (Boston, Mass.): Experimental Oral Pathology in the Syrian Hamster 518
Jordan, H. V. and van Houte, J. (Boston, Mass.): The Hamster as an Experimental Model for Odontopathic Infections 539

A Tumor Registry for Neoplasms Reported in Syrian Hamsters
List of Participants

Abelmann,1,2 Walter H., M.D., Thorndike Memorial Laboratory, Boston City Hospital, 818 Harrison Avenue, Boston, MA 02118 (USA)
Anastor, Barbara J, Lakeview Hamster Colony, P.O. Box 85, Newfield, NJ 08344 (USA)
Anderson, Jeff, Department of Animal Pathology, 232 Woodward Hall, University of Rhode Island, Kingston, RI 02881 (USA)
Anver, Miriam, Harvard Medical School, 25 Shattuck Street, Boston, MA 02115 (USA)
Bannon, Paul, St. Vincent Hospital, Worcester, MA 01610 (USA)
Barnett, Michael, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Benjamin, Stephen A., D.V.M., Ph.D., Lovelace Foundation, 5200 Gibson Blvd., S.E., Albuquerque, NM 87108 (USA)
Berman,1 Herbert J., Biological Science Center, Boston University, 2 Cummington Street, Boston, MA 02215 (USA)
Berman,1 Leonard D., M.D., Mallory Institute of Pathology, Boston City Hospital, Boston, MA 02118 (USA)
Bernfeld, Peter, Ph.D., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Bieber, Robert E., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Boger, Eliahu, Ph.D., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Bokdawala, Freny, Department of Pathology, University of Montreal, P.O. Box 6128, Montreal (Canada)
Brewer, N. R., D.V.M., Ph.D., 5526 Blackstone Avenue, Chicago, IL 60637 (USA)
Cappiello, Vincent P., Dr., New York University Medical Center, 550 First Avenue, New York, NY 10016 (USA)
Cassidy, Peggy, Biological Science Center, Boston University, 2 Cummington Street, Boston, MA 02215 (USA)

1 Speaker
2 Chairman

List of Participants VIII
Caubel, Micheline, M.D., Institut de Recherches Scientifiques sur le Cancer, Boîte Postale No. 8, 94 Villejuif (France)

Caulfield, James B., M.D., Department of Pathology, Massachusetts General Hospital, Boston, MA 02114 (USA)

Chesterman, F.C., Dr., Department of Environmental, Carcinogenesis, Imperial Cancer Research Fund, Burtonhole Lane, London, N.W. 7 (England)

Davis, G. W., Dr., Department of Veterinary Pathology, The Ohio State University, 1925 Coffey Road, Columbus, OH 43210 (USA)

Drobeck, Hans P., Dr., Sterling-Winthrop Research Institute, Columbia Turnpike, Rensselaer, NY 12144 (USA)

Duran-Reynals, Maria, Sc.D., Yeshiva University, 131 East 73rd Street, New York, NY 10016 (USA)

Eddy, Bernice E., Ph.D., Division of Biologics Standards, National Institutes of Health, Bethesda, MD 20014 (USA)

Eddy, Hubert A., Ph.D., School of Medicine and Dentistry, University of Rochester, 260 Crittenden Blvd., Rochester, NY 14620 (USA)

Ellen, Richard, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)

Farrell, Robert, Dr., Department of Veterinary Pathology, The Ohio State University, 1925 Coffey Road, Columbus, OH 43210 (USA)

Feron, V. J., Dr., Central Institute for Nutrition and Food Research TNO (CIVO), Utrechtsweg 48, Zeist, The Netherlands

Foster, Henry, Dr., The Charles River Breeding Laboratories, Inc., 251 Ballardvale Street, Wilmington, MA 01887 (USA)

Freeman, Aaron E., Dr., Microbiological Associates, 4813 Bethesda Avenue, Bethesda, MD 20014 (USA)

Frenkel, J. K., M.D., University of Kansas Medical Center, Rainbow Blvd. at 39th Street, Kansas City, KS 66103 (USA)

Friedell, Gilbert H., M.D., Department of Pathology, St. Vincent Hospital, Worcester, MA 01610 (USA)

Fulton, George P., Ph.D., Biological Science Center, Boston University, 2 Cummingston Street, Boston, MA 02215 (USA)

Galvin, Paulette, Biological Science Center, Boston University, 2 Cummingston Street, Boston, MA 02215 (USA)

Gertz, Edward W., M.D., Bio-Research Institute, Inc., 48 Cummingston Street, Boston, MA 02215 (USA)

Greenblatt, Melvin, M.D., University of Nebraska Medical Center, Omaha, NB 68105 (USA)

Handler, Alfred H., Ph.D., Boston University School of Medicine, 80 East Concord Street, Boston, MA 02118 (USA)

Haverland, Loren H., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge,
MA 02141 (USA)
Hemm, Roger D., Ph.D., Division of Biological Research, G.D. Searle & Co., P.O. Box 5110, Chicago, IL 60680 (USA)

1 Speaker
2 Chairman

List of Participants IX

Hobbs, Charles H., D.V.M., Lovelace Foundation, 5200 Gibson Blvd., S.E., Albuquerque, NM 87108 (USA)
Hoffman, Carolyn, Bio-Research Institute, Inc., 48 Cummingston Street, Boston, MA 02215 (USA)
Homburger,1,2 Freddy, M.D., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Howland, Peter A., Heart Station, Boston City Hospital, 818 Harrison Avenue, Boston, MA 02118 (USA)
Hsueh, Shung-Shing, Bio-Research Institute, Inc., 48 Cummingston Street, Boston, MA 02215 (USA)
Hubert, Doras D., Dr., Health Research Institute, Fairleigh Dickinson University, 285 Madison Avenue, Madison, NJ 07940 (USA)
Jasty, V., Department of Animal Pathology, 232 Woodward Hall, University of Rhode Island, Kingston, RI 02881 (USA)
Jones, Curt, Heart Station, Boston City Hospital, 818 Harrison Avenue, Boston, MA 02118 (USA)
Jordan,1 Harold V., Ph.D., Forsyth Dental Center, 140 Fenway, Boston, MA 02115 (USA)
Kallio, Donald, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Kerr, Clare S., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Kirkman,1,2 Hadley, Ph.D., School of Medicine, Stanford University, Stanford, CA 94305 (USA)
Kleinerman,1 Jerome, M.D., Saint Luke’s Hospital, 11311 Shaker Blvd., Cleveland, OH 44104 (USA)
Kreisher, John H., Dr., Council for Tobacco Research - U.S.A., 110 East 59th Street, New York, NY 10022 (USA)
Levkov, Mary Ann, Bio-Research Institute, Inc., 48 Cummingston Street, Boston, MA 02215 (USA)
McTighe, Arthur H., M.D., United States Public Health Service, 12720 Twinbrook Parkway, Rockville, MD 20852 (USA)
Merk, Linda P., Dr., Children’s Cancer Research Foundation, 462 Brookline Avenue,
Boston, MA 02115 (USA)
Miller, Carl E., Dr., National Institutes of Health, Bldg. 29, Room 432, Bethesda, MD 20014 (USA)
Miller, Linda, Massachusetts Institute of Technology, Cambridge, MA 02139 (USA)
Mirski, Marcia, Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Moore, John A., Dr., DHEW - NIH - NIEHS, P.O. Box 12233, Research Triangle Park, NC 27709 (USA)
Murphy, James C., Dr., New England Medical Center Hospitals, 171 Harrison Avenue, Boston, MA 02111 (USA)
Murphy, Michael, Massachusetts Institute of Technology, Cambridge, MA 02139 (USA)

1 Speaker
2 Chairman

List of Participants X

Murray, William S., Sc.D., TELACO, Bar Harbor, ME 04609 (USA)
Nettesheim,1 Paul, M.D., Oak Ridge National Laboratory, P.O. Box Y, Oak Ridge, TN 37830 (USA)
Pendola, Richard G., Department of Animal Pathology, University of Rhode Island, 232 Woodward Hall, Kingston, RI 02881 (USA)
Price, Paul, Dr., Microbiological Associates, 4813 Bethesda Avenue, Bethesda, MD 20014 (USA)
Rogers, Adriane E., M.D., Massachusetts Institute of Technology, 50 Ames Street, E18-615, Cambridge, MA 02139 (USA)
Rosenoer, Leonie, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Rys, Henry V., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Saad, Farida, Biological Science Center, Boston University, 2 Cummingston Street, Boston, MA 02215 (USA)
Saffiotti, Umberto, M.D. (Discussser), National Cancer Institute, National Institutes of Health, Bethesda, MD 20014 (USA)
Schwartz, Ann, Heart Station, Boston City Hospital, 818 Harrison Avenue, Boston, MA 02118 (USA)
Sellakumar, A., Dr., University of Nebraska Medical Center, 42nd and Dewey Avenue, Omaha, NB 68105 (USA)
Shklar,1 Gerald, D.D.S., M.S., Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Shubik,1’2 Philippe, Ph.D., University of Nebraska Medical Center, 42nd and Dewey Avenue, Omaha, NB 68105 (USA)
Slater, Gilbert M., Lakeview Hamster Colony, P.O. Box 85, Newfield, NJ 08344 (USA)
Smith, George D., University of California Medical Center, Hooper Foundation, San Francisco, CA 94122 (USA)
Somogyi, Arpad, Dr., Department of Biochemistry, Hoffmann-La Roche, Inc., Nutley, NJ 07110 (USA)
Sperounis, Jeanne, Bio-Research Institute, Inc., 48 Cummingston Street, Boston, MA 02215 (USA)
Stewart, Harold L., M.D., National Cancer Institute, National Institutes of Health, Bethesda, MD 20014 (USA)
Streilein, J. Wayne, M.D., School of Medicine, University of Pennsylvania, Philadelphia, PA 19104 (USA)
Sumney, David, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Terman, Stanley A., Ph.D., Department of Zoology, The University of Iowa, Iowa City, IA 52240 (USA)
Tolanyi, Michael, Dr., American Optical Co., Inc., Framingham, MA 01701 (USA)
Toolan, Helene Wallace, Ph.D., Putnam Memorial Hospital Institute for Medical Research, Bennington, VT 05201 (USA)

1 Speaker
2 Chairman

List of Participants XI

Treger, Abraham, Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Van Dongen, Cornelis, Ph.D., Bio-Research Institute, Inc., 9 Commercial Avenue, Cambridge, MA 02141 (USA)
Wagner, Richard L., Heart Station, Boston City Hospital, 818 Harrison Avenue, Boston, MA 02118 (USA)
Williams, Ray, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, MA 02115 (USA)
Yerganian, George, Ph.D., Children’s Cancer Research Foundation, 35 Binney Street, Boston, MA 02115 (USA)

1 Speaker

This volume is dedicated to
C. C. Little (1888-1971)

Late founder and first Director of Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Maine (now The Jackson Laboratory), who in 1941 predicted
(speaking of mice) that, ‘With inbred strains now available there is
a whole new field of attack, not only on the problems of experimental cancer,
but on those of the nature of individuality and of the fundamental processes
of ontogeny.’

and to
William S. Murray (1899-1971)

One of the pioneers in mammalian genetic research, late Associate
Director emeritus of The Jackson Laboratory, and co-founder, General
Manager and Treasurer of TELACO®, Bar Harbor, Maine, first commercial
producer of inbred Syrian BIO® hamsters.

Editor’s Foreword

This book is the result of many discussions among the members of the
Editorial Committee, George P. Fulton, Alfred H. Handler, F. Homburger
and Agnes Russfield who, each in his own field - microcirculation, transplantation,
virology, experimental comparative pathology and endocrinology
- has made extensive use of Syrian hamsters. All of us felt a need for
a reference work which would contain most of today’s available knowledge
on the pathology of Syrian hamsters. We also realized that no one
person could singlehandedly write such a volume and agreed that it could
best emerge from a meeting of those now actively engaged in research using
Syrian hamsters.

In these days of limited research support it was most difficult to obtain
funds for such a meeting and subsequent publication. After rejection of our
applications to the usual major sources for such moneys we decided to appeal
to drug houses and to our long-time friend and publisher, Thomas
Karger. Also, we limited travel subsidies for speakers and obtained registration
fees from most of the participants. The contributing sponsors are
most gratefully acknowledged below.

Nearly one hundred persons participated in the symposium, which was
held November 18th-20th, 1970, at the Museum of Science, Boston, with one
evening session at the Harvard Club of Boston. The response of the participants
was enthusiastic and we hope to repeat this kind of symposium at
intervals of two to three years, thereby updating these volumes on hamster
pathology. Since Syrian hamsters have an important role in carcinogenesis,
tumor transplantation and oncogenic virus studies, it is appropriate that
these volumes on hamster pathology become part of the well established
series, Progress in Experimental Tumor Research, even though the subjects covered in this serial publication range far afield from oncology.

We wish to thank the sponsors of this symposium, especially the publisher, not only for his financial support but also for his generous cooperation in other respects. We also express our appreciation to the participants for their promptness in submitting their papers and to Mrs. Mary Miller, editorial assistant, for her careful polishing of the manuscripts.

On behalf of the Editorial Committee,

F. Homburger, M.D.
Editor
Bio-Research Institute, Inc.
Cambridge, Mass., U.S.A.

Sponsors
Hoffmann-LaRoche, Inc., Nutley, New Jersey
The Interstate Drug Exchange, Inc., Plainview, L.I., New York
Johnson & Johnson, New Brunswick, New Jersey
S. Karger AG, Basel, Switzerland
The Sciences and Arts Foundation, Dedham, Mass.

Message of Welcome

by
The Honorable Elliot L. Richardson,
Secretary of Health, Education and Welfare,
Washington, D.C.

It is at best difficult for a layman to gauge the full significance of developments in the complex fields of biomedical research. Too often, I fear, we tend to grasp onto the dramatic and sensational achievements of medical science and overlook the more fundamental work that makes them possible. We seize on news of drugs that promise the control of cancer or heart disease, or on new insights into the cause of these and other afflictions, but we neglect, because we cannot appreciate, the arduous labors of those scientists whose work lays the foundations for such brilliant flashes of success. I have had the good fortune, in my personal life and my public life, to come close to the corridors of biomedical research, to the places where patient men and women forge the tools and the knowledge of which success is made. I know, with you who are participating in this symposium, that
the control of disease will come, as it must, from the continual, painstaking, often unheralded growth of man’s understanding of nature. In the intricate, almost awesome, environment of computers, of electron microscopes, of unbelievably sensitive devices with which to find, measure, and understand biological processes, one tends to forget that it is living things - cells, animals, people - toward which all this power and energy are directed. Without the model of life itself, facts pile up in formless masses that bring us no closer to the goal of understanding, no closer to the conquest of disease. You who are attending this symposium are helping to perfect a tool no less powerful, no less essential than the most sophisticated electronic device. Strains of laboratory animals, the Syrian hamster prominent among them, are literally revolutionizing our understanding of biology. Without them, and without the work of scientists like yourselves, mankind, even in this age of technological marvels, would be all but powerless to move toward the goal of health, of freedom from disease, of coexistence with the natural world of which we are a part.

Your research is a vital link in the chain of understanding that science seeks endlessly to pay out. I wish for you a successful and productive meeting, for I know that the well-being of mankind depends in no small way on your work.

Elliot Richardson
Secretary