Twenty Second Annual

Biotechnology Training Retreat

Saturday,
March 23, 2013

Christian Brothers Retreat & Conference Center
Napa, CA

Twenty Second Annual Biotechnology Training Retreat

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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2013 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 **2012-13 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. The DEB graduate program continues to grow to over 240 students from 30 graduate programs. Each of our students is listed on the DEB website (www.deb.ucdavis.edu). Our journal article, *The University of California, Davis, collaborative model of biotechnology education and training* was published in October 2012 in the Journal of Commercial Biotechnology.

Many thanks go out to the Biotech Team. The logistics of this retreat have been expertly overseen by **Marianne Hunter**, Assistant Director of Administration, Associate Director, **Dr. Denneal Jamison-McClung** and our new Program Assistant**, Jackie Baladerama.** Without their dedicated service, this annual event would not happen. We miss **Demian Sainz**, who left the Program in the fall to become the Student Affairs Officer for the Genetics Graduate Program.

It is a pleasure to introduce our current Biotechnology Fellows. Our five **NIH Fellows** include: **Brandon Brown,** Pharmacology & Toxicology (preceptor is Heike Wulff); **Jennifer Lee,** Biomedical Engineering (preceptor is Kyriacos Athanasiou); **Gabriel Rodriguez**, Chemistry (preceptor is Shota Atsumi); **Amelia Manlove,** Chemistry (preceptor is Sheila David) and **Abigail "Abby" Wu,** Genetics (preceptors are David Segal and Ian Korf). Our four **Biotechnology Fellows** (industry and campus fellowships) include: **Jesse Bakke**, Nutritional biology (preceptor is Fawaz Haj); **Kristin Beck,** BMCDB (preceptor is Ian Korf); **Siobhan Halloran**, Chemical Engineering (preceptor is Bill Ristenpart) and **Alan Lombard**, BMCDB (preceptor is Maria Mudryj).

The **2012-13 CREATE-IGERT UC Davis 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: Geoffrey Benn, Marta Bjornson, Timothy Butterfield, Elenor Castillo, Mitch Elmore, and Rachel Kerwin. 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 pre-doctoral candidates

and recent graduates (Lucas Arzola, Dawn Chiniquy, Tiffany Glavan, Ben Lindenmuth, Chris Simmons, and Mark Wolf). We are very proud of all of them.

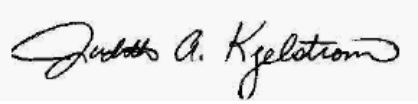
We will be selecting our **2013-14 NIH Fellows** in May. Nomination forms are on the web at www.deb.ucdavis.edu and the application deadline is **Tuesday, April 23rd.** Remember, you must be a member of the DEB to be eligible for funding, since it is the formal training program for the NIH training grant.

In regard to DEB internships, we placed over 20 students from 2012-summer 2013. **1) BioMarin Pharmaceuticals**: Dawn Fedor and Charity Ono; **2) Buck Institute:** Barbara Bailus; **3) Burrill & Co.:** Zane Starkewolfe**; 4) Celgene SF:** Crystal Berger and Astra Chang**; 5) Genentech**: Daniel Melters (regulatory affairs) and Jared Moore; **6) Igenica:** Anna Erickson; **7) Marrone Bio Innovations, Inc.**: Geetika Joshi; **8) Monsanto-Calgene campus**: Anand Rao; **9) Nestle (Switzerland):** David Dallas; **10) Novozymes:** Tiffany Glavan and Dave Woessner;**11) Nunhems**: FeiYian Yoong; **12) Prozyme:** Danielle Aldredge; **13) Stryker, Inc - Regulatory Affairs Dept.:** Michelle Tu; **14) Sandia –Livermore National Lab**: Sean Gilmore; **15) Texas Instruments**: Erin Fong; **16) UC Davis Innovation Access** - **Technology Transfer**: David Olivos; **17) UC Davis School of Medicine – Bioethics**: Mary Saunders. **18) UC Davis Professors for the Future**: Collin Ellis. 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 **Nektar Therapeutics, Intel, Sutro, Lpath** and others.

A number of our students graduated in 2012, earning a PhD with the Designated Emphasis in Biotechnology. DEB graduates have found positions in both academia and industry, some examples include: **Lucas Arzola** is currently a post doc in the McDonald lab, but is launching his start-up company, **Inserogen** (UC Davis will provide incubator space). **Crystal Berger** is still working at Celgene SF (post internship). **David Dallas** is a post-doctoral fellow (funded by the USDA National Institute of Food and Agriculture) in the Foods for Health Program at UC Davis. **Tiffany Glavan** is a scientist at **IntelligentMDX** in Cambridge, Mass.; **Dmitry Grapov** is a post-doctoral fellow in the West Coast Metabolomics Center in the Genome Center at UC Davis**. Rashida Lathan** is a post-doctoral fellow at Intstitute Pasteur, dept. of Mouse Genetics in Paris, France**. Maria (Olu) Ogunyankin** is a post-doc at the University of Minnesota. **Joseph Ramahi** is a post- doctoral fellow at St. Jude in Memphis, TN. **Zane Starkewolfe** was hired by Steve Burrill & Company after his internship. **John Strum** is a chemist with **OSHA** (federal government) in Salt Lake City, Utah. He is currently seeking an MS in Industrial Hygiene, so he can advance in the organization**. Erin Schwartz** is currently a post-doctoral fellow at Stanford University. **Ambrose Williams** turned his co-op into a full time career scientist position at Genentech. **Shuai Wu** is currently a scientist (mass spec expert) at DVS Science in Sunnyvale, CA.

We sincerely thank you for coming to our annual biotechnology training retreat. Please enjoy the day and make as many new friends as possible. Also enjoy the scenery, the food and wine as well as the great presentations and posters.

All the Best,



Judy Kjelstrom
Director,
UC Davis Biotechnology Program

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

Bruce D. Hammock, Director
Martina Newell-McGloughlin, Co-Director
Karen McDonald, Co-Director

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Ian Kennedy (Mechanical & Aeronautical Engineering)
Tonya Kuhl (Chemical Engineering)
J. Clark Lagarias (Molecular & Cellular Biology)
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Atul Parikh (Applied Science)
David Segal (Pharmacology/Genome Center)

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Vishva Dixit, Genentech
Tim Conner, Monsanto, Calgene Campus
Judith A. Kjelstrom, Program Coordinator

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UC Davis Biotechnology Program

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UC Davis Twenty Second Annual Biotechnology Training Retreat
March 23, 2013
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 – 8:45 am	**Welcome** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology **Vision Statement for Research** Harris Lewin, Vice Chancellor of Research, UC Davis
8:45 – 12:00 pm	**Morning Session** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology
8:45 – 10:50 am	**Presentations** 8:45 am Jennifer Lee..... *Mentor: Kyriacos Athanasiou* 9:10 am **Feng Xu**..... **Novozymes** 9:30 am Gabriel Rodriguez..... *Mentor: Shota Atsumi* 9:55 am Brandon Brown..... *Mentor: Heike Wulff*
10:20 – 10:35 am	**Break / Poster Viewing**
10:35 – 12:00 pm	**Presentations** 10:35 am **Beth Savidge**..... ..... **Monsanto-Calgene** 10:55 am Amelia Manlove..... *Mentor: Sheila David* 11:20 am Abigail "Abby" Yu..... *Mentor: Segal/Korf* 11:45 pm Martina Newell-McGloughlin ..... Bioethics Question (Handout)

Afternoon Schedule

12:00 – 1:00 pm	**Lunch / Poster Viewing**
1:00 – 1:15 pm	**Photo Taking for NIH/Biotech Fellows & CREATE-IGERT Trainees**
1:15 – pm	**Afternoon Session Chair** Karen McDonald Co-Director, NIH Training Grant in Biomolecular Technology
1:15 – 2:55 pm	**Presentations** 1:15 pm Martina Newell-McGloughlin..... Bioethics Question (Discussion) 1:35 pm Alan Lombard..... *Mentor: Maria Mudryj* 2:00 pm **Kristy Hawkins** ..... **Amyris Biotechnologies** 2:15 pm Kristen Beck ..... *Mentor: Ian Korf* 2:40 pm **John Lewicki** .... **OncoMed Pharmaceuticals**
2:55 - 3:10 pm	**Short Break (20 min)**
3:10 – 4:30 pm	**Presentations** 3:10 pm Siobhan Halloran ..... *Mentor: Bill Ristenpart* 3:35 pm Jesse Bakke ..... *Mentor: Fawaz Haj* 4:00 pm **Chandra Richter** ..... ***E.J. Gallo Winery*** 4:15 pm **Aaron Nguyen** ..... ***Celgene, SF***
4:30 pm	**Closing Remarks** Martina Newell-McGloughlin Co-Director, NIH Training Grant in Biomolecular Technology

5:20 pm – Bus departs Napa

2013 Poster Titles

A. **"Quantitative Proteomics Approach to Identify Rice Proteins Induced During the XA21-Mediated Immune Response Against the Bacterial *Xanthomonas oryzae* pv. *oryzae*"**

Daniel Caddell*[1] , Ophelia Papoulas[2], Chang Jin[1] Park, Edward Marcotte[1], and Pamela Ronald[1]
[1]Department of Plant Pathology, University of California, Davis
[2]Center for Systems and Synthetic Biology and Department of Chemistry and Biochemistry, Institute for Cellular and Molecular Biology, University of Texas, Austin, TX

B. **"Conversion of Lignocellulosics to a Renewable Fuel Source and a Valuable Chemical"**

Shuchi Desai*, Christine Rabinovich-Deere, and Shota Atsumi
Department of Chemistry, University of California, Davis

C. **"Attenuated Calcium Entry and Cytokine Release to the Environmental Toxicat, PBDE in Isolated Human PBMCS"**

Marjannie Eloi-Akintunde*[1,2], Diptiman D. Bose[4], Isaac N. Pessah,[2,4,5] and Judy Van de Water [1,2,4]
[1]School of Medicine, Division of Rheumatology, Allergy and Clinical Immunology, University of California, Davis
[2]NIEHS Center for Children's Environmental Health, University of California, Davis
[3]The M.I.N.D. Institute, University of California, Davis
[4]Department of Veterinary Molecular Biosciences, University of California, Davis

D. **"An Orchestra of Lights: Optogentic Control of Transcription"**

Alexander G. Gulevich* and J. Clark Lagarias
Department of Molecular and Cellular Biology, University of California, Davis

E. **"Inducing Matrix Remodeling to Increase Mechanical Properties of Engineered Tissue"**

Pasha Hadidi* and Kyriacos A. Athanasiou
Department of Biomedical Engineering, University of California, Davis

F. **"Nanostructured Materials for Advanced Bioanalytical and Biomedical Platforms"**

Özge Kurtuluş*[1], Pallavi Daggumati[2], Christopher Chapman[3], Damla Dimlioğlu[2], Atul Parikh[1,3], and Erkin Şeker[2]
[1]Department of Chemical Engineering and Materials Science, University of California, Davis
[2]Department of Electrical and Computer Engineering, University of California, Davis
[3]Department of Biomedical Engineering, University of California, Davis

***DEB Graduate Student**

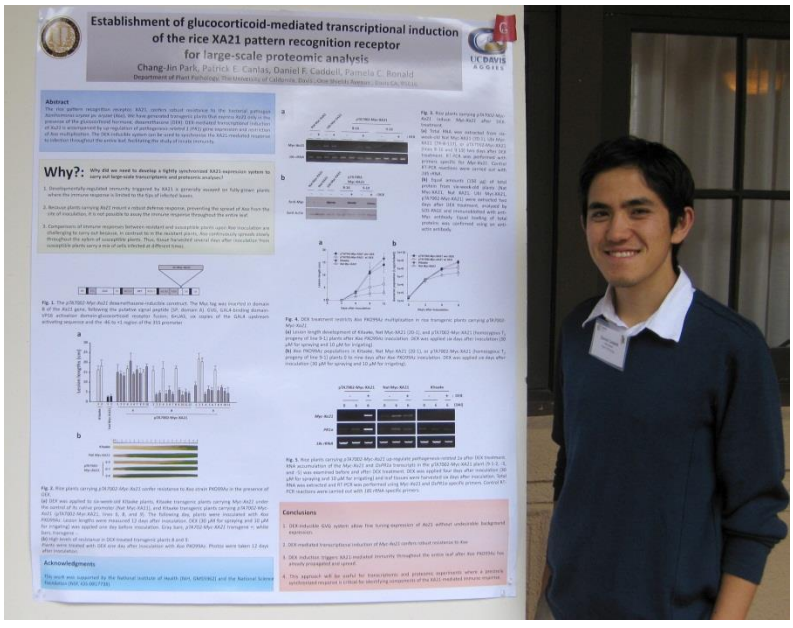
G. **"Fermentation of *Agrobacterium tumefaciens* for Large Scale Transient Expression of Transgenic Proteins in Plants"**
Ingrid Leth* and Karen McDonald
Department of Chemical Engineering and Materials Science, University of California, Davis

H. **"Potent and Selective Inhibition of A-to-I RNA Editing with 2'-*O*-Methyl/Locked Nucleic Acid-Containing Antisense Oligoribonucleotides"**
Rena A. Mizrahi*, Nicole T. Schirle, and Peter A. Beal
Department of Chemistry, University of California, Davis

I. **"Nanobacterial Biochemical Production"**
Nicole Nozzi*,John Oliver*, Iara Machado, Hisanari Yoneda, and Shota Atsumi
Department of Chemistry, University of California, Davis

J. **"Studying the Endomembrane Trafficking Processes Involved in Cell Wall Deposition"**
Natasha Worden*[1], Alex Schultink[2], Markus Pauly[2], Georgia Drakakaki[3]
[1]Department of Plant Sciences, University of California, Davis
[2]Department of Plant and Microbial Biology, University of California, Davis

K. **"The PLM Homotetramer Has a Structural Basis That Parallels That of PLB: The Leucine Zipper"**
Garrick K.Yuen*, Luiza Mamikonian, Joseph Li, Vladimir Yarov-Yarovoy, Julie Bossuyt, Donald M. Bers
Department of Pharmacology, University of California, Davis



***DEB Graduate Student**

2013 Presentation Titles

1. **"Influence of Thyroid Hormones in Cartilage Tissue Engineering"**
   Jennifer K. Lee*, Courtney A. Gregg, Jerry C. Hu, Kyriacos A. Athanasiou
   Department of Biomedical Engineering, University of California, Davis

2. **"Novozymes and Advances in Industrial Biotechnology for Biomass Conversion"**
   Feng Xu, PhD
   Department of Protein Chemistry, Novozymes, Inc., Davis, California 95618

3. **"Expanding the Repertoire of Enzymatic Reactions for Production of Non-Natural Chemicals"**
   Gabriel Rodriguez*and Shota Atsumi
   Department of Chemistry, University of California, Davis

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

5. **"Monsanto's Contribution to Global Agricultural Sustainability"**
   Beth Savidge, PhD
   Monsanto, Calgene Campus, Davis, CA

6. **"Synthesis and Muty-Mediated Repair of DNA Substrate Analogs"**
   Amelia Manlove*, Paige McKibbin, Tyler Allred, and Sheila S. David
   Department of Chemistry, University of California, Davis

7. **"Using Artificial Transcription Factors as Novel Tools for Malaria Treatment"**
   Abigail Yu*, Ian F. Korf, and David J. Segal
   Department of Molecular and Cellular Biology, University of California, Davis

8. **"Ethics Discussion"**
   Martina Newell-McGloughlin, DSc
   Co-Director of NIH Training Grant in Biomolecular Technology, University of California, Davis

***DEB Graduate Student**

9. **"Androgen Sensitive miRNAs Regulate the Cell Cycle via p27 and pRb"**
Alan Lombard*, SJ Libertini, K Fornaci, A Thunen, and Maria Mudryj
Department of Medical Microbiology and Immunology, University of California, Davis

10. **"Amyris Biotechnologies, Inc: The Industrialization of Synthetic Biology"**
Kristy Hawkins, PhD
Amyris Biotechnologies, Inc. Emeryville, CA 94608

11. **"Novel Methods in Proteomics: What's Human About the Human Milk Proteome?"**
Kristen Beck*, Brett Phinney, Katie Hinde, Ian Korf, and Danielle Lemay
Department of Molecular Biology, University of California, Davis

12. **"Targeting Key Pathways of Cancer Stem Cells"**
John Lewicki, Tim Hoey, Ann Kapoun, and Austin Gurney
OncoMed Pharmaceuticals
800 Chesapeake Drive, Redwood City CA

13. **"Airborne Disease Transmission via Expiratory Aerosols"**
Siobhan K. Halloran*[1], Anthony S. Wexler[2,3,4,5], and William D. Ristenpart[1,6]
[1]Department of Chemical Engineering and Materials Science,
[2]Department of Mechanical and Aerospace Engineering,
[3]Air Quality Research Center,
[4]Department of Civil and Environmental Engineering,
[5]Department of Land, Air, and Water Resources,
[6]Department of Food Science and Technology,
University of California, Davis

14. **"Pyruvate Kinase M2 Deficiency Promotes a Brown Fat-Like Phenotype in White Adipocytes"**
Jesse Bakke*[1], Ahmed Bettaieb[1], Naoto-Nagata, Alexey Tomilov, Siming Liu, Costas Lyssiotis, Yannan Xi, Daniel Abou Bechara, John Asara, Gino Cortopassi, Lewis Cantley, and Fawaz G. Haj
[1]Equal Contribution
Department of Nutrition, University of California, Davis

15. **"A Metabolomics Approach to Study Chardonnay Fermentations"**
Chandra L. Richter[1], Adam Kennedy[2], Lining Guo[2], and Nick Dokoozlian[1]
[1]E & J Gallo Winery, P.O. Box 1130, Modesto, CA 95353
[2]Metabolom, Durham, NC 27560

***DEB Graduate Student**

Oral Presentation Abstracts

NIH FELLOW: Jennifer K. Lee

INFLUENCE OF THYROID HORMONES IN CARTILAGE TISSUE ENGINEERING

Presenter: Jennifer K. Lee*
Authors: **Jennifer K. Lee***, Courtney A. Gregg, Jerry C. Hu, Kyriacos A. Athanasiou
Affiliations: Department of Biomedical Engineering, University of California, Davis
Preceptor: Kyriacos A. Athanasiou

As an avascular, aneural, and acellular tissue, hyaline articular cartilage is notoriously poor at self-healing after trauma- or wear-induced damage. Tissue engineering can provide a viable solution to restore tissue function. Our lab has developed a scaffoldless cartilage tissue engineering process termed self-assembly. The application of various chemical and mechanical stimuli promotes generation of neocartilage with properties on mpar with native tissue. However, native cartilage exists as a spectrum of zones associated with not only different composition, but also organization. During structural development of growth plate cartilage, parathyroid hormone (PTH) maintains the proliferative chondrocyte pool, while triiodothyronine (T3), the activated form of thyroxine (T4), promotes the transition from proliferation to hypertrophy. This study's objective was to promote the organization of self-assembled neotissue by application of 100ng/mL PTH, T3, or T4 during week 1 or 3 of a 4-week culture period. Hormone application is hypothesized to influence the structural organization of constructs and in turn, influence their mechanical or biochemical properties. Chondrocytes were obtained from juvenile bovine joints and self-assembled in non-adherent 5mm agarose wells. The control group received chondrogenic medium (CHG) for 4 weeks, with hormone groups receiving 100ng/mL PTH, T3, or T4 in CHG during weeks 1 or 3. Constructs were evaluated mechanically, biochemically, and histologically after 28 days of culture. Week 1 T3 and T4 treatment resulted in significantly smaller constructs (diameter, thickness, wet weight, water %) but significant increases in compressive (up to 96% over control) and tensile (up to 145.8% over control) properties. These groups also led to significant reduction in glycosaminoglycan content (GAG/DW). T3 and T4 treatment at either week caused a significant increase in collagen content (col/DW) compared to PTH week 1 and control groups. Immunohistochemistry revealed that differences in T3- and T4-treated construct properties may be due to deposition of collagen X, an early marker of cartilage hypertrophy. This study demonstrates that non-growth plate chondrocytes are capable of responding to the thyroid hormones. Future studies include determining appropriate hormone dosages and timing, and generation of a tissue spectrum using hormone gradients.

***DEB Graduate Student**

COMPANY AFFILIATE: Novozymes, Inc.

NOVOZYMES AND ADVANCES IN INDUSTRIAL BIOTECHNOLOGY FOR BIOMASS CONVERSION

Presenter:	Feng Xu, PhD
Authors:	**Feng Xu**
Affiliations:	Novozymes, Inc. 1445 Drew Ave. Davis, CA – 95618
Email:	fxu@novozymes.com

Lignocellulosic biomass can serve as large scale and renewable feedstocks for energy and chemical industries, enabling the development of a bio-economy that can drastically reduce dependence on fossil materials and damage on environment. Economic conversion of biomass to fuels and other industrial chemicals requires highly effective and efficient lignocellulose depolymerization to platform molecules, such as sugars, that can be more easily transformed in selected chemical or biological processes. One of the most promising technologies to break down lignocellulose involves enzymes, the key enablers in biological carbon cycling and energy transfer. Extensive research efforts have been made during the recent emergence, and continuing development, of cellulosic bioenergy industry, particularly in the discovery of natural biomass-active enzymes and engineering of industrial enzyme biocatalysts, as exemplified by the progress made by Novozymes and partners. Novozymes' leading platform biotechnology for biomass conversion has been driven by exploration of natural diversity of well-known (hemi)cellulolytic enzymes, discovery of previously unknown biomass-active, non-hydrolytic enzymes, and engineering of enzymes for industrial performance. Recently, significant improvements, in terms of productivity and robustness, have been made on Novozymes Cellic CTec2 products, through the performance enhancement of multiple individual enzyme components such as cellobiohydrolase I and II and ß-glucosidase, as well as GH61 enzyme. More than a decade of cellulosic bioenergy R&D will soon be validated as industrial-scale plants coming on line.

NIH FELLOW: Gabriel Rodriguez

EXPANDING THE REPERTOIRE OF ENZYMATIC REACTIONS FOR PRODUCTION OF NON-NATURAL CHEMICALS

Presenter: Gabriel Rodriguez*
Authors: **Gabriel Rodriguez*** and Shota Atsumi
Affiliations: Department of Chemistry,
University of California, Davis
Preceptor: Shota Atsumi

Synthetic biology combines enzymes from various metabolic systems to construct new pathways to produce a valuable chemical. This approach may allow for low cost, renewable production of pharmaceutical drugs or precursors, chemicals, and fuels. However, since enzymatic reactions are employed, synthetic biology is often limited to the production of natural compounds. To expand beyond the production of natural compounds, existing enzymes must be modified to attain activity toward non-natural chemicals. My project focuses on engineering acetolactate synthase (Als) to produce a non-natural amino acid (NNAA) renewably. This enantiomerically pure NNAA is an important intermediate for drugs such as γ-secretase inhibitors for Alzheimer's disease and hepatitis C virus inhibitors. Although syntheses for this NNAA have been described, these methods are too expensive for large-scale preparation. Construction of this NNAA pathway begins with the modification of Als, which is responsible for the condensation of two pyruvates. We are applying directed evolution to generate Als mutants capable of condensing larger substrates necessary to produce our target. Libraries are constructed using the recently developed cloning method, Sequence and Ligation-Independent Cloning (SLIC). We are also constructing a strain of *Escherichia coli* lacking several competing pathways for pyruvate in order to attain high yield product in the future. Gene deletions that improve yield are confirmed using the isobutyraldehyde pathway, an analogous pathway to our target.

***DEB Graduate Student**

NIH FELLOW: Brandon Brown

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

Presenter: Brandon Brown*
Authors: **Brandon Brown***, Nichole Colman, and Heike Wulff
Affiliations: Department of Pharmacology, University of California, Davis
Preceptor: Heike Wulff

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 SKA-111, which displays 160-fold selectivity for KCa3.1 (EC_{50}= 30nM) over KCa2.3 (EC_{50}= 5μM) in whole-cell patch-clamp experiments. SKA-111 is a positive-gating modulator making the channel more sensitive to calcium activation.

In addition to our work in synthesizing new compounds we are also doing mutational work to identify the binding sites of the benzothiazoles on the KCa family ion channels. Recent work has led to the discovery of the binding pocket for the related benzimdazolone EBIO on KCa2.2 (4) and we are currently mutating the corresponding residues in the C-terminus of KCa2.3 and KCa3.1. This information will assist with Rosetta modelling of KCa2.3 and, as a consequence, allow us to be able to develop compounds based on the orientation of the binding pocket.

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.
4. Zhang M, Pascal JM, Schumann M, Armen RS, Zhang JF (2012) Identification of the functional binding pocket for compounds targeting small-conductance Ca^{2+}-activated potassium channels. *Nature Communications*. **3**:1021

***DEB Graduate Student**

COMPANY AFFILIATE: Monsanto, Calgene Campus

MONSANTO'S CONTRIBUTION TO GLOBAL AGRICULTURAL SUSTAINABILITY

Presenter:	Beth Savidge, PhD
Authors:	**Beth Savidge**
Affiliations:	Monsanto, Calgene Campus 1920 Fifth Street Davis, CA 95616
Email:	beth.savidge@monsanto.com

Monsanto is focused 100% on providing solutions to enable sustainable agriculture. Monsanto technology efforts that focus on providing Agricultural solutions to improve food production, conserve more and reduce inputs, and improve lives through key platforms in Germplasm Development, Biotechnology, and Agronomics will be highlighted.

NIH FELLOW: Amelia Manlove

SYNTHESIS AND MUTY-MEDIATED REPAIR OF DNA SUBSTRATE ANALOGS

Presenter: Amelia Manlove*
Authors: **Amelia Manlove***, Paige McKibbin, Tyler Allred, and Sheila S. David
Affiliations: Department of Chemistry and Materials Science, University of California, Davis
Preceptor: Sheila S. David

No cellular events are more fundamental to carcinogenesis and to cancer therapy than the dueling processes of DNA damage and repair. Research in the David laboratory focuses on the mechanisms of base excision repair (BER) glycosylases, which catalyze the removal of damaged bases from DNA. These enzymes' ability to find and repair damaged bases plays a crucial role in preventing mutations that may lead to cancer; paradoxically, these same functions may make them valuable targets for chemotherapeutic intervention. One such BER glycosylase, MUTYH, has been linked to hereditary colorectal cancer, while its *E. coli* homolog, MutY, has recently been suggested to participate in the cell death triggered by certain antimicrobials. MutY and MUTYH act as failsafes in preventing mutagenesis due to the oxidized guanine lesion 8-oxoguanine when it is mispaired to adenine. We are currently using synthetic substrate analogs, in conjunction with kinetics and cellular repair assays, to investigate how MutY locates its substrate from among the overwhelming excess of undamaged DNA in cells. Our results have begun to elucidate the substrate requirements of MutY/MUTYH-mediated DNA repair on both the molecular and cellular levels. These studies will help to provide an understanding of the origins and mechanisms of carcinogenesis that is critical to finding new and better ways to fight cancer.

***DEB Graduate Student**

NIH FELLOW: Abigail "Abby" Yu

USING ARTIFICIAL TRANSCRIPTION FACTORS AS NOVEL TOOLS FOR MALARIA TREATMENT

Presenter: Abigail Yu*
Authors: **Abigail Yu***, Ian F. Korf, and David J. Segal
Affiliations: Department of Molecular and Cellular Biology, University of California, Davis
Preceptors: Ian F. Korf and David J. Segal

Malaria is a disease caused by the parasitic protists *Plasmodium*, and continues to devastate developing countries: afflicting 250 million people, and killing over 600,000 annually. Current drug treatments, while effective, are threatened by the emergence of resistant parasite populations. We aim to utilize artificial transcription factor (ATF) technologies to develop novel tools for malaria treatment that are more flexible than the current drug catalog.

At their core, ATFs are chimeric proteins consisting of a DNA-binding domain for target recognition, and an effector domain that is capable of affecting gene expression. This model allows us to target previously "undruggable" targets, which are typically conserved protein active domains. In addition, ATFs can be coupled to cell-penetrating peptides (CPP), which provide robust cargo delivery across cellular membranes *in vitro* and *in vivo*. We have selected two gene targets within the *Plasmodium falciparum* (Pf) genome: carbamoyl-phosphate synthetase II (CPSII), which is essential for parasite viability, and the upstream C sequence (upsC) of the *var* gene family, which contributes to parasite virulence. To guide our ATFs, we are using the transcription activator-like effector (TALE) architecture; DNA-binding proteins that are amenable to protein engineering to specifically recognize genomic targets. To complete the ATF, TALEs are combined with a CPP for delivery, and an effector domain: VP64 for gene activation, or the PfHDAC for repression. Our aim is to disrupt target gene function in the parasite, resulting in lowered pathogen viability or virulence.

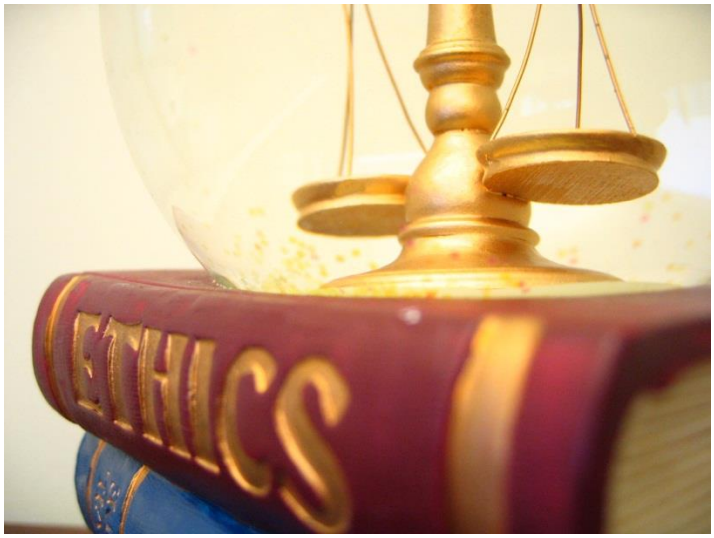
***DEB Graduate Student**

Bioethics Discussion

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

ETHICS QUESTION

COI AND LOOPER LAWS



COI AND LOOPER LAWS

Prof. Ally Hextall has spent many years working on a new drug for the treatment of Rheumatoid Arthritis (RA). The molecule she designed links a fragment of an anti-inflammatory drug with a protein that binds to TNF Alpha. Designing this new drug was made possible by two decades of research in the Immunology Lab at Long John Silver University Medical School, where Dr. Hextall works. Without the basic work in researching the molecular biology of this disease (the early stages of the research were funded by the National Institutes of Health), the highly specific drug would never have been developed.

At the same time that Dr. Hextall' research has yielded such promising results NIH support for biomedical research has declined. If this new agent were an effective treatment and a commercial success, it could be extremely helpful for Dr. Hextall, her department, and especially the medical school.

Dr. Hextall's research in the past five years has been supported by funds from Rheumania, Inc., a company that markets a number of drugs for arthritis. She was also given a consultancy fee of $50,000. Indeed, researchers working for Rheumania helped with methods for producing large amounts of the therapeutic molecule. Without the resources of a company, developing a marketable product would have been extremely difficult, if not impossible. Also, changes in federal regulations governing research encourage collaborations between academic scientists and companies in order to promote translation from bench to the clinic. There has also been a trend for institutions to hold equity interest in the start-up companies of their faculty. Because Rheumania is a local company and has been generous to the medical school, several members of the Long John Silver University Institutional Review Board (IRB) have bought stock in the company.

This long-standing relationship made it feasible for Rheumania and the medical school to enter into an agreement that entitles Rheumania to own the patent rights to all discoveries made in the course of the research it funds, and entitles Long John Silver University to 5% of Rheumania stock and a 5% royalty on sales of all products that result from the research.

In the highly competitive pharmaceutical industry, companies like Rheumania, Inc., seek patents on all promising discoveries. A patent gives the patent holder the right to exclude anyone else from making the patented product during the 20-year life of the patent. During those 20 years, the patent holder would hope to earn enough revenue from the product to recover the typically enormous costs of the basic and clinical research that leads to the production of the product. It is possible for the research and development of a drug, and the subsequent approval by the FDA, to take as long as 13 years and cost upwards of a billion dollars.

Included in the Rheumania-Long John Silver agreement is a non-disclosure agreement, whereby Rheumania will be able to protect its proprietary interests. There are restrictions regarding publication, including Rheumania's right to review all data and a mandate for Dr. Hextall to send to Rheumania all manuscripts at least 30 days prior to their submission for publication. This would allow Rheumania to delete any information that, according to the

company's directions, should not be published or presented, which might threaten its rights to any patentable invention.

Extensive use of the experimental drug in animal models of RA has been highly successful, producing the desired anti-inflammatory effects. Other similar drugs have been used without any serious toxicity. Thus, the drug is now ready for Phase I clinical trials. To encourage this collaboration, Rheumania would be pleased to pay for a trial at Long John Silver University Hospital. By all accounts, Dr. Hextall would be the ideal clinician to conduct the trial, because of her intimate knowledge of the drug. Rheumania is willing to issue to Dr. Hextall 2% of its common stock. In addition her husband will receive 2% of Rheumania stock and her 14-year-old son will receive 1%. If the trial is successful, this would go a long way toward covering her son's college tuition.

Dr. Hextall and her colleagues work in the Institute's Medical Clinic, which has a large number of patients with RA who would be available and thus easy to recruit for the clinical trial. Also, because of the department's reputation in research and patient care, Dr. Hextall would be able to enlist the cooperation of other hospital departments around the country in initiating a multicenter clinical trial of the new agent for treating RA. Dr. Hextall and her colleagues submitted a proposal to the IRB which they believe justifies the use of their clinic patients because of the benefit that this new drug will provide.

On the assumption that she will be conducting the trial, Dr. Hextall approaches her postdoc, Dr. Ian Sussman, to ask if he would join her in testing the new drug. But Dr. Sussman has been pursuing a different and potentially significant project, cloning a gene for gluten intolerance susceptability, and is close to completing his work on it. Completing the gluten project would put Dr. Sussman in an excellent position to apply for a faculty post and qualify for a grant under a newly announced federal program; working with Dr. Hextall means that he must set this work aside. Dr. Hextall tells Dr. Sussman that if he joins in the Rheumania project, the company will issue him shares of Rheumania common stock equal to 2% and also pay him a generous consulting fee. In addition, Dr. Sussman would continue to receive his postdoctoral stipend.

Dr. Sussman is already somewhat annoyed that Dr. Hextall is spending so much time at the Rheumania labs; he is not receiving the supervision for his gluten project from Dr. Hextall that he feels he needs. Long John Silver University Medical School allows a faculty member to spend 20% of his or her time on outside commitments, and Dr. Hextall is spending about 12-15 hours a week at the Rheumania labs. Since Dr. Hextall works closer to 60 hours a week (she always works on the weekends and takes work home every night), she does not feel that her time away from the medical school is excessive. Furthermore, this time away from her medical-school lab allows her to work on the therapeutic molecule using Lab equipment at Rheumania which her own lab lacks.

Meanwhile, Dr. Ellis Cheever, a colleague of Dr. Hextall's, asks Dr. Hextall for a small quantity of a reagent that has been used in the RA drug research. Drs. Cheever and Hextall were students together, entered the department at the same time, have openly discussed with each other all their research for many years, and are good friends. Each has been indispensable in the research success of the other. The secrecy covenant in the Long John Silver-Rheumania

contract now prevents Dr. Hextall from granting what would otherwise be Dr. Cheever's routine request for a reagent. Dr. Cheever wonders whether Dr. Hextall acted prudently in so restricting herself.

The IRB will meet soon to review Dr. Hextall' proposal to study the new drug at Long John Silver University Hospital. The IRB chair has been informed by the dean of the medical school how important this proposal is for the medical school and makes the IRB members aware of this.

1: What constitutes a conflict of interest?

2: Why does a conflict of interest matter? Why should the university be concerned?

3: What types of conflicts of interest can you identify in this case?

4: Should Long John Silver undertake the clinical drug trial? If so, should Dr. Hextall participate?

5: Does it matter if Dr. Hextall' financial interest in Rheumania consists of consulting fees, or common stock (equity), or both?

6: Should Dr. Hextall recommend to her patients that they enroll in the clinical trial if it is carried out at LJS? What about elsewhere?

7: Is Dr. Hextall being faithful to her obligation to provide an educational experience for Dr. Sussman?

8: Is Dr. Hextall acting properly in the way she chooses to allocate her time? Is this in violation of LJS policy?

9: How should Dr. Hextall respond to Dr. Cheever's request for the reagent?

10: What are the implications of the non-disclosure agreement for academic freedom?

BIOTECH FELLOW: Alan Lombard

ANDROGEN SENSITIVE miRNAs REGULATE THE CELL CYCLE VIA p27 AND pRb

Presenter: Alan Lombard*
Authors: **Alan Lombard***, SJ Libertini, K. Fornaci, A. Thunen, and Maria Mudryj
Affiliations: Department of Medical Microbiology and Immunology, University of California, Davis
Preceptor: Maria Mudryj

Prostate cancer is a commonly diagnosed malignancy and represents the second leading cause of cancer-related death in US men. Prostate cancer is initially dependent on androgens for survival and androgen signaling is mediated by the androgen receptor (AR). Due to the androgen dependency of prostate cancer, castration-therapy is a common course of action to combat the progression of this disease. However, almost inevitably, androgen independent prostate cancer later arises for which there are few effective treatment options available. Further research elucidating the pathways of androgen signaling and androgen independence is needed to discover novel therapeutic options for this disease. It has been shown that the AR represses the function of the cyclin dependent kinase inhibitor p27 and the tumor suppressor pRb, but the way in which this happens is not completely known and seems to be multi-pronged. Recent research has demonstrated that miRNAs play important roles in the progression of cancer and several miRNAs have been shown to be involved in prostate oncogenesis. Furthermore, several miRNAs have been shown to be regulated through androgen signaling. Two such miRNAs are miR-148a and miR-106b which are known to target p27 and pRb respectively but these findings have not been observed in prostate cancer. Here we show that these androgen sensitive miRNAs target p27 and pRb in the prostate cancer cell line LNCaP. We further show that these miRNAs provide a growth advantage to LNCaPs growing under castrate conditions indicating that these pathways are important for the AR to influence the cell cycle and that inhibition of miR-148a inhibits the proliferation of these cells. These results taken together indicate that the AR controls the cell cycle through miRNAs that target key regulators of cellular proliferation. It is our hope that inhibition of these miRNAs through antagomirs could be used therapeutically in the future.

***DEB Graduate Student**

COMPANY AFFILIATE: Amyris Biotechnologies, Inc.

AMYRIS BIOTECHNOLOGIES, INC: THE INDUSTRIALIZATION OF SYNTHETIC BIOLOGY

Presenter:	Kristy Hawkins, PhD**
Authors:	**Kristy Hawkins**
Affiliations:	Amyris Biotechnologes, Inc. 5980 Horton Emeryville, CA 94608

Amyris is building an integrated renewable products company by applying synthetic biology to genetically engineer microorganisms to serve as living cell factories. The Amyris story began with funding from the Bill and Melinda Gates foundation to produce the anti-malarial drug artemisinin in yeast. After successful completion of this work, Amyris continued to build upon this platform technology to produce other renewable fuels and chemicals. Along the way, Amyris has industrialized the nascent field of synthetic biology with groundbreaking capabilities for DNA assembly, strain engineering, and high-throughput screening that will accelerate the research time required to bring new products to market.

BIOTECH FELLOW: Kristen Beck

NOVEL METHODS IN PROTEOMICS: WHAT'S HUMAN ABOUT THE HUMAN MILK PROTEOME?

Presenter: Kristen Beck*
Authors: **Kristen Beck***, Brett Phinney, Katie Hinde, Ian Korf, and Danielle Lemay
Affiliations: Department of Molecular Biology, University of California, Davis
Preceptor: Ian Korf

Milk has served as the optimal neonatal nutrition source directing infant growth, neurological development, and immunity for millions of years. Presently, it has been shown that globally infants who breastfeed have a lower mortality rate than those who follow alternative feeding strategies such as formula[1]. One defining characteristic of mammals, the ability of mothers to provide milk for their young, is shown to strengthen infant development thus increasing their competitive advantage influencing later reproductive success[2]. The proteins in milk are a significant driving force of these benefits and have alternative end-points in addition to providing a rich amino acid source for the infant. For example, bioactive peptides bypass complete proteolysis in the gut and protect the infant against pathogenic bacteria and viruses[3]. Studying the proteins in milk will further allow us to understand their role in infant development and nutrition's role in evolution. Despite the biological necessity of milk, our knowledge of its components and their functions is incomplete. Even the most cutting edge proteomic studies have only been able to identify a fraction of the unique peptides in milk [4]. However, recent advancements in quantitative sequencing technologies have allowed us to investigate crescents associated with milk fat globules containing cytosolic RNA captured from mammary epithelial cells[5]. This sampling technique is most advantageous as it is non-invasive to the mother or infant. My project utilizes this advancement for the first time jointly with novel proteomics methods to describe the composition of milk in an unprecedented depth and to identify the components that are unique to humans.

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***DEB Graduate Student**

COMPANY AFFILIATE: OncoMed Pharmaceuticals

TARGETING KEY PATHWAYS OF CANCER STEM CELLS

Presenter:	John Lewicki, PhD
Authors:	**John Lewicki**, Tim Hoey, Ann Kapoun, and Austin Gurney
Affiliations:	Process Development, OncoMed Pharmaceuticals 800 Chesapeake Drive, Redwood City, CA 94063

OncoMed is focused on the discovery and development of a new generation of cancer therapeutics targeting cancer stem cells (CSCs). CSCs are a subpopulation of tumor cells that mediate tumor growth, metastasis and resistance to many current therapies. Therapeutic agents that effectively target CSCs have the potential to elicit more durable clinical responses in patients with a range of different cancers. With this goal in mind, we have focused on the discovery and development of monoclonal antibodies inhibiting key signaling pathways in CSCs, including members of the Notch, Wnt, and R-spondin/LGR pathways.

We have developed several technologies that enable the identification of CSCs and also afford an assessment of the effects of therapeutic agents on this subpopulation of tumor cells. These include novel methods for isolating and characterizing CSCs, including single cell gene expression analysis, and a human tumor bank, comprised of over 160 minimally-passaged human tumors. We have used these tumors in xenograft studies to assess the impact of our drugs on CSCs *in vivo* and to support the development of predictive biomarkers indicative of patients most likely to respond to our agents. These technologies have been applied to the discovery and development of a pipeline of novel drug candidates, including five products that are now being investigated in clinical trials. We have observed that a common mechanism associated with the blockade of key CSC pathways is the differentiation of chemo-resistant CSCs to a less tumorigenic cellular phenotype which is highly sensitized to the effects of chemotherapy. Thus, combinations of Wnt or Notch antagonists with standard chemotherapeutic agents lead to a profound reduction of CSCs in many different tumor types as will be highlighted in the presentation.

BIOTECH FELLOW: Siobhan K. Halloran

AIRBORNE DISEASE TRANSMISSION VIA EXPIRATORY AEROSOLS

Presenter: Siobhan K. Halloran*

Authors: **Siobhan K. Halloran*[1]**, Anthony S. Wexler[w,3,4,5], and William D. Ristenpart[1,6]

Affiliations: [1]Department of Chemical Engineering and Materials Science,
[2]Department of Mechanical and Aerospace Engineering,
[3]Air Quality Research Center,
[4]Department of Civil and Environmental Engineering,
[5]Department of Land, Air, and Water Resources,
[6]Department of Food Science and Technology,
University of California, Davis

Preceptor: William D. Ristenpart

The peak in influenza incidence during wintertime represents a longstanding, unresolved scientific question. One hypothesis, that airborne transmission is optimized for the low humidities and temperatures characteristic of wintertime, was corroborated by recent experiments using a guinea pig model, but little consideration has been given to the effect of the background airflow on transmission. Here we begin by providing a comprehensive model for assessing the probability of disease transmission via expiratory aerosols between test animals in laboratory conditions. The spread of aerosols emitted from an infected animal is modeled using dispersion theory for a homogeneous turbulent airflow. The concentration and size distribution of the evaporating droplets in the resulting "Gaussian breath plume" are calculated as functions of downstream position. The overall transmission probability is modeled with a combination of the time-dependent viral concentration in the infected animal and the probability of droplet inhalation by the exposed animal. We demonstrate that the breath plume model is broadly consistent with the guinea pig experiments. Next, we present our preliminary results for characterizing model airflow parameters in a laboratory setting. We measured the dispersivity of a tracer smoke plume, visualized using a laser and high-speed video. We show that the presence of a grid, which simulates the cage mesh used in transmission experiments, suppresses the turbulence and decreases the dispersivity. By limiting the spread of the plume, the probability of airborne disease transmission is increased for downstream.

***DEB Graduate Student**

BIOTECH FELLOW: Jesse Bakke

PYRUVATE KINASE M2 DEFICIENCY PROMOTES A BROWN FAT-LIKE PHENOTYPE IN WHITE ADIPOCYTES

Presenter: Jesse Bakke*

Authors: **Jesse Bakke*[1]**, Ahmed Bettaieb[1], Naoto Nagata, Alexey Tomilov, Siming Liu, Costas Lyssiotis, Yannan Xi, Daniel Abou Bechara, John Asara, Gino Cortipassi, Lewis Cantley, and Fawaz G. Haj

[1]Equal Contribution

Affiliations: Department of Nutrition,
University of California, Davis

Preceptor: Fawaz G. Haj

Brown adipose cells are specialized to dissipate energy as a physiological defense against hypothermia and obesity, and the appearance of brown-like adipocytes within white adipose tissue depots is associated with improved metabolic phenotypes. Brown fat expression has been extensively proposed as a potential mechanism to combat obesity. We demonstrate that pyruvate kinase M2 (PKM2) is expressed in brown and white adipose depots and adipocytes. Notably, shRNA-mediated depletion of PKM2 in white preadipocytes promotes the development of a brown fat-like program with a sharp increase in the expression of thermogenic genes such as UCP1, Prdm16, PGC-1a, elvol3, BMP7, and Cox8b. Induction of these genes is caused by PKM2 deficiency since reconstitution of knockdown cells with wild type PKM2 or constitutively active mutants (Y105F and K433E) abrogates the induction. In addition, metabolomic profile analyses of PKM2 deficiency reveal global changes in glucose metabolism specifically in glycolysis and pentose phosphate pathway that are comparable to *bona fide* brown adipocytes. Importantly, PKM2 deficiency in white adipocytes increases mitochondrial mass, enhances basal mitochondrial respiration, ATP turnover and mitochondrial respiratory capacity thus enabling fat cells to develop the respiratory activity characteristic of brown adipocytes. Moreover, transplantation of preadipocytes lacking PKM2 into mice gives rise to ectopic fat pads with morphological and biochemical characteristics of brown adipocytes and exhibit enhanced glucose uptake *in vivo*. Collectively, these findings indicate that PKM2 is a novel part of the molecular circuit that contributes to brown fat specification and may provide opportunities for the development of therapies for obesity and type 2 diabetes.

***DEB Graduate Student**

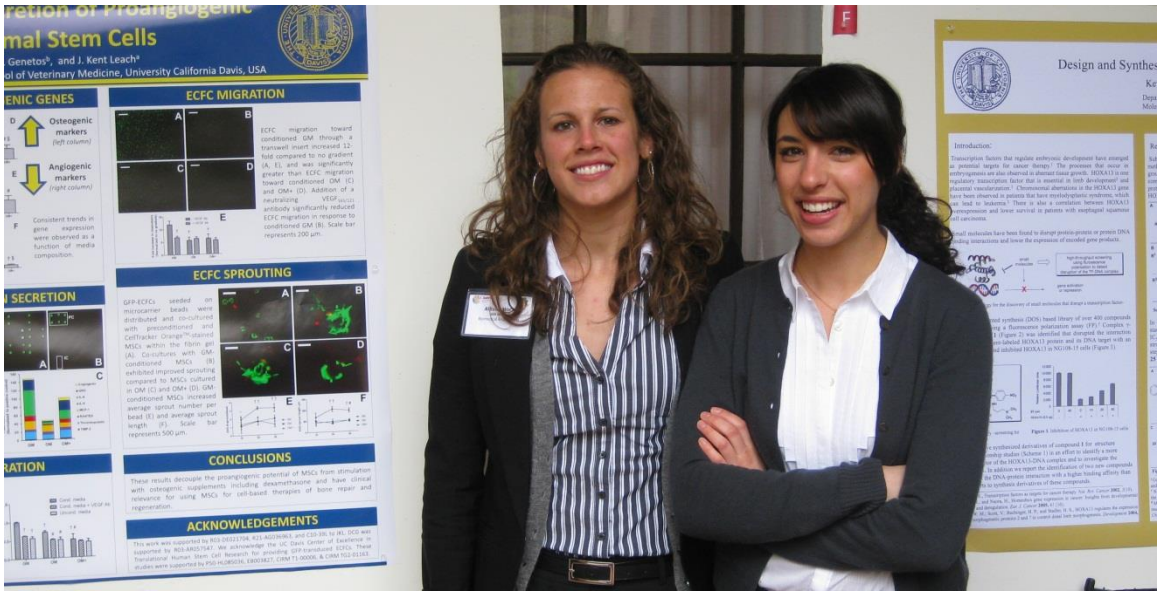
COMPANY AFFILIATE: E & J Gallo Winery

A METABOLOMICS APPROACH TO STUDY CHARDONNAY FERMENTATIONS

Presenter:	Chandra L., Richer, PhD
Authors:	**Chandra L. Richter**[1], Adam Kennedy[2], Lining Guo[2], and Nick Dokoozlian[1]
Affiliations:	[1]E & J Gallo Winery, P.O. Box 1130, Modesto, CA 95353 [2]Metabolom, Durham, NC 27560

The transformation of grape juice to wine is a complex metabolic relationship between two species, *V. Vinifera and S. Cerevisiae*. Grape juice, composed primarily of water, sugar, organic acids and additional secondary metabolites, provides nutrients for the yeast resulting in the production of wine, composed primarily of water, ethanol, glycerol, organic acids and additional components. The final molecular composition, developed from the grape/yeast relationship, contributes to the flavor, aroma and mouthfeel of the wine. In this study we examined this complex relationship by identifying the exo- and endo-metabolome at three timepoints of a Chardonny wine fermentation. We identified 227 metabolites in the exometabolome and 404 metabolites in the endometabolome, each of which was placed into metabolic pathways or families. Considerable metabolic variation was seen at each timepoint allowing us to describe patterns of primary and secondary metabolism during fermentation. Our results suggest that the regulation of metabolic pathways is coupled to fermentation progress. These data provide an understanding of the differential utilization and production of primary and secondary metabolites during a wine fermentation. This work provides key understanding of cell communication mechanisms, metabolic engineering and industrial biotechnological processes.

Poster Abstracts



A. QUANTITATIVE PROTEOMICS APPROACH TO IDENTIFY RICE PROTEINS INDUCED DURING THE XA21-MEDIATED IMMUNE RESPONSE AGAINST THE BACTERIAL *Xanthomonas oryzae* pv. *oryzae*.

Daniel Caddell*[1], Ophelia Papoulas[2], Chang Jin Park[1], Edward Marcotte[2] and Pamela Ronald[1]

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[2]Center for Systems and Synthetic Biology and Department of Chemistry and Biochemistry, Institute for Cellular and Molecular Biology, University of Texas, Austin, TX 78712

Plants and animals sense conserved microbial signatures through receptors, often called pattern recognition receptors (PRRs), which are localized to the plasma membrane. PRRs utilize intracellular kinase domains to initiate complex signaling networks cumulating in broad-spectrum resistance. While it is now widely appreciated that PRRs play a key role in the immune response of plants and animals, little is known about the signaling pathways governing these responses. XA21 is a PRR of rice which confers broad spectrum immunity to *Xanthomonas oryzae* pv. *oryzae (Xoo)*, the bacterial pathogen responsible for causing bacterial leaf blight of rice. In infected areas of Asia and Africa, *Xoo* can destroy as much as 50% of potential rice yields.

To expand our understanding of the immune response that follows perception of *Xoo* by the XA21 receptor, I performed a quantitative proteomics analysis using rice plants expressing XA21 under the control of a hormone (glucocorticoid)-inducible promoter (IP). In the absence of dexamethasone (DEX), *Xoo* spreads throughout entire inoculated rice leaves. Application of DEX seven days after inoculation induces Xa21 expression, triggering a robust and synchronized XA21-mediated immune response throughout the entire tissue. The advantage of this system is that we can harvest large amounts of DEX-treated tissue and capture a large array of dynamic interactions. We extracted proteins from *Xoo*-inoculated and mock-treated IP XA21 plants 0, 1, 3 days after DEX treatment (three biological replicates for each time point). Xa21 marker gene expression is significantly induced 2 days after DEX-treatment. Proteins were digested into peptides, separated by reverse phase chromatography, followed by LC-MS/MS analysis. Peptide identification was performed against our non-redundant rice protein database using the MSBlender computational pipeline. Individual replicates were combined using available algorithms based on PeptideProphet and ProteinProphet in order to generate the final peptide and protein assignments and the abundances of proteins across samples were calculated using isotope label-free protein

quantification. This proteomics dataset will be used to identify proteins involved in the XA21-mediated immune response and will also complement our experimentally validated genome-scale functional gene network of rice genes, named RiceNet, which is exploring PRR-mediated immune responses in cereals on a genome-wide scale.

***DEB Graduate Student**

B. CONVERSION OF LIGNOCELLULOSICS TO A RENEWABLE FUEL SOURCE AND A VALUABLE CHEMICAL

Shuchi Desai*, Christine Rabinovitch-Deere*, and Shota Atsumi
Department of Chemistry, University of California, Davis, CA

Current fuels used to power transportation vehicles are mainly made from petroleum, which is a finite resource. Biofuels, the conversion of biomass to a liquid fuel, are a renewable fuel source; however, existing methods to create these require many processes and are not cost-effective. Consolidated bioprocessing is a system that utilizes microorganisms to perform several steps of a chemical production system, which reduces cost and the number of processes required to produce the target chemical. Non-food crop lignocellulosics, such as forest debris and farm residues, can be harvested and broken down to valuable sugars, such as glucose and xylose, which in turn can be utilized to produce chemicals. In enzymatic hydrolysis of cellulose, one of the key intermediate is cellobiose. Cellobiose is often an inhibitor to cellulases, which are necessary for enzymatic hydrolysis of cellulose. We are developing a consolidated process to simultaneously produce isobutanol and gluconate from lignocellulosic materials in three steps. Lignocellulosics can be converted to cellobionic acid by fungus, which bypasses enzyme inhibition, it can be further broken down into glucose and gluconate. Glucose can be utilized to produce the advanced biofuel isobutanol. Isobutanol is a biofuel candidate because it contains comparable chemical properties to that of gasoline. Gluconate is a valuable chemical feedstock which is widely used in both the food and pharmaceutical industry. If successful, this system can be more efficient and cost effective compared to the conventional methods.

***DEB Graduate Student**

C. ATTENUATED CALCIUM ENTRY AND CYTOKINE RELEASE TO THE ENVIRONMENTAL TOXICANT, PBDE, IN ISOLATED HUMAN PBMCS

Marjannie Eloi Akintunde*[1,2], Diptiman D. Bose[4], Isaac N. Pessah,[2,4,5] and Judy Van de Water [1,2,4]

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[4]Department of Veterinary Molecular Biosciences, University of California, Davis

Exposure to the environmental toxicant, polybrominated diphenyl ethers (PBDEs), has been shown to alter immune and neurological function in both animal models. PBDEs are synthetic, lipid soluble persistent organic pollutants (POP), which are known to bioaccumulate in the food chain. Their use as flame-retardants has lead to widespread environmental contamination; PBDEs are ubiquitous in nature and are becoming an environmental health concern. The non-coplanar structure of PBDEs is analogous to polychlorinated biphenyls, another POP which been shown to interfere with proteins related to calcium signaling. It is hypothesized that PBDEs may also interfere with calcium signaling by a similar mechanism. Previous studies have indicated, in children with autism (ASD), PBDE congeners, specifically BDE-47 and BDE-49, may differentially alter immune signaling in isolated PBMCs, but the mechanism of action is currently unknown. Therefore, we propose that the altered immune signaling due by BDE-47 and BDE-49 in ASD subjects may be due to altered calcium signaling or stored operated calcium entry (SOCE). PBMCs were isolated from healthy human volunteers and exposed to the PBDE congeners BDE-49 and -47 (250nM, 24hr). PBMCs were loaded with fluo-4AM, and challenged with ATP (100μM). BDE-49 and 47 significantly decreased the amplitude of ATP mediated calcium transient and its decay ($t_{1/2}$) to baseline, indicating an inhibition of calcium influx via SOCEs. In parallel studies of immune cell activation, PBMCs exposed to BDE-47 and -49 (250nM, 24 hr) were challenged with immune activators (24hr) and cells supernatants were analyzed via Luminex techonlogy. Both PBDEs decreased the production of cytokines. These results are the first to identify inhibition of SOCEs by PBDEs in humans as potential key mechanisms affecting immune signaling and could contribute to the immunotoxicity of PBDEs in children with autism.

***DEB Graduate Student**

D. AN ORCHESTRA OF LIGHTS: OPTOGENTIC CONTROL OF TRANSCRIPTION

Alexander G. Gulevich* and J. Clark Lagarias
Department of Molecular and Cellular Biology, University of California, Davis, CA

The Lagarias Laboratory studies a group light-sensing proteins known as phytochromes and cyanobacteriochromes. Phytochromes are pigmented proteins present in all higher plants that serve a major role as shade detectors, which regulate "shade avoidance" responses. These proteins strongly absorb red light due to the covalent attachment of a linear tetrapyrrole (bilin) chromophore. When irradiated with red light, the bilin pigment rapidly photoisomerizes followed by a slower bilin-protein relaxation that leads to a spectrochromic shift of the red-absorbing Pr form to the far red-absorbing Pfr form. The reversibility of this interconversion process is the hallmark of plant phytochrome responses that are characteristically promoted by red and inhibited by far red light. The cyanobacteriochromes (CBCRs) are a class of phytochrome-related light sensors that have proliferated in cyanobacteria. Analogous to phytochromes, CBCRs are bilin-based sensors with reversible photocycles with a greater spectral sensing range from the ultraviolet to near-infrared region of the electromagnetic spectrum. CBCRs also possess more divergent output domains reflecting their distinct evolutionary history from the phytochrome family. Here we present research to construct a CBCR-based optogenetic system in which the transcription of a bioinspired gene module is activated by irradiation with violet light and deactivated with green light. This system will first be tested in the heterologous host organisms *Escherichia coli* and *Chlamydomonas reinhardtii*. Ultimately, we intend to re-engineer this CBCR to respond to other wavelengths of light and to exploit three systems with distinct wavelength specificities to independently activate transcription of three different promoter targets in real time using light as an inducer.

***DEB Graduate Student**

E. INDUCING MATRIX REMODELING TO INCREASE MECHANICAL PROPERTIES OF ENGINEERED TISSUE

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Due to its limited vascularity and relative hypocellularity, the knee meniscus displays insufficient healing capacity, making the generation of replacement tissue a priority for researchers and clinicians. This research hypothesized that inducing extracellular matrix (ECM) remodeling through lysophosphatidic acid (LPA) would increase the ECM organization and tensile properties of engineered constructs. Meniscus fibrocartilage constructs were generated by seeding a 1:1 ratio of primary articular chondrocytes and meniscus cells into ring-shaped, non-adherent agarose wells molded in the shape of the native rabbit meniscus. All constructs were cultured for 35 days in serum-free chondrogenic media, with LPA treatment occurring during days 21-28. Samples underwent tensile and compressive testing, histology and immunohistochemical staining, quantitative biochemistry assays, and actin as well as collagen visualization. ANOVA followed by a Tukey's HSD post-hoc analysis, as appropriate, was used to determine statistical significance ($p < 0.05$). As hypothesized, constructs treated with LPA displayed significant increases in tensile Young's modulus and ultimate tensile strength, reaching values of 503 ± 159 kPa (103% increase over control) and 204 ± 177 kPa (68% increase over control), respectively. Despite differences in tensile properties, collagen content was unchanged between control and treated constructs, indicating that a change in collagen organization, rather than collagen content, was responsible for the increased tensile properties. When visualized through polarized light microscopy, greater collagen organization was apparent in LPA treated constructs. This was accompanied by significant cytoskeletal reorganization of LPA treated cells. Therefore, it is likely that LPA treatment induced cytoskeletal remodeling and cell-ECM traction, leading to ECM remodeling, and increased organization, as well as greater tissue construct tensile properties. Thus, the hypothesis of this study was proven correct. To the best of our knowledge, this is the first investigation to use cell-mediated ECM remodeling to increase tissue mechanical properties.

***DEB Graduate Student**

F. NANOSTRUCTURED MATERIALS FOR ADVANCED BIOANALYTICAL AND BIOMEDICAL PLATFORMS

Özge Kurtuluş*[1], Pallavi Daggumati[2], Christopher Chapman[3], Damla Dimlioğlu[2], Atul Parikh[1,3], and Erkin Şeker[2]

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Miniaturization 0 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 requires innovations on the materials front, where nanostructured materials have shown significant promise. Nanoporous gold (np-Au), produced by a self-assembly process, is an underexplored nanomaterial for biotechnology applications. Its high effective surface area, ease of surface functionalization, electrical conductivity, and compatibility with microfabrication techniques enable multiple functions, including electrochemical pathogen detection, neuron-based sensors for toxin/drug screening, and drug delivery platforms. In these research directions, np-Au properties (e.g., nanostructure, surface chemistry) play an important role in defining platform properties (e.g., nucleic acid probe-target binding kinetic, neuron viability, drug release profile). Here, we report on our efforts in engineering a multiplexed screening platform for rapid identification of application-specific material. Following a discussion of material synthesis and characterization, biological evaluation, and study of structure-property relationships, we demonstrate np-Au's potential in DNA-based sensor, drug delivery, and electrophysiological recording performance. We conclude with a discussion of the broader potential of np-Au and remaining challenges to promote it as a new multifunctional material.

***DEB Graduate Student**

G. FERMENTATION OF *AGROBACTERIUM TUMEFACIENS* FOR LARGE-SCALE TRANSIENT EXPRESSION OF TRANSGENIC PROTEINS IN PLANTS

Ingrid Leth*, Karen McDonald
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Production of proteins through *in planta* transient expression offers an alternative to conventional microbial and mammalian cell culture systems. This platform is particularly appealing because of its rapid and relatively low-cost implementation and its ease of scale-up. Transient expression is induced by introducing a gene construct into a plant cell, where it is expressed for a period of time without being stably integrated into the plant genome. A common method for inducing transient expression is by using the gene transfer capability of *Agrobacterium tumefaciens*. *Agrobacterium*-mediated transient expression can be induced in whole plants or in pre-harvested plant tissue by "agroinfiltration," a process that introduces an *Agrobacterium* suspension to the interior of a plant leaf, allowing the bacteria to transfer the target gene to the plant cells using its natural virulence machinery. Large-scale transient expression of transgenic proteins in plants is a relatively new area, and studies are underway to optimize the stages of the process in order to make it economically competitive. One area that has not been examined is the fermentation of *Agrobacterium* for agroinfiltration at a large-scale. We are investigating the effects of growth conditions including temperature, pH, and media on *Agrobacterium* growth kinetics and gene transfer capability, with the goal of identifying optimal processing conditions for growing *Agrobacterium* at large scale in a 100L working volume bioreactor.

***DEB Graduate Student**

H. POTENT AND SELECTIVE INHIBITION OF A-TO-I RNA EDITING WITH 2'-*O*-METHYL/LOCKED NUCLEIC ACID-CONTAINING ANTISENSE OLIGORIBONUCLEOTIDES

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ADARs (adenosine deaminases acting on RNA) are RNA editing enzymes that bind double helical RNAs and deaminate select adenosines (A). The product inosine (I) is read during translation as guanosine (G) so such changes can alter codon meaning. ADAR-catalyzed A to I changes occur in coding sequences for several proteins of importance to the nervous system. However, these sites constitute only a very small fraction of known A to I sites in the human transcriptome and the significance of editing at the vast majority sites is unknown at this time. Site-selective inhibitors of RNA editing are needed to advance our understanding of the function of editing at specific sites. Here we show that 2'-*O*-methyl/locked nucleic acid (LNA) mixmer antisense oligonucleotides are potent and selective inhibitors of RNA editing on two different target RNAs. These reagents are capable of binding with high affinity to RNA editing substrates and remodeling the secondary structure by a strand-invasion mechanism. The potency observed here for 2'-*O*-methyl/LNA mixmers suggests this backbone structure is superior to the morpholino backbone structure for inhibition of RNA editing. Finally, we demonstrate antisense inhibition of editing of the mRNA for the DNA repair glycosylase NEIL1 in cultured human cells providing a new approach to exploring the link between RNA editing and the cellular response to oxidative DNA damage.

***DEB Graduate Student**

I. CYANOBACTERIAL BIOCHEMICAL PRODUCTION

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Cyanobacteria offer advantages to microbial fuel and chemical production, including use of non-arable land, high-efficiency photon harvesting, and direct production. Despite this, synthetic pathway construction in cyanobacteria is still nascent compared to model fermentative organisms. In this study we installed a new pathway as a model system to establish design methods for efficient exogenous chemical production from cyanobacteria. To adapt production to photosynthetic cells we matched reducing cofactors with the host, avoided oxygen sensitive enzymes, and optimized gene codons. We further applied irreversible enzymatic steps to create a driving force toward the target, and identified low toxicity of the product enabling high titers. By optimization of enzyme combinations we achieved production with apparent limitation only by endogenous carbon flux to synthetic precursors. We concurrently observed an increase in oxygen evolution by chlorophyll correlating to high carbon redirection away from metabolism, which may indicate possibilities for increases in photosynthetic efficiency overall.

***DEB Graduate Student**

J. STUDYING THE ENDOMEMBRANE TRAFFICKING PROCESSES INVOLVED IN CELL WALL DEPOSITION

Natasha Worden*[1], Alex Schultink[2], Markus Pauly[2], Georgia Drakakaki[1]
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In order to better understand and manipulate plant cell wall deposition, we need to investigate the endomembrane trafficking processes involved, because of their critical regulatory role on cell wall. We are 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. We are using a library of cell permeable molecules that disrupt endomembrane trafficking (Drakakaki, 2011), to elicit changes in the cell wall in *Arabidopsis thaliana.* As a result of this screen we have found a number of probes which selectively perturb cell wall trafficking pathways. These probes have potential to be used both to further investigate the role that trafficking plays on the cell wall and to alter the cell wall for biotechnological applications.

In parallel, we are investigating the role of proteins found in the SYP61 proteome for potential cell wall involvement. SYP61 (Syntaxin of Plants 61) is a SNARE protein involved in vesicle fusion, found mainly in the trans-Golgi network. To further study the intersection of endomembrane trafficking and cell wall deposition, SYP61 vesicles were extracted by affinity purification and proteomics analyses conducted on their contents (Drakakaki et al 2011). The proteome contained 145 proteins, including CESA, implying a role in cell wall polysaccharide deposition. Many of the proteins have an unknown relationship to the cell wall and we are investigating their function, looking for cell wall involvement.

***DEB Graduate Student**

K. THE PLM HOMOTETRAMER HAS A STRUCTURAL BASIS THAT PARALLELS THAT OF PLB: THE LEUCINE ZIPPER.

Garrick K. Yuen*, Luiza Mamikonian, Joseph Li, Vladimir Yarov-Yarovoy, Julie Bossuyt, Donald M. Bers
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Phospholemman (PLM or FXYD1) interacts with and inhibits the sodium potassium ATPase (mainly by reducing its Na affinity), an effect that is relieved by PLM phosphorylation. This is analogous to phospholamban (PLB) regulation of the sarcoplasmic reticulum calcium ATPase. Like PLB, PLM is thought to also form homo-oligomers, although the structural basis for this oligomerization is still unknown. Here we use both a computational and FRET approach to address this. Alanine substitutions of leucine and isoleucine residues in the PLM transmembrane segment were examined for their effect on PLM-PLM FRET. We found that substitutions at I23, I26, L30 and L33 all significantly reduce FRET, but not so for I29 and L36. In parallel experiments, we used Rosetta to model the PLM oligomer. Mapping of experimental data onto Rosetta models favored tetramer configuration for this oligomer rather than a trimer or pentamer. In the tetramer model, the I23, I26, L30 and L33 residues all face and interact with an adjacent PLM subunit, whereas the I29 and L36 residues face the center of the tetramer and appear unlikely to be involved in the stabilization of the tetramer structure. Additionally, the core of the tetramer is lined with hydrophobic residues and is spatially constricted, suggesting that the PLM tetramer does not function as a channel. We conclude that the PLM homo-oligomer is a tetramer with a structural basis that parallels that of PLB: the leucine zipper.

***DEB Graduate Student**

Company Affiliates

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- **Tethys Bioscience, Inc.**

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The success of our biotech fellows depends on the continued support of our affiliates. The Biotechnology Program would like to thank them for their committed sponsorship.

Agilent Technologies

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Agilent delivers critical tools and technologies that sense, measure and interpret the physical and biological world. Our innovative solutions enable a wide range of customers in communications, electronics, life sciences and chemical analysis to make technological advancements that drive productivity and improve the way people live and work.

Our life sciences and chemical analysis business provides application-focused solutions that include instruments, software, consumables and services that enable customers to identify, quantify and analyze the physical and biological properties of substances and products.

Our seven key product categories include microarrays; microfluidics; gas chromatography; liquid chromatography; mass spectrometry; software and informatics products; and related consumables, reagents and services.

AgraQuest, Inc. (now a Bayer company)

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AgraQuest is a biotechnology company that focuses on, discovering, developing, manufacturing and marketing effective, safe and environmentally friendly natural pest management products for the agricultural, institutional and home & garden markets

Fast. Nimble. Small. Competitive. These words not only describe a hummingbird, the symbol on AgraQuest's logo, but also embody the company's style and culture. And, like the hummingbird searches for nectar from a flower, AgraQuest searches for pesticidal products from naturally occurring microorganisms.

The founders of AgraQuest believed that the natural world was fertile ground for the search and discovery of new products for pest management. More than 50% of human drugs are derived from natural sources like plants and microorganisms; but only 7% of all pesticides are derived from these sources. Since 1995, AgraQuest has proven that the natural world is an untapped source of new, and natural, pesticidal products. After discovering and screening over 20,000 microorganisms, AgraQuest has developed and commercialized a line of innovative, effective, natural products for pest management.

Amgen, Inc

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Amgen is a leading human therapeutics company in the biotechnology industry. For 25 years, the company has tapped the power of scientific discovery and innovation to dramatically improve people's lives. Amgen pioneered the development of novel products based on advances in recombinant DNA and molecular biology and launched the biotechnology industry's first blockbuster medicines. Today, as a Fortune 500 company serving millions of patients, Amgen continues to be an entrepreneurial, science-driven enterprise dedicated to helping people fight serious illness.

Over the past quarter century, Amgen has pioneered the methods by which human proteins that play a role in disease processes are identified, isolated, produced in quantity and used as therapeutics. Today, Amgen has research programs in inflammation, metabolic disorders and osteoporosis, neurology, oncology and hematology. The company has R&D facilities in Thousand Oaks, CA; San Francisco, CA; Cambridge, MA; Cambridge, UK; Regensburg, Germany; and Seattle, WA. With expertise in proteins, small molecules, antibodies, peptibodies, and nucleic acids, Amgen's scientists can pursue the study of disease, choose the best target for a disease and then use the modality most likely to have an effect on that target. This approach positions Amgen as one of the only companies with capabilities across a range of modalities. Mastering the tools of therapeutic development, as they emerge, is crucial to Amgen's ongoing success. Accordingly, the company has invested at least 20 percent of product sales in research and development each year since 1994—a total of approximately $2.0 billion in 2004.

Amyris, Inc.

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Amyris Biotechnologies is focused on translating the promise of synthetic biology into solutions for real-world problems. Applying advances in molecular biology and chemistry, we have engineered microbes capable of cost-effectively producing high-value, complex molecules that are currently available only in small quantities through extraction from natural resources. We are employing these living microbial chemical factories to produce new pharmaceuticals, specialty chemicals, and biofuels.

Bayer HealthCare Pharmaceuticals, Inc.

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Bayer HealthCare is a globally active company with sites on all five continents. The Company markets products from its four divisions: Animal Health, Bayer Schering Pharma, Consumer Care, and Diabetes Care via regional and national distribution companies. More than 50,000 people are employed by Bayer HealthCare worldwide.

Our aim is to discover and manufacture innovative products that will improve human and animal health worldwide. Our products enhance well-being and quality of life by diagnosing, preventing and treating disease.

BioMarin Pharmaceutical, Inc.

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BioMarin develops and commercializes innovative biopharmaceuticals for serious diseases and medical conditions, focusing on product candidates that:

- Address currently unmet medical needs
- Suggest a clear-cut development profile
- Provide an opportunity to be first-to-market

Approval of Aldurazyme® (laronidase), the first specific therapy approved for the treatment of mucopolysaccharidosis I (MPS I), reflects the company's commitment and ability to execute its business strategy. Today, with two approved products on the market and a fully-integrated infrastructure in place, BioMarin is positioned to realize continued success in providing patients with innovative therapeutics for serious diseases.

Celgene Corp.

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Our life sciences and chemical analysis business provides application-focused solutions that include instruments, software, consumables and services that enable customers to identify, quantify and analyze Celgene is a global biopharmaceutical company committed to improving the lives of patients worldwide.

At Celgene, we seek to deliver truly innovative and life-changing drugs for our patients. Our mission as a company is to build a major global biopharmaceutical corporation while focusing on the discovery, the development, and the commercialization of products for the treatment of cancer and other severe, immune, inflammatory conditions.

There are more than 300 clinical trials at major medical centers using compounds from Celgene. Investigational compounds are being studied for patients with incurable hematological and solid tumor cancers, including multiple myeloma, myelodysplastic syndromes, chronic lymphocyte leukemia (CLL), non-Hodgkin's lymphoma (NHL), myelofibrosis, small cell lung cancer and prostate cancer.

As committed as we are to clinical accomplishment, we are equally committed to patient support, which is a guiding principle at Celgene. We believe all who can benefit from our discoveries should have the opportunity to do so. Celgene puts patients first with industry-leading programs that provide information, support and access to our innovative therapies.

***DEB Graduate**

Cytokinetics, Inc.

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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)

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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.

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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.

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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

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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)

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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

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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.

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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.

Tethys Bioscience, Inc.

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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 2012 - 2013	
Brandon Brown	Pharmacology & Toxicology
Jennifer Lee	Biomedical Engineering
Amelia Manlove	Chemistry
Gabriel Rodriguez	Chemistry
Abigail Yu	Genetics
Biotech Fellows 2012 - 2013	
Jesse Bakke	Nutritional Biology
Kristen Beck	Biochemistry, Molecular, Cellular & Developmental Biology
Siobhan Halloran	Chemical Engineering
Alan Lombard	Biochemistry, Molecular, Cellular & Developmental Biology
CREATE-IGERT Trainees	
Natasha Worden	Plant Biology
Graduate Students/Post-docs	
Adebayo Akintunde	African American African Studies
Lisa Anderson	DEB, Chemistry
Johnathon Anderson	DEB, Genetics
Brian Avanzino	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Barbara Bailus	DEB, Genetics
Doug Banda	DEB, Chemistry
Christopher Beitel	DEB, Genetics
Daniel Caddell	DEB, Plant Pathology
Nicole Chaffee	Chemistry
Christopher Abbott Reece Chapman	DEB, Biomedical Engineering
Dong Hee Chung	DEB, Chemistry
Pallavi Daggumati	Electrical and Computer Engineering
Elieke Demmer	DEB, Nutritional Biology
Shuchi Desai	DEB, Microbiology
Damla Dimlioglu	Electrical and Computer Engineering
Marjannie Eloi-Akintunde	DEB, Immunology
Kateryna Feokistova	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Alex Gulevich	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Pasha Hadidi	DEB, Biomedical Engineering
Özge Kurtuluş	DEB, Chemical Engineering
Ingrid Leth	DEB, Chemical Engineering
Nick Mahoney	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Kevin Martin	DEB, Chemistry
Rena Mizrahi	DEB, Chemistry

Jared Moore	DEB, Chemistry
Jessica Moore	DEB, Chemistry
Nicole Nozzi	DEB. Chemistry
John Oliver	DEB, Chemistry
Trisha Pfluger	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Benjamin Pyles	Genetics
JohnPatrick Rogers	DEB, Chemistry
Jennie Sotelo	DEB, Nutritional Biology
Clarissa Tadeus	DEB, Chemistry
Garrick Yuen	DEB, Biochemistry, Molecular, Cellular & Developmental Biology
Nancy Zeng	DEB, Chemical Engineering
UC Davis Faculty	
Sheila David	DEB, Chemistry
Paul Dodd	AVC, Interdisciplinary Research and Strategic Initiatives - Office of Research
Christopher Fraser	DEB, Molecular and Cellular Biology
Ian Korf	DEB, Molecular and Cellular Biology
J. Clark Lagarias	DEB, Molecular and Cellular Biology
Harris Lewin	Vice Chancellor of Research
Karen McDonald	DEB, Chemical Engineering and Materials Science
Martina Newell-McGloughlin	Plant Reproductive Biology
William Ristenpart	DEB, Chemical Engineering
David Segal	DEB, Molecular and Cellular Biology
Erkin Şeker	DEB, Electrical & Computer Engineering
Industry	
Kristy Hawkins	Amyris Biotechnologies, Inc.
John Lewicki	OncoMed
Aaron Nguyen	Celgene
Shandra Richter	E & J Gallo Winery
Beth Savidge	Monsanto, Calgene Campus
Feng Xu	Novozymes, Inc.
Guests	
Bernadette Galvan	James C. Enochs High School
Dave Menshew	James C. Enochs High School
Yin Wu	
Biotechnology Program	
Jacqueline Balderama	Biotechnology Program, Event Coordinator
Marianne Hunter	Biotechnology Program, Assistant. Director Administration
Denneal Jamison-McClung	Biotechnology Program, Associate Director
Judy Kjelstrom	Biotechnology Program, Director

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
Jaqueline Balderama – Event Coordinator
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
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
Heike Wulff	Pharmacology and Toxicology

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 2013

Nicholas Aguirre	Neurobiology, Physiology and Behavior
Natascia Al-Kass	Microbiology
Leif Anderson	Biomedical Engineering
Lisa Anderson	Chemistry
Johnathon Anderson	Genetics
Liz Anthony	Chemical Engineering
Brian Avanzino	Biochemistry, Molecular, Cellular & Developmental Biology
Mina Azimi	Biochemistry, Molecular, Cellular & Developmental Biology
Barbara Bailus	Genetics
Jesse Bakke	Nutritional Biology
Douglas Banda	Chemistry
Roberto Barrozo	Immunology
Kristen Beck	Biochemistry, Molecular, Cellular & Developmental Biology
Christopher Beitel	Genetics
Geoffrey Benn	Plant Biology
Marta Bjornson	Horticulture and Agronomy
Bárbara Blanco-Ulate	Plant Biology
Nicholas Bokulich	Food Science
Stephen Bolus	Plant Pathology
Casey Boosalis	Molecular, Cellular & Integrative Physiology
Brandon Brown	Pharmacology & Toxicology
Andrew Burch	Biochemistry, Molecular, Cellular & Developmental Biology
Candace Burke	Immunology
Timothy Butterfield	Plant Biology
Daniel Caddell	Plant Biology
Milo Careaga	Immunology
Jennifer Cash	Chemistry
Patricia Castillo	Immunology
Elenor Castillo	Plant Biology
Shannon Ceballos	Biochemistry, Molecular, Cellular & Developmental Biology
Astra Chang	Comparative Pathology
Pauline JoJo Chang	Electrical & Computer Engineering
Christopher Chapman	Biomedical Engineering
Arnold Chen	Biomedical Engineering
Xiguang (Ray) Chen	Biological Systems Engineering
Sum Ying (Annie) Chiu	Biochemistry, Molecular, Cellular & Developmental Biology
Leelyn Chong	Nutritional Biology
Dong hee Chung	Chemistry
Elizabeth Clark	Biochemistry, Molecular, Cellular & Developmental Biology
Caitlin Cooper	Animal Biology
Stephanie Crockett	Comparative Pathology
Ryan Davis	Chemistry
Destiny Davis	Plant Biology

Matthew Dawson	Biostatistics
Nicole De Jesus	Biomedical Engineering
Derek Decker	Biophysics
Elieke Demmer	Nutritional Biology
Shuchi Desai	Microbiology
Nithin Dhananjayan	Biophysics
Neha Dixit	Immunology
Matthew Doherty	Microbiology
Keith Dunaway	Genetics
James (Mitch) Elmore	Plant Biology
Marjannie Eloi-Akintunde	Immunology
Anna Erickson	Biochemistry, Molecular, Cellular & Developmental Biology
Aileen Espinoza	Immunology
Eugenel Espiritu	Biochemistry, Molecular, Cellular & Developmental Biology
Kenneth Eum	Molecular, Cellular & Integrative Physiology
Dawn Fedor	Nutritional Biology
Kateryna Feoktistova	Biochemistry, Molecular, Cellular & Developmental Biology
Brett Fite	Biophysics
Jonathan Flynn	Biochemistry, Molecular, Cellular & Developmental Biology
Zachary Fogassy	Microbiology
Michael Fong	Biomedical engineering
Erin Fong	Electrical & Computer Engineering
Greg Foster	Biomedical Engineering
Erik Fostvedt	Biochemistry, Molecular, Cellular & Developmental Biology
Amanda Fox	Immunology
Elizabeth Fox	Immunology
Jenna Gallegos	Plant Biology
Ehson Ghandehari	Biomedical Engineering
Hyrum Gillespie	Genetics
Sean Gilmore	Applied Science Engineering
Aiza Cathe Go	Biochemistry, Molecular, Cellular & Developmental Biology
Hossein Gouran	Plant Biology
Alex Gulevich	Biochemistry, Molecular, Cellular & Developmental Biology
Pasha Hadidi	Biomedical Engineering
Siobhan Halloran	Chemical Engineering
Brian Hamilton	Biochemistry, Molecular, Cellular & Developmental Biology
Mitchell Harkenrider	Plant Biology
Jason Harrison	Chemistry
Christine Hastey	Microbiology
Mateo Hernandez	Chemistry
Gina Herrera	Microbiology
Amanda Hildebrand	Biological Systems Engineering
Silvia Hilt	Biochemistry, Molecular, Cellular & Developmental Biology
Marissa Hirst	Microbiology
Steve Ho	Biomedical Engineering
Allison Hoch	Biomedical Engineering

Gena Hoffman	Plant Biology
Serenus Hua	Chemistry
Jonathan Hughes	Microbiology
Yi-Hwa (Patty) Hwang	Biochemistry, Molecular, Cellular & Developmental Biology
Vicki Hwang	Genetics
Shirin Jenkins	Biochemistry, Molecular, Cellular & Developmental Biology
Roger Jesinghaus	Chemistry
Rogelio Jimenez Espinoza	Chemical Engineering
Liequn "Leah" Jin	Biostatistics
Geetika Joshi	Soils & Biogeochemistry
Yun Joon Jung	Biomedical Engineering
Stefanos Kalomoiris	Biochemistry, Molecular, Cellular & Developmental Biology
Sercan Karav	Food Science & Technology
Robert Kauffman	Microbiology
Rachel Kerwin	Plant Biology
Nathaniel Kingsbury	Chemical Engineering
Brenna Kiniry	Microbiology
Nicholas Klug	Molecular, Cellular, and Integrative Physiology
James Kurniawan	Chemical Engineering
Özge Kurtuluş	Chemical Engineering
Timothy Kwa	Biomedical Engineering
Diana Lac	Pharmacology & Toxicology
Edna Lamsen	Chemistry
Rashida Lathan	Animal Biology
Katherine Lawrence	Biochemistry, Molecular, Cellular & Developmental Biology
Jennifer Lee	Biomedical Engineering
Linda Lee	Molecular, Cellular & Integrative Physiology
Karen LeGrand	Microbiology
Mark Lemos	Plant Biology
Ingrid Leth	Chemical Engineering
Zachery Lewis	Microbiology
Furong (Frank) Liu	Plant Pathology
Alan Lombard	Biochemistry, Molecular, Cellular & Developmental Biology
Michelle Lozada-Contreras	Chemical Engineering
Xiyuan (Lucy) Lu	Molecular, Cellular, & Integrative Physiology
Rita Luu	Microbiology
Regina MacBarb	Biomedical Engineering
Hamed Malekan	Chemistry
Liro Malgorzata	Biochemistry, Molecular, Cellular & Developmental Biology
Amelia Manlove	Chemistry
Kevin Martin	Chemistry
Lauren Matelski	Immunology
Philip Matern	Molecular, Cellular & Integrative Physiology
Jordan McEwen	Chemistry
Samuel McMahon	Biochemistry, Molecular, Cellular & Developmental Biology
Daniël Melters	Biochemistry, Molecular, Cellular & Developmental Biology

Amory Meltzer	Genetics
Emily Mills Ko	Immunology
Debika Mitra	Biomedical Engineering
Rena (Aviva) Mizrahi (nee Goodman)	Chemistry
Angela Monterrubio	Biochemistry, Molecular, Cellular & Developmental Biology
Jason Mooney	Immunology
Mary Moore	Biochemistry, Molecular, Cellular & Developmental Biology
Jessica Moore	Chemistry
Jared Moore	Chemistry
Alexi Morris	Chemistry
Akshata Mudinoor	Chemical Engineering
Sucheta Mukherjee	Pharmacology & Toxicology
Andrew Murley	Biochemistry, Molecular, Cellular & Developmental Biology
Meghan Murphy	Biomedical Engineering
Bernadette Nera	Biochemistry, Molecular, Cellular & Developmental Biology
Tin Ngo	Biochemistry, Molecular, Cellular & Developmental Biology
Alice Ngo	Chemistry
Chuong Nguyen	Pharmacology & Toxicology
Nicole Nozzi	Chemistry
Patrick O'Dell	Biological Systems Engineering
John Oliver	Chemistry
David Olivos	Comparative Pathology
Nadia Ono	Biochemistry, Molecular, Cellular & Developmental Biology
Charity Onore	Immunology
Richard Osibanjo	Chemistry
Gulustan Ozturk	Food Science & Technology
Angela Papalamprou	Molecular, Cellular & Integrative Physiology
Dipali Patel	Biomedical Engineering
Mira Patel	Chemical Engineering
Maria Peralta	Chemistry
Trisha Pfluger	Biochemistry, Molecular, Cellular & Developmental Biology
Jonathan Pham	Microbiology
Adam Poe	Biochemistry and Molecular Biology
Marc Pollack	Microbiology
Stephanie Pulford	Mechanical & Aeronautical Engineering
Jingyao Qu	Chemistry
Joseph Ramahi	Biochemistry, Molecular, Cellular & Developmental Biology
Kittipong (Nat) Rattanaporn	Chemical Engineering
Juan Reyes	Genetics
Gabriel Rodriguez	Chemistry
JohnPatrick (Patrick) Rogers	Chemistry
Shailise Ross	Chemistry
Mary Saunders	Comparative Pathology
Amy Schroeder	Biochemistry, Molecular, Cellular & Developmental Biology
Gail Sckisel	Immunology

Aubrey Scott	Applied Science
Guy Shani	Microbiology
Esther Shin	Pharmacology & Toxicology
Priyashiela Singh	Soils & Biogeochemistry
Juliane Smith	Biochemistry, Molecular, Cellular & Developmental Biology
Chelsea Snyder	Pharmacology & Toxicology
Jennie Sotelo	Food science & technology
Alanna Spees (nee O'Leary)	Immunology
Zane Starkewolfe	Chemistry
Michael Starr	Biomedical Engineering
Scott Strobel	Biological Systems Engineering
Wesley Sughrue	Biochemistry, Molecular, Cellular & Developmental Biology
Anandkumar (Anand) Surendrarao (Rao)	Plant Biology
Clarissa Tadeus	Chemistry
Tang Tang	Chemistry
Brandon Tautges	Chemistry
Justin Thomas	Chemistry
Nicholas Thomas	Genetics
Michelle Tjahjadi	Biochemistry, Molecular, Cellular, & Developmental Biology
George (Kenneth) Todd	Molecular, Cellular & Integrative Physiology
Elyse Towns	Chemistry
Adama Traore	Electrical & Computer Engineering
Vu Trinh	Biochemistry, Molecular, Cellular & Developmental Biology
Kim Truong	Pharmacology and Toxicology
Michelle Tu	Biochemistry, Molecular, Cellular & Developmental Biology
Anna Marie Tuazon	Biochemistry, Molecular, Cellular, and Developmental Biology
John Uhrig	Microbiology
Rachel Anne Valenzuela	Chemistry
Erica Vonasek	Biological Systems Engineering
Gordon Walker	Biochemistry, Molecular, Cellular & Developmental Biology
Katherine Walker (nee Byrne)	Biomedical Engineering
Donnelly West	Genetics
Damion Whitfield	Microbiology
Priscilla Williams	Biomedical Engineering
David Woessner	Microbiology
Diana Wong	Chemistry
Natasha Worden	Plant Biology
Dennis Wu	Immunology
Mon Shuan (Phoebe) Wu	Microbiology
Xiaochen (Ellie) Yin	Food science & technology
Fei Yian Yoong	Plant Biology
Chao Wei Yu	Biological Systems Engineering
Abigail Yu	Genetics
Garrick Yuen	Biochemistry, Molecular, Cellular & Developmental Biology
Benjamin Yuen	Biochemistry, Molecular, Cellular & Developmental Biology

Nancy Zeng	Chemical Engineering
Cui Jing (Tracy) Zeng	Microbiology
Wade Zeno	Chemical Engineering
Yuxuan (Eric) Zheng	Chemistry
Steve Zicari	Biological Systems Engineering

DEB Faculty Trainers

Venkatesh Akella	Electrical & Computer Engineering
Rajeevan Amirtharajah	Electrical & Computer Enginering
Paul Ashwood	UCD MIND Institute
Kyriacos Athanasiou	Biomedical Engineering
Shota Atsumi	Chemistry
Matthew Augustine	Chemistry
Alan Balch	Chemistry
Enoch Baldwin	Molecular and Cellular Biology Chemistry
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, Vet Med
Peter Beal	Chemistry
Laurel Beckett	Department of Public Health Sciences/Biostatistics
Craig Benham	Biomedical Engineering / Genome Center
Alan Bennett	Vegetable Crops (Plant Science)
Don Bers	Pharmacology
Charles L. Bevins	Microbiology & Immunology
Linda Bisson	Viticulture & Enology
Caroline Bledsoe	Soils and Biogeochemistry
David Block	Viticulture & Enology/Chemical Engineering & Materials Science
Eduardo Blumwald	Plant Sciences
Sue Bodine	Neurobiology, Physiology and Behavior (NPB)
Laura Borodinsky	Physiology & Membrane Biology, UCDMC
Richard Bostock	Plant Pathology
Kent Bradford	Vegetable Crops
Christine Bruhn	Food Science & Technology
Alan Buckpitt	VM: Molecuar Biosciences
Sean Burgess	Molecular & Cellular Biology
Judy Callis	Molecular and Cellular Biology
Christopher Calvert	Animal Science
Barbara Chapman	Neuroscience
Xi Chen	Chemistry
Xinbin Chen	Comparative Oncology; UCD Cancer Center
Hongwu Chen	Biochemistry & Molecular Medicine
Holland Cheng	Molecular & Cellular Biology
Simon Cherry	Biomedical Engineering
Nipavan Chiamvimonvat	Internal Medicine; Division of Cardiovascular Medicine

Joanne 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
Satya Dandekar	MED: Medical Microbiology & Immunology
Abhaya Dandekar	Pomology/Plant Sciences
Sheila David	Chemistry
Cristina Davis	Mechanical and Aeronautical Engineering
Scott Dawson	Microbiology
Katayoon (Katy) Dehesh	Plant Biology
Wenbin Deng	Cell Biology and Human Anatomy (School of Medicine)
Elva Diaz	Pharmacology
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	Molecular and Cellular Biology
Vladimir Filkov	Computer Science
Andrew Fisher	Chemistry
Paul Fitzgerald	MED: Cell Biology & Human Anatomy
Annaliese Franz	Chemistry
Christopher Fraser	Molecular and 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	Pomology
Jeffrey Gregg	MED: Pathology
Leigh Griffiths	Medicine and Epidemiology
Andrew Groover	Plant Biology
Paul Gumerlock	MED: Hematology/Oncology
Ting Guo	Chemistry
Fawaz Haj	Nutrition

Bruce Hammock	Entomology & Cancer Center
Stacey Harmer	Plant Biology
Richart W. Harper	Division of Pulmonary/Critical Care Medicine
Volkmar Heinrich	Biomedical Engineering
Wolf-Dietrich Heyer	Microbiology
David Horsley	Mechanical & Aerospace Engineering
Krassi Hristova	Land Air Water Resources
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
Rick Kiehl	Electrical & Computer Engineering
Dan Kliebenstein	Vegetable Crops & Weed Science
Paul Knoepfler	Cell Biology & Human Anatomy
Anne Knowlton	Cardiovascular Division, Department of Medicine & Department of Medical Pharmacology and Toxicology
Patrice Koehl	Computer Science/Genome Center & Bioinformatics Program
Ian Korf	Molecular & Cellular Biology/Genome Center & Bioinformatics Program
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	Molecular & Cellular Biology
Carlito Lebrilla	Chemistry
Pamela Lein	Molecular Biosciences
Noelle L'Etoile	Center for Neuroscience & Dept. of Psychiatry and Behavioral Sciences
Harris Lewin	Evolution & Ecology
Su-Ju Lin	Center for Genetics & Development & Section of Microbiology - UCD Cancer Center

Gang-yu Liu	Chemistry
Bo Liu	Plant Biology
Marjorie Longo	Chemical Engineering & Material Sciences
Angelique Louie	Biomedical Engineering
Paul Luciw	MED: Pathology
Neville C Luhmann, Jr.	Electrical & Computer Engineering
Maria Marco	Food Science & Technology
Laura Marcu	Biomedical Engineering
Verónica Martínez Cerdeño	Department of Pathology and Laboratory Medicine
Karen McDonald	Chemical Engineering & Material Sciences
Frank McNally	Molecular & Cellular Biology
Claude Meares	Chemistry
Juan Medrano	Animal Science
Richard Michelmore	Plant Sciences
Lisa Miller	Department of Anatomy, Physiology and Cell Biology, CNPRC, School of Veterinary Medicine
David Mills	Vitriculture & Enology
Maria Mudryj	Medical Microbiology & Immunology
William J. Murphy	Dept. of Dermatology
James Murray	Animal Science / Genetic Engineering Large Animals
Krishnan Nambiar	Chemistry
Lorena Navarro	Microbiology
Florence Negre-Zakharov	Department of Plant Sciences
John Newman	Nutrition & USDA-ARS-WHNRC
Stephen Noctor	Neuroscience
Jan Nolta	MED: Hematology & Oncology
Thomas North	Center for Comparative Medicine
Jodi Nunnari	Molecular and Cellular Biology
Martha O'Donnell	Physiology and Membrane Biology; Schl of Med
David Ogrydziak	Food Science & Technology
Tingrui Pan	Biomedical Engineering
Rebecca Parales	Microbiology
Atul Parikh	Applied Science
Anthony Passerini	Dept. of Biomedical Engineering
Timothy Patten	Chemistry
Randen Patterson	Department of Physiology and Membrane Biology
Niels Pedersen	Department of Medicine and Epidemiology
Ronald Phillips	Chemical Engineering & Material Science
Kent Pinkerton	Pediatrics, School of Medicine
David Pleasure	Neurology and Pediatrics
Robert Powell	Chemical Engineering & Material Science
Jerry Powell	Hemat & Oncol: Med
Ann Powell	Plant Sciences
Martin Privalsky	Microbiology
Jinyi Qi	Biomedical Engineering

Subhadip Raychaudhuri	Biomedical Engineering
Michael Reid	Environmental Horticulture
David Reid	Food Science & Technology
Alexander Revzin	Biomedical Engineering
Robert Rice	Environmental Toxicology
Subhash Risbud	Chemical Engineering & Material Science
William Ristenpart	Chemical Engineering & Materials Science & Dept. of Food Science & Technology
David Rocke	Applied Sciences/MED: Biostatistics
Ray Rodriguez	Molecular & Cellular Biology
Pamela Ronald	Plant Pathology
John Rutledge	MED: Endocrinology
Jon Sack	Physiology & Membrane Biology
Earl Sawai	Pathology & Laboratory Medicine
Kate Scow	Land, Air & Water Resources
David Segal	MED: Pharmacology/Genome Center
Erkin Seker	Electrical & Computer Engineering
Barbara Shacklett	Med Microbiology & Immunology: School of Med
Jared Shaw	Chemistry
Kazuhiro Shiozaki	Microbiology
Justin Siegel	Biochem & Molecular Med
Eduardo Silva	Biomedical Engineering
Scott Simon	Biomedical Engineering
Neelima Sinha	Plant Biology
David Slaughter	Biological & Agricultural Engineering
Jay Solnick	MED: Infectious & Immunological Diseases
Daniel Starr	Molecular & Cellular Biology
Francene Steinberg	Dept. of Nutrition
Ioannis Steriopoulos	Plant Pathology
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 & Clinical Immunology, GBSF
Alison Van Eenennaam	Animal Science
Marta Van Loan	Nutrition
Jean VanderGheynst	Biological Systems Engineering

John Voss	Biochemistry and Molecular Medicine
Bart Weimer	Vet Med: Population Health & Reproduction
Robert H. Weiss	Internal Medicine: Division of Nephrology, School of Medicine
Valerie Williamson	Nematology
Barry Wilson	Animal Science & Environmental Toxicology
David Wilson	Molecular & Cellular Biology
Matthew J. 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 (a Bayer company)
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
Igenica
Institut Charles Sadron
Marone Bio Innovations
Maxygen
Monsanto, Calgene Campus;
Novartis (formerly Chiron)
Novozymes Biotech
Nunhems
OncoMed
Scios
Somagenics
Syntex
Recovery Sciences
Roche Biosciences
State Water Control Resources Board
Tethys Bioscience, Inc.
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

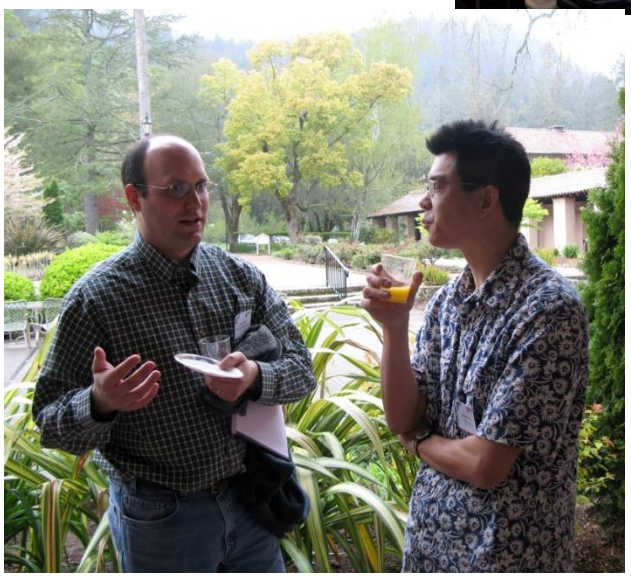
Students gain much from internships:

- 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 235 students enrolled, so we need more Academic-Industry Partnerships.

In Memoriam Simon Chan
(1974 – 2012)

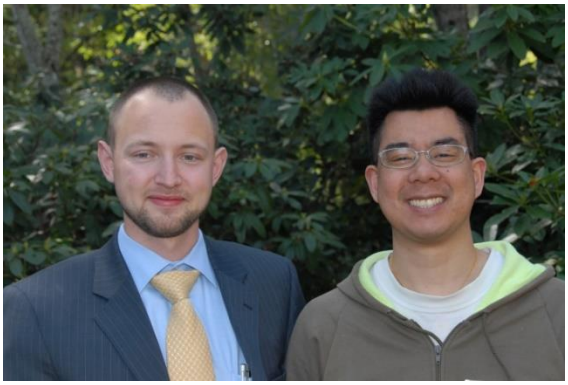
Our Biotechnology Family was very sad to say good-bye to Simon Chan, one of our NIH Faculty Trainers and strong supporter of the DEB Program. Simon passed away last August at the young age of 38. He was a brilliant researcher, known for his colorful Hawaiian shirts and super cool sneakers.



Dan Starr and Simon Chan, faculty mentors of Erin Tapley
and Joseph Ramahi - NIH Fellows, talking at a Napa Biotech Retreat



Simon was always great at engaging students into very interesting discussions

Simon had two NIH trainees through the Biotechnology Program, Joseph Ramahi and Daniel Melters.

Good-bye Simon Chan, we'll miss you!