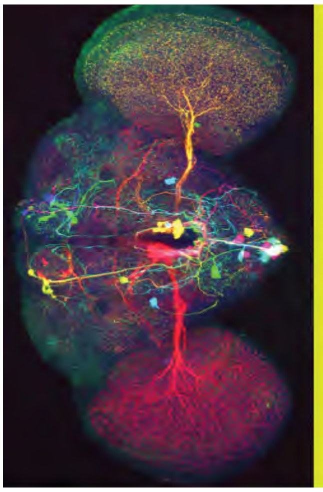


FLY NEUROSCIENCE WORKSHOP

DROSOPHILA AS A TOOL FOR UNDERSTANDING BRAIN & BEHAVIOUR

14-17th Dec 2015
Kumasi

http://fliact.org/welcomeghana

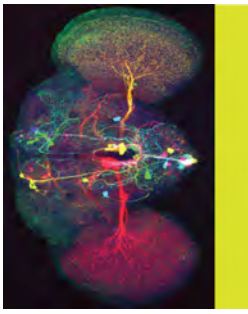
December 14-17, 2015

Venue Kwame Nkrumah University of Science and Technology

Provost, College of Science

Kumasi, Ghana

FLiACT MARIE CURIE ACTIONS SEVENTH FRAMEWORK PROGRAMME TReND The Company of Biologists ISN International Society for Neurochemistry



Fly Neuroscience Workshop

December 14-17, 2015

AGENDA

Monday, 14

Venue: Ibis Tek Board Room

9:00 Welcome lecture by Mathieu Louis
What is it about the fly? – A systems neuroscience perspective

10:00 Introduction of participants

10:30 Open Ceremony with Professor W.O. Ellis, Vice Chancellor, KNUST, Professor Kwasi Obiri Danso and Dr. Antonia Tetteh.

Topic 1: Fly as a model organism for neuroscience research

Venue: GF13

11:00 Elie Fink
The rich family of Drosophila and their ecology

12:00 Thomas Karikari
Introduction into using the fly as a model organism in neuroscience

13:00 Lunch

15:00 *Practical 1: Fly husbandry*
- *How to make fly food, raising flies in the lab*
- *Fly pushing*

16:00 Coffee break

Venue: GF13

16:30 *Practical 2: Demonstration of the Drosophila genus diversity*
- *How to collect them in nature*
- *How to identify them*

Venue: Computer Lab

17:30 *Practical 3: Online research tools for biologists (session with computer)*

Tuesday, 15

Topic 2: Fly for behavioural studies

Venue: GF13

9:00 Sercan Sayin
How to study the brain in the fly? Introduction to the fly toolkit

10:15 Coffee break

Venue: Ibis Tek Board Room

10:45 Simon Sprecher
The Drosophila adult eye as a model for neurodevelopment, neural diseases and behaviour

12:00 Sayanne Soselisa
Modulating neuronal activity

13:00 Lunch

Venue: Ibis Tek Board Room

15:00 *Practical 4: Dissection of larval brain*
Practical 5: Visualisation methods of the brain with fluorescent markers

16:45 Coffee break

17:15 *Practical 6: FlyPI exp. Light Driven Proboscis Extension markers*
Practical 7: Larval phototaxis (in Wild Type and mutants)

Wednesday, 16

Venue: Ibis Tek Board Room

9:00 Matthieu Louis
Neural basis of olfactory behaviors in the Drosophila larva I

9:45 Short break

10:00 Matthieu Louis
Neural basis of olfactory behaviors in the Drosophila larva II

10:45 Coffee break

11:15 Sercan Sayin
Fly on the ball: Decision-making dynamics for adult Drosophila

12:00 Sercan Sayin
Olfactory choice: T-maze

13:00 Lunch

Topic 3: Olfaction used for applied neuroscience research

Venue: Ibis Tek Board Room

15:00 John Abraham
Olfactory response of Drosophila suzukii to host volatiles

16:00 Andreas Kudom
The role of olfaction in host seeking and selection of oviposition sites in mosquitoes

17:00 Coffee break

17:30 *Practical 8: Determining the physiologically active compounds in plant volatiles*

Thursday, 17

Topic 4: Human disease models

Venue: Ibis Tek Board Room

9:00 Valentina Ferlito
Wouldn't hurt a fly: relevance of Drosophila neurodegenerative disease models in research and drug discovery (Alzheimer's and Parkinson's disease models)

10:00 Thomas Karikari
Use of fly models for studying non-nervous system human diseases

11:00 Coffee break

Venue: GF13

11:30 *Practical 9: Drosophila courtship behavior: a learning & memory assay*

Practical 10: The climbing assay: motor impairment as a readout for neurodegeneration

13:15 Lunch

Venue: Ibis Tek Board Room

15:00 Round table discussion:

- The process of research in Europe and in Africa, different approaches to scientific questions, and types of questions we ask to the problems we face
- Evaluation and feedback session

Chairs: Elie Fink and Sayanne Soselisa

17:00 Farewell event for all the participants at KNUST Engineering Guest House.

*Protocols for practical lessons 4,5,6,8 and 10 will be given by the instructors during the workshop.

JOHN ABRAHAM

Department of Entomology and Wildlife
University of Cape Coast, Ghana

Olfactory response of *Drosophila suzukii* to host volatiles

This lecture will be based on work done on *Drosophila suzukii* Matsumura. *D. suzukii* is an invasive pest insect of soft-skinned fruits. This insect pest shows preferences among its host plants; why? The lecture will introduce you to understanding the behavioural and antennal responses of *D. suzukii* to host plant volatiles, a knowledge that is applicable to any other insect and plant! You will learn how to collect volatile organic compounds from plants by closed-loop-stripping-analysis (CLSA), determine the physiologically active compounds among them by gas chromatography-electroantennography detection (GC-EAD) [theoretically] and apply that in monitoring pest insects in farms for early intervention.

Practical 8: Determining the physiologically active compounds in plant volatiles

Participants will learn how to collect plant volatile samples in the laboratory/field. In the laboratory, they will learn how to analyse the volatile samples in a gas chromatography-mass spectrometer (GC-MS) and identify the single compounds that constitute the volatile bouquet with the help of ChemStation software. The physiologically active compounds among the entire volatile compounds will be determined by gas chromatography-electroantennography detection (GC-EAD) theoretically.

VALENTINA C. FERLITO

Brainwave Discovery Ltd, UK
Armstrong Lab, Institute for Adaptive and Neural Computation
University of Edinburgh

Wouldn't hurt a fly: relevance of Drosophila neurodegenerative disease models in research and drug discovery

During this lecture we will learn about the most (sadly) common neurodegenerative diseases, their characteristics and why *Drosophila* is such an important model for drug discovery and screening.
Which are the main characteristics of *Drosophila* neurodegenerative disease models? How can we manipulate their genetic asset to establish new disease models? Which impact do this *in vivo* system has on understanding mechanisms for these diseases? Which is the importance of behavioural assays on drug discovery and screening? Knowing these aspects will make you aware of the importance of using *Drosophila* in studying neurodegeneration.

Practical 9: Drosophila courtship behaviour: a learning memory assay

Be prepared to deal with many flies during an intense hour where you will perform the *Drosophila* Courtship Learning Assay. We will make meet specific couples of flies in courtship arenas. You will learn how, in *Drosophila*, all the aspects of courtship are important and quantifiable. We will literally "spy" them while quantifying the vane attempts of naïve males to achieve mating with specific females. As in humans, male flies have to learn which female is "available". If we are lucky we might be able to spot a few differences in male learning capabilities. Will these guys learn that courting the proud haughty female of the best buddy is pointless?
In addition, we will test different disease models for their motility with the well know "bang assay".

ELIE FINK

Sensory Systems and Behaviour, Louis Lab
Systems Biology Programme
Centre for Genomic Regulation (CRG), Spain

The rich family of Drosophila and other insects and their ecology

The aim of this session will be to expose participants to the diversity of *Drosophila* species (and beyond!), focusing prominently on their behavior and ecological diversity.

Introduction into using the fly as a model organism in neuroscience

In this session a historical perspective will showcase the beginnings of *Drosophila melanogaster* as a genetic fly model and introduce the basics of fly research and the theory and practice of *Drosophila* genetics.

Practical 2: Demonstration of the Drosophila genus diversity

The introductory lectures on ***Drosophila* diversity** and **Using the fly as a model organism in neuroscience** will be complemented by hands-on sessions on practical handling of flies in the lab ('fly pushing'), species collection in the wild, species identification, and how to maintain and raise flies by preparing your own fly food. You will also receive an introduction to available fly databases.

THOMAS KARIKARI

Neuroscience, School of Life Sciences
University of Warwick, United Kingdom

The fly as a model organism for neuroscience research

In this lecture, we will look at some important historical perspectives in the development of the fly as a model organism and why it remains a preferred system for modelling human disease and physiology. We will also consider the fundamental aspects of establishing and operating a *Drosophila* research lab and why this may be more advantageous compared to using other model systems, particularly in a resource-limited setting.

Practical 1: Fly husbandry

What do flies eat? How are they raised in the lab? What is their life cycle and how long does it take to obtain adult flies? Is *Drosophila melanogaster* the only model fly species? How diverse is the Drosophila genus? How different is a male fly from the female? These are some of the questions we will address in this “hands-on” session. You will learn about fly food preparation, fly handling and diversity as well as some common behavioural assays. This session will be co-facilitated by Elie Fink and myself.

Use of fly models for studying non-nervous system human diseases

While flies are excellent for neuroscience research, their usefulness is not limited to this area. The genetic tools developed in *Drosophila* have been explored to model other diseases that do not primarily affect the brain. We will discuss some of these works, focusing on diseases that are common in Africa, including cholera, tuberculosis, diabetes and obesity. You will learn about how flies have been used in studying these diseases, helping you to think about possible ways to design similar experiments for your current research.

ANDREAS KUDOM

Department of Entomology and Wildlife
University of Cape Coast, Ghana

The role of olfaction in host seeking and selection of oviposition sites in Mosquitoes

Mosquitoes are among the best-known groups of insects because of their role as vectors of some of the most serious human diseases. They occupy diverse habitats, feed on a range of hosts, and transmit many diseases. Olfaction has a major role in host seeking and selection of oviposition sites. In this lecture we would discuss general aspects of mosquito behaviour relevant in mosquito control and the interplay of chemical, physical, and physiological factors in oviposition site selection, as well as host seeking.

MATTHIEU LOUIS

Sensory Systems and Behaviour, Louis Lab
Systems Biology Programme
Centre for Genomic Regulation (CRG), Spain

Neural basis of olfactory behaviors in the Drosophila larva

My lab is interested in understanding how behaviorally relevant olfactory stimuli are represented in the peripheral olfactory system of the *Drosophila melanogaster* larva. The larval 'nose' is composed of 21 olfactory sensory neurons (OSNs) expressing one, or occasionally two, specific odorant receptors along with the *Orco* co-receptor. Individual odorant receptors have overlapping, but distinct ligand tuning properties. Accordingly, each OSN can be viewed as distinct information channel to the olfactory system. Using a combination of behavioral analysis, optogenetics and *in vivo* electrophysiology, my lab has undertaken to disentangle the contribution of single OSNs to the encoding and the sensorimotor processing of dynamic olfactory stimuli. I will review our current understanding of how the information captured by a single functional OSN directs navigational decisions. I will also present evidence that a single functional OSN is sufficient to mediate odor quality discrimination.

SERCAN SAYIN

Sensory Neurogenetics Research Group

Max-Planck Institute of Neurobiology (MPIN), Germany

How to study the brain in the fly? Introduction to the fly toolkit

Drosophila neurobiology combines the genetic tools accumulated throughout the last century and the cutting-edge techniques in assessing neuronal activity along with animal behavior. In one hand, the efficiency and ease of producing transgenic lines led to the cracking of neuronal circuits at the single cell type resolution. Various approaches are available in manipulation of targeted neurons *in vivo*, which enables understanding of their roles in their participation in neuronal computations. The branching circuit components can be traced with double-labeling tools and functional imaging techniques, where immediate neuronal activity can be traced. The global readout of any perturbations is the animal behavior. The expansive catalogue of behavior provides a framework to analyze sequential behavior and its modulation. In this section, we will look at a snapshot at tools available in Drosophila research within the frame of olfaction.

Fly on the ball: Decision-making dynamics for adult Drosophila

Olfactory cues play crucial guiding roles for Drosophila in physiologically significant decisions. Understanding the underlying decision-making process requires drawing correlations of animal behavior and external stimuli. The particular challenging aspect of olfactory research is the turbulent nature of its stimuli. These fast spatio-temporal micro-fluctuations of odor plumes pushed olfactory sensory systems to evolve certain decoding strategies, including adaptation and desensitization, which also limits the capabilities of experimental olfactory paradigms. Furthermore, in general, the valence of these stimuli is evaluated with population assays, thus preventing to characterize the robustness of the response and its variance among individuals and the underlying reasons to those behaviors. We aimed to address this issue by analyzing the olfactory response of tethered flies on a spherical treadmill under firmly controlled odor stimuli. Using vinegar as a cue for food deprived flies, we are able to capture attraction towards the odor source and established the basic principles of the assay. The tools required for non-invasive, reversible neuronal manipulation, opto- and thermogenetic methods were also implemented and tested with candidate neuronal lines innervating the central and peripheral nervous system.

SAYANNE SOSELISA

Straw Lab
Research Institute of Molecular Pathology (IMP), Austria

Modulating neuronal activity

In order to understand how the brain processes information, we need a causative link between neuronal activity, and behaviour. This helps us make connections between neurons and their associated behaviour. In this lecture, we will discuss how we can use genetic tools to influence the fly's behaviour, by silencing or activating groups of neurons. We will discuss the underlying mechanisms of these tools, and talk about how to apply these tools in the lab.

Practical 3: Online research tools for fly biologists

A large amount of data and research tools are freely availably to fly researchers and neuroscientists online. This practical will demonstrate and give an overview of such tools. Participants are invited to actively explore these online tools.

SIMON SPRECHER

Sprecher Lab, Department of Biology.

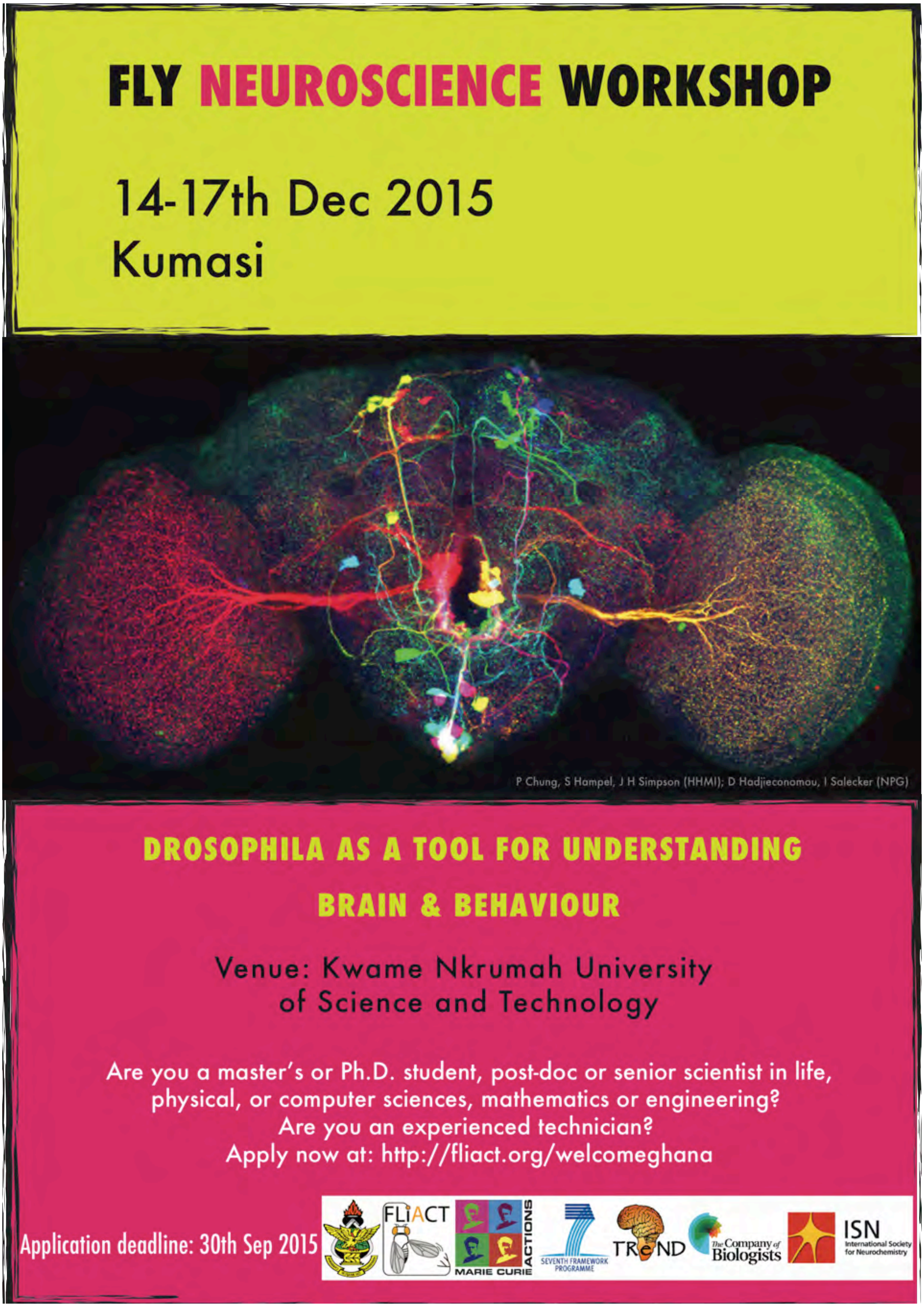
University of Fribourg, Switzerland

The Drosophila adult eye as a model for neurodevelopment, neural diseases and behaviour

The compound eye of the fruit *fly Drosophila melanogaster* has been widely used as an outstanding genetic model system to identify and characterize various fields of biology. Many genes and molecular pathways relevant for animal development and neuronal function have been identified in classical and advanced genetic screens using the eyes as model. I will provide a historical overview of how the eye emerged as model, highlighting some key events of making the fly the most advanced and elegant genetic animal model system. The main developmental processes and anatomical features of the compound eye will be discussed including some key examples of genetic pathways that have been identified and developmental events that can be easily used as model for specific biological processes.

Practical 7: Larval phototaxis

Fruit fly larvae are able to perceive various external stimuli through specialized sense organs. The eye of the fruit fly larva is comparably simple only consisting of two photoreceptor subtypes making up a total of 12 photoreceptor neurons per eye. About eight photoreceptors express the green-sensitive Rhodopsin 6 receptor protein, while about four photoreceptors express the blue-shifted Rhodopsin 5 receptor protein. Larvae respond strongly to light exposure by avoiding it. A simple light-choice assay can be used to study and describe light-avoidance behavior quantitatively in a rapid fashion. Using this assay we will test the relevance and impact of the two-photoreceptor subtypes for light avoidance behavior.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P Chung, S Hampel, J H Simpson (HHMI); D Hadjieconomou, I Salecker (NPG)
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Venue: Kwame Nkrumah University of Science and Technology
Are you a master's or Ph.D. student, post-doc or senior scientist in life, physical, or computer sciences, mathematics or engineering?
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Application deadline: 30th Sep 2015