

# UK - Brazil Frontiers of Science Symposium

Itatiba, Brazil  
August 27 to 30, 2010

## Organisers



## Partners





**UK – Brazil Frontiers of Science Symposium**  
**Itatiba, Brazil**  
**August 27 to 30, 2010**

**INDEX**

1. Schedule .....	5
2. About Frontiers of Science .....	7
3. UK – Brazil Frontiers of Science .....	9
4. Organisers .....	11
5. Organising Committee .....	15
6. Research Areas .....	17
7. Program of the Symposium .....	19
8. Participant Curricula - Brazil .....	21
9. Participant Curricula - UK .....	37
10. Participant Curricula - Chile .....	53
11. Abstracts .....	57
12. Poster Abstracts .....	67
13. Brazilian Nature Mystery and Destiny - Exhibition .....	75
14. Dona Carolina Hotel Map .....	77



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## 1. SCHEDULE

Time	August 27 <sup>th</sup> - Friday	August 28 <sup>th</sup> - Saturday	August 29 <sup>th</sup> - Sunday	August 30 <sup>th</sup> - Monday
08:15		<b>Session 1</b> Biofuels: new developments, challenges and limitations	<b>Session 5</b> Brain plasticity	<b>Session 8</b> Quantum entanglement
10:15		Brazilian Nature exhibition Coffee break	Poster Session Coffee break	Poster Session Coffee break
10:30		<b>Session 2</b> Mathematical modelling of populations and disease	<b>Session 6</b> Deep earth system	<b>Session 9</b> Plant development and climate change
12:30		Lunch	Lunch	Symposium Closing and Lunch
14:00			Visit to "Pedra Grande"	
14:30		<b>Session 3</b> Regulation of energy metabolism		
16:30		Brazilian Nature exhibition Coffee break		
17:00		<b>Session 4</b> Planet formation and evolution		
17:30			<b>Session 7</b> Science journalism and public perception on science	
18:00	"Botequim" Cocktail			
19:00		1 <sup>st</sup> day - closing	2 <sup>nd</sup> day - closing	
20:00	Dinner	Dinner	Dinner	



## 2. ABOUT FRONTIERS OF SCIENCE

- The Frontiers of Science programme is a prestigious series of international meetings for outstanding early career scientists, initiated by the US National Academy of Sciences in 1989, and which has since been adopted by the Royal Society and a number of other prestigious national science academies and organisations worldwide, including the Alexander von Humboldt Foundation, the Chinese Academy of Sciences and the Japanese Society for the Promotion of Science.

These multidisciplinary meetings aim to bring together future leaders in science to discuss the latest advances in their fields, and to learn about cutting edge research in other disciplines in a format that is designed to encourage informal networking and discussion, and to explore opportunities for collaboration.

The Society has co-organised 8 of these meetings since 2004 as follows:

Date	Meeting	Venue
20-22 June 2004	UK-US Frontiers of Science	Hinxton Hall, Cambridge, UK
30 March - 1 April 2006	UK-Germany Frontiers of Science	Robinson Centre, Wyboston, UK
21-23 February 2007	UK-V4* Frontiers of Science	Manggha Conference Centre, Krakow, Poland
16-18 January 2008	UK-Hong Kong Frontiers of Science	Hong Kong University of Science and Technology, Hong Kong
4-7 March 2008	UK-India Frontiers of Science	Hotel Sitara, Hyderabad, India
13-16 May 2008	UK-Germany Frontiers of Science 2	Steinberger Hotel Sanssouci, Postdam, Germany
4-6 October 2008	UK-Japan Frontiers of Science	Shonan Village Centre, Kanagawa, Japan
8-11 November 2009	UK-China-Netherlands Frontiers of Science	Fragrant Hill Empark Hotel, Beijing

\* V4 is the Visegrád group of countries (Poland, Czech Republic, Slovakia and Hungary).





### 3. ABOUT UK – BRAZIL FOS

The UK-Brazil Frontiers of Science symposium is one of the major international events of the Royal Society's 350th anniversary year. The symposium is being organised by the Royal Society, FAPESP (*Fundação de Amparo à Pesquisa do Estado de São Paulo* - The São Paulo Research Foundation), and *Academia Brasileira de Ciências* (Brazilian Academy of Sciences), and will take place from Friday 27 to Monday 30 August 2010 at the Hotel da Fazenda Dona Carolina, Itatiba (near the city of Campinas) in São Paulo State, Brazil. We are also grateful to the British Council, the UK Department of Business, Innovation and Skills (BIS) and the British Consulate in São Paulo for their support.

The Frontiers of Science programme is a prestigious series of international meetings for outstanding early career scientists, initiated by the US National Academy of Sciences in 1989, and which has since been adopted by a number of national academies and scientific organisations around the world. Frontiers of Science meetings are designed to bring together future leaders in science in all disciplines in an environment which encourages informal networking and discussion, and to explore opportunities for international and cross-disciplinary collaboration. Participants are encouraged to think about the 'big questions' at the frontiers of their field and those of others, and to identify new and emerging scientific challenges on the horizon of current knowledge.

76 outstanding early career scientists (with up to 20 years postdoctoral experience) will participate: 33 from the UK, 35 from Brazil and 8 from Chile, nominated by our Chilean partner, the *Academia Chilena de Ciencias* (the Chilean Academy of Sciences). These scientists will introduce a wide range of sessions on cutting edge research in their fields, designed to inform, inspire and capture the imaginations of their counterparts in other countries and disciplines; to forge new links; and to stimulate debate on some of the key issues in international scientific research in 2010.

The event will be broadcast online, and a DVD will be produced, with a view to fostering long-term cooperation across national boundaries after the conference.

Through the generous support of the British Council, some of the UK participants will also take part in a wide range of outreach activities including public lectures and visits to schools, laboratories and universities in Brazil.



## 4. ORGANISERS



### About the Society

The Royal Society is a Fellowship of the world's most distinguished scientists, which promotes the advancement of science and its use for the benefit of humanity and the good of the planet.

The Royal Society has had a hand in some of the most innovative and life changing discoveries in scientific history. It supports the UK's brightest and best young scientists, engineers and technologists, influences science policy, debates scientific issues with the public and much more.

Founded in 1660, the Society has three roles: as the UK academy of science promoting the natural and applied sciences, as a learned society, and as a funding agency.

Our five strategic priorities ensure our contribution to shaping the future of science in the UK and beyond has a deep and enduring impact. To do this we:

- Invest in future scientific leaders and in innovation
- Influence policymaking with the best scientific advice
- Invigorate science and mathematics education
- Increase access to the best science internationally
- Inspire an interest in the joy, wonder and excitement of scientific discovery

#### **The Royal Society: past and present**

As the world's oldest science academy, the Royal Society is celebrating its 350th anniversary in 2010. To raise the global profile of science, technology and engineering and to increase the public's involvement in science, our anniversary celebrations promote the scientific ideas, questions and issues of the 21st century among new audiences.

Since its foundation, the Society has played its part in some of the most significant scientific breakthroughs and discoveries. At 350 years old, it is as relevant as ever in its drive to champion the development and use of science, mathematics, engineering and medicine for the benefit of humanity and the good of the planet.

Our Fellows, who are elected for life from across the Commonwealth on the basis of excellence, have helped create the modern world. The Society has included some of the greatest thinkers and scientists of our times. Newton, Hooke, Faraday, Maxwell, Darwin, Hodgkin, the discovery of the electron, splitting the atom, the computer, and the double helix, all figure large in the annals of the Royal Society.

Our focus is on the science of the future - finding new solutions to the world's energy and food needs, addressing the threats of climate change and making the world a safer place. We look forward to what science can do for everyone's welfare and to future breakthroughs that will enrich science and society.



## The São Paulo Research Foundation, FAPESP

FAPESP is a public foundation, funded by the taxpayer in the State of São Paulo, with the mission to support research projects in higher education and research institutions, in all fields of knowledge. São Paulo has a population of forty million and generates 35% of Brazil's GNP. The constitution of the State establishes that 1% of all state taxes belong to the foundation and the government transfers these funds monthly. The stability of the funding and the autonomy of the foundation allow for an efficient management of the resources that has had a sizable impact: while São Paulo has 22% of the Brazilian population and 30% of the scientists with a doctorate in the country, the state responds for 52% of the country's scientific articles published in international journals.

The foundation works in close contact with the scientific community: all proposals are peer reviewed with the help of area panels composed of active researchers. Many times scientists in São Paulo bring proposals for programs to the Foundation, and these are carefully analyzed and, if deemed strong in academic terms, are shaped by the foundation into research programs that might congregate a set of research projects. Since the mandate of the foundation is to foster research and the scientific and technological development in the State, ideas for programs that match world class research with contributions that will impact social problems are welcome. The foundation supports large research programs in Biodiversity and in Information Technology. In 2008 the foundation announced broad research initiatives on Bioenergy and on Global Climate Change.

FAPESP invested R\$ 660 million (approximately US\$ 340 million) in research projects in 2009. One third of this value goes into fellowships for graduate and undergraduate students. About 55% goes into exploratory academic research, mostly fundamental in nature. The remaining 10% is invested into application oriented research, in many cases performed in Small Businesses or in joint research performed by academia and industry. The percentage invested in applied research has been growing in recent years, consistently with the foundation's mandate to foster the scientific and technological development in the State of São Paulo.

FAPESP maintains cooperation agreements with national and international research funding agencies, higher educational and research institutions and business enterprises. The international cooperation covered a wide range of countries. In the United Kingdom, the Foundation maintains, among others, important deals of scientific cooperation with the British Council, the UK Research Councils and the King's College London.



## Brazilian Academy of Sciences

The Brazilian Academy of Sciences, which in its first five years was named Brazilian Society of Sciences, was formally founded in May 3<sup>rd</sup>, 1916, in Rio de Janeiro, then the capital of the Brazilian Republic. It had its origin in informal gatherings at the School of Engineering of a group of professors from faculties of learned professions and specialists from other scientific institutions such as the National Museum, the National Observatory and the Oswaldo Cruz Foundation, then called Institute of Experimental Medicine of Manguinhos.

The new Society, modeled on the French Academy of Sciences, comprised three sections: Mathematics, Physico-Chemical Sciences and Biological Sciences. The main objectives of the Society were to encourage its members to pursue scientific research and to diffuse the notion of science as a factor of promotion of prosperity and development of the country. Although support and aid from the government was expected, the Academy was structured as a private, legally independent organization, appointing its own administrative officers and drawing up its own rules.

The Brazilian Academy of Sciences (ABC) is focused in promoting high scientific standards and the advancement of science and technology in Brazil, encouraging efforts to diffuse education at all levels and contributing for the social well being of the people. Its supra-institutional character and the diversity of its members are fundamental aspects of ABC. The credentials of its members assure their authority in this most important mission in our future, to brainstorm and propose solutions for scientific questions and socioeconomic issues, which require a multidisciplinary approach. It is a private, non-profit making organization of public interest, acting both as an honorific scientific society and an advisor to the government, when requested, on policy and technical issues.

Additionally to the advisory given to the government in policy and technical matters, the ABC promotes a wide range of activities. These include coordinating multidisciplinary programs, holding meetings and lectures for specialized and general audiences, publishing the results of research, rewarding outstanding performers in various fields, maintaining international relations, promoting the education and public understanding of scientific issues, funding individual researchers in special programs, maintaining a library, and developing other specific programs.

The Academy has 441 Full Members classified according to their areas of activity in the following Sections: Mathematical Sciences, Physical Sciences, Chemical Sciences, Earth Sciences, Biological Sciences, Biomedical Sciences, Health Sciences. Agrarian Sciences, Engineering Sciences and Social Sciences.

The BAS is affiliated to various International Scientific Bodies and supports various international scientific activities. Besides being the national representative at the International Council for Science (ICSU), at the InterAcademy Panel (IAP) and member of at th InterAcademy Council (IAC), the ABC houses the national offices of ICSU and TWAS.

The Brazilian Academy of Sciences has traditionally been engaged in international exchanges aimed at promoting cooperation between Brazilian scientists and the international community. Agreements were implemented with the Japan Society for the Promotion of Sciences for the last ten years and, more recently, with the French Academy of Sciences, the Royal Society of London, the Academy of Sciences of the Czech Republic, the National Academy of Sciences of India and the Korean Academy of Science and Technology. Through these agreements, the Academy receives around ten senior scientists of these countries per year and sends abroad approximately the same number of national researchers for study visits and to develop joint projects.

The Academy is structured as a private, legally independent organization, appointing its own administrative officers and drawing up its own rules.

The supra-institutional character of the Academy and the diversity of its members -whose credentials impose and assure a very high level of authority in a multidisciplinary task. Such authority is an important asset

when acting in an advisory role to the Brazilian government in policy and technical matters, as well as to various other National and International scientific bodies.

The Academy is actively engaged in a wide range of scientific activities, such at the National level.

## 5. ORGANISING COMMITTEE

- Co-Chairs:** Marcelo Knobel, Gleb Wataghin Physics Institute, of the University of Campinas (UNICAMP)  
Richard Kirby, School of Marine Science and Engineering, University of Plymouth
- Astronomy:** Dalia Chakrabarty, Department of Statistics, University of Warwick  
Silvia Helena Paixão Alencar, Department of Physics, Federal University of Minas Gerais (UFMG)
- Chemistry:** Saif Haque, Department of Chemistry, Imperial College London  
Alicia Kowaltowski, Chemistry Institute, University of São Paulo (USP)
- Geosciences:** Richard Kirby, School of Marine Science and Engineering, University of Plymouth  
Ricardo Trindade, Institute of Astronomy, Geophysics and Atmospheric Science, University of São Paulo (USP)
- Macrobiology:** Kerry Franklin, School of Biological Sciences, University of Bristol  
Mariana Cabral de Oliveira, Bioscience Institute, University of São Paulo (USP)
- Mathematics:** Jonathan Dawes, Department of Mathematical Sciences, University of Bath  
Henrique Bursztyn, National Institute for Pure and Applied Mathematics (IMPA)
- Microbiology:** Araxi Urrutia, Department of Biology and Biochemistry, University of Bath  
Anamaria Aranha Camargo, Ludwig Institute for Cancer Research – São Paulo
- Neuroscience:** Holly Bridge, Department of Clinical Neurology, University of Oxford  
Fernando Cendes, School of Medical Sciences, University of Campinas (UNICAMP)
- Physics:** Peter Vukusic, School of Physics, University of Exeter  
Marcelo Knobel, Gleb Wataghin Physics Institute, University of Campinas (UNICAMP)





## 6. RESEARCH AREAS

The conference will feature 9 sessions as follows, with the members of the organising committee who devised them:




























- **Biofuels: new developments, challenges and limitations:**  
Araxi Urrutia, Department of Biology and Biochemistry, University of Bath  
Anamaria Aranha Camargo, Ludwig Institute for Cancer Research – São Paulo
- **Brain plasticity:**  
Holly Bridge, Department of Clinical Neurology, University of Oxford  
Fernando Cendes, School of Medical Sciences, University of Campinas (UNICAMP)
- **Deep earth system:**  
Richard Kirby, School of Marine Science and Engineering, University of Plymouth  
Ricardo Trindade, Institute of Astronomy, Geophysics and Atmospheric Science, University of São Paulo (USP)
- **Mathematical modelling of populations and disease:**  
Jonathan Dawes, Department of Mathematical Sciences, University of Bath  
Henrique Bursztyn, National Institute for Pure and Applied Mathematics (IMPA)
- **Planet formation and evolution:**  
Dalia Chakrabarty, Department of Statistics, University of Warwick  
Sílvia Helena Paixão Alencar, Department of Physics, Federal University of Minas Gerais (UFMG)
- **Plant development and climate change:**  
Kerry Franklin, School of Biological Sciences, University of Bristol  
Mariana Cabral de Oliveira, Bioscience Institute, University of São Paulo (USP)
- **Quantum entanglement:**  
Peter Vukusic, School of Physics, University of Exeter  
Marcelo Knobel, Gleb Wataghin Physics Institute, University of Campinas (UNICAMP)
- **Regulation of energy metabolism:**  
Saif Haque, Department of Chemistry, Imperial College London  
Alicia Kowaltowski, Chemistry Institute, University of São Paulo (USP)
- **Science journalism and public perception on science:**  
Marcelo Knobel, Gleb Wataghin Physics Institute, University of Campinas (UNICAMP)  
Richard Kirby, School of Marine Science and Engineering, University of Plymouth

It is hoped that this meeting, by challenging future leaders in science to discuss the big questions at the frontiers of their fields and others, will stimulate participants to consider new directions in their research and help build new links between scientists from both nations, which may lead to international and cross-disciplinary collaborations.



## 7. PROGRAM OF THE SYMPOSIUM

### UK-Brazil Frontiers of Science – Nominated speakers and participants

Session	Speakers
Biofuels: new developments, challenges and limitations	<ul style="list-style-type: none"> <li>• Joaquim Eugênio Abel Seabra, Brazilian Bioetanol Science and Technology Laboratory (CTBE) </li> <li>• Chris Greenwell, Durham University </li> <li>• Glauca Mendes Souza, University of São Paulo (USP) </li> </ul>
Brain plasticity	<ul style="list-style-type: none"> <li>• Jacinta O'Shea, University of Oxford </li> <li>• Martin Cammarota, Pontifical Catholic University of Rio Grande do Sul - PUCRS </li> <li>• Edson Amaro Junior, University of São Paulo (USP) </li> </ul>
Deep earth system	<ul style="list-style-type: none"> <li>• Carolina Lithgow-Bertelloni, University College London </li> <li>• Rommulo Conceição, Federal University of Rio Grande do Sul (UFRGS) </li> <li>• Richard Holme, University of Liverpool </li> </ul>
The mathematical modelling of populations and disease	<ul style="list-style-type: none"> <li>• Claudio Struchiner, Brazilian School of Public Health - FIOCRUZ </li> <li>• Vincent Jansen, University of London </li> <li>• Ivana Gudelj, Imperial College London </li> </ul>
Planet formation and evolution	<ul style="list-style-type: none"> <li>• Jane Greaves, University of St Andrews </li> <li>• Douglas Galante, University of São Paulo (USP) </li> <li>• Ken Rice, University of Edinburgh </li> </ul>
Plant development and climate change	<ul style="list-style-type: none"> <li>• Anthony Hall, University of Liverpool </li> <li>• Carlos Alberto Martinez Y Huaman, University of São Paulo (USP) </li> <li>• Philip Wigge, John Innes Centre </li> </ul>
Quantum entanglement	<ul style="list-style-type: none"> <li>• Paulo Nussenzveig, University of São Paulo (USP) </li> <li>• Daniel Felinto, Federal University of Pernambuco (UFPE) </li> <li>• Libby Heaney, University of Oxford </li> </ul>
Regulation of energy metabolism	<ul style="list-style-type: none"> <li>• Nadja Cristina Souza-Pinto, University of São Paulo (USP) </li> <li>• Andrew J. Murray, University of Cambridge </li> <li>• Licio Augusto Velloso, University of Campinas (UNICAMP) </li> </ul>
Science journalism and public perception of science	<ul style="list-style-type: none"> <li>• Yuriy Castelfranchi, Federal University of Minas Gerais (UFMG) </li> <li>• Mariluce Moura, Pesquisa FAPESP Magazine </li> <li>• Tim Hirsch, Journalist </li> </ul>



## 8. PARTICIPANT CURRICULA - BRAZIL



### **Adriana Silva Hemerly**

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Professor Adriana S. Hemerly has a degree in Genetics awarded by the Federal University of Rio de Janeiro (UFRJ, 1987), a PhD in Biotechnology from Rijksuniversiteit Gent, Belgium (1989-1994), and a post-doctorate degree in Molecular and Cell Biology from Cold Spring Harbor Laboratory, NY, USA (2005-2007). At present, she is an associate professor at the Medical Biochemistry Institute of UFRJ. She has experience in Vegetal Molecular Genetics and is the coordinator of a research project concerned with regulatory networks to control cell divisions during vegetal development.

### **Alicia Juliana Kowaltowski**

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Alicia Kowaltowski has a degree in Medicine from University of Campinas (1997) and holds a PhD in Medical Sciences from the same university (1999). She is currently an associate professor at the Department of Biochemistry at the University of São Paulo. She has experience in Bioenergetics, Transport and Mitochondrial Redox State.



### **Anamaria Aranha Camargo**

Main Researcher for the Laboratory of Molecular Biology and Genomics from Ludwig Institute for Cancer Research in São Paulo

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Anamaria Camargo is a Bachelor in Biological Sciences and holds a PhD in Sciences from University of São Paulo. She has a post-doctoral degree from the Ludwig Institute for Cancer Research in São Paulo and has worked as a Main Researcher for the Laboratory of Molecular Biology and Genomics in the same institution since 2002. Her action in research involves featuring genetic and epigenetic changes in human tumors aiming at the application of such knowledge for the development of more sensitive as well as specific diagnoses, in addition to alternative, more effective alternatives for the disease. She received the Scientific and Technological Honor Award from the State of São Paulo and the Young Scientist Award in the area of Genetics offered by the Moinho Santista/Bunge Foundation.

### **Antonio José Roque da Silva**

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Antônio José Roque da Silva completed his bachelor's (1986) and master's degree (1989) in Physics at UNICAMP, and his PhD in Physics at University of California at Berkeley in 1994. He is now a full professor of University of São Paulo. He published over 90 papers in periodicals and is the co-author of over 180 works presented in both national and international events. He has over 1,600 quotations and an  $h=22$  parameter. He published three book chapters and a book of his own. He supervised two post-doctorates, four master's degree dissertations, three doctorate theses and co-supervised two other master's degree dissertations plus four doctorate theses. In addition, he was in charge of four undergraduate scientific research mentorships. At present, he supervises one post-doctorate, five doctorates, two master's programs and one undergraduate scientific research mentorship. His scope of action is Physics, with emphasis on Condensed Matter Physics and Atomic and Molecular Physics. He has a particular interest in computer simulation, electronic structure calculation and electronic transport properties, with a focus on nanostructures.



### **Antonio Lucio Teixeira Junior**

Associate Professor

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Professor Antonio Lucio Teixeira is a neurologist and psychiatrist who works with experimental models and human diseases which evolve through the inflammation of the central nervous system, investigating their associated behavioral changes as well.

**Carlos Alberto Martinez Y Huaman**

Professor

Ribeirão Preto School of Philosophy, Sciences and Literature

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Professor Martinez y Huaman is a specialist in Vegetal Physiology who develops research in Photosynthesis and Productivity of Tropical Fruit. His main projects are concerned with responses given by plants to abiotic stress as well as to the increase of CO<sub>2</sub> in the atmosphere. His research with abiotic stress is aimed at the physiological and biochemical characterization of genetic variation and the strategies used by plants to resist against luminous, hydric, oxidative, salt, and thermal stress. His research about the biological impact on environmental global change is aimed at explaining the effects caused by the increase of CO<sub>2</sub> and temperature in plants that grow in forests under optimal environmental and abiotic stress conditions.

**Carlos Henrique de Brito Cruz**

State of São Paulo Research Foundation (FAPESP)

Scientific Director, Email: brito@fapesp.br



An Electronic Engineering graduate of ITA Instituto Tecnológico da Aeronáutica (Aeronautics Institute), class of 1978, he concluded his Master's degree in 1980 and his PHD in 1983 at the Gleb Wataghin Institute of the University of Campinas (UNICAMP). During 1981, he was a researcher at the Quantum Optics Laboratory of the Italy-Latin American Institute of Università Degli Studi in Rome. In 1982, he was appointed associate professor at the Physics Institute at UNICAMP. He has worked as a resident Visitor at AT&T Bell Laboratories in Holmdel, N.J. (1986-87), and he was a visiting scientist for three months at AT&T Bell Laboratories, Murray Hill, NJ (1990). His research interests are ultra-fast lasers and ultra-short pulses, with emphasis on the study of electronic processes on a femtosecond timescale in optically nonlinear materials, centered on application in optical communications. From 1991 to 1994, and from 1998 to 2002, he was the Director of the Gleb Wataghin Physics Institute at UNICAMP. From 1994 to 1998, he was Dean of Research at this University. He has been Vice-President of the Brazilian Physics Society and a member of the International Advisory Committee of the Optical Society of America. In 2000, he became a member of the Brazilian Academy of Sciences. He was FAPESP's President from 1996 to 2002 and Rector of UNICAMP from April 2002 to April 2005. Currently, he is the President of Technology and Competitiveness of FIESP, the São Paulo State Federation of Industries. Since April 2005, he has been the Scientific Director at FAPESP.

**Carolina Andrea Chavero**

Post-Doctorate

Department of Astronomy

Brazilian National Observatory

Field of expertise: Stellar Astronomy

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Carolina Chavero holds a degree in Astronomy from the National University of Córdoba (Argentina, 2005), and a PhD in Astronomy by the Brazilian National Observatory (Brazil, 2009). She is currently studying for her post-doctorate in the National Observatory. She has experience in Astronomy, with emphasis on Stellar Astrophysics, acting mainly with the following topics: Photometry IV, circumstellar disc evolution, chemical abundance of stars with extrasolar planets.



### **Claudio Jose Struchiner**

Full Professor

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Dr. Claudio José Struchiner, M.D. MSc ScD), Professor of Epidemiology and Statistics at the Brazilian School of Public Health, Oswaldo Cruz Foundation and Scientific Coordinator of the Program for Scientific Computing (PROCC/FIOCRUZ).

Dr. Struchiner's research interests are on the development of epidemiological, statistical, mathematical and computational methods applied to the evaluation and surveillance of Public Health interventions. His contributions include papers on several aspects of the epidemiology of the Brazilian AIDS epidemics and on the methodological aspects of the evaluation of health intervention programs, in particular, on estimating the efficacy of new vaccines. Dr. Struchiner is a senior scientist of the Brazilian Research Council.

### **Daniel Felinto Pires Barbosa**

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Professor Daniel Felinto is a doctor in Physics from UFPE (Brazil), with post-doctorates from USP (Brazil) and Caltech (EUA). He works in the fields of experimental optics and atomic physics, with applications in quantum information, coherent control of atomic systems, and metrology of optical frequencies. Since the end of 2006, he is a professor at UFPE, where he is currently setting up a laboratory focused in the development of quantum networks with atomic systems. Presently, he is also a researcher level 2 of CNPq and an affiliated member (period 2007-2011) of the Academia Brasileira de Ciências (Brazilian Academy of Sciences).



### **Daniela Zanchet**

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Daniela Zanchet holds a degree in Chemical Engineering from the Federal University of Paraná, a master's degree and a PhD in Physics from the University of Campinas, and a post-doctorate from the University of California at Berkeley. She was a researcher at the Brazilian Association of Synchrotron Light Technology from 1999-2010. At present, she is a professor at the Chemistry Institute of the University of Campinas. The actual focus of her research is the development and study of heterogeneous catalyzers along with the research in model systems and advanced characterization, including work developed in partnerships with industries. She has experience in nanomaterials, structural properties, characterization through synchrotron light techniques and microscopy, and the development of instrumentation for in situ studies about catalyzers.



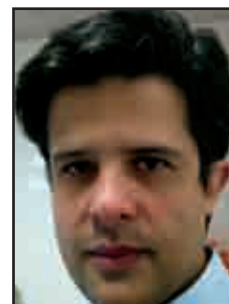
**Douglas Galante**

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The research developed by Dr. Douglas Galante has focused on understanding the effects of radiation, either photons or particles, in planetary chemistry and biology. This work has been developed on a theoretical basis and on an experimental basis whenever possible. This interaction plays a prominent role for Astrobiology for radiation was probably the original source of energy for the formation of prebiotic molecules, and it continued in action during the history of life, changing planet chemistry and interfering directly with life and evolution, leading to extinction events, increasing mutation rates, and acting through selective pressure.

**Edson Amaro Junior**

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Dr. Edson Amaro Jr is Associate Professor at University of São Paulo Medical School (FMUSP). Since 1994 has been involved in functional Magnetic Resonance Imaging (fMRI) of the Brain. He developed a new method to deal with acoustic noise using event-related fMRI during his PhD thesis. During his post-doctorate he spent 2 year as a Wellcome Trust Fellow at the Institute of Psychiatry - King's College - London. Today he is the Research Leader at the Neuroimaging Group at FMUSP, and Director of the Brain Institute at Albert Einstein Hospital, in São Paulo. His main interest is clinical fMRI and age-related brain modifications.

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Fabio Marcio Squina holds a degree in Pharmacy/Biochemistry from the University of São Paulo (1998), a Master's in Food Science from the University of Campinas (2001), and a PhD in Molecular and Cell Biology from the University of São Paulo (2005). He also has a post-doctorate from the Department of Biochemistry at the School of Medical Sciences of Ribeirão Preto, and in Biochemistry from the Department of Microbiology and Molecular Genetics from Oklahoma State University (OSU, USA). Nowadays, he is a researcher for the Brazilian Bioethanol Science and Technology Laboratory (CTBE).

His scientific interests include (1) Research through metagenomic and metaproteomic genomics of genes that codify enzymes involved in biomass conversion, (2) Establishment of analytical methodologies for the characterization of enzyme activity. (3) Development of heterologous systems of genic expression in mould and (4) Regulation of genic expression in mould.



### **Fernando Cendes**

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Professor Fernando Cendes is a neurologist with a specialization degree in clinical neurophysiology and epileptology from the Montreal Neurological Institute and Hospital (Canada), and holds a PhD in neurosciences from McGill University, Department of Neurology and Neurosurgery (1993-1997). He is a full professor at the Neurology Department of University of Campinas (Unicamp), and the coordinator of the Graduate Subcommittee for the Medical Physiopathology course (Medical School of Unicamp). His main research area is neuroimaging and epilepsy.

### **Glaucia Mendes Souza**

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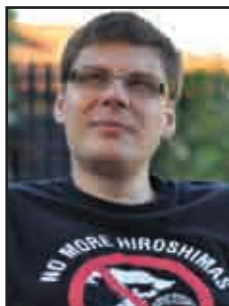
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Dr. Glaucia Souza is the coordinator of several initiatives in sugarcane genomics in Brazil and the Coordinator of FAPESP Bioenergy Research Program BIOEN. In 2000 she joined the SUCEST Project to sequence sugarcane ESTs. Within a network of over 200 researchers, the largest sugarcane EST collection was developed and annotated. In 2003 she became the SUCEST Project coordinator and started the SUCEST-FUN Project, a functional genomics initiative to identify genes associated to agronomic traits of interest. Among the SUCEST-FUN activities her group focused on the Transcriptome analysis and the generation of sugarcane transgenic plants. Genes were identified that are associated to sucrose content, biomass, drought tolerance, phosphate deficiency, herbivory, endophytic bacteria interaction, high CO<sub>2</sub>, sugars and hormones. In 2007 the SUCEST-FUN initiative progressed to the creation of a network of researchers working with the main sugarcane breeding programs in Brazil. The group aims to use biotechnological tools to increase sucrose content, alter fiber quality and quantity, develop drought and herbivory resistant cultivars, sequence the sugarcane genome and implement map-assisted breeding tools. Her interest in signaling and gene expression extends to comparative studies of regulatory networks in several grasses. Dr. Souza is developing the SUCEST-FUN database and collaborates with the GRASSIUS Initiative to study regulatory networks in maize, sugarcane, sorghum and rice. Since 2003 she develops work with the private sector to develop innovative research on sugarcane carbohydrate metabolism and stress responses. In 2008 Dr. Souza was appointed Coordinator of FAPESP Bioenergy Program (BIOEN). She is a member of the International Society of Cane Technologists Committee and serves the broader scientific community by contributing as ad hoc reviewer for FAPESP, CNPq and Embrapa and serving as Associate Editor for International Journal of Plant Genomics, Global Change Biology Bioenergy and Tropical Plant Biology. She has consistently participated in undergraduate and graduate research training in Biochemistry, Molecular Biology and Bioinformatics. She also supervises students in the recently created University of São Paulo Tripartite International Graduate Program on Plant Biology in collaboration with Ohio-State and Rutgers University.



### Guilherme Mallmann

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Dr Mallmann has a PhD from the Australian National University in experimental petrology and geochemistry. His research makes use of experimental tools to simulate the high temperature and pressure conditions of planetary interiors in order to understand fundamental petrological and geochemical processes, such as core-mantle differentiation, mantle melting and magma genesis.

### Hamilton Varela

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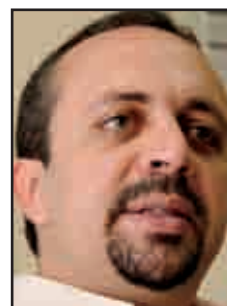
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Hamilton Varela (1973) graduated in Chemical Engineering at Universidade Federal do Rio Grande do Norte, Natal, in 1997, and obtained his Master in Physical Chemistry at the University of São Paulo (IQSC), São Carlos, in 2000. From 2000 to 2003 he did his PhD (magna cum laude) at the Physical Chemistry Department (headed by Prof. G. Ertl, Nobel Laureate in Chemistry, 2007) – Fritz Haber Institut der Max Planck Gesellschaft, Berlin. After spending eight months as a postdoctoral Max Planck Fellow at the Physics Department of the Technical University Munich, he returned to Brazil, first as a Group Leader, and since 2007 as an Assistant Professor at the Physical Chemistry Department, at IQSC/USP. He is currently interested in complex behaviour in physical-chemical systems, including dynamic self-organization and multidisciplinary approaches. Dr. Varela has published more than 45 articles in peer-reviewed journals and delivered about 50 oral presentations and invited lectures. He is Member of The Royal Society of Chemistry (UK), Member of the ERTL Center for Electrochemistry and Catalysis (South Korea), and Affiliated Member of the Brazilian Academy of Sciences.



### Henrique Bursztyn

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Henrique Bursztyn was granted his PhD in Mathematics in 2001 from University of California at Berkeley. At present, he is an associate professor at the Brazilian Institute of Pure and Applied Mathematics (IMPA). His research is focused on symplectic geometry and connections with mathematical physics.



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Professor Joaquim Seabra is a food engineer with a degree from the University of Campinas (Unicamp), where he also obtained his doctoral degree in Planning of Energetic Systems. His post-doctorate in Biorefinery Analysis was granted from the National Renewable Energy Laboratory (NREL, USA). His research experience and interests involve energetic planning, bioenergy and biorefinery, energetic systems sustainability, energy balance, and emission of greenhouse effect gases. He acted as a consultant for both private and public entities in the evaluation of bioenergetic systems, especially regarding the emission of greenhouse effect gases in the life cycle of sugarcane ethanol. Nowadays, he is a researcher for the Brazilian Bioethanol Science and Technology Laboratory (CTBE).

### José Antônio Brum

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José Antonio Brum holds a Bachelor's and a Master's Degree in Physics from the University of Campinas, a State Doctoral Degree (Doctorat d'Etat) from The Superior Normal School (ENS) of Paris, France, post-doctorate from IBM-Yorktown Heights and from the Walter Schottky Institute – University of Technology of Munich (TUM), Germany. He has been a professor at the Gleb Wataghin Institute of Physics (Unicamp) since 1987. From 2001-2009 he was the General Director of the Brazilian Association of Synchrotron Light Technology. His research is currently focused on the theoretical study of both electronic and optical properties of heterostructures of semiconductors and nanostructures.



### Katia Jasbinschek dos Reis Pinheiro

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Katia Pinheiro is a geophysical researcher in the National Observatory (Rio de Janeiro). Her research focuses on the time variation of Earth's magnetic field on timescales of few years to hundred of years.

Data analysis of magnetic observatory data is one of the topics of her research. She is most interested on the modeling of the mantle electrical conductivity by using rapid variations of the internal magnetic field, called geomagnetic jerks.

**Licio Augusto Velloso**

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Professor Lício A. Velloso holds a degree in Medicine from University of Campinas (Unicamp, 1986), a PhD from Uppsala University in Sweden, and a post-doctorate from Unicamp and Harvard. He acts in the characterization of molecular and cellular mechanisms concerned with the genesis of obesity and diabetes. His most important scientific contributions refer to demonstrating that a diet that is very high in saturated fat triggers an inflammatory process in the hypothalamus, a region of the central nervous system responsible for hunger control. Once inflamed, the hypothalamus loses its capacity to regulate hunger appropriately, which contributes to the onset of obesity.

**Luciane Carla Alberici**

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Prof. Luciane C. Alberici has degrees in Physical Education (1998), Master (2003) and Ph.D. (2006) in Medical Sciences at the University of Campinas. She is currently a PhD professor in the Department of Physics and Chemistry, Faculty of Pharmaceutical Sciences of Ribeirão Preto – USP. She studies the systems of mitochondrial energy dissipation and oxidative stress, and the involvement of mitochondria in diseases such as dyslipidemia, diabetes, obesity and cancer.




**Marcelo Knobel (co-chair)**

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Marcelo Knobel is a Full Professor of the Instituto de Física “Gleb Wataghin” (Gleb Wataghin Physics Institute), of the Universidade Estadual de Campinas (University of Campinas, UNICAMP). He has a PhD in Physics from UNICAMP, and post-doctorate stages at “Istituto Elettrotecnico Nazionale Galileo Ferraris”, Turin, Italy, and “Instituto de Magnetismo Aplicado”, Madrid, Spain. Since 1999 he leads the Laboratório de Materiais e Baixas Temperaturas (Materials and Low Temperatures Laboratory), from 2002 to 2006 he coordinated de Núcleo de Desenvolvimento da Criatividade (Creativity Development Center, NUDECRI), of UNICAMP and from 2006 to 2008 he was the Executive Director of the Campinas Science Museum, also at UNICAMP. He is the coordinator of the project NanoAventura (NanoAdventure), <http://www.mc.unicamp.br/nanoaventura>. He is nowadays the Dean for Undergraduate Programs at UNICAMP. Knobel has published more than 200 articles in refereed journals, mainly in the field of magnetism and magnetic materials. He works with soft magnetic materials, nanocrystalline materials and giant magnetotransport phenomena. Knobel has systematically published articles and chronicles on Science in popular magazines and newspapers, he has presented a number of introductory talks on several topics of Science to students and teachers of different levels, and also teaches a course on Scientific Literacy in the Specialization Course on Science Journalism, at UNICAMP. Dr. Knobel has presented 75 invited seminars in several institutions, and 40 invited lectures in international conferences, and he has been enthusiastically promoting the popularization of science and technology in Brazil.

**Mariana Cabral de Oliveira**

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Mariana Cabral de Oliveira is an associate professor at the University of São Paulo. She specializes in seaweed, and has experience in molecular biology and genomics, acting on the following topics: molecular phylogeny and taxonomy of algae, genomics of algae and bacteria, and studies in red algae (Rhodophyta). She is interested in the origin and evolution of red algae and how this group is phylogenetically related to other eukaryotes, in addition to the origin and evolution of chloroplasts and mitochondria in different groups of algae.

**Mariluce Moura**

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Mariluce Moura is a journalist and has worked with science journalism since 1988, after almost 20 years dedicated to economic journalism. A graduate of the Federal University of Bahia, she got a PhD in science communication at Federal University of Rio de Janeiro in 2006.

Mariluce worked for some of the major Brazilian magazines and daily newspapers over the past four decades and has been deeply involved in thinking of new ways to improve and deepen science communication.

She created and heads Pesquisa FAPESP, a leading science magazine published by the São Paulo Research Foundation and was responsible for setting up FAPESP's communication department in 1995. She also is the creator and anchor of Pesquisa Brasil, a weekly radio show broadcasted by Eldorado radio station.

**Martin Pablo Cammarota**

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Professor Cammarota has researched Memory Biochemistry since 1993. So far, he has published 101 papers about the theme in international periodicals with editorial board, which have been quoted 2,015 times according to the SCOPUS system. His h index is 26. Among his production, some outstanding papers were published in important magazines such as Science, Physiological Reviews, Neuron, TiNs, PNAS, Biological Psychiatry, The Journal of Neuroscience, and The Neuroscientist, in addition to other highly recognized periodicals concerned with neurochemistry and neuroplasticity, such as Hippocampus, Journal of Neurochemistry, and Learning & Memory. Directly related to the themes he approaches in his lecture, he coordinated experiments that demonstrated that the expression affects the storage of mnemonic trace and that the reestablishment process that allows the endurance of reactivated memories is not universal. He also supervised works demonstrating the molecular requirements of the reintroduction of conditioned fear memory after its extinction. He also described the effect of evocation in spatial memory persistence, of object recognition and conditioned fear extinction. The following are his most important scientific deeds: 1) The discovery of a functional connection involving the hippocampus and the VTA that controls memory persistence; 2) The discovery of CREB/ATF family members of transition factors in synaptic mitochondria and their role in memory formation; 3) The description of involvement of such factors in memory consolidation through a mechanism that requires the participation of rNMDA and kinases ERK1/2, p90RSK and Elk-1; 4) The finding of plastic changes undergone by rAMPA as well as the signaling cascades associated with them, during the aversive memory formation.

**Max Oliveira de Souza**

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Graduated in Mathematics from the Pontifical Catholic University in Rio (PUC-Rio) (1991), Master in Mathematics from PUC-Rio (1992), Part III from the University of Cambridge (1993), and Ph.D degree from the Department of Applied Mathematics and Theoretical Physics (DAMTP) under the supervision of Stephen J. Cowley (1998). He spent 5 year at the Department of Mathematics at PUC-Rio (1997-2002). Currently, he is Adjunct Professor at Universidade Federal Fluminense. His interests in Biomathematics (population dynamics, genetics, evolutive dynamics, epidemiology); Quantitative Finance (Stochastic volatility, Indifference Pricing, Real Options) and Fluid Dynamics (Vortex Dynamics, Boundary-Layer problems).

**Nadja C. de Souza Pinto Lardner**

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The team of Professor Nadja Souza-Pinto studies the mechanisms of formation and repair of mitochondrial DNA lesions. Their studies identified and characterized several base-excision repair enzymes in the mitochondria of mammal cells. In addition, Professor Souza-Pinto investigates the role of changes in DNA-repair in mitochondria under pathophysiological conditions, such as aging and neurodegeneration, a field to which she has made significant contributions, as demonstrating that DNA-repair activities vary according to the age and that they are decreased in Alzheimer disease patients.



**Osvaldo Novais de Oliveira Jr.**

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Osvaldo Novais de Oliveira Jr is a full professor of the Physics Institute of São Carlos (USP). He holds a PhD from University of Wales, Bangor, United Kingdom. His main areas are nanostructured organic films and the processing of natural languages. He belongs to the editorial board of three magazines and he is the associate editor of the Journal of Nanoscience and Nanotechnology. He supervised 30 master's and doctorate students. He is one of the founders of the Interinstitutional Center for Research and Development in Computational Linguistics (NILC), which developed the ReGra Grammar Reviser, available worldwide along with the Word for Windows. She was awarded the Scopus 2006 given by Elsevier and by the Brazilian Coordination for the Improvement of Higher Education Personnel (Capes).

**Paulo Alberto Nussenzeig**

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Professor Paulo Nussenzeig works with quantum optics. His most important contributions include the generation of quantum entanglement between intense light beams of different wave lengths. These works are included in the perspective of communicating information by using Quantum Mechanics resources.

**Peter Alexander Bleinroth Schulz**

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Professor Peter Schulz has a PhD in Physics and is a specialist in nanoscience based on semiconductor materials with around 60 scientific papers about this topic. He has also written scientific papers and a book about nanotechnology and risks. He was the curator of an exhibit about telecommunication and society, which was available for the public in Brasília (2009) and São Paulo (2010). In addition, he works with scientometrics by observing scientific activity from its bibliometrical indices.



### **Ricardo Ivan Ferreira da Trindade**

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Ricardo Trindade has a degree in Geology from the Federal University of Rio Grande do Norte (1995) and a PhD in Geophysics from the University of São Paulo (1999). In 2006 he became a full professor at the University of São Paulo. He worked as a post-doctorate and visiting professor at the universities of Toulouse and Paris VI (France). He entered the Department of Geophysics at the University of São Paulo in 2001, where he develops research on rock magnetism, magnetic anisotropy, paleomagnetism, and archeomagnetism. These are the main themes approached by Professor Trindade:

- Supercontinent formation and dispersion: paleomagnetic study of craton regions of South America and Africa, aiming at the definition of the paleogeographic configuration and the evolution of Precambrian supercontinents;

Variations of the Earth's Magnetic Field: study of the paleointensity registered in rocks and archeological artifacts as well as of their variations in different time scales, with implications for the definition of the formation age of the inner core (solid), of the mantle conductivity, and the influence of intensity variations on the terrestrial magnetic field on the climate; Paleoclimate: Definition of the paleogeographic context and the paleolatitude of neoproterozoic and paleoproterozoic glacial deposits aiming at the reconstruction of the Earth's climate during the Precambrian era.

He participates in different research projects supported by FAPESP, CNPq, the French CNRS, and UNESCO. He is an associate member of the Brazilian Academy of Sciences and a member of FAPESP and CAPES Consulting Committees.

### **Rommulo Vieira Conceição**

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Graduated in Geology from Universidade Federal da Bahia (1992), MSc in Geochemistry in the same University (1994) and PhD in Geology from Universidade Federal do Rio Grande do Sul and Australian National University (1999). Currently is professor in the Universidade Federal do Rio Grande do Sul. Research interest are in the following field: i) high pressure experimental petrology applied to mantle and subduction zone, ii) volatile and alkalis behaviour in the mantle; iii) isotope geochemistry, iv) mantle xenoliths from Patagonia (Argentina and Chile).

**Silvia Helena Paixão Alencar**

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Professor Sílvia Helena Paixão Alencar works for the Physics Department at the Federal University of Minas Gerais (UFMG), in the area of Astronomy with emphasis on Stellar Astrophysics. Her main research theme is star formation, either from an observational standpoint (spectroscopy and photometry) or a computational modeling standpoint (magnetic hydrodynamic models).

**Yurij Castelfranchi**

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Professor Yurij Castelfranchi has a PhD in Sociology, a Master's Degree in Science Communication, a Bachelor's Degree in Physics, and a specialist degree in the following areas: sociology of science and technology, public communication of science, scientific and environmental journalism, public perception of science and technology, social controversies about C&T. He is the author of five books, an associate editor of the Journal of Science Communication (JCOM), editor of the Teoria & Sociedade magazine, a collaborator of Organización de Estados Iberoamericanos para la Educación, la Ciencia y la Cultura (OEI).



## 9. PARTICIPANT CURRICULA - UK



### **Adrian Muxworthy**

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Dr. Adrian Muxworthy is an expert in geomagnetism, specialising in the ancient geomagnetic field behaviour as recorded by rocks when they form. He is particularly interested in the recording mechanisms of minerals and their recording fidelity. He applies his knowledge to both terrestrial rock, and also chondritic meteorites where he tries to understand the role of magnetic fields in the early Solar System.

### **Andrew Murray**

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Dr Andrew Murray is a Lecturer in Physiology at the University of Cambridge. Dr Murray's research concerns the control of mitochondrial function and corresponding effects on physiological performance. Dr Murray's group are currently investigating novel mechanisms that control mitochondrial function in disease states, with dietary manipulation and in extreme physiological states. Dr Murray is a member of the Caudwell Xtreme Everest Research Group, studying the adaptation of cardiac and skeletal muscle to high altitude hypoxia.

**Anthony Hall**

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Dr Anthony Hall has worked in the field of plant circadian biology for ten years. He was instrumental in the development of genetic and imaging technologies that he now uses to dissect the circadian clock mechanism in *Arabidopsis*. His recent work has provided key insights into the molecular basis for temperature compensation of the circadian oscillator and the validation of a predicted three-loop feedback oscillator model in *Arabidopsis*. Recently, he has initiated a number of sequencing projects. Firstly, developing novel strategies for the identification of EMS induced point mutations in *Arabidopsis* using high throughput sequencing, secondly, in collaboration with Bristol and the John Innes centre, to produce a first draft of the wheat genome. His future plans are to use plant genomics and the bioinformatics of next generation genetics to address key food security issues (climate change/yield/input) and develop tools to accelerate crop breeding.

**Araxi Urrutia**

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Dr Araxi Urrutia is a Royal Society Dorothy Hodgkin Research Fellow at the University of Bath. Her research in evolutionary genomics aims to understand the processes that shape our genome over millions of years. She found that genes are not ordered randomly along chromosomes. For her results she obtained the L'Oreal-Royal Institution Science Graduate of the Year 2003 award. Recently she received the Biochemical Society Early Career Scientist and SHE Inspiring Women awards.

**Carolina Lithgow-Bertelloni**

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Dr. Lithgow-Bertelloni has expertise in mantle dynamics and tectonics with wide interests in the connection between interior dynamics and surface deformation, from plate driving forces to lithospheric stresses. She approaches problems from an observational and modelling perspective, including fluid dynamical experiments of plumes with 3-D non-invasive visualization.

**Chris Greenwell**

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Dr Chris Greenwell is the Addison Wheeler Fellow at Durham University. Research focuses on the interactions between organic matter and minerals, with computational modelling and novel experiments used to understand structure, dynamics and reactivity. Fundamental and applied research is undertaken in areas including nano-composite materials, crude oil formation, offshore oil and gas drilling, and catalysis. An area of recent interest is the conversion of vegetable oils to diesel-like components for renewable biofuel applications.


**Claudia A Blindauer**

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Dr. Blindauer's research focuses on biomolecules involved in moving the essential nutrient zinc within an organism. About 10% of all proteins in an organism are thought to require zinc for activity, but the mechanisms by which zinc is incorporated into these proteins, and how its fluxes in a biological system are controlled, are not well understood.

Dr. Blindauer's team develops and employs various biophysical/analytical techniques to identify and characterise molecules involved in biological zinc trafficking. Particular interests include protein structure determination by solution Nuclear Magnetic Resonance, native Electrospray Mass Spectrometry, and the new research area of "Metalloomics".

**Cristina Lazzeroni**

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Dr Lazzeroni is a Royal Society University Fellow at the Department of Physics at the University of Birmingham.

Her research work focuses on rare processes in Particle Physics.

The World around us consists of matter, formed from particles such as protons, neutrons and electrons. Theory suggests that matter and antimatter - formed from antiparticles, mirror images of particles - were created in equal quantities in the Big Bang. I work on an experiments that try to understand the dominance of matter over antimatter we see today, and how this is linked to the appearance of new physics beyond the models we know.

I do this examining rare processes for which the theoretical prediction is particularly clear, and I try to see if I can spot any deviation from the predictions.



**Dalia Chakrabarty**

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Dr. Dalia Chakrabarty is an expert in the development of statistical methodologies aimed at estimating characteristics of physical systems that typically manifest complexity, given sparse, noisy and incomplete measurements on some parameter(s) of the system. Her particular interest lies in the Bayesian modelling of phase spaces of gravitational dynamical systems - such as galaxies - and the learning of the 3-D morphologies of astrophysical and nano-scaled systems, by inverting their 2-D images.

**Denis Schluppeck**

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Denis Schluppeck uses magnetic resonance imaging to study the structure and function of the human brain. His recent research has concentrated on the use of high-field imaging to measure the detailed layout of brain areas underlying our sense of vision and touch.

He read Natural Sciences at the University of Cambridge and obtained his PhD in Neuroscience from the University of Oxford before working as a post-doctoral researcher in the United States. He is currently an RCUK Research Fellow at the University of Nottingham, UK.


**Dimitris Stamatellos**

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Dr Dimitris Stamatellos is an expert in theoretical and computational star and planet formation. He has a BSc in Physics from Athens University, Greece, an MSc in Space Physics and Astronomy from Rice University, USA, and a PhD in Astrophysics from Cardiff University, UK. His research focuses on the formation of low-mass stars and planets in protoplanetary discs, and on the initial stages of star formation. Dr Stamatellos has developed novel computational methods for hydrodynamic and radiative transfer simulations. He is involved in a number of international collaborations, and uses major computational and observational facilities, like the Herschel Space Telescope.

**Hannah Clarke**

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Hannah Clarke is interested in the neurochemical modulation of higher-order cognitive and emotional behaviour. In particular, she focuses on linking the function of neurochemicals within specific brain structures to specific cognitive abilities – especially those associated with psychiatric disorders. Structures investigated so far include the prefrontal cortex and the striatum, and she hopes to look at the hippocampus soon. She has a Phd from Cambridge funded by a Wellcome Trust Prize Studentship and currently holds a Junior Research Fellowship from Newnham College, Cambridge.


**Helen M. Williams**

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Dr Helen Williams uses transition metal stable isotopes to understand the evolution of planetary interiors and is particularly interested in the interactions that take place between the silicate mantle of the Earth and its iron core. She currently holds an Advanced NERC Fellowship at the University of Oxford, and has previously held postdoctoral positions at Macquarie University, Sydney and ETH-Zürich. Her current research focuses on combining measurements of natural samples with high-pressure experiments that simulate conditions in the Earth's interior.

**Holly Bridge**

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Dr Bridge uses magnetic resonance imaging to investigate the human visual system. Having previously been a Dorothy Hodgkin Fellowship, she has held a URF in the department of Clinical Neurology at Oxford University since October 2008. Her current focus is the investigation into the brains of people with a variety of different visual deficits. A major ongoing project is looking at the reorganisation of function and connectivity in the brain in anophthalmic people, who are born without eyes, and therefore never experience vision.

**Ivana Gudelj**

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Dr Gudelj is a NERC Advanced Fellow and studies microbial evolution by developing multi-scale mathematical models that connect genetic, ecological and evolutionary processes. In particular she is interested in the role of mechanisms operating at the level of cell and sub-cellular function in shaping the patterns of microbial diversity. All Dr Gudelj's research is undertaken in close collaboration with microbiologists and experimental microbial evolutionary biologists.



### Jacinta O'Shea

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Dr. Jacinta O'Shea is a Royal Society Dorothy Hodgkin Fellow based in the Department of Clinical Neurology at the University of Oxford. She completed a DPhil in Neuroscience at Oxford in 2005. Over the past five years as a research fellow, her research has focussed on the development and application of non-invasive human brain stimulation to interrogate information flow between inter-connected brain regions, and increasingly, as an adjuvant intervention to promote functional recovery after stroke.

### Jane Greaves

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Dr Greaves works on planet formation, using observations of the nearest regions of young stars, in the far-infrared to radio wavelength regimes. Her special interest is in the probability of forming an Earth-analogue planet around other Sun-like stars, including astrophysical aspects such as water delivery by comets, and the survival of life under heavy bombardment. She is a leader in several observational consortia (SUNSS, DEBRIS, PEBBLES) looking at planet-forming and debris discs around stars.



### Jolanta Kisielewska

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Dr. J.Kisielewska is an expert in physiology of embryonic development. She is using fast dividing embryonic cells as a model system to study duplication of an animal genome and problems that can arise when mechanisms responsible for proper DNA synthesis fail, as is often seen in tumourgenesis. Since her Dorothy Hodgkin Fellowship award she has established her research laboratory in the Medical School at the University of Newcastle.



### Jonathan Dawes

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Dr Jonathan Dawes is an applied mathematician. He uses dynamical systems techniques to understand how spatial patterns and complicated oscillations arise in mathematical models for a broad variety of systems including fluid flows, sliding friction and epidemiological models. He completed his PhD in 2001 from the University of Cambridge and then held posts at Trinity College and Newnham College, Cambridge. He was appointed to a Royal Society University Research Fellowship in October 2007 and moved to take up a Readership at the University of Bath in January 2009. He organised an exhibition stand that was selected for the Royal Society's Summer Science Exhibition in June-July 2010. A brief summary of some of his recent research can be found in the 2010 'Visions of the Future' Theme Issue of the Royal Society's journal 'Philosophical Transactions'.

### Ken Rice

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Dr Rice is a Reader at the Institute for Astronomy, University of Edinburgh and is an expert on the formation and evolution of discs around young stars. What is of particular interest to Dr Rice is how the evolution of these discs influences the formation of the central star and the subsequent formation of planets and planetary systems.



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### **Libby Heaney**

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Dr. Libby Heaney graduated with an MSci in Physics from Imperial College London, during which time she spent a year investigating open quantum systems in Freiburg, Germany. She studied for her PhD at the University of Leeds on the topic of Quantum Entanglement in Non-interacting Bose gases. In 2008 she won the Institute of Physics' early career woman physicist of the year prize. After her PhD, Libby moved to the Centre of Quantum Technologies in Singapore, where she still holds a visiting position. She is now primarily based at the University of Oxford, where she is studying entanglement of indistinguishable particles with applications to quantum technologies, with a number of papers focusing on tests of non-locality.

### **Lorna Casselton**

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Lorna Casselton is Foreign Secretary and Vice-President of the Royal Society. She is also Emeritus Professor of Fungal Genetics in the Department of Plant Sciences at the University of Oxford. Professor Casselton researches sexual development in fungi, and is distinguished for her genetic and molecular analysis of the mushroom *Coprinus cinereus*. She was elected as a Fellow of the Royal Society in 1999 and became Foreign Secretary and Vice-President in 2006.

Professor Casselton began her career in lecturing and research as an assistant lecturer at Royal Holloway College, London. She became Professor of Genetics at Queen Mary College, London and was later awarded an AFRC/BBSRC Postdoctoral Fellowship, followed by a BBSRC Senior Research Fellowship in 1995. Professor Casselton was a Fellow of St Cross College Oxford from 1993-2003, and was appointed Professor of Fungal Genetics at Oxford in 1997. She was a member of the Royal Society's Council from 2002-2003, and rejoined the council in 2006.

As Foreign Secretary, Professor Casselton's duties include overseeing the Society's international relations programme, in particular its contact with other scientific academies, and its allocation of funding to both international researchers and UK researchers wanting to study abroad.



**Luke Clarke**

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Luke joined the Royal Society's Grants Section in 2004 and managed the Society's International Fellowships Programme from 2005 to 2007, before transferring to the Science Policy Centre. He works on the Royal Society's Frontiers of Science programme, the forthcoming Global Science Report, and a number of other international activities. Luke has a BA in Politics from the University of East Anglia.

**Maziar Nekovee**

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Dr Nekovee's research is focused on theory, modelling and simulations of complex computer and communication networks and systems. Current research areas include modelling and applications of spreading phenomena in human, computer and social networks, cognitive radio, vehicular communication networks and quantum communication. Dr Nekovee is the author of over 80 papers and has been a guest editor and referee for several leading journals in physics, computer science and electrical engineering. His new book "Cognitive Radio Communications and Networks" was published recently [http://www.elsevier.com/wps/find/bookdescription.cws\\_home/716820/description](http://www.elsevier.com/wps/find/bookdescription.cws_home/716820/description)

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Dr Olivier Restif is a theoretical biologist working on various aspects of host-pathogen dynamics, including within-host bacterial infection dynamics (*Salmonella*), pathogen evolution and host immunity evolution. He has developed collaborations with microbiologists, immunologists, ecologists and epidemiologists.

Olivier Restif obtained his PhD in Paris and has been at the university of Cambridge since 2003 where he is now a Royal Society University Research Fellow at the Department of Veterinary Medicine.

**Paula X. Kover**

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Dr. Kover is a Senior Lecturer at the University of Bath (UK). She was an undergraduate and master student at UFRJ (Brasil) and a PhD student at Indiana University (USA). She is interested in the evolution of quantitative traits (traits affected by many genes, environmental and parental effects) such as flowering time, drought resistance, fitness, etc. The lab uses mapping approaches to determine the genetic basis of natural variation, and study the evolutionary dynamics of these traits using experimental evolution.



**Peter Vukusic**

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Prof. Vukusic was recently a BBSRC David Phillips Advanced Fellow and now leads a research team at the School of Physics, University of Exeter that specialises in the discovery and characterisation of the designs and functionalities of photonic structures found biological systems. These designs are then used as bio-inspiration templates for systems and applications across technologies associated with materials, opto-electronics, textiles, anticounterfeiting and mainstream photonics. He has a long association with science outreach activity and participates internationally in science communication events in various media, publications and in public lectures.

**Philip Wigge**

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Philip Wigge is a principal investigator at the John Innes Centre, Norwich UK where he works on plant development and temperature sensing. Dr. Wigge was educated at Oxford and Cambridge Universities and did postdocs at the Salk Institute (CA, USA) and Max Planck Institute (Tübingen, Germany) before starting his own group. He is particularly interested in applying mathematical modelling approaches to understand biological questions as well as transferring knowledge from model systems into crop plants.

**Richard Holme**

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Dr. Holme is an expert in the study of the global geomagnetic field, and the magnetic fields of other planets, particularly the analysis and modelling of observations. He is further interested in constraining the physical processes of deep planetary interiors, particularly at the Earth's core-mantle boundary.

**Richard Kirby (co-chair)**

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Richard Kirby is a molecular ecologist and his research is focused on planktonic marine organisms within the broad subjects of population ecology and evolutionary ecology. He collaborates principally with the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) in Plymouth for whom he pioneered the molecular genetic analysis of Continuous Plankton Recorder samples allowing the molecular analysis of plankton at global scales. His current and future research is focused on understanding how climate signals propagate through the marine food web.

**Saif Haque**

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Dr. Haque is a Royal Society Research Fellow in the department of chemistry at Imperial College London. He is a physical chemist with a particular interest in photochemistry. Dr. Haques research involves the application of time-resolved laser spectroscopic techniques to probe charge transfer dynamics in nanostructured molecular materials. His current research activities include the function and development of solar cells based upon self-organizing molecular and hybrid inorganic – organic systems including quantum dots. Dr. Haque has published over 60 papers in the area of solar cells and molecular devices and has an h-index of >25. Dr. Haque has been recognised for his research in 2006 with the award of the Harrison Memorial Medal by the Royal Society of Chemistry.

**Steven Penfield**

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Steven Penfield began his career at the John Innes Centre in Norwich, UK studying the seed biology. He then moved to the University of York, UK where he made many contributions to the field of seed germination control and fatty acid metabolism in seeds. Today Dr Penfield's work focuses on the understanding of how temperature regulates key events in plant lifecycles, including germination, growth and seasonal dormancy, and how it affects plant-climate interactions.

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Environment Correspondent, BBC News, 1997-2006

Independent journalist and consultant, 2006-

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Global Biodiversity Outlook, Convention of Biological Diversity (2009-10)  
The Economics of Ecosystems and Biodiversity Study (TEEB) 2010



### **Veronica Grieneisen**

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Verônica Grieneisen develops and employs mathematical and computational methods to study morphogenesis in living systems. Her lab focuses on plant cell polarity control and multicellular organisation. Her research aims to unravel the complexity of the feedbacks between subcellular mechanisms of cell polarity and tissue-level patterning, in particular, of auxin patterning and biophysical interactions. The multi-level modelling is developed in close proximity with experimental research on: root growth, leaf and fruit development and auxin signalling.

#### Short Bibliography:

Verônica Grieneisen obtained her bachelors and masters degree in Theoretical Physics at the Universidade Federal do Rio Grande do Sul (UFRGS - Brazil), and her Biology doctorate degree cum laude at the Utrecht University (the Netherlands). For her thesis on auxin patterning in plant morphogenesis, for which she used a combination of physical models and mathematical methods within an experimental-modelling cycle, she received in 2009 the Hugo de Vries Award. In the same year she received the Royal Society Dorothy Hodgkin Fellowship and moved to the UK, to the University of East Anglia, starting her group in computational modelling of plant development at the John Innes Centre, Norwich, where she a Project Leader.

### **Vincent Jansen**

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Professor Vincent Jansen's research is on mathematical modelling in ecology, evolution and epidemiology. He formulates and analyses of mathematical models to understand how biological systems work, and how they evolve. He has worked on many topics including biodiversity, spatial population dynamics, network theory, systems biology and the evolution of cooperation and altruism.

## 10. PARTICIPANT CURRICULA - CHILE



### **Claudio Andres Hetz Flores**

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Claudio Hetz received his A.B. in Biotechnology at the University of Chile in 2000 and then performed his Ph.D thesis at Serono Pharmaceutical Research Institute, Switzerland. In 2004 he made two postdocs at Harvard University. He is currently Full Professor at the Institute of Biomedical Sciences of the University of Chile and adjunct professor at Harvard. He was recently awarded with the TWAS-ROLAC Young Scientist Prize, he was finalist in The Eppendorf and Science Award in Neurobiology, and also awarded as outstanding young scientist of Chile 2008 by the Chilean Society of Biology. His lab uses animal models to investigate the signalling responses involved in protein misfolding disorders in the brain.

### **Maria Elena Lienqueo Contreras**

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Dr. Lienqueo, PhD in Chemical Engineering of University of Chile, works on the area of bioethanol production, especially in the evaluation of chemical pre-treatment of lignocellulosic material with ionic liquids (ILs) as a step previous to the hydrolysis of cellulose. Additionally, her research interests are in biorefinery processes.



**Nicolás Walter Franck Berger**

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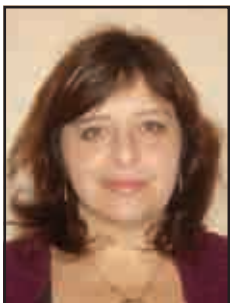
Professor Franck is an expert in plant ecophysiology and plant stress physiology working on process based models of plant and ecosystem carbon and water balance in arid zones as affected by climate change.

**Patricio Rojo**

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Professor Patricio Rojo is an astronomer expert in Extrasolar Planet research. His fields of study include both the search for new objects and the characterization of their atmospheres using, almost exclusively, ground-based instrumentation. Dr. Rojo obtained his Ph.D. at Cornell University in 2007 and then joined the faculty at the Astronomy Department at Universidad de Chile.



**Salomé Minerva Angélica Martínez Salazar**

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Professor Martínez is currently an Associate Professor of the Department of Mathematical Engineering of Universidad de Chile. She obtained a Ph.D. in Mathematics from University of Minnesota, and her field of expertise is partial differential equations and nonlinear analysis. Currently, her research is focused in the study of models arising in the study of interacting populations, in which the dispersal term can be local or nonlocal.





### **Sascha Wallentowitz**

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Professor Wallentowitz works in the field of Quantum and Atom Optics. Presently he is engaged, among others, in research on decoherence and disentanglement of quantum bits implemented in semiconductors and in optical homodyne measurements for quantum-state reconstruction.

### **Sofia Alejandra Valenzuela Aguila**

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Sofia Valenzuela is a Biochemist, with a PhD in Plant Biotechnology. She is in charge of a Consortium of Forest Genomics, a joint research among forest companies and the Universidad de Concepcion, their study focuses in finding and understanding how genes are involved in wood formation for pulp and bioethanol, being of main interest the lignin biogenesis. The group has identified and studied gene sequences involved in the guacyl/syringl ratio, which has an important effect in the industrial wood delignification processes.



### **Veronica Laura Oliveros Clavijo**

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Assistant Professor Oliveros works currently on isotope geochemistry and geochronology applied to the study of magmatism and metamorphism in the Andes during the Mesoizoc era (200 to 80 millions years ago), and its differences with the modern subduction system. She graduated as Geologist (2000) from the University of Chile. She has a Doctorate degree from the University of Nice-Sophia Antipolis, France (2005). Since 2007, she works at the Earth Sciences Department, University of Concepcion, Chile.





## 11. ABSTRACTS

### BIOFUELS: NEW DEVELOPMENTS, CHALLENGES AND LIMITATIONS - SESSION 1

#### Technological and sustainability aspects of biofuels

*Joaquim Eugênio Abel Seabra*

Biofuels for transport, including ethanol, biodiesel, and several other liquid and gaseous fuels, have the potential to displace a substantial amount of petroleum around the world over the next few decades, and a clear trend in that direction has begun. Compared to petroleum, the use of biofuels for transport is still quite low in nearly every country. By far the largest production and use is of ethanol in the United States and Brazil, where similar volumes are used – many times higher than in any other country. The benefits of biofuels are substantial, even though they are relatively difficult to quantify. Increasing the use of biofuels can improve energy security, reduce greenhouse gas and pollutant emissions, improve vehicle performance, enhance rural economic development and, under the right circumstances, protect ecosystems and soils. For this reason, the production and use of biofuels is increasingly being evaluated and pursued by many countries individually and multilaterally. Significant regulatory activities are ongoing worldwide, requiring that the higher biofuels production volumes come with environmental benefits. But a definition of a “global sustainable biofuels level” that will accommodate food, feed, fiber, and bioenergy production while preserving natural resources such as land, water, and biodiversity has yet to emerge. In the next twenty years, most of the expansion will rely on the first generation technologies, but an increasingly contribution from the so-called second generation technologies is projected. In this seminar, a brief overview of the current situation and the trends for the global energy demand and the role of biofuels for the transportation sector will be presented. Topics related to technological developments in biofuels production and biorefineries will be discussed, as well as the sustainability aspects involved, with especial attention to the Brazilian case.

#### Decarboxylation of fatty acids using mineral catalysts: from microalgae to road transport fuels and chemical feedstocks

*Chris Greenwell*

Biofuels have gained much attention in recent years as a source of renewable and potentially carbon neutral fuels. Where as other technologies exist for renewable power generation, there is little alternative other than biofuels for road transport fuels compliant with the existing transport infrastructure. Biofuels are divided along traditional transport fuel preferences, with bioethanol used as a substitute for petrol/gasoline in the US, for example, and biodiesel as a diesel substitute in Europe.

In this presentation the conversion of fatty acids to “green diesel” is reviewed and some of our recent work in this area is described. Green diesel is a direct replacement for fossil oil diesel, as opposed to “biodiesel” which is only a partial substitute. It is somewhat surprising, but the focus on biofuels has tended to be dominated by the challenges of growing the biomass, with relatively little consideration given to product streams. Some of our recent ongoing interdisciplinary work on biofuel topics will also be briefly discussed, with a focus on microalgae as the biomass crop.

#### From yeast to humans: a search for the genetic basis for the evolution of complexity over the last 1.4 billion years

*Araxi Urrutia*

The number of genes (functional units which code for proteins) in our genome are roughly the same as that of insects or worms prompting a hunt for the “missing information” which accounts for our increased

“complexity”. A process known as alternative splicing (AS), where different proteins can be produced from a single gene is the main suspect. But there were no comparable estimates of AS for organisms other than human to prove it. Here we have built a database to measure AS in 18 species, including yeast, insects, fish, birds, mammals, etc. Using this database combined with the data of gene numbers in each species, we calculated the total size of protein diversity. We found that protein diversity has increased steadily over the last 1.4 billion years and co-varies with increases in complexity (number of cell types). We also find that the number of genes associated with greater inter-cell interactions have increased dramatically whereas housekeeping genes have remained stable in numbers. Our data supports that protein diversity has increased during the past 1.4 billion years and that this increment has played a crucial role in allowing the emergence of more complex organisms.

## BRAIN PLASTICITY - SESSION 5

### Measuring and manipulating functional plasticity in the adult human brain

*Jacinta O’Shea*

The brain has a remarkable capacity to re-organise how it functions to support mental processes and behaviour. This ‘functional plasticity’ unfolds over the course of normal development, enables adaptive behavioural modification during learning, and can permit behavioural recovery from brain injury. Using non-invasive human brain imaging and stimulation techniques, it is possible to visualize dynamic changes in the functioning of brain circuits during cognitive processing. Stimulation also offers a means to manipulate brain plasticity, potentially enabling control over patterns of brain activity change that follow damage, such as that caused by stroke.

We will review recent findings on functional brain plasticity in the healthy and stroke-damaged adult human motor system. We will outline a variety of conceptual approaches from a growing research field that uses brain stimulation in an attempt to proactively shape those patterns of neural activity change that are the consequences of brain damage. Many of these changes are dysfunctional, and thus contribute to patient disability. Others may be advantageous, reflecting plastic reorganisation, and thus enabling partial recovery of lost functions previously carried out by the damaged tissue. This translational research effort aims to harness basic neuroscience understanding of brain plasticity processes for clinical gain: with the goal of further enhancing adaptive neural changes and suppressing maladaptive plasticity, thus facilitating behavioural recovery after stroke.

Abstracts for all papers below can be searched for free by PMID number at: [www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)

### How do memories persist?

*Martin Cammarota*

It is believed that the persistent storage of memories depends on detecting its behavioral salience. Theoretical speculations suggest that the ventral tegmental area (VTA) and hippocampus play a prominent role in this process. In this lecture I will comment about the experiments carried out in my laboratory in order to discover why some long duration memories last longer than others.

## Brain Plasticity: an introduction

*Edson Amaro Junior*

Brain plasticity has been described as the brain's ability to modify its functional and anatomical properties in order to evolve. This intrinsic property is fundamental to basic human processes, including learning (from experience or passive information), maturing and ultimately acquiring new skill processes. Not only that, but the repairing mechanisms acting after a chemical, physical or even psychological brain injuries are intimately related to brain plasticity, or simply neuroplasticity. Although we have accumulated a significant amount of information in this field, some questions still have to be answered. We know a few mechanisms in great detail, but most of them were investigated in animal models, and the human demonstration of such processes is hindered by experimental limitations. However, in the past decade, new methods have propelled the field of neuroplasticity investigation, and spearheaded the use of the basic concepts to better plan education, rehabilitation and even investigate new treatment possibilities. In this talk a brief historical perspective and recent developments will be presented, with a special focus on possible clinical applications. During this review, a few selected issues will be highlighted: what are the neural mechanisms underlying neuroplasticity during learning and recovery contexts; how neuroimaging can contribute to understand this topic; a few questions regarding the existence of a common cascade of events acting under various conditions; and we will discuss potential clinical use of these techniques to help improving learning and recovery.

## DEEP EARTH SYSTEM - SESSION 6

### Journey to the center of the Earth

*Carolina Lithgow-Bertelloni*

Earth's interior is remote and fascinating, not only to Earth scientists but to all from Jules Verne to Hollywood. Our fascination lies in its inaccessibility to direct observation, its exploration as daunting as that of distant planets and stars. For example, the deepest hole ever drilled (~ 15 km) only reached one quarter of 1% of Earth's radius. The conditions of the interior are extreme. Pressures at the center are 3.6 million times greater than atmospheric pressure and temperatures as hot as the surface of the sun. Such extreme conditions make the interior an extremely dynamic and complex engine, responsible for volcanic eruptions, earthquakes, mountain chains and indirectly modern civilization and communication systems. For without the magnetic field generated by the liquid metallic core, much of modern navigation would be impossible.

Most of what we know today about the interior comes from indirect observation and samples, meteorites, volcanic samples, Earth's magnetic field and most of all the seismic waves generated by earthquakes. Modern remote sensing techniques and measurement of the magnetic and gravity fields have expanded and will continue to expand our understanding of the interior and how it controls the surface environment.

In this introductory talk, I will present some basic facts about the composition, structure and dynamics of Earth's interior, its importance in shaping the surface we live in and the remaining questions about its composition and dynamics and how we are trying to solve them with modern observational, analytical and modelling techniques, which the other speakers will expand upon.

Extra reading for those interested:

Simpson, S, Deep thoughts - How to journey to the center of the Earth - Maybe  
SCIENTIFIC AMERICAN, 289 (2): 24-25 AUG 2003

Hirose, K, The Earth's Missing Ingredient  
SCIENTIFIC AMERICAN, 302 (6): 76-83 JUN 2010

## Where is the potassium in the Earth-Moon system?

*Rommulo Conceição*

Potassium is an incompatible element that in all mantle melting process prefers stay in the liquid (magma) than in the solid (mantle). However, if we get the current geothermal conditions of Earth, we will observe that Earth has more heating than that, which would be expected by Earth accretion or U decay in the mantle. So, we need a more efficient element to produce heating via radioactive decay that must be concentrated in the deep Earth. Potassium decay to argon, by its turn, produces more heating than U decay to Pb. The K/U ratio in the Earth-Moon system is not well constrained, although Bill McDonough (US) and Albarède (France) have assumed it almost solved. The Moon is considered to be a catastrophic consequence of a Mars size planet shock against Earth. Potassium composition of Moon (crust) is very depleted, compared to Earth. So, some potassium must be lost in such event. Bernard Wood (UK) has been showing that K acquires a chalcophile character, once pressure is high (huge) enough, and could be one important element in the Earth core. But, how potassium would reach such depth if it always prefers stay in the liquid (melt) instead in the solid (mantle)? The potassium geochemistry behavior must be better constrained and would help us to better understand the Earth origin composition and some aspects of the heating distribution. We have been working in such theme using phase diagrams studies under high pressure in our laboratory. We are trying to stabilize some potassic phases in high pressure conditions that would be expected in the Earth mantle. Such study would give us a clue about Earth origin and composition and would give us also better ideas about Earth-Moon formation.

## Geomagnetic probing of the Earth's Core

*Richard Holme*

The Geomagnetic field has been measured and studied for over 400 years. It varies on time scales of milliseconds to millions of years, and contains components from near-Earth space to the Earth's deep interior. Field variations on longer time scales (over a year, to many millions of years) and large length scales (3000km) are dominated by the field generated by a dynamo in Earth's fluid core. Early historical measurements are dominated by ship-borne observations; from 1840, magnetic observatories were established throughout the globe, and recent advances have been driven by data from dedicated, low-Earth orbiting satellites. These measurements allow construction of geomagnetic models, and constraint of the field at its point of origin, the top of the core. From these models, the physics of this region can be investigated, in particular modelling flow at the top of the core, and contributions of this region to variations in Earth rotation (the length of day). Features of particular interest are so-called geomagnetic jerks – rapid changes in the second time derivative of the geomagnetic field. Such changes are also reflected in the length of day; I present recent research linking these two observables, and discuss the implications for the understanding of the dynamics of the core and the structure of deep Earth.

## THE MATHEMATICAL MODELLING OF POPULATIONS AND DISEASE - SESSION 2

### Paradigm Shifts in Biology: Implications to the Modeling of Infectious Disease Dynamics

*Claudio Jose Struchiner*

Mosquito-borne diseases modeling enters the mathematical literature through the hands of Ronald Ross. We have come a long way since Ross' seminal contribution. Recent advances in molecular biology and genetics provide new tools to monitor diversity among pathogens, vertebrate and invertebrate hosts. The genetic manipulation of pathogens and vectors also holds a promising future. Current population dynamics paradigms seem ill-equipped to make appropriate predictions in this context and need to be expanded. We briefly review some of the current main research issues brought by these new technologies and argue that a new unifying modeling paradigm becomes necessary.

## On networks, behaviour and inference

*Vincent Jansen*

In this presentation I will briefly address two topics about the mathematical modelling of populations, and diseases in a population, and try to point out interesting challenges and open question. Firstly I will describe how networks models have been used in mathematical epidemiology. Models for populations often ignore the fact that real individuals interact do not mix randomly, but interact with a subset of other individuals. In recent years, network models have gained increasing popularity to capture the social structure of a population, and how diseases can transmit on this social network. Most network models assume that both transmission as well as the network itself is constant and not affected by the presence of the disease. Because humans can change their behaviour if a disease is present, this can have an impact on the spread of a disease. I will discuss some recent results on the effect of human behaviour on disease spread of disease and show that this can potentially affect the potential of a disease to form an outbreak. This provides proof of principle of how a change in human behaviour in response to presence of a disease can have an effect on the spread of this disease.

Secondly, I will discuss an example how models have been used to identify a mechanism for highly complex population dynamics. Midges in lake Myvatn in Iceland show enormous various in numbers over the years. What drives these fluctuations in numbers have not been well understood. We constructed a model for the dynamics of the Myvatn midges. The midges feed on algae and detritus in the lake. The model is a discrete time model, with a certain similarity to models used in epidemiology. An qualitative analysis of dynamics of the model shows that it can have a two simultaneously stable state: a stable equilibrium level, as well as a stable limit cycle. If the dynamics flip between these stable states, the model produces very similar dynamics to the Myvatn midges, which I will argue, explains the highly variable numbers. This leads on to the more general point of linking models to data and how we make inferences about mechanisms in population biology and epidemiology.

## Microbial evolution in theory and practice

*Ivana Gudelj*

Scientists have long been intrigued by the diversity we see in nature and understanding how this diversity is created and maintained remains the central goal in ecology and evolution. Ever since Darwin it has been acknowledged that if we want to study evolution, ideally we would like to be able to observe it in action. This can be achieved by growing fast-replicating microbes in test tubes where evolution happens over a number of days. But how do results we observe in the test tube apply to microbes in nature? Also, what can we learn from microbes about higher-level organisms? These questions can be addressed using mathematics and in this talk I will present a series of examples where this was successfully accomplished through a careful combination of mathematical models and test-tube experiments. In particular the examples are chosen to reflect different types of pressures that microbes repeatedly encounter in nature: 1. Evolution of metabolic cooperation and 2. Evolution of resistance to pathogens. I will demonstrate that system level mathematical models can make good quantitative predictions of a given laboratory experimental setup and discuss which of these predictions can be generalized to other microbial systems.

## PLANET FORMATION AND EVOLUTION - SESSION 4

### Observing planet formation in action

*Jane Greaves*

Within a few hundred light-years of the Sun, there are several regions where new stars are being born,

and these stars can be observed when they are a few million years old or even younger. This is when giant planets should form from the circumstellar discs, with remnant rocky material and gas being used up in the formation of terrestrial planets by ages of about 100 million years. We observe great diversity among systems of extrasolar planets, from rocky bodies of a few Earth masses to super-Jupiters, and in orbit from much more far out than Pluto to close to the stellar surface. Observational planet formation work seeks to understand this diversity, and to image planet formation in action. Long wavelength observations look through obscuring material to see solid grains forming into larger rocks and even collecting into planets. These data can be used to assess how common different types of planet system should be, and may be extrapolated to consider how many extrasolar Earths may exist. Conditions around young stars appear promising for planetary systems quite like that of the Sun to lie within about 50 light years, and their Earths could be detected with moderate advances in technology.

## Astrobiology – Studying Life in the Universe

*Douglas Galante*

Astrobiology is a recent branch of science that uses Astronomy, Biology, Physics, and Chemistry tools in order to understand one of the most complex systems of the Universe: Life – its appearance, evolution and distribution. We have introduced the first laboratory devoted to Astrobiology studies in Brazil – AstroLAB, at the Institute of Astronomy, Geophysics, and Atmospheric Sciences of University of São Paulo (USP). A simulation chamber is now being constructed as a main focus of our laboratory so we can mimic environmental parameters found in other solar system bodies as well as in primitive Earth in order to test both biological and chemical responses to such conditions. The laboratory is also designed to work with organisms known as extremophiles, that is, the ones able to survive in extreme environmental conditions.

## The formation and evolution of planets

*Ken Rice*

To date we have discovered in excess of 400 extrasolar planets. The properties of these planets are quite different to what was expected based on our understanding of our own Solar System. Some Jupiter-like planets – known as “hot Jupiters” - orbit very close to their parent stars. There is a wide range of eccentricities, much larger than is seen in the Solar System. We have now also directly observed planets with large orbital radii. In this talk I will discuss current views on how planets form and evolve. In particular I will consider the formation of gas giant planets and if there is a different formation mechanism for those with large orbital radii compared to those orbiting close to their parent stars. I will also consider how the “hot Jupiters” end up with very small orbital radii and how the large range of eccentricities is introduced. I will finish by considering the likelihood of us detecting an earth analogue within the next few years.

## PLANT DEVELOPMENT AND CLIMATE CHANGE - SESSION 9

### Network changes in response to temperature driving a robust circadian clock

*Anthony Hall*

The circadian clock is an endogenous 24h timer, found throughout nature. It allows an organism to temporally orchestrate metabolic, physiological, biochemical and development processes. It is used to predict and respond accurately to transitions at dusk and dawn. The clock also measures day length (photoperiod) and allows the organism to respond appropriately to seasonal rhythms. One of the key defining features of circadian clocks is its temperature compensated and ability to maintain robust and

accurate clock function of a broad range of physiological temperatures. Our recent research suggests that changes in clock architecture underlie this buffering mechanism. This will be discussed with specific reference to how light input changes with temperature.

## Impact of abiotic stress in tropical plants on the context of climate change: the role of biodiversity

*Carlos Alberto Martinez y Huaman*

Currently, abiotic stress, climate change and its effects on biodiversity are considered strategic themes of research in plants and where we need to develop greater scientific knowledge, especially for the tropics. Despite the incredulity of some, who even question the existence of global warming due to increasing atmospheric concentration of greenhouse gases, recent surveys show that because of human activities, processes essential for maintaining life on Earth as rate of biodiversity loss, climate change and interference with nitrogen cycle, have already exceeded the planetary boundaries. Moreover, the biological evidence and climate anomalies, observed with increasing frequency in various parts of the world, indicate that something is changing and that all living beings would be responding to climate changes, with different reaction, depending on the characteristics of each species. If the effects of climate change are positive or negative depends on the ability of adaptation, acclimation or survival of the species involved. However, serious limitations of knowledge about the ecology, physiology and genetics of native and crop plants difficult to predict the effects that climate change may cause. How tropical plants respond to climate change? What is their potential to absorb and sequester carbon from CO<sub>2</sub> in constant increase in the planet? What is the interaction of climate changes at the molecular processes, biochemical and physiological determinants of growth and productivity of plants? What are the effects of climate change on biodiversity or the effect of biodiversity on climate change? These are some of the relevant issues to be urgently answered and therefore a priority for research and will be discussed in lecture.

## Temperature perception in eukaryotes-why you should care

*Philip Wigge*

How temperature is perceived by eukaryotes is a major open question in biology. As well as being of fundamental interest, understanding how temperature is sensed has important applications in the development of crops resilient to climate change. Increases in temperature during the last century have already altered the phenology of wild plants, and strikingly, every 1 °C increase in mean global temperature causes a 2.5-16 % decrease in crop yields. The very diverse and complex effects of temperature on the cell suggest that the breeding of crops resilient to climate change will be a very complex process. It will be essential to have a detailed understanding of the mechanisms by which plants perceive and relay temperature signals as well as how plants adjust their physiology in response to differences in temperature. This requires expertise from a wide range of scientific disciplines, from biologists to engineers, and represents an exciting challenge for a generation of scientists.

## QUANTUM ENTANGLEMENT - SESSION 8

### Introduction to Quantum Entanglement

*Paulo Nussenzeig*

Quantum Mechanics, the theory created to unveil the mysteries of the microscopic world, has several ingredients that still challenge the intuition of most people, physicists included. Among all of its mind-boggling features, Schrödinger coined the term "entanglement" for strange correlations that arise among



quantum systems. He called this “not one but rather THE characteristic trait of quantum mechanics, the one that enforces its entire departure from classical lines of thought.” By the end of the last Century, at the dawn of the new Millenium, physicists realized that this strange ingredient could be potentially very useful for the realization of important tasks in information science. In this talk, an introduction to the notion of Quantum Entanglement will be presented in terms “as simple as possible, but not simpler”. By exploiting the wavelike character of quantum systems, we will discuss the importance of the relation between indistinguishability and interference and its implications for information science.

## Quantum Entanglement

*Libby Heaney*

Quantum entanglement is a property of a quantum state consisting of two or more subsystems, where observable quantities such as spin or position and momentum are shared between the subsystems. This means that one cannot describe one constituent without referring to the other(s). This interconnectivity between two particles is such that if someone measures a physical property of one particle, then the other will change it's behaviour instantaneously – even if the particles are separated by distances that can be so large that not even light could travel between them in the time that it would take to make the measurement.

This is why the correlations of entanglement are said to be nonlocal. Entanglement was first confirmed in an experiment in 1980, but was still then generally sidelined as a topic of philosophical discussions. That was until the 1990s, when it was realized that entanglement has many useful applications in quantum information processing, i.e. processing information using physical systems that obey quantum mechanics. For instance, quantum entanglement between two particles can be used for teleportation and also encoding information in an extremely compact manner. Moreover, it is believed that entanglement is a necessary ingredient in the speed up of quantum computers over their classical counterparts.

Entanglement can be manually generated between photons or atoms (as well as in many other physical systems), and it can also be found naturally in some magnets and gases that are at very cold temperatures. On the other hand, it was recently demonstrated that entanglement even exists in a biological system, namely the FMO photosynthetic light-harvesting complex found in green sulfur bacteria. Whether Nature supports and even makes use of quantum entanglement is a key question that is only just starting to be answered.

## Quantum Networks

*Daniel Felinto Pires Barbosa*

Quantum entanglement is a property of systems composed of multiple parties which are intrinsically interconnected in a way that measurements in a particular portion of the system affect the others even if they are very distant apart. It raises then many fundamental questions concerning our basic understanding of nature, including standard notions on how information is transmitted in space to assure causality between the physical phenomena, since there is no time interval separating such a measurement and its effects on the rest of the system. Experiments in the last three decades have repeatedly confirmed such strange aspects of quantum entanglement, highlighting our difficulties to build a complete intuitive picture of quantum theory. On the other hand, the experimental confirmation of such deep correlations between physical systems provided a great impulse for a series of proposals to explore entanglement for various new applications, effectively creating the new field of quantum information science. In my presentation I will discuss the general problem of quantum entanglement in light of a new series of experiments involving the distribution of entanglement in networks of massive systems, atomic ensembles, mediated by the exchange of light signals. These experiments stress even further the nontrivial character of such correlations, by exploring the mechanism of entanglement swapping between two independently entangled systems to obtain a pair of entangled massive systems without any prior physical contact between them. They represent also the first steps for a particular quantum information protocol to distribute entanglement over arbitrarily large distances, which possible applications to perform ultrasecure distribution of cryptographic keys.



## REGULATION OF ENERGY METABOLISM - SESSION 3

### An introduction to the regulation of energy metabolism

*Nadja Cristina Souza-Pinto*

All living organisms rely on energy transduction system to maintain their homeostasis. Most metabolic pathways converge to few key intermediates, which feed central metabolic pathways. Moreover, the organisms have to adapt and respond to changes in the environment and in the availability of energy supply, which involve changes in metabolic processes. Thus, a fine integration of the different metabolic and energy transducing pathways is critical for all living organisms. In this presentation we will discuss the strategies that cells and organisms use to integrate their metabolic pathways and to properly respond to changes in the environment.

### The genetics and energetics of heart failure – novel targets for metabolic therapies

*Andrew Murray*

Despite current therapies, which afford substantial benefit to patients, heart failure remains a relentlessly progressive disease and new approaches to treatment are necessary. Energetic abnormalities in cardiac and skeletal muscle occur in heart failure, and correlate well with clinical symptoms and mortality. It is likely that the cellular mechanism leading to energetic failure involves significant mitochondrial dysfunction. Therefore, it is crucial to understand the causes of mitochondrial myopathies in order to improve cardiac and skeletal muscle function, and hence quality of life, in heart failure patients. Recent studies from ourselves and others have identified a number of potential stresses leading to mitochondrial dysfunction in heart failure. Chronically elevated plasma free fatty acid levels in heart failure are associated with decreased metabolic efficiency and cellular insulin resistance. Tissue hypoxia, resulting from low cardiac output and endothelial impairment, can lead to oxidative stress and mitochondrial DNA damage which, in turn, causes dysfunction and a loss of mitochondrial mass. Our work has taken novel approaches, for example using high-fat diets or exposure to high altitude hypoxia, to model these stresses in humans and animals. We have therefore begun to identify novel targets for therapeutic intervention – particularly targets aiming to restore normal mitochondrial function. Such novel pharmacological agents, which optimise substrate metabolism and maintain mitochondrial integrity, improve the oxidative capacity of heart and skeletal muscle, and thereby alleviate many of the clinical symptoms associated with heart failure. Metabolic therapies could thereby provide a lifeline for the many patients diagnosed with heart failure each year.

### The hypothalamus and the genesis of obesity

*Licio Augusto Velloso*

Obesity is currently amongst the most prevalent diseases in the world. The installation of obesity increases significantly the risk for development of a number of highly lethal diseases such as atherosclerosis, hypertension, diabetes and cancer. Differently of what was previously suspected, obesity does not result exclusively from the consumption of increased amounts of caloric food and reduced physical activity. Recent studies show that an inflammatory process induced in the hypothalamus, the brain region that controls food intake and energy expenditure, is an important condition for the generation of an imbalance in the energy homeostasis in the body, favoring increased adiposity. In this presentation we will discuss the main advances obtained in this rapidly evolving field, focusing in the changes in the functional activity of the human brain as evaluated by neuroimaging.

## SCIENCE JOURNALISM AND PUBLIC PERCEPTION OF SCIENCE - SESSION 7

### Public engagement with Science and Technology: important for society, crucial for science

*Yurij Castelfranchi*

Public communication of S&T is usually not a major part in the work of an active scientist. However, in last years a lot of scientists decided to dedicate themselves to activities that try to reach general audience: science blogging, science writing, science in the radio or tv etc. Actually, as we will show, public communication of S&T and engagement with S&T are not only a right for the “lay public” and a responsibility for scientists, but also a growing necessity for scientific research itself. Based on recent data and investigations, I will show why engaging people in dialogues about science is so important today, and how to do it with success.

Bucchi, Massimiano, *Beyond Technocracy. Science, Politics and Citizens*. Springer, 2009.

CASTELFRANCHI, Yurij . When the data isn't there Disclosure: the scientific community (and society) at a crossroads . JCOM. Journal of Science Communication, v. 3, n. 2, 2004.

CASTELFRANCHI, Yurij . Scientists to the streets - Science, politics and the public moving towards new osmoses. JCOM. Journal of Science Communication, v. 1, n. 2, 2002.

### Open Doors to Science and Communication in Brazil

*Mariluce Moura*

Within the last ten years, scientific release in Brazil and the focus of Brazilian media on scientific knowledge have increased extraordinarily. In fact, some very clear milestones reveal this union between media and science. It is possible to predict that the process will steadily follow through, propelled by the Web and its multiple journalism/advertising/communication formats. The perception of such phenomenon influences the multiplication of scientific studies about the science divulgation field.

### Turning science into news

*Tim Hirsch*

Can there be a meeting of minds between scientists and journalists? Many scientists fear their work will be misrepresented, distorted and “dumbed down” by the media; yet do they make enough effort to communicate their work in language which non-specialists can be expected to understand? What are the responsibilities of scientists in a democratic society to make their research accessible to wider audiences, and of journalists to convey accurate nuances of risk and uncertainty etc? I will use some examples of coverage of scientific issues from my own experiences (including BSE, climate change); and take some sessions from the current symposium to discuss how they may be communicated as news stories.

## 12. POSTER ABSTRACTS

### From yeast to humans: a search for the genetic basis for the evolution of complexity over the last 1.4 billion years

*Araxi Urrutia*

A process known as alternative splicing (AS), where different proteins can be produced from a single gene is the main suspect. But there were no comparable estimates of AS for organism other than human to prove it. Here we have built a database to measure AS in 18 species, including yeast, insects, fish, birds, mammals, etc. Using this database combined with the data of gene numbers in each species, we calculated the total size of protein diversity. We found that protein diversity has increased steadily over the last 1.4 billion years and co varies with increases in complexity (number of cell types). We also find that the number of genes associated with greater inter cell interactions have increased dramatically whereas housekeeping genes have remained stable in numbers. Our data supports that protein diversity has increased during the past 1.4 billion years and that this increment has played a crucial role in allowing the emergence of more complex organisms.

### "Omics" approaches for prospection of biotechnological enzymes and their molecular characterization

*Fabio Squina*

Agricultural and forestry residues are an abundant and low-cost source of stored energy in the biosphere. Nowadays, biomass conversion into feedstock sugars has moved towards the forefront of the biofuel industry. However, the saccharification of plant biomass is a complicated and lengthy process, mainly due to the inherent recalcitrance and the complex heterogeneity of the polymers comprising plant cell walls. Lignocellulosic biomass must go through a pretreatment step, after a consortium of enzymes is used to break down the polysaccharides into simple sugar suitable for fermentation and ethanol production. Herein we report the approach being conducted in the Laboratório Nacional de Ciência e Tecnologia do Bioetanol (CTBE) aiming at the generation of a library for biomass-conversion enzymes. This effort may contribute to the field of bioenergy not only by improving techniques for rapid detection of polysaccharide hydrolysis through capillary electrophoresis and evaluation of enzymatic deconstruction plant biomass through microscopy analyses, but also by developing studies on structural characterization of biomass-conversion enzymes.

### Embryos: impressive fast and proper genome duplication

*Jolanta Kisielewska*

Proliferating cells must ensure that their genome is correctly duplicated and chromosomes are properly segregated into daughter cells. In somatic cells with efficient gene transcription this process is guarded by certain check points that stop progression through the cell cycle if any mistake is introduced preventing detrimental consequences for the next generation of cells. However early embryonic divisions are very distinct as they are transcriptionally silent and they have to duplicate their full genome over very short cell cycles. They do not have check points and if mistakes are introduced it is likely they will be passed to the next generation of cells. In most cases however fast embryonic cleavages lead to a healthy organism. Therefore efficient control of fast cell cycles relies on changing cell cycle protein-protein interactions rather than their full degradation and resynthesis.

## Contributions to the second generation bioethanol process

*M. Elena Lienqueo*

1. Evaluation of biological pretreatment of lignocellulosic material with white rot fungi (WRF) and chemical pretreatment (ionic liquids, ILs) as a step previous to the hydrolysis of cellulose.
2. Improve the cellulose conversion to fermentable sugars, using recombinant cellulases, previously isolated from fungi and optimized by protein engineering.
3. Comparative evaluation of ethanol yields from different lignocellulosics (wood residues and agronomic residues), using WRF and ILs combined with the engineered enzymes.

## Genomic of *Eucalyptus globulus* for pulp and biofuels

*Sofia Alejandra Valenzuela Aguila*

*Eucalyptus* is a specie of great interest for the pulp and paper industry. Worldwide there are 20 million hectares planted and within Chile a total of 650.000 ha, being the main species grown for short-fibre pulp *Eucalyptus globulus*, which is extensively used for pulping due to its fast growth, high pulp yield, and good fibre properties. Genetic programs of this specie have been oriented in improving commercial traits as volume, growth and form and recently there are including traits as pulp ability. Understanding the genomics basis of wood formation and indentifying genes that are responsible for the traits of interest is a major challenge. An EST library was made for each genotype, which was sequenced by the 454 platform, giving a total of 21,000 sequences, out of which 250 were differentially expressed. Due to the low amount of *Eucalyptus* sequences available, 28% of these sequences blasted to ESTs from wine grape, 22% to poplar and less than 5% to eucalypts. From these sequences, genes involved in lignin pathway, cellulose biosynthesis as well a transcription factors were identified. Among genes studied F5H, has higher expression levels in the high than in the low density and pulp yield genotypes.

Acknowledgments

Funding for this research was provided by Genomica Forestal (INNOVA-Chile, CORFO) and FONDEF 03i1103

## Role of Protein misfolding in neurodegenerative diseases: A look into the ER

*Claudio Hetz*

The most common neurodegenerative diseases, such as Alzheimer's Disease, Parkinson's Disease, Amyotrophic lateral sclerosis, and Huntington's disease, affect millions of people worldwide, but there is neither preventive nor curative therapy for them. These diseases share a common neuropathology, primarily featuring the presence of abnormal protein inclusions containing specific misfolded proteins. Recent evidence indicates that alteration in organelle function is a common pathological feature of protein misfolding disorders. The endoplasmic reticulum (ER) is an essential compartment for protein folding, maturation, and secretion. Signs of ER stress have been extensively described in most experimental models of neurological disorders. ER stress is caused by functional disturbances, which result in the accumulation of unfolded/misfolded proteins at the ER lumen. To cope with ER stress, cells activate an integrated signaling response termed the Unfolded Protein Response (UPR), which aims to reestablish homeostasis through transcriptional upregulation of genes involved in protein folding, quality control and degradation pathways. In this talk we overview our efforts to assess the role of ER stress in protein misfolding disorders, and discuss possible strategies to target the UPR with therapeutic benefits. This work was supported by FONCECYT # 1100176 and FONDAP #15010006 and Nucleo Milenio # P07-048-F.

## Neurochemical regulation of frontostriatal systems – implications for psychiatric disorders

*Hannah Clark*

Studies of monoaminergic modulation within the prefrontal cortex and related structures have revealed their involvement in diverse cognitive and affective control processes. Within the prefrontal cortex in particular, serotonin is associated with behavioural flexibility – the ability to change responding according to changes in the environment around you. We have used regionally specific serotonin and dopamine depletions to show that within the orbitofrontal cortex, serotonin, but not dopamine, is vital for successful, flexible responding on the object reversal paradigm. This finding is of particular significance to our understanding of a number of psychiatric disorders including obsessive-compulsive disorder (OCD), in which behavioural inflexibility is a prominent symptom, and which is commonly treated with drugs that target the serotonin system. Although dysfunction within the OFC can occur in this disorder, there is considerable evidence for more widespread dysfunction within OFC-subcortical networks that include the medial striatum. Lesions of the medial striatum also impair reversal learning, although in contrast to the orbitofrontal cortex, this deficit is dopaminergic and not serotonergic in origin. Consequently, defining how serotonin and dopamine differentially modulate fronto-striatal circuits may be crucial to understanding how these monoamines contribute to the diverse symptoms of OCD and other affective disorders.

## Mathematics for Complexity Science

*Jonathan Dawes*

New behaviour emerges from the interactions between simple things, for example in granular mixtures and flocks of birds. Understanding these kinds of collective dynamics mathematically is a huge challenge and hinges on averaging over small scales to produce robust large-scale descriptions.

## Potential benefits and challenges of magnetic resonance imaging at high field

*Denis Schluppeck*

Modern neuroimaging methods have made it possible to study many neuroscience questions directly in the human. By using functional magnetic resonance imaging (fMRI), for example, we can track changes in the local blood flow that go along with increased neural activity. One of the problems with studying the brain areas underlying our sense of touch is that in the human brain, they are relatively small. In a collaboration between the Schools of Psychology and Physics at the University of Nottingham, we have started using some cutting-edge technology to measure neural responses in human cortex at very high spatial resolution. This has enabled use to start studying these more difficult brain regions in the living human brain. By using ultra-high-field magnetic resonance imaging (MRI) techniques developed by the world-class Physics group at the University of Nottingham, we can measure robust neural responses non-invasively at a much higher spatial resolution than has previously been possible. Because imaging at very high field strengths requires a lot of technical expertise a collaborative link between researchers in neuroscience and physics is absolutely crucial.

## Improved cardiac energetics, endurance running capacity and cognition in rats fed a novel ketone ester diet

*Andrew Jephcoat*

The benefits of ketone metabolism on cardiac energetics, redox state and substrate availability suggest that mild ketosis may be a viable therapeutic strategy for heart failure and diabetic cardiomyopathy. Current ketogenic diets depend on elevation of plasma fatty acids, and hence activation of PPAR $\alpha$ , leading to inefficient fatty acid oxidation and mitochondrial uncoupling. We elevated blood ketone levels 2-fold, whilst decreasing levels of cholesterol and triglycerides, by feeding chow supplemented with (R)-3-hydroxybutyl (R)-3-hydroxybutyrate ester as 30% of calories. Rats consuming the ketone diet ran 32% further each day for 5 days on a treadmill test than rats fed isocaloric diets of palm oil or corn starch supplemented chow. Ketone-fed rats completed an 8-arm radial maze test 38% faster than rats fed the other diets, and were the only group to demonstrate improved working memory. Hearts from all rats were isolated and perfused for  $^{31}\text{P}$ -MRS experiments. The hearts from ketone-fed rats showed significantly greater free energy from ATP hydrolysis during increased work, following perfusion with isoproterenol, than hearts from rats fed the other diets. In vivo hyperpolarized  $^{13}\text{C}$ -MRS showed that ketone-fed rats had 50% lower pyruvate dehydrogenase flux, suggesting that the diet may provide energy to the insulin resistant heart. A ketone ester diet may therefore improve energetics in insulin resistant and failing human hearts.

## Unifying Discrete and Continuous Models in Evolutionary Dynamics

*Max Souza*

Starting from the Moran Model, which is a discrete model for evolutionary dynamics, we study a number of Thermodynamical limits for large populations, and obtain a framework that can accommodate as special cases several apparently disjoint models found in the classical literature, as the fitness Kimura Equation, and the Replicator Dynamics.

## Wireless Epidemics: Modelling and Applications

*Maziar Nekovee*

As wireless communication technologies spread, so the potential for viruses to exploit them grows. I present our recent research on both stochastic and deterministic modeling of virus spreading in fixed and mobile wireless computer networks, and examine how biological models of disease transmission via human contacts networks may assume new relevance for assessing the emerging threat.

## Nonlocal models for dispersing populations

*Salome Martinez*

In the poster we will show several models for interacting populations, in which the movement is nonlocal and modelled through an integral operator.

## The mystery of the formation of low-mass stars and planets

*Dimitri Stamatellos*

Stars, like our Sun, form with discs of gas around them. These discs are the cradle of other low-mass stars, planets, and life as we know it. I will present simulations of stars and planets forming in discs, using a novel method to treat the effects of radiative transfer in hydrodynamic simulations.

## The evolution of circumstellar disks: from protoplanetary to the debris fase

*Carolina Chavero*

A large percentage of stars are surrounded by dusty, disk-like structures. Infrared observations over the past few decades have yielded substantial information on these systems. Debris disks are often described as massive analogs to the debris in the solar system. The presence of a debris disk could indicate that planetary system formation is ongoing. The main subject of this work is to study the evolution of circumstellar disks around low-mass stars, based on infrared analysis, from the protoplanetary to debris stage.

## Radio imaging of proto-planets and their host discs

*Jane Greaves*

Large dust grains ('pebbles') emit in the radio regime. We describe the imaging of the proto-planet candidate HL Tau b within the parent disc, and present the near-future PEBBLES radio survey to be made with eMERLIN.

## Extrasolar Planet Research at U de Chile

*Patricio Michel Rojo Rubke*

I will present the latest publications and current status on projects lead by researchers and doctoral candidates at Universidad de Chile in the area of extrasolar planets. Making use of the privileged access to world-class telescopes, the research efforts are focused in groundbased observations. Long- and short-term projects are currently underway: (1) exoplanetary atmospheric characterization, (2) monitoring of southern transiting planets searching for transit-timing variations, (3) the Calan-Hertfordshire Extrasolar planet RV search (CHEPS), and (4) study of post main-sequence planetary hosts.

## The early Andean subduction system (northern Chile): a geochronological and geochemical study

*Veronica Oliveros*

Despite the large volumes of Mesozoic subduction-related igneous rocks in northern and central Chile, the onset of the Andean subduction system lacks of robust chronological constraints. This series of studies focuses on obtaining reliable geochemical data -isotope abundances in minerals and rocks- in order to better constrain the time relationships between magmatism, metamorphism and copper mineralization events occurred between 200 and 80 million years ago. Recently, the study has widened to volcanic rocks that do not belong to the primary volcanic front, and that do not have contemporaneous analogous, thus strengthening the hypothesis of the particular tectonic conditions that prevailed in the early Andes.

## Understanding how temperature controls plant growth cycles

*Steven Penfield*

The interaction of plant physiology and phenology with the earth's climate system is a key driver of the global carbon cycle. Temperature is an important regulator of plant growth and thus the understanding of the interaction between temperature and plant life cycles is a problem of global importance. This poster shows some of our latest work into the mechanisms through which temperature controls annual cycles of plant growth, using the genetic model plant *Arabidopsis thaliana*.



## Effects of elevated temperature in *Arabidopsis* flowering time and fitness under field conditions

*Paula Kover*

We have grown a set of 340 Multiparent Advanced Genetic InterCross (MAGIC) lines under natural field conditions in the Spring of 2009. Plants were grown in ten replicates, and half of them experienced an elevated temperature treatments (where temperature varied just as in control replicates, but was always 3 degrees warmer). We found significant genotype by environment effects and discuss the consequences of our findings to plant adaptation to future climatic changes.

## Response of crops and forests to high levels of carbon dioxide in the context of global climate change

*Carlos Alberto Martinez Y Huaman*

Despite extensive research on the effects of carbon dioxide on plants in other latitudes, especially in temperate species, there are still many uncertainties about the possible impact of climate change on agricultural systems and tropical forest ecosystems on the global carbon budget acting as sinks for atmospheric CO<sub>2</sub>. The predictions are difficult because the information about the effects of elevated CO<sub>2</sub> levels on crops and tropical tree species are scarce and not well understood. The information generated on molecular response, physiology, biochemistry and growth of crops and forest species to the combined action of environmental factors will determine the potential of species to establish in disturbed habitats, in a future climate simulation and will, ultimately, to increase the effectiveness of the prediction models of the effects of global climate change on agriculture and forest ecosystems in tropical countries in the region such as Brazil. In general, the results of our investigations carried out so far suggest that possible increases in crop productivity and the ability of carbon sequestration by forest trees of the tropics in a future environment of elevated CO<sub>2</sub> levels depend on the genotypic characteristics of the species and its successional characteristics, as well as the influence of other abiotic factors such as soil nutrition, water availability, among others. However, because most of the work was performed under controlled environments, to make real predictions, it is necessary to elucidate whether these responses occur under field conditions in interaction with other environmental factors like radiation, water and nutrients. Therefore, it is urgent to carry out experiments on systems FACE (free air CO<sub>2</sub> enrichment) that despite being very expensive and complex, provide information closer to reality in the field.

Financial support: FAPESP / CNPq.

## Research lines on the effect of climate

*Nicolas Franck*

The poster outlines the research lines that are currently being developed by the laboratory for agriculture and natural resources of arid zones (ARENA): carbon and water balance modelling at different levels (from leaf to ecosystem) of natural and cultivated Chilean arid zones aiming to predict the effect of climate change.

## Research activity in different countries from a bibliometric point of view

*Peter Schulz*

The profile of the research activities in different areas developed a given country is a powerful tool to identify correlations between the local scientific community behavior to other cultural and socio economic indexes, as well as the limitations of the use of bibliometric databases for research evaluation in certain areas.



## Investigation of Rare Processes in Particle Physics

*Cristina Lazzeroni*

One of the frontier researches in Particle Physics is the investigation of Rare processes in which scientists believe we will soon spot the appearance of New Physics beyond the establish models we all know. I will summarise my research in rare phenomena. Including some of the techniques used.

## Analytical model of non-Markovian decoherence in donor-based charge quantum bits

*Sascha Wallentowitz*

We develop an analytical model for describing the dynamics of a donor-based charge quantum bit (qubit). As a result, the quantum decoherence of the qubit is analytically obtained and shown to reveal non-Markovian features: The decoherence rate varies with time and even attains negative values, generating a non-exponential decay of the electronic coherence and a later recoherence. The resulting coherence time is inversely proportional to the temperature, thus leading to low decoherence below a material dependent characteristic temperature.

## The early Andean subduction system (northern Chile): a geochronological and geochemical study

*Libby Heaney*

The strange nonlocal correlations of entanglement are a key resource in quantum communication and quantum information processing protocols. Usually entanglement is thought to exist between two or more particles, however, it has recently been suggested that a single particle can also, in a certain sense, be entangled. This poster will track the history of single particle entanglement and refer to some recent work (Heaney and Vedral, Phys. Rev. Lett. 103, 200502 (2009)) that indicates the usefulness of this entanglement for quantum communication.

## Molecular mechanisms for zinc homeostasis

*Claudia Blindauer*

The poster would present an introduction to motivations behind studying the interactions of zinc and other metal ions with biological systems, complemented by selected recent examples.

## Hybrid inorganic – organic nanomaterials for photovoltaic energy conversion

*Saif Haque*

Concerns over security of supply, cost and the environmental impact of fossil fuels are all giving increasing urgency to the development of alternative renewable sources of energy. Photovoltaic devices based upon molecular materials are attracting considerable interest for the purpose. A typical molecular solar cell is based upon a nanostructured donor-acceptor photoactive layer sandwiched between two charge collecting electrodes. In this poster we will present some of our recent work focussed on the design and optoelectronic characterization of novel hybrid inorganic nanoparticle– polymer photoactive layers for solar cell applications. In particular, we will address the thin film nanomorphology, mechanisms of charge transfer at the donor-acceptor heterojunction and the photovoltaic performance of such layers. A key aim of this work is elucidation of quantitative structure-function relationships (engineering rules) that can be used to guide the design of next generation molecular materials for high performance photovoltaic devices.

## Trophic amplification of climate warming

*Richard Kirby*

Ecosystems can alternate suddenly between contrasting persistent states due to internal processes or external drivers. It is important to understand the mechanisms by which these shifts occur, especially in exploited ecosystems. There have been several abrupt marine ecosystem shifts attributed either to fishing, recent climate change or a combination of these two drivers. We show that temperature has been an important driver of the trophodynamics of a heavily fished marine ecosystem for nearly 50 years and that a recent pronounced change in temperature established a new ecosystem dynamic regime through a series of internal mechanisms. Using an end-to-end ecosystem approach that included primary producers, primary, secondary and tertiary consumers and detritivores, we found that temperature modified the relationships among species, through nonlinearities in the ecosystem involving ecological thresholds and trophic amplifications. Trophic amplification provides an alternative mechanism to positive feedback to drive an ecosystem towards a new dynamic regime. While overfishing is often held responsible for marine ecosystem degeneration, temperature can clearly bring about similar effects. Our results are relevant to ecosystem based fisheries management (EBFM), seen as the way forward to manage exploited marine ecosystems.

## Warm water decapods and the trophic amplification of climate in the North Sea

*Richard Kirby*

A long-term time series of plankton and benthic records in the North Sea indicates an increase in decapods and a decline in their prey species that includes bivalves and flatfish recruits. Here, we show that in the southern North Sea the proportion of decapods to bivalves doubled following a temperature-driven, abrupt ecosystem shift during the 1980s. Analysis of decapod larvae in the plankton reveals a greater presence and spatial extent of warm-water species where the increase in the decapods is greatest. These changes paralleled the arrival of new species such as the warm-water swimming crab *Polydora henslowii* now found in the southern North Sea. We suggest that climate-induced changes among North Sea decapods have played an important role in the trophic amplification of a climate signal and in the development of the new North Sea dynamic regime.

## 13. BRAZILIAN NATURE MYSTERY AND DESTINY EXHIBITION



### Acquiring Knowledge in Order to Preserve

Brazil has one of the world's richest diversities of natural environments and animal and plant species. It has six large biomas – Amazonia, Caatinga (scrubland), Atlantic Forest, Cerrado (savannah), Pantanal (wetlands) and Pampa – originally distributed across 8.5 million square kilometers of the country and more than 8 thousand kilometers of coast. This means that Brazil is home to between 15 and 20 per cent of the planet's biodiversity.

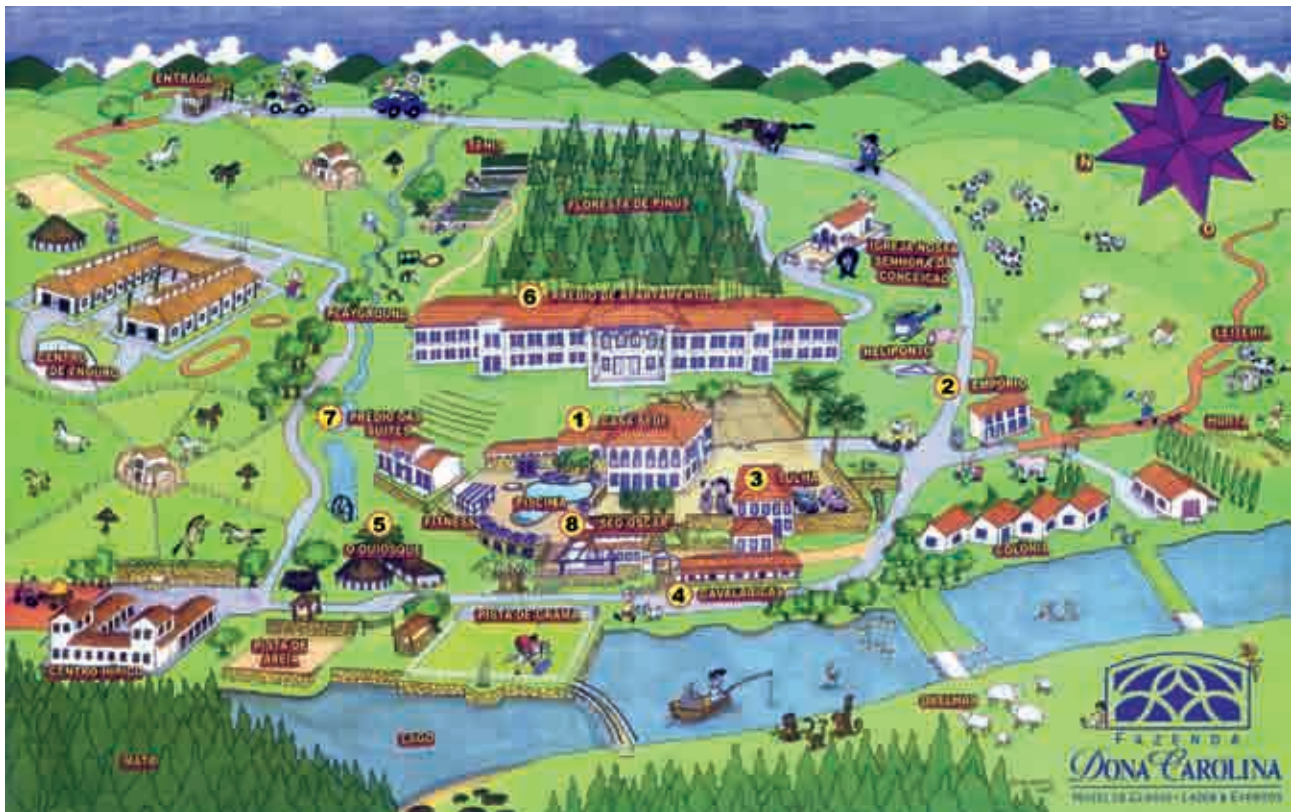
This variety of landscapes and of ways of life attracted European naturalists since the XVI century, but principally from the XIX century onwards. With the transfer of the Portuguese Court to Brazil in 1808, the then colony opened up to international commerce and also to the visits and scientific study of naturalists from several nationalities. One of them, the German Carl Friedrich Philipp von Martius, after a three-year journey through the country (1817-1820), was responsible for what is still the most complete survey of plants in Brazil, the *Flora brasiliensis*, published between 1840 and 1906, initially by Martius himself and, after his death, by August Eichler and Ignatz Urban.

Today, Brazilian specialists attempt to gauge more precisely this rare natural patrimony, so that it can be conserved and exploited in the best possible way. The São Paulo Research Foundation (FAPESP), one of Brazil's principal agencies for the funding of research, has had an outstanding role in this endeavor.

A partnership between FAPESP and the Berlin Botanical Museum has made it possible to stage the exhibition *Brazilian Nature: Mystery and Destiny*, displaying just a taste of this biological wealth and some of the scientific activities to preserve it. Ultimately, the preservation and sustainable use of biodiversity signify the very survival of humanity.



## 14. DONA CAROLINA HOTEL MAP



Itatiba - SP  
[www.donacarolina.com.br](http://www.donacarolina.com.br)

### Legenda:

1. CASA SEDE (Main House) – Check-in/Registration
2. CACHAÇARIA (Still-Room) – “Botequim Reception” and dinner – Aug 27<sup>th</sup>
3. CELEIRO (Barn) – Conference room and office
4. CAVALARIÇA (Stables) – Poster session and Coffee breaks – Aug 29<sup>th</sup> and 30<sup>th</sup>  
 Brazilian Nature Exhibition – Aug 28<sup>th</sup>
5. QUIOSQUE (Kiosk) – Barbecue – Aug 29<sup>th</sup>
6. PRÉDIO DOS APARTAMENTOS – Rooms and Breakfast
7. PRÉDIO DAS SUÍTES – Rooms
8. SEO OSCAR RESTAURANT – Lunch

