Active Site News
est. 1968
K-State Biochemistry & Molecular Biophysics
B M B
Spring, 2013

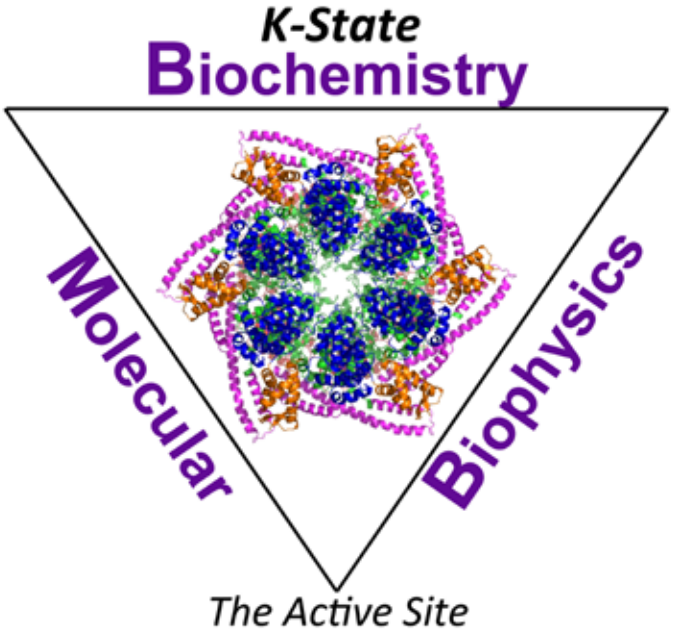
What's in a Name?

The Department underwent some changes this fall. First and foremost, we welcomed our new Department Head, Phillip E. Klebba, who joined us from Oklahoma. We also began a faculty search and revamped our undergraduate curriculum. Most public change: our new name.

Many professors in the department have diverged into biophysical science in their research. Grad Chair Michal Zolkiewski noted that while the name is new, the research is not. Zolkiewski, a biophysicist himself, described the discipline as "using physical principles to understand how different molecules participate in life processes." When added to biochemistry, this offers a more complete view of these processes. Zolkiewski continued, "Biophysics brings new approaches that aren't available in more traditional biochemistry, it will open opportunities for new collaborations and projects, and potentially some new funding."

Professor Michal Zolkiewski also emphasized one major benefit within the department: "I think we'll reach a much wider group of graduate students because of the new department title… especially students interested in biophysical research."

Does a diverse student body necessarily make a better department? Dr. Ramaswamy Krishnamoorthi thinks so. "By attracting suitable students for faculty to work with, the overall research efforts of the faculty will be enhanced," Krish said.



"A large number of the faculty members already do this kind of research. Hopefully, it will increase the research we're able to do… [and] put K-State on the map for biophysical research."

Dr. Larry Davis has been doing biophysical research for the department since the mid 1970's. His background in plant biochemistry and molecular biology has led to great success in understanding pathways of remediation of contaminants found in soil and water. Using biophysics he has analyzed water uptake in plants. "The first few years of my research, we did basic biophysics, things like how proteins associate with one another, and how gas substrates find enzymes to react with," Davis said. "We then made more applied biophysical breakthroughs – how molecules get from where they are to where in the plant they're cleaned up, which is all about diffusion. The next stages of my research involved primarily get from where they are to where in the plant they're cleaned up, which biochemistry, because we were trying to see what it is the plants do to filter [contaminants] out."

Because of this crossover, Davis sees scientific fields as a Venn diagram, constantly overlapping. "The disciplinary boundaries set up by universities are very artificial," Davis said. "The name change is not really changing what we're doing but stating it more clearly.

In This Issue:

Battling bacteria: Research shows iron's importance in infection, suggests new therapies

A K-State research team has resolved a 40-year-old debate on the role of iron acquisition in bacterial invasion of animal tissues.

The collaborative research - led by Phillip Klebba, professor and head of BMB - clarifies how microorganisms colonize animal hosts and how scientists may block them from doing so. The findings suggest new approaches against bacterial disease and new strategies for antibiotic development.

The study - in collaboration with Tyrrell Conway, director of the Microarray and Bioinformatics Core Facilities at OU, and Salete M. Newton, K-State BMB research professor - recently appeared in PLOS ONE. It shows how iron acquisition affects the ability of bacteria to colonize animals, which is the first stage of microbial disease.

"This paper establishes that iron uptake in the host is a crucial parameter in bacterial infection of animals," said Klebba. "The paper explains why discrepancies exist about the role of iron, and it resolves them."

Iron plays a key role in metabolism, leading bacteria and animals to battle each other to obtain it. Klebba's team found that E. coli must acquire iron from the host to establish a foothold and colonize the gut - a concept that was often debated by scientists.

"For years it was theorized that iron is a focal point of bacterial pathogenesis and infectious disease because animals constantly defend the iron in their bodies," Klebba said. "Animal proteins bind iron and prevent microorganisms from obtaining it. This is called nutritional immunity, and it's a strategy of the host defense system to minimize bacterial growth. But successful pathogens overcome nutritional immunity and get the iron."

Little was known about what forms of iron enteric bacteria - which are bacteria of the intestines - use when growing in the host, but this study shows that the native Gram-negative bacterial iron uptake systems are highly effective. Scientists questioned whether prevention of iron uptake could block bacterial pathogenesis. This article leaves no doubt about the importance of iron when E. coli colonizes animals because bacteria that were systematically deprived of iron became 10,000-fold less able to grow in host tissues, Klebba said.

"This is the first time our experiments unambiguously verified the indispensability of iron in infection, because here we created the correct combination of mutations to study the problem," Klebba said.

Enteric bacteria have so many iron transport systems that it's difficult to eliminate them all. For example, E. coli has at least eight iron acquisition systems.

"These transporters are redundant because iron is essential," Klebba said. "Bacteria are resilient. If one system is blocked, then another one takes over."

These findings suggest strategies to block microorganisms from creating diseases in animals and humans, including the potential for antibiotic development and for therapeutic antibodies.

"It gives us insight," Klebba said. "Now we know that iron deprivation protects against disease, but we must be comprehensive and inhibit multiple systems to completely shut down the microorganisms' ability to obtain the metal."

The researchers are using their findings to isolate antibodies that block bacterial iron uptake. This may help animals and humans defend themselves against microbial diseases.

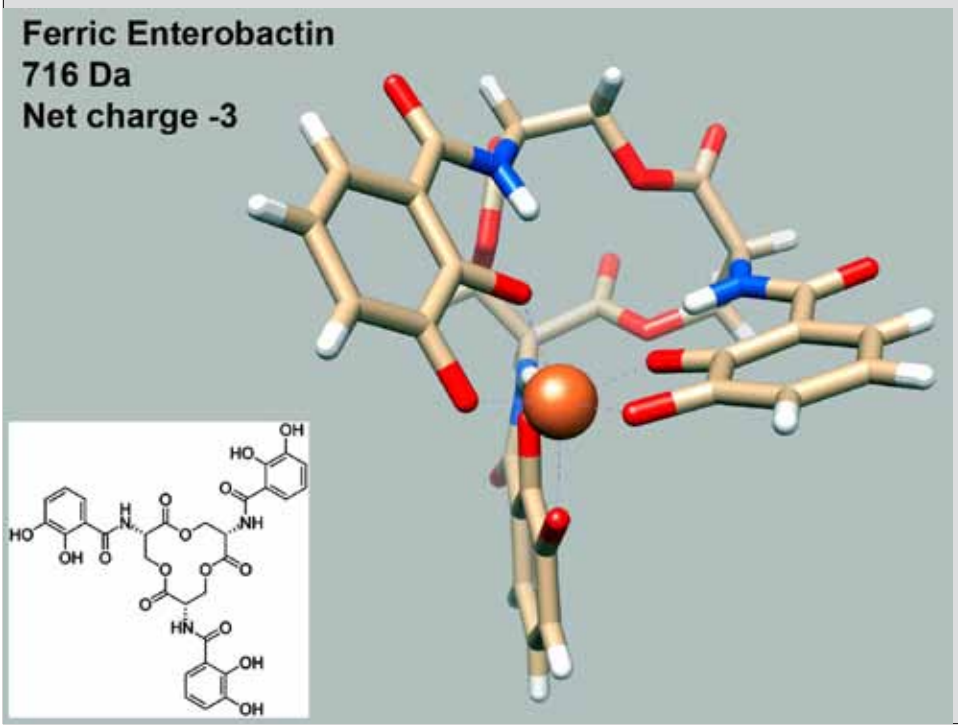
"We would like to apply this research and protect people from bacterial infection," Klebba said. "That's one of the focal points of our laboratory."

Klebba's research was supported by a $1.25 million grant from the National Institutes of Health.

The study was led by Hualiang Pi, Klebba's student at his former institution, the OU. Another K-State collaborator on the project was BMB doctoral student Lorne Jordan.

The PLOS ONE article is available at http://dx.plos.org/10.1371/journal.pone.0050020.

Originally published by
K-State Divison of Communications
and Marketing, Nov. 29, 2012



Student Accomplishments

Graduate Awards

Adriana Avila Flores (Tomich) and **Yue Qi** (Zolkiewska) each received a 2011-2012 Excellence in Biochemistry and Molecular Biophysics Graduate Teaching Award.

Xiangming Li received the 2011-2012 Excellence in Biochemistry and Molecular Biophysics Graduate Research Award.

Flores, Qi, and Li will have their names engraved on the respective Graduate Award plaques displayed in the Biochemistry and Molecular Biophysics office in Chalmers Hall.

Poster Presentation

Sara Duhachek Muggy (Zolkiewska) won first place for her poster presentation, "An essential role of metalloprotease-disintegrin ADAM12 in triple-negative breast cancer," during the 2012 University of Kansas Cancer Center Research Symposium held at KUMC on November 8, 2012. Collaborating with Duhachek-Muggy included fellow graduate students Hui Li and Yue Qi, and faculty member Anna Zolkiewska.

Where do Graduate Students Come from?

Check out this subject using a search engine. You'll find that the fraction of PhDs in sciences coming from small liberal arts colleges far exceeds what would be expected based on the numbers of students enrolled there. A big reason is because at those places, undergraduates routinely get to do lab research. Once in the lab, they often get bitten by the research bug, and experience success in making discoveries

K-State works hard at getting undergraduates into research labs. At minimum, every Biochemistry and Molecular Biophysics major has to do a research problem. Many, however, will greatly surpass this minimum before they graduate. Michael Kanost's research group includes three excellent examples of undergraduate researchers, all supported in part by grants from national agencies.

Caroline Braun is a junior with a major in Clinical Laboratory Science. She was recently awarded a Cancer Research Award from the Cancer Research Center and has been accepted into North Kansas City's Clinical Laboratory Science Program. Caroline is studying the function of insect multicopper ferroxidases. The multicopper oxidases are an essential part of the way that insects can take up iron from their environment and convert it to the many uses that it has in cells.

Larry Rodriquez is a junior with a major in Biochemistry and Molecular biophysics. He is a student in the Developing Scholars Program. An interview with Larry about his research experience can be found on YouTube http://youtu.be/15n0UKBQs6M. Larry is using proteomics methods to analyze the proteins in insect molting fluid. Molting fluid was run on two dimensional gels to separate proteins. Then individual spots on the gels were analyzed with a mass spectrometer in the Biotechnology Center. Interesting proteins are being studied further by matching them to the DNA that encodes them, then examining the genes for clues to their regulation. (The whole genome of the insect is available already.)

Jamilah Watkins is a sophomore with a major in Chemistry. She is a student in the Developing Scholars Program. Jamilah's research project was selected as the best first year research project in the Developing Scholars Program. She is studying serine protease inhibitors in insect blood. Serine proteases are a large family of enzymes that cut other proteins. The inhibitors, often members of a family called serpins, control when and where the proteases do their work. Jamilah's project is looking for inhibitors that are not just serpins.

-by **Larry Davis** & **Maureen Gorman**

Biochemistry Foundation Funds

F17870	BMB General Fund Account
F66998	Hageman (Richard/Elizabeth) Distinguished Lectureship
F68342	Havley (David/Tim) Biochemistry Discretionary Account
Q53097	Hedgcoth Biochemistry Graduate Scholarship Account Outstanding Graduate Teaching and Graduate Research Awards Graduate Student Travel to Scietific Meetings
Q17100	Hughes (J.S.) Memorial Scholarship Account Undergraduate Scholarships
F79431	Merrill (Fred/Virginia) Biochemistry Discretionary Account Undergraduate Scholarships
Q03227	Wanda Bates Undergraduate Scholarship Account Undergraduate Scholarships for students with financial need
N85330	Willard & Ora M. Ruliffson Memorial Scholarship Account Scholarship for pre-dentistry or pre-veterinary students
F81556	Philip Nordin Memorial Awards for Graduate Student Research Travel
F51745	W. Mack Barlow Memorial Scholarship
Q55486	R. Kenneth Burkhard Scholarship for Women in Biochemistry Scholarship for Outstanding Female BMB Juniors and Seniors

Kansas State University
Department of Biochemistry
& Molecular Biophysics
141 Chalmers
Manhattan, KS 66506-3702
312

KSU Biochemistry & Molecular Biophysics on the Web:
www.k-state.edu/bmb

"Like" us on Facebook at "K-State Biochemistry & Molecular Biophysics"
OR
"Follow" us on Twitter @KStateBMB

Our homepage contains info about the Department of Biochemistry and Molecular Biophysics, faculty, undergraduate and graduate programs, courses, seminars, and core facilities. Other K-State related pages that may be of interest:

K-State Alumni Foundation: www.k-state.com
&
E-Collegian Newspaper:
www.spub.ksu.edu