Interview with Dr. Meredith Defelice

Continuing the series of interviews with faculty and instructors in the BMB department (previous interviews can be found at http://bmb.psu.edu/undergraduate/student-news).

The BMB Undergraduate Newsletter will feature Instructional Faculty, Dr. Meredith Defelice, in this issue. http://bmb.psu.edu/directory/mrd22

Classes that I have taught: BMB442, BMB445W, BMB464, BMB221, BMB401, PSU016

UN: What led you to a career in academia?

MD: I started on a fairly traditional path in college, just loving science. I had my first exposure to research as an undergraduate student at Occidental College, and fell in love with the idea of pursuing a career where I could answer new questions, and analyze data on a daily basis. In order to pursue a career in research, I then went on to graduate school at Duke University where I received my Ph.D in cell biology. While my overall scientific knowledge and my ability to design and interpret experiments grew vastly during this time, I would say the most important thing that I took from my graduate career was an ability and confidence to think analytically and to delve into the scientific literature to tackle any question or problem that I may be interested in. The next step in my academic career was probably one of the most critical steps in shaping my future path as an academic. I chose to go to UNC Chapel Hill (even being an avid Duke fan) in order to participate in the SPIRE post-doctoral program, which is a program that like traditional postdocs allows you to gain more research experience, but unlike many traditional postdocs, this program also provides extensive training in teaching. It was during this time as a post-doc where I really came to the realization that I had two potential careers where I would love, in research and in education. I believe that I have always enjoyed taking complex or difficult concepts, finding the best way to distill those concepts into basic principles and then finally using those basic units as the building blocks to develop a coherent understanding of a complex issue. This is what made me love research and teaching as well. Eventually, I decided that I wanted to pursue a career where I focused on one of my two passions (research or education) instead of trying to do both at the same time. As I was in the process of making the decision as to which path to pursue, a job position as a lecturer here at Penn State opened up, and the opportunity seemed too good to pass up. The rest is history as they say, and after being able to interact and work with the students and faculty here at Penn State, I must say I am very happy with the decision I made.

UN: What advice would you give undergraduates in BMB about academic success?

MD: Most importantly, I would tell students to find their passion and also to take an active role in the learning process. Once you are studying something that you are passionate about, then the work does not seem so much like work but instead an incredible opportunity where you can allow your mind to grow. We have a set of excellent and highly regarded faculty in our department and in other departments here at Penn State as well. I would strongly recommend taking advantage of opportunities that you have to interact with the faculty, whether it be on a limited basis by attending office hours, or in a more extensive manner by participating in undergraduate research.

UN: How would you describe your teaching style?

MD: One concept that really guides and shapes my teaching style is my desire for students to learn to understand concepts and not just memorize. In order to help promote this type of learning, I utilize a number of different techniques to engage students in the classroom, and to help them visualize the process at hand. For example, I use a mixture of lecture, ---continued page 2
animations and videos, practice problems, guided inquiry question sets, and case studies to teach different concepts and to promote analytical thinking. I also think that it is very important for students to be able to place the information that they are learning into a larger context, and therefore I try to give as many real-life examples as possible.

UN: What do you want students to take with them when they leave your class?

MD: While I do have specific learning objectives that I want students to learn during the course of a semester, it is not solely the achievement of comprehension that I desire. Above and beyond the learning of specific pieces of knowledge, my highest priority is for students to learn to think independently and critically, and to be able to communicate effectively.

Dr. Defelice is the recipient of the Paul M. Althouse Outstanding Teaching Award and promoted to Sr. Lecturer I in 2012. Congratulations Dr. Defelice!

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BMB Welcomes 8 New Faculty

DR. LU BAI
Professor of Biochemistry and Molecular Biology
Assistant Professor of Physics
206B Life Sciences Building

The BMB department extends a warm welcome to Dr. Lu Bai. She joined the department in January 2012. Dr. Bai received her Ph.D in Biophysics at Cornell University. She has been a postdoctoral fellow with Dr. Fredrick Cross and Dr. Eric Siggia at Rockefeller University. The Bai Lab is interested in studying the relation between chromatin and gene expression at single cell / single molecule level by using a combination of biophysical, biochemical, genetics and computational methods. The goal of the lab is to identify sequence and chromatin features that affect the level, noise and dynamics of gene expression; to understand how these chromatin features are established and characterize their cell-to-cell variability and dynamic changes; and finally, to explore how these molecular processes affect cell phenotypes.

There are two general research directions in the lab:

1) Use single cell time-lapse microscopy to understand what chromatin features affect gene expression level, noise and dynamics, and to understand how these chromatin features are established.

2) Use single molecule techniques to probe nucleosome positioning and dynamics on single DNA molecules.

DR. PAUL CREMER
Professor of Chemistry
Professor of Biochemistry and Molecular Biology
Arriving Fall 2012

The BMB department extends a warm welcome to Dr. Paul Cremer. Dr. Cremer joins the department in the fall of this year. He was a professor and Arthur E. Martell Chair in the Department of Chemistry, Texas A&M University. He received his Ph.D. from the University of California at Berkeley. Research in the Cremer Lab involves the interplay of physical chemistry, biological chemistry, nanomaterials, and sensor design. His group has developed high throughput, low sample volume techniques to study biophysical and bioanalytical problems that would otherwise be very difficult to tackle. This approach of integrating lab-on-a-chip and nanomaterial platforms with molecular level studies of biological interfaces is illustrated by the figure below. On the analytical side, the Cremer group has developed temperature gradient - continued page 3
Recent studies have suggested that many complex genetic disorders are significantly influenced by rare mutations. One type of rare mutation, copy number variants (CNVs), account for approximately 15-20% of the genetic basis of human neurodevelopmental disease, also termed genomic disorders. Classically, CNVs associated with canonical syndromes such as Smith-Magenis syndrome and Williams syndrome arise de novo, are fully penetrant, and manifest with recognizable clinical features with little or no phenotypic variability. However, a majority of recently discovered CNVs are often inherited, with variable penetrance and expressivity, and are found in individuals with a wide range of neurodevelopmental phenotypes including autism, epilepsy, schizophrenia, intellectual disability, and congenital malformations. While these recently identified CNVs confer higher risk for disease, they are not necessarily sufficient genetic factors for disease causation. It is therefore clear that additional genetic factors potentially interacting in a disease-associated pathway be considered to explain phenotypic variability or comorbidity. Such a model has been already shown to be implicated in the pathogenicity of severe developmental delay. Integration of high-throughput exome and whole genome sequencing data with CNV data on many individuals for a disease in question is the emerging new model to study complex genetic disease.
combinations should be used depending on the regulatory environment in the starting cell type. While sequencing technologies are providing us with more and more data on various aspects of gene regulation, relatively little effort has gone into combining all available information into cohesive models of the regulatory environment. Dr. Mahony will develop integrative machine learning techniques that relate a transcription factor’s DNA-binding profile to all other available experimental data from related cell types. He hopes that this approach will yield a deeper understanding of how chromatin structure and the binding of other regulatory proteins determine the context-dependent activity of transcription factors.

**Mahony - continued from page 3**

Dr. Paul Medvedev

Assistant Professor of Computer Science and Engineering
Assistant Professor of Biochemistry and Molecular Biology
111H Information Science and Technology Building

The BMB department extends a warm welcome to Dr. Paul Medvedev. He joined the department in July 2012. Most recently, he was a postdoctoral scholar with Pavel Pevzner in UC San Diego. He received his Ph.D. at the University of Toronto under the supervision of Michael Brudno and Allan Borodin. During that time, he also visited Bielefeld University for a year, working with Jens Stoye. His main focus has been on genome assembly and variation detection, as well as interests in a variety of areas such as phylogenetics, graph theory, computational complexity, on-line algorithms, and networking. Recent advances in sequencing technologies hold the potential for tremendous biological and bio-medical discovery, however, the challenges posed by the novelty and sheer quantity of the data are increasingly computational. In this talk, we will describe algorithms for assembling genomes, discovering structural variants, and correcting errors in the reads. His methods are based on genome graphs, which is a combinatorial framework that captures the structure of a genome even when its sequence is not fully known (as with the case of sequencing data). His group shows how traditional genome graph models can be extended to capture paired-end read information, which is crucial for improving the quality of assembly, and to correct sequencing errors. His group also shows how genome graphs can be used for detecting structural variation by combining both depth-of-coverage and discordant paired-end reads. Their tool, called CNVer, showed significant improvement in accuracy over previous methods when run on a Yoruban human individual.

**DR. THOMAS E. MALLOUK**

Evan Pugh Professor of Materials Chemistry and Physics
Associate Head, Chemistry Department
Professor of Chemistry
Professor of Biochemistry and Molecular Biology
224 Chemistry Building

Dr. Tom Mallouk, Evan Pugh Professor of Materials Chemistry and Physics, and Biochemistry & Molecular Biology, joined the BMB department, in July 2012, with a joint appointment in chemistry. Dr. Mallouk is interested in several problems in materials chemistry, including photocatalysis, electrochemical energy conversion, nanoscale electronics, environmental remediation, superconductivity, and motion on the nanoscale. The approach involves the synthesis of materials that contain both molecular and solid state components, and the study of their structure and properties by a variety of physical techniques. Dr. Mallouk is also the associate director of Penn State MRSEC and Director of the Center for Solar Nanomaterials. Dr. Mallouk’s lab will soon be relocated from its present location in the Chemistry Building to newly renovated lab space on the 2nd floor of South Frear.

**DR. PAUL MEDVEDEV**

Assistant Professor of Computer Science and Engineering
Assistant Professor of Biochemistry and Molecular Biology
111H Information Science and Technology Building
The BMB department extends a warm welcome to Dr. Michael Mwangi. He joined the department in January 2012. He received his Ph.D. in theoretical physics from Cornell University. Dr. Mwangi was a member of the adjunct faculty in computational and experimental biology at Rockefeller University, New York. As a quantitative analyst at Citigroup, he was part of a group that develops mathematical models of various bond markets around the world. The primary focus of his research involves the use of whole genome sequencing to unravel the mechanisms of antibiotic resistance in MRSA. The World Health Organization has identified the emergence and spread of multidrug resistant pathogens as a global public health threat. Of these pathogens, arguably one of the most important is multidrug resistant Staphylococcus aureus (MRSA). Not only is MRSA a major source of infection in immunocompromised patients in healthcare settings, but it has begun to infect more and more people with no traditional risk factors in community settings. In MRSA, various types of resistance, like vancomycin resistance, appear to be highly polygenic traits, so much remains to be understood about the emergence of resistance, especially in vivo. Recently, we used high-throughput DNA sequencing to identify many mutations conferring resistance. While many genes seem to be involved in resistance, we did not merely end up with a laundry list of genetic determinants. Instead, we were surprised to find a stunning degree of parsimony and universality.

The BMB department extends a warm welcome to Dr. Thomas Wood. Dr. Wood joined the department in January 2012. At Texas A&M University, he was an Endowed Chair and Professor in the Department of Chemical Engineering. He received his Ph.D. from North Carolina State University. His research interests include understanding the genetic basis of biofilm formation to prevent disease and to utilize biofilms for beneficial biotransformations. In addition, he is interested in utilizing bacteria for remediation, green chemistry, and energy production. As a demonstration of the ability to control biofilm formation, his group engineered the global regulator Hha and cyclic diguanylate-binding BdcA (a protein we discovered and characterized) to create proteins that enable biofilm dispersal. They devised a biofilm circuit that utilizes these two dispersal proteins along with a population-driven quorum sensing switch. With this synthetic circuit, in a novel microfluidic channel, The Wood lab formed an initial colonizer biofilm, introduced a second cell type (dispersers) into this existing biofilm, formed a robust dual-species biofilm, and displaced the initial colonizer cells in the biofilm with an extra-cellular signal from the disperser cells. Dr. Wood also removed the disperser biofilm with a chemically-induced switch, and the consortial population could be tuned. Therefore, cells have been engineered that are able to displace an existing biofilm and then these cells may be removed on command allowing one to control consortial biofilm formation for various applications. Currently, the Wood Lab is developing biofilm consortia for green chemistry.

You ask, what is independent research?

BMB 496, Independent Research, is where students can obtain lab experience in faculty labs. Penn State faculty is awarded grants by government and private agencies to conduct research in the many academic disciplines within the university structure. Undergraduates who qualify are invited to participate in the on-going research programs of BMB faculty. Typically, between 70 - 80 students are engaged in undergraduate research during the fall and spring semesters. Participation in undergraduate research requires that an application be submitted which will be reviewed by faculty members selected by the student. Deadline to apply: October 19, 2012. Applications can be found on the BMB website under the section Undergraduate Research Opportunities.
Biotechnology - Clinical Laboratory Science Option

Clinical Laboratory Science is a critical healthcare field that impacts the health of every individual!

Now is the perfect time to pursue a career in clinical laboratory science. There are many job opportunities available offering good salaries and room for advancement.

Do you enjoy hands-on laboratory work and are you a good problem solver? Can you find that needle in a haystack? Do you think finding out HOW and WHY something works is fun? If you are interested in the scientific HOW’s and WHY’s of healthcare, a career in laboratory science may be a perfect fit. Lab scientists work in a lot of different areas including hospitals, clinics, and public health labs as well as industry, education and research.

Attention Junior CLS Option Students

The annual meeting of junior CLS students who are eligible for recommendation to affiliated hospital schools of clinical laboratory science will be held on September 11 at 7:00 p.m. in 101 South Frear Laboratory. To be eligible for recommendation, students must have completed ALL requirements of the CLS Option of the Biotechnology major, with the exception of the clinical courses (Micro 405 A-F), by the end of the SP13 semester. Information about the program, scheduling, grading, career opportunities and the recommendation process will be provided at that time. If you cannot make this meeting, please contact Rebecca Falsone (raf15@psu.edu) in room 104 S. Frear.

New Courses To Be Offered Spring 2013

BMB 497A – Practical Applications of Enzymology
2 credits – Schedule # 978604 – Dr. Allen Phillips
MW 12:20-1:10 - 011 Ferguson

This course will focus on how to understand enzymes and enzyme activity well enough to deal with their use in real-world situations. A significant portion of the class will look at how to design schemes for the purification of enzymes on moderate scale levels (i.e., greater than micrograms but less than kilograms) using techniques from the past and present. We also cover the development of enzyme assays, use of coupled reactions for activity measurements, what properties of enzymes are most important to study, and how to determine kinetic constants for enzymes as well as the value of knowing them. Several aspects of increasing importance, such as properties of tight binding or even irreversible enzyme inhibitors, are covered along with allosteric regulators of enzyme activity. The course will have at least one computer exercise that allows each student to design and perform reasonably sophisticated kinetic experiments (but in silico) using varied substrate and inhibitor concentrations to reveal interesting properties of an enzyme, including details on how the enzyme works. The class will also have at least one writing exercise and one brief oral presentation to help each person improve their skills for clear scientific communication.

BMB 498D – Human Genomics and Biomedical Informatics
3 credits – Schedule #958705 – Dr. Marylyn Ritchie
TR 9:45-11:00 – 008 Mueller

The purpose of this course is to introduce students to the field of human genomics and biomedical informatics, in particular in the context of genetic architecture of complex human diseases and traits. The field of human genomics has experienced a massive explosion in data generation technologies, new discoveries, and increasing popularity in many scientific fields. This course will cover the molecular, statistical, population, and analytical aspects of modern human genomics and biomedical informatics.
Attention First Year Students

Recommended Academic Plans provide, in table form, the courses students might schedule semester by semester as they pursue a particular degree. These tables serve several University purposes and assist multiple constituencies: students, advisers, departments, deans, registrars, admissions officers, and family members. The plans you received over the summer during your First-Year Testing and Consulting (FTCAP) session have been revised. You should follow the Fall 2012, Recommended Academic Plan (RAP). You can obtain copies of these forms on the BMB website (bmb.psu.edu) under the Undergraduate, Form Center section, or stop by 107 Althouse.

The RAP recommends you take MICRB 201 and 202 in your second semester. When scheduling your Spring 2013 courses, you should schedule MICRB 201 (Introductory Microbiology), section 001 (Schedule # 934612) and MICRB 202 (Introductory Microbiology Lab) Special inquiry-based section 001 (Schedule # 934621) with Dr. Ades and Dr. Keiler. These sections have a controls on them and is specifically for those with an intended major of BMB, BIOTC or MICRB.

Honors and Awards

FACULTY:

Melissa Rolls - recipient of Daniel R. Tershak Memorial Teaching Award

Meredith Defelice - recipient of Paul M. Althouse Outstanding Teaching Award

Carl Sillman - recipient of C.I. Noll Excellence in Teaching Award. The selection is made by science students.

J. Martin Bollinger, Jr. - recipient of Howard B. Palmer Faculty Mentoring Award

Sarah Ades and Ken Keiler - newly appointed fellows for the Center for Excellence in Science Education

Richard Frisque, Craig Cameron, and Mathew Crook - recipients of Eberly College of Science Dean’s Climate and Diversity Awards

Meredith Defelice - promoted to Sr. Lecturer I

GRADUATE:

Simpson Innovative (Risky) Science Award
- Saikat Chowdhury
- Daniel Corde

Alumni Association Dissertation Award - Life & Health Sciences Category
- Zhenfeng Liu

UNDERGRADUATE:

College Marshal
- Zachary Hostetler (B M B) escorted by Song Tan

Standard Bearers
- Chetan Safi (B M B) escorted by Dr. V. Reddy Padala
- Megan Fisher (MICRB) escorted by Dr. Yanming Wang
- Kian Hui Yeoh (BIOTC) escorted by Dr. Maria Krasilnikova

2012 Summer Research Awards
- Christin Folker (B M B) Research Adviser, Melissa Rolls Lab - Jacqueline Hemming Whitfield Student Research Endowment
- Sarah Moore (B M B) - Research Adviser, Yanming Wang Lab - Jacqueline Hemming Whitfield Student Research Endowment

Michael Connolly (B M B) - Research Adviser, Paul Babitzke - Edward B. Nelson Undergraduate Summer Research Award and the Paul and Mildred Berg Endowment for Eberly College of Science Summer Research

Christopher Natale (B M B) - Research Adviser, Teh-hui Kao - Charles & Vicki Grier Undergraduate Research Award and the John Lapinski Summer Scholar Award

2012 Undergraduate Discovery Summer Grant Recipient
- Adam Clemens (BIOTC) Eberly College of Science Molecular Cloning and Functional Analysis of LEAFY COTYLEDON2 Gene in Theobroma Cacao
- James Hauck (B M B) Eberly College of Science Expression of NELF in E. coli and Lepidopteran Cells
- Christopher Kozlowski (B M B) Eberly College of Science Role of Heterotrimeric G-Proteins in the Establishment of Microtubule Polarity
- Sarah Moore (B M B) Eberly College of Science A Comprehensive Analysis of p53-related Genes and Their Roles in Determining Cell Fate

Awards & Honors - continued page 8
Awards and Honors - continued from page 7

2012 Undergraduate Exhibition

- Benjamin Chambers (MICRB) and Hoon Chang (BMB) won first place in the Health & Life Sciences Division. Determining the Mechanisms of Action of Trans-Translation Inhibitors in Mycobacterium Smegmatis

- Vladimir Krhistov (BMB) and Garrett Cheung won second place in the Health & Life Sciences Division. Multi-disciplinary Approaches to Understanding the Role of GABAergic Inhibition in Mood Disorders

- Amarpreet Ahluwalia (BMB) won first place in the University Libraries Awards for Information Literacy. Towards and Experimentally Determined Coupling Free Energy Change in Deprotonated Guanine

- Stephen Wellard (BMB), Nari Kim (BIOTC), Qiao Kai Law (BIOTC) won first place in the University Libraries Awards for Information Literacy. The Identification & Characterization of Sufu Interacting Proteins.

Wedler Outstanding Undergrad Dissertation Award

- Qiao Kai Law

B M B Department awards and Eberly College of Science designated department awards.

- David Posocco
  Anderson Memorial Scholarship

- Ryan Henrici
  Atlas Scholarship

- Jessica Meyer
  Bright Scholarship

- Danielle Sabelli
  Cleveland Harding Facing

- Tait Huso
  Davey Scholarship

- Andrew Clemens
  Foster Scholarship

- Luke Brezovec
  Gerth Award

- Ryan Fine
  Gilmore Grant-In-Aid

- Jason Ferderber
  Herko Family Scholarship

- Ivy Co
  Hutchings Scholarship

- Andrew Bryant
  Maginnis

- Sarah Moore
  Miller Scholarship

- Christin Folker
  Morrow Family Scholarship

- Megan Hurry
  Ruth Ott Lewman Scholarship

- Angelia Reiber
  Ruth Ott Lewman Scholarship

- Paige Stanley
  Ruth Ott Lewman Scholarship

- Vladimir Krhistov
  Shigley Award

- Emily Rutan
  Stiles Scholarship

- Christopher Rae
  Thompson (BMB) Scholarship

Important Dates

8/13 - 9/10
File Intent to Graduate

9/3
Labor Day Holiday

9/5
Regular Drop Deadline

9/6
8 a.m. Regular Add Deadline

9/7
Late Registration Begins

9/11 - 9/13
Fall Career Days

9/11
Non-Technical Full-Time Career Day

BIOTC CLS Meeting for Junior Class

9/12
Internship & Co-op Career Day

9/13
Technical Full-Time Career Day

9/28 - 9/30
Parents Family Weekend

10/19
496 Applications are DUE

11/9
Rough Draft Thesis DUE BMB Dept

11/16
Final Thesis DUE BMB Dept

11/16
Late Drop Deadline
Declare Minor (Graduating Students)

11/18 - 11/24
Thanksgiving Holiday No Classes

12/14
Classes End

12/17 - 12/21
Final Exam Week

12/22
Commencement

This publication is available in alternative media on request.

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