

2014 Research Annual Report

Developmental Biology



Division Summary

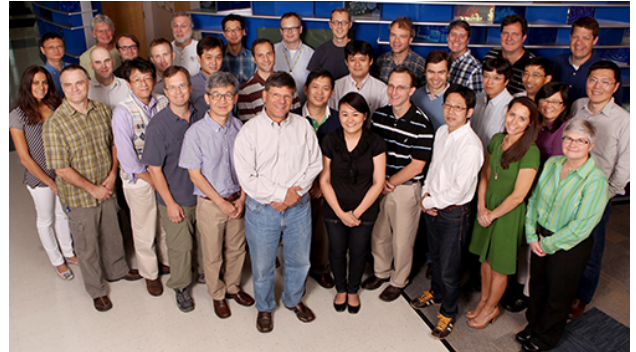
RESEARCH AND TRAINING DETAILS

Number of Faculty	23
Number of Joint Appointment Faculty	25
Number of Research Fellows	70
Number of Research Students	64
Number of Support Personnel	53
Direct Annual Grant Support	\$6,217,917
Peer Reviewed Publications	46

CLINICAL ACTIVITIES AND TRAINING

Number of Clinical Fellows	2
Number of Other Students	41

Division Photo



Row 1: K Campbell, M Nakafuku, J Wells, J Park, R Kopan, F Hamada, R Wacław, Y Ogawa, S Brugmann, S Huppert
Row 2: G Guasch, J Waxman, D Millay, T Nakamura, T DeFalco, X Lin, S Namekawa, S Sumanas, Y Yoshida, R Jiang, Y Lan, Y Hu
Row 3: J Ma, V Cleghon, M Weirauch, S Potter, S Cha, C Mayhew, A Zorn, B Gebelein, S Crone, M Kofron, R Stottmann

Significant Accomplishments

TAGE Core Formed to Enhance Research Capabilities

Our division was tasked with merging the Cincinnati Children's transgenic animal facilities, traditionally housed in Developmental Biology, with similar facilities at the University of Cincinnati. Yueh-Chiang Hu, PhD, was selected to direct the combined facility now called the Transgenic Animal and Genome Editing (TAGE) core. The TAGE core already has generated mutant mice using the CRISPR/Cas9 system and has numerous genome editing projects scheduled for the upcoming year. This critical enabling technology will help researchers across the medical center to improve their research product as well as compete more successfully for external funding. This core will be scaled up to support the new Center for Pediatric Genomics (CPG) at Cincinnati Children's.

Symposium Focuses on Systems Biology

Our division hosted the symposium, "Emerging Leaders in Systems-Level Biology," in April 2014. Thirteen postdoctoral and early-stage investigators were invited to present their latest research in systems biology as it relates to developmental biology and relevant diseases such as cancer. Three leaders in the field - David Sprinzak, PhD, of Tel Aviv University; Arjun Raj, PhD, of the University of Pennsylvania, and Rob Phillips, PhD, of the California Institute of Technology – were keynote speakers. Our division has initiated a faculty search for systems biologists studying developmental processes and related diseases and this symposium helped set the standard for potential candidates.

Annual Retreat Attracts 175 Participants

Our 15th annual retreat, held in Spring 2014, was the largest and most diverse to date. The event attracted 175

participating clinicians, basic scientists and students and included 75 posters from 20 research divisions at Cincinnati Children's. The volume of research presented is roughly on par with regional meetings of the Society of Developmental Biology and reflects the impressive size and depth of the developmental biology community at Cincinnati Children's.

Significant Publications

Fukuhara K, Imai F, Ladle DR, Katayama K, Leslie JR, Arber S, Jessell TM, **Yoshida Y**. **Specificity of monosynaptic sensory-motor connections imposed by repellent *Sema3E*-PlexinD1 signaling.** *Cell Rep*. 2013 14; 5(3):748-58.

The paper addresses a long-standing and still unresolved problem about the organization of functional circuitry in the mammalian spinal cord: what are the molecular mechanisms that impose the specificity of monosynaptic connections between proprioceptive sensory afferents and motor neurons? The remarkable specificity and fidelity of these connections was first pointed out by Eccles and colleagues in the 1950s, but despite 60 years of study of this canonical central connection, we still have little idea of underlying mechanism. This study shows that *plexinD1*⁺ proprioceptive sensory afferents normally avoid forming monosynaptic connections with *Sema3e*⁺ motor neurons, yet are able to form direct connections with *Sema3e*^{off} motor neurons. Anatomical and electrophysiological assays after genetic abrogation of *Sema3e*-plexinD1 signaling demonstrate that repellent signaling underlies aspects of the specificity of monosynaptic sensory-motor connections in these reflex arcs.

Raines AM, Adam M, Magella B, Meyer SE, Grimes HL, Dey SK, **Potter SS**. **Recombineering-based dissection of flanking and paralogous Hox gene functions in mouse reproductive tracts.** *Development*. 2013 140(14):2942-52.

The Hox genes are among the key regulators of development. Hox mutations in simpler organisms can cause dramatic homeotic transformations of one body part into another. In mammals, however, the study of Hox genes is greatly confounded by their high number, with thirty nine total, and overlapping function. In addition they are arranged in clusters, with shared interspersed enhancers. Deletion of blocks of DNA with multiple Hox genes therefore removes regulatory elements that are required for normal expression of the remaining Hox genes. To help overcome these obstacles the Potter lab devised a novel recombineering strategy that allows the simultaneous frame shift mutation of multiple flanking Hox genes. Mice with many different combinations of Hox gene mutations have been generated, thereby removing increasing layers of redundant function. This paper describes striking anterior homeotic mutations that result in the reproductive tracts of males and females. For example the *Hoxa9,10,11/Hoxd9,10,11* mutant uterus now expresses genes normally only expressed in the more anterior oviduct. In addition an unexpected posteriorization of the epithelial lining of the uterus was observed. The results show that both flanking and paralogous Hox genes redundantly provide a Hox code that properly defines segment identity and protects from both anterior and posterior shifts.

Ehrman LA, Mu X, **Waclaw RR**, **Yoshida Y**, Vorhees CV, Klein WH, **Campbell K**. **The LIM homeobox gene *Isl1* is required for the correct development of the striatonigral pathway in the mouse.** *Proc Natl Acad Sci U S A*. 2013 110(42):E4026-35.

This paper demonstrates the role of the LIM homeodomain protein *Isl1* in the development of the direct striatonigral pathway in the mouse. *Isl1* functions both cell autonomously in the striatonigral neurons to control survival as well as in thalamic neurons that reside along the pathway regulating their axon pathfinding. These findings have implications for the childhood neurological disorder ADHD because *Isl1* mutants exhibit hyperactivity and ablated response to stimulants, and thus, may model certain aspects of this disorder.

Grande A, Sumiyoshi K, Lopez-Juarez A, Howard J, Sakthivel B, Aronow B, **Campbell K**, **Nakafuku M**.

Environmental impact on direct neuronal reprogramming in vivo in the adult brain. *Nat Commun.* 2013;4:2373.

Direct reprogramming of non-neuronal cells to generate new neurons is a promising approach to repair damaged brains. Whether such cell reprogramming can be induced in vivo was unknown. This paper demonstrates that a combination of local exposure to growth factors and retrovirus-mediated overexpression of the neurogenic transcription factor Neurogenin2 can induce new neurons from non-neuronal cells in the adult rodent neocortex and striatum where neuronal turnover is otherwise very limited.

Liu H, **Lan Y**, Xu J, Chang CF, **Brugmann SA**, **Jiang R**. **Odd-skipped related-1 controls neural crest chondrogenesis during tongue development.** *Proc Natl Acad Sci U S A.* 2013 12;110(46):18555-60.

Development of the muscular tongue is a major vertebrate adaptation to terrestrial life. Interestingly, although the tongues of birds and mammals initially develop similarly, the bird tongue is under-pinned by an extensive internal skeleton, whereas the oral part of the mammalian tongue is boneless, which is critical not only for feeding but also for phonetic articulation and oral health. This paper shows that the mouse embryonic tongue, but not that in chick, expresses high levels of the odd-skipped related-1 (Osr1) transcription factor, which represses expression of Sox9, the master regulator of cartilage formation. Mice lacking Osr1 function develop a cartilage in the anterior tongue reminiscent of that in chick. These data provide unique insights into the mechanisms of tongue development and evolution.

Division Publications

1. Alqadah A, Hsieh YW, Chuang CF. **A molecular link between distinct neuronal asymmetries.** *Cell Cycle.* 2014; 13:1515-6.
2. Alqadah A, Hsieh YW, Chuang CF. **microRNA function in left-right neuronal asymmetry: perspectives from *C. elegans*.** *Front Cell Neurosci.* 2013; 7:158.
3. Bribian A, Nocentini S, Llorens F, Gil V, Mire E, Reginensi D, Yoshida Y, Mann F, Del Rio JA. **Sema3E/PlexinD1 regulates the migration of hem-derived Cajal-Retzius cells in developing cerebral cortex.** *Nat Commun.* 2014; 5:4265.
4. Brugmann SA, Wells JM. **Building additional complexity to in vitro-derived intestinal tissues.** *Stem Cell Res Ther.* 2013; 4 Suppl 1:S1.
5. Chiu H, Alqadah A, Chang C. **The role of microRNAs in regulating neuronal connectivity.** *Front Cell Neurosci.* 2014; 7:283.
6. Chiu H, Chang C. **Rejuvenating nerve cells in adults.** *Aging (Albany NY).* 2013; 5:485-6.
7. Delgiorno KE, Hall JC, Takeuchi KK, Pan FC, Halbrook CJ, Washington MK, Olive KP, Spence JR, Sipos B, Wright CV, Wells JM, Crawford HC. **Identification and manipulation of biliary metaplasia in pancreatic tumors.** *Gastroenterology.* 2014; 146:233-44 e5.
8. Dunty WC, Jr., Kennedy MW, Chalamalasetty RB, Campbell K, Yamaguchi TP. **Transcriptional profiling of Wnt3a mutants identifies Sp transcription factors as essential effectors of the Wnt/beta-catenin pathway in neuromesodermal stem cells.** *PLoS One.* 2014; 9:e87018.
9. Ehrman LA, Mu X, Waclaw RR, Yoshida Y, Vorhees CV, Klein WH, Campbell K. **The LIM homeobox gene *Isl1* is required for the correct development of the striatonigral pathway in the mouse.** *Proc Natl Acad Sci U S A.* 2013; 110:E4026-35.
10. Ehrman LA, Nardini D, Ehrman S, Rizvi TA, Gulick J, Krenz M, Dasgupta B, Robbins J, Ratner N, Nakafuku M, Waclaw RR. **The protein tyrosine phosphatase *Shp2* is required for the generation of oligodendrocyte progenitor cells and myelination in the mouse telencephalon.** *J Neurosci.* 2014; 34:3767-78.
11. Fukuhara K, Imai F, Ladle DR, Katayama K, Leslie JR, Arber S, Jessell TM, Yoshida Y. **Specificity of**

- monosynaptic sensory-motor connections imposed by repellent Sema3E-PlexinD1 signaling.** *Cell Rep.* 2013; 5:748-58.
12. Grande A, Sumiyoshi K, Lopez-Juarez A, Howard J, Sakthivel B, Aronow B, Campbell K, Nakafuku M. **Environmental impact on direct neuronal reprogramming in vivo in the adult brain.** *Nat Commun.* 2013; 4:2373.
 13. Hsieh YW, Alqadah A, Chuang CF. **Asymmetric neural development in the *Caenorhabditis elegans* olfactory system.** *Genesis.* 2014; 52:544-54.
 14. Katayama K, Imai F, Campbell K, Lang RA, Zheng Y, Yoshida Y. **RhoA and Cdc42 are required in pre-migratory progenitors of the medial ganglionic eminence ventricular zone for proper cortical interneuron migration.** *Development.* 2013; 140:3139-45.
 15. Katayama K, Imai F, Suto F, Yoshida Y. **Deletion of Sema3a or plexinA1/plexinA3 causes defects in sensory afferent projections of statoacoustic ganglion neurons.** *PLoS One.* 2013; 8:e72512.
 16. Kopan R, Chen S, Little M. **Nephron progenitor cells: shifting the balance of self-renewal and differentiation.** *Curr Top Dev Biol.* 2014; 107:293-331.
 17. Kopan R, Chen S, Liu Z. **Alagille, Notch, and robustness: why duplicating systems does not ensure redundancy.** *Pediatr Nephrol.* 2014; 29:651-7.
 18. Lan Y, Jia S, Jiang R. **Molecular patterning of the mammalian dentition.** *Semin Cell Dev Biol.* 2014; 25-26:61-70.
 19. Li Z, Guo Y, Han L, Zhang Y, Shi L, Huang X, Lin X. **Debra-mediated ci degradation controls tissue homeostasis in *Drosophila* adult midgut.** *Stem Cell Reports.* 2014; 2:135-44.
 20. Liu H, Lan Y, Xu J, Chang CF, Brugmann SA, Jiang R. **Odd-skipped related-1 controls neural crest chondrogenesis during tongue development.** *Proc Natl Acad Sci U S A.* 2013; 110:18555-60.
 21. Luebbering N, Charlton-Perkins M, Kumar JP, Rollmann SM, Cook T, Cleghon V. ***Drosophila* Dyrk2 plays a role in the development of the visual system.** *PLoS One.* 2013; 8:e76775.
 22. Ma T, Wang C, Wang L, Zhou X, Tian M, Zhang Q, Zhang Y, Li J, Liu Z, Cai Y, Liu F, You Y, Chen C, Campbell K, Song H, Ma L, Rubenstein JL, Yang Z. **Subcortical origins of human and monkey neocortical interneurons.** *Nat Neurosci.* 2013; 16:1588-97.
 23. McCauley HA, Guasch G. **Serial orthotopic transplantation of epithelial tumors in single-cell suspension.** *Methods Mol Biol.* 2013; 1035:231-45.
 24. Nolan K, Kattamuri C, Luedeke DM, Deng X, Jagpal A, Zhang F, Linhardt RJ, Kenny AP, Zorn AM, Thompson TB. **Structure of protein related to Dan and Cerberus: insights into the mechanism of bone morphogenetic protein antagonism.** *Structure.* 2013; 21:1417-29.
 25. Pandey RN, Wang TS, Tadjuidje E, McDonald MG, Rettie AE, Hegde RS. **Structure-activity relationships of benzobromarone metabolites and derivatives as EYA inhibitory anti-angiogenic agents.** *PLoS One.* 2013; 8:e84582.
 26. Potter SS, Brunskill EW. **Building an atlas of gene expression driving kidney development: pushing the limits of resolution.** *Pediatr Nephrol.* 2014; 29:581-8.
 27. Raines AM, Adam M, Magella B, Meyer SE, Grimes HL, Dey SK, Potter SS. **Recombineering-based dissection of flanking and paralogous Hox gene functions in mouse reproductive tracts.** *Development.* 2013; 140:2942-52.
 28. Reed C, Hutcheson J, Mayhew CN, Witkiewicz AK, Knudsen ES. **RB tumor suppressive function in response to xenobiotic hepatocarcinogens.** *Am J Pathol.* 2014; 184:1853-9.
 29. Rost MS, Sumanas S. **Hyaluronic acid receptor Stabilin-2 regulates Erk phosphorylation and arterial-venous differentiation in zebrafish.** *PLoS One.* 2014; 9:e88614.
 30. Runck LA, Method A, Bischoff A, Levitt M, Pena A, Collins MH, Gupta A, Shanmukhappa S, Wells JM,

- Guasch G. **Defining the molecular pathologies in cloaca malformation: similarities between mouse and human.** *Dis Model Mech.* 2014; 7:483-93.
31. Schiesser JV, Wells JM. **Generation of beta cells from human pluripotent stem cells: are we there yet?** *Ann N Y Acad Sci.* 2014; 1311:124-37.
 32. Serai SD, Wallihan DB, Venkatesh SK, Ehman RL, Campbell KM, Sticka J, Marino BS, Podberesky DJ. **Magnetic resonance elastography of the liver in patients status-post fontan procedure: feasibility and preliminary results.** *Congenit Heart Dis.* 2014; 9:7-14.
 33. Seto Y, Nakatani T, Masuyama N, Taya S, Kumai M, Minaki Y, Hamaguchi A, Inoue YU, Inoue T, Miyashita S, Fujiyama T, Yamada M, Chapman H, Campbell K, Magnuson MA, Wright CV, Kawaguchi Y, Ikenaka K, Takebayashi H, Ishiwata S, Ono Y, Hoshino M. **Temporal identity transition from Purkinje cell progenitors to GABAergic interneuron progenitors in the cerebellum.** *Nat Commun.* 2014; 5:3337.
 34. Suzuki T, Mayhew C, Salles A, Chalk C, Carey BC, Malik P, Wood RE, Trapnell BC. **Use of induced pluripotent stem cells to recapitulate pulmonary alveolar proteinosis pathogenesis.** *Am J Respir Crit Care Med.* 2014; 189:183-93.
 35. Wang S, Cha SW, Zorn AM, Wylie C. **Par6b regulates the dynamics of apicobasal polarity during development of the stratified *Xenopus* epidermis.** *PLoS One.* 2013; 8:e76854.
 36. Wells JM, Spence JR. **How to make an intestine.** *Development.* 2014; 141:752-60.
 37. Xu J, Liu H, Park JS, Lan Y, Jiang R. **Osr1 acts downstream of and interacts synergistically with Six2 to maintain nephron progenitor cells during kidney organogenesis.** *Development.* 2014; 141:1442-52.
 38. Yang D, Baumann JM, Sun YY, Tang M, Dunn RS, Akeson AL, Kernie SG, Kallapur S, Lindquist DM, Huang EJ, Potter SS, Liang HC, Kuan CY. **Overexpression of vascular endothelial growth factor in the germinal matrix induces neurovascular proteases and intraventricular hemorrhage.** *Sci Transl Med.* 2013; 5:193ra90.
 39. Yang D, Sun YY, Lin X, Baumann JM, Dunn RS, Lindquist DM, Kuan CY. **Intranasal delivery of cell-penetrating anti-NF-kappaB peptides (Tat-NBD) alleviates infection-sensitized hypoxic-ischemic brain injury.** *Exp Neurol.* 2013; 247:447-55.
 40. Yang D, Sun YY, Lin X, Baumann JM, Warnock M, Lawrence DA, Kuan CY. **Taming neonatal hypoxic-ischemic brain injury by intranasal delivery of plasminogen activator inhibitor-1.** *Stroke.* 2013; 44:2623-7.
 41. You J, Zhang Y, Li Z, Lou Z, Jin L, Lin X. **Drosophila Perlecan Regulates Intestinal Stem Cell Activity via Cell-Matrix Attachment.** *Stem Cell Reports.* 2014; 2:761-9.
 42. Zeng X, Lin X, Hou SX. **The Osa-containing SWI/SNF chromatin-remodeling complex regulates stem cell commitment in the adult *Drosophila* intestine.** *Development.* 2013; 140:3532-40.
 43. Zhang Q, Zhang Y, Wu L, Yang Y, Li X, Gao L, Hou X, Wu Y, Hou G, Li Z, Lin X. **dBrms1 Acts as a Positive Regulator of Notch Signaling in *Drosophila* Wing.** *J Genet Genomics.* 2014; 41:317-25.
 44. Zhou B, Yun EY, Ray L, You J, Ip YT, Lin X. **Retromer promotes immune quiescence by suppressing Spatzle-Toll pathway in *Drosophila*.** *J Cell Physiol.* 2014; 229:512-20.
 45. Zhou H, Zou S, Lan Y, Fei W, Jiang R, Hu J. **Smad7 modulates TGFbeta signaling during cranial suture development to maintain suture patency.** *J Bone Miner Res.* 2014; 29:716-24.
 46. Zhou J, Gao Y, Lan Y, Jia S, Jiang R. **Pax9 regulates a molecular network involving Bmp4, Fgf10, Shh signaling and the Osr2 transcription factor to control palate morphogenesis.** *Development.* 2013; 140:4709-18.

Faculty, Staff, and Trainees

Faculty Members

Raphael Kopan, PhD, Professor

Leadership Division Director

Research Interests Notch Signaling, Mouse

Nadean Brown, PhD, Adjunct

Research Interests Eye Development, Mouse and Drosophila

Kenneth Campbell, PhD, Professor

Leadership Associate Director; Director, Basic Science Research in Surgical Services

Research Interests CNS Patterning, Mammal

Sang-Wook Cha, PhD, Assistant Professor

Research Interests Early Vertebrate Development

Chieh Chang, PhD, Assistant Professor

Research Interests Nervous System, C. Elegans

Chiou-Fen Chuang, PhD, Assistant Professor

Research Interests Nervous System, C. Elegans, Laterality

Vaughn Cleghon, PhD, Associate Professor

Research Interests Kinase Function In Development, Signaling

Brian Gebelein, PhD, Associate Professor

Research Interests Transcriptional Regulation, Drosophila, Body Patterning, Nervous System

Geraldine Guasch, PhD, Assistant Professor

Research Interests Stem Cells in Epithelial Tissues and Their Role in Tumorigenesis, Transitional Epithelium and Anorectal Malformations

Rashmi S. Hegde, PhD, Professor

Leadership Director, Molecular and Developmental Biology Graduate Program

Research Interests Protein Structure/Function

Yueh-Chiang Hu, PhD, Assistant Professor

Leadership Director, Transgenic Core

Research Interests Transgenic Mouse Model

Rulang Jiang, PhD, Professor

Research Interests Genetic Basis and Developmental Mechanisms of Structural Birth Defects; Mammalian Organogenesis

J. Matthew Kofron, PhD, Assistant Professor

Leadership Imaging Core Director

Research Interests Ectodermal Organ Development In Vertebrates, Xenopus

Hung-Chi Liang, PhD, Instructor

Research Interests Affymetrix Core Manager

Xinhua Lin, PhD, Professor

Research Interests Cell Signaling, Drosophila

Christopher Mayhew, PhD, Assistant Professor

Leadership Co-Director, Stem Cell Core

Research Interests Human ES Biology and Differentiation

Masato Nakafuku, MD, PhD, Professor

Research Interests Nervous System Patterning And Stem Cells, Mammal

S. Steven Potter, PhD, Professor

Leadership Director, Affymetrix Core

Research Interests Transcription Regulation And Kidney Development, Mammal

Saulius Sumanas, PhD, Assistant Professor

Research Interests Vascular Development, Zebrafish

James M. Wells, PhD, Professor

Leadership Co-Director, Stem Cell Core

Research Interests Vertebrate Gut Development, Stem Cells, Mammal

Dan A. Wiginton (retired 10/4/13), PhD, Associate Professor

Research Interests Gut Differentiation, Mammal

Yutaka Yoshida, PhD, Assistant Professor

Research Interests Nervous System, Cell Migration, Mammal, Chicken

Aaron Zorn, PhD, Professor

Research Interests Vertebrate Gut Development, Xenopus, Mammal

Joint Appointment Faculty Members

Bruce Aronow, PhD, Professor (Pediatric Bioinformatics)

Research Interests Bioinformatics

Samantha Brugmann, PhD, Assistant Professor (Plastic Surgery)

Research Interests Molecular Basis for Craniofacial Development and Disease

Tiffany Cook, PhD, Associate Professor (Pediatric Ophthalmology)

Research Interests Eye Development, Drosophila

Steven Crone, PhD, Assistant Professor (Neurosurgery)

Research Interests Spinal Circuit Development and Repair

Tony DeFalco, PhD, Assistant Professor (Reproductive sciences)

Research Interests Gonad Development, Mammal

Sudhansu Dey, PhD, Professor (Director, Reproductive Sciences)

Research Interests Reproductive Biology

Prasad Devarajan, MD, Professor (Director, Nephrology and Hypertension)

Research Interests Urinary Tract Differentiation, Mammal

Fumika Hamada, PhD, Assistant Professor (Pediatric Ophthalmology)

Research Interests Molecular and Neural Mechanisms of Circadian Rhythm and Temperature Sensation in Drosophila

Stacey Huppert, PhD, Associate Professor (Gastroenterology, Hepatology, and Nutrition)

Research Interests Hepatic Development and Regeneration

Vladimir Kalinichenko, MD PhD, Associate Professor (Pulmonary Biology and Neonatology)

Research Interests Transcriptional Regulation of Lung Embryonic Development

Yu Lan, PhD, Associate Professor (Plastic Surgery)

Research Interests Genetic Control of Craniofacial Development, Mutant Mouse Models

Richard A. Lang, PhD, Professor (Pediatric Ophthalmology)

Research Interests Visual System Development, Mammal

Richard Lu, PhD, Professor (Exp Hem & Cancer Biology)

Research Interests Molecular Mechanisms of Glial Development and Brain Tumorigenesis

Jun Ma, PhD, Professor (Pediatric Bioinformatics)

Research Interests Transcriptional Regulation, Drosophila

Takahisa Nakamura, PhD, Assistant Professor (Endocrinology)

Research Interests Obesity-induced Metabolic Diseases

Satoshi Namekawa, PhD, Assistant Professor (Reproductive Sciences)

Research Interests Germ Cells, Epigenetics, Reproduction, Mouse

Yuya Ogawa, PhD, Assistant Professor (Reproductive Sciences)

Research Interests Long Noncoding RNA-mediated Transcriptional Regulation in Mammals

Joo-Seop Park, PhD, Assistant Professor (Urology)

Research Interests Molecular Biology, Genetics

Noah F. Shroyer, PhD, Associate Professor (Gastroenterology, Hepatology, and Nutrition)

Research Interests Vertebrate Gut Development, Mammal

Rolf Stottmann, PhD, Assistant Professor

Research Interests Genetic Approaches to Understanding Human Congenital Defects Affecting the Face and Forebrain.

Ronald Waclaw, PhD, Assistant Professor (Experimental Hematology)

Research Interests Forebrain Progenitor Cell Differentiation

Joshua Waxman, PhD, Assistant Professor (Molecular Cardiovascular Biology)

Research Interests Molecular Genetics of Cardiovascular Development

Matt Weirauch, PhD, Assistant Professor (Autoimmune Genomics and Etiology)

Research Interests Transcription Factors; Computational Biology, Functional Genomics, Bioinformatics

Jeffrey A. Whitsett, MD, Professor (Chief, Section of Neonatology, Perinatal, and Pulmonary Biology)

Research Interests Respiratory System, Mammal

Chunyue Yin, PhD, Assistant Professor (Gastroenterology, Hepatology, and Nutrition)

Research Interests Liver Development and Diseases

Trainees

- **Masaki Ueno, PhD**, Vis Ob, Osaka University
- **Ok Hee Chai, PhD**, Vis Re, Chonbuk National University, Republic of Korea
- **Emmanuel Tadjuidje, PhD**, Vis Re, University of Göttingen, Germany
- **Xudong Wang, DDS, MD**, Vis Re, Shanghai Second Medical University, China (end 12/13/14)
- **Baoyan Bai, PhD**, Res. A, Johns Hopkins University (end 7/19/14)
- **Tatyana Belenkaya, PhD**, Res. A, Russian Academy of Science

- **Eric Brunskill, PhD**, Res. A, University of Maryland
- **Kevin Burns, PhD**, Res. A, University of Cincinnati
- **Yinhui Chen, PhD**, Res. A, University of Massachusetts
- **Eunah Chung***, **PhD**, Res. A, Cornell University
- **Lisa Ehrman***, **PhD**, Res. A, University of Cincinnati
- **Tadahiro Goda***, **PhD**, Res. A, Kyushu University
- **Christina James-Zorn, PhD**, Res. A, University of Queensland, Australia
- **Matthew Hass, PhD**, Res. A, Harvard University Medical School
- **Yasuko Kato***, **PhD**, Res. A, Kyoto Institute of Technology, Japan
- **Junbo Lui***, **PhD**, Res. A, Fudan University, China
- **Athanasia Nikolaou***, **PhD**, Res. A, University of Melbourne, Australia
- **Taeko Noah***, **PhD**, Res. A, University of Nevada
- **Virgilio Ponferrada, PhD**, Res. A, Wright State University
- **Sujata Rao***, **PhD**, Res. A, Cornell University (End 8/1/13)
- **Jennifer Schumacher, PhD**, Res. A, University of Pennsylvania
- **Ho-Su Sin***, **PhD**, Res. A, Kanazawa University, Japan (end 2/21/14)
- **Huirong Xie***, **PhD**, Res. A, Vanderbilt University
- **Sivan Bezalel***, **PhD**, Res. F, University Medical School, Israel
- **Sarah Beckman***, **PhD**, Res. F, University of Pittsburgh
- **Ching-Fang Chang***, **PhD**, Res. F, University of Alabama
- **Mark Charlton-Perkins, PhD**, Res. F, University of Cincinnati
- **Enrico D'Aniello***, **PhD**, Res. F, Stazione Zoologica Anton Dohrn, Italy (end 12/20/13)
- **Sharina Desai, PhD**, Res. F, University of Cincinnati
- **Ashley Driver***, **PhD**, Res. F, University of Wisconsin-Madison
- **Tarsis Ferreira, PhD**, Res. F, Universidade Federal de Sao Paulo, Brazil
- **Amy Gresser, PhD**, Res. F, Harvard University (end 3/7/14)
- **Yi-Wen Hsieh, PhD**, Res. F, University of California, Los Angeles
- **Fumiyasu Imai, PhD**, Res. F, Yokohama City University of Medicine, Japan
- **Shihai Jia, PhD**, Res. F, Shanghai Institute for Biological Sciences, China
- **Donatien Kamdem Toukam, PhD**, Res. F, Ruhr University Bochum, Germany (end 9/13/14)
- **Vikram Kohli***, **PhD**, Res. F, University of Alberta, Canada
- **Hyuk-Jae Kwon, PhD**, Res. F, Yonsei University, Korea
- **Han Liu, PhD**, Res. F, University of Rochester
- **Alejandro Lopez Juarez***, **PhD**, Res. F, University of Mexico
- **Mayur Madhavan, PhD**, Res. F, Miami University (end 8/9/14)
- **Jaya Mallela, PhD**, Res. F, Univ of Mississippi
- **Pamela Mancini, PhD**, Res. F, University of Pisa, Italy
- **Paloma Merchan Sala, PhD**, Res. F, University of Murcia, Spain
- **Ajit Muley***, **PhD**, Res. F, Anna University, India
- **Jorge Munera, PhD**, Res. F, University of California, San Diego
- **Minh-Thanh Nguyen***, **PhD**, Res. F, University of Florida
- **Yoshinobu Odaka***, **PhD**, Res. F, Louisiana State University
- **Craig Park***, **PhD**, Res. F, McGill University, Canada
- **Anna Raines, PhD**, Res. F, University of Wisconsin (end 4/30/14)
- **Kaushik Roychoudhury, PhD**, Res. F, Jadavpur University, India

- **Gowri Sarangdhar***, PhD, Res. F, University of Sussex, UK
- **Jacqueline Schiesser**, PhD, Res. F, Monash University, Australia
- **Ankur Sharma**, PhD, Res. F, Indian Institute of Science
- **Emily Shifley**, PhD, Res. F, Ohio State University (end 7/26/13)
- **Xiaofang Tang**, PhD, Res. F, University of Cincinnati (end 2/7/14)
- **Jumpei Terakawa***, PhD, Res. F, Yamaguchi University, Japan
- **Quynh Ton**, PhD, Res. F, Lehigh University
- **Mustafa Turkoz**, PhD, Res. F, Washington University
- **Shruti Vemaraju***, PhD, Res. F, Texas A&M University
- **Yuhua Wang**, PhD, Res. F, Sun Yat-Sen University, China
- **Marcin Wlizia**, PhD, Res. F, University of Chicago
- **Baotang Xie***, PhD, Res. F, Chinese Academy of Sciences
- **Jingyue Xu**, PhD, Res. F, Nanjing University, China
- **Norishige Yamada***, PhD, Res. F, Kagoshima University, Japan
- **Eun-Jin Yeo***, PhD, Res. F, Seoul National University, South Korea
- **Jia You**, PhD, Res. F, University of Cincinnati
- **Celvie Yuan***, PhD, Res. F, Case Western Reserve University
- **Jing Zhou**, PhD, Res. F, Shanghai Institute for Biological Sciences, China
- **Yan Zou**, PhD, Res. F, Chinese Academy of Sciences (end 5/30/14)
- **Jonathan Howell**, MD PhD, Clin., Indiana University
- **Alan Kenny**, MD PhD, Clin., University of Rochester, School of Medicine and Dentistry
- **Douglas Brown***, , Grad., University of Cincinnati - College of Medicine
- **Marion Brusadelli**, , Grad., Luminy University, France (end 2/28/14)
- **Michael Craig**, , Grad., University of Cincinnati
- **Anne Heritier**, , Grad., University of Paris, Diderot
- **Meina Huang**, , Grad., Chinese Academy of Sciences
- **Xuemei Ling**, , Grad., Chinese Academy of Sciences (end 4/28/14)
- **Baptiste Martin**, , Grad., Polytech Marseille, France
- **Seema Sheoran**, , Grad., National Center for Biological Sciences, India (end 5/30/14)
- **Milesa Simic**, , Grad., Luminy University, France (end 9/20/14)
- **Jurate Skerniskyte**, , Grad., Vilnius Univ, Lithuania (6/30/14)
- **Mustafa Turkoz**, , Grad., Washington University (end 5/9/14)
- **Mathieu Viereria**, , Grad., University of Paris
- **Morgan Albert**, , Underg, University of Rochester
- **Christopher Anglin**, , Underg, Xavier University
- **Brittany Bayne**, , Underg, University of Cincinnati
- **Emily Blatz**, , Underg, University of Cincinnati
- **Sarah Braley**, , Underg, University of Cincinnati
- **Claudia Carrelli**, , Underg, University of Cincinnati (end 1/17/14)
- **Matthew Carter**, , Underg, Miami University, Oxford, OH
- **Emily Cata**, , Underg, Xavier University
- **Calyn Crawford**, , Underg, Xavier University
- **Mahima Devarajan**, , Underg, Case Western Reserve
- **Allison Estep**, , Underg, University of Cincinnati (end 6/1/14)
- **Mackenzie Gauck**, , Underg, University of Cincinnati

- **Carolyn Hensley**, , Underg, University of Cincinnati (end 9/1/13)
- **Nicholas Ingram**, , Underg, University of Cincinnati
- **Cameron Ingram**, , Underg, University of Cincinnati
- **Sarah Kastner**, , Underg, Cincinnati State
- **Osama Kasem**, , Underg, University of Cincinnati (end 7/30/13)
- **Mishi Liang**, , Underg, University of Cincinnati
- **Kelsey Lin**, , Underg, Ohio State University
- **Julia Madzia**, , Underg, University of Cincinnati
- **Madhulika Mamidi**, , Underg, University of Cincinnati
- **Mhadhumithan Naresh**, , Underg, University of Cincinnati
- **Jesse Niehaus**, , Underg, University of Cincinnati (end 11/17/13)
- **Thanh Phan**, , Underg, University of Cincinnati
- **Carolyn Stevenson**, , Underg, University of Cincinnati
- **Austin Wanek**, , Underg, University of Cincinnati
- **Dominique Wreh**, , Underg, University of Cincinnati (end 6/26/14)
- **Ian Campbell**, , HighS, Turpin High School
- **Kristen Martin**, , HighS, Oak Hills High School

Division Collaboration

The effects of altered development of the amygdala on fear and anxiety behaviors (Kenny Campbell, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » Louis J. Muglia, MD, PhD

Animals models of hydrocephalus (Kenny Campbell, PhD)

Neurosurgery » Francesco T. Mangano, DO, FACS, FACOS

Role of STAT5 in epithelial permeability in gut organoids (Sang-Wook Cha, PhD)

Gastroenterology, Hepatology, and Nutrition » Xiaonan Han, PhD

To examine accumulation of misfolded proteins in the epithelial cells of the lung (Steve Crone, PhD)

Pulmonary Biology » Timothy E. Weaver, MS, PhD

Uterine deletion of gp130 or Stat3 shows implantation failure with increased estrogenic responses (SK Dey, PhD)

Pulmonary Biology » Jeffrey A. Whitsett, MD

Assessing the role of Hox and Gfi-1 antagonism in regulating microRNA expression and blood cell proliferation during hematopoiesis and leukemia progression (Brian Gebelein, PhD)

Immunobiology » H. Leighton (Lee) Grimes, PhD

Molecular pathway in cloaca malformation (Geraldine Guasch, PhD)

Pediatric General and Thoracic Surgery » Andrea Bischoff and Alberto Pena

TGF β signaling inhibits goblet cell differentiation via SPDEF in conjunctival epithelium (Geraldine Guasch, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » Jeffrey A. Whitsett, MD

Neuropathy Target Esterase impairments result in a diverse spectrum of childhood and adult neurodegenerative

disorders (Rashmi Hegde, PhD)

Human Genetics » Robert Hufnagel, MD, PhD

Molecular mechanisms in retinal angiogenesis (Rashmi Hegde, PhD)

Ophthalmology » Richard A. Lang, PhD

SAM pointed domain Ets factor mediates epithelial cell-intrinsic innate immune signaling during airway mucous metaplasia; FOXA3 regulates goblet cell metaplasia and innate immunity in the airway (Rashmi Hegde, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » Jeffrey A. Whitsett, MD

Molecular regulation of palate and tooth development (Rulang Jiang, PhD)

Biomedical Informatics » Bruce Aronow, PhD

The role of Osr1 in tongue development (Rulang Jiang, PhD)

Plastic Surgery » Samantha A. Brugmann, PhD

Studies of Osr1 in kidney development (Rulang Jiang, PhD)

Pediatric Urology » Joo-Seop Park, PhD

Studies of Osr2 in palate development (Rulang Jiang, PhD)

Pediatric Urology » Joo-Seop Park, PhD

Identification of Notch target genes during the formation of multiple organs (Raphael Kopan, PhD)

Pediatric Urology » Joo-Seop Park, PhD

Genome-wide ChIP-seq analysis of Gsx2 and Ascl1 in adult neural stem cells (Masato Nakafuku, PhD)

Center for Autoimmune Genomics and Etiology » Matthew T. Weirauch, PhD

Use of neural progenitors for therapy of myelomeningocele (Masato Nakafuku, PhD)

Center for Fetal, Cellular, and Molecular Therapy » Jose L. Peiro, MD

Studies on the role of adult neurogenesis in obesity (Masato Nakafuku, PhD)

Immunobiology » Senad Divanovic, PhD

Molecular basis of congenital brain anomaly (Masato Nakafuku, PhD)

Human Genetics » Rolf W. Stottmann, PhD

Development of oligodendrocytes and astrocytes in early postnatal brains (Masato Nakafuku, PhD)

Experimental Hematology » Ronald R. Waclaw, MS, PhD

Single cell studies (Steve Potter, PhD)

Biomedical Informatics » Bruce Aronow, PhD

Studies of early kidney development (Steve Potter, PhD)

Urology » Joo-Seop Park

Single cell analysis of lung development (Steve Potter, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » Jeffrey A. Whitsett, MD

Recombineering-based dissection of flanking and paralogous Hox gene functions in mouse reproductive tracts (Steve Potter, PhD)

Reproductive Sciences » SK Dey, PhD

A translational approach towards the identification of causative genetic elements for ciliopathies (Rolf Stottmann, PhD)

Plastic Surgery » Samantha A. Brugmann, PhD

Functional role of miRNAs in craniofacial development (Saulius Sumanas, PhD)

Biomedical Informatics » Bruce Aronow, PhD

Pediatric General and Thoracic Surgery » Christopher B. Gordon, MD

Role of elastase like proteins in vertebrates (Saulius Sumanas, PhD)

Critical Care Medicine » Brian M. Varisco, MD

Identifying genetic causes of vascular and lymphatic malformations (Saulius Sumanas, PhD)

Pediatric General and Thoracic Surgery » Belinda Hsi Dickie, MD, PhD

Hemangioma and Vascular Malformation Center » Peter Dickie, PhD

Identification of direct targets of ETS transcription factors using ChIP-Seq (Saulius Sumanas, PhD)

Pediatric Urology » Joo-Seop Park, PhD

Identification of genome-wide susceptibility loci for eosinophilic esophagitis explains tissue specific nature of this allergic disease (Matt Weirauch, PhD)

Allergy and Immunology » Marc E. Rothenberg, MD, PhD

An intrachromosomal gene network drives high-risk del(5q) myeloid malignancies (Matt Weirauch, PhD)

Experimental Hematology and Cancer Biology » Daniel T. Starczynowski, PhD

Uncovering mechanisms of lupus transcriptional misregulation via mRNA-display proteomics (Matt Weirauch, PhD)

Molecular Genetics » C. Alexander Valencia, PhD

The 253-kb inversion and deep intronic mutations in UNC13D are present in North American patients with familial hemophagocytic lymphohistiocytosis (Matt Weirauch, PhD)

Molecular Genetics » Kejian Zhang, MD, MBA

DNA methylation dynamics during ex vivo differentiation and maturation of dendritic cells (Matt Weirauch, PhD)

Asthma Research » Hong Ji, PhD

Whole exome sequencing for familial bicuspid aortic valve identifies putative variants (Matt Weirauch, PhD)

Human Genetics » Lisa J. Martin, PhD

Epigenetic modifications in iPSCs derived from asthma patients (Jim Wells, PhD)

Asthma Research » Hong Ji, PhD

HIOs as a model of stem cell biology (Jim Wells, PhD)

Gastroenterology, Hepatology and Nutrition » Xiaonan Han, PhD

Using human iPSC from Fanconi's anemia to model disease (Jim Wells, PhD)

Oncology » Susanne Wells, PhD

Regionalization of intestinal stem cells in humans (Jim Wells, PhD)

Pediatric General and Thoracic Surgery » Michael A. Helmrath, MD, MS

Development of the enteric nervous system in chick and human intestinal organoids (Jim Wells, PhD)

Plastic Surgery » Samantha A. Brugmann, PhD

To examine how neural circuits controlling breathing are altered in an animal model of ALS (Yutaka Yoshida, PhD)

Neurosurgery » Steven A. Crone, PhD

Molecular pathways of respiratory progenitors (Aaron Zorn, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » John Shannon, PhD

Digestive Health Center (Aaron Zorn, PhD)

Gastroenterology, Hepatology and Nutrition » Jorge A. Bezerra, MD

"Lung MAP" Atlas Research Center (Aaron Zorn, PhD)

Section of Neonatology, Perinatal and Pulmonary Biology » Jeffrey A. Whitsett, MD

Transcriptome analysis of wnt signaling in liver development (Aaron Zorn, PhD)

Pediatric Urology » Joo-Seop Park, PhD

Grants, Contracts, and Industry Agreements

Grant and Contract Awards	Annual Direct
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CAMPBELL, K

Molecular Mechanisms Controlling Formation of Basal Ganglia Circuitry

National Institutes of Health

R01 MH 090740	04/01/10-01/31/15	\$247,500
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Roles of Gsh1 & Gsh2 in Telencephalic Neurogenesis

National Institutes of Health

R01 NS 044080	03/15/14-02/28/19	\$350,906
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CHA, S

Wnt/PCP Signaling in the Intestinal Epithelium

National Institutes of Health

K01 DK 101618	04/15/14-02/28/19	\$119,422
CHANG, C		
MicroRNA Regulation of Neuronal Connectivity in C. Elegans		
National Science Foundation		
IOS-1257023	09/15/13-08/31/17	\$117,410
Understanding MicroRNA Mechanisms for Developmental Decline in Axon Regeneration		
Whitehall Foundation, Inc.		
	10/01/13-09/30/15	\$71,322
CHUANG, C		
Specification of Stochastic Left-Right Asymmetric Neuronal Fates in C. Elegans		
National Institutes of Health		
R01 GM 098026	08/31/12-07/31/17	\$183,350
GEBELEIN, B.		
Hox Control of Cell-Specific EGF Signaling During Development		
National Institutes of Health		
R01 GM 079428	08/09/13-05/31/17	\$190,000
HEGDE, R		
EYA in Retinal Angiogenesis		
National Institutes of Health		
R01 EY 022917	08/01/13-07/31/17	\$250,000
Mechanism of Action of Retinal Determination Proteins		
National Institutes of Health		
R01 EY 014648	04/01/14-03/31/18	\$225,000
JIANG, R		
Molecular Genetic Analysis of Craniofacial Development		
National Institutes of Health		
R01 DE 13681	07/01/11-06/30/15	\$283,575
Molecular Patterning of Mammalian Dentition		
National Institutes of Health		
R01 DE 018401	09/12/13-06/30/18	\$337,777
A Developmentally-Based Tissue Engineering Approach to Improve Tendon Repair		
National Institutes of Health(University of Cincinnati)		
R01 AR 056943	04/01/13-06/30/14	\$168,827
KOFRON, M.		
Ectoderm Formation in the Early Xenopus Embryo		
National Institutes of Health		
R01 HD 45737	04/01/13-03/31/15	\$193,622

KOPAN, R**Assessing the Therapeutic Window for Future Anti-Notch Dimerization Agents**

National Institutes of Health

R01 CA 163653	07/01/13-04/30/18	\$215,443
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Biochemical and Genetic Analysis of Notch Signaling

National Institutes of Health

R01 GM 055479	09/01/13-04/30/15	\$84,732
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Imaging Notch Interactions With Members Of Its Pathways

National Institutes of Health(Washington University)

P50 CA 094056	01/01/14-12/31/14	\$39,753
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LIN, X**Regulation of Wingless (Wg) Signaling and Morphogen Gradient Formation**

National Institutes of Health

R01 GM 063891	04/01/12-03/31/16	\$200,000
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MAYHEW, C**Digestive Health Center: Bench to Bedside Research in Pediatric Digestive Diseases - Stem Cell Core**

National Institutes of Health

P30 DK 078392	06/01/12-05/31/17	\$25,590
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NAKAFUKU, M**Endogenous CNTF Receptors and Adult, In Vivo Neurogenesis**

National Institutes of Health(University of Cincinnati)

R01 NS 066051	07/01/09-06/30/14	\$10,392
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NAKAFUKU, M / CAMPBELL, K**Molecular Control of Neurogenesis in the Adult Subventricular Zone**

National Institutes of Health

R01 NS 069893	04/01/10-03/31/15	\$304,936
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POTTER, S**Digestive Health Center: Bench to Bedside Research in Pediatric Digestive Diseases - Gene Expression Core**

National Institutes of Health

P30 DK 078392	06/01/12-05/31/17	\$22,822
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Generating Molecular Markers that Selectively Label Urothelial Sub-Populations

National Institutes of Health(Columbia University Medical Center)

U01 DK 094530	09/30/11-08/31/16	\$24,167
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POTTER, S / WELLS**Single Cell/RNA-Seq Dissection of Human iPS Cell Development into Intestine**

National Institutes of Health

R01 DK 098350	09/20/13-07/31/17	\$217,500
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SHROYER, N**bHLH Factor Regulation of Mammalian Retinal Neuron Development**

University of California-Davis

01/01/12-12/31/14

\$57,000

SUMANAS, S**Inhibition of Etv2 Function as a Novel Strategy to Prevent Tumor-Induced Angiogenesis**

Ohio Cancer Research Associates

07/01/13-06/30/15

\$27,273

Molecular Mechanisms of Arterial-Venous Differentiation in Zebrafish

National Institutes of Health

R01 HL 107369

04/01/11-03/31/16

\$245,000

WELLS, J**Directing Differentiation of Human Pluripotent Stem Cells to Generate 3-Dimensional Lung Tissue In Vitro**

National Institutes of Health(University of Michigan)

R21 HL 115322

08/10/12-06/30/14

\$35,185

Generating Human Intestinal Organoids with an ENS

National Institutes of Health

U18 TR 000546

07/24/12-06/30/14

\$264,484

Human Endocrine Cell Development

National Institutes of Health

R01 DK 092456

04/07/12-02/28/17

\$297,412

YOSHIDA, Y**Mechanism of Neural Circuit Reorganization for Homeostasis after CNS Injury**

Japan Science and Technology Corporation

10/01/13-03/31/17

\$111,418

ZORN, A**Collaborative Research: Ontology-Enabled Reasoning across Phenotypes from Evolution and Model Organisms**

National Science Foundation(University of South Dakota)

DBI-1062542

07/01/11-06/30/15

\$7,534

Deciphering the Gene Regulatory Network Controlling Vertebrate Endodermal Fates

National Institutes of Health(The Regents of the University of California)

R01 HD 073179

07/05/13-04/30/18

\$80,000

Molecular Basis of Digestive System Development in Xenopus

National Institutes of Health

R01 DK 070858

04/01/14-03/31/18

\$223,613

Osr Transcription Factors Regulate Embryonic Lung Development

National Institutes of Health

R01 HL 114898

08/10/12-06/30/17

\$238,000

Production, Validation and Distribution of the Xenopus ORFeome

National Institutes of Health(University of Virginia)

R01 HD 069352

08/01/11-05/31/16

\$49,726

Xenbase: a Xenopus Model Organism Database

National Institutes of Health

P41 HD 064556

06/01/10-05/31/15

\$697,226

Current Year Direct \$6,217,917**Total \$6,217,917****Additional Information****Molecular and Developmental Biology Graduate Program**

The Graduate Program in Molecular and Developmental Biology is an interdepartmental program within the University of Cincinnati that offers the PhD degree. It has been based in the Department of Pediatrics for over 35 years. Drs. Timothy Weaver and Rashmi Hegde served as Directors of the Program with Associate Directors Drs. Jeffrey Whitsett - finance, Aaron Zorn - curriculum, Tim Le Cras - admissions, Edith Markoff – recruitment, Yi Zheng – faculty membership, and John Shannon– graduate studies.

There are 100 faculty members in the program. During the past year, there were 62 pre-doctoral students in the program, 8 of whom are pursuing MD/PhD degrees. Students and faculty continue to be productive as measured by their numbers of publications, presentations at meetings, honors and awards received. Grant support to faculty remains high.

During the past year, the University of Cincinnati continued to support the program by providing University Graduate Assistantships and funds appropriated from the Dean's office to support 6 first year students. The remaining students are supported through a variety of sources including Albert J. Ryan Fellowships (1), American Heart Association Fellowships (3), NIH training grants (4), external grants to their advisors (54), CHRF Special Purpose Funds to their advisors (1) and funds from the Children's Hospital Research Foundation to the Graduate Program (3).

The MDB Program provides an excellent research educational experience for students and has an excellent record in the placement of its graduates in scientific careers.

Molecular and Developmental Biology Graduate Program Students, 2013-2014

Student	Faculty Mentor	Admission
Thomas Acciani	Timothy Le Cras	2009
Amel Alqadah	Chiou-Fen Chuang	2010
Robyn Amos-Kroohs	Michael Williams	2009
Aria Attia	Rolf Stottmann	2010
Kristin Bell	Noah Shroyer	2010
Katie Bezold	Louis Muglia	2011
Gregory Bick	Paul Andreassen	2010

Markaisa Black	Tanya Kalin	2012
Adam Burr**	Jeffery Molkentin	2009
Heather Chapman	Kenneth Campbell	2007
Mark Charlton-Perkins	Tiffany Cook	2010
Jason Cowan	Stephanie Ware	2009
Angela (Matthews) Damen	Katherine Yutzey	2011
Andrew DiStasio	Rotating	2013
Tracy Dohn	Joshua Waxman	2009
Caitlin Dunn-Fletcher**	Louis Muglia	2013
Jieqing Fan	Richard Lang	2007
Ming Fang	Katherine Yutzey	2010
Alyssa Gallas	Geraldine Guasch	2011
Margaret Gardner	Kathryn Wikenheiser-Brokamp	2010
Vicky Gomez	Katherine Yutzey	2011
Zirong Gu	Yutaka Yoshida	2008
David Hahn	Timothy Weaver	2006
Lu Han	Aaron Zorn	2011
Jamie Havrilak	John Shannon	2008
Michael Hester	Steve Danzer	2009
Jillian Hufgard	Charles Vorhees	2012
Abigail (Bower) Kasberg	Steve Potter	2008
Jed Kendall**	Nancy Ratner	2011
Andrew Koenig	Saulius Sumanas	2012
Jeff Kuerbitz**	Kenneth Campbell	2012
Julie Lander**	Stephanie Ware	2011
Shan Lin	James Mulloy	2009
Mariana Louza Stevens	Aaron Zorn	2010
Bliss Magella	Steve Potter	2011
Amrita Mandal	Joshua Waxman	2011
Kate Maurer	Nadean Brown	2009

Heather McCauley	Geraldine Guasch	2009
Kyle McCracken**	James Wells	2010
Patrick “Sean” McGrath	James Wells	2012
Anna (Hake) Method	James Wells	2007
David Milewski	Rotating	2013
Grethel Millington	Rotating	2013
Edward “David” Muench	H. Leighton Grimes	2012
Shenyue Qin	Kenneth Campbell	2011
Stephen Riffle	Rotating	2013
Megan Rost	Saulius Sumanas	2008
Ariel Rydeen	Joshua Waxman	2011
Betsy Schock	Samantha Brugmann	2012
Moen Sen	Kathryn Wikenheiser-Brokamp	2011
Katie Sinagoga	James Wells	2012
Shatrunjai Singh	Steve Danzer	2010
Sneha Sitaraman	Rotating	2013
Mardi Sutherland	Stephanie Ware	2008
Brian Telek	Rotating	2013
Juli Uhl	Brian Gebelein	2008
Sha Wang	Christopher Wylie/Aaron Zorn	2009
Angela White	Rotating	2013
Michael Workman	James Wells	2012
Jia You	Xinhua Lin	2007
Arya Zandvakili**	Brian Gebelein	2013
Inuk Zandvakili**	Yi Zheng	2009
Xuzhe Zhang	Louis Muglia	2012
Zheng Zhang	Aaron Zorn	2008

**MD/PhD Students

Students completing their PhD work

Robyn Amos-Kroohs – “Developmental Neurotoxicity of Manganese: Behavioral and Cognitive Deficits in the

Context of a Complex Environment,” June 9, 2014.

Heather Chapman – “Gsx Genes Control the Neuronal to Glial Fate Switch in the Telencephalic Progenitors,” December 13, 2013.

Mark Charlton-Perkins – “Control of Drosophila Eye Specification, Patterning and Function by the Transcription Factors Prospero and Pax2,” May 14, 2014.

Jieqing Fan – “Crim1 Maintains Retinal Vascular Stability during Development by Regulating Endothelial Cell Vegfa Autocrine Signaling,” November 15, 2013.

David Hahn – “Autophagy: Catabolism at the Crossroads of Lung Epithelial Homeostasis and Influenza Pathogenesis,” December 17, 2013.

Abigail Kasberg – “The Molecular Mechanisms of Sp8 and Craniofacial Development,” March 4, 2014.

Mary Lee – “Identification of Twist1 Target Genes in Mesenchymal Cell Populations,” July 1, 2013.

Kyle McCracken – “Mechanisms of Endoderm Patterning and Directed Differentiation of Human Stem Cells into Foregut Tissues,” June 9, 2014.

Mardi Sutherland – “Zic3 and the Embryonic Mouse Node: Defining Early Processes Involved in Left-Right Patterning and Heart Development,” October 30, 2013.

Juli Uhl – “How Specificity: Constrained vs. Flexible Requirement for the PBC and MEIS Cofactors,” February 24, 2014.

Sha Wang – “The Apicobasal Polarity Proteins Network during Stratified Xenopus Epidermis Development,” March 12, 2014.

Jia You – “Functions of Heparan Sulfate Proteoglycans in Cell Signaling and Stem Cell Regulation during *Drosophila* Development,” September 6, 2013.

Students completing their MS work

Alyssa Gallas – “Lung Tumors Formed in the TGFβRII Conditional Knockout Mouse are the Result of Metastasis from the Spontaneous Tumor in the Anorectal Transition Zone,” June 3, 2014.

Anna Method – “Development of Cloacal Organs in Mouse and Human,” November 5, 2013.

Student Publications

During the past year, students from the Program authored or co-authored 32 articles.

Acciani TH, Brandt EB, Khurana Hershey GK, Le Cras TD. Diesel exhaust particle exposure increases severity of allergic asthma in young mice. Clin Exp Allergy. 2013 Dec;43(12):1406-18. PubMed PMID: 24112543.

Brandt EB, Kovacic MB, Lee GB, Gibson AM, **Acciani TH**, Le Cras TD, Ryan PH, Budelsky AL, Khurana Hershey GK. **Diesel exhaust particle induction of IL-17A contributes to severe asthma. J Allergy Clin Immunol. 2013 Nov;132(5):1194-1204.e2. PubMed PMID: 24060272; PubMed Central PMCID: PMC3845500.**

Madala SK, Edukulla R, Phatak M, Schmidt S, Davidson C, **Acciani TH**, Korfhagen TR, Medvedovic M, Lecras TD, Wagner K, Hardie WD. **Dual targeting of MEK and PI3K pathways attenuates established and progressive pulmonary fibrosis. PLoS One. 2014;9(1):e86536. PubMed PMID: 24475138; PubMed Central PMCID: PMC3903543.**

Alqadah A, Hsieh YW, Chuang CF. **A molecular link between distinct neuronal asymmetries**. *Cell Cycle*. 2014 May 15;13(10):1515-6. PubMed PMID: 24769883; PubMed Central PMCID: PMC4050152.

Alqadah A, Hsieh YW, Chuang CF. **microRNA function in left-right neuronal asymmetry: perspectives from *C elegans***. *Front Cell Neurosci*. 2013 Sep 23;7:158. PubMed PMID: 24065887; PubMed Central PMCID: PMC3779813.

Chiu H, **Alqadah A**, Chang C. **The role of microRNAs in regulating neuronal connectivity**. *Front Cell Neurosci*. 2014 Jan 3;7:283. PubMed PMID: 24427116; PubMed Central PMCID: PMC3879460.

Hsieh YW, **Alqadah A**, Chuang CF. **Asymmetric neural development in the *Caenorhabditis elegans* olfactory system**. *Genesis*. 2014 Jun;52(6):544-54. PubMed PMID: 24478264; PubMed Central PMCID: PMC4065219.

Subramanian S, Rudich SM, **Alqadah A**, Karunakaran CP, Rao MB, Mast TD. **In vivo thermal ablation monitoring using ultrasound echo decorrelation imaging**. *Ultrasound Med Biol*. 2014 Jan;40(1):102-14. PubMed PMID: 24239361; PubMed Central PMCID: PMC3849110.

Williams MT, Braun AA, **Amos-Kroohs RM**, McAllister JP 2nd, Lindquist DM, Mangano FT, Vorhees CV, Yuan W. **Kaolin-induced ventriculomegaly at weaning produces long-term learning, memory, and motor deficits in rats**. *Int J Dev Neurosci*. 2014 Jun;35:7-15. PubMed PMID: 24594360; PubMed Central PMCID: PMC4076389.

Seto Y, Nakatani T, Masuyama N, Taya S, Kumai M, Minaki Y, Hamaguchi A, Inoue YU, Inoue T, Miyashita S, Fujiyama T, Yamada M, **Chapman H**, Campbell K, Magnuson MA, Wright CV, Kawaguchi Y, Ikenaka K, Takebayashi H, Ishiwata S, Ono Y, Hoshino M. **Temporal identity transition from Purkinje cell progenitors to GABAergic interneuron progenitors in the cerebellum**. *Nat Commun*. 2014;5:3337. PubMed PMID: 24535035.

Zhang K, Chandrakasan S, **Chapman H**, Valencia CA, Husami A, Kissell D, Johnson JA, Filipovich AH. **Synergistic defects of different molecules in the cytotoxic pathway lead to clinical familial hemophagocytic lymphohistiocytosis**. *Blood*. 2014 Jun 10; PubMed PMID: 24916509.

Jukam D, Xie B, Rister J, Terrell D, **Charlton-Perkins M**, Pistillo D, Gebelein B, Desplan C, Cook T. **Opposite feedbacks in the Hippo pathway for growth control and neural fate**. *Science*. 2013 Oct 11;342(6155):1238016. PubMed PMID: 23989952; PubMed Central PMCID: PMC3796000.

Luebbering N, **Charlton-Perkins M**, Kumar JP, Rollmann SM, Cook T, Cleghon V. **Drosophila Dyrk2 plays a role in the development of the visual system**. *PLoS One*. 2013;8(10):e76775. PubMed PMID: 24146926; PubMed Central PMCID: PMC3795635.

Cowan J, Tariq M, Ware SM. **Genetic and functional analyses of ZIC3 variants in congenital heart disease**. *Hum Mutat*. 2014 Jan;35(1):66-75. PubMed PMID: 24123890; PubMed Central PMCID: PMC3946352.

Sorrell MR, **Dohn TE**, D'Aniello E, Waxman JS. **Tcf7l1 proteins cell autonomously restrict cardiomyocyte and promote endothelial specification in zebrafish**. *Dev Biol*. 2013 Aug 15;380(2):199-210. PubMed PMID: 23707897; PubMed Central PMCID: PMC3707317.

Fan J, Ponferrada VG, Sato T, Vemaraju S, Fruttiger M, Gerhardt H, Ferrara N, Lang RA. **Crim1 maintains retinal vascular stability during development by regulating endothelial cell Vegfa autocrine signaling**.

Development. 2014 Jan;141(2):448-59. PubMed PMID: 24353059; PubMed Central PMCID: PMC3879820.

Hahn DR, Na CL, Weaver TE. **Reserve autophagic capacity in alveolar epithelia provides a replicative niche for influenza A virus**. *Am J Respir Cell Mol Biol*. 2014 Mar 24;PubMed PMID: 24661119.

Hester MS, Danzer SC. **Hippocampal granule cell pathology in epilepsy - A possible structural basis for comorbidities of epilepsy?** *Epilepsy Behav*. 2014 Jan 24;PubMed PMID: 24468242; PubMed Central PMCID: PMC4110172.

Kasberg AD, Brunskill EW, Steven Potter S. **SP8 regulates signaling centers during craniofacial development**. *Dev Biol*. 2013 Sep 15;381(2):312-23. PubMed PMID: 23872235; PubMed Central PMCID: PMC4078980.

Raines AM, Adam M, Magella B, Meyer SE, Grimes HL, Dey SK, Potter SS. **Recombineering-based dissection of flanking and paralogous Hox gene functions in mouse reproductive tracts**. *Development*. 2013 Jul;140(14):2942-52. PubMed PMID: 23760953; PubMed Central PMCID: PMC3699281.

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Student Honors

Acciani, T. – Article “Diesel Exhaust Particle Exposure Increases Severity of Allergic Asthma in Young Mice,” selected as the Editor’s Choice article in the December 2013 issue of *Clinical and Experimental Allergy*

Amos-Kroohs, R. – NIH Training Grant (Teratology)

Bick, G. – NIH Training Grant (Teratology)

Cowan, J. – Awarded a University Research Council Summer Fellowship, University of Cincinnati, 2014

Dohn, T. – 1st Place, Heart Institute Co-Director’s Award for Best Platform Presentation, September 2013

Fang, M. – American Heart Association Pre-Doctoral Fellowship

Gomez, V. – 2nd Place, Heart Institute Co-Director’s Award for Best Platform Presentation, September 2013; American Heart Association Pre-Doctoral Fellowship; Cardiovascular Outreach Award, BCVS 2013 Scientific Sessions, July 2013

Han, L. – Question Prize at the Organogenesis, Stem Cells & Developmental Mechanisms Retreat, April 2014

Hufgard, J. – NIH Training Grant (Teratology)

Kasberg, A. – NIH Training Grant (Teratology)

Louza Stevens, M. – 3rd Prize Poster at the Organogenesis, Stem Cells & Developmental Mechanisms Retreat, April 2014

Mandal, A. – Student Travel Award from the Society for Developmental Biology, July 2013

McCracken, K. – 2nd Prize Poster, Graduate Student Research Forum, University of Cincinnati, October 2013

McGrath, S – 1st Prize Poster at the Organogenesis, Stem Cells & Developmental Mechanisms Retreat, April 2014

Rydeen, A. – Article “Cyp26 enzymes are required to balance the cardiac and vascular lineages within the anterior lateral plate mesoderm,” selected as the featured article in the March 2014 issue of *Development*

Schock, B. – Selected to attend the Woods Hole Course “Embryology: Concepts and Techniques in Modern Developmental Biology” held in June & July of 2013

Singh, S. – American Epilepsy Foundation Behavioral Sciences Student Fellowship; American Heart Association Pre-Doctoral Fellowship; Albert J. Ryan Fellowship

Workman, M. – 3rd Prize Poster, Graduate Student Research Forum, University of Cincinnati, October 2013

Zheng, Z. – 2nd Prize Poster at the Organogenesis, Stem Cells & Developmental Mechanisms Retreat, April 2014

Richard A. Akeson Fellowship Fund

The Richard A. Akeson Fellowship and Memorial Lectureship Fund continues to support the Annual Richard Akeson Memorial Lectureship and travel by students in our graduate program to relevant courses and meetings in which they are presenting results of their research. Dr. William Pu presented the Eighteenth Annual Richard Akeson Memorial Lectureship in conjunction with the annual Molecular and Developmental Biology Graduate Student Symposium in 2013.

The following students received funding from the Richard A. Akeson Fellowship and Memorial Fund for travel in 2013 - 2014:

Student	Meeting	Location	Presentation	Date
Abigail Kasberg	GRC: Neural Crest and Cranial Placodes	Easton, Massachusetts	Poster	July-13
Zirong Gu	Wiring the Brain	Cold Spring Harbor, New York	Poster	July-13
Megan Rost	NAVBO – Vascular Biology	Cape Cod, Massachusetts	Poster	October-13
Thomas Acciani	Autumn Immunology Conference	Chicago, Illinois	Poster	November-13
Jillian Hufgard	Society for Neuroscience	San Diego, California	Poster	November-13
Robyn Amos-Kroohs	Society for Neuroscience	San Diego, California	Poster	November-13
Sha Wang	Annual Meeting of the American Society for Cell Biology	New Orleans, Louisiana	Poster	December-13
Mark Charlton-Perkins	Midwest Ecology & Evolution Conference	Dayton, Ohio	Oral	March-14
Betsy Schock	Avian Model Systems	Cold Spring Harbor, New York	Poster	March-14
Inuk Zandvakili	AACR Annual Meeting	San Diego, California	Poster	April-14
Kate Maurer	GRC: Visual System Development	Lucca, Italy	Poster	May-14
Kristin Bell	Digestive Disease Week	Chicago, Illinois	Poster	May-14
Angie Damen	Weinstein Cardiovascular Conference	Madrid, Spain	Poster	May-14
Andrew Koenig	11th International Conference on Zebrafish Development & Genetics	Madison, Wisconsin	Poster	June-14
Ariel Rydeen	11th International Conference on Zebrafish Development & Genetics	Madison, Wisconsin	Poster	June-14
Tracy Dohn	11th International Conference on Zebrafish	Madison, Wisconsin	Poster	June-14

Development & Genetics

Amrita Mandal	11th International Conference on Zebrafish Development & Genetics	Madison, Wisconsin	Poster	June-14
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