UNIVERSITY OF CAPE TOWN

Department of Mathematics and Applied Mathematics

University of Cape Town • Rondebosch 7701 • South Africa
TEL: +27-(0)21-650-3191/2 • FAX: +27-(0)21-650-2334
EMAIL: admin@maths.uct.ac.za • TELEX: 5-22208 UCTAD SA
WEB SITE: http://www.mth.uct.ac.za

10 December 2004

Dear **Professor Rob de Ruyter van Steveninck**

Re: Assistant Professor Position in Biocomplexity

My area of expertise lies in the integration of quantitative skills to understand complex biological systems. In particular, I have developed mathematical models of mechanisms and processes in immunology and physiology.

Currently, I am seconded from the Department of Mathematics and Applied Mathematics at the University of Cape Town (South Africa), where I have an Assistant Professor (tenure) position, to the African Institute for Mathematical Sciences (http://www.aims.ac.za), which is a collaborative project between three universities in Cape Town (South Africa), Cambridge University (UK), Oxford University (UK) and Paris-Sud University (France). I am the Director for Academic Studies (Research and Teaching) and am responsible for developing (leading) and coordinating (managing) the graduate programme in mathematical sciences and research programmes at the institute.

I am interested in joining the Biocomplexity Institute at Indiana University for three reasons: (1) I want to work more closely with good experimental biologists in good experimental facilities - I have a number of good links with laboratories in the US, (2) I would like to realign my research focus to focus on systems biology (I have attached a project proposal), (3) My fiancée is an accountant and has secured a secondment to the US at the end of 2005. I believe that there is a great need to integrate both concepts (and

theories) and experimental data within a quantitative framework across spatial and temporal scales. Also, I feel that experimental data and concepts at the cellular level will catalyse the development of new quantitative approaches, which will require the integration of ideas from evolutionary biology (fitness landscape), networks, dynamics, and information processing.

My research has focused on two major themes:

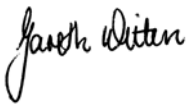
1. *Relationship between the dynamics of a system and its geometrical organization*. In particular, I have asked "how does the geometrical organization of a system affect its dynamical behaviour?", and conversely, "how does system dynamics modify it's organization (topology)?"
2. *Representing the dynamic behavior of biological systems in spatially extended, hierarchical systems.* In particular, I have asked "are the current quantitative tools to represent complex biological systems adequate?" and "what quantitative representation will represent particular systems adequately?"

My training in both mathematics and biology in my undergraduate and graduate degrees and my post-doctoral research in complex systems at the Santa Fe Institute (USA) has exposed me to many different biological systems (immune system, ecology and metabolism) and quantitative tools. Modelling different biological systems and learning new modelling techniques has stretched my biological and mathematical skills and has, more importantly, exposed me to the "grand" questions in biology and the limits of mathematics. Frustrated with the analysis of small biological systems and the quest for explicit solutions of toy mathematical models, and armed with a deeper understanding of key biological questions, I began to rethink both the representation and analysis of large biological systems and the approaches to understanding complex biological systems.

Enclosed please find a copy of my Curriculum Vitae, a summary of my current and past research projects, my teaching portfolio, and a potential project proposal in systems biology.

I hope that my application will meet with your favourable attention.

Thank you kindly



Gareth Witten, PhD

gareth@maths.uct.ac.za

gareth@santafe.edu

http://www.mth.uct.ac.za/~witten.html

CURRICULUM VITAE

- Director for Academic Studies (Teaching & Research), African Institute for Mathematical Sciences (www.aims.ac.za) Sept 2004- .
- International Fellow of the Santa Fe Institute (USA), 2001-2003.
- Fellow of the Stellenbosch Institute for Advanced Study (July 2004 – Dec 2005)
- Visiting Scientist at Los Alamos National Labs (USA) (Aug-Sept. 2003)
- Scientific Project Leader for South African Centre for Epidemiological Analysis and Modelling: Host Viral Dynamics (2003-)
- Coordinator of the South African Biomathematics Network (2000-).
- Nominated for the Distinguished Teacher Award 2003 (University of Cape Town)
- Summer Lecture Series (with Prof. G. Ellis): "Complexity in our Interconnected World", January 2004. http://www.ems.uct.ac.za/summer2004/index.htm
- Tenor soloist in Beethoven's 9th symphony (Hartford, Connecticut, 1999), trained with Santa Fe Opera (Summer 2002, 2003)

Gareth Witten, BSc, BSc (Med)(Hons), AMIMA, PhD

My research predominantly involves the application of mathematics to biology and medicine. My initial research activity was building models to understand the components of ecosystems (rangelands) and understanding the physiological mechanisms of animal adaptation. This work has contributed to the understanding of the physiological mechanisms of undernutrition. In addition, I am interested in modeling the interaction between the immune systems and viruses, in particular, HIV. Three specific contributions have been made: (1) we have estimated the kinetics of HIV in different tissues, (2) the effects of an intracellular delay under potent antiretroviral therapy, (3) the effect of an "accumulator" that accounts for the robust latent phase of infection and collapse of the immune system.

September 2004

CURRICULUM VITAE

Gareth Q. Witten
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch, 7701
Cape Town, South Africa
Ph: 27 21 650 3201, FAX: 27 21 650 2334
E-mail: gareth@maths.uct.ac.za, gareth@santafe.edu
http://www.mth.uct.ac.za/~webpages/witten/

Education

Ph.D (Applied Mathematics), University of Cape Town, South Africa, 2002.
Mathematical models of the physiological mechanisms affecting the adaptation of growing cattle during and after a period of undernutrition

BSc (Medicine)(Honours), Biomedical Engineering, University of Cape Town, South Africa, 1996.
Multiple-Frequency Bioelectric Impedance in the assessment of the pharmacokinetic parameters of amikacin in neonates

BSc (Biochemistry, Applied Mathematics) University of Cape Town, South Africa, 1993.

Positions

Director for Academic Studies (Teaching and Research), African Institute for Mathematical Sciences (Sept 2004 – Dec 2005)
Senior Lecturer in Applied Mathematics (September 2004-)
Assistant Professor (tenure) in Applied Mathematics (January 2003-)
Assistant Lecturer (tenure track) in Applied Mathematics (July 1999 - Dec 2002)
Part-time Lecturer in Business Statistics (1999)
Teaching Assistant in Mathematics at Wesleyan University, Connecticut, U.S.A. (1998/1999)
Teaching Assistant in Mathematics at Yale University (1999).
Lecturer of Introductory Statistics course (1998).
Assistant Lecturer in Engineering Mathematics in the Academic Support Programme for Engineering in Cape Town (ASPECT) (1996-1997)

Visiting Positions, Fellowships & Scholarships

Visiting Scientist, Los Alamos National Labs (July-August 2004)
International Fellowship in Complex Systems, Santa Fe Institute (2001-2003) (http://www.santafe.edu)
Fellow of the Stellenbosch Institute for Advanced Study (STIAS), May 2004 - May 2005 (http://www.stias.co.za)
Ernest Openheimer Trust Fellowship (2003)
Visiting Scientist, GEODES (Institute for Research and Development), France. (http://www.bondy.ird.fr/geodes/)
Graduate Fellowship in Mathematics at Wesleyan University, Connecticut, U.S.A. (1998/1999)

Honours, Awards & Leadership Positions	Nominated for the Third World Academy of Science Young Scientist Award, 2004. Finalist of the National Science and Technology Forum Awards, 2003 (http://www.nstf.org.za) Nominated for the Distinguished Teacher Award, 2002 & 2003, University of Cape Town. African Institute for Mathematical Sciences (AIMS, (http://www.aims.ac.za) Executive Member (2003-) SACEMA (South African Centre for Epidemiological Modeling and Analysis) executive member & group leader of Host-Viral dynamics team (2003-) (http://www.aims.ac.za/sacema/) Coordinator, South African Biomathematics Network (2000-) (http://www.mth.uct.ac.za/Affiliations/BioMaths/) Student travel award to Isaac Newton Institute (Cambridge University), SIAM student travel award, First SIAM conference in the Life Sciences, 2001. Landahl Travel Award, Society for Mathematical Biology, August 2000. Travel Award for Young Emerging Scientists, Penn State University, July 2000.
Professional Memberships	A.M.I.M.A. (Associate Member of the Institute for Mathematics and its Applications, 2001-) S.I.A.M. (Society for Industrial and Applied Mathematics) S.M.B. (Society for Mathematical Biology) SANUM (South African Numerical and Applied Mathematics) SABN (South African Biomathematics Network)

Research Interests

Mathematical Biology: Modelling physiological and metabolic systems and ecosystem dynamics.

My research is mainly concerned with understanding the dynamics between the immune responses (humoral and cellular) and the human immunodeficiency virus. In particular, my students and I build mathematical models to understand the replication dynamics of HIV within infected CD4+ T cells and latently infected cells, such as macrophages, and the effects of drug therapy on the dynamics of intracellular delays and dynamics. We are also integrating cellular-level models with epidemiological (population-level) models. In addition, we build models to predict the products of digestion and consequently the partitioning of energy in metabolism. This involves modeling the processes involved in the rumen of ruminants, which includes developing models of microbial competition and the spatial heterogeneity of nitrogen sources and its effects on microbial dynamics and ultimately on rumen function. I am also involved in modeling human energy regulation and the implication of management strategies, such as exercise and diet, on obesity and undernutrition. I am currently developing a team of colleagues and graduate students working in biological networks and asking questions about the robustness of particular networks in ecosystems. This work also interfaces with social networks where we are developing spatial network models of the migration of people between areas in a city.

Complex systems

I am fascinated by questions of how physiological and cellular systems are controlled. This fascination has led to the development of a model of how energy partitioning between fat and protein is controlled in cattle and humans. Recent research involves understanding the spatio-temporal dynamics of arid rangeland and to understanding how plant species richness, ecological resilience and scale are related. A current interest is in self-rewiring networks applied to brain function, signaling networks, and migration of people in areas of a city.

Invited Presentations

Plenary session at the CARI '04 International Conference in Computer Science, November 2004 (Tunisia) (http://www.cari-info.org/page_accueil.htm)
Plenary session at the RAMAD'04 International Conference in Biomathematics, August 2004 (Senegal)
Plenary Session at the International Workshop on Building Capacity in the Mathematical Sciences, AIMS (www.aims.ac.za, 13 April – 16 April 2004).
Plenary session at the International Workshop for Modelling HIV Dynamics, Stellenbosch, December 2003. (http://www.aims.ac.za/sacema/workshops.php)
Laboratory Seminar, Bauer Center for Genomics Research, Harvard University, November 2002.
Invited Presentation: University of Minnesota, "Modeling the flexibility of substrate use", Department of Decision Sciences, University of Minnesota, July 2003.
Departmental Colloquium, Department of Biomedical Engineering, University of Cape Town, August 2002.
Invited presentation: University of Minnesota, "Modeling the Dynamics of Human Energy Regulation.", July 2003.

Refereed Chapters and Articles

Witten G.Q. and Richardson, F.D. (2000). Modelling nutrient utilization in growing cattle subjected to short or long periods of moderate to severe undernutrition. In *Modelling Nutrient Utilization in Farm Animals*, ed. J P McNamara, J France and D Beever, CABI Publishing, Wallingford UK and New York, 241-252.

Witten G.Q. and Richardson F.D. (2003). Competition of three aggregated microbial species for four substrates in the rumen, *Ecological Modelling*, **164**(2-3): 121-135.

Cridland, J.S. and Witten, G.Q. (2003). Receptor simulation & the shape of the dose/response curve & its congeners. (*South African Journal of Science*, **99**, July/August, 302-303)

Witten, G.Q. (2003). Modelling the control of energy partitioning during submaintenance feeding in cattle (*Systems Analysis Modelling Simulation*, Vol **43** (8): 1065-1084.

Wayne M. Getz, Eleanor Gouws, Fritz Hahne, P. Ekkehard Kopp, Paul Mostert, Chris Muller, Cathal Seioghe, Brian Williams and Gareth Witten (2003). Mathematical models and the fight against diseases in Africa (*South African Journal of Science*, **99**, July/August pp305-306)

Witten, G.Q. and Perelson, A.S. (2004). Modelling the Cellular-level Interaction between the Immune system and HIV (To appear in the *South African Journal of Science*, 2004)

Witten, G.Q. (2004). What hope is there for a HIV vaccine? (To appear in the *South African Medical Journal*, 2004)

Witten, G.Q. and Hoffmann, K. (2004). Variability and transitions in a genetic regulatory network. (To appear in *Journal of Bifurcation and Chaos*)

Witten, G.Q. and Richardson, F. D. (2004). Modelling rumen function: the effects of different N supplements on low quality roughages. (To appear in *Journal of Agricultural Science, Cambridge*)

Witten, G.Q. (2004). Matrices and Graphs in Network Theory (Submitted to *Journal of Complexity*)

Witten G.Q. (2004). A Mathematics course for Geology and Chemistry majors. (To appear in *Educational Studies in Mathematics*, 2004)

Witten, G.Q., Richardson, F.D. and Shenker, N. (2004). A spatial- temporal analysis on pattern formation around water points in a semi-arid rangeland system. (To appear in *Journal of Biological Systems*)

Witten, G.Q. (2004). Managing arid and semi-arid rangelands accounting for the variability of key factors over space and time. (Submitted to *Journal of Range Management*)

In Preparation

Witten, G.Q., de Boer, R.J. and Perelson, A.S. (2004). Balancing HIV-1 production with clearance implies rapid viral clearance in lymphoid tissue (To be submitted to *Journal of Virology* in July 2004)

Fontana, W. and Witten, G.Q. (2004). Modelling signaling networks. (To be submitted in July 2004)

Krakauer, D. and Witten, G.Q. (2004). Host and immune interactions: modeling the adaptive modifications of RNA decay rates. (To be submitted in July 2004)

Witten, G.Q. and Blitz, G. (2004). A bioenergetics model of pediatric obesity. (To be submitted in April 2004)

Conference Papers/Posters Presentations

Witten, G.Q. and Richardson, F.D. (2000). Dynamic control of ammonia and urea diffusion across the rumen wall. Mathematical Modeling in Nutrition and the Health Sciences (Penn State University, USA, July 29 – August 1).

Witten, G.Q. (2000). Modelling the control of energy partitioning between protein and fat during undernutrition. International Conference on Mathematical Biology (University of Utah, USA, August 3-5).

Witten, G.Q. (2001). Targeted Intervention: A Mathematics course for Geology and Chemistry majors. (Published in the *Communications* of the Warthog Delta conference, July 2001).
Witten, G.Q. and Segal, L. (2001). Diffuse feedback from diffuse information in complex systems. (Presented at the Biomathematics Seminar February. 2001, U.C.T.)

Witten, G.Q. and Richardson, F.D. (2001). Competition of three aggregated microbial species for complementary substrates in the rumen (Presented at SANUM conference, Stellenbosch University, April 2001)

Witten, G.Q. (2001). Managing arid and semi-arid rangelands accounting for the variability of key factors over space and time. (Presented at the Arid Zone Forum, Calitzdorp, September 2001)

Witten, G.Q. (2001). Self-organised instability in complex ecosystems (Presented at the Third Biomathematics Symposium, February. 2002, U.C.T.)

Witten, G.Q. and Laurie H (2001). The role of mathematics to support the biotechnology initiative.(Presented at the Biotechnology Seminar, University of Cape Town, June 2001)

Witten, G.Q. (2002). Self-organised instability and networks in complex Systems (Presented at SANUM meeting, April, 2002 at Stellenbosch University)

Witten, G.Q. (2002). Modelling dry rangeland systems: System organisation and temporal and spatial variability (To be presented as a plenary session at the RAMAD International Conference in Biomathematics and published in a special volume of the *African Journal of Mathematics*, July 2002)

Witten, G.Q. (2002). Modelling rumen function: Diffuse feedback control of digestion and nitrogen transport (To be presented as a plenary session at the RAMAD International Conference in Biomathematics and published in a special volume of the *African* Journal of Mathematics, July 2002)

Presentation at the Santa Fe Institute (USA), January 2002. Managing Arid and Semi-arid Rangelands Systems: Modelling the Mechanisms of Animal Adaptation. http://www.santafe.edu/sfi/events/abstracts/pastAbstracts/index.html

Witten, G.Q. (2003). Adaptive modification of RNA decay rates in positive strand virus dynamics: Host and virus perspectives. (Presented at SANUM meeting, April, 2003 at Stellenbosch University)

Witten, G.Q. (2003). Reflecting on the design of a mathematics course for Chemistry and Geoscience students (Accepted for publication as a short paper in the *Proceedings of the AMESA '03* conference, July 2003).

GQ Witten (2004) "Modelling HIV-Immune System Dynamics" (Stellenbosch Institute for Advanced Study, 03 March 2004)

GQ Witten (2004). "Dynamics of an Emerging Infectious Disease: HIV". Workshop on Capacity Building in the Mathematical Sciences, African Institute for Mathematical Sciences, South Africa, 13-17 April 2004.

Witten GQ (2004), Perelson, A, & de Boer, R. (2004). Balancing HIV-1 production with clearance implies rapid viral clearance in lymphoid tissue. (Presented at SANUM meeting, April, 2004 at Stellenbosch University) http://dip.sun.ac.za/sanum2004/

Bashier, B & Witten GQ (2004). Computation and Synchronization in Complex Dynamical Networks. (Presented at SANUM meeting, April, 2004 at Stellenbosch University) http://dip.sun.ac.za/sanum2004/

Bouguerra, L, Salih, Z & Witten GQ (2004). What are the long-term outcomes of a disease modifying (non-sterilising vaccine? (Presented at SANUM meeting, April, 2004 at Stellenbosch University) http://dip.sun.ac.za/sanum2004/

Mugwagwa, T & Witten GQ (2004). Modelling the dynamics of CTL epitope dominance in HIV infections. (Presented at SANUM meeting, April, 2004 at Stellenbosch University) http://dip.sun.ac.za/sanum2004/

Research Grants

PI: Host Viral Dynamics Grant, R250 000 (2004-2006)
PI: Santa Fe Institute Fellow Grant Equipment Grant, 2002 ($2500)
PI: Ernest Oppenheimer Trust Grant (R23 000.00)
PI: Santa Fe Institute Fellow Research Grant ($1500)
University Research Committee Startup grant, 2000 (R10 000.00)
University Research Committee Grant, 2002 (R8 000.00)
University Research Committee Conference grant, 2000-2002 (R2 000.00)
University Research Committee Grant, 2003 (R15 000.00)
University Research Committee Grant, 2004 (R 8 000.00)
Emerging Researchers Grant, 2004 (R15 000.00)

TEACHING

Courses

- Lecturer in Applied Mathematics (Jan 2003-)
- Course Convenor: Numerical Analysis for Engineers (2003).
- Course Convenor: Complex Analysis and Linear Systems (1999)
- Course Convenor: Quantative skills for scientists in the chemical, geological and earth sciences (2000). Developed new curriculum for this course.
- Assistant Lecturer in Applied Mathematics (July 1999)
- Part-time Lecturer in Business Statistics (1999)
- Course Convenor: Business Statistics (Applications of parametric, non-parametric techniques and time-series analysis)
- Teaching Assistant in Mathematics at Wesleyan University, Connecticut, U.S.A. (1998/1999)
- Course Convenor: Introductory Statistics course (1998)
- Assistant Lecturer in Engineering Mathematics in the Academic Support Programme for Engineering in Cape Town (ASPECT) (1996-1997). Taught first and second year engineering mathematics. Developed a tutor training program.

Theses Directed/ Co-directed

Shenker, N. (2002). A spatio-temporal analysis on pattern formation around water points in a semi-arid rangeland system (Honours Thesis)

Patten, G (2003). How does relative diffusion rates affect the dynamics of a predatory-prey, grouping vs loneliness spatial game? (Honours Thesis)

	Honey, C (2003). Portfolio Selection by Economic Agents with Differing Utility Function (Honours thesis) *Postgraduate Diploma in Mathematical Sciences (AIMS, 2004):* - M. Altaj Mohammed (2004). Percolation Theory and Modelling - T. Mugwagwa (2004). The Role of CD8 Immune Responses in HIV Infection - Zakariya MS Mohammed. Epidemics on Scale-Free Networks. - Pierre AM Mutombo. Parameter effects on the viral set point in HIV infection: A sensitivity analysis approach. - Latifa Bouguerra. Models of Infectious Diseases on Networks. - Eihab Bashier. Computation and Synchorinization in complex dynamical networks.
Postdocs	Rachid Ouifki (IRD, France) (May 2004 – December 2005)

SHORT/EXTRA COURSES

DATE	COURSES	COURSE CONVENOR
• Dec. 1994	Management with Responsibility	
• August 1996	Science Writing	Dr V. Mawson (CSIRO, Australia)
• Semester 2 1995	Dynamical Systems	Prof. L. Slammert (University of the Western Cape)
• Semester 2 1995 (September. 1995)	Applied Logic (Mathematics Honours module)	Prof. J. Pelesca (University of Berlin)
	Continuing Engineering Education Courses	
• June 1996	a) Effective Teaching Workshop	Prof. R Felder (University of North Carolina) Prof. R Brent (University of South Carolina)
• June 1997	b)Problem-Solving Workshop	Prof. H. Scott Fogler (University of Michigan)
• May/June 2001	c) Project Management	Mr Gordon Lister (University of Cape Town)
• October 2001	d) Introduction to Java programming	Associate Professor Brian Hahn (University of Cape Town)

EMPLOYMENT

DATE		ORGANISATION	JOB TITLE
• Dec 1989-Feb 1990	PT	Old Mutual	Machine Operator
• Nov 1990-Feb 1991	PT	Old Mutual	Clerk Machine operator
• April 1992	PT	Biochemistry Dept.	Research Assistant
• June 1993	PT	Pharmacology Dept.	Research Assistant
• February 1994	PT	UCT Vac. Accommodation Department	Receptionist Temp. Sub-warden
• Jan 1994-April 1994	PT	Smithkline-Beecham Pharmaceuticals	Trial Co-ordinator
• June 1994	PT	Pharmacology Dept.	Research Assistant
• Dec.1994-Jan 1995	PT	Medical Physics Dept.	Research Assistant
• Feb 1995-Nov 1995	PT	Mathematics Dept.	Tutor in mathematics
• June 1997-Oct 1997	PT	Investec (Asset Allocation)	Consultant (Building asset allocation optimisation model)
• July 1995-Dec 1995	FT	Department of Mathematics and Applied Mathematics	Research Assistant on Rangeland Modelling Project
• Jan 1996- Dec 1997	FT	Academic Support Programme for Engineering in Cape Town (Faculty of Engineering)	Assistant Lecturer in Mathematics
• Feb 1998-July 1998	TPT	Department of Statistical Sciences	Lecturer in Commercial Mathematics and Introductory Statistics
• February 1998		Business Awareness Orientation Programme	Lecturer in Mathematics
• Nov 1997 - Jan 1998	FT	Investec (Asset Allocation)	Consultant (Visual basic programming)
• Nov 1998 - May 1999	TPT	Journal of Volcanology, EOS Magazine	Assistant Editor (Wesleyan University)
• June 1999 - Nov 1999	PT	Department of Statistical Sciences	Lecturer
• June 1999-	FT	Department of Mathematics and Applied Mathematics	Assistant Professor

FT = full-time **TPT = temporary part-time** **PT = part-time** **TFT = temporary full-time**

Extension/ Other Creative service

- Continuing Engineering Education (CEE) Java Programming Course (October 2001)
- Co-organised Vth International Workshop on Modeling Nutrient Utilization in Farm Animals, 25-27 October 1999.
- Organiser: Annual Biomathematics Symposium (2000-).
- Guest Speaker at York Road Primary School's Awards Evening, Thursday, 08 November 2001.
- Guest Speaker at Livingstone High School's Awards Evening, September 2000.
- Organiser: Special Session in Biomathematics at the SANUM

conference (April,2002, 2003, 2004)
- Organiser of International Workshop: The Sciences of Complexity in Africa, Jan 2005 at UCT (http://www.mth.uct.ac.za/Biomaths/Complexity/)
- I am a "partner" (South African representative) of an international team (France, Morocco, South Africa) attempting to develop a joint PhD program in complex systems.
- Science Advisory Board of Santa Fe Affiliates for a project on the environment: The Preservation and Restoration of the Rio Grande (USA).
- Chapter for a Maths Literacy textbook by the School's Development Unit at UCT. (2003)
- Co-organizer: International Workshop "Modelling the Dynamics of HIV" held in Cape Town (http://www.aims.ac.za/sacema/), December 2003.
- Consultant for Schools Development Unit, 2004.

EXTRAMURAL INTERESTS

Singing/Tenor

I sing tenor for the Gilbert and Sullivan Society, Eon Music group and MOSAIC and have performed in two musicals, Mikado and Ruddigore. My most memorable performance was singing the tenor part of Beethoven's 9th symphony in Connecticut, U.S.A. I am coached by Niccoli Cencherle (Cape Town) and Kirt Pavitt (Santa Fe Opera).

REFERENCES

Professor G.F.R. Ellis
Distinguished Professor of Complex Systems, University of Cape Town
Professor of Applied Mathematics
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch 7701
Cape Town, South Africa
E-mail: ellis@maths.uct.ac.za

Dr Christian Mullon
Director of Research
l'Unité de Recherches GEODES
Centre IRD Ile de France
32 avenue H.Varagnat, F-93143 Bondy Cedex
Tel: +33 (0)1 48 02 56 89
Fax: +33 (0)1 48 47 30 88
http://www.bondy.ird.fr/geodes/GEODES, IRD
E-mail : christian.mullon@wanadoo.com

Dr George Biltz
Researcher (University of Minnesota)
4928 4th. Ave. South Minneapolis,
Minneapolis 55409, USA
E-mail : gbiltz@mn.rr.com

Dr F.D. Richardson
Honorary Research Associate
Department of Mathematics and Applied Mathematics
University of Cape Town
Rondebosch 7701
Cape Town, South Africa
E-mail: fd.rich@mweb.co.za

Personal Mission Statement:

My Mission in life is to serve God above all things, each day practicing principles of humility, love, peace and wisdom.

I will strive to overcome my weaknesses.

I will serve and nurture love for my family and I will enrich my life and the lives of others with adventure, continual development and learning and care.

I will live each day to the fullest.