



## Basic Molecular Evolution Workshop – A trans-African virtual training course

“Virtual Workshops”: Is Africa ready to embrace the concept?

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### Why did we want to write this paper?

Why do we bother to organise scientific meetings? The amount of time, energy and resources they take up always surprises us. They do not help our career and promotion prospects – most hiring committees ignore our involvement in organising and participating in such meetings. So why do we do keep organising them?

For us, the reasons why we do continue to organise new meetings are similar to those motivating the funders who support the events: promoting research in areas (topical and

geographical) where we feel it is particularly needed; helping promote interactions between researchers; providing high-quality scientific impact, ideally at low cost. Not that we are altruists – we enjoy it too, in particular the opportunity it provides to contribute to the development of the scientific fields we work in. We were recently impressed by the effectiveness with which three events we were involved in achieved these and similar goals (Fig. 1) – we hope that, by sharing our enthusiasm for what was achieved through these meetings, we can encourage others to organise and fund similar projects in the future.

### Why focus on molecular evolution?

Part of the link between these events was thematic – the topic of molecular evolution playing an important role in all of them. At first glance, this might seem strange for scientists keen to promote development within the African continent – surely there are many more important topics to focus on in that context? However, despite first impressions, molecular evolutionary analyses can contribute to many applications associated with economic and public health issues in Africa. One important set of applications is in the epidemiology of diseases important in Africa. These studies may focus on the evolution of the pathogens themselves, including viruses (such as HIV

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### Author contributions:

Sheila Ommeh was an organiser of AFBIX09, an attendee of the EMBO Practical Course on Computational Molecular Evolution, and coordinated the BMEW; Aidan Budd was an organiser and trainer of the EMBO Practical Course on Computational Molecular Evolution, and one of the BMEW trainers; Mtakai Ngara was responsible for coordinating technical aspects of the BMEW and was an organiser of AFBIX09; Isaac Njaci was in charge of logistics for the BMEW; Etienne de Villiers supported the hosting of the BMEW, and was involved in AFBIX09 as a presenter and an organiser. All authors read and contributed towards the manuscript, with Sheila Ommeh and Aidan Budd making equal contributions to its writing and preparation.

### Abbreviations:

**AFBIX09**, First African Virtual Conference on Bioinformatics; **BecA**, Biosciences Eastern and Central Africa; **BMEW**, Basic Molecular Evolution Workshop; **ILRI**, International Livestock Research Institute; **RSG EA**, Regional Students Group Eastern Africa.

### African Virtual Conference on Bioinformatics 2009 (AFBIX09)

February 19-20, 2009

#### Organisers

Bioinformatics.org  
RSG Africa  
ASBCB  
BecA  
SANBI  
SMBI

Covenant University  
(including **Sheila Ommeh**, **Etienne de Villiers**, and **Mtakai Ngara**)

**Presenters:** 16

**Audience:** 150

#### Locations

ILRI, Kenya  
SANBI, South Africa  
Covenant University, Nigeria  
SMBI, Morocco  
Univeristy of Notredame, USA

#### Principle Funders

BecA  
SANBI  
Covenant University  
SMBI



Jeffrey Bizzaro, president of Bioinformatics.org, (top left), present at the main node, connected to the other AFBIX09 hubs



ILRI hub participants with Etienne de Villiers engaging participants in active discussions during a break session. Photo courtesy of Dr. Erik Bongkam-Rudloff

### EMBO Practical Course on Computational Molecular Evolution

May 3-12, 2010

#### Organisers

Nick Goldman  
Alexandros Stamatakis  
Ziheng Yang  
Giorgos Kotoulas  
**Aidan Budd**  
Antonis Magoulas  
Stelios Kastrinakis  
Eftichia Mironaki  
Pelagia Petraki  
Jacques Lagnel

**Presenters:** 17

**Audience:** 40  
(including **Sheila Ommeh**)

#### Location

HCMR-  
IMBG, Heraklion, Greece

#### Principle Funders

EMBO



Two of the authors, Sheila Ommeh and Aidan Budd, meet for the first time at the Practical Course in Crete



Participants working during a practical session

### Basic Molecular Evolution Workshop

July 1-2, 2010

#### Organisers

**Sheila Ommeh**  
**Mtakai Ngara**  
**Isaac Njaci**  
**Etienne de Villiers**  
Nelson Gichora  
Sonal Patel

**Presenters:** 5  
(including **Aidan Budd**)

**Audience:** 50

#### Locations

ILRI/BecA, Kenya  
SMBI Tangier-Morocco  
SMBI Casablanca-Morocco  
SMBI Rabat-Morocco  
SANBI UWC South Africa  
UCT South Africa  
University of Pretoria  
University of Mauritius

#### Principle Funders

ILRI/BecA



Kenyan participants gathered outside the ILRI buildings.



Kenyan participants at the ILRI during one of the training sessions.

**Figure 1.** An overview of the three events described in the article. To highlight the relationships between the different events, the names of the authors of this article are coloured red.

[1]), bacteria (such as *Mycobacterium tuberculosis* [2]) and eukaryotes (such as *Plasmodium falciparum* [3], one of the causative agents of malaria) – but also the evolution of the vectors responsible for transmitting many important diseases (such as *Glossina fuscipes fuscipes* [4], tsetse flies that are vectors of sleeping sickness, or *Anopheles* mosquitoes, important vectors of malaria [5]). Other medical applications involve analysis of the molecular basis of disease virulence in pathogens (such as in swine fever virus [6]), or disease immunity or resistance in hosts (such as the human Duffy blood group locus, which confers complete resistance to vivax malaria [7]). In a very different context, molecular evolutionary analyses have been applied in the fields of conservation and ecological genetics, including analyses of the history and evolution of indigenous species (such as cichlid fishes in the African Great Lakes [8]) and prioritisation of endangered species for conservation programs (such as Madagascan lemurs [9]). Other applications include attempts to understand the response of organisms to changing climatic conditions [10], crop plant research [11, 12] and analyses of human history and anthropology [13].

### The first event: The First African Virtual Conference on Bioinformatics (AFBIX09)

To tell the story of our work together, we will follow the path taken by Sheila Ommeh, the only one of us involved in all three events. The first of these was the AFBIX09 [14], which took place in July 2009.

Sheila was an organiser of this event, together with many others including Mtakai Ngara, and Etienne P. de Villiers, co-authors of this current paper. As its name suggests, this was a virtual event, where much of the interaction between participants was mediated by information and communication technologies rather than face-to-face. Crucially, AFBIX09 showed us that virtual technologies can successfully deliver useful, effective scientific interactions, at very low cost. Fourteen scientists were involved in organising and delivering

the event; four were keynote speakers, five were invited speakers and five were mentors who supported the various hubs through various funds. It also highlighted key points to be aware of when successfully setting up a virtual event of this kind – several of us summarised these lessons in a recent publication [15].

Training can play a key role in promoting development and equality, as recognised by international organisations such as UNESCO and the International Council for Science [16] and the European Union [17]. Therefore, increasing the provision and accessibility of training in developing countries could play a key role in bridging the gap between students worldwide. Students in so-called developed countries typically have easier and cheaper access to scientific training courses than their counterparts in developing countries. Part of the reason for this is that most trainers – and therefore most courses – are located in developed countries. With this in mind, several of us wanted to extend our experience of the effectiveness of virtual technologies to the more complicated context of a training course – where two-way interactions between presenter and audience are more diverse and important than for a conference.

### The second event: The EMBO Practical Course on Computational Molecular Evolution

But how could we find trainers for this virtual course – trainers that could be relied upon to deliver good, relevant training material? This problem was solved by Sheila's attendance of the EMBO Practical Course on Computational Molecular Evolution [18].

One of us, Aidan Budd, was an organiser of this course, which took place in May 2010 in Heraklion, Greece, at the Hellenic Centre for Marine Research, Institute of Marine Biology and Genetics. During the ten days of this course, Sheila experienced at first-hand the training of many prominent contributors to the field of molecular evolution, including developers of key software packages such as RAxML [19] (Alexandros Stamatakis), PhyML [20] (Olivier Gascuel), MrBayes

[21] (John Huelsenbeck) and PAML [22] (Ziheng Yang).

The openness and accessibility of the trainers, coupled with the way the course was organised, made it easy for trainees and trainers to get to know each other – providing great opportunities to develop longer-term relationships. This is exactly what Sheila did; approaching several of the trainers whose presentations covered topics she felt would be particularly useful for African scientists. She invited these trainers to deliver similar material – which she knew was of high educational quality – in a virtual context.

Everyone she asked was keen to participate – although unfortunately time constraints meant that not all of those she invited were able to get involved.

### The third event: The Basic Molecular Evolution Workshop (BMEW)

Using the contacts she made in Heraklion, Sheila, along with many others including co-authors Mtakai Ngara, Isaac Njaci and Etienne P. de Villiers, organised the first ever trans-African virtual bioinformatics training course. The BMEW [23] took place in July 2010, and was organised by the Regional Students Group Eastern Africa (RSG EA) [24] together with Biosciences Eastern and Central Africa (BecA). Financial and logistic support for the course was provided by the International Livestock Research Institute (ILRI) in Nairobi, Kenya.

The central hub was located at the ILRI/BecA, accompanied by seven satellite hubs (SMBI Tangier-Morocco, SMBI Casablanca-Morocco, SMBI Rabat-Morocco, SANBI UWC South Africa, UCT South Africa, University of Pretoria and University of Mauritius).

The course was attended by 50 trainees – 18 in Kenya, 15 in South Africa, 16 in Morocco and 1 in Mauritius. Four trainers from the Heraklion course made virtual presentations during the course: Maria Anisimova from Zurich, Switzerland; Aidan Budd from Heidelberg, Germany; Carolin Kosiol from Vienna, Austria and Rasmus Nielsen from Copenhagen, Denmark. Several of the trainers included African-specific examples in their presentations, including analyses of vivax malaria resistance in sub-Saharan

African populations [7] and cichlids fish diversity in African Great Lakes [8].

## Technologies and organisation of the virtual course

While presenting, external trainers were able to see and hear a 'question taker' who was located at the central Kenyan hub – but were not directly linked in this way to any of the training rooms. This was to avoid overwhelming the trainers with overlapping inputs from multiple different sources – although at the same time this made it harder to carry out two-way interactions between trainer and trainees. However, it was still possible to accept questions from the trainees via the 'question taker', and to initiate exercises involving direct interactions between trainees located at the same hub. Cisco's Webex [25], a proprietary, service-oriented software product provided by ILRI's Information and Computational Technology (ICT) department, was used for the online conferencing component of the course. This software can host a maximum of 25 satellite nodes (also referred to as 'hubs') situated in different locations and commonly used in scientific webinars e.g. Cambridge Healthtech Institute's Bio-IT World Web Symposia [26]. The central hub was located at the ILRI/BecA, with the other seven locations operating as satellite hubs. A Webex server was hosted on a Mac OS X laptop computer, using Ethernet cables for Internet connection, rather than via a wireless network, to obtain better connection stability and enable faster data transfer. Training presentations were transmitted from the central hub to satellite hubs on a 118.675 Kbps Internet connection. Remote hubs logged into the Webex system via a range of personal computers (both Windows and Mac OS X), and presentations were broadcasted to the audience using LCD projectors. Trainers delivered their presentations using the Webex clients on their local machines – as the trainer moved to a new slide, that new slide was shown almost instantly to the other hubs.

Prior to the course, tests were carried out with coordinators of the satellite hubs, and with the trainers, to identify potential problems and accustom them to the technology. During the course, trainee questions were communicated to trainers via the central hub, using voice connection and the chatting capabilities of Skype software [27].

## Benefits, challenges and feedback

Much of the feedback we collected from trainees and trainers involved in the course was positive – in particular, many participants were impressed by the way the course involved:

- (i) opportunities to network with participants in different locations,
- (ii) very cost-effective training provision,
- (iii) direct access provided to scientific experts in the field,
- (iv) no fee or travel/accommodation expenses for participants (both trainees and trainers).

All trainees indicated that they would like to see such virtual courses held on a regular basis, in particular with focus on topics of specific relevance to the continent.

At the same time, participants suggested several ways in which the educational experience could have been improved – and in which more trainees could have been attracted to attend. It was felt that trainees would have attended if the course had been held while the participating universities were in session, rather than during the holidays.

The stability of the Internet connection at some of the satellite hubs was also an issue, preventing several hubs from participating. Others felt that more trainees would have attended if the advertisement period for the course had been longer, making it easier for people to plan their attendance. Most trainees would have liked access to recordings of the sessions to be available after the virtual workshop was over.

The key feedback received from the trainers was that they would have liked more opportunity for two-way interaction between trainer and

audience. They acknowledged, however, that it could be difficult to achieve this without overloading the trainer with input from multiple sources. Overall, however, the trainers were impressed with the enthusiasm and commitment of the organisers – especially the prompt, enthusiastic, friendly, and efficient response to logistic and software issues.

Finally, the trainers were pleased to learn through their own experience that this kind of teaching can be effective. In particular, Aidan Budd is involved with a group of European bioinformatics trainers, the Bioinformatics Training Network [28], aiming to improve and coordinate bioinformatics training in Europe. Several members of the BTN want to develop the use of virtual technologies to increase the impact of current training activities [29]. As a result of his involvement in the BMEW, Aidan now has much more confidence in the effectiveness of virtualised courses, and is keen to develop these ideas further, and become involved in further virtual projects.

In the light of this feedback, and of our own experiences organising the course, we hope to organise more virtual courses in the future.

## Future prospects for the African continent

Virtual courses hold great potential for Africa and so-called developing countries in general as an efficient and cost-effective way of improving and increasing training provision. Expanding the program of virtual courses on offer will need a community of high-calibre trainers willing to participate in the courses – the limited and unusual interaction between trainers and trainees in virtual courses makes it particularly important that the trainers are both experienced and flexible in their presentation style. Other ways of increasing the impact of virtual courses are to increase both the number of hubs involved in the events, and the number of participants attending at each hub – which will be helped by the newly installed Africa-traversing fibre optic cable network. However, it is also clear that expansion of this kind will require increased support from funding bodies for virtual activities. Hopefully, the

successful interplay between virtual and regular events we have described here will encourage organisations to provide additional funding and support for activities of this kind.

Finally, we find it interesting to note that a key part of the development of the virtual course was a regular, non-virtual course. The regular course provided the social and scientific environment needed to establish and develop good, long-term relationships within the community relationships that led to the acquisition of good, committed and reliable trainers for the virtual course.

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