Twenty First Annual

Biotechnology Training Retreat

Saturday,
March 24, 2012

Christian Brothers Retreat & Conference Center
Napa, CA

Twenty First Annual Biotechnology Training Retreat

Co-sponsored by:

NIH Training Program in Biomolecular Technology (NIH-T32-GM08799)

UC Davis Designated Emphasis in Biotechnology Graduate Program (DEB)

UC Davis Biotechnology Program

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2012 Welcome

On behalf of the UC Davis Biotechnology Program, the executive committees of the Designated Emphasis in Biotechnology (DEB) and the NIH Training Grant in Biomolecular Technology, we thank you for joining us as we honor our **2011-12 fellows and their preceptors**, as well as **our industry affiliates**. We also welcome the faculty and trainees associated with the NSF CREATE-IGERT Training Program (directed by Karen McDonald) as they are members of the DEB program as well. We are thrilled that we received another five years of NIH funding for the Biotechnology Training Program. The DEB graduate program continues to grow (over 230 students from 29 graduate programs) and receives considerable attention. I was interviewed by **Science Careers** in January and our manuscript, "**A Collaborative Model for Biotechnology Education and Training**", was accepted by the Journal of Commercial Biotechnology in February. Each of our students is listed on the DEB website (www.deb.ucdavis.edu).

Many thanks go out to the Biotech Team. The logistics of this retreat have been expertly overseen by **Demian Sainz** (Account Manager), **Marianne Hunter** (newly promoted to Assistant Director of Administration) and Associate Director, **Dr. Denneal Jamison-McClung.** Without their dedicated service, this annual event would not happen.

It is a pleasure to introduce our current Biotechnology Fellows. Our five **NIH Fellows** include: **Mateo Hernandez,** Chemistry (preceptor is Donald Land); **Silvia Hilt**, Biochemical & Molecular Biology (preceptor is John Voss); **Regina MacBarb**, Biomedical Engineering (preceptor is Kyriacos Athanasiou); **Nancy Zeng**, Chemical Engineering (preceptor is Bill Ristenpart) and; **Wade Zeno**, Chemical Engineering (preceptor is Marjorie Longo). Our four **Biotechnology Fellows** (industry and campus fellowships) include: **Sean Gilmore**, Applied Science (preceptor is Atul Parikh); **Jared Moore**, Chemistry (preceptor is Jared Shaw); **Diana Lac**, Pharmacology and Toxicology (preceptor is Kit Lam) and; **Mike Starr**, Biomedical Engineering (preceptor is Marc Facciotti).

The **2011-12 CREATE-IGERT Trainees** are: **Hyrum Gillespie, Mitch Harkenrider, Mark Lemos, Patrick O'Dell, Erica Vonasek, Natasha Worden, Tracy Zeng,** and **Steve Zicari.** They join the previous cohort

trainees: Lucas Arzola, Geoffrey Benn, Marta Bjornson, Timothy Butterfield, Elenor Castillo, Dawn Chiniquy, Mitch Elmore, Tiffany Glavan, Rachel Kerwin, Ben Lindenmuth, Chris Simmons, and Mark Wolf. Due to the limited time for oral presentations, we will showcase research performed by these students, as well as other students in the DEB program, in the poster session. Please congratulate all of these outstanding predoctoral candidates and recent graduates (Ben Lindenmuth, Chris Simmons, and Mark Wolf). We are very proud of all of them.

We will be selecting our **2012-13 NIH Fellows** in May. Nomination forms are on the web at www.deb.ucdavis.edu and the application deadline is **Monday, April 25th.** Remember, you must be a member of the DEB to be eligible for funding, since it is the formal training program for the NIH training grant

In regard to DEB internships, we placed close to **30 students** over the 2011-2012 term. 1) **Abbott Diabetes Care, Inc.** (Alameda, CA): **Scott Hamilton;** 2) **Agilent Technologies** (Santa Clara, CA): **Shuai Wu;** 3) **American River College** (Sacramento, CA): **Shannon Ceballos;** 4) **Bayer Healthcare** (Richmond, CA): **Raquel Orozco-Alcaraz;** 5) **Caliber Biotherapeutics (G-Con, LLC)** (College Station, Texas): **Kittipong "Nat" Rattanaporn;** 6) **California Healthcare Institute** (CHI) (Sacramento): **Sarah Lockwood;** 7) **Center for Biophotonics Science and Technology (CBST)** (UC Davis): **Padmini Sirish;** 8) **Celgene Corp.** (South San Francisco, CA): **Erin Schwartz;** 9) **Cytokinetics** (San Francisco): **Darren Hwee;** 10) **Genentech** (South San Francisco): **Neha Dixit, Rashida Lathan, Thomas Luu, Maria Ogunyankin, Joseph Ramahi, John Strum,** and **Ambrose Williams;** 11) **Isador Cohen Elementary School** (Sacramento, CA): **Nathaniel Kingsbury;** 12) **National Inst. of Bioprocess Research and Training, (NIBRT)** (Dublin City University, Ireland): **Michelle Lozada-Contreras;** 13) **National University of Ireland, Maynooth** (Ireland): **Lucas Arzola;** 14) **Nestle** (Switzerland): **David Dallas;** 15) **Novozymes** (Davis, CA): **TuAnh Huynh; Tiffany Glavan, Shannon Ceballos**; 16) **OncoMed Pharmaceuticals** (Redwood City, CA): **Laura Hoang, Vu Trinh** and **Breanna Wallace;** 17) **Pfizer** (Pearl River, New York): **Zahra Khedri;** 18) **Takeda SF** (South San Francisco, CA): **Charles Nwosu;** 19) **University of Alabama, Birmingham Research Foundation** (Alabama): **Stephanie Crockett;** 20) **University College, Dublin** (Ireland): **Rachel Kerwin**. We would like to thank all of our industry and government affiliates for their support of our training program. With the rapid growth of the DEB, we are going to need even more training sites in the near future. We are currently developing partnerships with **Biogen Idec**, **Boehringer-Ingelheim, BioRad Laboratories**, and **JSRMicro**.

Twenty students graduated in 2011 and received their PhDs along with a Designated Emphasis in Biotechnology. Our graduates have found positions in both academia and industry.

Academia: Laura Ho Hoang is a postdoc for the Center for Health & Environment department at UC Davis. **Connie Jen** and **Erin Tapley** are post docs in the College of Biological Science at UC Davis. **Chris Simmons** and **Cheng-Yuk Lee** are postdocs in the College of Engineering. **Padmini Sirish** is a postdoc in the Center for Neuroscience on campus. **Dominik Green** is teaching in the chemistry department at Sacramento State University. **Pradeepa Gunathilake-Bandaranayake** returned home to a lecturer position at the University of Peradeniya in Sri Lanka. **Matthew Hoopes** secured a postdoc position at the University of Waterloo in Canada. **Sunny Shah** was hired as a senior scientist at the University of Notre Dame in the Advanced Diagnostics and Therapeutics department.

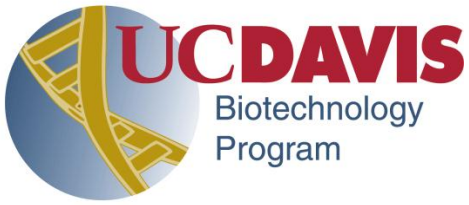
Industry: Chao Joy Yu and **Breanna Wallace** found positions at OncoMed. **Victor Haroldsen** is a scientific analyst at Morrison & Foerster LLP in San Francisco**. Kevin Holden** is a scientist at LS9 Inc. in San Francisco. **Ben Lindenmuth** is a process development engineer at Bayer Healthcare in Berkeley. **Thomas Luu** is a neuroscience intern at Genentech. **Juan Sanchez** was a postdoc on campus, but recently secured a scientist position at Monsanto, Calgene campus. **Shuai Wu** recently joined DVS Sciences, Inc. as a mass spectrometrist. **Charles Nwosu** is currently interviewing for positions in industry.

Dr. Christina Takanishi, a previous Biotech Fellow, also earned her PhD in 2011 and had just started a postdoc at UC Davis. We were shocked when we heard that she passed on January 25, 2012. The Biotechnology Program, in conjunction with BMCDB graduate group, held a Remembrance and Celebration of Her Life on campus. We all mourn the loss of our sweet Chris. Please take a moment to read our memoriam at the end of the retreat book.

Many thanks for coming to our annual retreat. Please enjoy the day and meet as many new friends as possible. As I always say, networking is one of the best parts of this special day in Napa.

All the Best,

Judy Kjelstrom
Director,
UC Davis Biotechnology Program



NIH Training Program in Biomolecular Technology
(NIH-1-T32-GM08799)

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Martina Newell-McGloughlin, Co-Director
Karen McDonald, Co-Director

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Lyle Crossland, Monsanto, Calgene Campus

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UC Davis Twenty First Annual Biotechnology Training Retreat
March 24, 2012
Christian Brothers Retreat & Conference Center

Morning Schedule

6:45 am – Bus departs Davis, Parking Lot #41

8:00 – 8:30 am	**Registration/Continental Breakfast**
8:30 – 8:50 am	**Welcome** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology
8:50 – 9:00 am	**Vision Statement for Research** Vice Chancellor of Research Harris Lewin
9:00 – 9:10 am	**Morning Session** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology
9:10 – 10:50 am	**Presentations** 9:10 am Mateo Hernandez..... *Mentor: Donald Land* 9:35 am **Ron Mullikin** ..... **Novozymes, Inc.** 9:55 am Silvia Hilt..... *Mentor: John Voxx* 10:20 am Regina MacBarb ..... *Mentor: Kyriacos Athanasiou*
10:45 – 10:55 am	**Break / Poster Viewing**
10:55 – 12:05 pm	**Presentations** 10:55 am **Torsten Schulz**..... ..... **Boehringer-Ingelheim, Inc.** 11:05 am Nancy Zeng..... *Mentor: Bill Ristenpart* 11:30 am Wade Zeno..... *Mentor: Marjorie Longo* 11:55 pm Martina Newell-McGloughlin ..... Bioethics Question (Handout)

Afternoon Schedule

12:05 – 1:10 pm	**Lunch / Poster Viewing**
1:10 – 1:25 pm	**Photo Taking for NIH/Biotech Fellows & CREATE-IGERT Trainees**
1:25 – 1:30 pm	**Afternoon Session Chair** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology
1:30 – 3:05 pm	**Presentations** 1:30 pm Martina Newell-McGloughlin ..... Bioethics Question (Discussion) 1:45 pm Sean Gilmore ..... *Mentor: Atul Parikh* 2:10 pm **Toni Voelker** ..... **Monsanto, Calgene** 2:30 pm Jared Moore ..... *Mentor: Jared Shaw* 2:55 pm **Esohe Idusogie** .... **OncoMed Pharmaceuticals**
3:05 - 3:25 pm	**Short Break (20 min)**
3:25 – 4:25 pm	**Presentations** 3:25 pm Diana Lac ..... *Mentor: Kit Lam* 3:50 pm Mike Starr ..... *Mentor: Marc Facciotti* 4:15 pm Dmitry Grapov ..... *New Short Course Instructor*
4:25 pm	**Closing Remarks** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology

5:20 pm – Bus departs Napa

2012 Poster Titles

A. **"NMR Spectroscopic Analysis of Microalgae Lipids For Bioenergy and Health Applications"**
Lisa A. Anderson* and Annaliese K. Franz
Department of Chemistry, University of California, Davis

B. **"Benzothiazoles, Novel Activators of Endothelial Calcium-Activated Potassium Channels As Potential Anti-Hypertensives"**
Brandon Brown*, Nichole Coleman, and Heike Wulff
Department of Pharmacology, University of California, Davis

C. **"Establishment of Glucocorticoid-Mediated Transcriptional Induction of the Rice XA21 Pattern Recognition Receptor For Large-Scale Proteomic Analysis"**
Chang-Jin Park, Patrick E. Canlas, Daniel F. Caddell*, and Pamela C. Ronald
Department of Plant Pathology, University of California, Davis

D. **"Developing a High-Throughput Screen for Anti-Quorum Sensing Compounds With Application in the Prevention of Citrus Greening Disease"**
Hyrum Gillespie* and Abhaya Dandekar
Department of Plant Sciences, University of California, Davis

E. **"Differentiation-Dependent Secretion of Proangiogenic Factors by Mesenchymal Stem Cells"**
Allison I. Hoch*[1], Bernard Y. Binder[1], Damian C. Genetos[2], and J. Kent Leach[1]
[1]Department of Biomedical Engineering, University of California, Davis
[2]Department of Anatomy, Physiology, and Cell Biology, School of Veterinary Medicine, University of California, Davis

F. **"Design and Synthesis of Small Molecules That Disrupt the Binding Interaction Between the HOXA13 Transcription Factor and Its DNA Target"**
Kevin S. Martin*[1], Darlene Q. Tan[1], Scott Stadler[2], and Jared T. Shaw[1]
[1]Department of Chemistry, University of California, Davis
[2]Molecular and Medical Genetics, Oregon Health and Science University, OR 97239

G. **"Exploring MUS81-EME1 as a Novel Anti-Cancer Therapeutic Target"**
Sucheta Mukherjee* and Wolf-Dietrich Heyer
Department of Microbiology, University of California, Davis

***DEB Graduate Student**

H. **"Nanoporous Gold as a Multifunctional Biomedical Device Coating"**
Özge Kurtuluş *[1], Atul Parikh[2,] and Erkin Şeker[3]
[1]Department of Chemical Engineering and Materials Science, University of California, Davis
[2]Department of Biomedical Engineering, University of California, Davis
[3]Department of Electrical and Computer Engineering, University of California, Davis

I. **"Resistance and Resilience of N and P Cycling Microbes in Agricultural Systems After Heat Perturbation"**
Priyashiela Singh*,and Kate M. Scow
Department of Land, Air and Water Resources, University of California, Davis

J. **"Development of Biopolymer Formulations with Encapsulated Bacteriophages for Applications in Agriculture and Food"**
Erica Vonasek*[1], Daniel Bricarello[2], Ping Liu[3], You-Lo Hsieh[3], and Nitin Nitin[1,2]
[1]Department of Biological and Agricultural Engineering, University of California, Davis
[2]Department of Food Science and Technology, University of California, Davis
[3]Department of Textiles and Clothing, University of California, Davis

K. **"Fluorescent Imaging of Neutral Lipids in Microalgae for Health and Biofuel Applications"**
Diana M. Wong* and Annaliese K. Franz
Department of Chemistry, University of California, Davis

L. **"Identifying the Biochemical and Molecular Components of Plant Primary Stress Response Networks"**
Geoffrey Benn*[1], Marta Bjornson*[1,2], and Katayoon Dehesh[1]
[1]Department of Plant Biology, University of California, Davis
[2]Department of Plant Sciences, University of California, Davis

M. **"Studying the Endomembrane Trafficking Processes Involved in Cell Wall Deposition for Biofuel Improvement"**
Natasha Worden* and Georgia Drakakaki
Department of Plant Sciences, University of California, Davis

N. **"EBA and CLIPA Are Required for Sustained Polorized Hyphal Tip Growth in the Fungus Aspergillus Nidulans"**
Cui Jing Zeng*,and Bo Liu
Department of Plant Biology, University of California, Davis

***DEB Graduate Student**

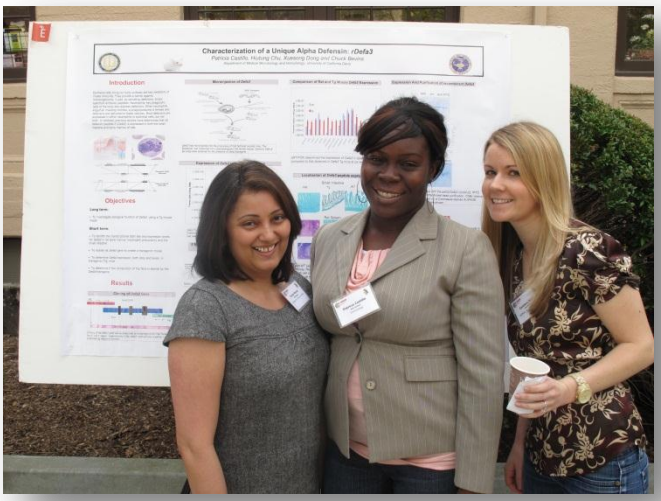
O. **"Fermentation Strategies for Whole Sugar Beet to Ethanol Production and *in planta* Production of Liquefaction Enzymes in an Integrated Biorefinery Approach"**
Steve Zicari*[1], Natthiporn Aramruerang[1], Chang Chen[1], Jean VanderGheynst[1], Karen McDonald[2], and Ruihong Zhang[1]
[1]Department of Agricultural and Biological Engineering, University of California, Davis
[2]Department of Chemical Engineering and Materials Science, University of California, Davis

P. **"Improving Phytophthora Resistance Through Manipulation of Arachidonic Acid Responses"**
Marta Bjornson*[1,2], Abhaya Dandekar[1], and Katayoon Dehesh[2]
[1]Department of Plant Sciences, University of California, Davis
[2]Department of Plant Biology, University of California, Davis

Q. **"Investigation of the Role of Sulfur Volatiles in Repelling Crop Pathogens"**
Elenor Castillo*, Florence Negre-Zakharov, and Abhaya Dandekar
Department of Plant Sciences, University of California, Davis

R. **"Phylogenomic Analysis of Cell Wall-Related Genes in Switchgrass"**
Mitchell Harkenrider*, Rita Sharma, Manoj Sharma, and Pamela Ronald
Department of Plant Pathology, University of California, Davis

S. **"Duckweed as a Biomass and Cellulase Source for Biofuel Production"**
Mark Lemos*, Steve Zicari*, SangKyu Jung, and Karen McDonald
Department of Chemical Engineering and Materials Science, University of California, Davis



***DEB Graduate Student**

2012 Presentation Titles

1. **"Infrared Spectroscopy of Biomolecular Interactions in Aqueous Solutions: Stability of Lipid Membrane Structures and Reactions at Their Interfaces"**
   Mateo Hernandez* and Donald P. Land
   Department of Chemistry, University of California, Davis

2. **"Fermentation Process Development for the Production of Industrial Enzymes"**
   Ronald K. Mullikin, PhD*, Audrey Diano, PhD, and Stephen Brown, PhD
   Novozymes, Inc., 1445 Drew Ave., Davis, California 95618

3. **"Molecular Crowding Influences Apolipoprotein E Folding Stability and AB Clearance"**
   Silvia Hilt*, Robin Altman, Madhu Budamagunta, and John Voss
   Department of Biochemistry and Molecular Medicine, University of California, Davis

4. **"The Statistical Optimization of Bioactive Regimens For Engineering Biomimetic TMJ Fibrocartilage"**
   Regina F. MacBarb*, and Kyriacos A. Athanasiou
   Department of Biomedical Engineering, University of California, Davis

5. **"Boehringer Ingelheim – The Value Through Innovation (VTI) Concept"**
   Torsten Schulz, PhD
   Biopharmaceutical Process Science
   Boehringer Ingelheim, Fremont, CA USA

6. **"Mechanical Response of Red Blood Cells to Increased Shear: Influence of Oxidative Stress"**
   Nancy F. Zeng* and William D. Ristenpart
   Department of Chemical Engineering and Materials Science, University of California, Davis

7. **"Entrapment and Preservation of Integral Membrane Proteins In Nanoporous Silica Gels Via Nanolipoprotein Particles"**
   Wade Zeno*[1], Marjorie Longo[1], Subhash Risbud[1], and Matthew Coleman[2]
   [1]Department of Chemical Engineering and Materials Science, University of California, Davis
   [2]Department of Radiation Oncology, University of California, Davis

8. **"Ethics Discussion"**
   Martina Newell-McGloughlin, DSc
   Executive Director of Life & Health Sciences Research Development in Office of Research, University of California, Davis

***DEB Graduate Student**

9. **"Salt and Fat: The Lipids of Extreme Halophiles and Their Applicability in Membrane-Mimetics"**
Sean Gilmore*, Andrew Yao, Marc Facciotti, Kelsey Cox, and Atul N. Parikh
Department of Biomedical Engineering, University of California, Davis

10. **"Re-Design of Soybean Oil Composition Through Genetic Engineering"**
Toni Voelker, PhD
Monsanto, Calgene Campus, CA

11. **"Synthetic Efforts Towards Inhibitors of Bacterial Cell Division Proteins"**
Jared Moore* and Jared Shaw
Department of Chemistry, University of California, Davis

12. **"The Role of Imaging in Drug Development"**
Esohe Idusogie, PhD
Process Development, OncoMed Pharmaceuticals
800 Chesapeake Drive, Redwood City CA

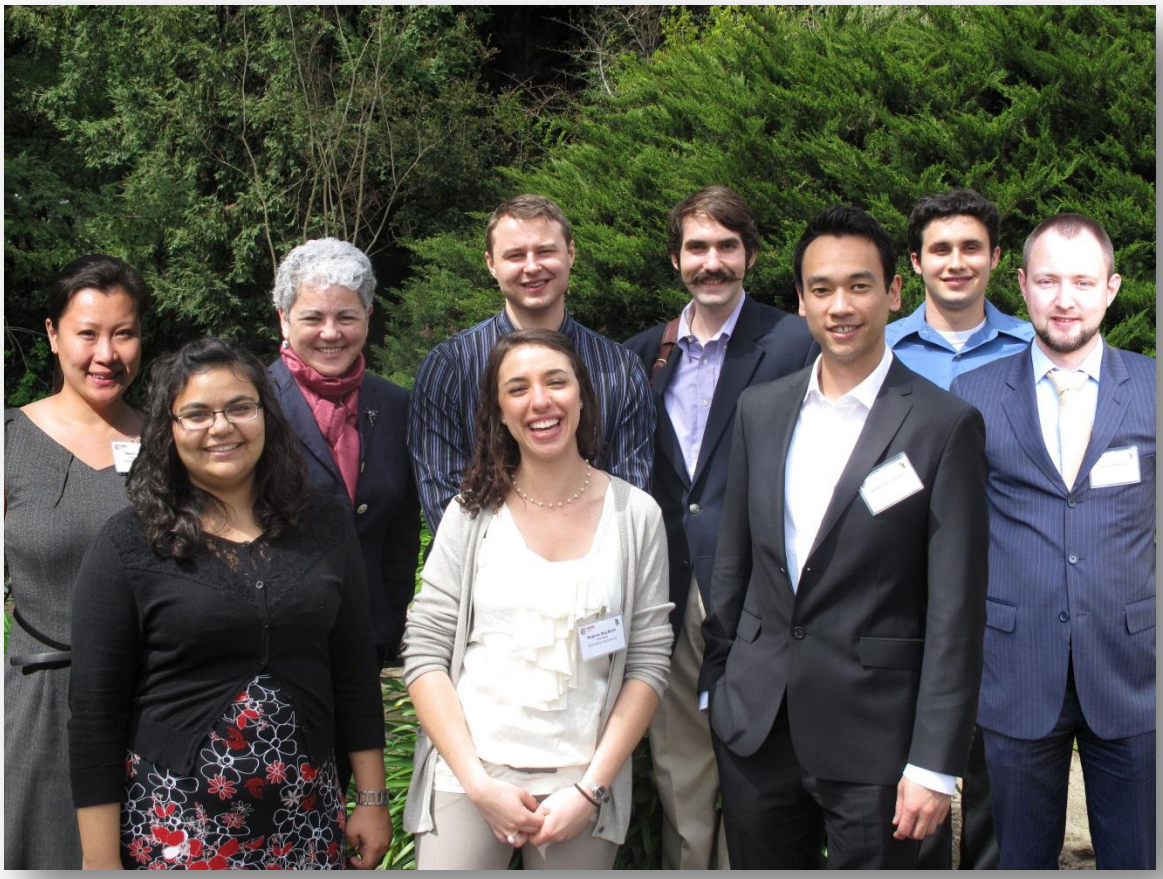
13. **"Identification of Novel Blood Brain Barrier Cell Penetrating Peptide"**
Diana Lac*, Urvashi Bhardwaj, and Kit Lam
Department of Biochemistry and Molecular Medicine, University of California, Davis

14. **"Systems Biology of Green Polyhydroxyalkanoate Production In Haloarchaea"**
Mike Starr*, Elizabeth Willbanks, Andrew Tritt, Andrew Yao, Erin Lynch, Philip Seitzer, and Marc Facciotti
Department of Biomedical Engineering & Genome Sciences, University of California, Davis

15. **"Introductory Workshop for Multivariate Data Analysis and Visualization"**
Dmitry Grapov*[1] and John Newman[1,2]
[1]Department of Nutrition, University of California, Davis
[2]USDA/ARS Western Human Nutrition Research Center, Davis, CA

***DEB Graduate Student**

Oral Presentation Abstracts



NIH FELLOW: Mateo Hernandez

INFRARED SPECTROSCOPY OF BIOMOLECULAR INTERACTIONS IN AQUEOUS SOLUTIONS: STABILITY OF LIPID MEMBRANE STRUCTURES AND REACTIONS AT THEIR INTERFACES

Presenter: Mateo Hernandez*
Authors: **Mateo Hernandez*** and Donald P. Land
Affiliations: Department of Chemistry, University of California, Davis
Preceptor: Donald P. Land

Our group specializes in novel methods for using infrared spectroscopy to probe reactions in aqueous solutions. Of particular interest are the interactions between biomolecules and membrane bilayers at physiological pH, ionic strength, and temperature. Biomolecules interacting with lipid bilayers comprise the single most important class of functional biochemistry, encompassing cell-signaling, cell recognition, and numerous other important aspects. In this talk, I will highlight several approaches to probing the reactivity and stability of various engineered nanoscale architectures of lipid bilayers in aqueous solution. Using a variety of approaches, I am able to produce stabile structures of 2-D extended lipid monolayer films, 2-D extended lipid bilayer films or 3-D lipid bilayers in 100 nm spherical liposomes. IR spectroscopy can distinguish these different structures and probe changes in the structures. For each type of bilayer structure, I demonstrate how *in situ* IR spectroscopy can be used to monitor reactions of the bilayers in solution. I also show how the effects of bilayer additives, such as cholesterol, have on the resulting lipid aggregate and hydrophobic lipid domains. I will present data showing how these methods can detect differing glycolipid – lipid membrane mixtures, as well as interactions between APO-AI and GM3/DMPC mixed membranes.

***DEB Graduate Student**

COMPANY AFFILIATE: Novozymes, Inc.

FERMENTATION PROCESS DEVELOPMENT FOR THE PRODUCTION OF INDUSTRIAL ENZYMES

Presenter: Ronald K. Mullikin, PhD**

Authors: **Ronald K. Mullikin****, Audrey Diano, and Stephen Brown

Affiliations: Novozymes, Inc.
1445 Drew Ave.
Davis, CA – 95618

Email: rmlk@novozymes.com

Industrial enzymes, which are subject to pricing and regulatory pressures, need to be produced cheaply and reliably using high yielding strains and optimized processes that are easily scaled-up. The use of laboratory scale fermentors to test strains and to optimize processes is necessary to achieve this at the large scales (1-1000 m^3) common in industrial settings. Lab scale fermentations are more reliable to scale up than shake flasks and microtiter plates because fermentation conditions such as pH, dissolved oxygen, feed rate, and agitation can be precisely controlled. This improved control of process conditions enables scale up to be done more easily using standard techniques. A particular challenge in scaling up fermentation processes is ensuring good oxygen mass transfer from an aeration gas to the fermentation broth. Oxygen mass transfer is influenced by many factors—including broth viscosity, aeration gas flow rate, power to volume ratios, tank geometry, and media composition. Strain related barriers to good scale up include genetic instability, poor transcription, poor translation, and poor secretion of enzyme product. Finally, the enzyme product itself can create barriers to high productivity through proteolysis, crystallization, autoinactivation, and deleterious effects on cell metabolism. Scale up of processes to larger scale tanks has to include considerations of mixing, tank cooling capacity, lower raw material quality, substrate mass transfer, and tank pH gradients. Lastly, upstream processes have to be designed so that recovery of enzyme product is economical, in high yield and free of any contaminants that may trigger regulatory concerns.

**Presenter

NIH FELLOW: Silvia Hilt

MOLECULAR CROWDING INFLUENCES APOLIPOPROTEIN E FOLDING STABILITY AND AB CLEARANCE

Presenter: Silvia Hilt*
Authors: **Silvia Hilt***, Robin Altman, Madhu Budamagunta, and John Voss
Affiliations: Dept. of Biochemistry and Molecular Medicine,
University of California, Davis
Preceptor: John Voss

Our lab is interested in defining the molecular mechanism by which apolipoprotein E4 (apoE4), one of the three apolipoprotein E isoforms, increases the risk for Alzheimer's Disease (AD). The clinical marker of the disease is the accumulation and deposition in the brain of clumps of Aβ protein known as amyloid fibrils. Major contributors leading to onset of AD are increased Aβ production, decreased Aβ clearance and stabilization of the toxic state conformation. ApoE, a cholesterol transport protein, regulates the brain Aβ levels and factors affecting apoE activity will likely influence Aβ deposition and clearance. While conventional laboratory experiments investigate protein behavior in buffer dilutions, most proteins in the cells compete for volume in a dense environment of various large structures and molecules commonly referred to as crowders. The molecular crowding is an excluded volume effect that changes the folding and function of the affected proteins. Conventional *in vitro* experiments are carried at ~ 4-10mg/mL, while *in vivo* proteins function at a density of ~ 400mg/ml macromolecules. This crowded environment can profoundly impact the protein structure and function.

Some proteins that are naturally tightly folded show no crowding effects while others that are loosely folded are more susceptible to changes in folding while in a crowded environment. This behavior is significant for apolipoproteins that have disordered domains and is especially of interest for us to know that the structure we are looking at *in vitro* is similar to what we would see in the cell. Additionally, Aβ is a "natively unfolded" peptide itself with regions of low stability that could be affected by molecular crowding. These regions are expected to readily increase or decrease their degree of order when competing for space. Using ficoll 70 as crowding agent, we have done circular dichroism (CD) analysis of apoE/Aβ complexes to look for changes in the protein folding by looking at changes in the α-helical/β-sheet content. We noticed an overall increase of about 20% in helical content of the proteins in the presence of ficoll 70. We have also done electron paramagnetic resonance (EPR) spectroscopy of site-directed spin labels that resolve multiple folding states at specific sites and are able to identify the more loosely packed C-terminus of the protein as the site with increased helical content. This finding is significant since the C-terminus of the protein not only contains the lipid-binding region (LBR) with a major role in cholesterol transport

but due to its interaction with the N-terminus, is also the subject of targeted therapeutics like small molecule structure correctors. Elucidation of the behavior of apolipoproteins in an *in vivo* like environment adds to our interest and ultimate goal of developing a diagnostic tool for early AD detection and treatment.

***DEB Graduate Student**

NIH FELLOW: Regina MacBarb

THE STATISTICAL OPTIMIZATION OF BIOACTIVE REGIMENS FOR ENGINEERING BIOMIMETIC TMJ FIBROCARTILAGE

Presenter: Regina MacBarb*
Authors: **Regina MacBarb***, and Kyriacos A. Athanasiou
Affiliations: Department of Biomedical Engineering, University of California, Davis
Preceptor: Kyriacos A. Athanasiou

The fibrocartilages of the temporomandibular joint (TMJ), whose main role is to provide smooth joint articulation, are unable to self-repair once afflicted by temporomandibular joint disorders (TMD). Affecting 20-25% of the population, TMD has been found to cost the U.S. over $4 billion annually. Due to the fact that there are currently no effective treatment options for TMD, the goal of this work is to engineer biomimetic TMJ fibrocartilage to repair and/or replace the function of compromised TMJ tissues. Using the self-assembly process, a spectrum of scaffold-free fibrocartilages was generated using different co-culture ratios of meniscus cells (MCs) and articular chondrocytes (ACs). To improve their functional properties, engineered constructs were subjected to chondroitinase-ABC (C-ABC) and transforming growth factor-β1 (TGF-β1), two bioactive agents that have previously been shown to independently enhance the functional properties of tissue engineered cartilage. It was therefore hypothesized that an optimized bioactive agent regimen combining both C-ABC and TGF-β1 could be found that synergistically enhanced the functional properties of engineered TMJ fibrocartilages. A full factorial study design was employed using two factors: cell ratio and bioactive treatment. These factors were examined at the following levels: 50:50 and 75:25 MC:AC cell ratios, and either C-ABC alone, TGF-β1 alone, the two combined, or no bioactive treatment during the 5 wk culture period. Results indicate that a combination of both bioactive agents significantly enhances the tensile properties of the constructs, with the Young's modulus of the 75:25 cell ratio group that received the combined treatment reaching a value of 2.5 MPa, compared to 1 MPa for controls. Furthermore, histological and biochemical examinations show a more dense, uniform matrix in constructs that received the combination treatment. Results of this work will lead toward a better understanding of the mechanisms behind how these stimuli enhance the engineered tissues' functional properties and will begin paving the way toward a clinically relevant treatment for TMD.

***DEB Graduate Student**

COMPANY AFFILIATE: Boehringer-Ingelheim, Inc.

BOEHRINGER INGELHEIM - THE VALUE THROUGH INNOVATION (VTI) CONCEPT

Presenter: Torsten Schulz, PhD**

Authors: **Torsten Schulz****

Affiliations: Biopharmaceutical Process Science
Boehringer-Ingelheim, Inc.
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As a new player in the Bay Area, Boehringer Ingelheim (BI) values innovation as a key driver for its own growth and business while at the same time seeking to capitalize on the movement of the industry. Founded 125 years ago, BI has been a successful, global company that is still family-owned to this day. This talk will allow insights into the growing and diverse company at large as well as introducing the production and development site in Fremont. The presentation of biopharmaceutical process development activities include examples of innovation concepts.

**Presenter

NIH FELLOW: Nancy Zeng

MECHANICAL RESPONSE OF RED BLOOD CELLS TO INCREASED SHEAR: INFLUENCE OF OXIDATIVE STRESS

Presenter: Nancy F. Zeng*
Authors: **Nancy F. Zeng***, and William D. Ristenpart
Affiliations: Department of Chemical Engineering and Materials Science, University of California, Davis
Preceptor: William D. Ristenpart

Deformability plays a vital role in the functionality of red blood cells (RBCs) and accordingly anything that alters RBC deformability will affect oxygen delivery in the microcirculation. One key determinant of RBC deformability is the level of oxidative stress, i.e., the imbalance of reactive oxygen species (ROS) associated with many disease states. Previous work has shown that oxidative stress rigidifies RBC membranes, but little is known about the mechanical response of RBCs to oxidative stress under physiological shear conditions. Here we show that oxidative stress significantly alters the dynamic mechanical behavior of RBCs undergoing a sudden increase in shear stress. Using high speed video, we tracked the motion of RBCs entering a narrow constriction in a microfluidic channel. Varied concentrations of hydrogen peroxide, a generator of ROS, were added to the RBCs to induce oxidative stress. We demonstrate that an H_2O_2 concentration as low as 30uM significantly decreases the percentage of RBCs undergoing stretching and twisting motions, while simultaneously increasing the percentage of RBCs undergoing tumbling motions. A key observation is that the H_2O_2 treatment reduced the average RBC volume by up to 30%, suggesting that the intracellular viscosity dramatically increased and consequently increased the propensity for RBCs to tumble. Because tumbling motion is known to increase the bulk viscosity of blood, our results suggest that H_2O_2-induced oxidative stress may have substantial consequences on macroscale hemorheology.

***DEB Graduate Student**

NIH FELLOW: Wade Zeno

ENTRAPMENT AND PRESERVATION OF INTEGRAL MEMBRANE PROTEINS IN NANOPOROUS SILICA GELS VIA NANOLIPROTEIN PARTICLES

Presenter: Wade Zeno*

Authors: **Wade Zeno*[1]**, Marjorie Longo[1], Subhash Risbud[1], and Matthew Coleman[2]

Affiliations: [1]Department of Chemical Engineering and Materials Science, University of California, Davis

[2]Department of Radiation Oncology, University of California, Davis

Preceptors: Marjorie Longo

Immobilization of integral membrane proteins (IMPs) in nanoporous silica gels (5-50 nm) has a variety of applications, including biosensors, chromatography columns, and drug discovery via high-throughput drug screening. Entrapment of IMPs in these transparent, porous matrices has been challenging, as current and previous techniques utilize liposomes as biological membrane hosts. The instability of liposomes in nanoporous gels is attributed by their size (~150 nm) and altered structure and lipid dynamics upon entrapment, ultimately resulting in disruption of protein activity. We intend to address these issues by using nanolipoprotein particles (NLPs) as biomembrane hosts and examining their lipid phase behavior inside of the gel. NLPs are discoidal patches of lipid bilayer that are belted by apolipoproteins (~5 nm thick and 10-30 nm wide). We will focus on bacteriorhodopsin - a robust IMP protein that indicates its proper conformation via distinct purple coloration – as a model IMP for this system, and then focus on Neurokinin-1 receptor to develop a new high throughput screening device. The IMP-NLP complexes will be created in a cell-free environment, which circumvents traditional protein reconstitution in membranes. We will also examine potentially stable dehydrated/rehydrated states of this system, which would allow long term storage and transport.

***DEB Graduate Student**

Bioethics Discussion

Written and Presented by

Martina Newell-McGloughlin
Co-Director of NIH Training Program
In Biomolecular Technology (NIH-T32-GM08799)

ETHICS QUESTION

Peter Parker Picked a Problematic Partner (Ad astra per aspera!)

Peter Parker Picked a Problematic Partner (Ad astra per aspera!)

Peter Parker and Mary Jane Watson are both graduate students working with Dr. Norman Osborn, an eminent environmental chemist branching into molecular biology. Although both are fourth year students, neither has published a manuscript. Both are beginning to worry that if they do not publish soon they will not be able to obtain good postdoc positions.

Finally, Peter's project starts to look promising. After many months of high throughput screening, he has honed in on a bug isolated near a plastics factory which he believes has the potential to degrade some hither to fore "non-biodegradable" plastics in an environmentally sound way. However it had low activity so he has it modified through random mutagenesis and selected a candidate in another round of screening. Peter now has to scale up to make sufficient carotherase so that he can perform a series of analyses on the product to verify some of its properties. The candidate bug is a notoriously recalcitrant fungus that just does not want to grow in culture conditions so he sets about isolating and cloning the gene. Dr. Osborn is very excited about Peter's progress, and tells him to begin to write up the results, because isolation and properties of the modified enzyme are unique enough to be published in a high profile journal, such as Nature Biotech, even before cloning the gene.

Although only small amounts of carotherase are available, Peter and Dr. Osborn agree that they must push ahead and work quickly. In order to help Peter as he works on isolating the gene and increasing expression of the enzyme, Dr. Osborn recruits Mary Jane to assist Peter in some analyses. Mary Jane has not been very successful with her project, which involves biotransformation of PCBs into a non-toxic compound, and Dr. Osborn feels that performing the analyses will teach her some skills that she could apply to her own project. Dr. Osborn promises her a second authorship on the paper if the results of her analytic studies pan out. Although Peter does not think highly of Mary Jane, believing her to be sloppy, he wants to move ahead with his research. He gives her the carotherase in two batches for the analytic studies.

Mary Jane completes the first set of analyses on the first batch and is excited by the results, which identify some novel characteristics. On the day she is doing the first experiment on the second batch of carotherase she phones Peter from the mass spec facility and asks him if a contaminant might have gotten mixed up, since the spectral pattern is not consistent. Peter asks Mary Jane to save the remaining material, telling her that he will perform the second round of analyses. But when Mary Jane comes back to the lab a few hours later, she does not give him the leftover carotherase. She tells Peter that she obtained positive results and that her mistake in the original interpretation was due to low blood glucose and to the fact that she had focused inadvertently on a reference sample, not on carotherase. There is no way for Peter to validate her findings, since there is not enough carotherase left to do another run. Mary Jane tried to reassure Peter by showing him the readout from the LC/MS/MS on the second batch.

Dr. Osborn is ecstatic about the findings, and tells Peter to quickly write up a manuscript. Peter doesn't want to accuse Mary Jane of manipulating research results, but later in the day he looks through her research notebook and sees a written procedure and data for the first batch of experiments. For the second batch, he sees that she has put only the readout in the notebook, which looks too clean to him. It also has no accompanying text. He wonders what might have happened. Perhaps she used a reference sample and some mechanical manipulation to make the peaks appear so clean.

Peter is unsure about whether he can trust Mary Jane's findings, but he proceeds to write up the manuscript about his mutagenesis, isolation and characterization of carotherase and its analysis by Mary Jane. The article is published in Nature Biotech, but in the next several months other scientists who repeat his characterization find anomalies with his published data. During that time, Peter has been able to clone the gene and express the enzyme in a high expression fungal system. So it is very upsetting to him that this clearly promising system may be tainted by the appearance of impropriety. In addition industry has come calling with clear interest in carotherase's commercial capabilities. When he repeats the analysis of carotherase, he finds a rather different outcome than that obtained by Mary Jane and which they had published. He believes that she must have manipulated the data.

QUESTIONS

1: How can the pressure to publish influence the conduct of research?

2: Was it appropriate for Dr. Osborn to promise Mary Jane second authorship based on performing some assays?

3: Trust is one of the central issues in science. What might Peter have done to feel better about working with Mary Jane if he didn't think highly of her?

4: At this point, it remains unclear whether Mary Jane has done anything wrong, even though she did not follow Peter's instructions to let him do the second analytic experiment. What action should Peter take?

5: Data collection and management are important issues in the responsible conduct of research. Independent of the possibility that Mary Jane might have engaged in manipulating data, what is the major problem in the way she kept her lab notebook?

6: What is misconduct? If it is found that Mary Jane engaged in misconduct, is Peter also guilty of misconduct, because he did not report his concerns earlier?

7: If science is self-correcting why do we need federal laws and regulations against misconduct?

8: It seems clear that there was a problem with Mary Jane's data. What should Peter do? Should industry's interest have any bearing on this decision?

Questions for Further Reflection

1: Have you ever taken shortcuts to produce results under pressure-filled conditions?

2: How do you think you would feel about accusing a colleague of misconduct?

3: Do you know whom you would speak to in case you had suspicions of misconduct by a graduate student, postdoctoral fellow, laboratory head, or department head?

BIOTECH FELLOW: Sean Gilmore

SALT AND FAT: THE LIPIDS OF EXTREME HALOPHILES AND THEIR APPLICABILITY IN MEMBRANE-MIMETICS

Presenter: Sean F. Gilmore*
Authors: **Sean F. Gilmore***, Andrew Yao, Marc Facciotti, Kelsey Cox, and Atul N. Parikh
Affiliations: Department of Biomedical Engineering, University of California, Davis
Preceptor: Atul Parikh

Extreme halophiles, such as *Halobacterium salinarium*, tolerate environmental conditions that would be lethal to many other organisms. These conditions include high salt concentrations (2.5M to 5M NaCl), extended ultraviolet exposure, and periods of anhydrobiosis. Recent work using purely lipid extracts of these halophilic organisms reveal that these unique combination of properties stem primarily from the lipid make-up of these organisms. Indeed, vesicles composed only of lipids from the total membrane extract have recently been shown to exhibit dramatic structural integrity, stability, and low permeability even in high salinity conditions.[1] Despite these interesting properties, studies aimed purportedly at characterizing physical-chemical characteristics of these lipid mixtures are sparse. Here, we report preliminary characterization of these lipid mixtures reconstituted as (1) Langmuir monolayers at the air-water interface; (2) small unilamellar vesicles in bulk aqueous suspension; and (3) substrate-immobilized lipid monolayers. Our results point to many salient properties of these lipid mixtures.

First, the monomolecular reconstitution of these lipid mixtures at air-water and solid surfaces reveal unusual phase behavior characterized by the formation of large, microscopic horse-shoe shaped domain morphologies. These discrete domains are taller, as confirmed by atomic force microscopy, suggesting preferential packing of taller, membrane-spanning lipid components (e.g., squalene and bacterioruberin). Remarkably, these domains are not dispersed homogeneously within the lipid phase. Rather they display domain-domain aggregation via long-range attraction.

Second, the phase transition properties of these lipid mixtures in the dry state corresponds to the melting temperature of the lipid mixture in a hydrated state. Such behavior is unusual as dessication typically elevates the phase transition temperature in lipid amphiphiles. This data suggests that these lipid mixtures may have evolved a remarkable innate property, which allows extreme halophiles to exhibit anhydrobiotic behavior, circumventing needs for soluble osmolytes (e.g., trehalose). Taken together, our results suggest that halophile lipid mixtures might be promising candidates for a broad range of membrane-mimetic applications

including drug delivery vehicles and stable membrane platforms for protein channels as used in some DNA sequencing technologies.

1. Tenchov, B., Vescio, E.M., Sprott, G.D., Zeidel, M.L. & Mathai, J.C. Salt tolerance of archaeal extremely halophilic lipid membranes. *The Journal of biological chemistry* **281**, 10016-23 (2006).

***DEB Graduate Student**

COMPANY AFFILIATE: Monsanto, Calgene Campus

RE-DESIGN OF SOYBEAN OIL COMPOSITION THROUGH GENETIC ENGINEERING

Presenter: Toni Voelker, PhD**

Authors: **Toni Voelker**

Affiliations: Monsanto, Calgene Campus
1920 Fifth Street
Davis, CA 95616

Due to its high degree of unsaturation, unhydrogenated soybean oil is not suitable for commercial frying applications. Monsanto has developed a new soybean variety which accumulates a reduced-saturates, less polyunsaturated soybean oil, Vistive® Gold, which currently in the pre-launch phase of R&D. To achieve this change, the fatty acid biosynthesis in the seeds was modified through a combination of RNAi and conventional mutants. Vistive® Gold allows to eliminate trans fats and significantly lower saturated fat content in fried foods without sacrificing flavor quality. I will discuss some aspects of its development.

**Presenter

BIOTECH FELLOW: Jared Moore

SYNTHETIC EFFORTS TOWARDS INHIBITORS OF BACTERIAL CELL DIVISION PROTEINS

Presenter: Jared Moore*
Authors: **Jared Moore*** and Jared Shaw
Affiliations: Department of Chemistry, University of California, Davis
Preceptor: Jared Shaw

Designing and synthesizing new compounds to investigate emerging targets of bacterial cell division is an essential step in development of antibiotics and target validation. The three major families of eukaryotic cytoskeletal proteins have prokaryotic homologs. Bacterial proteins FtsZ, MreB and crescentin are structurally similar to tubulin, actin, and intermediate filaments but have evolved to display different cellular functions. The discovery of small molecules (taxol, colchicine) that modulate the activity of tubulin was a crucial step in studying eukaryotic cell division. Developing a similar chemical "tool box" of compounds that inhibit the bacterial cell division process will give a better understanding of the biochemical processes involved and lead to new therapies. One of the goals of my project is to develop selective inhibitors of the prokaryotic skeletal protein FtsZ. FtsZ is highly conserved among bacteria and is essential for cellular division making this protein a valuable target for the development of antimicrobial compounds. One naturally occurring compound that has previously been shown to have activity against FtsZ is totarol, making it a promising starting point for structure-activity relationship studies. The totarol analogs I have synthesized proceed via a novel catalytic hetero-polycyclization reaction, however these compounds do not show improved activity towards FtsZ. To address this lack of success in developing more potent FtsZ inhibitors in our group, an analysis of reported inhibitors was undertaken. Unfortunately, aggregation was found to be the major mechanism of action of most of the compounds, including totarol. One exception is zantrin Z3 which was found to be active and does not cause aggregation. Zantrin Z3 is the current lead compound for discovering a more potent inhibitor of FtsZ.

***DEB Graduate Student**

COMPANY AFFILIATE: OncoMed Pharmaceuticals

MONITORING THE CHANGES OCCURRING IN A HUMAN MONCLONAL IgG ANTIBODY ON STABILITY USING SELECT ANALYTICAL METHODS

Presenter:	Esohe Idusogie, PhD**
Author:	**Esohe Idusogie****
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The stability of a human monoclonal IgG2 antibody is being evaluated through ongoing stability studies at different temperature conditions. Changes in the product with respect to appearance, purity, potency and identity have been observed at 25°C and 40°C from the 1 month timepoint onward. The stability results also showed an acidic shift in the charge profile from time zero that correlated with a significant decrease in potency after 6 months at 25°C. There appeared to be a correlation between the decrease in potency and the decrease in the main charge isoform (%), resulting from the increase in acidic variants. Peptide mapping revealed the acidic variants contain a higher level of a deamidated light chain peptide which could impact the structural and functional properties of the antibody. This study describes the changes occurring in this IgG2 antibody on long term stability and the select Analytical methods used for characterization.

**Presenter

BIOTECH FELLOW: Diana Lac

IDENTIFICATION OF NOVEL BLOOD BRAIN BARRIER CELL PENETRATING PEPTIDE

Presenter: Diana Lac*
Authors: **Diana Lac***, Urvashi Bhardwaj, and Kit Lam
Affiliations: Department of Biochemistry and Molecular Medicine, University of California, Davis
Preceptor: Kit Lam

The clinical application of potentially useful therapeutic and/or imaging agent for the treatment of neurological diseases is limited by the access of compounds to cross the blood brain barrier (BBB). The BBB is mainly formed by brain capillary endothelial cells that are closely sealed by tight junctions which also expresses high levels of active efflux transport proteins. This results in the limited access to both small molecules and large molecules like recombinant proteins or gene based therapies that do not cross the BBB. Therefore, overcoming this obstacle is a critical goal in CNS drug development. The use of combinatorial chemistry, namely the one-bead-one-compound (OBOC) method, is a powerful method to identify a novel brain endothelial cell penetrating peptide. In the present study, we reconfigured the traditional OBOC method for the discovery of nontoxic peptidic and peptidomimetic ligands that specifically penetrate brain endothelial cells. Through the screening of OBOC libraries, we have identified several D-amino acid containing peptide that bind specifically to brain endothelial cells. These compounds were resynthesized by conventional solid phase peptide synthesis. Solution phase peptides were conjugated to saporin and fluorophores that demonstrated its specific cell penetrating abilities toward brain endothelial cells. Work is currently underway to develop these peptides into targeting imaging agents. These peptides show great promise as specific vehicles to the BBB. We conclude that this approach can be used to discover a novel imaging probe that has potential to be used as targeting therapeutics across the BBB.

***DEB Graduate Student**

BIOTECH FELLOW: Michael Starr

SYSTEMS BIOLOGY OF GREEN POLYHYDROXYALKANOATE PRODUCTION IN HALOARCHAEA

Presenter: Michael Starr*
Authors: **Michael Starr***, Elizabeth Willbanks, Andrew Tritt, Andrew Yao, Erin Lynch, Philip Seitzer, and Marc Facciotti
Affiliations: Department of Biomedical Engineering and Genome Sciences, University of California, Davis
Preceptor: Marc Facciotti

Polyhydroxyalkanoates (PHAs) are a class of biodegradable plastics that have shown utility in commercial products, drug delivery, medical devices, and tissue engineering. PHAs are the only bioplastics that are completely synthesized and polymerized *in vivo*. The existence of different PHA monomers and the ability of these monomers to copolymerize in varying ratios lends to PHAs a wide variety of adjustable chemical and mechanical properties. The main reason that PHAs are not commonly used, however, is their higher cost of production compared to other bioplastics and conventional plastics. Thus, of particular interest is using organisms capable of producing PHAs from e.g. agricultural cellulosic waste or municipal sewage to reduce production cost. Our lab has recently sequenced 74 new Haloarchaeal genomes. Of the sequenced Haloarchaeal genomes, 48 contain at least one annotated PHA synthase and 42 contain at least on annotated cellulase. We present initial efforts to characterize the potential for PHA production from low cost carbon feedstocks in this subset of Haloarchaea. Ultimately, the goal is to use systems tools to understand the organism-scale behavior of PHA-producing Halobacteria to optimize feedstock utilization and bioplastic production. I will also discuss progress in the development of relevant analytical pipelines toward this goal.

***DEB Graduate Student**

NEW SHORT COURSE INSTRUCTOR: Dmitry Grapov

INTRODUCTORY WORKSHOP FOR MULTIVARIATE DATA ANALYSIS AND VISUALIZATION

Presenter: Dmitry Grapov*
Authors: **Dmitry Grapov***[1] and John W. Newman[1,2]
Affiliations: [1]Department of Nutrition, University of California, Davis
[2]USDA/ARS Western Human Nutrition Research Center, Davis, CA
Preceptor: John W. Newman

Next generation "omics" tools are harbingers of the golden age of biology. Biologists are on the cusp of breaking through the veil of complexity surrounding the emergent properties of complex biological systems. However these same rapid technological advances are also transforming the study of biology into a data intensive science. The ever growing gap between data and theory necessitates that biologists become familiar with multivariate computational and visualization methods in order to fully understand their experimental results.

We are offering a summer workshop covering introductory concepts and applications of multivariate data analysis (MDA) and visualization techniques. Join us for a week to familiarize yourself with concepts in MDA covering topics in: multiple hypothesis testing, exploratory projection pursuits, multivariate classification and regression modeling, networks and machine learning. Get experience with MDA through hands-on analyses of real-world data using freely available tools. Learn how to make the most of your time and experimental results by quickly understanding your data's complexity, main features and inter-relationships.

***DEB Graduate Student and Presenter**

Poster Abstracts

A. NMR SPECTROSCOPIC ANALYSIS OF MICROALGAE LIPIDS FOR BIOENERGY AND HEALTH APPLICATIONS

Lisa A. Anderson* and Annaliese K. Franz
Department of Chemistry, University of California, Davis

Microalgae lipids in the form of triacylglycerols (TAGs) are promising next generation biofuel feedstocks. Advancing methods for lipid analysis and rapid conversion to useful products will aid in the commercial development of biofuels. Our group has developed a microplate screening approach with microalgae to discover conditions that increase growth and lipid production. Conditions from the microplate assay have been evaluated in larger cultures to compare TAG composition and identify bioactive lipid constituents using NMR spectroscopy. ^{1}H NMR spectroscopy is a robust, rapid, and non-destructive tool that is particularly effective for comparing TAG composition of microalgae.[1] Because derivatization is not required prior to analysis, polyunsaturated fatty acids (PUFAs) are less prone to oxidation thus allowing for accurate product monitoring. NMR methods are also applicable in studying the kinetics of transesterification to monitor efficient conversion of TAGs to fatty acid alkyl esters (FAAEs, biodiesel). Molecules present during transesterification that can be monitored by ^{1}H NMR spectroscopy include TAGs, diacylglycerols (DAGs) monoacylglycerols (MAGs), free fatty acids (FFAs), glycerol and FAAEs. This research will discuss conditions that increase growth and lipid production, algae TAG profiling, catalysts for transesterification, and kinetics of transesterification.

1 Danielewicz, M. A., Anderson, L. A. & Franz, A. K. Triacylglycerol profiling of marine microalgae by mass spectrometry. *Journal of Lipid Research* **52**, 2101-2108, doi:10.1194/jlr.D018408 (2011).

***DEB Graduate Student**

B. BENZOTHIAZOLES, NOVEL ACTIVATORS OF ENDOTHELIAL CALCIUM-ACTIVATED POTASSIUM CHANNELS AS POTENTIAL ANTI-HYPERTENSIVES

Brandon Brown*, Nichole Coleman*, and Heike Wulff
Department of Pharmacology, University of California, Davis

The vascular endothelium modulates vascular tone and blood pressure by releasing nitric oxide, prostacyclin, and a third factor or signalling pathway termed "endothelium-derived hyperpolarizing factor" (EDHF), which directly hyperpolarizes the underlying smooth muscle cell layer (1). The calcium-activated potassium channels KCa3.1 and KCa2.3 are assumed to significantly contribute to EDHF-type dilator responses based on the observation that mice lacking one or both of these endothelial potassium channels exhibit a severe impairment in acetylcholine and/or sheer-stress induced vasodilations and an increase in mean arterial blood pressure (2). Pharmacological activation of KCa3.1 channels in particular has therefore been proposed as a novel anti-hypertensive therapy.

Our laboratory previously identified the K_{Ca} channel activator SKA-31 (naphtho[1,2-*d*]thiazol-2-amine) and demonstrated that it lowers blood pressure in both normotensive and angiotensine-II-induced hypertensive mice (3). We are currently using SKA-31 as a template for the design of more potent and selective K_{Ca} activators and are in the process of screening a small library of newly synthesized benzothizoles by whole-cell patch-clamp on HEK cells or multiple myeloma cells stably or natively expressing KCa3.1. We have already identified several new compounds that activate KCa3.1 with EC_{50}s in the submicromolar range and which exhibit moderate selectivity over the small-conductance KCa2 channels, which are also expressed in neurons. Our ultimate goal is to identify compounds that selectively activated KCa3.1 channels as novel anti-hypertensives.

1. Feletou M, Vanhoutte PM (2009) EDHF: an update. *Clin Sci (Lond)* **117**:139-55.
2. Brähler S, Kaistha A, Schmidt VJ, Wölfle SE, Busch C, Kaistha BP, Kacik M, Hasenau AL, Grgic I, Si H, Bond CT, Adelman JP, Wulff H, de Wit C, Hoyer J, Köhler R (2009) Genetic deficit of SK3 and IK1 channels disrupts the endothelium-derived hyperpolarizing factor vasodilator pathway and causes hypertension. *Circulation* **119**:2323-32.
3. Sankaranarayanan A, Raman G, Busch C, Schultz T, Zimin PI, Hoyer J, Köhler R, Wulff H (2009) Naphtho[1,2-*d*]thiazol-2-ylamine (SKA-31), a new activator of KCa2 and KCa3.1 potassium channels, potentiates the endothelium-derived hyperpolarizing factor response and lowers blood pressure. *Mol Pharmacol* **75**:281-95.

***DEB Graduate Student**

C. ESTABLISHMENT OF GLUCOCORTICOID-MEDIATED TRANSCRIPTIONAL INDUCTION OF THE RICE XA21 PATTERN RECOGNITION RECEPTOR FOR LARGE-SCALE PROTEOMIC ANALYSIS

Chang-Jin Park, Patrick E. Canlas, Daniel F. Caddell* and Pamela C. Ronald
Department of Plant Pathology, University of California, Davis

Elucidating the genetic basis of disease resistance will be important for developing new improved crop varieties. Towards this goal, we are interested in understanding how the rice pattern recognition receptor, XA21, is able to confer robust resistance to the bacterial pathogen *Xanthomonas oryzae pv. oryzae* (*Xoo*). *Xoo* causes bacterial leaf blight, and is responsible for destroying 20-50% of potential rice yield in Asia and Africa. We have generated transgenic plants that express *Xa21* only in the presence of the glucocorticoid hormone, dexamethasone (DEX). Following DEX application, we are able to observe a precisely synchronized XA21-mediated response to infection throughout the entire leaf. This enables us to compare the immune response of resistant and susceptible plants. DEX-mediated transcriptional induction of *Xa21* is accompanied by up-regulation of *pathogenesis-related 1* (*PR1*) gene expression and restriction of *Xoo* multiplication. We are interested in using the DEX-inducible system for future transcriptomic and proteomic experiments where a precisely synchronized response will be critical for identifying components of the XA21-mediated immune response.

***DEB Graduate Student**

D. DEVELOPING A HIGH-THROUGHPUT SCREEN FOR ANTI-QUORUM SENSING COMPOUNDS WITH APPLICATION IN THE PREVENTION OF CITRUS GREENING DISEASE

Hyrum Gillespie* and Abhaya Dandekar
Department of Plant Sciences, University of California, Davis

Why is orange juice so expensive? One big reason: Huanglongbing (HLB), an insect-borne disease, is decimating citrus production groves in Florida and Brazil and now Texas. Brazil, the world's largest sweet orange producer, and Florida, the largest U.S. domestic producer, supply approximately 85% of the world's orange juice. Currently, HLB management consists primarily of pesticide application and— after visual confirmation—elimination of entire orchard blocks. This has proven economically destructive and ineffective. New short-term therapeutic methods need to be developed to combat this and other high-risk plant pathogens during the development and regulatory approval of disease resistant plant varieties. These tools will help growers decrease their dependence on pesticides, and lead to more effective and more environmentally stable management strategies.

Bacterial quorum sensing is a new area of research with potential application in disease management. Quorum sensing (QS) is a bacterial system for cell to cell communication. This system is believed to be used by bacteria to "sense" their own community size. Quorum sensing has a role in the induction of virulence in plant pathogens and has been shown to regulate many bacterial functions, including biofilm formation, microbial movement, and plant-microbe interaction. AntiQS compounds, or compounds found to block QS activity, have been found naturally in many forms of life and have been created synthetically. As of yet, no high-throughput system has been developed for identifying compounds with anti-QS activity, however, we present progress in the development of such a system through the use of three bacterial strains with phenotypic color changes in the presence or absence of quorum sensing signals.

***DEB Graduate Student**

E. DIFFERENTIATION-DEPENDENT SECRETION OF PROGANGIOGENIC FACTORS BY MESENCHYMAL STEM CELLS

Allison I. Hoch*[1], Bernard Y. Binder[1], Damian C. Genetos[2], and J. Kent Leach[1]
[1]Department of Biomedical Engineering, University of California, Davis
[2]Department of Anatomy, Physiology, and Cell Biology, School of Veterinary Medicine, University of California, Davis

Mesenchymal stem cells (MSCs) are a promising cell population for cell-based bone repair due to their proliferative potential, ability to differentiate into bone-forming osteoblasts, and their secretion of potent trophic factors that stimulate angiogenesis and neovascularization. To promote bone healing, autogenous or allogeneic MSCs are transplanted into bone defects after differentiation to varying degrees down the osteogenic lineage. However, the contribution of the stage of osteogenic differentiation upon angiogenic factor secretion is unclear. We hypothesized that the proangiogenic potential of MSCs was dependent upon their stage of osteogenic differentiation. After 7 days of culture, we observed the greatest osteogenic differentiation of MSCs when cells were cultured with dexamethasone (OM+). Conversely, VEGF protein secretion and upregulation of angiogenic genes were greatest in MSCs cultured in growth medium (GM). Using conditioned media from MSCs in each culture condition, OM+-conditioned medium maximized proliferation of endothelial colony forming cells (ECFCs), yet GM-conditioned medium enhanced ECFC tubule formation on Matrigel. ECFCs seeded on microcarrier beads and co-cultured with MSCs previously cultured in GM in a fibrin gel exhibited superior sprouting compared to MSCs previously cultured in OM+. These results confirm that MSCs induced farther down the osteogenic lineage exhibit reduced proangiogenic potential, thereby providing important findings for consideration when using MSCs for bone repair.

***DEB Graduate Student**

F. DESIGN AND SYNTHESIS OF SMALL MOLECULES THAT DISRUPT THE BINDING INTERACTION BETWEEN THE HOXA13 TRANSCRIPTION FACTOR AND ITS DNA TARGET

Kevin S. Martin*[1], Darlene Q. Tan[1], Scott Stadler[2], and Jared T. Shaw[1]
[1]Department of Chemistry, University of California, Davis
[2]Molecular and Medical Genetics, Oregon Health and Science University, OR 97239

We are interested in designing small molecules that disrupt the binding interaction between the HOXA13 transcription factor and its DNA target. Transcription factors that regulate embryonic development have emerged as potential targets for cancer therapy. The processes that occur in embryogenesis are also observed in aberrant tissue growth. HOXA13 is one such regulatory transcription factor and is essential in limb development and placental vascularization. Chromosomal aberrations in the HOXA13 gene have been observed in patients that have myelodysplastic syndrome, which can lead to leukemia. Additionally, there is a correlation between HOXA13 overexpression and lower survival in patients with esophageal squamous cell carcinoma. Small molecules have been found to disrupt protein-protein or protein-DNA binding interactions and thus lower the expression of encoded gene products. A diversity-oriented synthesis (DOS) based library of over 400 compounds by Ng and coworkers was screened using a fluorescence polarization assay (FP). This led to the identification of a molecule **1** that disrupted the interaction between fluorescent-labeled HOXA13 protein and its DNA target with an IC_{50} of 6.5 μm. Derivatives of compound **1** were synthesized and structure activity relationship (SAR) studies were carried out in an effort to identify a more potent inhibitor of the HOXA13-DNA complex. Unfortunately, derivatives did not show any biological activity. In a subsequent biological screen of commercially available compounds aimed at identifying new inhibitors, stauprimide **2** and compound **3** were identified as inhibitors of the HOXA13-DNA complex with IC_{50} values of 0.33 μm and 0.50 μm respectively. Initial efforts to synthesize derivatives of **2** proved to be unproductive. Current efforts to synthesize derivatives of **3** for SAR studies are in progress and thus far have proven more productive. Our goal is to use these inhibitors to study the role of HOXA13 in cancer and to identify a new target in cancer therapeutics.

***DEB Graduate Student**

G. EXPLORING MUS81-EMEI AS A NOVEL ANTI-CANCER THERAPEUTIC TARGET

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A novel approach to cancer therapy is to take advantage of the replicative stress that tumor cells undergo during uncontrolled growth. MUS81-EME1 is an endonuclease involved in homologous recombination (HR) and rapidly dividing tumor cells are likely to depend on MUS81-EME1 to repair DNA damage associated with high levels of replication. In effect, this endonuclease has been identified as a potential anti-cancer therapeutic target that may disproportionately sensitize tumor cells to DNA damage-based therapy, while sparing adverse effects to normal cells. To evaluate MUS81-EME1 as a novel anti-cancer therapeutic target, my first aim is to elucidate the biochemical role of purified recombinant MUS81-EME1 using a fluorescence-based nuclease assay with various DNA substrates involved in HR. Then, the fluorescence-based assay will be utilized to conduct a high throughput inhibitor screen to identify MUS81-EME1 inhibitors. Lastly, the mechanism of action for lead MUS81-EME1 inhibitors will be characterized and their effects on normal and tumor cells will be assessed. This work will establish MUS81-EME1 as a cancer therapeutic target and identify MUS81-EME1 inhibitors that could potentially be used as a novel anti-cancer therapeutic.

***DEB Graduate Student**

H. NANOPOROUS GOLD AS A MULTIFUNCTIONAL BIOMEDICAL DEVICE COATING

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Miniaturization technology has produced versatile solutions for diagnostic and therapeutic applications. However, in order to meet demands of advanced biomedical devices, there is a need to pack even more functionality on small devices. This necessitates innovations on the materials front, where nanostructured materials have shown promise. Nanoporous gold (np-Au), produced by a self-assembly process, is an underexplored material for biological applications. Its high effective surface area, ease of surface functionalization, and electrical conductivity enable multiple functions as a biosensor and drug delivery medium. Here, we report np-Au's utility as a sensor that enhances detection of neural electrical activity from organotypic brain slices. As a second layer of functionality, we demonstrate that np-Au retains and releases drugs to modulate biological response such as cell proliferation. As the third layer of functionality, we illustrate its capability in on-demand electrophoretic release of molecules. Finally, we are interested in combining the multifunctional np-Au platform with stimuli-responsive bilayer systems to enable closed-loop control of drug release in response to a specific physiological stimulus. Following a discussion of material synthesis and characterization, as well as biological evaluation, we discuss the broader potential of np-Au and remaining challenges to promote it as a new multifunctional biomaterial.

***DEB Graduate Student**

I. RESISTANCE AND RESILIENCE OF N AND P CYCLING MICROBES IN AGRICULTURAL SYSTEMS AFTER HEAT PERTURBATION

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Agricultural management and resistance and resilience of microbial communities is key to long-term agricultural sustainability. Agricultural management practices impact soil through physical disturbance, inputs of fertilizers and pesticides, and cultivation of monoculture or low-diversity plant systems. Resistance and resilience of soil microbial communities to disturbance events is a topic of growing importance with predicted rising temperatures and large unpredictability in rainfall patterns associated with global climate change. Diverse microbial communities are essential for the sustainability of agriculture. Previous research has focused on the resistance of soil systems in relation to total microbial biomass but has ignored relationships with specific functional groups of microbes. Denitrifiers are key organisms in N cycling and these organisms control the pools of plant-available N in soil, while alkaline phosphatase is a key microbially produced enzyme involved in the regulation of pools of available phosphate. In this soil incubation experiment abundance of total bacteria and archaea were quantified along with denitrifying and alkaline phosphatase genes after subjecting differently managed agricultural soils to severe temperature perturbation (60 ^{o}C for 15 minutes). The organic treatment showed the lowest resistance and resilience in terms of total bacterial and archaeal abundance but was resilient in terms of respiration activity. The high input systems show the lower resistance for key functional groups of N and P cycling organisms compared to low input systems. However, all of the differently managed soils show higher levels of N cycling organisms and lower levels of P cycling organisms after 30 days compared to starting levels.

***DEB Graduate Student**

J. DEVELOPMENT OF BIOPOLYMER FORMULATIONS WITH ENCAPSULATED BACTERIOPHAGES FOR APPLICATIONS IN AGRICULTURE AND FOOD

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There is a need to develop sustainable antimicrobial solutions that can be highly specific for target pathogens and can be delivered in diverse environments including agricultural products, food processing, and packaging. Current antimicrobial materials lack specificity for target pathogens and non-discriminate use of many of the broad spectrum antimicrobials significantly increases the risk of developing resistant pathogens. In recent years, phage therapy has been gaining attention as a method to control bacterial pathogens in the food system. Phage therapy takes advantage of bacteriophages' extreme host specificity, ability to replicate and regenerate, and natural ability to co-evolve with the host bacterium to defeat host defense mechanisms. One of the significant barriers limiting application of phages in diverse environments is the limited shelf life of these viral particles in ambient storage conditions. The current formulations of phages need to be refrigerated and stored in dark containers. In our research, we have specifically evaluated formulations of phages using agricultural by-products (e.g. whey protein from milk processing) to form shelf stable materials. The results of our research have demonstrated that these compositions can significantly enhance the shelf life of phages without requiring any refrigeration and also provide controlled release of these phages in diverse plant and food materials. Future aims include developing thin film coating and lipid platform assemblies.

***DEB Graduate Student**

K. FLUORESCENT IMAGING OF NEUTRAL LIPIDS IN MICROALGAE FOR HEALTH AND BIOFUEL APPLICATIONS

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We chose to study microalgae for the synthesis of lipids that are important for nutraceuticals, high-value lipid products, and conversion to biodiesel. In this study, we show how nitrogen deficient conditions affect the accumulation patterns of neutral lipid accumulation, size, and volume of two different types of microalgae. We study these lipids throughout its growth phase using fluorescence spectroscopy and the 3D rendering capabilities of a laser scanning confocal microscope (LSCM). Volume was calculated based on the assumption that the droplets sphere and spheroid geometry, further approximated through visual inspections from a 3D rotation. The maximum fluorescence intensity was used to measure lipid changes over time. We found green microalgae, *T. suecica* accumulate 20-fold higher in droplet quantity than diatom *P. tricornutum*, but *P. tricornutum* can synthesize up to 55-fold larger volume droplets than *T. suecica.* Droplet size is consistent throughout the growth phase in *T. suecica*, whereas the volume of individual droplets increased 4-fold in *P. tricornutum.* Nitrogen deficient condition enhances the production of total lipids except during stationary phase. Reducing the amount of nitrogen immediately provides up to 9-fold difference in *P.tricornutum* and up to 2-fold in *T. suecica.* Overall growing microalgae at normal conditions gives higher volume of lipids in the long run. *T. suecica* provides total lipid volume 1-fold higher in nitrogen deficient conditions. In normal conditions, *P. tricornutum* provides 2-fold higher amount of total lipid volume than *T. suecica.* This knowledge can help us predict the best time and condition to harvest for maximum amount of lipids for biofuel application. Imaging lipids and studying its growth patterns could also be applicable to medical imaging and obesity studies.

***DEB Graduate Student**

L. IDENTIFYING THE BIOCHEMICAL AND MOLECULAR COMPONENTS OF PLANT PRIMARY STRESS RESPONSE NETWORKS

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Plants have evolved specialized perception and regulatory signaling networks to respond specifically to different biotic and abiotic stresses in their environments. However, given that many of these diverse stresses share common features, such as damage to membranes and other macromolecular structures, it was predicted that there should be a core set of genes that respond rapidly to a wide range of stresses. In order to identify these core plant stress-responsive genes, our lab chose to use mechanical wounding of *Arabidopsis* as a model system. A microarray-based approach identified 162 genes as being rapidly (within five minutes) and transiently up-regulated in response to wounding. Subsequent analysis determined that a novel *cis*-regulatory element, the rapid stress response element (RSRE), was overrepresented in promoters of the rapid wound response genes. The RSRE is sufficient to confer a transcriptional response to a variety of stressors, including wounding, cold, insect herbivory, and infection by the fungal pathogen *Botrytis cinerea*.

The goal of my research is to understand the biochemical and molecular events that occur prior to the induction of the RSRE in the rapid stress response. Initial experiments using transgenic *Arabidopsis* expressing the luciferase reporter under the control of the RSRE indicate that signaling by calcium and reactive oxygen species are involved in the induction of the *cis*-element in response to stress. Genetic approaches have determined that CAMTA3, a transcription factor (TF), is required for RSRE induction by cold and contributes to RSRE induction by wounding. Further genetics work will determine the role of other CAMTA TFs in RSRE induction. In order to identify upstream signaling components and develop a yeast one hybrid (Y1H) system, a screen of the yeast deletion array (collection of all non-lethal single mutants in yeast) was performed. This screen identified STE11 and NUP60 as required components of RSRE induction in yeast, suggesting involvement of a MAP kinase cascade and nuclear import machinery, respectively. These results are being followed up genetically in *Arabidopsis*. One of the yeast deletion lines will be used as a background for a Y1H screen of cDNA libraries derived from wounded and unwounded plants. This screen will complement our targeted genetic approaches by identifying additional RSRE-regulating TFs.

***DEB Graduate Student**

M. STUDYING THE ENDOMEMBRANE TRAFFICKING PROCESSES INVOLVED IN CELL WALL DEPOSITION FOR BIOFUEL IMPROVEMENT

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In order to better understand the plant cell wall and improve biofuel feedstocks, we need to understand the endomembrane processes involved in cell wall deposition. The cell wall is an interwoven meshwork of polysaccharides that surrounds the plant cell, functioning in cell growth and pathogen protection. It is composed of cellulose, hemicellulose, pectins and glycoproteins. Endomembrane trafficking is the transport of proteins and other compounds through a vesicular network known as the endomembrane system. Although cell wall structure and polysaccharide biosynthesis are generally understood, the transport processes of cell wall components to the periplasmic space, which play critical regulatory roles on the cell wall (Xiong, 2010), are unknown.

I am studying the trafficking of cell wall polysaccharides using chemical genomic screens, a revolutionary approach that involves the use of small molecules, rather than mutations to inactivate proteins. I am using a library of cell permeable molecules that disrupt endomembrane trafficking (Drakakaki, 2011), to elicit changes in xyloglucan in *Arabidopsis thaliana.* Xyloglucan is a hemicellulose and serves as scaffold within the cell wall that other cell wall components build upon. I have tested this chemical library against a xyloglucan deficient mutant *xxt1/xxt2* (Cavalier, 2008). Selected small molecules lead to either hypersensitivity or resistance in the *xxt1/xxt2* double mutant when compared to the wild type. **I hypothesize** that resistance of *xxt1xxt2* under chemical treatment is targeting a pathway involved in xyloglucan deposition, while mutant hypersensitivity is targeting a compensatory mechanism developed from a lack of xyloglucan. By studying the effect of these chemicals, I can determine details about xyloglucan deposition dependent pathways that are unidentifiable using classical genetics.

***DEB Graduate Student**

N. EBA AND CLIPA ARE REQUIRED FOR SUSTAINED POLORIZED HYPHAL TIP GROWTH IN THE FUNGUS ASPERGILLUS NIDULANS

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Filamentous fungi grow via polarized extension of hyphal tip cells. As a result, hyphae grow into tough substrates like woods and feed on organic compounds like complex carbohydrates while secreting hydrolytic enzymes. Hyphal tip growth depends on the cytoskeleton. Among the cytoskeletal networks, microtubules (MTs) undergo rapid polymerization and depolymerization and act as a rate-limiting factor for hyphal tip growth. It remains unclear how the dynamic properties of MTs are coupled with hyphal tip growth. Using the genetically tractable fungus *Aspergillus nidulans* as a model system, we aimed to understand how the dynamics of MT plus ends were coupled with tip growth. We report the functions of two MT plus-end-tracking proteins, EBA and CLIPA in hyphal apical cells. Both proteins are required for the cells to sustain unidirectional growth because the null *ebA*Δ and *clipA*Δ mutations led to wavy growth patterns. The *ebA*Δ null mutation also caused hypersensitivity to the MT-depolymerizing agent benomyl. To elucidate how the functions of these two proteins were linked to robust extension of hyphal tips, we assayed the dynamic properties of MTs in the absence of either or both proteins when compared to those in the control cells. It was found that EBA played a central role in regulating CLIPA and other MT plus-end-tracking proteins to "surf" at MT plus ends. EBA and CLIPA regulate robust generation of new MTs in hyphal tip cells and contribute quantitatively to unidirectional tip growth. We conclude that MT plus-end-tracking proteins form a regulatory network that allows MTs to rapidly polymerize towards newly formed hyphal tips in order to sustain polarized growth.

***DEB Graduate Student**

O. FERMENTATION STRATEGIES FOR WHOLE SUGAR BEET TO ETHANOL PRODUCTION AND *IN PLANTA* PRODUCTION OF LIQUEFACTION ENZYMES IN AN INTEGRATED BIOREFINERY APPROACH

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Supplying almost 1/3 of world sugar production, sugar beets are a large industrially relevant crop. Due to increased demand for biofuels, several European sugar manufacturers are co-producing ethanol from sugar processing intermediates as a means to adjust to fluctuating market demands and sugar beet leaves are being used by producers for methane generation in anaerobic digesters. Renewable fuel mandates in the US allowing sugar-based crop fuels to be eligible for Advanced Biofuel classification might pave the way for significant biofuel production from beets in the near future. As such, the opportunity exists to leverage this momentum through improved bioprocess design and high value co-product recovery employing an integrated biorefinery approach.

Specifically, our research on improving bioprocess design for conversion of whole beets to ethanol includes several strategies; Fermentation of whole beets, rather than processed sugar streams, may reduce costs dependent on identifying rapid and efficient enzymatic liquefaction conditions for the largely pectin components. Loadings of commercially available enzymes containing cellulases, hemicellulases, pectinases, and β-glucosidases are being investigated to determine optimum liquefaction and hydrolysis parameters. Secondly, fermentation designs employing both traditional *Saccharomyces cerevisiae* and engineered organisms for arabinose and uronic acid utilization (including *E. coli* KO11) are being evaluated. Lastly, due to the expected need for significant quantities of cell wall degrading enzymes, *in-planta* production methods for expression of cell wall degrading enzymes in sugar beet are being explored.

***DEB Graduate Student**

P. IMPROVING PHYTOPHTHORA RESISTANCE THROUGH MANIPULATION OF ARACHIDONIC ACID RESPONSES

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Diseases caused by *Phytophthora* species are among the most devastating and economically important plant diseases worldwide. I am attempting to engineer increased resistance to these diseases using plant responses to arachidonic acid. This fatty acid is not present in vascular plants, is released by *Phytophthora* spp. upon infection, and is capable of inducing plant defense responses when exogenously applied to plants. Transgenic plants engineered to produce arachidonic acid display greater resistance to certain classes of pathogens, including *Phytophthora* spp., due in part to transcriptional reprogramming of selected defense-related genes. I will investigate the molecular mechanisms regulating this response with the ultimate goal of devising a genetic tool box instrumental in replication of this enhanced resistance without engineered arachidonic acid production. Specifically, I will employ an affinity purification method aimed at the identification of plant transcriptional regulators responsible for altered expression of arachidonic acid responsive genes. These proteins, as well as protein products of genes induced in response to arachidonic acid, will then be studied as follows: the model plant Arabidopsis genetically engineered to up- or down-regulate expression of the gene encoding each of these proteins will allow me to discern the function of the respective protein, and to screen for those which affect infection by *Phytophthora* spp. Those gene constructs most successful at reducing disease severity will be selected for generation of transgenic tomato plants, for validation in this important crop species. Reduced disease susceptibility in tomato will form the groundwork for a novel strategy aimed at enhancing resistance to *Phytophthora* spp. in a wide range of crop plants.

***DEB Graduate Student**

Q. INVESTIGATION OF THE ROLE OF SULFUR VOLATILES IN REPELLING CROP PATHOGENS

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The goal of this project is to develop alternative methods to pesticide applications by using volatile compounds naturally produced by plants. Floral volatiles are commonly associated with attracting insects to flowers for pollination, while volatiles produced in vegetative tissues have been implicated with the plant's defense mechanisms, for example by repelling herbivores that feed on plants. This project takes advantage of the defense-related function of volatile compounds to design control strategies against the psyllid *Diaphorina citri* (or Asian Citrus Psyllid) that carries the bacterial disease Huanglongbing (HLB), also known as citrus greening disease. This disease, caused by *Candidatus* Liberibacter, is extremely virulent and has spread to many areas of the United States. Currently there is no cure for this disease, and infection of a citrus tree remains asymptomatic for many months but eventually leads to death within two years. In Florida this disease has spread to two-thirds of the state and threatens a billion dollar industry. In an effort to eradicate this disease, growers spray costly pesticides amounting to over 27 sprays a year. This dosage is excessive and can have adverse effects on our health and environment. In Vietnam, where the HLB disease is also present, citrus growers plant guava trees in their orchards to repel the psyllid. A recent characterization of guava leaf volatile profile identified sulfur-containing compounds (dimethyl sulfide, DMS, and dimethyl disulfide, DMDS) as the likely repellent.
A bacterial Methionine g-lyase (MGL) gene was introduced into tomato (cv. Micro Tom and Moneymaker) in order to engineer sulfur volatile emission in these plants. Transgenic Micro Tom expressing MGL emitted dimethyl sulfide (DMS) while wild type plants did not.

Dual choice preference tests with psyllids indicate that the transgenic MGL plants producing DMS may repel psyllids; however, further behavioral assays did not confirm this trend (data not shown). This may be due to the production of DMS rather than dimethyl disulfide (DMDS).

Moreover, MGL plants producing DMS appear to be more resistant to infection by *Botrytis cinerea*, compared to wild type plants. Further investigation is currently in process to statistically confirm this observation.

***DEB Graduate Student**

R. PHYLOGENOMIC ANALYSIS OF CELL WALL-RELATED GENES IN SWITCHGRASS

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Switchgrass (*Panicum virgatum L.*) is a perennial grass native to North America that is receiving renewed attention from breeders and molecular biologists due to its potential as a promising bioenergy crop. Although the genetic resources available for switchgrass are currently limiting, a tremendous opportunity exists to leverage genomic information from model grass species, such as rice (*Oryza sativa*), for switchgrass improvement. In order to identify switchgrass orthologs of rice genes controlling key biomass traits, we established an efficient, qPCR-based screening system. Two BAC libraries comprising >200,000 BAC clones, organized into pools and superpools, were screened using primers designed from switchgrass ESTs and rice sequences. Full-length sequences of selected BACs were obtained using Sanger's method. Members of Glycosyltransferase 2 (GT2) gene family were chosen for further investigation due to their characterized involvement in plant cell wall biosynthesis. We analyzed the expression profiles of switchgrass orthologs of GT2 family genes in six specific tissue types, including young leaf, mature leaf, stem, node, root and flower. Comparative analysis of these expression profiles with microarray-based expression data in rice tissues, sampled at similar stages of development, highlights differences and similarities in GT2 family function.

***DEB Graduate Student**

S. DUCKWEED AS A BIOMASS AND CELLULASE SOURCE FOR BIOFUEL PRODUCTION

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Available cellulosic biofuel feedstocks are estimated to be over 1 billion dry tons per year in the United States, which could replace an estimated 30% of current transportation fuels. Production of cellulosic biofuels is currently limited by the availability and high cost of required enzymes. It is estimated that 15-25 kilograms of cellulase per ton of biomass are needed to produce 84 gallons of ethanol. Therefore, meeting production targets of 21 billion gallons of "advanced biofuels" from cellulosic sources using fungal fermentation would create a market demand of over 3.75 million tons of cellulase enzymes in the United States alone. The scale, cost, and speed required to meet cellulase demands cannot be met using current technologies such as fungal fermentation.

One approach is to engineer plants to behave as bioreactors to produce the necessary cellulase enzymes. Duckweed is a small aquatic plant with a 2-3 day doubling time, low lignin content, high starch content, minimal need for pretreatment and the ability to be grown on non-arable land. This positions duckweed well as a non-food based source of biomass and industrial quantities of cellulase enzymes needed for cellulosic biofuels. The goal of the project is to transform duckweed using chloroplast transformation to express high levels of cellulase enzymes endoglucanase E1 and endo-1,4-beta-xylanase from *Acidothermus cellulolyticus*. We are currently screening 10 strains of duckweed under a range of conditions to identify a candidate with high biomass productivity and composition well suited for industrial applications. Once we identify a candidate, we will develop methods for chloroplast transformation in the duckweed strain.

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www.cytokinetics.com

Cytokinetics is led by a team of seasoned industry veterans working collaboratively and with a shared objective to create the next great biopharmaceutical company. Our management team is comprised of expert Research and Development and business executives who bring considerable prior experience to bear on the challenges and opportunities associated with our ambitious plans. We have assembled a cohesive professional team and through the top-flight activities and steadfast execution of our organization, we are well-equipped to advance Cytokinetics forward and to accomplish great things.

Our Board of Directors is comprised of highly experienced industry professionals, investors and senior members of company management. The Cytokinetics Board works diligently to ensure proper governance around a well-considered strategic course for the business and closely monitors our progress in line with those plans. Each member of the Board works as a steward to ensure our shareholders and other stakeholders are well served by company decisions and their interests are foremost in their minds and in line with company activities. Good governance and proper oversight is key to ensure Cytokinetics is properly delivering on the confidence entrusted in us every day

Cytokinetics was founded by cell biology pioneers who are leaders in the field of cytoskeletal biology and pharmacology. Early on, this team of forward-thinking scientists set out a vision for translating their expertise into new insights and approaches to novel drug discovery. Informed by an expanded team of consultants who represent leading scientific and medical thinkers in the fields of chemistry and drug discovery and development, our activities have been guided by the invaluable assistance of some of the world's key opinion leaders who share our goals and also take enormous pride in our successes.

Genencor (A Danisco Division)

Contact:
Colin Mitchinson, Ph.D., Director; Biomass Applications

925 Page Mill Road
Palo Alto, CA 94304
(650) 846-5853
www.genencor.com
colin.mitchinson@danisco.com

A Danisco Division, Genencor is amongst the largest developers and manufacturers of industrial enzymes and the second largest biotechnology company in the world.

Reaching diverse industries
Genencor discovers, develops, manufactures, and delivers eco-friendly, efficient enzyme product solutions for the agri processing, cleaning and textiles, food and feed, consumer, and industrial markets. We also develop innovative advancements for the biofuels, biodefense, and biosafety industries.

A technology leader
We are a recognized leader in protein and pathway engineering. No other biotechnology company offers the breadth of skills and experience that we do to deliver total solutions to a broad array of markets.

A catalyst for change
As a Catalyst of the Biobased Economy[sm], Genencor is committed to contributing to a sustainable industrial system that relies on renewable resources to produce effective, environmentally friendly products. Our focus on research and development and sustainability is making this happen by driving the application of biotechnology into new areas.

Genentech, Inc.

Contacts:
Ellen Filvaroff, PhD, Senior Scientist, Molecular Oncology
Melody Trexler Schmidt, Ph.D., Scientist (DEB Graduate)
Joan Greve, Ph.D., Director of Biomedical Imaging

1 DNA Way
South San Francisco, CA 94080-4990
(650) 225-1000
www.gene.com
filvarof@gene.com
schmidt.melody@gene.com
jgreve@gene.com

Genentech is a leading biotechnology company that discovers, develops, manufactures, and commercializes biotherapeutics for significant unmet medical needs. A considerable number of the currently approved biotechnology products originated from, or are based on, Genentech science. Genentech manufactures and commercializes multiple biotechnology products directly in the United States and licenses several additional products to other companies. The company has headquarters in South San Francisco, Calif., and is traded on the New York Stock Exchange under the symbol DNA.

Corporate Overview
Genentech, the founder of the biotechnology industry, is a company with a quarter-century track record of delivering on the promise of biotechnology. Today, Genentech is among the world's leading biotech companies, with multiple protein-based products on the market for serious or life-threatening medical conditions and over 30 projects in the pipeline. With its strength in all areas of the drug development process — from research and development to manufacturing and commercialization — Genentech continues to transform the possibilities of biotechnology into improved realities for patients.

Marketed Products:
Delivering innovative medicines to patients with serious or life-threatening medical conditions is what Genentech is all about. Since its beginning in 1976, the company has focused its drug discovery efforts on therapies that would fill unmet needs. Today, Genentech manufactures and commercializes multiple protein-based biotherapeutics for serious or life-threatening medical conditions — giving Genentech one of the leading product portfolios in the biotech industry.

Development Pipeline:
As a biotechnology leader, Genentech has a long-standing tradition of reinvesting a significant percentage of revenues back into research and development — a practice that has proved successful in transforming promising candidates into important new products. With the projects below under way, Genentech's development pipeline has never been more robust and promising. More than half of Genentech's pipeline is composed of potential antibody therapies.

Marrone Bio Innovations, Inc.

Contact:
Pam Marrone, Ph.D., CEO and Founder, Board of Directors

2121 Second Street, Suite 107B
Davis, CA 95618
(530) 750-2800
www.marronebioinnovations.com/index.php

Vision

We will be the world leader in natural product innovation. We will make natural, effective, safe, environmentally friendly products the mainstream future of pest management.

Values

1. We believe in sustainable business practices economically viable, socially equitable and environmentally responsible.
2. We encourage entrepreneurial attitudes and agility, and believe that ideas, out of the box thinking and creativity are the lifeblood of innovation. Our decisions and products are based on sound science, statistically vetted data, market research, direct contact with customers and good financial analysis.
3. We communicate openly and honestly, respect the views of others and minimize internal politics. Empowered employees, treated fairly, are productive employees. We involve all employees in the company's strategy, goal setting and decision-making.
4. We believe in diversity. A diverse work force and diverse opinions working together in teams result in better decision- making.
5. We have a culture of accountability, continuous learning, coaching, and mentoring for personal and professional growth.
6. We conduct all business dealings with integrity, treating all stakeholders, collaborators and trade partners with respect, fairness and honesty at all times and expect the same in return.

Monsanto Company – Calgene Campus

Contacts:
Lyle Crossland, Ph.D., Site Manager
Kristen Bennett*, Ph.D., Senior Scientist, Project Leader

1920 Fifth Street
Davis, CA 95616
(530) 753-6313
www.monsanto.com
kristen.a.bennett@monsanto.com

Calgene was founded in 1980 and is perhaps best known for the development of the first commercialized genetically engineered food, the FLAVR SAVR tomato. Monsanto acquired Calgene in 1997 and it is now a research and development site within Monsanto AG. Current research at Calgene focuses primarily on improving quality traits for feed and food, as well as nutritional approaches for the enhancement of health. Calgene has approximately 100 employees and it is the primary site within Monsanto for the canola biotech pipeline. Current projects include increasing the value of field crops by optimizing the micronutrient and oil profile of the grain. Several genomic-based approaches are being utilized for gene discovery. Functionality of candidate genes is then assessed in model systems. Examples of the use of genomic-based approaches to identify interesting gene leads will be presented.

Monsanto provides a wide array of integrated solutions to help meet the needs of growers and commercial customers who need to control unwanted vegetation safely and effectively. Monsanto also provides products to the dairy industry to increase the efficiency of milk production, and seeds for several cropping systems.

***DEB Graduate**

Novartis AG (formerly Chiron Corporation)

Contacts:
John Donnelly, Ph.D., Senior Director

4560 Horton Street
Emeryville, CA 94608-2916
(510) 655-8730

Matthew Coleman, Ph.D., Scientist, Manufacturing Technology
***Michael Plesha, Ph.D.**, BPO Graduate Position, Manufacturing Technology
2010 Cessna Drive
Vacaville, CA 95688
(707) 453-2200
www.chiron.com
john_donnelly@chiron.com
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michael.plesha@novartis.com

Mission
Novartis strives to be a leading biotechnology company by creating products that transform human health worldwide. We aim to prevent and treat diseases and improve people's lives.

Leadership Strategy
We will accomplish our mission through technological leadership, product-oriented research, superior manufacturing, and commercial strategies that create and expand markets.

Ethical Standards
We adhere to the highest legal and ethical principles in the conduct of all aspects of our business. We are committed to adhering to proven standards of financial and operational performance.

Values
Our purpose is to find solutions to human suffering caused by disease. Because disease does not wait for solutions, we are driven by a sense of urgency. As a result, our environment is intense, challenging, and focused on creating value for those who use our products and delivering sustained profitable growth for those who invest in our company.

Quality
Our goal at Novartis is to deliver quality products and services on time to all customers, internal and external. We provide employees with training and resources to meet or exceed

customer requirements. We monitor processes and products to identify opportunities for continuous improvement.

***DEB Graduate**

Novozymes, Inc

Contact:
Debbie Yaver, Ph.D., Director

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www.novozymesbiotech.com
dsy@novozymes.com

Enzymes are the natural solution to industrial problems. With enzymes we can reduce the consumption of water, energy and harmful chemicals and still make production more efficient. Novozymes is the world leader in enzyme solutions. Based on an advanced biotech platform we produce and sell more than 500 enzyme products in 120 countries. Since 1941 Novozymes has introduced almost every new industrial enzyme on the market, making us the world's largest manufacturer of enzymes today. With our minds set on innovation, we will continue to be so in the future.

Novozymes has introduced, with few exceptions, every new enzyme to the industry, from lipases, which remove grease stains during washing, to amylases, which are used to manufacture sweeteners. In our work we use the following technologies: microbiology, bioinformatics, gene technology, protein chemistry, computer chemistry, directed evolution, fermentation and recovery technology.

OncoMed Pharmaceuticals, Inc.

Contact:
Aaron Sato, Ph.D., Senior Director; Antibody Engineering

800 Chesapeake Drive
Redwood City, CA 94063
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aaron.sato@oncomed.com

OncoMed Pharmaceuticals is a biotechnology company dedicated to improving cancer treatment, by developing monoclonal antibodies that target the biologic pathways critical to tumor initiating cells, also known as "cancer stem cells". We are leveraging our understanding of these tumor initiating cells to discover and develop novel therapeutics that could provide important alternatives for the treatment of cancer.

Takeda San Francisco

Contact:
Greg Landes, Ph.D., VP of Discovery, Antibody Research and Preclinical Development

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S. San Francisco, CA 94080
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glandes@takedasf.com

Takeda San Francisco, Inc.(TSF) is Takeda's global center for excellence for biologics. TSF was founded in November 2007 and supports Takeda's therapeutic antibody research through our antibody technology platform. This platform is based on discovery, optimization and development technologies used to efficiently generate Investigational New Drug (IND) candidates for the treatment of cancer, inflammatory and metabolic diseases.

Tethys Bioscience, Inc.

Contact:
Edward J. Moler, Ph.D., Associate Director; Biostatistics and Informatics

5858 Horton Street, Suite 550
Emeryville, CA 94608
(510) 724-3260
www.tethysbio.com/index.html
emoler@tethysbio.com

Tethys Bioscience is dedicated to the discovery, development and commercialization of novel biological markers — biomarkers — that provide a practical tool to address the growing global challenge of chronic metabolic diseases such as diabetes.

By developing new tests that use protein and other bloodborne biomarkers to identify people at high risk for devastating and preventable diseases, we can arm patients and physicians with knowledge they can use to help prevent disease progression. These biomarkers give a snapshot of an individual's current risk, which may be modifiable. Our goal is to provide clinicians with an objective and convenient means to risk-stratify their patients and help them focus appropriate intervention strategies on those most likely to benefit. Our research strategies lead to sets of biomarkers that can be used to quantify the level of an individual's risk.

We approach the market with a unique combination of strengths:

- A research, management and commercialization team with extensive experience in diagnostic innovation
- Alliances with world-class researchers and partners
- A solid financial foundation

The company has become a pioneer in the discovery, development and value creation of novel biological markers for the clinical diagnostics marketplace: ***Biomarkers***. The company believes there is a large unmet need in both the discovery of potentially important biomarkers and the eventual use of them in routine clinical practice for many significant diseases.

Tethys Bioscience has built expertise, created significant intellectual property, and is executing its business plan around three key areas: ***Biomarker Discovery, Clinical Validation***

and ValueCreation. Tethys is focused upon introducing products that yield significant savings to the health care system and improve the quality of life for patients.

- Biomarker discovery efforts are focused on applying advanced research tools to identify important biomarkers associated with diseases that affect many people and are very costly to health care systems throughout the world today.
- Clinical validation involves a complex process that results in defining a set of new biomarkers and the application of the resulting test to enhance current clinical practice.
- Value creation encompasses the use of sophisticated health economic analyses to define appropriate performance criteria for new biomarkers and the execution of market development strategies to drive the adoption of new biomarkers in clinical practice.

Participants

Retreat Participants

NIH Fellows 2011 - 2012	
Mateo Hernandez	Chemistry
Silvia Hilt	Biochemistry & Molecular Biology
Regina MacBarb	Biomedical Engineering
Nancy Zeng	Chemical Engineering
Wade Zeno	Chemical Engineering
Biotech Fellows 2011 - 2012	
Sean Gilmore	Applied Science
Jared Moore	Chemistry
Diana Lac	Pharmacology & Toxicology
Mike Starr	Biomedical Engineering
CREATE-IGERT Trainees	
Geoffrey Benn	Plant Biology (Cohort3)
Marta Bjornson	Horticulture & Agronomy (Cohort 3)
Elenor Castillo	Plant Biology (Cohort 2)
Hyrum Gillespie	Genetics (Cohort 4)
Mitch Harkenrider	Plant Pathology (Cohort4)
Mark Lemos	Plant Biology (Cohort 4)
Erica Vonasek	Biological Systems Engineering (Cohort 4)
Natasha Worden	Plant Biology (Cohort 4)
Tracy Zeng	Plant Biology (Cohort 4)
Steve Zicari	Biological Systems Engineering (Cohort 4)
Graduate Students/Post-docs	
Lisa Anderson	DEB, Chemistry
Barbara Bailus	DEB, Genetics
Brandon Brown	DEB, Pharmacology & Toxicology
Daniel Caddell	DEB, Plant Pathology
Annie Chiu	DEB, Microbiology
Dong hee Chung	DEB, Chemistry
Nichole Coleman	Chemistry
Nithin Dhananjayan	DEB, Biophysics
Dmitry Grapov	DEB, Agricultural & Environmental Chemistry
Alex Gulevich	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Siobhan Halloran	DEB, Chemical Engineering
Allison Hoch	DEB, Biomedical Engineering
Jonathan Hughes	DEB, Microbiology
Geetika Joshi	DEB, Soils & Biogeochemistry

Özge Kurtuluş	DEB, Electrical & Computer Engineering
Diana Lac	DEB, Pharmacology & Toxicology
Edna Lamsen	DEB, Chemistry
Rita Luu	DEB, Microbiology
Kevin Martin	DEB, Chemistry
Jordan McEwen	DEB, Chemistry
Daniël Melters	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Amory Meltzer	DEB. Genetics
Angela Monterrubio	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Sucheta Mukerjee	DEB, Pharmacology & Toxicology
John Oliver	DEB, Chemistry
Gabriel Rodriguez	DEB, Chemistry
Shailise Ross	DEB, Chemistry
Priyasheila Singh	DEB, Soils & Biogeochemistry
Watumesa Tan	DEB, Microbiology
Elyse Towns	DEB, Chemistry
Diana Wong	DEB, Chemistry
UC Davis Faculty	
Georgia Drakakaki	DEB, Plant Sciences
Marc Facciotti	DEB, Biomedical Engineering
Kit Lam	DEB, Biochemistry & Molecular Medicine
Harris Lewin	UCD Vice Chancellor of Research
Margie Longo	DEB, Chemical Engineering
Rosane Oliveira	UCDHS, Integrative Medicine Program
Rebecca Parales	DEB, Microbiology
Atul Parikh	DEB, Applied Science
William Ristenpart	DEB, Chemical Engineering
Erkin Şeker	DEB, Electrical & Computer Engineering
Jared Shaw	DEB, Chemistry
John Voss	DEB, Chemistry
Heike Wulff	DEB, Pharmacology
Industry	
Cheyenne Cook	Boehringer-Ingelheim
Lyle Crossland	Monsanto, Calgene Campus
Esohe Idusogie	OncoMed Pharmaceuticals
Louise McGinnis	HDR Architecture
Ronald Mulikin	Novozymes, Inc.
Gary Nagamori	HDR Architecture

Monica Ravanello	Monsanto, Calgene Campus
Tosten Schulz	Boehringer-Ingelheim, Inc.
Toni Voelker	Monsanto, Calgene Campus
Guests	
Robin Altman	UCD, Biochemistry & Molecular Medicine
Dave Barber	SFO International Airport
Madhu Budamagunta	UCD, Biochemistry & Molecular Medicine
Dave Menshew	James Enoch High School
Biotechnology Program	
Marianne Hunter	Biotechnology Program, Assistant. Director Administration
Denneal Jamison-McClung	Biotechnology Program, Associate Director
Judy Kjelstrom	Biotechnology Program, Director
Martina Newell-McGloughlin	Executive Director Life & Health Sciences Research Dev.
Demian Sainz	Biotechnology Program, Account Manager

www.biotech.ucdavis.edu

The Mission of the Biotechnology Program:

The Biotechnology Program was created in 1986, to assist in the organization of university activities related to biotechnology and to coordinate such activities with other efforts on the Davis campus. It is a central facility of the Office of Research. The Program's missions include:

- Promoting and coordinating the development of biotechnology and biotechnology - related research on the campus;
- Assisting with development of new and improved facilities for biotechnology research;
- Promoting research interactions between faculty and private industry and public agencies;
- Recommending and implementing curriculum development and training in biotechnology;
- Serving as an information and education resource on biotechnology for the campus and the public.

The Program serves as the **Administrative Home** for educational programs:

- Designated Emphasis in Biotechnology (**DEB**) graduate program
  www.deb.ucdavis.edu
- Advanced Degree Program (**ADP**) for corporate employees
  A PhD program for the working professional
- NIH Training Program in Biomolecular Technology for PhD students
- BioTech SYSTEM – K-14 educational consortium

Biotechnology Program Office:

Dr. Judith Kjelstrom - Director
Dr. Denneal Jamison-McClung – Associate Director
Marianne Hunter – Assistant Director, Administration
Demian Sainz – Account Manager
Office Location: 0301 Life Sciences
Telephone: (530) 752-3260 (main line) FAX: (530) 752-4125
Email: biotechprogram@ucdavis.edu

- The DEB provides a formal accreditation (on diploma & transcript) to reflect interdisciplinary biotechnology training.
- Not all of the DEB students will be funded by the NIH Biotechnology Training Program.

The fellows are a select subset based on a highly competitive nomination & selection process:

1. Nomination by a Faculty Trainer and completion of an application by the student.
2. Ranking by the Executive Committee of the NIH Biotechnology Training Program is based on: academic merit; quality of the research; interdisciplinary nature of research; and willingness to complete an internship.

Information about the NIH Biotechnology Training Grant is publicized on the DEB (http://www.deb.ucdavis.edu/NIHTG/nihinfo.cfm) website.

NIH Training Grant Faculty

Director: Bruce Hammock	
Co-Directors: Karen McDonald and Martina Newell-McGloughlin	
Kyriacos Athanasiou	Biomedical Engineering
Shota Atsumi	Chemistry
Enoch Baldwin	Molecular & Cellular Biology
Peter Beal	Chemistry
David Block	Chemical Engineering
Alan Buckpitt	VM: Molecular Biosciences
Simon Chan	Plant Biology
Joanna Chiu	Entomology
Brett Chromy	Pathology
Abhaya Dandekar	Plant Sciences-Pomology
Sheila David	Chemistry
Elva Diaz	Pharmacology
Marc Facciotti	Biomedical Engineering
Roland Faller	Chemical Engineering & Materials Science
Annaliese Franz	Chemistry
Bruce German	Food Science & Technology
Paul Henderson	Internal Medicine, Hematology & Oncology
Ian Kennedy	Mechanical & Aeronautical Engineering
Patrice Koehl	Computer Science; Genome Center & Bioinformatics Program
Ian Korf	Molecular & Cellular Biology, Genome Center & Bioinformatics Program
Tonya L. Kuhl	Chemical Engineering
Kit S. Lam	MED: Internal Medicine; Hematology & Oncology
Donald Land	Chemistry
Kent Leach	Biomedical Engineering
Julie Leary	Chemistry
Carlito Lebrilla	Chemistry
Harris Lewin	Evolution & Ecology
Marjorie Longo	Chemical Engineering
Juan Medrano	Animal Science
Richard Michelmore	Plant Sciences – Vegetable Crops
David Mills	Viticulture & Enology
Lorena Navarro	Microbiology
John Newman	Nutrition

Jan Nolta	Internal Medicine, Hematology & Oncology
Tingrui Pan	Biomedical Engineering
Rebecca Parales	Microbiology
Atul Parikh	Applied Science
Alex Revzin	Biomedical Engineering
William Ristenpart	Chemical Engineering & Materials Science
David Rocke	Applied Science
David Segal	Pharmacology
Jared Shaw	Chemistry
Scott Simon	Biomedical Engineering
Daniel Starr	Molecular & Cellular Biology
Ilias Tagkopoulos	Computer Science
Jean VanderGheynst	Biological & Agricultural Engineering
John Voss	Biological Chemistry
Bart Weimer	Population Health & Reproduction

NIH Training Program in Biomolecular Technology

The DEB is a **formal training program** for the NIH Training Grant.

The DEB provides **training and a structure for interdisciplinary interactions**, in addition to established graduate programs.

The DEB provides a **formal accreditation** (on diploma & transcript) to reflect interdisciplinary biotechnology training.

Not all of the DEB students will be part of the NIH Biotechnology Training Program. The fellows are a **select subset** based on a highly competitive nomination & selection process:

- Nomination by a Faculty Trainer and completion of an application by the student.

- Ranking by the Executive Committee of the Program based on academic merit, quality of the research, interdisciplinary nature of research, and a willingness to complete an internship.

Designated Emphasis in Biotechnology Program (DEB)

Goals and Mission of the DEB

The Designated Emphasis in Biotechnology (DEB) is an inter-graduate group program that allows Ph.D. students to receive and be credited for training in the area of biotechnology. The DEB provides a nurturing interactive environment to promote integration of multiple disciplinary approaches to the conduct of research and to promote learning in biotechnology. The mission is to prepare well-educated students to approach problems with creativity and flexibility. The program will provide tools for the students to be leaders, visionaries, entrepreneurs, researchers and teachers in the broad area of biomolecular technology.

DEB Mission:

- To provide well-coordinated, cross-disciplinary training of graduate students in critical areas of biomolecular technology research.
- To promote interdisciplinary research environments that integrate basic biological science, engineering and computational disciplines.
- To allow cross-disciplinary training and trainee experience in a biotechnology company or cross-college laboratory.

Students come from a wide array of disciplines: Participating graduate programs currently include **29 programs**: Agricultural & Environmental Chemistry; Animal Biology; Applied Science Engineering; Biochemistry, Molecular, Cellular & Developmental Biology; Biological Systems Engineering; Biomedical Engineering; Biophysics; Chemistry; Chemical Engineering; Civil & Environmental Engineering; Comparative Pathology; Computer Science, Electrical & Computer Engineering; Entomology; Food Science Technology; Genetics; Immunology; Materials Science & Engineering; Mechanical & Aeronautical Engineering; Microbiology; Molecular, Cellular and Integrative Physiology; Neurosciences; Nutritional Biology; Pharmacology and Toxicology; Plant Biology; Plant Pathology; Soils & Biogeochemistry; and Statistics. The DEB program supplements a student's Ph.D. curriculum and those completing the program will obtain an official designation on their diploma & transcript indicating a qualification in biotechnology. Example: **Doctoral Degree in Microbiology with a Designated Emphasis in Biotechnology**

Brief History:

The DEB was formally established in 1997 as an outgrowth of the first NIH Training Grant in Biotechnology (funded in the early 1990s). The DEB became the formal training program for the current NIH Training Grant in Biomolecular Technology (1-T32-GM08799: July 1, 2002-June 30, 2017). The DEB provides a very effective multidisciplinary biotechnology concentration, which includes exposure to bioethics, business and legal aspects of biotechnology as well as a 3-6 month internship in a biotechnology company or research laboratory in another college or national laboratory. As of 2012, the DEB has 29 affiliated graduate groups or departmentally based graduate programs. The number of students in the Designated Emphasis in Biotechnology has increased dramatically over the last several years and now boasts over 230 members, with many being first year students. We have graduated 127 students with a DEB notation on their diplomas as of 2011.

Program Administration:

The administrative home for the DEB and the NIH Training Grant in Biomolecular Technology is the UC Davis Biotechnology Program. Dr. Judith Kjelstrom serves as the DEB and NIH Training Grant program coordinator for the DEB, in addition to directing the Biotechnology Program. She works closely with the DEB chair, Katayoon Dehesh (Department of Plant Biology) and the rest of the executive committee: Karen McDonald (Chemical Engineering and Materials Science), Abhaya Dandekar (Plant Sciences), Robert Rice (Environmental Toxicology) and David Rocke (Applied Science/Biostatistics) to oversee the day-to-day activities of the graduate program.

Course Work:

The DEB has a required core curriculum for students regardless of whether their graduate major is in biological science, engineering, statistics, etc. A key feature of the DEB is its requirement for a research internship at a cooperating biotechnology company or a cross-college site. When the students complete their Ph.D. requirements as well as the DEB requirements, their diploma notes not only their graduate major, but also that they have completed the DEB (e.g., "Ph.D. in Chemical Engineering with a Designated Emphasis in Biotechnology").

We have created a website for the Designated Emphasis in Biotechnology (http://www.deb.ucdavis.edu/) to advertise the program as well as the NIH Training Grant. The announcement of the grant is on the site. Program information, forms, pictures and other pertinent information is listed on the site. We have linked the website to graduate home pages of most of the 23 DEB program affiliates in the Division of Biological Sciences, College of Engineering, College of Letters and Science and the College of Agriculture and Environmental Sciences.

1. **Course Requirements**:

a. **MCB 263** (2 units): Biotechnology Fundamentals and Application (winter quarter, alternate odd numbered years)

An interdisciplinary course which includes: introduction to modern recombinant DNA technology; rate processes of biological systems, optimization of bioreactor performance; practical issues in biotechnology; and some specific case studies of the development of biotechnology products and

processes. Grading: Letter grade; two one-hour exams, one research paper (team project) on a selected topic relevant to biotechnology, and regular reading assignments.

b. **MCB 282** (variable): Biotechnology Internship (may be done any quarter)

The internship will expose qualified graduate students to research activities in a biotechnology company, to company culture, to legal and business aspects of industry, and to another career option. A minimum of 3 months internship at a local biotechnology company or cross college or national laboratory (i.e. Lawrence Berkeley Laboratory, Lawrence Livermore National Laboratory, etc.). S/U grading; research performance (student report) will be evaluated by the professor in charge and in consultation with the company trainer.

c. **MCB/ECH 294** (1 unit): Current Progress in Biotechnology (fall, winter and spring quarters). Three quarters of seminar are required for the DEB Program.

This course is an interdisciplinary seminar, featuring speakers from industry as well as academia. The students will have an opportunity to discuss the seminar topic with the lecturers, to learn about biotechnology research activities at companies and to network with speaker. Grading: S/U grading, attendance is required, and a summary report on the seminars is required at the end of the quarter.

d. **MIC 292** (1 unit): From Discovery to Product - An Introduction to Biotechnology at the Industrial Level. (winter quarter; even numbered years). MIC 292 is an approved **seminar elective** for the DEB program (may substitute for one quarter of MCB/ECH 294).

This course is designed to provide a unique opportunity to gain insight into basic and applied biotechnology at the industrial level. Lectures are presented by senior scientists from Novozymes Biotech, Inc. in Davis California (http://www.novozymesbiotech.com/). A tour of the industrial facilities will be arranged. Grading: S/U grading, attendance is required, and a summary report on the seminars is required at the end of the quarter.

e. **GGG 296** (2 units): Scientific Professionalism and Integrity (fall quarter)

The course will allow the student to become familiar with their roles and responsibilities as a professional scientist and/or instructor. While some standards of acceptable scientific behavior will be presented in class, most of the time will be spent discussing various "gray zone" scenarios, in which proper conduct is unclear. Grading: S/U grading; active class participation in class discussions is required. **This course is currently highly recommended, but will be required, pending approval.**

2. **Qualifying Exam Requirements**:

The Ph.D. qualifying exam should demonstrate appropriate knowledge with the area of biotechnology. At least one faculty member of the designated emphasis shall participate in the qualifying examination.

3. **Thesis Requirements**:

The dissertation committee shall include at least one faculty member of the designated emphasis. The major professor must be a participating DEB member.

4. **Additional Requirements**:

Regular attendance at the annual Biotechnology Training retreat and at the informal Pizza Chalk Talk Seminars (talks by students and faculty on current research) is expected.

DEB Program Students as of March 2012

Nicolas Aguirre	Molecular, Cellular & Integrative Physiology
Danielle Aldredge	Chemistry
Johnathan Anderson	Genetics
Lisa Anderson	Chemistry
Erica Andreozzi	Biomedical Engineering
Lucas Arzola	Chemical Engineering
Brian Avanzino	Biochemistry, Molecular, Cellular & Developmental Biology
Barbara Bailus	Genetics
Jesse Bakke	Nutritional Biology
Roberto Barrozo	Immunology
Kristen Beck	Biochemistry, Molecular, Cellular & Developmental Biology
Geoffrey Benn	Plant Biology
Crystal Berger	Biochemistry & Molecular Biology
Marta Bjornson	Horticulture & Agronomy
Bárbara Blanco-Ulate	Plant Biology
Nicholas Bokulich	Food Science & Technology
Brandon Brown	Pharmacology & Toxicology
Candace Burke	Immunology
Timothy Butterfield	Plant Biology
Katherine Byrne	Biomedical Engineering
Daniel Caddell	Plant Biology
Milo Careaga	Immunology
Jennifer Cash	Chemistry
Elenor Castillo	Plant Biology
Patricia Castillo	Immunology
Shannon Ceballos	Cellular & Developmental Biology
Astra Chang	Comparative Pathology
Pauline (JoJo) Chang	Electrical & Computer Engineering
Chao-Yu “Joy” Chen	Pharmacology & Toxicology
Xiaoyan “Helen” Chen	Biomedical Engineering
Xiguang “Ray” Chen	Biological Systems Engineering
Dawn Chiniquy	Plant Biology
Sum Ying “Annie” Chiu	Biochemistry, Molecular, Cellular & Developmental Biology
Leelyn Chong	Nutrition
Dong hee Chung	Chemistry

Elizabeth Clark	Biochemistry, Molecular, Cellular & Developmental Biology
Caitlin Cooper	Animal Biology
Stephanie Crockett	Comparative Pathology
David Dallas	Nutritional Biology
Ryan Davis	Chemistry
Nicole De Jesus	Pharmacology & Toxicology
Derek Decker	Biophysics
Elieke Demmer	Nutritional Biology
Nithin Dhananjayan	Biophysics
Neha Dixit	Immunology
Matthew Doherty	Microbiology
James Elmore	Plant Pathology
Marjannie Eloi	Immunology
Anna Erickson	Biochemistry, Molecular, Cellular & Developmental Biology
Aileen Espinoza	Immunology
Eugenel Espirtu	Biochemistry, Molecular, Cellular & Developmental Biology
Kenneth Eum	Molecular, Cellular & Integrated Physiology
Dawn Fedor	Nutritional Biology
Kateryna Feoktistova	Biochemistry, Molecular, Cellular & Developmental Biology
Brett Fite	Biophysics
Erin Fong	Electrical & Computer Engineering
Greg Foster	Biomedical Engineering
Erik Fostvedt	Biochemistry and Molecular Biology
Amanda Fox	Immunology
Elizabeth Fox	Immunology
Daniel Garrido	Food Science
Prasad Gawande	Chemistry
Ehson Ghandehari	Biomedical Engineering
Hyrum Gillespie	Genetics
Sean Gilmore	Applied Science
Tiffany Glavan	Microbiology
Aiza Cathe Go	Biochemistry, Molecular, Cellular & Developmental Biology
Hossein Gouran	Plant Biology
Dmitry Grapov	Agricultural & Environmental Chemistry
Alex Gulevich	Biochemistry, Molecular, Cellular & Developmental Biology

Eren Gultepe	Biomedical Engineering
Pasha Hadidi	Biomedical Engineering
Siobhan Halloran	Chemical Engineering
Brian Hamilton	Biochemistry & Molecular Biology
Oldham (Scott) Hamilton	Biochemistry & Molecular Biology
Mitchell Harkenrider	Plant Biology
Jason Harrison	Chemistry
Christine Hastey	Microbiology
Mateo Hernandez	Chemistry
Amanda Hildebrand	Biological Systems Engineering
Silvia Hilt	Biochemistry, Molecular, Cellular & Developmental Biology
Marissa Hirst	Microbiology
Allison Hoch	Biomedical Engineering
Gena Hoffman	Plant Biology
Serenus Hua	Chemistry
Jonathan Hughes	Microbiology
Tu Anh Huynh	Food Science Technology
Vicki Hwang	Genetics
Yi-Hwa (Patty) Hwang	Biochemistry & Molecular Biology
Darren Hwee	Molecular, Cellular & Integrative Physiology
Shirin Jenkins	Biochemistry, Molecular, Cellular & Developmental Biology
Roger Jesinghaus	Chemistry
Rogelio Jimenez Espinoza	Chemical Engineering
Liequn “Leah” Jin	Biostatistics
Geetika Joshi	Soils and Biogeochemistry
Yun Joon Jung	Biomedical Engineering
Sercan Karav	Food Science & Technology
Robert Kauffman	Microbiology
Rachel Kerwin	Plant Biology
Zahra Khedri	Chemistry
Nathiel Kingsbury	Chemical Engineering
Brenna Kiniry	Microbiology
James Kurniawan	Chemical Engineering
Ozge Kurtulus	Chemical Engineering
Timothy Kwa	Biomedical Engineering
Diana Lac	Pharmacology & Toxicology
Edna Lamsen	Chemistry
Rashida Lathan	Animal Biology
Katherine Lawrence	Cell & Developmental Biology

ChengYuk Lee	Chemical Engineering
Jennifer Lee	Biomedical Engineering
Karen LeGrand	Microbiology
Mark Lemos	Plant Biology
Ingrid Leth	Chemical Engineering
Zachery Lewis	Microbiology
Sarah Lockwood	Biochemistry & Molecular Biology
Alan Lombard	Biochemistry, Molecular, Cellular & Developmental Biology
Michelle Lozada-Contreras	Chemical Engineering
Thomas Luu	Biochemistry & Molecular Biology
Regina MacBarb	Biomedical Engineering
Kristina Mahan	Biochemistry & Molecular Biology
Hamed Malekan	Chemistry
Kinjal Maniar	Immunology
Amelia Manlove	Chemistry
Kevin Martin	Chemistry
Philip Matern	Molecular, Cellular & Integrative Physiology
Jordan McEwen	Chemistry
Samuel McMahon	Biochemistry, Molecular, Cellular & Developmental Biology
Daniël Melters	Cell & Developmental Biology
Amory Meltzer	Genetics
Emily Mills	Immunology
Rena Mizrahi	Chemistry
Angela Monterrubio	Biochemistry, Molecular, Cellular & Developmental Biology
Jason Mooney	Chemistry
Jared Moore	Chemistry
Jessica Moore	Chemistry
Mary Moore	Biochemistry & Molecular Biology
Alexi Morris	Chemistry
Sucheta Mukherjee	Microbiology
Andrew Murley	Biochemistry, Molecular, Cellular & Developmental Biology
Meghan Murphy	Biomedical Engineering
Bernadette Nera	Biochemistry, Molecular, Cellular & Developmental Biology
Alice Ngo	Chemistry
Tin Ngo	Biochemistry, Molecular, Cellular & Developmental Biology

Tarit Nimmanwudipong	Chemical Engineering
Charles Nwosu	Chemistry
Patrick O'Dell	Biological Systems Engineering
Maria Olubunmi Ogunyankin Marquez	Chemical Engineering
Alanna O'Leary	Immunology
John Oliver	Chemistry
David Olivos	Comparative Pathology
Nadia Ono	Biochemistry, Molecular, Cellular & Developmental Biology
Charity Onore	Immunology
Raquel Orozco-Alcaraz	Chemical Engineering
Richard Osibanjo	Chemistry
Gulustan Ozturk	Food Science & Technology
Angela Papalamprou	Molecular, Cellular & Integrated Physiology
Dipali Patel	Biomedical Engineering
Mira Patel	Biomedical Engineering
Maria Peralta	Chemistry
Jonathan Pham	Microbiology
Stephanie Pulford	Mechanical & Aeronautical Engineering
Jingyao Qu	Chemistry
Joseph Ramahi	Cell and Developmental Biology
Kittipong Rattanaporn	Chemical Engineering
Juan Reyes	Genetics
Gabriel Rodriguez	Chemistry
Patrick Rogers	Chemistry
Shailise Ross	Chemistry
Mary Saunders	Comparative Pathology
Amy Schroeder	Biochemistry, Molecular, Cellular & Developmental Biology
Erin Schwartz	Biochemistry & Molecular Biology
Gail Sckisel	Immunology
Aubrey Scott	Applied Science
Guy Shani	Microbiology
Mojtaba Sharifzadeh	Electrical & Computer Engineering
Esther Shin	Pharmacology & Toxicology
Priyashiela Singh	Land, Air & Water Resources
Chelsea Snyder	Microbiology
Zane Starkewolfe	Chemistry
Michael Starr	Biomedical Engineering
John Strum	Chemistry
Wesley Sughrue	Biochemistry & Molecular Biology

Anandkumar Surendrarao	Plant Biology
Tang Tang	Chemistry
Elyse Towns	Chemistry
Adama Traore	Electrical Engineering
Vu Trinh	Biochemistry & Molecular Biology
Michelle Tu	Cell & Developmental Biology
John Uhrig	Microbiology
Rachel Anne Valenzuela	Chemistry
Erica Vonasek	Biological Systems Engineering
Gordon Walker	Biochemistry, Molecular, Cellular & Developmental Biology
Donnelly West	Genetics
Damion Whitfield	Microbiology
David Woessner	Microbiology
Diana Wong	Chemistry
Natasha Worden	Plant Biology
Mon Shuan "Phoebe" Wu	Microbiology
Fei Yian Yoong	Plant Biology
Abigail Yu	Genetics
Chao Wei Yu	Biological System Engineering
Benjamin Yuen	Biochemistry, Molecular, Cellular & Developmental Biology
Garrick Yuen	Biochemistry, Molecular, Cellular & Developmental Biology
Cui Jing (Tracy) Zeng	Microbiology
Nancy Zeng	Chemical Engineering
Wade Zeno	Chemical Engineering
Steve Zicari	Biological Systems Engineering

DEB Faculty Trainers

Staff	Department
Venkatesh Akella	Electrical & Computer Engineering
Rajeevan Amirtharajah	Electrical & Computer Engineering
Paul Ashwood	UCD MIND Institute
Kyriacos Athanasiou	Biomedical Engineering
Shota Atsumi	Chemistry
Matthew Augustine	Chemistry
Alan Balch	Chemistry
Enoch Baldwin	Molecular and Cellular Biology
Abdul Barakat	Mechanical & Aeronautical Engineering
Diane Barrett	Food Science & Technology
Peter Barry	Center for Comparative Medicine
Stephen Barthold	Pathology, Microbiology & Immunology
Nicole Baumgarth	Department of Pathology, Microbiology and Immunology; CCM, VetMed
Peter Beal	Chemistry
Craig Benham	Biomedical Engineering / Genome Center
Alan Bennett	Vegetable Crops (Plant Science)
Charles L. Bevins	Microbiology & Immunology
Linda Bisson	Viticulture & Enology
Caroline Bledsoe	Soils and Biogeochemistry
David Block	Viticulture & Enology
Eduardo Blumwald	Viticulture & Enology/Chemical Engineering and Materials Science
Sue Bodine	Neurobiology, Physiology and Behavior (NPB)
Laura Borodinsky	Physiology & Membrane Biology UCDMC
Richard Bostock	Plant Pathology
Kent Bradford	Plant Sciences, Dir. Seed Biotech Center
Christine Bruhn	Food Science & Technology
Alan Buckpitt	VM: Molecular Biosciences
Sean Burgess	Molecular & Cellular Biology
Judy Callis	Molecular & Cellular Biology
Christopher Calvert	Animal Science
Simon Chan	Plant Biology
Barbara Chapman	Neuroscience
Hongwu Chen	Biochemistry & Molecular Medicine
Xi Chen	Chemistry

Xinbin Chen	Comparative Oncology
Holland Cheng	Molecular & Cellular Biology
Simon Cherry	Biomedical Engineering
Nipavan Chiamvimonvat	Internal Medicine; Division of Cardiovascular Medicine
Joanna Chiu	Entomology
Gitta Coaker	Plant Pathology
Luca Comai	Plant Biology
Douglas Cook	Plant Pathology
Stephen Cramer	Applied Science
Beate Crossley	California Animal Health and Food Safety Laboratory System
Abhaya Dandekar	Plant Sciences
Satya Dandekar	MED: Medical Microbiology & Immunology
Sheila David	Chemistry
Cristina Davis	Mechanical and Aeronautical Engineering
Scott Dawson	Microbiology
Katayoon (Katy) Dehesh	Plant Biology
Wenbin Deng	Cell Biology and Human Anatomy:MED
Elva Diaz	Neuroscience
Zhi Ding	Electrical & Computer Engineering
Georgia Drakakaki	Plant Sciences
Don Durzan	Environmental Horticulture
Jason Eiserich	Nephrology: INT MED
Nael El-Farra	Chemical Engineering & Material Science
Marc Facciotti	Biomedical Engineering
Robert Fairclough	Neurology: MED
Bryce Falk	Plant Pathology
Roland Faller	Chemical Engineering & Material Sciences
Zhiliang (Julia) Fan	Biological & Agricultural Engineering
Katherine Ferrara	Biomedical Engineering
Oliver Fiehn	Genome Center
Vladimir Filkov	Computer Science
Andrew Fisher	Chemistry
Paul Fitzgerald	MED: Cell Biology & Human Anatomy
Annaliese Franz	Chemistry
Christopher Fraser	Molecular & Cellular Biology
David Furlow	Section of Neurobiology, Physiology, and Behavior
Charles Gasser	Molecular & Cellular Biology

J. Bruce German	Food Science & Technology
Jacquelyn Gervay-Hague	Chemistry
Soheil Ghiasi	Electrical & Computer Engineering
David Gilchrist	Plant Pathology
Tom Gradziel	Plant Sciences
Jeffrey Gregg	MED: Pathology
Leigh Griffiths	Medicine & Epidemiology
Andrew Groover	Plant Biology
Paul Gumerlock	MED: Hematology/Oncology
Ting Guo	Chemistry
Fawaz Haj	Nutrition
Bruce Hammock	Entomology & Cancer Center
Stacy Harmer	Plant Biology
Richart W. Harper	Division of Pulmonary/Critical Care Medicine
Volkmar Heinrich	Biomedical Engineering
Wolf-Dietrich Heyer	Microbiology
David Horsley	Mechanical & Aeronautical Engineering
Krassi Hristova	Soils and Biogeochemistry
You-Lo Hsieh	Textiles & Clothing
Neil Hunter	Microbiology
Kentaro Inoue	Plant Sciences
M. Saif Islam	Electrical & Computer Engineering
Roslyn-Rivkah Isseroff	MED: Dermatology
Tina Jeoh	Biological & Agricultural Engineering
Thomas Jue	MED: Biochemistry
Carl Keen	Nutrition
Darshan Kelley	Western Human Nutrition Research Center, ARS, USDA Dept. of Nutrition
Ian Kennedy	Mechanical & Aeronautical Engineering
Richard Kiehl	Electrical & Computer Engineering
Dan Kliebenstein	Vegetable Crops & Weed Science
Paul Knoepfler	Cell Biology & Human Anatomy
Anne Knowlton	Cardiovascular Division, Dept. of Medicine & Dept. of Medical Pharmacology & Toxicology
Patrice Koehl	Computer Science
Ian Korf	Section of Molecular & Cellular Biology
Tonya Kuhl	Chemical Engineering & Material Science
Hsing-Jien Kung	MED: Biochemistry / UC Davis Cancer Center

John Labavitch	Plant Sciences
J. Clark Lagarias	Molecular & Cellular Biology
Kit Lam	MED: Hematology & Oncology
Donald Land	Chemistry
Delmar Larsen	Chemistry
Janine LaSalle	MED: Microbiology & Immunology
Jerold Last	Pulmonary / Critical Care Medicine
Kent Leach	Biomedical Engineering
Julie Leary	Biochemistry & Mass Spectrometry, Dept. of Chemistry
Carlito Lebrilla	Chemistry
Pamela Lein	Molecular Biosciences
Noelle L'Etoile	Center for Neuroscience & Dept. of Psychiatry & Behavioral Sciences
Harris Lewin	Evolution & Ecology
Su-Ju Lin	Center for Genetics & Development & Section of Microbiology - UCD Cancer Center
Bo Liu	Plant Biology
Gang-yu Liu	Chemistry
Marjorie Longo	Chemical Engineering & Material Sciences
Angelique Louie	Biomedical Engineering
Paul Luciw	MED: Pathology
Neville Luhmann, Jr.	Electrical & Computer Engineering
Laura Marcu	Biomedical Engineering
Karen McDonald	Chemical Engineering & Material Sciences
Claude Meares	Chemistry
Juan Medrano	Animal Science
Richard Michelmore	Plant Sciences, CBS, Med Micro, Dir. Genome Center
Lisa Miller	Department of Anatomy, Physiology & Cell Biology, CNPRC, School of Veterinary Medicine
David Mills	Viticulture & Enology
Maria Mudryj	Medical Microbiology & Immunology
William J. Murphy	Department of Dermatology
James Murray	Animal Science / Genetic Engineering Large Animals
Krishnan Nambiar	Chemistry
Lorena Navarro	Microbiology
Florence Negre-Zakharov	Plant Sciences

John Newman	Nutrition - USDA, ARS, Western Human Nutrition Research Center
Stephen Noctor	Neuroscience
Jan Nolta	UCDHS: Dept. of Hematology & Oncology
Thomas North	Center for Comparative Medicine
Jodi Nunnari	Molecular & Cellular Biology
Martha O'Donnell	Physiology & membrane Biology; School of Medicine
David Ogrydziak	Food Science & Technology
Tingrui Pan	Biomedical Engineering
Rebecca Parales	Microbiology
Atul Parikh	Biomedical Engineering
Anthony Passerini	Dept. of Biomedical Engineering
Timothy Patten	Chemistry
Niels Pedersen	Department of Medicine and Epidemiology
Ronald Phillips	Chemical Engineering & Material Science
Kent Pinkerton	Pediatrics, School of Medicine
David Pleasure	Neurology & Pediatrics
Ann Powell	Plant Sciences
Robert Powell	Chemical Engineering & Material Science
Jerry Powell	Hemat & Oncol: Med
Robert Powell	Chemical Engineering & Material Science
Martin Privalsky	Microbiology
Jinyi Qi	Biomedical Engineering
Subhadip Raychaudhuri	Biomedical Engineering
David Reid	Food Science & Technology
Michael Reid	Environmental Horticulture
Alexander Revzin	Biomedical Engineering
Robert Rice	Environmental Toxicology
Subhash Risbud	Chemical Engineering & Material Science
William Ristenpart	Chemical Engineering & Materials Science and Dept. of Food Science
David Rocke	Inst. For Data Analysis & Visualization
Ray Rodriguez	Molecular & Cellular Biology
Pamela Ronald	Plant Pathology
John Rutledge	MED: Endocrinology
Jon Sack	Neurobiolgy, Physiology & Behavior
Earl Sawai	Pathology & Laboratory Medicine
Kate Scow	Land, Air & Water Resources
David Segal	Pharmacology
Erkin Şeker	Electrical & Computer Engineering

Barbara Shacklett	Medical Microbiology & Immunology: School of Medicine
Jared Shaw	Chemistry
Kazuhiro Shiozaki	Microbiology
Wendy Silk	Soils and Biogeochemistry
Eduardo Silva	Biomedical Engineering
Scott Simon	Biomedical Engineering
David Slaughter	Biological & Agricultural Engineering
Jay Solnick	MED: Infectious & Immunological Diseases
Daniel Starr	Center for Genetics and Development
Francene Steinberg	Dept. of Nutrition
Pieter Stroeve	Chemical Engineering & Material Science
Gang Sun	Textiles & Clothing
Ilias Tagkopoulos	Computer Science
Dean Tantillo	Chemistry
Alice Tarantal	Pediatrics, School of Medicine, CA National Primate Center
Steven Theg	Plant Biology
Li Tian	Plant Sciences
Michael Toney	Chemistry
Jose Torres	MED: Medical Microbiology & Immunology
Renee Tsolis	Med Microbiology & Immunology: MED
Richard Tucker	Cell Biology & Human Anatomy
Judy Van de Water	Division of Rheumatology/Allergy and Clinical Immunology
Alison van Eenennaam	Animal Science
Marta van Loan	Nutrition
Jean VanderGheynst	Biological & Agricultural Engineering
John Voss	Biochemistry and Molecular Medicine
Bart Weimer	Population Health & Reproduction
Robert Weiss	Internal Medicine: Division of Nephrology, School of Medicine
Valerie Williamson	Nematology
Barry Wilson	Animal Science & Environmental Toxicology
David Wilson	Molecular & Cellular Biology
Matthew Wood	Environmental Toxicology
Reen Wu	MED: Pulmonary / Critical Care Medicine
Stefan Wuertz	Civil & Environmental Engineering
Heike Wulff	Pharmacology

Lifeng Xu	Microbiology
Soichiro Yamada	Biomedical Engineering
Yin Yeh	Applied Science
Tilahun Yilma	VM: Pathology, Microbiology & Immunology
John Yoder	Plant Sciences
Yohei Yokobayashi	Biomedical Engineering
Glenn Young	Food Science & Technology
Ruihong Zhang	Biological & Agricultural Engineering

The Value of Internships

Over the last 20 years (even before the formal DEB program was established), we have placed pre-doctoral students in a variety of biotechnology companies for their industrial research experience. They include:

Advanced Micro Devices (AMD)
Agilent Technologies
AgraQuest
Alza
Amgen
Amyris
Antibodies, Inc.
Aqua Bounty
Bayer
Berlex Biosciences
BioMarin Pharmaceuticals, Inc.
Carollo
Celera AgGen
Cytokinetics
DuPont
Exelixis
Expression Systems
Genencor
Genentech
Hoffmann Eitle
ICOS
Institut Charles Sadron
Marone Bio Innovations
Maxygen
Monsanto, Calgene Campus;
Novartis (formerly Chiron)
Novozymes Biotech
OncoMed
Scios
Somagenics
Syntex

Recovery Sciences
Roche Biosciences
State Water Control Resources Board
Unilever
Ventria Biosciences
and others

Industry Partners gain many things from internships:

- Access to highly talented creative researchers
- Opportunity to gain inside track on future employees
- Through students, further collaboration with scientists on campus
- Participate in the annual retreat to meet UC scientists students, potential interns, other company scientists
- Potential to use UC facilities through the collaboration
- Opportunity to participate in weekly campus seminars

Students gain much from internships:

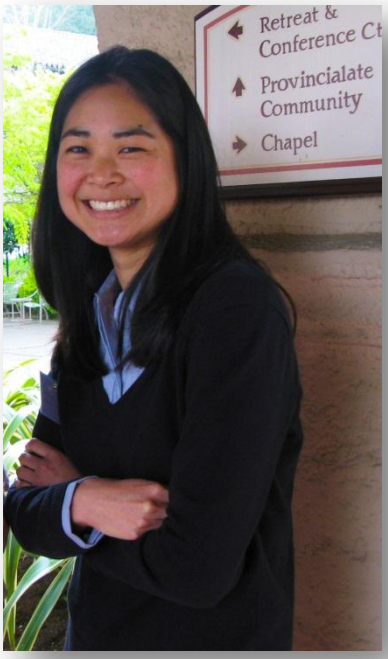
- Ability to work in a highly creative non-academic environment
- Opportunity to participate in focused team approach to defined research goals
- Ability to use equipment and facilities not available on campus
- Discover the type of environment, which suits future career goals
- Participate in industry seminars
- Enhanced curriculum vitae: reference letters and new skills
- Access to potential employment opportunities

Currently, there are 230 students enrolled, so we need more Academic-Industry Partnerships.

In Memoriam Christina Takanishi

Our Biotechnology Family is deeply saddened to learn of the passing of our dear Christina (Chris) Takanishi. She was just beginning her new journey as a young scientist... a PhD in Cell and Developmental Biology with a Designated Emphasis in Biotechnology. Chris was a stellar young scholar, who received a Biotechnology Fellowship from 2007-2009. She was thrilled to do her internship at Genentech, in hopes of launching her career in the biotechnology industry.

There is much to remember and be thankful for as we reminisce about Chris and the way she shared her life with those around her. I recall her smiling face as she interacted with children at the Biotech Event during Picnic Day. She was more than just a scientist; she was a caring human being who wanted to make a difference in the world. She exemplified the qualities of a UC Davis Aggie and a member of the Designated Emphasis in Biotechnology graduate program.



To all of Chris's loved ones, I wish you peace and blessings as you grieve.

From **Professor Jie Zheng**, Dept. of Physio & Membrane Bio:

> She was the first to join our research team when I set up the lab at UC Davis eight years ago. Chris was a fabulous lab mate and friend, having a positive influence on everyone around her. She will be missed by all of us who were fortunate to have worked together with her."

Christina was a Biotech Fellow

Prof. Matthew Wood (Christina's mentor), Heather Bolstad and Christina

Good bye Christina, we'll miss you!