
# The First EITA Conference on Agricultural Science and Technology, Biosystems Engineering

**(The EITA-New Agriculture 2013)**

## "Precision Agriculture: Challenges and Future Directions"

## Conference Proceedings

## Cornell University

**Ithaca, New York, U.S.A.**

## Thursday-Friday, June 27-28, 2013

## Table of Contents

## Conference Themes

"**Precision Agriculture: Challenges and Future Directions**"

The EITA-New Agriculture 2013 consists of following 3 workshops:

- **Workshop 1 (W1)**: Agroecology, Agricultural Biotechnology
- **Workshop 2 (W2)**: Precision and Information Agriculture, Renewable Energy and Smart Grid
- **Workshop 3 (W3)**: Animal and Veterinary Sciences, Biomedical Sciences and Engineering

# Planning Committee

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| Ta-Te Lin | 林達德 | National Taiwan University |

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| Ta-Te Lin | 林達德 | National Taiwan University |

#### *Workshop 1: Agroecology, Agricultural Biotechnology*

| | | |
|---|---|---|
| Ta-Te Lin | 林達德 | National Taiwan University |

#### *Workshop 2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

| | | |
|---|---|---|
| Kuan Chong Ting | 丁冠中 | University of Illinois at Urbana-Champaign |
| Suming Chen | 陳世銘 | National Taiwan University |

#### *Workshop 3: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

| | | |
|---|---|---|
| Yung-Fu Chang | 張永富 | Cornell University |
| Ya-Ching Shen | 沈雅敬 | National Taiwan University |

## ***Conference Manager***

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|---|---|---|
| Jiun-Ruey Chen | 陳君睿 | Cornell University |

## ***Publication***

### **Conference Program:**

| | | |
|---|---|---|
| Si-Yu Li | 李思禹 | National Chung Hsing University |

### **Conference Proceedings:**

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|---|---|---|
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Cornell Taiwanese Student Association
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## ***General Inquiries & Advanced Registration***

Investment & Trade Office, TECRO in the U.S.
駐美投資貿易服務處
Tel: +1-212-317-7395
E-mail: investny@msn.com

## ***On-Site Registration***

Cornell Taiwanese Student Association
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# Conference Program

## *Day 1 (Thursday, June 27, 2013)*

### 6/27 (Thu) 8:30 am - 5:00 pm: Registration
Room: **James Law Auditorium**

### 6/27 (Thu) 9:00 am - 9:30 am: Opening Session
Room: **James Law Auditorium**

General Conference Co-chairs:

**Dr. Yung-Fu Chang,** Professor, Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)

**Dr. Ta-Te Lin,** Distinguished Professor and Associate Dean, Department of Bio-Industrial Mechatronics Engineering, College of Bioresources and Agriculture, National Taiwan University
(臺灣大學生物資源暨農學院、生物產業機電工程系特聘教授林達德副院長)

**Welcome Remarks:**

**Dr. Michael Kotlikoff**
Professor, Department of Biomedical Sciences
Austin O. Hooey Dean, College of Veterinary Medicine
Cornell University

### 6/27 (Thu) 9:30 am - 11:00 am: Plenary Session (1)
Chair: **Dr. Yung-Fu Chang,** Professor, Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)
Room: **James Law Auditorium**

**Dr. Joel D. Baines**
James Law Professor of Virology
Associate Dean for Research and Graduate Education
College of Veterinary Medicine
Cornell University

"Intelligence Empowered Agricultural Systems for Food, Feed, Fiber, Fuel, and Furnishing"
**Dr. Kuan Chong Ting**
Professor and Head, Department of Agricultural and Biological Engineering
University of Illinois, Urbana-Champaign
(伊利諾大學農業暨生物工程學系教授兼系主任丁冠中教授)

### 6/27 (Thu) 11:00 am - 11:15 am: Break

## 6/27 (Thu) 11:15 am – 12:45 pm: Plenary Session (2)

Chair: **Dr. Ta-Te Lin,** Distinguished Professor and Associate Dean, Department of Bio-Industrial Mechatronics Engineering, College of Bioresources and Agriculture, National Taiwan University

(臺灣大學生物資源暨農學院、生物產業機電工程系特聘教授林達德副院長)

Room: **James Law Auditorium**

"Enhancements of Power Generation by Using Biogas in a Swine Farm"
**Dr. Chiun-Hsun Chen**
Dean, College of Engineering
Professor, Department of Mechanical Engineering
National Chiao Tung University
(交通大學工學院院長,高效率能源技術研究中心主任與機械工程系陳俊勳教授)

## 6/27 (Thu) 12:45 pm - 2:15 pm: Lunch

# Parallel Sessions:

## 6/27 (Thu) 2:15 pm – 3:45 pm: Technical Session D1-W1-T1: Agroecology, Agricultural Biotechnology

Chair: **Dr. Ta-Te Lin,** Distinguished Professor and Associate Dean, Department of Bio-Industrial Mechatronics Engineering, College of Bioresources and Agriculture, National Taiwan University

(臺灣大學生物資源暨農學院、生物產業機電工程系特聘教授林達德副院長)

Room: **LH1**

"Gene Deletor Technology and its Applications in the Second and Third Generation Breeding Technologies"
**Dr. Yi Li**
Professor, Department of Plant Science
Director, New England Invasive Plant Center
University of Connecticut, Storrs
(康涅狄格大学植物科学系李义教授)

"Seed Potatoes – A Cooperative Production System that Facilitates Technology Transfer"
**Dr. Amy Charkowski**
Professor, Department of Plant Pathology
University of Wisconsin, Madison

"Recycling Irrigation System – A Focal Point of Agricultural Water Security and Plant Biosecurity in the 21st Century"
**Dr. Chuanxue Hong**
Professor, Department of Plant Pathology, Physiology and Weed Science
Virginia Polytechnic Institute and State University

## 6/27 (Thu) 2:15 pm – 3:45 pm: Technical Session D1-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid

Chair: **Dr. Kuan Chong Ting,** Professor and Head, Department of Agricultural and Biological Engineering, University of Illinois, Urbana-Champaign

(伊利諾大學農業暨生物工程學系教授兼系主任丁冠中教授)

Room: **Hagan**

"Synthetic Silage: Engineering a Microbial Platform for Biomass Pretreatment"
**Dr. Tom L. Richard**
Professor of Biological Engineering
Director, Penn State Institutes of Energy and the Environment
Pennsylvania State University

"Bioenergy from Waste Biomass through the Bio-electrochemical System"
**Dr. Shaoan Cheng**
Changjiang Scholar & Professor, Department of Energy Engineering
Zhejiang University
(浙江大学能源工程学系长江学者成少安特聘教授)

"Automation on Precision Cultivation in Greenhouse"
**Dr. Suming Chen**
Professor, Department of Bio-lndustrial Mechatronics Engineering
Director of Bioenergy Research Center
National Taiwan University
(臺灣大學生物產業機電工程學系陳世銘教授)

## 6/27 (Thu) 2:15 pm – 3:45 pm: Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering

Chair: **Dr. Yung-Fu Chang,** Professor, Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)
Room: **S1-017**

"Tumor suppressor WWOX in cell-cell recognition and cancer stem cell regulation"
**Dr. Nan-Shan Chang**
Distinguished Professor and Director, Institute of Molecular Medicine
National Cheng Kung University
(成功大學分子醫學研究所所長張南山特聘教授)

"Production and Delivery of Bioactive Factors with Food Grade Bacteria to Enhance Performance of Early Weaned Pig"
**Dr. Julang Li**
Professor, Department of Animal and Poultry Science
University of Guelph

"Application of High-throughput RNA Sequencing in Animal Reproduction: Application to the Bull Spermatozoal Transcript Profile"
**Dr. Becky L. Sartini**
Associate Professor, Department of Fisheries, Animal and Veterinary Science
University of Rhode Island

"Regulation of Sperm Storage in Mammals"
**Dr. Pei-hsuan (Chris) Hung**
Postdoctoral Associate, Department of Biomedical Sciences
Cornell University

## 6/27 (Thu) 3:45 pm – 4:00 pm: Break

# Parallel Sessions:

## 6/27 (Thu) 4:00 pm – 5:30 pm : Technical Session D1-W1-T2: Agroecology, Agricultural Biotechnology

Chair: **Dr. Yi Li,** Professor, Department of Plant Science, Director, New England Invasive Plant Center
University of Connecticut, Storrs
Room: **LH1**

"What mechanisms of resistance to transgenic Bt-crops may be selected in insect populations in the field?"
**Dr. Ping Wang**
Associate Professor, Department of Entomology
College of Agriculture and Life Sciences
Cornell University

"Identify Soybean Genes Involved in Resistance to Phakopsora pachyrhizi Infection Using Biotechnology"
**Dr. Zhi-Yuan Chen**
Associate Professor, Department of Plant Pathology and Crop Physiology
Louisiana State University Agricultural Center

**Dr. Wenling Deng**
Assistant Professor, Department of Plant Pathology
National Chung Hsing University
(中興大學植物病理學系鄧文玲教授)

## 6/27 (Thu) 4:00 pm – 5:30 pm: Technical Session D1-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid

Chair: **Dr. Suming Chen,** Professor, Department of Bio-lndustrial Mechatronics Engineering
National Taiwan University
(臺灣大學生物產業機電工程學系陳世銘教授)
Room: **Hagan**

"Biofuels and Biorenewable Chemicals from Waste and Alternative Biomass Based Feedstock"
**Dr. Richard S. Parnas**
Professor of Chemical Engineering – Polymers Program, Institute of Materials Science &
Associated Faculty – Environmental Engineering Program, Department of Chemistry
University of Connecticut

**Dr. Ting Zhu**
Assistant Professor, Department of Computer Science
The University of New York at Binghamton

"Production of Biofuels from CO2"
**Dr. Si-Yu Li**
Assistant Professor, Department of Chemical Engineering
National Chung Hsing University
(中興大學化學工程學系李思禹教授)

## 6/27 (Thu) 4:00 pm – 5:30 pm : Technical Session D1-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering

Chair: **Dr. Ya-Ching Shen,** Professor, School of Pharmacy, College of Medicine, National Taiwan University
(臺大醫學院藥學系沈雅敬教授)
Room: **S1-017**

“Nutrition: at crossroads of human health and sustainable world”
**Dr. Xingen Lei**
Professor, Department of Animal Science
Cornell University

“IL-12 is Required for mTOR Regulation of Memory CTLs during Virus Infection”
**Dr. Zhengguo Xiao**
Assistant Professor, Department of Animal and Avian Sciences
University of Maryland, College Park

"In Vitro Embryogenesis, Animal Cloning and Embryonic Stem Cells"
**Dr. Jyh-Cherng Ju**
Distinguished Professor, Department of Animal Science,
National Chung Hsing University
(中興大學動物科學系朱志成特聘教授)

## ***Day 2 (Friday, June 28, 2013)***

### 6/28 (Fri) 9:00 am - 12:45 pm: Registration
Room: **LH1**

## Parallel Sessions:
### 6/28 (Fri) 9:30 am – 11:00 am: Technical Session D2-W1-T1: Agroecology, Agricultural Biotechnology
Chair: **Dr. Kuan-Chen Cheng,** Assistant Professor, Graduate Institute of Food Science and Technology,Institute of Biotechnology, National Taiwan University
(台灣大學食品科技研究所/生物科技研究所鄭光成教授)
Room: **LH1**

"New and Bioactive Terpenoids and Lignans from Schisandra"
**Dr. Ya-Ching Shen**
Professor, School of Pharmacy, College of Medicine
National Taiwan University
(臺大醫學院藥學系沈雅敬教授)

"Active DNA Demethylation during Gametogenesis Regulates Gene Imprinting and Transposon Silencing in Arabidopsis"
**Dr. Tzung-Fu Hsieh**
Assistant Professor, Plants for Human Health Institute & Department of Plant Biology
North Carolina State University

### 6/28 (Fri) 9:30 pm – 11:00 am: Technical Session D2-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid
Chair: **Dr. Kuan Chong Ting,** Professor and Head, Department of Agricultural and Biological Engineering, University of Illinois, Urbana-Champaign
(伊利諾大學農業暨生物工程學系教授兼系主任丁冠中教授)
Room: **Hagan**

"A Green Process for the Production of Starch/Cellulose Acetate Bio-Materials"
**Dr. Chunbao (Charles) Xu**
Associate Professor, NSERC/FPInnovations Industrial Research Chair in Forest Biorefinery, Department of Chemical and Biochemical Engineering and Institute for Chemicals and Fuels from Alternative Resources (ICFAR)
Western University

"From Biomass to Biofuels: the Power of Synthetic Biology"
**Dr. Kang Wu**
Assistant Professor, Department of Chemical Engineering
The University of New Hampshire
(新罕布什尔大学化学工程系吴康教授)

### 6/28 (Fri) 9:30 pm – 11:00 am: Technical Session D2-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering
Chair: **Dr. Yung-Fu Chang,** Professor, Department of Population Medicine and Diagnostic Sciences, College of Veterinary Medicine, Cornell University

(康乃爾大學獸醫學院張永富教授)

Room: **S1-017**

**Dr. Jiuzhou John Song**
Associate Professor, Department of Animal and Avian Sciences
University of Maryland, College Park

"Controlling Biofilms by Targeting Bacterial Cell-to-Cell Signaling"
**Dr. Dacheng Ren**
Associate Professor, Department of Biomedical and Chemical Engineering
Syracuse University
(雪城大学生物医学暨化学工程学系任大成教授)

"Lysosomal Dysfunction in Frontotemporal Lobar Degeneration"
**Dr. Fenghua Hu**
Research Scientist, Department of Molecular Biology and Genetics
Weill Institute for Cell and Molecular Biology
Cornell University
(康乃爾大學胡风华博士)

## 6/28 (Fri) 11:00 am – 11:15 am: Break

Room:

# Parallel Sessions:

## 6/28 (Fri) 11:15 am – 12:45 pm: Technical Session D2-W1-T2: Agroecology, Agricultural Biotechnology

Chair: **Dr. Tzung-Fu Hsieh,** Assistant Professor, Plants for Human Health Institute and Department of Plant Biology, North Carolina State University
Room: **LH1**

"Temperature Stress Tolerance in Plants: Role of Proteins and Small Non-coding RNAs"
**Dr. Jianhua Zhu**
Assistant Professor, Department of Plant Science and Landscape Architecture
University of Maryland, College Park

"Isoflavone Aglycones Enrichment in Soymilk by Agricultural Waste-Based Immobilized β-Glucosidase"
**Dr. Kuan-Chen Cheng**
Assistant Professor, Graduate Institute of Food Science and Technology
Institute of Biotechnology
National Taiwan University
(台灣大學食品科技研究所/生物科技研究所鄭光成教授)

## 6/28 (Fri) 11:15 am – 12:45 pm: Technical Session D2-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid

Chair: **Dr. Suming Chen,** Professor, Department of Bio-lndustrial Mechatronics Engineering National Taiwan University
(臺灣大學生物產業機電工程學系陳世銘教授)

Room: **Hagan**

**Dr. Liangcai Peng**
Changjiang Scholar & Professor of Plant Biology
Director of Biomass & BioEnergy Research Center
Huazhong Agricultural University
(华中农业大学植物科技学院长江学者彭良才特聘教授)

"Plant Growth Measurement and Modeling in Plant Factory"
**Dr. Ta-Te Lin**
Distinguished Professor and Associate Dean
Department of Bio-Industrial Mechatronics Engineering
College of Bioresources and Agriculture
Graduate Institute of Brain and Mind Sciences
National Taiwan University
(臺灣大學生物資源暨農學院、生物產業機電工程系特聘教授林達德副院長)

## 6/28 (Fri) 11:15 am – 12:45 pm : Technical Session D2-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering

Chair: **Dr. Ya-Ching Shen,** Professor, School of Pharmacy, College of Medicine, National Taiwan University
(臺大醫學院藥學系沈雅敬教授)
Room: **S1-017**

"Development of Subtype-specific Monoclonal Antibodies (MAb) to Avian Influenza Virus and MAb-based Assays for the Rapid Detection of Avian Influenza"
**Dr. Huaguang Lu**
Senior Research Associate - Avian Virologist
Animal Diagnostic Lab
Department of Veterinary and Biomedical Sciences
Pennsylvania State University

"Molecular Basis of Interactions between HIV-1 gp120 and Coreceptors CCR5/CXCR4"
**Dr. Shi-hua Xiang**
Assistant Professor, Nebraska Center for Virology
School of Veterinary Medicine and Biomedical Sciences
University of Nebraska-Lincoln
(内布拉斯加大学林肯分校兽医学院向世华教授)

"Molecular Analysis of LigB of Leptospira, a Potential Vaccine Candidate"
**Dr. Yung-Fu Chang**
Director, Infectious Disease Research Program, Animal Health Diagnostic Center
Professor, Department of Population Medicine and Diagnostic Sciences
College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)

## 6/28 (Fri) 12:45 pm - 2:15 pm: Lunch

## 6/28 (Fri) 2:15 pm – 5:30 pm: Conference Tours

# Abstracts and Biographies

*Opening Session (June 27th, 2013)*

## Opening Speech and General Conference Co-Chair

**Yung-Fu Chang**

Director, Infectious Disease Research Program, Animal Health Diagnostic Center
Professor, Department of Population Medicine and Diagnostic Sciences
College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)

BIOGRAPHY

Yung-Fu Chang, Veterinarian degree from National Pintung Institute of Agriculture, Taiwan in 1974, MS degree, University of Idaho in 1981 and Ph.D, Texas A&M University in 1984.

**Positions and Employment**

- **1974-1979** Assistant Pathologist, Veterinary Pathology Division, Taiwan Provincial Research Institute for Animal Health, Taiwan
- **1984-1985** Research Associate, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1986-1989** Assistant Research Scientist, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1989-1996** Assistant Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **1996-2003** Associate Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **2003 (Jan-July)** Visiting Professor, Department of Infectious disease and Medicine, Stanford University Medical School, Stanford, CA.
- **2003-present** Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.

**Honors**

Beta Rho Chapter of Phi Sigma National Honor Society (1983); Diplomat of the American College of Veterinary Microbiologist (1987); The Society of Phi Zeta; Who's Who in America? (1991); Editor Board, Bioengineered Bugs (2010-2012); Journal of Veterinary Science & Technology (2010-present) and PLoS One. Treasure, American Leptospirosis Research Conference, Inc. (2001-present). Distinguished alumni, National Pin-Tung University of Science and Technology, Taiwan (2007).

**Patents (active)**

Ehrlichia canis genes and vaccines. US patent no: 7,951,386 B2. Yung-Fu Chang; Compositions for eliciting an immune response against Mycobacterium avium subspecies paratuberculosis. US Patent no: 7, 732,580,B2 & 7,858,102 B2,European patent No: 1,855,716. Yung-Fu Chang; Protective coating for array material depositions. US Patent no. 7,781,378, B2. Reid N. Orth, M. Lin, T. C. Clark, Yung-Fu Chang, Harold G. Craighead, Jose Manuel Morqan-Mirabal; Immunogenic proteins of Leptospira. US Patent no. US 7,655,427. B2.Yung-Fu Chang and Raghavan U. M. Palaniappan.

*Opening Session (June 27th, 2013)*

## Opening Speech and General Conference Co-Chair

**Ta-Te Lin**

Distinguished Professor and Associate Dean
Department of Bio-Industrial Mechatronics Engineering, National Taiwan University
1, Sec. 4, Roosevelt Road, Taipei, Taiwan, ROC
Tel: +886-2-3366-5331, Fax: +886-2-2392-9416
Email: m456@ntu.edu.tw
(臺灣大學生物資源暨農學院、生物產業機電工程系特聘教授林達德副院長)

BIOGRAPHY

Ta-Te Lin was born in Taipei, Taiwan, R.O.C., on June 11, 1959. He received the B.S. degree in Agricultural Engineering from National Taiwan University, Taiwan, R.O.C. in 1981, and the MS and Ph.D. in Agricultural and Biological Engineering from Cornell University, U.S.A., in 1985 and 1989, respectively.

He has been on the faculty of National Taiwan University since 1989, and is currently Distinguished Professor of the Department of Bio-Industrial Mechatronics Engineering and Associate Dean of the College of Bioresources and Agriculture at the National Taiwan University. His research interests include agricultural mechanization and automation, digital image processing and machine vision, mathematical modeling of biological systems, artificial intelligence and bio-instrumentation.

He is a member of several international societies including the ASABE, the IEEE Computer Society, Japanese Society for Agricultural Informatics, and the Society for Cryobiology. Domestically, he served as board members of Chinese Institute of Agricultural Machinery, Taiwan Institute of Biomechatronics, and Taiwan Agricultural Information Technology Association. He was the President of Taiwan Institute of Biomechatronics from 2009 to 2012. He has received numerous recognitions for his outstanding performance in teaching and research. He has received twice the distinguished teaching award from National Taiwan University in 1999 and 2007. He received the academic achievement award for the Chinese Institute of Agricultural Machinery (CIAM) in 2005. He was elected as National Ten Outstanding Agriculture Experts by Kiwanis International, Taiwan, in 2012. He received the best annual paper awards from CIAM in 2000, 2003, and 2005, respectively, best poster paper awards from TIBM in 2005, 2006, 2009, 2011, 2012, best annual paper awards from Taiwan Entomological Society in 2007. He has authored or coauthored more than 200 journal and conference papers, and awarded more than 10 patents.

*Opening Session (June 27th, 2013)*

## Welcome Remarks

## Dean Michael Kotlikoff

Professor, Department of Biomedical Sciences
Austin O. Hooey Dean, College of Veterinary Medicine
Cornell University

BIOGRAPHY

*Plenary Session (1)*

**Joel D. Baines, VMD PhD**

**James Law Professor of Virology and Associate Dean for Research and Graduate Education, College of Veterinary Medicine, Cornell University**

Position, Affiliation
5132 Vet Med center, USA
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ABSTRACT

Herpesviruses are very important pathogens that cause a variety of both acute and chronic disease in animals and humans. While treatment with drugs against some herpesviruses have been very successful, resistance to these drugs is common. Moreover, many animal herpesviruses are not effectively treatable with existing therapies. In this presentation we will show an example of how structural biology can lead to the identification of novel antiviral compounds. Using a series of experiments to map critical domains of a protein required for scaffold and capsid assembly, we identified a peptide derived from the sequence of the HSV-1 capsid scaffold protein that has effective potency against herpes simplex virus replication with minimal toxicity. Because structural targets such as this are conserved, therapies that interfere with capsid assembly may have broad activities against many different herpesviruses.

BIOGRAPHY

Dr. Baines was born in Austin Texas. He received a B.S. degree from Kansas State University in microbiology in 1979, a veterinary degree at the University of Pennsylvania in 1983, and a PhD in virology at Cornell University in 1988.

He conducted a postdoctoral fellowship at University of Chicago in the laboratory of Bernard Roizman, and became an Assistant Professor at Cornell University in 1993. He moved upwards through the ranks to Professor and was named the James Law Professor of Virology in 2006. He was appointed Associate Dean for Research and Graduate Education at the College of Veterinary Medicine at Cornell in 2012. He and has He has published over 80 papers, reviews, and book chapters during his career on the molecular biology of herpesviruses. He is now interested in identifying novel therapies directed against this important group of viruses.

Associate Dean Baines is a member of the American Society of Microbiology, the American Society of Virology, and the American Association for the Advancement of Science. He is a member of the editorial board for Journal of Virology, is an associate editor for Plos Pathogens, co-chairs the National Institutes of Health Virology B Study Section Virology, and has reviewed papers for more than a dozen different scientific journals, and was mentioned as an outstanding reviewer for Journal of Virology.

*Plenary Session (1)*

# Intelligence Empowered Agricultural Systems for Food, Feed, Fiber, Fuel, and Furnishing

**Kuan Chong Ting**

Professor and Head
Department of Agricultural and Biological Engineering
University of Illinois at Urbana-Champaign
1304 W. Pennsylvania Ave., Urbana, Illinois 61801 USA
Tel: +1-217-333-3570, Fax: +1-217-244-0323
Email: kcting@illinois.edu
(伊利諾大學農業暨生物工程學系教授兼系主任丁冠中教授)

ABSTRACT

Agricultural systems (broadly defined) are positioned to continue to play an important role in solving today's large societal problems in food security, energy supply, environmental stewardship, and family/community development. Currently, there are many issues that agricultural systems are facing. Among them are how to manage and utilize resources to produce food, feed, fiber, fuel, and furnishing (i.e. ornamentals) while ensuring a sustainable environment; make agricultural system tasks comfortable for human operators and jobs more attractive; satisfy the increasing market demand for high product quality; and provide leadership in addressing food security and safety issues. Therefore, modernization of agricultural systems by employing human intelligence and machine power is of great importance. The advances in data science and information technology have brought about highly valuable intelligence to a huge range of human activities. Similar kind of intelligence has been employed in agricultural systems to produce very impressive results; especially for intensive controlled environment plant and/or animal production, precision and progressive farming operations, and food manufacturing plants. Although there have been substantial amounts of work toward applying information technology to agricultural systems, now is an opportune time to make a much larger effort to empower a wider spectrum of operations within the complex agricultural systems by transforming information into knowledge and wisdom with appropriate sophistication for different universal and site-specific scenarios. Core agricultural system activities include: (1) Production of plants and animals, (2) Processing including post-harvest and value-added, (3) Consumption and Utilization, and (4) Waste Management and Resource Recovery. Sustainability and competitiveness are two top system level issues to be addressed. Modern agricultural systems need to be empowered by intelligence that requires capability for information collection/processing and decision making, mechatronics devices for sensing, controls and actions, and ability to synergistically integrate components into functional systems. This presentation will discuss challenges and opportunities in empowering agricultural systems using human and machine intelligence. Examples from controlled environment plant production and biomass energy feedstock provision will be used to demonstrate the underlying concept of Concurrent Science, Engineering, and Technology (ConSEnT), an intelligent systems informatics and analysis platform.

BIOGRAPHY


**K.C. Ting** is Professor and Head of the Agricultural and Biological Engineering Department at the University of Illinois. He received his Ph.D. in agricultural engineering from the University of Illinois. He teaches and conducts research on automation, systems informatics and analysis, alternative energy, and phytomation (i.e. plant based engineering systems). He has participated in the efforts to obtain funding for a number of multi-million dollar centers, institutes and programs. He has received over $7.3 million dollars of research grants, under his direct administration, from federal governments, states, and the industry. He served as the leader of the Systems Studies & Modeling Team within the New Jersey NASA Specialized Center Of Research and Training (NJ-NSCORT) during 1996-2000. He currently leads a BP Energy Biosciences Institute program on "Engineering Solutions for Biomass Feedstock Production" and serves as a member of Steering Committee for the "ADM Institute for the Prevention of Postharvet Loss" at the University of Illinois. He is a co-editor/co-author of a monograph entitled "Robotics for Bioproduction Systems." He holds a professional engineer license in New Jersey. He has authored/co-authored over 260 articles, conference papers, and project reports. He has been invited to deliver close to 100 presentations in many countries. He was an Editor-in-Chief for Computers and Electronics in Agriculture during 2007-2010. He has received many major awards and recognitions including: ASABE James R. and Karen A. Gilley Academic Leadership Award, August 2011; ASABE Kishida International Award, July 2008; Guest Chair Professor, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China, April 2006; Honorary Scientist, Rural Development Administration, Republic of Korea, January 1, 2004-December 31, 2006; Fellow of ASME elected in July 2002; Fellow of ASABE inducted in July 2001; and Cook College/Alpha Zeta Professor of the Year, Rutgers University, 1997.

*Plenary Session (2)*

# Enhancements of Power Generation by Using Biogas in a Swine Farm

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ABSTRACT

Biogas generated from the anaerobic treatment of wastewater in a swine farm is a kind of natural renewable energy source, mainly consisting of $CH_4$ (60~70%) and $CO_2$ (20~30%). Both are greenhouse gases, and the corresponding effect of $CH_4$ is 20 times higher than that of $CO_2$. The electricity can be generated by combustion of $CH_4$ via engine/generator; whereas $CO_2$ inside biogas and generated by combustion can be removed and transformed into biodiesel by use of microalgae incorporating with photosynthesis, forming a carbon cycle. A pilot plant was set up to develop the wastewater recycling, the reduction of $CO_2$ emission and the transesterification technology as well as to generate electricity in a swine farm of Taiwan Sugar Corporation. The high concentration of $H_2S$ in biogas collected via anaerobic treatment was removed by the desulfurized bioreactor. Then, the treated biogas was supplied to a 30kW piston engine/generator for electricity generation. The removal of $H_2S$ is so effective that the engine is prevent from corrosion and it still can work normally after three years. Finally, microalgae were used to reduce the $CO_2$ concentration abundantly in engine exhaust gas, and the resultant algal biomass produced biodiesel by transesterification. In this presentation, the enhancements of 30kW piston engine performance (i.e. power generation) are discussed intensively.

The first, an oxyfuel combustion technology was applied. The extra oxygen mixed with the fuel, and the mixture flew into the piston engine. With 3% oxygen-enriched air, the maximum power generation, thermal efficiency, and $CH_4$ consumption percentage increased up to 28.2 kW, 30.2%, and approximately 100%, respectively, for a biogas supply rate of 260 L/min, and the engine can operate normally at a lower limited biogas supply rate of 220 L/min. The second, the effect of preheating the inlet gas to different temperatures was investigated by applying a waste-heat recovery system. The thermal efficiency increases with increasing methane concentration only when $\lambda$ (excess air ratio) > 0.95, although on the relatively rich side ($\lambda$ <

0.95), there is no benefit. The improved generator performance obtained by preheating the inlet gas is apparent when the excess air ratio is relatively high, such as when $\lambda > 1.3$. The third, the maximum power outputs of biogas supply at 200, 220 and 240L/min after dehumidification with $\lambda$=1.0 are 21.55kW, 24.78kW and 26.35kW. In comparison with the corresponding ones without dehumidifying, the increases in power generation are 4.7, 5.9 and 2.7%, respectively. The fourth, a complete ignition system, consisting of a spark-plug pressure sensor and a rotary encoder, was installed to record the in-cylinder pressure and crank angle of piston cylinder. The optimum spark timing is located at 13 degrees before top-dead center (BTDC13), which supplies the highest power generation. Delaying or advancing the optimum spark timing leads to poorer power outputs. The spark timing of BTDC13 possess a lower coefficient of variation in indicated mean effective pressure ($CoV_{IMEP}$) than the delayed and advanced timings, where the engine performs at more stable indicated mean effective pressures (IMEP) during combustion. In addition, it was found that the lower $CoV_{IMEP}$ results in a higher $CH_4$ consumption ratio. Finally, this work conducted a series of comparison tests by using piston and turbine engines, respectively, under the loads varying from 15 to 30kW. The results showed that the operation of turbine engine is more stable than that of piston one in such range. However, the lower load limit is 15kW for turbine engine, whereas piston engine still can be operated at as low as 8kW. As to the economic benefits of using biogas, it estimated that a swine farm with a scale of 3,000 heads in Taiwan can generate 145,000 kWh of electricity and decrease 3,000 tons of $CO_2$ per year. If the scale rises to 10,000 heads, then, the power generated increases to 495,000 kWh and $CO_2$ reduction is 10,000 tons. The durations of cost recovery are 13.6 and 5.6 years, respectively.

## BIOGRAPHY

Chiun-Hsun Chen received his B.S. (1978) in Mechanical Engineering from National Taiwan University. He received his M.S. (1983) and Ph.D. (1985) from Case Western Reserve University at Cleveland, Ohio, both in Mechanical and Aerospace Engineering, and served as a Research Associate of National Research Council at NASA Lewis (now Glenn) Research Center, Cleveland, Ohio from 1985 to 1987. After that, he was recruited as an Associate Professor by Department of Mechanical Engineering of National Chiao-Tung University at Taiwan, and promoted to Professor in 1990. Currently, he is the Dean of Engineering College. Professor Chen's research interests include: Energy Technologies (Green Buildings, Fuel Cells, and Carbon Capture and Segregation), and Fire Safety Engineering and Combustion Fundamentals. He publishes around 70 peer-reviewed journal and 80 conference papers in the corresponding areas. He received a National Youth Award in 1991 and an Outstanding Engineering Professor Award of Chinese Institute of Engineers in 2003. He has serves as a long-term consultant for Green Energy and Environment Research Laboratories of Industrial and Technology Research Institute, a planning committee member of Higher Education Evaluation and Accreditation Council of Taiwan, and organizing committees of various international conferences

*Technical Session D1-W1-T1: Agroecology, Agricultural Biotechnology*

## Session Chair

## Ta-Te Lin

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BIOGRAPHY

Ta-Te Lin was born in Taipei, Taiwan, R.O.C., on June 11, 1959. He received the B.S. degree in Agricultural Engineering from National Taiwan University, Taiwan, R.O.C. in 1981, and the MS and Ph.D. in Agricultural and Biological Engineering from Cornell University, U.S.A., in 1985 and 1989, respectively.

He has been on the faculty of National Taiwan University since 1989, and is currently Distinguished Professor of the Department of Bio-Industrial Mechatronics Engineering and Associate Dean of the College of Bioresources and Agriculture at the National Taiwan University. His research interests include agricultural mechanization and automation, digital image processing and machine vision, mathematical modeling of biological systems, artificial intelligence and bio-instrumentation.

He is a member of several international societies including the ASABE, the IEEE Computer Society, Japanese Society for Agricultural Informatics, and the Society for Cryobiology. Domestically, he served as board members of Chinese Institute of Agricultural Machinery, Taiwan Institute of Biomechatronics, and Taiwan Agricultural Information Technology Association. He was the President of Taiwan Institute of Biomechatronics from 2009 to 2012. He has received numerous recognitions for his outstanding performance in teaching and research. He has received twice the distinguished teaching award from National Taiwan University in 1999 and 2007. He received the academic achievement award for the Chinese Institute of Agricultural Machinery (CIAM) in 2005. He was elected as National Ten Outstanding Agriculture Experts by Kiwanis International, Taiwan, in 2012. He received the best annual paper awards from CIAM in 2000, 2003, and 2005, respectively, best poster paper awards from TIBM in 2005, 2006, 2009, 2011, 2012, best annual paper awards from Taiwan Entomological Society in 2007. He has authored or coauthored more than 200 journal and conference papers, and awarded more than 10 patents.

*Technical Session D1-W1-T1: Agroecology, Agricultural Biotechnology*

# Gene deletor technology and its applications in the second and third generation breeding technologies

**Yi Li 李义**

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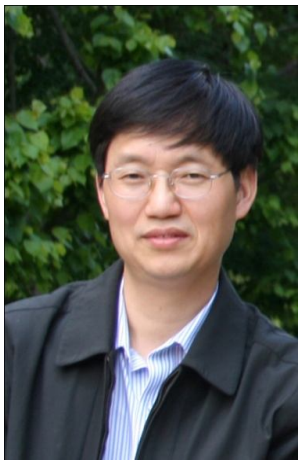
## ABSTRACT

The second generation plant breeding technologies, transgenic plant technologies, have been widely used as a powerful tool for genetic improvement of crop plants but some people worry about their environmental and food safety issues. The gene deletor technology we developed is capable of eliminating all transgenes in pollen, seed, fruit or any edible parts of transgenic plants. The gene deletor technology is based on the site specific FLP DNA recombinase from yeast and novel recognition sequences. Greenhouse and field evaluations of several versions of the gene deletor cassettes have been performed. Our results demonstrate that the gene deletor technology may be used to make transgenic plants to produce non-transgenic pollen, seed, fruit or other edible organs, resulting "safer" transgenic plants for planting and to consuming.

The third generation plant breeding technologies, that is genomics-guided and genome editing-based breeding technologies, can be used to create traits in crop plants effectively and timely. The third generation breeding technologies can be as efficient as transgenic plant technologies but resulting plants with desirable traits contain no transgenes. We are using some of these techniques for crop plant improvement. Examples are turf grass varieties with short growth and shade tolerance traits. Applications of the gene deletor technology in the third generation breeding technologies will be discussed.

## BIOGRAPHY



Yi Li obtained his B.S. in forestry from Beijing Forestry University, China and Ph.D. in plant physiology and biochemistry from State University of New York, College of Environmental Science and Forestry, Syracuse, New York. He was trained as a postdoctoral fellow in the area of molecular biology at University of Missouri-Columbia and then became an assistant professor at Kansas State University. He held assistant professor, associate professor and professor positions sequentially at the University of Connecticut. Currently he is the Director of New England Invasive plant Center and the Head of Transgenic Plant Facility. He has published 72 scientific papers and two books, received 4 patents, and developed the gene deletor technology, a seedless fruit technology and other technologies. He has also bred several new plant cultivars such sterile, non-invasive burning bush and less mowing and shade-tolerant turf grasses.

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# Seed Potatoes – A Cooperative Production System that Facilitates Techonology Transfer

**Amy Charkowski**

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## ABSTRACT

Most major non-grain starchy food crops and most fruit crops are vegetatively propagated, meaning that plants are propagated by planting rhizomes or tubers, or by making nodal stem cuttings in nurseries or tissue culture. Unlike the impact of the green revolution on grain production, reaping the benefits of research-based vegetable production relies as much or more on community-supported sustainable plant propagation and certification systems as it does on modern fertilizers, pesticides, and plant varieties. Almost without exception, the healthy planting stocks and breeding programs for the major vegetatively propagated crops, such as potato, sweet potato, cassava, plantain, and citrus, are maintained by government agencies, non-profit organizations, or grower cooperatives. Unlike with true seed crops, such as maize and soybean, large corporations do not invest in, produce, or sell planting material for vegetative fruit and vegetable crops to farmers. An exception to this rule is transgenic crops, such as transgenic sugarcane, or if a corporation controls the entire production process, from variety breeding to sale of the product, which occurs with banana, pineapple, and potato in some markets.

This talk will describe the development and sustainability of a seed potato production and certification system, with emphasis on analysis of long term data sets that describe the efficacy of this program and with the role that this program has played in technology transfer from university researchers to farmers. Some of the costs and benefits of certification and seed potato production technologies will be described, and likely future challenges to potato production will be highlighted.

## BIOGRAPHY

Amy Charkowski earned her B.S. in biochemistry and plant pathology at the University of Wisconsin-Madison in 1993 and her Ph.D. in Plant Pathology at Cornell University (Ithaca NY) in 1998.

She worked in Albany CA from 1998-2001 at a USDA Agricultural Research Service facility focused on food safety. She joined the Department of Plant Pathology at the University of Wisconsin-Madison in 2001, where she runs a research laboratory, teaches, and administers the Wisconsin Seed Potato Certification Program. Her current research interests focus on production of vegetatively propagated food crops, with a particular emphasis on seed potatoes and plant diseases that affect production of seed potato. Her laboratory group also conducts on-farm research aimed at making potato production more sustainable.

Dr. Charkowski is a member of the American Phytopathological Society, the Potato Association of America, and the American Society of Microbiology. She has won the Wisconsin Potato and Vegetable Grower Association Researcher of the Year award and the American Phytopathological Society Syngenta Award. She is an author on nearly 50 peer-reviewed publications describing original research in plant disease control, plant-microbe interactions, and food safety.

*Technical Session D1-W1-T1: Agroecology, Agricultural Biotechnology*

# Recycling irrigation system – a focal point of agricultural water security and plant biosecurity in the 21st century

**Chuanxue Hong**

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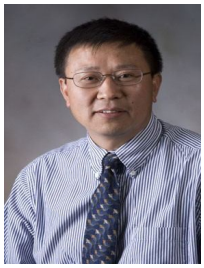
## ABSTRACT

Water is short in supply and has no substitute. Water shortage issue surely will aggravate under changing climate. Capture and reuse of agricultural runoff for irrigation is one of the few viable options to ensure an adequate supply of quality water while protecting the precious natural water resource. However, this practice potentially recycles and spreads plant pathogens from isolated infections to entire farm and from a single farm to all other farms sharing the same water resources. This presentation examines the scope and extent of impact of these waterborne pathogens on both plant biosecurity and agricultural water security, and call for plant pathologists to team up with agronomists, horticulturists, breeders, ecologists, limnologists, agricultural engineers, economists in addressing these highly interconnected issues of global significance, and discuss what are the current approach and long-term solutions.

## BIOGRAPHY



Dr. Hong received a Ph.D. degree in plant pathology from China Agricultural University in Beijing, 1990. After working in the Chinese Academy of Agricultural Sciences in Beijing for 3 years, he began his international journey in September 1993. He was a visiting scientist at the International Crop Research Institute for Semi-Arid Tropics in Hyderabad, India for 7 months, Rothamsted Research in England for 18 months and the University of California, Davis for three and half years before joining the faculty of Virginia Tech in May 1999. His current program focuses on agricultural water security and plant biosecurity. He has published 85 refereed journal articles, six books and eleven book chapters plus many reports in conference proceedings and newsletters. He has received numerous research and extension awards. He was promoted to Associate Professor in 2005 and full rank in 2010.

*Technical Session D1-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Session Chair

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BIOGRAPHY


**K.C. Ting** is Professor and Head of the Agricultural and Biological Engineering Department at the University of Illinois. He received his Ph.D. in agricultural engineering from the University of Illinois. He teaches and conducts research on automation, systems informatics and analysis, alternative energy, and phytomation (i.e. plant based engineering systems). He has participated in the efforts to obtain funding for a number of multi-million dollar centers, institutes and programs. He has received over $7.3 million dollars of research grants, under his direct administration, from federal governments, states, and the industry. He served as the leader of the Systems Studies & Modeling Team within the New Jersey NASA Specialized Center Of Research and Training (NJ-NSCORT) during 1996-2000. He currently leads a BP Energy Biosciences Institute program on "Engineering Solutions for Biomass Feedstock Production" and serves as a member of Steering Committee for the "ADM Institute for the Prevention of Postharvet Loss" at the University of Illinois. He is a co-editor/co-author of a monograph entitled "Robotics for Bioproduction Systems." He holds a professional engineer license in New Jersey. He has authored/co-authored over 260 articles, conference papers, and project reports. He has been invited to deliver close to 100 presentations in many countries. He was an Editor-in-Chief for Computers and Electronics in Agriculture during 2007-2010. He has received many major awards and recognitions including: ASABE James R. and Karen A. Gilley Academic Leadership Award, August 2011; ASABE Kishida International Award, July 2008; Guest Chair Professor, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China, April 2006; Honorary Scientist, Rural Development Administration, Republic of Korea, January 1, 2004-December 31, 2006; Fellow of ASME elected in July 2002; Fellow of ASABE inducted in July 2001; and Cook College/Alpha Zeta Professor of the Year, Rutgers University, 1997.

*Technical Session D1-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Synthetic Silage: Engineering a Microbial Platform for Biomass Pretreatment

**Tom L. Richard**

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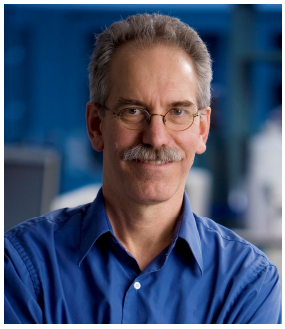
ABSTRACT

Production of ethanol and other sugar-derived fuels from lignocellulosic biomass, such as perennial grasses, trees, and agricultural residues, has significant potential to displace petroleum use in the United States. However, the complex nature of lignocellulose makes it difficult to degrade cellulose and other plant cell wall polymers into fermentable sugars. Another challenge is matching the seasonal production of agricultural biomass with the constant demand for fuel. In order to overcome both of these challenges, efficient and cost-effective methods for pretreatment and storage are a necessity. Our group has been addressing these challenges by utilizing *Lactobacillus spp.* to perform biomass pretreatment during storage. The process configuration we use is modeled after the traditional farm silo, which has been used for biomass storage in livestock production systems for over a millennium. Ensilage appears to be the most practical storage strategy in semi-humid and humid regions (where most US biomass will be grown, at least in the near future) with significantly lower mass losses than in dry outdoor storage. Results indicate ensiled storage creates a favorable environment for biocatalysis and partial pretreatment, increasing cellulose and hemicellulose hydrolysis to sugars and subsequent ethanol fermentation. Chemical and thermal pretreatment techniques currently constitute over 30% of the costs of biomass conversion to ethanol, so integration of biological approaches with pretreatment could increase the economic viability of this industry.

Wild-type *Lactobacillus spp.*, which naturally initiate the anaerobic storage process of ensilage, may have a modest benefit for downstream costs by reducing the severity of pretreatment required. However, we are also modifying strains to secrete enzymes borrowed from species that traditionally consume biomass. These heterologously-expressed enzymes will catalyze the controlled degradation of the biomass during storage, thus facilitating the liberation of the sequestered polysaccharides. This approach has also provided new knowledge and tools for control of protein expression in *Lactobacillus spp.*, expanding the practice of synthetic biology in an industrially relevant organism.

BIOGRAPHY



Tom Richard grew up in California, where he earned a B.S. in political economy of natural resources from the University of California at Berkeley in 1978. He earned an M.S. in agricultural engineering in 1987 and PhD in biological engineering in 1997, both from Cornell University in Ithaca, NY.

He is a professor of biological engineering at Penn State University in University Park, PA, and directs Penn State's Institutes for Energy and the Environment (PSIEE), where he coordinates a network of almost 500 faculty engaged in innovative interdisciplinary research. His teaching and research focus on the intersection of sustainable agriculture with sustainable bioenergy, including the integration of food and energy crops, nutrient and energy balances, and microbial engineering of solid-state fermentations. He currently directs the $10 million NEWBio Sustainable Bioenergy Consortium for the USDA's National Institutes of Food and Agriculture, and serves as the deputy technical director for the DOE's National Risk Assessment Partnership for carbon sequestration. Prior appointments include research positions at Cornell University and the U.S. Geological Survey, and service on the faculties of Iowa State University in Ames, IA and Wageningen University in the Netherlands.

Dr. Richard is a Fellow and Past President of the Institute of Biological Engineering, and has been an active member of the American Society of Agricultural and Biological Engineers for 25 years. He is a member of the Phi Beta Kappa, Gamma Sigma Delta and Alpha Epsilon honorary societies, and winner of numerous other awards. Dr. Richard is the author or co-author of over 140 research and technical publications.

*Technical Session D1-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Bioenergy from waste biomass through the bio-electrochemical system

**Shaoan Cheng**

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## ABSTRACT

Bioelectrochemical system is new green technology for recovering energy from wastes while simultaneously treating wastewater. In this talk we will discuss a microbial fuel cell (MFC) for electricity generation and a microbial electrolysis cell (MEC) for hydrogen production from waste. The application extensions (MXC) of this technology: microbial desalination cell (MDC), MEC for producing hydrogen peroxide, MEC for production of hydroxide, will be also introduced. Finally, a possible effective way for converting carbon dioxide into biofuel is also given.

## BIOGRAPHY

Shaoan Cheng, born on April 10, 1963 in Hubei, China. B.S. degree in 1983, the MS. Degree in 1992, and the Ph.D. degree in 1995 all in Materials Science and Engineering from Zhejiang University, Hangzhou, China; Major field of study is in the energy and environment.

He was a ASSOCIATE PROFESSOR at Zhejiang University in 1997-1998; VISITING PROFESSOR at Basque University, Spain in 1998-2001; POSTDOCTORAL FELLOW at The University of Hong Kong in 2001-2003; POSTDOCTORAL FELLOW (2004-2005), RESEARCH ASSOCIATE (2006-2007), SENIOR RESEARCH ASSOCIATE (2008-2009) at Penn State University, USA. Now he is a CHANGJIANG SCHOLAR PROFESSOR at Zhejiang University, Hangzhou, China. His resulted in around 120 research papers in prestigious journals such as PNAS and *Environ. Sci. Technol.*, and five US patents。Research interests focus on bioenergy, material science, electrochemistry, fuel cell, clean energy and environmental bioelectrochemistry.

Prof. Cheng is a member of Sigma Xi Scientific Research Society, a member of the American Chemical Society, and a member of the Internation Electrochemical Society.

*Technical Session D1-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Automation on Precision Cultivation in Greenhouse

**Suming Chen**

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ABSTRACT

It is important to effectively and precisely manage crop production in order to meet the increasing demands of high quality and safe agricultural products. Precision agriculture is a site-specific cultivation, and has been developed by using satellite remote sensing for field crops. However, more and more crops such as vegetables and ornamental plants are grown in greenhouses, and growth status monitoring of these crops is equally important as that for field-grown crops. Consequently, a ground-based remote sensing system for greenhouse precision cultivation needs to be developed.

This study aimed to develop a precision cultivation automation system based on remote spectral imaging and environmental sensing for greenhouse production. This work illustrated the precision cultivation approach using vegetable seedling as an example. Ground-based multi-spectral imaging system with plant-oriented sensing algorithm was developed in this study. The spectral images were grabbed with automatic exposure and signal gain controls through IEEE-1394 interface; and CCD cameras with optical filters at specific wavelengths were used. To obtain necessary spectral information of seedling growth status on greenhouse benches, a serial image processing procedures, including spatial calibration, gray-level calibration, image segmentation and image stitching were developed.

A mobile environmental sensing system, including temperature, relative humidity and light intensity, was also developed to measure and analyze the spatial distribution of these environmental parameters in the greenhouse. The data and information communication was conducted through a DataSocket server and wireless network. Irrigation policies corresponding to PLAI (Projected Leaf Area Index), NDVI (Normalized Difference Vegetation Index) and environmental conditions were established to provide a basis for precision irrigation. A variable rate spraying system was developed to implement the precision irrigation practices based on the status analyzed. This research successfully used RFID (Radio Frequency Identification) and remote spectral imaging for precision cultivation and traceability system in the greenhouse.

Keywords: Precision Cultivation, Greenhouse, Remote Sensing, Traceability System

BIOGRAPHY

Suming Chen received his B.S. (1978) in Agricultural Engineering from National Taiwan University, M.S. (1980) in Bio. & Agricultural Engineering from Rutgers University. He received M.S. (1982) in Chemical Engineering and Ph.D. (1985) in Bio. & Agricultural Engineering from University of California, Davis. Currently he is a professor in the Department of Bio-Industrial Mechatronics Engineering (BIME) and the director of the Bioenergy Research Center at National Taiwan University, and was the chair of BIME Department. His major research areas include automation in agriculture, nondestructive sensing of biomaterials, remote sensing and precision agriculture, computer simulation and control, knowledge engineering in agriculture, renewable energy. He is active in ASABE, CIAM, TIBM societies, and served as the president of CIAM during 2007-2010. Dr. Chen is the editor-in-chief of the Journal of Agricultural Machinery, and is also the representative editor of the journal "Engineering in Agriculture, Environment and Food".

*Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

## Session Chair

## Yung-Fu Chang

Director, Infectious Disease Research Program, Animal Health Diagnostic Center
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BIOGRAPHY

Yung-Fu Chang, Veterinarian degree from National Pintung Institute of Agriculture, Taiwan in 1974, MS degree, University of Idaho in 1981 and Ph.D, Texas A&M University in 1984.

**Positions and Employment**

- **1974-1979** Assistant Pathologist, Veterinary Pathology Division, Taiwan Provincial Research Institute for Animal Health, Taiwan
- **1984-1985** Research Associate, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1986-1989** Assistant Research Scientist, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1989-1996** Assistant Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **1996-2003** Associate Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **2003 (Jan-July)** Visiting Professor, Department of Infectious disease and Medicine, Stanford University Medical School, Stanford, CA.
- **2003-present** Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.

**Honors**

Beta Rho Chapter of Phi Sigma National Honor Society (1983); Diplomat of the American College of Veterinary Microbiologist (1987); The Society of Phi Zeta; Who's Who in America? (1991); Editor Board, Bioengineered Bugs (2010-2012); Journal of Veterinary Science & Technology (2010-present) and PLoS One. Treasure, American Leptospirosis Research Conference, Inc. (2001-present). Distinguished alumni, National Pin-Tung University of Science and Technology, Taiwan (2007).

**Patents (active)**

Ehrlichia canis genes and vaccines. US patent no: 7,951,386 B2. Yung-Fu Chang; Compositions for eliciting an immune response against Mycobacterium avium subspecies paratuberculosis. US Patent no: 7, 732,580,B2 & 7,858,102 B2,European patent No: 1,855,716. Yung-Fu Chang; Protective coating for array material depositions. US Patent no.

7,781,378, B2. Reid N. Orth, M. Lin, T. C. Clark, Yung-Fu Chang, Harold G. Craighead, Jose Manuel Morqan-Mirabal; Immunogenic proteins of Leptospira. US Patent no. US 7,655,427. B2.Yung-Fu Chang and Raghavan U. M. Palaniappan.

*Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Tumor suppressor WWOX in cell-cell recognition and cancer stem cell regulation

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## ABSTRACT

Tumor suppressor WWOX (FOR or WOX1) is anchored, in part, in cell membrane/cytoskeleton, and is a downstream effector of the TGF- 1/Hyal-2 signaling. We determined that WWOX-positive cells migrated collectively and repelled individually migrating WWOX-negative cells to undergo retrograde migration and subsequent division, as determined by time-lapse microscopy. We demonstrated that a surface-exposed C-terminal SDRrepl (WWOX286-299) epitope in the SDR domain could repel WWOX-negative cells, whereas an N-terminal WWgre (WWOX7-21) epitope in front of the first WW domain greeted any cells. Upon phosphorylation at Tyr287, SDRrepl lost repellence capability as shown in highly malignant cancer cells. These malignant cells selectively docked onto WWgre-activated target organs containing Ser14 phosphorylation. Furthermore, during cell-to-cell confrontation, cells may turn into stem cell phenotypes as their formation of colony spheres and expression of pluripotent markers such as Oct4, Sox2, SSEA-4, TRA-1-60, TRA-1-81. Majority of these stem cells or cancer stem cells express WWOX with phosphorylation at S14 but not Y287. Suppression of WWgre activation by a 7-amino-acid peptide Zfra4-10 abolished melanoma homing in the lung, as well as subcutaneous cancer-induced neuronal death in hippocampus. Importantly, Zfra can be utilized for immunization against the development of melanoma and many other types of cancers in vivo. (Supported by NSC and NHRI, Taiwan, and DoD, USA)

## BIOGRAPHY

Dr. Nan-Shan Chang is currently the director of the Institute of Molecular Medicine, National Cheng Kung University (NCKU). He is also an adjunct professor of the Upstate Medical University at Syracuse, New York, and the New York State Institute of Basic Research in Developmental Disabilities, Staten Island, New York. Dr. Chang has first discovered the tumor suppressor WW domain-containing oxidoreductase WWOX in 2000. Since then, this protein has been a hot target in cancer research. His recent research in Taiwan has been awarded by the Department of Defense, USA, and the National Science Council, Department of Health, and Nation Health Research Institute, Taiwan. He received a Distinguished Scientist Award of the Society of Experimental Biology and Medicine USA in 2011. His recent research focus is on WWOX-regulated 1) cell-to-cell recognition, migration, metastasis and organ docking, 2) cancer stem cell development, 3) cancer immunization, and 4) neurodegeneration and damage.

*Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Production and delivery of bioactive factors with food grade bacteria to enhance performance of early weaned pig

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ABSTRACT

Stress and incomplete gastrointestinal development in early-weaned piglets represent significant challenges in commercial swine farming. One likely cause of lag in growth and intestine development is the abrupt discontinue of maternal-supplied epidermal growth factor (EGF) to the intestine, which is known to be present in sow milk. The beneficial effects of providing additional EGF to young pigs have been previously demonstrated in newborn and weaned piglets. Systemic or oral administration of recombinant EGF stimulate intestinal development, reducing the incidence of pathogen infection and diarrhea. To provide a cost effective meant to allow the application of recombinant protein in animal production, we modified the food-grade bacterium *Lactococcus lactis* (*L. lactis*) to express biologically active EGF (EGF-LL). Orally-ingested recombinant epidermal growth factor (EGF) has been shown to remain biologically active in the gastrointestinal tract as well as stimulate intestinal development, reducing the incidence of pathogen infection and diarrhea. We modified the food-grade bacterium *Lactococcus lactis* (*L. lactis*) to express biologically active EGF (EGF-LL). When fed to early-weaned mice. Populations of EGF-LL were shown to survive throughout the intestinal tract, and the recombinant EGF protein was also detected in intestinal contents. Mice receiving EGF-LL gained significantly more weight as compared to control mice, and was comparable to the positive control mice receiving recombinant human EGF. EGF-LL increased mean villous height in the intestine. Immunohistochemistry also confirmed that intestine cell proliferation was enhanced in mice receiving EGF-LL, as revealed by higher number of proliferative cell nuclear antigen (PCNA) -stained cells in the intestinal tissues. Similar effect was also observed in early weaned piglets fed with low quality diet that is free of animal plasma. More recent study also revealed that oral dosing of the fermentation product of *L. lactis* [after removal of the genetically modified bacteria(GMO)] increased intestinal development and growth of early-weaned pig. Biofactor production/delivery using probiotic may offer novel means for formulating dietary supplements for pigs during their weaning transition stage. Moreover, it may allow reduced usage of animal proteins and reliance on in-feed antibiotics, which will further benefit the industry by addressing consumer concerns and food safety

BIOGRAPHY

Dr. Julang Li comes from Foshan, China. She was originally trained as a Veterinarian. She was employed as a Lecturer and Veterinarian in Foshan Veterinary College prior to her further postgraduate training in Canada. Dr. Li obtained her PhD. in Reproduction at the University of Ottawa, Canada. She is currently a Biotechnology Professor at the Department of Animal and Poultry Science, Ontario Agriculture College, University of Guelph. She also holds an Adjunct Professor appointment in Ontario Veterinary College of the same university.

Dr. Li's research program balances both the fundamental and applicable aspects of animal and biomedical science. Her fundamental research focus on the study of germ cell potential of skin-derived stem cells, and the mechanisms involved. In addition, her laboratory also studies the regulation of follicular development and oocyte maturation. The more applicable research program in the Li's laboratory aims to enhance animal and human health via biotechnological approaches. In this regard, they have been using food grade bacteria as a bioreactor and vehicle to produce and deliver recombinant proteins such EGF to the intestine for enhancing early weaned pig development. It is intend to use this approach to deliver other recombinant proteins for improving disease resistance in both veterinary and human medicine in the near future.

*Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Application of high-throughput RNA sequencing in animal reproduction: application to the bull spermatozoal transcript profile

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## ABSTRACT

High-throughput RNA-Sequencing (RNA-Seq) enables the sequencing of complete transcript profiles including identification of novel splice junctions and exons while also facilitating comparison of transcriptome expression levels. Compared to hybridization-based gene expression methods such as microarrays, RNA-Seq can also facilitate the discovery of full-length transcripts to elucidate mechanisms of RNA regulation that critical for an understanding of genomic and protemic analysis. Using RNA-Seq, our laboratory sequenced the complete transcript profile of transcriptionally-inert bovine spermatozoa. The bovine spermatozoal mRNA profile includes approximately 6,000 transcripts comprised of mRNA for ribosomal proteins, protamines and signaling molecules. While some spermatozoal transcripts are truncated, other transcripts remain full-length by retaining the 5' and 3' untranslated regions (UTR) and all coding exons. The functional significance of the full-length spermatozoal transcripts in spermatozoa function and the diagnostic potential in male fertility remains to be determined.

## BIOGRAPHY

B.S. Animal Biology, Hampshire College, Amherst, Massachusetts, USA, 1994
M.S. Animal Science, University of California Davis, 1997
Ph.D. Reproductive Biology, University of California, Davis, 2002

She completed postdoctoral research positions at Cornell University and the University of Massachusetts Medical School. She is currently an Associate Professor of Animal Science at the University of Rhode Island, Kingston, RI, USA. Research interests include gametogenesis, RNA regulation, alternative polyadenylation and fertility.

Dr. Sartini is a member of the Society for the Study of Reproduction, American Association of Animal Science and the International Embryo Transfer Society. Recent publications in the area of mRNA regulation in spermatogenesis include:

Card C, Anderson L, Zamberlan J, Kreiger KE, Kaproth M and Sartini BL. 2013. Cryopreserved bovine spermatozoal transcript profile as revealed by high-throughput ribonucleic acid sequencing. Biology of Reproduction. 88(2):1-9.

Sartini BL, Eerhart M and Green S. 2012. Differential cyclic-AMP responsive element modulator (CREM) mRNA isoform expression during testicular development in boars. Theriogenology. 77(5): 881-887.

Sartini BL, Wang H, Wang W, Millette CF, Kilpatrick DL. 2008. Pre-messenger RNA cleavage factor I (CFIm): potential role in male germ cell alternative polyadenylation. Biology of Reproduction 78(3): 472-482.

*Technical Session D1-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Regulation of Sperm Storage in Mammals

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## ABSTRACT

Storage of sperm in an oviductal reservoir is a widespread phenomenon in mammals that serves to maintain sperm motility until eggs are released from the ovary to be fertilized. In most species, sperm are held in the reservoir by a specific binding interaction between the sperm and the oviductal epithelium, which also serves to preserve the fertility of sperm during storage. Regulation of release of sperm from storage is critical to successful fertilization, because oocytes remain fertile for a very limited period after they are released from the ovary for fertilization.

Binder of SPerm (BSP) proteins, the major proteins secreted by seminal vesicles, are responsible for sperm binding to the oviductal epithelium to form the sperm storage reservoir in cattle. Homologs of these proteins have been detected in an array of mammalian species, including humans. BSP proteins (BSP1, 3, and 5) are adsorbed onto bull sperm membranes when sperm come into contact with vesicular secretions. Because release of sperm from storage is critical to the success of fertilization, we examined whether the coat of BSP proteins is modified by incubating sperm in a medium resembling oviduct fluid and which is known to prepare sperm for fertilization. When bull sperm were incubated for 5 h in vitro, one of the BSP proteins (BSP3) was proteolytically processed into a smaller molecule. Cleavage of BSP3 was significantly reduced when bull sperm were incubated in the presence of serine protease inhibitors, indicating that the cleavage was attributed to a sperm surface serine protease. In conclusion, sperm surface proteins are involved in modulating sperm movement in the oviduct. In addition to high quality of sperm motility, sperm surface proteins from different origins must work in synergy to move sperm up the upper region of the oviduct, where fertilization takes place.

## BIOGRAPHY

Pei-hsuan (Chris) Hung received his PhD in Molecular, Cellular, and Integrative Physiology from the University of California, Davis. He joined the laboratory of Dr. Susan Suarez as a postdoctoral associate in the Department of Biomedical Sciences at Cornell College of Veterinary Medicine in 2009. Chris's research is focused on sperm surface proteins, particularly Binder of SPerm (BSP) proteins and serine proteases and their interactions in regulating sperm transport in the female reproductive tract. Chris received his Bachelor of Veterinary Medicine and Master's of Science in Taiwan, where he is a board certified veterinarian.

*Technical Session D1-W1-T2: Agroecology, Agricultural Biotechnology*

## Session Chair

**Yi Li 李义**

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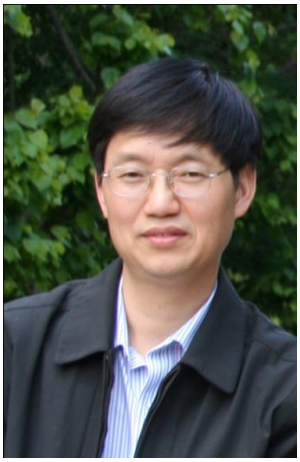
BIOGRAPHY



Yi Li obtained his B.S. in forestry from Beijing Forestry University, China and Ph.D. in plant physiology and biochemistry from State University of New York, College of Environmental Science and Forestry, Syracuse, New York. He was trained as a postdoctoral fellow in the area of molecular biology at University of Missouri-Columbia and then became an assistant professor at Kansas State University. He held assistant professor, associate professor and professor positions sequentially at the University of Connecticut. Currently he is the Director of New England Invasive plant Center and the Head of Transgenic Plant Facility. He has published 72 scientific papers and two books, received 4 patents, and developed the gene deletor technology, a seedless fruit technology and other technologies. He has also bred several new plant cultivars such sterile, non-invasive burning bush and less mowing and shade-tolerant turf grasses.

*Technical Session D1-W1-T2: Agroecology, Agricultural Biotechnology*

# What mechanisms of resistance to transgenic Bt-crops may be selected in insect populations in the field?

**Ping Wang**

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BIOGRAPHY

*Technical Session D1-W1-T2: Agroecology, Agricultural Biotechnology*

# Identify Soybean Genes Involved in Resistance to *Phakopsora pachyrhizi* Infection Using Biotechnology

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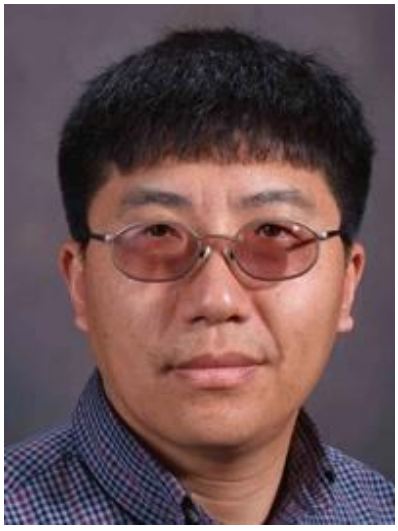
## ABSTRACT

Asian soybean rust, caused by *Phakopsora pachyrhizi*, is a new disease in the continental U.S. since its discovery in late 2004. This disease has the potential to cause severe yield reduction and billions of dollars in economic losses due to the lack of rust-resistant commercial soybean varieties. In an effort to understand soybean-*P. pachyrhizi* interaction at the molecular level, a number of soybean accessions, including the recombinant inbred line (RIL) derived sister lines were evaluated for resistance to soybean rust spores collected in Louisiana. Two accessions and one RIL derived sister line showed consistent immune response in both detached leaf assay and greenhouse inoculations. These rust resistant soybean lines along with susceptible controls were compared for protein profile differences during the time course of *P. pachyrhizi* inoculation through proteomics. Based on the gel analysis, approximately 70 differentially expressed spots were identified in our comparisons. These protein spots were recovered and sequenced through LC-MS/MS. Some of the identified proteins have known functions in host responses to biotic and abiotic stresses, such as pathogenesis related protein 10, chalcone isomerase, and β-1,3-endoglucanase. The expression of these proteins at transcript level has also been evaluated using qRT-PCR. It was found that susceptible soybean lines can induce the same set of genes, but at a much slower pace, which may contribute to the differences in their susceptibility to rust. The importance of some of these proteins in soybean rust resistance is being evaluated through a virus induced gene silencing (VIGS) approach.

## BIOGRAPHY



### A. EDUCATION

Ph.D., 1996. Plant Biology, Louisiana State University, Baton Rouge, Louisiana.
M. S., 1991. Plant Physiology, Biochemistry and Molecular Biology, Peking University (Beijing University), Beijing, China.
B. S., 1988. Plant Physiology and Biochemistry, Peking University.

### B. PROFESSIONAL EXPERIENCE

07/2009-present: Associate Professor (tenured), Dept of Plant Pathology and Crop Physiology, Louisiana State University Agricultural Center, Baton Rouge, investigating host-pathogen interactions in maize-*Aspergillus flavus* and soybean-*Phakopsora pachyrhizi* to understand host resistance mechanisms.

11/2005-06/2009: Assistant Professor (tenure track), Dept of Plant Pathology and Crop Physiology, Louisiana State University Agricultural Center, Baton Rouge, investigating host-pathogen interactions in maize-*Aspergillus flavus* and soybean-*Phakopsora pachyrhizi* to understand host resistance mechanisms.

09/2002-10/2005: Assistant Professor, Research, Dept of Plant Pathology and Crop Physiology, Louisiana State University Agricultural Center (stationed at Southern Regional Research Center, USDA-ARS, New Orleans), investigating possible roles of aflatoxin resistance-associated maize kernel proteins identified through proteomic comparisons.

11/1996-08/2002: Postdoctoral Fellow at Southern Regional Research Center, USDA-ARS, New Orleans), identifying protein factors associated with maize aflatoxin resistance.

For more information, please click link:
http://www.lsu.edu/ppcp/faculty_staff/chen/index.htm

*Technical Session D1-W1-T2: Agroecology, Agricultural Biotechnology*

## Dr. Wen-Ling Deng

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ABSTRACT

Dr. Deng, Wen-Ling was born in Taipei, Taiwan, on October 29, 1968. She received a bachelor's degree in agriculture at National Taiwan University in Taipei, Taiwan, on June 1991. Three years later, she past a competitive entrance examination and enrolled as a master student in Graduate Institute of Agricultural Biotechnology at National Chung Hsing University in Taichung, Taiwan, where she studied the functions and subcellular locations of two Type III secretion system (T3SS) proteins, HrcJ and HrcC, of *Pseudomonas syringae* pv. *syringae* under the guidance of Dr. Hsiou-Chen Huang. She earned the M. Sc. degree in agriculture on June, 1996. In the fall of 1996, she was admitted to the Ph.D. program of agriculture in the Graduate School at Cornell University, Ithaca, New York, USA, where she studied and acquired an in-depth knowledge about the organismal aspects of molecular plant-bacterium interactions from her graduate advisor Dr. Alan Collmer. Her Ph.D. dissertation focused on the functional characterization of *Pseudomonas syringae* pathogenicity island by genetics and cell biology approaches. She was awarded with a doctoral degree in philosophy in January of 2002. Subsequently, she pursued postdoctoral research in plant cell biology at Cornell University, USA.

Wen-Ling worked as a RESEARCH ASSISTANT in the laboratory of bacterial physiology in the Department of Microbiology and Immunobiology at the Chang Gung College of Medicine and Technology (currently College of Medicine at Chang Gung University) between 1991 and 1994. She was a GRADUATE RESEARCH ASSISTANT in the Agricultural & Biotechnology Labs at National Chung Hsing University from 1995-1996 and in the Department of Plant Pathology at Cornell University from 1996-2002. She was a TEACHING ASSISTANT for the course of molecular plant pathology in the Department of Plant Pathology at Cornell University in the spring semester of 1999. Since August 2003, she has been appointed as an ASSISTANT PROFESSOR in the Department of Plant Pathology with a secondary appointment in the Program in Microbial Genomics at the National Chung Hsing University, Taichung, Taiwan. The research being conducted in her laboratory focuses on the genetics and virulence mechanisms of plant pathogenic bacteria and the beneficial effects of soil microbe *Bacillus* spp. on plant health.

BIOGRAPHY

Dr. Deng is a member of the International Society for Molecular Plant-Microbe Interactions (IS-MPMI) and the Taiwan Society of Plant Pathology. She was awarded a fellowship for young scientists by the Rotary Club of Taiwan and the Liu Memorial Award from Cornell University, USA during her graduate study. Wen-Ling has published in academic journals and presented at conferences both in Taiwan and internationally. A list of her academic publications is shown below.

**Journal Articles**

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2. Badel, J. L., A. O. Charkowski, W.-L. Deng, and A. Collmer. 2002. A gene in the *Pseudomonas syringae* pv. *tomato* Hrp pathogenicity island conserved effector locus, *hopPtoA1*, is required for efficient formation of bacterial colonies in planta and is duplicated elsewhere in the genome. Mol. Plant-Microbe Interact. 15:1014-1024.
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*Technical Session D1-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Session Chair

## Suming Chen

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BIOGRAPHY

Suming Chen received his B.S. (1978) in Agricultural Engineering from National Taiwan University, M.S. (1980) in Bio. & Agricultural Engineering from Rutgers University. He received M.S. (1982) in Chemical Engineering and Ph.D. (1985) in Bio. & Agricultural Engineering from University of California, Davis. Currently he is a professor in the Department of Bio-Industrial Mechatronics Engineering (BIME) and the director of the Bioenergy Research Center at National Taiwan University, and was the chair of BIME Department. His major research areas include automation in agriculture, nondestructive sensing of biomaterials, remote sensing and precision agriculture, computer simulation and control, knowledge engineering in agriculture, renewable energy. He is active in ASABE, CIAM, TIBM societies, and served as the president of CIAM during 2007-2010. Dr. Chen is the editor-in-chief of the Journal of Agricultural Machinery, and is also the representative editor of the journal "Engineering in Agriculture, Environment and Food".

*Technical Session D1-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Biofuels and Biorenewable Chemicals from waste and alternative biomass based feedstock

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## ABSTRACT

The transition to a sustainable and energy secure future is a current fundamental challenge, driven as much by the threat of dwindling energy supplies and high cost as by environmental concerns. Dependence on conventional fossil fuels and its ramifications on global climate change makes diversification of the energy portfolio, with an emphasis on renewable fuels and chemicals, an imperative policy tool. Biomass feedstock based fuels and chemicals proffer advantages of excellent renewability, environmental friendliness and possible use in a wide variety of applications with existing infrastructure. Our group's research brings together an idea of a waste and alternative biomass based biorefinery integrating novel conversion processes to extract proteins, carbohydrates and lipids from algae and cellular wastes and utilizing municipal and other waste carbon sources to produce biodiesel, biobutanol, jet fuel, fertilisers and high value added biorenewable chemicals like HMF, 1,3 propanediol and nutraceutical products. The integrated processes involve novel extractive, biofermentative and catalytic pathways and subsequent purification methods for isolating fuels and biorenewable intermediate chemicals. The integrated processes maximise the value derived from the biomass feedstock, a benefit that addresses not just environmental and disposal concerns for the waste based feedstock, but also underscores the enormous positive ramifications on the overall process economics. Biorefineries are a window to the future of sustainability and shall play a vital role in reducing dependence on petroleum based fuels and chemicals along with essential ramifications on the global climate.

## BIOGRAPHY

Richard Parnas grew up in St.Louis Missouri, and then obtained a Bachelor's degree from MIT, Chemical Engineering in 1980. He obtained a MS in Chemical Engineering at UCLA in 1984, working on air pollution particle deposition. He subsequently obtained a PhD from UCLA in 1990, in the area of polymer behavior at solid surfaces.

He worked at Exxon Research & Engineering from 1980-82, and spent a year at SRI International in the Bay Area before returning to UCLA to obtain a PhD. Subsequently he spent nearly 10 years in the Polymer Division of NIST, the last 5 years as Head of the Composites Group, and worked extensively in

Liquid Composite Molding, publishing a book by that name. Before joining University of Connecticut, Storrs, CT, he spent a year at KU Leuven in Belgium on a Fulbright Fellowship, working on composites processing. He has over 100 scientific articles in refereed publications. He is internationally recognized in composites, providing courses and lectures in the USA, Europe, and the Far East. More recently, at UConn, he has focused on sustainable energy and sustainable materials. He has worked on fuel cell membranes with support from the US Army, on protein-based plastics with support from NSF, USDA and Thailand, and on biofuels with support from DOE, USDA and CTDECD. His research group has set up a financially self-sufficient biodiesel fuel quality testing lab at UCONN, developed patented reactor designs for biodiesel production, and recently formed a company to commercialize that work. His current work includes the development of novel interfacial chemistry to improve the performance of natural composites for construction boards, improvement of fermentative and catalytic processes for producing biofuels and bio renewable chemicals, the development of novel polymeric structures for membranes to purify biochemicals, and the design of new reactor systems to make high value products from low value byproducts produced during biodiesel production.

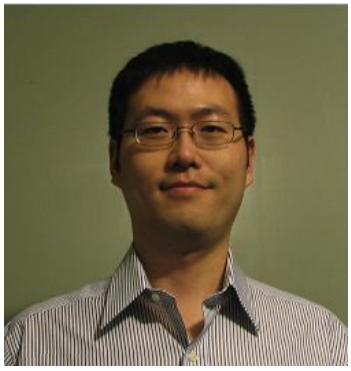
Dr. Parnas, over the past few years at UConn, has obtained more than 2 million dollars of external research funding to support his research. During his career he has published a book, several book chapters, roughly 100 peer reviewed journal articles, and received more than 1500 citations from other researchers leading to an H-index of 20. He was on the programming committee at Nat'l. Academy of Engineering Frontiers of Engineering, 1997-98. He has chaired the Gordon Research Conference on Composites, 1999, Bioenergy and Bioproducts Symposium at the 6th Sino-US Chemical Engineering Conference, 2011, the UCONN Sustainable Energy Symposium, 2008. He was awarded the Pioneering Nanotechnology Competition Certificate of High Merit and the UConn Environmental Achievement Award in 2007.

*Technical Session D1-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Ting Zhu

Assistant Professor, Department of Computer Science
The University of New York at Binghamton

BIOGRAPHY



*Technical Session D1-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Production of biofuels from $CO_2$

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## ABSTRACT

Carbon dioxide ($CO_2$) is one of the high potential carbon sources for bio-based chemical productions. It is generated and released by every chemical processes and biological activities. $CO_2$ is mainly fixed by Calvin cycle in our ecosystem where plants, algae, and cyanobacteria are responsible for carbon fixation. Calvin cycle has also been partially reconstructed in *Escherichia coli* previously. In this study, *in situ* $CO_2$ recycle to synthesize fermentation products with a low $CO_2$ emission fermentation process has been studied. The carbon dioxide emission, fermentation product titers, and physiology impacts of Rubisco-based engineered *E. coli* will be discussed.

## BIOGRAPHY

**EDUCATION**

2006-2010 **Ph.D.** in chemical engineering, University of Connecticut, USA
2003-2005 **M.S.** in chemical engineering, National Chung Hsing University, Taiwan
1999-2003 **B.S**. in chemical engineering, National Chung Hsing University, Taiwan

Si-Yu Li is now the Assistant Professor of chemical engineering department at National Chung Hsing University in Taiwan. He has authored 7 SCI peer-reviewed journal articles and 13 conference proceeding. He also has 2 non-provisional patent applications. His research interests are bio-fuel production, bio-degradable plastics production, and bio-separation.

1. Chen, S.-K., Chin, W.-C., Tsuge, K., Huang, C.-C., Li, S.-Y.* (2013). Fermentation approach for enhancing 1-butanol production using engineered butanologenic *Escherichia coli*. *Bioresource Technology* (IF=4.980, ranked 8/81 in Energy & Fuels).
2. Li, S.-Y., Zhuang, Z.-Y. (2012) Microorganism for forming fermentation products through fermentation of sugars. (patent application)

*Technical Session D1-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

## Session Chair

## Ya-Ching Shen

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BIOGRAPHY

Taipei, 1953

**Education**

BS, School of Pharmacy, Taipei Medical College, 1972 - 1976 (Pharmacy)

MS, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1978 - 1980 (Pharmacognosy)

PhD, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1983 - 1987 (Natural Product Chemistry)

PDF, School of Pharmacy, UNC at Chapel Hill, USA, 1989-1990; Scripps Institute of Oceanography, UCSD, USA, 1990-1992 (Synthetic Chemistry and Marine Natural Product Chemistry)

**Work Experiences**

Lieutenant, Military service, 1976 –1978
Pharmacist, Fu-Yeu Hospital, 1981 – 1983
Instructor, and Associate Professor, School of Pharmacy, College of Medicine, National Taiwan University, 1987 – 1989
Associate Professor, Department of Marine Resources, National Sun Yat-Sen University, 1992 – 1997
Professor, Department of Marine Resources, National Sun Yat-Sen University, 1997 – 2006
Professor, School of Pharmacy, College of Medicine, National Taiwan University, 2006 – Present

**Teaching Courses:** Pharmacognosy, Instrumental analysis, Chromatography, Advanced NMR spectroscopy, Drug separation techniques, Natural product chemistry, Chinese Medicine, Medicinal plants, etc.

**Research Interests:** Major research interests include 1. Discovery of new and bioactive natural products from terrestrial and marine organisms, 2. Preparation and modification of bioactive natural compounds for SAR studies, 3. Chinese herbal medicine, 4. Chemotaxonomy, 5. Medicinal plants, 6. Food chemistry, etc.

**Memberships:** American Society of Pharmacognosy, Taiwan Pharmaceutical Society

**Honors:** ISI Citation Award, 1999; CPJ outstanding contribution Award, 2004

**Selected Publications (187 scientific papers till now)**

1. "Schisarisanlactones A and B, A New Class of Nortriterpenoids from the Fruits of *Schisandra arisanensis", Food Chem.*, **2013**,*136*, 1095-1099.
2. "Anti-Liver Fibrotic Lignans from the Fruits of *Schisandra arisanensis* and *S. sphenanthera", Bioorg. Med. Chem. Lett.,* **2013***, 23*, 880-885.
3. "Bioactive Diterpenes from *Callicarpa longissima*", *J. Nat. Prod.*, **2012**, *75*, 689-693.
4. "New Briarane Diterpenoids from the Gorgonian Coral *Junceella juncea", Marine Drugs*, **2012**, *10*, 1321-1330.
5. "Schinarisanlactone A, A New Bisnortriterpenoid from *Schisandra arisanensis*", *Org. Lett.*, **2011**, *13*, 446-449.
6. "New and Bioactive Lignans from the Fruits of *Schisandra sphenanthera", Food Chem.*, **2011**, *128*, 348-357.
7. "Frajunolides L-O, Four New 8-Hydroxybriarane Diterpenoids from the Gorgonian *Junceella fragilis*", *Marine Drugs*, **2011**, *9*, 1477-1486.
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9. "Nortriterpene Lactones from the Fruits of *Schisandra arisanensis*", *J. Nat. Prod.*, **2010**, *73*, 1228-1233.
10. "Arisandilactone A, a New Triterpenoid from the Fruits of *Schisandra arisanensis*", *Org. Lett.*, **2010**, *12*,(5), 1016-1019**.**
11. "Asterolaurins A-F, Xenicane Diterpenoids from the Taiwanese Soft Coral *Asterospicularia laurae", J. Nat. Prod.*, **2009**, *72* (11), 1911-1916.
12."Oxygenated Lignans from the Fruits of *Schisandra arisanensis*", *J. Nat. Prod.*, **2009**, *72* (9), 1663-1668.
13."Cembrane Diterpenoids from the Taiwanese Soft Coral *Sinularia flexibilis," Tetrahedron*, **2009**, *65*, 9157-9164.
14. "Cespihypotins Q-V, Verticillene Diterpenoids from *Cespitularia hypotentaculata", J. Nat. Prod.*, **2008**, *71*, 1993-1997.
15. "Tasumatrols U-Z, Taxane Diterpene Esters from *Taxus sumatrana", J. Nat. Prod.*, **2008***, 71* (4), 576-580.
16. "Cembrane Diterpenoids from the Taiwanese Soft Coral *Sarcophyton stolidotum", J. Nat. Prod.*, **2008**, *71*, 1141-1145.12.
17. "Eight New Diterpenoids from Soft Coral *Cespitularia hypotentaculata*", *Tetrahedron*, **2007**, 10914-10920.
18. "Kadsuphilols A-H, New Oxygenated Lignans from *Kadsura philippinensis", J. Nat. Prod.*, **2007**, *70*, 1139-1145.
19."Nitrogen-containing Verticillene Diterpenoids from Taiwanese Soft Coral *Cespitularia taeniata* May", *J. Nat. Prod.*, **2007,** *70*, 1961-1965.
20. "$C_{-18}$ Dibenzocyclooctadiene Lignans from *Kadsura philippinensis*, *J. Nat. Prod.*, **2006**, *69*, 963-966.
21. "Cespitulactones A and B, New Diterpenes from *Cespitularia taeniata*", *Bioorg. Med. Chem. Lett.*, **2006**, *16*, 2369-2372.
22. «New Norditerpenoids from *Cespitularia hypotentaculata*, *Tetrahedron Lett.*, **2006**, *47*, 6651-6655.
23."Taiwankadsulins A, B and C, Three New C-19 Homolignans from *Kadsura philippinensis*", *Org. Lett.*, **2005**, *7* (23), 5297-5300.
24. "Kadsuphilactones A and B, Two New Triterpene Dilactones from *Kadsura philippinensi*"s, *Org. Lett.*, **2005**, *7* (15), 3307-3310
25. "Novel Taxane Diterpenes from *Taxus sumatrana* with the First C-21 Taxane ester", *Tetrahedron*, **2005,** *61*, 1345-1352.

*Technical Session D1-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Nutrition: at crossroads of human health and sustainable world

**Xingen Lei**

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BIOGRAPHY

*Technical Session D1-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# IL-12 is required for mTOR regulation of memory CTLs during virus infection

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ABSTRACT

Inflammatory cytokines are critical in the induction of memory CTLs, and inhibition of mTOR by rapamycin can enhance memory CTL generation. However, it is unknown if important inflammatory cytokines such as IL-12 are involved in the regulation of memory CTLs by mTOR during infection. We show here that inhibition of mTOR by rapamycin represses CTLs expansion and enhances memory CTL generation during vaccinia virus infection in mice. In addition, rapamycin promotes central memory phenotype in CTLs. However, the absence of IL-12 signal in CTLs diminishes rapamycin regulation on both CTL expansion and subsequent memory CTL formation, despite that rapamycin substantially increases memory CTLs when IL-12 signal is missing. Moreover, rapamycin-regulated memory CTLs in the absence of IL-12 are impaired in secondary expansion upon pathogen challenge, and subsequently form abolished secondary memory. In conclusion, IL-12 contributes to the strength of rapamycin regulation on primary memory CTLs, and lack of IL-12 signal leads to impaired secondary expansion of memory CTLs. Thus, the IL-12 signal is required for mTOR regulation on functional memory CTLs.

BIOGRAPHY

***Education:***

*I was born in Jiansu province in China, and got my education in both China and USA:*

| | |
|---|---|
| 1983-1988 | Nanjing Agricultural University (NAU), Nanjing, P.R.China. |
| | Degree: D.V.M. |
| 1988-1991 | Nanjing Agricultural University (NAU), Nanjing, P.R.China. |
| | Degree: M.S. (Veterinary Microbiology & Immunology) |
| | Advisor: Dr. Nianxing Du |
| 2000-2004 | University of Minnesota, St. Paul. |
| | Degree: Ph.D. (Veterinary Biomedical Science) |
| | Advisor: Dr. Michael P. Murtaugh |

**Academic Employment Background:**

2008- present Assistant Professor, Department of Animal & Avian Sciences, University of Maryland, College Park, MD: Percentage of official time devoted to: Instruction 30%; Research 70% (9 month appointment)

2004-2008 Department of Medicine, University of Minnesota Medical School, Minneapolis.
Position: Postdoctoral Fellow
Advisors: Drs. M.Mescher and S. Jameson

**Work experience:**

**1991-1999** Nanjing Animal and Plant Quarantine Bureau (NAPQB), Nanjing, P.R.China
Position: Researcher scientist &Veterinarian

**Other Experience and Professional Memberships**

| | |
|---|---|
| 2004-- | Ad Hoc reviewer, National Pork Board PRRS program |
| 2006-- | Member, the American Association of Immunologists |
| 2009-- | Guest editor, Journal of Biomedicine and Biotechnology |
| 2011-- | Member, American Diabetes Association |

**Competitive Grant Programs**

Ad Hoc Reviewer: National Pork Board and NRI/NC229 PRRS research program (2004-present)

**Peer-reviewed Journals**

Lead guest editor for a special issue on *Cytotoxic T Lymphocytes and Vaccine Development*, Journal of Biomedicine and Biotechnology, 2009-present.
Editorial board member for *Poultry, Fisheries & Wildlife Sciences*
Editorial board member for *The Open Access Journal of Science and Technology*

**Ad Hoc Manuscript Reviewer for:**

Analytical Chemistry
Archivum Immunologiae et Therapiae Experimentalis
Avian Disease
European Journal of Immunology
Journal of Virological Methods
Stem Cells and Development
Veterinary Immunology and Immunopathology
Virology Journal

1. **Xiao Z**, Curtsinger JM, Prlic M, Jameson SC, Mescher MF. 2007. The CD8 T cell response to vaccinia virus exhibits site-dependent heterogeneity of functional responses. International Immunology 19(6): 733-43.
2. **Xiao Z**, Mescher MF, Jameson SC. 2007. Detuning CD8 T cells: down-regulation of CD8 expression, tetramer binding, and response during CTL activation, The Journal of Experimental Medicine 204 (11): 2667-2677.
3. **Xiao, Z.,** K. A. Casey, S. C. Jameson, J. M. Curtsinger, and M. F. Mescher. 2009. Programming for CD8 T cell memory development requires IL-12 or type I IFN. J Immunol 182:2786-2794.
4. Li, X., K. Garcia, Z. Sun, and **Z. Xiao.** 2011. Temporal Regulation of Rapamycin on Memory CTL Programming by IL-12. PLoS ONE 6:e25177.
5. Smyth, K., Garcia, K., Sun, Z., Tuo, W., and **Xiao, Z**. (2012). Repetitive peptide boosting progressively enhances functional memory CTLs. Biochem Biophys Res Commun. DOI 10.1016/j.bbrc.2012.07.018
6. Smyth, K., K. Garcia, Z. Sun, W. Tuo, and **Z. Xiao**. 2012. TLR agonists are highly effective at eliciting functional memory CTLs of effector memory phenotype in peptide immunization. International immunopharmacology. DOI: 10.1016/j.intimp.2012.10.019

*Technical Session D1-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# *In vitro* embryogenesis, animal cloning and embryonic stem cells

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ABSTRACT

Animal cloning and embryonic stem (ES) cells have been two active research areas since the birth of Dolly the Sheep by Dr. Wilmut's group in 1997. Although with an extremely low efficiency (< 0.5%), more cloned animals including domestic and wild species were produced using the micromanipulator-based cloning procedure (i.e., somatic cells nuclear transfer, SCNT). The successful generation of SCNT embryos and animals provides potential applications in both agriculture (food-producing animals) and human medicine (therapeutic cloning). Expansion of transgenic animals or superior genetic animal herds can be speeded-up by cloning technologies, compared to traditional breeding program. A revolutionary cloning technique, i.e., handmade cloning (HMC) or oocyte bisection cloning technique (OBCT), was first reported by Dr. Vajta's group for cattle cloning a decade ago, and other domestic species including pigs, goats, and horses were also produced by using the same technology. This simplified and low cost cloning technique, was expected to surpass the traditional micromanipulator-based SCNT in terms of its efficiency in embryo and animal production.

Recently, several major progresses related to therapeutic cloning with stem cell technology have shed light on the treatment of human diseases and injuries. Among those, successful generation of human ES cell lines from cloned embryos, cellular reprogramming with some major genes to induce pluripotent stem (iPS) cells, directed differentiation of pluripotent stem cells, and a revolutionary improvement in cloning technology have also partaken in this critical linkage. However, much is still unclear and controversial issues exist while scientists are to gain more inside on the regulatory pathways of stem cell differentiation using animal models.

The rabbit has been an excellent model system for many biological studies including physiology, nutrition, toxicology, biomedicine and so forth. Recently, rES cell lines have been established in some laboratories including ours. However, authentic rES cell lines competent in germline transmission have not been derived, although new rES cells lines, parthenote-derived rES (p-rES cells) and SCNT ES (nt-rES) cells, as well as signaling molecule (such as GSK3 and MEK) inhibitor-derived rES cells are reportedly established. Following cell transplantation and establishing new rES cells derived from fertilized embryos, induced differentiation of rES cells into pancreatic cells, osteoprogenitor cells, retinal cells cardiomyocytes and germ cells are

major challenges for the next attempt. Future studies on rES cells would provide new perspectives on biomedical research and would essentially lend new insights into regenerative biology and cell replacement therapies in human medicine.

BIOGRAPHY

Professor Jyh-Cherng Ju, a reproductive biologist and embryologist, was born in Taiwan in 1958 and earned his Ph.D degree from the Department of Animal Science, Cornell University, Ithaca, New York, USA in 1999, when Drs. Xiangzhong Yang and John E. Parks were both his mentors.

After military service, he worked for National Chung Hsing University at the Department of Animal Science from 1986 till present, during which he has been working on *in vitro* production and thermotolerance of embryos in domestic species, animal cloning and rabbit embryonic stem (rES) cells. During 2002-2007, he visited Dr. O. J. Gintgher's lab at University of Wisconsin, Madison for a winter and two summers between semesters. In 2008, he also visited Dr. Su-Chun Zhang's lab at the renowned Waisman Center, UW Madison, for his sabbatical year. In addition to the successful generation of cloned animals including mice, rabbits, pigs and cattle, his team recently isolated rabbit ES cells from parthenotes, fertilized embryos and cloned embryos, as well as cloned the first miniature pig using handmade cloning (HMC) technique, aka. oocyte bisection cloning technique (OBCT). Till now, his group has published more than 60 research papers in peer-reviewed journals plus many other local scientific articles.

Prof Ju has been a member of the Society for the Study of Reproduction (SSR), Chinese Society of Animal Science (CSAS) and Veterinary Diagnostic Lab for more than a decade, as well as on the standing committee of the International Congress on Animal Reproduction (ICAR) since 2012. In 2009, he has been recognized as a distinguished professor of National Chung Hsing University, and received an Outstanding Researcher Award from the Chinese Society of Animal Science. He is currently a full professor affiliated with the department of Animal Science, Biotechnology Program, and the Center for Tissue Engineering and Stem Cell, National Chung Hsing University, Taichung, Taiwan.

Most recent representative publication are as follows :

Nguyen NT, NW Lo, SP Chuang, YL Jian, and **JC Ju***. 2011. Sonic Hedgehog supplemented in oocyte and embryo culture media enhances development of in vitro fertilized porcine embryos. Reproduction 142:87-97 (doi:10.1530/ REP-11-0049)

Siriboon C, CF Tu, M Kere, MS Liu, HJ Chang, LL Ho, ME Tai, WD Fang, NW Lo, JK Tseng, and **JC Ju***. 2013. Production of viable cloned miniature pigs by aggregation of handmade cloned embryos at the 4-cell stage. Reprod Fertil Dev (online early). doi.org/ 10.1071/RD12243

Intawicha P, SH Wang, YC Hsieh, NW Lo, KH Lee, SY Huang*, and **JC Ju***. 2013. Proteomic profiling of rabbit embryonic stem cells derived from parthenotes and fertilized Embryos. PloS One (accepted)

*Technical Session D2-W1-T1: Agroecology, Agricultural Biotechnology*

## Session Chair

## Kuan-Chen Cheng

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BIOGRAPHY

**Kuan-Chen Cheng**, receiving his Ph.D. degree of agricultural and biological engineering at The Penn State University in 2010, is from Miaoli, Taiwan. Dr. Cheng has more than 10 years of research experiences in the areas of microbial bioprocessing and fermentation.
He is now an assistant professor in the Graduate Institute of Food Science and Technology, National Taiwan University since Aug, 2011. Before he returned to Taiwan, Dr. Cheng was offered as a research associate in the Chemical and Environmental Engineering Dept. at The University of Arizona, where he also conducted research for the National Alliance for Advanced Biofuels and Bioproducts (NAABB). His specialties include algae cultivation, lipid analysis and evaluating water quality for algae cultivation. Dr. Cheng is a member of the Institute of Biological Engineering (IBE), Agricultural Chemical Society of Taiwan, the American Society of Agricultural and Biological Engineers (ASABE), and the honor societies Gamma Sigma Delta (agricultural) and Alpha Epsilon (agricultural, food, and biological engineering).

*Technical Session D2-W1-T1: Agroecology, Agricultural Biotechnology*

# New and Bioactive Terpenoids and Lignans from *Schisandra*

**Ya-Ching Shen**

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ABSTRACT

The constituents from plants of *Schisandra* have been investigated for several decades. The novelties of structures especially the recent discovered triterpenoids in the family of schisandraceae has attracted our lab to pursue compounds of novel structures with interesting biological activities.

*Schisandra arisanensis* Hayata is an endemic plant growing in the mountainous area of Taiwan. Its stems and roots were recommended to improve blood circulation, release of swelling and pain, hypertension, inflammation of stomach. The ripe berries of *S. arisanensis*, similar to *S. chinensis* and *S. sphenathera,* are edible fruits and can be used for the treatment of liver dysfunction and diabetes.

In our investigation of *S. arisanensis* and *S. sphenanthra* several terpenoids of novel skeletons and new lignans have been discovered. These compounds have been evaluated anti-HIV, immuno-modualatory, anti-inflammatory, antioxidative and anti-liver fibrotic activities. In this conference, isolation, structural elucidation, biogenesis, and bioactivity evaluation of new terpenoids and lignans will be presented.

References

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4. Schinarisanlactone A, A New Bisnortriterpenoid from *Schisandra arisanensis*, *Org. Lett.*, **2011**, *13* (3), 446-449.
5. New and Bioactive Lignans from the Fruits of *Schisandra sphenanthera, Food Chem.*, **2011**, *128*, 348-357.
6. Schisarisanlactones A and B, A New Class of Nortriterpenoids from the Fruits of *Schisandra arisanensis, Food Chem.*, **2013**, *136*, 1095-1099.

BIOGRAPHY

Taipei, 1953

**Education**

BS, School of Pharmacy, Taipei Medical College, 1972 - 1976 (Pharmacy)

MS, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1978 - 1980 (Pharmacognosy)

PhD, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1983 - 1987 (Natural Product Chemistry)

PDF, School of Pharmacy, UNC at Chapel Hill, USA, 1989-1990; Scripps Institute of Oceanography, UCSD, USA, 1990-1992 (Synthetic Chemistry and Marine Natural Product Chemistry)

**Work Experiences**

Lieutenant, Military service, 1976 –1978
Pharmacist, Fu-Yeu Hospital, 1981 – 1983
Instructor, and Associate Professor, School of Pharmacy, College of Medicine, National Taiwan University, 1987 – 1989
Associate Professor, Department of Marine Resources, National Sun Yat-Sen University, 1992 – 1997
Professor, Department of Marine Resources, National Sun Yat-Sen University, 1997 – 2006
Professor, School of Pharmacy, College of Medicine, National Taiwan University, 2006 – Present

**Teaching Courses:** Pharmacognosy, Instrumental analysis, Chromatography, Advanced NMR spectroscopy, Drug separation techniques, Natural product chemistry, Chinese Medicine, Medicinal plants, etc.

**Research Interests:** Major research interests include 1. Discovery of new and bioactive natural products from terrestrial and marine organisms, 2. Preparation and modification of bioactive natural compounds for SAR studies, 3. Chinese herbal medicine, 4. Chemotaxonomy, 5. Medicinal plants, 6. Food chemistry, etc.

**Memberships:** American Society of Pharmacognosy, Taiwan Pharmaceutical Society

**Honors:** ISI Citation Award, 1999; CPJ outstanding contribution Award, 2004

**Selected Publications (187 scientific papers till now)**

1. "Schisarisanlactones A and B, A New Class of Nortriterpenoids from the Fruits of *Schisandra arisanensis", Food Chem.*, **2013**,*136*, 1095-1099.
2. "Anti-Liver Fibrotic Lignans from the Fruits of *Schisandra arisanensis* and *S. sphenanthera", Bioorg. Med. Chem. Lett.*, **2013**, *23*, 880-885.
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9. "Nortriterpene Lactones from the Fruits of *Schisandra arisanensis"*, *J. Nat. Prod.*, **2010**, *73*, 1228-1233.
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*Technical Session D2-W1-T1: Agroecology, Agricultural Biotechnology*

# Active DNA Demethylation during Gametogenesis Regulates Gene Imprinting and Transposon Silencing in Arabidopsis

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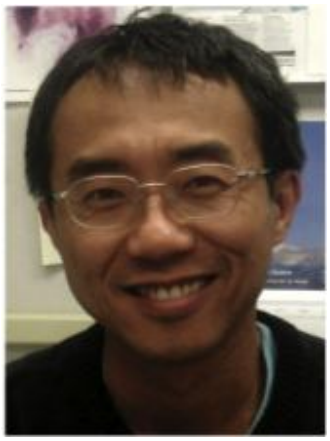
## ABSTRACT

The companion cells of the Arabidopsis thaliana egg and sperm, the central and vegetative cells, undergo active DNA demethylation prior to fertilization. However, its biological significance, extent of conservation, and targeting preferences are not yet clear. We showed that localized demethylation of interspersed, small transposable elements is a common feature of A. thaliana companion cells. The DEMETER DNA glycosylase has been shown to encode active DNA demethylase activity and is required for seed production. DME-mediated DNA demethylation in the central cell is required to establish imprinted gene expression in the endosperm, and is considered a master regulator for plant gene imprinting. However, the similarity among DME targets in the central and vegetative cells, despite their different functions and developmental fates, suggests that establishment of genomic imprinting may not be the basal function of DME. Lack of DEMETER in vegetative cells causes reduced methylation of transposons in sperm. This suggests that the basal function of companion cell demethylation is to reinforce transposon silencing in plant gametes.

## BIOGRAPHY



Tzung-Fu Hsieh was born in Feng-Yuan, Taiwan, in 1965. He received his Bachelor degree in Chemistry from National Tsing Hua University, Hsinchu Taiwan, in 1987. In 1997, he obtained his PhD degree in Biology from Texas A&M University in College Station, Texas. In 2001 he joined Dr. Robert Fischer's lab as a postdoctoral fellow in the Plant and Microbial Biology Department at University of California, Berkeley.

His main research interests include endosperm and embryo development, female gametogenesis and epigenetic regulation of plant gene imprinting. His recent research project focus on studying active DNA demethylation processes during plant gametogenesis using whole genome bisulfite sequencing strategies.

Dr. Hsieh is an Assistant Professor at the Plant for Human Health Institute and the Department Genetics at North Carolina State University since August, 2012. He is continuing his studies in epigenetic regulation of plant gene imprinting. He is also investigating the roles of epigenetics in the regulation of plant secondary metabolites biosynthesis.

*Technical Session D2-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Session Chair

## Kuan Chong Ting

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BIOGRAPHY


**K.C. Ting** is Professor and Head of the Agricultural and Biological Engineering Department at the University of Illinois. He received his Ph.D. in agricultural engineering from the University of Illinois. He teaches and conducts research on automation, systems informatics and analysis, alternative energy, and phytomation (i.e. plant based engineering systems). He has participated in the efforts to obtain funding for a number of multi-million dollar centers, institutes and programs. He has received over $7.3 million dollars of research grants, under his direct administration, from federal governments, states, and the industry. He served as the leader of the Systems Studies & Modeling Team within the New Jersey NASA Specialized Center Of Research and Training (NJ-NSCORT) during 1996-2000. He currently leads a BP Energy Biosciences Institute program on "Engineering Solutions for Biomass Feedstock Production" and serves as a member of Steering Committee for the "ADM Institute for the Prevention of Postharvet Loss" at the University of Illinois. He is a co-editor/co-author of a monograph entitled "Robotics for Bioproduction Systems." He holds a professional engineer license in New Jersey. He has authored/co-authored over 260 articles, conference papers, and project reports. He has been invited to deliver close to 100 presentations in many countries. He was an Editor-in-Chief for Computers and Electronics in Agriculture during 2007-2010. He has received many major awards and recognitions including: ASABE James R. and Karen A. Gilley Academic Leadership Award, August 2011; ASABE Kishida International Award, July 2008; Guest Chair Professor, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou, China, April 2006; Honorary Scientist, Rural Development Administration, Republic of Korea, January 1, 2004-December 31, 2006; Fellow of ASME elected in July 2002; Fellow of ASABE inducted in July 2001; and Cook College/Alpha Zeta Professor of the Year, Rutgers University, 1997.

*Technical Session D2-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# A green process for the production of starch/cellulose acetate bio-materials

Zhongshun Yuan, **Chunbao (Charles) Xu***

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## ABSTRACT

The objective of this research is to valorize the large amount of crop residues and starch produced in large quantity in the agriculture sector for value-added materials, specifically to convert cellulose and starch, two major bio-resources plant stems and seeds, to cellulose / starch acetates with wide commercial applications. Cellulose and starch are the two major renewable and abundant natural polymers, occurring in plant stems and seeds. They have the same building block glucose but with different spatial structure. Both of cellulose and starch are difficult to be utilized directly for materials due to their poor processibility (high melting points and brittle). In this research, cellulose and starch were converted to cellulose/starch acetates (CA and SA) or CA and SA mixed esters with controlled substitution levels using a novel catalytic acetylation/esterification method recently developed by our group, where no waste stream will be generated. The strength, proccessibility, and compatibility with other polymers of CA and SA are significantly higher than the source materials. CA and SA have wide applications to bio-plastics, composites, and biodegradable materials.

## BIOGRAPHY

Dr. Chunbao (Charles) Xu (徐春保), born in Jiangxi Province(江西省), P.R. China in 1971, received his B.Eng. degree in Metallurgical Engineering from Anhui University of Technology (formerly East China Institute of Metallurgy), Anhui Province, China in 1993. Dr. Xu earned two PhD degrees, one in Metallurgical Engineering from The University of Science and Technology Beijing, China in 1998, and the other in Chemical Engineering from The University of Western Ontario, Canada in 2004.

He was a **Postdoctoral Fellow** (funded by Japan Society for Promotion of Science, JSPS) and **Research Associate** (appointed by the Japanese Government Ministry of Education, Culture, Sports, Science and Technology (Monbukagakusho or MEXT) at Tohoku University, Japan during 1998 and 2001. After working at University of Alberta and Syncrude Canada Research Center as a **Postdoctoral Researcher**, he was appointed a tenure-track **Assistant Professor** in Chemical Engineering at Lakehead University in 2005, and promoted to **Associate Professor** with tenure in 2008. He was the **Director of Green Energy Laboratory** at Lakehead University. He became an **Associate Professor** of Chemical Engineering and **NSERC/FPInnovations Industrial Research Chair** in Forest Biorefinery at Western University (or UWO) in May 2011, and is leading the Industrial Bioproducts Laboratory funded by Canada

Foundation for Innovation. He is an emerging young researcher and building an international stature in the field of forest biorefinery - production of bio-energy, bio-fuels, bio-based chemicals and materials from forest biomass and forestry residues. He was awarded the Japan Institute of Energy Outstanding Young Scientists Award in 1999, Lakehead University Contribution to Research Award in 2007, and more recently the prestigious Syncrude Canada Innovation Award in 2011 by CSChE ((presented to a young Canadian chemical engineer under the age of 40 who has made a distinguished contribution to the field of chemical engineering while working in Canada). Dr. Xu has a Chinese patent awarded, 2 US/Canadian patents in process, and 3 invention disclosures. Dr. Xu has published 5 book chapters and more than 140 papers in journals and conferences, including more than 70 peer-reviewed journal papers. Dr. Xu is currently serving as a editor-in-chief for the *International Journal of Chemical Reactor Engineering* (IJCRE), an international peer reviewed journal published by De Gruyter.

*Technical Session D2-W2-T1: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# From Biomass to Biofuels: the Power of Synthetic Biology

**Kang Wu**

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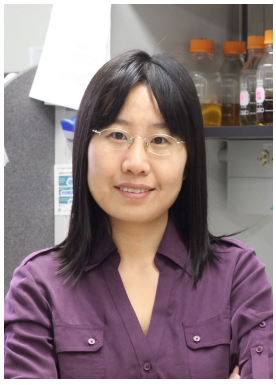
## ABSTRACT

Biofuels produced from lignocellulosic biomass, like energy crops and agricultural residues, is a promising alternative renewable fuel and offer several advantages including the capture of carbon dioxide by growing plants, and geographical flexibility, the addition of value to an agricultural crop, and reduced landfill disposal and pollution. However, the total cost of production is higher when compared with petroleum fuels. The production of biofuel from lignocellulosic biomass involves multiple stages: from pretreatment of biomass, hydrolysis of biomass, fermentation, to biofuel recovery. In this talk, I will discuss some examples from my work of using synthetic biology to engineer bacteria in this process for biofuel production, particularly, engineering bacteria for enzyme production and fuel fermentation.

## BIOGRAPHY



Dr. Kang Wu got her B.S degree in biochemical engineering at Tianjin University in China in 2003. She came to the United States in 2004 and got her M.S. degree in 2008 and Ph. D. degree in 2010, both in chemical engineering at University of Illinois at Urbana-Champaign.

Currently, she is an Assistant Professor in the Department of Chemical Engineering at University of New Hampshire. Before this, she was a Postdoctoral Research Associate in Dr. Christopher Rao's lab at University of Illinois at Urbana-Champaign from 2010 to 2012. Her work was published in multiple journals, including Molecular Microbiology, Journal of Biological Chemistry, Current Opinion in Chemical Biology, and so on. Her major research interests is to understand and engineer the intracellular networks governing the function of cells, particularly, developing bacteria for efficient protein secretion.

Dr. Wu is a member of the American Institute of Chemical Engineers, Society for Industrial Microbiology and Biotechnology, American Society for Microbiology and International Society for Pharmaceutical Engineering. She got the CAST Director's Award from American Institute of Chemical Engineers in 2008 and Shen postdoctoral Fellowship in 2012.

*Technical Session D2-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

## Session Chair

## Yung-Fu Chang

Director, Infectious Disease Research Program, Animal Health Diagnostic Center
Professor, Department of Population Medicine and Diagnostic Sciences
College of Veterinary Medicine, Cornell University
(康乃爾大學獸醫學院張永富教授)

BIOGRAPHY

Yung-Fu Chang, Veterinarian degree from National Pintung Institute of Agriculture, Taiwan in 1974, MS degree, University of Idaho in 1981 and Ph.D, Texas A&M University in 1984.

**Positions and Employment**

- **1974-1979** Assistant Pathologist, Veterinary Pathology Division, Taiwan Provincial Research Institute for Animal Health, Taiwan
- **1984-1985** Research Associate, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1986-1989** Assistant Research Scientist, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1989-1996** Assistant Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **1996-2003** Associate Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **2003 (Jan-July)** Visiting Professor, Department of Infectious disease and Medicine, Stanford University Medical School, Stanford, CA.
- **2003-present** Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.

**Honors**

Beta Rho Chapter of Phi Sigma National Honor Society (1983); Diplomat of the American College of Veterinary Microbiologist (1987); The Society of Phi Zeta; Who's Who in America? (1991); Editor Board, Bioengineered Bugs (2010-2012); Journal of Veterinary Science & Technology (2010-present) and PLoS One. Treasure, American Leptospirosis Research Conference, Inc. (2001-present). Distinguished alumni, National Pin-Tung University of Science and Technology, Taiwan (2007).

**Patents (active)**

Ehrlichia canis genes and vaccines. US patent no: 7,951,386 B2. Yung-Fu Chang; Compositions for eliciting an immune response against Mycobacterium avium subspecies paratuberculosis. US Patent no: 7, 732,580,B2 & 7,858,102 B2,European patent No: 1,855,716. Yung-Fu Chang; Protective coating for array material depositions. US Patent no.

7,781,378, B2. Reid N. Orth, M. Lin, T. C. Clark, Yung-Fu Chang, Harold G. Craighead, Jose Manuel Morqan-Mirabal; Immunogenic proteins of Leptospira. US Patent no. US 7,655,427. B2.Yung-Fu Chang and Raghavan U. M. Palaniappan.

*Technical Session D2-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

## Jiuzhou John Song

Associate Professor, Department of Animal and Avian Sciences
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BIOGRAPHY

*Technical Session D2-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Controlling Biofilms by Targeting Bacterial Cell-to-Cell Signaling

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## ABSTRACT

Bacteria have developed complex systems of cell-to-cell signaling and multicellular behaviors to survive in competitive environments. For example, sessile microbial consortia known as biofilms are ubiquitous in natural, medical, and engineering environments. Due to significantly enhanced tolerance to antibiotics (up to 1000 times), biofilms cause serious chronic infections with high mortality. Biofilm formation is a dynamic process involving cell-to-cell communication and significant changes in gene expression, which are sensitive to many environmental factors. Thus, interdisciplinary approaches are necessary for understanding and controlling biofilm formation and associated drug resistance. In this presentation, we will present our recent results of biofilm control by inhibiting quorum sensing, a bacterial system of gene regulation by sensing and responding to cell density. We will also discuss the effects of some quorum sensing inhibitors on dormant bacterial cells, known as persisters.

## BIOGRAPHY

Dr. Dacheng Ren received his Bachelor's degree in Applied Chemistry and Electric Engineering (dual major) from Shanghai Jiao Tong University in 1992, Master's degree in Chemical Engineering from Tianjin University in 1996, and Ph.D. in Chemical Engineering from University of Connecticut in 1999. After completing a postdoctoral training at Cornell University, he jointed Syracuse University in 2006.

Currently, Dr. Ren is an Associate Professor in the Department of Biomedical and Chemical Engineering at Syracuse University. His research focuses on microbial biofilm formation with broad interests in both fundamental studies and development of novel control methods.

Dr. Ren has 32 peer-reviewed journal publications and 7 pending/issued patents. He received an Early Career Translational Research Awards in Biomedical Engineering from the Wallace H. Coulter Foundation in 2009, and an NSF CAREER Award in 2011. He was named College Technology Educator of the Year by the Technology Alliance of Central New York (TACNY) in 2010.

*Technical Session D2-W3-T1: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Lysosomal dysfunction in Frontotemporal Lobar Degeneration

**Fenghua Hu**

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## ABSTRACT

Frontotemporal lobar degeneration (FTLD) is the most prevalent early onset dementia after Alzheimer's disease (AD) and accounts for 20-25% of pre-senile dementias. A large subset of FTLD cases contains ubiquitin-positive inclusions with the protein TDP-43 (FTLD-U). Mutations in *Progranulin (PGRN)* are one of the major causes of FTLD-U[3-5]. More recently, polymorphisms in the *TMEM106B* gene, resulting in increased levels of TMEM106B, were discovered as a risk factor for FTLD-U, especially in patients with *PGRN* mutations[6-13]. *TMEM106B* polymorphisms are also associated with cognitive impairment in ALS patients[12] and implicated in pathological presentation of Alzheimer's disease[14]. However, how TMEM106B modulates FTLD-U pathogenesis in *PGRN* mutant carriers remains unclear.

PGRN encodes an evolutionarily conserved, secreted glycoprotein of 88 kDa. PGRN is comprised of 7.5 granulin motifs and is involved in wound healing, inflammation, tumorigenesis and neuronal survival. We recently identified a member of the Vps10 family, sortilin, as a binding partner for PGRN. Sortilin regulates PGRN trafficking and PGRN levels by mediating PGRN endocytosis and targeting to lysosomes. Recent genetic and bioinformatics studies strongly suggest a role of PGRN in regulating lysosomal function_ENREF_18_ENREF_19.

*TMEM106B* encodes a type II transmembrane protein of unknown function. Our recent data demonstrated that TMEM106B is highly expressed in neurons and mainly localizes in late endosome/lysosome compartments. Increased TMEM106B levels result in enlarged vacuoles and a delay in the degradation of endocytic cargoes. These results indicate that increased TMEM106B levels exacerbate FTLD-U phenotypes in the PGRN haploinsufficiency background by interfering with lysosomal function. Lysosomal dysfunction might be one of the disease mechanisms underlying FTLD-U.

## BIOGRAPHY

Fenghua Hu is born in Zhejiang, China and received her B.S. in Biochemistry from Peking University in China in 1997 and her Ph.D. from Baylor College of Medicine in 2002. She received her postdoctoral training at Yale University from 2002 to 2008.

Currently, she is a research scientist in the Department of Molecular Biology and Genetics and is a member of the Weill Institute for Cell and Molecular Biology at Cornell University. Her lab is interested in studying molecular mechanisms of Frontotemporal Lobar Degeneration.

Dr. Hu has received many awards throughout her career, including Professor John J. Trentin Award for Scholastic Excellence and Platform Speaker Award from Baylor College of Medicine, Postdoctoral Fellowship from Paralyzed Veteran of American foundation and The Rosalinde and Arthur Gilbert Foundation/AFAR New Investigator Award in Alzheimer's Disease. Her research is currently funded by The Association for Frontotemporal Association, Alzheimer's Association, Muscular Dystrophy Association and National Institute of Health.

*Technical Session D2-W1-T2: Agroecology, Agricultural Biotechnology*

## Session Chair

## Tzung-Fu Hsieh

Assistant Professor, Plants for Human Health Institute &
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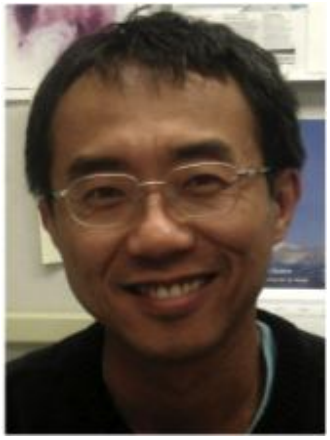
BIOGRAPHY



Tzung-Fu Hsieh was born in Feng-Yuan, Taiwan, in 1965. He received his Bachelor degree in Chemistry from National Tsing Hua University, Hsinchu Taiwan, in 1987. In 1997, he obtained his PhD degree in Biology from Texas A&M University in College Station, Texas. In 2001 he joined Dr. Robert Fischer's lab as a postdoctoral fellow in the Plant and Microbial Biology Department at University of California, Berkeley.

His main research interests include endosperm and embryo development, female gametogenesis and epigenetic regulation of plant gene imprinting. His recent research project focus on studying active DNA demethylation processes during plant gametogenesis using whole genome bisulfite sequencing strategies.

Dr. Hsieh is an Assistant Professor at the Plant for Human Health Institute and the Department Genetics at North Carolina State University since August, 2012. He is continuing his studies in epigenetic regulation of plant gene imprinting. He is also investigating the roles of epigenetics in the regulation of plant secondary metabolites biosynthesis.

*Technical Session D2-W1-T2: Agroecology, Agricultural Biotechnology*

# Temperature stress tolerance in plants: role of proteins and small non-coding RNAs

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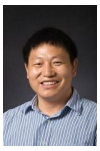
## ABSTRACT

Plants are sessile thus they have to endure many adverse environmental conditions such as temperature extremes (cold and heat). These environmental conditions not only restrict the geographical distribution of land plants but also limit crop production worldwide. We are interested in elucidating molecular mechanisms by which plants cope with temperature extremes with the long term goal of developing temperature stress-hardy crop plants through genetic engineering or other rational approaches. We have been using forward genetic analysis to dissect signal transduction pathways for temperature stress tolerance mainly in the widely used model plant *Arabidopsis thaliana*. We found that protein-coding genes as well as non-protein coding small regulatory RNAs play important roles in plant temperature stress responses. I will discuss several proteins identified in my lab that are critical for temperature stress-responsive gene expression and temperature stress tolerance. In addition, I will talk about miRNAs that are regulated by temperature stress or other protein-coding genes.

## BIOGRAPHY



Dr. Jianhua Zhu was born in Anhui province, China on Oct 10, 1975. Educational background:
Ph.D. plant molecular biology, Purdue University, West Lafayette, IN 47907, 2004
B.S. biological education, Anhui Institute of Education, Hefei, P. R. China, 1998

He worked as a POSTDOCTORAL FELLOW at the University of California-Riverside during 2004-2008. Since August 2008, he became an ASSISTANT PROFESSOR at the University of Maryland, College Park. His research work focuses on understanding the molecular mechanisms that plants have evolved to cope with environmental stresses such as salinity, drought, and temperature extremes (low and high). These are common environmental abiotic stress conditions that ultimately determine the distribution of land plants and adversely affect the agricultural productivity of crops worldwide. His laboratory has been focusing on the identification of key components in signal transduction pathways for plant responses to environmental stresses including salinity, drought, and temperature extremes, with the long term goal of developing new strategies to improve crop productivity and sustainability in agriculture and environment.

Dr. Zhu has memberships in the following professional societies: American Society of Plant Biologists (ASPB), American Association for the Advancement of Science (AAAS), and Gamma Sigma Delta, the Honor Society of Agriculture (University of Maryland - National Capital Area Chapter). He received CERTIFICATE OF MERIT – RESEARCH from the local chapter of Gamma Sigma Delta (University of Maryland - National Capital Area Chapter) in

2011. Dr. Zhu serves in several editorial boards of journals: *Plant Signaling & Behavior*, *Frontiers in Plant Traffic and Transport*, *Advances in Crop Sciences and Biotechnology, Cloning & Transgenesis.* Dr. Zhu served as ad hoc reviewer for Federal funding agencies such as USDA and NSF. He also served as ad hoc reviewer for manuscripts submitted to the following scientific journals: *Genes & Development*, *Plant Cell*, *Plant Journal*, *Plant Physiology*, *New Phytologist*, *Molecular Plant*, *Plant Cell & Environment*, *BMC Plant Biology*, *DNA Research*, *Planta*, *Plant Science*, *Genomics, Proteomics & Bioinformatics*, *Physiologia Plantarum*, *African Journal of Biotechnology*, *International Journal of Molecular Sciences*, *Internal Journal of Plant Physiology and Biochemistry*, *Molecular Biology Reports, Journal of Integrative Plant Biology, International Journal of Molecular Sciences,* and *Physiological Genomics*.

*Technical Session D2-W1-T2: Agroecology, Agricultural Biotechnology*

# Isoflavone Aglycones Enrichment in Soymilk by Agricultural Waste-Based Immobilized *β*-Glucosidase

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## ABSTRACT

Spent coffee grounds, discarded as environmental pollutants, were adopted as enzyme immobilization solid carriers instead of commercialized solid supports to establish an economical catalytic system. *β*-Glucosidase was covalently immobilized onto spent coffee grounds for the conversion of isoflavone glycosides into their aglycones in black soymilk. Optimum conditions were determined to be 40°C and pH 6 using 4-nitrophenyl *β*-D-glucuronide as an indicator. Operational reusability was confirmed for more than 30 batch reactions and the storage stability was capable of sustaining its highest catalytic activity for 20 days. The kinetic parameters including rate constant ($K$),time ($\tau_{50}$) in which 50% of isoflavone deglycosylation was reached, and time ($\tau_{complete}$) required to achieve complete isoflavone deglycosylation, were $0.16 \pm 0.02$ min$^{-1}$, $4.54 \pm 0.32$ min, 60 min for daidzin and $0.16 \pm 0.02$ min$^{-1}$, $2.28 \pm 0.11$ min, 60 min for genistin, respectively. The total aglycone content in black soymilk was enriched by $67.14 \pm 0.60\%$ in the enzymatic treatment of 60 min duration.

## BIOGRAPHY

**Kuan-Chen Cheng**, receiving his Ph.D. degree of agricultural and biological engineering at The Penn State University in 2010, is from Miaoli, Taiwan. Dr. Cheng has more than 10 years of research experiences in the areas of microbial bioprocessing and fermentation.
He is now an assistant professor in the Graduate Institute of Food Science and Technology, National Taiwan University since Aug, 2011. Before he returned to Taiwan, Dr. Cheng was offered as a research associate in the Chemical and Environmental Engineering Dept. at The University of Arizona, where he also conducted research for the National Alliance for Advanced Biofuels and Bioproducts (NAABB). His specialties include algae cultivation, lipid analysis and evaluating water quality for algae cultivation. Dr. Cheng is a member of the Institute of Biological Engineering (IBE), Agricultural Chemical Society of Taiwan, the American Society of Agricultural and Biological Engineers (ASABE), and the honor societies Gamma Sigma Delta (agricultural) and Alpha Epsilon (agricultural, food, and biological engineering).

**Selected Publications:**

Chen, KI; Lo, YC; Su, NW; Chou, CC; **Cheng, KC***; Enrichment of two isoflavone aglycones in black soymilk by immobilized beta-glucosidase on solid carriers. **2012**. *J Agric Food Chem* 60(51):12540-12546.

**Cheng, KC**; Ren M; Ogden KL; Statistical optimization of culture media for growth and lipid production of Chlorella protothecoides UTEX 250. **2013**. *Bioresource Technol* 128:44-48.

Chen, KI; Lo, YC; Liu, CW; Yu, RC; **Cheng, KC***; Enrichment of isoflavone aglycones in black soymilk by using coffee pulp as an immobilizer for beta-glucosidase. **2013**. *Food Chem* 139:79-85.

*Technical Session D2-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Session Chair

## Suming Chen

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BIOGRAPHY

Suming Chen received his B.S. (1978) in Agricultural Engineering from National Taiwan University, M.S. (1980) in Bio. & Agricultural Engineering from Rutgers University. He received M.S. (1982) in Chemical Engineering and Ph.D. (1985) in Bio. & Agricultural Engineering from University of California, Davis. Currently he is a professor in the Department of Bio-Industrial Mechatronics Engineering (BIME) and the director of the Bioenergy Research Center at National Taiwan University, and was the chair of BIME Department. His major research areas include automation in agriculture, nondestructive sensing of biomaterials, remote sensing and precision agriculture, computer simulation and control, knowledge engineering in agriculture, renewable energy. He is active in ASABE, CIAM, TIBM societies, and served as the president of CIAM during 2007-2010. Dr. Chen is the editor-in-chief of the Journal of Agricultural Machinery, and is also the representative editor of the journal "Engineering in Agriculture, Environment and Food".

*Technical Session D2-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

## Liangcai Peng

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BIOGRAPHY

*Technical Session D2-W2-T2: Precision and Information Agriculture, Renewable Energy and Smart Grid*

# Plant Growth Measurement and Modeling in Plant Factory

**Ta-Te Lin**

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ABSTRACT

Recent developments of plant factory research and technology in Asia have attracted vast attentions from various aspects. Plant factory, with its environmental conditions precisely controlled in a closed cultivation spaces, allows many advantages for agricultural production. The pluses include the efficient use of land, capable of stable year-round production, providing high-quality and safe produce, etc. Under controllable environment in a plant factory, the optimized protocol for vegetable production is more feasible and one of the keys to obtain optimum protocol is plant growth measurement and modeling under various environmental conditions. In order to find the most suitable environmental condition for plant growth, plant features can provide a good indication. Traditional direct measurements of fresh weight or dry weight are simple but destructive and laborious. In this presentation, an automatic plant growth measurement system, which is composed of a stereo vision system and a weight measurement system is introduced and discussed. The growth of various vegetables were monitored and measured with our automatic system in a plant factory. To acquire plant images, the camera mounted on a sliding rail was moved by a linear actuator to extend the field of view of the planting bed. Using image processing methods and stereo vision techniques, panoramic images of the planting bed were constructed and plant geometric features such as projected leaf area and plant volume were calculated. At the same time, plant weights were continuously recorded by the weight measurement instrument. Utilizing the integrated vision-based system and weight measurement system, the plant features of vegetables can be monitored throughout the whole growth cycle without affecting their growth. The modeling technique was also applied to determine the parameters of growth models that could be used to simulate and predict the growth of vegetables under various environmental conditions, and thus optimum protocols for vegetable cultivation can be obtained efficiently. With this non-destructive measurement and modeling approach, this integrated system would provide valuable information for plant factory managements and numerous agricultural research applications.

BIOGRAPHY

Ta-Te Lin was born in Taipei, Taiwan, R.O.C., on June 11, 1959. He received the B.S. degree in Agricultural Engineering from National Taiwan University, Taiwan, R.O.C. in 1981, and the MS and Ph.D. in Agricultural and Biological Engineering from Cornell University, U.S.A., in 1985 and 1989, respectively.

He has been on the faculty of National Taiwan University since 1989, and is currently Distinguished Professor of the Department of Bio-Industrial Mechatronics Engineering and Associate Dean of the College of Bioresources and Agriculture at the National Taiwan University. His research interests include agricultural mechanization and automation, digital image processing and machine vision, mathematical modeling of biological systems, artificial intelligence and bio-instrumentation.

He is a member of several international societies including the ASABE, the IEEE Computer Society, Japanese Society for Agricultural Informatics, and the Society for Cryobiology. Domestically, he served as board members of Chinese Institute of Agricultural Machinery, Taiwan Institute of Biomechatronics, and Taiwan Agricultural Information Technology Association. He was the President of Taiwan Institute of Biomechatronics from 2009 to 2012. He has received numerous recognitions for his outstanding performance in teaching and research. He has received twice the distinguished teaching award from National Taiwan University in 1999 and 2007. He received the academic achievement award for the Chinese Institute of Agricultural Machinery (CIAM) in 2005. He was elected as National Ten Outstanding Agriculture Experts by Kiwanis International, Taiwan, in 2012. He received the best annual paper awards from CIAM in 2000, 2003, and 2005, respectively, best poster paper awards from TIBM in 2005, 2006, 2009, 2011, 2012, best annual paper awards from Taiwan Entomological Society in 2007. He has authored or coauthored more than 200 journal and conference papers, and awarded more than 10 patents.

*Technical Session D2-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

## Session Chair

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BIOGRAPHY

Taipei, 1953

**Education**

BS, School of Pharmacy, Taipei Medical College, 1972 - 1976 (Pharmacy)

MS, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1978 - 1980 (Pharmacognosy)

PhD, Institute of Pharmaceutical Sciences, College of Medicine, National Taiwan University, 1983 - 1987 (Natural Product Chemistry)

PDF, School of Pharmacy, UNC at Chapel Hill, USA, 1989-1990; Scripps Institute of Oceanography, UCSD, USA, 1990-1992 (Synthetic Chemistry and Marine Natural Product Chemistry)

**Work Experiences**

Lieutenant, Military service, 1976 –1978
Pharmacist, Fu-Yeu Hospital, 1981 – 1983
Instructor, and Associate Professor, School of Pharmacy, College of Medicine, National Taiwan University, 1987 – 1989
Associate Professor, Department of Marine Resources, National Sun Yat-Sen University, 1992 – 1997
Professor, Department of Marine Resources, National Sun Yat-Sen University, 1997 – 2006
Professor, School of Pharmacy, College of Medicine, National Taiwan University, 2006 – Present

**Teaching Courses:** Pharmacognosy, Instrumental analysis, Chromatography, Advanced NMR spectroscopy, Drug separation techniques, Natural product chemistry, Chinese Medicine, Medicinal plants, etc.

**Research Interests:** Major research interests include 1. Discovery of new and bioactive natural products from terrestrial and marine organisms, 2. Preparation and modification of bioactive natural compounds for SAR studies, 3. Chinese herbal medicine, 4. Chemotaxonomy, 5. Medicinal plants, 6. Food chemistry, etc.

**Memberships:** American Society of Pharmacognosy, Taiwan Pharmaceutical Society

**Honors:** ISI Citation Award, 1999; CPJ outstanding contribution Award, 2004

**Selected Publications (187 scientific papers till now)**

1. "Schisarisanlactones A and B, A New Class of Nortriterpenoids from the Fruits of *Schisandra arisanensis", Food Chem.*, **2013**,*136*, 1095-1099.
2. "Anti-Liver Fibrotic Lignans from the Fruits of *Schisandra arisanensis* and *S. sphenanthera", Bioorg. Med. Chem. Lett.,* **2013***, 23*, 880-885.
3. "Bioactive Diterpenes from *Callicarpa longissima"*, *J. Nat. Prod.*, **2012**, *75*, 689-693.
4. "New Briarane Diterpenoids from the Gorgonian Coral *Junceella juncea", Marine Drugs*, **2012**, *10*, 1321-1330.
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6. "New and Bioactive Lignans from the Fruits of *Schisandra sphenanthera", Food Chem.*, **2011**, *128*, 348-357.
7. "Frajunolides L-O, Four New 8-Hydroxybriarane Diterpenoids from the Gorgonian *Junceella fragilis"*, *Marine Drugs*, **2011**, *9*, 1477-1486.
8. "Illicaborins A-C, Three Prenylated $C_6$-$C_3$ Compounds from the Fruits of *Illicium arborescens", Food Chem.*, **2010**, *123*, 1105-1111.
9. "Nortriterpene Lactones from the Fruits of *Schisandra arisanensis"*, *J. Nat. Prod.*, **2010**, *73*, 1228-1233.
10. "Arisandilactone A, a New Triterpenoid from the Fruits of *Schisandra arisanensis"*, *Org. Lett.*, **2010**, *12*,(5), 1016-1019**.**
11. "Asterolaurins A-F, Xenicane Diterpenoids from the Taiwanese Soft Coral *Asterospicularia laurae", J. Nat. Prod.*, **2009**, *72* (11), 1911-1916.
12."Oxygenated Lignans from the Fruits of *Schisandra arisanensis"*, *J. Nat. Prod.*, **2009**, *72* (9), 1663-1668.
13."Cembrane Diterpenoids from the Taiwanese Soft Coral *Sinularia flexibilis," Tetrahedron*, **2009**, *65*, 9157-9164.
14. "Cespihypotins Q-V, Verticillene Diterpenoids from *Cespitularia hypotentaculata", J. Nat. Prod.*, **2008**, *71*, 1993-1997.
15. "Tasumatrols U-Z, Taxane Diterpene Esters from *Taxus sumatrana", J. Nat. Prod.*, **2008***, 71* (4), 576-580.
16. "Cembrane Diterpenoids from the Taiwanese Soft Coral *Sarcophyton stolidotum", J. Nat. Prod.*, **2008**, *71*, 1141-1145.12.
17. "Eight New Diterpenoids from Soft Coral *Cespitularia hypotentaculata*", *Tetrahedron*, **2007**, 10914-10920.
18. "Kadsuphilols A-H, New Oxygenated Lignans from *Kadsura philippinensis", J. Nat. Prod.*, **2007**, *70*, 1139-1145.
19."Nitrogen-containing Verticillene Diterpenoids from Taiwanese Soft Coral *Cespitularia taeniata* May", *J. Nat. Prod.*, **2007,** *70*, 1961-1965.
20. "$C_{-18}$ Dibenzocyclooctadiene Lignans from *Kadsura philippinensis*, *J. Nat. Prod.*, **2006**, *69*, 963-966.
21. "Cespitulactones A and B, New Diterpenes from *Cespitularia taeniata"*, *Bioorg. Med. Chem. Lett.*, **2006**, *16*, 2369-2372.
22. «New Norditerpenoids from *Cespitularia hypotentaculata*, *Tetrahedron Lett.*, **2006**, *47*, 6651-6655.
23."Taiwankadsulins A, B and C, Three New C-19 Homolignans from *Kadsura philippinensis"*, *Org. Lett.*, **2005**, *7* (23), 5297-5300.
24. "Kadsuphilactones A and B, Two New Triterpene Dilactones from *Kadsura philippinensi"*s, *Org. Lett.*, **2005**, *7* (15), 3307-3310
25. "Novel Taxane Diterpenes from *Taxus sumatrana* with the First C-21 Taxane ester", *Tetrahedron*, **2005,** *61*, 1345-1352.

*Technical Session D2-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Development of Subtype-specific Monoclonal Antibodies (MAb) to Avian Influenza Virus and MAb-based Assays for the Rapid Detection of Avian Influenza

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## ABSTRACT

A global efforts on avian influenza (AI) control and prevention have started since the highly pathogenic avian influenza (HPAI) H5N1 outbreaks in Southeast Asian countries in 2003. Strategies for the control of both HPAI and low pathogenic avian influenza (LPAI) epidemic outbreaks include surveillance and "stamping-out" along with effective biosecurity measures. AI surveillance is the most important method to monitor AI virus (AIV) in poultry so as to effectively prevent and control AI outbreaks.

Monoclonal antibodies (MAb)-based assays are highly sensitive and specific for AIV detection, and much practical and economic for test-in-field or onsite. Many such assays have been developed and are still in developing before and after the HPAI H5N1 outbreaks. A MAb-based dot-enzyme-linked immunosorbent assay (ELISA) has been developed in our lab during late 1990's and early 2000s. Meanwhile, AIV H7 and H5 subtype specific-MAbs have been successfully developed in our laboratory to enhance the Dot-ELISA and other MAb-based assays for AIV detection. Production and purification of the H7 and H5 MAbs were made to provide essential reagents for Dot-ELISA and other immunoassays, and the current development of a novel Biosensor technique for rapid detection of AIV from clinical and field specimens. Virus isolation is a classic or "gold standard" for AIV surveillance and final diagnosis, but a disadvantage is time consuming. Molecular assays of gel PCR and real-time PCR are commonly used in well-equipped labs to make a rapid diagnosis, but they are much expensive tests. In practice or during outbreaks, a combination of applying these available assays can screen AIV on mass samples rapidly and make final AIV diagnosis on target samples accurately.

## BIOGRAPHY

Dr Huaguang Lu received his BS Degree in Veterinary Medicine (equivalent to DVM) at Shenyang Agriculture University (SAU) of China in 1982, a professional MPVM degree in Preventive Veterinary Medicine and a MS degree in comparative pathology from University of California Davis (UC Davis) in 1986 and 1987, respectively.

After completed his graduate studies in UC Davis, he returned to SAU in Dec 1987 and served as a faculty member in teaching veterinary students and conducting research in avian and swine infectious diseases. He received numerous awards in excellent teaching and research achievements, and was promoted a full professor in 1994. He was invited to join research projects of avian

infectious bronchitis (IB) and avian influenza (AI) studies at the Animal Diagnostic Laboratory (ADL) of Pennsylvania State University (PSU) in 1994 and has been working as a diagnostic avian virologist since then till the present time. He is currently a Head of the Avian Virology Section and Senior Research Associate (new title: Clinical Professor is in processing) at ADL PSU.

Dr Lu was appointed as an International Consultant on the control of highly pathogenic avian influenza (HPAI) H5N1 outbreaks by the United Nations Food and Agricultural Organization (FAO) in 2004. Dr Lu undertook 7 mission assignments by FAO on HPAI projects in Laos, Cambodia, Jordan and Saudi Arabia between 2004 and 2008, and also served on HPAI project for USAID program in Azerbaijan during 2006 and 2007. Dr Lu has served as expertise reviewer for national and international proposals, and guest reviewer for 6 refereed journals for reviewing manuscripts, and has served as Editorial Board Member for three referral Journals. Dr Lu has served as the Gerson Lehrman Group Councils Member since 2005, a member of American Association of Avian Pathologists (AAAP) since 1997 and a member of American Association of Veterinary Laboratory Diagnosticians (AAVLD) since 2000.

*Technical Session D2-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Molecular Basis of Interactions between HIV-1 gp120 and Coreceptors CCR5/CXCR4

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## ABSTRACT

Human immunodeficiency virus (HIV-1) entry into the host cells is mediated by the interactions of viral envelope glycoprotein (gp120) and a primary receptor CD4 and a coreceptor (chemokine receptors) CCR5 or CXCR4. The HIV-1 envelope glycoproteins form a trimeric spike that the three gp120 subunits are non-covalently bound to three membrane-anchored gp41subunits. HIV-1 entry involves an initial binding of gp120 to CD4 and induced the conformational change of gp120 for one of co-receptors (CCR5 or CXCR4) binding. The choice of co-receptors is dictated primarily by the sequence of a gp120 region, the third variable (V3) loop. According to the coreceptor usage, HIV-1 viruses are classified into three groups: R5 viruses (CCR5), X4 viruses (CXCR4) and R5X4 viruses (CCR5 or CXCR4), which is also called dual-tropic viruses.

The interactions between gp120 and the coreceptors are not well defined since the challenges in co-crystallization of gp120 and the coreceptors. We have been used the site-directed mutagenesis and other approaches to decipher their molecular interactions. Especially, some recent findings in the interactions of gp120 V3-loop and the coreceptors are very significant for distinguishing the binding sequence requirements for CCR5 or CXCR4. As some changes made in the V3-loop sequences, the prototypical X4 strain HXBc2 becomes to a standard dual-tropic (R5X4) strain that is able to use CCR5 as a coreceptor but still retains the ability to use CXCR4. In addition, we have also found that the X4 viruses are less sensitive to the envelope trimer stabilization due to V3-loop sequence changes.

## BIOGRAPHY

Shi-hua Xiang received his B.S. (1982) in biology from Hunan Normal University, and his M.S. (1986) in mycology from Huazhong Agricultural University, and Ph.D. (1995) in microbiology from University of Sydney, and his postdoctoral training from 1998-2004 in Harvard Medical School.

He had joined the faculty as an Instructor in Harvard Medical School from 2004-2010, and a Senior Principle Scientist in Pfizer, UK for a short of time before taken the faculty position in School of Veterinary Medicine and Biomedical Sciences, University of Nebraska-Lincoln as an Assistant Professor in 2011. Dr. Xiang's research is mainly on HIV/AIDS, focusing HIV entry, the envelope glycoprotein structure and function and vaccine development. Furthermore, he has recently started to work on small ruminant lentviruses (SRLV), which infect sheep and goats.

*Technical Session D2-W3-T2: Animal and Veterinary Sciences, Biomedical Sciences and Engineering*

# Molecular Analysis of LigB of Leptospira, a Potential Vaccine Candidate

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College of Veterinary Medicine, Cornell University
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## ABSTRACT

LigB (Leptospira Immunoglobulin-like protein B) is a surface protein specific to pathogenic strains of Leptospira. The Lig protein family has shown promise as a biomarker for leptospiral diagnosis and as a vaccine candidate against Leptospira spp. infection. We use NMR spectroscopy to solve the solution structure of the twelfth Ig repeat domain from LigB (LigB12). LigB12 has a similar greek key fold to the Ig domains from E. coli intimin and Yersinia's invasin. Identified using both ITC and NMR spectroscopy a calcium binding site stabilizes the fold. A tryptophan is located within hydrophobic core of the fold revealing a potential mechanism for its shifted fluorescence. For the LigB Ig domains, a conserved patch faces the next sequential domain while in LigB12, this region faces the non-repeat region and accordingly diverges from the other 11 repeats. The location of a possible domain-domain interaction surface can be inferred. The LigB12 structure is the first Ig domain structure from Leptospira spp. and should prove useful in understanding host interactions with the Lig protein family. A vaccine trial using a hamster model shown LigB is a potential vaccine candidate against human and animal leptospirosis.

## BIOGRAPHY

Yung-Fu Chang, Veterinarian degree from National Pintung Institute of Agriculture, Taiwan in 1974, MS degree, University of Idaho in 1981 and Ph.D, Texas A&M University in 1984.

**Positions and Employment**

- **1974-1979** Assistant Pathologist, Veterinary Pathology Division, Taiwan Provincial Research Institute for Animal Health, Taiwan
- **1984-1985** Research Associate, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1986-1989** Assistant Research Scientist, Medical Biochemistry and Genetics, College of Medicine, Texas A&M University, College Station, Texas
- **1989-1996** Assistant Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.

- **1996-2003** Associate Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.
- **2003 (Jan-July)** Visiting Professor, Department of Infectious disease and Medicine, Stanford University Medical School, Stanford, CA.
- **2003-present** Professor, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University, Ithaca, New York.

**Honors**

Beta Rho Chapter of Phi Sigma National Honor Society (1983); Diplomat of the American College of Veterinary Microbiologist (1987); The Society of Phi Zeta; Who's Who in America? (1991); Editor Board, Bioengineered Bugs (2010-2012); Journal of Veterinary Science & Technology (2010-present) and PLoS One. Treasure, American Leptospirosis Research Conference, Inc. (2001-present). Distinguished alumni, National Pin-Tung University of Science and Technology, Taiwan (2007).

**Patents (active)**

Ehrlichia canis genes and vaccines. US patent no: 7,951,386 B2. Yung-Fu Chang; Compositions for eliciting an immune response against Mycobacterium avium subspecies paratuberculosis. US Patent no: 7, 732,580,B2 & 7,858,102 B2,European patent No: 1,855,716. Yung-Fu Chang; Protective coating for array material depositions. US Patent no. 7,781,378, B2. Reid N. Orth, M. Lin, T. C. Clark, Yung-Fu Chang, Harold G. Craighead, Jose Manuel Morqan-Mirabal; Immunogenic proteins of Leptospira. US Patent no. US 7,655,427. B2.Yung-Fu Chang and Raghavan U. M. Palaniappan.

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