**Curriculum Vitae**

**Philip F. Copenhaver, Ph.D.**

Professor, Department of Cell and Developmental Biology

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# I. EDUCATION:

1979 Stanford University, Stanford, CA BS Biology

1979 Stanford University, Stanford, CA MS Biology

1985 Dept of Zoology, University of Washington, Seattle WA Ph.D. Zoology/Neurobiology

# II. PRINCIPAL POSITIONS HELD:

1986-1989 Postdoctoral trainee (NIH NRSA); Washington University School of Medicine, St. Louis, MO. Supervisor: Paul Taghert, Ph.D.

1989-1990 Postdoctoral trainee (NSF); Dept. of Zoology, University of Washington, Seattle, WA. Supervisor: William J. Moody, Ph.D.

1990-1996 Assistant Professor, Cell and Developmental Biology, Oregon Health & Science University, Portland, OR

1996-2011 Associate Professor, Cell and Developmental Biology, Oregon Health & Science University, Portland, OR

2011-present Professor, Cell and Developmental Biology, Oregon Health & Science University, Portland, OR

# III. HONORS AND AWARDS:

1979 Bachelor's of Science awarded "With Distinction"; Stanford University

1981-1985 NIH Predoctoral Traineeship

1986 Finalist, Donald B. Lindsley Prize in Behavioral Neuroscience, SFN

1986-1989 NIH Postdoctoral Fellowship

1995 Alan J. Hill for Excellence in Teaching, Oregon Health Sciences University.

1990 Outstanding Instructor Award, School of Medicine, Oregon Health Sciences

1991-1994 Basil O’Connor Starter Scholar Research Award, March of Dimes

1996 AMSA Golden Apple Award for Excellence in Teaching

1996 Invited speaker, 20th International Congress of Entomology; Florence, Italy.

1996 AMSA Golden Apple Award for Excellence in Teaching

2000 Faculty Excellence in Education Award, OHSU

2005 Allan J. Hill Award for Excellence in Teaching, Basic Sciences, OHSU

2011 Allan J. Hill Award for Excellence in Teaching, Basic Sciences, OHSU

1991-2019 Annual Excellence in Teaching Awards, School of Medicine, OHSU

**Teaching Awards:**

1990 Outstanding Instructor Award, School of Medicine, OHSU

1991 Excellence in Teaching Award, School of Medicine, OHSU

1992 Excellence in Teaching Award, School of Medicine, OHSU

1993 Excellence in Teaching Award, School of Medicine, OHSU

1994 Excellence in Teaching Award, School of Medicine, OHSU

1994 Excellence in Teaching Award, Basic Sciences Graduate Program, OHSU

1995 Excellence in Teaching Award, School of Medicine, OHSU

1995 Excellence in Teaching Award, Basic Sciences Graduate Program, OHSU

1995 Allan J. Hill Award for Excellence in Teaching, Basic Sciences, OHSU

1996 Excellence in Teaching Award, School of Medicine, OHSU

1996 AMSA Golden Apple Award for Excellence in Teaching

1997 Excellence in Teaching Award, School of Medicine, OHSU

1998 Excellence in Teaching Award, School of Medicine, OHSU

1999 Excellence in Teaching Award, School of Medicine, OHSU

2000 Excellence in Teaching Award, School of Medicine, OHSU

2000 Faculty Excellence in Education Award, OHSU

2001 Excellence in Teaching Award, School of Medicine, OHSU

2002 Excellence in Teaching Award, School of Medicine, OHSU

2003 Excellence in Teaching Award, School of Medicine, OHSU

2004 Excellence in Teaching Award, School of Medicine, OHSU

2005 Excellence in Teaching Award, School of Medicine, OHSU

2005 Allan J. Hill Award for Excellence in Teaching, Basic Sciences, OHSU

2005 Excellence in Teaching Award, School of Medicine, OHSU

2006 Excellence in Teaching Award, School of Medicine, OHSU

2006 Excellence in Teaching Award, Basic Sciences Graduate Program, OHSU

2007 Excellence in Teaching Award, School of Medicine, OHSU

2008 Excellence In Basic Medical Sciences Teaching Award

2009 Excellence In Basic Medical Sciences Teaching Award

2009 Excellence in Teaching Award, Basic Sciences Graduate Program, OHSU

2011 Allan J. Hill Award for Excellence in Teaching, Basic Sciences, OHSU

2012 OHSU Student Council Faculty Award, Certificate of Recognition

2013 Excellence In Basic Medical Sciences Teaching Award

2014 Excellence In Basic Medical Sciences Teaching Award

2016 Excellence In Basic Medical Sciences Teaching Award

2016 Edward J. Keenan Teaching Award, OHSU

2017 Excellence In Basic Medical Sciences Teaching Award   
2019 Excellence In Basic Medical Sciences Teaching Award

2020 OHSU Student Council Mentor Award

# IV. PROFESSIONAL ACTIVITIES:

* Membership in professional organizations:

Sigma Xi

Society for Developmental Biology

Society for Neuroscience

American Society for Neurochemistry

American Society for the Advancement of Science

* **Service to Professional organizations:**

1991: Nerve Net Regional Meeting Organizer, OHSU

1999-2000: Medical Research Foundation of Oregon; panel reviewer

2001-2002: NationsBank Research Grants Program; ad hoc reviewer

2001-2003: Austrian Science Fund (FWF) Grants program (2001-2003)

2009; NIH MCDN external reviewer; Challenge Grant Applications

2013-14: External Advisor, Pacific University; Developmental Biology Faculty Search

2015: External Advisor, Paul Allen Family Foundation; reviewer

2016 Panelist, National Science Foundation, Neural Systems Cluster (Organization)

2017: Netherlands Organization for Health Research and Development

  2017-18: External reviewer for The Deltaplan for Dementia

2008-present: Oregon Partnership for Alzheimer’s Research; Research Committee

2017-present: Center for Women’s Health Circle of Giving; reveiwer

2007-present: Alzheimer’s Association; external reviewer

2014-present: Developmental Biology Conference; Judge

2008-present: Oregon Partnership for Alzheimer’s Research; Research Committee

2018: Panelist, VA Merit Review Panel: Neurobiology D

* **Service to Professional Publications:**

2015-present: Editorial Board**,** Frontiers in Molecular Neuroscience

* **Periodic reviewer for:**

Aging Cell Alzheimer’s and Dementia Biochemica et Biophysica Acta BMC Neuroscience Brain Research Cell Motility and the Cytoskeleton Cellular and Molecular Life Sciences Developmental Biology

Development Developmental Neurobiology

FASEB Journal Frontiers in Molecular Neuroscience

Insect Biochemistry and Molecular Biology

Journal of Alzheimer’s Disease J. Clinical Investigation Journal of Comparative NeurologyJournal of Experimental Biology Journal of Insect Physiology Journal of Neurobiology Journal of Neuroscience Journal of Neuroscience Research

Molecular Neurobiology Neurobiology of Disease

Neuroscience Neuroscience Letters

Neurotoxicity Research PLoS Biology PLoS Genetics PLoS One

PNAS Scientific Reports

Steroids

# V. GOVERNMENT AND OTHER PROFESSIONAL SERVICE:

1993-4: Special Emphasis Panel, Career Advancement Awards for Women In Science

2003: National Institute of Environmental Health Sciences reviewer

2006-7: USDA: Suborganismal Biology and Genomics of Arthropods and Nematodes

2009: NIH MCDN external reviewer; Challenge Grant Applications

1995-2005: National Science Foundation; external reviewer for Developmental Neuroscience, Neuroendocrinology

2010: National Science Foundation; reviewer for Physiological and Structural Systems

2012: Panelist, National Science Foundation, Neural Systems Cluster (Organization)

2013-2014: External reviewer, NSF IOS CAREER grant applications

2016: Panelist, National Science Foundation, Neural Systems Cluster (Organization)

2018: Panelist, VA Merit Review Panel: Neurobiology

2019: Panelist, VA Merit Review Panel: Neural Systems Cluster (Organization)

2020 Panelist, NIH ZRG1 MDCN-V(50) Special Emphasis Panel; Alcohol on the Onset and Progression of Alzheimer’s Disease

# VI. UNIVERSITY AND PUBLIC SERVICE:

**Institutional Committees:**

1992-4; 1999-2003: School of Medicine Faculty Council

1990-1993: School of Medicine MS-1 Promotion Board

1999-2000; 2001-2007: Medical Research Foundation of Oregon**;** Research Committee

1991-2002: Curriculum Committee, Gross Anatomy, Imaging, Embryology (MS-1);

1992-1995: Curriculum Revision Committee, Human Growth & Development (MS-II);

1993-2002: Steering Committee and co-coordinator for Gross Anatomy, Imaging, Embryology (MS-1)

1992: Neuroscience Graduate Program, Annual Retreat; Chair and Organizer

1996-1997: LCME Accreditation Review Group

1997-1998: Cell and Molecular Training Program Admissions Committee

2002-2004: Program in Cell and Molecular Biology Steering Committee

1998-2005: Program in Cell and Molecular Biology Admissions Committee

2007: OHSU Steering Committee for the NIH Blueprint Initiative

2007-2`008: School of Medicine Research Committee; Presidential Bridge Fund Committee

2010-2012: School of Medicine LCME Educational Objectives Committee

2013-2014: Committee on Medical and Graduate Education Compensation

2009-2104: School of Medicine Committee on Committees

2009-2015: School of Medicine Medical Student Progress Board

2014: Internal Review Committee for Physiology and Pharmacology (Chair)

2015: AMA Accelerating Change in Medical Education (OHSU meeting)

2014-2015: Collaborative Advancement Award Committee

2014-2016: Biology of Aging Training Grant, faculty mentor

2014-2016: SOM Research Roadmap Portfolio (Neuroscience Cluster); Coordinator for

Alzheimer’s disease and Age-related Dementia Portfolio

2015-2016: Neuroscience Portfolio Committee (Working group for neurotherapeutics)

2008-present: Neuroscience Graduate Program Comprehensive Examination

2014-present: Admissions Interviewer, PMCB, NGP, and MD/PhD graduate program

2012-present: PMCB Steering and Curriculum Committees

2012-present: Conjoint Course Committee

2014-present: PMCB Training Grant, faculty mentor and first year advisor

2004-present: Neuroscience Graduate Program Curriculum and Exam Committees

2014-present: Oregon Brain Institute Leadership Council

2019-present: Director for ‘Development, Differentiation, and Disease’ Hub; Graduate Program in Biomedical Sciences

* **Departmental Committees:**

1992-98; Chair, 1993-98: Cell & Developmental Biology Graduate Admissions Committee

2000-2002: Cell & Developmental Biology Graduate Student Tracking Committee

(1991-2000; Chair 1993-2000: Organizer, Cell & Developmental Biology Annual Retreat

2001-present: Representative for Cell & Developmental Biology, Graduate Council

2007-present: Coordinator, “Biology of Neurodegeneration interest group” (weekly interdepartmental colloquium)

1995-present: Coordinator, “Invertebrate models in Research” weekly meeting (interdepartmental)

2005-2014: Coordinator, Interdepartmental Faculty Noontime Colloquium Series

2013-present: Cell & Developmental Biology Promotion and Tenure Committee

2001-present: Graduate Council, CDB representative

2012-present: Director, Cell & Developmental Biology Graduate Program

2014-present: CDCB Executive Committee (Chair)

2016-present: CDB representative, Commencement, Graduation and Hooding

2019: Director, Development Differentiation and Disease Hub (for PBS Grad Program)

2019: Co-Organizer, CDB/CANB Graduate Program Retreat (with Jeff Tyner)

* **Community Service:**

1990: State Science Educators; Opportunities for science educators at OHSU

1991-2: Research Opportunities for Advanced High School Students; presentation on Research in a medical school; OHSU

1992: Research Opportunities for High School Science Teachers; presentation

1997; Introduction to Research (for AP high school students, Beaverton High School)

1997: Presentation to graduate students, OHSU: “How to give a seminar”.

2002-2004: Coordinator, research internships for high school students, David Douglas

2002-2009; 2012-2015: Annual presentations on Brains in Model Systems (various topics)

2007-present: Organizer, “Biology of Neurodegeneration (BOND) weekly interest group”

1995-present: Coordinator, “Invertebrate models in Research” (weekly intercollegiate colloquium; with Reed, Lewis & Clark, Pacific University, Linfield College faculty

2016-present: Hooding and Commencement, Faculty representative for CDB,

2017-18: Asian Pacific American Medical Student Association (APAMSA) Regional

Meeting VIII Networking and Recruiting Fair, Feb. 27

2018: External Advisor for Ms. Vanessa Kelley; Wellesley College. Advisor: Dr. Beltz

2011-2018: OHSU Research Week Judge

2019: OHSU Unconscious Bias Campus-Wide Initiative (small group discussion)

2018-2019: Moderator, PMCB Faculty Auditions (for CDB)

2018-19: External Advisor/Mentor; Margaret Rose, Undergraduate Honors Thesis, PSU:

“Neuroprotective Effects of Selective Estrogen Receptor Modulators Against Amyloid Beta Toxicity and the Pathways that Provide Protection”

2019: Alliance for Visible Diversity in Science (OHSU): Small Group Discussions with

External Councilors/Speakers (student-sponsored)

2010-2019: OHSU Brain Fair (Brain Awareness Week), Oregon Museum of Science and Industry; interactive presentations on hormonal control of the nervous system

# VII. TEACHING AND MENTORING:

*NOTE: the following tables list teaching accomplishments for* ***2018-2020 only****; teaching accomplishments for previous years are summarized below.*

**Formal Scheduled Classes for OHSU Students:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Qtr** | **Academic Yr** | **Course No. & Title** | **Teaching Contribution** | **Units** | **Class Size** |
| F | 2018/2019 | Conj 650: The Practice and Ethics of Science | 1 hr participate in class discussion;  1 hr lead small group discussion on Scientific Integrity | 1 | ~40  ~10 |
| F | 2018/2019 | FUND 710; Fundamentals (in Medical Basic Science) | 8 hr lecture (4 x 2 hr) on fundamentals of embryology for 1st year medical students | 9 | 135 |
| F | 2018/2019 | DEVH 710 PDX F15 (Developing Human): | 2 hour lecture: Placental development  and congenital defects | 6 | 135 |
| W | 2018/2019 | SMB 710; Skin, Muscles and Bone | 2 hour lecture, embryology of the musculoskeletal system | 7 | 135 |
| W | 2018/2019 | NEUS 625: Cellular and Molecular Neuroscience | *Course Co-director and lecturer:*   * 3 hr lecture (2 X 1.5 hr): * history devel, neuroscience, * Mechs of neuronal migration | 4 | 8 |
| S | 2018/2019 | CPR 710; Cardiopulmonary & Renal | 1 hour lecture, embryology of the respiratory tract | 13 | 135 |
| S | 2018/2019 | HODI 710: Hormones and Digestion | 1.5 hour lecture, gastrointestinal development | 9 | 135 |
| S | 2018/2019 | HODI 710: Hormones and Digestion | 2 hr lecture, craniofacial development | 9 | 135 |
| Su | 2018/2019 | NSF 710: Nervous System Structure and Function | 2 hr lecture, CNS development | 9 | 135 |
| S | 2018/2019 | CELL 615: Adv. Topics in Dev. Neuroscience  (directors | 1.5 hr lecture, history of dev neuro  1.5 hr lecture, GFP revolution | 4 | 9 |
| F | 2019/2020 | FUND 710; Fundamentals (in Medical Basic Science) | 8 hr lecture (4 x 2 hr) on fundamentals of embryology for 1st year medical students | 9 | 135 |
| W | 2019/2020 | SMB 710; Skin, Muscles and Bone | 2 hour lecture, embryology of the musculoskeletal system | 7 | 135 |
| S | 2019/2020 | CPR 710; Cardiopulmonary & Renal | 1 hour lecture, embryology of the respiratory tract (online format) | 13 | 135 |
| S | 2019/2020 | HODI 710: Hormones and Digestion | 1.5 hour lecture, gastrointestinal development (online format) | 9 | 135 |
| S | 2019/2020 | HODI 710: Hormones and Digestion | 2 hr lecture, craniofacial development (online format) | 9 | 135 |
| Su | 2019/2020 | NSF 710: Nervous System Structure and Function | 2 hr lecture, CNS development  (online format) | 9 | 135 |

**SUMMARY OF TEACHING AND MENTORING HOURS IN 2018-19**

|  |  |  |
| --- | --- | --- |
| **Academic Year** | **Teaching/Mentoring Summary** | **Hours** |
| 2018/2019 | Formal class or course teaching hours:  Informal teaching hours and prep time:  Mentoring hours:  Total hours of teaching /mentoring: | 27  150  ~ 200  ~371 |

**SUMMARY OF PAST TEACHING ACCOMPLISHMENTS:**

### 1990-1992: Course director, primary lecturer in Medical Embryology (CELL 613; to 1st year medical students)

* **1992-2013**: Co-coordinator and lecturer for embryology in Gross Anatomy, Imaging, Embryology (MSC1 611; to 1st year medical students); 18 hr lectures, 3 hr review sessions

Lectures given annually on the following topics (2 hrs each):

Lecture: Fertilization, formation of the bilaminar embryo (2 hr)

Lecture: Gastrulation, formation of the trilaminar embryo (2 hr)

Lecture: Differentiation and division of the body cavity, morphogenesis (2 hr)

Lecture: Organogenesis, completion of the embryonic period (2 hr)

Lecture: Development of the respiratory development and related structures (2 hr)

Lecture: Gastrointestinal development (2 hr)

Lecture: Craniofacial development (2 hr)

Lecture: Musculoskeletal development (2 hr)

Lecture: Formation of the Skull and Brain (added in 2010; (2 hr)

Review: essentials of embryology (2-3 hr before examinations)

* **1993-2014**: Lecturer and laboratory demonstrator for Human Growth and Development (MSC1 626; to 2nd year medical students); 2 hr lecture, 2 hr laboratory; topics in placental development:

Presentations given annually:

* + Lecture: Placental formation (2 hr)
  + Laboratory: Placenta structure and function (2 hr)
* **1996-2005**: Lecturer, Introduction to Neuroanatomy (NEUS 623; to 1st year graduate students); lectures on development of the nervous system
  + Lecture: Development of the nervous system (2 hr)
* **1995-2006**: Lecturer, Topics in Neuroscience Research (NEUS 635; to 1st year graduate students); Lecture:
  + Model systems in the study of developmental neuroscience (2 hr)
* **1995-2004**: Lecturer, Mechanisms of Development (CELL 618; taught bi-annually to advanced graduate students):
  + Lecture: Mechanisms of cellular motility and migration (1.5 hr)
  + Directed Discussion: Topics in planar polarity and motility (1.5 hr)
* **1994-2019**: Lecturer, Developmental Neurobiology (CELL 615; taught bi-annually to advanced graduate students):
  + Lecturer, multiple topics; Course Director since 2003; re-designed course in 2007 (see below)
  + Lecture: A brief history of developmental neuroscience (1.5 hr)
  + Lecture: Cell migration in the developing nervous system (1.5 hr)
  + Lecture: Inhibition of neuronal motility in development and regeneration (1.5 hr)
  + Directed Discussion: Topics in neuronal guidance (With Gary Banker; 1.5 hr)
  + Directed Discussion: Topics in signal transduction and neuronal motility (1.5 hr)
* **2006-2019**: Lecturer and Course co-director since 2008: Cellular and Molecular Neuroscience (NEUS 625; taught to 1st year graduate students); multiple topics;Lecture: Brief history of developmental neuroscience,
  + Lecture: Mechanisms of neuronal migration
  + Plus 15 hr led discussion (with other faculty)
* **2013-2014**: BEHN 629: Neuroscience of Aging:
  + lecture: Normal functions for Amyloid Precursor Proteins
* **2010-2018**: CONJ 650: Theory and Practice of Ethics (discussion group leader)
* **2007-2019**: Course Director and lecturer, Advanced Topics in Developmental Neuroscience (CELL615/NEUS637; replaces previous course); multiple topics; taught bi-annually to advanced graduate students;
* In 2019:
  + Lectures in the history of developmental neuroscience; The GFP Revolution; New Advances in Neuronal Migration:
  + Plus 20.5 hr in-class participation in all other discussion groups of this course

Curriculum Development and instructional design:

1990-1992 Developed new curriculum for Medical Embryology (CBA 613), the first-year course given to all medical students at OHSU. Served as course coordinator and primary lecturer; course given “Best Course” award in 1990

1990 Workshop on Problem-Based Learning at OHSU (part of the

Curriculum Revision Committees)

1991-1992 Curriculum Revision Committee, Gross Anatomy, Imaging, Embryology (MSCI 611); development of a revised course that merged Gross Anatomy, Radiology, and Embryology into a single conjoint course for 1st year medical students and physician’s assistant students. Served on the Steering Committee and as co-coordinator for the course from 1992-2002; I continue to serve as primary lecturer for embryology; course was repeatedly given “Best Course” award

1992-1995 Curriculum Revision Committee, Human Growth and Development (MSCI 626): helped develop a revised course that merged topics in prenatal development with other aspects of post-natal growth and reproduction (now given to all 2nd year medical students at OHSU). I continue to serve as a lecturer and laboratory demonstrator in the course (placental development).

1994 Helped develop new course in Developmental Neurobiology (CELL 615) for advanced graduate students. Participated as block leader for topics on cell migration, axon outgrowth, neurodegeneration. Served as course director since 2003. (Now called Advanced Topics in Developmental Neuroscience; see below)

1995 Helped develop a new course in Mechanisms of Development (CELL 618) for advanced graduate students (taught bi-annually; course director, Dr. Jan Christian). Participated in periodic revisions to the curriculum from 1998-2006.

2007 Revised the format and curriculum of Cell 615 (now called “Advanced Topics in Developmental Neuroscience” to include a combination of interactive faculty presentations and mentored discussions by student participants to provide peer teaching experience

2008 Organized a new weekly colloquium on the Biology of Neurodegeneration, an interdepartmental meeting open to faculty, students, and post-doctoral fellows; rotating presentations; I continue to serve as coordinator for this colloquium

2009 Developed revised curriculum for Cellular and Molecular Neuroscience (NEUS 625), a required course in the Neuroscience Graduate Program. I currently serve as co-coordinator (with Dr. Phil Stork) and lecturer for topics in developmental neuroscience.

2014: Curriculum revision, Fundamentals course (new introductory course for first-year medical students)

2014: Curriculum, Skin, Bones and Musculature course (SBM) for 1st year medical students

2015: Curriculum revision, Cardiopulmonary and Renal course (CARE) for 1st year medical students

2015: Curriculum revision, Hormones and Digestion course (HODI) for 1st year medical students

2015: Curriculum revision, Hormones and Digestion course (HODI) for 1st year medical students; added unit on craniofacial development and congenital abnormalities

2015: Curriculum revision, Developing Human (DEVH) for 2nd year medical students

added unit on placental development and congenital abnormalities

2012-19: Bi-Annual Curriculum revision, CELL 615: Advanced Topics in Developmental Neuroscience: New topics for mentored discussions on recent literature

**Education Administration**:

1991-1992 Curriculum Revision Committee, Gross Anatomy, Imaging, Embryology (MSI)

1992-1995 Curriculum Revision Committee, Human Growth & Development (MSII)

1993-2002 Steering Committee & co-coordinator for Gross Anatomy, Imaging, Embryology

### 2004-present Neuroscience Graduate Program Curriculum and Examination Committees

2001-present: Graduate Council, CDB representative

2012-present Program in Molecular and Cellular Biosciences Curriculum Committee

2012-present Program in Molecular and Cellular Biosciences Steering Committee

2012-present: Conjoint Course Committee

2019: Director, Development Differentiation and Disease Hub (for PBS Grad Program

**Undergraduate Students Supervised in 2018-2020:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Dates** | **Name** | **Program or School** | **Faculty role** |
| 2014-2018 | Colleen Kawamoto | Portland State University | Supervisor of training as Laboratory Aide |
| 2014-2018 | Laurelyn Perry | Portland State University | Supervisor, NSF REU Summer research training supervisor; |
| 2015-2018 | Autumn Rainha | Portland State University | Supervisor of training as Laboratory Aide |
| 2014-present | Grace Walker-Stevenson | Portland State University | Supervisor of training as Laboratory Aide |
| 2017-present | Chandelle Bates | Portland State University | Supervisor of training as Laboratory Aide |
| 2017-present | Maggie Rose | Portland State University | Supervisor of training as Laboratory Aide |
| 2018-  present | Lela Brown | Portland State University | Supervisor of training as Laboratory Aide |
| 2018-  present | John Doherty | Portland State University | Supervisor of training as Laboratory Aide |

Mentoring for undergraduates, high school students, and high school teachers:

* Research Mentor for undergraduates:

Michelle McCleskey (1992)

Tina Juul-Damm (1995-6)

Katy King (1999-2000)

Stacy Rivera (2000-2001)

Steve Lagerquist (1999-2002)

Laurie Kaler (2003-2005

Kelsey Mauch (2004-5)

Janneke Bloem (University of Utrecht, NL; 2008-2009)

Laurelyn Perry; NSF REU award, 2012

Amy Nicolaysen; NSF REU award, 2013

Tamra Neblett (Spellman College, Atlanta GA; summer 2014)

Eve Lewinstein (Lewis & Clark; with Norma Velazquez Ulloa, primary advisor), 2017-18

Margaret Rose (PSU); Undergraduate Honors Thesis; 2018-19

* **Other Undergraduate trainees:**

Olivia Oudjehih Shafi Mohammad Tracy Carte Mary Christine Dana Lewis Amanda Hicks Jacquie Robinson Carmen Ocho Oribizil

Gail Borchard Diane Yates Michelle Rasmussen John Longeria Dayna Knapp Katerine Sherman Eric McNeil Andrew Carin Mary Irwin Dat Nguyen Kealii Ching Daniel Bottomly

Nicole Moreland Diep Nguyen Allison Hewlett Shari Ehara Tea Holmes Moonju Lee Jason Fargo Michele Mielcarz Wendy Doggett Chad Freitag Jake Weibel Helen Lee

Stephen Carey Joe Schumski Erika Lablanc Jessica Sepula Lean Hughes Amy Nicolaysen Michael Nguyen Kimberly Gotttshalk Jose Medina Amanda Jefferson

* **Research Mentor for high school science teachers:**

Mr. David Nichols, Vernonia High School, Oregon (1992-3); Murdoch Foundation Training Program for High School Science Educators

**Predoctoral Students Supervised or Mentored in 2018-20:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Dates** | **Name** | **Program or School** | **Faculty role** |
| 2014-  2018 | Caitlin Monaghan | Neuroscience graduate program, OHSU | Dissertation Advisory committee member |
| 2014-  2017 | Diana Parrish | Program in molecular and cell biosciences (PMCB), OHSU | Dissertation Advisory committee member  (chair) |
| 2014-  2018 | Marilynn Chow | PMCB, OHSU | Dissertation Advisory committee member |
| 2017-  present | Matthew Pomaville | PMCB, OHSU | Dissertation Advisory committee member |
| 2017-  present | Tzu-Hai Lin | Neuroscience graduate program, OHSU | Dissertation Advisory committee member |
| 2019 | Matthew Blake | PMCB, OHSU | Neuroscience graduate program, OHSU | Dissertation Advisory committee member |
| 2017-  present | Daniel Miller | Neuroscience graduate program, OHSU | Dissertation Advisory committee member |

**Predoctoral Students Supervised or Mentored in previous years:**

* Graduate student dissertation mentor:

Angela Horgan, Ph.D. 1992-1997; current position: Bionutritionist and coordinator of clinical trials, Clinical and Translational Research Center, OHSU

Jay Wright, Ph.D. 1994-2000; current position: Scientist, Oregon National Primate Research Center, Hillsboro, OR

Tom Coate, Ph.D. 2002-2008; current position: Assistant Professor, Department of Biology, Georgetown University

Jenna Ramaker (defended her dissertation: 10/28/13); currently working in the Global and Community Health programs, Madison Wisconsin

* Graduate Student Qualifying Examination committees:

Michael Varnum Kevin Brege Weihong Yu Kristofer Langlais (chair) Brian Link Susannah Weyte (chair)

YanZhen Cui Sylvia Nelsen (chair) Kay Larkin (chair) Jill Wentzell Gillian Bunker (chair) Brenda Polsner

Kristie Abelson Meghan L. Lindauer Alex Ho Robert Cargill (chair) Laura Knittel (chair) Kimmy Su (chair)

Inna Stetsenko Clayton Winkler (chair) Matt Silverman (chair) Waike Mo Vivian Deng (chair) Elizabeth Walters

Art Riddle (chair) Julia Peredery Derek Musashe Greg Scott (chair) Biliana Veleva Ryan Gardner

Jenna Ramaker Molly Harding Karen Thiebes Diana Parrish Tzu-Hai Lin Jiun-Min Hsu

Matt Pomaville Daniel Miller Alec Peters

* **Graduate Student Dissertation Advisory and examination committees:**

Susan Toth-Fejel Kay Larkin

Raymond Hurst Elizabeth Walters

Zheng Zhang (chair) Kristofer Langlais (chair)

Brian Link (chair) Marnie Preston

Angela Horgan (mentor) Edmund Reese (chair)

Mark Carey Susannah Kassler

Susan Hobson Catherine Selph

Jay Wright (mentor) Thomas Coate (mentor)

YanZhen Cui Brenda Polsner

Xia Ming Xia Wendy Carley Shaut

Kristie Abelson Jill Wentzell (chair)

Alex Ho (chair) Jennifer Petersen

Laura Knittel (chair) Art Riddle (chair)

Derek Musashe Robert Cargill

Jonathan Nelsen (chair) Clayton Winkler (chair)

Julia Maxson Kimmy Su (chair)

Brian Jenkins Julia Peredery

Molly Harding Ryan Gardner

Greg Scott Diana Parrish (chair)

Kang Wang (chair) Caitlin Monaghan (defense)

Alexandra Harrold (defense) Marilyn Chow (DAC, defense)

Alexandra Pincus (SOC) Matthew Blake

Tzu-Hai Lin Matt Pomaville

Daniel Miller Alec Peters

* **Research Mentor for medical students:**

Michelle McCleskey (1993)

Craig Cooms (1994)

* PMCB first year advisor

Erin Helms 2017-2018 (joined CDB)

Kyle Rominie 2017-2018

Alec Peters 2017-2018 (joined CDB)

Eve Lowenstein 2018-2019

Setereh Sharzehi 2018-2019

Haley DuBois 2018-2019 2018 (joined CDB)

Breanna Maniaci 2018-2019

Michelle Ozaki 2019-2020

Adrian Baris 2019-2020

Michael Martinez 2019-2020

Ben Woodruff 2019-2020

* **Postdoctoral Students Mentored:**

Angela Horgan, Ph.D. (2003-4)

Jay Wright, Ph.D. (2001-2)

Laura Knittel, Ph.D. (2003-5)

Thomas Coate, Ph.D. (2008)

Jenna Ramaker, PhD (2016-17

VIII. INVITED PRESENTATIONS:

1985 National Science Foundation, Washington, D.C.; (workshop): "Strategies for the Study of Invertebrate Neuropeptides."

1987 International Conference on Endocrinological Frontiers, Szklarska Poreba, Poland; Peptidergic neurons in the moth enteric nervous system."

1989 Washington University School of Medicine, Dept. of Anatomy and Neurobiology, St. Louis, MO; "Regulation of cell migration and neuronal differentiation in insect embryos."

1990 Keynote Speaker, Oregon State Science Educators Colloquium

1990 Keynote Speaker, Science Opportunities for Undergraduates in Oregon

1990 Oregon Health Sciences School of Dentistry, Portland, OR; "Towards a cellular analysis of neuronal migration during embryonic development”.

1991 Institute for Neuroscience, University of Oregon; Placodes, pathways, and phenotypes: migratory neurons and how they grow in the moth embryo."

1991 Oregon Regional Primate Research Center, Beaverton, OR; "How to make a neuron migrate: pathways, messengers, and regulated phenotypes in the moth embryo."

1992 Dow Institute for Neurological Sciences, Portland, OR "Towards a molecular analysis of neuronal migration during embryonic development."

1994 Invited speaker, Northwest Teratology Society Meetings, Seattle, WA; "Enteric neurodevelopment in the moth."

1995 Invited speaker, Gordon Conference, Cell Contact and Adhesion; "Signaling mechanisms that regulate migration in a simple embryo".

1996 Invited speaker, Reed College, Portland OR: "Cellular and molecular mechanisms controlling cell migration in a simple nervous system"

1996 Invited speaker, 20th International Congress of Entomology; Florence, Italy; “Molecular mechanisms controlling neuronal migration in the insect enteric nervous system”.

1998 Invited speaker, Dept. of Entomology, Oregon State University; "Cellular and Molecular mechanisms controlling neuronal migration in insects"

2000 Keynote speaker, Oregon State Undergraduate Research Forum; "Mechanisms of Cell Migration: what studies in a model system can tell us about mammalian development and disease"

2005 Layton Aging and Alzheimer’s Disease Research Center, Portland OR. “A model systems approach to understanding the role of APP family proteins in neuronal migration”

2007 OHSU Brain Institute; BrainNet (Portland, OR). “Basic Research and Alzheimer’s Disease: why it is critical”.

2008 Invited speaker, University of Oregon, Institute for Neuroscience; Eugene, OR; May 18, 2008; “Peering into the Ephrin paradox: new evidence for an unusual way of regulating neuronal guidance”.

2008 OHSU Foundation, Portland, OR: “A translational continuum of model systems for evaluating treatment strategies in Alzheimer’s disease.

2011 Invited Speaker, OHSU MD/PhD Retreat, Timberline Lodge (Sept. 16-17). “Defining the normal role of a “nasty” protein: Amyloid Precursor Proteins and the control of neuronal motility (a model systems approach)”.

2012 Invited speaker, Department of Biomedical Sciences, Cornell University (March 27). “Defining the normal role of a “nasty” protein: Amyloid Precursor Proteins and the control of neuronal migration”.

2012 Legacy Research Institute Portland (Dec. 13). “Amyloid Precursor Proteins and the control of neuronal migration”.

2013 Stowers Institute For Medical Research, Kansas City, MO (May 1-3).”Defining the normal role of a “nasty” protein:  Amyloid Precursor Proteins and the control of neuronal migration”.

2013 Anesthesiology & Perioperative Medicine, OHSU. “Control of neuronal migration via G proteins and Amyloid Precursor Proteins”.

2013 Pacific University, Forest Grove, Oregon. “Defining the normal role of a “nasty” protein: Amyloid Precursor Proteins and the control of neuronal migration”.

2014 Society for Developmental Biology Annual meeting, Seattle, WA (July 17-24);

Symposium on Neural Development. “Amyloid Precursor Proteins as regulators of G protein-dependent neuronal guidance”

2015 University of Portland, Portland OR; “Defining the normal role of a “nasty” protein:

Amyloid Precursor Proteins in development and Alzheimer’s disease”.

2016 Society for Neuroscience Annual Meeting, Chicago, IL (Oct. 16-21);

“Contactins as regulators of Amyloid Precursor Protein-dependent neuronal guidance”

2016 University of Portland (Nov. 17): “The Amyloid Precursor Protein:  Friend or Foe in Development and Disease?”

2017 Society for Neuroscience Annual Meeting, San Diego, CA (Nov 12-16)

2017 Pediatric Neuroscience, OHSU (Feb. 15): "Amyloid Precursor Protein (APP) signaling

and the control of neuronal development"

2017 Circle of Giving Center for Women’s Health (Sept. 14)

“A Novel Estrogen Receptor Modulator for the Treatment of Alzheimer’s Disease in Women”

2018 CART District Conference, Tri-Cities, TN (April 26-29)

“A Novel Modulator of Membrane Estrogen Receptors for Treating Alzheimer’s Disease

2018 Society for Developmental Biology National Meeting (July 22)

“Novel mechanisms of Ephrin reverse signaling in the control of neuronal migration”

2018 University of Missouri, Kansas City (Sept. 2018)

“Apps for Amyloid Precursor Proteins: how a protein linked with Alzheimer’s Disease helps build the nervous system”

2019 OHSU Brain Institute; BrainNet (Dec. 16, 2019; Portland, OR). “Testing a Novel Strategy for treating Alzheimer’s Disease”.

IX. RESEARCH

**A. CONTRIBUTION TO SCIENCE**

For the past 10 years, my research has focused on the normal functions of amyloid precursor proteins (APP) in the nervous system, and how the misregulation of neurotoxic proteins linked with AD induce neurodegenerative responses. In collaboration with Dr. Joseph Quinn at OHSU, we integrated our assays with into a translational suite for testing candidate compounds that might be protective against neurotoxic proteins associated with AD (Copenhaver et al. 2011). We also have also established assays that employ cultured hippocampal neurons from rats and transgenic mouse models of AD (Gray et al., 2016). Using these assays, we have now demonstrated that STX protects against the neurotoxic effects of Aβ, both in the context of endogenously neuroblastoma cells and in cultured hippocampal neurons from the Tg2576 and 5XFAD mouse models of AD (Gray et al., 2016, and unpublished). In addition, we have established protocols for analyzing the signal transduction mechanisms by which STX protects against the effects of neurotoxic proteins (including Aβ and tau oligomers), based on viability, dendritic complexity, synaptic spine dynamics, and assays of mitochondrial and function and gene expression. Most recently, we have successfully adapted multi-photon imaging protocols to analyze synaptic plasticity within the brains of intact mouse models of AD, which can also be used to analyze the protective effects of STX on mitochondrial function and synaptic integrity in vivo. My studies on STX in cultured neurons have been performed in close collaboration with Martin Kelly, who helped develop STX as an alternative to estrogen and has considerable expertise with brain slice electrophysiology; and with Joe Quinn, whose expertise includes whole-animal assays of cognitive behavior. I am enthusiastic about continuing our collaboration on this multiple-PI project, with the goal of comprehensively testing the mechanisms and benefits of STX in mouse models of AD pathology.

Relevant Publications:

* Copenhaver PF, Anekonda TS, Musashe D, Robinson KM, Ramaker JM, Swanson TL.

Wadsworth TL, Kretzschmar D, Woltjer RL, Quinn JF. (2011). A translational continuum of model systems for evaluating treatment strategies in Alzheimer’s disease: isradipine as a candidate drug Disease Models and Mechanisms 4, 634–48. PMCID: PMC3180227.

* Gray, NA, Zweig, JA, Kawamoto C, Quinn, JF, Copenhaver PF (2016). STX, a novel

membrane estrogen receptor ligand, protects against Aβ toxicity. J. Alzheimer’s Disease 51, 391-403. PMCID: PMC4961356

* Copenhaver, PF, Kögel D (2017). Role of APP Interactions with Heterotrimeric G

Proteins: Physiological Functions and Pathological Consequences. Frontiers Mol. Neurosci. 10:3 (DOI:10.3389/fnmol.2017.00003). PMCID: PMC5281615.

* Ramaker JM & Copenhaver PF (2017). Amyloid Precursor Protein family as

unconventional Go-coupled receptors and the control of neuronal motility. Neurogenesis 4: e1288510 (12 pages) DOI:10.1080/23262133.2017.1288510 (advanced online publication). PMCID: PMC5345750.

**Developmental analysis of the insect neuroendocrine system**

My early work focused on a functional analysis of identified neurosecretory cells in the insect brain that coordinate the essential behavior of adult emergence (eclosion). Using intracellular injection methods, customized bioassays, and polyclonal antibodies that I generated during my training, I mapped the cerebral

neuroendocrine system in Manduca and identified two different populations of brain neurosecretory cells that produce neuropeptides that can trigger Eclosion. I then used a combination of behavioral assays and electrophysiological recordings from semi-intact animals to demonstrate how developmentally regulated activation of specific neurosecretory cells help coordinate the sequence of events required for successful eclosion. This work provided the foundation for other investigators to expand our understanding of this process, which is now known to require a coordinated cascade of neurosecretory peptides and motor patterns to complete this essential behavior at appropriate stages.

Relevant Publications:

* Truman JW, Taghert PH, Copenhaver PF, Tublitz NJ, Schwartz LM. (1981). Eclosion hormone may control all ecdyses in insects. Nature (London) 291, pp. 70–71
* Copenhaver PF, Truman JW. (1986). Identification of the cerebral neurosecretory cells that contain eclosion hormone in the moth Manduca sexta. J. Neurosci. 6, 1738–1747.
* Copenhaver PF, Truman JW. (1986). Control of neurosecretion in the moth Manduca sexta: physiological regulation of the eclosion hormone cells. J. comp. Physiol 158, 445-55.
* Truman JW, Copenhaver PF. (1989). The larval eclosion hormone neurones in Manduca sexta: identification of the brain–proctodeal neurosecretory system. J. Exp Biol. 147, 457-70.

**Manduca as model system of neuronal migration**

During my postdoctoral training, I pioneered the establishment of Manduca as a model system for investigating the mechanisms of neuronal migration in the developing nervous system. Although the importance of neuronal migration had long been recognized in the mammalian brain, efforts to analyze the mechanisms controlling this process had been primarily confined to in vitro assays. By adapting whole-mount immunohistochemical and in situ hybridization protocols, single–cell labeling and time-lapse methods, and a customized embryonic culture assay, I demonstrated that the formation of the enteric nervous system (ENS) in Manduca involves a precise sequence of neuronal and glial migration that resembles the types of motile responses exhibited by developing neurons in the mammalian nervous system. In combination with other model systems, I have used this preparation to investigate a number of signaling pathways that regulate different types of neuronal motility in all higher organisms.

Relevant Publications:

* Copenhaver PF, Taghert PH (1991). Origins of the insect enteric nervous system: differentiation of the enteric ganglia from a neurogenic epithelium. Development 113, 1115–1132.
* Wright JW, Schwinof KM, Snyder MA, Copenhaver PF. (1998). A delayed role for nitric oxide- sensitive guanylate cyclases in a migratory population of embryonic neurons. Dev. Biol 204, 15–33.
* Swanson TL1, Knittel LM, Coate TM, Farley SM, Snyder MA, Copenhaver PF. (2005) The insect homologue of the amyloid precursor protein interacts with the heterotrimeric G protein Goin an identified population of migratory neurons. Developmental Biology. 288, 160–178. PMC2862231
* Copenhaver PF. (2007) How To Innervate A Simple Gut: Familiar Themes And Unique Aspects In The Formation Of The Insect Enteric Nervous System. Dev. Dynamics 236: 1841–1864. PMC3097047.

**Immunoglobulin superfamily in regulating neuronal and glial migration**

Using the Manduca ENS as a model system, I investigated the role of evolutionarily conserved members of the immunoglobulin superfamily of cell adhesion molecules (Ig-CAMs) in regulating neuronal and glial migration. Considerable interest about the role of Ig-CAMs in brain development had been generated by the discovery of the Ig-CAM family in vertebrates, but attempts to ascribe roles to specific receptors produced conflicting models for their normal function. By focusing on Fasciclin II (Fas II; the sole insect ortholog of mammalian NCAM), I demonstrated that different Fas II isoforms are expressed in a precisely regulated manner by developing neurons and glial cells and control distinct aspects of cell adhesion and motility. Collaborative projects with other research groups subsequently showed that different Fas II isoforms regulate similar aspects of motility during adult development. Most recently, we have investigated the signaling pathways by which Ig–CAMs regulate neuronal responses, which has revealed a previously unrecognized role for the G3BP family of Rho-GAP/RNA binding proteins. Our ongoing studies should provide the foundation for exploring how this enigmatic family of proteins contributes to the dynamics of Ig-CAMs in normal development, and in the context of developmental defects caused by the misregulation Ig-CAMs in the mammalian brain.

Relevant Publications:

* Wright JW, Snyder MA, Schwinof KM, Combes S, Copenhaver PF. (1999) A role for Fasciclin II in the guidance of neuronal migration. Development 126, 3217–3228. PMID:10375511.
* Wright JW, Copenhaver PF. (2000) Different isoforms of Fasciclin II play distinct roles in the guidance of neuronal migration during insect embryogenesis. Developmental Biology 225, 59–78. PMID: 10964464.
* Knittel LM, Copenhaver PF, Kent KS. (2001) Remodeling of motor terminals during metamorphosis of the moth Manduca sexta: Expression patterns of two distinct isoforms of Manduca Fasciclin II. J. Comp. Neurol. 434, 69–85. PMID: 11329130
* Higgins MR, Gibson NJ, Eckholdt PA, Nighorn A, Copenhaver PF, Nardi J, Tolbert LP. (2002) Different isoforms of Fasciclin II are expressed by a subset of developing olfactory receptor neurons and by olfactory–nerve glial cells during formation of glomeruli in the moth Manduca sexta. Developmental Biology. 244 134–54. PMID: 11900464

**Regulating Reverse Signaling in Migratory Neurons**

Bi-directional signaling between Ephrins and Eph receptors play crucial functions in the developing nervous system, but the mechanisms controlling these responses are only partially understood. In particular, the role of “reverse” signaling by GPI–linked (type-A) Ephrins had been postulated from cell culture assays, but authentic roles for this process in vivo had until recently been lacking. Taking advantage of the molecular simplicity of Manduca, which express only one type-A Ephrin (GPI–linked MsEphrin) and one corresponding Eph receptor (MsEph), we provided the first unambiguous evidence that reverse signaling via a type-A Ephrin regulates the guidance of migratory neurons, preventing them from crossing enteric midline. We subsequently showed that MsEphrin reverse signaling is mediated via a specific Src family kinase, which our studies suggest leads to retraction responses via Rho- and Rho kinase-dependent modulation of the actin cytoskeleton. Preliminary studies in glioblastoma cells suggest that this pathway is evolutionarily conserved, whereby its misregulation may contribute to invasive responses in metastatic cancers. We are currently testing the hypothesis that MsEphrin reverse signaling is transduced via a novel co-receptor (RPTP10D; a member of the receptor tyrosine kinase family). By exploiting Manduca as a model, these studies will establish a new paradigm for understanding the mechanisms of Ephrin-A reverse signaling in both normal and pathological contexts.

Relevant Publications:

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* Coate TM, Swanson TL, Proctor TM, Nighorn AJ, Copenhaver PF. (2007) Eph receptor expression defines midline boundaries for Ephrin–positive migratory neurons in the enteric nervous system of Manduca sexta. J. Comp. Neurol. 502, 175–191. PMCID: PMC1828045.
* Coate TM, Wirz JA, Copenhaver PF. (2008). Reverse signaling via a glycosyl phosphatidylinositol– linked Ephrin prevents midline crossing by migratory neurons during embryonic development in Manduca. J. Neurosci. 28, 3846–3860. PMCID: PMC2879879.
* Coate TM, Swanson TL, Copenhaver PF. (2009). Reverse signaling by GPI–linked Manduca Ephrin requires a Src family kinase to restrict neuronal migration in vivo. J. Neurosci. 29, 3404–18. PMCID: PMC3100805.

**Amyloid Precursor Protein role in normal development and Alzheimer’s disease**

Amyloid Precursor Protein (APP) is the source of –amyloid peptide fragments that accumulate Alzheimer’s disease (AD), but its normal functions in the brain have remained controversial. Although many studies have shown that APP is upregulated in regions of neuronal migration and growth, identifying the mechanisms by which it regulate neuronal motility has been complicated by compensatory interactions with two close orthologs (APLP1 and APLP2). In contrast, insects express only one ortholog (APPL), which is both functionally and structurally related to human APP, including a conserved intracellular Go-binding domain that interacts with the heterotrimeric G protein Go. Using Manduca and Drosophila for complementary studies, we have shown that APPL directly binds Goin developing neurons, and that APPL-Gosignaling restricts inappropriate migration in response to specific guidance cues. We have also demonstrated that Manduca Contactin expressed by ensheathing glial cells) serves as an authentic ligand that activates APPL-Go signaling in migratory neurons, consistent with evidence that other Contactin family members interact with APP in the mammalian nervous system. Using these different assay systems, we are currently testing the role of candidate effectors (RhoGEFs and TRPC channels) in controlling context-dependent responses mediated by the APP-Gopathway. The goal of these studies will be to establish a framework for understanding how APP-Gosignaling regulates neuronal growth and motility in the healthy brain, and how the misregulation of this pathway by A (or other neurotoxic factors) might contribute to AD.

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* Ramaker JM, Swanson TL, Copenhaver PF. (2013) Amyloid precursor proteins interact with the heterotrimeric G protein Go in the control of neuronal migration. J. Neurosci. 33, 10165–81. PMCID: PMC3682380.
* Ramaker JM, Swanson TL, Copenhaver PF (2016). Manduca Contactin regulates Amyloid Precursor Protein-dependent neuronal migration. J. Neurosci. 36, 8757-75. PMCID: PMC4987443.
* Ramaker, JM, Copenhaver, PF. (2016). Neuronal Migration during Development and the Amyloid Precursor Protein. Current Opinion in Insect Science 18: 1-10. PMCID: PMC5157842
* Ramaker, JM, Cargill R, Swanson TL, Quirindongo H, Cassar M, Kretzschmar D, Copenhaver PF (2016). Amyloid Precursor Proteins Are Dynamically Trafficked and Processed During Neuronal Development. Frontiers Mol. Neurosci. 9:130 (DOI 10.3389/fnmol.2016.00130). PMC5122739.

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Disease Model. WormBase Pub:Biology Dataset. DOI: http://doi.org/10.17912/W2WC7M.

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J.M. Ramaker, T. L. Swanson, P.F. Copenhaver (2010). New evidence that the heterotrimeric G protein Go may directly interact with an Amyloid Precursor Protein ortholog (APPL) in migrating neurons. Society for Neuroscience Abst. 436.15.

P.F. Copenhaver, Anekonda, T.S., Musashe, D., Ramaker, J., Robinson, K.M., Swanson, T.L, Wadsworth, T.L Kretzschmar, D., Woltjer, R.L., and. Quinn, J.F. (2011). A coordinated set of bioassays supports the use of isradipine as a candidate drug for treating Alzheimer’s disease. Society for Neuroscience Abst. 665.01.

J.M. Ramaker, T. L. Swanson, P.F. Copenhaver (2011). Amyloid Precursor Proteins interact with the heterotrimeric G protein Go-alpha during neuronal migration. Society for Neuroscience Abst. 754.05.

J.M. Ramaker, T. L. Swanson, P.F. Copenhaver (2012). A role for Amyloid Precursor Proteins in regulating Goα-dependent neuronal migration in the developing nervous system. Society for Neuroscience Abst. 528.18.

J.M. Ramaker, T. L. Swanson, , J.A. Zweig, P.F. Copenhaver (2013). Interactions between Amyloid Precursor Proteins and the heterotrimeric G protein Goα in the dynamic control of neuronal motility. Society for Neuroscience Abst. 413.17

P.F. Copenhaver, T. L. Swanson, L.J. Perry (2013). Defining a role for Rasputin in Fasciclin II-dependent neuronal migration. Society for Neuroscience Abst. 413;

J.A. Zweig, T. L. Swanson, J.M. Ramaker, P.F. Copenhaver (2014). Amyloid Precursor Proteins as regulators of G protein-dependent neuronal guidance. Society for Neuroscience Annual Meeting Abst. 768.07

P.F. Copenhaver (2014). Amyloid Precursor Proteins as regulators of G protein-dependent neuronal guidance. Society for Developmental Biology Annual meeting, Seattle, WA (July 17-24).

P.F. Copenhaver, J.A. Zweig, T. L. Swanson, J.M. Ramaker (2105). Contactins as regulators of Amyloid Precursor Protein-dependent neuronal guidance. Society for Neuroscience Annual Meeting Abst. 2015-S-5701-SfN

P.F. Copenhaver (2016). Contactins function as ligands for Amyloid Precursor Proteins in regulating polarized neuronal growth”. Society for Developmental Biology Annual meeting.

P.F. Copenhaver, J.M. Ramaker. (2017). New evidence that Amyloid Precursor Proteins function as unconventional Go-coupled receptors that regulate neuronal motility. Society for Neuroscience Annual Meeting Abst. 2017-S-1913-SFN.

P.F. Copenhaver, Kawamoto C, Rainha A. D., Bates C, Lee H-J. (2018). Novel mechanisms of Ephrin reverse signaling in the control of neuronal migration. Society for Developmental Biology Annual meeting, Portland, OR. Abst. 375.

P.F. Copenhaver, C. Bates, A.D. Rainha, C. Kawamoto, H-J Lee (2018), "A novel mechanism for ephrin reverse signaling in the control of neuronal migration. Society for Neuroscience Annual Meeting Abst. 2018-S-2294-SfN.

P.F. Copenhaver, J.M. Ramaker, H-J Lee, G. Walker-Stevenson, C. Bates, (2019), " New evidence that amyloid precursor protein can signal via the heterotrimeric G protein Go to regulate different aspects of neuronal motility”. Society for Neuroscience Annual Meeting Abst. 2019-S-4247-SfN

**A. CURRENT RESEARCH AWARDS AND GRANTS:**

NIH/NINDS R21 NS109884 (Copenhaver, PI) 01/01/19–12/31/20

“Normal and Abnormal Control of APP signaling”. $275K (direct)

NIH/NINDS RF1 NS115898 (Copenhaver, P.I) 04/01/2020 – 03/31/2025

“Novel Mechanisms of APP-Go signaling in the control of neuronal motility”. $1,885,550 (direct)

Veteran’s Administration Merit Grant (Joe Quinn, Copenhaver co-PI (10% FTE for PFC)

The non-classical estrogen receptor Gq-mER as a therapeutic target in AD

**Pending/Submitted Grant Applications:**

NIH/NIA RO1 AG071542 (Copenhaver, P.I; with Joseph Quinn and Martin Kelly, co-PIs))

“‘Neuroprotection by the small molecule STX in a mouse model of Alzheimer's Disease”

Requested budget $2,498,951 (direct)

**Prior Grant Support (completed):**

Medical Research Foundation of Oregon 392-511 (Copenhaver, PI); 03/01/1990-02/28/1991

Developmental physiology of migratory neurons in the moth enteric nervous system; $25,000

National Science Foundation BNS90-10538 (Copenhaver, P.I.); 02/01/1991-07/31/1994; Developmental physiology of migratory neurons in the moth enteric nervous system; $172,170

March of Dimes Basil O’Connor Award 5-FY91-0478 (Copenhaver, PI); 09/01/1991-08/31/1993;

Regulation of cell migration in the embryonic nervous system; $54,546

M.J. Murdock Foundation (Copenhaver, PI); 06/01/1992-05/31/1994

Role of G proteins in regulating migration during embryonic development; $13,000

American Heart Association (Pac NW); OHA 193 (Copenhaver, PI); 02/01/1992-01/31/1993; G proteins and the regulation of cell migration during embryonic development $29,991

March of Dimes Basil O’Connor Award 5-FY93-0979 (Copenhaver, PI); 09/01/1993-06/30/1994

Regulation of cell migration in the embryonic nervous system

Medical Research Foundation of Oregon 666-511 (Copenhaver, PI); 06/01/1994-05/31/1995

Role of APP-related proteins during neuronal migration; $25,000

American Heart Association (Pac NW) OHA 698 (Copenhaver, PI); 07/01/1996-06/30/1998

Developmental physiology of embryonic neurons; $30,000

Medical Research Foundation of Oregon (Copenhaver, PI); 09/01/1998-08/31/1999

Developmental role of monomeric G proteins in neuronal migration; $25,000

National Institutes of Health/NINDS RO1 NS35369 (Copenhaver, PI); 07/01/1994-06/30/2004

Developmental role of G proteins in neuronal migration; $1,068,317

National Institutes of Health/NINDS RO1 NS 34439 (Copenhaver, PI); 12/01/1996-04/30/2006

Guidance of neuronal migration in embryonic development; $1,361,040

Oregon Alzheimer’s Disease Research Small Grants Program (Copenhaver, PI); 05/01/2004-04/30/2005; Developmental role of APP-related proteins during neuronal migration; $25,000

OHSU Proteomics Seed Grant (P.F. Copenhaver, P.I) 01/01/06-01/01/07; A proteomics-based analysis of protein interactions with Fasciclin II during neuronal migration” $5,000

National Institutes of Health /NIA R56 AG025525 (Copenhaver, PI);09/01/2005-08/31/2007 Role of APP-related proteins during neuronal migration; $200,000

National Institutes of Health /NINDS R56 1R56NS065327 (Copenhaver, PI); 7/01/10-6/30/13

Novel mechanisms of Ephrin-A reverse signaling in neuronal migration $250,000

National Institutes of Health /NIA RO1 AG025525 (Copenhaver, PI); 07/06/2006-06/01/2013 Role of APP-related proteins during neuronal migration; $910,687

Medical Research Foundation of Oregon (Copenhaver, PI); 3/01/2012-11/30/2013

Defining the Role of RACK1 in Ephrin-A Reverse Signaling. $40,000

NIH R21 NS080036 (P.F. Copenhaver, P.I.) 05/01/12-04/30/14

A novel role for receptor tyrosine phosphatase in neuroblast migration. $423,500

National Science Foundation 1145716 (Copenhaver, PI) 01/2012–12/2016

Control of neuronal migration by Fasciclin II and Rasputin; $543,036

2016 OHSU Circle of Giving Grant (Copenhaver, PI) 06/01/16-12/31/17

“A novel estrogen receptor modulator for the treatment of Alzheimer’s disease”. $125,000

CART (Coins for Alzheimer’s Trust); (Copenhaver, P.I);

Testing the role of APP-Go misregulation in Alzheimer’s disease”. $75,000.

National Science Foundation 1557414 (Copenhaver, PI) 06/2016–05/2020

Defining the Role of RACK1 in Ephrin Reverse Signaling; $567,399

NIH R01 Supplement DK068098-12S1 (Kelly, P.I) 06/2019–05/2020

Cross-Talk between Leptin and Estrogen Signaling in Hypothalamic Arcuate Neurons

$14,631 (10% salary only)