Department of Biology at Case

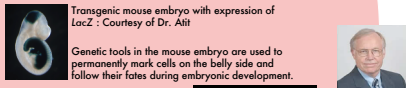
Chair: Joseph Koonce

The Department of Biology provides training for both undergraduate and graduate students. The strongest areas of training in the program are in Animal Behavior, Biochemistry, Cell and Developmental Biology, Computational Biology, Ecology and Evolutionary Biology, Genetics, Molecular Biology, Neurobiology, Physiology, and Plant Biotechnology. In addition, the Department is closely affiliated with other divisions such as the School of Medicine and the Case School of Engineering at Case Western Reserve University. Cooperative programs outside of Case including the Cleveland Museum of Natural History, Cleveland Metroparks Zoo, and Holden Arboretum allow for students to have a variety of resources at hand. Research in the department is primarily conducted in one of three focus areas: Cell and Developmental Biology, Neurobiology and Neuromechanical Systems, or Plant Dynamics and Disturbance Ecology. This focus framework allows faculty to build on common research interests. Mentored teaching and research programs with faculty and students foster a strong educational environment in the Department.

Cell and Developmental Biology

Tissue Engineering — Genetics and Development

Radhika Atit*:	Origin and development of dermis in the skin
Arnold Caplan*:	Use of stem cells to regenerate tissues
Chris Cullis*:	Plant genomes and crop improvement
S. Haynesworth:	Mesenchymal stem cells and adipocyte cell fate
Emmitt Jolly*:	Gene regulation in the parasitic schistosome worm
Claudia Mizutani*:	Genetic Mechanisms of body axis patterning
Charles Rozek:	Genetics of flies

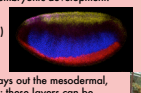


Transgenic mouse embryo with expression of *LacZ* : Courtesy of Dr. Atit

Genetic tools in the mouse embryo are used to permanently mark cells on the belly side and follow their fates during embryonic development.

Atit

Rozek



Fly embryo with genes expressed in the mesodermal (red), neuroectodermal (blue) and ectodermal (yellow and magenta) domains: Courtesy of Dr. Mizutani

Caplan

The formation of the dorsal-ventral axis lays out the mesodermal, neuroectodermal, and ectodermal layers; these layers can be tagged using flourescent DNA probes and tracked during development in order to investigate the roles of axis patterning

Jolly

Cullis

Mizutani

Haynesworth

Neurobiology and Robotics

Neurobiology and Neuromechanical Systems

Animal Behavior — Neurophysiology

Hillel Chiel*:	Soft tissue biomechanics, neural modeling, and soft robots
Darin Croft:	Mammilian paleontology, evolution, and community
Dmitri Kourennyi:	Electrophysiology; ion channels; retinal physiology
Kristan Lukas:	Effects of designed environments on animal behavior
Roy Ritzmann*:	Locomotion in insect through complex terrain
Peter Thomas:	Mathematical biology, computational neuroscience
Mark Willis*:	Olfactory orientation and flight behavior
Debra Wood*:	Rhythmic behaviors and analysis, neural network

Chiel

A single frame of video taken at 500 frames per second as a cockroach climbs a plastic barrier: Courtesy of Dr. Ritzmann

Thomas

With a combination of high-speed video analysis and electrophysiology one can begin to understand how insects deal with barriers to forward locomotion.

Lukas

Willis

Flight track of a *Manduca sexta* male as he tracks a pheromone plume upwind to it's source (wind is blowing from right to left): Pictures Courtesy of Dr. Willis.

Ritzmann

Wood

Moths use odor to navigate flights to find flowers or pheromones to for mating. By tracking flight muscules and patters, computer simulations can be created.

Plant Dynamics and Disturbance Ecology

Theoretical Ecology — Ecophysiology — Population and Community Ecology — Ecosystem Modeling

Joe B. Keiper:	Insect biology and ecology
Joseph Koonce*:	Great lakes land/water interactions
Mary Topa:	Whole-plant physiology, ecophysiology
David Burke:	Rhizosphere and plant ecology
Kurt Smemo:	Soil biogeochemistry
Robin Snyder*:	Effects of environmental variation
Michael Benard*:	Evolutionary biology and population ecology

Keiper

Researcher collecting samples off the shore of Lake Erie: Pictures courtesy of Dr. Koonce

Snyder

Data collected from water and samples are used to make a GIS database and models that will regulate the management of Lake Erie fisheries. The database provides documentation of river tributaries, including the geo-data, as well as evidence for linking land-change and non-point pollution to coastal fish habitat productivity

Koonce

Burke

Benard

Topa

Smemo

Teaching — Emeriti

Teaching and Emeriti Faculty

Jim Bader:	Aquatic Biology, K-12 outreach
Morris Burke:	Biochemistry, Intro Biology
Nancy Dilulio:	Cell biology and microbiology
Richard Drushel:	Anatomy, physiology, robotics, executive officer
Barbara Kuemerle:	Cell Biology, molecular biology
Valerie Haywood:	Systems biology, GOB chemistry
Ana Locci:	Biology lab, ecology
Ronald Oldfield:	Ichthyology, Anatomy, Vertebrate lab
Norman Rushforth:	Former chair of the Biology Department
Rui Sousa-Neves:	Biotech lab, Genetics
Joanne Westin:	Introductory biology, physiology
James Zull:	Human learning and Brain in education

Bader

Dilulio

Drushel

Kuemerle

Haywood

Locci

Oldfield

Rushforth

Burke

Westin

Zull

Highlights in Student and Post-doc Achievements and Publications

Graduate Student Publications, Honors, and Awards

Lewinger, W.A., **Harley, C.M.**, Watson, M.S., Ritzmann, R.E., Branicky, M.S., Quinn, R.D. (2008) Insect and Animal-Inspired Sensing to Enable Autonomous Mobile Robot Obstacle Avoidance Applied Bionics and Biomechanics (recently accepted for publishing).

Albro, S.L., S.M. Petersen, A.C. Bachmann, and P.B. Drewa. 2008. Effects of fragmentation on juvenile morphology of Acer saccharum Marsh. (sugar maple) in temperate forests of northeastern Ohio, USA. Forest Ecology and Management 254: 233-238

Talley, Jennifer L.: Chiel, Hillel J.; White, Edward B.; Willis, Mark A. Using characterized air flow to explain insect pheromone tracking behavior. SICB 2009 Meeting, Boston MA

Sarah Carrino and **Ramil Noche**. Phi Beta Kappa grant for student research competition. **Noche**: "Light Sensing Role of Exo-Rhodopsin in the Developing Zebrafish Pineal Organ", Case Western Reserve University, June 2006

Carrino-Kyker S.R. and **Swanson A.K.** 2007 "Seasonal physicochemical characteristics of thirty Northern Ohio temporary pools along gradients of GIS-delineated human land-use." Wetlands 27: 749-760

Sutton, G.P. and Chiel, H. J. 2006. Dynamics of multifunctional in *Aplysia*. Soc. Neurosc. Abstr.

Chesteck, C.A., Samsukha, P., Tabib-Azar, M., Harrison, R.R., Chiel, H.J. and Garverick, S. L. (in press) *Microcontroller-based wireless recording unit for neurodynamic studies in saltwater*, IEEE Sensors Journal

Summer Program in Undergraduate Research (SPUR) and SOURCE Student Publications

Ohtola J, Myers J, Akhtar-Zaidi B,Zuzindlak D, Sandesara P, Yeh K, Mackem S, Atit B. (2008) *Beta-Catenin has sequential roles in the survival and specification of ventral dermis*. Development. 2008 Jul;135(13):2321-9.

Zhu J, Beamish J.A., **Tang C.**, Marchant K.K., Marchant R.E. (2006). *Extracellular matrix-like cell-adhesive hydrogels from RGD-containing poly(ethylene glycol) diacrylate*. Macromolecules 39: 1303-1307.

Tang C., Mee Ja S., Bohnet S., Rehman A., Taishi P., Krueger J.M. (2005). *Interleukin-1 β induces CREB-binding protein (CBP) mRNA in brain and the sequencing of rat CBP*. Molecular Brain Research 137:213-222.

Elena Hoelein

Sheryl Petersen

Thu Tran

Peiyuan Guo

Sarah Kyker

John Bender, Ph.D.

Vance Holt

Nick Kathman

*Indicates Research Mentoring Faculty

Italics indicates adjunct faculty