

*Program*

# Enzyme Engineering XXI

September 18-22, 2011

Vail Marriott Mountain Resort & Spa  
Vail, Colorado, USA



Conference Chairs

**Lori Giver**  
Codexis, USA

**Steve Withers**  
University of British Columbia, Canada



**Engineering Conferences International**

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## Dr. David A. Estell

### Winner of the 2011 Enzyme Engineering Award



Since 1983 the Enzyme Engineering Award has been presented at ECI's biennial International Enzyme Engineering Conference. The 2011 Award will be presented at the 21st Enzyme Engineering Conference in Vail, Colorado. This award recognizes outstanding achievement in the field of enzyme engineering, through basic or applied research in academia or industry.

The 2011 Enzyme Engineering Award, presented in the name of Engineering Conferences International and Genencor, a division of Danisco A/S, will be awarded to **Dr. David A. Estell**.

Dr. Estell earned his B.S. in Chemistry at New Mexico State University (1972), and his PhD in Chemistry at Purdue University (1978) on proteases and their inhibitors. He was a Postdoctoral Fellow in Neurobiology with Eric Shooter at Stanford University (1978-1980) and started his professional career as a Research Scientist at Genentech (1980-1983) where he worked on interferon production and metabolic engineering for 2-keto-L-gulonic acid production.

As a Senior Scientist at Genencor (1983-1986), he initiated the protein engineering program and was promoted to Research Fellow / Vice President at Genencor (1986-1990) and Genencor International (1990-1993). In 1993 he co-founded Khepri Pharmaceuticals, and was Vice President of Research and Development until 1995 when the company merged with Arris Pharmaceutical Corporation, where he became Vice President.

In 1996 he returned to Genencor where as Research Fellow / Vice President Innovation, he is in charge of new technology development and all protein engineering programs.

Dr. Estell invented a new, efficient, proprietary protein engineering technology and holds more than 70 issued U.S. patents.

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## **Sunday, September 18, 2011**

15:00 – 17:00	Registration (Grand Ballroom Registration Desk)
17:00 – 17:45	Welcome Reception (Grand Ballroom Foyer)
17:45 – 18:00	Opening Remarks /Introduction
18:00 – 19:00	Keynote Address – <b>Steve Mayo</b> , California Institute of Technology, USA
19:00 – 20:30	Buffet Dinner

### **Notes**

- Technical sessions will be in the Grand Ballroom, Salons F-J.
- Poster Sessions will be in the Colorado Ballroom.
- Meals will be held in the Grand Ballroom, Salons A-E.
- Audiotaping, videotaping and photography of presentations are prohibited.
- Speakers – Please have your presentation loaded onto the conference computer prior to the session start (preferably the day before).
- Speakers – Please leave at least 3-5 minutes for questions and discussion.
- Please do not smoke at any conference functions.
- Turn your mobile telephones to vibrate or off during technical sessions.
- Be sure to make any corrections to your name/contact information on the Master Participant List or confirm (by your initials) that the listing is correct. A corrected copy will be sent to all participants after the conference.

## Monday, September 19, 2011

07:00 – 08:30 Breakfast

### ***Recent Developments in Enzyme Engineering***

08:30 – 08:35 Session introduction – **TBA**

08:35 – 09:10 **Neil Bruce** – University of York, UK  
Discovery and engineering of enzyme systems for the transformation and degradation of explosives

09:10 – 09:45 **Bengt Mannervick** – Uppsala University, Sweden  
Molecular quasi-species and the engineering of promiscuous glutathione transferases

09:45 – 10:15 **Florian Hollfelder** – University of Cambridge, UK  
Multiple catalytic promiscuity: Rules and tools

10:15 – 10:45 Coffee break

10:45 – 11:20 **Dick Janssen** - University of Groningen, Netherlands  
Engineering MIO-dependent aminomutase for production of beta-amino acids

11:20 – 11:55 **Michihiko Kobayashi** - University of Tsukuba, Japan  
Unique enzyme reactions involved in the formation of a carbon-nitrogen bond

11:55 – 12:30 **Yasuhisa Asano** - Toyama Prefectural University, Japan  
Use of enzymes in 'Aldoxime-Nitrile Pathway' in organic syntheses

12:30 – 14:00 Lunch

### ***Fundamentals in Enzyme Design and Biocatalysis***

14:00 – 14:05 Session Introduction – **Romas Kazlauskas**

14:05 – 14:40 **Jon Stewart** - University of Florida, USA  
Expanding the catalytic repertoires of alkene reductases

14:40 – 15:15 **Teruyuki Nagamune** – University of Tokyo, Japan  
Artificial multienzyme complex: PCNA-assisted molecular self-assembly of microbial cytochrome P450 system

15:15 – 15:45 **Kerstin Steiner** – Austrian Centre of Industrial Biotechnology, Austria  
Characterisation and engineering of novel enzymes with a Cupin fold

15:45 – 16:15 Coffee Break

**Monday, September 19, 2011**(continued)

- 16:15 – 16:50            **Ikuro Abe** - University of Tokyo, Japan  
Engineering plant polyketide synthases
- 16:50 – 17:25            **Daniella Grabs** – Arzeda, USA  
Arzetta™: Rapidly identifying and customizing enzyme activity
- 17:25 – 18:00            **Joelle N. Pelletier** – Universite de Montreal, Canada  
Expanding the synthetic utility of isopeptide bond-forming biocatalysts
- 18:00 – 19:30            Dinner
- 19:30 – 21:00            Poster Session and Social Hour



**Tuesday, September 20, 2011**

07:00 – 08:30 Breakfast

***Pathway and genome engineering for biofuels and chemicals***

08:30 – 08:35 Session introduction – **Joel Kaar**

08:35 – 09:10 **Mike Lynch** – Opxbio, USA  
Enzyme and pathway engineering for the production of renewable chemicals and fuels

09:10 – 09:45 **Y.-H. Percival Zhang** - Virginia Technical University, USA  
Replacing crude oil with sugar (before we run out of oil)

09:45 – 10:15 **Min Zhang** – National Renewable Energy Laboratory, USA  
Advances in Engineering of *Zymomonas mobilis* for lignocellulosic biomass sugar conversion to ethanol

10:15 – 10:45 Coffee break

10:45 – 11:20 **Kevin Dietzel** - Amyris, USA  
High throughput pathway engineering and screening for the high volume production of renewable chemicals in *Saccharomyces cerevisiae*: the industrialization of synthetic biology

11:20 – 11:55 **Volker Sieber** – Technical University of Munich, Germany  
Cell free biotechnological production of industrial alcohols

11:55 – 12:25 **Ryan Gill** - University of Colorado, USA  
Multiplex synthetic biology strategies for directed protein, pathway and genome evolution

12:30 – 14:00 Lunch

***Young protein engineers***

14:00 – 14:05 Session introduction – **Stefan Lutz**

14:05 – 14:40 **Ronald Koder** – City College New York, USA  
Designed proteins and hybrid meta materials for solar energy conversion

14:40 – 15:15 **Vikas Nanda** - Robert Wood Johnson Medical School, USA  
Computational design of buried charges in allergens and enzymes

15:15 – 15:45 **Wendy Kelly** - Georgia Institute of Technology, USA  
Engineering thioestrepiton analogs

**Tuesday, September 20, 2011** (continued)

15:45 – 16:15            **Gavin Williams** – North Carolina State University, USA  
Reprogramming natural product biosynthesis by directed evolution

16:15 – 16:45            *Coffee break*

***Navigating sequence space***

16:45 – 16:50            Session introduction – **Richard Fox**

16:50 – 17:25            **Trish Choudhary** – Codexis, Inc., USA  
Novel approaches to improve carbonic anhydrase for carbon dioxide capture

17:25 – 18:00            **Eric Gaucher** – Georgia Institute of Technology, USA  
Ancient enzymes for protein engineering

18:00 – 18:35            **Sridhar Govindarajan** – DNA 2.0, USA  
Using infologs as information-rich gene variants to engineer enzymatic function

18:45 – 20:15            Dinner

20:15 – 21:45            Poster Session and Social Hour

**Wednesday, September 21, 2011**

07:00 – 08:30 Breakfast

***Enzyme engineering for biofuels***

08:30 – 08:35 Session introduction – **Joel Kaar**

08:35 – 09:25 **Mike Crowley** – National Renewable Energy Laboratory, USA  
Engineering an Improved cellobiohydrolase I for biofuels production

09:25 – 10:00 **Thijs Kaper** – Genencor, USA  
Engineering of cellulases for improved performance on lignocellulosic substrates

10:00 – 10:30 **Mark Wogulis** – Novozymes, USA  
Rational design of CBH IIs for improved activity and thermostability

10:30 – 11:00 Coffee break

***Applications in pharmaceutical development and manufacture***

11:00 – 11:05 Session introduction – **Andy Bommaris**

11:05 – 11:45 **Jeffrey Moore** – Merck and Co., Inc., USA  
The directed evolution of a transaminase for the production of sitagliptin

11:45 – 12:30 **Michael Abrahamson** – Georgia Institute of Technology, USA  
Substrate Specificity Change of a Dehydrogenase

12:30 – 13:00 **JN Copp** – Victoria University of Wellington, New Zealand  
Seek and Destroy: Engineering Enzymes to Target Tumors in Cancer Gene Therapy

13:00 Boxed Lunch  
Free time / *ad hoc* sessions

18:15 – 18:45 Reception (Grand Ballroom Foyer)

18:45 – 19:00 Introduction to Enzyme Award Lecture

19:00 – 20:00 ***Enzyme Engineering Award Lecture***  
**David Estell** – Genencor, USA

20:00 – 22:00 Conference Banquet

**Thursday, September 22, 2011**

07:00 – 08:30 Breakfast

***Understanding and design of enzymes***

08:30 – 08:35 Session introduction – TBA

08:35 – 09:10 **Alan Berry** - University of Leeds, UK  
New enzymes from old: changing the specificity and stereochemistry of an aldolase

09:10– 09:45 **Nobuhiko Tokuriki** - University of British Columbia, Canada  
Smooth and gradual transition of function and structure of enzyme in the laboratory evolution

09:45 – 10:20 **Burckhard Seelig**, University of Minnesota, USA  
Artificial enzymes created by *in vitro* evolution adopt a new fold

10:20 – 10:50 Coffee break

***Brief Oral Presentations of Selected Posters***

10:50 – 10:55 Session Introduction – Poster Chair

10:55 – 11:45 Brief Oral presentations of selected posters

11:45 – 12:00 Closing comments

12:00 Lunch and departures

# Enzyme Engineering Poster List

- 1. A Stereoselective Vanadium-Dependent Chloroperoxidase in Bacterial Antibiotic Biosynthesis**  
Peter Bernhardt, Scripps Institution of Oceanography, UCSD, USA
- 2. Structural stability of E. coli transketolase to temperature and pH denaturation**  
Raha Jahromi, University College London, United Kingdom
- 3. New Insight of Lantibiotic Engineering: Characterization of the enzymes, design and mode of action of lantibiotics, and immunity proteins**  
Kenji Sonomoto, Kyusyu University, Japan
- 4. Development of Novel Tools for Gene Therapy via Protein Engineering**  
Ning Sun, University of Illinois at Urbana-Champaign, USA
- 5. A smarter strategy for further evolution of  $\beta$ -lactamase activity from glyoxalase II to different quasi-species**  
Wei Zhang, DUppsala University, Sweden
- 6. Creation of a generally applicable NAD(P) recycling system from a NADH specific NADH oxidase**  
Barbara Petschacher, Graz University of Technology, Austria
- 7. A novel enzymatic route to  $\beta$ -amino acids**  
Andreas Vogel, c-LEcta GmbH, Germany
- 8. Construction of a linker library with widely controllable flexibility for design of fusion proteins**  
Ziliang Huang, Tsinghua University, China
- 9. Descriptor-based computational analysis and molecular simulation studies reveals a novel classification scheme and structure-function relationship elements for feruloyl esterases**  
D.B.R.K. Gupta Udatha, Chalmers University of Technology, Sweden
- 10. Engineered protease chain reactions**  
Philip N. Bryan, University of Maryland/IBBR and Dept of Bioengineering, USA
- 11. Engineering Human Enzymes as Chemotherapeutic Agents for the Treatment of Tumors**  
Everett Stone, University of Texas at Austin, USA
- 12. Engineering Pyranose 2-Oxidase: Turning Sugars into Electrical Energy**  
Clemens Peterbauer, University of Natural Resources and Life Sciences, Austria

13. **Mutein Database guided engineering of human enzymes for drug metabolite synthesis**  
Anton Glieder, Austrian Centre of Industrial Biotechnology, AUSTRIA
14. **Evolving a P450 hydroxylase for the fermentative production of Pravastatin in *Penicillium chrysogenum* cells**  
J.M.van der Laan, DSM Biotechnology Center, Netherlands
15. **Bioconversion of Lignin Degradation Products To Higher Value Chemicals Using  $\alpha$ -Transaminase**  
Chuanjie Du, University College London, United Kingdom
16. **Micro-scale Methods for Rapid Evaluation of Process Options to Increase the Yield of Equilibrium-Controlled Bioconversions: Application to the  $\omega$ -Transaminase Synthesis of Chiral Amines**  
Murni Halim, University College London, United Kingdom
17. **Insertions and deletions as a commonly overlooked source of diversity**  
Alexander Pisarchik, Genencor Int, USA
18. **Probing the human gut microbiome for dietary fiber catabolic enzymes by functional metagenomics**  
Pierre F. Monsan, LISBP-INRA-CNRS-INSA-University of Toulouse, France
19. **Protein Design of TAL Effector Nucleases (TALENs) as a New Genome Engineering Tool**  
Ning Sun, University of Illinois at Urbana-Champaign, USA
20. **Characterization of the novel carbohydrate metabolic enzymes from the thermophilic archaea and their improvement**  
Yutaka Kawarabayasi, Kyushu University, Japan
21. **Development of biomass conversion process using water jet and hyperthermophilic cellulase**  
Kazuhiko Ishikawa, AIST, Japan
22. **Targeted protein quantification for screening of improved microbial enzymes by mass spectrometry**  
Denise I. Jacobs, DSM Biotechnology Center, The Netherlands
23. **Engineering a functional DXP pathway in *Saccharomyces cerevisiae***  
Eugene Antipov, Amyris Inc., USA

24. **Holoabzyme: a single antibody catalyzes multiple chemical transformations upon replacement of artificial cofactors**  
Takeshi Tsumuraya, Osaka Prefecture University, Japan
25. **Power generation combined with the dehydrogenase reaction using NAD<sup>+</sup> as a cofactor**  
Hidekatsu Maeda, Soka University, Japan
26. **Structure-based Engineering of Curcuminoid Synthase**  
Hiroyuki Morita, The University of Tokyo, Japan
27. **Fingerprint-based strategy for rapid engineering of P450 monooxygenases with tailor-made regio- and stereoselectivity**  
Rudi Fasan, University of Rochester, USA
28. **Site-specific streptavidin-protein labeling application using sortase A**  
Takuya Matsumoto, Kobe University, Japan
29. **Construction of a highly complex and well folded protein library based on the (beta/alpha)<sub>8</sub> barrel fold for the evolution of enzymes by mRNA display**  
Misha Golynskiy, University of Minnesota, Minneapolis, USA
30. **Expanding the substrate specificity of propanediol dehydrogenase from *Escherichia coli* through directed evolution**  
Cecilia Blikstad and Mikael Widersten, Uppsala University, Sweden
31. **Relating sequence properties to protein secretion**  
Bastiaan A. van den Berg, Delft University of Technology, The Netherlands
32. **Engineering phenylalanine aminomutase (PAM) for the production of β-amino acids**  
Matthew M. Heberling, University of Groningen, Netherlands
33. **Switch of Substrate Specificity of Hyperthermophilic Acylaminoacyl Peptidase by Combining of Protein Engineering and Solvent Engineering**  
Guangyu Yang and Yan Feng\*, Shanghai Jiao Tong University, China
34. **Characterization and modification of novel glucose dehydrogenase from hyperthermophilic archaeon**  
Hirosi Aiba, Tsuruga Tsuruga Institution of Biotechnology, TOYOBO CO., LTD., Japan
35. **Clarification of Hydrolysis Mechanism of An Ester on Lip-A: (2) Reaction Analysis based on FMO and MOPAC PM6 methods**  
Yukihiro Abe, Research Center, Toyobo Co., Ltd., Japan

36. **Directed Evolution of Metal-Substituted Carbonic Anhydrase**  
Levi M. Stanley, University of Illinois at Urbana-Champaign, USA
37. **Inter-particle type Mesoporous Silica support for enzyme immobilization**  
Hideaki Togashi, JGC, Japan
38. **Studies on enantioselectivity of lipase from Burkholderia cepacia KWI-56**  
Yuichi Koga, Osaka University, Grad.Sch. of Engineering, Japan
39. **Biocatalytic Synthesis of 3-[5-(4-Fluorophenyl)-5(S)-Hydroxypentanoyl-4(S)-4-Phenyl-1, 3-Oxazolidin-2-One: A Crucial Intermediate of Antihyperlipidemic Drug, Exetimibe**  
Amit Singh, National Institute of Pharmaceutical Education & Research, India
40. **Creation of cellooligosaccharide-assimilating E. coli by displaying active BGL on the cell surface using novel anchor protein**  
Tsutomu Tanaka, Kobe University, Japan
41. **Enhancement of lipase activity and stability by spring model**  
Young Joo Yeon, Seoul National University, Korea
42. **Exploiting Clickable Unnatural Amino Acid Incorporation for Inhibitor Directed Enzyme Prodrug Therapy (IDEPT) for Prostate Cancer**  
Margaret E. Black, Washington State University, USA
43. **Exploring Catalytic Promiscuity in the Alkaline Phosphatase Superfamily by Directed Evolution**  
Charlotte Miton, University of Cambridge, UK
44. **SNAP-dendrimers: Multivalent protein display on dendrimer-like DNA for directed evolution**  
Miriam Kaltenbach, University of Cambridge, United Kingdom
45. **Synergistic Effect on Xylan Degradation by Highly Thermostable Acetyl Xylan Esterase and Endo-Xylanase from *Thermotoga neapolitana***  
Tae-Jip Kim, Chungbuk National University, Republic of Korea
46. **Effect of co-expression of Genes from *has Operon* on Hyaluronic Acid production and Real-Time Analysis of their Expression in Metabolically Engineered *L. lactis***  
Shashi Bala Prasad, Department of Biotechnology, Indian Institute of Technology, Madras, India
47. **Quinone methide generating substrates in high-throughput enzyme screening**  
David Kwan, University of British Columbia, Canada



48. **Reverting and Understanding the Enantioselectivity of a Potato Epoxide Hydrolase**  
Åsa Janfalk Carlsson & Mikael Widersten, Uppsala University, Sweden
49. **Structure and Functional Relationship of the Thermophilic Endo- $\beta$ -1,4-glucanase**  
Yan Feng, Shanghai Jiao Tong University, China
50. **Targeted mutagenesis of bacterial nitroreductases for anti-cancer gene therapy**  
EM Williams, Victoria University of Wellington, New Zealand
51. **Towards the Deimmunization of Protein Therapeutics**  
Daniel C. Osipovitch, Dartmouth College, USA
52. **Polymerized Ionic Liquid Nanostructures for Biocatalytic Fuel Production**  
Millicent A. Firestone, Argonne National Laboratory, USA
53. **Production of Hyaluronic Acid in pH Inducible P170 Expression System in *Lactococcus Lactis***  
Ashish Chauhan, Indian Institute of Technology Madras, India
54. **Studies to characterize high molecular weight species of bacterial Hyaluronic acid**  
Sneh Sanjay Badle, Indian Institute of Technology, Madras, India
55. **On the influence of ionic liquids on structure and function of alcohol dehydrogenase**  
Mehran Miroliaei, University of Isfahan, I.R.Iran
56. **Synthesis of Phenylalanine Analogs by Dynamic Kinetic Resolution Using Engineered Mutant L19V and L78T of ACL Racemase**  
Kazuyuki Yasukawa, Toyama Prefectural University, Japan
57. **Development of a Oxygenation Platform Technology for Biocatalysis**  
Iwona Kaluzna, DSM, The Netherlands
58. **Generation of Novel Amino Acid Dehydrogenase Activity Through Single Mutations of a Highly Specific Alanine Dehydrogenase**  
Emily C Mundorff, Vassar College, USA
59. **Directed Evolution of Carotenoid and Isoprenoid Synthases for Cellulaar Production of Novel Compounds**  
Daisuke Umeno, Chiba University, Japan
60. **Enzyme Structure-Function-Microenvironment Relationships in Ionic Liguids**  
Erik M. Nordwald, University of Colorado Boulder, USA