ABBY D. BENNINGHOFF

Assistant Professor
Animal, Dairy and Veterinary Sciences, Graduate Program in Toxicology
and USTAR Applied Nutrition Research
Utah State University
4815 Old Main Hill
Logan, UT 84322-4815

Office location: Ag Science Bldg (AGSC) 240A
Office phone: (435) 797-8649
Fax: (435) 797-2118
email: abby.benninghoff@usu.edu

RESEARCH PROGRAM

The goal of my research program in the Department of Animal, Dairy and Veterinary Sciences is to understand the influence of environmental factors on epigenetic mechanisms of gene regulation in determining health and disease in animals and humans. In other words, we focus on the intersection of nature and nurture by investigating gene-environment interactions. My research group will strive to address three key questions: *How is the fetal epigenome impacted by the environment? How are these epigenetic changes related to the health or disease status of the offspring? Can optimal maternal dietary conditions be identified to reduce disease risk in adulthood?* Our studies center on a class of environmental pollutants important to Utah and the world – polycyclic aromatic hydrocarbons (PAHs), derived from burning of fossil fuels and biomass materials. We also investigate the beneficial effects of certain nutrition supplements and bioactive food components derived from a number of key food crops, several of which are important to Utah agriculture, in counter-acting the adverse effects of PAHs to prevent or suppress cancer. In addition, I have collaborative research projects with colleagues in ADVS to investigate epigenome programming in early embryo development and with faculty in the Department of Nutrition, Dietetics and Food Sciences to investigate diet and cancer risk and prevention. My research program is supported by funds from the Utah Agricultural Experiment Station, the National Cancer Institute and the National Institute of Environmental Health Sciences.

EDUCATION

2004	Ph.D.	University of Texas at Austin Marine Science (*Area of specialization*: Comparative Endocrinology)
1997	B.S.	University of Tennessee, Knoxville Biochemistry and Biology, *Manga cum laude*

RESEARCH AND TEACHING EXPERIENCE

01/10-present	**Assistant Professor,** Animal, Dairy and Veterinary Sciences Department; the Graduate Program in Toxicology; and USTAR Applied Nutrition Research, Utah State University
05/08-12/09	**Faculty Research Associate,** Dept. of Environmental and Molecular toxicology, Oregon State University
01/07-01/09	**Science Communication Fellow,** Environmental Health Sciences
11/06-05/08	**Ruth L. Kirschstein National Research Service Award (NRSA) Postdoctoral Fellow,** Dept. of Environmental and Molecular Toxicology, Oregon State University
01/05-11/06	**NIEHS Postdoctoral Fellow,** Environmental Health Sciences Center and the Dept. of Environmental and Molecular Toxicology, Oregon State University.

08/04-01/05 **Postdoctoral Fellow,** Dept. of Marine Science, University of Texas at Austin.

08/97-07/04 **Doctoral Candidate and Graduate Research Assistant,** Dept. of Marine Science, University of Texas at Austin. *Dissertation*: Signal Transduction Pathways Regulating Steroidogenesis in the Ovary of Atlantic Croaker (*Micropogonias undulatus*)

06/00-08/00 **Teaching Assistant** (Reproductive Fish Physiology), Dept. of Marine Science, University of Texas at Austin

01/98-05/98 **Teaching Assistant** (Introduction to Oceanography), Dept. of Marine Science, University of Texas at Austin

08/95-08/97 **Undergraduate Research Fellow**, Dept. of Biochemistry, Cellular and Molecular Biology, University of Tennessee, Knoxville.

GRANT SUPPORT

Current (listed by order of expiration)

01/10-12/14 **Influence of environmental factors on the epigenome in early life**
Role: Primary Investigator
Utah Agricultural Experiment Station: Project No. UTA00172. $65,000 operating budget awarded.
The goal of this research program is to determine how the fetal epigenome is impacted by environmental exposures, include anthropogenic toxins and natural dietary anti-cancer agents.

04/10-03/12 **Impact of transplacental PAH exposure on the epigenome**
Role: Primary Investigator
NIEHS: R03ES018919-01. $140,000 in total costs awarded.
The primary objective of this project is to determine the impact of gestational exposure to polycyclic aromatic hydrocarbons (PAHs) on the fetal and adult offspring epigenome in the mouse lung.

05/10-04/12 **Role of the regulatory protein p53 in somatic cell nuclear transfer**
Role: Primary Investigator
Utah Agricultural Experiment Station. $20,000 awarded.
In this project, our research group will determine how stress responses in embryos generated by somatic cell nuclear transfer cloning technology differ from *in vitro* fertilized embryos. Our experiments will focus on the key stress response protein p53 and its regulated molecular targets involved in cell stress pathways leading to apoptosis and cell arrest.

04/09-03/11 **Cancer prevention by indole-3-carbinol via modulation of the epigenome**
Role: Primary Investigator
NCI: R21CA13523-01A2. $353,804 in total costs awarded.
The goal of this proposal is to determine how dietary indole-3-carbinol modifies the epigenome to decrease the overall risk of lymphoma with primary focus on the epigenetic modification of CYP1B1.

01/10-12/10 **Combination of DIM and EGCG in transplacental chemoprevention of lung cancer**
Role: Primary Investigator
Utah State University, Vice President for Research Office. $20,000 awarded.
The main purpose of this project to determine whether combinations of specific bioactive food components, EGCG and DIM, are more effective in preventing cancer than are the chemicals individually.

05/10-12/11 **Nutrient density, hidden hunger and cancer susceptibility**
Role: Co-I (Project Leaders, Robert Ward and Korry Hintze)
Utah Agricultural Experiment Station. $20,000 awarded.
The relationship between cell death (apoptosis) and nuclear reprogramming in somatic cell nuclear transfer embryos will be investigated using a non-invasive assay for apoptosis followed by an analysis by qPCR of a panel of eight genes related to nuclear reprogramming.

05/10-12/11 **Apoptosis and nuclear reprogramming in somatic cell nuclear transfer embryos**
Role: Co-I (Project Leaders, Robert Ward and Korry Hintze)
Utah Agricultural Experiment Station. $14,000 awarded.
We will test the hypothesis that consumption of an energy-dense, micronutrient-poor diet will affect consumption, weight gain and cancer susceptibility in rodents. The test diet will be modeled on the least nutritious diet pattern consumed in the U.S. and will be valuable to prioritize specific dietary interventions to improve health.

06/11-05/13 **Growth, viability and productivity studies using recombinant CHO cells in stirred-tank bioreactors**
Role: Primary Investigator (multiple PIs)
Utah Agricultural Experiment Station. $18,500 awarded.
Project goal is to determine whether a new bioreactor design reduces stress encumbered by cells during *in vitro* culture, allowing for more robust and rapid growth and enhanced protein production, with an ultimate goal to optimize methods for vaccine production.

Pending

04/11-03/14 **Impact of Western diet on colon cancer risk and prevention by EGCG via epigenome**
Role: Primary Investigator (Multiple PIs)
NCI: R15CA159012 $420,000 total costs requested
The goals of this project are to determine the impact of a nutritionally poor diet reflective of current Western nutritional status on colon cancer susceptibility and the efficacy of cancer prevention by the green tea bioactive food component epigallocatechin gallate (EGCG). This project will focus on epigenetic mechanisms of carcinogenesis and cancer prevention.

07/11-06/15 **Apoptosis and genome reprogramming in bovine IVF and nuclear transfer embryos**
Role: Primary Investigator (Multiple PIs)
NIH/USDA: R01 $1,380,920 total costs requested
The primary objective of this proposal is to determine the relationship between apoptosis and nuclear reprogramming as it relates to the competence of embryos generated by somatic cell nuclear transfer.

08/11-07/14 **MRI: Acquisition of the Fluidigm BioMark Genetic Analysis Platform for single-cell biology and high-throughput genotyping in research, education and outreach**
Role: Co-Investigator
NSF $392,196 total costs requested
The primary objective of this equipment proposal is to obtain funding to support the purchase of the Fluidigm BioMark Genetic analysis platform for analysis of gene expression, DNA methylation and other molecular markers at the level of a single cell (single embryo).

Completed

11/06-05/08 **Role of estrogen receptor β in cancer chemoprevention by indole-3-carbinol**
Role: Primary Investigator
NIEHS: 1F32ES01477-01A1. $71,169 awarded.
The primary objective of this grant was to evaluate the role of ERβ in modulating the chemopreventive properties of dietary I3C against transplacentally induced thymic lymphoma and lung adenocarcinoma.

09/06-12/07 **Perfluorinated chemicals (PFCs) as modulators of tumorigenesis in rainbow trout**
Role: Primary Investigator
NIEHS Marine and Freshwater Biomedical Sciences Center Pilot Project. $20,000 awarded.
The primary objective of this study was to examine the influence of several model perfluorinated chemicals, including perfluorooctanoic acid, on hepatic tumorigenesis in rainbow trout, a well-established animal model of human hepatocellular carcinoma.

01/06-12/06 **Toxicogenomics in chemical profiling: an evaluation of the utility of *in vitro* hepatic gene expression profiles for predicting chemical classification.**
Role: Primary Investigator
Society of Toxicology & Colgate-Palmolive Grants for Alternative Research. $40,000 awarded.
The goal of this study was to examine the utility of hepatic gene expression profiles for predicting chemical classification by apparent mechanism of action.

PROFESSIONAL AND ACADEMIC HONORS

Research Fellowships

2006-2008 **Ruth L. Kirschstein National Research Service Award Individual Postdoctoral Fellowship,** National Institute of Environmental Health Sciences
2005-2006 **Ruth L. Kirschstein National Research Service Award Institutional Postdoctoral Fellowship** Environmental Health Sciences Training Grant, Oregon State University
2003 **David Bruton, Jr. Graduate School Fellowship,** University of Texas at Austin Graduate School
2000-2003 **U.S. EPA STAR Fellowship for Graduate Environmental Study,** National Center for Environmental Research, U.S. EPA
2000-2003 **E.J. Lund Graduate Fellowship in Marine Science,** University of Texas at Austin
1999-2000 **Graduate Research Fellowship,** Houston Livestock and Rodeo Show
1995-1997 **Howard Hughes Medical Institute Undergraduate Research Fellowship** Threshold Scholars Program in Biological Research, University of Tennessee

Other Honors

2008 **Postdoctoral Research Award Finalist,** International Society for the Study of Xenobiotics
2007 **Postdoctoral Travel Award,** NIEHS/EPA Future Research on Endocrine Disruption Meeting
2006 **Postdoctoral Research Award Finalist,** International Society for the Study of Xenobiotics
2006 **Colgate/Palmolive Grants for Alternative Research Award,** Society of Toxicology and the Colgate/Palmolive Company
2003 **Travel Scholarship,** Office of Graduate Studies, University of Texas at Austin
1998 **Summer Tuition Scholarship,** Department of Marine Science, University of Texas at Austin
1996-1997 **Phi Beta Kappa**, University of Tennessee, Knoxville
1997 **Tri-Beta Biological Honor Society**, Charter Member, University of Tennessee, Knoxville

PUBLICATIONS

Manuscripts Submitted/In Preparation/In Press

Shorey, L.E., Williams, D.E., and **Benninghoff, A.D.** (Submitted) 3,3'-Diindolylmethane induces G_1 arrest and apoptosis in human acute T-cell lymphoblastic leukemia cells. PLoS One

Benninghoff, A.D., Orner, G.A., Buchner, C., Hendricks, J.D., and Williams, D.E. (In preparation) Promotion of hepatocarcinogenesis by perfluoroalkyl acids in rainbow trout. Environmental Health Perspectives.

Benninghoff, A.D., Shorey, L.E. and Williams, D.E. (In preparation) Role of estrogen receptor beta in transplacental cancer prevention by indole-3-carbinol. Cancer Prevention Research

Orner, G.A., **Benninghoff, A.D.,** Pereira, C., Hendricks, J.D., Bailey, G.S. and Williams, D.E. (In preparation) Aflatoxin B_1-dependent liver cancer: a study employing 50,000 trout to assess response at ultra-low dose. Environmental Health Perspectives.

Published Articles

Benninghoff, A.D., Bisson, W., Koch, D., Koluri, S.K., and Williams, D.E. (2010) Estrogen-like activity of polyfluorinated chemicals *in vivo* and interaction with human and trout estrogen receptors *in vitro*. Toxicological Sciences. doi: 10.1093/toxsci/kfq379 [Online 16 December 2010].

Salinas, K., Hemmer, M.J., Serrano, J., Higgins, L., Anderson, L.B., **Benninghoff, A.D.**, Williams, D.E., Walker, C. (2010) of estrogen-responsive vitelline envelope protein fragments from rainbow trout (Oncorhynchus mykiss) plasma using mass spectrometry. Molecular Reproduction and Development 77(11): 963-970.

Krueger, S.K., Henderson, M.C., Siddens, L.K., VanDyke, J.E., **Benninghoff, A.D.,** Andrew, A.P., Furnes, B., Schlenk, D. and Williams, D.E. (2009) Characterization of Sulfoxygenation and Structural Implications of Human Flavin-Containing Monooxygenase Isoform 2 (FMO2.1) Variants S195L and N413K. Drug Metabolism and Disposition 37(8): 1785-91.

Williams, D.E., Willard, K.D., Orner, G.A., Hendricks, J.D., Pereira, C., **Benninghoff, A.D.** and Bailey, G.S. 2009 Rainbow trout (*Oncorhynchus mykiss*) and ultra-low dose cancer studies. Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology 149(2): 175-81.

Tilton, S.C., Orner, G.A., **Benninghoff, A.D.,** Hendricks, J.D. and Williams, D.E. (2008) Genomic profiling reveals an alternate mechanism for hepatic tumor promotion by perfluorooctanoic acid in rainbow trout. Environmental Health Perspectives 116(8):1047-55. Selected as highlight article for this issue: http://www.ehponline.org/docs/2008/116-8/ss.html#alte

Benninghoff, A.D. and Williams, D.E. (2008) Identification of a transcriptional fingerprint of estrogen exposure in rainbow trout liver. Toxicological Sciences 101(1): 65-80.

Benninghoff, A.D. (2007) Toxicoproteomics – the next step in the evolution of environmental biomarkers? Toxicological Sciences 95(1): 1-4.

Mohamed, J.S., **Benninghoff, A.D.**, Holt, G.J., and Khan, I.A. (2007) Cloning of three GnRH genes and their mRNA expressions during larval development and prior to active gametogenesis in the cobia, *Rachycentron canadum*. Journal of Molecular Endocrinology. 38(2):235-44

Faulk, C.K., **Benninghoff, A.D.** and Holt, G.J. (2007) Ontogeny of the gastrointestinal tract and selected digestive enzymes in cobia (*Rachycentron canadum*) larval development. Journal of Fish Biology. 70: 567–583.

Benninghoff, A.D. and P. Thomas (2006) Gonadotropin regulation of testosterone synthesis by theca and granulosa cells of Atlantic croaker (*Micropogonias undulatus*): II. Involvement of a mitogen-activated protein kinase pathway. General and Comparative Endocrinology 147(3): 288-296.

Benninghoff, A.D. and P. Thomas (2006) Gonadotropin regulation of testosterone synthesis by theca and granulosa cells of Atlantic croaker (*Micropogonias undulatus*): I. Role of CaMK in calcium-mediated steroidogenesis and interactions between calcium and adenylyl cyclase pathways. General and Comparative Endocrinology 147(3): 276-287.

Thomas, P., Dressing, G., Pang, Y., Berg, H., Tubbs, C., **Benninghoff, A.**, and Doughty, K. (2006) Progestin, estrogen and androgen G-protein coupled receptors in fish gonads. Steroids 71(4): 310-316.

Benninghoff, A.D. and P. Thomas (2005) Involvement of calcium and calmodulin in the regulation of ovarian steroidogenesis in Atlantic croaker (*Micropogonias undulatus*) and modulation by Aroclor 1254. General and Comparative Endocrinology 144(3): 211-23.

Benninghoff, A. and P. Thomas (2003) Interactions of calcium and cyclic AMP signaling pathways regulating steroidogenesis in primary cultured theca and granulosa cells of Atlantic croaker. Fish Physiology and Biochemistry 28 (1-4): 327-328.

Book Chapters

Walter, R.B., Tilton, S.C., Orner, G.O., **Benninghoff, A.D.**, Bailey, G.S. and Williams, D.E. (2008). Carcinogenesis models: focus on xiphophorus and rainbow trout. In: Oceans and Human Health. Risks and Remedies

from the Seas. (Eds. Walsh, P.J., Smith, S.L., Fleming, L.E., Solo-Gabriele, H.M. and Gerwick, W.M. Elsevier, New York, pp 585-611.

Published Abstracts & Presentations

Hintze, K.J., Ward, R.E., and **Benninghoff, A.D.** (2011) Formulation of the Total Western Diet (TWD) as Basal Diet for Rodent Cancer Studies. American Chemical Society 2011 National Meeting. Denver, Colorado, August 28 – September 1.

Benninghoff, A.D., Louderback, M., Fish, T., Packard, B., Castro, D.J., Shorey, L.E., and Williams, D.E. (2011) Cancer prevention by indole-3-carbinol via estrogen receptor beta. AACR 102nd Annual Meeting 2011 Proceedings.

Benninghoff, A.D. (2010) Emerging role of epigenetics in food choices and disease prevention. Utah Dietetics Association Annual Meeting. Ogden, Utah, April 8-9. *Invited speaker.*

Benninghoff, A.D., Bisson, W., Koch, D., Kolluri, S. and Williams, D.E. (2010) Interaction of perfluoroalkyl acids with human estrogen receptor alpha. Society of Toxicology 49th Annual Meeting. Salt Lake City, Utah, March 7-11.

Shorey, L.E., **Benninghoff, A.D.**, and Williams, D.E. (2010) Diindolylmethane (DIM) targets multiple pathways in human acute T-cell lymphoblastic leukemia cells in vitro to reduce cell survival. Society of Toxicology 49th Annual Meeting. Salt Lake City, Utah, March 7-11.

Hemmer, M.J., **Benninghoff, A.D.**, Salinas, K.A., and Williams, D.E. (2010) Proteomic Screening of Perfluoroalkyl Acids for Estrogenic Activity Using Mass Spectrometry. Society of Toxicology 49th Annual Meeting. Salt Lake City, Utah, March 7-11.

Shorey, L.E., **Benninghoff, A.D.**, and Williams, D.E. (2009) Diindolylmethane inhibits proliferation of human derived acute T-cell lymphoblastic leukemia alone and in dietary phytochemical mixtures *in vitro*. Diet and Optimum Health Conference 2009. Portland, Oregon, May 13-16.

Benninghoff, A.D., Buchner, C., Hendricks, J.D., and Williams, D.E. (2008) Multiple perfluoroalkyl acids promote liver cancer in rainbow trout. Society of Environmental Toxicology and Chemistry (SETAC) North America 29th Annual Meeting. Tampa, Florida, November 16-20.

Salinas, K., Serrano, J., Higgins, L., **Benninghoff, A.,** Williams, D., Walker, C., Hemmer, M. Identification of two isoforms of vitelline envelope protein in the plasma of rainbow trout exposed to 17β-estradiol. Society of Environmental Toxicology and Chemistry (SETAC) North America 29th Annual Meeting. Tampa, Florida, November 16-20.

Benninghoff, A.D., Buckner, C., Hendricks, J.D., Williams, D.E. (2008) Multiple perfluoroalkyl acids enhance aflatoxin B1-initiated hepatocarcinogenesis in rainbow trout via possible estrogen-like mechanism of action. Society of Environmental Toxicology and Chemistry (SETAC) 4th World Congress. Sydney, Australia, August 3-7. *(Platform presentation)*

Perry, K.M., Orner, G.A., McQuistan, T., **Benninghoff, A.D.,** Percifield, T., Tilton, S.C., Pereira, C.B., Fisher, K.A., Löhr, C.V., Egner, P., Kensler, T., Hendricks, J.D., Bailey, G.S., and Williams, D.E. (2008) Analysis of ultra-low dose aflatoxin B1 exposure in rainbow trout. 25th Annual Meeting of the Pacific Northwest Regional Chapter of the Society of toxicology. Corvallis, Oregon, September 19.

Benninghoff, A.D., Buchner, C.H., Orner, G.A., Hendricks, J.D. and Williams, D.E**.** (2008) Promotion of hepatocarcinogenesis by perfluoroalkyl acids by an estrogenic mechanism. 10th European Regional International Society for the Study of Xenobiotics Meeting. Vienna, Austria, May 18-21.

Benninghoff, A.D. and Williams, D.E. (2008) Gene expression profiles of perfluorooctanoic, -nonanoic and -decanoic acids and 8:2 fluorotelomer alcohol in rainbow trout, a model for human hepatocarcinogenesis. Society of Toxicology 47th Annual Meeting. Seattle, Washington, March 16-20th.

Duong, L., **Benninghoff, A.D.,** Tanguay, R. (2008) Assessment of perfluorinated chemicals (PFCs) developmental toxicity using embryonic zebrafish. Society of Toxicology 47th Annual Meeting. Seattle, Washington, March 16-20th.

Benninghoff, A.D. (2008) Importance in Communicating About Estrogen-like Pollutants. Presentation for the Academy of Lifelong Learning. Corvallis, Oregon, February 28.

Benninghoff, A.D. and Williams, D.E. (2007) Estrogen receptor (ER) interaction as an alternative mechanism of toxicity of perfluoroalkyl acids (PFAAs). Society of Environmental Toxicology and Chemistry (SETAC) North America 28th Annual Meeting. Milwaukee, Wisconsin, November 11-15. *(Platform presentation)*

Benninghoff, A.D., Orner, G.A., Tilton, S.C., Field, J.A., and Williams, D.E. (2007) Perfluorooctanoic acid (PFOA) and structurally related perfluoroalkyl acids (PFAAs) are xenoestrogens in rainbow trout, a model organism for endocrine disruption and human carcinogenesis. NIEHS and EPA sponsored meeting on Future Research on Endocrine Disruption: Translation of Basic and Animal Research to Understand Human Disease. Durham, North Carolina, August 27-29.

Perry, K.M., Orner, G.A., **Benninghoff, A.D.**, Hendricks, J.D., Pereira, C.B., Bailey, G.S., Fisher, K.A., Lohr, C.V., and Williams, D.E. (2007) Identifying potential biomarkers for ultra-low dose aflatoxin B1 (AFB1) exposure in the rainbow trout model of hepatocellular carcinogenesis. 3rd Diet and Optimum Health Conference. Portland, Oregon, May 18-21.

Benninghoff, A.D., Field, J.A. and Williams, D.E. (2007) Assessment of the estrogen activity of perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS) and other structurally diverse perfluorinated chemicals in rainbow trout. 46th Annual Meeting of the Society of Toxicology. Charlotte, North Carolina, March 25-29.

Walker, C.C., Salinas, K.A., Harris, P.S., **Benninghoff, A.D.**, Springman, K.R. and Hemmer, M.J. Estrogen responsive plasma protein biomarkers in four fish species. 46th Annual Meeting of the Society of Toxiclogy. Charlotte, North Carolina, March 25-29.

Khan, I.K., Mohamed, J.S., **Benninghoff, A.D.**, Holt, J.G. (2007) Developmental expression of the G protein-coupled receptor 54 and three GnRH mRNAs in cobia. Aquaculture 2007, meeting of the World Aquaculture Society. San Antonio, Texas, February 26-March 2.

Benninghoff, A.D., Huset, C.A., Field, J.A. and Williams, D.E. (2006) Estrogenicity of perfluoroalkyl carboxylic acids in rainbow trout: results from a screen of 36 structurally diverse perfluorinated chemicals. Society of Environmental Toxicology and Chemistry (SETAC) North America 27th Annual Meeting, Montréal, Québec, Canada, November 5-9. *(Platform presentation)*

Benninghoff, A.D. and Williams, D.E. (2006) Identification of an estrogen receptor-mediated transcriptional fingerprint in rainbow trout liver. 14th North America International Society for the Study of Xenobiotics (ISSX) Meeting, Rio Grande, Puerto Rico, October 22-26. *(Platform presentation)*

Benninghoff, A.D. and Williams, D.E. (2006) A toxicogenomics approach to the discovery of mechanism of action-based biomarkers: a case study for the estrogen receptor. Gordon Research Conference: Mechanisms of Toxicity. Colby College, Waterville, Maine, July 23-28.

Benninghoff, A.D. and P. Thomas (2006) Signal transduction pathways regulating steroidogenesis in the ovary of Atlantic croaker. Western Regional Conference on Comparative Endocrinology. Newport, Oregon, March 24-25. (*Platform presentation*)

Benninghoff, A.D. and Williams, D.E. (2006) Tamoxifen-induced changes in hepatic gene expression: agonist and antagonist activities of this selective estrogen receptor modulator (SERM). 45th Annual Meeting of the Society of Toxicology. San Diego, California, March 5-9.

Mohamed, J.S., **Benninghoff, A.D.**, Holt, J.G., and Khan, I.A. (2006) Cloning and differential expression of three GnRH mRNAs during larval and gonadal development in the cobia Rachycentron canadum. Aquaculture America. Las Vegas, Nevada, February 13-16

Tilton, S.C., Orner, G.A., **Benninghoff, A.D.,** Hendricks, J.D. and Williams, D.E. (2005) Possible mechanism for hepatic tumor promotion by perfluorooctanoic acid in rainbow trout: a toxicogenomic approach. Society of Environmental Toxicology and Chemistry (SETAC) North America 26th Annual Meeting, Baltimore, Maryland, November 13-17.

Benninghoff, A.D. and P. Thomas (2003) Interactions of calcium and cyclic AMP signaling pathways regulating steroidogenesis in primary cultured theca and granulosa cells of Atlantic croaker. 5th International Symposium on Fish Endocrinology. Mie, Japan, May 18-22.

Benninghoff, A.D. and P. Thomas (2002) Signal transduction pathways involved in the regulation of steroid production by Atlantic croaker theca and granulosa cells in primary culture. 35th Annual Meeting of the Society for the Study of Reproduction. Baltimore, Maryland, July 28-31. *(Platform presentation)*

(older abstracts available upon request)

PROFESSIONAL SOCIETIES

American Association for Cancer Research
Society of Environmental Toxicology and Chemistry
Society of Toxicology

SERVICE

2010	Production Committee, Animal, Dairy and Veterinary Sciences Dept., Utah State University
2010	Judge, Intermountain Graduate Research Symposium
2007 – present	SETAC North America Mentoring Committee (Chairperson, 2007-2009; Executive Steering Committee, 2010)
2008 – 2009	Oregon State University President's Taskforce on the Postdoctoral Experience Postdoctoral Representative

Expert Scientific Peer Review

- Grant proposal review, US Defense Department, Defense Threat Reduction Agency program in basic research
- *Ad hoc* manuscript review
  - Toxicological Sciences
  - Toxicology and Applied Pharmacology
  - Toxicology Environmental Science & Technology
  - General and Comparative Endocrinology
  - Journal of Biomedicine and Biotechnology
- Agency for Toxic Substance and Disease Research (ATSDR) Toxicological Profiles: Perfluoroalkyl Acids (PFAAs)
- GENANIMAL program for the French National Research Agency (2007)