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The Faculty of MCDB, kindness of everyone!
Friends of MCDB who have asked to remain nameless, but are warmly thanked.

Descriptions and Credits of Cover Illustration

Upper left: A light micrograph of the nucleus of a mouse embryonic fibroblast infected by murine polyomavirus. A short pulse of EdU (5-ethynyl-2'-deoxyuridine) was used to label nascent viral DNA at its sites of synthesis. EdU (white) co-localizes with dense regions of viral Large T-Antigen protein (red) within the nucleus (blue). These sites of viral DNA synthesis are juxtaposed with clusters of GFP-tagged Replication Protein A (green), where aspects of the DNA damage response are thought to process viral DNA for packaging into progeny virions. From Douglas K Peters in the lab of Robert Garcea.

Upper Center: Skin stem cells are specified and rapidly expanded to fuel body growth during early development. This light micrograph of mouse skin shows two hair follicles where many stem cells reside in the upper portion of the follicle. Cell nuclei are stained blue, the basal lamina that separates the epithelium from underlying dermal cells is red, and a microRNA that helps to regulate stem cell proliferation is stained green. This small RNA (miR-205) is highly expressed in skin progenitor cells and stem cells where its presence not only marks stem cell fate, it helps to regulate the expansion of hair follicle stem cells that are required for proper hair growth. From the lab of Rui Yi. Wang et al., "MicroRNA-205 controls neonatal expansion of skin stem cells by modulating the PI(3)K pathway," *Nat. Cell Biol.* 15:1153(2013).

Upper Right: Two mammalian cells in mitosis. These images show osteosarcoma cells (strain U2OS) dividing in culture. The microtubules of the mitotic spindle are stained red, chromatin is dark blue, and the sites of attachment between chromosomes and microtubules, called kinetochores, are bright yellow. The upper image shows a cell in metaphase, the lower a cell in mid-anaphase. Images prepared by Paula Grissom in the McIntosh lab.

Bottom: *A* transgenic *C. elegans* worm expressing a CPR-4::mCherry fusion in its pharynx. CPR-4 is a factor that mediates the radiation-induced bystander effects in this organism. It is a homologue of the human cathepsin B protease, a cancer biomarker. The radiation-induced bystander effect is a process in which factors released by irradiated cells or tissues exert effects on other parts of the animal not exposed to radiation, causing genomic instability, stress responses and altered apoptosis or cell proliferation**.** CPR-4 is secreted from worms irradiated with ultraviolet light or ionizing gamma rays and is the major factor in conditioned medium that leads to the inhibition of cell death and increased embryonic lethality in unirradiated animals of the same population. From the lab of Ding Xue. Peng et al., "Cysteine protease cathepsin B mediates radiation-induced bystander effects." Nature 547:458(2017).

MCDB Anniversary Celebration Program

Saturday AM Chaired by Andrew Staehelin

9:00 Dick McIntosh **Welcome to the Anniversary Celebration**

9:10 Sean Eddy **Computational searches for unusual catalytic and structural RNAs**
Sean was a graduate student with Larry Gold, studying T4 phage. He is now a Professor of Molecular and Cellular Biology and of Applied Mathematics at Harvard University and an Investigator of the Howard Hughes Medical Institute. The Eddy lab is interested in deciphering the evolutionary history of life by comparative analysis of genome sequences. Their research currently focuses on the development of computational methods for RNA, protein, and genome sequence analysis. They use probabilistic modeling approaches to build statistical models of interesting biological features, and use such models for Bayesian or likelihood-based statistical inference in large scale genome analysis and annotation.

9:35 Steve Block **Molecular mechanics observed with biophysical tools**
Steve was a graduate student with Howard Berg, studying bacterial chemotaxis. He moved with Howard to Cal Tech to finish his Ph.D. He is currently a professor of Sciences in the Departments of Applied Physics and of Biology at Stanford University. The Block lab works at the intersection of physics and biology, having long used optical traps ("optical tweezers") to study the nanomechanics of biological macromolecules, including motor proteins, nucleic acids, and nucleic acid-modifying enzymes, such as polymerases. His group was the first to detect directly the 8.2-nm steps made by kinesin motors, as well as the 3.4-angstrom steps taken by RNA polymerase enzymes transcribing DNA. Their current research focuses on understanding the biomolecular mechanisms responsible for movement, fidelity, folding, and ligand binding by proteins and structured nucleic acids, such as riboswitches. Steve also serves as a member of JASON, a group of academics the consults on technical issues for the U.S. government, working mainly in the area of biosecurity.

10:00 Alison Cleary **There is no "I" in cancer**
Alison was an undergraduate research student with Leslie Leinwand, studying the effects of genetic heart diseases on exercise behavior of mice; she received a B.A. from MCDB. She then earned an M.D. and a Ph.D. in Cell and Molecular Biology from Pennsylvania State University College of Medicine and is now a Resident in Clinical Pathology at the Brigham and Women's Hospital in Boston. Her current research uses mouse models to study cell-cell interactions in mammary tumorigenesis. Her focus is tumor heterogeneity in breast cancer and how it influences tumor behavior and responses to therapy. She will talk about her experiences as a researcher and a clinician.

10:25 **A science blitz by current MCDB graduate students**

1) Thomas Vogler - Olwin lab - TDP-43 amyloid oligomers in skeletal muscle regeneration

2) Bridget Menasche - Jing Shi lab - Human genetic screens pull apart cell-cell interactions

3) Giancarlo Bruni - Krajl lab - Illuminating bacterial electrophysiology

10:55 **Coffee break Muenzinger Foyer**

11:15 Dominique Bergmann **Making adaptable plants by adjusting the (epidermal) valves**

Dominique was a graduate student in Bill Wood's lab, studying the embryonic development of left-right asymmetry in C. elegans. She is now a Professor of Biology at Stanford and an investigator of the Howard Hughes Medical Institute. The Bergmann lab is studying the aspect of postembryonic plant development by which the epidermis generates several distinct cell types, including stomatal guard cells. Stomata act as valves through which atmospheric CO_2 can enter the plant and O_2 and water vapor can escape. The lab works at many scales, from the molecular to the global, to identify the factors that ensure critical cell types are made and that they are made in numbers and patterns optimized for the prevailing environment.

11:40 Kathy King **Insight to impact.**

Kathy is an Associate Principle at Redstone Strategy Group, a social sector consulting firm based in Boulder, Colorado. She studied MCDB and Philosophy at CU Boulder. She went on to earn an MSc in Neuroscience from Oxford University and a PhD in Philosophy, Logic, and the Scientific Method from the London School of Economics as a Marshall Scholar. After a few years working on health policy and ethics as a Greenwall Scholar at Johns Hopkins and Georgetown Universities, she found herself at the University of Toronto supporting the Bill & Melinda Gates Foundation in navigating ethical, social, and cultural issues raised by their innovative global health investments – from immunizations to genetically modified mosquitoes. She continues this work, helping foundations and non-profits translate innovations into large-scale impact with Redstone, where she embraces every opportunity to help collaboratives shape innovations and discover ways to scale their reach and impact.

12:05 Pat O'Farrell **Havoc raised by the rogue genome in your mitochondria**

Pat worked as a graduate student in the labs of Jacques Pène, David Hirsh, and Larry Gold. To understand protein changes in the development of the green alga, Volvox, he invented a method for 2-dimensional electrophoretic separation of proteins. He is now a Professor of Biochemistry and Biophysics at the University of California, San Francisco. The O'Farrell lab has long pioneered molecular analysis of embryonic pattern formation. Working in fruit flies, they identified the gene encoding the homeodomain protein, Engrailed. Their analysis of Engrailed function in segmentation defined processes used throughout the regulatory cascade that patterns embryos. The lab has also made contributions through the study of control of cell division during development. In recent work, they have been exploring the mechanisms that integrate mitochondrial function with events in the rest of the organism.

12:30 – 2:00 Lunch: box lunches available in the Muenzinger Foyer, take them where you like.

If you want to eat outside, feel free to do so. Several members of the current MCDB faculty will be present in the following rooms to host your lunch, if you want to eat inside and/or see what's going on in the teaching and research facilities of the department.

Teaching labs

The Courses		Course Locations and People
Phage Genomics (From Dirt to DNA)	(MCDB 1161)	Porter B0026 Nancy Guild and Christy Fillman
Freshman Discovery-based Teaching Labs I & II (MCDB 1171 & 2171)		Porter B0046 Pam Harvey
Cell Biology Teaching Labs	(MCDB 3140)	Gold A1B16 Alison Vigers
Internat. Gen. Eng. Machine (iGEM) competition labs		Porter B154 Brian DeDecker
CRISPR Mutagenesis in *Xenopus*		Porter B436 Mike Klymkowsky and Berge Bilsoy

Research Facilities

The Facilities	Locations	People
Light Microscopy	Porter B047A	James Orth
Electron Microscopy	Porter B026, 0020	Eileen O'Toole, Garry Morgan, Cynthia Page
Flow Cytometry	Porter B059	Rui Yi
Mass Spectrometry	Porter B325	Will Old

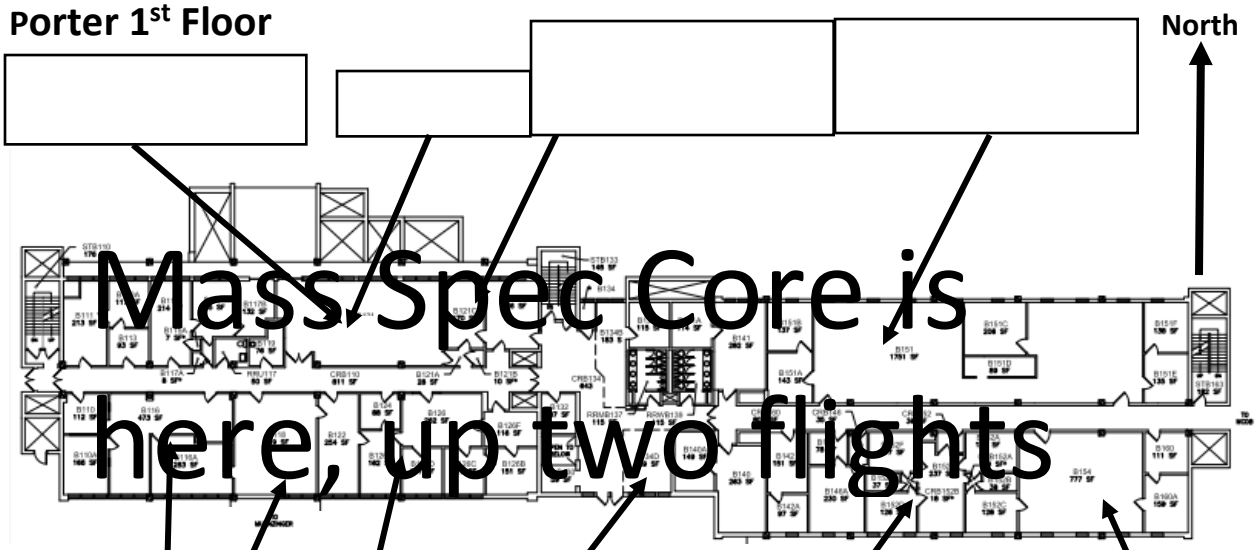
Faculty hosting rooms for conversation

People	Topics	Locations
Leslie Leinwand	A woman is not a small man	A120 Classroom
Joel Kralj	Lighting up microbiology	"
Tin Tin Su	Generation and Regeneration	"
Min Han	Nutrition, Aging, and microbiology	A150 Seminar room
Michael Stowell	Synaptic structure	A250 "
Zoe Donaldson	Social Neuroscience, Neural networks and learning	A250 "
Ding Xue	Human disease models	A350 "
Dick McIntosh	Mitosis and microscopy	B031 Meeting room
Norm Pace	Microbiology	B121 Classroom
Edward Chong	Evolutionary Genomics	B121 "
Rui Yi	Generation and Regeneration	4th interaction room
Lee Niswander	"	"
Brad Olwin	"	"
Justin Brumbaugh	"	"

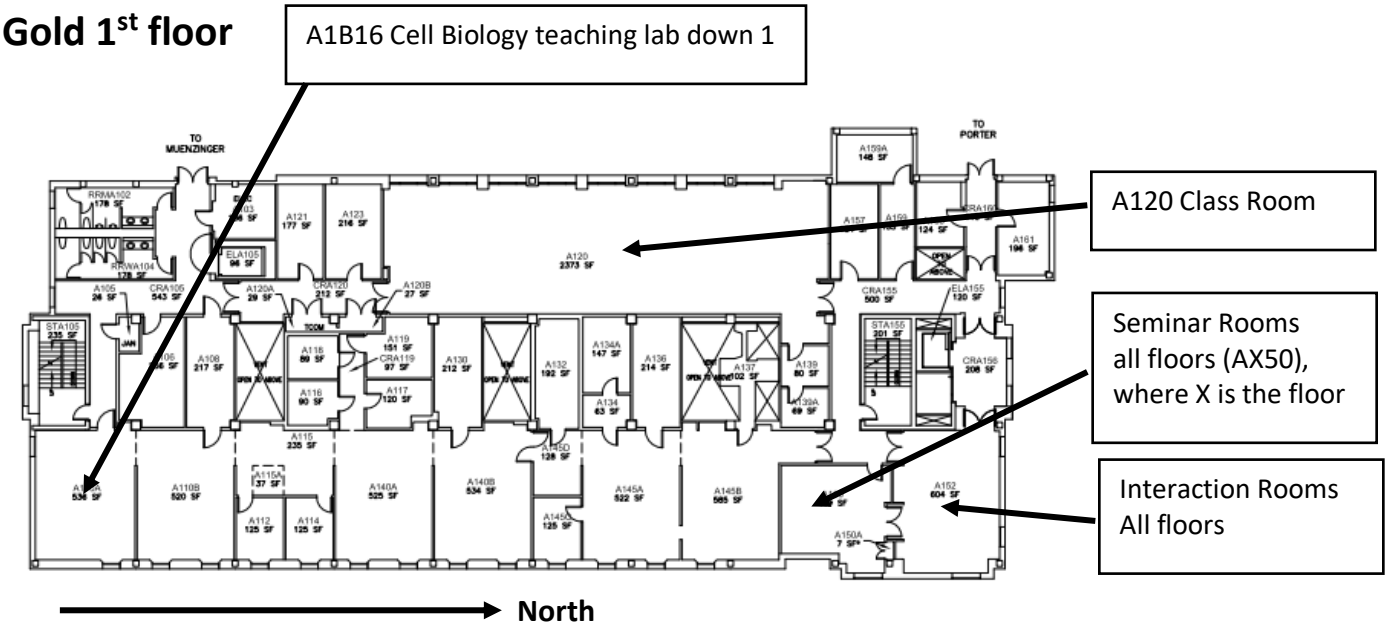
For the locations of these rooms,
See the next page

Map of the First Floor of Porter Biosciences. All room numbers beginning with B are here. B1XX are on this floor, B0XX or B00XX are one or two flights down, B2XX, etc., are one or more flights up. Room numbers are above each door; they start at the west end of the building (left on diagram) and increase, going east. Some key rooms are indicated here.

Porter 1st Floor



Gold 1st floor



Saturday PM **Chaired by Norm Pace**

2:00 Tom Maniatis **A cell surface protein "barcode" provides individual human neurons with unique identities.**

Tom was an undergraduate in CU's Dept. of Chemistry, earned a Ph.D. in Molecular Biology with Leonard Lerman at Vanderbilt, and is now Professor of Biochemistry and Molecular Biophysics at Columbia University's College of Physicians and Surgeons. The Maniatis lab studies the molecular mechanisms by which individual neurons distinguish themselves from each other in the human brain, with particular attention to a cluster of genes called the protocadherins. These genes provide a cell surface "identity code" for each neuron. When individual neurons come into contact, this code is "read" by homophilic interactions between protocadherin proteins on opposing cell membranes. If the match is perfect (that is from the same neuron), neurites repulse each other. If the code is different (neurites from another neuron) they do not repulse, thus allowing synaptic interactions. Mutations in mouse protocadherin genes lead to clumping of neurites throughout the brain, due to the loss of self-avoidance. DNA sequence variants in human protocadherin genes associate with autism. Tom will describe how the protocadherin identity code is generated by a remarkable mechanism of stochastic gene expression and formation of a multi-protein lattice at the cell surface.

2:25 Susan Strome **Passing an epigenetic "memory of germline" from parents to offspring**

Susan was a postdoctoral fellow with Bill Wood, studying cytoplasmic granules that segregate asymmetrically during the embryonic cell division of C. elegans. She is now a Distinguished Professor of MCD Biology at the University of California, Santa Cruz. The Strome lab investigates germ cells, which give rise to eggs and sperm. They are interested in the molecular mechanisms used by these cells to establish and maintain their identity, immortality, and totipotency. Immortality allows germ cells to be perpetuated from generation to generation, and their totipotency allows them to generate all the cell types of the body in each generation. Susan's group is studying germ cells in C. elegans with a variety of approaches, including genetics, imaging, molecular biology, biochemistry, and whole-genome microarray and sequencing technologies. Their current focus areas are transmission of chromatin states, the control of gene expression in germ cells, and regulation of RNA metabolism by germline-specific cytoplasmic "P granules".

2:50 Chandra Richter **Studying winemaking with molecular biology tools**

Chandra did her graduate work with Mark Winey, studying the basal bodies of Tetrahymena. She is now a Senior Scientist at the E&J Gallo Winery. The Richter lab studies transcriptomic changes in grape development to improve fruit quality traits. They follow these quality metabolites through the fermentation and winemaking processes to create new and interesting wine varietals. Transforming grape juice into wine is the result of complex metabolic relationship between materials from the grape, Vitis vinifera, and the yeast S. cerevisiae. The final molecular composition developed contributes to the flavor, aroma and mouth-feel of the wine, but the dynamics of metabolite formation are not yet fully understood. The Richter lab examines these complex relationships by identifying the metabolites present both intra- and extra-cellularly at three times during Chardonnay wine fermentation. Considerable metabolic variation is seen at each stage of fermentation, which suggest that regulation of metabolic pathways is coupled to fermentation progress. The lab's analysis is helping to provide an understanding of cell communication mechanisms in this industrial, biotechnological processes.

3:15 Pat Zambryski **Plants and microbes: a feast of fundamental insights**

Pat did her graduate work with Larry Gold, studying the regulation of gene expression in bacteria infected by T4 phage. She is now Professor of Plant and Microbial Biology at the University of California, Berkeley. The Zambryski lab performs research in two distinct areas. In microbial biology, they study the molecular mechanisms utilized by Agrobacterium that lead to the genetic transformation of plant cells. In plant biology, they study how plant cells communicate with each other via unique plant-specific intercellular structures called plasmodesmata. Very recent Agrobacterium research has revealed bacteria can grow from a single pole versus uniform lateral elongation that has been abundantly documented in model bacterial species. Notably polar growth is also utilized by bacterial pathogens that elicit disease in animal systems. Additional studies expose unexpected players in the regulation of plant cell-to-cell communication via plasmodesmata.

3:40 **Coffee break**

4:10 Craig Mello **RNA-mediated regulation of gene expression**

Craig did graduate work with David Hirsh, seeking DNA fragments from C. elegans that would direct the mitotic segregation of plasmids in yeast. He is now Distinguished Professor in the Institute of RNA Therapeutics at the University of Massachusetts Medical School. The Mello lab has pioneered in the identification, characterization, and use of small interfering RNA molecules, for which he was awarded a Nobel Prize. His lab continues to characterize the pathways of RNA metabolism and regulation in C. elegans and other organisms. Their work has not only elucidated the ways in which cells modify RNA and use it for aspects of gene regulation but also the ways some viruses interact with cellular RNA.

4:45 **A science blitz by current MCDB graduate students**

1) Andrew Morganthaler - Copley lab – A 6 minute journey through an evolving genome

2) Haoxi Wu - Voeltz lab - The endoplasmic reticulum regulates endosome distribution and maturation through inter-organelle contact sites

3) Alison Gilchrist - Sawyer lab - The dengue virus protease cuts to the chase

5:15 Judith Kimble **Of niches and naïveté**

Judith was a graduate student with David Hirsh, studying embryonic cell lineages in the gonadal tissues of C. elegans. She is currently a Professor at the University of Wisconsin-Madiaon and an Investigator of the Howard Hughes Medical Institute. The Kimble lab investigates fundamental controls of animal development, taking advantage of the genetic power and cellular simplicity of the nematode Caenorhabditis elegans*. Their goal is to understand the molecular logic of stem cells and differentiation within a single tissue by focusing on the germ line, which is composed of totipotent cells that generate sperm or oocytes to launch the next generation. A stem cell "niche" or "microenvironment" is required to maintain stem cells in all organisms, so the work has implications for germ cells throughout phylogeny.*

5:45 **Reception at the Glenn Miller Ball Room, CU's UMC**

Posters describing undergraduate research will be available for your reading enjoyment

Poster Presenters: Sarah Bates, Sarah Eastwood, Grace Engel, Kyla Foster, Emily Greenspan, Kenzie Hardt, Jack Johnson, Courtney Kaufman, Kayla Marshall, Declan Moyer, Michaela Nelsen, Nate Nickrent, Jade Ponder

6:30 **Dinner at the UMC for all Anniversary Registrants**

After Dinner Entertainment

Master of Ceremonies	Larry Gold
Presenters	Lee Niswander Innovations in both teaching and research
Three student researchers	Grace Engel, Kyla Foster, and Michaela Nelsen

MCDB Trivia Bowl – Prizes for the winning table

Music by MCDBers and friends, organized by Bill Wood and Paul Muhlrad

Speaker, Steve Block (mandolin & banjo), Rick Carlson (fiddle and vocals), and former faculty members, Minx Fuller (vocals), Gary Stormo (bass), and Bill Wood (guitar & vocals)

Sunday AM Session open to the public. Muenzinger Auditorium Chaired by Dick McIntosh

10:00 Larry Goldstein **Human stem cells in the treatment of neurological diseases**

Larry was a postdoctoral fellow with Dick McIntosh, working to identify and understand microtubule-related motor enzymes in fruit flies. He is now a Distinguished Professor in the Depts. of Cellular and Molecular Medicine and of Neurosciences at the University of California, San Diego. He serves as the Director of the UCSD Stem Cell Program and the Sanford Stem Cell Clinical Center, as well as the scientific director of the Sanford consortium for regenerative medicine. The primary goals in the Goldstein lab are to unravel how molecular motors interact with axonal vesicles and then to relate this understanding to the molecular basis of neuronal defects in Alzheimer's disease. They take advantage of pluripotent stem cell lines containing known mutations that cause hereditary Alzheimer's disease and use both these cell lines and animal models to probe how such mechanisms inter-relate with disease development. They are also asking how genetic variation predisposes individuals to different diseases by developing pluripotent stem cell lines carrying genomes of people who developed sporadic Alzheimer's disease.

10:30 Ken Miller **Does Science Really Matter in America Today? *How Scientists and Educators Can Address a Culture of Denial***

Ken was a graduate student with Andrew Staehelin, studying the structure of membranes and inclusions in chloroplast. He is now a Professor of Biology at Brown University. The Miller lab focuses on the organization of biological membranes, but Ken's work extends beyond the lab in numerous ways. He is coauthor of the nation's leading high school biology textbook, and he has written several books for general readers, most recently The Human Instinct – How We Evolved to Have Reason, Consciousness, and Free Will*. In 2005 Ken was the lead witness for the victorious plaintiffs in the landmark Kitzmiller v. Dover trial on the teaching of evolution in public schools. For these many projects, he has received the Gregor Mendel Medal from Villanova University, the Laetare Medal from Notre Dame University, the Stephen Jay Gould Prize from the Society for the Study of Evolution, and the Public Understanding of Science Award from the American Association for the Advancement of Science.*

11:00 Sean Carroll **The Thrill of Discovery**

Sean was a postdoctoral fellow with Matt Scott, studying genes that govern the segmentation and patterning of fruit fly embryos. He is now a Profession of genetics and molecular biology at the University of Wisconsin, Madison. Sean is an evolutionary biologist, author, and film producer. He leads the Department of Science Education of the Howard Hughes Medical Institute, the largest private supporter of science education activities in the US, and is Professor of Biology at the University of Maryland. He is the author of several books including The Serengeti Rules, Brave Genius, The Making of the Fittest, Endless Forms Most Beautiful *and* Remarkable Creatures*. Sean is also the*

executive producer of more than a dozen documentary films. He will talk about the complex linkage between thought, chance, and discovery.

11:30 Coffee break

11:45 Zoe Donaldson **Decoding monogamy: The neuroscience of social bonding**
Zoe earned a Ph.D. in psychiatry at Emory University and did postdoctoral work at Columbia. She is now an Assistant Professor jointly appointed in MCDB and the Dept. of Psychology and Neuroscience. The Donaldson lab studies how close social bonds, such as those that mediate friendships and romantic love, are encoded in the brain. In order to understand the cells and molecules that make bonding possible, her lab uses monogamous prairie voles. Unlike rats and mice, these rodents form lifelong pair bonds between mates akin to human romantic partnerships. By examining the neurobiology underlying these bonds and what happens when they are lost, she hopes to identify novel treatments for psychiatric and neurodevelopmental disorders.

12:05 Sara Sawyer **Bird flu, Ebola, and HIV: When animal viruses threaten humans**
Sara earned a Ph.D in genetics and development from Cornell University and did postdoctoral work at the Fred Hutchison Cancer Research Center. She is now an Associate Professor in MCDB and in CU's BioFrontiers Institute. The Sawyer lab studies how animal viruses evolve as they infect new species, including humans. They study mainly HIV and dengue virus, but have published research on the spillover of many other viruses as well. Understanding spillover is critical for predicting and controlling viral epidemics, and it also provides an outstanding example of evolution in action that informs us about biology more generally.

12:30 Lee Niswander **MCDB today and envisioning the future**
Lee earned her Ph.D. at Case Western Reserve University and did postdoctoral work at University of California, San Francisco. From 1997 – 2014 she was an Investigator of the Howard Hughes Medical Institute, working at the University of Colorado School of Medicine, Denver. She is now Professor and Chair of MCDB. The Niswander lab studies mouse models of embryonic development with the overarching goal of providing insights into fundamental developmental processes, major human birth defects and potential clinical therapies. They examine the interplay among genes, environment, and epigenetic mechanisms. Their particular focus is on early neural formation and the molecular mechanisms that prevent neural developmental disorders.

This event was organized and implemented by a committee of faculty and staff from MCDB.

Thanks to Kathleen Asta, Jaime Birren, Zoe Donaldson, Erik Hedl, Joel Kralj, Leslie Leinwand, Kathleen Lozier, Dick McIntosh, Paul Muhlrad, Lee Niswander, and Rui Yi