



ARC CENTRE FOR  
**COMPLEX SYSTEMS**

# **ACCS Complex Systems Winter School**

**4<sup>th</sup> – 8<sup>th</sup> July 2005**

**The Women's College,  
College Rd, UQ, St Lucia**

**&**

**GPS Building (Room 78-122),  
Staff Rd, UQ, St Lucia**

## Monday 4th July - Introduction to Complex Systems

8:15-8:45am	<i>Registration</i> Coffee served until 9am
9:00-9:30am	<b>Winter School opening</b> Professor Alan Lawson, Director of the UQ Graduate School
9:30-9:45am	<b>Welcome</b> Prof Peter Lindsay, Director of the ARC Centre for Complex Systems
9:45-10:30am	<b>What is a complex system?</b> Speaker: Dr Jennifer Hallinan
10:30-11:00am	<i>Morning tea</i>
11:00-11:45am	<b>Cellular automata</b> Speaker: A/Prof Janet Wiles
11:45-12:30pm	<b>Networks and network analysis</b> Speaker: Dr Jennifer Hallinan
12:30-1:30pm	<i>Lunch</i>
1:30-3:00pm	Tutorial 1: <b>Cellular automata using StarLogo</b>  (Room GPS78-122)
3:00-3:30pm	<i>Afternoon Tea</i>
3:30-5:00pm	Tutorial 2: <b>Network analysis with Pajek</b>  (Room GPS78-122)

## Tuesday 5th July - Genetic Regulatory Networks

9:00-9:45am	<b>Fractals, plants and ecosystems: Capturing nature's patterns with L-systems</b> Speaker: Jim Hanan
9:45-10:30am	<b>The modelling and simulation of cellular kinetics</b> Speaker: Kevin Burrage
10:30-11:00am	<i>Morning tea</i>
11:00-11:45am	<b>Mapping biology onto computation: A complex systems approach</b> Speaker: Janet Wiles Multiple levels of complexity link genotypes to phenotypes, from molecules to minds. Networks are a generic way of studying complexity and provide a basis for exploring the computational properties of biological systems, abstracting away from the myriad details of real biology. This talk will describe a network-based approach to modelling mappings between three levels of biological complexity: nucleotide sequences, genetic regulatory networks and ontogeny.
11:45-12:30pm	<b>Die, divide or differentiate: networks underlying cancer</b> Speaker: Jennifer Hallinan
12:30-1:30pm	<i>Lunch</i>
1:30-3:00pm	<b>Lab tutorial 1: L-systems using L-studio</b> Jim Hanan (assisted by Kai Willadsen)  (Room GPS78-122)
3:00-3:30pm	<i>Afternoon Tea</i>
3:30-5:00pm	<b>Lab tutorial 2: Random Boolean networks using Matlab</b> Kai Willadsen This session will begin with a brief introduction to Matlab then go on to visualise some of the behaviours of Random Boolean Networks and investigate what these networks tell us about complex systems of interacting elements.  (Room GPS78-122)

## Wednesday 6th July - Air Traffic Control

9:00-9:45am	<b>Free flight and air traffic control</b> Speaker: Peter Lindsay This talk will introduce fundamental concepts and terminology of Air Traffic Control (ATC). It will describe plans for major changes to the way ATC is done in Australia and overseas.
9:45-10:30am	<b>Case study of an operator model</b> Speaker: Peter Lindsay An in detail look at a model how air traffic controllers go about one part of their task, namely resolving conflicts by revising flight level clearances.
10:30-11:00am	<i>Morning tea</i>
11:00-11:45am	<b>Using intelligent agents for modelling in the ATC domain</b> Speaker: Peter Robinson An overview of the Qu-Prolog language and its use in the ATC domain.
11:45-12:30pm	<b>Monte Carlo simulation in air traffic control</b> Speaker: Ariel Liebman An overview of Monte Carlo simulation and the use of probability distributions to perform risk management.
12:30-1:30pm	<i>Lunch</i>
1:30-3:00pm	<b>A real air traffic control simulation exercise, Part I</b> Starting with an introduction to the tools used at the ACCS to simulate behaviour and going on to experimentation with some potentially hazardous airspace scenarios.  (Room GPS78-122)
3:00-3:30pm	<i>Afternoon Tea</i>
3:30-5:00pm	<b>A real air traffic control simulation exercise, Part II</b> Getting into solving some interesting modelling problems to resolve a more difficult airspace problem.  (Room GPS78-122)

## Thursday 7th July - Micro Meso Macro

9:00-10:30am **Complexity and economic evolution: With applications to financial markets**

Speakers: Jason Potts and John Foster

We shall present in this session an overview of the micro meso macro framework for evolutionary economic analysis, and discuss some applications to modelling coordination and change with particular attention to financial markets.

10:30-11:00am *Morning tea*

11:00-12:30pm **Complexity and economic evolution: With applications to financial markets (continued)**

Speakers: Jason Potts and John Foster

12:30-1:30pm *Lunch*

1:30-2:00pm Opportunity to discuss postgraduate opportunities with key ACCS and UQ staff

*Afternoon* *Free time to explore UQ and Brisbane*

## Friday 8th July - Computational Game Theory

- 9:00-10:30am **Computational methods in noncooperative game theory**  
Speakers: Stuart McDonald  
Multi-agent modelling is one common methodology in complex systems research. One multi-agent modelling methodology is game theory. Noncooperative game theory studies the way in which multiple agents interact with each other in strategic situations. Computational methods in non-cooperative game theory will be surveyed and presented in the computer lab.  
  
(Room GPS78-122)
- 10:30-11:00am *Morning tea*
- 11:00-12:30pm **How complex is sharing the cost of non-pointsource pollution?**  
Speakers: Rodney Beard  
Complex systems has had an interest in the properties of networks, cooperative game theory provides a methodology for analyzing resource allocation on networks. Computational issues involved in resource allocation on networks will be covered from the perspective of complexity theory with application to water resources issues and cost-sharing of pollution in the computer lab.  
  
(Room GPS78-122)
- 12:30-1:30pm *Lunch*
- 1:45-2:45pm **Comparative metagenomics**  
Guest Speaker: [Dr. Phil Hugenholtz](#)  
  
Phil Hugenholtz received his Ph.D. in Microbiology from the University of Queensland in 1994. He has subsequently worked in the Department of Biology at Indiana University, the Department of Plant and Microbial Biology at the University of California, Berkeley, the Department of Microbiology at the University of Queensland, and the Computational Biology and Bioinformatics group in the Mathematics Department at UQ. He currently leads the Microbial Ecology program at the DOE Joint Genome Institute (JGI) in the USA. His group is developing methods for analysing metagenomic datasets and applying them to a variety of communities.
- 2:45-3:00pm **Winter School closing**  
Peter Lindsay
- 3:00-4:00pm *Drinks at The Women's College*