Department of Developmental Biology

The principal research activities of the Department of Developmental Biology are focused on attaining a mechanistic understanding of animal development, encompassing the earliest cell fate specification and movement processes that shape the early embryo, organogenesis, stem cell biology and engineering, tissue homeostasis and repair, and aging. Students and postdoctoral fellows work closely with faculty and staff on research projects and participate in weekly journal clubs and seminars at which recent literature and ongoing research are discussed.

The developmental biology faculty employ a variety of model organisms and cell-based systems to answer key outstanding questions about the fundamental mechanisms of development and to apply this knowledge to pathogenic mechanisms that lead to human birth defects and disease; they also use this knowledge to create improved future therapies. The department takes a broad view of developmental biology, with research groups studying diverse developmental processes (e.g., early embryogenesis, organogenesis, aging) and applying multidisciplinary approaches that include forward and reverse genetics, epigenetics, molecular and chemical methods, and computational methods. Embryogenesis is a fascinating process during which a fertilized egg undergoes divisions to form a mass of pluripotent cells that signal to one another to establish embryonic polarity, diverse cell types, and organs and that also undergo massive cell migrations and rearrangements to sculpt the embryonic body.

Research is also carried out on the processes involved in tissue degeneration, repair and regeneration, the biology of embryonic and adult stem cells, and cellular reprogramming. It is a particularly opportune time for developmental biology research, as recent technological breakthroughs in both animal model systems and genomics afford insights into developmental processes at the epigenetic, genetic and molecular levels and also enable the monitoring of cell behaviors in vivo. We are discovering the genes that are responsible for birth defects and defining connections between many adult human diseases and their origins during embryogenesis. The studies of stem cells, cellular reprogramming and regeneration are bringing us closer to curing human diseases, repairing damaged organs, and extending the boundaries of aging.

Website: https://developmentalbiology.wustl.edu/

Faculty

Lilianna Solnica-Krezel, PhD
Department Head

Visit our website for more information about our faculty and their appointments.

B

Irving Boime, M.S., Ph.D.
Professor of Developmental Biology (primary appointment)
Professor of Reproductive Biology in Obstetrics and Gynecology
Bachelor of Science, Saint Louis College of Pharmacy, 1964
Master of Science, Purdue University-Main Campus, 1966
Doctor of Philosophy, Washington University in St Louis, 1970

C

Douglas Floyd Covey, M.A., Ph.D.
Professor of Pharmacology in Developmental Biology (primary appointment)
Andrew C and Barbara B Taylor Distinguished Professor of Psychiatry
Professor of Anesthesiology
Professor of Psychiatry
Master of Arts, Johns Hopkins University, 1969
Doctor of Philosophy, Johns Hopkins University, 1973

D

Aaron DiAntonio, M.Phil., Ph.D., M.D.
Professor of Developmental Biology (primary appointment)
Alan A and Edith L Wolff Professor of Developmental Biology
Bachelor of Arts, Harvard University, 1988
Master of Philosophy, University of Cambridge, 1989
Doctor of Philosophy, Stanford University, 1995
Doctor of Medicine, Stanford University, 1995

Sabine Dietmann, M.S., Ph.D.
Assistant Professor of Developmental Biology (primary appointment)
Assistant Professor of Medicine
Master of Science, Goethe University, 1994
Doctor of Philosophy, Freie Universität Berlin, 1999

G

Geoffrey John Goodhill, Ph.D.
Professor of Developmental Biology (primary appointment)
Director of the Center for Theoretical Neuroscience
Professor of Neuroscience
Professor in Computer Science and Engineering
Doctor of Philosophy, University of Sussex, 1992

Andrew Kelton Groves, M.A., Ph.D.
Professor of Developmental Biology (primary appointment)
Head of Department of Developmental Biology
null, University of Cambridge, 1988
null, University of Cambridge, 1991
null, Ludwig Institute for Cancer Research, 1992

H

Tracey O Hermanstyne, Ph.D.
Assistant Professor of Developmental Biology (primary appointment)
Assistant Dean Academic Pathway Programs

Doctor of Philosophy, University of Maryland Baltimore, 2012

I

Shin-Ichiro Imai, Ph.D., M.D.
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Theodore and Bertha Bryan Distinguished Professor of Environmental Medicine
Professor of Medicine
Doctor of Medicine, Keio University, 1989
Doctor of Philosophy, Keio University, 1995

J

Aaron N Johnson, Ph.D.
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Bachelor of Arts, Arizona State University, 1998
Doctor of Philosophy, Arizona State University, 2006

K

Shafqat Ali Khan, Ph.D.
Instructor in Developmental Biology (primary appointment)
Doctor of Philosophy, Homi Bhabha National Institute, 2015

Stephen K Kornfeld, Ph.D., M.D.
Professor of Developmental Biology (primary appointment)
Bachelor of Arts, Yale University, 1984
Doctor of Philosophy, Stanford University, 1991
Doctor of Medicine, Stanford University, 1991

Kristen Louise Kroll, Ph.D.
Professor of Developmental Biology (primary appointment)
Bachelor of Arts, Northwestern University, 1988
Doctor of Philosophy, University of California Berkeley, 1994

L

Yangjian Liu, M.S., Ph.D.
Instructor in Developmental Biology (primary appointment)
Bachelor of Science, Nanjing University (####), 1998
Master of Science, Chinese Academy of Sciences, 2002
Doctor of Philosophy, Johns Hopkins University, 2006

M

Helen McNeill, Ph.D.
Professor of Developmental Biology (primary appointment)
Larry J Shapiro and Carol-Ann Uetake-Shapiro Professor
Bachelor of Science, Ramapo College of New Jersey, 1985
Doctor of Philosophy, Stanford University, 1993

Craig Anthony Micchelli, Ph.D.
Associate Professor of Developmental Biology (primary appointment)
Bachelor of Science, University of Wisconsin Madison, 1993
Doctor of Philosophy, University of Wisconsin Madison, 1999

Maryssa Mokalled, M.S., Ph.D.
Associate Professor of Developmental Biology (primary appointment)
Bachelor of Science, American University of Beirut, 2003
Master of Science, American University of Beirut, 2005
Doctor of Philosophy, University of Dallas, 2010

N

Jeanne M Nerbonne, Ph.D.
Professor of Developmental Biology (primary appointment)
Alumni Endowed Professor of Molecular Biology and Pharmacology in Developmental Biology
Bachelor of Science, Framingham State College, 1974
Doctor of Philosophy, Georgetown University, 1978

O

David M Ornitz, Ph.D., M.D.
Professor of Developmental Biology (primary appointment)
Alumni Endowed Professor of Developmental Biology
Bachelor of Science, University of California Davis, 1981
Doctor of Philosophy, University of Washington, 1987
Doctor of Medicine, University of Washington, 1988

P

Debabrata Patra, M.S., Ph.D.
Associate Professor of Developmental Biology (primary appointment)
Bachelor of Science, University of Mumbai, 1985
Doctor of Philosophy, University of Pittsburgh, 1993
Master of Science, University of Mumbai, 2005

Elizabeth Pollina, Ph.D.
Assistant Professor of Developmental Biology (primary appointment)
Bachelor of Arts, Princeton University, 2007
Doctor of Philosophy, Stanford University, 2015

R

John Hall Russell, Ph.D.
Professor Emeritus of Developmental Biology
Bachelor of Science, Juniata College, 1968
Doctor of Philosophy, Washington University in St Louis, 1974

S

Jimann Shin, M.S., Ph.D.
Assistant Professor of Developmental Biology (primary appointment)
Bachelor of Science, Kyung Pook National University, 2002
Master of Science, Kyung Pook National University, 2004
Doctor of Philosophy, Vanderbilt University, 2007

Lilianna Solnica-Krezel, M.S., Ph.D.
Professor of Developmental Biology (primary appointment)
Alan A and Edith L Wolff Professor of Developmental Biology
Master of Science, Medical University of Warsaw, 1985
Doctor of Philosophy, University of Wisconsin Madison, 1991

T

Ankita Thawani, Ph.D., Master, Bachelor
Instructor in Developmental Biology (primary appointment)

null, Indian Institute of Technology Delhi, 2012
null, Indian Institute of Technology Delhi, 2012
null, Purdue University-Main Campus, 2019

Thorold W Theunissen, M.A., Ph.D.
Associate Professor of Developmental Biology (primary appointment)
Bachelor of Arts, Harvard University, 2007
Master of Arts, University of Cambridge, 2008
Doctor of Philosophy, University of Cambridge, 2011

Yu-Chen Tony Tsai, Ph.D., M.D.
Assistant Professor of Developmental Biology (primary appointment)
Doctor of Medicine, National Taiwan University, 2005
Doctor of Philosophy, Stanford University, 2013

W

Spencer Gaffney Willet, Ph.D.
Instructor in Developmental Biology (primary appointment)
Bachelor of Science, University of Tennessee, 2007
Doctor of Philosophy, Vanderbilt University, 2014

Y

Yongjun Yin, Ph.D.
Assistant Professor of Developmental Biology (primary appointment)
Doctor of Philosophy, Hebrew University of Jerusalem, 2004

Andrew Seungjo Yoo, M.S., Ph.D.
Professor of Developmental Biology (primary appointment)
Philip and Sima K Needleman Distinguished Professor of Medicine
Bachelor of Science, McGill University, 1995
Master of Science, University of British Columbia, 1997
Doctor of Philosophy, Columbia University, 2005

Z

Bo Aber Zhang, Ph.D.
Associate Professor of Developmental Biology (primary appointment)
Bachelor of Science, Inner Mongolia University (#####), 2004
Doctor of Philosophy, Chinese Academy of Sciences, 2011

Research Electives

Developmental Biology Research Electives

During the fourth year, opportunities exist for many varieties of advanced clinical or research experiences.

Research in the Department of Developmental Biology occurs in a highly collegial atmosphere and involves interdisciplinary collaborations between the members of the department as well as among investigators from different departments and centers throughout the School of Medicine, the College of Arts & Sciences, and the McKelvey School of Engineering. Developmental biology faculty have leading roles in several research centers, including the Center of Regenerative Medicine, the Center for the Investigation of Membrane Excitability Diseases, the Center for Cardiovascular Research, and the Hope Center. The department has a rich tradition of mentoring undergraduate, graduate and medical students as well as postdoctoral fellows. We are committed to creating a research environment in which our trainees reach their maximum scientific potential and career goals while addressing key outstanding questions and making important discoveries.

Douglas F. Covey, PhD
355 McDonnell Medical Sciences Building
Phone: 314-362-1726

Medicinal chemistry of steroids.

Aaron DiAntonio, MD, PhD
7150 Jeffrey T. Fort Neuroscience Research Building
Phone: 314-362-9925

Neurodevelopment, neurodegeneration, and axon regeneration in *Drosophila* and mouse.

Geoff Goodhill, PhD
8322 Jeffrey T. Fort Neuroscience Research Building
Phone: 314-273-7691

The Goodhill Lab's overall goal is to understand the computational principles that underlie brain development using a combination of experimental and theoretical approaches. Previously, the lab has studied how growing nerve fibers detect and respond to molecular gradients to find their targets and how visual experience affects the development of maps in the developing brain. Currently, we are using the larval zebrafish as a model to understand the links between the development of patterns of brain activity and complex behaviors and to study how the development of brain and behavior is altered in autism spectrum disorders.

Shin-ichiro Imai, MD, PhD
362A McDonnell Medical Sciences Building
Phone: 314-362-7228

Molecular mechanisms of aging and longevity in mammals, particularly focusing on the tissue-specific functions of the mammalian NAD-dependent deacetylase Sirt1 and the physiological significance of systemic NAD biosynthesis mediated by Nampt (nicotinamide phosphoribosyltransferase) in an intimate connection between metabolism and aging.

Aaron N. Johnson, PhD
3602 Cancer Research Building
Phone: 314-273-1834

Molecular mechanisms of muscle development and regeneration.

Kerry Kornfeld, MD, PhD
3607 Cancer Research Building
Phone: 314-747-1480

Signal transduction during development; zinc metabolism; aging.

Kristen Kroll, PhD
320 McDonnell Medical Sciences Building
Phone: 314-362-7045

Transcriptional networks that regulate the formation of neurons in early embryos and embryonic stem cells; role of chromatin regulatory complexes in controlling pluripotency and differentiation.

Helen McNeill, PhD
305 McDonnell Medical Sciences Building
Phone: 314-273-3050

Our lab interests are focused on the cadherin family of molecules and their regulation of cellular polarity, growth, tissue organization and metabolism. The overall goal of our research is to understand how tissue growth and tissue organization are coordinately regulated. We are focusing on how Fat cadherins function in Hippo pathway-regulated growth control, planar cell polarity tissue organization, and metabolism in flies, mice and hydra. A second, new focus is studying how the nuclear envelope regulates gene expression and fertility.

Craig Micchelli, PhD
328 McDonnell Medical Sciences Building
Phone: 314-362-7036

Our lab studies the regulation of stem cell biology in development, homeostasis and disease.

Maryssa Mokalled, PhD
3601 Cancer Research Building
Phone: 314-273-1835

Spinal cord injury, degeneration and regeneration in zebrafish and mouse.

Jeanne M. Nerbonne, PhD
9900 Clinical Sciences Research Building
Phone: 314-362-2564

Structure, function and regulation of voltage-dependent ion channels in the cardiovascular and nervous systems; regulation of membrane excitability in health and disease.

David M. Ornitz, MD, PhD
3902 South Building
Phone: 314-362-3908

Regulation of cardiovascular, lung, skeletal, and inner ear development, injury response, and regeneration by fibroblast growth factors.

Liz Pollina, PhD
3830 North Medical Building
Phone: 314-362-7054

The Pollina Lab is broadly interested in identifying the molecular mechanisms that preserve longevity across the diverse cell types of the nervous system.

Lila Solnica-Krezel, PhD
3911A South Building
Phone: 314-362-8768

Genetic regulation of vertebrate embryogenesis; genetic mechanisms that regulate cell fates and movements during early vertebrate development using forward and reverse genetics in the zebrafish model and human embryonic stem cells.

Thorold W. Theunissen, PhD
3313 Couch Biomedical Research Building
Phone: 314-362-8768

The Theunissen lab seeks to understand the molecular mechanisms that regulate pluripotent stem cell states and to develop optimal conditions for the derivation, maintenance and differentiation of human ESCs and iPSCs. We also explore whether naive pluripotent stem cells can be used to model early human development and disease.

Tony Tsai, PhD
333 McDonnell Medical Sciences Building
Phone: 314-362-7054

The Tsai lab is interested in control principles of tissue patterning and morphogenesis during embryo development. We seek to understand how cells integrate biochemical and mechanical inputs to make reliable decisions on what cell types they become, where they migrate, and what structure they collectively build.

Andrew Yoo, PhD
361E McDonnell Medical Sciences Building
Phone: 314-362-1811

Cell fate control by microRNAs; neuronal reprogramming to generate human neurons; chromatin controlling factors and genetic pathways that regulate neurogenesis.

Courses

The Department of Developmental Biology also offers courses through the College of Arts & Sciences.

BIOL 5152 Rad Journal Club (Regeneration, Aging, and Development)
Focuses on developing a dialog around current topics in developmental and regenerative biology at the molecular, cellular and systems levels.
Credit 1 unit.
Typical periods offered: Fall, Spring

BIOL 5352 Developmental Biology
Analysis of a selected set of key processes in development, such as pattern formation, cell-cell signaling, morphogenesis, etc. The focus is on molecular approaches applied to important model systems, but framed in classical concepts. The discussion section provides instruction in presenting a journal club and writing a research proposal. Prerequisites, Molecular Cell Biology (Bio 5068) and Nucleic Acids (548).
Credit 3 units.
Typical periods offered: Spring

BIOL 5900 Research
Enrolled students will meet in-person with faculty for a minimum of 1 hour per week. Pass/No Pass Only.
Credit 12 units.
Typical periods offered: Fall, Spring, Summer