Oxford University Scientific Society — Trinity Term 2013

“The Science behind Drugs and Doping in Sport”

Professor Chris Cooper, University of Essex — Wednesday, 24th April 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

What are the limits of human performance? How fast can we run, swim or throw? Do we really need artificial biochemical aids to enhance performance? Will new drugs be discovered one day that are even better than steroids?

Chris Cooper is the author of the book *Run, Swim, Throw, Cheat* on doping in professional sports, as well as a blog of the same title. He will be talking how various drugs have affected professional sport to date; and what the future holds. He is a professor of Biochemistry at the University of Essex, where his research is on oxygen gas in medicine and biology, and is the director of the Centre for Sports and Exercise Science.

“Big Bad Pharma”

Professor Joe Sweeny, University of Huddersfield — Wednesday, 1st May 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

The use of chemicals to treat disease was an ancient practice, but modern chemotherapy is a relatively young discipline. Since the 1930s, the use of drugs to treat and cure illness has become a modern paradigm, to the point where society now considers access to pharmaceuticals to be a human right. This lecture will give an overview of how chemotherapy has evolved from its early beginnings, the challenges involved in bringing medicines to market in the 21st-century, and will consider how pharmaceuticals might be made and distributed in the future.

Joe Sweeney works in the Chemistry department at the University of Hudderfield on the design and implementation of new processes in organic chemistry, with a focus on asymmetric and target-oriented synthesis, and chemical biology.

“Life in the Frozen State”

Professor Lloyd Peck, British Antarctic Survey — Wednesday, 8th May 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Organisms can respond to environmental stress with a range of mechanisms that vary over biological as well as spatial and temporal scales. In terms of responses to climate change it has been argued that phenotypic plasticity and changes in population gene complement via gene transfer and the production of new genes via mutation are the most important. However, pre-existing adaptations predicate the capacities of organisms to respond. Organisms adapted to environments with low fluctuation lose the capacity to tolerate variation. Here, the current data on Antarctic marine species abilities to resist warming and altered pH are summarised. The likely outcomes following predicted climate change are considered in the light of the main characteristics of this fauna, namely slowed rates of growth, development, deferred maturity and the general loss of the heat shock response, and the loss of haemoglobin by Antarctic ice fish.

Professor Lloyd Peck is a biologist studying giant sea spiders. They and other small animals grow far larger than usual in the extreme cold. Studies suggest that sea temperatures are rising, and Professor Peck investigates whether the animals he researches will be able to adapt and survive.

"Cancer's Hidden Networks"

Dr Eric Werner FLS, University of Oxford — Wednesday, 22nd May 2013 at 8.15pm in the Inorganic Chemistry Lecture Theatre on South Parks Road

Eric Werner is the founder of **Cellnomica**, Inc., and the Oxford Advanced Research Foundation. He is in the Department of Physiology, Anatomy and Genetics, Department of Computer Science, Balliol Graduate Centre, University of Oxford.

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The standard theory of cancer is that cancer results from uncontrolled growth, due to mutations in genes **(Hanahan and Weinberg, 2000)**. Previous mathematical models accept this paradigm. In contrast I present a new paradigm of how cancer works based not on genes but developmental networks that control both normal cells and cancer cells**(Werner, 2011b)**. This shift in understanding of how cancer works leads to a classification of all possible cancers based on their developmental control networks. It is a kind of periodic table of cancers that suggests fundamentally new research approaches to diagnosing, treating and curing cancers. The various cancer types have been modeled and simulated. In the talk I will describe the networks behind cancer stem cells. I will describe some interesting mathematical properties of stem cell networks that relate their ideal growth rates to the figurative numbers and Pascal's Triangle. Additionally, when cancer has spread the types of metastases that form depend on the kind of cancer network that generates the original tumor. There is a hierarchy of cancer networks with a corresponding hierarchy of metastases going from relatively harmless to increasingly dangerous tumors. I will also show why some cancers, like brain tumors, grow very slowly and then can suddenly become explosive. Cell signaling cancer networks similar to those underlying some bone cancers will also be described. This revolutionary new paradigm is related to the recent quest to understand the hidden code or dark matter the non-coding genome that makes up some 95% of all DNA in humans.

References:

1. Hanahan, D. and Weinberg, R.A., 2000. The hallmarks of cancer, *Cell* **100**, 57–70.
2. Werner, E., 2011b. Cancer Networks: A general theoretical and computational framework for understanding cancer, arXiv:1110.5865v1 [q-bio.MN]. **http://arxiv.org/abs/1110.5865**.