· **Name of School***
1st IBRO school on insect neuroscience and Drosophila neurogenetics in Africa

· **Topic**
Introducing students to insect neuroscience, from basic concepts to the latest discoveries in the field.

· **Location***
School of Health Sciences, Kampala International University, Bushenyi, Uganda

· **Dates***
20th August – 7th September 2012

· **Organizer (s)***
Lucia Prieto Godino, Tom Baden, Jimena Berni and Sadiq Yusuf

· **Email (one address only)***
lucia.prieto@cantab.net

· **Countries represented by the students**
Students selected to attend the course were from the following nationalities: Nigeria, Uganda, Kenya, Democratic Republic of Congo, Egypt, and Ethiopia.
Students who accepted the offer to join the course were from the following nationalities: Nigeria, Uganda, Kenya

· **Faculty list**
Dr. Alexander Arenz (MPI Martinried, Munich, Germany)

Dr. Tom Baden (CIN/BCCN, Tübingen, Germany)

Prof. Mike Bate (Dept. Zoology, Cambridge, UK)

Dr. Jimena Berni (Dept. Zoology, Cambridge, UK)

Jorge Castillo Quan (UCL, London, UK)

Dr. Berthold Hedwig (Dept. Zoology, Cambridge, UK)

Dr. Adria Le Boeuf (CIG, Lausanne, Switzerland)

Dr. Alex Mauss (MPI Martinried, Munich, Germany)

Dr. Isabel Palacios (Dept. Zoology, Cambridge, UK)

Dr. Laura Lucia Prieto Godino (CIG, Lausanne, Switzerland)

Dr. Horst Schneider (Innowep, Wurzburg, Germany)

Prof. Abdul H. Mohammed (Karolinska Inst., Stockholm, Sweden)

Prof. Sadiq Yusuf (KIU, Bushenyi, Uganda)

· **Rationale behind the school and its content**
The goal of the course was to promote and to continue providing the blueprint for the use of insects, with a special focus on *Drosophila,* as a model organism for neuroscience research and education in Africa.

The use of insects as model organisms in neuroscience in the developing world provides key advantages over the use of more complex vertebrate organisms such as rats: First, insects are inexpensive to obtain and maintain. Second, their nervous system shares basic organizational principles to that of vertebrates, but is much simpler. Third, powerful genetic tools are available in *Drosophila,* which are to date unparalleled by any other model organism. Fourth, larger insects, such as *Calliphora*, *Schistocerca* or *Gryllus* are very suitable for neurophysiological approaches. Thus, taken together, the use of *Drosophila* in combination with larger insects provides researchers with a powerful toolkit for the study of the nervous system.

Despite the extensive use of insects in neuroscientific research and the emergence of *Drosophila* as a leading model organism across developed world, insects are rarely used as neuroscience models in Africa. However, it is precisely in Africa where the low maintenance and experimental cost of *Drosophila* and other insects would give researchers an unparalleled opportunity to perform cutting-edge neuroscience research with limited economical resources. Thus, our course aimed at stimulating the advance training and research in neuroscience, and to encourage an optimal utilization of the available manpower and economical resources in neurosciences.

To attain these goals we introduced the subject not only theoretically but in particular through practical laboratory sessions in which students could learn to perform experiments using insects as model organisms. The courseran 6 days a week, for 3 weeks. Each day consisted on morning theoretical lectures, where students were introduced to theoretical concepts in each of the subjects, and afternoon laboratory sessions, where students performed experiments in one of the subjects of the course.

The first week consisted of a series of theoretical and practical session common to all of the students that introduced them to the field of insect neuroscience. The second and third weeks consisted of theoretical lectures common to all students and a series of alternative practical modules. Students had to choose one out of three practical modules running in parallel each week (For more details see the attached School program).

Week 1: **Introduction**

Insects as Model Systems in Neuroscience, Introduction to Neurogenetics, Scientific Ethics and Method.

Week 2:

Module A: Auditory systems.

Module B: Motor and Mechanosensory systems.

Module C: *Drosophila* as a model for human diseases.

Week 3:

Module A: Vision.

Module B: Electrophysiology: Theory & Assembly.

Module C: Chemosensory systems.

During the practical sessions we made a particular effort to expose the students to both state-of- the-art equipment as well as more cost-effective alternatives, critically comparing each method's suitability to perform experiments at hand. If the more expensive option clearly yielded superior results, we encouraged students to consider the quality of data needed to satisfactorily address their scientific question. Moreover we attempted to reproduce selected findings published in top-ranked journals, demonstrating that often the same conclusions could have been drawn from a much more basic experiment. Additionally, in every practical module, we aimed at introducing a simple question of unknown results for the scientific community, motivating students at the prospect of making a small discovery within this newly learnt field.

· **Level of school and students**

The students were young scientist either at theMSc or PhD level. The background of the students was very varied: Entomology, medicine, computational biology, neuroanatomy, psychiatry and pharmacology.
The school was an introductory school that aimed at teaching students that had never been exposed before to the field of insect neuroscience, but we aimed at achieving an advanced level in the concepts taught by gradually building up from basic concepts to the latest advances and techniques in the field.

· **Describe how students actively participated in the School program**

Students actively participated in the School program in the following ways:

1- Students were encouraged to interrupt the theoretical lectures to ask questions and debate their ideas at any point
2- There were "round tables" in which students and faculty sit around forming a circle to discuss. This format offered a more informal setting for the students to actively participate than the theoretical lectures
3- Every student had to perform experiments at the bench every single day. At any given time we had a ratio of at least 1 faculty per 3 students, which meant that every student could be independently doing his/her experiments and collaborate with other students, while being closely supervised.
4- At the end of each week students had to present their results from the laboratory experiments to the rest of the class in a scientific-conference format.

· **Any obstacles, and how they were overcome**

The main obstacle we found was the fact that three students cancelled last minute, after we had already bought their plane tickets. On the one hand it is a waste of resources as we could only get partial refund of their plane tickets, on the other hand some very good students that were on the waiting list could not join the course because the cancellation was just a day or two before the start of the course, and we did not have the funds to pay for their plane tickets.
The way we overcame the problem was by inviting students from the host university that had applied but that had not initially been selected. These students were extremely keen to join the course, and because they were at the host institution they could join the course at no additional cost.

Regarding the money lost in the plane tickets of the students that cancelled last minute, we took two measures. First, we contacted the regional president of the IBRO branch in Africa, and asked to put these students on the "black list" so that they can not apply for IBRO course fellowships in the future. Second, we have decided that for next year's course, students will need to pay a deposit of $100 to secure a place to be returned upon completion of the entire course. We hope that this measure will prevent students with low motivation from accepting our initial offer to participate in the course.

Another aspect of the course that could potentially be perceived as an obstacle, but that we rather took as an advantage, was the diverse background of the students. We overcame this potential difficulty by providing the basis of the subject during the first week, and making sure that all students were put to the same level regarding basic concepts in insect neuroscience. Furthermore, we encouraged students to help each other, and share their expertise. The success of the strategy was captured in a sentence that a student wrote on the questionnaire that we run at the end of the course: "It really helped to hear other colleagues' views on the same problems, and since we were all from different disciplines, this gave insights into other fields of science."

· **Did the school contribute to capacity building for Neuro- science in the region, and if so, how?**

The school contributed to capacity building in the region by bringing donated equipment in partnership with TReND in Africa (http://www.trendinafrica.com/Furnishing.html). After being used for the course the equipment stayed at the host institution, importantly because some of the students of the course are members of the host institution they are in privileged position to make use of the equipment and teach other scientist how to use it. Furthermore, the equipment is donated to the host institution under the condition that its use should be open at no cost (besides maintenance cost) to any researcher in Africa. Therefore the course establishes the basis for the creation of a top-research facility that any African scientist can benefit from. Our seed is already giving the first fruits with the creation of the Institute for Biomedical research at the Kampala International University (http://shs.kiu.ac.ug/index.php/institute-of-biomedical-research/about-the-institute). Moreover, as several students were affiliated with the host institution, they new gained knowledge and experience will form the foundation of a strengthened local Neuroscience community. Their contacts with students from other African countries, as well as with the largely European faculty contributes to the building of interregional scientific networks.

· **Social activities, if any**

Besides the generally social atmosphere of the course, where students and faculty freely interacted during the laboratory sessions, as well as during meals at the hotel, we specifically organized the following social activities:

1- Field trip to collect wild insects to use for experiments in the lab. We took all students in a to a nearby area to collect local insects together with the faculty. This activity doubled as social and academic, because it promoted interaction between students and faculty in a more relaxed setting than the lab.
2- We organized an optional dance night where students could join faculty at a local pub

3- Farewell lunch for the faculty of the second week.
4- Final farewell dinner and party at the hotel on the last day of the course

· **Faculty and student comments**

Immediately after the course all students completed an online survey using "The Student Assessment of their Learning Gains" (SALG) (http://www.salgsite.org/about). Here we are presenting a summary of the most relevant results.

On a scale of 1-5, with 5 being the highest, students on average evaluated their learning gains in each topic covered as 4.2 ± 0.3, and rated their gain in confidence about the subject area as 4.2 ± 0.8, with 76% of students selecting "4" or "5". This overwhelming self-assurance from the students was greatly satisfying, especially since students had not being exposed to the subject before, and were rather unsecure at the beginning.

To evaluate which teaching resources and strategies proved most effective we asked students to rate from 1-5 the different resources used. "Acessibility of the faculty to ask questions at any time" was rated the highest (4.7 ± 0.80). "Visual resources such as Power point presentations, or practical demostrations by faculty" rated second (4.7 ± 0.82). Notably, students preferred printed reading materials (4.5 ± 0.85) over electronic copies (4.2 ± 0.97).

Throughout the course we aimed at educating students beyond the immediate subject matter, in particular by also highlighting approaches to perform science with low economic resources. In response to the question "As a result of the course what gains did you make in the following skills?: Developing a research project, How to search for funding sources and write grants to fund your own projects, finding articles for a particular topic, critically reading articles, working efficiently with others, how to search for open source programs to analyse your data, how to analyse your own data, and giving oral presentations", where in a scale from 1 (no gains) -5 (great gains), students evaluated each of the skills above 4.1, with an average of 4.4 ± 0.2. Additionally when we asked students about the different topics covered in the course they rated highest "Learning how to perform various inexpensive experiments using insects as models"

Then, we inquired about the overall organization of the course. Students rated on average the course three week duration as appropriate (1.8 ± 0.4, were 1 is too long, 2 is just right, and 3 means too short). Equally they found that the time allotted to theory (1.9 ± 0.3) and practicals (1.9 ± 0.3) was just right. The difficulty of the taught materials was also mainly rated as "Just right", specifically on a scale from 1 (too easy) – 5 (too difficult), with 3 being "Just right", the scores were: theoretical lectures (3.2 ± 0.8) and practical lectures (2.8 ± 0.5). This highlights that the course format was appropriate to adequately guide our diverse group of students from very basic to more specialized concepts within the 3 week course duration.

Additionaly, all students either "agreed" or "strongly agreed" to the following statements: "I believe that this course is likely to have a great impact in the way that science is carried out in Africa", "I think it is likely that I will use *Drosophila* as a

model organism sometime in the future", "I am likely to bring the knowledge that I have gained during the course to other students/faculty at my host institution".

When we asked the students about what could be done to improve the course in the future, many students answered "nothing", but also a few students expressed that they would like to have more molecular biology both during the theory and during the practicals. Some of them also noted that it would be useful for them to have the material for the course sent to them in advance. We will take note of this an implement it in next year course.

Finally, when we asked students whether there is something else that they wanted to say we obtained encouraging sentences like: "This has been a wonderful experience for me. My orientation about science is positively affected. I am now more confident to complete my doctoral studies", "A bid thanks to the organisers and faculties. It was indeed an inspiring and educating experience"," I want to express my appreciation to the organizers for this golden opportunity; it has been a transforming and rewarding experience for me"

Finally regarding faculty, everyone said that it was a fantastic experience and that they would like to repeat.

· **Who was elected Class President and Co-President?**
Class President: Oladipo Olushola
Class Secretary: Mulka Ajagun Ogunleye

· **Other sponsors**
- The Company of Biologist (http://www.biologists.com/grants.html): £5,000
- The British Biochemical Society: £1,000
- TReND in Africa (www.trendinafrica.com): Donations of equipment used in the course
- ADinstruments: Borrowed equipment: ~£20,000
- StarLabs – Donated Equipment: ~£2,000
- DinoLite – Donated Equipement: ~£1,000