

KIMBERLY MULLIGAN, PhD

Associate Professor of Biological Sciences

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EDUCATION

PhD **Stanford University**, Stanford, CA
2008 Developmental Biology

BS **University of California at San Diego**, La Jolla, CA
1999 Biochemistry and Cell Biology

POSITIONS & TRAINING

2020 - current **Associate Professor of Biological Sciences:** California State University, Sacramento

2015 - 2020 **Assistant Professor of Biological Sciences:** California State University, Sacramento
Courses: BIO227 Developmental Biology & Regenerative Medicine, BIO 220 Introduction to Scientific Inquiry, BIO 294A Seminar in Molecular and Cellular Biology, BIO 127 Developmental Biology, BIO121 Molecular Cell Biology, BIO2 (Laboratory) Introduction to Cells, Molecules and Genes

2014 **Lecturer, Biological Sciences:** California State University, Sacramento
Courses: BIO186A Cell and Molecular Biology Seminar, BIO 100 Introduction to Scientific Analysis, BIO 1 (Laboratory) Biodiversity, Evolution and Ecology

2011 - 2012 **NIH Ruth L. Kirschstein NRSA Postdoctoral Fellow:** University of California, San Francisco (UCSF)
Department of Psychiatry, Center for Molecular Neurodevelopment
Project: Functional analysis of Dixdc1, a candidate risk gene for neuropsychiatric illness, in mammalian embryonic neurodevelopment
Advisor: Benjamin Cheyette, M.D., PhD

2008 - 2011 **Postdoctoral Research:** Stanford University
Department of Developmental Biology
Project: CIRM-funded initiative to optimize the expression and purification of Wnt proteins for liposome-mediated delivery to stem cell populations. Advisor: Roel Nusse, PhD

2001 - 2008

Doctoral Research: Stanford University

Department of Developmental Biology

Dissertation: Molecular characterization of Swim, a novel Wnt binding protein that promotes long-range signaling in the developing wing disc by maintaining Wingless solubility in the extracellular space.

Advisor: Roel Nusse, PhD

PEER-REVIEWED PUBLICATIONS

- 2022 Welch C and **Mulligan K** "Is bisphenol A a risk factor for neurodevelopmental disorders? What we've learned from developmental neurotoxicity studies in animal models" Invited Review. *International Journal of Molecular Sciences (In peer-review); Preprint published on preprints.org: <https://www.preprints.org/manuscript/202202.0198/v1>*
- 2022 Murphy LN, Nguyen K, Stryder B, Welch C, Sidhu H, Ceballos A, Chu D, Penn A, Tinsley B, Ivory-Ford I, Ghenta K, and **Mulligan K** "Developmental exposure to the environmental neurotoxicant PCB 95 causes mushroom body axon outgrowth defects in *Drosophila melanogaster*" *Science Matters (Submitted, Reviewed, In Revision Phase)*
- 2022 Niosi A, Vo NH, Sundar P, Welch C, Penn A, Yuldasheva Y, Alfareh A, Rausch K, Rukshar T, Cavanaugh J, Yadav P, Peterson S, Brown R, Hu A, Ardon-Castro A, Nguyen D, Crawford R, Lee W, Jensen MH, Morris E, and **Mulligan K**. "Kismet/CHD7/CHD8 affects gut biomechanics, the gut microbiome, and gut-microbiome-brain axis in *Drosophila melanogaster*" *PLoS One (Submitted); Preprint published on bioRxiv: <https://www.biorxiv.org/content/10.1101/2021.12.17.473216v1>*
- 2022 Welch C, Johnson E, Tupikova A, Anderson J, Tinsley B, Newman J, Widman E, Alfareh A, Davis A, Rodriguez L, Visger C, Miller-Schulze JP, Lee W, and **Mulligan K**. "Bisphenol A affects neurodevelopmental gene expression, cognitive function, and neuromuscular synaptic morphology in *Drosophila melanogaster*" *NeuroToxicology*, 89, Pages 67-78, ISSN 0161-813X, <https://doi.org/10.1016/j.neuro.2022.01.006>.
- 2021 Nguyen U, Tinsley B, Sen Y, Stein J, Palacios Y, Ceballos A, Welch C, Nzenkue K, Penn A, Murphy L, Leodones K, Casiquin J, Ivory I, Ghenta K, Danziger K, Widman E, Newman J, Triplehorn M, Hindi Z, **Mulligan K**. (2021) "Exposure to bisphenol A differentially impacts neurodevelopment and behavior in *Drosophila melanogaster* from distinct genetic backgrounds" *NeuroToxicology*, 82, Pages 146-157, ISSN 0161-813X, doi.org/10.1016/j.neuro.2020.12.007
- 2020 Poston RG, Murphy LN, Rejepova A, Ghaninejad-Esfahani M, Joshua Segales J, **Mulligan K**, Saha RN "Specific ortho-hydroxylated brominated ethers inhibit neuronal MEK-ERK signaling and disrupt

neurodevelopmental processes" *J. Biol. Chem.* jbc.RA119.011138.
doi:10.1074/jbc.RA119.011138

- 2018 Martin PM, Stanley RE, Ross AP, Freitas AE, Moyer CE, Brumback AC, lafrati J, Stapornwongkul KS, Dominguez S, Kivimae S, **Mulligan KA**, Pirooznia M, McCombie WR, Potash JB, Zandi PP, Purcell SM, Sanders SJ, Zuo Y, Sohal VS, Cheyette BNR "DIXDC1 contributes to psychiatric susceptibility by regulating dendritic spine and glutamatergic synapse density via GSK3 and Wnt/ β -catenin signaling" *Mol Psych*, Oct 18. doi: 10.1038
- 2017 **Mulligan KA** and Cheyette B "Neurodevelopmental Perspectives on Wnt Signaling in Psychiatry" Invited Review. *Mol Neuropsych*, Jan 13. (2) 219-246
- 2014 Dhamdhare GR, Fang MY, Jiang J, Lee K, Cheng D, Olveda RC, Liu, B, **Mulligan KA**, Carlson J, Ranson R, Weis W, Helms J. (2014) Drugging a Stem Cell Compartment Using Wnt3a Protein as a Therapeutic. *PLoS ONE* 9(1): e83650. <https://doi.org/10.1371/journal.pone.0083650>
- 2012 **Mulligan KA** and Cheyette B (2012) "Wnt signaling in vertebrate neural development and function" Invited Review. *J NeuroImmune Pharmacol.* Dec; 7(4) 774-87
- 2012 **Mulligan KA**, Fuerer C, Ching W, Willert K, Fish M, Nusse R (2012) "Secreted-Wingless interacting molecule (Swim) promotes long-range signaling by maintaining Wingless solubility" *Proc Natl Acad Sci USA.* Jan10;109 (2):370-7
- 2008 Nusse R, Fuerer C, Ching W, **Harnish K***, Logan C, Zeng A, ten Berge D, Kalani Y. (2008) "Wnt signaling and stem cell control" *Cold Spring Harb Symp Quant Biol.* Nov (73) 59-66. Review
- 2004 Johnson ML, **Harnish K***, Nusse R, Van Hul W (2004) "LRP5 and Wnt signaling: a union made for bone." *J Bone Mineral Research.* Nov;19 (11):1749-57. Review

* Kimberly Harnish is my maiden name

MANUSCRIPTS IN PREPARATION

Miller-Schulze JP, Rodriguez LA, **Mulligan K**, Hernandez E. "Quantification of Bisphenol A invertebrate Larval Tissue by High Performance Liquid Chromatography-tandem Mass Spectrometry" *Methods X* (*Submission expected Spring 2022*)

Mulligan K, Welch C, Tupikova A. "Evaluating the neurodevelopmental impacts of toxicants using *Drosophila*" *Current Protocols-Toxicology* (*Submission expected Spring 2022*)

BOOK CHAPTER

2016 **Mulligan K** and Cheyette B "Introduction to Wnt signaling" *Inborn Errors of Development*, 3rd Edition, Oxford University Press

AWARDS AND FELLOWSHIPS

Teaching/Pedagogy Awards

2018 – 2019 Outstanding Teaching Award (CSUS, College of Natural Sciences and Mathematics)
2018 – 2019 Pedagogy Enhancement Award (CSUS, Center for Teaching and Learning)
2017 – 2018 Pedagogy Enhancement Award (CSUS, Center for Teaching and Learning)
2016 – 2017 Promising Practices Course Redesign with Technology Award (CSU Chancellor's Office)

Mentorship Awards

2018 - 2019 SEE Outstanding Faculty Mentor Award (CSUS, Science Educational Equity Program Award)
2017 – 2018 Exceptional Assigned Time Committee Award (CSUS, Faculty Senate Subcommittee Award)

Programmatic Awards

2021 – 2026 California Institute of Regenerative Medicine (CIRM) EDUC2 Bridges Award (\$2,946,500; CIRM Award); Role: PI

Research Awards

2019 – 2022 National Institutes of Health SCORE (SC2) Pilot Award (\$426,000; NIH Award); Role: PI
2021 – 2022 Research and Creative Activities Award (\$7,500; CSUS Award); Role: PI
2021 – 2022 G2E Award (\$2,500; CSUS Award); Role: PI
2017 – 2018 CSUPERB New Investigator Research Award (\$15,000; CSU-wide award)
Role: co-PI
2020 – 2021 Instructionally Related Activities Award (\$5,500; CSUS, Associated Students Incorporated Award); Role: PI
2020 – 2021 Research and Creative Activities Award (\$7,500; CSUS Award); Role: co-PI
2020 – 2021 Goethe Research Award (\$5,000; CSUS Award); Role: PI
2019 – 2020 Goethe Research Award (\$5,000; CSUS Award); Role: PI
2019 – 2020 Instructionally Related Activities Award (\$7,500; CSUS, Associated Students Incorporated Award); Role: PI
2019 – 2020 Sac State Retirees Faculty Development Award (\$500; CSUS Award); Role: Awardee (not an aim-related award)
2019 – 2020 Research and Creative Activities Award (\$7,500; CSUS Award); Role: PI

2018 – 2019 Instructionally Related Activities Award (\$7,000; CSUS, Associated Students Incorporated Award); Role: PI

2018 – 2019 Research and Creative Activities Award (\$7,500; CSUS Award); Role: PI

2018 – 2019 Goethe Research Award (\$2,500; CSUS Award); Role: PI

2018 Faculty Research Incentive Grant (\$2,500; CSUS Award)

2017 – 2018 CSUPERB New Investigator Research Award (\$15,000; CSU-wide award); Role: PI

2017 – 2018 Research and Creative Activities Award (\$7,500; CSUS Award); Role: PI

2017 – 2018 Instructionally Related Activities Award (\$5,759; CSUS, Associated Students Incorporated Award); Role: PI

2017 – 2018 Goethe Research Award (\$2,500; CSUS Award); Role: PI

2016 – 2017 CSUPERB New Investigator Research Award (\$15,000; CSU-wide award)

2016 – 2017 CSUPERB Travel Award (\$1,500; CSU-wide award); Role: PI

2015 – 2016 Provost's Research Incentive Funds Award (\$5,000; CSUS Award)

2011 – 2012 NIH Ruth L. Kirschstein NRSA T32 Fellowship (postdoctoral training grant)

2002 – 2005 Stanford Graduate Fellowship (Stanford University doctoral training grant)

Other Awards

2021 Woman of Influence Award, faculty category, CSUS award

2021 Academic Sabbatical, *Determining the Neurodevelopmental Impacts of Bisphenol Exposure*, "Best of Proposals Submitted" awarded Feb 2021

2020 Awarded Early Tenure

SELECTED SEMINARS

2021 *Getting STEM-FIT! STEM-Forum for Inclusive Teaching as a Model for Broad Dissemination of Inclusive Teaching Practices*
Accelerating Systemic Change Network (ASCN), Transforming Institutions Conference

2021 *Use of an inclusive summative assessment increases deep learning and reduces test anxiety in an undergraduate molecular cell biology course.*
62nd Annual Drosophila Genetics Research Conference

2020 *Using fruit flies to identify autism risk factors.* STEM Scholars Lecture, Sacramento State (Archived lecture recording:
<https://www.csus.edu/college/natural-sciences-mathematics/center-science-math-success/stem-lecture-archive.html>)

2019 *Using Drosophila melanogaster to identify chemicals that confer risk of neurodevelopmental disorders.* West Coast Regional Society for Developmental Biology Conference

- 2019 *Using Drosophila melanogaster to identify chemicals that confer risk of neurodevelopmental disorders.* CSUPERB 31st Annual Biotechnology Symposium.
- 2019 *Using Drosophila melanogaster to identify chemicals that confer risk of neurodevelopmental disorders.* Chico State University Seminar Series
- 2019 *Using Drosophila melanogaster to identify chemicals that confer risk of autism spectrum disorder.* CSUS Chemistry Department Seminar.
- 2018 *Using the Common Fruit Fly to Study Autism.* Sacramento Area Science Project—Science in the River City (an educational partnership between University of California, Davis and Sacramento State University)
- 2017 *Developing Drosophila melanogaster as a Tool to Identify Factors that Confer Risk of Autism.* San Francisco State University Seminar Series.
- 2017 *Using Online Learning Modules to Institute Elements of a Flipped Classroom.* CSUS Biological Sciences Department Seminar.

RESEARCH MENTORING ACTIVITIES

Total number of research students mentored = 77

Current research students = 2 graduate students, 10 undergraduates

Undergraduate student alumni = 60

Graduate student lab alumni = 5

(Complete list of lab alumni: <https://www.mulliganlab.com/people>)

SELECTED STUDENT POSTERS & PRESENTATIONS

(Only recent external conferences are included here; students also present their research at three annual on-campus research symposiums)

- 2022 Anderson J, Raghulan R, Lee W, and Mulligan K. "Bisphenol A affects neurodevelopmental gene expression, cognitive function, and synapse development in *Drosophila melanogaster*" **34th CSUPERB Annual Biotechnology Symposium**
- 2021 Penn A and Mulligan K. "Kismet/CHD7/CHD8 affects gut biomechanics, the gut microbiome, and gut-microbiome-brain axis in *Drosophila melanogaster*" **West Coast Regional Society for Developmental Biology Meeting (Oral presentation)**
- 2021 Penn A, Nguyen U, Tinsley B, Sen Y, Stein J, Palacios Y, Ceballos A, Welch C, Nzenkue K, Murphy L, Widman E, Newman J, and Mulligan K "Bisphenol A Exposure Differentially Impairs Neurodevelopmental Phenotypes in Wild-Type *Drosophila* and in a *Drosophila* Model of Fragile X Syndrome" **Annual Biomedical Research Conference for Minority Students (ABRCMS)**

- 2021 Nzenkue K and Newman J "Bisphenol A differentially impacts neurodevelopment in *Drosophila melanogaster* from distinct genetic backgrounds" **33rd CSUPERB Annual Biotechnology Symposium**
- 2021 Niosi A, Vo N, Amin-Rahbar T, Welch C, Nguyen D, Lew A, Hu A, Crawford R, and Mulligan K "The autism-associated chromatin modifier, Chromodomain Helicase DNA Binding Protein 8, affects gastrointestinal phenotypes in *Drosophila melanogaster*" **33rd CSUPERB Annual Biotechnology Symposium**
- 2021 Tupikova A, Aldafari S, and Mulligan K "Measuring the Impact of Bisphenol A on Nonassociative Learning and Memory in *Drosophila melanogaster* Using the Endoparasitoid Wasp Predator-Response Paradigm" **62nd Annual Drosophila Genetics Research Conference**
- 2021 Penn A and Mulligan K "Bisphenol A differentially impacts neurodevelopment in *Drosophila melanogaster* from distinct genetic backgrounds" **62nd Annual Drosophila Research Conference (Oral presentation)**
- 2021 Welch C, Hojeij N, Murphy L, Ghenta K, Hindi Z, Newman J, Nguyen K, Stryder B, Tinsley B, Triplehorn M, Widman E, and Mulligan K "Developmental exposure to the neurotoxicant polychlorinated biphenyl-95 elicits a synergistic gene by environment response in *fmr1* mutant *Drosophila melanogaster*" **62nd Annual Drosophila Research Conference**
- 2021 Penn A, Nguyen U, Tinsley B, Sen Y, Stein J, Palacios Y, Ceballos A, Welch C, Nzenkue K, Murphy L, Widman E, Newman J, and Mulligan K "Bisphenol A differentially impacts neurodevelopment in *Drosophila melanogaster* from distinct genetic backgrounds" **Stanford Undergraduate Research Conference**
- 2020 Penn A, Nguyen U, Tinsley B, Murphy L, Palacios Y, Ceballos A, Welch C, Mulligan K "Bisphenol A Differentially Impacts Neurodevelopment in *Drosophila melanogaster* from Distinct Genetic Backgrounds" **2020 SACNAS National Diversity in STEM Virtual Conference**
- 2020 Larson H, Newman J, Widman E, Penn A, Witherspoon J, and Mulligan K "Developmental exposure to Bisphenol F impairs courtship behavior and causes developmental lethality" **61st Annual Drosophila Genetics Research Conference**
- 2020 Penn A, Nguyen U, Tinsley B, Sen Y, Stein J, Palacios Y, Ceballos A, Welch C, Nzenkue K, Murphy L, Widman E, Newman J, and Mulligan K "Bisphenol A differentially impacts neurodevelopment in *Drosophila melanogaster* from distinct genetic backgrounds" **61st Annual Drosophila Genetics Research Conference**

- 2020 Niosi A, Vo N, Amin-Rahbar T, Welch C, Nguyen D, Lew A, Hu A, Crawford R, and Mulligan K "The Autism-Associated Chromatin Modifier, Chromodomain Helicase DNA Binding Protein 8, Affects Gastrointestinal Phenotypes in *Drosophila melanogaster*" **Towards Targeted Therapies for Neurodevelopmental Disorders Virtual Symposium**
- 2020 Tupikova A, Nguyen U, Sen Y, Nzenkue K, Leodones K, Danzinger K, Newman J, Widman E, and Mulligan K "Impact of Bisphenol-A on Behavior in the Fragile X Syndrome Model of *Drosophila*" **Towards Targeted Therapies for Neurodevelopmental Disorders Virtual Symposium**
- 2019 Welch C, Ardon-Castro A, Hu A, Lew A, Murphy L, Nguyen D, and **Mulligan K.** "The Autism-Associated Chromatin Modifier, *kismet1* Chromodomain Helicase DNA Binding Protein 8, Affects Axon Guidance and Behavioral Phenotypes in *Drosophila melanogaster*" **West Coast Regional Society for Developmental Biology Meeting**
- 2019 Murphy L, Chu D, Penn A, Hindi Z, Ghenta K, and **Mulligan K.** "Exposure to the Environmental Neurotoxicant Polychlorinated Biphenyl-95 Phenocopies a Common Autism Risk Gene in *Drosophila melanogaster*" **West Coast Regional Society for Developmental Biology Meeting**
- 2019 Tinsley B, Nguyen U, Casiquin J, Ceballos A, Chu D, Palacios Y, Sen Y, Welch C, and **Mulligan K.** "Developmental Exposure to Bisphenol-A Causes Neurodevelopmental Defects in *Drosophila melanogaster*" **32nd CSUPERB Annual Biotechnology Symposium**

STUDENT AWARDS

- 2021 Aliyah Penn (undergraduate)—Best undergraduate talk; Awarded to one undergraduate presenter; West Coast Regional Society for Developmental Biology Meeting
- 2021 Seham Aldafari (undergraduate)—President's Medal; Awarded to one undergraduate; Sacramento State
- 2021 Angelo Niosi (graduate student)—Eden Award winner; Awarded to one master's student; 33rd CSUPERB Annual Biotechnology Symposium
- 2021 Aliyah Penn (undergraduate)—First place oral presentation; CSU Research Competition
- 2021 Aliyah Penn (undergraduate)— First place oral presentation; Sacramento State Research Competition
- 2021 Chloe Welch (graduate student)—Second place oral presentation; Sacramento State Research Competition

- 2020 Lillian Murphy (undergraduate)—President’s Medal; Awarded to one undergraduate; Sacramento State
- 2020 Lillian Murphy (undergraduate)—National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) Award; prestigious NSF fellowship awarded to select incoming graduate students across the US
- 2020 Kevin Nzenkue (undergraduate)—Summer Undergraduate Research Experience (SURE) Award; Sacramento State Natural Sciences and Mathematics (NSM) research award
- 2020 Nguyen (Henry) Vo (undergraduate)—SURE Award; Sacramento State NSM research award
- 2020 Brendan Tinsley (graduate student)—Eden Award finalist; Six finalists from across the CSU system; 32nd CSUPERB Annual Biotechnology Symposium
- 2020 Taylor Moore (undergraduate)—NIH RISE Award recipient
- 2019 Heather Larson (graduate student)—CSUPERB Travel Grant
- 2019 Kaitlin Danziger & Aliyah Penn (undergraduates)—Best poster in their category; West Coast Biological Sciences Undergraduate Research Conference (WBSURC)
- 2019 Chloe Welch (undergraduate)—Best oral presentation in her category; West Coast Biological Sciences Undergraduate Research Conference (WBSURC)
- 2019 Lillian Murphy (undergraduate)—Best undergraduate poster; Awarded to one undergraduate presenter; West Coast Regional Society for Developmental Biology Meeting
- 2019 Lillian Murphy (undergraduate)—Nagel Award winner; Awarded to one undergraduate across CSU system; 31st CSUPERB Annual Biotechnology Symposium
- 2019 Chloe Welch (undergraduate)—Nagel Award finalist; Six finalists from across the CSU system; 31st CSUPERB Annual Biotechnology Symposium
- 2019 Brendan Tinsley (graduate)—First place presenter; Sacramento State Research Competition
- 2019 Jacqueline Stein (undergraduate)—SURE Award; Sacramento State NSM research award
- 2019 Ishmeal Ivory Ford (undergraduate)—Louis Stokes Alliance for Minority Participation (LSAMP) Research Award recipient

- 2019 Alex Ceballos (undergraduate)— LSAMP Research Award recipient
- 2018 Any Ardon-Castro & Alain Hu (undergraduates)— First place poster; Sacramento State Research Competition
- 2018 Chloe Welch (undergraduates)—Best oral presentation in her category; West Coast Biological Sciences Undergraduate Research Conference (WBSURC)
- 2018 Lillian Murphy (undergraduate)—Second place oral presentation in her category; West Coast Biological Sciences Undergraduate Research Conference (WBSURC)
- 2018 Lillian Murphy (undergraduate)—CSUPERB Travel Grant
- 2018 Semaj Hornbuckle & Yomira Palacios (undergraduate)—Louis Stokes Alliance for Minority Participation (LSAMP) Research Award recipients
- 2018 Daniel Chu (undergraduate)—SURE Award; Sacramento State NSM research award
- 2018 Chloe Welch (undergraduate)—Society for Developmental Biology Travel Award
- 2017 Brandon Trafton (undergraduate)—Second place presenter; CSU Research Competition
- 2017 Brandon Trafton (undergraduate)—First place presenter; Sacramento State Research Competition
- 2017 Kimberly Nguyen (undergraduate)—First place poster; Sacramento State Research Competition
- 2017 Darren Nguyen, Aliyah Penn, and Lillian Murphy (undergraduates)—NIH RISE Award recipients
- 2017 Chloe Welch (undergraduate)—SURE Award recipient; Sacramento State NSM research award
- 2017 Lillian Murphy (undergraduate)—SURE Award recipient; Sacramento State NSM research award
- 2017 Lillian Murphy (undergraduate)—CSUPERB Travel Award recipient

PROFESSIONAL LEARNING COMMUNITIES

- 2021 - current STEM Inclusive Teaching Project (National Science Foundation)
- 2021 - 2022 STEM-FIT (Forum for Inclusive Teaching), co-developer (CSUS, College of NSM)

2019 – 2020	Designing for Equity and Student Success (CSUS, Center for Teaching and Learning)
2018 - current	STEM Education Research Collaborative (CSUS, NSM faculty)
2018 - 2019	Equity & Scholarship of Teaching and Learning: Demonstrating Success at Closing the Equity Gap (CSUS, Center for Teaching and Learning)
2016 - 2017	Innovations for STEM Success (CSUS, Center for Teaching and Learning)
2015 - 2016	Course Redesign with Technology (CSU Chancellor's Office)

FACULTY SCHOLARSHIP COMMUNITIES

2018 - 2019	The Collaborative Organization for Research Productivity and Sustainability (CSUS)
2018 - 2019	Translational Health-Related Research: Connecting Basic Science to Clinical Practice (CSUS)
2017 - 2018	The Collaborative Organization for Research Productivity and Sustainability (CSUS)

PROFESSIONAL ASSOCIATIONS

2017 – current	Faculty for Undergraduate Neuroscience
2015 – current	Society of Developmental Biology
2015 – current	Genetics Society of America