

CURRICULUM VITAE

RICHARD I. HUME

Contact Information:

Richard I. Hume, Ph.D.
Arthur F Thurnau Professor, Department of Molecular, Cellular and Developmental Biology
Director, Undergraduate Program in Neuroscience
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Major Research Interests:

Molecular Neurobiology
 Structure and Function of Ion Channels
 Formation and Maintenance of Synaptic Connections

Place of Birth: Youngstown, Ohio

Citizenship: USA

Education:

B.A. Department of Biology 1975
Wesleyan University, Middletown, CT

Ph.D. Department of Biological Sciences 1980
Stanford University, Stanford, CA
Advisor: Peter Getting

Additional Professional Experience:

Post-doctoral fellow Department of Physiology & Biophysics 1979-1981
Washington University School of Medicine
Advisor: Dale Purves

Post-doctoral fellow Department of Anatomy & Neurobiology, 1981-1983
Washington University School of Medicine
Advisor: Gerald Fischbach

Instructor	Cold Spring Harbor Lab Summer Course "Single Channel Recording"	1983
Visiting Scientist	Salk Institute San Diego, CA Host: Stephen Heinemann	1990-1991
Visiting Scientist	University of Chicago Chicago, IL Host: Francisco Bezanilla	Fall 2008
Visiting Scientist	Columbia University New York, NY Host: Martin Chalfie	Winter 2012

Faculty Positions:

Assistant Professor	Department of Biology University of Michigan, Ann Arbor, MI	1983-1989
Associate Professor	Department of Biology University of Michigan, Ann Arbor, MI	1989-1995
Professor	Department of Biology University of Michigan, Ann Arbor, MI	1995- 2001
Professor	Department of Molecular, Cellular and Developmental Biology University of Michigan, Ann Arbor, MI	2001-

Major Administrative Positions:

Associate Director	Interdepartmental Neuroscience Graduate Program University of Michigan	1995- 1998
Associate Chair for Curriculum	Department of Biology University of Michigan	1995-1998
Director	Interdepartmental Neuroscience Graduate Program University of Michigan	1999- 2003
Chair	Department of Molecular, Cellular and Developmental Biology University of Michigan, Ann Arbor, MI	2003- 2008

Acting Chair	Department of Molecular, Cellular and Developmental Biology University of Michigan, Ann Arbor, MI	Winter Term 2013
Director	Undergraduate Program in Neuroscience University of Michigan, Ann Arbor, MI	June 1, 2013-

Honors and Awards:

Faculty

Alfred P. Sloan Foundation Research Fellow, 1984
University of Michigan Neuroscience Faculty Excellence Award, May 1995
LS&A Award for excellence in teaching, 1996
Michigan Association of Governing Boards Distinguished Faculty Award, 1999
Sokol Award of Rackham School of Graduate Studies, 2003
Arthur F. Thurnau Endowed Professorship 2003-
University of Michigan Neuroscience Faculty Excellence Award, 2008

Postdoctoral:

Muscular Dystrophy Association Postdoctoral Fellowship
Washington University Neurobiology Training Grant

Graduate:

Stanford University Integrative Biology Training Grant
Stanford University Biology Fellowship

Undergraduate:

Wesleyan University Summer Research Grant
High honors in Biology
Magna cum laude
Phi Beta Kappa

Current Research Support:

External – NIH 5 - R01 - DK – 115474 “Ion channels in the tubulovesicles” Richard Hume PI,
Mohammed Akaaboune and Wanlu Du Co-PIs. Dec 1, 2017-Nov 30, 2023. Total Direct costs
\$1,250,000 [This original PI of this grant was Haoxing Xu. I replaced him as senior co-PI on July
10, 2020. I managed the grant for years -03 and -04 and wrote the non-competing renewal for year
-04]

Internal – Approximately \$20,000 per year available from Thurnau Professorship and UPiN Directorship

Previous Grants on which Richard Hume was PI:

- CM00002996-00 “Network Properties of Circadian Clock Modulation and Entrainment” Richard I. Hume, PI (Note that this was a subcontract of a grant where the Principal Investigator was Orié Shafer, City University of New York)01/01/19 - 11/30/19 Total direct and indirect costs \$28,568
- NIH R01 NS039196-07 “Studies of P2X ATP receptors” – Richard I. Hume, PI, Dec 1, 2005- Nov 30, 2010. Total direct costs initially authorized \$ 900,000
- NIH R01NS039196-08S1 Supplement to Studies of P2X ATP receptors” – Richard I. Hume, PI, Sep 1, 2009- Nov 30, 2010. Total direct costs \$ 71,902
- NIH F01 NS051001 “Mechanism of Zinc Potentiation of P2X Receptors” (Fellowship for Rachel Tittle), Richard I Hume, PI. Jan. 1, 2005-Dec. 31, 2007. Total direct costs \$95,268
- NIH R01 NS039196 “Studies of P2X ATP receptors” – Dec 1, 2001- Nov 30, 2005, Total direct costs \$800,000
- NIH T32 DC005341 “Early Stage Training in the Neurosciences” (Training Grant) July 1, 2001- June 30, 2006. Total direct costs \$ 1,593,868
- NSF IBN-0077634 “Studies of P2X and P2Y ATP receptors in neuromuscular development” Aug 15, 2000- July 31, 2004. Total Direct costs \$202,771
- NIH NS 33965 "Structure and Function of Glutamate Receptors" July 1, 1996-June 30, 2000. Total Direct costs \$374,910
- NIH NS 21043 "Regulation of synaptic connections during development" July 1, 1992-June 30, 1997. Total Direct costs \$398,276
- NIH NS 25782 "Analysis of the excitatory action of ATP" Feb 1, 1991- Jan 31, 1996. Total Direct costs \$288,876
- NIH NS 25782 "Analysis of the excitatory action of ATP" Feb 1, 1989- Jan 31, 1991. Total Direct costs \$100,576
- American Paralysis Association Grant HB2-9004 "In vitro analysis of cellular mechanisms regulating spinal cord regeneration" Dec 8, 1989- Jan 14, 1992. Total Direct costs \$74,679
- NIH NS 21043 "Regulation of synaptic connections during development" July 1, 1987-June 30, 1991. Total Direct costs \$93,735
- NIH NS 21043 "Regulation of synaptic connections during development" July 1, 1984-June 30, 1987. Total Direct costs \$60,000.

Previous Grants on which Richard Hume was Co-PI:

NIH R01 NS047332-05 “The Dynamics of Synaptic Component at the Neuromuscular Junction of Living Animals” – Mohammed Akaaboune PI, Richard I. Hume participating researcher, Oct 1, 2008-May 31, 2017 Total direct costs \$ 1,093,750

M-cubed Project Overexpressed P2X2 receptors as a potential therapy for neuromuscular disorders- Richard Hume, PI Total direct costs \$20,000. 6/1/2013- 7/30/2014. This project is linked to projects directed by Mohammed Akaaboune and Gabrielle Rudenko, each of who also had \$20,000.

NSF “Research Training Group in Developmental Neurobiology” 1995-2001 Total Direct costs \$1,045,371 Bruce Oakley, PI

NSF “Building the brain: Cellular and Molecular Approaches” 1990-1995, Total Direct costs \$1,207,646 Bruce Oakley, PI

NIH “Laser Scanning Confocal Microscope” 1990. Total Direct costs \$267,000 Steve Easter PI

Major External Service:

NIH Study Section Biophysics of Neural Systems (BPNS)	Ad Hoc reviewer- Feb 2010
NIH Service declined because of administrative load	May 2005, May 2006, April 2007
NIH Special Study Section	May 2004
NIH Special Study Section,	Feb 2003
Chair, Neuroscience Advisory Task Force to the Michigan Health and Aging Research and Development Initiative	1999- 2000
NIH Study Section MDCN-3 (chartered member)	1998- 2000
NIH Study Section Neurology B-1 (chartered member)	1996- 1998
Society for Neuroscience Chapters Committee	1996- 1999

Journals for which papers have been reviewed

Biophysical Journal	Molecular Pharmacology
Brain Research	Nature
British Journal of Pharmacology	Nature Neuroscience
Channels	Neuron
Journal of Biological Chemistry	Neuropharmacology
Journal of Comparative Neurology	Neuroscience
Journal of General Physiology	Proceedings of the National Academy of Sciences USA
Journal of Membrane Biology	Purinergic Signaling
Journal of Neurochemistry	Science
Journal of Neurophysiology	Trends in Biochemical Sciences
Journal of Neuroscience	Trends in cardiovascular medicine
Journal of Neuroscience Methods	
Journal of Physiology	

Organizations for which grants have been reviewed

British Biochemistry & Cell Biology Committee	Paralyzed Veterans of America
GRIN2B Foundation	Spinal Cord Research Foundation
National Institutes of Health	VolkswagenStiftung
National Science Foundation	Huntington's Disease Foundation
Israeli National Science Foundation	Wellcome Foundation
Israel Science Foundation	MRC (Great Britain)
American Paralysis Association	

Committee Service at the University of Michigan

Department of Biology (* Chair of the Committee)

PhD admissions committee 1984-1986 (1985-1986*)
Graduate Studies Committee 1987-1989 (1988-1989*)
Molecular Neurobiology Search Committee 1986-1988
Planning committee for biology external review 1989-1990*
Executive Committee 1991-1993, 1996-1998
Cell Biology Search Committee, 1991-92 *
Head, Neurobiology Subgroup, 1987-1989 *, 1993-95*
Chair, Neurobiology Prelims, 1991-93*
Five year planning committee 1993-94
Molecular Biology Search Committee, 1993-94
Physiology Search Committee 1994-95*
Curriculum Committee 1995-1998 *
Committee to implement new concentrations 1997-98 *
Promotion and Merit Committee 1999-2001 (2000-2001*)
Transition to MCDB Committee 2000-2001

Department of MCDB (* Chair of the Committee)

Promotions and Merit Committee 2001-2003*, 2009*
Neurobiology Search committee 2001-2003 * (Successfully hired one Assistant Professor)
Long Range Neurobiology planning committee 2001-2003 *
Department Chair, 2003-2008 * (successfully hired one Professor and 9 Assistant Professors)
Multi-area Search committee 2009-10 *(co-chair) – (Successfully hired two assistant professors)
Genes, Environment and Behavior Search Committee 2010-11* - (successfully hired one Assistant Professor)
Graduate Admissions committee 2012-2015 *
Acting Chair, 2013- successfully hired one Assistant Professor
Senior career advisor to Assistant Professor Sara Aton 2012-
Member, promotion review committees for Assistant Professors Kwoon Wong and Ann Miller 2016-2017
Faculty Search Committee Prescreening panel 2015-16

UPiN steering committee 2013- *
Neuroscience Search Committee 2016-17*(successfully hired one Assistant Professor)
Promotions review panel for Associate Professor Catherine Collins *
Promotions review panel for Assistant Research Scientist Wanlu Du *
Third Year Review Panel and Tenure Review Panel for Assistant professor Monica Dus 2018-21 *
Third Year Review Panel and Tenure Review Panel for Assistant Professor Josie Clowney 2019-2022 *

Neuroscience Graduate Program (* Chair of the Committee)

Executive Committee 1988-1990, 1992-1994 , 2016- 2018
Admissions Committee 1992-1995 1993-95*, 1997-2000*
Associate Director 1995-1998
Director 1999-2003 *
Prelim revision Committee 2016*

University Level (* Chair of the Committee)

NSF grant steering committee 1992-2002
Provost's ad hoc committee on undergraduate research 1996-97
Provost's ad hoc committee on cognitive neuroscience 1997-98
PIBS curriculum committee 1998-2003
PIBS admission committee 1998-2003
Provost's ad hoc committee on Life Science course design 1999-2000
Rackham Executive Board 2000-2003
LSA and Medical School Dean's committee on the future of Neuroscience 2000-2001
Undergraduate Science Building design committee 2000-2003
LSA ad hoc committee on outreach 2005-2006
PIBS Executive Committee 1998-2008
Biological Scholars Committee 2003-2008
Provost's Committee on textbooks 2007-2008
Five Department Committee to prepare proposal to President's New Faculty Initiative 2009 *
Provost's Committee to provide recommendations to revitalize Neuroscience 2014-15
Launch Committee for Assistant professor of Psychology Gideon Rothschild 2017- 18
Launch Committee for Assistant professor of Chemistry and Biophysics Markos Koutmos 2018- 19*
Launch Committee for Assistant professor of Statistics Jeffrey Reiger 2019- 20*
Provost's Neuroscience Scholars Committee 2001-
Rackham Distinguished Dissertation Award Committee 2018-2021
Neuroscience Graduate Program Director Search Committee 2021

Classroom Teaching Experience

Major Courses Taught (* New Course Developed by Richard I. Hume), *italicized courses are still in the curriculum*, typical enrollment per term and years taught by Richard Hume

Biology 154	Introductory Biology Term B, 600 students, 1995-1997
Biology 201*	Introduction to honors research in Biology, 20 students, 1997, 1999
Biology 222*	Introduction to Neurobiology, 180 students 2005- 2010
Biology 222*	Principles of Cellular and Molecular neuroscience, 100-200 students 2017- 2021
Biology 225/325	<i>Principles of Human and Animal Physiology, 200-400 students, 1984-1990, 2000, 2001, 2014, 2015, 2018</i>
MCDB 322*	Principles of Cellular and Molecular Neuroscience 2022, 125 students
MCDB 351*	Synapses, 2012-2016 Approximately 80 students per year
MCDB 403 *	<i>Molecular Biology of Synapses, 50 students, 2010</i>
MCDB 422*	<i>Molecular Neurobiology, 60 students, 1991-1993, 1996</i>
MCDB 423*	<i>Lab in Molecular Neurobiology, 24 students, 1995-2004</i>
MCDB 453*	<i>Channels and channelopathies 10-20 students, 2016, 2017</i>
MCDB 461*	Neurobiology Senior Thesis – 20 students 2020
Biology 523*	Molecular approaches to Neurophysiology, 10 students, 1984-6, 1988, 1994
Neuroscience 601*	<i>Principles of Neuroscience I, 20 students, 2000-2002, 2006, 2009-2010, 2013-15</i>
MCDB 614*	<i>Model systems in molecular, cellular and developmental biology, 18 students, 2006, 2013</i>
Biology 622*	Topics in Molecular Neurobiology, 12 students, 1991-93
Neuroscience 623*	<i>Graduate Student Molecular Neurobiology lab, 18 students, 2001-2005, 2013-2015</i>
Biology 690	Neuroscience, 25 students, 1988-1990
MCDB 600/800	<i>Graduate seminars in developmental neurobiology, ion channel molecular biology or synaptic development (typically 5-10 registered students plus 5-10 unregistered postdocs and faculty members)- 1995- 2012. 2020</i>

Research Teaching to Undergraduate and Graduate Students

MCDB/Biology 300/360 Undergraduate research, 1984-present
MCDB/Biology 400/460 Advanced Undergraduate research, 1984-present
MCDB/Biology/Neurosci. 700/900/995 PhD Thesis research, 1984-present

Average number of students in these classes for 2013-2020

MCDB 300 or 360 (working in Hume lab)	1 /year
MCDB 300 or 360 (co-sponsored work in another lab)	20/year
MCDB 400 or 460 (working in Hume lab)	1/year
MCDB 400 or 460 (co-sponsored work in another lab)	30/year
MCDB 995/Neurosci 700	1 /year

Trainees for individualized research:

Current lab members

- 1) Meiqin Hu – Originally a Xu lab trainee now co-mentored by Hume, Mohammed Akaaboune and Wanlu Du
- 2) Chenlang Gao – Full time Technician

Current PhD Dissertation Committees memberships, program and mentor

- 1) Elham Asghari Adib – MCDB – Collins
- 2) Jessy Martinez- MCDB- Aton
- 3) Nicholas Denomme – Pharmacology- Isom
- 4) Angelica Previero – MCDB – Dus
- 5) Nichelle Jackson- Pharmacology – Kevin Jones

Former Ph.D. students and last known position

- 1) Beverly Clendening, Ph.D. 1990, Associate Professor, Hofstra University
- 2) Steven Thomas, MD/PhD. 1991, Associate Professor, University of Pennsylvania School of Medicine
- 3) Xi (Erick) Lin, Ph.D. (Co-sponsor) 1993, Professor, Director, Hearing Research Laboratories Emory University
- 4) Hui Liu, Ph.D., 1997, (Subsequently received MBA from University of Michigan)– Chief Financial Officer, Merus B.V.
- 5) Zhen Zhou, Ph.D. 1997, Biotechnology Company, Shanghai China
- 6) Cheryl McCullumsmith MD/PhD 1999, Professor and Chair of Psychiatry, University of Toledo Medical School
- 7) J. Dylan Clyne, Ph.D. 2002, Dean, School of Arts and Sciences and Professor of Biology, Post University, Waterbury CT
- 8) Donna Cross (Co-sponsor after Satoshi Minoshima left the University)- Ph.D. 2007, Assistant Professor, University of Utah
- 9) Andy Hegle- (Co-sponsored after Gisela Wilson left the University)- Ph.D. 2007 Adjunct Professor, University of British Columbia and co-founder of biotechnology company Canalytic Laboratories
- 10) Shlomo Dellal- Ph.D. 2008 Postdoctoral Fellow, New York University Medical School
- 11) Rachel Tittle- Ph.D. 2008 Research Associate at Finnell Birth Defects Research Laboratory University of Texas, Austin
- 12) Sean Low- (Co-sponsored with John Kuwada) PhD. 2008 –Deceased- At the time of his death his title was Visiting Assistant Professor, Department of Chemistry and Biological Sciences, Aoyama Gakuin University, Japan
- 13) Sean Friday-- Ph.D. 2008 Self employed
- 14) Sukanya Punthambaker Ph.D. 2012- Postdoctoral Fellow, Harvard Medical School
- 15) Jenna Persons – 2018 (Co-Sponsored after Orié Shafer left the Department of MCDB) Postdoctoral Fellow Stowers Institute
- 16) Mingxue Gu – 2020 -Originally a Xu lab trainee – Postdoctoral Fellow, HHMI, Bayor College of Medicine (Bellen lab)
- 17) Ce Wang – 2020 PhD student – Originally a Xu lab trainee - AbbVie, Worcester MA

Former Postdoctoral Fellows position and current positions

- 1) Marcia Honig –Professor, University of Tennessee Medical School
- 2) James Walker – Associate Professor, Purdue University
- 3) Stephen Moorman – Professor and Chair of Anatomy, Tauro College of Osteopathic Medicine
- 4) John Burrill- Research scientist, Incyte Genomics
- 5) David Wells – left Assistant Professorship at Yale University to move to prep school teaching at The Doane Stuart School, Rensselaer, NY
- 6) Heejeong Kim- Research Assistant Professor, University of Nebraska
- 7) Luciano Moffatt- Research Investigator, University of Buenos Aires
- 8) Naomi Nagaya- Research Assistant Professor, Texas A & M University
- 9) Louis St. Amant- left Assistant Professorship at University of Montreal for family reasons
- 10) Ping Li – Biotechnology company in China

Completed PhD. Dissertation Committees (year, program and current position of student if known)

- 1) Fred Lamb, MD/PhD.1989, Physiology- Associate Professor, Department of Pediatrics, University of Iowa
- 2) Charlene Waggoner, 1989, Biology- Lecturer, Center for Environmental Programs. Bowling Green State
- 3) Marisela Velez, 1989, Biophysics- Professor- Universidad Autónoma de Madrid
- 4) Mark Washburn, 1990, Neuroscience -
- 5) Sally Schroeter, 1990, Biology- Elan Pharmaceuticals
- 6) Chu-Kuang Chen, MD/PhD 1990, Neuroscience- Assistant Professor of Neurology, University of Michigan
- 7) John Burrill, 1993, Neuroscience- Research scientist, Incyte Genomics
- 8) Jenifer Knight, 1994, Neuroscience – Lecturer, Department of MCDB, University of Colorado, Boulder
- 9) Will Kowalchuk,1995,- Chemistry - Technology and Applications, Mettler Toledo
- 10) Julie Staple, 1995, Neuroscience – Patent Attorney, Gifford, Krass, Groh, Sprinkle, Anderson and Citkowski
- 11) Paul Mermelstein, 1995, Neuroscience – Associate Professor of Neuroscience, University of Minnesota
- 12) Rui Mei, 1996, Biology-
- 13) Matthew Sanders, 1996, Biology-
- 14) Rachel Brewster, 1996, Biology – Associate Professor, University of Maryland Baltimore County
- 15) Monique Mansoura, 1996, Physiology - Genomic Policy and Program Analyst in the Office of Policy and Public Affairs (OPPA) at the National Human Genome Research Institute
- 16) Michael Steketeer, 1996, Neuroscience- Assistant Professor of Ophthalmology, University of Pittsburgh Medical Center
- 17) Charles Yee, 1997, Biology – Software Engineer
- 18) Nicholas Plummer, 1998, Human Genetics- Staff Scientist, NIEHS

- 19) Larry Adams, 1998, Biological Chemistry-
- 20) Mel Dickerson, 1998, Biology- Pfizer Global Research, Ann Arbor, MI
- 21) Qun Zeng, 1998, Biology-
- 22) Maiyon Park, 1998, Biology - Assistant Professor of Biochemistry and Microbiology, Joan C. Edwards School of Medicine, Marshall University
- 23) Kevin Haas, MD/PhD 1998, Neuroscience- Assistant Professor of Neurology, Vanderbilt University
- 24) Kristen Hardiman, 2000, Biology- died in automobile accident
- 25) Wendy Banka, 2000, Cell and Developmental Biology- MS Public Policy 2005- Public Policy consultant
- 26) Brian Mickey, MD/PhD 2002 Neuroscience- Assistant Professor, Department of Psychiatry, University of Michigan
- 27) Matt Bianchi, MD/PhD 2002 Neuroscience- Instructor in Neurology, Harvard Medical School
- 28) David Hinkle, MD/PhD 2003 Neuroscience- Resident in Pediatrics- St. Louis Children's Hospital
- 29) Qin Li, 2004, MCDB- Postdoctoral Fellow, UCLA
- 30) Dorothy Jones-Davis, 2004, Neuroscience- Scientific Project Manager, Neuroscience at Foundation for the National Institutes of Health
- 31) David M. Wu, MD/PhD 2003, Neuroscience- Assistant Surgeon, Massachusetts Eye and Ear Hospital and Instructor in Ophthalmology, Harvard Medical School
- 32) Weibin Zhou, 2005, MCDB- Research Investigator, University of Michigan
- 33) Wilson Cui, 2005, CMB program – Assistant Professor of Anesthesiology, University of California San Francisco
- 34) Tyler Brown- 2007, Postdoctoral Fellow, Brown University
- 35) Dan Marble- 2007, MCDB – Taking time off to care for child
- 36) Emile Bruneau- 2008 Neuroscience Program-Research Scientist, MIT
- 37) John Perkowski- 2008 Neuroscience Program- Postdoctoral Fellow, Burnham Institute
- 38) Michael Manookin- 2009 Neuroscience Program- Instructor, Department of Ophthalmology, University of Washington
- 39) Zhao Qin- 2010- MCDB- Postdoctoral fellow- NYU medical School
- 40) Howard Gritton- 2011- Neuroscience – Postdoctoral Fellow Boston University
- 41) Eric Horstick – 2011- MCDB- Postdoctoral Fellow NIH
- 42) Dongbiao Shen- 2012- MCDB – Law School, University of California Berkeley
- 43) Xiang Wang- 2013- MCDB- Researcher, Denali Therapeutics
- 44) Jeremy Linsley- 2013-CMB Program- Postdoctoral Fellow, University of California San Francisco
- 45) Adam Ilif- 2014-Neuroscience Program- Postdoctoral Fellow, University of Michigan
- 46) Marcelo deOliveira- 2014-MCDB- Left science to pursue the priesthood
- 47) Mohammad Samie- 2014-MCDB – Postdoctoral Fellow, Yale University
- 48) Katherine Lelito – 2014-MCDB- Research Scientist, BASF Agricultural Solutions
- 49) Alison Althouse, 2015 Neuroscience Program- Postdoctoral Fellow, University of Michigan
- 50) Abigail Garrity 2015- Neuroscience –McKinsey Consulting
- 51) Xinran Li-2016 MCDB – Postdoctoral Fellow, Zhejiang University
- 52) Chris Valdez-2016- Neuroscience – National Research Council Postdoctoral Fellowship, United States Air Force

- 53) Jiaxing Li – 2017 MCDB – Postdoctoral Fellow University of Washington
- 54) Nicolette Ognjanovski- 2017 MCDB - Postdoctoral Fellow
- 55) Qiong Gao- 2017 - MCDB, Xu
- 56) Johnny Saldade- 2018- Neuroscience Program, Postdoctoral Fellow UCLA
- 57) Jacob Hull- 2019 -Neuroscience Program, Isom Postdoctoral Fellow, Stanford
- 58) Pou-Ju Chen- 2019- MCDB, Akaaboune, Postdoctoral Fellow, University of Michigan
- 59) Krystal Harrison- 2020 MCDB, Wong, Eli Lily
- 60) Brittany Clawson – 2020- MCDB, Aton, NRC fellowship for research on outreach in STEM
- 61) James Delorme- 2020 Neuroscience, Aton

Former Undergraduate and Masters Students sponsored for research in the Hume lab, subsequent degrees and last known position (= honors thesis)*

Karen Tsuchiya *- M.D. Michigan, Program Director, Molecular Pathology, Seattle Children's Hospital
Kathryn Borden * - Ph.D. Yale- Associate Professor, Department of Pathology and Cell Biology, Faculty of Medicine, Université de Montréal
Katherine Gold * - MSW, M.D. Michigan- Lecturer, Department of Family Medicine University of Michigan
Mark J. Zawisa * M.D. Michigan- Practicing Family Medicine, Brighton MI
Jason Hawley- M.D. Armed Forces Medical School, Department of Neurology, Walter Reed Medical Center
Fawn Juvinal * - M.D. Medical College of Ohio- Practicing Internal Medicine in Ottawa MI
Joanne Greenstein – Program coordinator- Northwestern University Hospital
Lisa LaPointe * - Withdrew from University of Michigan Medical School- Currently working in conservation biology in Alaska and California.
Lin-Fan Wang * - Medical Student, Yale Medical School- Family physician Philadelphia PA
Jamila Power- Medical Student, Michigan State University- Emergency Medicine Sparrow Hospital Lansing MI
Sean Low – (Deceased) PhD University of Michigan. Last position was Assistant Professor, Department of Chemistry and Biological Sciences, Aoyama Gakuin University, Japan
Amir-Kianoosh Fallahi- M.D. Wayne State University- Resident in Surgery Rush Presbyterian Hospital, Chicago, IL
Mahmoud Reza Rahbari- M.D. University of Cincinnati- General Surgeon, Fresno CA
Peter Chi * - PhD in Biostatistics, University of Washington- Assistant Professor Villanova University
Sheela Toprani- Cleveland Clinic Medical School- Neurologist Seattle WA
Joseph Seymour- Medical Student, Wayne State University
Nir Saar * - Teach for America- Educator in Detroit Public Schools
Kashif Shaikh –Indiana University School of Medicine- Neurosurgeon in South Bend IN
Adam Kilian- Medical Student, Michigan State University- Currently Assistant Professor George Washington Medical School
Kimberly Bylsma * - MS genetic counseling, University of Pittsburgh, Research Coordinator, University of Michigan
Chen Li – Unknown
Ian Hsu * – Attended Johns Hopkin Medical School- Psychiatrist, Cambridge MA
Nahid Rashid *, Attended Ohio State Medical School- Internist Barnes Hospital St. Louis MO

Connie Truong *, Medical College of Wisconsin- Pediatrician Aurora CO
Noah Eisen, Software Engineer, San Francisco CA
Jenni Westerhuis – Master’s student – technical sales consulting with Miltenyi.Biotec
Matthew Brown* – high honors 2015- PhD student - Johns Hopkins University
Lynn Daboul*- high honors 2016 – student, Cleveland Clinic Medical School
Sanjna Chokshi* honors 2020 – University of Michigan School of medicine
Chenlag (Spring) Gao * honors 2021 – Currently research assistant in the Hume/Xu lab

Undergraduate Students co-sponsored for research in other labs by Richard Hume

Approximately 90 since 1996, of whom 27 completed honors theses.

Publications: ORCID Number 0000-0001-9807-112X

Papers in refereed journals:

- 1) Hume RI and Berlind A. (1976) Heart and scaphognathite rate changes in a euryhaline crab, *Carcinus maenas*, exposed to a dilute environmental medium. *Biological Bulletin*. 150: 241-254
- 2) Getting PA, Lennard PR and Hume RI (1980) Central pattern generator mediating swimming in Tritonia. I. Identification and synaptic interactions. *Journal of Neurophysiology*. 44:151-164
- 3) Getting PA, Lennard PR and Hume RI (1980) Central pattern generator mediating swimming in Tritonia. II. Initiation, maintenance, and termination. *Journal of Neurophysiology*. 44: 154-173
- 4) Purves D and Hume RI (1981) The relation of postsynaptic geometry to the number of presynaptic axons that innervate autonomic ganglion cells. *Journal of Neuroscience*. 1:441-452
- 5) Hume RI and Purves D (1981) Geometry of neonatal neurones and the regulation of synapse elimination. *Nature*. 293: 469-471
- 6) Hume RI, Getting PA and del Beccaro MA (1982) Motor organization of Tritonia swimming. I. Quantitative analysis of swim behavior and flexion neuron firing patterns. *Journal of Neurophysiology*. 47: 60-74
- 7) Hume RI and Getting PA (1982) Motor organization of Tritonia swimming. II. Synaptic drive to flexion neurons from premotor interneurons. *Journal of Neurophysiology*. 47: 75-90
- 8) Hume RI and Getting PA. (1982) Motor organization of Tritonia swimming. III. Contribution of intrinsic membrane properties to flexion neuron burst formation. *Journal of Neurophysiology*. 47: 91-102
- 9) Hume RI and Purves D (1983) Apportionment of the terminals from single preganglionic axons to target neurons in a mammalian autonomic ganglion. *Journal of Physiology* 338:259-275
- 10) Hume RI, Role LW and Fischbach GD (1983) ACh release from growth cones detected with patches of ACh receptor rich membrane. *Nature*. 305:632-634
- 11) Hume RI and Honig MG (1986) Excitatory action of ATP on embryonic chick muscle. *Journal of Neuroscience*. 6: 681-690.
- 12) Honig MG and Hume RI (1986) Fluorescent carbocyanine dyes allow living neurons of identified origin to be studied in long-term cultures. *Journal of Cell Biology*. 103:171-187
- 13) Hume RI and Thomas SA (1988) Multiple actions of Adenosine-5'-Triphosphate on chick skeletal muscle. *Journal of Physiology*. 406:503-524

- 14) Honig MG and Hume RI (1989) DiI and DiO: versatile fluorescent dyes for neuronal labeling and pathway tracing. *Trends in Neuroscience*. 12:333-341
- 15) Hume RI and Thomas SA (1989) A calcium- and voltage-dependent chloride current in developing chick skeletal muscle. *Journal of Physiology*. 417:241-261
- 16) Thomas SA and Hume RI (1990) Permeation of both cations and anions through a single class of ATP-activated ion channels in developing chick skeletal muscle. *Journal of General Physiology*. 95:569-590
- 17) Moorman SJ and Hume RI (1990) Growth cones of Chick Sympathetic Preganglionic Neurons in vitro Interact with other neurons in a Cell-Specific Manner. *Journal of Neuroscience*. 10:3158-3163
- 18) Thomas SA and Hume RI (1990) Irreversible desensitization of ATP responses in Developing Chick Skeletal Muscle. *Journal of Physiology*. 430: 373-388
- 19) Clendening B and Hume RI (1990) Expression of Multiple Neurotransmitter Receptors by Sympathetic Preganglionic Neurons in vitro. *Journal of Neuroscience*. 10:3977-3991
- 20) Clendening B and Hume RI (1990) Cell Interactions Regulate Dendritic Morphology and Responses to Neurotransmitters in Embryonic Chick Sympathetic Preganglionic Neurons in vitro. *Journal of Neuroscience*. 10: 3992-4005
- 21) Hume RI and Honig MG (1991) Physiological Properties of Newly Formed Synapses between Sympathetic Preganglionic Neurons and Sympathetic Ganglion Neurons. *Journal of Neurobiology*. 22: 249-262
- 22) Thomas SA, Zawisa MJ, Lin X, and Hume RI (1991) A receptor that is highly specific for extracellular ATP in developing chick skeletal muscle. *British Journal of Pharmacology*. 103:1963-1969
- 23) Hume RI, Dingledine R and Heinemann S (1991) Identification of a site in glutamate receptor subunits that controls calcium permeability. *Science*. 253: 1028-1031
- 24) Dingledine R., Hume RI and Heinemann S. (1992) Structural determinants of barium permeation and rectification in non-NMDA glutamate receptor channels. *Journal of Neuroscience*. 12: 4080-4087
- 25) Thomas SA and Hume RI (1993) Single potassium channel currents activated by extracellular ATP in developing chick skeletal muscle: A role for second messengers. *Journal of Neurophysiology*. 69:1556-1566
- 26) Lin X, Hume RI and Nuttall AF (1993) Voltage-dependent block by neomycin of the ATP-induced whole cell current of guinea-pig outer hair cells. *Journal of Neurophysiology*. 70: 1593-1605
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Institutions and meetings where invited presentations were given

Case Western Reserve University
Columbia University
First International Meeting, Society for Zinc in
Biology, Banff Alberta 2008
Gordon Conference on Ion Channels
International Symposium on Adenosine and
Adenine Nucleotides
Medical University of Vienna, Austria
Michigan State University
Purines, 2000 (Madrid)
Purines, 2004 (Chapel Hill)
Purines 2008, Copenhagen Denmark

Salk Institute
St. Louis University
Stanford University
SUNY Stony Brook
University of California Berkeley
University of California, Davis
University of California, San Diego
University of California, San Francisco
University of Chicago
University of Pittsburgh
University of Southern California

University of Toledo
Washington University, St. Louis

Wesleyan University
Yale University

Research Experience:

Current:

The focus of much of the research over my career has been on the how the biophysical properties of ion channels shape the normal and pathological functions of the nervous system. We have also explored the role of ion channels in the physiology of other systems, and mechanisms of synaptic development in the nervous system. Our primary approach is usually electrophysiology, but we also use a wide range of molecular biological, biochemical and imaging approaches both *in vitro* and *in vivo*. We currently are engaged in projects that use mice, zebrafish and fruit flies, as each organism has advantages for answering specific types of questions.

The focus of the current NIH grant is the role of ion channels in tubulovesicles, a lysosome related organelle found in the acid secreting parietal cells of the stomach. This project was initiated in the lab of Haoxing Xu, and I took over directing it when he was no longer able to serve as PI, with Mohammed Akaaboune and Wanlu Du as the co-PIs. Goals 1 and 2 use studies of cultured cells, while goal 3 is using *in vivo* mouse models. The aims of Goal 1, to investigate the role of the calcium permeable ion channel Transient Receptor Potential Mucolipin-1 (ML1), were mostly completed while Professor Xu was the PI and he and his collaborators published a paper in *Developmental Cell* explaining the molecular mechanisms that make TRP-ML1 essential for acid secretion. We are currently working on completing Goal 2, to test the role of KCNQ1 channels in acid secretion (in collaboration with Dr Xu's former postdoc Nirakar Sahoo, of the University of Texas, Rio Grande Valley) and Goal 3, to test the effects of over or under activation of these channels on stomach function and the development of stomach cancers (in collaboration with Dr Juanita Merchant of the University of Arizona).

I am also currently working with MCDB colleague Monica Dus and University of Michigan Biophysics faculty member Sarah Veatch to help train and mentor their lab members in electrophysiological approaches.

Previous research as a faculty member:

The majority of the work done within my lab over the past 30 years has focused on the structure and function of ligand gated ion channels. These molecules mediate rapid signaling from one neuron to the next, by opening ion selective pores in the surface membrane in response to the binding of neurotransmitter released from the adjacent presynaptic terminal. The opening of these pores elicits ion flows that cause excitation or inhibition. When ligand-gated channels spend too much or too little time open, the brain cannot process information correctly. Furthermore, alterations in ligand-gated channel activity can result in overt neurological disease, including epilepsy and neurodegenerative diseases.

For a number of years we examined receptors for glutamate, the major excitatory transmitter in the mammalian brain. A major unanswered question in this area was why there are so many glutamate receptor genes. Molecular cloning work done in several labs showed that there are at least 18 genes that

code for subunits of neuronal glutamate receptors. We took two approaches toward explaining this diversity. The first involved making detailed physiological measurements of the properties of receptors composed of known combinations of glutamate receptor subunits. To achieve this goal we expressed cDNA clones of wild types subunits, and subunits modified by site directed mutagenesis, in *Xenopus* oocytes. A second approach was to make recordings from neurons in primary cell culture, when they were grown with and without their synaptic partners, in order to determine the extent to which cell-cell interaction can regulate the expression of specific types of glutamate receptors. One notable element of this work with the discovery of the Q/R/N site, which is an essential regulator of ion permeation in all classes of glutamate receptors. The specific amino acid at this site plays an essential role in long term potentiation, a molecular mechanism of learning in many parts of the brain.

P2X receptors, which are activated by extracellular ATP (adenosine 5' triphosphate) have been the focus of most of the rest of my work. Over my time as a faculty member, it became clear that P2X receptors are widely expressed in the brain and in skeletal, cardiac and smooth muscle. However, understanding the role of specific subtypes of P2X receptors in brain and muscle function continues to be a topic of interest. One long-term project explored P2X receptor structure and function. Our work and the work of others led to the conclusion that P2X receptors have a molecular architecture that is completely unlike any other type of ligand gated ion channel. We therefore used molecular modeling to make predictions that we then tested by site directed mutagenesis followed by electrophysiological analysis. One major project determined the molecular mechanisms by which three endogenous modulators of P2X receptor activity (Zn^{+2} , H^+ and membrane potential) act to alter P2X channel activity. The reason for focusing on these modulators is that there is abundant evidence that Zn and H^+ levels rise in the brain as a consequence of normal activity, and are dramatically elevated by seizures and by ischemia. It is potentially of great significance that the modulation of P2X₂ receptors by all three conditions goes in the opposite direction to that of the widely expressed NMDA type of glutamate receptors. NMDA receptors are believed to play a key role in learning and memory in the normal brain, and in causing neurological damage following brain injury. Hyperpolarization, low pH and elevated Zn all inhibit current through NMDA receptors, but potentiate current through P2X₂ receptors. Thus the ratio of P2X receptors to NMDA receptors is likely to be a key determinate of whether changes in the brain environment result in a net increase in excitation or inhibition.

The goal of another long term project that spanned my first dozen years on the Michigan faculty was aimed at understanding the cellular interactions that allow neuronal growth cones to find their way to their targets, and then to form synapses, both in the developing and the damaged central nervous system. We used time-lapse video microscopy to observe, *in vitro*, the growth and interaction of processes of identified neurons from the chick spinal cord and the rat brain. We are also used Fura-2 imaging of intracellular free calcium to test the potential role of calcium as a signal involved in transducing one specific behavior, growth cone collapse. As part of this project, we developed techniques for labeling neurons with the fluorescent dye, DiI, which became a very widely used method in neurobiology.

Postdoctoral research:

As a postdoctoral fellow in the laboratory of Dr. Gerald Fischbach, I examined the formation and maintenance of neuromuscular junctions. These experiments involved electrophysiological and morphological examination of cells in culture.

As a postdoctoral fellow in the laboratory of Dale Purves, I studied the mechanisms that regulate the number of presynaptic axons that contact a target neuron. The approach involved intracellular recording from neurons in mammalian autonomic ganglia, followed by dye injection and morphological analysis at the light and electron microscopic levels.

Graduate research:

As a graduate student in the laboratory of Dr. Peter Getting, I analyzed the cellular basis of escape swimming in the nudibranch mollusk, *Tritonia*. The approach was primarily electrophysiological, and involved intracellular recording with multiple microelectrodes from the central neurons that generate this behavior.