



Department of  
Molecular and  
Integrative and  
Physiology

Department of  
Microbiology

Department of  
Cell and  
Developmental  
Biology

Department of  
Biochemistry

HISTORY AND FUTURE  
OF MCB



# LETTER FROM THE DIRECTOR



Dr. Stephen G. Sligar

Welcome to another publication devoted to bringing you the latest news from the School of Molecular and Cellular Biology. As you can feel even by its weight, this issue is packed with information that includes the story of MCB's creation, a memorial to Founding Director Charles Miller, the history of the MCB building and physical infrastructure, as well as a personal look at a few of our distinguished faculty. Through an interview with our Associate Director for Undergraduate Education, we again stress the importance of the school's central academic mission: providing the educational experience for our majors to enjoy success in whatever career they choose.

You will learn in this issue of MCB's birth through the scission of the old School of Life Sciences into the Schools of Molecular and Cellular Biology and Integrative Biology. MCB is the place where a molecular understanding of biology is the quest. With multiple cross-departmental research initiatives, though, one might ask, "Why do we have two Schools?" In fact, Biology (with a capital "B") is pervasive across campus. From the Department of Physics and the revitalized Department of Bioengineering on the north campus, to new initiatives in plant engineering endeavors centered in the agriculture quadrangle, we are clearly in the Century of Biology. Thus there are many paths to a given career endpoint. We are working to establish new synergies between the Schools of MCB and SIB in the College of Liberal Arts and Sciences. Perhaps most visible now is our creation of a single "Biology at Illinois" portal which seeks to provide a common entry point for prospective graduate and undergraduate students (<http://biology.illinois.edu>). We believe that science offers the paths for significant advances to improve society, from health to the critical commodities of energy and water. MCB offers the grounding in fundamental molecular understanding needed for success in all of these endeavors.

MCB Magazine is growing in size, and we look forward to further opportunities to share with you our successes and provide a personal interaction with the MCB family.

A handwritten signature in black ink that reads "SgSligar". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

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**MCB** is published by the School of Molecular and Cellular Biology

**MCB Director**

Stephen G. Sligar

**Managing Editor**

William Gillespie

**Graphic Designer**

Kurt Bielema

**Additional Editing**

Jessica Ruddell

**Assistant Director of Development**

Sean D. Williams

**Photography**

Chelsey Coombs

Kurt Bielema

William Gillespie

L. Brian Stauffer

School of MCB

**MCB Communications Office**

393 Morrill Hall, MC-119  
505 South Goodwin Avenue  
Urbana, IL 61801

phone | 217.265.6594

fax | 217.265.6595

[mcbcommunications@illinois.edu](mailto:mcbcommunications@illinois.edu)

[www.mcb.illinois.edu](http://www.mcb.illinois.edu)



Produced by the MCB Communications Office with Single-Stereo Design for the School of Molecular and Cellular Biology. The University of Illinois is an equal opportunity, affirmative action institution.

Printed on recycled paper with soy-based ink. 12.038

# MCB and the Age of Biology

Doug Peterson

## A New School Emerges With a New Millennium

The nineteenth century has been called “the Age of Engineering” and the twentieth “the Age of Chemistry and Physics.” But what does that make this century? The late Charles Miller, MCB’s first director, saw the twenty-first century as the emerging **Age of Biology**. So it was only fitting that the new School of Molecular and Cellular Biology would have its genesis in the year 2000, just as we crossed the threshold into the new century and new millennium.

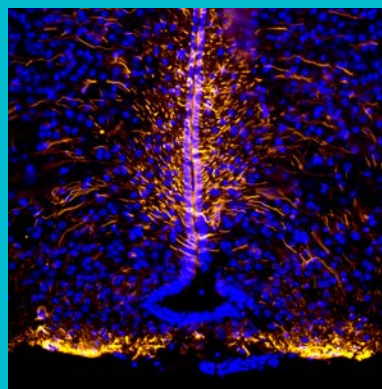
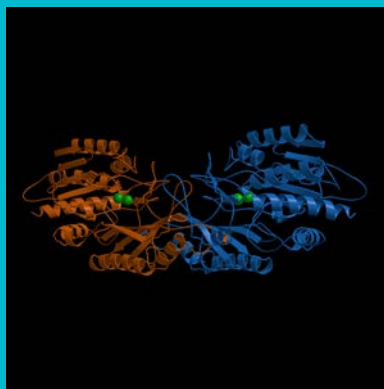
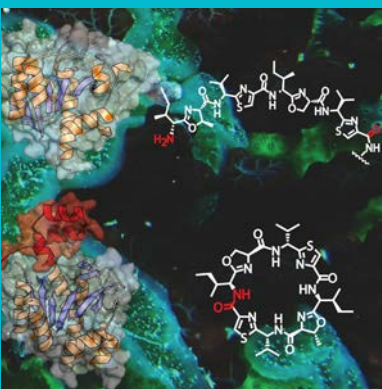
According to Charles Miller (see *MCB* issue 1), “The reorganization plan for MCB was fundamentally based on the idea that the dramatic progress in the biological sciences had not just blurred the lines between the disciplines represented by our four departments, but in a significant way had caused these disciplinary lines to disappear. Many faculty members in each of our departments could have fit comfortably in one or more of the other departments. But overall, all four departments shared a common scientific culture with more similarities than differences. We also realized that our undergraduate students required a more focused and progressive curriculum. We hoped to provide them with a broad background that would prepare them not only for graduate and professional schools but also for entry into the biotechnology, pharmaceutical, and other industries seeking workers trained in molecular and cellular biology.”

MCB was actually the culmination of changes in biology that had been building for half a century. This wave of change was triggered by the genetic revolution, beginning with the discovery of DNA’s double-helix structure in the 1950s and accelerating with the biomolecular revolution of the 1980s and 90s, explained Robert Switzer, professor emeritus of biochemistry. Since then, biology has been steadily permeating many other disciplines, particularly engineering and physics, and biotechnology is now a major research area.

“Biology was utterly transformed by molecular genetics,” Switzer says. “Before the genetic revolution, biology was more descriptive. You reported what you saw, and what you could see was anatomy and behavior.”

Biology eventually split along this molecular fault line, separating into two disciplines—systematic biology and molecular biology—says Stephen Sligar, MCB director. In general, systematic biology is about large biological systems, while molecular biology is more focused on the particulars of biomolecular machinery.

Changes began to emerge in biology departments across the country in the 1990s. In fact, says Switzer, there was a sense that Illinois was falling behind as other universities separated molecular and systematic biology. In the 1990s, the U of I had a single School of Life Sciences, but under the leadership of Larry Faulkner, dean of the College of Liberal Arts and Sciences, talks about dividing the school began. When Jesse Delia became LAS dean, the push for division became even stronger, and the process of creating two new schools officially began in 1997.



“In 1997, the School of Life Sciences began to function as two separate units,” recalls Ann Zielinski, MCB’s associate director for administration and business affairs. Zielinski was there from the very beginning, moving into the new MCB administrative offices along with Miller, administrative aide Christine Smith (retired), and only one student employee. It would take until the year 2000 for the two new schools to jump through all of the necessary hoops: approval by the units involved, LAS, the Office of the Provost, the U of I Board of Trustees, and ultimately the Illinois Board of Education.

Separating into two schools was like separating conjoined twins, for disconnecting them was complicated and often controversial. Nevertheless, the separation became official in July of 2000, and the School of Life Sciences became two—the School of MCB and the School of Integrative Biology (SIB). Entomologist Fred Delcomyn would be director of SIB, while Miller would take over as MCB’s first director.

Delcomyn says the university couldn’t have made a better choice for MCB director with Miller, because the division into two schools could have been disastrous if not for his even-handedness.

“On the one hand, you had MCB, with two-thirds of the faculty and more than two-thirds of the funding, not to mention an experienced administrator at the helm in Miller,” says Delcomyn. “On the SIB side, we had one-third of the faculty, and I had no experience at the time as an administrator.”

Delcomyn and Miller met regularly to hash out the division, and Delcomyn says, “Charles recognized that the success of MCB depended on the success of SIB. You couldn’t have one unit succeed and the other unit fail.”

In other words, it was necessary to view the two new schools as a whole—like a completely integrated biological organism.

“Charles never tried to run roughshod over us,” Delcomyn adds. “He was always collegial and there was always the attitude that we were in

this together.”

But the balancing act didn’t just apply to SIB and MCB. There were also internal tensions within MCB. As Martha Gillette, professor of cell and developmental biology, points out, the various departments that would eventually make up MCB had to give up some control, particularly in undergraduate teaching.

MCB absorbed three departments from the old School of Life Sciences, and two of them changed their names, eventually resulting in the Departments of Microbiology, Cell and Developmental Biology, and Molecular and Integrative Biology. Administrators decided to bring a fourth department—Biochemistry—into the MCB fold. At the time, Biochemistry was located in an entirely different school, the School of Chemical Sciences (SCS).

It became obvious that there needed to be biochemists in the newly formed MCB, Switzer says, but administrators didn’t want there to be two biochemistry departments, one in MCB and the other still in SCS. So Biochemistry shifted to MCB.

“The chemists were not happy about our leaving at the time. It was controversial,” Switzer says. After all, chemistry has had a long and illustrious history at Illinois. When the dust settled and MCB became operative in 2000, it had four departments, none of which had interacted closely together before.

They were moving into uncharted waters.

On the undergraduate level, biology majors would no longer be balkanized into an array of majors, says James Imlay, MCB’s associate director for graduate affairs. All undergraduates would enter as biology majors and then decide between MCB and SIB by their sophomore year.

The undergraduate curriculum also underwent a complete overhaul, an effort spearheaded by Miller and Melissa Michael, assistant director for undergraduate instruction. Sligar credits them with coming up with a brilliant new system—creating an infrastructure of academic professionals who would run the education program and take responsibility for

grade management and administrative issues.

This freed top-level researchers to take on classroom teaching since they would no longer be responsible for time-consuming administrative duties.

“When Charles asked if I could teach a big class, I thought it would be too much, that it would kill my research program,” Sligar recalls. “But then he said, ‘Let me explain to you how this new system works.’ And he was right. It worked.”

“The undergraduate program dramatically improved,” Imlay says. “We were able to sharpen its focus and at the same time make it more rigorous. Because of that, our undergraduate students have done extremely well and medical school acceptance rates are quite high.”

To make all of this happen, Gillette says, “I think Charles was able to get people to work together, get past their concerns, and give up some of the things they wanted, so they could work as a group.”

The irony is that nearly 13 years past the division into MCB and SIB, the separation between the two areas—systematic biology and molecular biology—is a lot fuzzier than it once was. “Fast forward to today, and you’ll see that it’s an artificial division,” Sligar says. “Everybody is doing genomics, both MCB and SIB. So it’s no longer clear where the division lies between systematic and molecular biology.”

Still, the changes that came with the new millennium have been a boon for MCB, and the school has been “wildly successful,” says Sligar. In this Age of Biology, MCB has emerged as one of the largest majors on campus, with over 1,800 undergraduate majors and over 350 graduate students. The new arrangement has also ushered in an era of unprecedented cooperation between MCB and departments all across campus.

As Switzer puts it, “It’s in our DNA now.” ■

#### FOR FURTHER READING

Introduction by Charles Miller. *MCB I*: <http://mcb.illinois.edu/magazine>

# MCB

## TIMELINE

July 2, 1862: President Abraham Lincoln signs Morrill Land-Grant College Act of 1862 into law.

1860

March 2, 1867: Illinois Industrial University opens doors of one campus building.

# MCB

## BUILDINGS

The School of MCB provides a strong foundation for its students and faculty members to push the boundaries of current knowledge, and pioneer breakthroughs in their respective fields. As current and former members of the MCB family can attest, this academic infrastructure is fostered in part by more concrete kinds of foundations—the buildings that house the instructional and research facilities of the school.



November 8, 1868: Thomas J. Burrill becomes Assistant Professor of Natural History and Botany.

1871-1872: First classes encompassing microbiology are offered by Professor Burrill.

1884: Stephen A. Forbes named Professor of Zoology.

1870

1880

1890

March 11, 1868: University inaugurated and formally opens. Tuition is set at \$5 a term, \$15 annually. 77 students are enrolled during the first term.

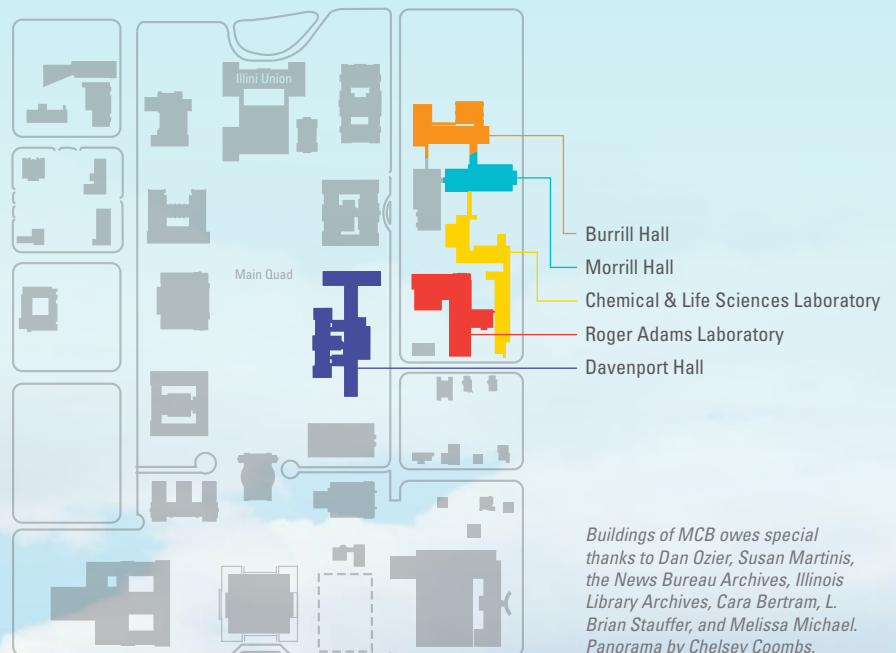
1878: The School of Natural History of the College of Natural Science begins to offer courses in Microscopy and Fungology.

1885: Illinois Industrial University renamed University of Illinois.

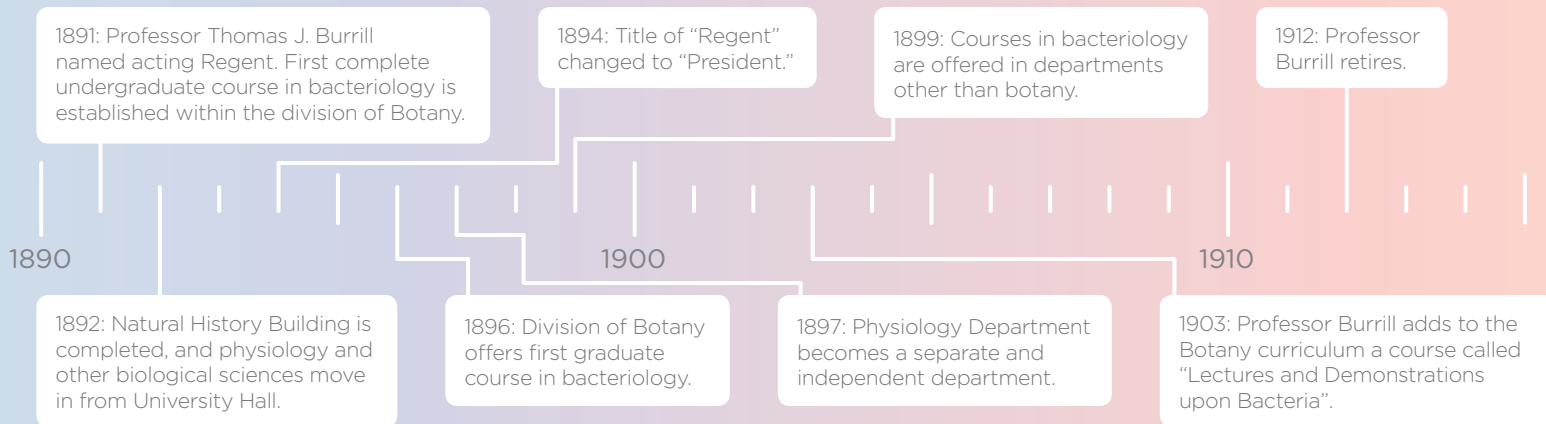
1886: General biology is added to the courses listed in botany.

There are five key buildings in the School of MCB: the Chemical and Life Sciences Laboratory, Roger Adams Laboratory, Davenport Hall, Morrill Hall and Burrill Hall. Their distinctive architectural features and instructional spaces complement their unique histories with the program.

The buildings of MCB are as diverse as its students, faculty members, and alumni. Over time these structures have been added to, renovated, and reconfigured; these changes mirror the dynamic state of the field of molecular and cellular biology itself. We continue to address the instructional and research needs of students and faculty members to maintain the standards of research and teaching excellence that are the hallmarks of MCB.



## MCB TIMELINE



## DAVENPORT HALL



Davenport Hall aerial view, 1900. Note the Observatory in the upper right.

*Courtesy of University of Illinois Archives*

The 94,900 square foot Agriculture Building originally cost the university \$122,972 to build and was dedicated on May 21, 1901. Its front entrance showcases the unique architecture of the building, which includes two terra cotta Ionic columns and two quotes inscribed in stone: "Industrial education prepares the way for a millennium of labor," and "The wealth of Illinois is in her soil and her strength lies in its intelligent development," attributed to Professor Jonathan Baldwin Turner and University President Andrew S. Draper, respectively.

A \$6000 addition was added to the building in 1917. In 1947, the building was renamed "Davenport Hall" in honor

of Eugene Davenport, a professor at the university from 1895 to 1922 who also served as the dean of the College of Agriculture and vice-president of the university during his long career. In the 1950s, the building was remodeled for \$305,000. Over the years, the building has housed the Departments of Agronomy, Animal Nutrition, and Dairy Production, the Regional Soybean Laboratory, and the US Department of Agriculture. Around 1991, the School of Life Sciences reconfigured Davenport's second floor with new laboratory and instructional space. This floor currently houses the MCB Instructional Program and hosts many introductory MCB labs.

## ROGER ADAMS LABORATORY



Roger Adams Lab, date unknown.

*Courtesy of News Bureau Archives.*

Roger Adams Laboratory (RAL), completed in 1950, was known as the "East Chemistry Building" for twenty-two years. It was renamed in honor of Adams in 1971, a year after his death. Adams was a professor affiliated with the Departments of Chemistry and Chemical Engineering whose career at the university spanned fifty-six years and whose contributions were significant to the advancement of the field of organic chemistry. The Biochemistry Department has been a part of RAL since the building's opening. The department moved from the School of Chemical Sciences to the School of MCB when MCB was created in 2000.

Over the years, an addition was added to RAL, and beginning in 2006, a project was undertaken to renovate the building's infrastructure, ventilation systems, and laboratory spaces. Central air

conditioning and new cold rooms make up some of the added features, and the floor layouts have been reconfigured into a modular scheme in which laboratory spaces are on the perimeter surrounding central office spaces. Lab spaces continue to be remodeled each year to fit the school's needs as new professors join the Department of Biochemistry. A state-of-the-art video conference room is being established in recently renovated space to honor Professor Lowell Hager's enormous service and contributions to the Department of Biochemistry and the University of Illinois. Donations will be matched by a friend of Lowell Hager's. Funds that exceed the cost of the new conference room will be used for the Lowell P. Hager Graduate Fellowship Fund. For more information: <http://mcb.illinois.edu/departments/biochemistry/giving>.



1921: Trustees approve the organization of the departments of Bacteriology, Botany, Entomology, Physiology, and Zoology into a Division of Biological Sciences.

1941: The Departments of Zoology and Physiology are combined.

1920

1930

1940

1933: Rumors spread that a new Biology Building will be built.

## BURRILL HALL



Laying the corner stone of Burrill Hall. From left to right: F.M. Clark, Bacteriology; Dean of LAS J.R. Smiley; Library Director R.B. Downs; University President David Dodds Henry (after whom the Henry Administration Building was named); Building Committee Head Norman Parker; Board of Trustees President Park Livingston; LAS representative on Building Project John D. Anderson; and Provost and Vice President Gordon Ray.

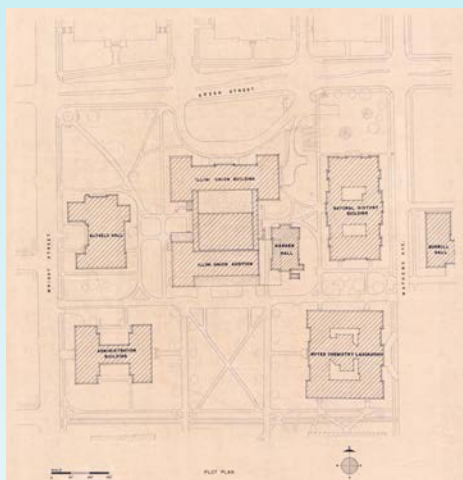
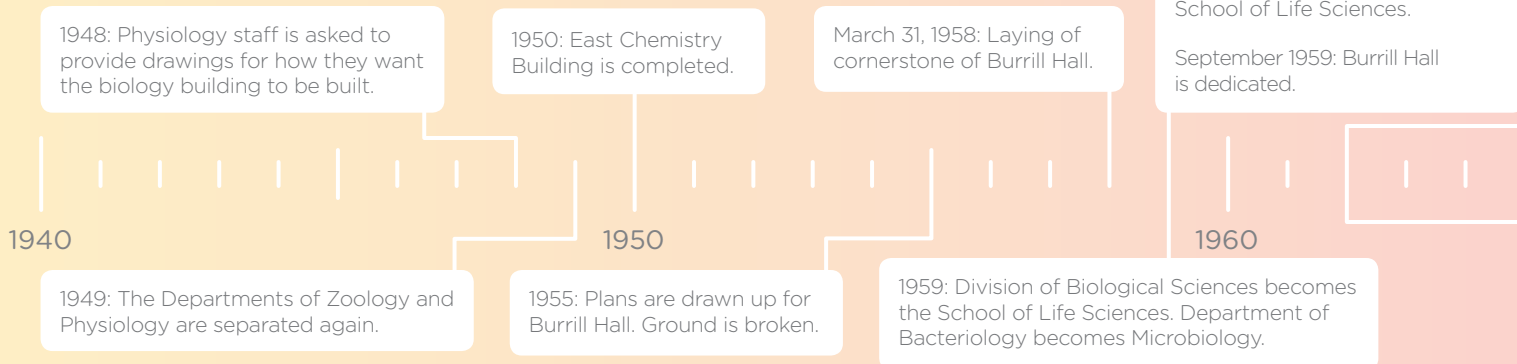
*Courtesy of University of Illinois Archives.*

Burrill Hall is named after Thomas J. Burrill, one of the first faculty members and administrators of the University of Illinois. Burrill is considered to be the father of the science of plant pathology and he taught the world's first general bacteriology course.

In 1933, rumors began to circulate that a new biology building, in addition to the Natural History Building, was to be built. However, due to disagreements between the Illinois legislature and governor that delayed its funding, the Burrill Hall groundbreaking ceremony did not occur until late 1955. In February 1959, the building was completed, and by August 1959, the Departments of Physiology, Microbiology and Biophysics, as well as the Biology and Botany Departmental Libraries, had completed their moves to the new building.

Since its opening, Burrill Hall has gone through several major changes. In 1970, university trustees approved plans for an addition to increase the number of research and teaching laboratories so as to increase the number of medical doctors being trained in Illinois. Recently, space adjustments

# MCB TIMELINE

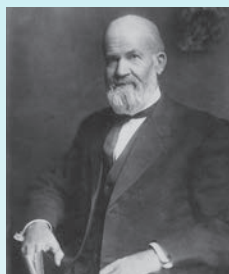


Plot plan showing Main Campus. Buildings include Altgeld Hall, Illini Union Building and Addition, Harker Hall, Natural History building, Burrill Hall, Administration Building, Noyes Chemistry Laboratory.  
*Courtesy of University of Illinois Archives.*

within the School of MCB have created large-scale renovations for the building in both research laboratory and instructional spaces. The new instructional spaces on the second floor utilize modular lab spaces that can be organized for each individual course to promote an active and collaborative learning environment. Burrill also hosts the MCB Learning Center, furnished with computers and large tables which allow students to meet with their teaching assistants and fellow students easily.

Plans are in the works to convert the former Biology Library into a consolidated and modernized instruction and advising space.

## Thomas J. Burrill (1839–1916)



Thomas J. Burrill, circa 1890s.  
*Courtesy of University of Illinois Archives.*

Thomas J. Burrill was born in 1839 in Pittsfield, Massachusetts. After graduating in 1865 from Illinois State Normal University (its name then reflecting its primary mission as a teacher training institution, at that time called a “normal school”), in 1868 he became an associate professor of Botany at the University of Illinois (then called Illinois Industrial University), just one year after it was founded, becoming department head in 1892. While studying a disease called pear blight in 1880, he discovered evidence that microorganisms cause disease in plants; he is now considered the father of bacterial plant pathology. Burrill is credited with teaching the first American course in bacteriology, and introducing laboratory study in the classroom—being the first to put microscopes in front of students, a tradition that continues in the MCB undergraduate curriculum.

In addition to his roles as a pioneering research scientist and professor, he also served as the acting president of the University beginning in 1891. During his presidency, he increased faculty power; increased faculty salaries to make the university more competitive with other Midwestern universities; abolished the loyalty oath, demerit system, and compulsory chapel; established the Graduate School; expanded the enrollment of women students; and emphasized research in the undergraduate curriculum, reinvigorating several subjects—notably in the liberal arts—and expanding the number of courses by 45 percent. While his eight years as president were highly influential, setting the university on a course it continues on today, he declined a permanent presidency because of his love of teaching and research.

After his death in 1916, entomology professor Stephen Forbes said, “If [Burrill] may not be called the Father of the University of Illinois, he was at least its elder brother, intimately acquainted with its aims, character, and history. Long may he live in these halls and on this campus, in memory, in spirit, in example, and in the gratitude and honor of all good men.”

## Interview with Rich Burrill, Great Grand-Nephew of Thomas Burrill



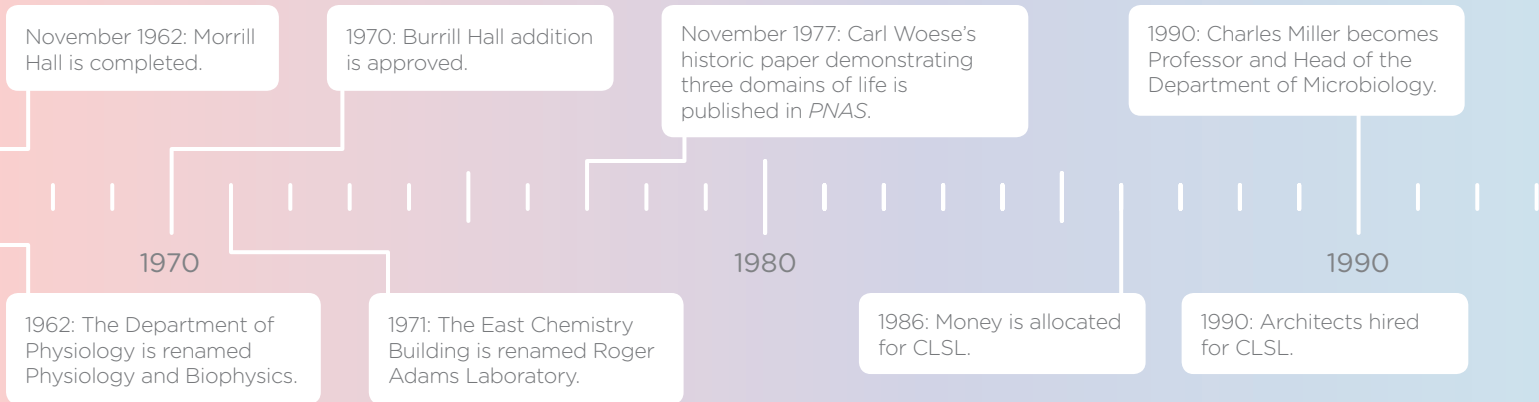
**What do you think made your great grand-uncle unique in his relationship with the university?**

He was clearly very passionate about his duties at the university, especially in terms of his research and scientific discoveries. His

dedication to the university and sometimes controversial views on how the university treated both students and faculty were instrumental in making the University of Illinois what it is today. His impact on scientific discovery through research and its importance in the development of “scientific thinking” opened the door for undergraduate as well as graduate students to gain practical experience found at few other universities.

**Do you have any fond or interesting memories of Burrill Hall?**

My visit in August 2012 was my first to Burrill Hall and the university. It was a pleasure and delight to see the legacy of my great grand uncle and his influence over the years. Burrill Hall is truly a magnificent memorial to my uncle’s impact at Illinois. The modernization effort currently underway will enhance the educational experience for the thousands of students in the MCB program, furthering Thomas’s legacy.



# MORRILL HALL



Assumed to be a proposal drawing of Justin Smith Morrill Hall (known as the Entomology Building during construction).  
 Courtesy of University of Illinois Archives.



Morrill Hall, date unknown.  
 Courtesy of News Bureau Archives.

Completed in November 1962, Morrill Hall is named after Justin Smith Morrill, US Representative from Vermont. His Morrill Land-Grant Colleges Act of 1862 granted each state public land for the founding of a public university based on the number of senators and representatives the state had in Congress. The act was signed into law by President Lincoln, leading to the formation of 69 universities. According to Visiting Archival Specialist Ryan Ross, “Prior to the passage of the Morrill Act, only the very privileged class could afford to attend universities.”

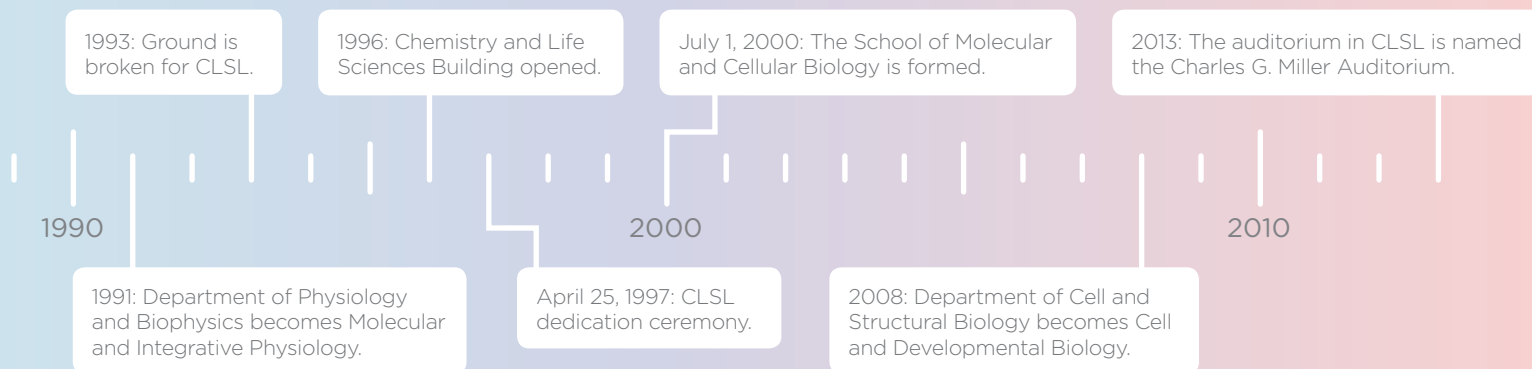
Throughout its construction, Morrill Hall was referred to as the “Entomology Building” because of its use in a project sponsored by the National Institutes of Health to study arthropod-borne diseases. The building originally housed members of the departments

of Entomology, Botany, and Zoology. A press release announcing its naming says that the building was created to “reflect the university’s broad interest in research and instruction, emphasized since the early days of science, and cooperative arrangements between state and federal governments in encouragement of the program of land-grant universities.”

A 1964 addition tripled the size of Morrill Hall and increased space for new research laboratories and the administrative offices of the original School of Life Sciences. A bridge on the second and third floors to Burrill Hall was also added at that time.

Today, the School of MCB shares the building with the School of Integrative Biology. The departments of Cell and Developmental Biology, Microbiology, and Biochemistry all have a presence in the space.

# MCB TIMELINE



## CHEMICAL & LIFE SCIENCES LABORATORY



Chemical and Life Sciences Laboratory architectural drawing.  
*Courtesy of News Bureau Archives.*

The Chemical and Life Sciences Laboratory (CLSL) opened in the spring of 1997. The university originally allocated the money for the interdisciplinary building in 1986 and hired architects in 1990. However, after the 1993 groundbreaking, a series of events, including a concrete contractor strike and heavy spring and summer rains, delayed the building's completion. Research groups finally began moving into the state-of-the-art 227,500 square foot building in the fall of 1996.

According to the *News-Gazette* (2 July 1995), "at \$61 million, it's the most expensive project ever undertaken by the University of Illinois—though Memorial Stadium would cost more to build today." Upon opening, one of the facility's crown jewels was a \$5 million Keck nuclear magnetic resonance center.

At the time, current School of Molecular and Cellular Biology Director Stephen Sligar, who was then the director of the School of Chemical Sciences, said, "The facility will allow us to physically and intellectually bridge the gap between the chemical and life sciences."

This goal has certainly been accomplished. The A wing of the building is predominantly occupied by Department of Chemistry laboratories, but a short walk over the bridge that spans the former California Avenue leads to the School of MCB's B and C wings. The Departments of Cell and Developmental Biology and Microbiology are located in this northern section of CLSL. ■

FOR FURTHER READING

*Student Life at the University of Illinois 1967–Present*  
<http://archives.library.illinois.edu/slc/researchguides/timeline/index.php>

*C. Ladd Prosser: Scientific Autobiography and Personal Memoir* (Stipes, 2002), edited and produced by Essie Meisami (see page 29) and Ian Meinertzhagen

**A MESSAGE FROM THE DIRECTOR**

Throughout this issue of the MCB magazine, you will find frequent references to our facilities from several vantage points—from an important historical perspective, highlighting such figures as Thomas Burrill and Roger Adams, to the state-supported facilities such as the Chemical and Life Sciences Laboratory (CLSL). Looking into the future, it is vitally important for us to continually plan for the needs of our outstanding faculty and talented students. Classroom spaces in all the current facilities are generally managed by the campus. It is important that we annually make the case to Chancellor Phyllis Wise, Provost Ilesanmi Adesida, and others the needs for updated lecture, classroom and seminar spaces to accommodate the impressive growth of our undergraduate population.

We have been fortunate in identifying various sources of departmental and school funds to enable us to renovate various laboratory and office spaces, and we will continue to work on a short-term plan. However, as state resources continue to diminish, it is incumbent on us to develop a long-term facilities plan. The importance of strategic partnerships with industry as we look at such a plan will be crucial, as will the support of friends and alumni across MCB departments with multiple naming opportunities. Future communications will keep you apprised of this planning process. In the meantime, I welcome your feedback on the physical spaces within MCB.

—Stephen Sligar



This February, the B103 Auditorium was renamed the Charles G. Miller auditorium, following a redesign of a three-story atrium to give MCB a distinctive architectural presence, and provide a focal point for the school's many buildings. Highlights of the new environmental design include a lightbox gallery showcasing scientific imagery from researchers in each of the four departments, two-story high banners, and a translucent blue MCB sign covering a large window, all creating a striking visual impact from within and outside, especially at night.

# MCB: Undergraduate Excellence

## An Interview with Michel Bellini, Associate Director for Undergraduate Education

### What are the emphases of the MCB undergrad curriculum?

We have a very diverse population of students, and so the primary goal is to offer them the means to do well after graduation. Most of our students are pre-health declared majors, so we need to be able to offer new ways and opportunities for them to be successful in their careers. We also need to provide students with extremely solid foundations in cell and microbiology, and that means training in the basic science. Because everything is interdisciplinary, they need to learn about genetics, cell biology, biochemistry, chemistry, physics and math. We try to provide students with an integrated view of what the cell is and how it works.

### What makes the MCB undergrad curriculum innovative and unique?

I was recruited by Charles Miller, the founding director [of the School of MCB], and during that time, the MCB curriculum was being redeveloped. He simply told me, “We really want the students to get the fundamentals in MCB.” What makes it unique is that we focus on telling students the fundamental concepts and the experimental approaches of MCB rather than telling them all the different facts about the cell or about a molecule that they would simply have to memorize and regurgitate at the exam. The students are challenged in their classes to think about what the experimental data means and what conclusions they can draw and how they can put it in perspective of how the cell works. It’s unique because in many other curricula, students are simply being given the facts without being enticed to try to understand how we know these facts, what the experiments are that have been used to get to those facts and what we are going to do with them. Because of our new approach, students realize that the field of MCB is ever-changing.

The other aspect that makes us quite unique is we try to provide students with laboratory experiences. We are one of the last large institutions to still offer lab courses at 100, 200, 300 and 400 levels because we believe without hands-on experience, students cannot really understand the fundamentals of what is being offered to them during lectures or during discussions. What we’re trying to do in MCB is

complement whatever is being discussed in lecture and discussion with a more experimental approach.

Students are well trained to continue their education in either a graduate program or medical school program, or seek employment in a pharmaceutical or other company. MCB has at least 70-80 amazing faculty researchers. Every year we welcome students to work on projects that are extremely current and ask fundamental questions in cell and molecular biology or biochemistry. This is a unique place to really get the most out of a four-year college experience.

### What kind of interactions with faculty members do students enjoy in the program?

I hear a lot from students about extremely positive experiences that they have had with our faculty. All the faculty who are teaching undergraduate students make themselves available to those students. It’s not uncommon to see undergraduate students in research labs where they are exposed not only to faculty, but also to members of the lab, post-docs and graduate students and research specialists. If a student approaches a faculty member with specific questions about a lecture or about a societal problem in which science has an impact, the faculty member is going to be extremely happy to discuss it with him or her. There’s nothing better than to interact with students outside of the lecture hall because that’s when you actually get to know the next generation of scientists. It’s a synergistic interaction between students and faculty that makes the learning experience as rich as possible.

### How will the renovated spaces, especially Burrill Hall, improve curriculum delivery?

These are critical and they’re going to improve the delivery of the lab courses tremendously. Burrill Hall now offers state of the art instructional space with modular lab spaces. You can organize your classroom the way you want for a specific lab course. And that’s going to provide both teachers and students with an outstanding level of education.



### What are you most proud of about the MCB undergrad program?

I’m amazed by how much students are learning. I know many students end up in graduate school, in medical school, and in most cases, all the students have been interacting with faculty on a one-to-one basis. If a student joins MCB and says, “I’m a pre-med, I want to go to medical school,” chances are, if he or she follows our guidance, they’re going to end up in medical school. That’s the beauty of the curriculum. If a student comes to MCB and is engaged in his or her learning experience, I know for sure that he or she will be successful in whatever he or she does. ■

#### FOR FURTHER READING

Articles about our undergraduate program from previous issues of *MCB*:  
<http://mcb.illinois.edu/magazine>

“Undergraduate Laboratory Experience Part One” (*MCB 2*)

“Undergraduate Laboratory Experience Part Two” (*MCB 3*)

“MCB as Pre-Med” (*MCB 4*)

# STUDENT TESTIMONIALS



**Chelsey B. Coombs**  
Current Junior in MCB

I recently found out that one of the graduate programs that I will apply to my senior year requires its applicants to take a GRE subject test. Because I am a Molecular and Cellular Biology major, I naturally chose to take the Biochemistry, Cell and Molecular Biology subject test.

The MCB core curriculum is designed to address these topics in detail, but upon reading the full, bulleted list of content on the Educational Testing Service website, my heart began to race. Would I be prepared to ace the exam by the time April rolled around?

I downloaded a practice exam. The first question asked, "Which of the following represents the most reduced form of carbon?"

A smile came to my face as the answer, "R-CH<sub>3</sub>," came to me immediately. After two hours, I finished all 180 questions and scored my first attempt.

I am happy to report that I answered a majority of the questions correctly, and I realized that in just two-and-a-half years, the School of MCB has prepared me well for my future career.

I remember sitting in the giant lecture hall the first day of MCB 150, the introductory MCB core course, and being nervous for what was to come. As soon as Professor Brad Mehrtens came onstage with a greeting of, "Good afternoon everyone! Happy Monday to you all! Welcome to MCB 150," my fears dissipated and I was ready to begin as an MCB major.

MCB professors like Mehrtens are instrumental in making sure students learn what they need to know, not only for class, but also for our lives after we hand in our final exam. From the RNA extractions and cDNA syntheses I do in my research laboratory every day to the explanations I give relatives at the dinner table about how a certain drug works, the material I have learned has already helped me in a real way.

I'm looking forward to taking the Biochemistry, Cell and Molecular Biology GRE subject test. I can't wait to show how much I've learned from the University of Illinois Molecular and Cellular Biology program.

## Hani Kuttab

Class Of 2012; Currently Studying At Loyola University Of Chicago Stritch School Of Medicine

I chose MCB because I enjoyed my biology courses in high school and wanted to continue learning and understanding it at a deeper level. I knew early on what career path I wanted to achieve, and I knew that upper level MCB courses (and the MCB curriculum in general) would get me there.

In my opinion, MCB is definitely one of the most difficult majors at the University of Illinois. A lot of focus is placed on engineering, even though the MCB and Chemistry departments at our school are some of the best in the nation. During my time at Illinois, I found the major very difficult, but very rewarding. I liked the challenge of the subject matter.

The upper level MCB courses, (e.g. Anatomy, Immunology, Physiology, Neurobiology, Microbiology) were all very interesting. I liked that I was able to take specific classes on subject matters that appealed to me! Moreover, although not a direct part of the major, I truly enjoyed the vast amount of research opportunities in MCB and chemistry. I feel that these experiences supplemented the courses I was taking nicely and have made me a well-rounded individual overall.

Being in medical school with other biology majors from across the country allows me to see, first-hand, the differences in the University of Illinois MCB program. Without a doubt, the quality of the education in Molecular and Cellular Biology that I received at the



University of Illinois has been top-notch. The MCB major taught me to work hard early and to seek out help when I needed it. Moreover, the availability of resources at the University of Illinois, such as peer tutoring from LIGASE, the availability of professors and TAs, and the accessibility of classmates and professors via the Lon-Capa and Compass websites all helped me better understand the lecture material as I was learning it. In combination with the plentiful research opportunities at the University of Illinois, I would definitely say that I received a high-quality education similar to some of the best schools in the nation.

The MCB curriculum has also prepared me for my medical school education. Now that I have completed my first year of medical school at Loyola University Chicago Stritch School of Medicine, I realize how valuable the MCB degree I received was in preparing me for the field of medicine. The core coursework helped prepare me for our Biochemistry/Genetics course here, and the upper level courses, including Anatomy and Physiology, have also prepared me for the challenges of medical school. Even more importantly, MCB taught me how to study and work hard. The curriculum helped me build a strong foundation in the field, and I know that this foundation will continue to help me throughout my time in medical school.



**Sonja Bromann**  
Current Junior in MCB

I originally came in through the Division of General Studies. When I mentioned to my advisor that I enjoyed the natural sciences, she placed me in the appropriate pre-med courses. After experiencing both MCB 150 and IB 150, I felt as though the cellular focus of MCB suited my interests best.

Students in the MCB major are willing to dedicate a substantial amount of time to their studies. The core classes in the MCB curriculum challenge students mentally in terms of content, but also encourage time management with other supplemental courses.

Far and above all else, I have enjoyed getting to know my fellow MCB peers. Dr. Shawna Naidu has created a wonderful MCB honors concentration program where students can interact more closely with one another, as well as with the professors. The large class size of the lectures forces students to do more independent study. Students are held more accountable for their own success and must actively seek a professor's guidance if desired. The Illinois MCB program develops students' ability to forge their own path.

While I have not yet experienced the freedom of choosing from a number of advanced courses, I believe the sheer volume of possibilities allows for students to pick which courses suit their own interests. The core curriculum lays a foundation for any health sciences career, while the upper level courses result in specialty even during one's undergraduate career.

# From the Pacific to the Prairie

Chelsey Coombs



## Martha & Rhanor Gillette

The School of Molecular and Cellular Biology is known for its research collaborations. Professors often work cross-departmentally, sharing their expansive knowledge base to solve problems in the life sciences. Two such collaborators are a special case because they share not only their knowledge, but a family.

Martha Gillette is a professor in the Department of Cell and Developmental Biology who studies the circadian clock of the brain—which controls the timing of cells, tissues and organs based upon a 24-hour cycle—and the suprachiasmatic nucleus, or SCN, where it is located.

Rhanor Gillette, professor emeritus in the department of Molecular and Integrative Physiology, examines animals' behavioral expression and their underlying neural network circuitries to learn how their behaviors harmonize through motivation, experience and sensation.

Both Gillettes started on their paths toward the field of biology as kids, because the natural environments around them fostered their curiosities.

"I was always interested in how things worked and was always asking questions, especially about nature, and I think that's probably what makes you into a biologist. I wasn't particularly interested in making people well, which my mother especially was very disappointed by, but I really liked figuring out how things worked," Martha says.

Martha comes from the small town of Hooper, Nebraska, which had a high school with only one instructor to teach all of the science courses. Her favorite class was biology, and she followed her passion for the subject in her undergraduate career at Grinnell College in Iowa. After taking and enjoying a summer class at Caltech on marine biology, Martha Gillette moved to the University of Hawaii to earn a master's degree in zoology.

"I realized that measuring the behavior of snails underwater was not what I wanted to do. I mean, it's actually fascinating, it's just that I like to answer questions that are at a more mechanistic level," she says.

Martha then realized that she was more interested in understanding the cognitive mechanisms of these behaviors.

Rhanor Gillette was born in Bushnell, Florida, and grew up in various parts of Florida and Georgia. He attended the University of Miami as an undergraduate, concentrating on marine biology and spending most of his recreational time fishing and diving around the inner tidal zones. Gillette worked with Howard Lenhoff, a biochemist and enzymologist who made a lasting impression on him.

"He allowed me to come into the lab and work with the sea anemones, and just watching how he thought about things and how he felt was very important," Rhanor says.

After graduating from the University of Miami, Rhanor left the continental US to study in the Aloha State.

"I went to work at the University of Hawaii intending to work with someone there who was working with sea anemones and that didn't work out, so I did a project on symbiosis and sea anemones and anemone fish by myself and that was pretty interesting. It got me really interested in behavior," Rhanor Gillette says.

The two met at the University of Hawaii. Martha remembers how Rhanor chivalrously offered her his helmet when he first took her for a ride on his motorcycle. They married on a beach in 1969.

For his thesis project at the University of Hawaii, Rhanor worked on nucleic acids and the brain, which he found interesting, so he went to the York University in Toronto to become a neurochemist specializing in learning.

"I worked there for a year on RNA/DNA hybridization in rats, looking for differences in hybridization in a training paradigm. That fell resoundingly flat, and I realized it was time to move," Rhanor says.

He then moved downtown to the University of Toronto and worked



on the nervous system of the mollusc *Aplysia* to earn his doctoral degree.

Martha Gillette was also at the University of Toronto studying developmental biology for her doctoral degree, looking at the development of the cellular slime mold.

At one point during his Ph.D. work, Rhanor heard about a molluscan preparation that showed learning and had a simple set of behaviors, a predatory sea slug called *Pleurobranchaea* that is native to the west coast of the United States.

The couple moved to the University of California at Santa Cruz for Rhanor's post-doctoral research on the *Pleurobranchaea*

because, according to Martha, the two "couldn't decide on one place to go."

"Never having been to the west coast, I left Toronto in a blinding snowstorm and drove all the way to California, getting lost several times on the way, and arrived in Santa Cruz at night," Rhanor says. "I walked into the building where I was going to be

working, looked around, came back out, scared a ten point buck that was walking down the road in front of me, went back to my car in the redwoods, took my wristwatch off, put it in the glove compartment and I didn't put it back on for four and a half years."

Although Rhanor had found the perfect system for studying his new sea slug, Martha found that no one at UCSC was working in her area of expertise: the ways in which extracellular signals tell a cell to differentiate into another kind of cell. Instead of giving up, she became like the cells she had previously studied, taking the signals from her new environment and "differentiating" to become a neuroscientist, and working in the same lab as Rhanor.

"I basically had to completely retool and become a different kind of scientist. That was the best thing that ever happened to me. It wasn't fun at the time, but I became comfortable changing fields and learning new techniques and new ideas," Martha says, adding with a smile, "And I found out I love neuroscience."

After completing their post-doctoral training, in 1978, the Gillette family, which now included two children, Eben and Megan, packed up their lives in California to move to the University of Illinois where Rhanor had received an assistant professorship.

Martha was given the title of visiting assistant professor and Rhanor gave her space

and equipment in his lab so she could focus on her own research. Martha began working on a single, important cell within the brain of a simple mollusk.

However, one of Rhanor's graduate students who was working on keeping a slice of the brain alive in a life support system was looking for a new project, so Martha and the grad student switched projects.

"I said I could work on that brain slice, and I could work on signaling, which is what I've always worked on, and so that was the defining moment. It wasn't that I chose it, it was basically a whole bunch of unpredicted issues that then caused me to say, 'Well, I could



Rhanor Gillette, 1999. Photographer unknown.



Martha Gillette, 2012. Photo by L. Brian Stauffer.

work on that," Martha says. "I brought some of the techniques I had learned in molluscan neurobiology using a simpler nervous system, and I applied them to this part of the mammalian brain."

As it turned out, this brain slice, the SCN, had differential sensitivity to signals that came in depending on the time of day.

This finding became the basis of Martha's research, and in 1986, she published her first paper about the SCN. She was then promoted to visiting associate professor, and in 1988, she applied for and received a position in the Department of Cell and Developmental Biology.

"The decision I made was not to do something iterative where you're sort of sailing along the shore of knowledge and following what other people are doing, but I took off in a new way and said, I'm going to go here, because I just think it's so interesting. It turns out it was the right decision to do that. I really feel very, very lucky," Martha says.

With all of their individual achievements since then, the Gillettes have become a power couple within the School of Molecular and Cellular Biology.

They have published many journal articles, some together, and have developed successful research and outreach programs. They have especially enjoyed the mentoring opportunities that have come with their careers.

"I've run courses in Curaçao and Puerto Rico and places like Monterey, CA, taking students out into a biologically rich area, lecturing on the mechanics of behavior and the properties. I can then watch them observe all of the things that we covered in the lecture. That's definitely something I'm proud of," Rhanor says.

"I have terrific graduate students. They all contribute to the ideas, to the execution. I see them really mature and flower, and by the time they leave, they are becoming independent researchers. It's extraordinarily rewarding," Martha says.

They are also co-teaching a class during the

spring 2014 semester called "Integrative Neuroscience."

"Rhanor and I talk about research all the time and we teach together. We're complementary on what we teach. Rhanor's synthetic, I'm mechanistic, and we're both integrative," Martha said.

The Gillettes have had a huge impact on the School of Molecular

and Cellular Biology, and although their paths to Champaign-Urbana were full of twists and turns, they are both happy as to where the unexpected has taken them.

"Everybody's different. Everybody takes a different path. Some people work well in very structured environments, other people when allowed greater latitude for curiosity. Find out what's best for yourself and don't be afraid to cut your losses," Rhanor says.

"My advice is to do something you're passionate about, don't be afraid to change areas. I mean, that's not just in science, it's all of life," Martha says. "If you can get the confidence to try new methods and explore new ideas, you can master them. But you've got to try it. Don't be too afraid, because you will have to change your goals a bit as time goes by. It's inevitable." ■

*With thanks to Megan Gillette.*

#### FOR FURTHER READING

"Metabolism in the brain fluctuates with circadian rhythm:"

[http://news.illinois.edu/news/12/0828metabolism\\_MarthaGillette.html](http://news.illinois.edu/news/12/0828metabolism_MarthaGillette.html)

"A Core Circuit Module for Cost/Benefit Decision." *Frontiers in Neuroscience*:

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3431595/>

# LEADER of the BAND

## The Legacy of Charles G. Miller (1940–2012)

Doug Peterson

When Charles Miller was an undergraduate student, he faced a pivotal choice. Would music or science be his life's work? At first, it was music.

Miller started out as a music major at Indiana University, where he studied trombone. “But after two years, he decided that music wasn't really his calling,” says his wife Judy. “But it wasn't because he didn't enjoy the music.” She says her husband wasn't sure he had what it took to be a professional musician, so he shifted to his other big interest—chemistry.

Ironically, he wound up becoming a bandleader of a different sort, orchestrating the creation of the School of Molecular and Cellular Biology in 2000. As so many colleagues have says, Miller had a knack for getting scientists from all backgrounds to work together, like a conductor getting the woodwinds, brass, and strings to play as one.

“He had a good touch,” says James Imlay, a microbiology professor who worked closely with him until Miller's death in 2012. “Charles could talk clearly and with candor, without people in the room getting insulted.”

This unique combination of tact and forthrightness served MCB well, as Miller played a key role in splitting the old School of Life Sciences into two new schools: MCB and the School of Integrative Biology (see “MCB and the Age of Biology,” page 2).

Charles Miller grew up in Greensburg, Indiana, a small city found between Indianapolis and Cincinnati. His family owned a nearby farm that had been under their stewardship since the homesteading days of 1824, “so he felt quite attached to the farm,” says Judy.

However, he never saw himself as a farmer, so after receiving his bachelor's degree in chemistry in 1962, he went to Northwestern, where he received his PhD in biochemistry in 1968. That's also where he met Judy, a fellow biochemistry graduate student, and they married in 1965.

From the start, Judy discovered that music was a big part of his life, even though it wouldn't be his life's calling. One of her most memorable dates with Charles was going to hear Miles Davis play jazz in a small bar on the South Side of Chicago. “I was entranced,” she says.

She was also struck by Charles' curiosity and intellectual honesty. “When he was trying to figure something out, he had to understand it thoroughly,” Judy points out. “And once he understood something, he remembered it. I was astonished.”

The need to understand things completely even applied to everyday activities, such as working on the car or cooking. “He didn't just use eggs when he cooked,” she says. “He learned about the protein in an egg and the chemistry behind it.”

This intellectual curiosity showed through as he served as the director of MCB. “He was very sharp and very interested in a wide range of science, not just microbiology,” says Imlay. “The other science going on in MCB always interested him, and he really understood what was going on in the different departments. It showed he was not provincial in his thinking.”

Miller's first professorship after his post-doctoral work at Berkeley came in 1970 in microbiology at Case Western Reserve University in Cleveland. He also played, on a volunteer basis, for the Cleveland Heights Symphony Orchestra.

Miller stayed at Case Western for 20 years until the late 1980s, when Illinois began recruiting him for the chair of microbiology. Judy says he was drawn to the U of I position because of microbiology's reputation at Illinois.

“He was always proud of it as a department that functioned well, without egos clashing, and he wanted to further this reputation. However, he used to joke that here he was, as the chair of



microbiology, and he had never taken a microbiology course.”

The lack of microbiology classwork was never an obstacle because his research took him deep into molecular biology. From the beginning as a PhD student, Miller studied the work of peptidases in breaking down amino acids in the body, and he continued this same line of research at Illinois.

Proteases attack a long chain of amino acids, breaking them into smaller pieces, explains Robert Switzer, a fellow biochemist at Illinois. Then peptidases go after the smaller pieces, breaking them down even further—a critical process in the body’s quest for nutrients. Miller’s lab used an innocuous strain of salmonella to study the roles of different peptidases and the genes that controlled the process.

When the university began looking for someone to guide the formation of the new School of MCB in the late 1990s, Miller was the logical choice. “He had a good sense of where the field was going,” says Martha Gillette, head of cell and structural biology when Miller first took the reins of MCB. He embraced the trend toward interdisciplinary research, which was why he was also one of the major forces behind the establishment of the Institute for Genomic Biology (IGB).

“Charles worked tirelessly with IGB when it was being built,” says Stephen Sligar, the current head of MCB. “He even spent an enormous amount of time on the interior design of the building.

## Excerpts from the Miller Auditorium dedication ceremony

### Stephen Sligar



One of the things that Charles envisioned was that rather than have a balkanized department-centric undergraduate program, we would run undergraduate education at the school level. This was a radical idea at the time, and it meant giving up historically protected areas of undergraduate education, but it was wildly successful, and today we have some 2000 undergraduate majors who have declared MCB their home. With a cadre of academic professionals that Charles also envisioned as critical to delivering undergraduate education, we now teach some 17,000 undergraduate students a year. The instructional staff that Charles created was an important piece of that, because he wanted to put our best faculty in front of the undergraduate students. That has been one of our great strengths.

### Judy Miller



Charles was a very talented person, and he had many options for study as an undergraduate. After deciding that he would make his career in science rather than music, and that was a decision that was made after an honest, painful analysis to how he could best contribute, he chose chemistry. His very nature, when he learned things, what he needed was a deep, genuine understanding of the topic, no matter what it was.

Charles also had a talent for seeing the big picture. When he was studying in the 1960s, he realized that the exciting new frontier for study would be understanding biological processes. Time has proved him spectacularly right with the explosion of the molecular biological knowledge. He believed this is the age of biology.

Charles would have felt deeply honored, but we think he also would have felt humble and he might have even protested that he was being honored for simply doing something that needed to be done. His hope would be—our hope and his hope also—would be that students who study here are lucky enough to experience some of the passion and the wonder that he felt over the years with the elucidation of all these details of molecular biology, and perhaps understand what a gift it is to be able to contribute to this body of knowledge.

# CHARLES G. MILLER: LEADER OF THE BAND



Former Department of Biochemistry Head Colin Wraight and Charles Miller.

Charles G. Miller will become Head of the Department of Microbiology effective August 21, 1990. He will also serve as Head of Microbiology for the College of Medicine at U-C. He comes to the University of Illinois from Case Western Reserve University, Department of Molecular Biology and Microbiology, Cleveland, Ohio where he has been on the faculty since 1970. From 1978 to 1981 he served as Acting Chairman of the Department of Microbiology at Case Western Reserve.

Dr. Miller received his B.A. in Chemistry from Indiana University in 1963 and his Ph.D. in Biochemistry from Northwestern University in 1968. From 1968 to 1970 he was a postdoctoral fellow in the Department of Molecular Biology at the University of California at Berkeley.

Professor Miller has an international reputation as an excellent scientist. Professor Miller's research focuses on protein degradation in bacteria. His work has important implications in biotechnology, where overproduction of genetically engineered proteins is often limited by proteolysis. In addition, he has made important contributions to understanding how oxygen regulates gene expression. In both cases, the hallmark of Professor Miller's work is his use of sophisticated genetic and biochemical approaches to understand complex biological problems.

Official university press release upon hiring of Charles Miller.

Yet he always had time for people.”

“He was so personal and down to earth,” says Gillette. “He had a great ability to make people feel like they could work together.”

“Charles had a calm reserve about him,” added Switzer. “He was thorough and thoughtful and evenhanded, and it seemed almost natural that he would be MCB’s first director.”

His willingness to take time for people was echoed by many. “You never saw him flinch when you walked through his door to talk,” says Imlay. “Charles was the first person I told when my dad suddenly died, and when we discovered we were going to have our fourth child.”

When Miller stepped down as head of MCB in 2007, he threw himself into teaching undergraduates, for he was passionate about education. But he also continued to indulge his many other interests, including literature and Formula One Racing, a passion that came to him from growing up so close to Indianapolis.

“He could name all of the Indy 500 winners, and he knew how all of the principal racers were doing,” Judy says.

He also kept up with his music, and a grand piano is still the first thing you see upon entering the Miller house. But perhaps his greatest passion of all was his family, including his three grandsons.

“Charles was blown away when he became a grandfather. He told people that he figured he would like being a grandparent, but he didn’t know just how much. It astonished him.”

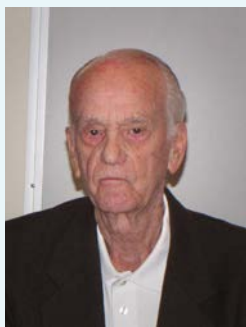
In memory of Miller, MCB’s main auditorium in the Chemical and Life Sciences Building has been named the Charles G. Miller Auditorium (see page 11). “This is only fitting,” says Imlay. “Architecturally, the auditorium is the focus of the building, and Charles was the heart and soul of MCB.” ■

# CHARLES G. MILLER AUDITORIUM



Excerpts from the Miller Auditorium dedication ceremony continued

## Ralph Wolfe



[Charles] approached administration like a science. He collected evidence, he got advice, he evaluated the evidence and the advice, and then he made a decision, all in a very low-key manner. And he really obtained the respect of his faculty.

Most of the time that an administrator spends has to do with nitty-gritty stuff like personality problems and budget problems, and a lot of these things never see the light of day. They're confidential.

But occasionally, the administrator really has the chance to do something tangible. And so it should not be forgotten that the modernization of the third floor of Burrill Hall was Charles's idea. He convinced Chancellor Herman that he should spend over a million dollars remodeling and air conditioning it, and everyone in that space now should be very grateful to Charles Miller for carrying this out. Also, the third floor in biochemistry.

But it must not be forgotten that the IGB (and it's not generally known) was Charles's idea. He fleshed out the idea in his mind, he typed it up on his computer, he presented in to the university, and they bought it verbatim, and so it was to come to pass that this was a reality.... And so the IGB is Charles Miller's legacy.

## John Cronan



We hired him because we thought he was a fine scientist, but we also believed that he had a generosity of spirit you don't find elsewhere. In fact, that's why we're here today. This is Charles's generosity of spirit. With Charles's generosity of spirit to burn, he took on the job of making this new school and curriculum. He gave and gave and gave and that's why we have this. He was a noble person and it was

great to have had him all these years.

## Tina Knox



He was a great teacher, a mentor, and a friend to me, as well as to all of the students in his lab... someone who valued good, quality writing and good music. He was very witty, and he appreciated a good sense of humor. Many of us in lab would spend hours trying to come up with something intelligent we could say that would amuse him.

He pushed us to do rigorous, quality work. He had extremely high standards and he wouldn't publish just anything. He made sure that we didn't leave his lab without accomplishing something important, something that we could be proud of, and something that truly made a difference within the scientific community. One of Dan Broder's favorite quotes that he remembers Charles saying often is, "If you don't have time to do it right, you have time to do it again." And Charles did things right. He made sure that we understood how important it was to focus on what we were doing and really think it through so that we didn't make mistakes.

Charles and his lab members would go out to lunch a lot, and if the conversation would die down and it got too quiet, he would pound his fist on the table and tell us, "Say something intelligent!" So hopefully, all of those who present in this auditorium will do just that, and make Charles proud.

## Stephen Farrand



Charles understood the idea of education. He didn't understand education as a way to learn a whole bunch of facts. What Charles saw education as was a way to master a body of information. To become an expert in thinking about something. To become, in addition, a well-rounded individual who would be part of a productive society.

# The Best of Both Worlds

Nick Zagorski



## Kannanganattu & Supriya Prasanth

For professional couples these days, a key to balancing work and family life is to not let one side of the pendulum spill too heavily into the other.

*Photo by Chelsey Coombs.*

For Kannanganattu and Supriya Prasanth, that proves to be a little more challenging than normal. The pair are not only a married couple and parents of a six-year old, but were also recently tenured as Associate Professors in the Department of Cell and Developmental Biology. They work in the same department, in the same building, on the same floor, in the same wing. Such an occurrence is not rare, of course, amongst scientific couples, who typically meet through a shared research interest and thus remain personally and professionally intertwined. And such husband-and-wife teams will agree that the line between work and home can get quite blurry: “We definitely talk science at the dinner table a little more than we should,” Supriya says.

However, the Prasanths have embraced their close personal connection and used it to develop a close scientific collaboration, and, much like a successful marriage, they each use their individual strengths—Kannanganattu with his expertise in RNA biology and gene regulation, Supriya with her expertise in cell cycle and chromosome biology—to complement the research of the other.

It’s a strategy that so far has been of great benefit to the tandem as well as the students and post-docs in their labs, even if it has led to occasional spirited disagreements. However, they both agree that you can’t have great science with some disagreements along the way.

Supriya’s lab is interested in addressing how cells coordinate all the different aspects of cell division; Kannanganattu’s lab is working towards unraveling how non protein-coding RNA is involved in fine-tuning gene expression in mammalian systems.

The seeds of their scientific collaboration started long before they shared a hallway in the Chemical and Life Sciences Laboratory building. In fact, science brought them together. They initially met when Kannanganattu was a graduate student in India, working on heat-shock induced non-coding RNAs and their role in regulating gene expression, and Supriya came into his lab as a summer trainee and began working on a project with him.

But it was after they both finished school and arrived in the United States in 2001, to begin post-doctoral studies at Cold Spring Harbor Laboratory, that they took on a directed effort to combine their talents.

They had picked Cold Spring Harbor because of its reputation as a nexus of biological research. “If you look at the history of great discoveries, even before they get published they get discussed at Cold Spring Harbor meetings,” Kannanganattu says. “We wanted to join a place where things were happening, and this was it.”

Initially, they each came with their own individual research agendas; Kannanganattu, for example, wanted to pursue studies into non-coding RNA after finding some RNA fragments that were being produced along with proteins in response to heat shock. “This was quite intriguing,” he says, “because at that time in the early 2000s, the only extensively studied long non-coding RNA was Xist RNA, which is involved in X-chromosome inactivation in female mammalian cells.”

Kannanganattu had worked with fruit flies as a graduate student, but he wanted to explore non-coding RNA in mammalian systems, which might have more clinical relevance. So he approached David Spector, a renowned expert in mammalian gene regulation. “David provided the support and platform to study long non coding RNAs in mammalian cells,” Kannanganattu said.

Supriya, meanwhile, took on her post-doc with the opposite goal in mind, becoming more fundamental in her research. Her PhD studies had focused on how a cell receptor called c-kit affected sperm development and fertility in rats, and that led to an interest in how cells proliferate.

“I decided I needed to get a more basic understanding of how cells grow and divide, so I joined Bruce Stillman’s group, since he was a leader in studying how DNA replication and cell division are linked in eukaryotic cells,” Supriya said.

Not long after starting, however, both of them came to the realization that their individual projects did share commonalities. Both were localized in the nucleus, the heart of a cell, and involved the chromosomes, the structures containing our genetic code.

Looking closer, more connections emerged. Kannanganattu primarily worked on a cellular level, examining how long RNA segments were affecting gene expression, a bigger-picture understanding of nuclear and chromosome structure was a vital component. Likewise, a detailed knowledge on the spatial distribution of proteins involved in DNA replication was essential for Supriya in her studies of cell division and the cell cycle.

“When you start focusing your efforts on a few specific molecules or a certain signaling

pathway, your thinking/views can become myopic,” Supriya says. “That’s why it’s always good to bring in someone with an outside perspective to help you find something you might have missed.”

So the pair thought, why not share some of their expertise with each other?

“It was a perfect blend,” Kannanganattu says. “Between the two of us, we had training in biochemistry, molecular biology, molecular genetics, and cell biology. Together, we could look at a problem from two different angles, which would help us find the best course of action.”

Both of their supervisors were very supportive of this proposed collaboration, and it fit well with Cold Spring Harbor’s spirit of bringing scientists together. And the tag-team effort paid off; during their time as post-docs the two of them produced many high-impact findings.

Today, their titles are different; Supriya and Kannanganattu are no longer post-docs. Their close working relationship, however, remains the same.

“The ability for us to keep collaborating was one of the several important factors we considered when looking for positions,” Kannanganattu says. “We wanted to make sure we found a university that would provide support to both of us and we were fortunate that Illinois turned out to be that institution.”

They’ve found Urbana-Champaign a very welcoming home, and are very excited at the opportunities Illinois presents to expand their research horizons, a valuable asset as laboratory research becomes ever more interdisciplinary. In addition to both a medical school and veterinary school, the Urbana-Champaign campus also offers strong programs in engineering and computational sciences.

Since arriving on campus in 2007, the Prasanth’s have continued their close scientific partnership, and as research heads, they have now included both of their labs in the mix as well. They hold joint lab meetings where all the students and post-docs share expertise, and help each other design and troubleshoot experiments.

“There are lots of plus points to this kind of arrangement,” Kannanganattu says. “For example, it doubles the scientific fields of expertise the students learn, which helps them advance their career.”

In Kannanganattu’s case, his lab has identified several new non-coding RNA fragments and he is having a hard time deciding which ones to prioritize. “I wish there were more than 24 hours in a day,” he bemoans.

One particular RNA fragment of interest is the recently identified MALAT1, which hangs around in the nucleus and regulates a family

of proteins called splicing factors. By doing so, MALAT1 can influence how other protein-coding RNAs are processed and what proteins get synthesized. “MALAT1 is intriguing because some of these downstream proteins are involved in cancer, and I’m looking forward to translating these findings into more applied science,” Kannanganattu said.

Supriya meanwhile, wants to uncover how the Origin Recognition Complex (ORC) assembly—a multi-subunit DNA binding complex—integrates all the cues that regulate the molecular orchestra that is cell division: DNA replication, chromosome separation, and cytokinesis. Supriya’s group identified a protein called ORCA (for ORC-Associated) that is critical in letting ORC attach to the chromosomes and initiate the whole replication process.

Some of her post-docs have also just identified even more novel proteins associated with ORC, and she’s excited to delve deeper into what these new proteins do. “It’s hard to predict what these proteins might do until we get some more work done,” she says, “but I think it will be pretty exciting no matter what the answers.”

Down the road, however, once both Supriya and Kannanganattu are more established, there are already opportunities for more direct and overlapping collaborations. As Kannanganattu notes, current estimates suggest that as much as 50% of the genome might be involved in making non-coding RNAs, and not surprisingly some of these RNA pieces have emerged with connections to DNA replication and cell division.

“There is some literature out there showing some non-coding RNAs are involved in chromatin organization and cell cycle check point control,” Supriya says, “we want to put our efforts and expertise together to understand how long noncoding RNAs regulate DNA replication and cell cycle progression.

“And we already have some ideas in our minds on how we can team up and pursue this and other questions.” ■

#### FOR FURTHER READING

“Long Noncoding RNA MALAT1 Controls Cell Cycle Progression by Regulating the Expression of Oncogenic Transcription Factor B-MYB.” *PLoS Genetics*:

<http://www.plosgenetics.org/article/info%3Adoi%2F10.1371%2Fjournal.pgen.1003368>

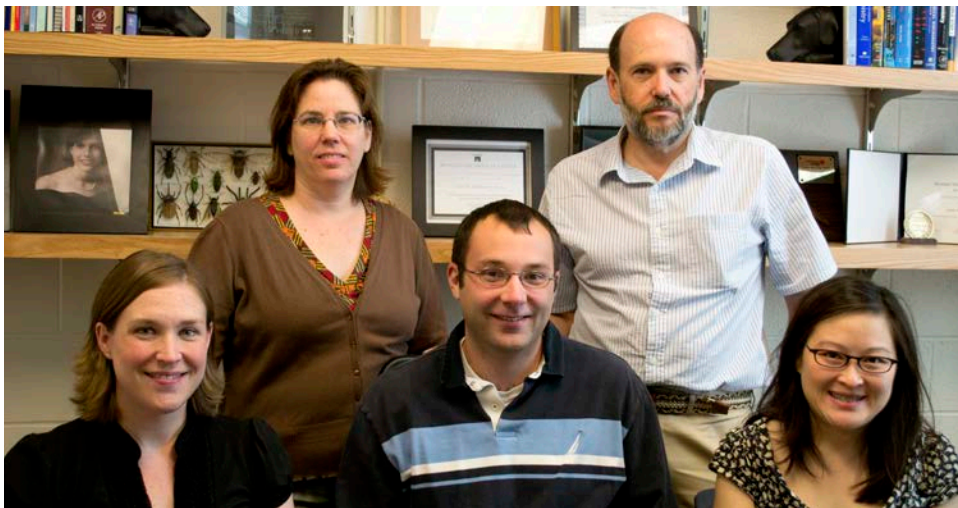
“Dynamic association of ORCA with prereplicative complex components regulates DNA replication initiation.” *Mol Cell Biol*:

<http://www.ncbi.nlm.nih.gov/pubmed/22645314>

# Science in the Blood

Chelsey Coombs

## James Morrissey



From left, Julie Collins, a research specialist in health sciences; Stephanie Smith, a research professor of biochemistry; Richard Travers, a biochemistry graduate student; James H. Morrissey, a professor of biochemistry; and Sharon Choi, a recent Ph.D. in biochemistry.

*Photo by Chelsey Coombs.*

Professor of Biochemistry and Roy and Eva Hong Professor of Molecular and Cellular Biology James H. Morrissey and colleagues have identified a group of small molecules that interfere with the activity of a compound that initiates multiple steps in blood clotting, including those that lead to the obstruction of veins or arteries, a condition called thrombosis. Blocking the activity of this compound, polyphosphate, could treat thrombosis with fewer bleeding side effects than the drugs that are currently on the market.

Blood clots are formed at the site of an injured blood vessel to prevent blood loss. Sometimes, however, blood clots completely clog an artery or vein and the surrounding tissues are damaged. The US Centers for Disease Control and Prevention report that 300,000 to 600,000 Americans are afflicted annually with deep vein thrombosis or pulmonary embolism, a blocked lung artery that often results from thrombosis, and 60,000 to 100,000 people die each year as a result of these conditions.

There are two pathways that trigger blood clotting. The “tissue factor pathway” helps stop bleeding if a person is injured. If any of the proteins of this pathway are missing, a bleeding problem will develop. In contrast, the “contact pathway” is activated when blood comes into contact with some artificial substances. Although this pathway can cause pathological

blood clots, humans who lack proteins in this pathway do not have bleeding problems. These two pathways eventually converge to form a complex clotting cascade.

In 2006, the researchers found that compounds called polyphosphates can, when released from cell fragments called platelets, activate the contact pathway, said Professor Morrissey, who led that study and the new analysis.

Because the contact pathway is not essential for normal blood clotting after an injury, interrupting polyphosphate “wouldn’t have the bleeding side effects that touching anything downstream of it in the clotting cascade (would) have,” Morrissey said.

The researchers found a variety of positively charged molecules that can bind to the negatively charged polyphosphate molecule and inhibit its ability to induce blood clotting. By adding these compounds to human blood and plasma isolated from the body, Morrissey and his colleagues were able to measure their effectiveness in inhibiting polyphosphate’s pro-thrombotic and pro-inflammatory activities.

The researchers also tested these inhibitors in mice afflicted with venous and arterial thrombosis or inflammation, and found that these inhibitors prevented or reduced these negative effects.

“What this shows is that you could put really potent inhibitors of polyphosphate in

and interrupt the clotting system by decreasing thrombotic risk, but probably not increasing (a person’s) bleeding risk,” Morrissey said. “This is the proof of principle that it works.”

Although the compounds identified would not, by themselves, be good drug candidates, Morrissey said, the new study offers clues for developing more suitable drugs to target polyphosphates.

“I think that the work going forward would be to identify compounds that would be better drug candidates,” he said.

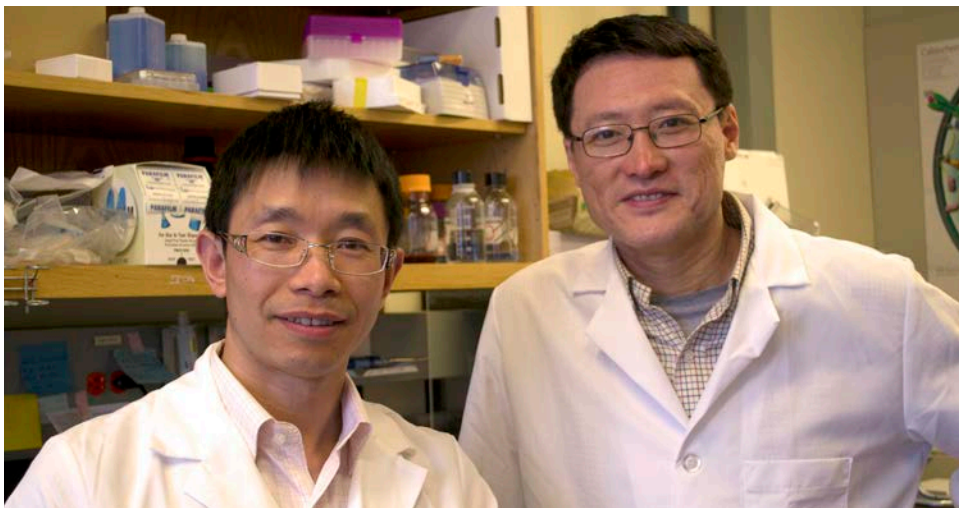
The study team also included researchers from the Medical College of Wisconsin. The National Heart, Lung and Blood Institute at the National Institutes of Health supported this research.

### FOR FURTHER READING

“Inhibition of polyphosphate as a novel strategy for preventing thrombosis and inflammation” is published online in *Blood*: <http://bloodjournal.hematologylibrary.org/content/early/2012/09/11/blood-2012-07-444935.abstract?cited-by=yes&legid=bloodjournal;blood-2012-07-444935v1>



# Fei Wang



Dr. Fei Wang and the co-corresponding author Dr. Dong Li.

Photo by Chelsey Coombs.

Associate Professor of Cell and Developmental Biology Fei Wang and colleagues have created a new technique to study how myeloids, a type of blood stem cell, become the white blood cells important for immune system defense against infections and tissue damage. This tool provides an improved understanding of the molecular mechanisms at work during this myeloid differentiation process, and may improve our ability to treat myeloid diseases like leukemia.

Myeloids are blood stem cells from bone marrow or the spinal cord that are turned into common types of white blood cells like neutrophils and macrophages through the process of myeloid differentiation. Deficiencies in this differentiation process cause leukemia, or cancer of the white blood cells. Researchers in the field had previously studied myeloid differentiation using two types of cell systems. In one method of study, scientists performed experiments using primary cells, or those cells taken directly from animals. Scientists have also utilized leukemia tumor cells in this research by returning them to their previous myeloid stem cell-like states. However, primary cells are hard to grow and manipulate genetically, and tumor cells still contain the genetic mutations that caused these cells to divide uncontrollably in the first place.

The drawbacks of these systems prompted Associate Professor Wang to develop a

different system to better understand the mechanisms of myeloid differentiation. Wang and his team began by turning mouse embryonic stem cells into myeloid progenitor cells. They then added a protein called Hoxb8 to these cells that had been shown previously to immortalize myeloid progenitor cells so that they do not die and grow indefinitely.

“This really simplified the whole system, so, number one, we didn’t have to deal with animals or human bodies, and, number two, we immortalized these cells so that they can be easily handled in culture and maintain normal myeloid progenitor cell genetic information,” Wang said.

The researchers wanted to prove that their model is effective in determining the molecular mechanisms important to myeloid differentiation. Enzymes called protein kinases are known to mediate processes like cell development, immune response, and cell differentiation. They screened a variety of protein kinase inhibitors to find potential key regulators of myeloid differentiation. A protein kinase inhibitor of a molecule called mTor, a master regulator of cell behavior, was found to interfere with myeloid differentiation, signifying that mTor is a key regulator of this process. A variety of experiments were performed both inside and outside the mouse body with mTor to further prove that this molecule is necessary for myeloid differentiation.

“The function of this molecule had not been defined prior to this study in the context of myeloid differentiation,” Wang said, “This is the first evidence showing that this molecule plays a significant role in myeloid differentiation.” This finding serves as a proof of principle that the new system provides a powerful tool for future studies of normal and abnormal myeloid differentiation. “Using this system, we can introduce genetic manipulations that tell us something very important about how normal myeloid differentiation works, and what kind of molecular events in this process can go wrong, leading to diseases like leukemia,” Wang said.

“People can use this as a platform for large-scale screening analysis for drugs that potentially can promote myeloid differentiation and can slow down or stop myeloid disease processes.” ■

## FOR FURTHER READING

“Identification of key regulatory pathways of myeloid differentiation using an mESC-based karyotypically normal cell model” is published online in *Blood*:  
<http://bloodjournal.hematologylibrary.org/content/early/2012/10/18/blood-2012-03-414979.abstract>

# Study Identifies Prime Source of Ocean Methane

Diana Yates

Up to 4 percent of the methane on Earth comes from the ocean's oxygen-rich waters, but scientists have been unable to identify the source of this potent greenhouse gas. Now researchers report that they have found the culprit: a bit of "weird chemistry" practiced by the most abundant microbes on the planet.

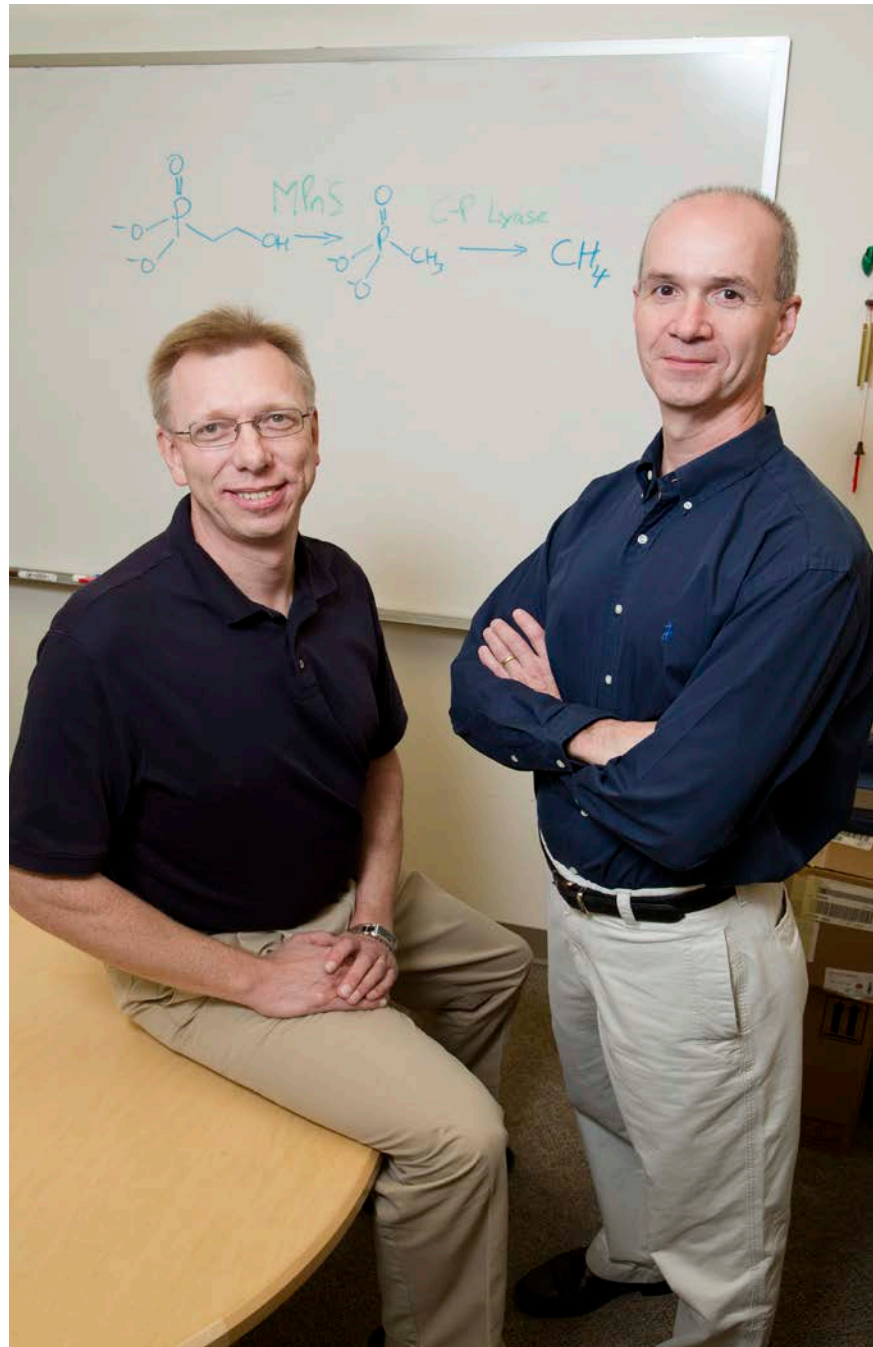


Photo by L. Brian Stauffer.

The researchers who made the discovery did not set out to explain ocean geochemistry. They were searching for new antibiotics. Their research, funded by the National Institutes of Health, explores an unusual class of potential antibiotic agents, called phosphonates, already in use in agriculture and medicine.

Many microbes produce phosphonates to thwart their competitors. Phosphonates mimic molecules the microbes use, but tend to be more resistant to enzymatic breakdown. The secret of their success is the durability of their carbon-phosphorus bond.

“We’re looking at all kinds of antibiotics that have this carbon-phosphorus bond,” says Professor of Microbiology William Metcalf, who led the study with chemistry and IGB professor Wilfred van der Donk. “So we found genes in a microbe that we thought would make an antibiotic. They didn’t. They made something different altogether.”

The microbe was *Nitrosopumilus maritimus*, one of the most abundant organisms on the planet and a resident of the oxygen-rich regions of the open ocean. When scanning microbial genomes for promising leads, Benjamin Griffin, a postdoctoral researcher in Metcalf’s lab, noticed that *N. maritimus* had a gene for an enzyme that resembled other enzymes involved in phosphonate biosynthesis. He saw that the microbe also contained genes to make a molecule, called HEP, which is an intermediate in phosphonate biosynthesis.

To determine whether *N. maritimus* was actually producing a desirable phosphonate antibiotic, chemistry postdoctoral researcher Robert Cicchillo cloned the gene for the mysterious enzyme, expressed it in a bacterium (*E. coli*), and ramped up production of the enzyme. When the researchers added HEP to the enzyme, the chemical reaction that ensued produced a long sought-after compound, one that could

explain the origin of methane in the aerobic ocean.

Scientists had been searching for this compound, methylphosphonic acid, since 2008, when David Karl at the University of Hawaii, Edward DeLong at MIT and their colleagues published an elegant – yet unproven – hypothesis to explain how methane was arising in the aerobic ocean. The only microbes known to produce methane are anaerobes, unable to tolerate oxygen. And yet the aerobic ocean is saturated with methane.

To explain this “methane paradox,” Karl and DeLong noted that many aerobic marine microbes host an enzyme that can cleave the carbon-phosphorus bond. If that bond were embedded in a molecule with a single carbon atom, methylphosphonic acid, one of the byproducts of this cleavage would be methane. Karl and DeLong even showed that incubation of seawater microbes with methylphosphonic acid led to methane production.

“There was just one problem with this theory,” van der Donk says. “Methylphosphonic acid has never been detected in marine ecosystems. And based on known chemical pathways, it was difficult to see how this compound could be made without invoking unusual biochemistry.”

Van der Donk’s lab conducted further experiments that demonstrated that the *N. maritimus* was actually synthesizing phosphonic acids.

“The chemical analysis was a Herculean effort,” Metcalf says. The microbe is “one-tenth the size of the standard lab rat microbe, *E. coli*, and grows at much lower cell densities,” he says. The team relied on *N. maritimus* discoverer David Stahl, of the University of Washington, to grow the microbe in culture for their analysis.

“So we grew 100 liters of culture to get a few, maybe 50 or 100 milligrams

of cells, of which maybe 1 percent is phosphorus, of which maybe 5 percent is methylphosphonate,” Metcalf says.

The experiments indicated that the methylphosphonate was bound to another molecule, likely a sugar attached to the microbe’s surface, van der Donk says. When *N. maritimus* dies, other marine microbes break the carbon-phosphorus bond of the methylphosphonate to gobble up the phosphorus, an element that is rare in the oceans but essential to life. This encounter generates methane.

The biochemistry that allows *N. maritimus* to produce methylphosphonate is “unprecedented,” Metcalf says.

“Organisms that make phosphonates tend to use weird chemistry for all kinds of things,” van der Donk says. “But this is very unusual. One of the carbon atoms of the HEP is oxidized by four electrons and the other is turned into a methyl group. I’m not aware of any other cases where that happens.”

The new findings will help those modeling the geochemistry of the ocean to understand climate change, Metcalf says.

“We know that about 20 percent of the greenhouse effect comes from methane and 4 percent of that comes from this previously unexplained source,” he says. “You have to know where the methane comes from and where it goes to understand what will happen when the system changes.” ■

#### FOR FURTHER READING

See the entire article in *Science*:  
<http://www.sciencemag.org/content/337/6098/1104.abstract?sid=4926b2b0-55d0-4270-9474-1234bafd278a>



# FACULTY NEWS

## Select Faculty Publications



Professor of Cell and Developmental Biology **Mary Schuler** and colleagues have published a new study in *Science* called “A Gain-of-Function Polymorphism Controlling Complex Traits and Fitness in Nature.” According to Schuler, the study is “the first time that anyone has mapped how a plant species has acquired a new biosynthetic ability as it has adapted to a new location.”

Alumni Professor of Cell and Developmental Biology **Martha Gillette** led a research team whose study, “Circadian Rhythm of Redox State Regulates Excitability in Suprachiasmatic Nucleus Neurons,” appeared in *Science*. The study gives new insight into cellular redox states, linking them to the brain’s circadian clock.

Professor of Biochemistry **Emad Tajkhorshid** and colleagues have discovered that membrane transporters help not just sugars and other specific substrates cross from one side of a cellular membrane to the other—water also comes along for the ride. “Transient formation of water-conducting states in membrane transporters” appeared in *PNAS*.



In a new finding published in *Nature Chemical Biology*, Associate Professor of Molecular and Integrative Physiology **Claudio Grosman** and research scientist **Gisela Cymes** applied single-molecule electrophysiology to determine the properties of a ring of acidic amino acid side chains that catalyzes the flow of cations through the nicotinic acetylcholine receptor channel.

Associate Professor of Molecular and Integrative Physiology **Jongsook Kim Kemper** is corresponding author on “Aberrantly elevated microRNA-34a in obesity attenuates hepatic responses to FGF19 by targeting a membrane coreceptor  $\beta$ -Klotho” in *PNAS*. This work indicates that a microRNA causes metabolic problems like diabetes and fatty liver often associated with obesity.

Professor of Cell and Developmental Biology and Howard Hughes Medical Investigator **Phillip Newmark** lead a research team whose paper, “Adult somatic stem cells in the human parasite *Schistosoma mansoni*,” appeared in the journal *Nature*. The report showed that parasitic flatworm *Schistosoma mansoni* has adult non-sexual stem cells that are able to migrate to different parts of its body for tissue replenishment.

Associate Professor of Cell and Developmental Biology and Alexander Von Humboldt Scholar **Brian Freeman** and a team published a study in the journal *Molecular Cell* entitled, “The p23 Molecular Chaperone and GCN5 Acetylase Jointly Modulate Protein-DNA Dynamics and Open Chromatin Status.” The paper describes how the p23 molecular chaperone disassembles protein-DNA complexes and how GCN5 acetyltransferase prolongs this state, affecting transcription factor activation potential and response time to an environmental cue. ■

## Awards and Honors

Professor of Biochemistry and Director of the School of MCB **Stephen G. Sligar** was named as a Swanlund Chair, the highest endowed title at the University of Illinois. Alumna Maybelle Leland Swanlund provided a \$12 million endowment for chairs to recognize current faculty members who have made exceptional contributions in their fields. Sligar was recognized for his record of internationally recognized scholarship, cross-campus service, outstanding teaching and leadership.

Professor of Cell and Developmental Biology and Howard Hughes Medical Investigator **Phillip Newmark** has been recognized as a University Scholar by the Illinois Office of the Vice President for Academic Affairs. Outstanding faculty members from each of the Illinois campuses are chosen and given a \$10,000 award for each of three years for the enhancement of their careers. Newmark is recognized as one of the foremost proponents of reviving the use of *planaria* as a new model organism ideally suited for molecular and genetic analysis of regeneration.

Professor of Biochemistry **James H. Morrissey** has been appointed as the Roy and Eva Hong Professor of Molecular and Cellular Biology, the first endowed position held entirely at the school level. Morrissey is internationally recognized for his translational research program that centers on efforts to understand the regulation and mechanism of blood clotting. Upon their retirement, Illinois alumni Roy and Eva Hong established this professorship in their name to support a senior faculty member and their translational research endeavors.

Professor of Microbiology **Robert B. Gennis** was named as the inaugural J. Woodland Hastings Endowed Chair in Biochemistry. Professor “Woody” Hastings was a faculty member at the University of Illinois (1957-1966), before moving to Harvard University as the Paul C. Mangelsdorf Professor of Natural Sciences. His University of Illinois graduate student, Dr. George Mitchell and Mitchell’s wife Tamara generously endowed this Chair to honor his mentor. George Mitchell co-founded SLM Instruments, Inc., which designed innovative instruments to investigate biological molecules.

Department of Microbiology Professor **William Metcalf** has been appointed to the G. William Arends Professorship in Life Sciences for his accomplishments in research, education, and service. Arends was a member of the 1939 graduating class in the University of Illinois College of Medicine. This endowed professorship, established by G. William and Clair Mae Arends, recognizes extraordinary research achievement. ■



Sligar investiture.  
Photo by L. Brian Stauffer.



Hastings investiture from left to right: Stephen Sligar, Robert Gennis, George Mitchell III, Tamara Mitchell, Woodland “Woody” Hastings, Susan Martinis.

# ALUMNI NEWS



Since 2010, Illinois Biology alum and private practice anesthesiologist Richard Berkowitz has been the head of the award-winning MCB Pathway to Health Careers Mentorship Program, a program that connects undergraduate MCB students with an interest in the health professions with Illinois alumni already practicing in the field.

Berkowitz was the first person in his family to attend a four-year institution and says he “was left to navigate the pre-med curriculum” by himself, and did not have anyone to show him the ropes of being a physician. This motivated him to create the MCB Pathway to Health Careers Mentorship Program.

“I believe mentoring serves several purposes, not the least of which is it gives students the opportunity to show medical schools that they have done their due diligence about what it takes to be a physician in today’s environment,” Berkowitz says.

Students shadow their mentors at least once or twice a year, but also connect with the mentor by e-mail or phone when the student needs more guidance. Mentors typically work with one or two students at a time.

“The overall minimum time commitment from a mentor is small, but can be as great as one’s job allows,” Berkowitz says.

Berkowitz said the program is also a way for alumni to remain connected and give back to the University of Illinois.

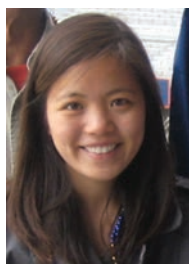
“I am truly grateful and appreciative for the education I received at the University of Illinois. I wanted to find a way to give back,” Berkowitz says. “We are always actively recruiting alumni to help with the program.”

The MCB Pathway to Health Careers Mentorship Program recently won the “Outstanding Established Program” award from the Academic Advisors at the University of Illinois (IlliACC) organization. This award is given based upon a program’s creative utilization of resources, effectiveness, and adaptability for other departments.

The program is open to all MCB pre-medicine, pre-dental and allied health professions students interested in exploring careers in the medical field. In the spring, just prior to the annual seminar hosted by Dr. Berkowitz in Urbana, the MCB Advising Office, through Tina Knox, the Coordinator for Undergraduate Instruction and Advising, sends the application information to students. Applicants provide information about their year in school, GPA, academic achievements, and extracurricular activities. They also answer a provocative essay question that is used to “get to know the student” and perhaps connect them to the mentor best suited for their interests.

If you would like more information or are interested in becoming a mentor for the MCB Pathway to Health Careers Mentorship Program, contact Rich Berkowitz at [berky3@aol.com](mailto:berky3@aol.com).

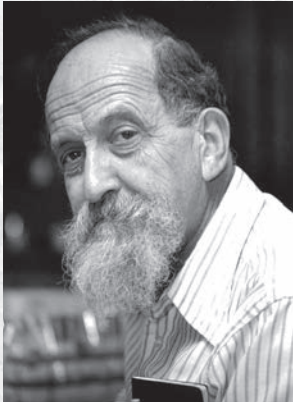
“I want to extend my thanks to you and the MCB department for establishing this mentorship program and having the panel of doctors speak to us today. It was a really wonderful and comfortable atmosphere and all the doctors were beyond wonderful. I learned a lot about the career path to being a doctor that is not found on any website and I walked out of Noyes feeling confident about pursuing a career in medicine. Meeting with Dr. Berkowitz was really great too. I learned a lot from him and it is amazing how these doctors take the time to help us through the process. I look forward to hearing more about the mentorship opportunity in the near future. Thank you again for creating this bridge between the students, the doctors, and the faculty around me in helping me go through this process.”



—Jessica Ang, senior, premed student majoring in MCB and minoring in chemistry

# IN MEMORIAM

## Howard Ducoff (1923–2012)



Howard S. Ducoff, 89, passed away on August 28, 2012. Dr. Ducoff, appointed assistant professor of physiology in 1957, promoted to associate professor in 1959, and to full professor in 1965, was professor emeritus at the time of his death. He received a B.S. from College of the City of New York and a Ph.D. in physiology from the University of Chicago in 1953. He was an associate biologist at the Argonne National Laboratories from 1946-57.

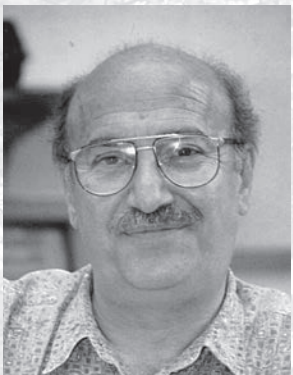
Howard's research focused on the effects of radiation on living organisms which included the effects of radioactivity, UV, and X-rays on a variety of microorganisms and insects, and he continued his research in the basement of Burrill Hall into his late 80s. He taught a

course on radiobiology and gave lectures on this topic in physiology and biophysics courses. Ducoff was a charter member of the Radiation Research Society, the North American Hypothermia Society and the American Society of Cell Biology. He mentored more than 30 graduate students and received the Radiation Research Society SIT Excellence in Mentoring Award in 2007. Staying true to his love of science, he donated his brain to the Columbia University Medical Center for Essential Tremor Research in New York.

Howard was born May 5, 1923, in New York, NY, and in 1946 married Rose Hirsch, who preceded him in death. He had three daughters, Sandra, Barbara, and Laura; a son, Paul; four grandchildren; and a great-grandson.

The Howard S. Ducoff Award for Best Senior Thesis is awarded annually by MIP in Dr. Ducoff's honor. Memorials to this fund may be made in his honor to MIP at <http://mcb.illinois.edu/giving/>.

## Esmail Meisami (1942–2013)



Associate Professor of Molecular and Integrative Physiology and Neuroscience Esmail "Essie" Meisami died in Urbana on January 22, 2013, at the age of 70. Meisami was born on November 19, 1942, in Tehran, Iran.

He received a bachelor's degree in 1967 at the University of California, Berkeley, and then went on to receive his Ph.D. from UC Berkeley in 1970. After graduating, he traveled back to Iran to become a faculty member in the Biology Department at the University of

Tehran, creating the Department of Cell and Molecular Biology and the Institute of Biochemistry and Biophysics while he was there. While at the University of Tehran, he created laboratories for neurophysiology and electrophysiology and organized three international symposia.

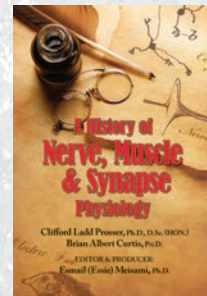
In 1980, Meisami returned to UC Berkeley, and in August of 1986 he became faculty in what was then the Department of Physiology and Biophysics at the University of Illinois.

Meisami's research focused on the neuroscience of the olfactory system and the function of hormones and other factors in brain

development and plasticity as well as recovery from damage. His research was highly successful, with the publication of over 50 papers during his career. He wrote and edited several books on biology, physiology, human growth and development, and developmental neurobiology and co-authored the highly successful "The Physiology Coloring Book," a work that has become the "go-to" for most undergraduate physiology courses and has been translated into many languages.

He was known to be an influential mentor for graduate and undergraduate students alike and was well known for his friendly demeanor and ever-present smile.

Meisami is survived by his wife, Nooshin, and his two daughters, Mona and Ayda.



### FOR FURTHER READING

*A History of Nerve, Muscle and Synapse Physiology*, started by the late Professor C. Ladd Prosser and completed with Professors Brian Curtis and Essie Meisami as coauthors and editors. In 600 pages and 24 chapters, the book traces the history of the development of the physiology and neurobiology of nerve, muscle and synapses from the seventeenth century to the late twentieth century.

# IN MEMORIAM

## Welton I. Taylor (1919–2012)



Taylor graduating from Illinois as a Cadet Second Lieutenant, Advanced ROTC, in 1941.

Distinguished microbiologist and reportedly the Department of Microbiology's (then the Department of Bacteriology) first African-American Ph.D. recipient Welton I. Taylor died in Chicago on November 1, 2012, at the age of 93. Taylor was born on November 12, 1919, in Birmingham, Alabama. During Taylor's infancy, Ku Klux Klan members threatened his mother, causing Taylor and his family to move to Chicago. In 1937, Taylor graduated as valedictorian from DuSable High School, then went on to attend the University of Illinois. During his senior year at the U of I, he became the first

black cadet of the Advanced ROTC Field Artillery Unit. In 1941, he received his bachelor's degree in bacteriology. A little less than a month later, the Army ordered him to active duty where he flew liaison and reconnaissance missions in the South Pacific during World War II. After returning from the war, Taylor married Jayne Kemp Taylor in 1945, and, soon after, the two returned to UIUC for graduate school. Taylor earned master's and doctorate degrees in bacteriology in 1947 and 1948, respectively.

He went on to teach at the University of Illinois at Chicago and Northwestern University medical schools, consulted at various hospitals in the Chicago area, published forty journal articles, and developed a product still used by laboratories today to certify that foods do not contain *Salmonella*.

In 1985, the Centers for Disease Control and Prevention named a species of bacteria, *Enterobacter taylorae*, after Taylor and a British colleague for their contributions to the field. The Tuskegee Airmen awarded him with the Congressional Gold Medal in 2006, and in 2012, Taylor published a memoir about his war experiences called *Two Steps from Glory*.

He is survived by his daughters Karyn and Shelley.

*Thanks to James Slauch for bringing this story to our attention.*

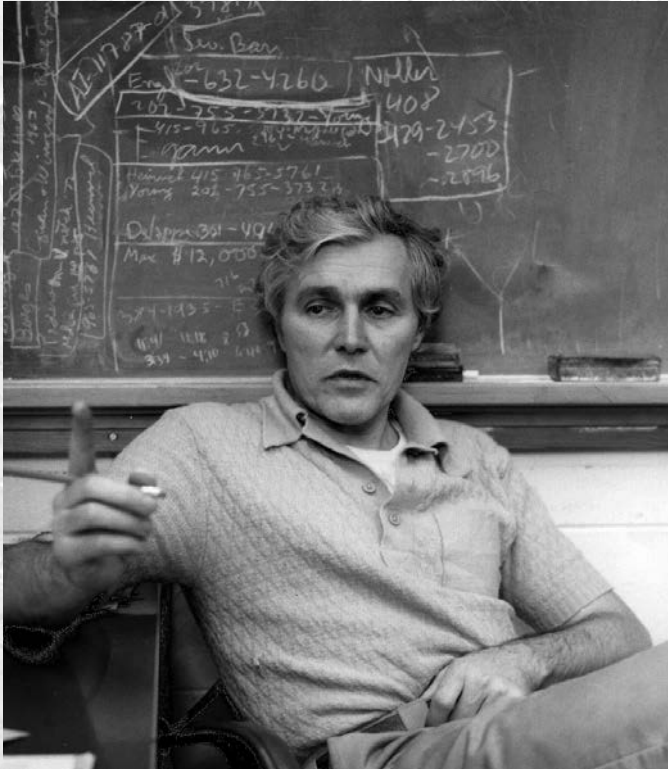


### FOR FURTHER READING

In his memoir, *Two Steps From Glory: A World War II Liaison Pilot Confronts Jim Crow and the Enemy in the South Pacific*, by Major Welton I. Taylor with Karyn J. Taylor (Winning Strategy, 2012), Major Taylor provides an eye-opening account of his spirited, clever, and successful battles against segregation in Champaign-Urbana upon arriving at the University of Illinois in the late 1940s.



## Carl Woese (1928–2012)



Professor of Microbiology Carl Richard Woese died in Urbana on December 30, 2012, at the age of 84. He was born on July 15, 1928, in Syracuse, New York.

In a 2005 interview published in *Current Biology*, Woese said that he was compelled to become a scientist because he had “no other way to cope with my world.”

Following this passion for truth, Woese studied both mathematics and physics at Amherst College in Massachusetts, receiving his bachelor’s degree in 1950. According to the *Current Biology* interview, it was one of his physics instructors, Bill Fairbank, who led him to the field of biology.

Following Fairbank’s advice, Woese studied biophysics at Yale University and received his Ph.D. in 1953. After studying medicine at the University of Rochester for two years, he returned to Yale to study biophysics for five years, and then worked as a biophysicist in the General Electric Research Laboratory in Schenectady, New York. In 1964, Woese became a faculty member in the Department of Microbiology at the University of Illinois where he remained for the rest of his career.

Woese was best known for his 1977 discovery of a third domain of life, the archaea. At that time his laboratory was studying a group

of microorganisms called methanogens, which live in harsh anaerobic environments and produce methane gas as a byproduct of their metabolism. Woese noticed that these methanogens have a much different ribosomal RNA (rRNA) profile than that of eukaryotes and prokaryotes. Every organism has ribosomes—multisubunit molecular machines that are made up of rRNAs and proteins and are responsible for protein synthesis. This makes rRNA an invaluable resource for comparative phylogenetic studies between species to determine their similarities and differences.

In an October 1977 paper published in the *Proceedings of the National Academy of Sciences*, Woese showed that the 16S ribosomal RNA sequences of ten species of methanogens was quite different than those of the typical bacteria. This publication also stated that “methanogens might have existed at a time when an anaerobic atmosphere... enveloped the planet and, if so, could have played a pivotal role in this planet’s physical evolution.”

In a follow-up paper published in *PNAS* in November 1977, Woese provided evidence against the belief that there were only two domains of life, the eukarya, consisting of plants, animals, and fungi, and the prokarya, consisting of what we typically think of as bacteria, which had been held by scientists for years. He stated that the previously characterized methanogens “appear to be no more related to typical bacteria than they are to eukaryotic cytoplasm.”

At the time, Woese’s revelation provoked a highly negative response from many of the microbiologists of the time. However, after a long battle with skeptics, Woese’s three domain theory is now recognized by a majority of scientists and textbooks.

Woese’s groundbreaking research earned him a plethora of awards over the years. In 1984, he received a John D. and Catherine T. MacArthur “Genius” grant. In 1992, the Royal Netherlands Academy of Arts and Sciences gave him the Leeuwenhoek Medal, microbiology’s premier honor. Woese also received the Crafoord Prize in Biosciences from the Royal Swedish Academy of Sciences, an award for areas of science that are not recognized by the Nobel Prize, but considered to be equivalent in prestige.

In an article published in *Microbiology and Molecular Biology Reviews* in 2004, Woese expressed his hope for biological research as it continues into the twenty-first century.

“Bacterial evolution is just beginning to come to the fore,” Woese said. “And with it will come a fundamental change in all of biology, for biology is now on the threshold of answering the great question: ‘Where did we come from?’” ■

### FOR FURTHER READING

The Carl Woese memorial service video is online:  
<http://www.igb.illinois.edu/about/archaea>

# MCB GRADUATES

## Graduate Degrees

### Biochemistry

Sharon Choi, Ph.D.  
Surya Karunakaran, Ph.D.  
Ke Ke, Ph.D.  
Tian Lan, Ph.D.  
Zhi Li, Ph.D.  
Lionel Low, Ph.D.  
Ray Morales, Ph.D.  
Evelyn Nieves, Ph.D.  
Terry Sasser, Ph.D.  
Narjes Tavoosi, Ph.D.  
Cong Wu, Ph.D.  
Aaron Knowlton, M.S.

Zhe Shen, M.S.  
Paige Sheraden, M.S.  
Ming Wu, M.S.  
Can (Molly) Zhang, M.S.

### Cell and Developmental Biology

Tracy Chong  
Ya-Chi Lin  
Jonathan Rhine  
Zhen Shen

### Microbiology

Mianzhi Gu, Ph.D.  
Bryan Hart, Ph.D.  
Nicole Held, Ph.D.  
Carolyn Keeton, Ph.D.  
Jennifer Laprise, Ph.D.  
Steven Lin, Ph.D.  
Yuanyuan Liu, Ph.D.  
Crystal Randall, Ph.D.  
Yan Sun, Ph.D.  
Isabel Neacato, M.S.  
Madelyn Shapiro, M.S.

### Molecular and Integrative Physiology

Jennifer Arnold, Ph.D.  
Tongfei Wang, Ph.D.  
Congcong Chen, M.S.  
Milu Cherian, M.S.  
Ting Fu, M.S.  
Samuel Irving, M.S.  
Itamar Livnat, M.S.  
Lily Mahapatra, M.S.

### Biophysics and Computational Biology

Vinayak Agarwal, Ph.D.  
Marat Baday, Ph.D.  
Xiaoyi Cao, Ph.D.  
Brian Dorvel, Ph.D.  
John Eichorst, Ph.D.  
Amin Haghighat Jahromi, Ph.D.  
Zhi Qi, Ph.D.  
Yi-Liang Liu, Ph.D.  
Johan Strumpf, Ph.D.  
Daniel Baker, M.S.  
Kenneth Tussey, M.S.

### Neuroscience

Marcus Lawson  
Zhengzheng Liang  
Claudia Lutz  
Ken Morris  
David Papke  
Renee Sadowski  
Jihye Seong  
Carolina Soto  
Jessica Stanis  
Joel Stary  
Patrick Watson  
Claudia Winograd

## Undergraduate Degrees—Bachelor of Sciences

### Biochemistry, Specialized Curriculum, Highest Distinction

Jay Goodman  
Nikita Ikon  
Jeffrey Trost  
Michelle Wegscheid  
Weikun Xiao

### Biochemistry, Specialized Curriculum, High Distinction

Carolyn Draus  
Amanda Hayward  
Nora Ibrahim  
Ching Kai Wu

### Biochemistry, Specialized Curriculum, Distinction

Anthony Chau  
Debra Chin  
Archit Ghosh  
Boxiao Liang  
Tania Velez

### Biochemistry, Specialized Curriculum

James Abdo  
Julie Bray  
Sheila Egan  
Steven Ippolito, Summer 2013  
Samuel Lee  
Yunli Ma  
Caitlin Odera

### Molecular and Cellular Biology Honors Concentration, High Distinction

Ryan Kelsch

### Molecular and Cellular Biology Honors Concentration, Distinction

Erika Bongen  
Kathleen Kwedar  
Adam Szmelter  
Georgiy Yudin

### Molecular and Cellular Biology Honors Concentration

Franklin Azie  
Cameron Baldes  
Karthic Chandran  
Amanda Ciechanowski  
Bradley Feng  
Christina Ferraro  
Idia Ifianayi  
Ran Pang  
Lauren Pellant  
Sean Watts  
Jessica White  
Kathryn Witte  
Ryan Young, Fall 2012

### Molecular and Cellular Biology, Highest Distinction

Lauren Radlinski

### Molecular and Cellular Biology, High Distinction

Christopher Mularczyk  
Alvan Ni  
Jennifer Weiss

### Molecular and Cellular Biology, Distinction

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Trisha Bailey  
Chris Deamont  
Keegan Dueller  
Brian Gallagher  
Matthew Green, Fall 2012  
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Steven Lord  
Catherine Selen  
Whitney Vuong  
Joseph Weber  
Luye Yang

### Molecular and Cellular Biology

Marall Abbaszadeh  
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Asad Ahmed, Fall 2012  
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Philip Schoenrock  
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Eric Silverman  
Matthew Sloan  
Christopher Smith  
James Smith  
Kyle Smith  
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Matthew Soltys  
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Joo-Eun Song  
Anthony Spina  
Ila Sruti  
Kurt Stanke  
Jackson Stark  
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Kellie Taylor  
Samih Thalji  
Sunil Thomas  
Kun Tian  
Sandra Topor  
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Erica Yuen  
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Weichao Zhang  
Yueming Zhao  
Zhi Zheng  
Yang Zhou  
Sean Zilligen, Fall 2012  
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Marcin Zuberek

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University of Illinois, Urbana-Champaign

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