

# MMG news

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The Department of Microbiology and Molecular Genetics offers study in the areas of Biomedical Sciences, Clinical Laboratory Science, Microbial Ecology/ Environmental Microbiology, Molecular Genetics, and Microbial Pathogenesis.

### DEPARTMENT HEAD

Dr. William D. Picking

### GRADUATE PROGRAM COORDINATOR

Dr. Wouter D. Hoff

### UNDERGRADUATE ACADEMIC ADVISOR

Tiffany Frieitze

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SUCCESS**

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## DEPARTMENT OF Microbiology & Molecular Genetics

# A Message from the Department Head

The Department of Microbiology and Molecular Genetics has been on the move recently. Our faculty continue to balance an ambitious agenda that includes teaching, research and service to the community, state and nation. This effort has been rewarding and the department has thrived as seen in the growth of our academic and research programs. To be associated with such an actively growing program has been a privilege, but there is still much to do, as we strive to become the best comprehensive microbiology program in the region. As we step back and take a look at our progress over the last few years, we realize that we are part of something special at Oklahoma State University. We are nationally recognized for our collegiate athletics, our standing as a strong regional center of higher education and for our expanding research mission. I hope that you find this newsletter informative and that makes you proud to be a part of America's Brightest Orange.

### ACADEMIC PROGRAMS

Since fall 2010, MMG has increased its number of undergraduate majors by more than 250% (we currently have more than 170 majors). These students' interests span the entire discipline, including cell & molecular biology, environmental microbiology, molecular genetics, microbial pathogenesis and clinical laboratory sciences. We also continue to offer courses that serve the entire OSU community with Introduction

to Microbiology (MICR 2123/2132) and our general education course Microbes: Friends or Foes (MICR3103). Our graduates also continue to earn admission into quality profession and graduate programs as well as acquire positions within the workforce.

Funding per Tenure-Track Faculty Member 2000-2012



### RESEARCH

An outstanding achievement by MMG over the past five years has been its status as a nationally recognized research entity. Two of our faculty members have served as NSF program officers and our faculty members routinely serve on editorial boards and grant review panels at the NIH, NSF and elsewhere. The number of peer-reviewed papers published by our faculty has increased more than 50% since 2010 and we have been the top externally funded department in the OSU College of Arts & Sciences for the last four years (see figure). This success has been made possible by the monumental efforts of our faculty, staff and students.

*continues*

As you can see, we have been hard at work building our program, but we have no intentions of slowing down. MMG just hired two new tenure-track faculty who will start in fall 2013. They will be highlighted in our next newsletter. In the mean time, we ask you to consider joining us as we reach new heights. Please feel free to contact us at any time to find out more about what we are doing and to express your support for our program. We look forward to hearing from you. Likewise, we appreciate any financial support you may be able to provide to support our student-oriented academic goals or research mission. Your help may help provide our students with opportunities to travel to national or international meetings or perhaps support a student assistantship or scholarship. We are doing great things and with your help we can do even more. I hope you enjoy reading more about our program as you peruse this newsletter.

Regards

*Bill*

**Bill Picking,  
Professor and Head  
Department of Microbiology  
and Molecular Genetics  
Oklahoma State University**



## Cotton Swabs

Here come the bashful beginners  
In their newly unpackaged lab coats,  
Wielding cotton swabs like magic wands,  
Hunting the halls and stairways  
in search of bacteria.

The unaccustomed passer-by  
might shy away,  
Afraid the swabs might probe  
some body cavity.  
But that comes later in the semester.

When only the lab partners  
have cause to fear.

The students avoid the toilets.  
The custodian has ruined that experiment.  
Unlike the stair rails, elevator  
buttons and door knobs  
Which await, unspoiled by disinfectant.

They will spread their soiled  
swabs on discs of jelly  
And come back for the next class early,  
As they once awoke at dawn  
to see the petunia seed  
Break through the carefully watered earth.

Perhaps the swabs are magic after all,  
Abracadabra and small spots appear,  
Conjured as by countless  
wizards gone before,  
In their own rite of passage.

# Biofuel Integrated into the Natural Carbon Cycle: The Sustainable Fuel Solution for the Future

Alternative fuels such as bioethanol and butanol are important environmentally sustainable commodities that could seamlessly amalgamate the natural carbon cycle with the need for automotive and transportation fuels. Biomass, which is atmospheric carbon dioxide fixed into carbohydrates, cellulose, hemicellulose and lignin accumulate alongside industrial agro operations in the U.S. and most countries with advanced agricultural practices.

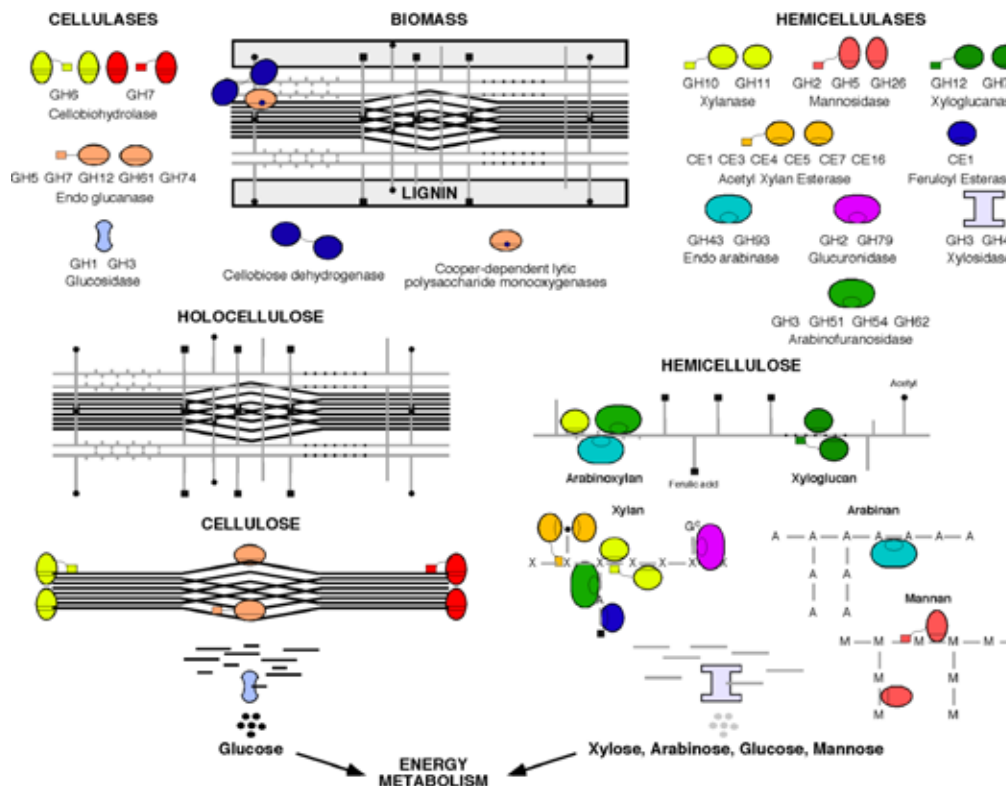
Biomass is constituted of renewable carbon rich polymers that could be used as building blocks generating synthetic biofuels such as ethanol and butanol. Currently, the major bottleneck hindering biomass conversion into biofuels is the deconstruction of cellulose and hemicellulose into their simple sugars, the starting feedstocks for biofuel synthesis.

A team of Microbiology & Molecular Genetics researchers received an excess of two million dollars in funding from the **Oklahoma Bioenergy Center (Mostafa Elshahed and Rolf Prade)**, Department of Energy (**Rolf Prade**), United States Department of Agriculture (**Rolf Prade**), National Science Foundation (**Mostafa Eshahed**) and South

**Central Region Sun Grant Initiative (Babu Fathepure)** to develop a comprehensive enzyme-based biomass degradation program involving hyper thermo active and stable enzymes that operate at high temperatures such as 85-96° Celsius, genetically integrate biomass deconstructing genes into biomass generating crops, identification of novel biocatalysts needed to delignify biomass by bacteria and decompose biomass by gut anaerobic fungi.

Drs. **Elshahed** and Youssef looked into the gut microflora of herbivores (they eat lots of biomass) to find exciting new anaerobic fungi that show enormous adaptability to the rumen and gut environment where biomass degradation is a dominant activity. Dr. **Fathepure** looked for long time bacterial enrichment cultures for lignin-degrading enzymes, and Dr. **Prade** developed a protein discovery platform specifically directed to the discovery of plant cell-wall degrading enzymes and found extreme thermophilic cellulases and hemicellulases that operate optimally at temperatures 85° Celsius and above.

For further interactive reading on the topic of biofuels at **OSU Microbiology** visit the website: <http://microbiology.okstate.edu/faculty/biofuels>.



## Currently Funded Research Projects of the MMG Faculty

### Dr. Robert Burnap

#### DEPARTMENT OF ENERGY (DOE):

Unraveling Genetic Regulatory Circuits

#### NATIONAL SCIENCE FOUNDATION (NSF):

Assembly and Function of Cyanobacterial Photosystem II Complex

#### RESEARCH EXPERIENCES FOR UNDERGRADUATES (NSF REU):

Assembly and Function of Cyanobacterial Photosystem II Complex

### Dr. D. Kim Burnham

#### AIR FORCE OFFICE OF SCIENTIFIC RESEARCH:

Regulation of Langerhans Cell Migration and Function Following Laser Exposure

### Dr. Mostafa Elshahed

#### NSF:

Collaborative Research: A Genomics and Cultivation-based Study

#### RESEARCH EXPERIENCES FOR UNDERGRADUATES (NSF REU):

Collaborative Research: A Genomics and Cultivation-based Study

#### OKLAHOMA EXPERIMENTAL PROGRAM TO STIMULATE COMPETITIVE RESEARCH (EPSCOR):

Biofuel Production for Lignocellulosic Biomass

### Dr. Babu Fathepure

#### OIL TRADE CONSORTIUM (OTC):

Biofuel Production for Lignocellulosic Biomass

Characterization and Mediation of Microbial Deterioration of Concrete Infrastructure

#### NSF:

Rapid: Understanding Early Time Biophysical Signals of the Microbial Degradation of Crude Oil from the BP Spill in Saline Marshlands

#### SUN GRANT INITIATIVE:

Discovery Of Novel Lignin-Degrading Genes ...

### Dr. Jeff Hadwiger

#### NATIONAL INSTITUTES OF HEALTH (NIH):

Role of STAT Proteins in MAPK Signal Transduction Pathways

### Dr. Wouter Hoff

#### NSF:

Bacterial Light Sensing by Photoactive Yellow Protein

### Dr. Gilbert John

#### NSF:

Structure and Function Studies of Azoreductase

#### RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU):

Structure and Function Studies of Azoreductase

#### NATIONAL ACTION COUNCIL FOR MINORITIES IN ENGINEERING (NACME):

2010-2011 Recruitment

#### SLOAN FOUNDATION:

Graduate Student Fellowship

### Dr. Marianna Patrauchan

#### DOE:

Induced Polarization of Biofilms in Porous Media: From Laboratory Experiments to Theoretical Developments and Validation

#### NIH:

Antimicrobial Effect of New Class of Light Resistant Silver (I) complexes. Adhesion and biofilm studies.

#### OKLAHOMA CENTER FOR THE ADVANCEMENT OF SCIENCE AND TECHNOLOGY (OCAST):

Antibiotic Resistance in Human Pathogen *Pseudomonas aeruginosa*

### Dr. Bill Picking

#### NIH:

A Mechanisms for *Shigella* Type III Secretion Activation  
The Multiple States of IpaB in *Shigella* Type III Secretion

#### OCAST:

Targeting *Shigella* Secretion to Prevent Dysentery

#### UNIVERSITY OF MARYLAND-BALTIMORE (UMB)/NIH:

CCHI: Mucosal Immunity, Vaccines and Microbiota:  
Core C – Antigen Purification Core

### Dr. Wendy Picking

#### NIH:

Control of Type III secretion in *Shigella* by IpaD

#### PROGRAM FOR APPROPRIATE TECHNOLOGY IN HEALTH (PATH):

Use of Type III Secretion System Antigens as a Novel Vaccine Against *Shigella*

#### UMB:

A *L. lactis*-Based Vaccine for Children with Broad Spectrum for Enteric Pathogens

#### OCAST:

TTSS Proteins as Protective Antigens Against *Salmonella*

#### BILL AND MELINDA GATES FOUNDATION:

A Novel Vaccine Against Salmonella

#### DEFENSE THREAT REDUCTION AGENCY (DTRA):

Assessment of Type IV Secretion System Proteins as Vaccines Against *Coxiella burnetii*

### Dr. Ed Shaw

#### NIH:

Analysis of the *Coxiella burnetii* Type IV Secretion System During Infection

Analysis fo the *Coxiella burnetii* Type IV Secretion System During Infection: Student Supplement

#### ZINPRO:

Analysis of the *C. burnetii* Phase II (Avirulent) in Colostrum Whey

#### DTRA:

Assessment of Type IV Secretion System Proteins as Vaccines Against *Coxiella burnetii*



## MMG Faculty Professional Service

The national and international scientific influence of the department is illustrated by the role that the department plays in (i) the review process of research grants as panel members or program officers, in (ii) the reviewing of scientific publications as editorial board members of international scientific journals, and (iii) as invited speakers at major national and international scientific conferences.

In the period 2010-2012 two departmental faculty members served as program officers at the National Science Foundation: Professor **Robert Burnap** at the **Division of Molecular and Cellular Biosciences**, and Professor **Gilbert John** at the **Division of Graduate Education**. Four additional faculty members served as panel members for reviewing research grants submitted to the NSF and to the National Institutes of Health.

Departmental faculty members are on the editorial board of seven international scientific journals in the area of microbiology and molecular biology, including highly influential journals in the field such as *Applied and Environmental Microbiology* and *the Journal of Biological Chemistry*.

Since 2011, departmental faculty members gave 14 invited oral presentations at major national and international conferences, including the **International Society for Microbial Ecology** in Denmark, the **6th International Conference on Vaccines for Enteric Diseases** in France, the **BIT Life Sciences 4th Annual PepCon2011** in China, the **International Dictyostelium Conference** in Baltimore, the Indo-U.S. workshop on **Cyanobacteria: Molecular Networks to Biofuels** in India, the **1st Brazilian BioEnergy Science and Technology Conference** in Brazil, the **Telluride Research Workshops**, the **5th Asia Oceania Conference on Photobiology** in Japan, and the **American Physical Society March Meeting 2012** in Boston.



## Note from the Graduate Program Director — Dr. Wouter Hoff

During the past 12 months, 31 students have actively participated in our graduate program. In the period 2011 until April 2013, 22 publications have appeared in international scientific literature reporting results from research performed by graduate students working with faculty in our department.

Many of these papers appeared in leading journals in the field, including publications in *Plos One* and *Journal of Biological Chemistry*, three publications in *Applied and Environmental Microbiology*, and three publications in *Biochemistry*.

These papers reported original contributions to a range of important fields, including the molecular mechanisms of bacterial diseases (particularly shigellosis and Q fever), photosynthesis, cellular signaling, bacterial physiology, biodegradation of pollutants, bacterial genomics, protein biophysics and bacteria in gas wells.

All 12 of the students who obtained degrees from our graduate program in 2011 and 2012 (8 Ph.D. and 4 M.S. degrees) found employment in an area related to microbiology (see below), including one tenure-track faculty position and 7 postdoctoral fellowships at prestigious institutions.

The department has just completed its 2013 graduate student admission process and in the fall of 2013 our graduate program will experience substantial growth with an incoming class of 11 new graduate students, including a Fulbright scholar.

One of our new graduate students will be the first to join our just approved 1-year accelerated non-research M.S. degree program. In addition, we have made a range of improvements to the graduate courses offered in our graduate program, which are on track to be fully implemented by Fall 2014.

As our faculty continue to be successful in obtaining funding to offer research assistant positions to the students in our graduate program and with a recent increase in the number of teaching assistant positions in our department, we are well-positioned to continue the upward momentum in our graduate program.

## Recent graduate student degree awardees (and where they are now):

**Epler, Chelsea** (PhD 2012): Postdoctoral Fellow at Boston University

**Prabhakaran, Madhu** (MS 2012): Work in biotechnology company in Maryland

**Dilbeck, Preston** (PhD 2012): Postdoctoral Fellow at the University of Washington in St. Louis

**Davis, James** (PhD 2012): Postdoctoral Fellow at the University of Oklahoma Health Science Center

**Nagarajan, Aparna** (PhD 2012): Postdoctoral Fellow at the University of Washington in St. Louis

**Luedtke, Brandon** (PhD 2012): Postdoctoral at the USDA, Nebraska

**Nair, Jayalakshmi** (MS, 2012): Enrolled in certification program at OSU

**Nguyen, Nghia Hoai** (PhD 2011): Postdoctoral at Johns Hopkins University

**Deole, Ratnakar** (PhD 2011): Tenure-track assistant professor at Northeastern University

**Mahapatra, Saugata** (PhD 2011): Postdoctoral at Cornell University

**Perryman, Rian** (MS 2011): Microbial quality control professional in industry

**Christian, Laura** (MS 2011): Microbial bioremediation professional in industry

## Microbiology & Molecular Genetics Student Honors and Awards for the 2012/2013 Academic Year

### GRADUATE STUDENTS

**Phil Adam** was the recipient of the **Eduard A. Grula Graduate Fellowship**. This fellowship is in honor of the late **Eduard A. Grula** who served as head of the Department of Microbiology until his untimely death. Phil Adam also received a second place among graduate student presenters at the **Missouri-Valley Regional American Society for Microbiology (ASM)** meeting.

**Jessica Morrison** received a renewal of her **Distinguished Graduate Fellowship** from the **OSU Graduate College**.

**Shayamal Choudhari** received a second place award at the annual OSU BMBGSA Symposium.

**Manita Gurgain** received a **Summer Dissertation Fellowship** and was also named as the **OSU Outstanding Club Secretary**.

**Shelby Rice** received a **Sloan Foundation Fellowship**.

And **Shalaka Lotlikar** and **Olivis Arizmendi Perez** both received **ASM Sustaining Member Student Travel Awards** for the **General Meeting of the ASM** in Denver, CO.

### UNDERGRADUATE STUDENTS

**Kelsie Brooks** was named as the **Outstanding Senior** in our department. This award is based on scholarship, leadership and service as a student. **Erin Best**, **Ali McCully** and **Jamison Miller** were all finalists for this award.

**Rosa Yorks** was named a **Top 10 Senior for the College of Arts & Sciences**.

**Rachel Rice** received a second place award for undergraduate presenters at the **Missouri Valley Regional ASM** meeting. She also served as the president of our **Microbiology Club**.



### Connie Budd received the OSU Outstanding Arts & Sciences College Staff Award for 2012.

This award was truly earned. Connie does the support work for our student lab courses and also teaches the Introductory Microbiology lab. The high quality of our student lab courses is a direct result of Connie's exceptional devotion and hard work.



Dr. **Robert Miller**, a long-term faculty member of the MMG Department, was inducted into the **Oklahoma Higher Education Hall of Fame**. This is a very prestigious commendation and we congratulate him on this exceptional achievement.

## Our prior student and new colleague — Tiffany Frieze



**Tiffany Frieze** is the new undergraduate advisor for the Department of Microbiology & Molecular Genetics. This was very much a homecoming for Tiffany. She became associated with our department when still a junior high student in Pawnee, Oklahoma, while attending our Native Americans in Biological Science (NABS) Junior High Science Summer Camp in 1994 and 1995. Then, over the next two years, she participated in our NABS High School Science Summer Camp.

Tiffany attended Northern Oklahoma College before returning to OSU in 2000 and majoring in Microbiology. She received her bachelor's of science degree in microbiology from OSU in 2003. Tiffany then pursued a master's of public health degree at New Mexico State University.

After receiving her Master's of Public Health degree, Tiffany served as a health education coordinator at Eastern Washington University. Then Tiffany came back to Oklahoma to serve her tribe as the Health Department Manager for the Pawnee Nation. Finally, she returned to her other home — OSU — and is serving the students now following in her footsteps as microbiology undergraduates in our department.

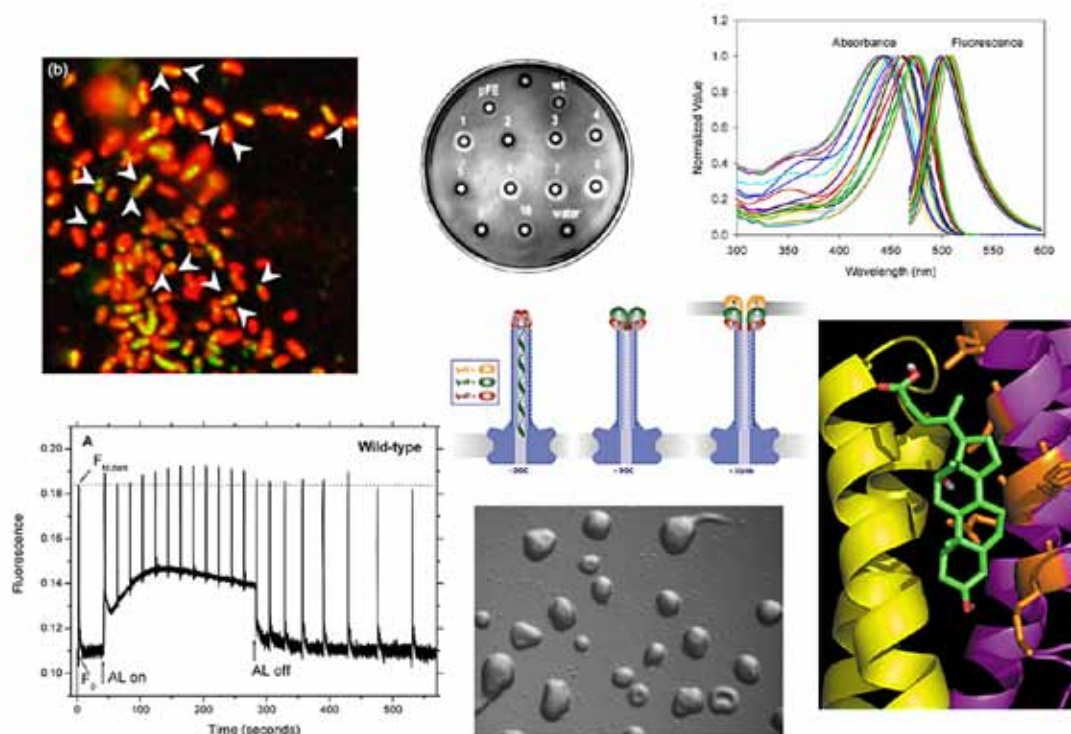
## Graduate Students Association's Corner!

Greetings from the **Microbiology and Molecular Genetics Graduate Student Association!** The past academic year the MMGGSA organized its **4th Annual Microbiology and Molecular Genetics Symposium** at Oklahoma State University on April 29th, 2013. The symposium was open to all the biological sciences departments at the Oklahoma State University and was well attended by the scientific community on campus. The symposium proved to be a great platform for scientific discussions related to the field of microbiology and for fostering interactions between inter and intra-departments on campus. The symposium began with a graduate students organized lunch with the guest and keynote speaker **Dr. Ellen L. Neidle** from the Department of Microbiology at the University of Georgia in Athens. This provided the graduate students with an opportunity to interact with Dr. Neidle, and discuss and share their thoughts and ideas about the field of microbiology. This was followed by her keynote address titled "Metabolic Lessons from a Soil Bacterium: It's all About the Regulation (More or Less)."

MMGGSA wishes to thank the other sponsors of this event – American Society of Microbiology, Department of Microbiology and Molecular Genetics, Oklahoma State University, Graduate and Professional Student Government Association, Oklahoma State University.

**Shalaka Lotlikar**





### BACTERIAL PATHOGENESIS

**Dr. William D. Picking, Professor and Head:** Biophysical analysis of the triggers of type III secretion in *Shigella*, *Salmonella* and *Burkholderia*.

Dickenson NE, Choudhari SP, Adam PR, Kramer RM, Joshi SB, Middaugh CR, Picking WL and Picking WD. 2013. Oligomeric states of the *Shigella* translocator protein IpaB provide structural insights into formation of the type III secretion translocon. *Prot. Sci.* 22:614-627.

Dickenson NE and Picking WD. 2012. Förster resonance energy transfer (FRET) as a tool for dissecting molecular interactions and structural changes within the bacterial type III secretion needle tip complex. *Int. J. Mol. Sci.* 13:15137-15161.

Barta ML, Dickenson NE, Patil M, Keightley A, Wyckoff G, Picking WD, Picking WL and Geisbrecht BV. 2012. The structures of coiled-coil domains from type III secretion system translocators reveal homology to pore-forming toxins. *J. Mol. Biol.* 417:395-405.

Barta ML, Guragain M, Adam P, Dickenson NE, Patil M, Geisbrecht BV, Picking WL and Picking WD. 2011. Identification of the bile salt binding site on IpaD from *Shigella flexneri* and the influence of ligand binding on IpaD structure. *Proteins: Struct. Funct. Bioinform.* 80:935-945.

Dickenson NE., Zhang L, Epler CR, Adam PR, Picking WL, and Picking WD. 2011. Conformational changes in IpaD from *Shigella flexneri* upon binding bile salts provide insight into the second step of type III secretion. *Biochemistry* 50:172-180.

**Dr. Wendy L. Picking, Associate Professor:** Molecular and genetic analysis of type III secretion in *Shigella* and exploitation of the type III secretion system for vaccine development.

Choudhari SP, Kramer RM, Greenwood III JC, Barta ML, Geisbrecht BV, Joshi SB, Picking WD, Middaugh CR, and Picking WL. 2013. Analysis of empirical phase diagrams reveals insights into the conformational stability of IpaB from *Shigella flexneri*. *Prot. Sci.* 22:666-670.

Adam PR, Patil MK, Dickenson NE, Choudhari S, Barta M, Geisbrecht BV, Picking WL and Picking WD. 2012. Binding affects the tertiary and quaternary structures of the *Shigella* translocator protein IpaB and its chaperone, IpgC. *Biochemistry* 51:4062-4071.

Epler CR, Dickenson ND, Bullitt E, and Picking WL. 2012. Structural analysis of the first static intermediate of *Shigella flexneri* type III secretion system needle tip, IpaD, by Transmission Electron Microscopy. *J. Mol. Biol.* 420:29-39.

Martinez-Becerra FJ, Kissmann JM, Diaz-McNair J, Clements JD, Pasetti MF and Picking WL. 2012. A broadly protective *Shigella* vaccine based on Type III secretion apparatus proteins. *Infect. Immun.* 80:1222-1231.

Simon JK, Maciel M Jr, Weld E, Wahid R, Pasetti MF, Picking WL, Kotloff KL and Levine MM. 2011. Antigen-specific IgA B memory cell responses to *Shigella* antigens elicited in volunteers immunized with live attenuated *Shigella flexneri* 2a oral vaccine candidates. *Clin. Immunol.* 139:185-192.



**Dr. Edward I. Shaw, Associate Professor:** Invasion of, and molecular interaction between the obligate-intracellular pathogen *Coxiella burnetii* and its eukaryotic host cell, including protein secretion systems and secreted protein.

Herrin B, Mahapatra S, Blouin EF and Shaw EI. 2011. Growth of *Coxiella burnetii* in the *Ixodes scapularis*-derived IDE8 tick cell line. *Vector-Borne and Zoonotic Diseases* 11: 917-922.

## CELLULAR PHYSIOLOGY

**Dr. Robert Burnap, Professor and Vennerberg Chair: Molecular Biology and genomics of photosynthesis; the function and biogenesis of membranes**

Chiu YF, Chen YH, Roncel M, Dilbeck PL, Huang JY, Ke SC, Ortega JM, Burnap RL and Chu HA. 2013. Spectroscopic and functional characterization of cyanobacterium *Synechocystis* PCC 6803 mutants on the cytoplasmic-side of cytochrome b559 in photosystem II *Biochim. Biophys. Acta-Bioenergetics* (in press).

Daley SME, Kappell AD, Carrick MJ and Burnap RL. 2012. Regulation of the cyanobacterial CO<sub>2</sub>-concentrating mechanism involves internal sensing of NADP<sup>+</sup> and  $\alpha$ -ketoglutarate levels by transcription factor CcmR. *PLoS ONE* 7(7): e41286. doi:10.1371/journal.pone.0041286.

Nagarajan A and Burnap RL. 2012. Patterns of structural conservation and divergence of the photosystem II complex, in *Functional Genomics and Evolution of Photosynthetic Systems* pp 317-344, Burnap and Vermaas, eds., Volume 33 in the series *Advances in Photosynthesis and Respiration*, Series Editor: Govindjee, Springer, New York.

*Functional Genomics and Evolution of Photosynthetic Systems*, (2012) Volume 33 in the series *Advances in Photosynthesis and Respiration*, Series Editor: Govindjee, Springer, New York, Burnap, RL and WFJ Vermaas W, Editors. 427 pages, ISBN-10: 9400715323.

Dilbeck PL, Hwang HJ, Zaharieva I, Gerencser L, Dau H and Burnap RL. 2012. The mutation D1-D61N in *Synechocystis* sp. PCC 6803 allows the observation of pH-sensitive intermediates in the formation and release of O<sub>2</sub> from photosystem II, *Biochemistry* 51:1079-91.

Nagarajan A, Winter R, Eaton-Rye J and Burnap R. 2011. A synthetic DNA and fusion PCR approach to the ectopic expression of high levels of the D1 protein of photosystem II in *Synechocystis* sp. PCC 6803 *J. Photochem. Photobiol. B.* 104, 212-219.

**Dr. Jeffrey Hadwiger, Associate Professor:** Molecular mechanisms of signal transduction in eukaryotic cell chemotaxis and differentiation.

Hadwiger JA. 2013. Role of the Vps9-domain protein RgfA in *Dictyostelium* chemotaxis and development. *Canadian J. Microbiol.* 59:22-27.

Hadwiger JA and Nguyen H-N. 2011. MAPKs in development: insights from *Dictyostelium* signaling pathway. *Biomolec. Concepts* 2: 39-46. (Invited review).

Nguyen H-N, Raisley B and Hadwiger JA. 2010. MAP kinases have different functions in *Dictyostelium* G protein-mediated signaling. *Cell. Signaling* 22: 836-847.

Raisley B, Nguyen H-N and Hadwiger JA. 2010. G5 subunit-mediated signaling requires a D-motif and the MAP kinase ERK1 in *Dictyostelium*. *Microbiology* 156: 789-797.

**Dr. Wouter D. Hoff, Professor:** Photoreceptors as model systems for protein folding and function; signal transduction; protein spectroscopy; single molecule studies; high-throughput biophysics; bacterial genomics of halophiles, protein-based sensors for biodetection.

Deole R, Challacombe J, Raiford DW and Hoff WD. 2013. An extremely halophilic proteobacterium combines a highly acidic proteome with a low cytoplasmic potassium content. *J. Biol. Chem.* 288: 581-588.

Challacombe JF, Majid S, Deole R, Brettin TS, Bruce D, Delano SF, Detter JC, Gleasner CD, Han CS, Misra M, Reitenga KG, Saunders E, Tapia R, Lapidus A, Ivanova N and Hoff WD. 2013. Complete genome sequence of Halorhodospira halophila SL1, *Standards in Genome Science*, (in press).

George DK, Knab JR, He Y, Kumauchi M, Birge RR, Hoff WD and Markelz AG. 2013. Terahertz characterization of photoactive yellow protein intermediate states, *IEEE Transact. Terahertz Sci. and Technol.*, (in press).

Gordon WR, Banga D, Hoff WD and Kent SBH. 2013. Total chemical synthesis of fully functional photoactive yellow protein, *Bioorg. & Med. Chem.*, (in press).

Rathod R, Kang Z, Hartson SD, Kumauchi M, Xie A, Hoff WD. 2012. Side-chain specific isotopic labeling of proteins for infrared structural biology: the case of ring-D4-tyrosine isotope labeling of photoactive yellow protein. *Prot. Purif. Expr.* 85: 125-132.

Gomelsky M and Hoff WD. 2011. Light helps bacteria make important lifestyle decisions. *Trends Microbiol.* 19, 441-448 (cover story).

van der Gulik TS and Hoff WD. 2011. Unassigned codons, nonsense suppression and anticodon modifications in the evolution of the genetic code. *J. Mol. Evol.* 73, 59-69 (cover story).

*continues*



## Recent Research Milestones

Oklahoma State University

Summer 2013

Hoff WD. 2011. Single-molecule and nanoscale approaches to biological signaling. In *Comprehensive Nanoscience and Technology* Vol. 4, pp. 287-323, editors: van Grondelle R, Krueger B, Walker G, Elsevier.

Hoff WD, Kang Z, Kumauchi M and Xie A. 2011. Changes in active site hydrogen bonding upon the formation of the electronically excited state of photoactive yellow protein. In *Hydrogen Bonding and Transfer in the Excited State*, editors: Zhao G-J and Han K-L, Wiley, pp. 839-855.

**Dr. Gilbert H. John, Associate Professor: Xenobiotic metabolism by intestinal microorganisms, structure and function analysis of enzymes, and biological sensor research.**

Morrison JM, Wright CM and John GH. 2012. Identification, isolation, and characterization of a novel azoreductase from *Clostridium perfringens*. *Anaerobe* 18: 229-34.

**Dr. Marianna Patrauchan, Assistant Professor: Physiology and molecular biology of bacterial biofilms.**

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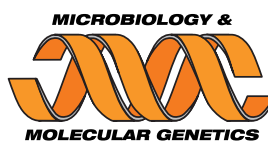
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