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Statement of Dr. Jerrold M. Ward Concerning the Carcinogenicity of
Ethylene Oxide in Rats

I have reviewed reports of the NIOSH and Bushy Run inhalation carcinogenesis bioassays of ethylene oxide in rats and the published paper by Dunkelberg, (Brit. J. Cancer, Volume 46, pages 924-933, 1982) on the chronic intragastric administration of ethylene oxide in rats. Also, I reviewed selected microscope slides of the mononuclear cell leukemias and mesotheliomas in rats of the Bushy Run study on January 28, 1981.

It is my opinion that the 3 bioassays provide significant evidence for the carcinogenicity of ethylene oxide. In the Bushy Run Study, the increased incidences of mononuclear cell leukemia in female and male rats, mesothelioma in male rats, and brain tumors in male and female rats were associated with exposure to ethylene oxide. In the NIOSH study, the incidence of leukemia was not related to ethylene oxide exposure as presented in the report's table. My conclusion regarding the possible increase in incidence of leukemia, however, awaits for the analysis of the data since mortality was greatest in rats exposed to ethylene oxide. Brain tumor incidence was increased in rats exposed to ethylene oxide in the NIOSH study. In the Dunkelberg study, ethylene oxide induced a dose-dependent incidence of squamous cell carcinomas of the stomach.

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CURRICULUM VITAE

Name: Jerrold Michael Ward

Date of Birth: October 29, 1942

Citizenship: United States

Marital Status: Married, 2 children

Education:

- 1970 Ph.D. Comparative Pathology, University of California,
Davis
1966 D.V.M. Cornell University, Ithaca, New York

Chronology of Employment:

- 1966 - 1970 Research Pathologist and NIH Trainee, Department
of Microbiology Pathology, School of Veterinary Medicine
University of California, Davis
- 1970 - 1971 Supervisory Veterinary Medical Officer, Bureau of
Radiological Health, DHEN, DHS, Rockville, MD
- 1971 - 1972 Supervisory Veterinary Medical Officer (Veterinary
Pathologist), Division of Research and Monitoring, Radiation
Programs, Environmental Protection Agency, Rockville, MD
- 1972 - 1974 Supervisory Veterinary Medical Officer (Veterinary
Pathologist), Carcinogen Metabolism and Toxicology Branch,
Carcinogenesis, Division of Cancer Cause and Prevention,
(DCCP), National Cancer Institute (NCI), National Institutes
of Health (NIH), Bethesda, MD
- 1974 - 1977 Supervisory Veterinary Medical Officer (Veterinary
Pathologist), Laboratory of Toxicology, Division of Cancer
Treatment, NCI, NIH, Bethesda, MD
- 1977 - 1978 Veterinary Medical Officer (Veterinary Pathologist),
Tumor Pathology Branch, Carcinogenesis Testing Program,
Division of Cancer Cause and Prevention, NCI, NIH, Bethesda,
MD
- 1978 - Acting Chief, Tumor Pathology Branch, Carcinogenesis
Testing Program, DCCP, NCI, NIH, Bethesda, MD
- 1978 - Program Leader, Tumor Pathology, National Toxicology Program,
NCI, NIH, Bethesda, MD
- 1980 - 1981 Chief, Tumor Pathology, National Toxicology Program,
NCI, NIH, Bethesda, MD
- 1981 Chief, Tumor Pathology and Pathogenesis Section,
Laboratory of Comparative Carcinogenesis, DCCP, NCI, Frederick,
MD

Teaching Experience

- 1968 - 1970 Graduate Assistant, Department of Veterinary Pathology,
School of Veterinary Medicine
University of California-Davis
- 1975 - 1980 Faculty, Foundation for Advanced Education in the Sciences,
Comparative Pathology Course
Bethesda, Maryland
- 1978 - 1980 The Center for Professional Advancement, Carcinogenesis/
Mutagenesis Course
East Brunswick, New Jersey
- 1979 Lecturer, Department of Pathology, Uniformed Services
University of the Health Sciences, Bethesda, Maryland
- 1981 - Lecturer, Pathology of Tumors of Rats, Armed Forces
Institute of Pathology Course on Pathology of Laboratory
Animals, Washington, D.C.
- 1981 - 1982 Adjunct Associate Professor of Pathology, The George
Washington University School of Medicine and Health
Sciences, Washington, D.C.
- 1981 Faculty, Endocrine Histopathology of Laboratory Animals
Seminar, International Life Sciences Institute and
Institute of Experimental Pathology, Hannover Medical
School, Hannover, West Germany
- 1982 Faculty, Neoplastic and Nonneoplastic Lesions in Mice,
Intox Laboratories, Arlington, Virginia, June, 1982
- 1983 Faculty, Endocrine Histopathology Seminar, Nara Medical
University and International Life Sciences Institute,
Nara, Japan
- 1983 Faculty, Endocrine Histopathology Seminar, Harvard
Medical School and International Life Sciences
Institute, Boston, Massachusetts

Professional Organizations

- Diplomate, American College of Veterinary Pathologists
- American Veterinary Medical Association
- International Academy of Pathology
- American Association for Cancer Research

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Awards

- 1966 Cornell University Clinical Conference Award
- 1974 National Academy of Sciences Travel Grant to the International
Cancer Congress, Florence, Italy
- 1979 Special Achievement Group Award, NCI Carcinogenesis Testing
Program

Service on Boards or Committees

- 1975 - 1981 Editorial Board, VETERINARY PATHOLOGY
- 1976 - 1978 Chairman and Organizer, Viral Specialty Group,
American College of Veterinary Pathologists
- 1978 Member, Education Committee - Carcinogenesis, American
College of Veterinary Pathologists
- 1979 Co-Chairman, Infectious Disease Specialty Group, American
College of Veterinary Pathologists
- 1981 Editorial Board, PATHOLOGY OF LABORATORY ANIMALS
(International Life Sciences Institute)

Professional Advisory and Consultant Activities

Member, Discussion Group-Criteria for Tumor Diagnosis and Classification of Malignancy. Conference on Carcinogenesis Testing in the Development of New Drugs, May 23-25, 1973, Washington, DC, National Academy of Sciences.

Member, FDA, FD&C Red No. 40 Second Interim Working Group, December, 1977-1981.

Consultant and Expert Witness, FDA Hearing on Denial of Petition for Listing of FD&C Red No. 4 for Use in Marishino Cherries and Ingested Drugs, April 12, 1978, Rockville, Maryland.

Member, FDA Interagency Committee on Nitrite Research, 1978-1981.

Member, Project Group on Standardization of Measurements and Tests, Task Force on Cancer and Heart and Lung Disease, Environmental Protection Agency, 1979.

Consultant, Scientific Advisory Board, National Center for Toxicological Research, Jefferson, Arkansas, 1979.

Member, Mouse Lymphoma Study Group, 1979. Sponsored by the Nutrition Foundation.

Consultant, Division of Pathology, Bureau of Foods, Food and Drug Administration, 1978-1982.

Member, Working Group on Evaluation of Carcinogenic Risk of Chemicals to Man, International Agency for Research in Cancer, Lyon, France, February 10-17, 1981.

Consultant and Expert Witness, FDA Hearing on Proposal to Withdraw Approval of Certain New Animal Drug Applications: Furazolidone (NF-160), 1978-

Alternate Member, TSCA Interagency Testing Committee, 1981-

Consultant, Carcinogen Identification and Risk Assessment Branch, Occupational, Safety and Health Administration, Dept. of Labor, Washington, D.C., 1979-1981

Expert Witness, State of California, Department of Health, OSHA, Sacramento, California, November 12, 1981, Hearing on Standards for Occupational Exposure Levels to 1,2-Dibromoethane.

Consultant, Chemical Pathology Branch, National Toxicology Program, National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, 1982-

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Invited Lectures and Seminars

Animal Medical Center, New York, N.Y., "Feline Infectious Peritonitis," July, 1968.

Armed Forces Institute of Pathology, Washington, D.C., Pathology of Laboratory Animals Course, "Diseases of the Cat," September, 1972.

American College Vet. Pathology, Annual Meeting, Chicago, Illinois, "Hepatic Lesions Induced by Azoxymethane," December, 1974.

New York State Veterinary College, Cornell University, Ithaca, N.Y., "Feline Infectious Peritonitis," April 1975.

Washington State University College of Veterinary Medicine, Pullman, Washington, "Feline Infectious Peritonitis," December, 1975.

Angell Memorial Animal Hospital, Boston, Massachusetts, "Feline Infectious Peritonitis," March, 1976.

Armed Forces Institute of Pathology, Washington, D.C., Comparative Pathology Course, "Model Studies into the Etiology and Pathogenesis of Naturally-Occurring Cancer," May, 1976.

Armed Forces Institute of Pathology, Washington, D.C., Pathology of Laboratory Animals Course, "Viral Diseases of Cats," September, 1976.

American College of Vet. Pathologists' Annual Meeting on Inflammation, Miami, Florida, "Feline Infectious Peritonitis: A Coronavirus Infection of Macrophages," December, 1976.

NIH, Bethesda, Maryland, "Effects of Cellulose on the Chemical Induction of Cancers in the Small and Large Bowel in Rats," Role of Dietary Fiber in Health, March 23-30, 1977.

Johns Hopkins School of Medicine, Division of Comparative Medicine, "Viral Diseases of Nude Mice," May 20, 1977.

NCI-NCTR Pathology Workshop, Little Rock, Arkansas, "Statistical Analysis of Hepatocarcinogenesis," November 3, 1977.

American College of Veterinary Pathologists' Annual Meeting, Toronto, Canada, "Intestinal Cancer Model Systems," November 19, 1977.

National Center for Toxicological Research, Little Rock, Arkansas, "Pre-neoplastic Lesions in Aging F344 Rats," August 30, 1978.

University of California, Department of Biochemistry, Berkeley, "Carcinogenesis Bioassays of 200 Environmental Chemicals," October 12, 1978.

Mid-Atlantic Veterinary Pathology Colloquy, "Implications of the Toxic Substances Control Act and Environmental Pathology for the Veterinary Pathologist," October 18, 1978.

National Institutes of Health Animal Model Seminar Series, Bethesda, Maryland, "Animal Models of Colon Cancer," February, 1979.

National Institutes of Health, Bethesda, Maryland, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," June, 1979.

NCI Workshop on Chemoprevention of Cancer, "Methods for the Evaluation of Anticarcinogenesis Experiments," October, 1979.

Cold Spring Harbor Conference on Cell Proliferation, Cold Spring Harbor, New York, "The Carcinogenicity of 1,2-Dichloroethane in Osborne-Mendel Rats and B6C3F1 Mice," November 15-16, 1979.

National Institute of Occupational Safety and Health, Rockville, Maryland, "The Evaluation of Rodent Carcinogenesis Tests," December 12, 1979.

American Health Foundation, Valhalla, New York, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," February 12, 1980.

Government of Canada Health Protection Branch, Food Directorate, Ottawa, Canada, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," June 4, 1980.

AVMA Annual Meeting, Washington, D.C., Symposium on Environmental Influence on Cancer Development, "Chemical Carcinogenesis," July 23, 1980.

EPA Mouse Liver Tumor Workshop, Silver Spring, Maryland, "The Significance of the Mouse Liver Tumor in Rodent Carcinogenesis Tests," June 11-12, 1980.

University of Maryland School of Medicine, Department of Pathology, Baltimore, Maryland, "Toxicity and Carcinogenesis," January 22, 1981.

The George Washington University School of Medicine and Health Sciences, Department of Pathology, Washington, D.C., "Lesions Produced in Rodents by Environmental Toxins," January 26, 1981.

University of Zurich, Institute of Pathology, Zurich, Switzerland, "Pathology of the Aging F344 Rat," February 18, 1981.

University of Zurich, Institute of Toxicology, Schwerzenbach, Switzerland, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," February 18, 1981.

NCTR Rodent Lymphoma Workshop, Jefferson, Arkansas, "A Classification of Reactive Lesions of Rodent Lymph Nodes," March 5, 1981.

NTP-NIEHS, Research Triangle Park, North Carolina, "Response of Rodent Liver to Toxins and Carcinogens from a Pathologist's Viewpoint," March 12, 1981.

The Johns Hopkins Medical School, Dept. of Comparative Medicine,
"Interpretation of Rodent Carcinogenicity Bioassays," May 15, 1981.

Armed Forces Institute of Pathology, Washington, D.C., "Pathology of Tumors of Rats," in Course on Pathology of Laboratory Animals. August 12, 1981.

Hannover Medical School, Institute of Experimental Pathology, Hannover, West Germany, "Technology of and the Production of Endocrine Disorders," Seminar on the Endocrine System of Laboratory Animals, September 9, 1981.

Boehringer Ingelheim KG, Dept. of Pathology and Toxicology, "The Mouse Liver Tumor as An Endpoint in Carcinogenesis Tests," Ingelheim, West Germany, September 7, 1981.

Harvard University School of Public Health, Dept. of Biostatistics, Boston, Mass., "Comparative Tumor Pathology and Evaluation of Rodent Carcinogenesis Tests," October 23, 1981.

The American College of Toxicology, Arlington, VA, "Background Data and Variations in Tumor Incidences of Control Animals," November 5, 1981.

American College of Toxicology, Arlington, VA, "Refinements of Rodent Pathology and The Pathologist's Contribution to Evaluation of Carcinogenesis," J.M. Ward and G. Reznik, November 5, 1981.

The Chemical Industry Institute of Toxicology, Raleigh, North Carolina, "Morphology of Liver Tumor in Mice: A Comparison with Other Species", at the Fourth CIIT Conference on Toxicology - Current Perspectives in Mouse Liver Neoplasia, December 3-4, 1981.

Boston University, School of Medicine, Boston, Mass, "Background Variations of Tumor Incidence in Rodent Populations", at the International Conference on Safety Evaluation and Regulation of Chemicals, February 24-26, 1982.

Cornell University, NYS College of Veterinary Medicine, Department of Pathology, Ithaca, New York, "Pathology and Biology of Tumors in F344 Rats", May 10-11, 1982.

American College of Veterinary Pathologists, Monterrey, California, "Adrenal Lesions in Mice", November 10, 1981.

Armed Forces Institute of Pathology, Washington, D.C., "Tumors of Rats", in Pathology of Laboratory Animals Course, August 11, 1982.

Formaldehyde Institute, "Skin Initiation/Promotion Study with Formaldehyde in Sencar mice", In Formaldehyde Toxicology-1982 Update, Washington, D.C. November 3, 1982

National Toxicology Program, "Large Granular Lymphocyte Leukemia in Rats", Pathology Round Table, Research Triangle Park, North Carolina, November 22-23, 1982.

National Cancer Institute, Laboratory of Pathology, Division of Cancer Biology and Diagnosis, Bethesda, Maryland, "Immunohistochemical localization of the large granular lymphocyte, the effector cell of NK activity, in health and disease of the rat. December 1, 1982.

Nara Medical University, First Department of Pathology, Nara, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Rats in Health and Disease", April 22, 1983.

Nagoya City University Medical School, First Department of Pathology, Nagoya, Japan, "Initiation-Promotion Studies of Mouse Liver Tumors", April 25, 1983.

Nippon Medical School, Departments of Surgery and Pathology, Tokyo, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Rats", April 26, 1983.

National Institute of Hygienic Sciences, Department of Chemical Pathology, Setagaya-Ku, Tokyo, Japan, "The Mouse Liver Tumor", April 27, 1983.

Cancer Institute, Ikebukuro, Tokyo, Japan, "Large Granular Lymphocyte Leukemia with Natural Killer Cell Activity in F344 Rats", April 27, 1983.

National Cancer Center Research Institute, Tsukiji, Tokyo, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte, The Effector Cell of Natural Killer Cell Activity, in Health and Disease of the Nude Rat", April 28, 1983.

Tokai University, Department of Pathology, Isehara, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Health and Disease of the Rat", April 28, 1983.

Book Chapters and Books

1. Ward, J.M.: Feline Infectious Peritonitis. In Current Veterinary Therapy IV (R. Kirk, ed.) W.B. Saunders, Co., Philadelphia, PA., pp. 650-659, 1971.
2. Ward, J.M. and Grabin, M.: Intestinal Tumors of Mice. In Inbred and Genetically Defined Strains of Laboratory Animals. Part 1. Mouse and Rat (P. Altman and D. Katz, eds.), Bethesda, Maryland, FASEB, pp. 208-210, 1979.
3. Ward, J.M.: Background Data and Variations in Tumor Incidence of Control Animals. Prog. Exp. Tumor Res. 26: 241-258, 1983.
4. Reznik, G. and Ward, J.M.: Refinements of Rodent Pathology Protocol and the Pathologist's Contribution to Better Evaluation of Carcinogenesis. Prog. Exp. Tumor Res. 26: 256-291, 1983.
5. Ward, J.M.: Pathology of Toxic, Preneoplastic and Neoplastic Lesions in Rodents in Carcinogenesis-Mutagenesis. Humana Press, 1982.
6. Ward, J.M.: Background Variations of Tumor Incidence in Rodent Populations. In Proc. Int. Conference on Safety Evaluation and Regulation of Chemicals, 1982.
7. Reznik, G. and Ward, J.M.: Adrenal Ganglioneuroma and Neuroblastoma in Rats In Pathology of Laboratory Animals, Volume I - Endocrine Pathology. Springer-Verlag, 1983.

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ABSTRACTS & PRESENTATIONS

Bertino, J. R., Ward, J., Sartorelli, A. C., and Silber, R.: An Effect of Ethanol on Folate Metabolism. *J. Clin. Invest.* 44: 1028, 1965

Sundaresan, P. R., Ward, J. M., and DeLuca, L. M.: The Occurrence of Vitamin A in Mucinous Adenocarcinomas of Rat Small Intestine. *Fed. Proc.* 33: 670, 1974

Ward, J. M., and Habermann, R. T.: Pathology of Stomach Cancer Induced by the Agricultural Chemicals Ethylene Dibromide and Dibromochloroethane in Rats. *Internat. Academy Pathology, San Francisco, Calif., March, 1974.*

Ward, J. M.: Pathology of Chemically-Induced Colon Cancer in Rats. *Internat. Cancer Congress, Florence, Italy, October 1974.*

Ward, J. M.: Persistent Parainfluenza Virus (Sendai) Infection of Nude Mice. *Internat. Academy Pathology, Boston, MA, March, 1976.*

Ward, J. M.: Nephropathology of Platinum Cancer Chemotherapeutic Agents in Rats. *Internat. Meeting, Internat. Academy of Pathology, Washington, D.C., October, 1976.*

Young, D. M., Ward, J. M., and Prieur, D. J.: Neoplasia and Skeletal Homeostasis: An Animal Model. *XII European Symposium on Calcified Tissues. York, England, July, 1976.*

Young, D. M., Fioravante, J. L., Prieur, D. J., and Ward, J. M.: Hypercalcemia and Malignancy: The VX-Carcinoma. *Fed. Proc.* 35: 866, 1976

Young, D. M., Mettler, F. P., Pelham, J. F., and Ward, J. M.: Effect of Co Q10 on Adriamycin-Induced Cardiotoxicity in the Rabbit Model. *Proc. Amer. Assoc. Cancer Res.* 1977

Ward, J. M.: Clinical Chemistry and Toxicologic Pathology of Platinum Compounds. *International Symposium-Toxic Metals. Monaco, March 2-5, 1977.*

Ward, J. M.: NCI Carcinogenesis Testing Program: Toxicology and Pathology. *American College of Veterinary Pathologists Annual Meeting. Toronto, Canada, November 17, 1977.*

Young, D. M., Ward, J. M., and Pelham, J. F.: Quelamycin-Induced Cardiotoxicity in Rabbits and Rats. *Annual Meeting of the American Association for Cancer Research, 1978.*

Ward, J. M.: Carcinogenicity of Hair Dye Components. *Toxicology Special Interest Group. Annual Meeting American College of Veterinary Pathologists, November 14, 1978, San Antonio, Texas.*

Ward, J. M.: The Classification of Feline Infectious Peritonitis Virus as a Coronavirus. Viral Disease Special Interest Group. Annual Meeting American College of Veterinary Pathologists. November 17, 1978, San Antonio, Texas.

Hoover, K. L., Ward, J. M., and Stinson, S. F.: Histopathology Differences Between Nitrofen-Induced and Naturally-Occurring Hepatocellular Carcinomas in the B6C3F₁ Mouse. Annual Meeting, U.S. Cancer Division. Internat. Academy of Pathology, March, 1979. Lab. Invest. 40: 25, 1979.

Hyde, C. L., Ward, J. M., and Poirier, L. A.: Comparative Hepatotoxicity of Subchronic Doses of Ethionine in Mice, Rats and Hamsters. Proc. AACR, 20: 515, 1979.

Reznik, G., and Ward, J. M.: Induction of Preneoplastic and Neoplastic Lesions in the Kidney of Rats and Mice after Treatment with the Flame Retardant TRIS (2,3-Dibromopropyl) phosphate. European Society of Pathology, June, 1979.

Reznik, G., Ulland, B., Banas, D., Voelker, R., Ward, J. M., Reznik-Schuller, H., and Stinson, S. F.: Respiratory Tract Neoplasms Induced in Rodents by Two Soil Fumigants. Internat. Academy Pathol., New Orleans, LA. February 27, 1980.

Morgan, R. W., Ward, J. M., and Hartman, P. E.: Induction by Aroclor 1254 of Gastric Lesions in the Glandular Stomachs of F344 Rats. Poster Session. Am. Assoc. Cancer Res., May 28, 1981, Washington, D.C.

Ward, J. M., and Reznik, G.: Non-hematopoietic Sex-Dependent Sarcomas of the Spleen Induced by 6 Aromatic Amines or Derivatives and Their Association with Splenic Fibrosis and Methemoglobinemia. Poster Session. Am. Assoc. Cancer Res., May 28, 1981, Washington, D.C.

Reynolds, C. W., and Ward, J. M.: Characterization of Large Granular Lymphocyte (LGL) Tumors in the Rat. 11th Annual UCLA Symposium on B and T Cell Tumors. February 28 - March 5, 1982, Squaw Valley, California. J. Cellular Biochem. Suppl. 6, 1982.

Ward, J. M., Reynolds, C. W., Denn III, A. C., Bere, E. W., Lynch, P. H., and Djurickovic, D.: Morphologic and Immunologic Identification of F344 Rat Leukemia as a Heterogeneous Large Granular Lymphocyte Leukemia. Amer. Assoc. Lab. An. Sci., Washington, D.C., October 5, 1982.

Ward, J. M., and Reynolds, C. W.: Large Granular Lymphocyte Leukemia in the F344 Rats, Immunopathology Specialty Group, Amer. College of Vet. Pathologists, Atlanta, Georgia, November 3, 1982.

Ward, J. M., Reynolds, C. W., Argilan, F., and Mittlehner, E. A.: Immunohistology of the Natural Killer Cell in Health and Disease of the Rat, Infectious Disease Specialty Group, Amer. College Vet. Pathologists, Atlanta, Georgia, November 4, 1982.

Reynolds, C. W., Denn III, A. C., Bere, E. W., and Ward, J. M.: Characterization of Large Granular Lymphocyte (LGL) Tumors in the F344 Rat. 15th Internat. Leukocyte Culture Conference, December 5-10, 1982, Asilomar, California.

Rice, J. M., Palmer, A. E., Ward, J. M., Cicmanec, J. L.: Hepatocellular Neoplasia in Non-Human Primates after Transplacental Diethylnitrosamine and Postnatal Phenobarbital. FASEB, Chicago, Illinois, April, 1983.

Ward, J. M., and Reynolds, C. W.: Immunohistology of the Large Granular Lymphocyte, The Effector Cell of Natural Killer Cell Activity in Health, Infectious Disease and Tumors of the Athymic Nude Rat. Amer. Assoc. Cancer Res., San Diego, May 27, 1983.

Diwan, B., Ward, J. M., Colburn, N., Spangler, F., Creasia, D., Lynch, P., and Rice, J. M.: Promoting Effects of Di(2-ethylhexyl) Phthalate in Mouse Liver, Skin and JB-6 Epithelial Cells. Amer. Assoc. Cancer Res., 1983.

Adams, P. G., Sherwin, S. A., Ward, J. M., Heyman, M. R., St. John, R., Fein, S., Bottino, G. C., Smalley, R., and Oldham, R.: Phase I Trial of Recombinant Leukocyte A Interferon Administered by Intralesional Injection. Amer. Soc. Clin. Oncology, San Diego, May 24, 1983.

Reynolds, C. W., and Ward, J. M.: Functional Characterization of Large Granular Lymphocyte (LGL) Tumors in the Rat. Fifth International Congress of Immunology, Kyoto, Japan, September, 1983.

PUBLICATIONS

1. Ward, J. M., and Whitlock, R. M.: Chemotherapy of equine leukemia with amethopterin. Vet. Med. Sm. Am. Clin. 62: 1003-1008, 1967
2. Dungworth, D. L., Theilen, G. H., and Ward, J. M.: Early detection of the lesions of bovine lymphosarcoma. Bibl. Hemat. 31: 206-211, 1968
3. Ward, J. M., Munn, R. J., Gribble, D. H., and Dungworth, D. L.: An observation of feline infectious peritonitis. Vet. Rec. 83: 416-417, 1968
4. Ward, J. M.: Feline infectious peritonitis. Calif. Vet. pp. 8-11, May 1969.
5. Ward, J. M., Sodikoff, G. H., and Schalm, O. W.: Myeloproliferative disease and abnormal erythropoiesis in the cat. J.A.V.M.A. 155: 879-888, 1969
6. Ward, J. M., and Theilen, G. H.: Generalized phlebitis and peritonitis in a kitten. Vet. Med. Sm. Am. Clin. 64: 1050-1056, 1969
7. Theilen, G. H., Dungworth, D. L., Kawakami, T. G., Munn, R. J., Ward, J. M., and Harrold, J. B.: Experimental induction of lymphosarcoma in the cat with "C"-type virus. Cancer Res. 30: 401-408, 1970
8. Ward, J. M.: Morphogenesis of a virus in cats with experimental feline infectious peritonitis. Virology 41: 191-194, 1970
9. Ward, J. M., Smith, R., and Schalm, O. W.: Inclusions in neutrophils of cats with feline infectious peritonitis. J.A.V.M.A. 158: 348, 1971
10. Ward, J. M.: Feline infectious peritonitis. In Kirk, R. (Ed.): Current Veterinary Therapy IV. Philadelphia, W. B. Saunders, Co., 1971, pp. 658-659.
11. Ward, J. M., Nelson, N., Wright, J. F., and Berman, E.: Chronic nonclinical cerebral toxoplasmosis in cats. J.A.V.M.A. 159: 1012-1014, 1971
12. Nelson, N., Berman, E., Rosenstein, L., Ward, J., and Wright, J.: Bio-effects of continuous short-term exposure of felines to radioactive strontium. AEC Symposium Series 25: 182-206, 1972
13. Ward, J. M., and Wright, J.: Pathology of radiostrontium exposure in cats. Radiat. Res. 51: 84-96, 1972
14. Ward, J., Wright, J., and Wharran, G.: Ultrastructure of granulocytes in the peripheral blood of the cat. J. Ultrastructure Res. 39: 389-396, 1972

15. Ward, J., Wright, J., Nelson, N., Berman, E., and Liddle, C.: Bone and soft tissue neoplasms in cats exposed to radiostrontium. J. Natl. Cancer Inst. 48: 1543-1546, 1972
16. Ward, J., and Hurvitz, A.: Ultrastructure of normal and neoplastic mast cells of the cat. Vet. Path. 9: 202-211, 1972
17. Lappenbusch, W. L., and Ward, J. M.: Synergistic bio-effects of oil and formalin in an aquatic organism. Toxicol. Contam. Environ. Contam. Tox. 9: 75-79, 1973
18. Ward, J. M., Yamamoto, R. S., and Weisburger, J. H.: Cellulose dietary bulk and azoxymethane-induced intestinal cancer. J. Natl. Cancer Inst. 51: 713-715, 1973
19. Ward, J. M., Yamamoto, R. S., and Brown, C. A.: Pathology of intestinal neoplasms and other lesions in rats exposed to azoxymethane. J. Natl. Cancer Inst. 51: 1029-1039, 1973
20. Ward, J. M., Yamamoto, R. S., Weisburger, J. H., and Benjamin, T.: Transplantation of chemically-induced metastatic mucinous adenocarcinomas of the jejunum and colon in rats. J. Natl. Cancer Inst. 51: 1997-1999, 1973
21. Ward, J. M., Yamamoto, R. S., Benjamin, T., Brown, C. A., and Weisburger, J. H.: Experimentally-induced colon cancer in rats and mice. J.A.V.M.A. 164: 729-732, 1974
22. Olson, W. A., Habermann, R. T., Weisburger, E. K., Ward, J. M., and Weisburger, J. H.: Induction of stomach cancer in rats and mice with halogenated aliphatic fumigants. J. Natl. Cancer Inst. 51: 1993-1995, 1973
23. Weisburger, E. K., Ward, J. M., and Brown, C.A.: Dibenamine: Selective protection against diethylnitrosamine-induced hepatic carcinogenesis but not oral, pharyngeal and esophageal carcinogenesis. Toxic. Appl. Pharm. 28: 477-484, 1974
24. Ward, J. M.: Morphogenesis of chemically-induced neoplasms of the colon and small intestine in rats. Lab. Invest. 30: 505-513, 1974
25. Cohen, A. E., Weisburger, E. K., Weisburger, J. H., Ward, J. M., and Putnam, C. L.: Cystoscopy of chemically-induced bladder neoplasms in rabbits administered the carcinogen dibutyl nitrosamine. Invest. Urology 12: 262-266, 1975
26. Ward, J. M., and Habermann, R. T.: Pathology of stomach cancer in rats and mice induced with the agricultural chemicals ethylene dibromide and dibromochloropropane. Bull. Soc. Pharm. Environ. Path. 2: 10-11, 1974
27. Ward, J. M., Gribble, D. H., and Dungworth, D. L.: Feline infectious peritonitis: Experimental evidence for its multiphasic nature. Amer. J. Vet. Res. 35: 1271-1275, 1974

28. Ward, J. M., Weisburger, E. K., Benjamin, T., and Moss, R. A.: Shift of organotropy of azoxy compounds - replacement of methyl with an octyl group. J. Natl. Cancer Inst. 53: 1181-1185, 1974
29. Ward, J. M., Weisburger, J. H., Yamamoto, R. S., Benjamin, T., Brown, C. A., and Weisburger, E. K.: Long-term effect of benzene in C57BL/6N mice. Archiv. Environ. Health 30: 22-25, 1975
30. Ward, J. M., and Weisburger, E. K.: Effect of benzene on the life span of mice. Anim. Sci. 24: 933-942, 1974
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Bibliography, J. M. Ward

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Statement of Dr. Jerrold M. Ward Concerning the Carcinogenicity of
Ethylene Oxide in Rats

I have reviewed reports of the NIOSH and Bushy Run inhalation carcinogenesis bioassays of ethylene oxide in rats and the published paper by Dunkelberg, (Brit. J. Cancer, Volume 46, pages 924-933, 1982) on the chronic intragastric administration of ethylene oxide in rats. Also, I reviewed selected microscope slides of the mononuclear cell leukemias and mesotheliomas in rats of the Bushy Run study on January 28, 1981.

It is my opinion that the 3 bioassays provide significant evidence for the carcinogenicity of ethylene oxide. In the Bushy Run Study, the increased incidences of mononuclear cell leukemia in female and male rats, mesothelioma in male rats, and brain tumors in male and female rats were associated with exposure to ethylene oxide. In the NIOSH study, the incidence of leukemia was not related to ethylene oxide exposure as presented in the report's table. My conclusion regarding the possible increase in incidence of leukemia, however, awaits for the analysis of the data since mortality was greatest in rats exposed to ethylene oxide. Brain tumor incidence was increased in rats exposed to ethylene oxide in the NIOSH study. In the Dunkelberg study, ethylene oxide induced a dose-dependent incidence of squamous cell carcinomas of the stomach.

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Marital Status: Married, 2 Children

Education:

1970 Ph.D. Comparative Pathology, University of California,
Davis

1966 D.V.M. Cornell University, Ithaca, New York

Chronology of Employment:

1966 - 1970 Research Pathologist and NIH trainee, Department
of Veterinary Pathology, School of Veterinary Medicine
University of California, Davis

1970 - 1971 Supervisory Veterinary Medical Officer, Bureau of
Radiological Health, DHEW, PHS, Rockville, MD

1971 - 1972 Supervisory Veterinary Medical Officer (Veterinary
Pathologist); Division of Research and Monitoring, Radiation
Programs, Environmental Protection Agency, Rockville, MD

1972 - 1974 Supervisory Veterinary Medical Officer (Veterinary
Pathologist), Carcinogen Metabolism and Toxicology Branch,
Carcinogenesis, Division of Cancer Cause and Prevention,
(DCCP), National Cancer Institute (NCI), National Institutes
of Health (NIH), Bethesda, MD

1974 - 1977 Supervisory Veterinary Medical Officer (Veterinary
Pathologist), Laboratory of Toxicology, Division of Cancer
Treatment, NCI, NIH, Bethesda, MD

1977 - 1978 Veterinary Medical Officer (Veterinary Pathologist),
Tumor Pathology Branch, Carcinogenesis Testing Program,
Division of Cancer Cause and Prevention, NCI, NIH, Bethesda,
MD

1978 - Acting Chief, Tumor Pathology Branch, Carcinogenesis
Testing Program, DCCP, NCI, NIH, Bethesda, MD

1979 - Program Leader, Tumor Pathology, National Toxicology Program,
NCI, NIH, Bethesda, MD

1980 - 1981 Chief, Tumor Pathology, National Toxicology Program,
NCI, NIH, Bethesda, MD

1981 Chief, Tumor Pathology and Pathogenesis Section,
Laboratory of Comparative Carcinogenesis, DCCP, NCI, Frederick,
MD

Teaching Experience

- 1968 - 1970 Graduate Assistant, Department of Veterinary Pathology,
School of Veterinary Medicine
University of California-Davis
- 1975 - 1980 Faculty, Foundation for Advanced Education in the Sciences.
Comparative Pathology Course
Bethesda, Maryland
- 1978 - 1980 The Center for Professional Advancement, Carcinogenesis/
Mutagenesis Course
East Brunswick, New Jersey
- 1979 Lecturer, Department of Pathology, Uniformed Services
University of the Health Sciences, Bethesda, Maryland
- 1981 - Lecturer, Pathology of Tumors of Rats, Armed Forces
Institute of Pathology Course on Pathology of Laboratory
Animals, Washington, D.C.
- 1981 - 1982 Adjunct Associate Professor of Pathology, The George
Washington University School of Medicine and Health
Sciences, Washington, D.C.
- 1981 Faculty, Endocrine Histopathology of Laboratory Animals
Seminar, International Life Sciences Institute and
Institute of Experimental Pathology, Hannover Medical
School, Hannover, West Germany
- 1982 Faculty, Neoplastic and Nonneoplastic Lesions in Mice,
Intox Laboratories, Arlington, Virginia, June, 1982
- 1983 Faculty, Endocrine Histopathology Seminar, Nara Medical
University and International Life Sciences Institute,
Nara, Japan
- 1983 Faculty, Endocrine Histopathology Seminar, Harvard
Medical School and International Life Sciences
Institute, Boston, Massachusetts

Professional Organizations

- Diplomate, American College of Veterinary Pathologists
- American Veterinary Medical Association
- International Academy of Pathology
- American Association for Cancer Research

Awards

- 1966 Cornell University Clinical Conference Award
- 1974 National Academy of Sciences Travel Grant to the International Cancer Congress, Florence, Italy
- 1979 Special Achievement Group Award, NCI Carcinogenesis Testing Program

Service on Boards or Committees

- 1975 - 1981 Editorial Board, VETERINARY PATHOLOGY
- 1976 - 1978 Chairman and Organizer, Viral Specialty Group, American College of Veterinary Pathologists
- 1978 Member, Education Committee - Carcinogenesis, American College of Veterinary Pathologists
- 1979 Co-Chairman, Infectious Disease Specialty Group, American College of Veterinary Pathologists
- 1981 Editorial Board, PATHOLOGY OF LABORATORY ANIMALS (International Life Sciences Institute)

Professional Advisory and Consultant Activities

Member, Discussion Group-Criteria for Tumor Diagnosis and Classification of Malignancy. Conference on Carcinogenesis Testing in the Development of New Drugs, May 23-25, 1973, Washington, DC, National Academy of Sciences.

Member, FDA, FD&C Red No. 40 Second Interim Working Group, December, 1977-1980.

Consultant and Expert Witness, FDA Hearing on Denial of Petition for Listing of FD&C Red No. 4 for Use in Marishino Cherries and Ingested Drugs, April 12, 1978, Rockville, Maryland.

Member, FDA Interagency Committee on Nitrite Research, 1978-1981.

Member, Project Group on Standardization of Measurements and Tests, Task Force on Cancer and Heart and Lung Disease, Environmental Protection Agency, 1979.

Consultant, Scientific Advisory Board, National Center for Toxicological Research, Jefferson, Arkansas, 1979.

Member, Mouse Lymphoma Study Group, 1979. Sponsored by the Nutrition Foundation.

Consultant, Division of Pathology, Bureau of Foods, Food and Drug Administration, 1978-1982.

Member, Working Group on Evaluation of Carcinogenic Risk of Chemicals to Man, International Agency for Research in Cancer, Lyon, France, February 10-17, 1981.

Consultant and Expert Witness, FDA Hearing on Proposal to Withdraw Approval of Certain New Animal Drug Applications: Furazolidone (N.F.-160), 1970-

Alternate Member, TSCA Interagency Testing Committee, 1981-

Consultant, Carcinogen Identification and Risk Assessment Branch, Occupational, Safety and Health Administration, Dept. of Labor, Washington, D.C., 1979-1981

Expert Witness, State of California, Department of Health, OSHA, Sacramento, California, November 12, 1981, Hearing on Standards for Occupational Exposure Levels to 1,2 Dibromoethane.

Consultant, Chemical Pathology Branch, National Toxicology Program, National Institute of Environmental Health Sciences, Research Triangle Park, North Carolina, 1982-

Invited Lectures and Seminars

Animal Medical Center, New York, N.Y., "Feline Infectious Peritonitis," July, 1968.

Armed Forces Institute of Pathology, Washington, D.C., Pathology of Laboratory Animals Course, "Diseases of the Cat," September, 1972.

American College Vet. Pathology, Annual Meeting, Chicago, Illinois, "Hepatic Lesions Induced by Azoxymethane," December, 1974.

New York State Veterinary College, Cornell University, Ithaca, N.Y., "Feline Infectious Peritonitis," April 1975.

Washington State University College of Veterinary Medicine, Pullman, Washington, "Feline Infectious Peritonitis," December, 1975.

Angell Memorial Animal Hospital, Boston, Massachusetts, "Feline Infectious Peritonitis," March, 1976.

Armed Forces Institute of Pathology, Washington, D.C., Comparative Pathology Course, "Model Studies into the Etiology and Pathogenesis of Naturally-Occurring Cancer," May, 1976.

Armed Forces Institute of Pathology, Washington, D.C., Pathology of Laboratory Animals Course, "Viral Diseases of Cats," September, 1976.

American College of Vet. Pathologists' Annual Meeting on Inflammation, Miami, Florida, "Feline Infectious Peritonitis: A Coronavirus Infection of Macrophages," December, 1976.

NIH, Bethesda, Maryland, "Effects of Cellulose on the Chemical Induction of Cancers in the Small and Large Bowel in Rats," Role of Dietary Fiber in Health, March 28-30, 1977.

Johns Hopkins School of Medicine, Division of Comparative Medicine, "Viral Diseases of Nude Mice," May 20, 1977.

NCI-NCTR Pathology Workshop, Little Rock, Arkansas, "Statistical Analysis of Hepatocarcinogenesis," November 3, 1977.

American College of Veterinary Pathologists' Annual Meeting, Toronto, Canada, "Intestinal Cancer Model Systems," November 19, 1977.

National Center for Toxicological Research, Little Rock, Arkansas, "Pre-neoplastic Lesions in Aging F344 Rats," August 30, 1978.

University of California, Department of Biochemistry, Berkeley, "Carcinogenesis Bioassays of 200 Environmental Chemicals," October 12, 1978.

Mid-Atlantic Veterinary Pathology Colloquy, "Implications of the Toxic Substances Control Act and Environmental Pathology for the Veterinary Pathologist," October 18, 1978.

National Institutes of Health Animal Model Seminar Series, Bethesda, Maryland, "Animal Models of Colon Cancer," February, 1979.

National Institutes of Health, Bethesda, Maryland, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," June, 1979.

NCI Workshop on Chemoprevention of Cancer, "Methods for the Evaluation of Anticarcinogenesis Experiments," October, 1979.

Cold Spring Harbor Conference on Ethylene Dichloride, Cold Spring, New York, "The Carcinogenicity of 1,2-Dichloroethane in Osborne-Mendel Rats and B6C3F1 Mice," November 15-16, 1979.

National Institute of Occupational Safety and Health, Rockville, Maryland, "The Evaluation of Rodent Carcinogenesis Tests," December 12, 1979.

American Health Foundation, Valhalla, New York, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," February 12, 1980.

Government of Canada Health Protection Branch, Food Directorate, Ottawa, Canada, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," June 4, 1980.

AVMA Annual Meeting, Washington, D.C., Symposium on Environmental Influence on Cancer Development, "Chemical Carcinogenesis," July 23, 1980.

EPA Mouse Liver Tumor Workshop, Silver Spring, Maryland, "The Significance of the Mouse Liver Tumor in Rodent Carcinogenesis Tests," June 11-13, 1980.

University of Maryland School of Medicine, Department of Pathology, Baltimore, Maryland, "Toxicity and Carcinogenesis," January 22, 1981.

The George Washington University School of Medicine and Health Sciences, Department of Pathology, Washington, D.C., "Lesions Produced in Rodents by Environmental Toxins," January 26, 1981.

University of Zurich, Institute of Pathology, Zurich, Switzerland, "Pathology of the Aging F344 Rat," February 18, 1981.

University of Zurich, Institute of Toxicology, Schwerzenbach, Switzerland, "The Mouse Liver Tumor as an Endpoint in Carcinogenesis Tests," February 18, 1981.

NCTR Rodent Lymphoma Workshop, Jefferson, Arkansas, "A Classification of Reactive Lesions of Rodent Lymph Nodes," March 5, 1981.

NTP-NIEHS, Research Triangle Park, North Carolina, "Response of Rodent Liver to Toxins and Carcinogens from a Pathologist's Viewpoint," March 12, 1981.

The Johns Hopkins Medical School, Dept. of Comparative Medicine,
"Interpretation of Rodent Carcinogenicity Bioassays," May 15, 1981.

Armed Forces Institute of Pathology, Washington, D.C., "Pathology of
Tumors of Rats," in Course on Pathology of Laboratory Animals, August 12,
1981.

Hannover Medical School, Institute of Experimental Pathology, Hannover,
West Germany, "Pathology of the Rat Pituitary Gland," in Histopathology
Seminar on the Endocrine System of Laboratory Animals, September 9, 1981.

Boehringer Ingelheim KG, Dept. of Pathology and Toxicology, "The Mouse
Liver Tumor as An Endpoint in Carcinogenesis Tests," Ingelheim, West
Germany, September 7, 1981.

Harvard University School of Public Health, Dept. of Biostatistics,
Boston, Mass., "Comparative Tumor Pathology and Evaluation of Rodent
Carcinogenesis Tests," October 23, 1981.

American College of Toxicology, Arlington, VA, "Background Data and
Variations in Tumor Incidences of Control Animals, November 5, 1981.

American College of Toxicology, Arlington, VA. "Refinements of Rodent
Pathology and The Pathologist's Contribution to Evaluation of Carcinoge-
nesis," J.M. Ward and G. Reznik, November 5, 1981.

The Chemical Industry Institute of Toxicology Raleigh, North Carolina,
"Morphology of Liver Tumor in Mice: A Comparison with Other Species", at
the Fourth CIIT Conference on Toxicology - Current Perspectives in Mouse
Liver Neoplasia, December 3-4, 1981.

Boston University, School of Medicine, Boston, Mass, "Background Variations
of Tumor Incidence in Rodent Populations", at the International Conference
on Safety Evaluation and Regulation of Chemicals, February 24-26, 1982.

Cornell University, NYS College of Veterinary Medicine, Department of
Pathology, Ithaca, New York, "Pathology and Biology of Tumors in F344
Rats", May 10-11, 1982.

American College of Veterinary Pathologists, Monterrey, California,
"Adrenal Lesions in Mice", November 10, 1981.

Armed Forces Institute of Pathology, Washington, D.C., "Tumors of Rats",
in Pathology of Laboratory Animals Course, August 11, 1982.

Formaldehyde Institute, "Skin Initiation/Promotion Study with Formaldehyde
in Sencar mice", In Formaldehyde Toxicology-1982 Update, Washington, D.C.
November 3, 1982

National Toxicology Program, "Large Granular Lymphocyte Leukemia in Rats",
Pathology Round Table, Research Triangle Park, North Carolina,
November 22-23, 1982.

National Cancer Institute, Laboratory of Pathology, Division of Cancer Biology and Diagnosis, Bethesda, Maryland, "Immunohistochemical localization of the large granular lymphocyte, the effector cell of NK activity, in health and disease of the rat, December 1, 1982.

Nara Medical University, First Department of Pathology, Nara, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Rats in Health and Disease", April 22, 1983.

Nagoya City University Medical School, First Department of Pathology, Nagoya, Japan, "Initiation-Promotion Studies of Mouse Liver Tumors", April 25, 1983.

Nippon Medical School, Departments of Surgery and Pathology, Tokyo, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Rats", April 26, 1983.

National Institute of Hygienic Sciences, Department of Chemical Pathology, Setagaya-Ku, Tokyo, Japan, "The Mouse Liver Tumor", April 27, 1983.

Cancer Institute, Ikebukuro, Tokyo, Japan, "Large Granular Lymphocyte Leukemia with Natural Killer Cell Activity in F344 Rats", April 27, 1983.

National Cancer Center Research Institute, Tsukiji, Tokyo, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte, The Effector Cell of Natural Killer Cell Activity, in Health and Disease of the Nude Rat", April 28, 1983.

Tokai University, Department of Pathology, Isehara, Japan, "Immunoperoxidase Localization of the Large Granular Lymphocyte in Health and Disease of the Rat", April 28, 1983.

Book Chapters and Books

1. Ward, J.M.: Feline Infectious Peritonitis. In Current Veterinary Therapy IV (R. Kirk, ed.) W.B. Saunders, Co., Philadelphia, PA., pp. 658-659, 1971.
2. Ward, J.M. and Goshin, M.: Intestinal Tumors of Mice. In Inbred and Genetically Defined Strains of Laboratory Animals, Part 1. Mouse and Rat (P. Altman and D. Katz, eds.), Bethesda, Maryland, FASEB, pp. 208-210, 1979.
3. Ward, J.M.: Background Data and Variations in Tumor Incidence of Control Animals. Prog. Exp. Tumor Res. 26: 241-258, 1983.
4. Reznik, G. and Ward, J.M.: Refinements of Rodent Pathology Protocol and the Pathologist's Contribution to Better Evaluation of Carcinogenesis. Prog. Exp. Tumor Res. 26: 265-281, 1983.
5. Ward, J.M.: Pathology of Toxic, Preneoplastic and Neoplastic Lesions in Rodents in Carcinogenesis-Mutagenesis. Humana Press, 1982.
6. Ward, J.M.: Background Variations of Tumor Incidence in Rodent Populations. In Proc. Int. Conference on Safety Evaluation and Regulation of Chemicals, 1982.
7. Reznik, G. and Ward, J.M.: Adrenal Ganglioneuroma and Neuroblastoma in Rats In Pathology of Laboratory Animals, Volume I - Endocrine Pathology. Springer-Verlag, 1983.

ABSTRACTS & PRESENTATIONS

- Bertino, J. R., Ward, J., Sartorelli, A. C., and Silber, R.: An Effect of Ethanol on Folate Metabolism. *J. Clin. Invest.* 44: 1028, 1969
- Sundaresan, P. R., Ward, J. M., and DeLuca, L. M.: The Occurrence of Vitamin A in Murine Adenocarcinomas of Rat Small Intestine. *Fed. Proc.* 33: 670, 1974
- Ward, J. M., and Habermann, R. T.: Pathology of Stomach Cancer Induced by the Agricultural Chemicals Ethylene Dibromide and Dibromochloroethane in Rats. *Internat. Academy Pathology*, San Francisco, Calif., March, 1974.
- Ward, J. M.: Pathology of Chemically-Induced Colon Cancer in Rats. *Internat. Cancer Congress*, Florence, Italy, October 1974.
- Ward, J. M.: Persistent Parainfluenza Virus (Sendai) Infection of Nude Mice. *Internat. Academy Pathology*, Boston, MA, March 1976.
- Ward, J. M.: Nephropathology of Platinum Cancer Chemotherapeutic Agents in Rats. *Internat. Meeting, Internat. Academy of Pathology*, Washington, D.C., October, 1976.
- Young, D. M., Ward, J. M., and Prieur, D. J.: Neoplasia and Skeletal homeostasis: An Animal Model. *XII European Symposium on Calcified Tissues*. York, England, July, 1976.
- Young, D. M., Fioravante, J. L., Prieur, D. J., and Ward, J. M.: Hypercalcemia and Malignancy: The VX-Carcinoma. *Fed. Proc.* 35: 866, 1976
- Young, D. M., Mettler, F. P., Pelham, J. F., and Ward, J. M.: Effect of Co Q10 on Adriamycin-Induced Cardiotoxicity in the Rabbit Model. *Proc. Amer. Assoc. Cancer Res.* 1977
- Ward, J. M.: Clinical Chemistry and Toxicologic Pathology of Platinum Compounds. *International Symposium-Toxic Metals*. Monaco, March 2-5, 1977.
- Ward, J. M.: NCI Carcinogenesis Testing Program: Toxicology and Pathology. *American College of Veterinary Pathologists Annual Meeting*. Toronto, Canada, November 17, 1977.
- Young, D. M., Ward, J. M., and Pelham, J. F.: Quetamycin-Induced Cardiotoxicity in Rabbits and Rats. *Annual Meeting of the American Association for Cancer Research*, 1978.
- Ward, J. M.: Carcinogenicity of Hair Dye Components. *Toxicology Special Interest Group. Annual Meeting American College of Veterinary Pathologists*, November 14, 1978, San Antonio, Texas.

Ward, J. M.: The Classification of Feline Infectious Peritonitis Virus as a Coronavirus. Viral Disease Special Interest Group. Annual Meeting American College of Veterinary Pathologists. November 17, 1978, San Antonio, Texas.

Hoover, K. L., Ward, J. M., and Stinson, S. F.: Histopathology Differences Between Nitrofen-Induced and Naturally Occurring Hepatocellular Carcinomas in the B6C3F1 Mouse. Annual Meeting - U.S. - Canadian Division - Internat. Academy of Pathology, March, 1979. Lab. Invest. 40: 25, 1979

Hyde, C. L., Ward, J. M., and Poirier, L. A.: Comparative Hepatotoxicity of Subchronic Doses of Ethionine in Mice, Rats and Hamsters. Proc. AARC, 20: 515, 1979

Reznik, G., and Ward, J. M.: Induction of Preneoplastic and Neoplastic Lesions in the Kidney of Rats and Mice after Treatment with the Flame Retardant TRIS (2,3-Dibromopropyl) phosphate. European Society of Pathology, June, 1979.

Reznik, G., Ulland, B., Banas, D., Voelker, R., Ward, J. M., Reznik-Schuller, H., and Stinson, S. F.: Respiratory Tract Neoplasms Induced in Rodents by Two Soil Fumigants. Internat. Academy Pathol., New Orleans, LA. February 27, 1980.

Morgan, R. W., Ward, J. M., and Hartman, P. E.: Induction by Aroclor 1254 of Gastric Lesions in the Glandular Stomachs of F344 Rats. Poster Session. Am. Assoc. Cancer Res., May 28, 1981, Washington, D.C.

Ward, J. M., and Reznik, G.: Non-hematopoietic Sex-Dependent Sarcomas of the Spleen Induced by 6 Aromatic Amines or Derivatives and Their Association with Splenic Fibrosis and Methemoglobinemia. Poster Session. Am. Assoc. Cancer Res., May 28, 1981, Washington, D.C.

Reynolds, C. W., and Ward, J. M.: Characterization of Large Granular Lymphocyte (LGL) Tumors in the Rat. 11th Annual UCLA Symposium on B and T Cell Tumors. February 28 - March 5, 1982, Squaw Valley, California. J. Cellular Biochem. Suppl. 6, 1982

Ward, J. M., Reynolds, C. W., Denn III, A. C., Rere, E. W., Lynch, P. H., and Djurickovic, D.: Morphologic and Immunologic Identification of F344 Rat Leukemia as a Heterogeneous Large Granular Lymphocyte Leukemia. Amer. Assoc. Lab. An. Sci., Washington, D.C., October 5, 1982.

Ward, J. M., and Reynolds, C. W.: Large Granular Lymphocyte Leukemia in the F344 Rats, Immunopathology Specialty Group, Amer. College of Vet. Pathologists, Atlanta, Georgia, November 3, 1982.

Ward, J. M., Reynolds, C. W., Argilan, F., and Mittlehner, E. A.: Immunohistology of the Natural Killer Cell in Health and Disease of the Rat, Infectious Disease Specialty Group, Amer. College Vet. Pathologists, Atlanta, Georgia, November 4, 1982.

Reynolds, C. W., Denn III, A. C., Bere, E. W., and Ward, J. M.: Characterization of Large Granular Lymphocyte (LGL) Tumors in the F344 Rat. 15th Internat. Leukocyte Culture Conference, December 5-10, 1982, Asilomar, California.

Rice, J. M., Palmer, A. E., Ward, J. M., Cicmanec, J. L.: Hepatocellular Neoplasia in Non-Human Primates after Transplacental Diethylnitrosamine and Postnatal Phenobarbital. FASEB, Chicago, Illinois, April, 1983.

Ward, J. M., and Reynolds, C. W.: Immunohistology of the Large Granular Lymphocyte, The Effector Cell of Natural Killer Cell Activity in Health, Infectious Disease and Tumors of the Athymic Nude Rat. Amer. Assoc. Cancer Res., San Diego, May 27, 1983.

Diwan, B., Ward, J. M., Colburn, N., Spangler, F., Creasia, D., Lynch, P., and Rice, J. M.: Promoting Effects of Di(2-ethylhexyl) Phthalate in Mouse Liver, Skin and JB-6 Epithelial Cells. Amer. Assoc. Cancer Res., 1983.

Abrams, P. G., Sherwin, S. A., Ward, J. M., Heyman, M. R., St. John, R., Fein, S., Bottino, G. C., Smalley, R., and Oldham, R.: Phase I Trial of Recombinant Leukocyte A Interferon Administered by Intralésional Injection. Amer. Soc. Clin. Oncology, San Diego, May 24, 1983.

Reynolds, C. W., and Ward, J. M.: Functional Characterization of Large Granular Lymphocyte (LGL) Tumors in the Rat. Fifth International Congress of Immunology, Kyoto, Japan, September, 1983.

PUBLICATIONS

1. Ward, J. M., and Whitlock, R. H.: Chemotherapy of equine leukemia with amethopterin. Vet. Med. Sm. Am. Clin. 62: 1003-1008, 1967
2. Dungworth, D. L., Theilen, G. H., and Ward, J. M.: Early detection of the lesions of bovine lymphosarcoma. Br. J. Haemat. 31: 200-211, 1968
3. Ward, J. M., Munn, R. J., Gribble, D. H., and Dungworth, D. L.: An observation of feline infectious peritonitis. Vet. Rec. 83: 416-417, 1968
4. Ward, J. M.: Feline infectious peritonitis. Calif. Vet. pp. 8-11, May 1969.
5. Ward, J. M., Sodikoff, C. H., and Schalm, O. W.: Myeloproliferative disease and abnormal erythropoiesis in the cat. J.A.V.M.A. 155: 879-886, 1969
6. Ward, J. M., and Theilen, G. H.: Generalized phlebitis and peritonitis in a kitten. Vet. Med. Sm. Am. Clin. 64: 1050-1056, 1969
7. Theilen, G. H., Dungworth, D. L., Kawakami, T. G., Munn, R. J., Ward, J. M., and Harrold, J. B.: Experimental induction of lymphosarcoma in the cat with "C"-type virus. Cancer Res. 30: 401-408, 1970
8. Ward, J. M.: Morphogenesis of a virus in cats with experimental feline infectious peritonitis. Virology 41: 191-194, 1970
9. Ward, J. M., Smith, R., and Schalm, O. W.: Inclusions in neutrophils of cats with feline infectious peritonitis. J.A.V.M.A. 158: 348, 1971
10. Ward, J. M.: Feline infectious peritonitis. In Kirk, R. (Ed.): Current Veterinary Therapy IV. Philadelphia, W. B. Saunders, Co., 1971, pp. 658-659.
11. Ward, J. M., Nelson, N., Wright, J. F., and Berman, E.: Chronic nonclinical cerebral toxoplasmosis in cats. J.A.V.M.A. 159: 1012-1014, 1971
12. Nelson, N., Berman, E., Rosenstein, L., Ward, J., and Wright, J.: Bio-effects of continuous short-term exposure of felines to radioactive strontium. AEC Symposium Series 25: 182-206, 1972
13. Ward, J. M., and Wright, J.: Pathology of radiostrontium exposure in cats. Radiat. Res. 51: 84-96, 1972
14. Ward, J., Wright, J., and Wharran, G.: Ultrastructure of granulocytes in the peripheral blood of the cat. J. Ultrastructure Res. 39: 389-396, 1972

15. Ward, J., Wright, J., Nelson, N., Berman, E., and Liddle, C.: Bone and soft tissue neoplasms in cats exposed to radiostrontium. J. Natl. Cancer Inst. 48: 1543-1546, 1972
16. Ward, J., and Hurvitz, A.: Ultrastructure of normal and neoplastic mast cells of the cat. Vet. Path. 9: 202-211, 1972
17. Lappenbusch, W. L., and Ward, J. M.: Synergistic bio-effects of oil and irradiation in an aquatic organism, Taricha granulosa. Bull. Environ. Contam. Tox. 9: 75-79, 1973
18. Ward, J. M., Yamamoto, R. S., and Weisburger, J. H.: Cellulose dietary bulk and azoxymethane-induced intestinal cancer. J. Natl. Cancer Inst. 51: 713-715, 1973
19. Ward, J. M., Yamamoto, R. S., and Brown, C. A.: Pathology of intestinal neoplasms and other lesions in rats exposed to azoxymethane. J. Natl. Cancer Inst. 51: 1029-1039, 1973
20. Ward, J. M., Yamamoto, R. S., Weisburger, J. H., and Benjamin, T.: Transplantation of chemically-induced metastatic mucinous adenocarcinomas of the jejunum and colon in rats. J. Natl. Cancer Inst. 51: 1997-1999, 1973
21. Ward, J. M., Yamamoto, R. S., Benjamin, T., Brown, C. A., and Weisburger, J. H.: Experimentally-induced colon cancer in rats and mice. J.A.V.M.A. 164: 729-732, 1974
22. Olson, W. A., Habermann, R. T., Weisburger, E. K., Ward, J. M., and Weisburger, J. H.: Induction of stomach cancer in rats and mice with halogenated aliphatic fumigants. J. Natl. Cancer Inst. 51: 1993-1995, 1973
23. Weisburger, E. K., Ward, J. M., and Brown, C. A.: Dibenamine: Selective protection against diethylnitrosamine-induced hepatic carcinogenesis but not oral, pharyngeal and esophageal carcinogenesis. Toxic. Appl. Pharm. 28: 477-484, 1974
24. Ward, J. M.: Morphogenesis of chemically-induced neoplasms of the colon and small intestine in rats. Lab. Invest. 30: 505-513, 1974
25. Cohen, A. E., Weisburger, E. K., Weisburger, J. H., Ward, J. M., and Putnam, C. L.: Cystoscopy of chemically-induced bladder neoplasms in rabbits administered the carcinogen dibutyl nitrosamine. Invest. Urology 12: 262-266, 1975
26. Ward, J. M., and Habermann, R. T.: Pathology of stomach cancer in rats and mice induced with the agricultural chemicals ethylene dibromide and dibromochloropropane. Bull. Soc. Pharm. Environ. Path. 2: 10-11, 1974
27. Ward, J. M., Gribble, D. H., and Dungworth, D. L.: Feline infectious peritonitis: Experimental evidence for its multiphasic nature. Amer. J. Vet. Res. 35: 1271-1275, 1974

28. Ward, J. M., Weisburger, E. K., Benjamin, T., and Moss, R. A.: Shift of organotropy of azoxy compounds - replacement of methyl with an octyl group. J. Natl. Cancer Inst. 53: 1181-1185, 1974
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30. Ward, J. M.: Naturally occurring sendai virus disease of mice. Lab. Anim. Sci. 24: 938-942, 1974
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35. Ward, J. M.: Dose response to a single injection of azoxymethane in rats. Vet. Path. 12: 165-177, 1975
36. Ward, J. M., Sontag, J. M., Weisburger, E. K., and Brown, C. A.: Effect of lifetime exposure to aflatoxin B₁ in rats. J. Natl. Cancer Inst. 55: 107-113, 1975
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