

## **Evolutionary Game Theory, Natural Selection, Darwinian Dynamics and Modeling of Carcinogenesis**

**9.00am - 5.00pm, Oct 13 & 14 2005**

**The Verco Room, Hanson Institute, Frome Rd, Adelaide.**

### **ABOUT THE WORKSHOP**

Quantitative methods are essential for defining system dynamics and critical parameters in complex, fundamentally nonlinear processes such as carcinogenesis. Although many of the genetic events in carcinogenesis are known, their precise interactions with environmental factors that control clonal expansion and malignant progression are unclear in the absence of a generalised model.

A comprehensive, mechanistic, quantitative model of carcinogenesis is proposed. It's based on methods developed in population biology and game theory that mathematically frames the Fearon-Vogelstein model as a sequence of competing populations subject to random mutations resulting in the evolution of optimal proliferative strategies in a changing adaptive landscape.

All of life is a game and evolution by natural selection is no exception. The evolutionary game theory presented in this workshop provides the tools necessary for understanding many of nature's mysteries, including coevolution, speciation, extinction and the major biological questions regarding fit of form and function, diversity, procession, and the distribution and abundance of life. Mathematics for the evolutionary game are developed based on Darwin's postulates leading to the concept of a fitness generating function (G-function). G-function is a tool that simplifies notation and plays an important role developing Darwinian dynamics that drive natural selection. Natural selection may result in special outcomes such as the evolutionarily stable strategy (ESS). An ESS maximum principle is formulated and its graphical representation as an adaptive landscape illuminates concepts such as adaptation, Fisher's Fundamental Theorem of Natural Selection, and the nature of life's evolutionary game.

The approach used is unlike many others intended for the study of evolution. It may be thought of as a workshop on mathematical Darwinism. Darwin used logical verbal arguments to understand evolution. These arguments are presented here in a mathematical setting useful for not only understanding evolution but allowing for prediction as well. The focus is on phenotypes rather than genes. While genes are critical as the recipe for inheritance, it is the heritable phenotype that forms the interface between the organism and its environment.

### **Who Should Attend?**

Persons interested in the subject of evolution in its many contexts including theory and applications will be interested in this workshop. Individuals with knowledge of models of carcinogenesis, ecology, applied mathematics, game theory, economics, or management (of biological systems) will find the workshop to be of interest

### **Presenter**

Dr. Vincent is professor emeritus with the Aerospace and Mechanical Engineering at the University of Arizona, where he received his Ph.D. in Aerospace Engineering (1963). He taught at the University for 41 years. He currently serves on the editorial board of *Optimal Control Applications and Methods*, *Journal of Optimization Theory and Applications*, *Nonlinear Dynamics and System Theory*. His main research interests are in the area of Nonlinear Control System Design, Optimal Control and Game Theory, and Evolution and Adaptation of Biological Systems. He has 156 publications including 81 journal articles, and 9 books. Dr. Vincent's latest book, **Evolutionary game theory, natural selection, and Darwinian dynamics** is coauthored with Joel Brown with the University of Illinois at Chicago. This book will be used as the major reference for the workshop.

## COURSE OUTLINE

The content of the workshop is split up into six lectures and two discussion periods. Numerous examples will be provided.

First day of workshop

1. Introduction to Evolutionary Games
2. Break
3. The G-function Method
4. Lunch
5. Darwinian Dynamics
6. Break
7. Discussion

Second day of workshop

8. Evolutionarily Stable Strategies and the ESS Maximum Principle
9. Break
10. Speciation and Extinction
11. Lunch
12. Application: Model of Carcinogenesis
13. Break
14. Discussion

Further Information may be found at:

[Evolutionary Game Theory Workshop](#)

Further Information on the book may be found at:

[Evolutionary game theory, natural selection, and Darwinian dynamics](#)

# Evolutionary Game Theory, Natural Selection, Darwinian Dynamics and Modeling of Carcinogenesis

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## Workshop Registration

### Contact details

Family Name		First Name	
Organisation			
Mailing address			Postcode
Phone	( )	Email	

### Fees : (The registration fee includes 2 day workshop, lunches, morning and afternoon teas)

Registration received before <b>23/9/2005</b>	
Full Registration (includes a copy of the book 'Evolutionary Game Theory, Natural Selection and Darwinian Dynamics')	1 @ AUD\$800 (including GST)
Full-Time Staff of Academic Departments	1 @ AUD\$440 (including GST)
Research Students	1 @ AUD\$110 (including GST)
<b>Registration after 23/9/2005</b>	<b>Add AUD \$100 to the Above.</b>

**Refund Policy :** Due to organisational aspects there will be no refund. However, a substitute delegate, within the same organisation, may be nominated up to the beginning of the conference.

### Payment options

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### Note For GST Purposes

The Australian Business Number (ABN) for the University of South Australia is 37 191 313 308. Please regard this registration form as a conference offer. No separate invoice will be issued. Upon payment of the appropriate amount this registration form will become a tax invoice. Please keep a copy of this form for taxation purposes. **Tick here if you need a receipt**

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