

7th Annual
Australia-China
Symposium

Agriculture and food security relating to health

14-16 November 2010



Program

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Welcome message

The Australian Academy of Science and the Australian Academy of Technological Sciences and Engineering are pleased to welcome the delegation from the Chinese Academy of Sciences that will participate in the 7th annual Australia-China Symposium on Agriculture and Food Security Relating to Health in the Barossa Valley, South Australia, 14-16 November 2010.

The Chinese delegation is being led by Professor Yongxiang Lu, President of the Chinese Academy of Sciences, and Vice-Chairman of the Standing Committee of the National People's Congress.

The Academies value Professor Lu's involvement in, and support of, all the joint Academies symposia that have been held annually since 2004 in China and Australia on topics of national importance such as energy, water, biotechnology, and sustainability.

The symposium will have plenary sessions as well as breakout workshops where Chinese and Australian presenters will discuss the climate change impacts on food security, food nutrition and human health, agricultural productivity, biosecurity and future demand for food.

These workshops will lead to clearer understandings of the interests and capabilities of Australia and China in the areas of agriculture and food security and how they impact on human health. It is expected that the conclusions reached by the participants will provide a platform for the development of enhanced collaboration between the two countries.

The Australian Academies are delighted to be hosting this meeting and wish to thank the Australian Department of Innovation, Industry, Science and Research and the Chinese Academy of Sciences for their continued support and, in particular, for funding this event.

We also wish to acknowledge the strong support of the Chinese Embassy in Canberra.

We hope that the discussions are productive and enjoyable and that our Chinese visitors enjoy the environment in which the Symposium is being held.



Professor Suzanne Cory AC PresAA FRS
President
Australian Academy of Science



Professor Robin Batterham AO FREng FAA FTSE
President
Australian Academy of Technological
Sciences and Engineering



Contents

General program.....	1
Workshop programs.....	4
Workshop 1: Climate change and impacts on food security	4
Workshop 2: Food safety, food nutrition and human health.....	6
Workshop 3: Agricultural productivity, biosecurity and future demand for food	9
Biographies	
Presidents	
Professor Suzanne Cory AC PresAA FRS.....	12
Professor Robin Batterham AO FEng FAA FTSE	13
Professor Yongxiang Lu	14
Symposium Convenors	
Professor Zucong Cai.....	17
Dr Xiaobing Liu.....	18
Dr Oliver Mayo FAA FTSE	19
Professor Mike McLaughlin FTSE	29
Dr Jim Peacock AC FAA FRS FTSE.....	20
Dr John Radcliffe AM FTSE	20
Dr Nigel Steele Scott FTSE	21
Dr Daowen Wang.....	21
Dr Yong-Guan Zhu	22
Mentors	
Dr Andrew Ash	25
Professor Snow Barlow FTSE.....	25
Professor Robert Gibson.....	26
Dr TJ Higgins FAA FTSE	26



Contents

Speakers

Dr David Adelson	28
Dr Michael Ayliffe	29
Dr Keith Bristow	30
Dr Xiaofeng Cao.....	31
Professor Ziyuan Duan.....	32
Dr Michael Francki.....	33
Dr Jiming Gong.....	34
Dr Soressa Kitessa	35
Professor Yongchao Liang	36
Professor Hong-Qing Ling.....	37
Professor Mark Morrison.....	38
Dr Manny Noakes.....	39
Dr Kathy Ophel Keller	40
Professor John Pluske.....	41
Professor Le Qing Qu.....	42
Dr Greg Rebetzke.....	43
Associate Professor Victor Sadras	44
Professor Stephen Simpson FAA	45
Professor Fengbin Song.....	46
Dr Daryl Stevens	47
Professor Dr Jianghua Sun.....	48
Dr David Topping	49
Professor Richard Trethowan	50
Dr Fudi Wang.....	51
Professor Han Xiao.....	52
Dr Liyong Xie	53
Professor Yonghui Yang.....	54
Associate Professor Chao-Dong Zhu.....	55

Notes



General program

Sunday, 14 November 2010

- 1630 **Official welcome**
- Professor Suzanne Cory** AC PresAA FRS
President, Australian Academy of Science
- Professor Robin Batterham** AO FREng FAA FTSE
President, Australian Academy of Technological Sciences and Engineering
- Professor Yongxiang Lu**
President, Chinese Academy of Sciences
- Ms Mary Finlay**
*General Manager, International Science Branch
Department of Innovation, Industry, Science and Research*
- 1700 **Plenary address**
- Professor Snow Barlow** FTSE
Professor of Horticulture and Viticulture University of Melbourne
- 1730 **Plenary address**
- Professor Weicai Yang**
*Deputy Director General, Institute of Genetics and Developmental Biology
Chinese Academy of Sciences*
- 1800 **Photo opportunity**
- 1810 **Drinks and canapés**
Function Foyer
- 1830 **Official welcome dinner**
Cabernet Room
- 2100 **Conclusion of official welcome dinner**

Monday, 15 November 2010

0700 – 0800	Breakfast available at Harry's Restaurant
0815	Registration and tea and coffee in Function Foyer
0830	Commencement of concurrent workshops 1, 2 and 3 Session 1: 4 presentations Workshop 1: Climate change and impacts on food security Workshop 2: Food safety, food nutrition and human health Workshop 3: Agricultural productivity, biosecurity and future demand for food
1030	Wrap up end Session 1
1040	Morning tea
1110	Workshop sessions continue Session 2: 3 presentations
1240	Wrap up end Session 2
1250	Lunch
1350	Workshop sessions continue Session 3: 3 presentations
1520	Wrap up end Session 3
1530	Working afternoon tea Wrap up end Day 1: Session Chairs to report back to workshop groups
1600	Conclusion of Symposium for Day 1 Networking time for participants
1730	Depart for Wolf Blass Winery and Visitor Centre
1800-1900	Wine tasting and canapés
1900	Informal dinner at Wolf Blass Winery
2100	Return to Novotel Barossa Valley Resort

Tuesday, 16 November 2010

0700 – 0830	Breakfast available at Harry's Restaurant Breakfast meeting for Workshop Convenors to report back on discussion from Day 1
0900	Workshop groups reconvene to discuss areas of mutual interest and participate in roundtable discussion
1100	Morning tea
1130	Main group reconvene and Workshop Convenors report back on the outcomes from each workshop
1300	Close of Symposium
1300	Lunch
1400	Optional site visit to Nuriootpa or ground transportation to Adelaide Airport

Wednesday, 17 November

All day	Site visits for Chinese delegation in Adelaide
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Workshop programs

Workshop 1: Climate change and impacts on food security Novotel Barossa Valley Resort | Merlot A and B Room

Co-convenors

Dr John Radcliffe AM FTSE
CSIRO Land and Water

Dr Nigel Steele Scott FTSE
Former Chair, Horticulture Australia Ltd

Professor Zucong Cai
Institute of Soil Science, CAS

Mentors

Professor Snow Barlow FTSE
Department of Agriculture and Food Systems, University of Melbourne

Dr Andrew Ash
CSIRO Climate Adaptation Flagship

Monday, 15 November

Session 1

- 0830 **Associate Professor Liyong Xie**
The College of Agronomy, Shenyang Agricultural University
Impacts of climate change on regional crop production
- 0900 **Associate Professor Victor Sadras**
South Australian Research and Development Institute
*Agricultural opportunities and challenges associated with rising temperature:
A crop physiologist's viewpoint*
- 0930 **Professor Zucong Cai**
Institute of Soil Science, CAS
Greenhouse gas emissions from croplands in China and mitigation options
- 1000 **Professor Richard Trethowan**
Plant Breeding Institute, University of Sydney
Maintaining wheat productivity in a changing climate: Genetic options
- 1030 **Wrap up end Session 1**
- 1040 **Morning tea**

Session 2

- 1110 **Professor Han Xiao**
Institute of Plant Physics and Ecology, Shanghai Institutes for Biological Sciences (SIBS), CAS
Genetic basis of high productivity and adaptation in tomato
- 1140 **Dr Daryl Stevens**
Atura Pty Ltd
Improved water management technologies for agriculture
- 1210 **Professor Yonghui Yang**
Centre for Agricultural Resources Research, Institute of Genetics and Developmental Biology, CAS
Improving water use efficiency for a sustainable food production in the North China Plain
- 1240 **Wrap up end Session 2**
- 1250 **Lunch**

Session 3

- 1350 **Dr Keith Bristow**
CSIRO Land and Water
System harmonisation: Irrigation within a catchment context
- 1420 **Professor Mark Morrison**
CSIRO Livestock Industries and Preventative Health Flagship
Differences downunder: Macropods, methane and metagenomics
- 1450 **Wrap up end Session 3**
- 1530 **Working afternoon tea**
Wrap up end Day 1: Session Chairs to report back to workshop groups
- 1600 **Conclusion of Symposium for Day 1**

Tuesday, 16 November

- 0700 – 0830 **Breakfast available at Harry's Restaurant**
Breakfast meeting for Workshop Convenors to report back on discussion from Day 1
- 0900 **Workshop groups reconvene to discuss areas of mutual interest and participate in roundtable discussion**
- 1100 **Morning tea**
- 1130 **Main group reconvene and Workshop Convenors report back on the outcomes from each workshop**
- 1300 **Close of Symposium**
- 1300 **Lunch**
- 1400 **Optional site visit to Nuriootpa or ground transportation to Adelaide Airport**

Workshop 2: Food safety, food nutrition and human health Novotel Barossa Valley Resort | Cabernet A Room

Co-convenors

Dr Jim Peacock AC FAA FRS FTSE
CSIRO Plant Industry

Dr Oliver Mayo FAA FTSE
CSIRO Livestock Industries

Professor Zucong Cai
Institute of Soil Science, CAS

Professor Yongguan Zhu
Institute of Urban Environment, CAS

Mentors

Professor Robert Gibson
Foodplus Research Centre, University of Adelaide

Dr TJ Higgins FAA FTSE
CSIRO Plant Industry

Monday, 15 November

Session 1

- 0830 **Professor Stephen Simpson** FAA
School of Biological Sciences, University of Sydney
Lessons from locusts: A tale of swarms, cannibals, ageing and human obesity
- 0900 **Associate Professor Manny Noakes**
CSIRO Food and Nutritional Sciences
Greenhouse gas emissions from Australian diets
- 0930 **Dr Michael Ayliffe**
CSIRO Plant Industry
Determining nonhost resistance mechanisms to cereal rusts
- 1000 **Professor Fudi Wang**
Institute for Nutritional Sciences, Shanghai Institutes for Biological Sciences (SIBS), CAS
Heavy metal pollution and food safety in China
- 1030 **Wrap up end Session 1**
- 1040 **Morning tea**

Session 2

- 1110 **Professor Leqing Qu**
Institute of Botany, CAS
Development of health promotion crops via biotechnology strategies
- 1140 **Dr David Topping**
CSIRO Food Futures National Research Flagship
Dietary Fibre Polysaccharides and human health
- 1210 **Dr Soressa Kitessa**
CSIRO Food and Nutritional Sciences
Modifying animal-derived foods for better human health
- 1240 **Wrap up end Session 2**
- 1250 **Lunch**

Session 3

- 1350 **Professor Yongguan Zhu**
Institute of Urban Environment, CAS
Trace elements: Healthy soil for healthy food
- 1420 **Professor Yongchao Liang**
Institute of Agricultural Resources and Regional Planning, CAAS
Improving food safety by reducing accumulation of heavy metals into edible parts of cereal and vegetable crops
- 1450 **Professor Jiming Gong**
Institute of Plant Physiology and Ecology, Shanghai Institute for Biological Sciences (SIBS), CAS
Omics analysis of mineral nutrient and toxic metal transport in plants
- 1520 **Wrap up end Session 3**
- 1530 **Working afternoon tea**

Session 4

- 1540 **Professor Hongqing Ling**
State Key Laboratory of Plant Cell and Chromosome Engineering, Institute of Genetics and Developmental Biology, CAS
Molecular regulation mechanisms of iron uptake in higher plants
- 1610 **Professor Daowen Wang**
Institute of Genetics and Developmental Biology, CAS
Understanding and improving the genetic basis of nutritional quality in bread wheat
- 1640 **Wrap up end Session 4**
- 1650 **Conclusion of Symposium for Day 1**

Tuesday, 16 November

- 0700 – 0830 **Breakfast available at Harry's Restaurant**
Breakfast meeting for Workshop Convenors to report back on discussion from Day 1
- 0900 **Workshop groups reconvene to discuss areas of mutual interest and participate in roundtable discussion**
- 1100 **Morning tea**
- 1130 **Main group reconvene and Workshop Convenors report back on the outcomes from each workshop**
- 1300 **Close of Symposium**
- 1300 **Lunch**
- 1400 **Optional site visit to Nuriootpa or ground transportation to Adelaide Airport**

Workshop 3: Agricultural productivity, biosecurity and future demand for food Novotel Barossa Valley Resort | Cabernet B Room

Co-convenors

Professor Andrew Smith FAA
University of Adelaide

Professor Mike McLaughlin FTSE
CSIRO Land and Water

Professor Xiaobing Liu
Northeast Institute of Geography and Agroecology, CAS

Monday, 15 November

Session 1

- 0830 **Professor Ziyuan Duan**
Office of Agriculture Innovation Bases, Bureau of Life Sciences and Biotechnology, CAS
Problems and approaches for sustainable grain production in Northeast China
- 0900 **Dr Greg Rebetzke**
CSIRO Plant Industry
Integration of new tools for improving genetic gain for yield in water-limited environments
- 0930 **Professor Xiaobing Liu**
Northeast Institute of Geography and Agroecology, CAS
Problems and approaches for sustainable grain production in Northeast China
- 1000 **Dr Michael Francki**
Genetic and Product Innovation, Department of Agriculture and Food Western Australia
Current and future pre-breeding technologies to improve wheat grain production in changing environments
- 1030 **Wrap up end Session 1**
- 1040 **Morning tea**

Session 2

- 1110 **Professor Xiaofeng Cao**
Institute of Genetics and Developmental Biology, CAS
Deciphering histone methylation and demethylation in higher plants
- 1140 **Dr Kathy Ophel Keller**
South Australian Research and Development Institute
Molecular diagnostics and plant root health
- 1210 **Professor Fengbin Song**
Northeast Institute of Geography and Agroecology, CAS
Utilisation of alkaline-saline soils and related technological issues in safeguarding food security in China

1240 **Wrap up end Session 2**

1250 **Lunch**

Session 3

1350 **Dr David Adelson**
School of Molecular and Biomedical Science, University of Adelaide
Mammalian genome repeats and genome evolution

1420 **Associate Professor Chao-Dong Zhu**
Institute of Zoology, CAS
Searching for potential biological control agents and wild pollinator bees within agro-ecosystem in the virtual taxonomy laboratory

1450 **Professor John Pluske**
Animal Research Institute, Murdoch University
Animal production systems of the future

1520 **Wrap up end Session 3**

1530 **Working afternoon tea**

Session 4

1540 **Professor Jianghua Sun**
Institute of Zoology, CAS
CAS Research and Development Centre for integration of green agricultural technology

1640 **Wrap up end Session 4**

1650 **Conclusion of Symposium for Day 1**

Tuesday, 16 November

0700 – 0830 **Breakfast available at Harry's Restaurant**
Breakfast meeting for Workshop Convenors to report back on discussion from Day 1

0900 **Workshop groups reconvene to discuss areas of mutual interest and participate in roundtable discussion**

1100 **Morning tea**

1130 **Main group reconvene and Workshop Convenors report back on the outcomes from each workshop**

1300 **Close of Symposium**

1300 **Lunch**

1400 **Optional site visit to Nuriootpa or ground transportation to Adelaide Airport**

Presidents



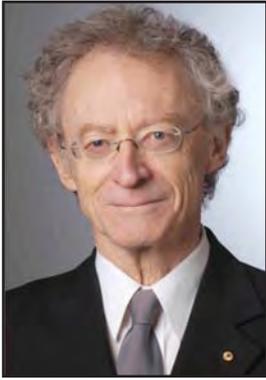


Professor Suzanne Cory AC PresAA FRS

President, Australian Academy of Science

Suzanne Cory is one of Australia's most distinguished molecular biologists. She was born in Melbourne, Australia and graduated in biochemistry from The University of Melbourne. She gained her PhD from the University of Cambridge, England and then continued studies at the University of Geneva before returning to Melbourne in 1971, to a research position at the Walter and Eliza Hall Institute of Medical Research. She was Director of the Walter and Eliza Hall Institute and Professor of Medical Biology of The University of Melbourne from 1996 to 2009. She is currently a Professorial Research Fellow in the Molecular Genetics of Cancer Division of the Walter and Eliza Hall Institute and a Vice-Chancellor's Fellow of The University of Melbourne. Professor Cory was elected President of the Australian Academy of Science in May 2010.

Cory's research has had a major impact in the fields of immunology and cancer. Her scientific achievements have attracted numerous honours and awards, including the Burnet Medal of the Australian Academy of Science, the Australia Prize (joint recipient), the Charles S. Mott Prize (joint recipient) of the General Motors Cancer Research Foundation in 1998, a L'Oréal-UNESCO Women in Science Award in 2001 and the Royal Medal of The Royal Society in 2002. She was elected a Fellow of the Australian Academy of Science in 1986, a Fellow of the Royal Society in 1992, a Foreign Member of the US National Academy of Sciences of the US in 1997, a Foreign Member of the American Academy of Arts and Sciences in 2001, an Associate Foreign Member of the French Academy of Sciences in 2002, an Academician of the Pontifical Academy of Sciences in 2004 and an Associate Member of the European Molecular Biology Organization in 2007. In 1999 she was appointed Companion in the General Division of the Order of Australia and in 2009 she was awarded the French decoration of Chevalier de l'Ordre de la Légion d'Honneur.



Professor Robin J Batterham AO FREng FAA FTSE

President, Australian Academy of Technological Sciences and Engineering

Professor Batterham is Kernot Professor of Engineering at the University of Melbourne. He is also President of the Australian Academy of Technological Sciences and Engineering and until recently was Group Chief Scientist, Rio Tinto Limited. He has had a distinguished career in research and technology, in the public and private sectors in areas such as mining, mineral processing, mineral agglomeration processes, and iron making.

Professor Robin Batterham was Chief Scientist to the Australian Federal Government from 1999 to 2005 and remains on the Prime Ministers Science, Engineering and Innovation Council.

He has been President of the Institution of Chemical Engineers and the International Network for Acid Prevention and is President of the International Mineral Processing Congress as well as chairing the Australia India Collaborative Research Fund. He chairs the International Energy Agency Expert Group on Science for Energy. He is an elected Fellow (or Foreign Fellow) of the Royal Academy of Engineering, the National Academy of Engineering, the Swiss Academy of Technological Sciences, the Australian Academy of Science, the Australian Academy of Technological Sciences and Engineering as well as Fellow of several learned societies.

Previous roles within Rio Tinto included Vice President Resource and Processing Developments as well As Managing Director for Research and Development. In these roles he worked closely with geoscientists to develop and apply new measurement techniques and to better understand and delineate ore bodies. He was also responsible for some years for early stage delivery of major new mining projects covering all aspects, from detailed understanding of the geology, mine planning, ore processing, economic evaluation, and pre-marketing.



Professor Yongxiang Lu

Professor Yongxiang Lu is currently Vice-Chairman of the Standing Committee of the National People's Congress; President of the Chinese Academy of Sciences (CAS); Chairman of the CAS Presidium; Member of the Chinese Academy of Sciences; Member of the Chinese Academy of Engineering; Vice-Chairman of the Academic Degrees Committee of the State Council; Co-Chair of InterAcademy Council (IAC); President of the Chinese Mechanical Engineering Society; Professor of Zhejiang University; and Honorary Professor of the University of Hong Kong etc.

Professional Accomplishments

Born in Zhejiang Province on April 28, 1942, he graduated from Zhejiang University in 1964 and worked there as a teaching assistant and lecturer from 1964 to 1979. In 1979, he went to Germany as a Humboldt Fellowship scholar and studied at the Institute of Fluid Power Drives and Controls of Technical University of Aachen. Upon returning, he became a lecturer, associate Professor and then Director of the Fluid Power Transmission and Control Lab in Zhejiang University in 1981. He became Professor and Director of the Institute of Fluid Power Transmission and Control of the Department of Mechanical Engineering of the University in 1983. He was appointed Vice-President of Zhejiang University in 1985 and worked as President of the University from 1988 to 1995. He was appointed Vice-President of the Chinese Academy of Sciences in 1993 and Executive Vice-President from 1994 to 1997. Professor Lu has been President of the Chinese Academy of Sciences and Chairman of the CAS Presidium since July, 1997. Since March, 2003, he has served as Vice-Chairman of the Standing Committee of the National People's

Congress

He was Vice-Chairman of the China Association for Science and Technology from 1986 to 1996 and Chairman of the Higher Education Consultative Committee of the State Education Commission from 1990 to 1994; Chairman of China History of S&T Society from 1995 to 2004. He was Member of the University Grants Committee of Hong Kong SAR from 1996 to 2003; Member of the Chief Executive's Commission on Innovation and Technology, Hong Kong SAR, from 1998 to 1999 and is Special Advisor of the Advisory Commission on Innovation and Technology, Hong Kong SAR, from 2000. He was elected Vice Chairman of the Academy of Sciences for the Developing World (TWAS) from 1998 to 2006. He has also been President of the Chinese Mechanical Engineering Society since November 2001. He has been elected Co-Chair of InterAcademy Council (IAC) since February 2005.

Educational Background

Professor Lu got his Doctor Degree in Engineering (Dr.Eng) from the Technical University of Aachen, Germany in 1981. He holds a number of honorary Doctor Degrees, including Doctor of Engineering, honoris causa, from Hong Kong University of Science and Technology in 1995; Honorary Doctor of Engineering from the City University of Hong Kong in 1997; Doctor of Law, honoris causa, of the University of Melbourne, Australia; Doctor of Science, honoris causa, of the University of Nottingham, UK; and Doctor of Science, honoris causa, of the Open University of Hong Kong in 2004; Honorary Degree of Doctor of Science of Loughborough

University, UK; Honorary Doctor Degree of Engineering Sciences of the National Academy of Sciences of Ukraine in 2005; the Degree of Doctor Honoris Causa of Linköping University, Sweden. Honorary Doctor of Eng. from the National University of Engineering, Peru, Honorary Doctor of Eng. from the University of Minnesota, US in 2006; Honorary Doctor of Eng. from the University of Hong Kong in 2007; Honorary Doctor of Eng. from Curtin University of Technology, Australia in 2008; Honorary Doctor of Eng. from UNSW, Australia in 2009.

Memberships in Honorary Societies Worldwide

He was elected Fellow of the Academy of Sciences for the Developing World(TWAS) in 1990; Member (in the Division of Technological Sciences) of the Chinese Academy of Sciences in 1991; and Member of the Chinese Academy of Engineering in 1994; Honorary Foreign Member of the Korean Academy of Sciences and Technology in 1999; Honorary Member of Hungarian Academy of Sciences; Honorary Fellowship of the Institute of Mechanical Engineering, UK; and the Corresponding Member of the Australian Academy of Science in 2004; Member of the German Academy of Natural Scientists Leopoldina in 2005; and Foreign Member of the Russian Academy of Sciences in 2006.

Academic Contributions

In his academic career, Professor Lu has made important contributions to the development of mechanical engineering, especially in the field of fluid power transmission and control and higher education of engineering. He has achieved about 25 patents in China, Europe and USA, and published at home and abroad over 250 papers in research and engineering education and 5 monographs. As a professor, he has supervised 25 master degree students, 30 PhD students and 5 postdoctoral researchers. Based on existing knowledge, he creatively set up a new principle on feedback of measuring rate of two basic parameters "C pressure and flow rate, and had it applied in pilot operated pressure and flow control components. This achievement changed the traditional principle of Freeman-Jinken on controlling rate of flow, which had been applied for over 100 years, and another basic principle of Vickers on pilot-operated type pressure control, which had been used for over 40 years. Based on this principle, he has obtained 5 patents at home and abroad, for instance, 2-way cartridge electro-hydraulic proportional flow control device and electro-hydraulic proportional pressure control device, which improves remarkably the static and dynamic control performances for large flow rate and high pressure control. Combining with mechanical-electro-hydraulics' Cartridge Technique, he extended his principle into valve control, pump control and hydraulic motor, and successfully developed a series of new electro-hydraulic proportional control components and engineering application systems. His achievement in the electro-hydraulic proportional control has been regarded as one of the most important progresses from the 1980's in the field of the electro-hydraulic control technique and the principle has been widely used and cited in research papers, textbooks as well as manuals in Germany, Japan, Sweden and some other countries. The electro-hydraulic proportional control technique he developed has been listed for wider application in the Torch Program launched by the Ministry of Science and Technology. Professor Lu has also developed the related CAD and CAT supporting systems, which have been widely applied in a number of domestic enterprises and have promoted the technology progress of the mechanical industry in China. The Institute of Fluid Power Transmission and Control at Zhejiang University founded by him has now become a State Key Laboratory, a National Engineering Centre and Postdoctoral Research Station.

Awards

Professor Lu has been awarded the second prize of National Invention Award in 1988;the third prize of National Invention Award and National Engineering Higher Education Prize of China in 1989;the super prize for Guanghai Science Foundation in 1993. He has received a number of honours from Germany for his accomplishments, including Rudolf-Diesel Medal in Gold in 1997, Alexander von Humboldt Medal in 1998, the Knight Commander's Cross (Badge & Star) of the Order of Merit of the Federal Republic of Germany in 2000 and Werner Heisenberg Medal from the Alexander von Humboldt Foundation in 2001. He received the Gold Badge for Science and Culture of Public President of Italy in 2004;and the first prize of National Higher Education Scholarship in 2005. He was awarded the Abdus Salam Medal of the Academy of Sciences for the Developing World(TWAS) in 2006;and the Harnack-Medaille of Max-Planck Gesellschaft.Medaille of Max-Planck Gesellschaft.

Symposium Convenors





Professor Zucong Cai

Professor of soil chemistry, Institute of Soil Science,
Chinese Academy of Sciences

Email: zcaai@issas.ac.cn

Professor Cai undertook postdoctoral studies at the Department of Environmental Science, Rutgers University, New Jersey, USA. He was a visiting scholar at the Department of Agricultural and Environmental Sciences, Queen's University Belfast UK and Executive Director of the State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, CAS. Professor Cai is currently Chief of Soil and Global Change Center, Institute of Soil Science, CAS.

Professor Cai has been a member of the Council of Soil Science Society of China, a member of IGBP-China Committee, lead author of IPCC WGIII AR4 and Editor of Soil Science and Plant Nutrition. He has trained more than ten students for their PhD degrees.

Greenhouse gas emissions from croplands in China and mitigation options

The research on greenhouse gas emissions from Chinese croplands started from the field measurements of CH₄ emissions from rice fields in the late 1980's. Extremely large CH₄ emissions from rice fields in China were estimated in the early 1990's. These estimates attracted a world-wide attention to measure CH₄ emissions from rice fields in China and to understand the mechanisms for the extremely large emission. These measurements improved our knowledge greatly on CH₄ and N₂O emissions from rice fields. Now, it is clear that the CH₄ emissions from rice fields in China was overestimated in the early 1990's, while rice fields in China is also an important source of atmospheric N₂O, but N₂O emission factor in rice fields is smaller than that in upland soils, being about one third to half of that in upland soils. The total CH₄ and N₂O emissions from rice fields in China were estimated to be 6-10 Tg CH₄/yr and 18-35 Gg N/yr, respectively. A trade-off relationship was found between CH₄ and N₂O emissions in rice fields. The spatial variation of water regimes in the off-rice season is a key factor controlling the spatial variation of CH₄ emissions from rice fields in China.

China consumes about one third of world nitrogen fertilizers. N₂O emissions from croplands, including uplands and rice paddies, were estimated to be 292-476 Gg N/yr.

Based on the dataset from the Second National Soil Survey, which was conducted from the late 1970's to the early 1980's, organic carbon storage in Chinese soils was estimated to be 80-90 Pg C. Long-term experiments across the country, meta-analysis, and direct measurement showed that the organic carbon storage in cropland soils have been increased since the Second National Soil Survey. Increases in crop yields, crop straw incorporation, and conservation tillage, etc. during the period are recognized to be main factors increasing soil organic carbon storage.

Considering the facts of low in averaged contents of soil organic carbon in croplands and N use efficiency in China, there would be large potentials to sequester carbon and reduce N₂O emission. There are many technical options available to increase soil organic carbon content in croplands and N use efficiency in China, however, their application are limited by a number of socioeconomic factors. Drainage of rice fields in the off-rice season would be an applicable option to mitigate CH₄ emissions from rice fields.

Publications

More than 290 research papers, of which, more than 90 are in SCI journals



Dr Xiaobing Liu

Professor, Deputy Director, Northeast Institute of Geography and Agroecology,
Chinese Academy of Sciences

Email: songfb@neigae.ac.cn

Dr Xiaobing Liu is a professor in Plant and Soil Science. He is the vice director of Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. He was conferred a PhD by University of Massachusetts, Amherst, USA in Plant and Soil Science in 2004, and a PhD by Northeast Agricultural University, Harbin, China in Agronomy in 1994. With 26 years research experience in Crop Eco-physiology and Soil Science, he had 36 publications in international journals, 100 peer review papers in China, two books and 13 presentations at

national and international conferences. He is the editor of Journal of Agronomy and Crop Science (Germany) and four Chinese academic journals. He has 6 patents, 8 academic prizes, 4 special awards and 3 honors, and released 2 soybean varieties.

Problems and approaches for sustainable grain production in Northeast China

A dramatic increase in grain production, necessary to safeguard world supply, is an urgent, long-term component of global stability, peace and development. The Chinese government attaches great importance to grain security, and has given it high priority on its agenda. China is currently able to meet 95% of its own demand for grain, providing food security to 22% of the world population. It does this with only 9% of global cultivated farmland. This is a tremendous contribution to world food security and stability. However, with China's population estimated to reach 1.485 billion by 2030, and with an expected gradual decrease in farmland due to accelerated industrialization and urbanization, and changes in diet and consumption at least 594 billion kg grain will be needed to meet China's increased demand by 2030. This will require a 1% increase in total grain production annually with no change in the current 120 million ha of cultivated farmland. As reserve farmland in China is extremely limited, increased yield is the only solution. The problem we face is how to accomplish this goal. Northeast China, the grain production base of China or bread basket of China has greater responsibility and share in materializing the food demand for the coming 20 years. This presentation analyzes the problems, reasons, scientific/technological issues, and development pattern for efficient farmland use and in the region.

Publications

Zhang, S.L., X. Y. Zhang T. Huffman, X B Liu J Y Yang 2010 Influence of topography and land management on soil nutrients variability in Northeast China Nutrient Cycling Agroecosystem (in press)

Jin, J. G.H. Wang X B Liu, M.Liang, S.J. Herbert 2010 Genetic improvement of yield shapes the temporal and spatial root morphology of soybean grown in Northeast China. New Zealand Journal of Crop and Horticultural Science, 38(3) (in press)

Song, C Y, X.Y. Zhang, X B Liu, Y.Y. Sui, and Z.L.Li 2010. Impact of long-term fertilization on soil water content in Haploborolls. *Plant, Soil, and Environment* 56(9): 408-411

Liu, B. X B Liu, C. Wang, Y.S. Li, J. Jin, S.J. Herbert. 2010. Soybean yield and yield components distribution across the main axis in response to light enrichment and shading under different densities *Plant, Soil, and Environment* 56(8): 384-392

Liu X B X Y Zhang S J Herbert 2010. Feeding China's growing need for grain *Nature* Vol. 426, 420



Dr Oliver Mayo FAA FTSE

Honorary Research Fellow CSIRO Livestock Industries

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Oliver Mayo is a statistician and geneticist who has carried out research in human, plant, animal and theoretical evolutionary genetics. He has contributed to plant and animal breeding. He has worked extensively on the improvement of experimental design for field trials.

Mayo was educated in Adelaide and worked in Edinburgh and Leiden before spending many years as Head of Biometry and later Dean of the Faculty of Agricultural Science at the Waite Agricultural Research Institute of the University of Adelaide. After this he was Chief of CSIRO

Animal Production at Prospect NSW for over a decade, where he oversaw the commercialisation of biological wool harvesting, world-leading genetic engineering of sheep, and many other advances. He is currently a research fellow with CSIRO Livestock Industries in Adelaide.

Mayo has published some nine books on topics from evolutionary biology to plant breeding to Australian wine. His 150 research papers are in the fields mentioned above.

Mayo is a Fellow of the Australian Academy of Science and of the Australian Academy of Technological Sciences and Engineering and a Foreign Member of the Russian Academy of Agricultural Science.



Professor Mike McLaughlin FTSE

Chief Research Scientist CSIRO Land and Water

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Mike McLaughlin is a Professor in the School of Earth and Environmental Sciences at University of Adelaide and also a Chief Research Scientist of CSIRO Land and Water. Mike is a graduate of the University of Ulster in N. Ireland, from the University of Reading (UK) and from the University of Adelaide.

Prof. McLaughlin's research interests are principally in soil and environmental chemistry, the behaviour of nutrients and the toxicity of contaminants in soils, the assessment and remediation of contaminated soils, and use of advanced techniques to measure and monitor nutrients and pollutants in the environment. He has performed extensive research on reactions of fertilisers in soils and uptake of macro- and micronutrients by crops.



Dr Jim Peacock AC FAA FRS FTSE

CSIRO Fellow and General Manager Science Leadership and Outreach

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Dr Jim Peacock is a Fellow in CSIRO. Dr Peacock was Australia's Chief Scientist from March 2006-August 2008. Dr Peacock is an outstanding scientist with a record of academic excellence and is highly respected by the science, engineering and technology community.

Dr Peacock is an award winning molecular biologist and fervent science advocate. He is recognised internationally as an eminent researcher in the field of plant molecular biology and its applications in agriculture.

Dr Peacock is an expert in using molecular biology, and particularly the latest genomic technologies, to improve the qualities of the major foods that we produce from cereal and legume crops.

Dr Peacock is a strong advocate for the integration of science and global business. He drives innovative communication efforts to inform the general public as to the outcomes and value of modern science. He has brought the excitement of science to a broad cross-section of the community and to Australian school students.



Dr John Radcliffe AM FTSE

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Dr John Clive Radcliffe is an Honorary Research Fellow in CSIRO, a member of the Council of the University of Adelaide, Chair of the Department of Agriculture, Fisheries and Forestry Eminent Scientists Group and Chair of the Australian Academy of Technological Sciences and Engineering's Water Forum. He was a Commissioner of the National Water Commission from 2005 to 2008. Prior to formal retirement in 1999, Dr Radcliffe was a Deputy Chief Executive of CSIRO. Previously, he had been the last South Australian Director-General of Agriculture. He has an agricultural science degree from the University of Adelaide, a PhD from Oregon State

University and a Graduate Diploma from the Australian Institute of Company Directors. He was awarded the Medal of the Order of Australia in 1987 for his contribution to museum development, an AM in 2001 for natural resource management and in 2009 the Australian Medal of Agricultural Science.



Professor Andrew Smith FAA

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Andrew (F.A.) Smith works in the Soils Group of the School of Agriculture, Food and Wine at the University of Adelaide. His research focuses mainly on soil-plant interactions in terms of both plant nutrients and toxic soil materials, and especially on functional aspects of the widespread beneficial fungus-plant (mycorrhizal) symbioses. This research interest resulted in ongoing research collaborations with Professor Sally Smith FAA.

Prof. Smith was awarded a Centenary Medal from the Australian Government in 2001 for services to biology and education. Strong links with China include an Honorary Professorship at the Research Center for Eco-Environmental Sciences, CAS, Beijing, and a Visiting Professorship at the Institute of Urban Environment, CAS, Xiamen. Until recently he was Chair of the selection panel for three components of the International Science Linkages Program of the Department of Innovation, Industry, Science & Research, and he frequently represents the Australian Academy of Science in joint China-Australia scientific activities and has paid many visits to China.



Dr Nigel Steele Scott FTSE

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Dr Steele Scott graduated with a PhD in Agricultural Science from the Waite Institute and joined the CSIRO Division of Food Preservation. He has been involved in the molecular genetics of plants since the inception of the science. He retired as Deputy Chief of CSIRO Plant Industry in 2003. Until 2009 he was Chair of Horticulture Australia Ltd and is a member of the executive of the South Australian Premiers Food Council. He is a Fellow of the Australian Academy of Technological and Engineering Science and was awarded a Centenary Medal for services to Australian Horticulture.



Dr Daowen Wang

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Dr Daowen Wang received his PhD degree in plant virology in July, 1994 from University of East Anglia in Britain, and carried out postdoc research in the John Innes Center in Britain from 1994 to 1997. He has worked as a research professor and project leader in the Institute of Genetics and Developmental Biology, Chinese Academy of Sciences since March, 1997. Dr Daowen Wang's current research interests include genetic analysis and molecular breeding of important agronomic traits in wheat, and comparative study of key genes functioning in plant nutrition. He

has been the principal project leader of two national wheat genetic improvement programs, and is in charge of the team grant on comparative study of important genes functioning in nutrient utilization and the development of nutrient efficient wheat lines (sponsored by National Natural Science Foundation of China). He has published more than 50 research papers in main stream scientific journals on the topics of plant virology, molecular plant nutrition, and wheat genetics.

Understanding and improving the genetic basis of wheat nutritional quality

Wheat is one of the most important food crops worldwide. The continuous refinement of wheat processing and nutritional quality traits is essential for the development of healthier foods for human consumption. To understand and improve wheat nutritional quality, we have carried out three lines of investigations. The first one is to decrease the content of gliadin proteins, which are the main cause of the celiac disease in human, in wheat grains through selecting gliadin gene deletion mutants. As some gliadin species may be required for the processing quality of wheat, efforts are being taken to identify those mutants that have desirable processing quality but contain reduced amounts of celiac disease triggering gliadins. The second line of investigations concerns the genetic improvement of functional pigment content in wheat grains. The anthocyanin pigments accumulated in colored (purple, blue or black) grains have strong antioxidant properties. Although wheat varieties bearing colored grains have been developed in China, their yield levels and pigment contents are generally low. To improve this problem, the mechanism controlling anthocyanin accumulation in colored wheat is being studied, and efforts are being made to develop new colored wheat lines with improved yield potential and grain pigment content. The objective of the third line of research is to develop wheat lines with improved storageability and nutrient stability by decreasing the lipoxygenase (LOX) activity in wheat grains using RNAi strategy. More than 20 transgenic wheat lines with reduced grain LOX activity levels have been selected, and their tolerance to adverse storage conditions has been evaluated. In this symposium, the latest data on the research mentioned above will be presented, and their implications on improving wheat nutritional quality are discussed.

Publications

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Qian W, Yu C, Qin H, Liu X, Zhang A, Johansen IE, Wang D*. Molecular and functional analysis of phosphomannomutase (PMM) from higher plants and genetic evidence for the involvement of PMM in ascorbic acid biosynthesis in *Arabidopsis* and *Nicotiana benthamiana*. *Plant Journal* 2007; 49: 399-413.

Zhou H, Li S, Deng Z, Wang X, Chen T, Zhang J, Chen S, Ling H, Zhang A, Wang D*, Zhang X*. Molecular analysis of three new receptor-like kinase genes from hexaploid wheat and evidence for their participation in wheat hypersensitive response to stripe rust fungus infection. *Plant Journal* 2007; 52: 420-434.



Dr Yong-Guan Zhu

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Yongguan (Y-G) Zhu, PhD (London), Professor of Soil Environmental Sciences and Environmental Biology, currently works in the Chinese Academy of Sciences CAS, he is the director general of the Institute of Urban Environment in Xiamen, previously he was the Assistant Director of the Research Center for Eco-environmental Sciences, also part of CAS, where he still leads a research team working on various aspects of soil-plant interactions. Before joined CAS in 2002, he was working as a postdoctoral fellow in The University of Adelaide, Australia. He obtained his BSc in soil science from the former Zhejiang Agricultural University in 1989, and MSc in soil science from the Institute of Soil Science, CAS in 1992, and then a PhD in environmental biology from Imperial College, London in 1998.

Dr Zhu has been offered the Royal Fellowship Award from The Royal Society, London in January 1994; Best presentation award and the postgraduate student of the year 1998 from the Institution of Nuclear Engineers, UK, April 1998; Outstanding young scientist from National Natural Science Foundation of China, October 2002; Achievement award from the state government of China for overseas returnees, September 2003; National Young Scientist Award, July 2006; "Top Ten Youth" of the Chinese Academy of Sciences, April 2007 and National Natural Science Award in 2009.

Prof Zhu serves as a Member, Standing Advisory Group of Nuclear Applications, International Atomic Energy Agency (IAEA); Associate Editor, Environmental Pollution; Advisory Editorial Board, Trends in Plant Science; Marschner Reviews Editor, Plant and Soil; Advisor, New Phytologist and Editorial board, Environment International

Professor Zhu has published extensively in the last ten years, so far over 150 papers have been published in international journals, including Environmental Science and Technology, Plant Physiology, Environmental Microbiology, Trends in Plant Science, New Phytologist, Environmental Pollution, Plant and Soil etc. These publications have attracted more than 2500 citations with an H-index of 26.

Trace elements in soil-plant systems: Progress in health impacts and mitigation in China

Trace elements refer to the elements that are present in the environment and biological systems in minute quantities, but are important in the health of any organism, in terms of essentiality and/or toxicity. Human intake of trace elements is largely through food, cereals in particular, and therefore soil-plant transfer of trace elements is important in human health. Thanks to the green revolution and high inputs of agrochemicals (with environmental costs though), starvation is largely eradicated in China, and food quality is becoming the important theme in safeguarding food security in China. This presentation will provide a general overview of trace elements in soil-plant systems, with particular emphasis on problems in China. China, being very diverse in food production systems and geochemical environments, is facing issues ranging from metal toxicity to malnutrition of essential trace elements, such as selenium. It is therefore important that data will be gathered in providing a detailed picture of trace elements in diets of populations on regional scales. In addition, efforts should be directed towards dissecting the linkages between dietary trace elements and health outcomes under different socio-economic conditions. The presentation will then discuss recent progresses and identify some the gaps, and will discuss how science can provide viable tools to solve the problems associated with trace elements.

Mentors





Dr Andrew Ash

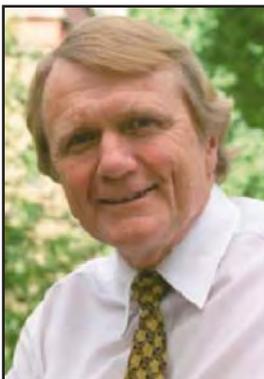
CSIRO Climate Adaptation Flagship

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Dr Andrew Ash is the director of the CSIRO Climate Adaptation National Research Flagship, which aims to equip Australia with practical and effective options to prepare for the impacts of climate change and variability.

Andrew works closely with government agencies, businesses and communities, raising awareness of the need to adapt to unavoidable climate change. He oversees a \$40 million nationwide portfolio of research projects, partnerships and collaborations.

Andrew has a keen interest in better integrating our understanding of climate science with decision-making and developing ways to mainstream climate adaptation into policy processes. Throughout his career, a feature of Andrew's research has been a systems approach that strives to examine both biophysical and management aspects of environmental sustainability. Much of his past work has been in the link between climate, ecosystems and management and in particular investigating how climate, grazing and fire influence the productivity, health and management of rangelands in northern Australia.



Professor Snow Barlow FTSE

Department of Agriculture and Food Systems, University of Melbourne

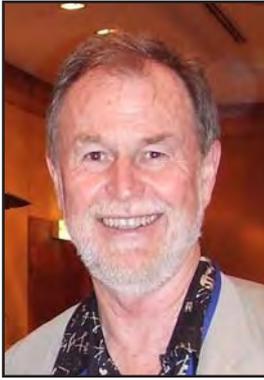
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Professor Barlow is Foundation Professor of Horticulture and Viticulture at the University of Melbourne and Associate Dean (Strategic Relationships) in the Melbourne School of Land and Environment. He is a plant physiologist and agricultural scientist with research interests in plant water use efficiency, viticulture and impacts of climate change on agriculture, water management and global food security.

He currently chairs the Expert Assessment Panel of the DAFF climate change R & D program, convenes the Primary Industries Research Adaptation Network of the National Climate Change Adaptation Research Facility and is a member of the Prime Minister's NGO Roundtable on Climate Change. He is chair of the Victoria Endowment for Science, Knowledge and Innovation, a member of the Australian Landcare Council, the research advisory committee of the Australian Farm Institute and the science advisory committee of the Australian Science Media Centre.

Professor Barlow is a Fellow of the Australian Academy of Technological Sciences and Engineering, the Australian Institute of Agricultural Science and Technology and in 2009 was awarded the 'Australian Medal of Agricultural Science'. He graduated with honours in Rural Science from the University of New England winning blues in Cricket and Rugby prior to completing a PhD at Oregon State University.

Together with his partner Winsome McCaughey, he operates a commercial farm incorporating vineyards, grazing and farm forestry enterprises in the Strathbogie Ranges in North Eastern Victoria and markets wine under the Baddaginnie Run label.



Professor Robert Gibson

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Robert A Gibson, Senior NHMRC Research Fellow, Fellow of the Nutrition Society and Professor, Food Science and Nutrition, School of Agriculture, Food and Wine, University of Adelaide.

Prof Gibson has been actively involved in nutrition research in cells, animals and humans for over 25 years and has published over 200 papers in this area. He has designed and conducted many randomised controlled trials involving nutrition interventions in the perinatal period. The trials were designed to test the effects of interventions with iron, selenium, probiotics, nucleotides and

long chain polyunsaturated fatty acids (PUFA) on infant biochemistry, growth, physiology and developmental outcome. Two human trials have recently been published in JAMA – DINO: a National DHA-dose response study on mental development in 650 preterm infants and DOMInO: a National DHA in pregnancy study on postnatal depression and child development in 2500 women/infants.

Prof Gibson has recently established the Foodplus Research Centre <http://www.adelaide.edu.au/foodplus/>



Dr TJ Higgins FAA FTSE

CSIRO Plant Industry,

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TJ Higgins is an Honorary Fellow at CSIRO Plant Industry. He works on protecting food legumes from insect damage, researching the application of gene technology for plant improvement. His current research is focused on international agriculture with particular emphasis on West Africa and India. He has a special interest in public awareness of science. Higgins has a Bachelor of Agricultural Science from National University of Ireland, and a PhD from the University of California. He is a Fellow of the Australian Academy of Science and a Fellow of the Academy of Technological Sciences and Engineering.

Speakers





Dr David Adelson

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David Adelson is Professor and Chair of Bioinformatics and Computational Genetics, in the School of Molecular and Biomedical Science at the University of Adelaide. Prof. Adelson's current research focuses on the computational analysis of repetitive, so called "Junk DNA" in mammalian genomes and on bioinformatic tools to mine Quantitative Trait Loci. He has led the analysis of repetitive DNA for the Bovine and Equine genome sequencing consortia and is currently working on the Elephant, Armadillo and Sheep repetitive DNA

analyses. In addition to genome analysis, Prof. Adelson is also a founding member of bovinegenome.org, a single point of integration for bovine genome data. Prof. Adelson is currently Head of School for Molecular and Biomedical Science.

Mammalian genome repeats and genome evolution

Mammalian genomes are constantly changing because up to fifty percent of their length is made up of repetitive DNA elements that have replicated and relocated. How does this contribute to evolutionary processes in the long term, and are some parts of the genome less likely to be perturbed by these elements? The bovine genome contains typical eutherian mammal repeats, but also has a significant number of LINE RTE (BovB) elements proposed to have been horizontally transferred from squamata. Our analysis of the BovB repeats has indicated that only a few of them are currently likely to retrotranspose in cattle. Bovine L1 repeats (L1 BT) on the other hand have many likely active copies. Comparison of substitution rates for BovB and L1 BT indicate that L1 BT is a younger repeat family than BovB. In contrast to mouse and human, L1 occurrence is not negatively correlated with G+C content. However, BovB, Bov A2, ART2A and Bov-tA are negatively correlated with G+C, though Bov-tAs correlation is weaker. We have also performed genome wide correlation analysis of repeats that has identified genome territories by repeat content. These territories appear to define ancestral vs ruminant-specific genomic regions. These ancestral regions are largely conserved between bovine, equine and human.

Publications

Adelson DL, Rayson JM, Edgar RC (2009) Characterization and Distribution of Retrotransposons and Simple Sequence Repeats In The Bovine Genome. *Proc Natl Acad Sci* 106(31), pp.12855-60.

Wade CM, Giulotto E, Sigurdsson S, Zoli M, Gnerre S, Imsland F, Lear T, Adelson DL, Penedo MCT, Bellone RR, Bailey E, Mauceli E, Garber M, MacLeod JN, Sharpe T, Vogel J, Andersson L, Antczak DF, Biagi T, Binns MM, Blöcker H, Chowdhary BP, Coleman SJ, Della Valle G, Distl O, Edgar RC, Fryc S, Guérin G, Hasegawa T, Hill EW, Jurka J, Kiialainen A, Leeb T, Lindgren G, Liu J, Magnani E, Mickelson JR, Murray J, Nergadze SG, Onofrio R, Pedroni S, Piras MF, Raison J, Raudsepp T, Rocchi M, Røed KH, Ryder O, Searle S, Skow L, Swinburne JE, Syvänen AC, Tozaki T, Valberg SJ, Vaudin M, White JS, Zody MC, Broad Institute Genome Sequencing Platform, Broad Institute Whole Genome Assembly Team, Lander ES, and Lindblad-Toh K (2009) Genome sequence, comparative analysis and population genetics of the domestic horse. *Science* 326(5954):865-7.

Bovine Genome Sequencing Consortium (2009) The Genome Sequence of Taurine Cattle: A window to ruminant biology and evolution *Science* 324(5926):522-8.

Salih H, Adelson DL (2009) QTL global meta-analysis: are trait-determining genes clustered? *BMC Genomics* 10(1):184.

Adelson DL, Raison JM and Edgar RC (2010) Interspersed Repeats in the Horse (*Equus caballus*); Spatial Correlations Highlight Conserved Chromosomal Domains. *Animal Genetics* (in press).



Dr Michael Ayliffe

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Dr Ayliffe is a Senior Research Scientist at CSIRO Plant Industry and has worked at this institution since completing a PhD in 1992 at The University of Adelaide. His research interests include plant pathogen interactions, transposon tagging and chloroplast genome evolution.

Determining nonhost resistance mechanisms to cereal rusts

A plant species is parasitized by only a limited number of plant pathogens. The immunity of a plant species to most potential plant pathogens is manifested by nonhost resistance (NHR), the mechanisms of which are poorly understood. Plant pathogens infrequently colonize new plant species providing testimony to the durability of NHR mechanisms and making the possibility of transferring this resistance to host plant species potentially attractive. We have been investigating the NHR mechanisms of both rice (*Oryza sativa*) and the model grass *Brachypodium distachyon* to cereal rusts. Rice is atypical in that it is an intensively grown agricultural cereal that is immune to rust pathogens. In contrast, *Brachypodium* is parasitized by a rust pathogen species but is considered a nonhost of rust species that infect cereal crops. Details of the strategies being undertaken and progress to date are provided.

Publications

Ayliffe M, Jin Y, Kang Z, Persson M, Steffenson B, Leung H (2010) Determining the basis of nonhost resistance in rice to cereal rusts. *Euphytica* (in press).

Ayliffe MA, Agostino A, Clarke BC, Furbank R, von Caemmerer S, Pryor AJ (2009) Suppression of the barley *uroporphyrinogen III synthase* gene by a *Ds* activation tagging element generates developmental photosensitivity. *Plant Cell* 21: 814-831.

Ayliffe M, Singh R, Lagudah E (2008) Durable resistance to stem rust needed. *Current Opinions in Plant Biology* 11: 187-192.

Ayliffe MA, Pallotta M, Langridge P, Pryor AJ (2007) A barley activation tagging system. *Plant Molecular Biology* 64: 329-347.

Dodds PN, Lawrence GJ, Catanzariti A-M, Teh T, Wang C-LA, Ayliffe MA, Kobe B, Ellis JG (2006) Direct protein interaction underlies gene-for-gene specificity and coevolution of the flax L5/L6/L7 resistance genes and flax rust avrL567 avirulence genes. *Proceedings of the National Academy of Science USA* 103: 8888-8893.



Dr Keith Bristow

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Dr Keith L. Bristow is a Senior Principal Research Scientist with CSIRO Land and Water and Honorary Professor at the University of Pretoria in South Africa. He is a soil physicist/hydrologist by training with 25 years experience in scientific research and scientific leadership. He has been involved in planning and management of strategic and tactical research activities across Australia, and particularly in northern tropical Australia; building partnerships with communities, industries and government agencies; leading major national research projects; and conducting research nationally and internationally in irrigated systems, groundwater

systems, coastal floodplains, integrated water management, vadose zone hydrology, and measurement and modeling of soil-plant-atmosphere processes. He has most recently served as Program Leader for the CRC for Irrigation Futures System Harmonisation Program which pioneered application of transdisciplinary approaches to irrigation research and practice

System Harmonisation: Irrigation within a catchment context

Environmental, water and food security are interdependent and impacted in one way or another by irrigation, which in most countries accounts for 60-70% of national freshwater withdrawals. It is no surprise therefore that irrigation is facing increasing scrutiny with many in society demanding changes to the way irrigation is currently practiced and that more water be returned to the environment. The concept of System Harmonisation recognises that the core challenges faced by irrigation in particular and societies in general are complex and cannot be solved in isolation. System Harmonisation employs transdisciplinary approaches to integrate science, policy, management and community, and works at the interfaces, including the socio-economic-ecological, surface water-groundwater, water quantity-quality, and land-water interfaces to emphasise that the whole is more than the sum of the parts. This presentation provides an overview of System Harmonisation and argues for irrigated systems that are more sympathetic to and in tune with natural systems. The productivity of irrigation, and hence food supply, will ultimately depend on the health of our environment.

Publications

Bristow, K.L. & T. Stubbs. 2010. Reinventing Irrigation Catchments: The System Harmonisation Story. CRC for Irrigation Futures, 146 pp. (ISBN-978 0 9808109 5 0)

Lenahan, M.J. & K.L. Bristow. 2010. Understanding subsurface solute distributions and salinization mechanisms in a tropical coastal floodplain groundwater system. *J. of Hydrology* 390: 131-142.

Brennan, L.E., Lisson, S.N., Poulton, P.L., Carberry, P.S., Bristow, K.L. & S. Khan. 2008. A farm-scale, bio-economic model for assessing investments in recycled water for irrigation. *Aust. J. Agric. Res.* 59: 1035–1048.

Thayalakumaran, T., Bristow, K.L., Charlesworth, P.B. & T. Fass. 2008. Geochemical conditions in groundwater systems: Implications for the attenuation of agricultural nitrate. *Agric. Water Management* 95: 103-115.

Cote, C.M., Bristow, K.L., Charlesworth, P.B., Cook, F.J. & P.J. Thorburn. 2003. Analysis of soil wetting and solute transport in sub-surface trickle irrigation. *Irrig. Sci.* 22: 143-156.



Dr Xiaofeng Cao

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Dr Xiaofeng Cao received her PhD degree in Peking University in 1997 and completed postdoctoral fellow in Washington State University in 1998. From 1999 to 2003 she worked as a research associate in UCLA. She received The Young Talented Investigator Award from CAS (2002) and joined Institute of Genetics and Developmental Biology (IGDB) as a professor in 2003. Currently, she is a director assistant of IGDB and vice director of the State Key Laboratory of Plant Genomics.

Cao lab is working on epigenetic regulation in higher plants. Using both Arabidopsis and rice as model organisms, she and her team members try to understand how gene expression and plant development are regulated by histone modifications and small non-coding RNAs. Particularly she focuses on histone methylation in Arabidopsis flowering time regulation and small RNA biogenesis and their action in rice development. Dr Cao has been studying Epigenetic mechanisms over 10 years and published more than 40 papers including Science, PNAS, Current Biology, Plant Cell and Annual Review of Plant Biology in that field.

Currently, Dr Cao is a member of the Establishment of an Epigenomics of Plants International Consortium (EPIC) International Steering Committee. She has joined the editorial board of several leading scientific journals including "The Plant Cell" and "Current Opinion in Plant Biology" ect. Dr Cao has also obtained many awards including The National Outstanding Young Investigator Award from National Natural Science Foundation of China (2003) and DuPont Young Professor Award (2008). As chief scientist, she presided over several cooperative projects from CAS, NSFC and The Ministry of Science and Technology of China studying Epigenetic mechanisms in higher plants.

Identification and characterization of histone demethylases in arabidopsis

Histone lysine methylation plays an essential role in regulating chromatin functions such as transcription and heterochromatin formation. The methylation marks are dynamically regulated. Recent findings in mammals have demonstrated that histone methylation is reversible by a family of Jumonji C (JmjC) domain-containing proteins. *Arabidopsis* has H3K4 and H3K9 demethylases with similar enzymatic activities and specificities to their animal counterparts. We showed that JMJ14 is an active histone H3K4 demethylase involved in flowering time regulation. We also demonstrated that IBM1/JMJ25 is an H3K9 demethylase and active chromatin is stabilized by an autocatalytic loop of transcription and H3K9 demethylation.

Histone H3 Lysine 27 tri-methylation (H3K27me3), a major silencing mechanism in protein coding regions of the *Arabidopsis* genome, plays essential roles in gene repression and developmental regulation. However, no clear orthologs of H3K27me3 demethylase were identified among a dozen potential active JMJ demethylases in *Arabidopsis*. How this mark is removed remains unknown. Here we demonstrate that REF6/JMJ12 (RELATIVE OF EARLY FLOWERING 6/ JmjC domain-containing protein 12) is an H3K27me3 and H3K27me2 demethylase. Plants overexpressing REF6/JMJ12 resemble mutants defective in H3K27me3-mediated gene silencing. Genetic interaction tests indicate that REF6/JMJ12 acts downstream of H3K27me3 methyltransferases. Loss of REF6/JMJ12 leads to ectopic and increased H3K27me3 and decreased mRNA expression of a large spectrum of genes involved in development and hormone responses. Our studies identify a new subfamily of H3K27me3 demethylases and demonstrate an important mechanism in gene activation through active removal of the H3K27me3 repressive mark in plants.



Professor Ziyuan Duan

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Professor Duan received his PhD from the Kunming Institute of Zoology, Chinese Academy of Sciences. He has worked at the Gansu Agricultural University, was a Postdoctoral Research Associate at the Laboratory Animal Center, Institute of Genetics and Developmental Biology, CAS, and Director, Office of Modern Agricultural S&T Innovation Base, CAS. He is a member of the Genetics Association of China and a Steering Committee member of the Asian Partnership on Avian Influenza Research.

He received a First Class Award for Advancement in Science and Technology, Department of Sci.-Tech of Gansu province Government, 1998

Agricultural sciences and biotechnology in Chinese Academy of Sciences

The presentation will briefly introduce the Chinese Academy of Sciences (CAS) and the Bureau of Life Sciences and Biotechnology under CAS, and mainly summarize the overall arrangement and planning of CAS in the field of agriculture. The representative achievement in ago-biology and extension research will also be exhibited.

Publications

Xiao-Ling Liu, Feng-Lin Zhang, Zhi-Yong Zhou, Hua-Lu Zhao, Guo-Min Shen, Wu-Yun Baohan, Zi-Yuan Duan, Wei Li, Jun-Wu Zhang, Analysis of two sequence variants in peroxisome proliferator activated receptor gamma gene in Tajik population at high altitudes and Han population at low altitudes in China, *Molecular Biology Reports*, 201037(1): 179-84

Duan Ziyuan, Zhao Kai, Peng Zuogang, Li Junbing, Diogo Rui, Zhao Xinquan, He Shunping Comparative phylogeography of the Yellow River schizothoracine fishes (Cyprinidae): vicariance, expansion, and recent coalescence in response to the Quaternary environmental upheaval in the Tibetan Plateau. *Molecular Phylogenetics and Evolution*, 2009(53):1025–1031.

Wenyong Ding, Lin Lin, Feng Ren, Hanfa Zou, Ziyuan Duan(*Corresponding author*), Jianwu Dai, Effects of splice sites on the intron retention in histamine H3 receptors from rats and mice *J. of Genetics and Genomics*, 2009(36): 475-482

Wenyong Ding, Lin Lin, Zhifeng Xiao, Hanfa Zou, Ziyuan Duan(*Corresponding author*), Jianwu Dai, Multiple sequence elements determine the intron retention in histamine H3 receptors in rats and mice, *The International Journal of Biochemistry & Cell Biology*, 2009 (41):2281-2286

Zhao Kai, Duan Ziyuan (*Co-first author*), Peng Zuogang, Guo Songchang, Li Junbing, He Shunping, Zhao Xinquan The youngest split in sympatric schizothoracine fish (Cyprinidae) is shaped by ecological adaptations in a Tibetan Plateau glacier lake, *Molecular Ecology*, 2009,18,3616–3628.



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Genetic and Product Information

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Dr Michael Francki was awarded a BSc (Hon) from Flinders University of South Australia in 1989 and completed a PhD in cereal molecular genetics from the University of Adelaide in 1995. He has held research appointments at Purdue University (USA) and The University of Western Australia. He is currently Manager of Biotechnology at the Department of Agriculture and Food Western Australia with a focus on wheat pre-breeding for trait improvement in grain quality, biotic and abiotic stress tolerance. His program has external collaborations with local, national

and international research organisations and strong interactions with breeding companies to deliver pre-breeding outcomes for commercial variety development. He has held research management responsibilities as a member of the Senior Management Group for the Value Added Wheat CRC and Research Director for the Molecular Plant Breeding CRC. He is an Adjunct Professor at both Murdoch University (Australia) and University of Nebraska (USA) and a representative on various national and international committees for biotechnology and the wheat industry.

Current and future pre-breeding technologies to improve wheat grain production in changing environments.

The demand to feed the growing global population together with climate variability and changes in grain production environments are major challenges facing future food production. Australia has a moral obligation to contribute to future food security by increasing high quality wheat exports to the international market and transfer knowledge, resources and technologies to assist developing countries create productive and sustainable cropping systems. Western Australia is the major exporter in Australia contributing approximately 1.5% of global wheat production. The rate of genetic gain is less than 1% per annum and substantial improvements are needed to meet the future demands for stable wheat yields. R&D in new and emerging technologies is essential if we are to meet future demands of grain production. This presentation will provide an overview of current pre-breeding activities and how biotechnology together with other disciplines are making significant contributions to improving adaptability of commercial wheat varieties to grain production environments. Moreover, emerging technologies and technology transfer will add substantial contributions to ensure grain yields are improved under increasing environmental pressures and contribute to meeting the world's demand for future global grain production.

Publications

Francki MG (2009). Genomics for wheat improvement. In "Molecular Techniques in Crop Improvement" 2nd Edition, SM Jain and DS Brar (ed.), Springer Verlag, Germany. pp281-306.

Mullan DJ, Mirzaghaderi G, Walker E, Colmer TD, Francki MG (2009). Development of wheat–*Lophopyrum elongatum* recombinant lines for enhanced sodium 'exclusion' during salinity stress. *Theoretical and Applied Genetics* 119: 1313-1323.

Francki MG, Walker E, Crawford AC, Broughton S, Ohm HW, Barclay I, Wilson RE, McLean R (2009). Comparison of genetic and cytogenetic maps of hexaploid wheat (*Triticum aestivum* L.) using SSR and DArT markers. *Molecular Genetics and Genomics* 281: 181-191

Shankar M, Walker E, Golzar H, Loughman R, Wilson R, Francki M. (2008) QTL for seedling and adult plant resistance to *Stagonospora nodorum* in wheat. *Phytopathology* 98: 886-893.

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Dr Jiming Gong

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Jiming Gong was born in Sichuan, China in 1972. He completed his undergraduate study at Beijing Normal University in 1995. He went on to perform his Ph.D research at the Institute of Genetics and Developmental Biology, CAS under the supervision of Professor Shouyi Chen between 1995 and 2000. Dr. Gong's postdoctoral training was at the University of California, San Diego with Professor Julian I Schroeder from 2000 to 2006, focusing on ion transport and functional genomics. Dr Gong was recruited by the CAS "one hundred talent" program and

appointed Professor for Molecular Genetics at the Institute of Plant Physiology and Ecology CAS. From 2008, Dr Gong has served as the Chair of China Phytoremediation Committee in CSPB (China Society of Plant Biologist), and also serves on the Editorial Boards for Chinese Plant Physiology Communications and Chinese Journal of Applied Ecology.

Omics analysis of mineral nutrient and toxic metal transport in plants

Atmospheric CO₂ increase and chemical pollution in soil are two major environmental changes, which either interacts with nitrogen metabolism or accumulates to toxic levels in plants thus essentially affecting food safety and food security. To tackle these concerns, multidisciplinary approaches including ionomic and transcriptomic profiling and classical molecular genetics, have been adopted in the Ionomics group in SIPPE, and significant progress has been achieved in 1) molecular mechanism that regulates cross talk between nitrogen nutrition and stress tolerance; 2) quantitative genetics that controls cadmium reallocation into rice grains and 3) molecular mechanisms that regulate cadmium sequestration into vacuoles. Our most recent progress and further research plan in these areas will also be presented and possible international collaborations are highly welcome.

Publications

Li J-Y, Fu Y-L., Pike S., Bao J, Tian W, Zhang Y, Chen C-Z, Li H-M, Huang J, Li L-G, Schroeder JI, Gassmann W, Gong J-M*. (2010) The Arabidopsis nitrate transporter NRT1.8 functions in nitrate removal from the xylem sap and mediates cadmium tolerance. *Plant Cell*. 22: 1633-1646

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Gong J-M, Waner DA, Horie T, Li S-L, Horie R, Abid KB, Schroeder JI. (2004) Microarray-based rapid cloning of an ion accumulation deletion mutant in Arabidopsis thaliana. *Proc Nat Acad Sci USA* 101, 15404-15409.

Lahner B, Gong J-M, Mahmoudian M, Smith EL, Abid KB, Rogers EE, Guerinot ML, Harper JF, Ward JM, McIntyre L, Schroeder JI & Salt DE. (2003) Genomic scale profiling of nutrient and trace elements in Arabidopsis thaliana. *Nature Biotechnology* 21, 1215-1221

Gong J-M, Lee DA, Schroeder JI. (2003) Long-distance root-to-shoot transport of phytochelatins and cadmium in Arabidopsis. *Proc Nat Acad Sci USA* 100 (17): 10118-10123



Dr Soressa Kitessa

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Soressa Kitessa is a senior research scientist in CSIRO. He has been accredited Registered Animal Nutritionist by the Nutrition Society of Australia. In CSIRO, Soressa's research over the past decade was focused on ways of manipulating the fatty acid profiles of animal-derived foods for better human health outcomes. Soressa was the recipient of the AFFA Science Award for Young People in 2001, and a member of a team that won the CSIRO Medal for Research Achievement in 2010. During the last three months of 2009, Soressa was a visiting scholar at Cornell University, USA. He is currently working in a team in CSIRO Food and Nutritional Sciences, Adelaide, who are

interested in identifying and characterising how food and food components influence colon cancer risk.

Modifying animal-derived foods for better human health

Animal-derived foods are staple ingredients in the Western diet. Over the last few decades the interest in animal-derived foods, as well as other food ingredients, has moved beyond energy and nutrient requirements. This is especially true for dietary fats where both researchers and consumers appreciate the roles of saturated, monounsaturated, and omega-3 and omega-6 polyunsaturated fatty acids (PUFA) in health and disease. CSIRO has conducted a number of studies to improve the fatty acid profile of meat and milk from livestock by using a protection technology that enables unsaturated and polyunsaturated dietary fatty acids to by-pass ruminal biohydrogenation. The initial studies showed that inclusion of protected tuna oil in the diets of sheep and cattle was very effective in significantly enriching meat and milk with the omega-3 long-chain ($\geq C_{20}$) PUFA - EPA and DHA. With the prediction of global decline in marine sources of omega-3 LC-PUFA supply, we have been investigating the potential of vegetable oils and novel GM oils in enriching meat and milk with EPA and DHA. The presentation summarises our research in this area and presents highlights of the latest developments with respect to the future supply of omega-3 LC-PUFA.

Publications

- Kitessa, S. M., Liu, S., Briegel, J., Pethick, D. W., Gardner, G., Ferguson, M., Allingham, P., Natrass, G., McDonagh, M., Ponnampalam, E., Hopkins, D. (2010) The effects of intensive or pasture finishing in spring and linseed supplementation in autumn on the omega-3 content of lamb meat and its carcass distribution. *Animal Production Science* 50, 130-137.
- E. N. Ponnampalam, E. N., Warner, R. D., Kitessa, S. M., M. B. McDonagh, M. B., Pethick D. W., D. Allen, D. and D. L. Hopkins, D. L. (2010) Influence of finishing systems and sampling site on fatty acid composition and retail shelf-life of lamb. *Animal Production Science* 50, 575-581.
- Kitessa, S. M. & Young, P. (2009) Echium oil is better than rapeseed oil in enriching poultry meat with n-3 polyunsaturated fatty acids, including eicosapentaenoic acid and docosapentaenoic acid. *British Journal of Nutrition* 101, 709-715.
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- Greeff, J. C., Harvey, M., Young, P., Kitessa, S. M. and Dowling, M. 2007. Heritability estimates of individual fatty acids in Merino meat. *Proceedings of the Association for Advancement of Animal Breeding and Genetics*, 17: 203-206.



Professor Yongchao Liang

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Professor Liang received his PhD from Nanjing Agricultural University, Nanjing. He was a Visiting Research Scholar at the Department of Biology, Hong Kong Baptist University, Hong Kong. He was an Alexander von Humboldt Research Fellow at the Institute of Plant Nutrition, University of Hohenheim, Stuttgart. Professor Liang is currently Professor, Deputy Head of Dept. of Plant Nutrition and Fertilizer at the Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing. His research interests include: Mechanisms of Adaptation of Higher

Plants to Abiotic Stresses, Phytoremediation of Contaminated Soils and/or Environments, Plant Nutrition and Plant Health (Plant disease Control), Plant Stress Physiology and Molecular Biology, Fertilizer Resources Use and Management

Improving food safety by reducing accumulation of heavy metals into edible parts of cereal and vegetable crops

Over the last decades, substantial amounts of heavy metals including cadmium have been released by geological activities or by anthropogenic impacts and industrialization such as the combustion of fossil fuels, mining, smelting activities, release of wastes and sewage water, and repeated use of organic manures, chemical fertilizers and pesticides containing appreciable amounts of heavy metals. Cadmium (Cd) is a highly toxic heavy metal with high mobility in the environment. It can cause serious problems to microbes, plants and animals even at trace concentrations, and can be highly toxic to human beings through its easy transport and accumulation into edible parts of crops, particularly rice grain and vegetables. It is estimated that approximately 20 million ha of arable land in China is subjected to heavy metals contamination and its annual economic loss is about 30 million USD. Cadmium accumulation in the environment and its bioaccumulation in the food chain pose high environmental problems and human health risks in China as well as in the whole world. In the present paper, we proposed some priority strategies to restrict heavy metals from uptake and transport into edible parts of cereal and vegetable crops to enhance food safety. The results show that screening low-accumulating crop species and/or varieties, immobilizing heavy metals via using chemical amendments and keeping paddy rice soil under flooding condition can significantly and effectively restrict translocation of cadmium from roots to rice grain and consequently enhance food safety. It can be concluded that "low-tech" but knowledge-intensive technologies such as some agronomic measures including proper soil moisture management, fertilization and low-accumulating variety screening can also be cost-effective, environmentally friendly and feasible techniques to reduce heavy metals bioaccumulation and improve food safety.

Publications

Sun WC, Zhang J, Fan QH, Xue GF, Li ZJ, Liang YC* 2010. Silicon-enhanced resistance to rice blast is attributed to silicon-mediated defence resistance and its role as physical barrier. *European Journal of Plant Pathology*. 128: 39-49

*Corresponding author

Ge GF, Li ZJ, Fan FL, Chu GX, Hou ZA, Liang YC*. 2010. Soil biological activity and their seasonal variations in response to long-term application of organic and inorganic fertilizers. *Plant and Soil*. 326:31–44 *Corresponding author

Wakelin SA, Chu GX, Lardner R, Liang YC, McLaughlin MJ. 2010. A single application of Cu to field soil has long-term effects on bacterial community structure, diversity, and soil processes. *Pedobiologia* 53: 149-158

Wakelin SA, Chu GX, Broos K, Clarke KR, Liang YC, McLaughlin MJ. 2010. Structural and functional response of soil microbiota across a Cu gradient are moderated by addition of plant substrate. *Biology and Fertility of Soils* 46: 333-342

Song AL, Li ZJ, Zhang J, Xue GF, Fan FL, Liang YC*. 2009. Silicon-enhanced resistance to cadmium toxicity in *Brassica chinensis* L. is attributed to Si-suppressed cadmium uptake and transport and Si-enhanced antioxidant defense capacity. *Journal of Hazardous Materials*. 172:74-83 *Corresponding author



Professor Hong-Qing Ling

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1978-1981, B.S. agronomy, Sichuan Agricultural University, China

1986-1988, Dipl.-Ing. agr. Christian-Albrechts-University of Kiel, Germany

1989-1992, PhD. Christian-Albrechts University of Kiel, Germany

1993-1997, Postdoctoral training, Institute for Plant Genetics and Crop Research, Germany

1998-2000, Senior research scientist, Institute of Plant Biology, University of Zurich, Switzerland

2001-now, principal investigator, Institute of Genetics and Developmental Biology, Chinese Academy of Sciences; Since 2006, Director of the State Key Laboratory of Plant Cell and Chromosome Engineering

Research Interests:

1) *Molecular biology of plant nutrition: Mainly working on the molecular mechanisms of iron and phosphate uptake and metabolism in plants*

2) *Molecular genetics of wheat: Focusing on identification and characterization of the genes involved in important agronomic traits of wheat*

Molecular Regulation Mechanism of Iron Uptake in Higher Plants

Iron is an essential element for all organisms. It functions as a component of many important enzymes and proteins involved in fundamentally biochemical processes. Iron deficiency afflicts more than one billion peoples worldwide. Biofortification (increasing iron concentration and bioavailability) in main crop grains is a most effective approach to solute iron malnutrition for human health.

In plants, iron is one of the most common elements limiting plant growth because it exists predominantly in an oxidized ferric form [Fe(III)] in aerobic environments, which has an extremely low solubility at neutral or basic pH, and is not readily available to plants. To meet iron demand for growth and development, two effective iron acquisition systems known as strategy I (in all plants except of grasses) and strategy II (in grasses) have been evolved in higher plants. The main research activity in my lab is to understand the molecular mechanism of iron uptake in strategy I plants. During last several years, we have isolated and characterized more than ten genes involved in iron homeostasis, and illustrated the molecular regulation mechanism of iron uptake in strategy I plants. Recently, we found that epigenetics is also involved in the regulation of iron uptake.

Publications

Wu, H., Y. Ji, J. Du, D. Kong, H. Liang, H.-Q. Ling*: ClpC1, an ATP-dependent Clp protease in plastids, is involved in iron homeostasis in Arabidopsis leaves. *Annals of Botany* 105: 823-833 (2010)

Li, J., X.D. Wu, S.-T. Hao, X.J. Wang, H.-Q. Ling*: Proteomic response to iron deficiency in tomato root. *Proteomics* 8, 2299-2311 (2008)

Yuan, Y., H. Wu, N. Wang, J. Li, W. Zhao, J. Du, D. Wang, H.-Q. Ling*: FIT interacts with AtbHLH38 and AtbHLH39 in regulating iron uptake gene expression for iron homeostasis in *Arabidopsis*. *Cell Research* 18, 385-397 (2008)

Zhao, T., H.-Q. Ling*: Effects of pH and nitrogen forms on expression profiles of genes involved in iron homeostasis in tomato. *Plant Cell and Environment* 30: 518-527 (2007)

Yuan, Y.X, J. Zhang, D.W. Wang, H.-Q. Ling*: AtbHLH29 of Arabidopsis thaliana is a functional ortholog of tomato FER involved in controlling iron acquisition in strategy I plants. *Cell Research* 15(8): 613-621 (2005)



Professor Mark Morrison

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I returned to CSIRO in 2006 as an OCE Science Leader, after spending nearly 20 years in the United States, where I still hold a Professorial appointment with The Ohio State University. My scientific expertise resides in the fields of microbial physiology and genomics. I have a long-standing interest in host-microbe interactions, with a special emphasis on the ecophysiology of polysaccharide degradation in the gastrointestinal tracts of herbivores, as well as terrestrial environments. I currently serve as a member of the Scientific Advisory Group for New Zealand's

Pastoral Greenhouse Gas Research Consortium; and also as the Australian science representative to the International Human Microbiome Consortium.

Differences downunder – macropods, methane and metagenomics

Biology has been experiencing a wave of technological innovation, perhaps most evident in our ability to rapidly and comprehensively produce the genetic code for virtually any organism. The same approaches now support detailed examinations of the structure and function of entire microbial communities, including the vast number of microorganisms that cannot readily be cultured. This field of study is referred to as metagenomics. The conceptual framework of our microbial biology and metagenomics program in CSIRO Livestock Industries is to use metagenomic methods to better understand the role of gut microbiomes in animal (and human) health and nutrition. As the program elucidates the function(s) encoded within these metagenomes, the knowledge will be used to devise ecological, bioactive, and (or) plant breeding approaches that productively alter gut microbiome function. In the short- to medium-term, our livestock and animal research seeks to devise practical ways to redirect fermentation and reduce methane emissions; as well as to improve forage degradation. My presentation will outline some of our recent findings in these areas, including our research with native Australian herbivores.

Publications

Pope, P.B., S.E. Denman, M. Jones, S. Tringe, K. Barry, S. Malfatti, A. McHardy, J-F. Cheng, P. Hugenholtz, C.S. McSweeney, and M. Morrison (2010). Adaptation to herbivory by the Tammar wallaby includes bacterial and glycoside hydrolase profiles different to other herbivores. *Proc. Nat. Acad. Sci. USA* 107:14793-14798.

Attwood, G.T., E. Altermann, B. Kelly, B., S.M. Leahy, L. Zhang, and M. Morrison (2010) Exploring rumen methanogen genomes to identify targets for methane mitigation strategies. *Anim. Feed Sci. Technol. in press (invited paper as part of 2010 Greenhouses Gases in Animal Agriculture Conference, Banff, Canada.*

Yu, Z., M. Morrison, and F.L. Schanbacher (2010) Production and Utilization of Methane Biogas as Renewable Fuel. pp. 403-433. *In: Biomass to Biofuels – Strategies for Global Industries.* A.A. Vertes, H.P. Blaschek, N. Qureshi and H. Yukawa (eds). Wiley Publishing. UK. ISBN 9780470513125

Morrison, M., P.B. Pope, S.E. Denman, and C.S. McSweeney (2009) Plant biomass degradation by gut microbiomes: more of the same or something new? *Curr. Opin. Biotechnol.* 20:358-363.

Yu, Z, and M. Morrison (2009) The Gut Microbiome: Current Understanding and Future Perspectives. pp. 19-40. *In: Food-borne microbes: Shaping the host ecosystem* (L-A. Jaykus, H. H. Wang, and L.S. Schlesinger, Editors) ASM Press. Publication release date May 30th, 2009. ISBN10: 1555814050



Dr Manny Noakes

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*Dr Noakes is currently the senior research scientist and dietitian at CSIRO Food and Nutritional Sciences. Dr Noakes manages the nutrition, behaviour and health capability within CSIRO which also conducts research on individual foods, diets and supplements requiring expertise in dietary intake methodologies, understanding biomarkers of disease risk as well as understanding behaviours and motivators relating to food consumption. She has been involved in the conduct of many published clinical studies to establish the health potential of diets, food products, nutrients, supplements and pharmaceuticals. Dr Noakes was instrumental in leading the research, development and communication of the best selling book series *The CSIRO Total Wellbeing Diet* which is aimed at maximizing health and wellbeing through better nutrition and weight management. The CSIRO Healthy Heart Program is a more recent addition to the series of commercial publications which aim to translate scientific evidence for the community.*

Greenhouse gas emissions from Australian diets

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Background – Mitigating climate through reducing greenhouse gas emissions (GHG) from food will guide national dietary recommendations along with nutritional factors.

Aims – We modelled the life cycle GHG of 4 dietary patterns using input-output analysis. The diets were a lacto-ovo-vegetarian diet (LVD), a high carbohydrate diet modelled on the Australian Guide to Healthy Eating (AGHE), a high protein diet modelled on the CSIRO Total Wellbeing Diet (TWD) and the average Australian diet (AAD).

Methods - Information was categorised according to major food groups and matched to food production sectors data from the input-output model. GHG expressed as kg CO₂ per kg of food were converted to kg CO₂ per dietary pattern per person per annum.

Results - Current Australian eating patterns indicated a large proportion of GHG from high kilojoule nutrient poor foods. Of the nutrient dense foods, beef was a major contributor to GHG emissions - 27% of AGHE, 37% of TWD and 25% of AAD GHG emissions. Lamb provided 7%, 9% and 6% respectively. On LVD dairy products were the main source of GHG at 27%.

Conclusion – The total nutrient profile of dietary patterns need to be considered in managing net GHG emissions. Overall reductions in excessive food intake and reductions in nutrient poor foods may benefit both obesity and health as well as the environment.

Publications

Noakes, M., Keogh, J.B., Foster, P.R. and Clifton, P.M. (2005) Effect of an Energy-Restricted, High-Protein, Low-Fat Diet Relative to a Conventional High-Carbohydrate, Low-Fat Diet on Weight Loss, Body Composition, Nutritional Status, and Markers of Cardiovascular Health in Obese Women. *American Journal of Clinical Nutrition* 81, 1298-1306. This paper comprehensively assessed the efficacy and safety of high protein diets demonstrating that they may be advantageous in women with elevated triglycerides.

Clifton, P.M., Keogh, J.B. and Noakes, M. (2004) Trans Fatty Acids in Adipose Tissue and the Food Supply Are Associated With Myocardial Infarction. *Journal of Nutrition* 134, 874-879 First study conducted in Australia with an objective marker of trans fatty acid intakes and was able to show a decline in adipose tissue trans during the period when they were being removed from domestic margarines

Noakes, M., Foster, P.R., Keogh, J.B. and Clifton, P.M. (2004) Meal Replacements Are as Effective as Structured Weight-Loss Diets for Treating Obesity in Adults With Features of Metabolic Syndrome. *Journal of Nutrition* 134, 1894-1899. Prior literature suggested an advantage of meal replacements to convention dietary patterns. We were able to show for the first time that dietary structure is a key component in weight management and if this is controlled, meal replacements are no more effective than whole food diets.



Dr Kathy Ophel Keller

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Dr Kathy Ophel Keller is the Acting Chief, Sustainable Systems Division, South Australian Research and Development Institute (SARDI). She oversees a research Division of 120 staff with responsibilities for research management of plant health, entomology, climate change and water resources programs. After receiving her PhD from the University of Adelaide she led a program in the Cooperative Research Centre (CRC) for Soil and Land Management using DNA technology to detect and identify soil micro-organisms. In 1996 Kathy moved to SARDI

to set up, with Dr Alan McKay the Root Disease Testing Service -a world-first service to grain-growers to measure disease risk in soil. Research links have formed with researchers globally to develop DNA tests to measure the risk of soil-borne pathogens of potatoes on soil and seed, and to measure potential biological indicators of soil quality. The core technology has a broad range of current research applications from monitoring soil health, monitoring gut microflora, and measurement of environmental impact of aquaculture

Molecular diagnostics and plant root health

Management decisions to minimise losses from soilborne diseases need to be made before the crop is sown, so knowledge on pre-plant levels of soilborne pathogens is useful for growers. DNA tests to quantify soilborne pathogens have been available to Australian grain growers for more than a decade. These tests are most useful where there are good strategies developed to manage disease risk, e.g. management of cereal cyst nematode by rotation with non-host crops, or use of resistant and tolerant cereal varieties. As part of an international collaborative effort, tests have been developed for key pathogens of processing and fresh potatoes. In the potato industry, growers regularly lease new ground so DNA testing has a clear role in paddock selection where there may be little information about soil pathogen status. Pathogen load on seed tubers is a significant issue for the potato industry, and visual inspection of tubers may significantly underestimate pathogen status. Some of the tests developed for potato soilborne pathogens have broader applicability for other horticultural industries.

Tests have been developed for a range of beneficial soil organisms including arbuscular mycorrhizal fungi (AMF) and *Trichoderma* species. New research is underway to develop tests to monitor biological status of soil including selected genera of free-living nematodes. Highly sensitive tests have been developed to quantify plant roots in soil (wheat, barley, canola and key pasture species). Research to date indicates that these assays are useful to monitor root growth and function.

Publications

Bott NJ, Ophel-Keller KM, Sierp MT, Herdina, Rowling KP, McKay AC, Loo MGK, Tanner JE, Deveney MR. 2010. Toward routine, DNA-based detection methods for marine pests. *Biotechnology Advances*, in press.

Torok, VA, Hughes, RJ, Ophel-Keller, K., Ali, M., MacAlpine, R. 2009. Influence of different litter materials on cecal microbiota colonization in broiler chickens. *Poultry Science* 88: 2474–2481.

Herbert, K., Powell, K., McKay, A., Hartley, D., Herdina, Ophel-Keller, K., Schiffer, M., Hoffman, A. 2008. Developing and testing a diagnostic probe for grape phylloxera applicable to soil samples. *J. Economic Entomology* 101 (6):1934-1943.

Ophel Keller, K, McKay, A., Hartley, D., Herdina, Curran, J 2008. Development of a routine DNA-based testing service for soil borne diseases in Australia. *Australasian Plant Pathology* 37, 243-53.

G. R. Stirling, D. Griffin, K. Ophel-Keller, A. McKay, D. Hartley, J. Curran, A. M. Stirling, C. Monsour, J. Winch and B. Hardie. 2003. Combining an initial risk assessment process with DNA assays to improve prediction of soilborne diseases caused by root-knot nematode (*Meloidogyne* spp.) and *Fusarium oxysporum* f. sp. *lycopersici* in the Queensland tomato industry. *Australasian Plant Pathology* 33: 285-293.



Professor John Pluske

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Professor John Pluske is currently Director of the Institute for Animal Research at Murdoch University in Perth, Western Australia. Prior to this position, John held appointments as Associate Faculty Dean in the Faculty of Health Sciences and Associate Professor (Biochemistry and Nutrition) in the School of Veterinary and Biomedical Sciences. He joined Murdoch University in 1999. John has a Bachelor of Science (Agriculture) degree with First Class Honours and a PhD from The University of Western Australia in pig nutritional physiology and biochemistry. Professor Pluske has spent time working in Canada, UK and New Zealand on a range of projects. His major research interests relate to nutrition and digestive physiology of pigs, and particularly weanling pigs. Other research interests encompass alternatives to antimicrobials in piglet diets, role of nutrition in modifying immune function and the gastrointestinal tract microbiota, feedstuff evaluation, meat science, and controlling enteric diseases in pigs without antimicrobials.

Animal production systems of the future

Increased demand will place even greater pressure on current animal production systems to produce enough products, whether it is eggs, fibre, meat or milk, to meet the future demands and needs of societies throughout the world. Society will also increasingly demand that producers of animal products place greater attention to “credence” values rather than necessarily the quality of the product *per se*. These issues relate predominately to animal welfare and the environmental impacts of animal production, and may well drive future demand and (or) price of products.

In overall terms, the major issues that will determine the sustainability of animal production systems in the future are first, which species will be best supported by the available resources, and second, which production system(s) is/are appropriate to the country. For example, increasing competition for grain from both the monogastric (pig, poultry) and ruminant (feedlot cattle, non grass-fed dairy systems) industries with the grain-fed ethanol industries will result in pressure on grain availability and price. Parallel issues associated with methane mitigation and a ‘carbon price’ for ruminants will also continue to be discussed, however the animal resources and the feed base of cellulose-rich biomass are abundantly available and inefficiently utilised at present by ruminants.

Future research will inevitably be targeted at not only increasing production of animal products to satisfy demand, but will need to consider “credence” values in a resource-constrained environment. Current research at Murdoch University is attempting to tackle some of these issues, and will be discussed in my presentation.

Publications

De Lange, C.F.M., Pluske, J.R., Gong, J. and Nyachoti, M. (2010). Strategic use of feed ingredients and feed additives to stimulate gut health and development in young pigs. *Livestock Science* 134: 124-134.

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Heo, J.M., Kim, J.C., Hansen, C.F., Mullan, B.P., Hampson, D.J. and Pluske, J.R. (2009). Feeding a diet with decreased protein content reduces indices of protein fermentation and the incidence of post-weaning diarrhea in weaned pigs challenged with an enterotoxigenic strain of *Escherichia coli*. *Journal of Animal Science* 87: 2833-2843.

Kim, J.C., Mullan, B.P., Heo, J.M., Hansen, C.F. and Pluske, J.R. (2009). Decreasing dietary particle size of lupins increases apparent ileal amino acid digestibility and alters fermentation characteristics in the gastrointestinal tract of pigs. *British Journal of Nutrition* 102: 350-360.

Pluske, J.R. and Hampson, D.J. (2009). Digestive disorders of pigs associated with nutrition, with emphasis on proliferative enteropathy and swine dysentery. In *Sustainable Animal Production: The Challenges and Potential Developments for Professional Farming* (A. Aland and F. Madec, editors), pp. 275-285. Wageningen Academic Publishers, The Netherlands.



Professor Le Qing Qu

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PhD. in 2000 at Kyushu University, Japan; Associate Professor in Institute of Genetics and Developmental Biology, CAS from 2000 to 2001; Postdoctoral Researcher in National Institute of Agrobiological Science, Japan from 2001 to 2005; Professor and team leader in Institute of Botany, CAS since 2005. Main research interests include: Mechanism of rice glutelin intra-cellular transportation Regulatory mechanism of gene expression in plant seed and Creation of crops with health promotion functions.

Development of health promotion crops via biotechnology strategies

Life-style related diseases, such as anemia, hypertension, cardiovascular diseases, etc. have become one of the most serious social health problems. Usually, the treatment of these diseases depends on the use of expensive chemical drugs with considerable side effects. Transgenic rice has been used as an attractive bioreactor for the production of recombinant proteins including pharmaceuticals. It is reasonable to develop transgenic rice with health promotion functions via biotechnology strategies.

We have obtained the trans-ferritin rice lines by introducing soybean ferritin gene *soyfer-2* under the control of a strong endosperm specific promoter. The Fe content in the transgenic rice seeds increased up to three-folds as high as that of the non-transformant control. We also obtained transgenic rice lines with the α -linolenic acid content in seed increased more than ten-folds by ectopic and over-expression of fatty acid desaturase (FAD) genes in rice endosperm. These lines are expected to be ideal food materials for treating and preventing anemia and cardiovascular diseases through ordinary diet.

Publications

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Dr Greg Rebetzke

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Dr Greg Rebetzke is a quantitative plant breeder who works with a team of physiologists, geneticists and breeders to identify and select traits important in improving wheat adaptation to Australian environments. His main focus is around understanding genetic control and development of germplasm for traits conferring improved water-use efficiency. This work has led to a greater understanding of performance under drought, and release of germplasm and varieties used by Australian wheat growers.

Integration of new tools for improving genetic gain for yield in water-limited environments

Climate change threatens to reduce rainfall and increase rainfall variability in many of the world's rainfed and irrigated wheat-growing regions. Together with increasing population growth and a reduction in water for irrigation, more efficient water use is being targeted in the development of new wheat varieties and cropping systems. Breeding and selection for water-limited environments have been successful but at rates of genetic gain well below that of favourable environments. A range of tools that compliment empirical selection are available to increase genetic gain under drought. These include the use of simulation modelling, improved physiological understanding and rapid, cost-efficient phenotyping, and molecular techniques aimed at more efficient screening. Attention has moved from traits that improve cell and plant survival to those that improve productivity in water-limited environments. In turn, pre-breeding and breeding activities are focusing on coupling quantitative and molecular genetic understanding with high throughput phenotyping tools to enrich populations for yield or traits for improved water-use efficiency. Evidence exists where this can be achieved in early generations of a breeding cycle.

Publications

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Victor Sadras is the Principal Crop Eco-physiologist with the South Australian Research & Development Institute. His research interest is the physiology and evolution of adaptive traits of crops in relation to environmental stresses including water deficit, heat stress, frost, nutrient deficit, soil chemical and physical constraints (e.g. salinity, compaction), diseases and arthropod pests. He has measured and modelled aspects of the carbon, nitrogen and water economies of grapevines and annual crops (maize, wheat, cotton, sunflower, soybean)

*on rainfed and irrigated cropping systems of Australia, Argentina and Spain. He is a member of the editorial boards of international journals *Field Crops Research*, *Crop & Pasture Science* and *European Journal of Agronomy*. He is an affiliate member of the University of Adelaide and advisor to FAO on crop water issues.*

Agricultural opportunities and challenges associated with rising temperature: A crop physiologist's viewpoint

This paper illustrates the opportunities associated with warming trends in both high latitude and temperate environments. A wider frost-free window would enhance the capture of resources and productivity of individual crops potentially increasing the share of grain production from high latitude cropping systems such as those of northern China. In temperate environments, faster phenological development would allow for greater frequency of multiple cropping, increase productivity and profit associated with both enhanced capture and efficiency in the use of radiation and water, and dilution of fixed costs. Increasing frequency and intensity of untimely heatwaves is one of the main challenges associated with increasing temperatures; the role of water supply in managing the damaging effect of high temperature is highlighted.

Publications

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Professor Stephen Simpson is an Australian Research Council Laureate Fellow in the School of Biological Sciences at the University of Sydney, having returned to Australia in 2005 as an ARC Federation Fellow after 22 years at Oxford where he was Professor of Entomology and Curator of the University Museum of Natural History. Before that he had undertaken his PhD at the University of London, and his undergraduate degree and Honours at the University of Queensland.

Stephen has been Visiting Professor at Oxford, a Fellow of the Institute for Advanced Study (Wissenschaftskolleg) in Berlin, Distinguished Visiting Fellow at the University of Arizona, and Guest Professor at the University of Basel. In 2007 he was elected a Fellow of the Australian Academy of Science, in 2008 he was awarded the Eureka Prize for Scientific Research, and in 2009 he was named NSW Scientist of the Year.

Lessons from locusts: a tale of swarms, cannibals, ageing and human obesity

Locust plagues are one of the most infamous insect scourges, affecting the lives of 1 in 10 people on the planet. But they have also provided important new clues into the causes of human obesity, how we age, and the complex behaviour of crowds. Professor Steve Simpson takes us on a strange journey that begins in the midst of a locust swarm and ends with the human obesity epidemic. Along the way you will see what you can discover by ticking a locust's leg with a paintbrush, how recreational drugs turn shy solitary locusts into swarming party animals, how robotic helicopters are being used to track swarms, the sinister role played by cannibalism in locust swarms, and how a powerful appetite for protein can explain not only locust mass marching but also human obesity and ageing.

Publications

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Professor Song received his PhD in Agronomy from Shenyang University in 1996. He undertook postdoctoral research work in Agronomy at the Iwate University, Japan. His field of specialization is in crop ecophysiology, especially focusing on stress environmental biology, physiology and ecology of high yielding as well as high quality maize.

Utilization of saline sodic soils and related technological issues in safeguarding food security in Northeast China

There are about 3.42 million hectares of Saline-alkali land in Songnen Plain, Northeast China. Over 95% of the salt affected lands are located in the west part of the area. With annual rainfall of 400mm, there is a great potential for agricultural grain development in the salt-affected land. A newly initiated irrigation scheme covers 280,000 hectares of saline-sodic land in the western part of the Songnen Plain. Irrigation and drainage infrastructure construction started in May 2006, and will be completed before 2011. There will be three types of land use that would benefit from this initiative: 1) a new paddy production area that is situated on sodic lands; 2) dry land crops will be irrigated for higher yields, and 3) wetlands that will receive water from the drainage. It is estimated that approximately 200,000 rural poor people will benefit from the project. However, the soil is characterized with salt and sodium accumulation. Natural and human activities are the primary causes for the salinization and sodification. Land degradation from salinity and sodicity has resulted in a decrease in agricultural production and environment quality. Based on more than ten years research on the problem region, we developed rice production practices which enabled the local farmers to get more profit from their problem soil than they did before. Several effective measures were undertaken to minimize the injury of salt and sodium. Well-designed and established irrigation and drainage systems were the foundation of both high yield rice production and secondary salinization control. "Changbai 9" and other salt tolerant rice varieties were selected and planted. Leaching and flushing 2-3 times was used for taking the salt away from the upper layer of the soil before transplantation.

Publications

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Song Fengbin. Theory and Practice of Regulated Deficit Irrigation. Chinese Agricultural Science Bulletin, 2004 20 173-176.



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Dr Stevens has worked as a researcher for the University of Adelaide and CSIRO Land and Water. For the last five years (2005-2010) he has work for the National Environmental Protection Council as Coordinator and Scientific Services for the Environmental Risk component of the Australian Guidelines for Water Recycling. During this time he has also been the Australian Coordinator for Recycled Water use in Horticulture for Horticulture Australia Limited. This work as be completed through his consulting company Atura Pty Ltd which specialises in terrestrial risk assessment and

management of the environment (Rural and urban) with a special interest in recycling beneficial components from waste-water and water-solids (Recycled water and biosolids).

Improved water management technologies for agriculture

Climate change has caused a scarcity of water for agriculture in many parts of Australia over the last decade and this has lead to a concerted effort to use water more efficiently. These efficiencies have included selection of appropriate plant species, soil amendments to improve water holding capacity, improved irrigation systems and exploration of alternative water supplies. Subsurface drip irrigation and systems are growing in popularity in several agricultural industries (Amenity and production horticulture) due to their high efficiency of delivering water to the plant roots with limited water loss.

Alternative water supplies being utilised now in Australia include: water recycled from effluent, managed aquifer recharge, desalination and rainfall harvesting (e.g. poly/glass-house or catchment). All water sources come with their inherent risks and the increased demand for recycling of water from wastewaters has lead to the development of Australian advanced risk management frameworks to ensure the quality of water supplied is fit for the intended agricultural use.

Many of these improvements in water management are designed with the underlying aim to increase production per volume of water and to supply sufficient water to where current farming operations and associated infrastructure are located. However, already (at great cost) some farming operations have relocated to areas where more secure supplies of water can be sourced.

Publications

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Professor Jianghua Sun

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I was born in Heilongjiang Province, China, and obtained my Doctor of Forestry degree from the College of Forestry, Stephen F. Austin State University in Texas, USA in 1991, followed by a postdoctoral stay at the INRA-CRF, Orleans, France. I have been working with forest insects in China, USA and France in chemical ecology and IPM development with over 130 publications. Current research focus is on understanding evolutionary process between host tree and invasive forest insect pest through chemical ecology and molecular biology, by which we are also studying invasion biology of forest invasive insect pest and developing monitoring and control technologies based on semiochemicals for those invasive species. I am also interested in impact of climate change on interactions between host tree/bark beetle/associated fungi and forest health in general.

Research and Development Center for Integration of Green Agricultural Technology Chinese Academy of Sciences

The establishment of the Research and Development Center for Integration of Green Agricultural Technology, Chinese Academy of Sciences RDCIGAT, CAS in 2009 was seen as an important step to further materialize the Knowledge Innovation Program and serve the nation's increasing demand for agricultural production and food safety. CAS is a leading research organization in basic sciences in China, however, many outcomes of this basic research either has direct or indirect applications in agriculture. The center provides an extension/technology transfer platform for such research from 23 research institutes related with agricultural science in CAS. Further more by working with relevant governmental agencies and enterprises, we organize demonstration or pilot projects by integrating those green agricultural technologies with the aim to increase the production while reducing the use of chemicals.

Nine sub-centers were set up affiliated with a leading institute, they are: Bio-pesticides Sub-center, Crop Variety Sub-center, Fruits, Vegetables and Flowers Sub-center, Plant and Animal Resistance Preparation Sub-center, Environmental Friendly Fertilizer Sub-center, Ecological Breeding Sub-center, Fine Aquiculture Sub-center, Precision Irrigation Sub-center, Green Agricultural Information Service Sub-center.

In this presentation, I will introduce the existing technologies in those areas and what we did and what we are doing.

Publications

Min Lu¹, Michael J. Wingfield², Nancy E. Gillette³, Sylvia R. Mori³, Jiang-Hua Sun^{1*} 2010. Complex interactions of the fungi vectored by an invasive bark beetle and hosts. *New Phytologist* 187:859-866.

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Dr David Topping

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David Topping is a biochemist and gained his BSc and PhD from Liverpool and London Universities, respectively. He has a strong interest in basic nutrition research and its application to improve public health through the prevention of diet-related disease. He is a Fellow and past president of the Nutrition Society of Australia and is an adjunct Professor of the University of Illinois. He is involved in several major CSIRO initiatives including the National Food Futures and Preventative Health National Research Flagships. David is particularly interested in the conduct of basic research and its application to the development of consumer food products which give added value for the manufacturer and improve public health through the prevention and management of important diet-related diseases including colo-rectal cancer and diabetes. He was elected to Fellowship of the Academy of Technological Sciences and Engineering for his achievements in this latter area.

Dietary fibre polysaccharides and human health

Non-infectious conditions including diabetes, inflammatory bowel diseases (IBD) and colo-rectal cancer (CRC) are serious global socio-economic problems. Large prospective population studies have established that lifestyle factors modify disease risk considerably. Early observational studies suggested that ethnic groups consuming unrefined cereal foods, apparently high in fibre, were at much lower risk of these conditions than people eating refined diets. Consequently, it was concluded that non-starch polysaccharides (NSP, major components of dietary fibre) were the protective factor. Australian cereal fibre consumption has increased substantially but national CRC rates remain stubbornly high. Re-evaluation of the population data showed that starch not digested in the small intestine (resistant starch, RS) may be more important than NSP in promoting large bowel function through the products of its large bowel bacterial fermentation. RS levels are very low in modern processed foods. CSIRO is developing new cereals to manufacture consumer foods to supply this fibre component. The first is a high amylose barley (BARLEYmax™) which has been made into a range of whole grain foods which have low glycaemic responses and high RS and good consumer acceptance. Other grains including a high amylose wheat and rice with low glycaemic index are also under development.

Publications

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Richard Trethowan is Professor of Plant Breeding and Director of the IA Watson Grains Research Centre at the University of Sydney. He has extensive international experience in wheat breeding and associated research and has a particular interest in developing water-use-efficient wheat cultivars and germplasm.

Maintaining wheat productivity in a changing climate: Genetic options

Reducing the impact of variable and limited water supply on wheat productivity is one of the great challenges facing wheat researchers today. More water-use-efficient farming systems and cultivars will mitigate the effects of periodic drought on crop productivity thus ensuring continuity of food supply. This paper examines genetic options for improving the water-use-efficiency of wheat.

Heritable and relevant field based phenotyping under drought, relevant genetic diversity, and characterization of both background and foreground genotype have improved the selection of parents. However, to realize significantly improved rates of genetic gain in water-limited environments more effective selection strategies must be employed. The options available to wheat breeders to improve rates of genetic gain are examined, including traditional marker assisted selection, exploitation of genotype x farming system interactions, association genetics and genome based recurrent selection strategies. However, this new complexity brings additional challenges. Managing and exploiting the wealth of genotypic and phenotypic data to optimize breeding program decisions is dependent upon access to appropriate bioinformatic tools. The use of the International Crop Information System to access, combine and interpret these data in a collaborative international wheat breeding program is presented.

Publications

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DeLacy, I.H., P.N. Fox, Graham McLaren, Richard Trethowan, and Jeffrey W. White. 2009. A Conceptual Model for Describing Processes of Crop Improvement in Database Structures. *Crop Science* 49: 2100-2112

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Dr Fudi Wang M.D, PhD earned his Bachelor's degree from HeBei Medical University in 1992, and received his PhD. from Second Military Medical University in 1998. Since then, he was recruited as an Assistant Professor, an Associate Professor, and the Chair of Department of Naval Medicine at Second Military Medical University till 2002. From 2002 to 2004, Dr Wang completed his postdoctoral training at the Department of Nutritional Sciences and Biochemistry, University of Missouri-Columbia. And then, he served as an Instructor at Harvard Medical School and Children's

Hospital Boston. In 2008, Dr Wang was appointed as Research Associate Professor at the Department of Human Nutrition and Food Science, University of Florida. He then joined the faculty of the Institute for Nutritional Sciences at Shanghai, China in 2009. Dr Wang's laboratory is mainly focus on investigating molecular mechanisms of zinc and iron metabolism by applying molecular biology, cell biology, biochemical, and genetic approaches. Recently, Wang lab is also studying the impact of heavy metal pollution on food safety.

Heavy metal pollution and food safety in china

Key Laboratory of Nutrition and Metabolism, Institute for Nutritional Sciences, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, Graduate School of the Chinese Academy of Sciences, Shanghai 200031, China.

Heavy metal contamination threatens many ecosystems worldwide. As a result, this affects public health from many aspects. One of them is the issue of food safety. The nature of bioaccumulation of heavy metals results in integrating of these pollutants into the human food chain. In this presentation, I would like to assess the health risks of heavy metals in edible resources, to summarize the current status of heavy metal contamination and food safety in China, and to briefly touch upon our strategies to tackle the problem. I believe that the key solution is to minimize the influx of pollutants into the food chain to break up vicious cycle.

Publications

The type IV mucopolipidosis-associated protein TRPML1 is an endolysosomal iron release channel
Xian-Ping Dong, Xiping Cheng, Eric Mills, Markus Dellling, Fudi Wang, Tino Kurz & Haoxing Xu

Genetic variation in Mon1a affects protein trafficking and modifies macrophage iron loading in mice
Fudi Wang, Prasad N Paradkar, Angel O Custodio, Diane McVey Ward, Mark D Fleming, Dean Campagna, Kristina A Roberts, Victor Boyartchuk, William F Dietrich, Jerry Kaplan & Nancy C Andrews.

*Zinc-stimulated Endocytosis Controls Activity of the Mouse ZIP1 and ZIP3 Zinc Uptake Transporters**
Fudi Wang, Jodi Dufner-Beattie, Byung-Eun Kim, Michael J. Petris, Glen Andrews, and David J. Eide

The Mammalian Zip5 Protein Is a Zinc Transporter That Localizes to the Basolateral Surface of Polarized Cells
Fudi Wang, Byung-Eun Kim, Michael J. Petris, and David J. Eide

Acrodermatitis enteropathica mutations affect transport activity, localization and zinc-responsive trafficking of the mouse ZIP4 zinc transporter Fudi Wang, Byung-Eun Kim, Jodi Dufner-Beattie, Michael J. Petris, Glen Andrews and David J. Eide.



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My laboratory mainly focuses on the genetic, molecular and biochemical mechanisms underlying the variations of plant organ shape and size, especially the Solanaceous fruits. Current research projects in my lab include identification of new genetic loci controlling fruit and seed development in tomato, and comparative analysis of fruit development in several Solanaceous crops, including eggplant and pepper. We are also initiating projects on unraveling the mechanisms underlying tomato adaptation to different environments.

Genetic basis of high productivity and adaptation in tomato

China is the largest producer and exporter of tomato in the world. Originally from South America, tomato prefers relatively cooler temperature, thus its productivity will be limited in hot and humid lowlands, which is the characteristic climate of southern China during crop growth season. To overcome the impact of high temperature and humidity on fruit set, Chinese tomato growers are heavily dependent on application of plant growth regulators. Those practices dramatically reduce the fruit quality, and ultimately lower farmer's profit. Unpredictable high temperature spells and high humidity due to global climate change will further lower tomato productivity. One of the effective ways addressing the problem is to look insight of the adaptation mechanism in tomato to the sub-optimal environments and ultimately to provide new ways to develop heat- and humid-tolerant breeding lines. In addition to our effort in understanding the genetic and biochemical bases of tomato fruit development, we are also trying to identify genetic components governing tomato adaptation to sub-optimal environments. In this presentation, I will discuss genetic analysis of tomato fruit growth and development, and also some of our work on tomato adaptation.

Publications

Jiang N., Gao D., Xiao H., van der Knaap E. 2009 Genome organization of the tomato *sun* locus and characterization of the unusual retrotransposon *Rider*. *Plant J.* 60(1):181-193

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Dr Liyong Xie, an associated professor in Shenyang Agricultural University (SAU), has studied Agro-meteorology and climate change impacts on and adaptation to agriculture. He studied Agronomy Meteorology at SAU and graduated in 1992, then obtained a Master degree in 2000 and a PhD degree in 2004 both from the same university. He has also pursued further education in the China Agricultural University in 2001.

Dr Xie worked in the Chinese Academy of Agricultural Sciences as a postdoctoral from 2005 to 2008. He worked in the University of Melbourne, Australia from July to September 2007 as a senior visiting scholar, and his research topic there was focusing on the impacts of CO₂ enrichment on yield and quality of wheat. He has visited many countries for scientific communication related to climate change, including the Netherlands, Belgium, United Kingdom and Sweden.

Dr Xie has published four books and more than 30 papers as the first author. He presided and finished four projects, including the China Postdoctoral Science Foundation and a key project in the National Science & Technology Pillar Program (adaptive technologies research and demonstration to global change). He is a main author both for the China National Strategy Report to Adapt to Climate Change and the Second China National Assessment Report on Climate Change. He is also the Coordinate Leader Author for agriculture chapter of IPCC 5 assessment report.

Impacts of and adaptation to climate change on regional crop production

Climate change is a global issue, but the impacts of climate change have typical regional characteristics, especially in crop production. The impact of and adaptation to climate change in regional crop production is becoming one of the most urgent issues. Climate change affected crop production is very complex depending on different regions and different crops, even different crop varieties. There were both positive and negative effects on regional crop production under the circumstance of temperature increase and elevation of atmospheric CO₂ concentration. With the global population increasing, mainly in Southeast Asia, food demand (rice is a priority) will be enhanced quickly in coming years. So when we discuss climate change and its impacts on crop production, we have to discuss the regional impacts, and search for regional adaptation strategies to crop production. We suggest that we take more experiment research through international collaboration, to get to know about climate change impacts on regional crop production and obtain effective adaptation measures to climate change.

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Professor Yonghui Yang

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Prof. Yonghui Yang investigates how water systems are influenced by climate change and human activities, such as agricultural expansion and land use change in recent decades. Specially, our team carries out research from field work to computer modeling to understanding how agricultural water use is changing spatially and temporally, and how agricultural water use is influencing the regional water balance, in order to achieve a sustainable use of water resources in the Haihe Catchment, North China.

Factors influencing agricultural water supply in the North China Plain

North China Plain (NCP) is one of the most important agricultural production regions in China. Agriculture heavily relies on groundwater for irrigation. Our present studies show that agricultural water supply is strongly influenced by upper stream recharge, decrease in vertical groundwater recharge, increase of industrial and domestic water use, and future climate change. In the upper stream, expansion of agricultural water use is the most dominant factor resulting in the decrease of river water flow, as there was an abrupt decline in runoff, of which only 24% was caused by climate variation, started from the rural reform period. Also the strongest runoff decline took place in the central part of China's most famous agricultural movement. In the plain, evidence shows that agricultural water use has heavily exhausted cultivation layer, which result in decrease of vertical groundwater recharge. All those studies suggest that agricultural water supply in the long-term is not sustainable. Under future climate change, the increase of crop growing season and likely increase of evaporation change at a warmer climate can also increase future instability of water supply. To maintain sustainable use of agricultural water use, improving water use efficiency at three scales: molecular scale, field scale, and regional scale is under studying.



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Studies on Parasitic Hymenoptera

Since 1996, I started working on the parasitic wasp family Eulophidae in Prof. Da-Wei Huang's group. It is one of the most important groups of parasitoids, which includes many small-sized wasps which are parasitic on various insect pests. My major interests on this group include its systematics and biogeography. Morphological studies of this group of insects is difficult due to their small body size (1-3 mm), their tendency to collapse or shrivel, non-descript morphology and within species variation. After several years, I realized that morphological data are not adequate

to understand the phylogeny. Since 2002, I started to combine DNA data with morphological data to get a better understanding of relationships. DNA sequences have been obtained from some important biological control agents, such as *Diglyphus isaea* (Sha et al. 2006). The combined data sets have allowed the testing of interesting issues such as phylogeography, within species variation, and the detection of cryptic species.

Searching for potential biological control agents and wild pollinator bees within agro-ecosystem in the virtual taxonomy laboratory

With efforts from both sides of CAS and CSIRO, a virtual taxonomy laboratory was set up in September 2009. However, it will not be only limited to both sides. We are laying the foundation for what could be an all-Asian or even global initiatives. Virtual Taxonomic Laboratory (VTL) will accelerate taxonomic productivity via web-based activities. With world-wide websites, researchers from different real laboratories, departments, countries or regions are able to work together on diagnoses, descriptions, writing manuscripts by extracting, comparing morphological features and DNA sequences. Taxonomists can look at specimens, even the rare types materials via remote microscopy or even select ones they want to borrow for examinations.

Without understanding the biology of those insects, pesticides have caused adverse effects on the environment. When people get richer, they prefer food with better quality and more safety. Biological control agents are among major beneficial organisms that we need to study and utilize. Most crops will not produce food for us without pollinator insects. However, there are a lot more new organisms, including wasps and bees, to discover before we can mass rear them.

We will use the VTL to promote taxonomy to speed up in searching for biological control agents and pollinator insects:

Collaborative research; Real-time remote diagnostics to support bio-security and sustainable agriculture; Teaching and training; Virtual curation; The creation of a global network of taxonomic institutes working together to accelerate that taxonomic process

Publications

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