



**SACEMA**  
DST/NRF Centre of Excellence in Epidemiological Modelling and Analysis

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## SACEMA NEWSLETTER

**No 29: December 2015**



*We wish all our friends, colleagues, students and collaborators a Peaceful and Joyful Holiday Season!*



### NEWS:

#### **Collaboration with Swiss Federal Institute of Technology (ETH) in Zurich**

Wim Delva completed his one-year research stay at the Swiss Federal Institute of Technology (ETH) in Zurich. In collaboration with colleagues from the Zurich-based Theoretical Biology Group, the Computational Evolution Group in Basel and the University Hospital Zurich, he developed a research agenda for bridging the gap between HIV epidemiological inference with agent-based models and phylodynamic (molecular clock) models. The proposed work formed the basis for a postdoctoral research grant proposal, which was recently approved by the Research Foundation - Flanders (FWO). Besides brainstorming about a new conceptual framework for HIV epidemiology, the research stay also provided "protected time" to acquire and advance technical skills such as developing interactive apps, fitting computation-intensive simulation models to data using Bayesian likelihood-free methods, running simulations on a high performance computer grid. He also developed and tested teaching

material for a short course in modelling HIV transmission in dynamic sexual networks using the Simpack software package. This sabbatical was in part funded by the National Research Foundation (NRF) of South Africa.



Wim Delva with daughter Gia enjoying a sunny day in Zurich

### **SACEMA student selected as ambassador at Next Einstein Forum**

SACEMA Masters student, Tokpa Jamah has been selected as an ambassador at the Next Einstein Forum (NEF) to represent his country (Liberia). As part of his functions at this forum, he will bring forth critical issues that are serving as major hindrance for the development of science and technology in Liberia and Africa at large. He will not only point out those lapses his country and continent are faced-with regarding the development of STEM education, suggestions on the way forward will be also recommended to stake-holders and political actors for possible implementation. He will also have the opportunity to inform the audience about his current research work at SACEMA and its relevance to Africa.



Tokpa is a graduate of AIMS-Cameroon where he obtained a structured Masters degree in Mathematical Sciences. He also holds a BSc degree in Mathematics from the University of Liberia. He has been very involved in working with the youth community both as National Volunteer and as a United Nations Volunteer (UNV) – where he helped build the capacity of youth groups and working colleagues, and also helped formulate programs that had youth groups positively and fully engaged with their communities. He is currently doing a research Masters in Mathematical Sciences at the University of Stellenbosch and working with John Hargrove and Rachid Ouifki on Modelling the Economics of Trypanocides and Insecticides-Treated Cattle Interventions on Trypanosomiasis Disease within a Multi-host Population using delay differential equations.



## SACEMA exhibits at launch of National Science Week

National Science Week is an event that takes place in different locations in the country, where learners have the opportunity to meet and interact with professionals who followed scientific and technological careers. This year's launch event was hosted by the North West University, at the Mafikeng campus on 1 August. The Minister of Science and Technology, Ms Naledi Pandor, addressed the learners and encouraged them look up to the successful scientists in the country and motivated them to pursue scientific careers. Other speakers included senior and young scientists from North West University. Their talks were all in keeping with the United Nation's announcement for 2015's theme: "International Year of Light and Light based Technologies". Different scientific groups, institutions and companies were present and showcased their scientific and technological achievements.

SACEMA participated in the event and had a booth held by Alex Welte (SACEMA Director), Eva Ujeneza (PhD student) and Yuruo Li (visiting student from Pittsburgh University). SACEMA's booth was visited by several high school students as well as some teachers that showed interest in understanding the role of Epidemiology in fighting communicable diseases; and the prerequisites for following a career in Epidemiology.



Yuruo Li (above) and Eva Ujeneza (below) with learners at North West University

## Graduations 2014/2015

Congratulations to the following SACEMA-funded students who graduated in 2014/2015:



Monyamaku Happy Mamadisa graduated cum laude with a Masters in Herbal Science from the University of the Western Cape. Her thesis titled “Utilization of traditional herbal medicine used for the treatment of stroke in an urban township in the Western Province” was supervised by Prof Gail Hughes and co-supervised by Prof Thandi Puoane.

Bibi Adam graduated with a Masters in Statistics from the University of KwaZulu-Natal. Her thesis titled “Modelling time to postnatal HIV infection” was supervised by Prof Glenda Matthews.



Morna Cornell graduated with a PhD in Public Health from the University of Cape Town. Her thesis titled “The evolution and effectiveness of the South African National Antiretroviral Therapy Programme” was supervised by Prof Landon Myer.

Anna Grimsrud graduated with a PhD in Public Health from the University of Cape Town. Her thesis titled “Loss to follow-up from South Africa’s Antiretroviral Treatment Programme: Trends, risk factors, and models of care to improve retention” was supervised by Prof Landon Myer.



Tanya Maistry graduated with a PhD in Cardiology from the University of KwaZulu-Natal. Her thesis titled “Genetic contribution to the risk for metabolic syndrome: an investigation of candidate gene polymorphisms related to lipid and carbohydrate metabolism” was supervised by Prof DP Naidoo.

Moise Muzigaba graduated with a PhD in Public Health from the University of the Western Cape. His thesis titled “Paediatric Severe Malnutrition and the Recommended WHO Treatment Modality. An Epidemiological and Care Quality Assessment in the Context of HIV/AIDS Co-morbidity” was supervised by Prof Thandi Puoane and co-supervised by Prof David Sanders, Prof Ann Ashworth, Prof Brian van Wyk and Prof Martin Nieuwoudt.



## Visiting Students



Yuruo Li, a Masters student in Epidemiology from the University of Pittsburgh visited SACEMA for 6 weeks from 23 June 2015 as part of the Public Health International Modelling Fellows Initiative. During her time at SACEMA she worked with Alex Welte on HIV Incidence Estimation.

Nikola Beck visited SACEMA as an intern from 20 July to 27 September 2015. She is an Epidemiology student from the Johannes Gutenberg University Mainz in Germany. During her time at SACEMA she worked with Alex Welte on the CEPHIA database.



Petra Bäumler is visiting SACEMA as an intern from 16 November 2015 to 3 February 2016. She holds a Masters in Biotechnology and is currently completing her PhD at the Multidisciplinary Pain Centre, Department of Anaesthesiology, University of Munich. Her internship at SACEMA forms part of an additional Masters program in Public Health. While at SACEMA Petra is working on an R package which implements an HIV incidence estimation method developed by the director of SACEMA, Alex Welte and his colleagues. This method is known as assay based incidence estimation (ABIE) and uses the information about approximate time of infection based on biomarker assays.

## INTERNATIONAL MEETINGS:

### Conference on Micro and Macro Systems in Life Sciences

Rachid Ouifki was invited to give a presentation at a conference on Micro and Macro Systems in Life Sciences, which took place in the Stefan Banach International Mathematical Center in Bedlewo (Poland) from 8 - 13 June 2015.

The focus of the conference was on applying mathematical modelling at microscopic, mesoscopic and macroscopic levels of various phenomena in Life Sciences and related natural sciences. Dr Ouifki's presentation was on "Modelling the control of trypanosoma brucei-rhodesiense through mass chemoprophylaxis and insecticide-treated cattle".

## INTERNATIONAL EXCHANGE PROGRAMMES:

### Pittsburgh exchange student programme

The Public Health Dynamics Laboratory (PHDL) of the University of Pittsburgh recently hosted a few exchange scholars that participated in the Public Health International Modelling Fellows Initiative. The Initiative was established in 2011 with support from the Benter Foundation. The goal of the Initiative is to enhance international capacity to apply advanced computational modelling methods to critical problems in global health. SACEMA has been involved in different projects with the University of Pittsburgh over the past few years and most recently, in October 2014, the PHDL hosted three of SACEMA faculty, Alex Welte (Director), Wim Delva (Deputy Director) and Cari van Schalkwyk (Researcher), as part of the Public Health International Modelling Fellows Initiative.

To further enhance the collaboration between the two institutions, students were invited to apply to become exchange fellows of the Initiative. A Masters student from the University of Pittsburgh, Yuruo Li, was selected to spend about six weeks during the summer break at SACEMA. During the same time, Faikah Bruce was selected to spend time with the PHDL at Pittsburgh. By participating in the exchange program, fellows were able to gain insight into the types of research methodologies performed at either institution. Each fellow then embarked on a fellowship research project, with Yuruo advised by Alex Welte at SACEMA and Faikah advised by Mark Roberts of the PHDL.



Faikah Bruce with Prof Don Burke (Dean, Graduate School of Public Health, Univ. of Pittsburgh) and fellow exchange students, Claudia Torres and Wan-Jen Wu



Yuruo Li at the Cape of Good Hope Nature Reserve



## **International Clinic on Disease Dynamics, and Data (ICI3D) Research Scholars Exchange Program**

Under this program, which provides former MMED and DAIDD participants the opportunity to do a 6-week research exchange abroad, SACEMA hosted Sarah Ackley in 2013, and Roger Ying in early 2015. In the first half of 2016 we are expecting Avery MacIntosh from the University of Boston at SACEMA (on March 25) to work with Alex Welte, and Jenny Lord from the University of Liverpool, to work with John Hargrove. SACEMA doctoral student, Joseph Sempa, visited Steve Bellan at the University of Texas in 2014. An article resulting from this work titled “Re-evaluating Cumulative HIV-1 viral load as a Prognostic Predictor: Predicting Opportunistic Infection Incidence and Mortality in a Ugandan cohort”, was recently accepted for publication in the American Journal of Epidemiology.

### **EVENTS:**

#### **Clinic on the Meaningful Modelling of Epidemiological Data (MMED), 1-12 June 2015**

The Clinic on Meaningful Modelling of Epidemiological Data took place 1-12 June, at AIMS in Muizenberg. This was the 7th edition of the Clinic, an annual two week training event that brings together African and American student participants and is organized jointly by a consortium of North American faculty and SACEMA faculty. This year a total of 63 people participated in the Clinic. Institutions represented among the student participants were: University of Stellenbosch; University of Cape Town; University of the Western Cape; Nelson Mandela African Institute of Science and Technology, Tanzania; Makerere University, Uganda; Covenant University, Nigeria; KEMRI-Wellcome Trust, Kenya; University of Antananarivo, Madagascar; University Research Co, LLC., Swaziland; University of Zimbabwe; University of Ghana; Ladoke Akintola Univ. of Technology, Nigeria; University of Yaounde I, Cameroon; Notre Dame University, USA; University of Texas at Austin, USA; McMaster University, Canada; Johns Hopkins University, USA; Emory University, USA; Princeton University, USA; Boston University, USA; University of Minnesota, USA.



MMED Clinic faculty and participants, June 2015: Muizenberg

## Missing Data

A first for SACEMA was this three-day course, 16-18 September, on the important topic of *Missing Data*, presented by Jonathan Bartlett, from the Department of Medical Statistics, London School of Hygiene & Tropical Medicine. The issue of missing data is ubiquitous in analysis of epidemiological and clinical data, reducing the precision of statistical estimates, and introducing bias. The course aimed at a principled and practical approach to handling the problem. Nine SACEMA people participated, and 13 participants attended from other institutions: University of Stellenbosch, University of Fort Hare, University of Cape Town, University of the Western Cape, University of KwaZulu-Natal (5), WITS School of Public health (HE2RO), University of Pretoria, Human Sciences Research Council, Western Cape Department of Health.

Some comments from participants: "The main strength of the course is the careful preparation of its materials, especially the practicals, with solutions printed out." "The course was well-designed and carefully implemented in such a way that (with my little background in statistics) I managed to do almost all the practicals with minimum assistance." "Helped to grasp the real meaning of missing data, and was full of practical real-life examples."



Missing Data course participants with Jonathan Bartlett and SACEMA staff, September 2015: Stellenbosch

## SACEMA Workshop on Projection & Public Speaking

This took place over 3 hours on Monday 30 November, led by Kevin Hanssen, Zimbabwean actor/drama teacher/director/musician, theatre-improv expert, Edinburgh Fringe veteran, and author of the book *How to Make a Play*. The workshop was very interactive, and participants had great fun. While not science-specific, the skills being developed are crucial for science communication. After some relaxation and warm up games, designed to get the group focused on one another and into the space, and to relax physically, the group was introduced to diaphragmatic breathing, important in theatrical training. A little biology on lungs, windpipe, vocal chords and diaphragm was followed by a 'gorilla exercise' to 'discover' the diaphragm, and breathing exercises to begin to engage the diaphragm. Vocal exercises followed, to explore the physical sense of projecting the voice, applied in exercises with song lyrics. An exercise in pairs using pop songs as material focused on enunciating words as clearly as possible. After lunch came a brief lecture and discussion on the way objectives can inform, enliven, and shape the style of presentation.



We explored: finding your own style, focusing on a few simple, clear objectives that you really believe in personally, the use of emotion, generating a sense of anticipation, the power of humour, using visuals, concrete examples, real life stories, using a motif that runs through the presentation, working from the inside out: *why* to *how* to *what*. For the finale, participants had 10 minutes to prepare a 1-2 minute presentation on their own research subject, focusing on communicating just one core idea. After each presentation a group discussion followed, exploring what was good about the presentation, and what might be improved.

## Joint Modelling

Dimitris Rizopoulos, of the Department of Biostatistics, Erasmus University Medical Center, the Netherlands, presented this three-day course: *Introduction to the Joint Modelling of Longitudinal and Survival Data, with Applications in R*, 19-21 October. (This is the second time Dimitris has given such a course at SACEMA, the last edition being over five days in 2013.) The course was attended by 24 people, including six from SACEMA. Six of the external participants travelled to South Africa especially for the course. Institutions represented included Polytechnic of Namibia, Zimbabwean Ministry of Health and Child Care, International Union against TB and Lung Disease, Johns Hopkins Research Project, Metropolitan Health, Medical Research Council, Human Sciences Research Council, University of Fort Hare, University of Stellenbosch, University of Cape Town (CIDER and Dept. of Statistics), University of Pretoria, University of Witwatersrand.

In feedback, participants commended the overall structure of the course, the degree of class participation, and the balance between theory and practicals. Day 1 began by considering the types of research question arising in follow-up studies, and presented reviews of mixed effects models and relative risk models, together with practicals. Day 2 presented the basic joint model, with a practical, and then an extension: parametrizations, and a practical. Day 3 extended the discussion to multivariate joint models, and dynamic predictions, with practical. The final topic was assessing the quality of dynamic predictions.



Joint Modelling course participants with Dimitris Rizopoulos and SACEMA staff, October 2015, Stellenbosch

## Bayesian Analysis of Longitudinal Studies

This course was presented over two days (26-27 November) by Emmanuel Lesaffre of the Leuven Biostatistics and Statistical Bioinformatics Centre (L-BioStat), Catholic University of Leuven, Belgium. Emmanuel is already well known in South Africa for his Bayesian Biostatistics course presented twice at SACEMA. This was the first time he has given this course applying the Bayesian approach to longitudinal studies. Such data can be analysed in the classical, frequentist framework, but the Bayesian approach offers more flexible modelling options which can be useful when the data structure is complex -- multivariate outcomes, multiple levels in the data, some missing data patterns, joint modelling, etc. Day 1 included a review of both frequentist longitudinal studies and Bayesian longitudinal studies, as well as an introduction to the packages WinBUGS, OpenBUGS, JAGS, r2WinBUGS, followed by a practical on Bayesian longitudinal studies. Day 2 continued to develop the theory of Bayesian longitudinal studies, enriching it with examples and applying it in practical sessions.

Ten SACEMA people took part, together with 12 external participants, from CDC (Namibia), SARS, and the Universities of Stellenbosch, Rhodes, Johannesburg, Western Cape, UNISA, WITS, and Munich (Germany). One participant wrote: "a phenomenally impressive person, it's a huge privilege to be taught by him."



Bayesian Analysis course participants with Emmanuel Lesaffre and SACEMA staff, November 2015, Stellenbosch

## DAIDD 2015: Fourth annual Clinic on Dynamical Approaches to Infectious Disease Data

This one-week modelling clinic (the sister-clinic of the annual MMED) took place in Jacksonville, Florida from 13-19 December. SACEMA's Gavin Hitchcock attended as Evaluator. The clinic brought together about 18 graduate students, postdoctoral students, and researchers from Africa and North America, with seven faculty, and encouraged participants to focus on how dynamical modelling can be used for addressing appropriate problems in their own work, and, in general, how the complex dynamics of pathogen transmission can and should influence study design and data collection in infectious disease research.

## SACEMA Seminars

The following seminars were held between June and December:

- 19<sup>th</sup> June: Juliet Pulliam, Department of Biology and Emerging Pathogens Institute, University of Florida, USA: “Understanding Japanese encephalitis virus transmission in Bangladesh”.
- 19<sup>th</sup> June: Carl Pearson, Emerging Pathogens Institute, University of Florida, USA: “Better Model Specification Using Test Driven Development”.
- 24<sup>th</sup> July: Gavin Hitchcock (with Alex Welte, Eduard Grebe and Simon Daniel): “Remarkable similarities: A dialogue between De Morgan & Boole”.
- 9<sup>th</sup> September: Maynard Meiring, SACEMA MSc Student: “Modelling of the invasion dynamics of Plasmodium falciparum merozoite into red blood cells”.
- 23<sup>rd</sup> September: Simon Daniel, visiting researcher, Melbourne, Australia: “A Gentle Introduction to the Estimation of HIV Incidence from Cross-Sectional Surveys”.
- 23<sup>rd</sup> September: Nikola Beck, University of Mainz: “Internship at SACEMA - Working on the CEPHIA database and the ritcalib R package”.
- 8<sup>th</sup> October: Bewketu Bekele, SACEMA PhD Student, PhD Defence: “Modelling the impact of early HIV treatment on the HIV epidemic in South Africa”.
- 13<sup>th</sup> October: Khaphetsi Joseph Mahasa, SACEMA PhD Student: “Multiscale modelling with Tellurium and CompuCell3D”.
- 13<sup>th</sup> October: Faikah Bruce, SACEMA PhD Student: “Student Exchange Program with University of Pittsburgh – Feedback”.
- 2<sup>nd</sup> December: Dr Nkengafac Villyen Motaze, Centre for Vaccines and Immunology, (CVI), National Institute for Communicable Diseases (NICD): “Modelling HPV and Rubella”.
- 11<sup>th</sup> December: Maynard Meiring, SACEMA MSc Student, MSc Defence: “Modelling of the invasion dynamics of Plasmodium falciparum merozoite into red blood cells”.



## **UPCOMING EVENTS:**

### **SACEMA Research Days, 15-18 March, 2016**

For 2016 there are plans to extend the concept of Research Days to include more training, some opportunity for research collaborational group work, and more review talks and hot research talks from staff and others. We also expect to have more students in 2016. The event will therefore take place over four days, Tuesday to Friday, 15-18 March. SACEMA staff, students and supervisors will receive invitations in January. Meanwhile, keep the dates!

### **Bayesian Biostatistics: 4-8 April 2016**

Prof Emmanuel Lesaffre of the Leuven Biostatistics and Statistical Bioinformatics Centre (L-BioStat), Catholic University of Leuven, Belgium, will be presenting, for the third time in Stellenbosch, his now famous five-day course, introducing Bayesian statistical methods, from basic concepts to hierarchical models, model building and model testing, illustrated with numerous biostatistical examples. The course has a practical emphasis, with classroom teaching balanced by many computer exercises.