TMS Annual Symposium 2016 - Sunday 21 February, Winstanley Lecture Theatre

Joy Thompson, "*Tissue mechanics in early brain development*" [10:15am – 10:45am]

Neuronal growth is essential for nervous system development and is also required for regeneration after nervous tissue injury. Recent in vitro studies suggest that neuronal growth can also be regulated by mechanical properties of the substrate; however, the role of mechanical cues in axon pathfinding in vivo, and the spatiotemporal dynamics of tissue mechanics during early nervous system development, are still largely unknown. I am investigating the role of tissue stiffness in axon guidance within the early embryo, using the Xenopus laevis optic tract as a model system. I find that the path of optic tract growth is correlated with stiffness gradients in the living brain, before growth stalls after reaching the softer region. This is consistent with a role for substrate mechanics in axon pathfinding.

Mary Fortune, "*So Your Experiment Hasn't Worked: How to Lie with Statistics*" [10:45am – 11:15am]

Lab work can be so hard sometimes. Is your discovery that your patented snake oil formula (available from your website for the low price of only $199 a bottle) can cure cancer being prevented from seeing the light of the day by science's unreasonable demand for evidence? Well, worry no more! With a few simple statistical fallacies, you can quickly produce significant results, and even the most disappointing dataset can become a published paper.

Dr. Jonathan Nelson (ATASS Sports), "*Smashing the Racket: Detecting Match-fixing in Tennis via In-play Betting Irregularities*" [11:20am – 12:05pm]

An unfortunate consequence of the recent growth in tennis betting markets has been a heightened incentive for match-fixing - particularly at lower levels of the sport, where earnings are modest, and where the market for one match may dwarf the prize money for an entire tournament. Against this backdrop, an unscrupulous player may be tempted to profit from their position of influence by secretly agreeing to "throw" a particular match, with a complicit third party betting on the result.

This talk summarises the results of a match-fixing study spanning over 5,000 in-play tennis betting markets. After developing a natural point-by-point probabilistic model, featuring novel mechanisms for selecting parameters robustly from the data, we demonstrate that the observed market trajectories correlate extremely closely with this model. We argue that substantial discrepancies represent a "red flag" that something is amiss - either an injury, or something more covert. We also provide visualisations of recent matches where the market evolved pathologically, and assess the evidence that these matches were fixed.

Jean Pichon, "*Semantics*" [12:45pm – 1:15pm]

Programs never do what you want them to do. To figure out what a program means, if you are lucky, you just have to wade through long, tedious, imprecise, and ambiguous prose documents. If you're unlucky, the meaning is left as an exercise to the reader. In this talk, I will discuss how to formally give meaning to programs using elementary mathematics: sets, functions, and inductive relations. I will show how this makes it possible to actually make sure programs do what we want them to do."

Dr. Thomas Forster (DPMMS), "*Axiom of Choice*" [1:15pm – 2:10pm]

The Trinity Mathematical Society has had a long-standing relationship with Dr. Thomas Forster, who has given us number of excellent talks and spoken at various debates. At the Symposium, he will be talking about that intriguing thing in mathematics called the Axiom of Choice.

Patrick Short, "*Mutations in Developmental Disorders*" [2:15pm – 2:45pm]

The majority of children with severe developmental disorders remain without a genetic diagnosis. Families often describe the road to reaching a diagnosis as an 'odyssey' lasting years and involving dozens of different medical professionals. The Deciphering Developmental Disorders (DDD) study has collected detailed clinical phenotypes and genome sequence data from 14,000 children with undiagnosed developmental disorders and their parents as an effort to quickly and definitively reach a genetic diagnosis.

Using data from the first 4,000 DDD patients, my computational analyses have already generated hypotheses relating to specific variants in individual genomic functional elements. This work will contribute to an improved understanding of the role of the regulatory genome in developmental disorders and provides a scalable model for the interpretation of non-coding elements in rare disease cohorts.

Prof. Malcolm Perry (DAMTP), TBC [3:00pm – 4:00pm]

Prof. Malcolm Perry has recently collaborated with Prof. Stephen Hawking (DAMTP) and Prof. Andrew Strominger (Harvard) on a paper, which is said to have made genuine progress in solving the black-hole information paradox. He may or may not speak about this in his talk.

Lawrence Barrott, TBC [4:00pm – 4:30pm]

Mr. Barrott is currently working on mirror symmetry. He may or may not speak about this in his talk.

Prof. Miles Reid FRS (Warwick), "*Finite subgroups of SL(2,CC) and SL(3,CC) and their role in algebraic geometry*" [4:30pm – 5:30pm]

Felix Klein classified the finite subgroups of SL(2,CC) around 1860; there are two infinite families corresponding to regular polygons in the plane, together with three exceptional groups of order 24, 48 and 120 that are "spinor" double covers of the symmetry groups of the regular polyhedra (the tetrahedron, octahedron and icosahedron). The finite subgroups of SL(3,CC) are also classified (and also SL(n,CC) for higher n), although the problem gets harder and it is not clear how to view the assortment of solutions with any pretence to elegance.

The quotient spaces X = CC^2/G by Klein's finite subgroups G in SL(2,CC) form a very remarkable family of isolated surface singularities, that were studied by Du Val during the 1930s (aided by Coxeter). Du Val's work was central to the study of algebraic surfaces during the 1970s and 1980s, and played a foundational role in the study of algebraic 3-folds from the 1980s onwards. In the 1980s McKay observed that the representation theory of the group G is reflected in the geometry of the resolution of singularities of X. This correspondence has been generalised to 3-dimensions, with the same proviso concerning the nature of the problem and its solutions.