

CURRICULUM VITAE

HEIDI ELIZABETH HAMM, Ph.D.

Vanderbilt University Medical Center
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DATE AND PLACE OF BIRTH

August 26, 1950, Loma Linda, California

RESEARCH INTERESTS

Structure and function of GTP binding proteins
Molecular mechanisms of signal transduction
Photoreceptors and visual transduction
Regulatory mechanisms of GTPases
Cellular and molecular neurobiology

EDUCATION

- 1980 - 1983: University of Wisconsin-Madison, Postdoctoral Traineeship
(Advisor: M. Deric Bownds, Ph.D.)
- 1976 - 1980: University of Texas-Austin, Ph.D. Zoology, Feb. 1980.
(Advisor: Michael Menaker, Ph.D.)
- 1974 - 1976: University of Florence, Italy, Biology.
- 1969 - 1973: Atlantic Union College, Lancaster, Massachusetts, B.A., Foreign
Language, June, 1973.

RESEARCH AND PROFESSIONAL EXPERIENCE

- 2000 – present: Earl W. Sutherland, Jr. Professor and Chair, Department of
Pharmacology. Vanderbilt University Medical Center.
- 2006 – present: Professor, Department of Orthopaedics and Rehabilitation, Vanderbilt
University Medical Center.
- 2001 – present: Professor, Department of Ophthalmology and Visual Sciences,
Vanderbilt University Medical Center.

- 1996 - 2000: Professor, Northwestern University Institute for Neuroscience
Departments of Molecular Pharmacology and Biological Chemistry
and Ophthalmology, Northwestern University School of Medicine.
- 1994 - 1996: Professor, Department of Physiology and Biophysics, University of
Illinois at Chicago College of Medicine.
- 1990 - 1994: Associate Professor, Department of Physiology and Biophysics,
University of Illinois at Chicago College of Medicine.
- 1990 - 1994: Professore Straordinario, Universita di Sassari, Sassari, Italy.
- 1984 - 1990: Assistant Professor, Department of Physiology and Biophysics,
University of Illinois at Chicago College of Medicine.
- 1983 - 1984: Assistant Professor, Department of Visual Science, School of
Optometry, Indiana University.
- 1980 - 1983: Postdoctoral research, Institute of Biophysics and Molecular
Biology, University of Wisconsin, Madison, WI.
- 1976 - 1980: Thesis research, Department of Zoology, University of Texas at
Austin.

HONORS

Earl W. Sutherland, Jr. Endowed Chair, 2000-present.

Stanley Cohen Award “*For Research Bringing Diverse Disciplines, such as Chemistry or Physics, to Solving Biology’s Most Important Fundamental Problems*” Outstanding Contributions to Research Awards; Vanderbilt University 2003.

Hyman Niznik Memorial Keynote Lecture, Great Lakes G Protein-Coupled Receptor Retreat, London, Ontario, 2007.

Keynote Lecture, European Conference on Hormones and Cell Regulation, GPCR-complexes and GPCR complexity. Mont Sainte Odile (Alsace), France, 2007.

Keynote Speaker, 2007 FASEB Summer Research Conferences, Proteases in Hemostasis and Vascular Biology, Indian Wells, California, 2007.

Grable Investigator, 2003 Distinguished Investigator Award, NARSAD.

Harland G. Wood Memorial Lecturer, Case Western University, Cleveland Ohio, May 2003.

Fritz Lipmann Memorial Lectureship “*In recognition of Outstanding Research Contributions*” presented 92nd Annual Meeting ASBMB, Orlando Florida April 2001.

Lee and Robert Peterson Distinguished Investigator Award, National Alliance for Research in Schizophrenia and Depression, 1998.

Faculty of the Year, University of Illinois College of Medicine, 1996.

Fudderman Memorial Lecture, Department of Ophthalmology, University of Washington, Seattle, Washington, 1995.

Eli Lilly Lecture, Department of Biochemistry, Michigan State University, East Lansing, Michigan, 1995.

Robert H. Mitchel University Scholar, University of Illinois, 1995.

Glaxo Cardiovascular Discovery Award, 1989-1991.

National Science Foundation Research Opportunities for Women Career Development Award, 1987-1989.

PROFESSIONAL RESPONSIBILITIES

Member, Scientific Advisory Board, Center of Advanced European Studies and Research,
Max Planck Society, 2009-2014

Peer Review Advisory Committee, National Institutes of Health, 2007-2010

Member, Federation of American Societies for Experimental Biology, Science Policy Committee Peer Review Subcommittee, 2006-present

Board Advisor, Federation of American Societies for Experimental Biology, Excellence in Science Awards Committee, 2007-08

Ex-Officio Member, U.S. National Committee for the International Union of Biochemistry and Molecular Biology, The National Academy of Sciences, 2007

President, American Society for Biochemistry & Molecular Biology, 2006-2008.

American Society for Biochemistry & Molecular Biology Public Affairs Advisory Committee, 2006-2009

American Society for Biochemistry & Molecular Biology Finance Committee, 2006-2009

American Society for Biochemistry & Molecular Biology Awards Committee, 2006-2009

American Society for Biochemistry & Molecular Biology Nominations Committee, 2006-2009

Member, Association of American Medical Colleges, Panel on Safe and Effective Prescribing Practices, 2007-08

Mount Sinai Medical Center Department of Pharmacology Departmental Review Committee, 2006

Research Focus Group, The National Academies Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, 2005

HHMI Review Board, 2004, 2008.

University of Pennsylvania Department of Pharmacology Departmental Review Committee, 2003.

Protein Kinase Resource Advisory Board, 2000–present

Executive Committee, International Conference on Second Messengers and Phosphoproteins, 1998-2004

University of California San Diego Biomedical Sciences Graduate Program Review, 2002

Board of Scientific Councilors, National Heart Lung and Blood Institute, 1997-2002

Program Committee, American Society for Biochemistry and Molecular Biology, 1996, 1999

Chair, Program Committee, American Society of Biochemistry and Molecular Biology Annual Meeting, 1998

Secretary, American Society for Biochemistry and Molecular Biology, 1995-1998

NIH Reviewers Reserve, 1995-1997

Biophysical Society Councilor, 1993-1997

NIH Medical Biochemistry Study Section, ad hoc member 1996

Chairman, Gordon Conference on Cyclic Nucleotides and Protein Phosphorylation, 1995

NIH Visual Sciences C Study Section, regular member, 1991-1995

Editorial Boards: Mount Sinai Journal of Medicine, 2007-2011
Chemical Biology & Drug Design, 2006-present
Molecular Pharmacology, 1994-present
Journal of Biological Chemistry, 1994-1999
Biochemistry, 1994-1998
American Journal of Physiology, Cellular and Molecular Lung
Biology, 1999-2002
Molecular Cell Biology Research Communications, 1999-2002
Investigative Ophthalmology and Visual Science, 1993-1997

Biochemistry Organizing Committee, Association for Research in Vision and
Ophthalmology, 1990-1993

PROFESSIONAL SOCIETIES

American Society for Biochemistry and Molecular Biology

American Society for Pharmacology and Experimental Therapeutics

Biophysical Society

Association for Research in Vision and Ophthalmology

Association of Medical School Pharmacology Chairs

RECENT GRANTS AND AWARDS

1985 – 2012 NIH-NEI Research Grant, EY06062 Title: Immunological Studies of
Visual Transduction Pathways. Years 23-27, P.I., H. E. Hamm,
Annual Direct Costs, \$250,000; Total Direct Costs, \$1,250,000.

1997 – 2011 NIH-NEI Research Grant, EY10291 Title: G protein Structure and
Function. P.I., H. E. Hamm, Annual Direct Costs Years 13-17,
\$250,000; Total Direct Costs, \$1,250,000.

2006 – 2010 NIH-NHLBI Research Grant, HL084388-01, Regulation of Vascular
Permeability by Thrombin Mediated Signaling Pathways, \$250,000;
Total Direct Costs, \$1,000,000.

2006 – 2011 NIH-NHLBI SCCOR in Hemostatic and Thrombotic Diseases. P.I.
Doug Vaughan, Project 3 – H.E. Hamm, PI, Role of PAR Receptors in
Human Platelet Function. Annual Direct Costs Years 1-5, \$2,081,405;
Annual Direct Costs for Project 3, \$246,965

- 1978 – 2008 NIH-NIGMS 2T32 GM07628-29 Training in Pharmacological Sciences. Annual Direct Costs, \$514,920; Total Direct Costs, \$2,771,724. Pending Renewal 2008-2012, priority score 139.
- 2006 – 2010 NIH Research Grant, Title: $G\alpha_{12/13}$ Signaling in Zebrafish Embryogenesis, P.I. Lilianna I. Solnica-Krezel. Current Year Direct Costs, \$174,810.
- 2003 – 2008 NIGMS Research Grant, Title: Mathematical & Computational Modeling of Signal Transduction-NSF/NIH Mathematical Biology Initiative. P.I. Emmanuele DiBenedetto, Co-P.I. H.E. Hamm, Direct Costs Year1, \$170,888; Total Direct Costs, \$695,888.
- 2005 – 2007 NHLBI-NRSA to Michael Holinstat, Title: PAR Mediated RAS1 Regulation of Platelet Aggregation. Preceptor, H.E. Hamm, Direct Costs, \$92,272.
- 2006 – 2011 NINDS NS052446-01A1 G-Protein Regulation of Exocytotic Transmitter Release. P. I., Kevin Currie, Co-P.I. H.E. Hamm.
- 2003 – 2005 NHLBI-NRSA to John Cleator, Title: Role of G Proteins in Activation of Endothelial Cells, Preceptor, H.E. Hamm, Direct Costs, \$90,404.
- 2003 – 2005 NARSAD Distinguished Investigator Award (Hamm, Heidi E.) Regulation of dopamenergic systems by RGS proteins in striatal Neurons. Direct Costs, \$100,000.

OTHER NATIONAL RESPONSIBILITIES

Journal Reviewer: Science, Nature, Proc. Natl. Acad. Sci. USA, EMBO J., Biochemistry,

Oncogene, Neuron, Journal of Neurochemistry, Expert Opinion on Therapeutic Targets, Protein Science, BMC Structural Biology, Thrombosis and Haemostasis, J. Cell Biol.

REGIONAL COMMITTEES

American Heart Association of Metropolitan Chicago Peer Review Committee, 1992-1994

Organizing Committee, Chicago Signal Transduction Group

Councilor, Society for Neuroscience Chicago Chapter

MediChem Corp. Scientific Advisory Board Chicago, 2000 – 2002

UNIVERSITY COMMITTEES

Vanderbilt University Medical Center

Faculty Awards Committee, Annual Faculty and Staff Research Awards, 2009-2011

Internal Advisory Board, Vanderbilt University Vanderbilt Institute for Clinical and Translational Research, CTSA, 2008

Executive Committee of Executive Faculty, 2004-2007

Search Committee for Director of Vanderbilt-Ingram Comprehensive Cancer Center, 2007

Search Committee for Chair of Anesthesiology, 2005

Advisory Committee for the Vanderbilt Building Interdisciplinary Research Careers in Women's Health (BIRCWH) program, 2006-present

Internal Advisory Panel, Program Project Grant "Biology of Arrhythmia Susceptibility," Vanderbilt University, 2006-present.

Faculty Reward Plan Advisory Committee, Vanderbilt University, 2006-present.

Delbrook Centennial Symposium Planning Committee, 2006

Medical Scientist Training Program Faculty Advisory Committee, 2004-present

Search Committee for Chair of Biomedical Informatics, 2003-2004

LCME Self Study Internal Advisory Committee for Center for Structural Biology, 2003-present

Executive Committee of the Bioengineering Research Partnership, 2003-present

Internal Advisory Committee, Vanderbilt Center for Structural Biology, 2003-present.

Vanderbilt Institute for Chemical Biology Executive Committee, 2002-present

Drug Discovery Round Table, 2002-2003

Zebrafish Initiative Committee, 2002-present

Executive Faculty Executive Committee, 2002-2007

Trans-Institutional Bioinformatics Recruiting Team, 2001-2003

Capital Allocation Process Planning Committee, 2002-2003

Centers of Excellence Complex Biomedical Systems Research Committee, 2002-2003

Bioinformatics Executive Steering Committee, 2001-2003

Strategic Trajectory Committee, 2001-2002

Department of Pharmacology Committees

Strategic Planning Committee, 2005-present

Graduate Education Committee, 2000-present

Promotion and Tenure Committee, 2000-present

Mentoring Committee, 2000-present

Curriculum Committee, 2000-present

Northwestern University and Medical School Committees

Medical School Council for Research, 1999 – 2000

Medical School Genetics Task Force, 1999 – 2000

MSTP Executive Committee, 1999 – 2000

Biotech Oversight Committee, 1999 – 2000

Director of IGP Curriculum on Neurobiology, 1999 – 2000

Cancer Center Signal Transduction in Cancer Program Co-Leader, 1998 – 2000

Ad hoc Promotions and Tenure Committee, 1998 - 2000

Director of IGP Curriculum on Biochemistry and Structural Biology, 1997 – 2000

Steering Committee, Cancer Signal Transduction Training Program, 1997 - 2000

Howard Hughes Medical Institute Executive Committee, 1996 - 2000

Steering Committee, Training Grant in Vision Sciences, 1996 – 2000

Search Committee, Chair of Pediatrics, 1998-1999

Medical School Council for Planning, 1997 – 1999

MSTP Admissions Committee, 1997 – 1999

NUIN Admissions Committee, 1997-1998

Appointments Committee, 1997-1998

Ad hoc committee on Future Plans for New Research Space, 1997

Department of Molecular Pharmacology and Biological Chemistry Committees

Program Review Committee

Executive Committee

Education Committee

Space Committee

Crystallography Search Committee, 1997, recruited Doug Freymann.

University of Illinois at Chicago Committees

Graduate College Executive Committee, 1994-1996

Molecular and Cellular Biology Training Program Founding Committee, 1991-1996;
Director, 1993-1996

Neuroscience Strategic Planning Committee, 1993-1996

Pharmaceutical Biotechnology Program Member, 1993-1996

Protein Synthesis/Sequencing Laboratory Advisory Committee, 1989-1996

Task Force on Neuroscience at UIC, 1989-1996

Colloquium on Signal Transduction Organizing Committee, Founding Member, 1988-
1996

Search Committee for the Vice Chancellor for Research and Dean of the Graduate
School, 1994-1995

Search Committee for Research Director of Illinois State Psychiatric Institute, 1994-1995

Ad Hoc Committee to review the Head of Neurology, 1994 - 1995

Search Committee to recruit a Protein Chemist to head the Protein Sequencing and Synthesis Facility, 1993 - 1995

Search Committee for Head of Pharmacology, 1993 - 1994

Liaison Committee on Medical Education Research Subcommittee, 1993

Structural Biology Program Committee, 1989-1992

UIC Molecular Biology Annual Retreat Planning Committee, 1989-1992

Organizer, UIC Molecular Biology Annual Retreat, 1990-1992

Cell Biology Program Committee, 1988-1992

Animal Care Committee, 1988-1991

Graduate Divisional Committee for the Life Sciences, 1985-1989

Search Committee, Head/Chief of Ophthalmology, 1989

Facilities Subcommittee of the Animal Care Committee, 1984-1988

COMCOR Committee for medical student summer research fellowships

TEACHING ACTIVITIES COURSES:

Vanderbilt University Medical Center

2005 Department of Pathology, "Thrombin receptor signaling in platelets"

2001- present IGP Course: Bioregulation

2001 – present: Receptor Theory: Cell-Surface Receptors and Signal Transduction Pathways

Northwestern University and Medical School

Macromolecular Structure and Function, course director

IGP Core Course in Biochemistry, 4 lectures

Scientific Basis of Medicine, Ophthalmology section, 1 lecture

NUIN: DO5, Molecular and Cellular Neuroscience Graduate Course, 1 lecture

NUIN E10, Advanced Topics in Visual Science, 1 lecture

MPBC: Ligands and Signal Transduction Graduate Course, 3 lectures

Lectures in the Life Sciences journal club, 1 lecture

University of Illinois at Chicago

- 1992 - 1996: Synapses Graduate Course in Anatomy and Cell Biology.
Guest lecturer on Signal Transduction at the Synapse
- 1991 - 1996: Signal Transduction Graduate Course, PHYB596
- 1987 - 1996: Cell Physiology Graduate Course, PHYB586
- 1988 - 1996: M1 Medical Physiology: Vision and Visual Processing,
Auditory and Vestibular Physiology, Hypothalamus
- 1988 - 1996: Pathophysiology (Pharmacy), PHYB331. Sensory and
Neurophysiology
- 1987 - 1996: Dental Physiology, PHYB321. Sensory Physiology and CNS
- 1985 - 1996: Human Physiology, PHYB303
Physiology Techniques, PHYB569
- 1990: Organized a Workshop on Animal Research in a Hostile Environment.
Society for Neuroscience, Chicago Chapter Annual Symposium
- 1990 - 1992: Tutorial on Signal Transduction and Oncogenesis
Department of Medicine Cancer Center Oncogene Lecture Series,
Rush University
- 1991: Summer Course on Signal Transduction. Montana State University,
Bozeman, Montana

THESIS ADVISOR

Kyong-Houn Suh "Molecular and Functional Characterization of Cyclic Nucleotide-Dependent Phosphoproteins in Frog Rod Outer Segment." Current position, Assistant Professor, Paichai University, Daejeon, Korea.

Helen Maheras Rarick "Mechanisms of Activation and Inactivation of Light-Sensitive Retinal cGMP Phosphodiesterase." 1988-1992. Current position, Assistant Professor, Wright College.

Kathrine Warpeha, Department of Biological Sciences, "Investigation of blue light-induced signal transduction in pea." 1987-1990. Current position, Research Associate, Queens University of Belfast, Ireland.

Hyunsu Bae "Mechanisms of Receptor-Mediated G protein activation." 1993-1997. Current position, Associate Professor, Department of Physiology, Kyung-Hee University, Seoul, Korea.

Chii-Shen Yang "Regulation of G protein subunit interaction," 1994-1998. Current Position, Assistant Professor, Department of Biochemical Science and Technology, National Taiwan University, Republic of China.

Trillium Blackmer, "Heterotrimeric G protein $\beta\gamma$ subunits mediate presynaptic inhibition independently of Ca^{2+} entry and bind the fusion core complex," 1997-2000. Current position, Postdoctoral Fellow, Vollum Institute, Oregon Health and Science University.

Tarita Thomas, MSTP student, "G Protein Signaling Mechanisms in Thrombin Stimulated Endothelial Cells," 1998-2002. Current position, Resident, Northwestern University.

E.J. Dell, "The $\beta\gamma$ Subunit of Heterotrimeric G Proteins Interacts With Three WD Repeat Proteins, Including RACK1," 1998-2003. Current position, scientific writing.

Anita Preininger, "The Structure and Function of the Myristoylated Amino Terminus of $G\alpha$ Subunits and its Role as a GTP-Dependent Myristoyl Switch," 1999-2003. Current Position, Research Assistant Professor, Vanderbilt University.

Laurie Earls, "Signaling Partners of RGS9L in the striatum," 2001-2005. Current position, laboratory of David Miller, Vanderbilt University

Will Oldham, "Mechanisms of Receptor-G protein interaction and G protein activation," 2001-2006. MD PhD student. Defended PhD July, 2006, currently in Medical School, Vanderbilt University

Eun-Ja Yoon, "Mechanism of G protein $\beta\gamma$ subunit interaction with SNARE proteins," 2003-present.

Bryan Voss, "Acute uncoupling of G proteins from their receptors with permeable peptides from $G\alpha$'s carboxyl terminus," 2003-present.

Xin Li, joined lab April, 2007.

Summer Young, joined lab April, 2007

THESIS ADVISOR, UNIVERSITY OF SASSARI

Grazia Galleri, 1992, Regolazione dell'attività della fosfodiesterasi GMP ciclico da parte di peptidi dalla subunità α della transducina.

Maria Vittoria Podda, 1993, Struttura e funzione della transducina: Meccanismo di interazione con il suo effettore, fosfodiesterasi GMP ciclico.

Lucia Mura, 1994, Le G proteine in *Saccharomyces cerevisiae*: La regolazione dell'interazione della subunità α con la $\beta\gamma$.

Gianluca Cossu, 1995, Ruolo di miristoilazione della subunità α della transducina e i suoi mutanti.

POSTDOCTORAL AND RESEARCH ASSOCIATE ADVISOR

Dusanka Deretic, Ph.D. "Epitope mapping of monoclonal antibodies against G α t using synthetic peptides." Current position, Associate Professor of Cell Biology and Physiology, University of New Mexico.

Maria Mazzoni, M.D. "Regulation of G protein α - $\beta\gamma$ subunit interaction and effect of monoclonal antibody binding." Current position, Associate Professor, Department of Pharmacy, University of Pisa, Italy.

Justine Malinsky, Ph.D. "Intrinsic fluorescence spectroscopy as a kinetic probe for conformational states of G protein subunits." Current position, Research Assistant Professor, Biochemistry, Baylor University.

Theresa Schepers, Ph.D. "Molecular basis of receptor activation of G proteins." Current position, Research Associate, Abbott Laboratories, North Chicago, Illinois.

John Mills, Ph.D. "Fluorescence studies of the kinetics of protein-protein interaction in the signal transduction cascade of vision." Current position, Assistant Research Professor, Department of Chemistry and Biochemistry, Montana State University.

Nikolai O. Artemyev, Ph.D. "cGMP phosphodiesterase structure-function studies." Current position, Professor, Molecular Physiology and Biophysics, Department of Physiology, University of Iowa.

Navreena Gill, Ph.D. "Molecular modeling of homologous G proteins based upon the crystal structure of transducin α subunit." Current position, Indigo Systems and Technology Consulting, Incorporated, Chicago, Illinois.

Stephanie Rens-Domiano, Ph.D. "A random peptide library approach to the study of affinity and specificity of receptor-G protein interaction." Current position, mother of twins.

Carolyn Ford, Ph.D. “Molecular basis of G protein $\beta\gamma$ subunit interaction with $G\alpha$, rhodopsin, and effectors.” Current position, Visiting Assistant Professor, Wheaton College, Wheaton, Illinois.

Nikolai P. Skiba, Ph.D. “Site-directed mutagenesis and chimeric expression studies of $G\alpha_t$ and cGMP phosphodiesterase.” Current position, Scientist, Millennium Pharmaceuticals, Cambridge, Massachusetts.

Annette Gilchrist, Ph.D. “High-affinity competitive antagonists of receptor G protein interaction as tools for the study of signaling pathways.” Current position, President and CEO, Caden Biosciences, Madison, Wisconsin.

Theresa Vera, Ph.D. “Molecular basis of specificity of receptor-G protein interactions.” Current position, Manager, Educational Grants, Gastroenterology, Takeda Pharmaceuticals North America, Deerfield, Illinois.

Jurgen Vanhauwe, Ph.D. “High-affinity inhibitors of thrombin receptor-mediated signal transduction.” Current position, Invitrogen, Germany.

Anna Anderssen Ph.D. “Regulation of G protein turnoff by RGS proteins.” Current position, Astra-Zeneca Pharmaceuticals, Stockholm, Sweden.

Lee Shekter, Ph.D. “G protein $\beta\gamma$ subunit interaction with channels.” Current position, Postdoctoral Fellow, Brown University, Providence, Rhode Island.

Ramesh Bhatt, Ph.D. “Mechanisms of RGS9 regulation by effectors.” Current position, Researcher, Lilly Research Laboratories.

Martina Medkova, Ph.D. “Site-directed Cys mutagenesis for studies of G protein conformational changes.” Current position, Senior Scientist, RainDance Technologies, Lexington, Massachusetts.

Cheryl Bartleson, Ph.D. “G protein $\beta\gamma$ subunit interactions with SNAREs.” Current position, Study Director, CellzDirect, Incorporated, Durham, North Carolina.

Corey Fowler, Ph.D. “Functional selectivity in thrombin receptors.” Current position, Clinical Research Associate, Perioperative Medicine, Duke Clinical Research Institute, Durham, North Carolina.

Bryan Spiegelberg, Ph.D. “Interactions of histone deacetylase with G protein $\beta\gamma$ subunits.” Current position, Assistant Professor, Gustavus Adolphus College, St. Peter, Minnesota.

Joseph McLaughlin, Ph.D. “Mechanisms of thrombin-mediated gene regulation.” Current position, Research Assistant Professor, Pharmacology, University of Illinois, Chicago, Illinois.

John Cleator, M.D., Ph.D. “Mechanisms of thrombin activation of exocytosis of Wiebel-Palade bodies.” Current position, Assistant Professor of Medicine, Cardiology, Vanderbilt University.

Matt Bilodeau, M.D., Ph.D, “Mechanisms of cyclic nucleotide protection from platelet aggregation.” Current position, Cardiology fellow, Vanderbilt University.

Songhai Chen, Ph.D. “Functional roles for G protein $\beta\gamma$ subunit interactions with RACK1.” Assistant Professor of Pharmacology, University of Iowa, Iowa City, Iowa.

Fang Lin, Ph.D. “G proteins in zebrafish development.” Assistant Professor, Anatomy & Cell Biology, University of Iowa, Iowa City, Iowa.

Michael Holinstat, Ph.D. “PAR Mediated Rap1 Regulation of Platelet Aggregation.” Postdoctoral Fellow, Vanderbilt University.

Lixin Shen, Ph.D., “Mathematical and computational modeling of visual signal transduction.” Postdoctoral Fellow, Vanderbilt University.

Anita Preininger, Ph.D. “The Structure and Function of the Myristoylated Amino Terminus of $G\alpha$ Subunits and its Role as a GTP-Dependent Myristoyl Switch.” Research Assistant Professor, Vanderbilt University.

Chris Wells, M.D., Ph.D, “Mechanisms of $G\beta\gamma$ interaction with SNARE proteins.” Cardiovascular Fellow, Vanderbilt University.

Lenoci, Leonardo, Ph.D., “Mathematical and computational modeling of visual signal transduction.” Postdoctoral Fellow, Vanderbilt University.

PRECEPTOR FOR MEDICAL STUDENTS

John Ortega, Tom McNanley, Joe Kalisky, Tom Ham, Russ Zwilinsky, Michael Klein, Brian Aldred, John Pietrowski, Joe Mastro, Gary Schaffel, David Roccaforte, Anant Bhawe, Daran Maxon, Eric Roundtree, Alan Betensley, Andrew Dice, Richard Boxer, Eric Cuasay, Han-Sue Bae, Ingrid Lim

PRECEPTOR FOR HOWARD HUGHES UNDERGRADUATE FELLOWS

Sima Patel, Amit Garg, Lida Aris

GRADUATE STUDENT PRETHESIS AND THESIS COMMITTEES

Vanderbilt University

Laurie Earls, Yi Feng, Efrain Garcia, Aaron Hata, Lee Henage, Arlene Kray, Jamie McConnell, Susan Hanson, William Oldham, Daniela Popescu, Bryan Voss, Eun-Ja Yoon, David Andrew Petersen, Sarah Nordstrom, Xiaohui Yan, Ronald Bruntz

Northwestern University and Medical School

Kathy Lee, David Lorber, Rachel Powers, Ann Marie Girvin, Bill Ashley

University of Illinois at Chicago

Yan Kun, Nan Wang, Kyong-Houn Suh, Larry Rufer, Dennis McNally, Kate Warpeha, Helen Rarick, Beth Etscheid, Paul Goldspink, Kim Palmiter, Hyunsu Bae, Miroslav Stojanovic, Haiping Tang, Jianlong Zhou, Wen Ying Qin, Keith Barr, Kim Chaney, Ning Fang Chen, Kim Palmiter, Chii-Shen Yang, Paul Rubenstein.

PUBLICATIONS

1. Shen, Lixin, G. Caruso, P. Bisegna, D. Andreucci, V.V. Gurevich, **H.E. Hamm**, and E. DiBenedetto. Dynamics of Mouse Rod Phototransduction and Its Sensitivity to Variation of Key Parameters. *IET Systems Biology* 4(1):12, 2010.
2. Marjoram R.J., B. Voss, Y. Pan, S.K. Dickeson, M.M. Zutter, **H.E. Hamm**, S.A. Santoro. Suboptimal activation of protease-activated receptors enhances $\alpha_2\beta_1$ integrin-mediated platelet adhesion to collagen. *J. Biol. Chem.* 284(50):34640-7, 2009.
3. **Hamm H.E.**, S.M. Meier, G. Liao, A.M. Preininger. Trp fluorescence reveals an activation-dependent cation- π interaction in the switch II region of G α (i) proteins. *Protein Science* 18(11):2326-35, 2009.
4. Holinstat M., A.M. Preininger, S.B. Milne, W.J. Hudson, H.A. Brown, **H.E. Hamm**. Irreversible platelet activation requires PAR1-mediated signaling to phosphatidylinositol phosphates. *Mol. Pharmacol.* 76(2):301-13, 2009.
5. Mazzoni M.R., F. Porchia, **H.E. Hamm**. Proteolytic fragmentation for epitope mapping. *Methods Mol. Biol.* 524:77-86, 2009.
6. Lin F., S. Chen, D.S. Sepich, J.R. Panizzi, S.G. Clendenon, J.A. Marrs, **H.E. Hamm**, L. Solnica-Krezel. G $\alpha_{12/13}$ regulate epiboly by inhibiting E-cadherin activity and modulating the actin cytoskeleton. *J. Cell. Biol.* 184(6):909-21, 2009.
7. Preininger A., M. Funk, S. Meier, W. Oldham, C. Johnston, S. Adhikary, A. Kimple, D. Siderovski, **H.E. Hamm**, T. Iverson. Helix dipole movement and conformational variability contribute to allosteric GDP release in G α_i subunits. *Biochemistry.* 48(12): 2630–42, 2009.
8. Wen, X.H., L. Shen, R.S. Brush, N. Michaud, M.R. Al-Ubaidi, V.V. Gurevich, **H.E. Hamm**, J. Lem, E. Dibenedetto, R.E. Anderson, C.L. Makino.

- Overexpression of rhodopsin alters the structure and photoresponse of rod photoreceptors. *Biophys. J.* 96(3):939-50, 2009.
9. Yoon, E.-J., **H.E. Hamm** and K.P.M. Currie. G protein $\beta\gamma$ subunits modulate the number and nature of exocytotic fusion events in adrenal chromaffin cells independent of calcium entry. *J. Neurophysiol.* 100:2929-2939, 2008.
 10. Preininger, Anita M., Joseph Parello, Scott M. Meier, Guihua Liao, and **Heidi E. Hamm**. Receptor-Mediated Changes at the Myristoylated Amino Terminus of Gail Proteins. *Biochemistry* 47(39):10281-93, 2008.
 11. Chen, Songhai, Fang Lin, M.E. Shin, F. Wang, Lixen Shen and **Heidi E. Hamm**. RACK1 regulates directional cell migration by acting on $G\beta\gamma$ at the interface with its effectors $PLC\beta$ and $PI3K\gamma$. *Mol Biol Cell* (9):3909-22, 2008.
 12. Oldham, W.M. and **H.E. Hamm**. Heterotrimeric G protein activation by G-protein-coupled receptors. *Nat Rev Mol Cell Biol.* 9(1):60-71, 2008.
 13. Bisegna, P., G. Caruso, D. Andreucci, L. Shen, V.V. Gurevich, **H.E. Hamm**, and E. DiBenedetto. Diffusion of the Second Messengers in the Cytoplasm Acts as a Variability Suppressor of the Single Photon Response in Vertebrate Phototransduction. *Biophysical Journal* 94(9):3363-83, 2008.
 14. Yoon, E.J., T. Gerachshenko, B.D. Spiegelberg, S. Alford, **H.E. Hamm**. Gbetagamma interferes with Ca^{2+} -dependent binding of synaptotagmin to the soluble N-ethylmaleimide-sensitive factor attachment protein receptor (SNARE) complex. *Mol Pharmacol.* 72(5):1210-19, 2007.
 15. Oldham, W.M. and **H.E. Hamm**. How do receptors activate G proteins? *Advances in Protein Chemistry* 74:67-93, S. Sprang, Ed., 2007.
 16. Bilodeau, M.L. and **H.E. Hamm**. Regulation of PAR1 and PAR4 signaling in human platelets by compartmentalized cyclic nucleotide actions *J. Pharmacol. Exp. Ther.* 322(2):778-88, 2007.
 17. Oldham, William M., Ned Van Eps, Anita M. Preininger, Wayne L. Hubbell, and **H.E. Hamm**. Mapping allosteric connections from the receptor to the nucleotide-binding pocket of heterotrimeric G proteins *Proc Natl. Acad. Sci. USA* 104(19): 7927-7932, 2007.
 18. Voss, Bryan, J.N. McLaughlin, M. Holinstat, R. Zent, and **H.E. Hamm**. PAR1, but not PAR4, activates human platelets through a $G_{i/o}/PI3K$ signaling axis. *Mol. Pharmacol.* 71(5): 1399-1406, 2007.
 19. Huang, Kui, Bryan M. Voss, Disha Kumar, **H.E. Hamm**, and Eva Harth. Dendritic Molecular Transporters Provide Control of Delivery to Intracellular Compartments. *Bioconjugate Chem.* 18(2):403-9, 2007.

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130. Artemyev, N.O. and **H.E. Hamm**. Two site high affinity interaction between inhibitory and catalytic subunits of rod cGMP-phosphodiesterase. *Biochem. J.* 283:273-279, 1992.
131. **Hamm, H.E.** Defining sites and mechanisms of interaction between rhodopsin and transducin. In *Peptides as Probes in Muscle Research*, Ed. J. C. Rüegg, pp. 141-149. Springer-Verlag, Berlin. 1991.
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133. Mazzoni, M.R., J.A. Malinski and **H.E. Hamm**. Structural analysis of rod GTP-binding protein, G_t. Limited proteolytic digestion pattern of G_t with four proteases defines monoclonal antibody epitope. *J. Biol. Chem.* 266:14072-14081, 1991.
134. **Hamm, H.E.** Molecular interactions between the photoreceptor G protein and rhodopsin. In *Cellular and Molecular Neurobiology*, J. M. Saavedra, Ed. 11:563-578, 1991.
135. Robinson, P.R., S.F. Wood, E.Z. Szuts, A. Fein, **H.E. Hamm** and J.E. Lisman. Light-dependent GTP binding proteins in squid photoreceptors. *Biochem. J.* 272:79-85, 1990.
136. Mazzoni, M. and **H.E. Hamm**. Physical studies of α - $\beta\gamma$ subunit interactions of rod outer segment G protein, G_t: Effects of monoclonal antibody binding. In *Sensory Transduction*, Ed. L. Cervetto, V. Torre. NATO ASI Series 197:147, 1990.
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138. **Hamm, H.E.** Surfaces of interaction between G_t and rhodopsin in the GDP-bound and empty-pocket configurations. *Advances in Second Messenger and Phosphoprotein Research*, Ed. A. Robison and P. Greengard. 24:76-81, 1990.
139. **Hamm, H.E.** Regulation by light of cyclic nucleotide-dependent protein kinases and their substrates in frog rod outer segments. *J. Gen. Physiol.* 95:545-567, 1990.
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- A. Brown. Coupling of receptors to effectors by G proteins. In *Recent Progress in Hormone Research*, Ed. J. H. Clark. Vol. 45, pp. 121-208, 1989.
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143. **Hamm, H.E.**, D. Deretic, M.R. Mazzoni, C.A. Moore, J.S. Takahashi and M.M. Rasenick. A monoclonal antibody against the rod outer segment guanyl nucleotide-binding protein, transducin, blocks the stimulatory and inhibitory G proteins of adenylate cyclase. *J. Biol. Chem.* 264:11475-11482, 1989.
144. Birnbaumer, L., A. Yatani, J. Codina, R. Mattera, R. Graf, C.F. Liao, A. Themmen, J. Sanford, **H.E. Hamm**, R. Iyengar, M. Birnbaumer and A.M. Brown. Signal transduction by G proteins - regulation of ion channels as seen with native and recombinant subunits and multiplicity of intramembrane transduction pathways. In *Molecular and Cellular Endocrinology of Testis*, Ed. Cook, B.A. Serono Symposia Vol. 50, pp. 35-58, Raven Press (New York), 1989.
145. Brown, A.M., A. Yatani, Y. Imoto, G. Kirsch, **H.E. Hamm**, J. Codina, R. Mattera, and L. Birnbaumer. Direct coupling of G proteins to ionic channels. *Cold Spring Harbor Symposium on Quantitative Biology, Vol. LIII, Molecular Mechanisms of Signal Transduction*, pp. 365-373, 1989.
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147. **Hamm, H.E.**, D. Deretic, A. Arendt, P.A. Hargrave, B. Koenig and K.P. Hofmann. Site of G protein binding to rhodopsin mapped with synthetic peptides from the α subunit. *Science* 241:832-835, 1988.
148. Deretic, D. and **H.E. Hamm**. Topographic analysis of antigenic determinants recognized by monoclonal antibodies to the photoreceptor guanyl nucleotide-binding protein, transducin. *J. Biol. Chem.* 262:10839-10847, 1987.
149. **Hamm, H.E.**, D. Deretic, K.P. Hofmann, A. Schleicher and B. Kohl. Mechanism of action of monoclonal antibodies that block the light activation of the guanyl nucleotide-binding protein, transducin. *J. Biol. Chem.* 262:10831-10838, 1987.
150. **Hamm, H.E.** and M.D. Bownds. Protein complement of rod outer segments of frog retina. *Biochemistry* 25:4512-4523, 1986.
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153. **Hamm, H.E.**, and M.D. Bownds. A monoclonal antibody to guanine nucleotide binding protein inhibits the light-activated cyclic GMP pathway in frog rod outer segments. *J. Gen. Physiol.* 84:265, 1984.
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155. **Hamm, H.E.**, J.S. Takahashi and M. Menaker. Light-induced decrease of serotonin N-acetyltransferase activity and melatonin in the chicken pineal gland and retina. *Brain Res.* 266:287-293, 1983.
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157. **Hamm, H.E.** and M. Menaker. Pineal and retinal serotonin N-acetyltransferase activity: Modulation by phosphate. *J. Neurochem.* 37:1567-1572, 1981.
158. Takahashi, J.S., **H.E. Hamm** and M. Menaker. Circadian rhythms of melatonin release from individual superfuse chicken pineal glands in vitro. *Proc. Natl. Acad. Sci. USA* 77:2319-2322, 1980.
159. Goldman, M., **H.E. Hamm**, and C.K. Erickson. Determination of melatonin by high performance liquid chromatography with electrochemical detection. *J. Chromatography* 190:217-220, 1980.
160. **Hamm, H.E.** and M. Menaker. Retinal rhythms in chicks: Circadian variation in melatonin and serotonin N-acetyltransferase activity. *Proc. Natl. Acad. Sci. USA*, 77:4998-5002, 1980.
161. **Hamm, H.E.** Circadian rhythms of melatonin synthesis in the avian retina. Ph.D. Dissertation, University of Texas at Austin, 1980.

SUBMITTED AND IN PREPARATION

1. Jernigan, Kristin K., Christopher S. Cselenyi, Curtis A. Thorne, Nicole Hajicek, William M. Oldham, Laura A. Lee, **Heidi E. Hamm**, John R. Hepler, Tohru Kozasa, Maurine E. Linder, and Ethan Lee. G $\beta\gamma$ promotes LRP6-mediated β - catenin/TCF signaling by stimulating membrane association and activation of

GSK3. Submitted, *Science Signaling*, 2009.

2. Shen, Lixin, Paolo Bisegna, Giovanni Caruso, Daniele Andreucci, Vsevolod V Gurevich, **Heidi E. Hamm**, and Emmanuele DiBenedetto. Kinetics of Rhodopsin Deactivation and Its Role in Regulating Recovery and Reproducibility in WT and Transgenic Mouse Photoresponse. Resubmitted, *Biophys. J.*, 2008.

BOOKS

1. Synthetic Peptides as Probes of Protein-Protein Interaction. **H. E. Hamm**, Editor. *Methods: A Companion to Methods in Enzymology, Vol. 5*. Academic Press, San Diego, CA, 1993.
2. GTPases as Molecular Machines, D. Corda, **H. Hamm** and A. Luini, Editors. Ares-Serono Symposia, *Challenges in Endocrinology and Modern Medicine*, Vol. 6, 1994.

PATENTS

Patent # 6559128, Inhibitors of G protein-mediated signaling, methods of making them, and uses thereof. Issue date 05.06.2003.

Patent Pending, U.S. Publication #20080221043, Dendritic molecular intracellular transporters and methods of making and using same. Inventors: Eva M. Harth, James E. Crowe, Kui Huang, Sharon K. Hamilton, **Heidi E. Hamm**, Bryan Voss.

RECENT INVITED SYMPOSIA AND MEETING ORGANIZATION

1. Invited Speaker, Systems Biology Center Symposium 2009, "Systems biology of thrombin signaling," New York, New York, December 3, 2009.
2. Invited Speaker, Signal Transduction Branch, National Meeting, "Structural Basis of G Protein Signaling," Ixtapan de la Sal, Mexico, September 6, 2009.
3. Invited Speaker, Gordon Research Conference on Phosphorylation and G-protein mediated signaling networks, "Dynamics of G protein activation by GPCRs." Biddeford, Maine, June 11, 2009.
4. Invited Speaker, Keystone Symposium on Protein Dynamics, Allostery and Function, "Allosteric Connections from a G Protein-Coupled Receptor to the Nucleotide-Binding Pocket of a Heterotrimeric G Protein." Keystone, Colorado, June 7, 2009.
5. Invited Speaker, ASBMB Experimental Biology Meeting, "How GPCRs Catalyze G Protein Activation." New Orleans, Louisiana, April 21, 2009.

6. Plenary Lecture, ASPET G-Protein Targets Colloquium, "G-Protein Effector Interaction: A Target for Drug Discovery?" New Orleans, Louisiana, April 18, 2009.
7. Invited Speaker, Federation of American Societies for Experimental Biology: Experimental Biology Meeting, "Receptor-catalyzed activation of heterotrimeric G proteins." San Diego, California, April 5-9, 2008.
8. Hyman Niznik Memorial Keynote Lecture, Eighth Annual Joint Meeting of the Great Lakes G Protein-Coupled Receptor Retreat. London, Ontario, September 27-29, 2007.
9. Keynote Lecture, European Conference on Hormones and Cell Regulation, "GPCR-complexes and GPCR complexity." Mont Sainte Odile (Alsace), France, September 13-16, 2007.
10. Invited Speaker, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences. "Role in vesicular exocytosis of G $\beta\gamma$ interaction with soluble N-ethylmaleimide-sensitive factor attachment protein receptor (SNARE) complex." Shanghai, China, July 5, 2007.
11. Invited Speaker, Guangzhou Institute of Biomedicine and Health, Chinese Academy of Sciences, Symposium on Biochemistry and Molecular Biology. "Role of G-Protein Coupled PAR Receptors in Platelets." Guangzhou, China, July 2, 2007.
12. Invited Speaker, Chinese National Institute of Biological Sciences. "How do receptors catalyze G protein activation?" Beijing, China, June 28, 2007.
13. Invited Speaker: Gordon Research Conference, Phosphorylation and G Protein Mediated Signaling Networks, "Novel G-beta/gamma Signaling Partners." University of New England, Biddeford, Maine, June 10-15, 2007.
14. Keynote Speaker, 2007 FASEB Summer Research Conferences, Proteases in Hemostasis and Vascular Biology, "Signaling thru phospholipase D and polyphosphoinositides required for PAR1-mediated human platelet activation." Indian Wells, California, June 2-7, 2007.
15. Invited Speaker: PreARVO Meeting, "Rhodopsin: Advances and Perspectives," "Mechanism of rhodopsin-catalyzed GDP release on G protein alpha subunits." Ft. Lauderdale, Florida, April 28-29, 2006.
16. Symposium Speaker: 2006 Keystone Symposium, "GPCR Activation: Studies with peptides and antibodies." Keystone, Colorado, February, 2006.

17. Invited Speaker: 2005 Annual Meeting, Southeastern Pharmacology Society and Southeastern Society of Toxicology, "Differential regulation of platelet activation by PAR-1 and PAR-4." Nashville, Tennessee, October 19-21, 2005.
18. Invited Speaker: 2005 Annual Meeting, American Society of Bone and Mineral Research, Hormone-Receptor Interactions Workshop, "How receptors activate G proteins." Nashville, Tennessee, September 23, 2005.
19. Symposium Speaker: 2005 FASEB Summer Research Conference on Receptors and Signal Transduction, "Modeling G protein signaling pathways downstream of PAR receptors." Snowmass, Colorado, July 30 - August 4, 2005.
20. Symposium Speaker: Gordon Conference 2005 Second Messengers & Protein Phosphorylation, "How do receptors activate G proteins?" Biddeford, Maine, June 13, 2005.
21. Symposium Speaker: DeLange Conference V, "G-protein structure and function." Houston, Texas, March 8, 2005.
22. Keck Futures Initiative, Irvine, California, November, 13-17, 2003.
23. Symposium Speaker, 17th Symposium of the Protein Society, "How receptors activate G proteins." Boston, Massachusetts, July 26-30, 2003.
24. Symposium Speaker, Gunter-Schultz Conference, VIIIth International Dahlem Symposium on "Cellular Signal Recognition and Transduction." Berlin, Germany, June 18-21, 2003.
25. Symposium Speaker, Karolinska Institute Nobel Conference, "Advances in G Protein Coupled Receptor Research." Stockholm, Sweden, June, 2003.
26. Invited Speaker, Gordon Conference on Molecular Pharmacology, Ventura, California, February, 2003.
27. Invited Speaker, G-coupled receptor meeting, Tarrytown, New York, November, 2002.
28. Invited Speaker, IBC's 7th annual GPCR Conference, San Diego, California, October, 2002.
29. Invited Speaker, Grover Conference; 11th Scientific Conference, American Heart Association and the Pulmonary Foundation, Sedalia, Colorado, September, 2002.
30. Invited Speaker, IUPHAR XIVth World Congress of Pharmacology "Structural Basis of G Protein-Coupled Receptor Signaling." San Francisco, California, July, 2002.

31. Invited Speaker, FASEB: Receptors and Signal Transduction Salt Lake City, Utah, July, 2002.
32. Invited Speaker, FASEB: Calcium and Cell Function Salt Lake City, Utah, June, 2002.
33. Invited Speaker, Gordon Research Conference: Second Messengers and Protein Phosphorylation: "Receptor G Protein Interaction." Kimball Union Academy, New Hampshire, June, 2001.
34. Invited Speaker, 11th International Conference on Second Messengers and Phosphoproteins : "Trimeric G Proteins." Melbourne , Australia, April, 2001.
35. Symposium Speaker, Earl W. Sutherland Jr. Symposium, Vanderbilt University, May, 2001.
36. Invited Speaker, Merck Research Labs GPCR Retreat: "Regulation of G Protein Activation and Deactivation." Cape May, New Jersey, April, 2001.
37. Symposium Speaker, ASPET/ASBMB, Orlando Florida, March, 2001.
38. Symposium on Insights into Signal Transduction sponsored by NHLBI in honor of Martha Vaughan 75th birthday. March, 2001.
39. Woods Hole Vision Research Course, August 22-23, 2000.
40. ASPET Short Course on Principles of Pharmacology, ASPET Annual Meeting, Boston Mass., "Introduction to Receptors and Cell Signaling." June 4, 2000.
41. Invited speaker, Mosbach Colloquium of the Gesellschaft fur Biochemie und Molekularbiologie, GTP binding proteins: Central Regulators in Cell Biology. April 2-5, 2000.
42. Keystone Symposium on Localization of Intracellular Signaling Complexes. Plenary Lecture, March 6-8, 2000.
43. Chair and Speaker, Symposium on G Protein Signaling: From Receptor to Effector, Biophysical Society Annual Meeting, New Orleans, LA, February 12-16, 2000.
44. Invited speaker, FASEB Conference on the Biology and Chemistry of Vision, July 13-17, 1999.
45. Invited Keynote Speaker, Proteins Symposium of Italian Biochemical Society, June 1-4, 1999.
46. Invited speaker, 10th International Conference on Second Messengers & Phosphoproteins, Jerusalem, Israel, November 8-13, 1998.

47. Invited speaker, ASBMB Fall Symposium on Phosphoryl Transfer: A Molecular Basis for Signaling. Granlibakken, Lake Tahoe, California, October 23-26, 1998.
48. Invited speaker, FASEB Summer Conference on Molecular Biophysics of Cellular Membranes, August 2-6, 1998.
49. Symposium Speaker, American Society for Biochemistry and Molecular Biology, May 17-21, 1998.
50. Invited speaker, Gordon Conference on Hormone Action, Tilton, New Hampshire, July 27 - August 1, 1997.
51. Symposium Speaker, Three-dimensional structures of Nervous System Proteins, International Society of Neurochemistry, Boston, Massachusetts, July 20-25, 1997.
52. Invited speaker, Gordon Conference on Second Messengers and Protein Phosphorylation, Tilton, New Hampshire, June 15-20, 1997.
53. Symposium Speaker, Advances in G protein signaling, Endocrine Society, Minneapolis, Minnesota, June 11-14, 1997.
54. Symposium Speaker, New Developments in Protein Structure, Association for Research in Vision and Ophthalmology Annual Meeting, Fort Lauderdale, Florida, May 11-16, 1997.
55. Inaugural Speaker, Group for Biotechnology in Pharmacology, Department of Medical Pharmacology, University of Milano, Milano, Italy, March, 1997.
56. Invited speaker, Colloquium on Signaling and Molecular Structure in Pharmacology, Annual Meeting ASPET, San Diego, California, March 11-12, 1997.
57. Symposium Speaker, Molecular Switches in Motor Proteins, Biophysical Society Annual Meeting, New Orleans, Louisiana, March 2-6, 1997.
58. Session Chair, Ninth Annual Winter Conference on Neuroplasticity, St. Lucia, West Indies, February 22-March 1, 1997.
59. Invited speaker, Molecular Pharmacology Gordon Conference, Holiday Inn, Ventura, California, February 9-14, 1997.
60. Invited speaker, Second International Colloquium on Cellular Signal recognition and transduction, Berlin-Dahlem, Germany, October 9-12, 1996.
61. Invited speaker, IBC Conference on G protein-coupled receptors, Therapeutic Advancements and Applications, Philadelphia, Pennsylvania. October 2-4, 1996.

62. Session Chair, Mechanisms of Receptor G protein Coupling. IBC Conference on G protein-coupled receptors: Therapeutic Advancements and Applications. Philadelphia, Pennsylvania. October 2-4, 1996.
63. Invited speaker, Caledonian Research Foundation/Royal Society of Edinburgh, Symposium on "Molecular Mechanisms of Signal Transduction in Health and Disease." Edinburgh, Scotland, November 14-15, 1996.
64. Organizer, with Gary Johnson, ASBMB Fall Symposium, "Molecular Recognition in G protein Signaling." Keystone, Colorado, October 18-21, 1996.
65. Invited speaker, Cambridge Symposium on Genetic, Molecular and Structural Control of Signal Transduction, Lake Tahoe, Nevada, October 31-November 6, 1996.
66. Invited speaker, Gordon Conference on Molecular Cell Biology, June, 1996.
67. Invited speaker, Beckman Symposium, University of Illinois, Urbana, Illinois, June 7-9, 1996.
68. Symposium speaker, American Society for Biochemistry and Molecular Biology, June 2-6, 1996.
69. Organized Symposium "G proteins." American Society for Biochemistry and Molecular Biology, June 2-6, 1996.
70. Program Committee, American Society for Biochemistry and Molecular Biology, June 2-6, 1996.
71. Bristol Myers Squibb Symposium on Neuronal Signal Transduction. "G protein-coupled receptors: Signaling in the msec to second time frame." Emory University, April 17-18, 1996.
72. Symposium speaker, American Society for Pharmacology and Experimental Therapeutics, "Methods for the study of G proteins." April, 1996.
73. Symposium speaker, Biophysical Society, "Structural aspects of signal transduction." February 21, 1996.
74. Symposium speaker, American Society for Cell Biology, "Use of synthetic molecules to understand and control signal transduction." December 13, 1995.

RECENT COLLOQUIA

2009 Tulane University. "G protein structure and function." New Orleans,

Louisiana, November 20, 2009.

University of California, San Diego. "G Protein Signaling Mechanisms in Platelets." San Diego, California, October 1, 2009.

University of Illinois. "Molecular regulation of G protein function." Champagne-Urbana, Illinois, September 17, 2009.

2008 Iowa State University. Extracellular Proteases n Cell Signaling: "Thrombin-mediated G protein signaling pathways." Ames, Iowa, September 19, 2008.

University of Georgia, "Novel Gbg signaling pathways." Athens, Georgia, April 25, 2008.

University of Virginia, "Novel regulation of synaptic transmission by GBg subunits." Charlottesville, Virginia, March 14, 2008.

National Institute of Environmental Health Services, National Institutes of Health, Laboratory of Neurobiology, "Novel regulation of synaptic transmission by Gbg subunits." Durham, North Carolina, March 13, 2008.

Vanderbilt University, Molecular Biophysics Training Grant seminar, "How receptors activate G proteins." Nashville, Tennessee, February 5, 2008.

Cincinnati Children's Hospital, "G protein structure and function." Cincinnati, Ohio, January 9, 2008.

2007 Newmark Award Lecture in Biochemistry, "How do receptors catalyze G protein activation?" University of Kansas, Lawrence, Kansas, October 8, 2007.

Comprehensive Neuroscience Seminars, University of Alabama, "Human Platelet Signaling through PAR1 and PAR4," Birmingham, Alabama, May, 2007.

Case Western Reserve University, "Mechanism of rhodopsin-catalyzed GDP release on G protein alpha-subunits," Cleveland, Ohio, February, 2007.

2006 Seminar Series in Cardiovascular Research, "Role of G-Protein Coupled PAR Receptors in Platelets," Vanderbilt University, Nashville, Tennessee, July, 2006.

Membrane Biology and Protein Trafficking Seminar, "G $\beta\gamma$ regulation of exocytosis," Vanderbilt University, Nashville, Tennessee, March 17, 2006.

Visiting Professorship, University of New Mexico, "Thrombin-mediated G protein signaling pathways." Albuquerque, New Mexico, February 17, 2006.

- Department of Pathology, University of Alabama, "Signaling through protease activated receptors in the cardiovascular system." Birmingham, Alabama, January 17, 2006.
- 2005 Cardiology Fellows Program, "PAR Receptor Signaling in Acute Coronary Syndrome," Vanderbilt University, Nashville, Tennessee, September, 2005.
- 2004 Thrombin-mediated G protein signaling pathways in endothelial cells, Kimmel Cancer Center, Jefferson University, October 28, 2004.
- G-Protein Regulation of Synaptic Transmission, Committee on Cell Physiology Seminar Series, University of Chicago, May 14, 2004.
- G Protein Regulation of Synaptic Transmission, Pharmacology Seminar, University of Tennessee, Memphis, February 25, 2004.
- Membrane Biology Group, Role of G Proteins in Regulation of Synaptic Transmission, Vanderbilt University, January 30, 2004.
- 2003 Vanderbilt Institute of Chemical Biology, Targeting the Receptor-G Protein Interface for Drug Design, Vanderbilt University, September 24, 2003.
- Harland G. Wood Memorial Lecture, Mechanism of receptor G Protein Interaction, Case Western University, Cleveland, Ohio, May, 2003.
- Research Seminar, Modulating Rhodopsin Function, Ophthalmology and Visual Sciences Department, University of Chicago, Illinois, April, 2002.
- 2002 Molecular Physiology and Biophysics Department, Vanderbilt University Medical Center, February, 2002.
- Signal Transduction Colloquium, Duke University Medical Center, March 2002.
- Vollum Institute for Advanced Biomedical Research "G Protein Structure Function and Regulation", Portland, Oregon, April, 2002.
- Hemostasis/Thrombosis Seminar Series, University of Michigan, May, 2002.
- Brigham Young University, Provo, Utah, June, 2002.
- 2001 Graduate Program Research Seminar, Cornell University Medical Center, December 2001.

- 2000 Institut für Medizinische Physik und Biophysik, Charité / Humboldt Universität, Berlin
- Pulmonary and Critical Care Research Conference, Department of Medicine, Northwestern University Medical School
- 1999 IBIS/IGP Graduate Programs Joint Seminar, Northwestern University
- University of California San Diego Division of Cellular and Molecular Medicine/Ludwig Cancer Institute Seminar Series
- Synaptic Pharmaceuticals, Paramus, New Jersey
- Hershey Medical Center, Cell and Molecular Biology Graduate Program Seminar Series, Hershey, Pennsylvania
- 3-D Pharmaceuticals, Exton, Pennsylvania
- 1998 Division of Nephrology, Department of Medicine, University of Chicago, Chicago, Illinois
- Department of Biochemistry, Università' di Roma Tor Vergata, Rome, Italy
- Lurie Cancer Center, Northwestern University, Chicago, Illinois
- Department of Biochemistry, University of Lausanne, Lausanne, Switzerland
- Department of Physiology, Johns Hopkins University, Baltimore, Maryland
- Department of Pathology, Northwestern University, Chicago, Illinois
- 1997 Joint seminar, Department of Biochemistry and Department of Pharmacological and Physiological Sciences, University of Chicago, Chicago, Illinois
- Department of Cell and Molecular Biology, Northwestern University, Chicago, Illinois
- Department of Biochemistry, University of California, San Francisco, California
- Tumor Cell Biology Seminar Series, Cancer Center, Northwestern University Chicago, Illinois
- Department of Physiology, Northwestern University, Chicago, Illinois

Children's Memorial Institute for Education and Research, Chicago, Illinois

Department of Medicine, Division of Endocrinology, Northwestern University, Chicago, Illinois

Visual Science Lecture Series, Department of Ophthalmology, Northwestern University, Chicago, Illinois

1996 Department of Biochemistry, University of Texas, Galveston, Texas

Department of Biochemistry, University of North Carolina, Chapel Hill, North Carolina

Department of Pharmacology, Emory University, Atlanta, Georgia

Institute of Neurobiology, Northwestern University, Chicago, Illinois

Department of Biochemistry and Biomembranes Graduate Group SUNY Buffalo, New York

Department of Pharmacology Signal Transduction Seminar Series, Mount Sinai Medical Center, New York, New York

1995 Fudderman Memorial Lecture, Department of Ophthalmology University of Washington, Seattle, Washington

Eli Lilly Lecture, Department of Biochemistry, Michigan State University East Lansing, Michigan

Departments of Pharmacology and Molecular Cancer Biology, Duke University Durham, North Carolina

Department of Biochemistry and Molecular Biology, University of Florida Gainesville, Florida

Department of Pharmacology, University of Iowa, Iowa City, Iowa

Department of Pharmacology, University of Texas Southwestern, Dallas, Texas

R. W. Johnson Pharmaceutical Research Institute, Raritan, New Jersey