

Ten Years of The Teaching Tools Workshops in Africa – 2008-2017

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Why is there a need for the Teaching Tools Workshop (TTW) in Neuroscience?

The study of the brain and neuroscience is challenging and complex. The topic is feared by many: medical students, graduate students, allied health students, neurology and psychiatry residents. This anxiety can result in a weak grasp of the material and an incomplete understanding of how the brain functions. For clinical and basic scientists, as well as neurocare providers, the lack of a solid foundation in neuroscience may lead to an imperfect comprehension of disease mechanisms that affect the central nervous system, resulting in poor diagnosis, and an unwillingness to thoroughly investigate such disorders. Indeed, diseases that involve the nervous system, such as epilepsy or schizophrenia, are often misinterpreted to result from non-medical causes; this can lead to withholding effective drug therapies and the social ostracization and alienation of people suffering from such conditions. Although medical education in Africa is evolving and many countries have embraced novel and updated curricula, “neuroscience” as an independent subject remains a fragmented discipline in many institutions of higher education throughout the continent. Neuroscience is often taught piecemeal in courses such as Anatomy, Biology, and Physiology. In consequence, the myriad subdisciplines of neuroscience — such as neuroanatomy, neurophysiology, and neurochemistry — are not taught as a single integrated discipline.

To tackle these global challenges in neuroscience education, a working group of African and international neuroscientists and neurologists met during the Society of Neuroscientists of Africa (SONA) Congress held in 2007 in the Democratic Republic of the Congo (DRC). The group identified a need for a coordinated effort to teach and engage African scientists to promote neuroscience throughout the continent. With the financial assistance of the Society for Neuroscience (SfN, USA), we initiated the first Teaching Tools Workshop (TTW) in 2008. Our goal was to offer methods and tools for teaching general neuroscience concepts in Africa in a form that allowed each attendee to adapt the tools to their personal classroom situation. The TTW provides a diverse variety of didactic strategies and materials to young African educators who are already engaged in teaching aspects of neuroscience. These young faculty members are then expected to share their learning experience as well as the teaching materials we provide with their colleagues and senior faculty in their home institutions.

Our initial Workshop took place in Senegal, with the assistance of our first host and co-organizer, Professor Amadou Gallo Diop (Figure 1). Since then, the TTW has been held in eight additional countries (Egypt, Kenya, Ghana, South Africa, Morocco, DRC, Ethiopia, and Uganda, in chronological order). Various factors influenced our decision to hold a TTW in a particular country. In many instances, the TTW is held with the biennial meeting of SONA or another major meeting, in part to use financial resources more efficiently. In other instances, we held a competition advertised through the

International Brain Research Organization (IBRO) website for countries and institutions interested in hosting the Workshop.

Who are the attendees?

As very few independent courses in neuroscience are taught on the African continent, most of the attendees are junior faculty teaching the subject as part of a larger course. We advertise through the IBRO website for applicants from any country in Africa; since 2008 we hosted teachers from 25 countries. We target younger faculty who have been teaching for 3-5 years and who live and work in Africa. Occasionally, African faculty with more experience attend, and provide feedback to the TTW leadership on how to best to build neuroscience education capacity on the continent. In general, we have the largest number of applicants from West Africa, likely because of the large population density in this region. We have, however, included a strong representation from each sub-region: North, West, East, Central, and South. (See Figure 2.) Overall, more males than females (~70 vs ~ 30%) have attended.

What do we do? Who are the faculty?

Our Workshop focuses on five primary areas: learner-centered teaching, fundamentals of neuroscience, developing effective presentations, hands on experience with principles of electrophysiology, and focused discussions on challenges and opportunities facing neuroscience education in Africa today. One of the more important ideas we offer is that of ***learner-centered teaching***. Working from Maryellen Weimer's influential book, "Learner-Centered Teaching: Five Key Changes to Practice" (2013), we examine the evidence-based theory and practice of focusing on how students learn, rather than how we teach. We discuss evidence based theory and the practice of learner centered teaching with specific application to the field of neuroscience. We expose each TTW attendee to proven methods for promoting deeper learning and encouraging student participation even in large classrooms. For ***fundamentals of neuroscience***, we present lectures that cover a number of basic concepts including neural excitability and connectivity, aspects of sensory and motor function, pain, the organization of neural centers mediating higher processes, and many other topics. Our strategy is to include topics that are essential for medical students to grasp, but also to cover material pertinent to students of basic neuroscience that can elicit possible research interest. Each year we offer ***hands on experience with electrophysiological principles*** using software or interactive materials that the participants can bring home with them. Regarding ***developing effective presentations***, each student delivers a short lecture to the group; our faculty work with each individual to implement the best resources for effective delivery. Another important aspect of our Workshop incorporates several hours of ***focused discussion*** in small groups. During these sessions, we tackle a series of questions that address issues such as *What do you consider the biggest challenge(s) in being an effective teacher at your institution?* Near the end of the Workshop each group presents conclusions and responses to specific queries including: *How can we overcome neurophobia and make the teaching of Neuroscience more appealing to African*

students? How can you best use the materials in your teaching? We ask them to propose methods to actively promote and share the information gained in the TTWs.

Although we cannot provide a complete course in Neuroscience during the six days of our Workshop, we aim to cover key topics relevant to the basic understanding of the nervous system. Everything we present is given to each student on a USB drive, which includes many additional materials such as brain atlases, interactive laboratories, information on neuroimaging, added lectures, and PowerPoint materials.

The core faculty (primarily the authors of this article) have worked together for the 10 years the TTWs have been offered, although others have joined us in various years. We include faculty who have extensive experience in Neuroscience teaching from Universities in the USA, Europe, and Africa. Over the years, we learned to work together and implement the principles of learner centered teaching and to engage students while teaching. Each year we also ask one or two prior students to participate in the Workshop as faculty. This aspect of our program has been expanded and is strongly appreciated by the students asked to contribute as teachers and by the current attendees. Although the official language of the Workshop is English, we aim to be sensitive to potential language obstacles; several of our faculty are fluent in French. We additionally include local faculty in each host country. We have been privileged to include a few additional faculty from time to time such as Dr. Marina Bentivoglio (Italy), Dr Raj Kalaria (UK/Kenya), Dr Sadiq Yusuf (Uganda), Dr. Vivienne Russell (South Africa), and Dr Musa Mabandla (South Africa).

We hosted about 240 young faculty over the 10 TTWs. After the 4th Workshop (in 2012), the SfN created a survey to question the participants of the first 4 Workshops. By extrapolating the number of people at the Workshops with the number of students they taught in their respective countries, the survey suggested that in 2012 we already reached 8-10,000 students of neuroscience-related subjects in Africa. Now, five years later, we have probably reached at least twice as many people throughout the continent.

What have we accomplished and how have we changed over the years?

Over the years, our Workshops changed and improved considerably. We expanded from an initial offering of 3 days to our present duration of 6 days; each year we accept 25-26 attendees; this number has grown from 15 in the first group. These changes were in part due to our ability to attract more funds, but also because the limited number of topics we could cover in 3 days was restrictive. Our initial Workshops focused on a specific relevant theme, such as motor systems and motor disorders. Over time we expanded our focus to include a broader range of subjects integral to the study of Neuroscience. By expanding the breadth of concepts we cover in each Workshop, we hope to provide a solid foundation for students and teachers of Neuroscience. Ideally, we would like to extend the Workshop to an increased period of time, as each year our survey indicates the students aspire to gather more information

on multiple topics. Moreover, lengthening the Workshop would also allow us to run more practical sessions (see below).

We continue to solicit and increase the supplemental materials. Regarding the topics presented in each Workshop, we gradually augmented the amount of time dedicated to learner centered teaching. We also consider an important component of our Workshop to be the physiological concepts of neural function, such as general principles of membrane excitability (mechanisms underlying membrane physiology, action potentials, and membrane potentials). This year, with the support of The Grass Foundation, we used “Spiker boxes”, created by *Backyard Brains*, to effectively teach, listen to, and watch action potentials elicited in insects. Each student who attended the Workshop received a Spiker Box to take to their home Institution and use in teaching their classes (see Figure 3). Prior to this year, we used the software, *Neurons In Action* (NIA) to teach neurophysiology (Moore and Stuart, 2007). Each student received a copy of the software package and we also included practical sessions during the Workshop dedicated to training in using this product. NIA is also an excellent resource to convey neurophysiological principles using software simulations.

Since we began in 2008 until now in 2017, substantial changes have occurred in African infrastructure and the availability of resources. During our first sessions, teachers from many countries worked in facilities that did not have a reliable supply of electricity, projectors, or internet access. They taught under extremely difficult conditions, often having to use a black board in classes of hundreds of students. As a result, in 2008 and several subsequent years, a portion of our Workshop was dedicated to solving problems of teaching related to infrastructure. In 2017, although some regions in Africa continue to experience such problems, they have become much less frequent and much less time is required to unravel such problems. In evidence of these changes - for the past two years, we introduced information on teaching Neuroscience using web-based materials that are easily obtained and used in Africa. For much of this teaching, the students and faculty can use the web-based materials on their cellular phones.

We also know from the survey conducted by the SfN and from the surveys we conduct after each Workshop, that nearly 100% of our students report the TTWs benefit their teaching efforts to a great extent. Many participants hold seminars and information sessions once they return home in order to share the resources provided by the TTWs with their colleagues. One of the questions asked in our surveys is whether or not participation in the TTWs will assist in creating a Neuroscience program or course in their facility; this year, 85% of students agreed that it does.

What does the future hold?

One of our goals is to facilitate the creation of Neuroscience programs or courses in Africa. During our Workshops, we attempt to spend time on curriculum development, but hope to expand this focus to make the topic easier for those attending the TTWs. The young faculty attending our Workshop cull from multiple disciplines, including those teaching undergraduate medical students, allied health students, dentistry

students, optometrists, pharmacy, basic science, and veterinary students. We also host those teaching medical residents. The proportion of each varies from year to year, but although many topics are useful to all of these disciplines, the specific curriculum of each group varies. We hope to assist in facilitating the tailoring of Neuroscience curricula to each type of student.

Although people from 25 African countries have participated so far, we would like to involve young faculty from many more countries that have not yet attended our Workshop. We hope that the effect of our Workshop will translate into a wider reach than just for those who attended and just the Neuroscience classroom. As indicated, many additional students on the African continent should receive benefit from being a pupil of a TTW attendee. We anticipate that these experiences will yield better classroom knowledge, and as a result of better education, more graduates will choose nervous system related specialties such as neurology, psychiatry, neurosurgery, physical medicine and rehabilitation. We also hope that a better understanding of the neuroscience basis of brain disease opens a portal to a more marketable science and technology transfer into the workforce.

We also acknowledge those who have generously provided support for the TTWs over the years. These include: The Society for Neuroscience, the African Regional Committee of IBRO, UNESCO (United Nations Educational, Scientific and Cultural Organization), The Grass Foundation, and the International Society for Neurochemistry (ISN).

Figure Legends

Figure 1 – An example of a group portrait taken from the first Teaching Tools Workshop held in Saly Senegal. The group includes the attendees, the faculty, and several observers from nearby countries.

Figure 2 – A map of Africa modified from <http://www.worldatlas.com/webimage/countrys/af.htm>. This Figure shows the countries where Teaching Tools participants originated. The participating countries are listed next to the color heat map in alphabetical order. The colors on the red-orange end of the scale represent countries that provided the most students. The colors on the blue end of the scale provided fewer students. The arrows indicate the specific colors that were used in the map.

Figure 3 – This photograph was taken by Thomas Tagoe, one of the participants in the 10th TTW. He used the Spiker Box, provided by our Workshop, to demonstrate to local students (in association with the Ghana Neuroscience Society) the principles he learned during the TTW.

References

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