

## Research Needs and Safety Assessment of Mutiwalled Carbon Nanotubes

**Günter Oberdörster**

Division of Respiratory Biology & Toxicology  
University of Rochester, Rochester, New York, U.S.A.

Dr. Oberdörster earned his D.V.M. and Ph.D. (Pharmacology) from the University of Giessen in Germany and is Professor in the Department of Environmental Medicine at the University of Rochester, Director of the University of Rochester Ultrafine Particle Center, PI of a Multidisciplinary Research Initiative in Nanotoxicology and Head of the Pulmonary Core of the NIEHS Center Grant. His research includes the effects and underlying mechanisms of lung injury induced by inhaled non-fibrous and fibrous particles, including extrapolation modeling and risk assessment. His studies with ultrafine particles influenced the field of inhalation toxicology, raising awareness of the unique biokinetics and toxicological potential of nano-sized particles.

### *CURRICULUM VITAE*

**Address: Home**     121 Southern Parkway, Rochester, NY 14618     **Phone** 585-473-5880  
**Office**     U. of Rochester,     **Phone** 585-275-3804  
                   Dept. Environ. Med., Rochester, NY 14642     **Fax**     585-256-2631  
**E-mail:** Gunter\_Oberdorster@urmc.rochester.edu  
**Citizenship**     F.R. Germany, United States of America

### ACADEMIC EDUCATION

<u>University</u>	<u>Field of Study</u>	<u>Degree Earned</u>	<u>Year</u>
<u>Univ. of Giessen, F.R. Germany</u>	<u>Veterinary Medicine</u>	<u>cand.med.vet.</u>	<u>1961</u>
<u>Univ. of Vienna, Austria</u>	<u>Veterinary Medicine</u>		<u>1961-1962</u>
<u>Univ. of Giessen, F.R. Germany</u>	<u>Veterinary Medicine</u>	<u>DVM</u>	<u>1964</u>
<u>Univ. of Giessen, F.R. Germany</u>	<u>Pharmacology</u>	<u>Ph.D. (Dr. med.vet.)</u>	<u>1966</u>

(Thesis title: Comparative Investigations of the Coronary Circulation of the Dog Using the  
FELIX- Bubble Flow Meter and the LUTZ Thermistor Flow Meter)

### POSTDOCTORAL TRAINING

Laboratory of Pharmacology; Troponwerke, Cologne, F.R. Germany (pharmac.indust.)     1966-67

**Licensure - State(s)** FR Germany, Veterinarian (Approbation10/64)

**Professional Board Certification** -Diplomate, Veterinary Board of Pharmacology and Toxicology  
(Fachtierarzt für Pharmakologie und Toxikologie)     1974 (F.R. Germany)

### PROFESSIONAL APPOINTMENTS

1968 - 1971     Assistant Professor in Physiology  
                   University of Cologne Medical Faculty, Cologne, Germany  
 1971 - 1979     Scientific Staff Member,  
                   Fraunhofer Institute for Toxicology & Aerosol Research, Graftschaff, Germany

1975 - 1976	Visiting Assistant Professor in Radiation Biology & Biophysics University of Rochester School of Medicine, Rochester, NY
1979 - 1981	Visiting Associate Professor in Radiation Biology & Biophysics University of Rochester School of Medicine, Rochester, NY
1981 - 1987	Associate Professor in Radiation Biology & Biophysics University of Rochester School of Medicine, Rochester, NY
1987 - 1989	Associate Professor of Toxicology in Biophysics University of Rochester, School of Medicine, Rochester, NY
1989 - 1992	Professor of Toxicology in Biophysics University of Rochester School of Medicine, Rochester, NY
1992 -	Professor of Toxicology in Environmental Medicine University of Rochester School of Medicine, Rochester, NY
1995 -	Head, Division of Respiratory Biology and Toxicology University of Rochester School of Medicine, Rochester, NY
1999 - 2001	Professor of Oncology, Univ. of Rochester School of Medicine & Dentistry
1999 -	Director, UR-EPA Particulate Matter Center

#### **MEMBERSHIP IN NATIONAL AND INTERNATIONAL ACADEMIC PROFESSIONAL ORGANIZATIONS**

<u>Organization</u>	<u>Year(s)</u>
<u>German Physiological Society</u>	1970 to 1992
<u>Association for Aerosol Research (Gesellschaft für Aerosolforschung)</u>	1978 to 1994
<u>American Thoracic Society</u>	1980 to date
<u>Society of Toxicology</u>	1983 to date
<u>American Conference of Governmental and Industrial Hygienists (ACGIH)</u>	1983 to date
<u>International Society for Aerosols in Medicine</u>	1987 to date

#### **AWARDS/HONORS**

Joseph von Fraunhofer Prize, 1982 (Munich, F.R.Germany)(for demonstrating pulmonary carcinogenicity of inhaled Cd in rats)

Career Achievement Award, Inhalation Specialty Section of the Society of Toxicology, 1996  
(for meritorious contributions to the field of Inhalation Toxicology)

Paper of the Year Award, Inhalation Specialty Section of SOT, 1997 (Pulmonary inflammatory chemokine and mutagenic response in rats after subchronic inhalation of carbon black. *Tox. & Appl. Pharma.* 136: 372-380, 1996).

Thomas T. Mercer Joint Prize, 2003 (awarded by AAAR and ISAM for outstanding contributions in the field of aerosols in medicine).

EHP Paper of the Year, 2008: Most frequently cited article over the preceding 60 mos. in the environmental health sciences literature (*Oberdörster, et al., Invited Review: Nanotoxicology: An emerging discipline evolving from studies of ultrafine particles. EHP 113, 823-829, 2005*).

*Emerging Research Fronts Paper in the Multidisciplinary Field: Thomson Reuters' ScienceWatch, June 2008.* (<http://sciencewatch.com/dr/erf/2008/08junerf/08junerfOberETAL/>).

#### **Professional Administrative Assignments and Responsibilities at the University of Rochester**

Policy Committee, Dept. of Biophysics (RBB before 1987) 1984-1988

TOX-Admissions Committee, 1983-1991

Animal Care Committee (Chmn.) (Biophysics) 1983-1990

Planning Committee for Defining Faculty and Program Needs of Biophysics Department, 1986/87

Search Committee for Aerosol Scientist (Chmn.) 1983/84; Search Committee for Pulmonary Immunologist,

1983/84; Search Committee for Pulmonary Cell Biologist/Immunologist (Chmn.) 1987/88; Search Committee

for Director of Vivarium (member) 2000/01

Interviewer for Med. Students, Admissions 1984/85; 85/86; 87/88

*Ad hoc* Promotions Committee, 1987; 1990; 1994

Program Head of Pulmonary Toxicology Program of Environmental Health Sciences (EHS) Center, 1987-

Director, Inhalation Facility, 1987 -

Organizing Committee for 1988 Rochester Conference "Aerosols in Medicine"

Policy Committee, EHS Center and Dept. of Environmental Medicine, 1989-

Organizer and chairman of 1990 Rochester Symposium "Particle-Lung Interactions"

Enrichment Program of EHS Center, 1990-1995

Head of Inhalation Risk Program of NSCORT (NASA Specialized Center of Research & Training), 1991-1995

Executive Committee, Dept. of Environmental Medicine, 1995 – 1998

Director, EPA Ultrafine Particle Center, University of Rochester, 1999 -

### **Educational Contributions**

#### **A. Thesis advisor and member of Thesis Advisory Committees:**

##### **1.M.S. - Thesis advisor:**

Peter Archbold:

Potential tumorigenic effect of amorphous man-made mineral fibers. M.S. Thesis, Rochester, 1981.

John F. Wojciak:

Phospholipid aerosols: Growth, evaporation, and surface activity M.S. Thesis, Rochester, 1984.

Steven S. Drago:

Generation and behavior of TC-99m-DTPA particles as a diagnostic aerosol.

M.S. Thesis, Rochester, 1986.

Jeffrey D. Korb:

Developing particle size selective threshold limit values for beryllium: Applying the ACGIH-PSS-TLV decision-making process to an airborne contaminant. M.S. Thesis, 1991.

Deborah R. Gordon:

Indoor air quality and the interim inhalation RfC methodology: Risk assessment and regulation of airborne contaminants. M.S. Thesis, 1991.

John Scot Brandeburg:

Pulmonary Toxicity of cadmium: The role of metallothionein. M.S. Thesis, 1992.

Samuel J. Sanguedolce:

Assessment of the potential health effects of Man-made Vitreous Fibers. M.S. Thesis, 1995.

##### **2.Ph.D. Thesis Advisory Committee member:**

James W. Platner:

Altered clearance of inhaled <sup>99m</sup>Tc-pentetate aerosol following ozone or CdCl<sub>2</sub> aerosol exposure. Ph.D. Thesis, Rochester, 1986.

Helene Gardner:

Characterization of Vitamin E uptake from blood into lung and the effect of NO<sub>2</sub> Ph.D. Thesis, Rochester, 1986.

David Waldman:

Studies on lung epithelial permeability measurements using <sup>99m</sup>Tc-DTPA aerosols and other small molecular weight solutes. Ph.D. Thesis, Rochester, 1988.

Carol Baylock: Surfactant recycling during lung injury. Ph.D. Thesis, Rochester, 1990.

John Breen: Role of placental metallothionein in Cd toxicity.

Ph.D. Thesis, Rochester, 1994.

Theresa Liberati: Mechanism of fiber induced lung injury.

Ph.D. Thesis, Rochester, 1995.

Roger Hawks:

Radiation-induced alteration of selected functions in murine alveolar macrophages.

Ph.D. thesis, Rochester, 1997.

Edward G. Barrett: Particle-induced alveolar macrophage activation. Ph.D. Thesis,

Rochester, February, 1999.

Meghan Hahn:

Development of Functionalized Colloidal Semiconductor Nanocrystal Quantum Dots as Selective Labels for a Pathogenic Bacterium, Ph.D. Thesis, Rochester, June, 2006.

### 3. Ph.D. Thesis advisor:

John F. Wojciak: (co-advisor with Dr. R.H. Notter)

Experimental and theoretical analyses of aerosol deposition: Implications for human health effects. Ph.D. Thesis, Rochester, January 1988.

Steve Gavett:

Effects of cadmium exposure on lung epithelial and inflammatory cells: *in vivo* and *in vitro* studies. Ph.D. Thesis, Rochester, July 1989.

Mark Osier:

TiO<sub>2</sub> particle interactions with pulmonary cells. Ph.D. Thesis, Rochester, 12/97.

Erik Rushton:

Evaluation of engineered nanoparticle toxicity utilizing pulmonary cell lines.

Co-advisor (in program since 8/2003).

Xianglu Han:

Elucidating the mechanisms of nanoparticle toxicity using microarray and proteomics approaches. Co-advisor (in program since 9/2004).

### 4. Post doctoral fellow, supervisor:

Dr. I.H. Lee, 1982-1984; Dr. H. Wieczorek, 1985-1986;

Dr. Ch. Kenaga, 1992-1994; Dr. Alison Elder, 1997-2000;

Dr. Vanessa Silva, 2002-2004

Dr. Amber Rinderknecht, 2006 -

### 5. External Thesis Advisor:

Te-Hsin Hsieh, SUNY-Buffalo: Reader and External Reviewer of Ph.D. Thesis, "Dosimetry Models of Ni-compounds in the Lungs" (2000)

Lynda Anderson, University of Edinburgh, UK; Ph.D. Co-advisor:

"Studies with ultrafine particles *in vitro*"(2002).

Elizabeth Cunningham, U. Tasmania, Australia: External examiner of Ph.D. thesis:

"A study of nanoparticles: Silica fume and woodsmoke" (2002)

JingKun Jiang, Washington University in St. Louis/Dept. of Energy, Environmental and Chemical Engineering: External advisory committee member, for Ph.D. thesis. Qualifying exam. 8/2007.

### B. Educational Grants obtained:

95/96; 96/97; 97/98; 98/99: Recipient of the "Du Pont Educational Aid Program" for unrestricted support of our department's educational programs: \$60,000 total.

C. Lecturing in the following graduate courses:

- a) Past: TOX521; TOX424; TOX471; TOX564; PHM521; PSO407; PM470; Pulmonary Physiology Series of the Pulmonary Unit of the Med. Ctr.
- b) Present: TOX 521 (Toxicology Core Course); TOX 558 (Toxicol Seminar; Course Coordinator 1996-99); Pulmon. Physiol. series; TOX 531 (Course on Principles of Health Risk); PTH 500 Med.Pathol.; ENV 456 (Environm. Hazards).

**Chairmanships - Meetings**

Session Co-Chairman, Society of Toxicology, Annual Meeting, Atlanta, 1984  
 Session Co-Chairman, International Society of Aerosols in Medicine, 5th Intl Mtg, Adelaide, Australia, 1984  
 Session Co-chairman, Society of Toxicology, Annual Meeting, San Diego, 1985  
 Session, Chairman, Association for Aerosol Research, Annual Meeting, Garmisch-Partenkirchen, FRG, 1985  
 Round Table Discussant on "Inhalation of Radioactive Aerosols: Dosimetry and Health Effects" at 2<sup>nd</sup> Intl.Sym.  
 on Deposition and Clearance of Aerosols in the Human Respiratory Tract, Salzburg, Austria, Sept. 1986  
 Session Chairman, Second International Aerosol Conference, Berlin-West, September 1986  
 Session Chairman, Society of Toxicology, Annual Meeting, Dallas, 1988  
 Session Co-Chairman, American Thoracic Society, Annual Meeting, Las Vegas, 1988  
 Session Chairman, 4th IUPAC Cadmium Workshop, Schmallingenberg, FRG, 1988  
 Moderator, 6th Intl. Congress on Aerosols in Medicine, Rochester, 1988  
 Session Co-Chairman, Third World Aerosol Conference, Kyoto, Japan, September 1990  
 Session Co-Chairman, Symp. on Role of the Alveolar Macrophage in Lung Injury, Oxford, UK, 9/90  
 Session Co-Chairman, Sixth International Workshop on Pulmonary Fibrosis, Stowe, VT, October 1990  
 Session Co-Chairman, Third European Meeting of Environmental Hygiene, Düsseldorf, Germany, June 1991.  
 Session Co-Chairman, Fourth Hans Wolfgang Nürnberg Memorial Workshop: "Toxic Metal Compounds." Les Diablerets, Switzerland, March 1991  
 Session Co-Chairman of Expert Meeting: Definition of different therapeutic, diagnostic and environmental aerosols at: Eighth Congress of ISAM, Davos, Switzerland, April 1991  
 Session Co-Chairman and Panel Discussant, IARC Workshop: "Cadmium in the Human Environment," Gargnano, Italy, September 1991  
 Session Co-chairman, SOT Annual Meeting: Lower Respiratory Tract Toxicology, Feb. 1992, Seattle, WA.  
 Session co-chairman, sympos. co-organizer, Fine Particle Soc. Mtg.: Pharma. Aerosols, 7/92 Las Vegas, NV.  
 Session Co-chairman, 2nd Intl. Mtg. on Molecular Mechanism of Metal Toxicity & Carcinogenicity, 1/93, Madonna di Campiglio, Italy.  
 Symposium Chairman and Organizer: Space Exploration and Toxicology: A New Frontier. SOT Annual Meeting, New Orleans, March, 1993.  
 Co-chairman, workshop organizer: The Maximum Tolerated Dose for Inhalation Bioassays. SOT Annual Meeting, Baltimore, MD, 3/95.  
 Session chairman, Vth COMTOX Sym.on Toxicol.& Clinical Chem. of Metals; Vancouver, Canada, 7/95.  
 Session chairman, British Assoc. for Lung Res., Summer mtg. 1995, Edinburgh, UK, 9/95.  
 Session chairman, Society of Toxicology 35th Annual Meeting, 1996, Anaheim, CA  
 Meeting Co-chairman & co-organizer: Sixth Intl. Mtg. on the Toxicology of Natural and Man-made Fibrous and Non-Fibrous Particles, Lake Placid, 1996.  
 Session Chairman & Organizer, Biodiesel symposium, Berlin, Germany, 2/97.  
 Additional listings under "Invited Presentations".

**Elective Offices**

Member of "Society of Toxicology" Committee "Animals in Research", 1984-86  
 Regional Vice President for North America, International Society for Aerosols in Med., 1988-1992  
 Councilor, Society of Toxicology, Metals Specialty Section, 1990-1992  
 Vice President Elect, Society of Toxicology, Inhalation Specialty Section, 1991  
 Vice-President, Society of Toxicology, Inhalation Specialty Section, 1992/93  
 President, Society of Toxicology, Inhalation Specialty Section, 1993/94  
 Councilor, Society of Toxicology, Inhalation Specialty Section, 1994/95  
 Board Member, International Society of Aerosols in Medicine, 1995 – 99

**Advisory and Health Councils and Scientific Committees**

Member of "Contact Group on Heavy Metals" of the European Community, 1977-1979.  
 Reviewer of EPA Health Assessment Document for Carcinogenicity of Cadmium, 1983.  
 Reviewer, NIH study section on Respiratory Protection Devices, 1983.  
 Advisory Committee for EPRI (Electric Power Research Institute, California) on Development of Research Plans for Health Effect Studies on Fly Ash, 1982/1983.  
 Member of Site Visit Team for EPRI of Air Pollution Health Effects Lab., University of CA, Irvine, 1983.  
 WHO consultant for Government of Kuwait on Environmental and Occupational Health, 1983/84  
 Grant reviewer for American Oncological Hospital, Philadelphia, 1984  
 Grant reviewer for Veterans Administration, Medical Center, Chicago, 1984, 1985  
 EPA Science Advisory Board, Subcommittee "Heavy Metals," 1984-1992  
 Interagency Task Force on Environmental Cancer and Heart and Lung Disease, EPA, Consultant, 1985  
 DOE, Member of Site Visit team for Argonne National Laboratory, 1985  
 WHO Consultant for Ministry of Health of Government of Iraq on Air and Water Pollution, 1986  
 Society of Toxicology Committee "Animals in Research," 1984-1986  
 IUPAC Division of Clinical Chemistry, Commission on Toxicology (VII.4); Subcommittee on Environmental & Occupational Toxicology of Cadmium (Corresponding Member), 1986-1988  
 State of New York Department of Health, Reviewer of Health Criteria Documents for Manganese, Beryllium, Cadmium; 1986-1987  
 Member of Site Visit Team for NIEHS Program Project Review at Univ. of California, Davis, CA, May, 1988  
 IUPAC, Division of Clinical Chemistry, Commission on Toxicology. Subcommittee on Risk Assessment; Member, 1988 — 1992  
 DOE, Member, peer review panel for assessment of the Dept.'s research projects on chemical toxicology 1989  
 NIH, Member of National Institutes of Health Reviewers Reserve (NRR), June, 1989- Fall, 1991  
 U.S. Department of the Interior, Bureau of Mines, Reviewer of biomedical research grant proposals, 1990-1995  
 OSHA (Occupational Safety & Health Admin.). Expert witness for occupational exposure standard for Cd, 1990  
 NIH, Special Reviewer, Pharmacology Study Section, June, 1990  
 EPA, Participant of review panel of "Health Assessment Document for Diesel Emissions", 1990  
 HEI (Health Effects Institute), Member of Scientific Review Panel, 1990, for NTP/HEI collaborative study  
 EPA, Invited Participant, Workshop on Inhalation Toxicology of High Molecular Weight Polymers, Jan., 1991, Bethesda, MD  
 EPA, Invited Participant, Manganese/MMT Conference and Workshop, Research Triangle Park, NC, 3/91.  
 NIH, Member NIEHS Toxicology Study Section, Fall 1991 — Fall 1995  
 EPA, Promotion Review Board, *Ad hoc* board member, 1991  
 NIEHS, Reviewer of Program Project applications for the Superfund Hazardous Substances Basic Research Program, October/November, 1991.  
 ACGIH, Science Advisor to Committee for Threshold Limit Values for Chemical Substances and Physical Agents (TLV-Committee) 4/92 - 1997  
 CIIT (Chemical Industry Institute of Toxicology), member of Scientific Advisory Panel, 1992  
 IARC (International Agency for Research on Cancer) Member of Monograph Committee for Cadmium, Beryllium and Mercury; Lyon, February, 1993.  
 WHO: Coordinator of IPCS Monograph and member of working group on Principles and Methods for Assessing Respiratory Tract Injury Caused by Inhaled Substances (Geneva, Switzerland; Rochester, NY; Durham, NC; Eindhoven, Netherlands; 1993-97)  
 WHO/IPCS: Review of WHO Health Criteria Document on Diesel (Geneva, December, 1993)  
 Federal Health Office, Germany: Invited Expert - Hearing on classification of manmade fibers, Berlin, 12/93.

**Advisory and Health Councils and Scientific Committees (cont)**

French Ministries of Health, Labor, Environment and Industry: Invited Moderator and Rapporteur for Workshop on Man-Made Fibers, Paris, February, 1994.  
 WHO: Chairman, Review Group meeting-WHO Health Criteria Doc. on Diesel Fuel & Exhaust(Hannover,6/94)

- Ministry of Natl. Hlth & Welfare, Canada: Preparation of Health Criteria Doc. on Animal Toxicology of Inhaled Particles, 1994.
- American Institute of Biological Sciences: Member of Peer Review Panel on Depleted Uranium (Gulf War Syndrome, Arlington, VA, 8/94).
- CIIT (Chemical Toxicology Centers for Health Research): Member of Scientific Advisory Committee (SAC), Respiratory Toxicol Prog., 1994- 2000.
- Schuller International, Inc.: Member of Science Advisory Group, Fiber Toxicology, 1994.
- EPA: Review of Health Criteria Document on Particulate Matter, 1994/95
- National Academy of Sciences: Review of Cd-toxicity and carcinogenicity for NAS meeting to discuss the Army's Toxicological Risk Assessment for Zinc-cadmium-sulfide, 1/95.
- Member of ad hoc working group of NTP Board of Scientific Counselors: Review of criteria for selecting substances for Biannual report on carcinogens; 1995.
- EPA Workshop on Chronic Inhalation Toxicity and Carcinogenicity Testing of Respirable Fibrous Particles: Workshop Chairman, 5/95.
- NIH, NIEHS Reviewers Reserve (NRR) Fall 1995 — 2000.
- IARC, Member of review panel for carcinogenicity evaluation of carbon black, Lyon, France, October, 1995.
- API - EPA review of toxicity testing of oxygenated fuels, member of review group, 12/1995.
- IARC, Member of review panel to evaluate mechanisms of fiber carcinogenicity, 1995/96.
- NiPERA Panel member, Nickel Research Workshop, Rockville, MD, 6/96.
- HEI - Member of Review Panel for Grant Applications, 1/97.
- NRC, Reviewer of doc.: "Toxicologic Assessment of the Army's zinc cadmium sulfide dispersion tests", 3/97.
- API, Workshop on Clinical Studies and Particulate matter, invited speaker and chair of working group, 4/97.
- CIIT: Chairman, panel to develop White Paper on Respiratory Toxicology Research, 10/97.
- WHO, Consultant to Regional Office of Western Pacific, Manila, Philippines, for establishing inhalation facility at Taejon, Republic of Korea, 11/97.
- NRC, Member of Committee on Toxicology, 1997 - 2002.
- NRC, Member, Cte. on Research Priorities for Airborne Particulate Matter, 1998-2004.
- EPA, Member, Site Visit Team reviewing EPA's Human Studies Division, 2/98.
- CIIT: Chairman, Tech. Advisory Panel (TAP) for Mn-Toxicology, 1998 -
- ILSI: Workshop on the Relevance of the Rat Lung Response to Particle Overload for Human Risk Assessment. Invited participant, 3/98.
- EPA, Clean Air Science Advisory Committee, Consultant, 1998 -- 2006
- European Commission, European Chemicals Bureau, Joint Research Center, Ispra, Italy: *Ad hoc* Expert Group on Calibration/Validation of Testing Methods for Man-made Fibers, Invited speaker and participant, 5/98.
- EPA, reviewer, new draft Health Criteria Doc. For Particulate Matter, Research Triangle Pk, 4/99
- NIEHS, reviewer, Special Emphasis Panel, Superfund Basic Research Program, October, 1999.
- Canadian Department of Foreign Affairs & Intl. Trade, Reviewer of chrysotile studies, Dec 99/Jan 00.
- NIOSH, member of Special Study Section to review grants in response to RFA on Effects of Mixed Dusts, 7/00.
- EPA, Member of Food Quality Protection Act (FQPA) Science Review Board (SRB), 2000 -
- EPA, Consultant to Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Scientific Advisory Panel "Test Guidelines for Chronic Inhalation Toxicity and Carcinogenicity of Fibrous Particles," 9/00.
- German Research Association (Deutsche Forschung sgemeinschaft) Workshop of MAK Committee, Munich, Germany: "Evaluation of Fiber and Particle Toxicology," invited speaker and session chair, 10/00.

### **Advisory and Health Councils and Scientific Committees (cont)**

- Univ. of Düsseldorf, Member of Search Cte. for Chair, Inst. Environm. Med., 7/00-1/01.
- IARC (Intl. Agency for Research on Cancer)/WHO, member and subgroup chair of review panel for carcinogenicity evaluation of man-made vitreous fibers, Lyon, France, October, 2001.
- Inst. For Work Safety, Germany, Workshop on "Ultrafine aerosols at the workplace", August 2002, St. Augustin, Germany: Invited participant and speaker.
- ATSDR (Agency for Toxic Substances Disease Registry), member of expert panel on asbestos and synthetic vitreous fibers, 2002 – 2003
- ILSI (International Life Sciences Institute), member of Core Working Group, "Testing of Fibrous particles: Short-term assay, methods and strategies", 2002 –

- Health Canada (Canadian EPA): Invited speaker and workshop participant on Government of Canada Discussion Session on Nanotechnology: Policy Implications Arising from Health, Environmental and Other issues, Ottawa, Canada, 11/03.
- Taiwanese EPA and Industry Technology Research Institute of Taiwan: Environmental Nanotechnology Symposium. Invited speaker: "Effects and Fate of Inhaled Ultrafine/Nanoparticles, Taipei, Taiwan, 12/03.
- European Commission, Directorate-general for health and Consumer Protection: Invited Expert to attend meeting "Mapping out Nano Risks," Brussels, Belgium, March, 2004.
- European Commission for Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR), member on reserve list of scientists effective 7/04 – (European Union/Decision 2004/210/EC).
- ANSI Nanotechnology Standards Panel, Sept. 29-30, 2004, Washington, DC, Advisory Board member.
- ICON (Intl. Council on Nanotechnology) Inaugural mtg, Rice Univ., Houston, TX, 10/04- present, Advisory Cte member.
- ILSI (Intl. Life Sciences Inst., Wash., DC): Nanomaterial Toxicity Screening Working Group, Meeting on Principles for Characterizing the Potential Human Health Effects from Exposure to Nanomaterials: Elements of a Screening Strategy, Feb. 23-25, 2005; Chairman.
- NIH, Center for Scientific Review Special Emphasis Panel, Respiratory Sciences ad hoc Study Section: Review of BRP (Bioengineering Research Partnerships) applications, Wash., DC, 7/7/05.
- Intl Assoc for Research on Cancer (IARC), IARC Monograph mtg: carbon black, TiO<sub>2</sub> and non-asbestiform talc. Invited observer, Lyon France, 2/2006.
- Nanotechnology Tech. Advisory. Group (President's Council of Advisors on Sci.&Technol. [2007- ]. Council of Canadian Academies, Member, Expert Panel on Nanotechnology: Evaluating risks of nanotechnology, 2007 – 2008.
- National Research Council, Member, Cte. for review of the Federal strategy to address environmental, health and safety research needs for engineered nanoscale materials, 2008/09.
- EPA SAB OSWER Interim Method to Assess Asbestos-Related Carcinogenic Risk, Member, 2008 ---
- EPA-IRIS Review Panel on Toxicological Review for Cerium Oxide and Cerium Compounds, panel member, 2008.
- European Commission (EC) Health and Consumer protection Directorate General: Safety for Success Dialogue, Invited keynote speaker and participant, Brussels, 2008.
- Institute for Research on Workers Health and Safety, Canadian Standards Association, and Industrial Accident Prevention Association to assess health, safety and standardization of nanomaterial in Canada, 2008.
- IOC (Intl. Olympic Committee), member of Air Quality Expert Panel to provide advice prior and during the 2008 Olympic Games in Beijing, China, 2007-2008.