

**CURRICULUM VITAE**

David Crews

Ashbel Smith Professor of Zoology and Psychology

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*PERSONAL DATA*

Married to Andrea Gore, Ph.D. Three children (Rachel, Sarah, and Isaac).

*EDUCATION*

Summer, 1980 Trainee, Summer Course in Embryology, Marine Biological Laboratories, Woods Hole, Massachusetts.  
 Summer, 1975 Trainee, Summer Training Institute in Behavioral Genetics, Institute for Behavioral Genetics University of Colorado, Boulder, Colorado.  
 1973-1975 NSF Postdoctoral Trainee. Integrative Biology, University of California, Berkeley (Mentor: Paul Licht).  
 1969-1973 NIMH Predoctoral Trainee in Psychobiology (Ph.D.; June, 1973), Institute of Animal Behavior, Rutgers University, New Jersey. (Mentors: Daniel S. Lehrman and Jay S. Rosenblatt).  
 1967-1969 Undergraduate (B.A.; June, 1969), University of Maryland, College Park, Maryland.  
 1965-1967 Undergraduate, University of Maryland, Munich, Germany.

*PROFESSIONAL EXPERIENCE*

1998- present Ashbel Smith Professor of Zoology and Psychology, University of Texas at Austin  
 2001-2012 Director, Center for Behavioral Neuroendocrinology, University of Texas at Austin  
 1983-present Director, University of Texas Undergraduate Biomedical Training Program.  
 1987-2005 Director, National Institute of Mental Health Training Program in Neurobiology and Behavior.  
 1987-1990 Associate Chairman and Acting Chairman, Department of Zoology, University of Texas at Austin.  
 1984-1998 Professor of Zoology and Psychology, University of Texas at Austin.  
 Summer, 1986 & 1987 Faculty, University of Hawaii Institute of Marine Biology Summer Study Program  
 1982-1986 Research Associate, The Kinsey Institute for Research in Sex, Gender, and Reproduction, Indiana University.  
 1983-1984 Adjunct Associate Professor of Psychology, University of Texas at Austin.  
 1982-1984 Associate Professor of Zoology, University of Texas at Austin.  
 1975-1982 Associate, Museum of Comparative Zoology, Harvard University.  
 1979-1981 Associate Professor in Biology and Psychology, Harvard University.  
 1976-1978 Assistant Professor in Biology and Psychology, Harvard University.  
 1975-1976 Lecturer in Biology and Psychology, Harvard University.  
 1973-1975 Research Zoologist, Department of Zoology, University of California at Berkeley. Postdoctoral sponsor: Paul Licht.

- 1969-1973 NIMH Predoctoral Trainee, Institute of Animal Behavior, Rutgers University, NJ. Thesis advisors: Daniel S. Lehrman (deceased) and Jay S. Rosenblatt.
- Summer, 1969 Research Assistant, Department of Experimental Psychology, Walter Reed Army Institute of Research, Washington, D.C. Sponsor: William Hodos.
- 1968-1969 Research Assistant, Bureau of Social Science Research, Washington, D.C.

*AWARDS AND HONORARY SOCIETIES* (Reverse chronological order)

**2016 D. O. Hebb Distinguished Scientific Contribution Award**, Division 6 (the Society for Behavioral Neuroscience and Comparative Psychology), American Psychological Association; 2015 George C. Wheeler Distinguished Lecture, University of North Dakota; 2015 Elsevier Keynote Speaker, Society for Behavioral Neuroendocrinology; Center for the Integrative Study of Animal Behavior Exemplar Award (2015); Charles H. Sawyer Distinguished Lecture, UCLA (2014); **Daniel S. Lehrman Lifetime Achievement Award, Society for Behavioral Neuroendocrinology (2012)**; William's Lecture, University of Akron (2011); Rushton Lecture, Florida State University (2009); University Cooperative Society's 2008 Research Excellence Award for Best Research Paper, University of Texas at Austin; (2008); "100 Top Science Stories of 2007." *Discover: Science, Technology, and The Future* January 2008: 40; Allen Edwards Lecture, University of Washington, Seattle (2002); Bruce Stewart Lecture, American Society of Reproductive Medicine (2002); John Wiley Distinguished Speaker, International Society of Developmental Psychobiology (2001); **Fellow, American Psychological Association, Division 6 (2001)**; Ashbel Smith Professor of Zoology and Psychology (1998); Grass Foundation Traveling Scientist Lecturer (1997); **Fellow, The American Academy of Arts and Sciences (1996)**; Fellow, American Association of Applied and Preventive Psychology (1995); Rolex Awards for Enterprise, Honorable Mention (1993); Walker-Ames Professor, University of Washington, Seattle (1991); **Charter Fellow, American Psychological Society (1991)**; **NIMH MERIT Award (1989)**; Irving I. Geschwind Memorial Lecturer (1989); **NIMH Research Scientist Award (1987-1998)**; First Esquire Register of Outstanding Americans Under Age 40 (1984); Fellow, American Association for the Advancement of Science (1983); **American Psychological Association Distinguished Scientific Award for an Early Career Contribution to Psychology (1979)**; President's Award for Innovative Teaching, Harvard University (1978); Sloan Fellow in Neuroscience (1977-1979); **NIMH Research Scientist Development Award (1977-1987)**; Sigma Xi Scientific Research Honorary (1976); Psi Chi Psychology Honorary (1969); Key Scholar (1968-1969), University of Maryland.

*PROFESSIONAL SOCIETIES*

American Association for the Advancement of Science; American Psychological Society; American Psychological Association; Society for Integrative and Comparative Biology; Society of Neuroscience; Endocrine Society; Society of Experimental Biology and Medicine.

*PROFESSIONAL AND PUBLIC SERVICE*

Editor-in-Chief, *Journal of Experimental Zoology Part A*  
Review Editor and Editorial Board, *Frontiers in Behavioural Neuroscience*  
Review Editor, *Frontiers in Genetics*  
Co-Editor, Special Issue on Epigenetics, *Frontiers in Neuroendocrinology*  
Associate Editor, *Sexual Development*  
Associate Editor, *General and Comparative Endocrinology*  
Associate Editor, *Frontiers in Genetics*  
Associate Editor, *Endocrine Disruptors*  
Editorial Board, *Epigenetics*  
Editorial Advisory Board of *Ethology, Ecology and Evolution*  
Member of the Board, Society for Behavioral Neuroendocrinology  
Council Member, North American Society for Comparative Endocrinology (NASCE; La Société Nord-Américaine d'Endocrinologie Comparée; La Sociedad Norteamericana de Endocrinología Comparada)

Associate Editor, *Journal of Experimental Zoology A* (2000-2012)  
Editorial Advisory Board of *Hormones and Behavior* (1995-2005)  
Advisory Editorial Board of *Behavioral Ecology and Sociobiology* 1(1987-1997)  
*Ad hoc* reviewer for the following journals and granting agencies: Animal Behaviour; Biology of Reproduction; Canadian Journal of Zoology; Copeia; Developmental Psychobiology; Endocrinology; Genetics; Growth; Journal of Morphology; National Institutes of Health; National Science Foundation; Nature; Pharmacology, Biochemistry and Behavior; Physiological Zoology; Physiology and Behavior; Science.  
Organized symposium "Molecular, Organismal, and Evolutionary Approaches to the Study of Behavior". March 16, 1979. Harvard University.  
Public Lecture entitled "Animal Sexuality", Texas Memorial Museum, September 23, 1987, Austin, Texas.  
Member, Organizing Committee, VII World Congress of Sexology, November 4-9, 1985, New Delhi, India.  
Member, Board of Trustees, Austin Metropolitan Zoological Society, 1985-1989.  
Annual Science Lecture for the Layman, Buena Vista College, May 3, 1988, Storm Lake, Iowa.  
Chairman, N.I.H. Special Study Section, 1989, 1994, and 1996.  
Member, Biological Models and Materials Resources Study Section, 1994, N.I.H.  
Member, MBRS Review Subcommittee, 1989, National Institute of General Medical Sciences.  
Member, International Union for Conservation of Nature and Natural Resources (IUCN), Species Survival Commission (SSC) Crocodile Specialist Group, 1990-2012.  
President, Reproductive Sciences Incorporated, a chapter S corporation (1988-1998).  
Chairman of Board, Reptile Conservation International, Incorporated, a 501(c)(3) corporation (1992-present).  
Host, 1992 Southwestern Regional Conference on Comparative Endocrinology.  
Co-Organizer, Winter Animal Behavior Conference-XXI (1999), Jackson Hole, Wyoming.  
Member, Behavioral Science Track Award for Rapid Transition (B/START) Review Committee, 1992 and 1993, N.I.M.H.  
Program Committee, Fourth International Congress, 1995; Society for Neuroethology, Cambridge, England.  
Member, Psychobiology, Behavior, and Neuroscience Review Committee, N.I.M.H. Initial Review Group, 1994-1998.  
Member, Integrative Functional and Cognitive Neuroscience Committee (IFCN-2), N.I.H. Initial Review Group, 1998-2000.  
Member, Organizing Committee, VI International Conference on Hormones, Brain and Behavior and the IV Meeting of the Society for Behavioral Neuroendocrinology, August 18-25, 2000, Madrid, Spain.  
Member and Acting Chair, Panel on Membership for Class II, Section 3 of the American Academy of Arts and Sciences.  
Member, Integrative Functional and Cognitive Neuroscience Committee (IFCN-4), N.I.H. Initial Review Group, February, 2000.  
Annual Science Lecture for the Layman, Buena Vista College, March 27, 2000, Storm Lake, Iowa.  
Reviewer, National Academy of Science Committee on Understanding the Biology of Sex and Gender Differences. *Exploring the Biological Contributions to Human Health, Does Sex Matter*. 2000. <[www.nap.edu](http://www.nap.edu)>  
Epidemiology Panel Member, National Longitudinal Cohort (NLC) Study, 2000-2001.  
Mount Sinai Superfund Basic Research Program Advisory Council, 2001-present.  
Member, International and Cooperative Projects Study Section 1, National Institutes of Health.  
Organizer, Environmental Epigenetics Symposium: New frontiers in autism research. University of California at Davis, Mind Institute. March 22-23, 2013.

*STUDENTS AND POSTDOCS THAT HAVE COMPLETED TRAINING (including those grants obtained while under my supervision)*

Ph.D. Students

- William R. Garstka, 1983 Ph.D., Harvard University. Present position: Professor, University of Alabama at Huntsville.
- Joan M. Whittier, 1986 Ph.D., University of Texas at Austin. Present Position: Senior Lecturer, University of Queensland, Australia. (Individual NIH NRSA Predoctoral Fellow)
- Robert T. Mason, 1987 Ph.D., University of Texas at Austin. Present Position: Professor, Oregon State University. (Individual NIH NRSA Predoctoral Fellow)
- Jonathan Lindzey, 1990 Ph.D., University of Texas at Austin. Present Position: Assistant Professor, University of South Florida.
- Juli Wade, 1992 Ph.D., University of Texas at Austin. Present Position: Professor, Michigan State University. (Individual NIH NRSA Predoctoral Fellow)
- Alan J. Tousignant, 1993 Ph.D., University of Texas at Austin. Present Position: Curator of Research, Trevor Zoo, New York. (Individual NIH NRSA Predoctoral Fellow)
- Larry J. Young, 1994 Ph.D., University of Texas at Austin. Present Position: William P. Timmie Professor, Emory University. (NSF Predoctoral Fellow)
- Patricia Coomber, 1995 Ph.D., University of Texas at Austin. Present Position: Colonel, USAF, Senior Research Fellow, Center for Technology and National Security Policy.
- Judith M. Bergeron, 1997 Ph.D., University of Texas at Austin. Present Position: Research Associate, UT-MD Anderson Cancer Center. (NSF Predoctoral Fellow)
- Kira Wennstrom, 1997 Ph.D., University of Texas at Austin. Present Position: Professor, Shoreline Community College. (NSF Predoctoral Fellow)
- Elaine B. Day, 1999 Ph.D., University of Texas at Austin. Present Position: Assistant Professor, University of Mississippi (Individual NIH NRSA Predoctoral Fellow)
- Steven M. Phelps, 1999 Ph.D., University of Texas at Austin. Co-sponsored with W. Wilczynski Final thesis project supervisor: M. J. Ryan. Present Position: Assistant Professor, University of Florida. (Individual NIH NRSA Predoctoral Fellow)
- Alice Fleming, 2000 Ph.D., University of Texas at Austin. Present Position: Postdoctoral Fellow, University of California, Los Angeles.
- Turk Rhen, 2000 Ph.D., University of Texas at Austin. Present Position: Assistant Professor, University of North Dakota. (Individual NIH NRSA Predoctoral Fellow)
- Jon T. Sakata, 2001 Ph.D., University of Texas at Austin. Present Position: Assistant Professor, McGill University. (NSF Predoctoral Fellow)
- Sarah Woolley, 2002 Ph.D., University of Texas at Austin. Present Position: Assistant Professor, McGill University. (Individual NIH NRSA Predoctoral Fellow)
- Mary Ramsey, 2007 Ph.D., University of Texas at Austin. Present Position: Postdoctoral Associate, University of Texas at Austin.
- Nicholas S. R. Sanderson, 2007 Ph.D., University of Texas at Austin. Present Position: Postdoctoral Associate, University of California at Los Angeles.
- Brian Dias, 2008 Ph.D., University of Texas at Austin. Present Position: Postdoctoral Associate, Emory University, Georgia.
- Christina May Shoemaker, 2009 Ph.D., University of Texas at Austin. Present Position: Postdoctoral Associate, Harvard University.
- Victoria Huang, 2013 Ph.D., University of Texas at Austin.
- Yuiko Matsumoto, 2014 Ph.D., University of Texas at Austin.

M.A. Students

- Gregory Lopreato, 1993 M.A., University of Texas at Austin. Ph.D., 2000, University of Texas at Austin.
- Deborah L. Flores, 1994 M.A., University of Texas at Austin. Present Position: Assistant Professor, Department of Psychiatry, Harbor-UCLA Medical School.
- Amador R. Cantú, 1995 M.A. not completed, El Paso medical school, graduated in 1999.
- C. Todd Osborn, 1999 M.A., University of Texas at Austin. Present Position: Director of Sales, Advanced Digital Solutions.

Emily Willingham, 2000 M.A., University of Texas at Austin. Present Position: Postdoctoral Fellow, University of California, San Francisco.  
Kimberly Hillsman, 2005 M.A., University of Texas at Austin. Present Position: Postdoctoral Fellow, Harvard University.

Postdoctoral Trainees

Richard R. Tokarz. Present Position: Professor, University of Miami.  
Michael C. Moore. Present Position: Professor, University of Delaware. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Janet E. Joy. Present Position: Research Associate, N.I.H. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Mark Grassman. Present Position: Advanced MicroDevices, Austin. (N.I.H. Individual NRSA Postdoctoral Fellow)  
William Gutzke. (Deceased) Last Position: Professor, Memphis State University.  
Randolph W. Krohmer. Present Position: Professor, St. Xavier University, Illinois.  
Ethan Allen. Present Position: Director of Science, Technology, Engineering, and Mathematics with Pacific Resources for Education and Learning (prel.org), Hawaii. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Mary T. Mendonça. Present Position: Alumni Professor, Auburn University. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Manfred Gahr. Present Position: Professor and Director, Max Planck Institute of Ornithology, Seewiesen, Germany.  
Thane Wibbels. Present Position: Professor, Univ. of Alabama, Birmingham. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Ellen Prediger. Present Position: Research Scientist, Ambion. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Matthew Rand. Present Position: Associate Professor, Carleton College.  
John Godwin. Present Position: Associate Professor, North Carolina State Univ. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Cynthia Gill. Present Position: Assistant Professor, Hampshire College. (N.I.H. Individual NRSA Postdoctoral Fellow)  
Oliver Putz. Present Position: Graduate Theological Union at Berkeley.

Sabbatical Visitors

Professor William E. Cooper, University of Nebraska  
Professor Deborah Olster, University of California, Riverside  
Professor Magda Morales, University of Puerto Rico

*RESEARCH SUPPORT* (Reverse chronological order)

**University of Texas at Austin:** \*\*\*Not listed are a total of **17** N.I.H. Individual National Research Service Awards at the predoctoral and postdoctoral levels and **5** National Science Foundation Predoctoral Fellowships (Counting present graduate students).  
NIEHS 1R01ES023254-01 Ancestral Exposures/Modern Responses to EDCs. (Total costs \$1,877,765)  
NIEHS R01 ES020662 (Co-PI) Sexually dimorphic effects of endocrine disruptors on brain & behavior (Total costs \$1,877,765)  
NSF IOS-1051623 Environmental sex determination and endocrine disruption (Total costs \$625,000).  
NIEHS R21-ES017538 Interaction of epigenetic and stress effects on brain and behavior. (Total costs \$314,600).  
NSF IOS 0750938 Interaction of embryonic and adult experience. (Total costs \$360,000).  
NIMH 1 ROI MH41770 Years 19-23 Evolution of brain-behavior relationships (Total direct costs: \$1,598,850).

NIMH R21 MH068273 Epigenetic influences on brain and behavior (Total direct costs \$257,000).

NSF IBN 0095753 Temperature-dependent male sex determination in the red-eared slider turtle (Total direct costs \$225,000).

NIMH 1 T32 MH18837 Years 11-15 Training Program in Neurobiology and Behavior (Total direct costs: \$600,00).

NIMH 1 ROI MH41770 Years 14-18 Evolution of brain-behavior relationships (Total direct costs: \$922,516).

NIMH 1 R01 MH57874. Environmental influences on brain plasticity (Total direct costs \$579,046).

NSF IBN-9723617. Temperature--not chromosomes--determines the gender of certain lower vertebrates (Direct plus indirect costs: \$150,000).

NIMH 2 K05 MH00135 Years 16-20 Research Scientist Award (Total direct costs: \$350,424).

NIMH 1 T32 MH18837 Years 6-10 Training Program in Neurobiology and Behavior (Total direct costs: \$513,500).

NIMH 2 R37 MH41770 Under-represented Minorities in Biomedical and Behavioral Research (Total direct costs: \$52,562).

NSF BSR-9205207. Temperature--not chromosomes--determines the sex of certain lower vertebrates (Direct plus indirect costs: \$300,000).

NICHD 2 T32 HD07264 Years 11-15 Regulatory factors in vertebrate reproduction (Co-Investigator on Training Grant with Frank Bronson and James J. Bull) (Total direct costs: \$265,250).

NIMH 2 R37 MH41770 (MERIT AWARD) Years 4-13 Evolution of hormone-behavior controlling mechanisms (Total direct costs: \$1,678,506).

NIMH 2 R37 MH41770 Under-represented Minorities in Biomedical and Behavioral Research (Total direct costs: \$13,799).

NICHD 1 R01 HD24976 Environmental sex determination and differentiation (Total direct costs: \$307,773).

NIMH 2 K05 MH00135 Years 11-15 Research Scientist Award (Total direct costs: \$279,000).

Texas Advanced Research Program: Natural Products Chemistry: Semiochemicals (Total direct costs: \$143,866).

Texas Advanced Technology Program: Hormones and Sex Reversal (Co-Principal Investigator with J. J. Bull; Total direct costs: \$115,000).

NIMH 1 T32 MH18837 Years 1-5 Training Program in Neurobiology and Behavior (Total direct costs: \$413,500).

University of Texas URI Grant (Total direct costs: \$24,500).

NIMH 1 ROI MH41770 Years 1-3 Evolution of brain-behavior relationships (Total direct costs: \$218,751).

NICHHD 2 R01 HD16687 Hormone-behavior interactions regulating reproduction (Total direct costs: \$140,088).

NSF BNS 85-12362 Psychobiology of parthenogenesis (Total direct costs: \$38,028).

NICHHD 1 T32 HD07264 Years 6-10 Regulatory factors in vertebrate reproduction (Co-Investigator on Training Grant with Frank Bronson and Claude Desjardins) (Total direct costs: \$194,612).

Whitehall Foundation (Total direct costs: \$113,202).

Kinsey Institute of Research on Sex, Gender, and Reproduction (Total direct costs: \$4,500).

National Geographic Society (Total direct costs: \$3,490).

NSF BNS 82-02531 Parthenogenesis: A model for sexual differentiation (Total direct costs: \$88,890).

NIMH 1 KO2 MH00135 Years 6-10 Research Scientist Development Award (Total direct costs: \$279,000).

University of Texas URI Grant (Total direct costs: \$9,139).

NICHHD 1R01 HD-12709/16687 Hormone-behavior interactions regulating reproduction (Total direct costs: \$116,378).

**Harvard University:**

Sigma Xi (Total direct costs: \$150).

Clark Fund, Harvard University (Total direct costs: \$1000).

NICHHD 1R01 HD12709 Hormone-behavior interactions regulating reproduction (Total direct costs: \$94,220).

Sloan Fellowship in Basic Research in Neuroscience (Total direct costs: \$20,000).

NINCDS 1R01 NS15305 Neuroendocrine control of reproductive behavior (Total direct costs: \$168,794).

President's Fund for Innovative Teaching, Harvard University (Total direct costs: \$3,000).

William F. Milton Fund for Research in the Natural Sciences, Harvard University (Total direct costs: \$3,500).

NIMH 1 KO2 MH00135 Years 1-5 Research Scientist Development Award (Total direct costs: \$131,000).

NSF BNS 75-13796 Psychobiology of reptilian reproduction (Total direct costs: \$117,701).

NIMH 1 F22 MH58572 Social stimuli in reproduction (Total direct costs: \$28,000).

*INVITED SYMPOSIUM PARTICIPANT*

Keynote. *LAMP* (Learning Activities for Mature Persons). University of Texas at Austin. November 5, 2015

Keynote Speaker, 9<sup>th</sup> Biennial Meeting, Society for the Study of Human Development, Austin, Texas. October 16-18, 2015.

George C. Wheeler Distinguished Lecture, Biology Department, University of North Dakota. October 5-10, 2015.

Elsevier Keynote Speaker, 2015 Society for Behavioral Neuroendocrinology, Asilomar Conference Grounds, Pacific Grove CA. June 10-14, 2015.

Keynote Speaker, 2015 Animal Behavior Conference, Indiana University, Bloomington, IN. March 26-28, 2015.

Plenary Speaker, New perspectives in behavioural development: Adaptive shaping of behaviour over a lifetime? Zentrum für Interdisziplinäre Forschung (Center for Interdisciplinary Studies Workshop). September 29-October 1, 2014, Bielefeld, Germany.

Plenary Speaker, American Institute for Cancer Research (AICR) Annual Research Conference on Food, Nutrition, Physical Activity and Cancer, November 7, 2013. Hyatt Regency, Bethesda, MD.

Plenary Speaker, XXX I Annual Meeting of Ethology. Sao Paulo, Brazil, November 10-13, 2011. Symposium: Hormonal Control of Circuits for Complex Behaviors. October 27-30, 2013. Janelia Conference, Janelia Farm Campus, Virginia.

Transgenerational Epigenetic Modifications Grantee meeting. October 1-4, 2013. Raleigh, North Carolina

Plenary Speaker, Rapid Responses to Steroid Hormones. September 19-21, 2013. Erie, Pennsylvania.

Plenary Speaker. 17th International Symposium on Pollutant Responses in Marine Organisms (PRIMO 17). May 4-9, 2013. Faro, Portugal.

Symposium: New Frontiers in Autism Research: Epigenetics, Prenatal and Germline Exposures, and Transgenerational Inheritance. Autism Speaks, March 21-23, 2013.

Plenary Speaker. Norwegian Research Council, "Environmental Exposures and Health Outcomes". Oslo, Norway. March 18-19, 2013.

Symposium: Hormone-mediated sex ratio adjustment in vertebrates. SICB Annual Meeting 2013, January 3-7, 2013, San Francisco, CA.

American Institute for Cancer Research (AICR) Annual Research Conference on Food, Nutrition, Physical Activity and Cancer, November 1-2, 2012. Capital Hilton Hotel, Washington, DC.

Building the Path Forward for the Next Generation of Sustainable Chemicals. October 15-17, 2012. The Pocantico Center of the Rockefeller Brothers Fund, Tarrytown, NY.

Gordon Research Conference on Environmental Endocrine Disruptors. Mount Snow Resort, West Dover, VT, June 3-8, 2012.

Mentor. Environmental Endocrine Disruptors through the Lenses of Evolution, Development, and Phenotypic Variability. Gordon Research Seminar. Mount Snow Resort, West Dover, VT, June 2-3, 2012.

Keynote Speaker, Model Systems for Genes & Behavior. Gordon Research Seminar. Galveston, Texas, March 17-18, 2012.

NIEHS Meeting: Women's Reproductive Environmental Health Consortium, January 2012.

Student Satellite Symposium, Neuroethology: Behavior, Evolution, and Neurobiology Gordon Research Conference, Stonehill College, Easton, Massachusetts, August 14-19, 2011.

Endocrine Disruptors Workshop 2011, Messina, Italy, September 7-9, 2011.

Keynote Speaker, Neuroethology: Behavior, Evolution, and Neurobiology Gordon Research Conference, Stonehill College, Easton, Massachusetts, August 14-19, 2011.

Keynote Speaker, Student Satellite Symposium, Canadian Society of Zoologists. Ottawa, Canada, May 16-20, 2011.

Keynote Speaker, Behavioural and Cognitive Neurosciences Symposium, University of Groningen, the Netherlands, May 11, 2011.

Green Chemistry and Environmental Health: Principles and Tools for Next-Generation Materials, Cavallo Point Lodge, Sausalito, CA, March 21-23, 2011.

Summer School of Behavioral Neuroendocrinology, Emory University, July 12, 2010.

Gordon Research Conference on Environmental Endocrine Disruptors. Les Diablerets Conference Center, Switzerland. May 30-June 4, 2010.

27<sup>th</sup> Midwest Symposium on Family Systems Theory and Therapy. Family Service Center. May 7-8, 2010.

Gordon Research Conference on Genes & Behavior. Ventura Beach Marriott, Ventura, CA. March 14-19, 2010.

e.Hormone Symposium, Tulane University. New Orleans, LA. October 20-24, 2009

Impacts of environmental change on reproduction and development in wildlife. Zoological Society, London, London October 15-16, 2009.

Neural Circuits Controlling Sexual Behavior. Janelia Conference, Janelia Farm Campus. October 11-14, 2009.

Environmental Factors and Nosology of the Endocrine System, Mykonos, Greece, October 2-4, 2009.

Gordon Research Conference on Hormone Action in Development and Cancer– 2009, Holderness School, New Hampshire, July 26-31, 2009.

Rushton Lecture. 'Epigenetics and Behavior' Florida State University. April 4-5, 2009.

NESCent National Evolutionary Synthesis Center Catalysis meeting. What role, if any, does heritable epigenetic variation play in phenotypic evolution, Durham, North Carolina. April 1-3, 2009.

Endocrine Perspectives on Environmental Endocrine Disruption. Endocrine Society 90<sup>th</sup> Annual Meeting, San Francisco, June 15-18, 2008.

Gordon Research Conference on Environmental Endocrine Disruptors – 2008. Waterville Valley Resort, New Hampshire. June 8-13, 2008.

Emergence and Convergence “Epigenetics and Behavior,” IPSEN and Nature Publishing Group, Houston, Texas. March 22, 2008.

The 2<sup>nd</sup> Annual Integrating Genotype and Phenotype (IGP) Workshop. Tallahassee, Florida. January 25, 2008.

International Symposium on “Molecular Mechanisms of Sex Determination and Differentiation”. 77<sup>th</sup> Conference of the Zoological Society of Japan. Shimane, Japan. September 21-24, 2006.

Biology of Social Cognition. Banbury Center, Cold Spring Harbor Laboratory. July 13-20, 2006.

2006 Workshop on Steroid Hormones and Brain Function and the Conference on Sex and Gene Expression. Breckenridge, Colorado. March 28-April 1, 2006.



- International Symposium of Reproductive and Social Behaviors: An integrative approach. The Centre Saint-Paul. October 5-8, 2005.
- Workshop "Affect and Social Behavior Program," NIMH, Bethesda, Md. July 14-15, 2005.
- Comparative Models: Lessons from lizards, songbirds, rodents, and Ted Bullock. Society for Behavioral Neuroendocrinology, Austin Texas, June 22-25, 2005
- Ninth Annual Neuroscience Symposium, University of Texas at Austin, Austin, Texas. November 20, 2004.
- Persistent Contaminants: New Priorities, New Concerns. Mount Sinai Superfund Basis Research Program, Bear Mountain, NY, September 29-30, 2004.
- Evolution of Reproductive Signals. Endocrine Society, New Orleans, June 18, 2004.
- Environmental and Endocrine Signaling. Center for Bioenvironmental Research, Tulane and Xavier Universities. June 15, 2004.
- The Impact of Relationships on Sex and Reproduction. Center for the Study of Natural Systems and the Family. The Houston Arboretum and Nature Center. February 26 and 27, 2004.
- Evolution, Function, Development and Causation. Tinbergen's Four Questions and Contemporary Animal Biology. Royal Dutch Zoological Society and the Dutch Society for Behavioural Biology. September 5, 2003. Leiden, Netherlands.
- Evolutionary Aspects of Gender and Sexuality, American Association for the Advancement of Science Symposium. February 13-18, 2003. Denver, Colorado.
- Physiology underlying phenotypic plasticity and polyphenism. Society of Integrative and Comparative Biology. January 4-8, 2003. Toronto, Canada.
- Environmental Implications of Endocrine Active Substances: Present state of the art and future research needs. The Scientific Committee on Problems of the Environment (SCOPE) and the International Union of Pure and Applied Chemistry (IUPAC) International Symposium, November 17-21, 2002. Yokohama, Japan.
- Bruce Stewart Lecture. American Society of Reproductive Medicine, October 12-17, 2002. Seattle, Washington.
- Comparative Biology of Sex Determination and Sex Differentiation in Vertebrates. February 9, 2002. Waseda University, Tokyo, Japan.
- Symposium on Ecological Developmental Biology: Developmental Biology Meets the Real World. Society for Integrative Biology. January 6-10, 2002. Anaheim, California.
- John Wiley Distinguished Speaker, International Society for Developmental Psychobiology, November 7-9, 2001. San Diego, California.
- e.Hormone 2001. Tulane University. October 15-19, 2001. New Orleans, Louisiana.
- US/Japan Symposium on Neuroplasticity, Development and Steroid Hormone Action. Hawaii-Imin International Conference Center. September 26-29, 2000. Honolulu, Hawaii.
- Endocrine Disruptors, VI International Hormones, Brain, and Behavior and Society of Behavioral Neuroendocrinology. August 5-10, 2000. Madrid, Spain.
- Environmental Endocrine Disruptors, Gordon Conference. June 18-23, 2000. Plymouth, New Hampshire.
- 2<sup>nd</sup> International Symposium on Sex Determination and Differentiation. April 10-14, 2000. Honolulu, Hawaii.
- Endocrine Disruptors and Children's Health. March 16-17, 2000. The New York Academy of Medicine, New York.
- Second International Symposium on Environmental Endocrine Disruptors. December 9-11, 1999. Kobe, Japan.
- Environmental Hormones: Past, Present, Future. October 17-20, 1999. Center for Bioenvironmental Research, Tulane and Xavier Universities, New Orleans.
- Binational Workshop on Reproductive and Behavioral Neuroendocrinology. August 5-8, 1999. Queretaro, Mexico.
- Society of Behavioral Neuroendocrinology. June 25-30, 1999. Charlottesville, Virginia.
- 1999 Keystone Symposium on Endocrine Disruptors. January 31-February 5, 1999. Granlibakken, Tahoe City, California.

- Comparative Vertebrate Reproduction: Neuroendocrinology, Behavior and Life Aspects. Society for Integrative and Comparative Biology. January 6-10, 1999. Denver, Colorado.
- Endocrine Disrupting Contaminants: From Gene to Ecosystems. Society for Integrative and Comparative Biology. January 6-10, 1999. Denver, Colorado.
- Physiological Ecology Symposium, International Conference on Turtles and Tortoises. July 30-August 2, 1998. Carson, California.
- 14th Working Meeting of the Crocodile Specialist Group. Singapore 14-17, 1998. Singapore.
- Winter Animal Behavior Conference-XX. January 24-31, 1998. Jackson Hole, Wyoming.
- Facts of Life. The Study of Natural Systems and Human Behavior in Illness and Health. Family Health Services. January 7-8, 1998. Houston Texas.
- Biological Models Workshop. National Research Council. December 11-12, 1997. Washington D.C.
- Sexual Differentiation of Brain and Behavior: A Special Tribute to Robert Goy. Society for Behavioral Neuroendocrinology. April 28-May 1, 1997. Baltimore, Maryland.
- Comparative Neuroendocrinology of Vertebrate Reproduction and Growth. Society for Experimental Biology. April 7-11, 1997. University of Kent at Canterbury, England.
- 64th Stated Meeting of Associates of the Neurosciences Research Program. March 16-19, 1997. The Neurosciences Institute, San Diego, California.
- Animal Behavior: Integration of Proximate and Ultimate Mechanisms. American Society of Zoologists. December 26-30, 1996. Albuquerque, New Mexico.
- First Annual NOLA conference. December 12-13, 1996. New Orleans, Louisiana.
- Sexuality, Smithsonian Symposium. October 15, 1996. Washington DC.
- "Is There a Neurobiology of Love?" Wenner-Gren Center International Symposium. August 28-31, 1996. Stockholm, Sweden.
- International Herpetology Symposium. June 27-29, 1996. San Antonio, Texas.
- Principles and Processes for Evaluating Endocrine Disruption in Wildlife. March 16-19, 1996. Kiawah Island, South Carolina.
- The Integrative Neurobiology of Affiliation. New York Academy of Sciences. March 14-17, 1996. Washington, D.C.
- Plenary Presentation. XXIVth International Ethological Conference. August 10-17, 1995. Honolulu, Hawaii.
- Plenary Presentation. Ecological Risk of Endocrine Disrupters, Environmental Protection Agency Workshop. June 12-14, 1995. Duluth, Minnesota.
- Endocrine Disruptor Workshop. U.S. Environmental Protection Agency. April 10-13, 1995. Raleigh, North Carolina.
- Workshop on Steroid Hormones and Brain Function. March 31-April 4, 1995. Breckenridge, Colorado.
- Endocrine Disrupters in the Environment. Society of Toxicology. November 18-19, 1994. M.D. Anderson Cancer Center, Houston, Texas.
- Keynote Speaker. Conference on Reproductive Behavior. June 18-21, 1994. Lehigh University, Bethlehem, Pennsylvania.
- Workshop on Steroid Hormones and Brain Function. April 1-5, 1994. Breckenridge, Colorado.
- Estrogens in the Environment III: Global Health Implications. January 9-11, 1994. Washington D.C.
- International Conference on Hormones, Brain and Behaviour. August 24-27, 1993. Tours, France.
- Sexual Selection in Lower Vertebrates. Herpetologists' League and the American Society of Ichthyology and Herpetology. May 30-June 4, 1993. Austin, Texas.
- Hormonal Control of Behaviour. Twelfth International Symposium/First International Congress on Comparative Endocrinology. May 17-22, 1993. Toronto, Canada.
- New Approaches to Developmental Endocrinology. Joint Japan-U.S. Conference. January 11-15, 1993. Maui, Hawaii.
- Environmental Sex Determination in Reptiles: Patterns and Processes. American Society of Zoologists. December 30, 1992.

- Keynote Speaker, Sex Differences in Brain and Behavior. The J. B. Johnston Club. November 23-25, 1992. Anaheim, California.
- The Differences Between the Sexes. Interunion Commission for Comparative Physiology. September 11-14, 1992. Crans-sur-Sierre, Switzerland.
- Keynote Speaker. Triangle Conference on Reproductive Biology. Triangle Consortium for Reproductive Biology. January 11, 1992. Raleigh, North Carolina.
- International 2-DG Workshop. Satellite Workshops to the Annual Meeting of Society for Neuroscience. November 7-9, 1991. Austin, Texas.
- Determinants of Sexual and Reproductive Behavior. National Institute of Mental Health Workshop. September 19-20, 1991. Rockville, Maryland.
- Captive Management and Conservation of Amphibians and Reptiles. Annual meeting of the Society for the Study of Amphibians and Reptiles and the Herpetologist's League. August 9-10, 1991. University Park, Pennsylvania.
- Conference on Reptilian Chemical Senses. June 15-16, 1991. Philadelphia, Pennsylvania.
- Plenary Address. Annual Meeting of Association for the Study of Animal Behaviour. December 5-7, 1990. London, England.
- Keynote Speaker. Canadian Spring Conference on Behaviour and Brain. April 19-22, 1990. Banff, Alberta, Canada.
- Developmental Neuroscience Workshop. National Institutes of Mental Health. April 3-4, 1990. Poolesville, Maryland.
- Sexual Selection and Communication in Amphibians and Reptiles. First World Congress of Herpetology. September 11-19, 1989. Kent, England.
- Hormones, Brain, and Reproductive Behaviour. August 17-22, 1989. European Society for Comparative Physiology and Biochemistry. Liege, Belgium.
- NIH Symposium Unconventional Vertebrates as Animal Models in Endocrine Research. December 5-6, 1988. National Institutes of Health, Bethesda, Maryland.
- NATO Workshop on Animal Models in Neuroscience. August 26-30, 1987. Bergen, Norway.
- Plenary Presentation. XXth International Ethological Conference. August 8-16, 1987. Madison, Wisconsin.
- Biology of Unisexual Vertebrates. American Society of Zoologists. June 21-26, 1987. Albany, New York.
- Winter Animal Behavior Conference - IX. January 24-31, 1987. Park City, Utah.
- Workshop on Genetic Markers in Sexual Differentiation. Center for Population Research, National Institutes of Child Health and Human Development. October 9-10, 1986. Bethesda, Maryland.
- Snake Behavior and Ecology. Symposium of 66th Annual meeting of the American Society of Ichthyologists and Herpetologists. June 15-21, 1986. Victoria, British Columbia, Canada.
- Chemical Signals in Vertebrates IV. July 27-29, 1985. Laramie, Wyoming.
- Winter Animal Behavior Conference-VII. January 26-February 2, 1985. Park City, Utah.
- Symposium on the Biology of *Cnemidophorus*. Annual meeting of the Society of Ichthyology and Herpetology. August 1-2, 1984. Norman, Oklahoma.
- Institute of Animal Behavior Symposium in Honor of Jay S. Rosenblatt. June 6-8, 1984. Newark, New Jersey.
- "Masculinity/Femininity: Concepts and Definitions." First Kinsey Institute Symposium. January 26-29, 1984. Bloomington, Indiana.
- Plenary speaker at Texas Herpetological Society Annual Meeting, November 5, 1983 at University of Texas at Tyler, Tyler, Texas.
- Plenary Presentation. Western Regional Conference in Comparative Endocrinology. March 24-25, 1983. Berkeley, California.
- Plenary speaker at San Antonio Herpetological Society, March 5, 1983 at Trinity University, San Antonio, Texas.
- Winter Animal Behavior Conference-V. January 22-29, 1983. Park City, Utah.
- Alternative Reproductive Tactics. American Society of Zoologists Symposium. December 27-30, 1982. Louisville, Kentucky.

Hormones and Behaviour in Higher Vertebrates, IV European Society for Comparative Physiology and Biochemistry. September 9-11, 1982. Bielefeld, West Germany.

Plenary speaker to Texas Herpetological Conference, March 6, 1982 at Trinity University, San Antonio, Texas.

Reproductive Biology of Reptiles. Society for the Study of Amphibians and Reptiles. August 9-14, 1981. Memphis, Tennessee.

Plenary Presentation, Advances in Vertebrate Neuroethology. NATO Advanced Study Institute. August 13-24, 1981. Kassel, West Germany.

Winter Animal Behavior Conference-III. January 24-31, 1981. Park City, Utah.

Lizard Ecology Symposium. American Society of Zoologists Annual Meetings. December 27-30, 1980. Seattle, Washington.

Plenary Presentation, Endocrine Regulation of Vertebrate Seasonal Reproductive Cycles. American Physiological Society Annual Meetings. October 17, 1980. Toronto, Canada.

Hormones and the Nervous System. Neurobiology Course Symposium. July 7, 1980. Woods Hole, Massachusetts.

Winter Animal Behavior Conference-II. January 19-27, 1980. Steamboat Springs, Colorado.

Plenary Presentation, Reproductive Cycles of Chordates. Canadian Society of Zoologists. May 7-11, 1980. Banff, Alberta, Canada.

Social Signals-Comparative and Endocrine Approaches. American Society of Zoologists Symposium. December 27-30, 1979. Tampa, Florida.

Sensory Systems and Adaptation. Society for Neuroscience Symposium. November 2-6, 1979. Atlanta, Georgia.

Winter Animal Behavior Conference-I. January 27-February 3, 1979. Jackson Hole, Wyoming.

Reproductive Biology of Captive Reptiles. Society for the Study of Amphibians and Reptiles. May 29-31, 1978. Tempe, Arizona.

The Neuroendocrinology of Reproduction. Society for the Study of Reproduction Symposium. August 14-17, 1978. Carbondale, Illinois.

Vertebrate Neuroethology Workshop. Society for Neuroscience. November 5-7, 1976. Toronto, Canada.

Communication and Display Behavior in Reptiles. American Society of Zoologists and Animal Behavior Society Symposium. June 2, 1976. New Orleans, Louisiana.

Conference on the Behavior and Neurology of Lizards. Laboratory of Brain, Evolution, and Behavior. May 5-7, 1975. NIMH, Front Royal, Virginia.

Anoline Reproductive Biology. Smithsonian Tropical Research Institute. December 16-20, 1972. Barro Colorado Island, Canal Zone.

Anolis Symposium. American Society of Zoologists, Harvard University. June 22-23, 1972. Cambridge, Massachusetts.

*INVITED LECTURES AND SERVICE TO OTHER UNIVERSITIES*

2015: University of Texas at Austin; Indiana University; University of North Dakota

2014: Brain Research Institute, University of California at Los Angeles

2013: Weismann Institute of Science, Israel

2012: Washington State University; University of Texas at Austin (Pharmacology); Tianjin Medical University, China; University of Tel Aviv, Israel

2011: University of Akron; Indiana University; Columbia University; Rockefeller University; Mount Sinai School of Medicine

2010: University of Texas at Austin; Emory University

2009: Hanna Boys Center

2008: Florida State University; University of Minnesota; University of Maryland; Southwestern University.

2007: University of Michigan; Rutgers University; Hope College.

2006: Waseda University, Japan; Rockefeller University.

2005: University of California, Davis; University of California, San Diego; Cornell University; Washington State University; University of Tsukuba, Japan.

- 2004: Purdue University; University of Oregon; Arizona State University.
- 2003: Stanford University Hopkins Marine Station; University of Groningen (Netherlands)
- 2002: Waseda University, Japan; Research Unit for Environmental Endocrine Disrupters adjunct to Faculty of Science, Yokohama City University, Japan; University of Washington, Seattle
- 2001: Columbia University (Biology); Columbia University (Psychology); Ohio State University.
- 2000: Rockefeller University; Buena Vista College, Emory University.
- 1999: North Carolina State University; Mt. Sinai School of Medicine; Columbia University; University of Brussels; Michigan State University; Indiana University; University of Brussels; Tokyo Metropolitan Institute for Neuroscience, Japan.
- 1998: Stanford University; Waseda University, Japan; Juntendo University, Japan; National Institute of Basic Biology, Japan; University of Chicago; Southwest Texas University; University of Texas Medical Branch at Galveston; Rockefeller University.
- 1997: Uppsala University, Sweden; University of Alaska; Indiana University.
- 1996: University of Virginia; Southwest Texas University; M.D. Anderson Science Park; University of Maryland; Smithsonian Institution; Harvard College; Harvard Medical School.
- 1995: University of Pittsburgh; National Institute of Basic Biology, Japan.
- 1994: University of Toronto; Oregon State University; University of Chicago; Johns Hopkins University; College of Physicians and Surgeons; Columbia University.
- 1993: Southwestern Medical School; University of Indiana; Rutgers University; Rockefeller University; Williams College.
- 1992: North Carolina State; University of Illinois; University of Kentucky; Southwestern Research Station; Max Planck Institute für Verhaltenphysiologie; Rockefeller University.
- 1991: Baylor College of Medicine; University of Washington, Seattle; Friday Harbor.
- 1990: University of Michigan; National Institutes of Mental Health; Southwestern Research Station; Texas A&M; University of Cambridge, England; University of Oxford, England.
- 1989: Portland State University; Rockefeller University; University of Cambridge, England; Indiana University; University of Massachusetts at Amherst.
- 1988: California Institute of Technology; Buena Vista College; Southwestern Research Station; Baylor College of Medicine.
- 1987: National Institute of Mental Health-Main Campus; University of California, Los Angeles; University of California, Irvine; University of California, Riverside; Southwestern Research Station; Boston College, Boston University; Harvard University.
- 1986: Baylor College of Medicine; National Institutes of Mental Health-Poolesville; University of Maryland; National Institute of Mental Health-Main Campus.
- 1985: Vanderbilt University; Washington University; Texas Christian University; Michigan State University; University of Kentucky; Harvard University.
- 1984: The University of Tennessee; University of Hawaii; Rockefeller University; Downstate Medical Center; University of Massachusetts; Boston College; Rockefeller University Field Research Station.
- 1983: The University of Texas Marine Sciences Institute; University of Utah; San Antonio Herpetological Society; Rice University; Arizona State University; National Science Foundation; University of Texas at Tyler.
- 1982: Texas A & M University.
- 1981: Harvard Medical School (MacLean Hospital); Institute of Animal Behavior, Rutgers University; Max Planck Institute für Verhaltenphysiologie, Germany; Skidmore College; Boston College.
- 1980: University of Michigan; Bowling Green University; Harvard Medical School Peabody Society; University of Connecticut; University of Alberta; Harvard Medical School (Laboratory of Human Reproduction and Reproductive Biology); Massachusetts Herpetological Society; University of California, Berkeley; University of California, Irvine; University of Texas at Austin.

- 1979: Smithsonian Tropical Research Institute, Panama; Villanova University; Rockefeller University; University of Illinois; Harvard Medical School (Neurobiology); Clemson University; University of Tennessee; Massachusetts Institute of Technology; University of Massachusetts.
- 1978: University of Pennsylvania; Rutgers University; North Carolina State University; University of Texas at Austin; University of Tennessee.
- 1977: Brandeis University; Harvard Medical School (Children's Hospital).
- 1976: University of Colorado; University of Iowa; Cornell University; Northeastern University.
- 1975: University of Missouri-St. Louis; Boston University; Rutgers University; Brooklyn College; University of Florida; Harvard University.
- 1974: University of Maryland; National Institutes of Mental Health; University of California, Los Angeles; University of Colorado; University of Pennsylvania.
- 1973: University of Minnesota; University of California, Berkeley; Institute of Animal Behavior, Rutgers University.

## PUBLICATIONS AND CONTRIBUTIONS

### Books

- The Psychobiology of Reproductive Behavior: An Evolutionary Perspective. 1987. Prentice-Hall, Inc., Englewood Cliffs, N.J. xii + 350pp. ISBN 0-13-732090-6.
- Behavioral Endocrinology. First Edition. (Co-editor with Jill Becker and S. Marc Breedlove) 1992. Bradford Books, M.I.T. Press, Cambridge, MA. xxvi + 573pp. ISBN-0-262-02342-3.
- Biology of the Reptilia. Volume 18, Physiology E: Hormones, Brain, and Behavior. (Co-editor with C. Gans) 1992. University of Chicago Press, Chicago, Illinois. xxiii + 564pp. ISBN 0-226-28122-1.
- Behavioral Endocrinology. Second Edition. (Co-editor with Jill Becker, S. Marc Breedlove, Margaret McCarthy). 2002. Bradford Books, M.I.T. Press, Cambridge, MA. xxvii + 776 pp. ISBN 0-262-02511-6.

### Special Editions

- Social Behavior in Reptiles. (Co-editor with Neil Greenberg) *American Zoologist* 17: 153-285 (1977).
- Special Issue: Behavioral Endocrinology. *BioScience* 33: 545-583 (1983).
- Special Issue: Epigenetics, Frontiers in Neuroendocrinology (Co-editor with Margaret McCarthy) 29: 341-444 (2008).

### Articles (published)

1. David Crews. 1973. Behavioral correlates to gonadal state in the lizard, *Anolis carolinensis*. *Hormones and Behavior* 4: 307-313. [Also reprinted in C. Finch (ed.), *Biology of Sex: Effects of Hormone Treatments on Adult Mating Behavior in Non-mammalian Vertebrates*. MSS Information Corporation, 1975].
2. David Crews. 1973. Coition-induced inhibition of sexual receptivity in female lizards (*Anolis carolinensis*). *Physiology and Behavior* 11: 463-468.
3. David Crews, Jay S. Rosenblatt, and Daniel S. Lehrman. 1974. Effects of unseasonal environmental regime, group presence, group composition and male's physiological state on ovarian recrudescence in the lizard, *Anolis carolinensis*. *Endocrinology* 94: 541-547.
4. David Crews. 1974. Effects of group stability, male-male aggression and male courtship behavior on environmentally-induced ovarian recrudescence in the lizard, *Anolis carolinensis*. *Journal of Zoology, London* 172: 419-441.
5. David Crews. 1974. Castration and androgen replacement on male facilitation of ovarian activity in the lizard, *Anolis carolinensis*. *Journal of Comparative and Physiological Psychology* 87: 963-969.
6. David Crews and Paul Licht. 1974. Inhibition by corpora atretica of ovarian sensitivity to environmental and hormonal stimulation in the lizard, *Anolis carolinensis*. *Endocrinology* 95: 102-106.

7. David Crews. 1975. Effects of different components of male courtship behaviour on environmentally induced ovarian recrudescence and mating preferences in the lizard, *Anolis carolinensis*. *Animal Behaviour* 23: 349-356.
8. David Crews. 1975. Inter- and intraindividual variation in display patterns in the lizard, *Anolis carolinensis*. *Herpetologica* 31: 37-47.
9. David Crews and Paul Licht. 1975. Stimulation of *in vitro* steroid production in turtle ovarian tissue by reptilian, amphibian, and mammalian gonadotropins. *General and Comparative Endocrinology* 27: 71-83.
10. Paul Licht and David Crews. 1975. Stimulation of ovarian and oviducal growth and ovulation in female lizards by reptilian (turtle) gonadotropins. *General and Comparative Endocrinology* 25: 467-471.
11. David Crews. 1975. Psychobiology of reptilian reproduction. *Science* 189: 1059-1065.
12. David Crews and Paul Licht. 1975. Site of progesterone production in the reptilian ovarian follicle. *General and Comparative Endocrinology* 27: 553-556.
13. Paul Licht and David Crews. 1976. Gonadotropin stimulation of *in vitro* progesterone production in reptilian and amphibian ovaries. *General and Comparative Endocrinology* 29: 141-151.
14. Judy Stamps and David Crews. 1976. Seasonal changes in reproduction and social behavior in the lizard, *Anolis aeneus*. *Copeia* 1976: 467-476.
15. David Crews. 1976. Hormonal control of male courtship behavior and female attractivity in the garter snake (*Thamnophis sirtalis sirtalis*). *Hormones and Behavior* 7: 451-460.
16. David Crews and Ernest E. Williams. 1977. Hormones, reproductive behavior, and speciation. *American Zoologist* 17: 271-286.
17. David Crews. 1977. The annotated anole: Studies on the control of lizard reproduction. *American Scientist* 65: 428-434.
18. Patrick Ross and David Crews. 1977. Influence of the seminal plug on mating behavior in the garter snake. *Nature* 267: 344-345.
19. Joel Sohn and David Crews. 1977. Size mediated onset of genetically determined maturation in the platyfish, *Xiphophorus maculatus*. *Proceedings of the National Academy of Sciences* 74: 4547-4548.
20. Paul Valenstein and David Crews. 1977. Mating-induced termination of behavioral estrus in the female lizard, *Anolis carolinensis*. *Hormones and Behavior* 9: 362-370.
21. David Crews. 1977. Integration of internal and external stimuli in the regulation of lizard reproduction. In *The Behavior and Neurology of Lizards*, Neil B. Greenberg and Paul D. MacLean (eds.). National Institutes of Mental Health, Rockville, Maryland. pp. 149-171.
22. Paul Licht, Harold Papkoff, Susan Farmer, Charles Muller, Hing Wo Tsui, and David Crews. 1977. Evolution of gonadotropin structure and function. *Recent Progress in Hormone Research* 33: 169-248.
23. David Crews, Valerie Traina, F. Todd Wetzel and Charles Muller. 1978. Hormonal control of male reproductive behavior in the lizard, *Anolis carolinensis*: Role of testosterone, dihydrotestosterone, and estradiol. *Endocrinology* 103: 1814-1821.
24. David Crews. 1978. Hemipenile preference: Stimulus control of male mounting behavior in the lizard, *Anolis carolinensis*. *Science* 199: 195-196.
25. Patrick Ross, Jr. and David Crews. 1978. Stimuli influencing mating behavior in the garter snake, *Thamnophis radix*. *Behavioral Ecology and Sociobiology* 4: 133-142.
26. James M. Wheeler and David Crews. 1978. The role of the anterior hypothalamus-preoptic area in the regulation of male reproductive behavior in the lizard, *Anolis carolinensis*: Lesion studies. *Hormones and Behavior* 11: 42-60.
27. Abraham Morgentaler and David Crews. 1978. Role of the anterior hypothalamus-preoptic area in the regulation of reproductive behavior in the lizard, *Anolis carolinensis*: Implantation studies. *Hormones and Behavior* 11: 61-73.
28. David Crews. 1979. Endocrine control of reptilian reproductive behavior. In *Endocrine Control of Sexual Behavior*, Carlos Beyer (ed.). Raven Press. New York. pp. 167-222.

29. David Crews. 1979. Neuroendocrinology of lizard reproduction. *Biology of Reproduction* 20: 51-73.
30. Donald McNicol, Jr. and David Crews. 1979. Estrogen/progesterone synergy in the control of female sexual receptivity in the lizard, *Anolis carolinensis*. *General and Comparative Endocrinology* 38: 68-74.
31. David Crews and Abraham Morgentaler. 1979. Effects of intracranial implantation of oestradiol and dihydrotestosterone on the sexual behavior of the lizard, *Anolis carolinensis*. *Journal of Endocrinology* 82: 373-381.
32. David Crews. 1979. The hormonal control of behavior in a lizard. *Scientific American* 241: 180-187.
33. Katherine Farragher and David Crews. 1979. The role of the basal hypothalamus in the regulation of reproductive behavior in the lizard, *Anolis carolinensis*: Lesion studies. *Hormones and Behavior* 13: 185-206.
34. Joan I. Morrell, David Crews, Arlene Ballin, Abraham Morgentaler, and Donald W. Pfaff. 1979. <sup>3</sup>H-estradiol, <sup>3</sup>H-testosterone, and <sup>3</sup>H-dihydrotestosterone localization in the brain of the lizard, *Anolis carolinensis*: An autoradiographic study. *Journal of Comparative Neurology* 188: 201-224.
35. Jeffrey K. Conner and David Crews. 1980. Sperm transfer and storage in the lizard, *Anolis carolinensis*. *Journal of Morphology* 163: 331-348.
36. Michael R. Alderete, Richard R. Tokarz, and David Crews. 1980. Luteinizing hormone-releasing hormone (LHRH) and thyrotropin releasing hormone (TRH) induction of female sexual receptivity in the lizard, *Anolis carolinensis*. *Neuroendocrinology* 30: 200-205.
37. David Crews and Kevin T. Fitzgerald. 1980. "Sexual" behavior in parthenogenetic lizards (*Cnemidophorus*). *Proceedings of the National Academy of Science* 77: 499-502.
38. David Crews and Leslie D. Garrick. 1980. Methods of inducing reproduction in captive reptiles. In *Reproductive Biology and Diseases of Captive Reptiles*, James B. Murphy and Joseph T. Collins (eds.). Society for the Study of Amphibians and Reptiles. pp. 49-70.
39. Richard R. Tokarz and David Crews. 1980. Induction of sexual receptivity in the female lizard, *Anolis carolinensis*: Effects of estrogen and the antiestrogen CI-628. *Hormones and Behavior* 14: 33-45.
40. David Crews. 1980. Interrelationships among ecological, behavioral and neuroendocrine processes in the reproductive cycle of *Anolis carolinensis* and other reptiles. In *Advances in the Study of Behavior. Volume 11*, Jay S. Rosenblatt, Robert A. Hinde, Colin G. Beer, and Marie C. Busnel (eds.). Academic Press, New York. pp. 1-74.
41. Brian Camazine, William Garstka, Richard R. Tokarz, and David Crews. 1980. Effects of castration and androgen replacement on male courtship behavior in the red-sided garter snake (*Thamnophis sirtalis parietalis*). *Hormones and Behavior* 14: 358-372.
42. David Crews. 1980. Studies in squamate sexuality. *BioScience* 30: 835-838.
43. Brian Camazine, William Garstka, and David Crews. 1981. Techniques for gonadectomizing snakes (*Thamnophis*). *Copeia* 1981: 884-886.
44. David Crews and Neil Greenberg. 1981. Function and causation of social signals in lizards. *American Zoologist* 21: 273-294.
45. Jill E. Gustafson and David Crews. 1981. Effect of group size and physiological state of a cagemate on reproduction in the parthenogenetic lizard *Cnemidophorus uniparens* (Teiidae). *Behavioral Ecology and Sociobiology* 8: 267-272.
46. David Crews and Neil Greenberg. 1981. Social signals in lizards. *BioScience* 31: 51-53.
47. Frank L. Moore, R. Thomas Zoeller, Sandra P. Spielvogel, Michael J. Baum, Suk-Jin Han, David Crews, and Richard R. Tokarz. 1981. Arginine vasotocin enhances influx of testosterone in the newt brain. *Comparative Biochemistry and Physiology* 70A: 115-117.
48. William Garstka and David Crews. 1981. Female sex pheromone in the skin and circulation of a garter snake. *Science* 214: 681-683.
49. Richard R. Tokarz, David Crews, and Bruce S. McEwen. 1981. Estrogen-sensitive progesterin binding sites in the brain of the lizard, *Anolis carolinensis*. *Brain Research* 220: 95-105.



50. Richard R. Tokarz and David Crews. 1981. Effects of prostaglandins on sexual receptivity in the female lizard, *Anolis carolinensis*. *Endocrinology* 109: 451-457.
51. William Garstka, Brian Camazine, and David Crews. 1982. Interactions of behavior and physiology during the annual reproductive cycle of the red-sided garter snake, *Thamnophis sirtalis parietalis*. *Herpetologica* 38: 104-123.
52. David Crews and William Garstka. 1982. The ecological physiology of a garter snake. *Scientific American* 247: 158-168.
53. Andrew Halpert, William Garstka, and David Crews. 1982. Sperm transport and storage and its relation to the annual sexual cycle of the female red-sided garter snake, *Thamnophis sirtalis parietalis*. *Journal of Morphology* 174: 149-159.
54. David Crews. 1982. On the origin of sexual behavior. *Psychoneuroendocrinology* 7: 259-270.
55. Richard Tokarz and David Crews. 1982. Failure of a variety of antiestrogens to mimic estrogen action in the induction of sexual receptivity in a female lizard. *Hormones and Behavior* 16: 364-369.
56. William R. Garstka and David Crews. 1982. Female control of male reproductive function in a Mexican snake. *Science* 217: 1159-1160.
57. Neil Greenberg and David Crews. 1983. Physiological ethology of aggression in amphibians and reptiles. In *Hormones and Aggressive Behavior*, Bruce Svare (ed.). Plenum Press. pp. 469-506.
58. William D. McKenzie Jr., David Crews, Klaus D. Kallman, David Policansky, and Joel J. Sohn. 1983. Age, weight and the genetics of sexual maturation in the platyfish, *Xiphophorus maculatus*. *Copeia* 1983: 770-774.
59. William R. Garstka, Andrew Halpert, and David Crews. 1983. Metabolic changes in male snakes, *Thamnophis melanogaster*, during a breeding period. *Comparative Biochemistry and Physiology* 74A: 807-811.
60. David Crews, Jill E. Gustafson, and Richard R. Tokarz. 1983. Psychobiology of parthenogenesis. In *Lizard Ecology. Studies of a Model Organism*, Raymond B. Huey, Eric R. Pianka, and Thomas W. Schoener (eds.). Harvard University Press, Cambridge. pp. 205-231.
61. David Crews. 1983. Regulation of reptilian reproductive behavior. In *Advances in Vertebrate Neuroethology*, Jorg-Peter Ewert, Robert R. Capranica, and David J. Ingle (eds.). Plenum Press, New York. pp. 997-1032.
62. Richard E. Jones, Louis J. Guillette Jr., Cliff H. Summers, Richard R. Tokarz, and David Crews. 1983. The relationship among ovarian condition, steroid hormones, and estrous behavior in *Anolis carolinensis*. *Journal of Experimental Zoology* 227: 145-154.
63. David Crews. 1983. Control of male sexual behavior in the Canadian red-sided garter snake. In *Hormones and Behavior in Higher Vertebrates*, J. Balthazart, E. Pröve, and R. Gilles (eds.). Plenum Press, London. pp. 398-406.
64. David Crews. 1983. Alternative reproductive tactics in reptiles. *BioScience* 33: 562-566.
65. Neil Greenberg, Thomas Chen, and David Crews. 1984. Social status, gonadal state, and the adrenal stress response in the lizard, *Anolis carolinensis*. *Hormones and Behavior* 18: 1-11.
66. David Crews. 1984. Gamete production, sex hormone secretion, and mating behavior uncoupled. *Hormones and Behavior* 18: 22-28.
67. David Crews, Brian Camazine, Maireanne Diamond, Robert Mason, Richard R. Tokarz, and William R. Garstka. 1984. Hormonal independence of courtship behavior in the male garter snake. *Hormones and Behavior* 18: 29-41.
68. Neil Greenberg, Michelle Scott, and David Crews. 1984. Role of the amygdala in the reproductive and aggressive behavior of the lizard, *Anolis carolinensis*. *Physiology and Behavior* 32: 147-151.
69. Michael C. Moore, Joan M. Whittier, and David Crews. 1984. Environmental control of seasonal reproduction in a parthenogenetic lizard, *Cnemidophorus uniparens*. *Physiological Zoology* 57: 544-549.

70. David Crews, Linden T. Teramoto, and Hampton L. Carson. 1985. Behavioral facilitation of reproduction in sexual and parthenogenetic *Drosophila*. *Science* 227: 77-78.
71. David Ingle and David Crews. 1985. Vertebrate neuroethology: Definitions and paradigms. *Annual Review of Neuroscience* 8: 457-494.
72. Michael C. Moore, Joan M. Whittier, Allen J. Billy, and David Crews. 1985. Male-like behavior in an all-female lizard: Relationship to ovarian cycle. *Animal Behaviour* 33: 284-289.
73. David Crews and Rae Silver. 1985. Reproductive physiology and behavior interactions in nonmammalian vertebrates. In *Handbook of Behavioral Neurobiology, Vol. 7: Reproduction*, Norman T. Adler, Donald W. Pfaff and Robert W. Goy (eds.). Plenum Press, New York. pp. 101-182.
74. William R. Garstka and David Crews. 1985. Mate preference in garter snakes. *Herpetologica* 41: 9-19.
75. Joan M. Whittier, Robert T. Mason, and David Crews. 1985. Mating in the red-sided garter snake, *Thamnophis sirtalis parietalis*. Differential effects on male and female sexual behavior. *Behavioral Ecology and Sociobiology* 16: 257-261.
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*The Nature of Sex*: PBS

*Beyond 2000*: Artarmon

*Understanding Sex*: Discovery

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### GenBank

1. S79938 *Cnemidophorus uniparens* androgen receptor mRNA, partial cds  
gil1195595|bbml378726|bbsl172702|gblS79938.1|[1195595]
2. S79937 *Cnemidophorus uniparens* progesterone receptor mRNA, partial cds  
gil1195593|bbml378718|bbsl172700|gblS79937.1|[1195593]
3. S79923 estrogen receptor=reptilian sex steroid receptor [*Cnemidophorus uniparens*=unisexual whiptail lizards, oviduct and kidney, mRNA Partial, 923 nt]  
gil1195591|bbml378710|bbsl172698|gblS79923.1|[1195591]
4. AY545462 *Cnemidophorus (Aspidoscelis) uniparens* dopamine D1 receptor-like mRNA, partial sequence  
gil47834292|gblAY545462.1|[47834292]

5. AY331975 Synthetic construct reconstructed ancestral steroid receptor ligand-binding domain gene, partial cds gil37683430|gblAY331975.1|[37683430]
6. AY331974 Synthetic construct reconstructed ancestral steroid receptor DBD gene, partial cds gil37683428|gblAY331974.1|[37683428]
7. AY545567 *Cnemidophorus (Aspidoscelis) uniparens* tyrosine hydrolase mRNA, partial cds gil44894815|gblAY545567.1|[44894815]
8. AY169972 *Eublepharis macularius* fos proto-oncogene protein mRNA, partial cds gil27413561|gblAY169972.1|[27413561]
9. DQ848987 *Trachemys scripta* Estrogen receptor  $\alpha$
10. DQ848988 *Trachemys scripta* Estrogen receptor  $\beta$
11. DQ848989 *Trachemys scripta* Androgen receptor
12. DQ848990 *Trachemys scripta*  $\beta$  actin
13. DQ848991 *Trachemys scripta* PP1 (protein phosphatase 1 gamma)
14. DQ848993 *Trachemys scripta* HPRT1 (hypoxanthine guanine phosphoribosyl transferase 1)
15. DQ848994 *Trachemys scripta* ALAS1 (aminolevulinic acid synthase 1)
16. DQ848992 *Trachemys scripta* UBE2D2 (ubiquitin-conjugating enzyme E2D2)
17. EF030656 *Cnemidophorus (Aspidoscelis) inornatus* ribosomal protein large PO subunit mRNA.
18. DQ141603 *Cnemidophorus (Aspidoscelis) uniparens* neuronal nitric oxide synthase.
19. EF564795 *Cnemidophorus (Aspidoscelis) uniparens* Sox 9 mRNA.
20. EF564796 *Cnemidophorus (Aspidoscelis) uniparens* Dmrt1 mRNA.
21. EU124509 *Cnemidophorus (Aspidoscelis) inornatus* gamma-aminobutyric acid A receptor alpha 4 (GABA) mRNA, partial cds
22. EU124510 *Cnemidophorus (Aspidoscelis) inornatus* serotonin receptor 1b (Adra1b) mRNA, partial cds.
23. EU124511 *Cnemidophorus (Aspidoscelis) inornatus* adrenergic alpha-2A receptor (ADRA2A) mRNA, partial cds.
24. EU124512 *Cnemidophorus (Aspidoscelis) inornatus* glutamate receptor ionotropic N-methyl D-aspartate 1 (grin1) mRNA, partial cds.
25. EU124513 *Cnemidophorus (Aspidoscelis) inornatus* tryptophan hydroxylase 2 (TPH2) mRNA, partial cds.
26. EU124514 *Cnemidophorus (Aspidoscelis) inornatus* tyrosine hydroxylase (Th) mRNA, partial cds.
27. EU124515 *Cnemidophorus (Aspidoscelis) inornatus* glutamate receptor ionotropic AMPA2 (Gria2) mRNA, partial cds.
28. EU124516 *Cnemidophorus (Aspidoscelis) inornatus* dopamine receptor 2 mRNA, partial cds.
29. EU124517 *Cnemidophorus (Aspidoscelis) inornatus* alpha-1A adrenergic receptor mRNA, partial cds.
30. EU358568: *Cnemidophorus (Aspidoscelis) inornatus* dopamine receptor 1 mRNA, partial cds
31. EU358569: *Cnemidophorus (Aspidoscelis) inornatus* gamma-aminobutyric acid A receptor alpha 3 mRNA
32. EU358570: *Cnemidophorus (Aspidoscelis) inornatus* gamma-aminobutyric acid A receptor alpha 2 (GABA) mRNA, partial cds.
33. EU358571: *Cnemidophorus (Aspidoscelis) inornatus* gamma-aminobutyric acid A receptor alpha 1 (GABA) mRNA, partial cds
34. EU358572: *Cnemidophorus (Aspidoscelis) inornatus* 5-hydroxytryptamine (serotonin) receptor 1A (Htr1a) mRNA, partial cds
35. EU358573: *Cnemidophorus (Aspidoscelis) inornatus* dopamine receptor 5 mRNA, partial cds
36. EU358574: *Cnemidophorus (Aspidoscelis) inornatus* glutamate decarboxylase 1 (brain, 67kDa) mRNA, partial cds.
37. EU358575: *Cnemidophorus (Aspidoscelis) inornatus* gonadotropin-releasing hormone receptor 3 mRNA, partial cds

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*RESEARCH INTERESTS* (numbers in parentheses indicates publication number)

My research has focused on problems in reproductive biology, principally on the development and function of sex differences. The research strategy employed has been to identify important problems or gaps in our understanding and then find a species that allows me to address that problem in a unique way. Experience has taught me that Nature provides all of the experimental preparations required. Conventional animal models are also utilized when they enable me to extend findings to the mammalian condition, or provide unique preparations with which to study neuroendocrine mechanisms.

All of my research uses a comparative, interdisciplinary approach that combines and integrates the molecular, cellular, physiological, morphological, organismal, ecological, and evolutionary levels of analysis. The research is conducted both in the laboratory and in the field to illustrate how the causal mechanisms and functional outcomes of reproductive processes operate at each level of biological organization while, at the same time, illuminating the relations among the levels. It has been my experience that field and laboratory studies are complementary; the field has proven to be a valuable testing ground for adaptive functions, whereas the laboratory is the only possible arena for determining many of the physiological and molecular bases of phenomena observed in the field.

What follows is a description of the current research projects in the laboratory. All but the last are supported by long-standing federal research grants; it is my intention to apply for NIH extramural funds for the research on the evolution of the human estrogen receptor in the near future.

1. Diversity and evolution of brain mechanisms controlling reproduction and behavior (MH R01 41770) Here I seek to (i) determine how stimuli relevant to reproduction are perceived and integrated in the central nervous system, (ii) demonstrate how the central nervous system regulates internal reproductive state, and (iii) examine how changes in internal state influence the expression of behavior (c.f., 85, 144, 209 and 225). Three animal model systems have been developed in the course of this research: the green anole lizard, the red-sided garter snake, and two species of whiptail lizards. This work has revealed that great diversity exists among vertebrates in reproductive behaviors and the neuroendocrine mechanisms underlying these behaviors. Comparisons of animals with different hormone-brain-behavior relationships suggest three factors which may explain species differences in endocrine physiology and behavior: (i) sensitivity to sex steroid hormones, (ii) hormone-dependent regulation of sex steroid hormone receptor gene expression, and (iii) neuroanatomical distribution of steroid receptor gene expression, especially in non-limbic structures.

This work with reptiles has led us to re-examine certain assumptions in behavioral neuroendocrinology. One revelation concerns the idea that progesterone is a “female-specific” hormone with no function in males. We have found, however, that progesterone is vital to the display of male copulatory behavior in lizards as well as in mice and rats and, further, that androgen and progesterone synergize in males much like estrogen and progesterone synergize in females to facilitate sexual receptivity (c.f., 189 and 199). To study further the role of the progesterone and its receptor in the regulation of male sexual behavior, we have shown that male mice lacking the progesterone receptor (knockouts) show deficits in their mating behavior and sensitivity to androgen treatment (e.g., 237). This led recently to studies of the role of dopamine, a neurotransmitter implicated in both male and female sexual behavior. We find that the progesterone receptor can be activated by dopamine independently of its natural ligand progesterone. Further, this response to dopamine is dependent upon progesterone receptor as wild type mice given an anti-progestin fail to respond to administration of a specific D1 dopamine agonist.

2. The origins of phenotypic and neural plasticity (NSF IOS 0750938) Phenotypic plasticity refers to the process by which the environment induces different phenotypes from a given genotype. The mechanisms underlying plasticity can either be committed and fixed or labile and reversible or can vary among or within individuals. When we consider that even in species with sex chromosomes each individual possesses all of the genes necessary to develop the phenotype

of both sexes, it becomes apparent that the process of sexual differentiation represents a form of phenotypic plasticity.

Using the leopard gecko as the animal model system, I am able to determine how the experience of temperature during embryogeny affects the phenotype of the adult organism, including sexual and aggressive behaviors and the structure and activity of brain areas mediating these behaviors (c.f., 226, 228, 234, 239, and 251). For example, I have established that incubation temperature accounts for much of the variation observed among individuals in morphology, growth, endocrinology, neural activity, and neuroanatomy. Some sociosexual behaviors and brain measures are affected directly by incubation temperature, whereas both incubation temperature as well as gonadal sex influences others. The theoretical contributions of this work relate to a fundamental question in neuroethology, namely, what are the factors that determine individual variability, particularly as it relates to sexually dimorphic behaviors. Thus, this animal model allows us to separate environmental effects from those imposed by the genetically determined sex of the individual. Findings to date have already proven important in furthering our understanding of the role of environmental factors in sex hormone mediated neural plasticity and have been extended to mammals (e.g., 227).

2. Signal transduction and temperature-dependent sex determination (NSF IBN-200001269 & IOS 1051623) Because of its categorical nature, sex determination has become a model for understanding development in general. Further, sex determination is a case study in how evolution has produced very different mechanisms for achieving the same end. Here I take advantage of the fact that in many reptiles the sex of the offspring depends on the incubation temperature of the egg, a process known as temperature-dependent sex determination (TSD) (c.f., 180, 187, and 215). One question concerns how the physical stimulus of temperature is transduced into a physiological stimulus that operates ultimately at a molecular level to determine an individual's gonadal sex. In this work I use the red-eared slider turtle as the animal model system. I have demonstrated that sex steroid hormones are the physiological equivalent of incubation temperature, serving as the proximate trigger for male and female sex determination. Temperature appears to accomplish this end by acting on genes coding for steroidogenic enzymes (e.g., steroidogenic factor 1 and aromatase) and sex steroid hormone receptors (e.g., estrogen and androgen receptors)(e.g., 232 and 258). Phylogenetic analysis indicates that TSD is the precursor of sex determination by genotypic mechanisms (e.g., sex chromosomes). There is suggestive evidence that similar dynamics are present in mammalian and avian species but are masked by homeothermy (e.g., 192 and 215).

This work has also contributed to new paradigms for understanding sexuality (c.f., 54, 180, 191, 209, 225, 231, 251, and 254). For example, working with animals that lack sex-linked sex determining genes has reinforced the conclusion that the molecular cascades that lead to males and females are contained in each individual. That is, the species may differ in their patterns of regulation, but the genes associated with sex determination are conserved. What differs is the trigger; in some it is sex chromosomes at fertilization, in others it is environmental factors during embryogenesis, and still others it is the social context the adult might find itself. This is overturning the classic paradigm idea of an "organized" and a "default" sex; rather, we now regard both sexes as organized and the question now becomes why the activation of one cascade (e.g., the ovary-determining cascade) actively suppresses the complementary sex determining cascade? Further, I have put forward another paradigm to take the place of the organized-default concept, namely that the female is the ancestral sex and the male the derived sex. These findings have led to a new concept, namely why might males be more like females, than females are like males? The utility of this concept is becoming apparent as we continue to gather evidence for gender differences in genetic and mental disorders.

4. Endocrine disruption (NSF IBN-200001269 & IOS-1051623; NIH R01 ES020662) My fourth research interest relates to the application of basic research to real life concerns. A particularly powerful example is in the area of endocrine disruptors. There is now abundant and undisputed evidence that a variety of natural and man-made chemicals can mimic or antagonize the actions of natural endogenous steroid hormones. Agents such as polychlorinated biphenyls (PCBs), various fertilizers, detergents, and plasticizers acting in minute dosages during embryogenesis



result in impaired reproductive performance or even sterility in adulthood. The fact that sex determination in the red-eared slider turtles involves estrogens provides a sensitive bioassay for environmental quality, and we have developed this animal model system as a biomarker of potential contamination by environmental estrogens. Five discoveries that have had a major impact in endocrinology, and particularly relevant to the issue of endocrine disruptors and reproductive development, were made first on the red-eared slider turtle. (i) Alternative form of estrogen receptor mRNA lacking exon four (177); (ii) Synergistic actions of hydroxylated PCBs resulting in reproductive dysfunction (190); (iii) Synergistic actions of steroidal estrogens in estrogen-mediated events (242); (iv) Evidence that the concept of a threshold dosage does not apply for estrogen-mediated endocrine disruptors (243); (v) that mixtures of compounds in ecologically relevant concentrations have different effects than in single compound exposures. This work has been extended to the study of the behavior of mixtures of endocrine disruptors on sex determination (244) as well as long-term effects on reproductive physiology (261).

5. Epigenetic Influences and the Development of Behavior (NIH MH068273 & ES017538). Behavioral phenotypes of knockout mice are often interpreted as the effects of the absence of the gene product on adult behavior, yet behavioral differences among genotypes may be exaggerated or blurred by the postnatal environment. For example, mice develop in litters of varying sex ratios and genotypes, and it is possible that some of these behavioral differences may result from the composition of the litter. We have developed a paradigm in which any effect of sex can be dissociated from any effect of genotype. In one such study, pups derived from matings of males and females heterozygous (HTZ) for a null mutation of estrogen receptor ( $ER\alpha$ ) or ERKO were sexed and genotyped within two days of birth (301). Litters were then reconstituted, forming either same-sex/mixed-genotype litters of equal numbers of ERKO and wildtype (WT) individuals or mixed-sex/same-genotype litters of equal numbers of male and female HTZ young. As adults, ERKO and WT individuals were tested in standard resident-intruder paradigm; other individuals from all three genotypes were given open field tests. Behavioral differences between the genotypes were more sharply defined than reported previously. ERKO females displayed only aggressive behavior whereas their WT littermates displayed only mounting behavior; both aggression and mounting behavior was greatly reduced in aERKO males. Open field activity differed between males and females across genotypes but not among males or females of different genotypes. These data suggest that litter composition influences the development of sociosexual behaviors but does not influence behaviors associated with open field activity.

*TEACHING*

Typically I offer in the Spring semester a course entitled Animal Sexuality with an enrollment typically of 35-55 students. A copy of the current Syllabus can be provided upon request. I also supervise and teach in the Spring the Seminar in Reproductive Biology, in which students and faculty meet each week to discuss important papers in reproduction and present seminars on their research.

*UT-UNDERGRADUATE BIOMEDICAL TRAINING PROGRAM*

However, I feel that my greatest impact in teaching at the undergraduate level has been in mentoring undergraduates in individual instruction. At any one time I typically have 6-10 undergraduates in the laboratory, some work-study but most volunteers. A select few of these undergraduates are members of the UT-Undergraduate Biomedical Training Program (UT-UBTP) had its genesis while I was on the faculty at Harvard University. The UT-UBTP strategy is to teach the techniques, principals, and ethics of biomedical research to a select group of promising undergraduate students destined for professional school. Potential trainees are identified by faculty and administrative advisors to undergraduate honors programs and societies (e.g., premedical, pre dental, and preveterinary societies). Students accepted into the program spend at least two years in the laboratory, including the summer of the junior year; many have spent the summer of their sophomore year in the lab as well. Throughout this period the students work under my direction on a variety of important biomedical problems, most often in behavioral neuroscience. During the first six months of their tenure, each student is integrated into ongoing experiments in the laboratory. During this time the necessary technical skills are developed and the pertinent literature is reviewed. By the end of the first year students choose a problem that becomes the focus of their research activities. Working in close collaboration with me a research project is developed and an experimental protocol is prepared; special emphasis is placed during this period on experimental design and hypothesis testing. Each trainee is then responsible for all phases of their project, from care and maintenance of the experimental animals to data acquisition and statistical analysis. If warranted, the results are prepared for publication, again in close collaboration with me. Thus, the trainee is exposed at the hands-on level to every phase of the scientific process.

All previous UT-UBTP students have graduated Magna cum Laude or Summa cum Laude. Further, their research projects have been published in major scientific journals. Of the 113 undergraduates who have completed the program to date (Harvard + UT undergraduates), 100 have graduated from, or are currently in, medical schools. The other individuals switched from premedical to research and obtained Ph.D. degrees from Cornell University, Yale University, Baylor College of Medicine, etc.; one received a D.V.M. by the School of Veterinary Medicine at Cornell. Students in the program produced more than 95 original papers with the students as authors, in many cases as first author (n = 25). This training program was awarded the President's Award for Innovative Teaching at Harvard University in 1978 and at UT has received substantial financial support from the Denton Cooley Foundation and the Abell-Hanger Foundation.

I also have been proactive in recruiting and training minority students. In this regard I have received several supplements to NIH grants under the "Under-represented Minorities in Biomedical and Behavioral Research" programs. Other opportunities for mentoring arise in the Training Program in Neurobiology and Behavior that I developed and has been supported by a NIMH Training Grant since 1988.