



SACEMA
DST-NRF Centre of Excellence in Epidemiological Modelling and Analysis

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SACEMA NEWSLETTER

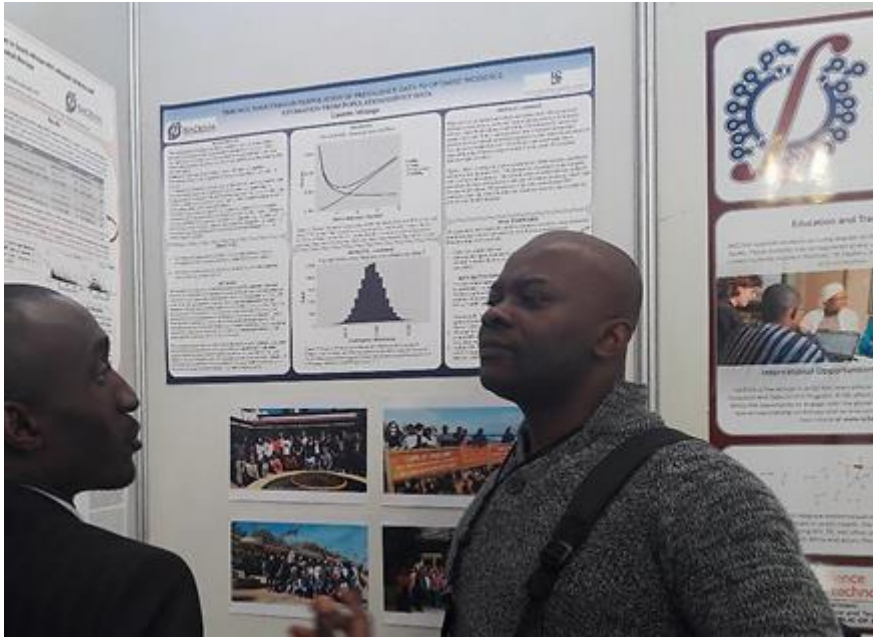
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NEWS:

Annual Centres of Excellence Directors' Forum (CDF2017)

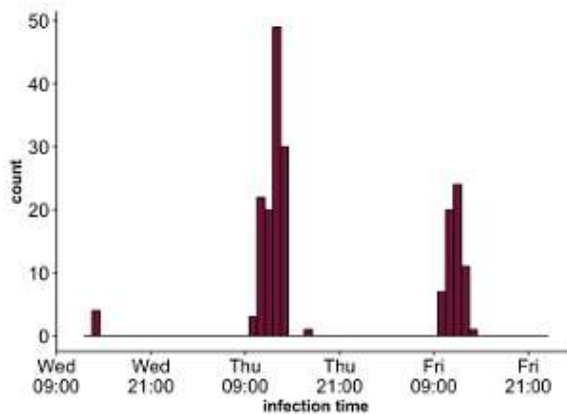
The annual Centres of Excellence Directors' Forum was held from the 31st August to the 1st of September, at Nelson Mandela University, under the theme, "Triumvirate Transformation in the CoEs: People, Knowledge Enterprise and Engagement with Society". The event was colourful with each CoE showcasing their current work and successes for the past year. Several delegates graced the event and the Minister of Science and Technology, Hon. Naledi Pandor was the keynote speaker at the ceremony. The highlight of the forum was the interaction with learners from different schools in Port Elizabeth. The forum presented an exciting learning platform for the learners. SACEMA was represented by Juliet Pulliam, Lynnemore Scheepers, Laurette Mhlanga, and Joseph Sempa. The highlight at the SACEMA booth was a game for a fictional Forum Fever epidemic which everyone was eligible to participate in. This was a simple exercise showing how an epidemic spreads in the population, but this time among the forum attendees. Data collection and analysis was done in real time and the participants tracked the progress of the epidemic by data visualizations using the epidemic curve, maps by province, and age-gender distribution.



Joseph Sempa (left) speaking to a visitor to the SACEMA booth at the CoE Directors' Forum in Port Elizabeth

One hundred and ninety-two people visited our booth and were "infected" with Forum Fever. Eighty-nine (46.4%) were learners of whom 61 (68.5%) were female. See data visualisations below.

When were people infected?



On Thursday, 125 people were infected.

On Friday, 63 people were infected.

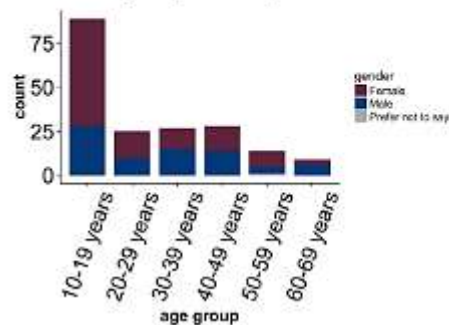
The smaller number of infections on the second day of the forum results from the "immunity" of people who attended both days of the forum and were infected on the first day.

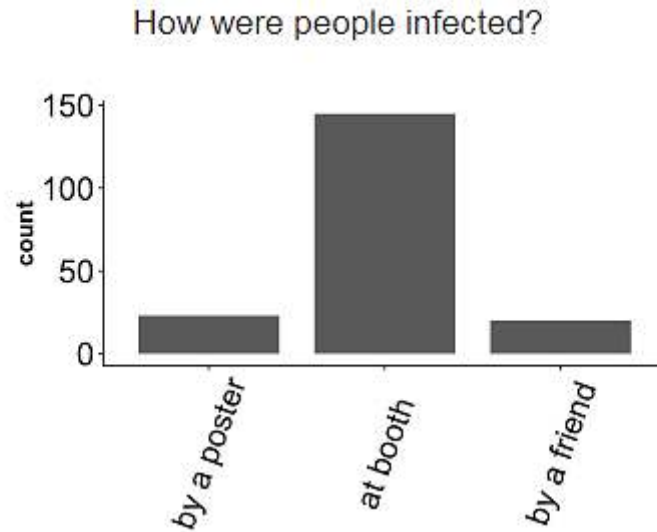
Who was infected?

By province



By age and gender





This exercise piqued interest of mathematics among learners as they asked about the subjects they should do to become epidemiologists. We found it useful to demonstrate to learners that we can start from data like forum fever data to build models based on the problem at hand. Further, we observed that providing learners with day-to-day examples of using mathematics enabled a change in the perceptions of some learners about this subject. Postgraduate students showed a lot of interest in the epidemiological modelling and analysis that we do at SACEMA. One of the PhD students (see figure above) from University of Limpopo asked about our involvement of zoonotic diseases modelling, and expressed interest in attending the annual Clinic on Meaningful Modelling of Epidemiological Data.

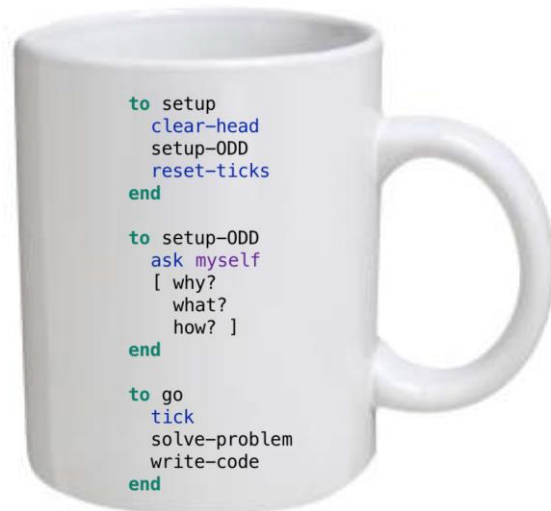
The excitement and challenges of introducing an introductory course

In March, Wim Delva and Lander Willem organized the first edition of the short course "Individual-based modelling in epidemiology: A practical introduction". The course took place at the Stellenbosch Institute for Advanced Studies, next door to SACEMA, and was attended by 22 participants, of whom two thirds were SACEMA students and staff. Wim writes: "Without much marketing and advertising we received plenty of course applications, and we were excited at the realization that there are plenty of researchers interested in learning how to develop, explore, and fit individual-based models to address questions in epidemiology.

However, in the final days before the course I remember being apprehensive about more or less every aspect of the course. This was not just the first edition of the course. For both of us it was the first time we would be teaching for a full week. Moreover, for pedagogical reasons we had chosen NetLogo as one of the main software packages in the course (next to R), but up to a few months before the course, we had never actually written any NetLogo code. Due to my limited teaching experience, and the fairly heterogeneous landscape of participants' backgrounds, I stressed about having included too few or too many concepts and techniques in the course.

Lucky for us, we had the most wonderful group of participants ... we were impressed by the dedication and enthusiasm with which the participants worked on their mini modelling project until the final hours of the course. During the week, we also received very useful and constructive feedback, which helped us through the classroom examples in a more interactive and time-efficient manner.

The feedback at the end of the course was overwhelmingly positive, which left us feeling empowered and encouraged to not leave it at this first edition. Participants appreciated the combination of printed course notes and online access to all course materials. They also enjoyed the combination of theory and practical applications related to the transmission dynamics of HIV, influenza, and African animal trypanosomiasis. Perhaps the biggest lesson for us, in preparation of the second edition, is that *less is more*. In our insecurity about designing a sufficiently broad and deep introduction to individual-based modelling in epidemiology, we overcompensated by including too many topics. Therefore, participants of the next edition should expect an even more hands-on course, with more time to acquire skills in developing, exploring, and fitting individual-based models. Two things we are hoping will remain unchanged in future editions are the contagious energy of participants, and the farewell coffee mug.”



Wim Delva is an epidemiologist at SACEMA, and Ghent University, Hasselt University and KU Leuven, Belgium. His areas of interest include: statistical analysis of sexual behaviour data, stochastic and deterministic modelling of sexual network dynamics and HIV transmission.



Lander Willem is a modeller at the Centre for Health Economic Research and Modelling Infectious Diseases, University of Antwerp, Belgium. His areas of interest include: transmission models for airborne diseases, parameter estimation, social contact patterns, and computational efficiency.

Visiting Researchers



Lamin Jawara, an MSc Biostatistics student at McGill University, Canada and AIMS (South Africa) alumnus, visited the HIV surveillance team at SACEMA from June to August 2017. He worked primarily with Alex Welte, developing R-shiny web applications based on existing spreadsheet implementations of Assay Based Incidence Estimations (ABIE version 3) tools.

Lamin reports: “During my visit, I recoded existing shiny applications for estimating incidence based on Kassanjee et al, to use functionalities provided by the R package *inctools* and further developed new shiny applications for available ABIE spreadsheet tools. I also had the opportunity to participate in the annual MMED clinic organized by SACEMA which provided me with a gentle and enlightening introduction to various dynamical modelling paradigms. I am truly grateful to Prof Alex Welte and the entire SACEMA team for an educative and productive experience at SACEMA. The visit has enhanced my understanding of statistics and immensely improved my R programming skill, particularly in building R shiny web applications. To Prof Alex Welte, Prof Juliet Pulliam, and the entire SACEMA team, thank you for all the mentorship, the training and an exciting visit”.



Katriona Shea, professor of Ecology and alumni professor in the Biological Sciences at the Pennsylvania State University in the USA, visited SACEMA from 11-15 September, following the conference on Models in Population Dynamics and Ecology (MPDE 2017), where she was a plenary speaker. Her research interests lie in the using various methods to study invasive and outbreaking species, and their management (see full bio at <https://kshealab.wordpress.com/>).

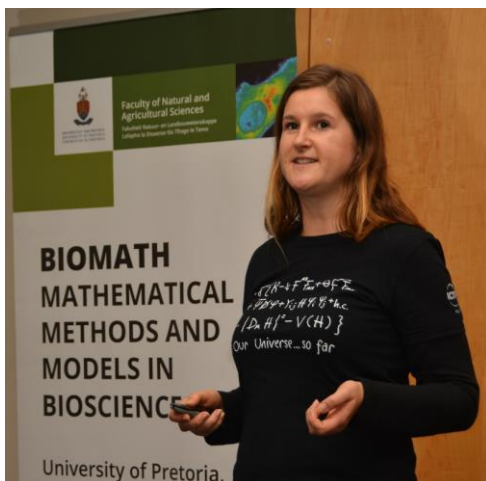
Prof Shea’s visit was very productive kicking off with a half-day workshop on “Optimal control of disease outbreaks under uncertainty”, which drew on case studies from animal and public health and took participants through ideas about uncertainty, value of information, theory for making optimal decisions, and adaptive management for disease outbreaks. She also presented a seminar to SACEMA researchers and students on “Objectives matter in epidemiology: Optimal management of foot-and-mouth disease, measles, and Ebola.”



Group photo taken at workshop presented by Kat Shea, September 2017

STUDENT SCIENTIFIC ACTIVITIES:

International Conference on Mathematical Methods and Models in BioSciences (BIOMATH 2017)



SACEMA Master's student Frieda Geldenhuys attended the International Conference on Mathematical Methods and Models in BioSciences and school for Young Scientists held on 25-30 June 2017 at Skukuza Camp in the Kruger Park. She reports: "If you can only visit two continents in your lifetime, visit AFRICA twice." - R. Elliot. I agree with this statement, am proud to be from Africa with its beautiful biodiversity, and this is how I started my presentation to thank the Biomath 2017 organizers. What an amazing opportunity to present my work: "Using Species Distribution Models for Spatial Conservation Planning for African Penguins", as

these penguins only occur in South Africa and Namibia. There were a broad range of talks, as it is a multidisciplinary meeting forum for researchers who develop and apply mathematical and computational tools to the study of phenomena in the broad fields of biology, ecology, medicine, biotechnology, bioengineering, environmental science, etc. A highlight of the School for Young scientists was the "Hot Topics Workshop" where several scholars act as moderators, presenting "hot areas" and related open problems. Biomath 2018 will be hosted by the Bulgarian Academy of Sciences and will take place in Sofia from 24 to 29 June 2018".



Group photo taken at BIOMATH 2017, Skukuza Camp, Kruger Park

The 2017 Society for Mathematical Biology Annual meeting

SACEMA PhD student, Khaphetsi Mahasa attended the annual meeting of the Society for Mathematical Biology (SMB), held at the University of Utah in Salt Lake City, on July 17 – 20, 2017. The conference theme was Mathematics and Health, with a special emphasis on how mathematics plays a crucial role in biology and medicine. The conference brought together groups of experimental biologists, research clinicians, biophysicists, and theoretical and mathematical biologists to exchange ideas and initiate collaborations. There was an impressive number of high quality talks, which were classified into 54 different mini-symposiums. The poster session was held at the beautiful [Natural History Museum of Utah](#) which gave all conference attendees an opportunity to take a look at the museum, while simultaneously enjoying the poster session.



Group photo taken at SMB, July 2017

This year plenary talks brought broad perspectives from distinct fields. Mahasa writes: “I personally enjoyed the talk by Mark Chaplain (University of St. Andrews) who gave an intriguing talk on “*Modelling cancer at multiple scales: From simplifications and idealizations to validations and predictions*”, and Jonathan Dushoff (McMaster University) who gave a breath-taking talk captioned “*Epidemic strength and speed: rethinking metrics for infectious disease spread and control*”.

On the second day of the conference, Mahasa gave a contributed talk captioned “Mathematical modelling of oncolytic potency and reduced virus tumour-specificity in virotherapy”, under the mini symposium titled “Mathematical Models of Cancer Development and Treatment” organised by Prof Peter S. Kim. He reports: “After my presentation I had an indispensable opportunity to work with my United States based co-supervisors, Profs Amina Elladdadi and Lisette de Pillis, on my research. For the rest of the week, Prof Amina advised me to attend the sessions focused on cancer. What great advice this turned out to be! I learned a lot about different techniques that I could apply to my own research. As usual, SMB ran a mentoring program which is aimed at fostering collaborations and career development for junior researchers, like me, with more experienced mentors in the field of interest. My mentor, Prof Shannon Mumenthaler (University of Southern California), was very motivational and nice to talk to. She gave me many constructive suggestions about my long-term career goals and maintenance of quality research”.



Khaphetsi Mahasa (centre) with Prof Amina Eladdadi (left) and Prof Lisette de Pillis (right)

The ASSAf 7th Annual South African Young Scientists Conference & 3rd Worldwide Meeting of Young Academies

SACEMA PhD student David Niyukuri attended the ASSAf 7th Annual South African Young Scientists Conference in Johannesburg on 19 July 2017. The conference was hosted by the South African Young Academy of Science (SAYAS), Department of Science and Technology (DST) and Academy of Science of South Africa (ASSAf) and other partners on the theme: “*Young Scientists Role in Science Advice*”. He also attended the 3rd Worldwide Meeting of Young Academies on 20 to 21 July. Within the framework of the Sustainable Development Goals (SDGs) of the UN 2030 agenda, the theme was “*One health – health development in the context of an urbanising planet and implications for science policy*” which focused on SDGs 3, 8 & 11. Among others, David presented his poster on “*Human Migration and HIV-1 Transmission in East Africa Community*”, using phylogenetic analysis. This work sheds light on the existence of individuals who acted as trans-national bridges between within-country sexual networks, and subsequently has potential to enhance and streamline regional strategic plans to reduce the further spread of HIV.

INTERNATIONAL MEETINGS:

International AIDS Society Conference on HIV Science

SACEMA researchers Cari van Schalkwyk and Eduard Grebe attended the 9th IAS Conference on HIV Science from the 23rd to the 26th July 2017 in Paris, France. More than 6000 delegates attended the conference, and sessions on clinical, basic, implementation and prevention science ran in parallel. Cari presented a poster and slides during a prevention science session entitled “It’s time to focus on STIs”. Her presentation focused on whether observed associations between HIV and HPV transmission are attributable to biological effects or to behavioural factors and network-level effects. The poster can be accessed at this [link](#). Cari was also co-author on another poster presented by Dr Jean Maritz from the National Health Laboratory Service and the Faculty of Medicine and Health Sciences. The [poster](#), presented in the implementation science track, illustrated the cost-efficiency and accuracy of pooled nucleic acid testing of dried blood spots for early infant diagnosis of HIV infection. Eduard presented a [poster](#) revealing the first city-wide hepatitis C virus prevalence estimate for San Francisco, prepared in the context of an elimination campaign recently launched by that city. These estimates were produced by ‘triangulating’ a range of data sources and for a number of high-risk ‘key populations’ including HIV-infected men who have sex with men. The poster was also presented at the 4th International HIV/Viral Hepatitis Co-Infection Meeting, held on 22 and 23 July. This meeting brought together researchers and policy-makers engaged in global efforts to prevent, treat, and eventually eliminate viral hepatitis infections.



International Association of Providers of AIDS Care (IAPAC) meeting

Eleanor Gouws and SACEMA Research Fellow Brian Williams attended the IAPAC satellite meeting and the IAS Conference on HIV Science in Paris on 22nd July. Eleanor, representing UNAIDS, took part in the discussion of the Fast Track Cities Initiative in which over two hundred cities have made a commitment to End AIDS by 2030. All the cities involved have shown great enthusiasm and a commitment not only to reach 90-90-90 but to go on to reach 100-100-100 and to see the fight against AIDS as part of a broader fight against poverty and ill-health. Brian gave a presentation on “Modelling the Impact and Economics of 90-90-90”. The SHIMS study in Swaziland, showing a 50% reduction in HIV-incidence between 2011 and 2016, was greeted with enthusiasm as it demonstrated directly what can be achieved. The Minister for Health for Botswana gave an impassioned presentation on having reached 90-90-90 and stressed that the most important determinant of their success has been the strong commitment from the national government. All those present are now committed to reaching 90-90-90 by 2020 and Ending AIDS by 2030. We live in exciting times and the key will be to end what has been started and bring about a world free of the scourge of HIV and AIDS.



Brian Williams (right) at the IAPAC meeting in Paris

22nd International Workshop on Virus Evolution and Molecular Epidemiology (VEME2017)

Prof Wim Delva and his student David Niyukuri attended the 22nd International Workshop on Virus Evolution and Molecular Epidemiology (VEME2017) in Lisbon, Portugal which was held from August 27 to September 1, 2017. This workshop was an added value to ongoing research at SACEMA initiated by Prof Wim Delva which focuses on the merging of phylogenetic analysis of HIV sequence data and agent-based modelling of sexual networks and HIV transmission.



Group photo taken at VEME2017 in Portugal

EVENTS:

SACEMA Research Days 2017

SACEMA's annual 'Research Days' meeting took place 21 - 24 August 2017, at the Wallenberg Centre adjacent to SACEMA, with a total of over seventy people taking part. This included SACEMA bursary holders, their supervisors, and postgraduate students from the Biochemistry Department working with Prof Snoep, who holds the SACEMA-associated South African Research Chair (SARChI). A number of external supervisors, associates and collaborators were able to attend, and three members of SACEMA's newly formed Scientific Advisory Committee were also present. Seven SACEMA staff members gave talks, as did nine students, while thirty-four students presented posters in two poster sessions, prefaced by enticing 2-minute poster-pitches. As usual, the meeting offered an opportunity for emerging researchers to receive constructive critique and practise presentational skills in a friendly environment. Social events during Research Days were: a spit-braai on Monday evening, a reception on Tuesday, and the conference dinner in town on Wednesday.



PhD student, Eva Ujeneza explaining her poster at SACEMA Research Days

This year, for the first time, prizes were awarded for student presentations. The prize for the best talk went to **James Azam**, the prize for the best poster presentation to **David Phair**, and the prize for the best poster pitch to **Floris van Zyl**. Honourable mention was made of the poster presentations of **Zinhle Mthombathi** and **Khotso Matlou**. The meeting included a Student Forum organised by James Azam and Wanja Chabaari, and a Supervisor Forum.



James Azam



David Phair



Floris van Zyl



Zinhle Mthombothi



Khotso Matlou

The four days climaxed with an animated debate chaired by Martin Nieuwoudt on the currently important and contentious issue of Open Data, with John Hargrove and Eduard Grebe propounding and arguing opposite views, before the debate was opened to the audience. Four training workshops were offered to students over the first two days: *Speaking Confidently in Public* was led by media trainer Vicky Davis; *Open Science*, led by Eduard Grebe, a Researcher at SACEMA, explored the nature and potential of the movement calling for greater access to scientific information, including scientific articles, and the raw data and tools used in the research; *Introduction to Scientific Writing Skills for Academic Articles* was led by Selene Delport of the Writing Lab, at the Language Centre of Stellenbosch University; *Introduction to Scientific Writing Skills for Theses and Dissertations* was led by Rose Richards of the Stellenbosch University Writing Centre.

Two Keynote talks were presented, the first by long-time SACEMA Research Fellow Brian Williams, on *Modelling and Analysis to Improve Public Health*, and the second by Dr Nonjabulo Gule, a University of Stellenbosch researcher named in 2013 as one of the Mail & Guardian Top 200 Young South Africans. Dr Gule's presentation was entitled *It's about the Journey, not so much the Destination*. A SACEMA staff member summarised her key message thus: if you are selective in your work and seek challenges that you are really excited and passionate about, then you will find the stamina to push through when things are not going as planned.

For more detail on Research Days, see the September issue of the SACEMA Quarterly <http://sacemaquarterly.com/short-item/sacema-research-days-2017.html>.



Group photograph taken at SACEMA Research Days - August 2017, Stellenbosch

Mathematical Modelling for Infectious Diseases (MMID), UCT, 8 -19 May 2017

SACEMA students Emanuel Dominic and Laurette Mhlanga participated in the second edition of this two-week course facilitated by Dr Sheetal Silal of the Department of Statistical Sciences, UCT. The course aimed to give postgraduate students and health-based researchers an in-depth introduction to the application of mathematical modelling and computer simulation to predict the dynamics of infectious diseases. Participants were introduced to building compartmental models and fitting to data, gradually increasing complexity by adding deaths, births, waning immunity, and seasonality. The concept of herd immunity was illustrated by using Vax!, an online game about epidemic prevention which works by breaking networks, quarantining, and vaccinating a limited number of nodes in the network so as to protect most of the individuals in the model world from acquiring an infection. The course included economic evaluation methods and individual based models.

A guest lecture was given by Dr Leigh Johnson on how mathematical modelling is being used to inform HIV prevention policy in South Africa. Two other guest sessions were conducted online by Prof Lisa J White of the University of Oxford. Laurette writes: "The second session involved working with an RShiny app to assess the relationship between intervention coverage and epidemiological measures, and to explore the predicted impact of typical malaria interventions." Emanuel writes: "On the final day of the course, we had a paper writing exercise in groups working on different sections of a typical scientific paper followed by presentations which turned out to be very productive and engaging."

Clinic on the Meaningful Modelling of Epidemiological Data (MMED): 29 May-10 June 2017

This annual two-week modelling clinic was held at the African Institute for Mathematical Sciences (AIMS) in Muizenberg. Mounted as part of the International Clinics on Infectious Disease Dynamics and Data (ICI3D) Program and in collaboration with AIMS, the clinic participants included twelve faculty, two faculty observers, three selected MMED alumni mentors, and forty seven students. Of the students, five were currently Biomathematics Honours and twenty AIMS Structured Masters, four were SACEMA-based, and eighteen were graduate or post-doctoral students and researchers from Africa and North America, selected and funded by the ICI3D Program. Asked at the end what they really enjoyed about the clinic, participants highlighted some scientific sessions, among them: participatory coding, introduction to likelihood, and fitting dynamical models to data. They also acclaimed the interaction with people from different countries.

The MMED Clinic emphasizes the use of data in understanding infectious disease dynamics and aims to engage participants in interdisciplinary modelling projects that use real data to grapple with practical questions in a meaningful way. Both the MMED and its sister-clinic DAIDD (the up-coming fifth edition is announced below), continue to develop innovative ways of enriching real-world modelling discourse, encouraging mathematical modellers to engage meaningfully with important data, as well as encouraging epidemiologists and biologists to embrace the possibilities of dynamical modelling.



Group photo of MMED participants and faculty, June 2017, Cape Point

“How to be a Scientist” – weekly discussion sessions at SACEMA

Most Monday afternoons throughout the year, locally based SACEMA students and junior researchers have met together with some senior SACEMA staff for interactive discussions exploring the different aspects of being a being a scientist. Topics in recent months have included: visual display of data, rethinking our indicators of impact and excellence, choosing a new lab and supervisor, and revisiting the p-value cut-off for statistical significance.

Introduction to Epidemiology and Research Methodology

This University of Stellenbosch Short Course, presented annually at SACEMA by Dr Jo Barnes, is currently running with weekly sessions on Tuesday mornings June - September, attracting external participants from a number of departments as well as SACEMA students.

SACEMA Seminars

The following seminars were held between April and September:

- 26/04/2017: Jennifer Lord: Quantifying the effects of land-cover change and climate on savannah tsetse population dynamics: implications for surveillance and control.
- 05/05/2017: Elissa Swartz: Modelling equine infectious anaemia virus infection: virus dynamics, immune control, and escape.
- 19/05/2017: Fanuel Otieno: Masters defence: A meta-analysis of the association between intimate partner violence and age disparity in sub-Saharan Africa.

- 26/05/2017: Wim Delva: Recasting agent-based model calibration as a missing data problem.
- 30/06/2017: Nicola Foster: Modelling disease, resource use and patient cost: investing to improve the value of TB diagnostics in South Africa.
- 07/07/2017: Martin Nieuwoudt: Update on Institute for Biomedical Engineering (IBE) initiative.
- 14/07/2017: Melissa Wallace: Research at CANSA.
- 21/07/2017: Jean Nachega: Addressing the Achilles' heel in the HIV care continuum to achieve the UNAIDS 90-90-90 targets.
- 04/08/2017: Taryn Young: The role of researchers in knowledge translation.
- 18/08/2017: Tollulah Oni: TB in the context of epidemiological transition and urbanisation.
- 18/08/2017: Christianah Olojede: Masters defence: Analysis of partner turnover rate and the lifetime.
- 08/09/2017: Wim Delva: Improving the estimation of temporal trends in HIV incidence by calibrating agent-based simulation models to phylogenetic tree data.
- 13/09/2017: Katriona Shea: Objectives matter in epidemiology: Optimal management of foot-and-mouth disease, measles, and Ebola.
- 15/09/2017: Juliet Pulliam: On thinking about epidemics.
- 21/09/2017: Joseph Sempa: PhD defence: The effects of longitudinal HIV viral load exposure on Immune outcomes, Mortality, and Opportunistic infections amongst ART naive patients in sub-Saharan Africa.
- 22/09/2017: Alex Welte: Dating HIV infections
- 29/09/2017: Nick Ogden: Climate change and the emergence and re-emergence of vector-borne diseases.

UPCOMING EVENTS:

Introduction to R: Management, Exploration, and Communication of data, 23-27 October 2017

This five-day course, registered as a University of Stellenbosch Short Course, will be presented by Roxanne Beauclair (SACEMA and the International Centre for Reproductive Health, Ghent University) with assistance from tutors at SACEMA. Participants will be introduced to programming in the open-source, statistical software R, and will learn how to import, clean and visualize data, and report results.

Bayesian Biostatistics: 20-24 November 2017

This popular course will be presented for the fourth time in Stellenbosch by Prof Emmanuel Lesaffre (Leuven Biostatistics and Statistical Bioinformatics Centre, Catholic University of Leuven, Belgium). It will take place at the Department of Statistics and Actuarial Sciences, and will introduce participants smoothly into Bayesian statistical methods, from basic concepts to hierarchical models, model building and model testing. Many biostatistical examples and exercises will illustrate the theory via computer practicals. More details can be found on SACEMA's website www.sacema.org.

Clinic on Dynamical Approaches to Infectious Disease Data, 10-16 December 2017

The sixth edition of the annual DAIDD clinic will take place at White Oak, near Jacksonville, Florida, US, mounted by the International Clinics on Infectious Disease Dynamics and Data (ICI3D) Program. The clinic will bring together graduate students, postdoctoral students, and researchers from North America and Africa, and instruction will focus on how the complex dynamics of pathogen transmission influence study design and data collection for addressing problems in infectious disease research. The deadline for African applicants was 15 September 2017. Details can be found on the website <http://www.ici3d.org/daidd/>

Individual-based Modelling in Epidemiology: A Practical Introduction

The highly successful first edition of this course took place in March at the Stellenbosch Institute for Advanced Studies, was mentioned briefly in the last newsletter, and is described in detail above. A second edition of this course is planned to be held in Belgium in November, jointly presented by Wim Delva (SACEMA, Ghent University, Hasselt University and KU Leuven) and Lander Willem (Centre for Health Economic Research and Modelling Infectious Diseases, University of Antwerp). It is likely that a third edition will be mounted at SACEMA in 2018. Watch the SACEMA website for announcements.