DECLARATION OF JOSHUA HAMILTON

DECLARATION OF JOSHUA W. HAMILTON

I, Joshua W. Hamilton, declare:

1. I serve as the Chief Academic and Scientific Officer at the Marine Biological Laboratory ("MBL") in Woods Hole, Massachusetts and as Senior Scientist at the MBL's Bay Paul Center for Comparative Molecular Biology & Evolution, and also hold an appointment as a professor in the Department of Pathology and Laboratory Medicine at Brown University. Prior to joining the MBL in 2008, I held concurrent appointments in the Department of Pharmacology & Toxicology at the Dartmouth Medical School and Dartmouth's Department of Chemistry, as well as serving as an Associate Director and Senior Researcher at Dartmouth's Norris Cotton Cancer Center.

2. In 2000, I founded Dartmouth's Center for Environmental Health Sciences, a multi-disciplinary research, education and outreach program bringing together over thirty members of the faculty and their laboratories from fourteen Dartmouth departments to focus on the human health effects of environmental chemicals. I served as the Center's Director until 2008. I was also the former Director and Principal Investigator of the largest of the Center's research programs, the Superfund Research Program Project on Toxic Metals, sponsored by the National Institute of Environmental Health Sciences of the National Institutes of Health and by the U.S. Environmental Protection Agency to investigate the human health effects of chemicals in the environment. I am still affiliated with the program where I direct one of its five research projects. It is considered one of the scientific world's pre-eminent research programs on toxic metals. The principal focus is on the effects of chromium, arsenic and other metals on human health, which has been the primary focus of my own laboratory's research for the past two-plus decades. I have been continuously funded by NIH and other federal and non-federal agencies for the past twenty-six years, and have published numerous articles on these topics.

3. I am considered one of the leading experts on the toxicology of chromium. As such, I recently served as an External Reviewer for U.S. EPA's draft update of its Toxicological Profile for Hexavalent Chromium [1]. I have served on numerous other state and national

scientific committees as a toxicology expert, and regularly consult with local, state and federal agencies on issues related to toxic metals exposure and health effects. Attached to this Declaration as Exhibit A is a copy of my curriculum vitae.

4. I was asked by PG&E to consult on toxicology issues related to the chromium plume at Hinkley, California. I have reviewed the draft Cleanup and Abatement Order No. R6V-2011-0005A1 (the "Draft CAO") under consideration by the Lahontan Board [2].

5. The Draft CAO demonstrates a significant misunderstanding of the draft California EPA Office of Environmental Health Hazard Assessment (OEHHA) Public Health Goal ("PHG") [3] and the PHG process. Two passages in the Draft CAO are indicative of the Lahontan Board staff's misunderstanding of what is known as a Reference Exposure Level ("REL"), a PHG, and other public health and regulatory guidelines, how they relate to background levels of Cr(VI), and how they should be interpreted and applied. The first refers to OEHHA's establishment of a chronic inhalation REL: "[The REL][1] is important because it *demonstrates established science* that inhaled hexavalent chromium has *adverse impacts on human health at extremely low levels.*" ([2] § 15, p. 4; emphasis added) The second passage reads: "Based on the draft 2010 PHG, the Water Board has determined that hexavalent chromium in domestic wells above 0.02 µg/L *poses an immediate health risk to Hinkley residents* through continued household use of *contaminated water*, including drinking, preparing foods and beverages, bathing or showering, flushing toilets, and other household uses resulting in potential dermal and inhalation exposures." ([2] § 26, p. 7; emphasis added) These statements by the Lahontan Board suggest a fundamental misunderstanding about the difference between conservative public policy practices such as the setting of RELs and PHGs and the scientific information on which they are based.

6. The scientific community's foundational information about the relationship of Cr(VI) to potential adverse human health effects comes from two principal sources that bear little

[1] The Draft CAO also confuses Cr(VI) with chromic acid. The OEHHA REL for soluble Cr(VI) compounds is 0.2 µg/m^3, and is based on an animal exposure study in which rats were exposed to Cr(VI) for eighteen hours per day at concentrations ≥ 50 µg/m^3. The REL for chromic acid is 0.002 µg/m^3, and is based on human exposures to chromic acid in a chromium plating plant. The form of Cr(VI) in Hinkley is *not* chromic acid and, therefore, the chromic acid REL is irrelevant. In this regard, see http://oehha.ca.gov/air/chronic_rels/pdf/hexChroms.pdf.

to no resemblance to Cr(VI) concentrations to which Hinkley residents have been and are being exposed:

(a) Epidemiology studies of workers in occupational settings who were exposed to high concentrations of airborne Cr(VI) in chemical and physical forms that are *not* representative of exposures to Cr(VI) in Hinkley groundwater; and

(b) Studies of laboratory animals exposed to extremely high levels of Cr(VI) – in most cases at or near the maximum tolerated dose, and at thousands to tens of thousands of times higher levels than Hinkley well concentrations – over the practical lifetime of the animals.

7. The current California and Federal Maximum Contaminant Levels ("MCLs") for total chromium, which can include up to 100% Cr(VI), are 50 ppb and 100 ppb, respectively. The background concentrations in Hinkley are between 1 and 3 ppb, and the draft California PHG [3] seemingly embraced by the Draft CAO as a regulatory guideline is 0.02 ppb. Despite over eighty years of intense study reported in tens of thousands of scientific papers, the only demonstrated adverse health effects of chromium occurred at levels of exposure that are more than a thousand times higher than those that would be encountered in environmental and household settings, including those in Hinkley. Conversely, there are no studies showing any adverse effects of Cr(VI) at levels anywhere near the current MCLs, let alone the background concentrations at Hinkley or the level proposed for the draft PHG.

8. The statements in the Draft CAO also indicate a fundamental misunderstanding about risk assessment methodology. For regulatory and public health purposes, risk assessors start with the scientific data from the high-dose studies, and then apply conservative assumptions using mathematical modeling to predict health risks at exposures that are tens of thousands to millions of times lower. For example, the lowest Cr(VI) concentration that caused tumors in animals in the National Toxicology Program study [4] which was the foundation for the draft PHG, was 20,000 µg/L. Notwithstanding, OEHHA proposed a PHG of 0.02 µg/L, *one million times lower* than the concentration that caused cancer in mice from a lifetime of drinking water exposure. The calculations embodied in the draft PHG do not represent "established science." And even if the *draft* PHG is adopted, regulators should not assume that exposures of the type

and duration that would be experienced by Hinkley residents will result in any adverse health impacts. In fact, there is no way to confirm any of the risk assessors' assumptions in constructing the models that ostensibly support the draft PHG, or to determine whether there are any measurable health effects as a result of exposures at 0.02 µg/L. They reflect a highly conservative, overly-protective regulatory limit that assumes a lifetime of exposure, but they do not represent levels that suggest a significant or immediate health threat.

9. EPA and OEHHA both understand and clearly articulate the limitations of PHGs and their equivalents. For example, in commenting on its Toxicological Profiles, including the profile for Cr(VI), EPA notes: "It should be emphasized that [the regulatory risk assessment methodology] leads to a plausible upper limit to the risk....Such an estimate, however, does not necessarily give a realistic prediction of the risk. *The true value of the risk is unknown, and may be as low as zero.*" ([1] emphasis added) EPA also noted in its 1996 Carcinogen Risk Assessment Guidelines: "Use of health protective risk assessment procedures as described in these cancer guidelines means that estimates, while uncertain, are more likely to overstate than understate hazard and/or risk." [5] Similarly, OEHHA is explicit that the draft Cr(VI) PHG is not and should not be used as a regulatory or cleanup standard: "PHGs are not regulatory requirements, but instead represent non-mandatory goals....PHGs are not developed as target levels for cleanup of ground or ambient surface water contamination, and may not be applicable for such purposes, given the regulatory mandates of other environmental programs." ([3] p. iii.) In sum, the draft Cr(VI) PHG, as its name implies, is at most a goal, not a regulatory level, and in no way should exposures to concentrations above 0.02 µg/L be interpreted as an immediate health risk to Hinkley residents nor should this proposed goal be used to set action or cleanup levels.

10. The Lahontan Board has also previously contended that the draft Cr(VI) PHG represents the best and most recent science. An objective assessment indicates otherwise:

(a) The initial draft Cr(VI) PHG drew on two principal studies: The 1968 Borneff, *et al.*, animal study [6], and the 1987 Zhang and Li epidemiology study. [7] Both are outdated and flawed, and they have been rejected by EPA and mainstream toxicology experts as

a foundation for Cr(VI) toxicology risk assessment. The Borneff study in particular is so profoundly flawed that it is unlikely it would be published if submitted today for peer review. One expert for the plaintiffs in a personal injury lawsuit alleging health effects from Cr(VI) exposure was quoted as saying it would be "totally stupid and scary" to base the OEHHA risk assessment on the Borneff study.[2] Likewise, the Zhang study is little more than a report, and lacks the necessary data to permit epidemiologists to evaluate Cr(VI) hazards and calculate risks. As a result, the Zhang study is not an appropriate foundation for assessing potential risk. Based on these and other criticisms [8], California withdrew its initial draft Cr(VI) PHG, and generated a revised draft PHG when the National Toxicology Program's studies of lifetime cancer risk in rodents were published. [4,9,10] Although OEHHA based the revised calculation of the current draft PHG principally on those NTP studies, the Borneff and Zhang studies are still cited as justification for the 0.02 μg/L.

(b) EPA is currently updating its Toxicological Profile for Cr(VI), which will form the basis for a possible federal MCL for Cr(VI) and/or total chromium in drinking water. The revised draft Profile [1] has been released for public comment, and an expert panel recently reviewed it in a public session.[3] I served on that panel, which presented and discussed its review of the draft Profile and listened to public comments from stakeholders. EPA's draft Profile appropriately omits any reference to the Bornoff study in its review of key animal studies. While the draft Profile discusses the Zhang study and three follow-up analyses, it correctly states that it should not be used for risk assessment purposes.[4] The panel agreed with these assessments. Thus, there is already significant disagreement between the draft PHG and EPA's draft Cr(VI) Toxicology Profile.

(c) During the Public Comment period the US EPA panel was given an overview of nearly-completed ninety-day toxicity studies that will soon be published in the peer-

---

[2] Max Costa, Los Angeles Times, Nov. 11, 2000, "Mice and Scientific Unknowns At Heart of Chromium Debate."
[3] U.S. Environmental Protection Agency, Notice of Peer Review Workshop, May 12, 2011. Federal Register, Volume 76, No. 70 (April 12, 2011), Pg. 20349-20350. See also U.S. EPA web site: http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433.
[4] U.S. EPA, referring to the Zhang study: "The epidemiology data are not sufficient to establish a causal association between exposure to hexavalent chromium by ingestion and cancer." ([1] p. 201, Lines 20-23).

reviewed literature (see for example [11,12] as emerging publications from these studies). Based on the results presented to date, these studies will unequivocally support a threshold mechanism as the Mode of Action ("MOA") for Cr(VI) in vivo via ingestion and inhalation exposure. In fact, these studies were specifically designed to investigate the MOA and to complement the 2008 NTP studies in all respects, including study design. The pending studies are even being conducted by the same scientists that conducted the 2008 NTP studies. The panel's consensus was that the pending studies provided important new information that was critical to an overall understanding of Cr(VI), and should be incorporated into the EPA's Profile. Thus, the panel urged EPA to wait for these studies to be published so that they may be taken into account in their assessment. The panel also called for other substantive changes to the draft Profile based on its view that EPA's Cr(VI) risk assessment model was flawed and should be revised based on a likely threshold MOA.

11. Once EPA's Cr(VI) Toxicological Profile is finalized, EPA will undertake to promulgate a federal MCL for Cr(VI). It would be prudent for OEHHA to wait to finalize the PHG for Cr(VI) until such time as the federal MCL for Cr(VI) is finalized. Again, it is worth noting that the current MCL for chromium (total chromium, up to 100% Cr(VI)) is 100 ppb, which was actually raised from 50 ppb several years ago in recognition that the scientific literature indicated a threshold mechanism for toxic and carcinogenic effects. Some have urged OEHHA to quickly finalize the draft PHG. However, as the US EPA Administrator stated at a public meeting in May 2011 in response to comments urging EPA to move quickly in finalizing the Toxicological Profile for Cr(VI): "We want it to be based on the best science....we want to get it right." [Personal Communication]

12. The Draft CAO expresses concern about potential exposure to Cr(VI) from evaporative coolers and other household appliances. OEHHA concluded in its draft Cr(VI) PHG that the principal exposure pathway of concern for chromium in drinking water is ingestion [2]. OEHHA also studied exposure to chromium via showering, which is generally assumed to be the principal inhalation pathway of concern for households with contaminants in drinking water supplies. However, OEHHA did not include dermal contact, having determined that such

exposures were insignificant. In addition, OEHHA concluded that exposure by inhalation during showering did not contribute significantly to the overall risk. And even with conservative assumptions regarding exposure during showering, the contribution to risk from inhalation was 180 times lower than that from drinking water exposure.[5]

13. I have further investigated exposure via inhalation from the use of swamp coolers and have concluded that exposure to airborne Cr(VI) from swamp coolers is not a pathway of concern for households in Hinkley or elsewhere:

(a) The scientific and regulatory literature confirms that inorganic constituents, including chromium, that may be present in the water used in swamp coolers are not volatile and do not evaporate with the water. Instead, the inorganic constituents remain behind on the filter or, for those units with recirculation versus a drip line and drain, in the sump. Moreover, a 1996 scientific publication by Finley et al. [13] examined Cr(VI)-contaminated water in an evaporative cooler, in a trial experiment in a Hinkley-area house with a typical evaporative cooler. They demonstrated that even using a concentration of Cr(VI) of 20,000 ppb in a unit running for twenty-four hours, there was no increase in the airborne Cr(VI) concentration above the natural outside and indoor backgrounds. Thus, there is no basis for any concerns regarding inhalation exposure risk from evaporative coolers, particularly at the concentrations in any impacted Hinkley households, which are more than 4,000 times lower than the levels examined in these experiments.

(b) To further evaluate the potential, if any, for exposure to Cr(VI) from the use of swamp coolers, I did a comprehensive search for studies in peer-reviewed scientific literature. Only two relevant studies were located, Finley et al. 1996, and Paschold et al. 2003. [13,14] The Paschold findings supported the Finley results discussed above. Paschold studied airborne particulate matter, PM10 and PM2.5, and cooling water in ten residences in El Paso, Texas. [14] The homes were monitored for concurrent indoor and outdoor PM2.5 and PM10 with the use of swamp coolers. More than thirty elements in the PM fractions – including lead,

[5] The PHG associated with inhalation exposure may be readily calculated from the information in the draft PHG assessment by removing the contribution from oral exposures. The PHG associated with inhalation exposure is 3.6 µg/L.

manganese, copper, barium and chromium – were evaluated. Comparisons of the elemental concentrations of the evaporative cooler supply water and indoor PM demonstrated little or no correlation in all ten houses, including those with disabled bleed-lines.[6] From this, Paschold concluded that evaporative coolers were not introducing dissolved solids from the supply water into indoor air.

(c) To summarize, swamp coolers work by evaporating water into warmer air drawn in from the outdoors. The evaporation process cools the air, which is then blown into the house. Minerals that are non-volatile, including Cr(VI), are not transferred from the feed water into the cooled air, but remain in the system or are eliminated through the bleed-line. For these reasons, swamp coolers are not expected to be a source of Cr(VI) or other non-volatile constituents in indoor air, and the published studies of swamp coolers support this conclusion.

14. Like swamp coolers, other similar appliances (such as humidifiers and hot water vaporizers) that act by volatilizing heated water or by evaporating water from a filter will not be a potential source of Cr(VI) into indoor air because Cr(VI) will not be volatilized with the water.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that this Declaration was executed on July 9, 2011, at Falmouth, Massachusetts.

Joshua W. Hamilton Ph.D.

[6] A bleed-line is a drainage tube with an external discharge inserted into the pad water supply hose for continuous removal of particle-laden cooler pan water.

References

1. Environmental Protection Agency (EPA). 2010. Toxicological Pofile of Hexavalent Chromium. External Review Draft National Center for Environmental Assessment, Office of Research and Development, Washington, DC. September, 2010
2. California Regional Water Quality Control Board, Lahontan Region, Draft Cleanup and Abatement Order to PG&E, June 10, 2011.
3. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Draft Public Health Goal for Hexavalent Chromium in Drinking Water, August 2009.
4. NTP. 2008. NTP technical report on the toxicology and carcinogenesis studies of sodium dichromate dihydrate (CAS No. 7789-12-0) in F344/N rats and B6C3F1 mice (drinking water studies), NTP TR 546. NIH Publication No. 08-5887.
5. Enviromental Protection Agency (EPA). 2005. Guidelines for carcinogen risk assessment, EPA/630/P-03/001F. Risk Assessment Forum: U.S. Environmental Protection Agency, Washington, D.C.
6. Bornoff I, Engelhardt K, Greim W, et al. 1968. Kankzerogene substanzen in wasser und boden XXII. Mausentrankversuch mit 3,4-benzpyren und kaiumchromat. Arch Hyg Bakter 152:45-53.
7. Zhang JD, Li S, 1987. Chromium pollution of soil and water in Jinzhou. J Chinese Prevent Med 21262-264.
8. Flegal, R., J. Last, E.E. McConnell, M. Schenker and H. Witschi. Scientific review of toxicological and human health issues related to the development of a public health goal for chromium(VI). Report of the Chromate Toxicity Review Committee, California Department of Health Services and Office of Environmental Health Hazard Assessment, Cal. Environmental Protection Agency, Sacramento CA, August 31, 2001.
9. NTP. 2007. NTP technical report on the toxicity studies of sodium dichromate dihydrate (CAS No. 7789-12-0) administered in drinking water to male and female F344/N rats and B6C3F1 mice and male BALB/c and am3-C57BL/6 mice. NTP Toxicity Report Series Number 72, NIH Publication No. 07-5964
10. Stout, M. D., Herbert, R. A., Kissling, G. E., Collins, B. J., Travlos, G. S., Witt, K. L., Melnick, R. L., Abdo, K. M., Malarkey, D. E. and Hooth, M. J. (2009). Hexavalent chromium is carcinogenic to F344/N rats and B6C3F1 mice after chronic oral exposure. *Environ Health Perspect* **117**, 716-22.
11. Thompson, C. M., Haws, L. C., Harris, M. A., Gatto, N. M. and Proctor, D. M. (2011a). Application of the U.S. EPA mode of action Framework for purposes of guiding future research: a case study involving the oral carcinogenicity of hexavalent chromium. *Toxicol Sci* **119**, 20-40.
12. Thompson, C. M., Proctor, D. M., Haws, L. C., Hebert, C. D., Grimes, S. D., Shertzer, H. G., Kopec, A. K., Hixon, J. G., Zacharewski, T. R., Harris, M. A., (2011b). Investigation of the mode of action underlying the tumorigenic responses induced in B6C3F1 mice exposed orally to hexavalent chromium. *Toxicol Sci*, In press.
13. Finley BL, Kerger BD, Dodge DG, et al. 1996. Assessment of airborne hexavalent chromium in the home following the use of contaminated tapwater. J Exp Anal Environ Epi 6, 229-245.
14. Paschold H, Li W-W, Morales H, et al. 2003. Elemental analysis of airborne particulate matter and cooling water in west Texas residences. Atmos Environ 37, 2681-90.

EXHIBIT A

Curriculum Vitae

JOSHUA W. HAMILTON, PH.D.

Chief Academic and Scientific Officer, and
Senior Scientist, Bay Paul Center for Comparative Molecular Biology and Evolution,
Marine Biological Laboratory (MBL)
Professor (MBL), Department of Pathology and Laboratory Medicine, Brown University

Marine Biological Laboratory
7 MBL Street
Woods Hole MA 02543
(508) 289-7300
(508) 289-7415 (direct)
fax (508) 289-7934
e-mail: jhamilton@mbl.edu

PERSONAL:

Born: July 31, 1956, Salem MA
Married, two children

EDUCATION:

Cornell University, Ithaca, NY 14853. 1982 to 1985. Ph.D., Genetic Toxicology, 1985. Thesis: *Correlation Between Mixed-Function Oxidase Enzyme Induction and the Genotoxicity of Chemical Mutagen-Carcinogens in the Chick Embryo In Vivo.* (Stephen Bloom, Christopher Wilkinson, advisors)

Cornell University, Ithaca, NY 14853. 1980 to 1982. M.S., Genetics, 1982. Thesis: *Development of Basal and Induced Aryl Hydrocarbon (Benzo[a]pyrene) Hydroxylase Activity in the Chick Embryo In Ovo.* (Stephen Bloom, Christopher Wilkinson, advisors)

Bridgewater College, Bridgewater, MA 02324. 1976 to 1980. B.S., Biology, 1980 (*cum laude*).

POSTDOCTORAL TRAINING:

Postdoctoral Research Fellow (NIEHS, Norris Cotton Cancer Center and Department of Chemistry), Department of Chemistry (Karen E. Wetterhahn, advisor), Dartmouth College, 1985 to 1988.

ACADEMIC APPOINTMENTS:

Professor (MBL), Pathology and Laboratory Medicine, Brown University, 2010 to present.
Senior Scientist, Bay Paul Center, Marine Biological Laboratory (MBL), 2008 to present.
Professor (with tenure) of Pharmacology & Toxicology, Department of Pharmacology & Toxicology, Dartmouth Medical School, 2003 to 2008.

Adjunct Professor of Chemistry, Department of Chemistry, Dartmouth College, 2003 to 2008.
Adjunct Senior Scientist, Center for Integrated and Applied Toxicology, Bioscience Research Institute, University of Southern Maine, 2003 to present.
Associate Professor of Pharmacology & Toxicology, Department of Pharmacology & Toxicology, Dartmouth Medical School, 1994 to 2003.
Adjunct Associate Professor of Chemistry, Department of Chemistry, Dartmouth College, 1994 to 2003.
Adjunct Assistant Professor of Biology, Department of Biology, Dartmouth College, 1992 to 1993.
Assistant Professor of Pharmacology & Toxicology, Department of Pharmacology & Toxicology, Dartmouth Medical School, 1990 to 1994.
Adjunct Assistant Professor of Chemistry, Department of Chemistry, Dartmouth College, 1990 to 1994.
Member, Norris Cotton Cancer Center, Dartmouth-Hitchcock Medical Center, 1988 to present.
Research Assistant Professor of Chemistry, Department of Chemistry, Dartmouth College, 1988 to 1990.

OTHER PROFESSIONAL POSITIONS:

Acting Director, Cellular Dynamics Program, Marine Biological Laboratory, 2010-present.
Chief Academic and Scientific Officer, Marine Biological Laboratory, 2008 to present.
Associate Director, Norris Cotton Cancer Center at Dartmouth, 2006 to 2008.
Visiting Scientist, Harvard School of Public Health, September 2005 to June 2006.
Associate Director, Dartmouth College Center of Biomedical Research Excellence (COBRE) Program Project on Lung Biology, 2003 to 2008.
Director, Center for Environmental Health Sciences at Dartmouth, Dartmouth College / Dartmouth Medical School, 2000 to 2008.
Director / Principal Investigator, Dartmouth College Superfund Basic Research Program Project on Toxic Metals, Dartmouth College / Dartmouth Medical School, 1997 to 2008.
Director, Molecular Biology & Proteomics Core Facility (macromolecular synthesis and sequencing), Dartmouth College, 1995 to 2008.
Co-Director, Dartmouth College Superfund Basic Research Program Project on Toxic Metals, Dartmouth College / Dartmouth Medical School, 1995 to 1997.

AWARDS AND HONORS:

Teaching Assistantship, Department of Poultry and Avian Sciences, Cornell University, 1980.
Graduate Research Assistantship, National Institutes of Health (CA28953, Stephen E. Bloom, advisor), 1981.
Outstanding Teaching Assistant Award, Cornell University, 1983.
Jacob H. Bruckner Memorial Award for Excellence in Graduate Study, Cornell University, 1983.
Graduate Research Fellowship, National Institutes of Health (Environmental Toxicology Training Grant 08 T2 ES07052, Institute of Comparative and Environmental Toxicology, Cornell University), 1984.
Individual National Research Service Award (Postdoctoral Fellowship), National Institutes of Health (F32 ES05399, Molecular Biology, Karen E. Wetterhahn, advisor), 1987.

Junior Faculty Research Award, American Cancer Society (JFRA-323), 1991-1993.
Bohan Visiting Lecturer, University of Kansas Medical Center, May 1998.
Master of Arts (Honorary), Dartmouth College, May 2004.

PROFESSIONAL SERVICE, MAJOR COMMITTEE ASSIGNMENTS AND CONSULTATIONS:

Program Reviews:

Member, External Advisory Committee, Massachusetts Institute of Technology Center for Environmental Health Sciences (NIEHS Center Grant) (1997 to 2003).
External Advisor, Plymouth State University, Plymouth NH, Planning Group for creation of a new Center for the Environment at PSU, October 25-26, 2003.
Member, External Advisory Committee, Dartmouth Medical School NIH-NCRR COBRE Lung Pathobiology Program, 2008 - present.
External Advisor, Brown University NIH-NIEHS Superfund Research Program, 2008-present.
Chair, External Advisory Committee, Brown University NIH-NIEHS Children's Environmental Health Sciences Center, 2010 - present.
Member, External Advisory Committee, Rhode Island NSF EPSCoR Program, 2010 - present.

Scientific Report Reviews:

External Reviewer, National Research Council Report, *Arsenic in Drinking Water, 2001 Update*, National Academy of Sciences, National Academy Press, 2001.
Member, U.S. EPA Science Advisory Board (SAB) Review Committee, Framework for Metals Risk Assessment, 2004 - 2008.
Member, U.S. EPA Science Advisory Board (SAB) External Review Committee, PAH Mixtures Risk Assessment, 2010 – present.
Member, U.S. EPA Science Advisory Board (SAB) External Review Committee, Toxicological Profile for Hexavalent Chromium (September 2010 Draft), 2011 – present.

Grant Reviews:

Ad Hoc Reviewer, Chemical Pathology A (CPA) Study Section, National Institutes of Health, June 1989, June 1993, June 1996.
Ad Hoc Reviewer, Experimental Therapeutics A (ET1) Study Section, National Institutes of Health, June 1996.
Chair, Special Emphasis Panel, Experimental Therapeutics A (ET1) Study Section, National Institutes of Health, December 1996.
Ad Hoc Reviewer, Metabolic Pathology (MEP) Study Section, National Institutes of Health, December 1997.
Ad Hoc Reviewer, Alcohol and Toxicology I (ATI) Study Section, National Institutes of Health, December 1998, February 1999.
Ad Hoc Reviewer, W.M. Keck Foundation Faculty Fellowship Program, February 1999.
Ad Hoc Reviewer, Center for Research on Environmental Disease Grant Program, M.D. Anderson / University of Texas, April 1999.
Ad Hoc Reviewer, NSF SBIR / STTR Grant Program, April 2003.
Ad Hoc Reviewer, NSF Civilian Research & Development Foundation (CRDF) Grant Program, May 2003.

Ad Hoc Reviewer, Kentucky Science & Engineering Foundation Grant Program, November 2001; September 2005.

Member, Special Review Committee, Environmental Sciences / Developmental Toxicology Grant Program, National Institutes of Health, December 2001.

Member, Review Panel, Beckman Foundation Scholars Program, 2001 - present.

Chair, Special Review Committee, NIH-NIEHS / Superfund Basic Research Program Small Business Innovative Research (SBIR) Grants, National Institutes of Health, March 2002.

Ad Hoc Reviewer, University of Arizona Center for Toxicology Pilot Projects Program, June 2002.

Ad Hoc Reviewer, United Kingdom National Environmental Research Council Environmental Genomics Research Grants Programme, June 2002.

Member, External Advisory Committee, Dartmouth NIH-NCRR COBRE Immunology Program Project (W. Green P.I.), 2003 - present.

Ad Hoc Reviewer, University of Wisconsin – Milwaukee WATER Institute Pilot Grant Program, 2004-2005.

Ad Hoc Reviewer, North Carolina Biotechnology Center, Science & Technology Development Program, January 2004.

Ad Hoc Reviewer, Woods Hole Oceanographic Institute Sea Grant Program, June 2005.

Ad Hoc Reviewer, University of Wisconsin – Milwaukee Research Growth Initiative, April 2006.

Ad Hoc Reviewer, NIH-NIEHS Special Emphasis Grant Review Panel, Environmental Influences on Epigenetic Regulation, April – May 2006.

Member, Review Committee, NIH-NIEHS P50 DISCOVER (Disease Investigation through Specialized Clinically-Oriented Ventures in Environmental Research) Program Project Grant Review (RFA-ES-06-001), National Institutes of Health, March 2007.

Member, Special Emphasis Panel Review Committee, NIH-NIEHS ONES (Outstanding New Environmental Scientist) Grant Review (ZES1 JAB-C-R2), National Institutes of Health, March 2008.

Member, Systemic Injury by Environmental Exposure (SIEE) Special Emphasis Panel (ZRG1 DKUS-C 90S), National Institutes of Health, 2008 – 2010.

Manuscript Reviews:

Ad Hoc (1988 to present): *Archives of Biochemistry and Biophysics, Aquatic Toxicology, Biochemica Biophysica Acta, Biochemical Journal, Biochemical Pharmacology, Cancer Research, Carcinogenesis, Cell Growth & Differentiation, Chemical Research in Toxicology, Chemico-Biological Interactions, Comparative Biochemistry & Physiology, Environmental & Molecular Mutagenesis, Environmental Health Perspectives, Hepatology, Journal of Biological Chemistry, Journal of Inorganic Biochemistry, Journal of Pharmacology & Experimental Therapeutics, Journal of Toxicology & Environmental Health, Molecular Carcinogenesis, Molecular Pharmacology, Pharmacology and Experimental Therapeutics, Toxicological Sciences, Toxicology and Applied Pharmacology, Xenobiotica.*

Editorial Board: *Toxicology and Applied Pharmacology* (1997 to 1998), *Chemico-Biological Interactions* (1998 to 2008).

National Committees:

Member, Directors Association, NIEHS Superfund Basic Research Program, 1997 to 2008; President, 2002 to 2004.

Co-Organizer, Karen E. Wetterhahn Memorial Symposium, American Chemical Society Meeting, Boston MA, August 23-27, 1998.

Organizer and Chair, Society of Toxicology Continuing Education Course, "Methods in Cell Signaling," SOT Meeting, Seattle WA, March 1998.

Member, Society of Toxicology Program Committee, 1998 to 2000.

Organizer and Chair, NIH-NIEHS-sponsored Scientific Conference on "Arsenic in New England," Manchester NH, May 29-31, 2002 (Organized and hosted by the Dartmouth Superfund Basic Research Program).

Member, Expert Panel on Biomonitoring, Research Foundation for Health and Environmental Effects (RFHEE), Herndon VA, November 12-13, 2004.

Member, U.S. EPA Science Advisory Board, Risk Assessment Framework Review Panel, 2004 to 2006.

Member, Human Health Risk Assessment Committee, Chesapeake Bay Research Consortium, Spring 2005.

Member and Presenter, Fundulus Genomics Strategy Workshop, Charleston SC, May 4-5, 2006. Organized by the Hollings Marine Laboratory, College of Charleston, Charleston SC.

Co-Organizer and Host, NIH-NIEHS-sponsored New England Workshop on "Arsenic in Landfills," Boston MA, Oct. 2-4, 2006 (Second of two workshops co-organized by the Arizona and Dartmouth Superfund Basic Research Programs).

Member, U.S. EPA Science Advisory Board, Polycyclic Aromatic Hydrocarbon (PAH) Mixtures External Review Panel, 2010 to present.

Member, U.S EPA Science Advisory Board, Toxicological Profile for Hexavalent Chromium (September 2010 Draft) External Review Panel, 2011 to present.

Regional Committees:

Organizer, Ninth Annual New England Membrane Enzyme Group (Nutmeg) Conference, Center Harbor NH, November 10-12, 1991.

Organizer, Tenth Annual New England Membrane Enzyme Group (Nutmeg) Conference, Center Harbor NH, November 8-10, 1992.

Member, New Hampshire Healthy NH 2010 Committee, NH Department of Health and Human Services, Concord NH, May - September 2000.

Member, Montshire Museum of Science Corporation, 2000 to present.

Member, New Hampshire Arsenic Consortium (Dartmouth Toxic Metals Program, NH Dept. Health & Human Services, NH Dept. Environmental Services, U.S. Geological Survey, U.S. EPA region I, Agency for Toxic Substances & Disease Registry), 2000 - present.

Member, New Hampshire Public Health Biomonitoring Committee, NH Dept. Health & Human Services, 2002 - 2008.

Member, Montshire Museum of Science Board of Trustees, 2002 to present.

Member, New Hampshire Health Tracking Program Advisory Committee, NH Dept. Health & Human Services, 2004 – 2008.

Co-Organizer, Fourteenth Annual MDIBL / NIEHS Center Environmental Health Sciences Symposium, "Human Health and the Environment: Arsenic and Mercury, A Public Health Crisis?" Mt. Desert Island Biological Laboratory, Salsbury Cove ME, July 18-19, 2007.

Member, Independent Technical Review Team, Sediment in Baltimore Harbor: Quality and Suitability for Innovative Reuse, sponsored by Maryland Sea Grant and Maryland Department of Environmental Service, 2008-2009.

Co-Organizer, Twenty-first Annual Nutmeg Conference, Woods Hole MA, October 4-6, 2009.

Co-Organizer, Twenty-second Annual Nutmeg Conference, Woods Hole MA, October 7-9, 2010.

Co-Organizer, 2011 Northeast Regional SRP Meeting, Woods Hole MA, April 24, 2011

University / Program Committees:

Dartmouth College Radiation Safety Sub-Committee (of Biosafety), 1989 to 1991.
Dartmouth College Biosafety Committee, 1989 to 1992.
Co-organizer, Dartmouth College Structural Biology Seminar Series, 1990 to 2005.
Hughes Undergraduate Research Initiative Grant Review Committee, 1990 to 2005.
Dartmouth College Radiation Safety Committee, 1991 to 1996; Chair, 1991 to 1996.
Mary Hitchcock Memorial Hospital Radiation Safety Committee (*ex officio*), 1991 to 1996.
Dartmouth College Environmental Health and Safety Policy Advisory Committee, 1992 to 1996; Chair, 1994 to 1995.
Dartmouth College Search Committee, Environmental Health and Safety Specialist, Spring-Summer 1992.
Dartmouth College Women in Science Program (WISP) Advisory Committee, 1992 to 2008.
Dartmouth College Task Force on the Library of the 21st Century, 1993 to 1998.
Dartmouth College Task Force on Information Technology, 1995 to 1998.
Dartmouth College Computer Technology Venture Capital Fund Advisory Committee, 1995 to 2008.
Dartmouth College Search Committee, Director of Environmental Health and Safety, Spring-Summer 1995.
Dartmouth College / Norris Cotton Cancer Center Molecular Biology Core Facility Advisory Committee, Chair, 1995 to 2008.
Dartmouth College / Norris Cotton Cancer Center's Center for Biological and Biomedical Computing Core Facility Advisory Committee, 1995 to 2008.
Norris Cotton Cancer Center Scientific Advisory Committee, 1995 to 2001.
Dartmouth Superfund Basic Research Program Project Executive Committee, 1995 to 2008 (Chair, 1997 to 2008).
Dartmouth College Search Committee, University Radiation Safety Officer, Spring-Fall 1996.
Dartmouth College Women in Science Program (WISP) Task Force, 1996 to 1997.
Norris Cotton Cancer Center, Committee to Review Clinical Protocol Office, 1996 to 1997.
Dartmouth Medical School Search Committee, Facilities Director, Fall 1996.
Dartmouth Cystic Fibrosis Program Project Executive Committee, 1996 to 2008.
Norris Cotton Cancer Center, American Cancer Society Scientific Advisory Committee, 1997 to 2008.
Dartmouth College Re-Accreditation Internal Evaluation Committee, Undergraduate Research Opportunities Sub-Committee, 1998 to 1999.
Center for Environmental Health Sciences Executive Committee (Chair), 2000 to 2008.
Dartmouth-Hitchcock Medical Center / Norris Cotton Cancer Center Committee for Expansion of Rubin Cancer Center Building, 2001 to 2005.
Dartmouth Medical School Research Resources Advisory Committee, 2001.
Dartmouth COBRE Lung Pathobiology Research Program Executive Committee, 2003 to 2008.
Dartmouth College Women in Science Program (WISP) External Review Committee, May 2003.
Dartmouth Medical School / Norris Cotton Cancer Center Faculty Search Committee (Asst. / Assoc. Prof. - Proteomics position), 2004 to 2006.
Dartmouth College Women in Science Program (WISP) Faculty Advisory Committee, 2005 to 2008.
Dartmouth Medical School / Dartmouth-Hitchcock Medical Center Planning Committees for Koop Medical Research and Education Complex, 2006 to 2008; Chair, Core Committee.
Norris Cotton Cancer Center at Dartmouth Executive Committee, 2006 to 2008.
Norris Cotton Cancer Center at Dartmouth Cancer Research Committee, 2006 to 2008.

Dartmouth Medical School Graduate Program in Experimental and Molecular Medicine (PEMM) Program Committee, 2006 to 2008.
Dartmouth Medical School Appointments, Promotions and Titles Committee, 2007 to 2008.
Brown University Pathobiology Graduate Program Admissions Committee, 2008-2009.

Departmental Committees:
Dartmouth Medical School, Pharmacology & Toxicology Faculty Search Committee (Assistant Professor), Fall 1990 to Winter 1991.
Dartmouth College, Chemistry Faculty Search Committee (Assistant Professor - Structural Biology), Fall 1990 to Winter 1991.
Dartmouth Medical School, Pharmacology & Toxicology United Way Campaign Coordinator, 1991 to 2005.
Dartmouth Medical School, Pharmacology & Toxicology Graduate Pharmacology Course Committee, 1993 to 1995.
Dartmouth Medical School, Pharmacology & Toxicology Graduate Program Committee, 1994 to 2001.
Dartmouth Medical School, Microbiology Faculty Search Committee (Assistant / Associate Professor – Immunology), Winter / Spring 2003.

MEMBERSHIPS IN PROFESSIONAL SOCIETIES:

American Association for the Advancement of Science (AAAS), 1981 to present.
Environmental Mutagen Society (EMS), 1981 to 2008.
American Association for Cancer Research (AACR), 1988 to 2008.
Society of Toxicology (SOT), 1990 to present.
American Chemical Society (ACS), 1998 to 2008.
Society of Enviromental Toxicology and Chemistry (SETAC), 2008 to present.

TEACHING EXPERIENCE / RESPONSIBILITIES:

Courses:
Biology Tutor (undergraduate), Bridgewater State College, 1978 to 1980.
Lecturer, *Animal Cytogenetics* (undergraduate/graduate), Cornell University, 1981 to 1985.
Laboratory Instructor, *Animal Cytogenetics* (undergraduate/graduate), Cornell University, 1981 to 1984.
Lecturer, Pharmacology 123, *Topics in Toxicology: Mechanisms of Chemical Carcinogenesis* (graduate), Dartmouth Medical School, Winter 1989.
Co-organizer and Lecturer, Biochemistry 134 (co-listed as Chemistry 134), *Biochemistry of Nucleic Acids* (graduate), Dartmouth Medical School, Fall 1990, Winter 1993. Course revised 1995: Organizer and Lecturer, Pharmacology 134 (co-listed as Chemistry 134 and Biochemistry 134), *Nucleic Acids: Chemistry, Biochemistry and Pharmacology* (graduate), Dartmouth Medical School, Winter 1995, Winter 1997.
Lecturer, Pharmacology 122, *Topics in Pharmacology: Cancer Biology* (graduate), Dartmouth Medical School, Winter 1991.

Coordinator, *Pharmacology & Toxicology Workshop* (graduate), Dartmouth Medical School, Fall 1991, Fall 1996.

Organizer and Lecturer, Medical Pharmacology PharmFlex Unit, *Introductory Toxicology* (medical/graduate), Dartmouth Medical School, Fall 1991, 1992, 1993.

Lecturer, Pharmacology 123, *Principles of Toxicology* (graduate), Dartmouth Medical School, Fall 1992.

Organizer and Principal Lecturer, Pharmacology 123 (revised), *Graduate Toxicology* (graduate and undergraduate), Dartmouth Medical School, Fall 1995, Spring 1998, Spring 2001, Spring 2003, Spring 2005, Winter 2008.

Co-organizer and Lecturer, Biology 77/78, *Introductory Biochemistry* (undergraduate), Dartmouth College, Fall 1992/Winter 1993.

Lecturer, *Environmental Pathology* (graduate), University of Vermont, Spring 1994.

Lecturer, Pharmacology 215, *Medical Pharmacology* (medical), Dartmouth Medical School, Fall 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005.

Lecturer, Pharmacology 129, *Principles of Receptor Action* (graduate and undergraduate), Dartmouth Medical School, Spring 1994, 1996; Fall 1997; Winter 2000, Spring 2002, Winter 2004.

Lecturer, Pharmacology 130, *Graduate Pharmacology* (graduate and undergraduate), Dartmouth Medical School, Spring 1995, 1997, 2008.

Faculty Facilitator, *Nature Medicine Course* (first year medical), Dartmouth Medical School, Spring 1997.

Lecturer, Pharmacology 133, *Heavy Metals II: Chemistry, Biochemistry and Pharmacology* (graduate and undergraduate), Dartmouth Medical School, Winter 1998.

Lecturer, Hematology & Oncology Fellows Continuing Education Lecture Series, Summer 1996, 1997, 1998, 1999, 2000.

Lecturer, Chemistry 67, *Biophysical Chemistry* (undergraduate and graduate), Dartmouth College, Winter 1999.

Lecturer, Chemistry 63, *Environmental Chemistry* (undergraduate), Dartmouth College, Summer 2000, 2001, 2002, 2003, 2004, 2005.

Lecturer, Immunology 142, *Advanced Immunology* (graduate), Dartmouth Medical School, Fall 2001.

Lecturer, Pharmacology 122, *Modern Approaches in Experimental Therapeutics* (graduate), Dartmouth Medical School, Winter 2003.

Lecturer, Evaluative and Clinical Sciences 151, *Environmental and Occupational Health* (graduate), Dartmouth Medical School, Winter 2003, 2004, 2005, 2008.

Undergraduate Research Advising:

Sally Lim (Dartmouth '94) 1/91 - 4/91. WISP fellow.

Nicole Baptiste (Dartmouth '92, Biochemistry) 3/91 - 9/92. Hughes fellow, Honors thesis.

Steven Hunt (Dartmouth '92, Biology) 6/91 - 6/92. Waterhouse fellow, Honors thesis.

Kristen Doherty (Regis College, '93, Chemistry) 6/91 - 9/91. Dartmouth REU fellow.

Michael Reed (Dartmouth '92, Biology) 9/91 - 6/92. Honors thesis.

Nandini Joseph (Dartmouth '93, Biochemistry) 1/92 - 9/92. Hughes fellow.

Rukmini Sichitiu (Dartmouth '95) 1/92 - 2/94. WISP fellow.

Kamala Dansinghani (Dartmouth '94, Biology) 8/92 to 8/93. Hughes, Waterhouse, Presidential Scholars fellow.

Patsa Hungspreugs (Dartmouth '96) 12/92 to 6/93. WISP fellow.

Vijay Shankaran (Dartmouth '94, Chemistry) 12/92 to 6/94. Waterhouse fellow, Honors thesis.

Carrie Pesce (Dartmouth '97, Biology) 1/94 to 6/97. WISP, Presidential Scholars, Hughes, Waterhouse fellow.
Nicole LaRonde (Rivier College, '95, Chemistry) Dartmouth REU fellow, 6/94 - 9/94.
Anne Stone (Dartmouth '96, Psychology) 9/94 to 12/94.
Bruce Turpie (Dartmouth '96, Biology) 9/94 to 6/96.
Johanna Blaxall (Dartmouth '98) 1/95 to 6/95. WISP fellow.
Erin Rowell (Dartmouth '96, Art History/Chemistry) 3/95 to 6/96. Waterhouse fellow, Honors thesis.
Sara Ogdon (Dartmouth '96, Chemistry) 6/95 to 6/96. Waterhouse fellow, Honors thesis.
Elaine Gilmore (Providence College '96, Chemistry / Biology) 6/95 to 8/95, Dartmouth REU fellow.
Karana Pierre (Xavier College '96, Biology) 6/95 to 8/95, Leadership Alliance fellow.
Susan Darling (Amherst College, '97, Biology) 6/96 to 8/96, Dartmouth REU fellow.
Nadine Burnett (Dartmouth '98, Biology), 9/96 to 6/97, E.E. Just Fellow.
Jannet Oh (Dartmouth '98, Biology), 9/96 to 6/98.
Joie Jager-Hyman (Dartmouth '00, Biology), 12/96 to 6/97. WISP Fellow.
Amy Feldmann (Dartmouth '98, Chemistry), 9/97 to 6/98.
Kaili Temple (Dartmouth '01, Biology), 12/97 to 6/01. WISP Fellow, Presidential Scholar
Stacey Davis (Dartmouth '99, Chemistry), 1/98 to 6/99.
Alisa Davis (Dartmouth '01, Chemistry), 6/98 to 6/01. Goldwater Fellow, Hughes Fellow, Waterhouse Fellow, Beckman Scholar, Presidential Scholar.
Daniel Paik (Dartmouth '00, Biology), 9/98 to 6/00. Hughes Fellow.
Emily Feingold (Dartmouth '02, Biology), 12/98 to 6/99. WISP Fellow, Presidential Scholar.
Rahshaana Green (Dartmouth '00, Biology), 3/99 to 6/00. E.E. Just Fellow, NIEHS Minority Fellow.
Lauren Kingsley (Dartmouth '04, Chemistry), 11/00 to 6/04. WISP Fellow, B.E. Krute Memorial Fellow, Presidential Scholar, Beckman Scholar, Richter Scholar, Honors thesis.
Caryn Barnet (Dartmouth '03, Chemistry), 12/01 to 6/03.
Rebecca Wang (Dartmouth '05), 12/01 to 6/02. WISP Fellow.
Katherine Harrison (Dartmouth '06), 12/02 to 9/04. WISP Fellow.
Caitlin Stanton (Brown U. '06), 6/03 to 8/06. MDIBL Fellow.
Manida Wungjiranirun (Dartmouth '07), 12/03 to 6/07. WISP Fellow, Presidential Scholar.
Jenna Sherman (Dartmouth '08), 12/04 to 6/07. WISP Fellow.
Angela Wang (Dartmouth '10), 12/06 to 8/07. WISP Fellow.
Anais Carnescu (Dartmouth '11), 12/07 to 6/08. WISP Fellow.
Chelsea Connolly (Valdosta State University '12), 6-8/10. NSF REU Fellow.
Morgan Kelly (Harvard '14), 6-8/11. NSF REU Fellow.

Post-Baccalaureate Training:
Cavus Batki (B.S., U. Bristol, UK '02), 9/02 – 8/03. Council Exchange Internship USA graduate internship.
Liam Ingram (B.S., U.Bristol, UK '03), 10/03 – present. Council Exchange Internship USA graduate internship.

Graduate Research Advising:
Major Advisor:

Jennifer McCaffrey (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 1/94. Thesis: *The Effects of Chemical Carcinogens on Hormone-Inducible Gene Expression.* Strohbehn Award 1994.

Rosemary Caron (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 10/95. Thesis: *Differential Effects of Mitomycin C on Constitutive and Inducible Gene Expression in the Chicken Embryo Liver In Vivo: Correlation with Developmental Age and Chromatin Structure.* Borison Fellowship 1994. Strohbehn Award 1996.

Amy Warren (Dartmouth College, Chemistry) Ph.D. 6/96. Thesis: *Characterization of the Interaction of the Chemotherapeutic Drug Mitomycin C with DNA In Vitro and In Vivo and Effects on Specific DNA-Protein Interactions.* Wolfenden Teaching Prize 1995. Croasdale Award 1996.

Michael Ihnat (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 3/97. Thesis: *Effects of Mitomycin C and Other DNA Crosslinking Agents on Gene Expression: Modulation of Cancer Cell Multidrug Resistance in Cell Culture and In Vivo.* Ryan Fellow 1994-1996. AACR Travel Award 1996.

Jeu-Ming Yuann (with Karen Wetterhahn) (Dartmouth College, Chemistry) Ph.D. 6/97. Thesis: *The Roles of Glutathione and Ascorbate in Chromium(VI)-Induced Carcinogenesis In Vivo.*

Ronald Kaltreider (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 6/00. Thesis: *Characterization of the Molecular Mechanism by which Arsenic and Chromium alter Inducible Gene Expression.* Ryan Fellow 1998-2000. SOT Travel Award 2000. SOT Metals Specialty Section Award 2000. Strohbehn Award 2000.

David Mustra (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 6/01. Thesis: *The Biophysical Characterization of the Interaction of Xeroderma Pigmentosum A Protein with a Mitomycin C-DNA Complex.*

Rangan Maitra (Dartmouth Medical School, Pharmacology & Toxicology) Ph.D. 6/01. Thesis: *Regulation of the Cystic Fibrosis Transmembrane Conductance Regulator by P-Glycoprotein Modulators.*

Athena Nomikos (Dartmouth Medical School, Pharmacology & Toxicology) M.S. 12/07. Thesis: *Physiological consequences of low dose arsenic exposure in culture and in whole mouse liver.* SOT Travel Award 2007.

Courtney Kozul (Dartmouth Medical School, Program in Experimental & Molecular Medicine) Ph.D. 4/10. Thesis: *Immunomodulatory effects of chronic low dose arsenic exposure.* SOT Travel Award 2007, 2009. NIEHS-SBRP Best Student Poster Award 2007, 2008. Nutmeg Wetterhahn Student Poster Award 2007. SOT MBSS Student Research Award 2008, 2009. NIH-NIEHS International Conference Invitation and Travel Award, 2008. NIH-NIEHS Wetterhahn Award, 2010.

Committee Member:

Licheng Xu (Dartmouth Medical School, Pharmacology & Toxicology, E. Bresnick advisor) Ph.D. 6/91.

William Berndt (Dartmouth Medical School, Pharmacology & Toxicology, T. Ciardelli advisor) Ph.D. 6/93.

Injae Chung (Dartmouth Medical School, Pharmacology & Toxicology, E. Bresnick advisor) Ph.D. 6/94.

Bruce Sneddon (Dartmouth Medical School, Pharmacology & Toxicology, P. Friedman advisor) Ph.D. 10/94.

Claudine Louis (Dartmouth Medical School, Pharmacology & Toxicology, J. Sinclair advisor) Ph.D. 2/95.

Melinda Treadwell (Dartmouth Medical School, Pharmacology & Toxicology, A. Barchowsky advisor) Ph.D. 1/96.

Flora Ciampolillo (Dartmouth Medical School, Physiology, B. Stanton advisor) M.S. 6/96.

Pamela Buchli (Dartmouth Medical School, Pharmacology & Toxicology, T. Ciardelli advisor) Ph.D. 12/96.

Salvatore Morana (Dartmouth Medical School, Pharmacology & Toxicology, A. Eastman, advisor) Ph.D. 6/98.

Elizabeth Cox (Dartmouth College, Chemistry, D. Wilcox advisor) Ph.D. 8/98.

Jason Nawrocki (Dartmouth Medical School, Pharmacology & Toxicology, C. Lowrey, advisor) M.S. 11/98.

Jennifer Shumilla (Dartmouth College, Chemistry, A. Barchowsky / K. Wetterhahn, advisors) Ph.D. 4/99.

Stefano Liparoto (Dartmouth Medical School, Pharmacology & Toxicology, T. Ciardelli, advisor) Ph.D. 9/00.

Michael Nemeth (Dartmouth Medical School, Pharmacology & Toxicology, C. Lowrey, advisor) Ph.D. 6/01.

Keith DePetrillo (Dartmouth Medical School, Pharmacology & Toxicology, F. Gesek, advisor) Ph.D. 5/02.

Michael Layon (Dartmouth Medical School, Pharmacology & Toxicology, C. Lowrey, advisor) Ph.D. 6/04.

Kyle MacLea (Dartmouth Medical School, Pharmacology & Toxicology, A. Eastman, advisor) Ph.D. 12/02.

Ethan Kohn (Dartmouth Medical School, Pharmacology & Toxicology, A. Eastman, advisor) Ph.D. 9/03.

Scott Gleim (Dartmouth Medical School, Pharmacology & Toxicology, advisor) Ph.D. 8/09.

External Committee Member:

Edward Cable (Biochemistry, University of Massachusetts (Worcester), Herbert Bonkovsky advisor) Ph.D. 6/93.

Joseph Lynch (Toxicology, University of Southern Maine, John Wise advisor) 2/04 to 4/06.

Beth Peterson-Roth (Biochemistry, Brown University, Anatoly Zhitkovich advisor) Ph.D., 4/06.

Post-doctoral Research Training:

Carolyn Bentivegna (Ph.D. 1991, Environmental Toxicology, Rutgers) 6/91 to 8/94. Post-doctoral Fellow.

Stephen Anthony (D.O. 1988, Philadelphia College of Osteopathic Medicine) 10/94 to 6/97. Hematology / Oncology Fellow.

Janet Jeyapaul (Ph.D. 1991, Toxicology, Cancer Research Institute, Bombay India) 8/95 to 10/95. Post-doctoral Fellow.

Olga Bajenova (Ph.D. 1987, Molecular Biology, St. Petersburg Academy of Sciences USSR) 12/95 to 11/97. Post-doctoral Fellow.

Angela Nervi (M.D. 1993, Stanford) 1/97 to 6/99. Hematology / Oncology Fellow. 7/99 to present, Post-doctoral Research Associate.

Veronika Dubrovskya (Ph.D. Chemistry, Institute for Bioorganic Chemistry, Novosibirsk USSR) (with Karen Wetterhahn) 1/97 to 11/97. Post-doctoral Fellow.

Edward Dudek (Ph.D. Toxicology, Illinois Institute of Technology) (with Karen Wetterhahn) 1/97 to 12/97. Post-doctoral Fellow.

Bogdan Gulanowski (Ph.D. Chemistry, Wroclaw Medical University, Wroclaw Poland) (with Karen Wetterhahn) 1/97 to 6/98. Post-doctoral Fellow.

Diane Stearns (Ph.D. Chemistry, UC Berkeley) (with Karen Wetterhahn) 1/97 to 6/97. Research Assistant Professor.

Kent Sugden (Ph.D. Chemistry, Montana State University, Bozeman) (with Karen Wetterhahn) 1/97 to 12/98. Post-doctoral Fellow / Research Assistant Professor.

Amy Warren (Ph.D. 1996, Chemistry, Dartmouth) 8/97 to 3/01. Postdoctoral Fellow.

Joseph Shaw (Ph.D., 2001, Toxicology, Kentucky) 3/01 - present. Postdoctoral Fellow.

Angeline Andrew (Ph.D., 2001, Pharmacology & Toxicology, Dartmouth) 9/01 – 6/04. Postdoctoral Fellow / Research Assistant Professor.

Julie Gosse (Ph.D., Chemistry, Cornell) 3/05 – 12/07. Postdoctoral Fellow. SOT Travel Award 2007. Women in Toxicology Award 2007.

Fokko Zandbergen (Ph.D., Nutrition, Metabolism and Genomics, Wageningen Netherlands) 11/08 – present. Postdoctoral Fellow.

RESEARCH INTERESTS:

Dr. Hamilton's principal research interests are in the areas of molecular toxicology, metals toxicology, developmental toxicology, gene regulation, pathophysiology associated with toxicant exposures, and the use of –omics technologies to understand the environmental etiology of human disease. The primary focus of his research over the past decade has been on the molecular toxicology of arsenic and other toxic metals. The current focus of the laboratory is on three principal research directions related to this interest.

The first area is focused on understanding the molecular and mechanistic basis for the effects of arsenic as an endocrine disruptor, which was first discovered and reported by Dr. Hamilton's lab. They have demonstrated in a series of studies that arsenic is a very potent endocrine disruptor at extremely low concentrations at or below the current U.S. drinking water standard, i.e., 10 ppb. This was first demonstrated with the steroid hormone receptor for glucocorticoids, but has since been shown to also occur with the steroid receptors for estrogen, progesterone, androgen and mineralocorticoids, i.e., all five steroid receptor classes. Similar effects have also been seen with other non-steroid nuclear hormone receptors, i.e., those for thyroid hormone and retinoic acid. Interestingly, the mechanism for this appears to be unique since arsenic does not act as a ligand for these receptors, i.e., it is neither an agonist or competitive antagonist, nor does arsenic appear to interfere with normal hormone binding, activation of the receptor, translocation to nuclear chromatin, or binding to hormone-responsive DNA elements that regulate hormone-responsive genes. However, in the presence of arsenic these hormone-activated, chromatin-bound receptors function abnormally as transcription factors, with either greatly enhanced gene signaling at very low doses or greatly suppressed signaling at slightly higher doses. The shared effects of arsenic on all these different receptors that represent two entirely different classes of nuclear hormone receptors, despite their lack of absolute shared sequence or structure, suggests that there is a common regulatory component or other shared machinery which is the actual molecular target(s) for arsenic. Current research in this area is focused on precisely how arsenic is able to elicit these effects on receptor-mediated gene expression at the cell and molecular level.

The broad effects of arsenic on this suite of important hormone pathways also suggests an important role of arsenic-mediated endocrine disruption on arsenic's ability to increase the risk of various cancers, type 2 diabetes, reproductive and developmental effects, vascular and cardiovascular disease, neurological and cognitive disorders, and the growing list of other known pathophysiological consequences on humans and on natural populations that are exposed chronically to arsenic environmentally in food or water. Thus, a second major focus of the lab is to investigate these pathophysiological consequences of such endocrine disruption using model whole animal systems, and also in collaboration with epidemiologists and ecologists studying human or natural populations, respectively. Recent work from the lab has shown that arsenic can profoundly disrupt certain developmental or physiological programs that are critically dependent on hormone receptors that have been shown to be disrupted by low dose arsenic. For example, arsenic at very low doses, equivalent to human drinking water levels of concern, blocks thyroid hormone-dependent tadpole metamorphosis in the frog, *Xenopus*. Likewise, arsenic at similar levels disrupts the ability of the euryhaline fish, *Fundulus*, to adapt to changes in water salinity equivalent to the changing salt marsh tides, a process which is regulated by the glucocorticoid hormone, cortisol, and its control of a key salt regulatory protein, CFTR (the same protein which, when mutated, causes the human disease, cystic fibrosis). Current research is extending these studies to other systems to determine what other

effects, at what levels, and the extent to which such endocrine disruption can explain the myriad adverse effects of arsenic observed in exposed populations.

The third area focuses on using genomics and proteomics tools to investigate more broadly the effects of arsenic, chromium and other toxicants on gene and protein expression in model systems in order to understand their overall biological effects. These experiments are useful both to test hypotheses and to generate new avenues of research based on biological discovery. Previous work in the lab has shown, using whole genome microarrays, that arsenic broadly affects hormone regulation of gene expression at low doses. For example, the lab demonstrated that the synthetic glucocorticoid hormone, dexamethasone, significantly alters expression of over a thousand genes in mouse liver, and that low doses of arsenic affect the hormone regulation of virtually all of these genes. Conversely, in the lungs of the mice in these same experiments, it was observed that the dominant effect of arsenic at low doses is to profoundly alter immune response, and this is now a new avenue of research in the lab based on this discovery. The lab has also pioneered the use of microarrays in environmentally relevant species, particularly the aquatic freshwater zooplankton, *Daphnia*, and the marine fish, *Fundulus*. These two species are ideal because they can be used both in controlled laboratory experiments and also in the environment as sentinel species for natural populations. The lab is continuing to develop and apply genomics tools in these species in collaboration with other laboratories in order to establish them as model organisms for use in their own studies but also broadly shared within a larger research community. Related to this genomics research, the lab has been pioneering the development and application of new analytical tools and methods for obtaining richer and more accurate biological information from the large data sets that are generated in a typical whole genome microarray, which allows comparisons among different treatments and different experimental species.

RESEARCH FUNDING:

As Principal Investigator:

Previous:

6/87 - 11/88. NIH Individual NRSA Postdoctoral Research Fellowship F32 ES05399 (Molecular Biology, Karen E. Wetterhahn, advisor).

10/87 - 9/88. American Cancer Society Institutional Research (Seed) Grant IN-157D, total direct costs $10,000.

12/88 - 6/94. NIH FIRST Grant R29 CA49002, "Effect of carcinogens on gene expression *in vivo*," total direct costs $348,062.

1/91 - 12/93. American Cancer Society Junior Faculty Research Award (JFRA) JFRA-323, "Effect of carcinogens on gene expression *in vivo*," total direct costs $90,500.

7/91 - 6/94. International Life Sciences Institute Research Foundation Research Award, "Targeting of DNA damage *in vivo*," total direct costs $100,000.

11/92 - 6/94. Hitchcock Foundation, "Antibodies to MMC-DNA adducts," total direct costs $6,500.

7/94 - 3/99. NIH Research Grant R01 CA49002, "Effect of carcinogens on gene expression," total direct costs $658,404.

1/95 - 6/96. Norris Cotton Cancer Center Interactive Program Project, "Suppression of p-glycoprotein expression by mitomycin C," total direct costs $25,000.

4/96 - 3/00. NIH / NIEHS Program Project P42 ES07373, Project Director of "Toxic Metals in the Northeast: from Biological to Environmental Implications," total direct costs $4,410,619. As Principal Investigator: Project 2, "Molecular basis for effects of carcinogenic metals on inducible gene expression," total direct costs $479,808. Core 1, "Adminstrative Core," total direct costs, $264,600. Core 2, "Molecular Biology Core Facility," total direct costs $408,058. Core 4, "Education and Training Core,"total direct costs $513,665.

12/96 - 5/97. Bristol-Myers Squibb, "Modulation of multidrug resistance by mitomycin C," total direct costs $50,000.

1/97 - 12/98. Cystic Fibrosis Foundation Pilot Project, "Modulation of CFTR expression by mitomycin C," total direct costs $69,100.

1/97 - 12/98. Immunex, "A pilot clinical trial of mitomycin C modulation of multidrug resistance proteins," total direct costs $20,000.

3/97 - 7/99. NIH Research Grant R01 CA45735, "Chromium effect on gene expression," total direct costs $684,170 (Dr. Hamilton assumed responsibility for this grant for the late Dr. Karen Wetterhahn and is managing it for her laboratory through its completion date).

3/97 - 6/99. NIH Research Grant R01 ES07167, "Mechanism of chromium carcinogenicity," total direct costs $1,212,100 (Dr. Hamilton assumed responsibility for this grant for the late Dr. Karen Wetterhahn and is managing it for her laboratory through its completion date).

6/98 - 5/01. Bristol-Myers Squibb, "Modulation of multidrug resistance by DNA crosslinking agents," total direct costs $320,000.

4/00 - 3/05. NIH / NIEHS Program Project P42 ES07373, Program Director of "Toxic Metals in the Northeast: from Biological to Environmental Implications," total direct costs (5 years) $10,457,254. As Principal Investigator: Project 2, "Effects of carcinogenic metals on gene expression," total direct costs $975,301; "Administrative Core," total direct costs, $917,864; "Molecular Biology Core Facility," total direct costs $841,837; "Education and Training Core,"total direct costs $562,002.

6/01 - 5/02. NIH National Council for Research Resources (NCRR) Grant S10 RR14644, "Purchase of LCQ Mass Spectrometer System," total direct costs $220,950.

9/01 - 8/02. NSF Major Research Instrumentation (MRI) Grant 0116413, "Acquisition of a MALDI-TOF Mass Spectrometer," total direct costs $217,176.

4/01 - 3/03. Cystic Fibrosis Foundation Grant HAMILT01GO, "Anthracyclines for treatment of CF," total direct costs $129,600.

4/02 - 4/03. NIH-NCI Contract 263-MQ-209007, "NCI Contract to measure arsenic in water samples," total direct costs $7,620.

5/02 - 12/03. BioReliance Contract BCR-1108-28, "Selenium determination in association with selective tumors," total direct costs $28,050.

4/05 - 3/08. NIH-NIEHS SBRP Program Project P42 ES07373, Program Director of "Toxic Metals in the Northeast: from Biological to Environmental Implications," total direct costs (3 years) $5,765,083. As Principal Investigator: Project 2, "Arsenic as an endocrine disruptor," total direct costs $656,186; "Administrative Core," total direct costs, $299,016; "Molecular Biology & Proteomics Core Facility," total direct costs $313,094.

9/02 - 8/08. NSF BE/GEN-EN Research Grant DEB-0221837, "Development of methods linking genomic and ecological responses in a freshwater sentinel species," total direct costs $2,000,000.

4/06 – 12/08. Cystic Fibrosis Foundation Pilot & Feasibility Grant HAMILT0610, "Anthraquinones for treatment of CF," total direct costs $86,400.

Current:

4/08 - 3/13. NIH-NIEHS Program Project P42 ES07373, "Toxic Metals in the Northeast: from Biological to Environmental Implications" (PI Bruce A. Stanton), total direct costs (5 years) $9,551,339. As Principal Investigator: Project 2, "Arsenic as an endocrine disruptor," total direct costs $1,165,149.

9/09 – 8/11. NIH-NCRR Program Project Supplement to P41 RR001395-27S1, "Biocurrents Research Center: Physiological Factors Affecting Ovarian Cancer," total direct costs $895,215.

Pending:

None.

As Co-investigator:

Previous:

7/87 - 6/90. NIH Research Grant R01 CA45735, "Effect of chromium on gene expression *in vivo*," (P.I. Karen E. Wetterhahn), total direct costs $411,687.

6/89 - 5/94. NIH Research Grant R01 CA34869, "Mechanism of chromium carcinogenicity," (P.I. Karen E. Wetterhahn), total direct costs $909,186.

9/91 - 7/94. NIH Research Grant R01 CA45735, "Effect of chromium on gene expression *in vivo*," (P.I. Karen E. Wetterhahn), total direct costs $324,818.

3/97 - 7/99. NIH Research Grant R01 CA45735, "Chromium effect on gene expression," (P.I. Karen E. Wetterhahn), total direct costs $684,170.

3/97 - 6/99. NIH Research Grant R01 ES07167, "Mechanism of chromium carcinogenicity," (P.I. Karen E. Wetterhahn), total direct costs $1,212,100.

7/03 – 6/06. NIH Research Grant R01 R01 CA098889, "DNA repair gene polymorphisms and pancreatic cancer," (P.I. Eric J. Duell), total direct costs $600,000.

9/02 - 6/08. NIH Research Grant R01 R01 ES11819, "Arsenic effects on glucocorticoid receptor action," (P.I. Jack E. Bodwell), total direct costs $900,000.

7/03 – 6/08. NIH-NCRR COBRE Program Project Grant P20 RR018787, "Cellular and Molecular Mechanisms of Lung Disease," (P.I. Bruce A. Stanton), total direct costs $8,000,000. Co-Director of program project, Director of Proteomics Core, Senior Mentor on Project 4, "Respiratory effects of air pollution in New Hampshire" (P.I. Melinda Treadwell), Advisor on Project 5, "Environmental epidemiology of lung cancer in New Hampshire: a multilevel approach using GIS and case-control methods."

4/05 – 3/10. NIH Research Grant R01 ES013168, "Arsenic, Histone Modifications, and Transcription" (P.I. Lynn Sheldon), total direct costs $1,125,000.

Current:
None.

Pending:
None.

CLINICAL RESEARCH TRIALS (TRANSLATIONAL)

Active / Completed Clinical Protocols:

DMS 9503: A pilot clinical trial of mitomycin C modulation of P-glycoprotein and a Phase I evaluation of mitomycin C and paclitaxel in patients with advanced carcinoma and lymphoma. P.A. Kaufman (PI), J.W. Hamilton, S.P. Anthony, A.M. Nervi, M.S. Ernstoff, L.D. Lewis, R.J. Barth, and V.A. Memoli.

DMS 9614: A pilot clinical trial of mitomycin C modulation of multidrug resistance proteins and a Phase I evaluation of mitomycin C and mitoxantrone in patients with acute myelogenous leukemia. C.H. Lowrey (PI), J.W. Hamilton, S.P. Anthony, A.M. Nervi, M.S. Ernstoff, L.D. Lewis, and N.B. Levy.

DMS 9704: A study of carboplatin as a modulator of the multidrug resistance phenotype followed by concurrent chemo/radiotherapy utilizing paclitaxel in head and neck cancer. T.H. Davis (PI), J.W. Hamilton, S.P. Anthony, A.M. Nervi, M.S. Ernstoff, L.D. Lewis, J.J.B. Gosselin, R.J. Amdur, and A. Siegel.

DMS 9715: A Phase I study of carboplatin and paclitaxel used post bone marrow transplantation for women with Stage IV breast cancer. L.E. Mills (PI), J.W. Hamilton, S.P. Anthony, A.M. Nervi, M.S. Ernstoff, L.D. Lewis, R.J. Barth and V.A. Memoli.

DMS 9816: A pilot clinical trial of carboplatin modulation of P-glycoprotein and a Phase I evaluation of carboplatin and paclitaxel in patients with advanced carcinoma and lymphoma. M.S. Ernstoff (PI), J.W. Hamilton, A.M. Nervi, S.P. Anthony, L.D. Lewis, R.J. Barth, and V.A. Memoli.

PATENTS

Pending:

Three patents have been filed based on discovery of novel application of chemotherapy drugs for treatment of deltaF508 CFTR CF patients.

One patent has been filed based on discovery of a novel application of chemotherapy drugs for treatment of multidrug resistant human solid and hematological malignancies.

Intl. Appl. No. PCT/US00/27443. J.W. Hamilton and B.A. Stanton. Compositions and methods for modulating ATP-binding cassette transmembrane reporter protein expression. Priority Date Oct. 6, 1999; Intl. Filing Date Oct. 4, 2000; Intl. Publ. Date Apr. 12, 2001.

INVITED PRESENTATIONS

Scientific Presentations (selected 2000 - present):

University of California at Davis, Environmental Toxicology Seminar Series, Davis CA, January 31, 2000, "Arsenic as an essential element, cancer chemotherapy drug and human carcinogen."

Society of Toxicology 39th Annual Meeting, Philadelphia PA, March 21, 2000, Poster Discussion Session (Organizer and Chair): Mechanisms of Arsenic Carcinogenesis.

Dartmouth Community Medical School 2000: Environmental Toxins: Are Our Public Policies Rational?, Dartmouth College, April 17-18, 2000, "An introduction to toxicology: environmental carcinogens as a paradigm."

NIOSH Molecular Mechanisms of Metal Toxicity Meeting, National Institute of Occupational Safety and Health, Morgantown WV, September 12, 2000, " Mechanistic basis for arsenic and chromium carcinogenicity: insights from gene expression studies."

Dartmouth Community Medical School 2000: Environmental Toxins: Are Our Public Policies Rational?, Manchester NH, October 26, 2000, "An introduction to toxicology: environmental carcinogens as a paradigm."

NIEHS Conference, Superfund Basic Research Program: Oxidative Processes: Stress to Remediation, Chapel Hill NC, December 13, 2000, "The New Hampshire Arsenic Coalition: A partnership of university, state and federal agencies."

Dartmouth Community Medical School 2001: Heal Thyself?, Dartmouth College, April 10, 2001, "Foreign Invasion: How Our Bodies Deal With Vitamins, Drugs, Toxins And Dietary Supplements."

Dartmouth Community Medical School 2001: Heal Thyself?, Manchester NH, October 3, 2001, "Foreign Invasion: How Our Bodies Deal With Vitamins, Drugs, Toxins And Dietary Supplements."

North American Cystic Fibrosis Conference 15th Annual Meeting, Orlando FL, October 26, 2001, CFTR New Therapeutic Strategies session, "The model anthracycline, doxorubicin, increases functional cell surface expression of □F508-CFTR protein by altering its structure and biogenesis."

Northeast Society of Toxicology 2001 Annual Meeting, Cambridge MA, November 16, 2001, "Toxic metal-induced alterations in patterns of gene expression."

NIEHS Conference, Superfund Basic Research Program: Assessing Risks of Hormonally Active Agents, Gainesville FL, December 11, 2001, "Arsenic as an endocrine disruptor."

University of Arizona, Southwest Environmental Health Science Center, Tucson AZ, May 16, 2002, "Arsenic as an endocrine disruptor."

University of Oklahoma Health Sciences Center, Oklahoma Center for Toxicology Interdisciplinary Seminar Program, Oklahoma City OK, May 17, 2002, "Arsenic as an endocrine disruptor: possible role in carcinogenesis, vascular disease and diabetes."

Tufts University Medical School, Pharmacology and Toxicology Seminar Series, Boston MA, June 12, 2002, "Arsenic is an endocrine disruptor: role in carcinogenesis, vascular disease and diabetes."

NIEHS / Center for Environmental Health Sciences at Dartmouth Scientific Conference: Arsenic in New England: A Multidisciplinary Scientific Conference, Manchester NH, May 30, 2002, "Arsenic as an endocrine disruptor: role in cancer, vascular disease, and diabetes."

First Annual Daphnia Genome Consortium Meeting, Indiana University, Bloomington IN, October 3, 2002, "Differential display and microarray: linking genomic responses to metal toxicity."

New England Society of Toxicology Annual Meeting, Phfizer Inc., Groton CN, November 8, 2002, K-12 Educational Program on Introduction to Toxicology, "Arsenic: Poison of Kings and king of poisons."

NIH-NIEHS Division of Extramural Research and Training (DERT) Leadership Annual Retreat, Wilmington NC, November 21-22, 2002, "Molecular mechanisms of arsenic toxicity."

Society of Toxicology 42nd Annual Meeting, Salt Lake City UT, March 10, 2003, Symposium on Health Risk Assessment of Hexavalent Chromium in Drinking Water: Carcinogenicity, Research and Regulation, "Mechanism of Hexavalent Chromium [Cr(VI)] Toxicity and Carcinogenicity."

Boston University, Boston MA, Biomolecular Seminar Series, March 31, 2003, "Arsenic as an Endocrine Disruptor: Role in Cancer, Diabetes and Vascular Disease."

Second Annual Daphnia Genome Consortium Meeting, University of New Hampshire / Dartmouth College, at Center of New Hampshire, Manchester NH, September 9-11, 2003, "Development of methods linking genomic and ecological responses in a freshwater sentinel species."

University of Southern Maine, Bioscience Research Institute, Applied Medical Sciences Seminar Series, Portland ME, January 22, 2004, "Arsenic as an endocrine disruptor."

University of Vermont Medical School, Pathobiology Seminar Series, Burlington VT, March 15, 2004, "Arsenic is a potent endocrine disruptor at very low levels: implications for cancer, diabetes and other arsenic associated diseases."

York College of Pennsylvania, Biology Department, Richard Clark Lecture Series, York PA, March 22, 2004, "Arsenic: It's not just for breakfast anymore."

Stony Brook University, Marine Sciences Research Program Seminar Series, Stony Brook NY, May 7, 2004, "Arsenic and old mines – or – don't take it for granite."

3rd International Conference on Non-Linear Dose-Response Relationships in Biology, Toxicology and Medicine, U. Massachusetts – Amherst, Amherst MA, June 9, 2004, "Arsenic as an endocrine disruptor: Complex dose dependent effects of arsenic on steroid receptor signaling."

New England England Water Environment Association (NEWEA) Arsenic Symposium, University of New Hampshire, Durham NH, October 14, 2004, "Arsenic: Human health effects."

U.S. EPA Research Seminar Series, Region I U.S. EPA, "Arsenic: Health Effects and Public Policy," Boston MA, December 15, 2004, "Arsenic and health effects: mechanisms of action."

Upper Valley Chapter, New Hampshire League of Women Voters, Hanover NH, February 15, 2005, "Environmental Chemicals and Human Health Risks."

Dartmouth-Montshire Institute, Hanover NH, NYC high school student summer workshop, July 6, 2005, "An introduction to toxicology and environmental health."

8th Annual John B. Little Symposium, J.B. Little Center for Radiation Sciences and Environmental Health, Harvard School of Public Health, Boston MA, October 28, 2005, "Use of genomics to examine low level effects of environmental agents."

SETAC North America 26th Annual Meeting, Baltimore MD, November 15, 2005, Symposium on Omics Technologies – Current and Future Applications to Ecotoxicology, "Differences in microarray gene expression profiles of *Daphnia pulex* exposed to metals."

Third International Daphnia Genome Consortium Meeting, Indiana University, Bloomington IN, January 17, 2006, Keynote Address, "Daphnia as a model for toxicogenomics."

2006 Toxicology and Risk Assessment Conference, Cincinnati OH, April 26, 2006, Symposium on Heavy Metals of Emerging Toxicological Concern, "Toxicogenomics as a tool for identifying biomarkers and assessing mechanisms of action of toxic metals."

Fundulus Genomics Strategy Workshop II, Hollings Marine Laboratory, Charleston SC, May 5, 2006, "Killifish as a toxicogenomics model to investigate effects of arsenic as an endocrine disruptor."

New England Society of Environmental Toxicology and Chemistry (SETAC) Annual Meeting, Portland ME, June 9, 2006, "Toxicogenomics as a tool for identifying biomarkers and assessing mechanisms of action of toxic metals in the environment."

Mt. Desert Island Biological Laboratory, Mt. Desert Island ME, August 27, 2006, "Use of toxicogenomics to investigate the mechanism of action of arsenic as an endocrine disruptor."

Columbia University, New York City NY, September 18, 2006, "Toxicogenomics of arsenic."

CIESM - the Mediterranean Science Commission, Research Workshop No. 31, "Marine Sciences and Public Health – Some Major Issues," Geneva Switzerland, September 27-30, 2006, "Use of toxicogenomics to investigate the effects of toxicants in aquatic systems."

NIH-NIEHS SBRP / U.S. EPA / ATSDR Workshop on Arsenic, "Arsenic and Landfills: Protecting Water Quality," Boston MA, October 3-4, 2006, "Recent Advances in understanding health effects of arsenic: molecular and cellular mechanisms."

Third Annual Great Issues in Medicine and Global Health Symposium on Cancer, "Cancer, Nutrition and the Environment," Dartmouth-Hitchcock Medical Center, Hanover NH, November 16, 2006, "Environmental toxins: how much cause for concern?"

Dartmouth Medical School, Pharmacology and Toxicology Seminar Series, June 6, 2007, "Use of genomics to understand the biology of low dose arsenic."

Mt. Desert Island Biological Laboratory / NIEHS Center 14th Annual Environmental Health Sciences Symposium, "Human Health and the Environment," Salsbury Cove ME, July 19, 2007, "Arsenic and endocrine disruption."

U.S. Environmental Protection Agency, Research Triangle Park NC, January 17, 2008, "The biology and toxicology of low dose arsenic."

Duke University, NIEHS Environmental Health Sciences Center Interdisciplinary Seminar Series, Durham NC, January 18, 2008, "The biology and toxicology of low dose arsenic."

University of Vermont, Lung Pathology Program, May 5, 2008, "The biology and toxicology of low dose arsenic: effects on lung biology and pathophysiology."

Brown University, Pathobiology Graduate Program Retreat, August 26, 2008, "A biologically based approach to genomics analysis: insights from studies of low dose arsenic."

Marine Biological Laboratory, Bay Paul Center, September 19, 2008, "Use of genomics tools to understand the biology and toxicology of low dose arsenic."

Nutmeg Conference, Woods Hole MA, October 7, 2008, "Arsenic as an endocrine disruptor."

Tufts University, Biology Department (student invited speaker), October 10, 2008, "Arsenic: King of poisons, poison of kings."

Superfund Basic Research Program Annual Meeting, Asilomar CA, December 9, 2008, "Arsenic as an endocrine disruptor."

Workshop on Mercury Exposure and Public Health, New York NY, May 20, 2009, "Current issues in mercury exposure, effects and risk analysis."

Third Congress of the International Society of Nutritigenetics and Nutrigenomics, NIH, Bethesda MD, October 22, 2009, "Laboratory diet profoundly alters gene expression and confounds genomic analysis."

Bridgewater State College, Bridgewater MA, Department of Biology FISH Seminar Series, February 26, 2010, "Arsenic: it's not just for breakfast anymore."

National Institute of Environmental Health Sciences, Research Triangle Park NC, Toxicology and Pharmacology Seminar Series, April 8, 2010, "The biology and toxicology of low dose arsenic."

NIH-NIEHS Workshop, Phenotypic Anchoring of Arsenic Dose-Response in Experimental Models of Human Disease, October 21, 2010, "Phenotypic anchoring of low-dose arsenic effects in the C57BL6 mouse."

Bridgewater State College, Bridgewater MA, Department of Biology FISH Seminar Series, April 8, 2011, "MBL Stew: Arsenic, glowing frogs, limping lampreys and other fun projects."

Woods Hole Oceanographic Institution, Woods Hole MA, Department of Biology, April 28, 2011, "Arsenic: number one environmental health threat."

Harvard School of Public Health, Boston MA, Superfund Research Program Seminar Series, May 5, 2011, "Arsenic as an endocrine disruptor and immune modulator."

Community Service / Public Communication:

WNTK radio station (Lebanon NH), March 4, 1992, "Viewpoint" call-in/discussion show: "Chemicals and Health - Part I."

WNTK radio station (Lebanon NH), April 22, 1992, "Viewpoint" call-in/discussion show: "Chemicals and Health - Part II."

Norris Cotton Cancer Center, Fourth Annual Symposium on Breast Cancer, October 6, 1997, "Lab to bedside: drug resistance."

Dartmouth Community Medical School, Spring / Fall 2000 Curriculum (April 17-18, October 26, 2000 lectures), "Environmental Toxins: Are Our Public Policies Rational?"

Newton Middle School, South Strafford VT, 7th and 8th grade science classes, November 20, 2000, "An Introduction to Toxicology."

"Living on Earth" National Public Radio program interview, "Arsenic as an endocrine disruptor," March, 2001.

Ad Hoc Toxicology Consultant, Elizabeth Mines Community Advisory Group, South Strafford VT, April 2000 to present.

Dartmouth Community Medical School, Spring / Fall 2001 Curriculum (April 10, 2001 and October 3. 2001 lectures), "Foreign Invasion: How Our Bodies Deal With Vitamins, Drugs, Toxins And Dietary Supplements."

New England Society of Toxicology Annual Meeting, Phfizer Inc., Groton CN, November 8, 2002, K-12 Educational Program on Introduction to Toxicology, "Arsenic: Poison of Kings and King of Poisons."

Thetford Academy Middle School, Thetford VT, 7th and 8th grade science classes, February 11, 2003, "An Introduction to Toxicology."

Barre Middle School, Barre VT, 7th and 8th grade science classes, October 30, 2003, "An Introduction to Environmental Toxicology."

Rivendell Middle School, Orford NH, 7th and 8th grade science classes, November 20, 2003, "An Introduction to Environmental Toxicology."

Lebanon High School, Lebanon NH, 11th and 12th grade Advanced Biology class, May 21, 2004, "Introductory Toxicology and the Problem with Arsenic."

New England England Water Environment Association (NEWEA) Arsenic Symposium, University of New Hampshire, Durham NH, October 14, 2004, "Arsenic: Human health effects."

Upper Valley Chapter, New Hampshire League of Women Voters, Hanover NH, February 15, 2005, "Environmental Chemicals and Human Health Risks."

Dartmouth-Montshire Institute, Hanover NH, NYC high school student summer workshop, July 6, 2005, "An introduction to toxicology and environmental health."

Phillips Exeter Academy (grade 9-12 private school), June 1, 2006, lecture in environmental chemistry course on "An introduction to toxicology and environmental health."

Third Annual Great Issues in Medicine and Global Health Symposium on Cancer, "Cancer, Nutrition and the Environment," Dartmouth-Hitchcock Medical Center, Hanover NH, November 16, 2006, "Environmental toxins: how much cause for concern?"

"Greener Living with Dr. G" radio show, WTIC AM 1080, June 6, 2009, "Arsenic effects on immunity and H1N1 flu exposure."

"The Point with Mindy Todd" radio show, WCAI FM 90.1, February 24, 2011, "Environmental chemicals and human health."

"What's Falmouth Reading 2011?" and Falmouth Hospital Cancer Center Winter 2011 joint public seminar series, February 26, 2011, "Environmental chemicals and cancer."

BIBLIOGRAPHY

Research Articles:

1. Hamilton JW, Bloom SE. Developmental differences in basal and induced aryl hydrocarbon (benzo[a]pyrene) hydroxylase activity in chick embryo liver and lung, *in ovo*. *Biochem Pharmacol* 32:2986-2988, 1983.
2. Hamilton JW, Denison MS, Bloom SE. Development of basal and induced aryl hydrocarbon (benzo[a]pyrene) hydroxylase activity in the chicken embryo, *in ovo*. *Proc Natl Acad Sci USA* 80:3372-3376, 1983.
3. Hamilton JW, Bloom SE. Correlation between mixed-function oxidase enzyme induction and aflatoxin B_1-induced unscheduled DNA synthesis in the chick embryo, *in vivo*. *Environ Mutagen* 6:41-48, 1984.
4. Denison MS, Hamilton JW, Wilkinson CF. Comparative studies of aryl hydrocarbon hydroxylase and the *Ah* receptor in nonmammalian species. *Comp Biochem Physiol* 80c:319-324, 1985.
5. Denison MS, Okey AB, Hamilton JW, Bloom SE, Wilkinson CF. *Ah* receptor for 2,3,7,8-tetrachlorodibenzo-*p*-dioxin: Ontogeny in chick embryo liver. *J Biochem Toxicol* 1:39-49, 1986.
6. Hamilton JW, Bloom SE. Correlation between induction of xenobiotic metabolism and DNA damage from chemical carcinogens in the chick embryo *in vivo*. *Carcinogenesis* 7:1101-1106, 1986.
7. Hamilton JW, Wetterhahn KE. Chromium(VI)-induced DNA damage in chick embryo liver and blood cells *in vivo*. *Carcinogenesis* 7:2085-2088, 1986.
8. Faribault G, Weibkin P, Hamilton JW, Longnecker DS, Curphy TJ. γ-Glutamyl transferase activity in atypical acinar cell nodules of rat pancreas. *Toxicol Appl Pharmacol* 88:338-345, 1987.
9. Hamilton JW, Bement WJ, Sinclair PR, Sinclair JF, Wetterhahn KE. Expression of 5-aminolaevulinate synthase and cytochrome P-450 in chicken embryo hepatocytes *in vivo* and in cell culture: Effect of porphyrinogenic drugs and haem. *Biochem J* 255:267-275, 1988.
10. Hamilton JW, Wetterhahn KE. Differential effects of chromium(VI) on constitutive and inducible gene expression *in vivo* and correlation with chromium(VI)-induced DNA damage. *Mol Carcinog* 2:274-286, 1989.
11. Qureshi MA, Bloom SE, Hamilton JW, Dietert RR. Toxic effects of methyl methanesulfonate (MMS) on activated macrophages from chickens. *Environ Mol Mutagen* 13:253-262, 1989.
12. Wetterhahn KE, Hamilton JW. Molecular basis of hexavalent chromium carcinogenicity: Effect on gene expression. *Sci Total Environ* 86:113-129, 1989.
13. Wetterhahn KE, Hamilton JW, Aiyar J, Borges KM, Floyd R. Mechanism of chromium(VI) carcinogenesis: Reactive intermediates and effect on gene expression. *Biol Trace Element Res* 21:405-411, 1989.
14. Hamilton JW, Bement WJ, Sinclair PR, Sinclair JF, Alcedo JA, Wetterhahn KE. Heme regulates hepatic 5-aminolevulinate synthase mRNA expression by decreasing mRNA half life and not by altering its rate of transcription. *Arch Biochem Biophys* 289:387-392, 1991.
15. Mackie JE, Back DW, Hamilton JW, Marks GS. Elevation of □-aminolevulinic acid synthase and cytochrome PB_1 P-450 messenger RNA levels by dihydropyridines, dyhidroquinolines, sydnones, and N-ethylprotoporphyrin IX. *Biochem Pharmacol* 42:475-483, 1991.

16. Hamilton JW, Bement WJ, Sinclair PR, Sinclair JF, Alcedo JA, Wetterhahn KE. Inhibition of protein synthesis increases the transcription of the phenobarbital-inducible *CYP2H1* and *CYP2H2* genes in chick embryo hepatocytes. *Arch Biochem Biophys* 298:96-104, 1992.
17. Hamilton JW, Louis CA, Doherty KA, Hunt SR, Reed MJ, Treadwell MD. Preferential alteration of inducible gene expression in vivo by carcinogens that induce bulky DNA lesions. *Mol Carcinogen* 8:34-43, 1993.
18. Alcedo JA, Misra M, Hamilton JW, Wetterhahn KE. The genotoxic carcinogen chromium(VI) alters the metal-inducible expression but not the basal expression of the metallothionein gene *in vivo*. *Carcinogenesis* 15:1089-1092, 1994.
19. Hamilton JW, McCaffrey J, Caron RM, Louis CA, Treadwell MD, Hunt SR, Reed MJ, Doherty KA. Genotoxic chemical carcinogens target inducible genes *in vivo*. *Ann NY Acad Sci* 726:343-345, 1994.
20. McCaffrey J, Hamilton JW. Comparison of effects of direct-acting DNA methylating and ethylating agents on inducible gene expression *in vivo*. *Environ Mol Mutagen* 23:164-170, 1994.
21. McCaffrey J, Hamilton JW. Developmental regulation of basal and hormone-inducible phosphoenolpyruvate carboxykinase gene expression in chick embryo liver *in vivo*. *Arch. Biochem Biophys* 309:10-17, 1994.
22. McCaffrey J, Wolf CM, Hamilton JW. Effects of the genotoxic carcinogen chromium(VI) on basal and hormone-inducible phosphoenolpyruvate carboxykinase gene expression *in vivo*: correlation with glucocorticoid- and developmentally-regulated expression. *Mol Carcinogen* 10:189-198, 1994.
23. Caron RM, Hamilton JW. Preferential effects of the chemotherapeutic DNA crosslinking agent mitomycin C on inducible gene expression *in vivo*. *Environ Mol Mutagen* 25:4-11, 1995.
24. Warren AJ, Hamilton JW. Synthesis and structural characterization of the N^2G-mitomycin C-N^2G interstrand crosslink in a model synthetic 23 base pair oligonucleotide DNA duplex. *Chem Res Toxicol* 9:1063-1071, 1996.
25. Ihnat MA, Lariviere J, Warren AJ, La Ronde N, Blaxall JRN, Pierre KM, Turpie BW, Hamilton JW. Suppression of p-glycoprotein expression and multidrug resistance by DNA crosslinking agents. *Clin Cancer Res* 3:1339-1346, 1997.
26. Bentivegna CS, Ihnat MA, Baptiste NS, Hamilton JW. Developmental regulation of the 3 methylcholanthrene- and dioxin-inducible *CYP1A5* gene in chick embryo liver *in vivo*. *Toxicol Appl Pharmacol* 151:166-173, 1998.
27. Caron RM, Hamilton JW. Developmentally specific effects of the DNA crosslinking agent mitomycin C on phosphoenolpyruvate carboxykinase gene expression *in vivo*: Correlation with changes in chromatin structure within the promoter region of the gene. *J Biochem Mol Toxicol* 12:325-337, 1998.
28. Hamilton JW, Kaltreider RC, Bajenova OV, Ihnat MA, McCaffrey J, Turpie BW, Rowell EE, Oh J, Nemeth MJ, Pesce CA, Lariviere JP. Molecular basis for effects of carcinogenic heavy metals on inducible gene expression. *Environ Hlth Perspect* 106(S4):1005-1015, 1998.
29. Warren AJ, Ihnat MA, Ogdon SE, Rowell EE, Hamilton JW. Binding of nuclear proteins associated with mammalian DNA repair to the mitomycin C-DNA interstrand crosslink. *Environ Mol Mutagen* 31:70-81, 1998.
30. Warren AJ, Maccubbin AE, Hamilton JW. Detection of mitomycin C-DNA adducts *in vivo* by ^{32}P-postlabeling: Time course for formation and removal of adducts and biochemical modulation. *Cancer Res* 58:453-461, 1998.

31. Benbow U, Maitra R, Hamilton JW, Brinckerhoff CE. Selective inhibition of collagenase-1, gelatinase A, and gelatinase B by chemotherapeutic agents. *Ann NY Acad Sci* 878: 662-664, 1999.
32. Benbow U, Maitra R, Hamilton JW, Brinckerhoff CE. Selective modulation of collagenase-1 gene expression by the chemotherapeutic agent doxorubicin. *Clin Cancer Res* 5:203-208, 1999.
33. Ihnat MA, Nervi AM, Anthony SP, Kaltreider RC, Warren AJ, Pesce CA, Davis SA, Lariviere JP, Hamilton JW. Effects of mitomycin C and carboplatin pre-treatment on multidrug resistance-associated P-glycoprotein expression and on subsequent suppression of tumor growth by doxorubicin and paclitaxel in human metastatic breast cancer xenografted nude mice. *Oncol Res* 11:303-310, 1999.
34. Kaltreider RC, Pesce CA, Ihnat MA, Lariviere JP, Hamilton JW. Differential effects of arsenic(III) and chromium(VI) on nuclear transcription factor binding. *Mol Carcinogen* 25:219-229, 1999.
35. Raha A, Hamilton JW, Bresnick E. The existence of the 4S polycyclic aromatic hydrocarbon-protein binding in 14-day-old chick embryo liver. *Toxicol Appl Pharmacol* 158:1-8, 1999.
36. Yuann J-MP, Liu KJ, Hamilton JW, Wetterhahn KE. In vivo effects of ascorbate and glutathione on chromium uptake, formation of chromium(V), chromium-DNA binding and 8-OH-dG levels in liver and kidney of Ostegenic Disorder Shionogi (ODS) rats following treatment with chromium(VI). *Carcinogenesis* 20:1267-1275, 1999.
37. Hamilton JW, Kaltreider RC, Davis AM, Green RA. Arsenic(III) and chromium(VI) alter glucocorticoid receptor (GR) function and GR-dependent gene regulation. *Metal Ions Bio Med* 6:66-68, 2000.
38. Kaltreider RC, Davis AM, Lariviere JP, Hamilton JW. Arsenic alters the function of the glucocorticoid receptor as a transcription factor. *Environ Hlth Perspect* 109:245-251, 2001.
39. Maitra R, Halpin PA, Karlson KH, Page RL, Paik DY, Leavitt MO, Moyer BD, Stanton BA, Hamilton JW. Differential effects of mitomycin C and doxorubicin on P-glycoprotein expression. *Biochem J* 355:617-624, 2001.
40. Maitra R, Shaw CM, Stanton BA, Hamilton JW. Functional enhancement of CFTR expression by mitomycin C. *Cell Physiol Biochem* 11:93-98, 2001.
41. Maitra R, Shaw C, Stanton BA, Hamilton JW. Increased functional cell surface expression of CFTR and ΔF508 CFTR by the anthracycline doxorubicin. *Am J Physiol Cell Physiol* 280:C1031-C1037, 2001.
42. Mustra DJ, Warren AJ, Hamilton JW. Preferential binding of human full length XPA and the minimal DNA binding domain (XPA-MF122) with the mitomycin C-DNA interstrand crosslink. *Biochemistry* 40:7158-7164, 2001.
43. Warren AJ, Mustra DJ, Hamilton JW. Detection of mitomycin C-DNA adducts in human breast cancer cells grown in culture, as xenografted tumors in nude mice and in human breast cancer patient tumors as determined by ^{32}P-postlabeling. *Clin Cancer Res* 7:1033-1042, 2001.
44. Andrew AS, Karagas MR, Hamilton JW. Decreased DNA repair gene expression among individuals exposed to arsenic in US drinking water. *Intl J Cancer* 104:263-268, 2003.
45. Andrew AS, Warren AJ, Barchowsky A, Temple KA, Klei L, Soucy NV, O'Hara KA, Hamilton JW. Genomic and proteomic profiling of responses to toxic metals in human lung cells. *Environ Hlth Perspect* 111:825-838, 2003.
46. Zheng H, Wang X, Warren AJ, Legerski RJ, Nairn RS, Hamilton JW, Li L. NER and polymerase η (Pol H) mediated error-prone removal of mitomycin C interstrand cross-links. *Mol Cell Biol* 23:754-761, 2003.

47. Bodwell JE, Kingsley LA, Hamilton JW. Arsenic at very low concentrations alters glucocorticoid receptor (GR)-mediated gene activation but not GR mediated gene repression: complex dose-response effects are closely correlated with levels of activated GR and require a functional GR DNA binding domain. *Chem Res Toxicol* 17:1064-1076, 2004.
48. Kamat CD, Green DE, Curilla Warnke SL, Hamilton JW, Sturup S, Clark C, Ihnat MA. Role of HIF signaling on tumorigenesis in response to chronic low dose arsenic administration. *Toxicol Sci* 86:248-257, 2005.
49. Karagas MR, Park S, Warren AJ, Hamilton JW, Nelson HH, Mott LA, Kelsey KT. Gender, smoking, glutathione-S-transferase variants and bladder cancer incidence: a population-based study. *Cancer Lett* 219:63-69, 2005.
50. Maitra R, Hamilton JW. Arsenite regulates cystic fibrosis transmembrane conductance regulator and P-glycoprotein: evidence of pathway independence. *Cell Physiol Biochem* 16:109-118, 2005.
51. Andrew AS, Burgess JL, Meza MM, Demidenko E, Waugh MG, Hamilton JW, Karagas MR. Arsenic exposure is associated with decreased DNA repair in vitro and in individuals exposed to drinking water arsenic. *Environ Hlth Perpect* 114:1193-1198, 2006.
52. Bodwell JE, Gosse JA, Nomikos AP, Hamilton JW. Arsenic disruption of steroid receptor gene activation: complex dose-response effects are shared by several steroid receptors. *Chem Res Toxicol* 19:1619-1629, 2006.
53. Shaw JR, Dempsey TD, Chen CY, Hamilton JW, Folt CL. Comparative toxicity of cadmium, zinc and mixtures of cadmium and zinc to daphnnids. *Environ Toxicol Chem* 25:182-189, 2006.
54. Stanton CR, Thibodeau R, Lankowski A, Shaw JR, Hamilton JW, Stanton BA. Arsenic inhibits CFTR-mediated chloride secretion by killifish (*Fundulus heteroclitus*) opercular membrane. *Cell Physiol Biochem* 17:269-278, 2006.
55. Andrew AS, Bernardo V, Warnke LA, Davey JC, Hampton T, Mason RA, Thorpe JE, Ihnat MA, Hamilton JW. Exposure to arsenic at levels found in U.S. drinking water modifies expression in the mouse lung. *Toxicol Sci* 100:75-87, 2007.
56. Davey JC, Bodwell JE, Gosse JA, Hamilton JW. Arsenic as an endocrine disruptor: effects of arsenic on estrogen receptor-mediated gene expression. *Toxicol Sci* 98:75-86, 2007.
57. Maitra R, Hamilton JW. Altered biogenesis of ΔF508-CFTR following treatment with doxorubicin. *Cell Physiol Biochem* 20:465-472, 2007.
58. Miller DS, Shaw JR, Stanton CR, Barnaby R, Karlson KH, Hamilton JW, Stanton BA. MRP2 and acquired tolerance to inorganic arsenic in the kidney of killifish (*Fundulus heteroclitus*). *Toxicol Sci* 97:103-110, 2007.
59. Mustra DJ, Warren AJ, Wilcox DE, Hamilton JW. Preferential binding of human XPA to the mitomycin C-DNA interstrand crosslink and modulation by arsenic and cadmium. *Chem-Biol Inter* 168:159-168, 2007.
60. Shaw JR, Colbourne J, Davey JC, Glaholt SP, Hampton TH, Chen CY, Folt CL, Hamilton JW. Gene response profiles for *Daphnia pulex* exposed to the environmental stressor cadmium reveals novel crustacean metallothioneins. *BMC Genomics* 8:477, 2007.
61. Shaw JR, Gabor K, Hand E, Lankowsky A, Durant L, Thibodeau R, Stanton CR, Barnaby R, Coutermarsh B, Karlson KH, Sato JD, Hamilton JW, Stanton BA. Role of glucocorticoid receptor in acclimation of killifish (*Fundulus heteroclitus*) to seawater and effects of arsenic. *Am J Physiol Regul Integr Comp Physiol* 292:R1052-1060, 2007.

62. Shaw JR, Jackson B, Gabor K, Stanton S, Hamilton JW, Stanton BA. The influence of exposure history on arsenic accumulation and toxicity in the killifish, *Fundulus heteroclitus*. *Environ Toxicol Chem* 26:2704-2709, 2007.
63. Davey JC, Nomikos AP, Wungjiranirun M, Sherman JR, Ingram L, Batki C, Lariviere JP, Hamilton JW. Arsenic as an endocrine disruptor: effects on retinoic acid receptor and thyroid hormone receptor signaling in cell culture and effects on thyroid hormone-mediated metamorphosis in an amphibian tail model. *Environ Hlth Perspect* 116:165-172, 2008.
64. Kozul CD, Nomikos AP, Hampton TH, Davey JC, Gosse JA, Warnke LA, Ihnat MA, Jackson BP, Hamilton JW. Laboratory diet profoundly alters gene expression and confounds genomic analysis in mouse liver and lung. *Chem-Biol Interact* 173:129-140, 2008.
65. Ye S, MacEachran DP, Hamilton JW, O'Toole GA, Stanton BA. Chemotoxicity of doxorubicin and surface expression of P-glycoprotein (MDR1) is regulated by the Pseudomonas aeruginosa toxin Cif. *Am J Physiol: Cell Physiol* 295:C807-C818, 2008.
66. Hays AM, Lantz RC, Rodgers LS, Sollome JJ, Vaillancourt RR, Andrew AS, Hamilton JW, Camenisch T. Arsenic down-regulates vascular matrix. *Toxicol Pathol* 36:805-817, 2008.
67. Kozul CD, Hampton TH, Davey JC, Gosse JA, Nomikos AP, Eisenhauer PL, Weiss DJ, Thorpe JE, Ihnat MA, Hamilton JW. Chronic exposure to arsenic in the drinking water alters the expression of immune response genes in mouse lung. *Environ Hlth Perspect* 117:1108-1115, 2009.
68. Barr FD, Krohmer LJ, Hamilton JW, Sheldon LA. Disruption of histone modification and CARM1 recruitment by arsenic represses transcription at glucocorticoid receptor-regulated promoters. *PLoS ONE* 4(8): e6766. doi:10.1371/journal.pone.0006766, 2009.
69. Kozul CD, Ely KH, Enelow RI, Hamilton JW. Low-dose arsenic compromises the immune response to influenza A infection *in vivo*. *Environ Hlth Perspect* 117:1441-1447, 2009.
70. Fei DL, Li H, Kozul CD, Black KE, Singh S, Gosse JA, DiRenzo J, Martin KA, Wang B, Hamilton JW, Karagas MR, Robbins DJ. Activation of Hedgehog signaling by the environmental toxicant arsenic may contribute to the etiology of arsenic-induced tumors. *Cancer Res* 70:1981-1988, 2010.
71. Wolf B, SchwarzerA, Cote AL, Hampton TH, Schwaab T, Huarte E, Tomlinson CR, Gui J, Fisher J, Fadul CE, Hamilton JW, Ernstoff MS. Gene expression profiles in peripheral blood lymphocytes from metastatic renal cell cancer patients treated with IL-2, interferon-α and autologous dendritic cell vaccine. *Cancer Res*, in press, 2011.

Reviews, Book Chapters, Conference Proceedings, Technical Reports, Other Media:

1. Hamilton JW, Wetterhahn KE. Chromium. In: Seiler HG, Sigel H, Sigel A, eds, *Handbook on Toxicity of Inorganic Compounds,* Marcel Dekker Inc, New York, 1987, pp 239-250.
2. Warren AJ, Hamilton JW. Mitomycin C. In: Creighton TE, ed, *Encyclopedia of Molecular Biology, Volume 3*, John Wiley and Sons, New York, pp 1515-1519, 1999.
3. Hamilton JW. Gentamicin in pharmacogenetic approach to treatment of cystic fibrosis. *Lancet* 358:2014-2016, 2001.
4. Hamilton JW. Chemical Mutagenesis and Carcinogenesis. In: Bertino J, ed, *Encyclopedia of Cancer*, Academic Press, San Diego CA, 2002.
5. Shaw JR, Chen CY, Davey JC, Folt CL, Hamilton JW. The *Daphnia* Genomics Consortium. *Mar Environ Res* 58:591, 2004.
6. Bates MN, Hamilton JW, LaKind JS, Langenberg P, O'Malley M, Snodgrass W. Biomonitoring Workshop Report: Biomonitoring study design, interpretation, and

communication – lessons learned and path forward. *Environ Hlth Perspect* 113:1615-1621, 2005.
7. Hamilton JW. Toxicogenomic and Toxicoproteomic Approaches for Biomarkers. In: DeCaprio AP, Ed, *Toxicologic Biomarkers*, Marcel Dekker, Inc, New York NY, 2006.
8. Hamilton JW. Use of toxicogenomics to investigate the effects of toxicants in aquatic systems. In: CEISM Monograph #31, A Report on the CIESM Workshop, *Marine Sciences and Public Health – Some Major Issues* (Geneva Switzerland, September 27-30, 2006), CIESM, Monaco, pp. 43-45, 2007.
9. Gosse JA, Hampton TH, Davey JC, Hamilton JW. A new approach to analysis and interpretation of toxicogenomic gene expression data and its importance in examining biological responses to low, environmentally relevant doses of toxicants. In: Sahu S, Ed, *Toxicogenomics: An Experimental Tool for Toxicity Testing*, John Wiley and Sons Ltd, New York NY, 2008.
10. Hamilton JW. The use of microarrays to understand the biology and toxicology of low dose arsenic. In: Tomlinson C, (ed), *Microarrays: Their design and use*, The Biomedical & Life Sciences Collection, Henry Stewart Talks Ltd, London (online at http://www.hstalks.com/bio), April 2009.
11. Independent Technical Review Team (Cornwell JC, Dickhut RM, Douglas WS, Hamilton JW, Kramer JG, Nipper M, Rumbold D, Sellner KG, Smits J, Windom HL). Sediment in Baltimore Harbor: Quality and Suitability for Innovative Reuse. An Independent Technical Review. Kramer JG, Smits J, Sellner KG (eds), Maryland Sea Grant Publication UM-SG-TS-2009-04, CRC Publ. No. 09-169, 2009.

Selected Published Abstracts:

1. Bloom SE, Hamilton JW, Denison MS. Sister chromatid exchanges as an indicator of promutagen activation and mutagenic potency in early embryonic development. *Proc Somat Cell Genet* 23:10, 1982.
2. Bloom SE, Hamilton JW, Denison MS. Metabolic activation of promutagen-carcinogens in the early chick embryo. *Proc Genet Soc Am* 100:6, 1982.
3. Hamilton JW, Denison MS, Bloom SE. Development of basal and induced benzo[a]pyrene metabolism in the chick embryo. *Environ Mutagen* 4:307, 1982.
4. Bloom SE, Schaefer OP, Hamilton JW. Avian embryonic liver homogenates for activating promutagens in the Chinese hamster cell sister chromatid exchange assay. *Environ Mutagen* 5:386-387, 1983.
5. Hamilton JW, Bloom SE. Unscheduled DNA synthesis as a measure of genetic damage in the chick embryo, *in vivo*. *Environ Mutagen* 5:491, 1983.
6. Hamilton JW, Bloom SE. Developmental differences in basal and inducible pulmonary and hepatic aryl hydrocarbon (benzo[a]pyrene) hydroxylase activity in the chick embryo. *Fed Proc* 42:370, 1983.
7. Hamilton JW, Bloom SE. Alkaline elution as a measure of genetic damage in the chick embryo, *in vivo*. *Environ Mutagen* 6:445, 1984.
8. Hamilton JW, Bloom SE. Developmental control of the xenobiotic-metabolizing enzyme system in the chick embryo. *Poultry Sci* 63 (suppl. 1):109, 1984.
9. Hamilton JW, Denison MS, Bloom SE, Wilkinson CF. Ontogeny of the cytosolic TCDD receptor in the chick embryo and neonate. *Fed Proc* 43:577, 1984.
10. Hamilton JW, Bloom SE. Correlation between mixed-function oxidase enzyme induction and genotoxicity, *in vivo*. *Fed Proc* 44:502, 1985.

11. Hamilton JW, Wetterhahn KE. Chromium-induced DNA damage *in vivo* in the chick embryo. *Environ Mutagen* 8 (suppl. 6):33-34, 1986.
12. Qureshi MA, Bloom SE, Hamilton JW, Dietert RR. Toxic effects of methyl methanesulfonate (MMS) on chicken activated macrophages. *Fed Proc* 45:331, 1986.
13. Hamilton JW, Wetterhahn KE. Effect of chromium-induced DNA damage on gene expression in the chick embryo *in vivo*. *Environ Mutagen* 9 (suppl. 8):44-45, 1987.
14. Hamilton JW, Wetterhahn KE. Differential effect of the carcinogen chromium(VI) on gene expression in vivo. *Environ Mutagen* 11 (suppl. 11):43, 1988.
15. Hamilton JW, Wetterhahn KE. Differential effects of the genotoxic carcinogen chromium(VI) on constitutive and inducible gene expression *in vivo*. *Proc Am Assoc Cancer Res* 30:184, 1989.
16. McCaffrey J, Hamilton JW. Differential effects of methyl methanesulfonate on constitutive and inducible gene expression *in vivo*. *Proc Am Assoc Cancer Res* 31:134, 1990.
17. Caron RM, McCaffrey J, Louis CA, Hamilton JW. Targeting of inducible gene expression by carcinogens *in vivo*. *Proc Am Assoc Cancer Res* 32:135, 1991.
18. McCaffrey J, Hamilton JW. Differential effects of methyl methanesulfonate on constitutive and inducible gene expression *in vivo*. *Environ Mutagen* 17 (suppl. 19):49, 1991.
19. Caron RM, Hamilton JW. Differential effects of mitomycin C on constitutive and inducible gene expression *in vivo*. *Proc Am Assoc Cancer Res* 33:170, 1992.
20. Hamilton JW, Baptiste NS. Regulation of expression for a 3-methylcholanthrene-inducible cytochrome P450 mRNA in chick embryo liver. *The Toxicologist* 12:186, 1992.
21. Caron RM, Hamilton JW. The DNA crosslinking agent mitomycin C alters hormone- and drug-inducible gene expression *in vivo*. *Proc Am Assoc Cancer Res* 34:5, 1993.
22. McCaffrey J, Hamilton JW. The carcinogenic DNA crosslinking agent chromium(VI) alters hormonal regulation of phospho-*enol*-pyruvate carboxykinase gene expression *in vivo*. *Proc Am Assoc Cancer Res* 34:5, 1993.
23. Caron RM, Ihnat MA, Hamilton JW. The promoter represents the critical target for the preferential effects of carcinogens on inducible gene expression, and chromatin structure is important for these effects. *Proc Am Assoc Cancer Res* 35:142, 1994.
24. Hamilton JW, Ihnat MA. The preferential effects of carcinogens on inducible gene expression are not mediated by the "UV response" pathway. *Proc Am Assoc Cancer Res* 35:143, 1994.
25. Caron RM, Hamilton JW. Developmentally specific effects of mitomycin C on PEPCK gene expression and correlation with chromatin structure. *Proc Am Assoc Cancer Res* 36:158, 1995.
26. Ihnat MA, Hamilton JW. Suppression of multi-drug resistance gene *mdr1b* mRNA and p-glycoprotein expression by mitomycin C in rat H4IIE cells. *Proc Am Assoc Cancer Res* 36:345, 1995.
27. Warren AJ, Hamilton JW. Reaction of mitomycin C with a synthetic 23 bp duplex DNA containing a single CpG site. *Proc Am Assoc Cancer Res* 36:374, 1995.
28. Anthony SA, Ihnat MA, Ernstoff MS, Kaufman PA, Lewis LD, Barth RJ, Memoli VA, Dain BJ, Arvizu CI, MacKay K, Daly-Finn L, Hamilton JW. Suppression in expression of p-glycoprotein and other proteins associated with multidrug resistance (MDR) by mitomycin C in metastatic breast cancer patients: preliminary results from a pilot clinical trial. *Proc Am Soc Clin Oncol* 15:188, 1996.
29. Warren AJ, Rowell EE, Ogdon SE, Hamilton JW. Detection of mammalian nuclear proteins that specifically recognize the mitomycin C-DNA interstrand CpG crosslink. *Proc Am Assoc Cancer Res* 37:121-122, 1996.

30. Warren AJ, Maccubbin AE, Hamilton JW. Detection of mitomycin C DNA adducts in chick embryo liver in vivo by ^{32}P post-labeling: time course for formation and removal of adducts and biochemical modulation. *Proc Am Assoc Cancer Res* 37:121, 1996.
31. Ihnat MA, Hamilton JW. Suppression of p-glycoprotein expression and multi-drug resistance by DNA cross-linking agents in rat and human cancer cells. *Proc Am Assoc Cancer Res* 37:333, 1996.
32. Anthony SP, Lewis LD, Beaulieu B, Ernstoff MS, MacKay K, Dain BJ, Arvizu CI, Ihnat MA, Kaufman PA, Hamilton JW. Paclitaxel pharmacokinetics when preceded by mitomycin C as a modulator of multidrug resistance in patients with advanced carcinoma. *Proc Am Soc Clin Oncol* 16:230A, 1997.
33. Kaltreider RC, Ihnat MA, Pesce CA, Nemeth MJ, Lariviere JP, Hamilton JW. Arsenic and chromium induce metal-, dose-, time-, and cell factor-dependent alterations in transcription factor binding. *The Toxicologist* 36(S1):116, 1997.
34. Bajenova OV, Lariviere JP, Oh J, Ihnat MA, Hamilton JW. Effects of carcinogens on inducible gene expression using cell lines stably transfected with a PEPCK/luciferase model gene. *Proc Am Assoc Cancer Res* 38:39, 1997.
35. Ihnat MA, Lariviere JP, Kaltreider RC, Warren AJ, Hamilton JW. Mitomycin C suppression of multidrug resistance-associated protein expression in human breast cancer / nude mouse xenografts *in vivo*. *Proc Am Assoc Cancer Res* 38:481, 1997.
36. Kaltreider RC, Warren AJ, Ihnat MA, Rowell EE, Hamilton JW. The DNA crosslinking agents mitomycin C and chromium(VI) alter transcription factor binding principally through DNA damage-dependent mechanisms. *Proc Am Assoc Cancer Res* 38:38, 1997.
37. Bajenova OV, Lariviere JP, Oh J, Hamilton JW. Effects of the heavy metals chromium and arsenic on hormone-inducible expression of PEPCK/luciferase genetic constructs. *The Toxicologist* 42(S1):320-321, 1998.
38. Dudek EJ, Dobson AW, LeDoux SP, Wilson GL, Martin BD, Hamilton JW, Wetterhahn KE. Chromium(VI) induces specific types of mitochondrial DNA damage in human lung A549 cells. *The Toxicologist* 42(S1):321, 1998.
39. Kaltrieder RC, Ihnat MA, Andrew AS, Oh J, Lariviere JP, Hamilton JW. Effects of the heavy metals arsenic and chromium on transcription factor binding and gene expression. *The Toxicologist* 42(S1):321, 1998.
40. Dudek EJ, Dobson AW, LeDoux SP, Wilson GL, Martin BD, Hamilton JW, Wetterhahn KE. Chromium(VI) induces specific types of mitochondrial DNA damage in human lung A549 cells. *Proc Am Assoc Cancer Res* 39:240, 1998.
41. Kaltreider RC, Bajenova OV, Warren AJ, Mustra DJ, Ihnat MA, Pesce CA, Lariviere JP, Hamilton JW. Identification of specific transcription factors and gene promoter regions mediating the preferential effects of DNA crosslinking agents on inducible gene expression. *Proc Am Assoc Cancer Res* 39:631, 1998.
42. Maitra R, Ihnat MA, Hamilton JW. Reciprocal induction of CFTR mRNA expression and suppression of MDR1 mRNA expression by mitomycin C in human HT-29 cells. *Pediatric Pulmonology* Suppl. 17:278-279, 1998.
43. Warren AJ, Mustra DJ, Ihnat MA, Anthony SP, Kaltreider RC, Lariviere JP, Hamilton JW. Detection of mitomycin C-DNA adducts in the tumors of human breast cancer patients and human metastatic breast cancer xenografted nude mice by 32P-postlabeling. *Proc Am Assoc Cancer Res* 39:631, 1998.
44. Kaltreider RC, Davis AM, Hamilton JW. Chromium(VI) induces a hormone-independent activation of the glucocorticoid receptor. *The Toxicologist* 48(S1):333, 1999.

45. Kaltreider RC, Davis AM, Hamilton JW. Hormone-independent activation of the glucocorticoid receptor by chromium(VI) in H4IIE cells. *Proc Am Assoc Cancer Res* 40:504, 1999.
46. Maitra R, Halpin PA, Stanton BA, Hamilton JW. Alterations in trafficking of P-glycoprotein to the cell surface by mitomycin C. *Proc Am Assoc Cancer Res* 40:314, 1999.
47. Maitra R, Shaw C, Stanton BA, and Hamilton JW. Increases in CFTR mRNA expression, protein trafficking and functional membrane expression by systemic chemotherapy drugs. *Pediatric Pulmonology* Suppl. 19:187, 1999.
48. Mustra DJ, Warren AJ, Hamilton JW. Interaction of the DNA binding domain of the repair protein XPA with a mitomycin C-DNA interstrand crosslink. *Proc Am Assoc Cancer Res* 40:155-156, 1999.
49. Lewis LD, Kaufman PA, Anthony SP, Nervi AM, Beaulieu B, MacKay K, Barth RN, Ernstoff MS, Nierenberg DW, Hamilton JW. Mitomycin C (MMC) combined with paclitaxel (PCTX) - A clinical and pharmacokinetic study. *Clin Pharmacol Ther* 65:198, 1999.
50. Nervi AM, Kohn EA, Ihnat MA, Anthony SP, Page RL, Hamilton JW. Correlation between tumor and liver Pgp expression *in vivo*. *Proc Am Assoc Cancer Res* 40:663, 1999.
51. Warren AJ, Mustra DJ, Hamilton JW. Mitomycin C-DNA adducts in human breast cancer xenografted nude mice and in human breast cancer cells determined by ^{32}P-postlabeling. *Proc Am Assoc Cancer Res* 40:509, 1999.
52. Davis TH, Amdur RJ, Donegan JO, Gosselin BJ, Anthony SP, Lewis LD, Hamilton JW, Siegel A, Nervi AM, Bengtson EM, McDonnell CE, Beaulieu B. Phase I trial of carboplatin as a multidrug resistance (MDR) phenotype modulator with concurrrent paclitaxel and hyperfractionated radiotherapy (HyRT) in squamous cell cancer of the head and neck (SCCHN). *Proc Am Soc Clin Oncol* 19:203A, 2000.
53. Kaltreider RC, Green RA, Hamilton JW. Arsenic(III) alters glucocorticoid receptor (GR) function and GR-dependent gene regulation in H4IIE cells. *The Toxicologist* 54(S1):133, 2000.
54. Kaltreider RC, Davis AM, Green RA, Hamilton JW. Arsenic(III)-induced alterations in glucocorticoid receptor (GR) function and correlation with alterations in GR-dependent gene expression. *Proc Am Assoc Cancer Res* 41:506, 2000.
55. Warren AJ, Hamilton JW. Metal-induced alterations in expression of nucleotide excision repair genes. *Proc Am Assoc Cancer Res* 41:177, 2000.
56. Hamilton JW, Davis AM, Kaltreider. Chromium(VI) alters glucocorticoid receptor (GR)-dependent and cAMP-dependent gene expression through a chromium(III)-sensitive, cAMP-mediated pathway. *The Toxicologist* 60(S1):316, 2001.
57. Sillett KS, Chen CY, Folt CL, Hamilton JW. Using differential display RT-PCR to identify cadmium-responsive genes in *Daphnia pulex*. *Proc Soc Environ Toxicol Chem* 21:168, 2001.
58. Hamilton JW, Maitra R. The model anthracycline, doxorubicin, increases functional cell surface expression of ΔF508-CFTR protein by altering its structure and biogenesis. *Pediatric Pulmonology* Suppl. 22:258-259, 2001.
59. Andrew AS, Karagas MR, Hamilton JW. Decreased expression of DNA repair genes ERCC1, XPF, and XPB, but not XPG or XPA among individuals exposed to arsenic in drinking water. *Proc Am Assoc Cancer Res* 40:1029, 2002.
60. Andrew AS, Warren AJ, Temple KA, Hamilton JW. Differential effects of arsenic, chromium, cadmium, nickel and mitomycin C on gene expression as measured by DNA microarray. *The Toxicologist* 66(S1):116, 2002.
61. Hamilton JW, Bodwell JE, Kaltreider RC, Davis AM, Davey JC, Kingsley LA, Lariviere JP. Arsenic is an endocrine disruptor, blocking hormone-mediated gene regulation by the estrogen and glucocorticoid receptors *in vivo*. *The Toxicologist* 66(S1):85, 2002.

62. Soucy NV, Barchowsky A, Klei LR, Hamilton JW, Ihnat MA. Potential cellular mechanisms for arsenite-induced vascular diseases. *The Toxicologist* 66(S1):86, 2002.
63. Wolf KK, Davis AM, Kaltreider RC, Davey JC, Lariviere JP, Hamilton JW. Chromium(III) and chromium(VI) stimulate cAMP-mediated cell signaling in cell culture and *in vivo*. *The Toxicologist* 66(S1):32, 2002.
64. Shaw JR, Davey JC, Hamilton JW. Silver inhibits estrogen mediated gene transcription. *Proc Soc Environ Toxicol Chem* 23:298-299, 2002.
65. Hamilton JW, Bodwell JE, Kingsley LA, Barnet CS, Davey JC. Arsenic alters hormone-mediated positive, but not negative, regulatory effects of steroid receptors. *The Toxicologist* 72(S1):16, 2003.
66. Andrew AS, Karagas MR, Klei L, Hamilton JW. Drinking water arsenic exposure is associated with decreased DNA repair gene expression. *The Toxicologist* 72(S1):184, 2003.
67. Zheng H, Wang X, Warren AJ, Legerski RJ, Nairn RS, Hamilton JW, Li L. Transcription-coupled nucleotide excision repair in error-prone removal of mitomycin C interstrand cross-links. *Proc Am Assoc Cancer Res* 44:1437, 2003.
68. Stanton C, Prescott D, Lankowski A, Karlson K, Mickle J, Shaw J, Hamilton JW, Stanton BA. Arsenic adaptation to seawater in killifish (*Fundulus heteroclitus*). *The Bulletin* 42:117-119, 2003.
69. Davey JC, Andrew AS, Barchowsky A, Soucy NV, Mayka DD, Lantz RC, Hays A, Hamilton JW. Toxicogenomics of drinking water arsenic *in vivo*: effects of replicates on microarray analysis. *The Toxicologist* 78(S1):60, 2004.
70. Andrew AS, Barchowsky A, Davey JC, Soucy NV, Mayka DD, Lantz CR, Hayes A, Hamilton JW. *In vivo* exposure to drinking water arsenic modifies expression of genes in the mouse lung. *The Toxicologist* 78(S1):145, 2004.
71. Barchowsky A, Klei LR, Mayka DD, Davey JC, Hamilton JW, Soucy NV. Chronic arsenic exposure enhances FGF-2-stimulated angiogenesis *in vivo* and tissue expression of angiogenic genes. *The Toxicologist* 78(S1):170, 2004.
72. Folt CL, Gaholt SP, Chen CY, Hamilton JW, Shaw JR. Metal tolerance in *Daphnia pulex*. *Proc Soc Environ Toxicol Chem* 25:52, 2004.
73. Shaw JR, Curtis-Barnes J, Stanton BA, Hamilton JW. The toxicity of arsenic to the killifish, *Fundulus heteroclitus*: effects of salinity. *The Bulletin* 43:134, 2004.
74. Shaw JR, Chen CY, Davey JC, Folt CL, Hamilton JW, Colbourne JK. Using microarrays to determine metal induced gene-response in *Daphnia pulex*. *Proc Soc Environ Toxicol Chem* 25:153, 2004.
75. Davey JC, Ingram L, Batki C, Lariviere JP, Hamilton JW. Arsenic causes dose-dependent enhancement and suppression of Retinoic Acid Receptor (RAR)-mediated gene activation. *The Toxicologist* 84(S1):28, 2005.
76. Hays A, Pandey R, Ahmad R, Andrew AS, Hamilton JW, Lantz RC. Determination of transcription factors important in arsenic-induced alterations in gene expression. *The Toxicologist* 84(S1):32-33, 2005.
77. Shaw JR, Chen CY, Glaholt SP, Folt CL, Davey JC, Hampton TH, Hamilton JW, Bukoski E, Andrews J, Colbourne JK. Differences in microarray gene expression profiles of Daphnia pulex exposed to metals: characterization and comparative sequence analysis of responsive genes. *Proc Soc Environ Toxicol Chem* 26:73, 2005.
78. Shaw JR, Durant L, Thibodoeau R, Barnaby R, Karlson KH, Hamilton JW, Stanton BA. Effects of cortisol and arsenic on seawater acclimation in killifish (*Fundulus hereroclitus*). *The Bulletin*, 44:108, 2005.

79. Shaw JR, Gabor K, Hand E, Stanton S, Thibodeau R, Barnaby R, Karlson K, Sato D, Hamilton JW, Stanton BA. Effects of glucocorticoid-receptor inhibition and arsenic on seawater acclimation. *The Bulletin* 45:125, 2006.
80. Ihnat MA, Shakir S, Thorpe JE, Warnke LA, Andrew AS, Hamilton JW. Chronic low dose As(III) together with continuous high glucose results in a ROS-mediated stimulation of hypergycemic stress markers in isolated endothelial cells. *The Toxicologist* 90(S1):420, 2006.
81. Davey JC, Nomikos AP, Wungjiranirun M, Sherman JR, Ingram L, Batki C, Lariviere JP, Hamilton JW. Arsenic Disrupts Thyroid Hormone-induced Gene Transcription in GH3 Cells and Amphibian Tail Metamorphosis. *The Toxicologist* 96(S1):15, 2007.
82. Gosse JA, Hampton TH, Bodwell JE, Barr FD, Kozul CD, Hamilton JW. Toxicogenomic Studies with Primary Human Lung Fibroblasts Reveal Global Effects of Low-dose Arsenic on Glucocorticoid Receptor Signaling. *The Toxicologist* 96(S1), 2007.
83. Hampton TH, Davey JC, Gosse JA, Warnke LA, Ihnat MA, Andrew AS, Shaw JR, Hamilton JW. Nonparametric and graphical methods reveal new gene patterns in low dose arsenic microarray experiments. *The Toxicologist* 96(S1):252, 2007.
84. Kozul CD, Nomikos AP, Hampton TH, Davey JC, Gosse JA, Warnke LA, Ihnat MA, Jackson BP, Hamilton JW. Laboratory Diet Alters Gene Expression in Mice. *The Toxicologist* 96(S1):154-155, 2007.
85. Nomikos AP, Hampton TH, Davey JC, Gosse JA, Kozul CD, Warnke LA, Ihnat MA, Hamilton JW. Chronic low dose arsenic exposure in mice causes gene expression changes associated with cholesterol biosynthesis. *The Toxicologist* 96(S1):15, 2007.
86. Kozul CD, Hampton TH, Davey JC, Gosse JA, Nomikos AP, Warnke LA, Ihnat MA, Hamilton JW. Chronic low-dose arsenic exposure alters key regulators of innate immune response in vivo. *The Toxicologist* 102 (S1):269, 2008.
87. Davey JC, Gosse JA, Kozul CD, Hampton TH, Nomikos AP, Bodwell JE, Hamilton JW. Microarray analysis of mouse liver transcripts following arsenic / dexamethasone exposure. *The Toxicologist* 102 (S1):293-4, 2008.
88. Hampton TH, Davey JC, Gosse JA, Kozul CD, Ihnat MA, Hamilton JW. Analysis of global patterns in microarray gene expression due to low dose arsenic exposure using correlation and gene set enrichment. *The Toxicologist* 102 (S1):321, 2008.
89. Kozul CD, Ely K, Enelow R, Hamilton JW. Chronic low-dose arsenic exposure alters the response to respiratory viral infection in vivo. *The Toxicologist* 108 (S1), 2009.
90. Kozul CD, Horvath RJ, Bomberger JM, Hamilton JW. Low-dose arsenic decreases the migration of dendritic cells. *The Toxicologist* 114 (S1), 2010.
91. Kozul-Horvath CD, Hamilton JW, Enelow R. Developmental immunotoxicity of low dose arsenic exposure. *The Toxicologist* 114 (S1), 2011.
92. Zandbergen FJ, Chatikavanij V, Kozul-Horvath CD, Hamilton JW. Arsenite inhibits 3T3-L1 adipogenesis and suppresses induction of nuclear receptors during the earliest stages of differentiation. *The Toxicologist* 120 (S1), 2011.