Oxford University Scientific Society — Hilary Term 2014

“Remaking the 21st Century”

Dr Eric Drexler — Thursday, 23rd January 2014 at 8.15pm in the Clarendon Laboratory, Oxford (Lindemann Lecture Theatre) on Parks Road Note: different place

NOTE: this event is in the Lindemann Lecture Theatre, Clarendon Laboratory, on Parks Road, not in the usual place, and takes place on **THURSDAY**.

Can we ever 3D print a jet engine? What does nanotechnology hold for the future of the manufacturing industry?

Abstract: Can industry as we know it be made obsolete? If so, then the problems of the 21st century, including climate disruption, are not as they seem. Physical principles indicate the feasibility of developing a high-throughput atomically precise manufacturing technology that operates at low cost, with common materials, and with an extraordinary scope of application. The prospective technology resembles 3D printing, but capable of producing, for example, photovoltaics, jet engines, and nanoscale digital electronics. Rapid progress in atomically precise fabrication, primarily in the molecular sciences, points the way to an incremental development path that leads to a genuinely revolutionary set of capabilities. This prospect calls for a multifaceted shift in today's research agenda.

Eric Drexler is a pioneering nanotechnology researcher and author. In his 1986 book, Engines of Creation, he introduced a broad audience to the promise of high-throughput atomically precise manufacturing, a prospective technology using nanoscale machinery to guide molecular motion and bonding, thereby structuring matter from the bottom up. In his publications and lectures, Dr. Drexler describes the implementation and applications of advanced nanotechnologies, and their potential impact on global problems.

8:15pm, Thursday 23rd Jan., Lindemann Lecture Theatre, Clarendon Lab

Jointly with the Oxford University Physics society.

Entry: Free for members (Â£2 for non-members

“Are we Seeing Signals from Before the Big Bang?”

Professor Sir Roger Penrose OM FRS — Wednesday, 29th January 2014 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Is our universe's history just one aeon of a continual succession of aeons? Roger Penrose presents recent evidence of signals from a previous aeon.

Abstract:
In 2005 I proposed the unconventional scheme of conformal cyclic cosmology (CCC). This takes what is currently regarded as the entire history of the universe, from its Big-Bang origin (with no inflationary phase) to its final exponential expansion, to be but one aeon of a continual succession of such aeons. The big bang of each is taken to be

an infinitely scaled down continuation of the exponentially expanding remote future of the previous one. A positive cosmological constant (dark energy) and some primordial scalar material (dark matter) are both essential to CCC's consistency. Supermassive black-hole encounters in the aeon previous to ours would have observational implications for CCC, detectable within the cosmic microwave background. Recent evidence of such signals in both the WMAP and Planck satellite data will be presented.

8:15pm, Wednesday 29th Jan, Inorganic Chemistry Department, South Parks Road

Entry: Free for members (Â£2 for non-members)

About The Speaker:
Sir Roger Penrose OM FRS, is a mathematical physicist, mathematician and philosopher of science. He is the Emeritus Rouse Ball Professor of Mathematics at the Mathematical Institute of the University of Oxford, as well as an Emeritus Fellow of Wadham College. Penrose is known for his influential work in mathematical physics, in particular for his contributions to general relativity and cosmology. He has received a number of prizes and awards, including the 1988 Wolf Prize for physics, shared with Stephen Hawking for their contribution to our understanding of the universe. Popular science works include *The Emperor's New Mind*, *Shadows of the Mind: A Search for the Missing Science of Consciousness*, and *The Road To Reality*.

“Erasmus Darwin, evolution and slavery”

Dr Patricia Fara — Wednesday, 5th February 2014 at 8.15pm in theInorganic Chemistry Lecture Theatre on South Parks Road

Half a century before his famous grandson, Erasmus Darwin published controversial ideas about evolution that put his medical text on the Vatican's banned list. Dr Patricia Fara explores fresh ways of thinking about this champion of Enlightenment thought.

Abstract:
Erasmus Darwin — Charles's grandfather — was well-known among his eighteenth-century contemporaries, highly respected by many but reviled by others. Energetic and sociable, this corpulent tee-totaller ran a successful medical practice, was a Fellow of the Royal Society and did much to alter the public face of science by sponsoring industrial innovation in the Midlands as well as writing best-selling poems on plants, technology and evolution. In this lecture, Patricia Fara explores fresh ways of thinking about this champion of Enlightenment thought. More than fifty years before his famous grandson, Erasmus Darwin dared to publish controversial ideas about evolution that put his medical text on the Vatican's banned list. Politically radical, he campaigned for the abolition of slavery, supported the French Revolution, promoted education for women, and challenged Christian orthodoxy.

About The Speaker:
Patricia Fara has a degree in physics from Oxford and a PhD in History of Science from London. Now based at Cambridge University, she is the Senior Tutor of Clare College and lectures in the History and Philosophy of Science Department. Her major research topics are eighteenth-century England and scientific portraits but she has published a range of academic and popular books on the history of science including *Science: A Four Thousand Year History* and *Newton: The Making of Genius*. In addition to her work for TV and radio she regularly writes reviews and articles for publications such as *Nature*, *The Times Literary Supplement*, *BBC Knowledge* and *Endeavour*.

“How to Win a Nobel Prize — The secret of cell division”

Sir Tim Hunt FRS — Wednesday, 12th February 2014 at 8.15pm in theInorganic Chemistry Lecture Theatre on South Parks Road

Nobel Laureate Sir Tim Hunt FRS describes his career as a scientist, from studying haemoglobin synthesis to discovering cyclin and its role in cell cycle regulation.

Abstract:
I grew up in Oxford wanting to be a scientist, loving gadgets and processes like melting lead pipes or electrolyzing salt solutions to make poisonous and explosive gases. Luckily, I had excellent teachers who channeled these enthusiasms into a deeper and more formal understanding of chemistry and biology (physics, alas, was beyond my grasp) so that it was possible to study at Cambridge University and carry on there with a Ph.D. in biochemistry, on the control of haemoglobin synthesis. I'll explain how I arrived at this—it was an accident—and also where I pursued the subject. It took ten years, many interesting side roads, a lot of travel and a devastating fire to solve the problem of how the synthesis of haem was coordinated with the synthesis of globin.

After that, it took another 7 years or so to find a really good new problem to work on, but on July 22nd 1982 I was teaching and researching at the Marine Biological Laboratory, Woods Hole, and saw to my amazement that a prominent protein, later called cyclin, disappeared just before fertilized sea urchin eggs divided for the first (and every subsequent) time they divided. Finding out what this protein was, and what it did, took another six or seven years of very exciting work, leading away from the control of protein synthesis to the control of cell division. Yet amazingly, the underlying mechanisms were identical, involving a class of enzymes known as protein kinases, which attach phosphate residues onto other proteins, thereby modifying their behavior. I've always liked biological switches and finding how they work.

Most recently, however, I've been drawn to the study of the enzymes that remove phosphates from proteins and their control, which turn out to be very important in the switches that initiate and terminate cell division. The path was marked by unexpected discoveries all along the way, almost always stemming from sensible experiments designed to test something different!

About The Speaker:
Sir Tim Hunt studied Natural Sciences at Clare College, Cambridge and joined the Department of Biochemistry as a research student in 1964, completing his PhD in 1968, entitled “The Synthesis of Haemoglobin”. While teaching in 1982 at the Marine Biological Laboratory in Woods Hole, Massachusetts, he discovered cyclins, and in 2001 was awarded the Nobel Prize in Physiology or Medicine with Lee Hartwell and Paul Nurse for their discoveries of “Key regulators of the cell cycle”. In 1990, Dr Hunt left Cambridge to work at the Clare Hall Laboratories of the Imperial Cancer Research Fund, now Cancer Research UK. He was elected a fellow of the Royal Society in 1991. In 2006, he was awarded the Royal Medal for his work on cell cycle control and was knighted by the Queen in the same year.

Cancer Research UK, Clare Hall Laboratories, South Mimms, Herts EN6 3LD, U.K.

“The Door to Identity”

Professor Nicky Clayton FRS and Mr Clive Wilkins — Wednesday, 19th February 2014 at 8.15pm in the Inorganic Chemistry Lecture Theatreon South Parks Road

Abstract:
Re-living memories and imagining future scenarios lies at the heart of humanity. The very nature of imagination impedes and disorientates, memories, and diversifies reality. We make use of this to define multiple realities, coexisting side by side. But are we unique among the animal kingdom in travelling mentally in time?

About the Speaker:
Nicola Clayton is Professor of Comparative Cognition in the Department of Psychology at the University of Cambridge, a Fellow of Clare College and a Fellow of the Royal Society. Her expertise lies in the contemporary study of comparative cognition, integrating a knowledge of both biology and psychology to introduce new ways of thinking about the evolution and development of intelligence in non-verbal animals and pre-verbal children. She is also Rambert Dance Company's first Scientist in Residence. She collaborates with Mark Baldwin, the Artistic Director, on new choreographic works inspired by science including the Laurence Oliver award winning *Comedy of Change*, and *Seven For A Secret Never To Be Told*.

"Tales from Zooniverse: the role of citizen science in modern research"

Dr Chris Lintott — Wednesday, 26th February 2014 at 8.15pm in theInorganic Chemistry Lecture Theatre on South Parks Road

Christopher John Lintott is an English astrophysicist, working as a researcher in the Department of Physics in the University of Oxford. Lintott is involved in a number of popular science projects aimed at bringing astronomy to a wider audience. He is the primary presenter of the BBC series *The Sky at Night*, having previously acted as a co-presenter alongside Patrick Moore until Moore's death in 2012. Lintott is also a co-author of the book *Bang! — The Complete History of the Universe* with Patrick Moore and *Queen*guitarist and astrophysicist Brian May.

The Improbable Origin of Complex Life

Dr Nick Lane (in conjunction with Oxford University Biological Society) — Wednesday, 5th March 2014 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

All morphologically complex life on Earth is eukaryotic, and shares a common ancestor that arose just once in 4 billion years of evolution. Recent genomic evidence suggests that eukaryotes arose in an endosymbiosis between two prokaryotes, in which an archaeal host cell engulfed a bacterium, the ancestor of mitochondria. I will discuss the singularity of eukaryotic origins, and why mitochondria enabled the evolution of enormous genomic complexity, while simultaneously forcing the evolution of many curious eukaryotic traits, from programmed cell death to two sexes.

About The Speaker:
Dr Nick Lane is an evolutionary biochemist and writer in the Department of Genetics, Evolution and Environment, University College London. He was awarded the inaugural Provost's Venture Research Prize for his research on evolutionary biochemistry and bioenergetics. His work focuses on the origin of life, and the origin and evolution of eukaryotes. He was a founding member of the **UCL Consortium for Mitochondrial Research**, and is leading the **UCL Research Frontiers** *Origins of Life* programme. He is the author of three critically acclaimed books on evolutionary biochemistry, the most recent of which, *Life Ascending*, won the 2010 Royal Society Prize for Science Books.

“Finding the right balance — from rare gases to rotary motors”

Professor Dame Carol Robinson DBE FRS — Wednesday, 12th March 2014 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Abstract:
When JJ Thompson and colleagues first separated the isotopes of neon in a glow discharge tube back in 1913 they could scarcely have imagined the foundations they would be laying. Their experiments led to the discovery of the first mass spectrometer, a sophisticated balance that can separate and record species based on mass to charge ratio. Today mass spectrometry underpins many walks of life, from worldwide efforts in proteomics to forensic detection at airports.

My lecture will focus on a series of developments that have opened up a whole new area of research: gas phase structural biology. By finding ways to project components of cells directly into mass spectrometers, we have learned not only about their composition, but also unexpectedly about their function. In this entirely new environment, we can capture the workings of key complexes as they synthesise proteins, shuttle, spin and pump across the membrane bilayer or wobble around an asymmetric axis. This new view of cellular components contributes to the discovery of new regulatory mechanisms and provides valuable insight into drug discovery programs.