

Oxford University Scientific Society — Michaelmas Term 2013

“Reducing waste in deciding what research to do”

Sir Iain Chalmers — Wednesday, 16th October 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

In a paper published in *The Lancet* in 2009, (374:86–89), Chalmers and Glasziou estimated that **85 per cent of the substantial investment in medical research was being avoidably wasted**. The paper prompted one large research funding agency to review how its commissioning and management of research could be made more efficient, and *The Lancet* to commission a series of papers on waste in pre-clinical, clinical and epidemiological research. I will present evidence relevant to reducing waste in deciding what research to do.

Sir Iain Chalmers is a British health services researcher, one of the founders of the Cochrane Collaboration. His contributions have been instrumental in advancing international policies on research for health — such as PAHO's Policy on Research for Health, and to promote a better understanding of the importance of building bridges between users and producers of research for health policy and health care delivery. Chalmers previously co-chaired the Research Strategy Committee of the MS Society.

“What can mathematics say about liquid crystals?”

Professor Sir John Ball FRS FRSE — Wednesday, 23rd October 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Liquid crystals represent a vast and diverse class of materials which are intermediate between isotropic liquids and crystalline solids. Liquid crystal ordering is found in a wide variety of systems, ranging from fluids made up of simple rods, polymers, elastomers and biological organisms. Liquid crystals have a multitude of applications, notably those in flat panel display technology, which has fundamentally impacted modern life. The lecture will describe these fascinating materials and what mathematics, in particular the study of partial differential equations, can tell us about them.

Professor Sir John Ball FRS is currently Sedleian Professor of Natural Philosophy at the Mathematical Institute, University of Oxford and Director for Oxford Centre for nonlinear PDE. Between 2003–2006 President of the International Mathematical Union. He was elected a fellow of Royal Society, Royal Society of Edinburgh. Other awards include the 1981 Whittaker Prize of the Edinburgh Mathematical Society, the 1990 Keith Prize of the Royal Society of Edinburgh, the 1995 Naylor Prize in Applied Mathematics of the London Mathematical Society, and the 2003 David Crighton Medal.

“CHANGING DIETS, CHANGING MINDS: The Importance of Nutrition for Mental Health, Performance and Wellbeing”

Dr Alex Richardson — Wednesday, 30th October 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

It has been recognised for some time that consumption of a typical modern, western-type diet — rich in highly processed and refined foods — significantly increases the risks for many physical health disorders, including obesity, Type 2 diabetes, cardiovascular disease (CVD), immune system disorders, and cancer. Nutrition is equally fundamental to mental health and wellbeing, and the evidence is now undeniable that diet plays an important role in many developmental and mental health conditions. In developed countries, these now contribute more to the overall burden of ill-health than do physical health disorders, and the associated cost burdens are already threatening to overwhelm public health services.

The nutritional composition of human diets changed quite fundamentally following industrialisation, and many of these changes are pathological for both brain and body. Two of the most notable are a dramatic increase in the intake of sugar and other refined carbohydrates (and a corresponding lack of fibre and essential micronutrients), and substantial changes in the type and balance of dietary fats (with a particular increase in the ratio of omega-6 to omega-3 fats). Both have important implications for brain development and functioning, as does a lack of essential micronutrients, which is common in the general population, and particularly so in vulnerable groups.

This talk will provide an overview summarising the role of nutrition and diet in mental health, and the effects of both sugar and different types of dietary fat on brain function. Evidence for causal links between diet and behaviour will be highlighted in a framework following the lifespan, starting with pregnancy and early life, childhood (when developmental conditions such as ADHD, autism and dyslexia usually first manifest), adolescence and young adulthood (typically the peak age of onset for antisocial behaviour, depression and schizophrenia) and older adulthood (associated with age-related cognitive decline and dementia).

Greater awareness of the importance of nutrition and diet for brain function is needed among both policymakers and the general public — along with better education and training in these areas for professionals working in health, education, social services and allied areas — if we are to succeed in meeting the challenges presented by the current ‘epidemic’ of mental health disorders.

Summary of key points

- Mental health disorders have now overtaken physical health disorders in terms of their cost burden in the UK and other developed countries.
- Nutrition affects mental as well as physical health, because diets that are good (or bad) for the body will also be good (or bad) for the brain.
- Typical modern, western-type diets (rich in highly processed foods) contain an excess of sugar, insufficient fibre, and are relatively deficient in omega-3 fatty acids and often other essential nutrients. Any of these features can compromise brain function and therefore mood, behaviour and learning.
- Good evidence shows that diet plays a role in many mental health conditions, ranging from ADHD and depression to dementia. Better public education and professional training in the relevance of nutrition could help in both prevention and management.

About Dr Alex Richardson

Dr Alex Richardson is a Founder/Trustee of [FAB Research](#) and a Senior Research Fellow at the [Centre for Evidence Based Intervention](#), University of Oxford, having previously been based at Oxford's Dept of Physiology,

Anatomy and Genetics from 1987–2007. She is internationally known for her work on the role of nutrition in behaviour, learning and mood, and is one of the world's leading researchers on the influence of omega-3 and other dietary fats on mental health and performance, particularly in relation to developmental conditions such as ADHD, dyslexia, depression and schizophrenia. Her research has always been multi-disciplinary, and currently involves both experimental studies and nutritional treatment trials. Alex is much sought after as a speaker for public, professional and academic audiences both nationally and internationally. She has over 90 research publications to date, and is also author of *They Are What You Feed Them*.

“Chemistry: Live and in 3D”

Dr Nick Greeves — Wednesday, 6th November 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

ChemTube3D (<http://www.chemtube3d.com>) is a freely available web site based at the University of Liverpool aimed at students, lecturers and practicing chemists. It contains interactive 3D animations and structures, with supporting information for some of the most important topics covered during an undergraduate chemistry degree including Organic Mechanisms, Organic Structure and Bonding, Solid State structures, Polymers and A level topics.

The demonstration will showcase selected pages containing some information about the structures or an intuitive interactive reaction scheme that controls the display. A novel method for linking physical textbooks to the web-based resource will be illustrated together with evidence for success.

Dr Nick Greeves is currently a Senior Lecturer at Department of Chemistry, University of Liverpool. His research interests are in synthetic organic chemistry covering the design, discovery, development, and deployment of new stereoselective synthetic methods with particular interest in asymmetric reactions. He was selected for a HEA National Teaching Fellowship in 2009 and is a co-author of the bestselling (100,000 copies) textbook *Organic Chemistry* now in 2nd edition.

“An outsider's take on autism”

Professor Martin Raff FRS — Wednesday, 13th November 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Autism spectrum disorders (ASDs) are common. From being the least understood of the neuropsychiatric disorders, they are now arguably the best understood. Progress has come largely through recent advances in human genetics that have identified large-effect mutations that cause or predispose to these disorders and through studies of mouse models based on these mutations.

Remarkably, in a number of mouse models caused by single gene mutations, correcting the problem in the adult brain with drugs or genetic manipulations largely reverses many of the behavioural and neurobiological abnormalities, providing hope for the development of therapies for ASDs. In my talk, I will review the basic features of ASDs, using home videos of the development of my eleven-year-old autistic grandson as an example, and I will discuss some of the recent advances in ASD research, consider current puzzles, and speculate on possible ways forward.

Professor Martin Raff FRS is Emeritus Professor at [MRC Laboratory for Molecular Cell Biology](#), UCL. Raff has attained many prestigious awards and honours: he is a Fellow of the Royal Society, a Foreign Associate of the

National Academy of Sciences of the USA, and was President of the British Society of Cell Biology. Awarded with Feldberg Prize and the Biochemical Society Award. Co-author of *Essential Cell Biology* and *Molecular Biology of the Cell*.

“A Bird's eye view of the chemical compass – the chemistry of animal navigation in magnetic fields”

Dr Christiane Timmel – Wednesday, 20th November 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Abstract TBA

Dr Christiane Timmel is currently a fellow of New College and a University Lecturer at the Department of Chemistry, University of Oxford. Her research interest lies mainly in the area of Spin- and Photochemistry.

“Stability and complexity in financial ecosystems”

Professor Robert M. May (Lord May of Oxford, OM AC FRS) – Wednesday, 27th November 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Recent events have made it clear that complex financial instruments (derivatives and their kin), which allegedly enabled individual banks and investment funds to get good returns with minimal risks, had dynamical properties which were poorly understood. In particular, it is astonishing that essentially no attention was given to the overall systemic risks posed by these instruments. Deliberately oversimplified mathematical caricatures of banking ecosystems, which capture some of the essential dynamics and which have parallels (along with significant differences) with earlier work on stability and complexity in ecological food webs, have interesting implications. This talk will first sketch these models, giving particular attention to the role of confidence in propagating shocks, and will conclude with an outline of ensuing regulatory implications.

Professor Robert May (Lord May of Oxford, OM AC FRS) is a professor of zoology at University of Oxford and until recently President of the Royal Society (2000–2005), and before that Chief Scientific Adviser to the UK Government and Head of the UK Office of Science and Technology. His many honours include: the Royal Swedish Academy's Crafoord Prize (bioscience and ecology's equivalent of a Nobel Prize); the Swiss–Italian Balzan Prize and the Japanese Blue Planet Prize. In 2007 he received the Royal Society's Copley Medal, its oldest (1731) and most prestigious award, given annually for outstanding achievements in research in any branch of science.

“Foundations of Quantum Mechanics”

Professor James Binney FRS – Wednesday, 4th December 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

It is physically obvious that the theory of objects as small as atoms has to be probabilistic in nature. It is equally obvious that any such theory must engage with the physics of measurement. The standard Copenhagen interpretation of quantum mechanics is built around a picture of measurement that is a caricature: it captures essential elements of reality by exaggerating and distorting them. For a deeper understanding of phenomena one would like in a specific worked examples to dig beneath the Copenhagen interpretation, but doing so is hard. Prof. Binney will argue that just one thing about quantum mechanics is mysterious and enormously convenient: the use of amplitudes (complex numbers) to compute probabilities (non-negative real numbers). The entire formalism follows naturally from this unexplained assumption. In this view the many-worlds interpretation of QM is mindless chatter that merely distracts attention from the fundamental issue.

Professor James Binney FRS is an astrophysicist, **Professor of Physics** at University of Oxford where he is head of the **Sub-Department of Theoretical Physics**. He has received a number of awards and honours for his work, including the Maxwell Prize of the Institute of Physics, the Brouwer Award of the American Astronomical Society, the Dirac Medal, and the Eddington Medal and has authored over a hundred articles in peer-reviewed journals, and several textbooks, including *The Physics of Quantum Mechanics*. His research mainly concerns the structure, dynamics and formation of galaxies.