The IBRO Simons
Computational Neuroscience
Imbizo

Muizenberg, South Africa

2017 - 2019

IN BRIEF, the Imbizo was conceived in 2016, to bring together and connect those interested in Neuroscience, Africa, and African Neuroscience. To share knowledge and create a pan-continental and international community of scientists. With the generous support from the Simons Foundation and the International Brain Research Organisation (IBRO), the Imbizo became a wild success. As a summer school for computational and systems neuroscience, it's quickly becoming an established force in African Neuroscience. Here, we review and assess the first three years and discuss future plans.

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Understanding the brain is one of the most challenging scientific problems faced by mankind. The payoffs are huge, not only for mental health, but many scientific spinoffs, like artificial intelligence, brain-computer interfacing and treatment of neurological disease. Consequently developed countries are pouring ever increasing research funds into brain science – witness the BRAIN initiative in the US and the Human Brain Project in Europe.

In this area, as in many areas, developing countries are at a huge disadvantage, simply because research is expensive. In South Africa (and the African subcontinent more generally) experimental neuroscience is a small but energetic field with a proud history; however, running a a technologically advanced lab is often financially unsustainable. Theoretical neuroscience, on the other hand, needs little more than a laptop, pencil and paper. And yet, this rapidly emerging discipline is critical for analyzing and understanding increasingly complex experimental data and for modelling the brain in its own right. With a rich background in mathematical sciences and similarly good educational programmes in physics and engineering, it should be relatively easy to create world class scientific centers focusing on theoretical neuroscience. These in turn could serve as bridgeheads for the development and strengthening of all aspects of neuroscience in Africa.

Action

To accelerate the development of neuroscience in southern Africa, we organise a 3-week long Imbizo (from Zulu - Xhosa, "a gathering to share knowledge") in Muizenberg, South Africa. We brought together 12 world leaders in computational/theoretical neuroscience and machine-learning with 31 African and Intercontinental students. Over 21 days, we lectured and learned, coded, brain-stormed, ate, celebrated, and created a tight knit network of inspired young scientists.

In the century of the brain, African scientists and educators are poised to make important contributions to global neuroscience research. The "IBRO Simons Computational Neuroscience Imbizo" aimed to further this goal, offer insight into the status quo, and enable knowledge transfer from the current leaders of the field. In the following pages we will argue that we were largely successful.

The announcement poster for the first Imbizo in 2017.

Course Structure

The Imbizo is modelled after the numerous other neuroscience summer schools in the northern hemisphere. We pick the best and favourite parts of each school and bring it to the Cape of Good Hope. But the Imbizo, as the most southern of all summer schools, faces a number of special challenges that come with its location and its diverse student body. Over the past three years we have tweaked lectures, tutorials and projects, and also dinning, accommodation and social activities to deliver the best learning experience for all of our students.

Intense homework sets in week one, and beach football matches over lunch. (2017)

Lectures and Projects

The Imbizo takes place in the last 3 weeks of January. Each week has a different theme and director, and features 6 working days and 1 day for social activities. Days begin with 4 hours of lectures from 9:00 to 13:00. After a common lunch, the afternoons and evenings are dedicated to work, either in the form of tutorials (in week 1) or free project time (in weeks 2 & 3). All dinners are held together at various locations around Muizenberg. In the latter part of the school, each student works with a team of tutors on a dedicated mini-research project. On the last day of the Imbizo, students present their results. Note that we have moved the weekly schedule around over the past three years but we have settled on the following structure:

The end of 2017's week one at the foot of table mountain.

Week 1: Biophysics, physiology, disease - the fundamentals

The first week is an in depth exploration (and tour-de-force) of the fundamentals of neuroscience. In the lectures, we introduce the basic anatomy and physiology of the nervous system, and then quickly focus on the electrical properties of neurons. We describe the foundations of biophysics as applied to neurons and explain the basis of membrane potentials, action potentials and synaptic conductances. Next, we focus further on ion channel function and how channels of all kinds can be studied and modelled using NEURON. By the middle of the week, we begin to explore the relevance of complex dendritic morphologies for understanding neuronal information processing.

For the second half of the week we introduce the vast, wonderful and heterogeneous world of synapses and their plasticity mechanisms. We switch gears and discuss the nature and origin of various neurological and psychiatric diseases, and finish the week with an overview of the various cutting edge experimental techniques for recording, and manipulating nervous systems.

The afternoons of the first week are devoted to hands-on tutorials, organised and run by the tutors. Our tutors generally take on a major role in shaping the syllabus – and the atmosphere – at the Imbizo, and we have been extraordinarily fortunate to have a consistently excellent group of teaching assistants. Tutorials range from building simple (single compartment) spiking models to using the NEURON simulation environment to perform biophysically realistic compartmental simulations of neurons; from hierarchical sensory processing to the basics of information theory; from models of learning and memory, and working memory, all the way to reinforcement learning.

A special highlight of week one is an opportunity for students to record action potentials from live insect neurons using Backyard Brains "spiker boxes". Using two drawing pins (electrodes), wired up to a spikerbox bioamplifier, it's possible to record from cockroach leg nerves. The exposure to a "real experiment" provides valuable insight into how data is collected and the associated difficulties (e.g. electrical noise). Witnessing a spike 'in the flesh' was an exciting experience.

Week 2: Network dynamics, spiking systems & machine learning

After the broad and comprehensive overview of week one, week two moves to the topic of neural networks. Starting with neuronal processing at a cellular level, lectures introduce spiking systems and discuss the neural code they use to communicate. Concepts such as signal propagation in feedforward and recurrent networks and the balance of excitation and inhibition as a fundamental mechanism in neural systems lead to lectures on general principles of information theory, and finishing the neuroscience part of the week with lectures on associative and working memory.

2017 Students crowded around the spikerbox amplifiers to record from real neurons.

The end of week 2 brings a significant switch of gear, leaping into a comprehensive overview of developments in machine learning over the past two decades. Following the historical narrative, the development of different network architectures for performing functions are described and compared to the nervous system. In additional machine learning tutorials students learn to use the TensorFlow open source library for performing computations using artificial neural networks. These lectures were very well received. Week 2 also features an overview of the business end of science: How to design figures and posters, how to structure papers and grants and how to present oneself in talks.

A unique feature of the Imbizo is the "Gender in Science Lunch", an informal event in which male and female students and instructors separately discuss the status quo of gender and race based discrimination in science. Discussions are led by faculty and summaries of the conversa-

Larry Abbott and Tim Lillicrap's chat at the water cooler drew some crowds....

..and discussions could last long into the night time.

tions are recorded and exchanged between the two groups afterwards. The ability to speak freely and without worry to offend facilitates a lively and often very educational discussion on many topics.

With the exception of a few tutorials, the afternoons and evenings throughout week 2 are used for project time.

Week 3: Higher-order brain function

The final week of the Imbizo saw the students in full swing, working feverishly on the projects, and interacting between themselves and with the faculty with ease and confidence. The goal of the third week was to provide insight into the difficulty of the problems faced by the brain.

Lectures begin with a high level view of the computations performed by the brain, divided loosely into sensory processing, action selection and motor control. These topics are revisited in more detail in the following lectures, leading to learning under risk and the topic of reinforcement learning. The Imbizo comes to an end with a summary of the big picture of the brain: the problems it faces, and how neuroscientists go about figuring out how it works.

Week 2 concluded at the beach.

Science and socials in 2017....

A highlight of the third week is the "Diversity Lunch", similar to the "Gender in Science Lunch" of Week 2, but held in one group, and with a focus on the African experience, which usually ends with a rich and lively conversation. Finally, the last lecture is led by Peter Latham as an AMA, "ask

.... in 2018.

.... and 2019.

me anything": Students are allowed one question each, anything goes, and Peter – along with the other faculty who are present, tutors, and even, sometimes, students – spend 90 minutes answering them. The students usually ask very good questions, and the discussion offers new perspectives on science for the students.

The last day of the Imbizo is spent on student presentations. Each student has 10+2 minutes to present their project and results, and the day is usually over before anyone notices that 31 young scientists have presented their ideas and results to their peers and friends. All that is left then is a party and good-byes.

Extracurricular activities and network building

The best achievement of the Imbizo in all three years was that our student body formed a cohesive, tight-knit group that transcended race, gender and national boundaries. We believe that they will provide support, networking and scientific advice to each for many years to come, also borne out in ongoing activity on all Whatsapp lists. We believe that these kinds of bonds and links are crucial for building a successful scientific career and are especially critical for students from Africa. For this reason we made every effort to ensure that relationships between students were formed early and strengthened throughout the course through social activities, and celebrated rituals such as Wednesday Night Science Socials and special dinner outings once a week.

Next page: The moon is rising on the way back from Tuesday night dinner.

Most importantly, we simply ensured that students spent a great deal of time together. Breakfasts, dinners and most lunches were eaten communally. Student interaction was amplified by the fact that lectures, tutorials and refreshments were all provided in the same room. Consequently, the students were together approximately sixteen hours per day. We also placed a large emphasis on fostering interactions between the students and both tutors and faculty. The students interacted with the teaching assistants on a daily basis to help them digest the contents of the course and also keep their projects on track. The students were also given multiple opportunities to interact with the faculty. For example, place settings were used for the majority of our dinners, which allowed students the opportunity to choose which faculty to sit next to. All of our faculty were chosen not based just on scientific quality, but also on their willingness to engage with students.

We also aimed to enhance a sense of community through planned social activities and weekend excursions. We wanted our students to work, but we also made sure they enjoyed themselves.

The 2018 group assembles to walk to dinner at the Brass Bell.

Tuesday Dinner Walks

Tuesday night dinners were organised at a restaurant by the water, about a 30 minutes walk along the coast. During the walk, there are many natural opportunities to interact with each other in an informal setting, and the students often enjoy the one-on-one time with some of our famous faculty. The dinner spot itself, the "Brass Bell", with the backdrop of the Cape of Good Hope is spectacular. One of our faculty described it as one of the most beautiful dinner spots on Earth.

'Free' Sundays

The Imbizo features 2 travel days, 18 work days, and 2 free (Sun)days for activities. We provide activities for these days, both to facilitate communication, and to prevent the often stark financial inequalities within the student body to affect who can go on trips. On the first Sunday, we charter a sight-seeing "red" bus for a tour of the Cape Peninsula. We visit Kirstenbosch Gardens, Groot Constantia Winery, and Signal Hill, touristic highlights of the Cape region. The trip also allowed students to see and enjoy Cape Town's natural splendours. For the second Sunday, students were given a choice between three exciting excursions: surfing lessons on Muizenberg beach, a trip to visit the penguins at nearby Boulders beach, or a hike up Muizenberg peak, under local guidance.

Swimming, hiking and yoga at the beach is part of the Imbizo.

Wednesday Night Science Socials

On Wednesday nights we host a social events with topical lectures by South Africans, according to who is available. In the past we had talks on the abundant local marine life, South Africa's Nobel Laureate Alan Cormack, and on the South African Astronomy project, SKA. We also had neuro-inspired magic shows, and we hosted a quiz at the local pizzeria. Students and faculty were divided into teams and required to answer questions on a wide range of topic from African general knowledge to 'how well do you know your classmates?'.

For early risers: Swimming, Yoga, Boot Camp

Outside activities on breaks was facilitated by our great location of our school at the beach-side suburb of Muizenberg, and lunch breaks are often spent at the beach, playing football and swimming. But the Imbizo offers more. Right from the start of the Imbizo in 2017, the Tutors played a large role in shaping the atmosphere and spirt of the group. It has become a habit that some of our tutors offer early morning sessions ranging from Yoga and boot camp by the beach, for those who seek exercise. Equally exciting and enthusiastically engaged with are swimming lessons in the tidal pools by the beach. Some of our African students arrive not being able to swim, and they leave not only as better scientists, but also as swimmers. We are deeply indebted to the drive and motivation of our tutors, who are joining us without financial compensation and on their own time (and especially Nassi Papoutsi who started this tradition). It is these impromptu activities through which students built strong relationships with each other, creating a well connected community.

Ending in style: The Gala Dinner

The crowning event of the school was the Gala Dinner and Party held on the final evening of the school (see picture on the next page). Students had all put a tremendous amount of work into their projects, which had been presented individually that day. As a result, the Gala Dinner gave students the opportunity to enjoy each other's company and that of faculty, and to reflect on all that had been achieved over the prior 3 weeks. In summary we believe that the shared experience of this rigorous but rewarding course will hopefully result in long standing relationships with productive international collaborations in the years to come.

The Class of 2017
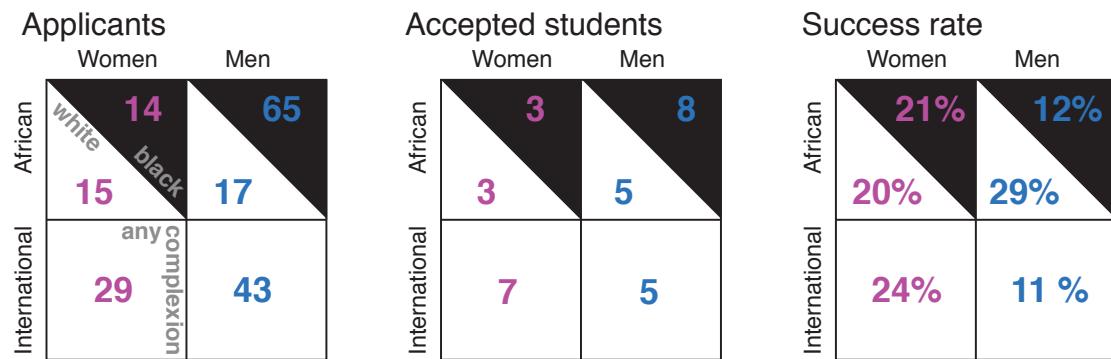
Origins

In the planning stages of the Imbizo, we aimed for 15 intercontinental and 15 African students. When we received 177 applications with over 100 applications from Africa, we created an additional studentship and, given the depth and qualifications of the African applicant pool, we admitted 19 African and 12 intercontinental students. The global distribution of their nationalities can be found in the chart below. South African participation was high, but with increasing visibility of the course, we are hoping to expand the circle of countries we recruit from in future years.

Nationalities of 2017 Imbizo students.

Distribution of gender and ethnicity

We aimed to create the most diverse student body possible. We separated the applicant pool along two axes: intercontinental or African applicants and male or female applicants. As such, the applicant pool comprised of: 82 (65 black / 17 white) African men, 43 intercontinental men, 23 (14 black / 15 white) African women, and 29 intercontinental women. (We did not ask for information regarding religion or sexual orientation). We evaluated each group separately through different assessors, and initially allotted roughly equal numbers of studentships to these four groups. Because of the uneven distribution of applicants in the four groups, we had to adjust the final numbers slightly, and ended up with the final roster below. The difference in success rates of African men may suggest bias, but it should be noted that the applicant pool of black men featured a high number of incomplete applications so that the realistic success rates were slightly higher.

Applicants

	Women	Men
African (white)	14	65
African (black)	15	17
International (any complexion)	29	43

Accepted students

	Women	Men
African	3	8
African	3	5
International	7	5

Success rate

	Women	Men
African	21%	12%
African	20%	29%
International	24%	11 %

Levels of education

With two exceptions (an early-stage principle investigator and a last-year undergraduate student), all students Imbizo were graduate students, finishing their Masters or in the first years of their PhD work.

Midnight maths at the Soul Surfer.

Student roster
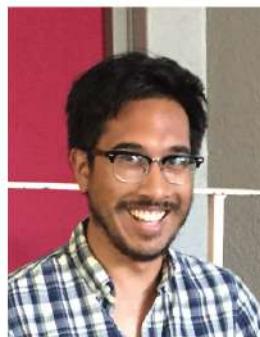
The following two pages contain the complete roster of our students.

Kayode Ayodele
Nigeria

Reshma Basak
India

Jay Bhasin
USA

Annik Carson
Canada

André, Castro
Portugal

Christopher Currin
South Africa

Kira Düsterwald
South Africa

Abib Duut
Ghana

Maxime Kepnang Pebu
Cameroon

Gift Khangamwa
Malawi

Phumlani Khoza
South Africa

Tresia Holtzhausen
South Africa

Lola Sze Ying Lam
China

Mirjana Maras
Montenegro

Stanard Mebwe Pachong
Cameroon

Lungile Mtetwa
South Africa

Laura Naumann
Germany

Lizelle Niit
South Africa

Arthur Powanwe
Cameroon

Luke Prince
United Kingdom

Yassine Ramdani
Algeria

Jonathan Rayner
South Africa

Lucas Rudelt
Germany

Victoria Shavina,
Russia

Saray Soldado Magraner
Spain

Ryan Sweke
South Africa

Luke Taylor
South Africa

Sushrut Thorat
India

Fatima Yusuf Hussein
Somalia

Girma Mesfin Zelleke
Ethiopia

Sicelukwanda Zwane
South Africa

Student case studies - "What did the Imbizo do for you? "

The next section features a closer look at some of our students, and their responses to what they particularly enjoyed at the Imbizo.

Abib Duut

Abib and Eszter working it out.

Abib Duut received his MSc. from the African Institute for Mathematical Sciences (AIMS), Ghana. The need to support his siblings through school and his interest in models and data analysis led him to find a data analysis job where he applied Markov-Chains to analyze rainfall data in Ghana. The analysis supported small to medium scale farmers in the North of Ghana and helped them answer the basic question of what and when to plant. His work led him naturally to the discovery of machine learning and finally computational neuroscience. Now Abib Duut wants to primarily focuses on the latter, hoping to fundamentally change existing approaches and methods of data modelling and machine learning, to eventually serve his community better. Currently, Abib Duut is volunteering at the Mathematics Department of the University of Ghana and dreaming of a PhD in Computational Neuroscience.

"I really felt privileged to be a part of the 2017 IBRO SIMONS Computational Neuroscience Imbizo in Cape Town. The travel experience, the opportunity to interact with a world-class faculty and such a diverse group of participants was really enriching. The courses were equally enriching and exciting, of course. The breath of the school covering biophysics, data analysis, and machine learning was particularly useful for a newbie like me. Some of lectures took on the life of the lecturer, it was as if the spirit of the lecturer was embodied in the lecture thus such lectures were naturally eponymously named like Mate's Lengyel's lecture, or Tim Vogels's lecture. I still carry the spirit of the place with me, the intensity and hunger for learning, in seeking to understand one of nature's mysteries: how the brain works; this spirit I will always carry. I also carry some memories of the experience with me, the runs in the morning, the chills of the winds just after noon and at night, the warmth of personalities, the confused faces during difficult lecturers, and the happy faces and the smiles during dinners. These memories I will forever carry. Ultimately, I can only imagine the worth of the experience at the school; For now, I can only say this: I have really been inspired and challenged during these three weeks, and I feel really confident about pursuing my interests, which in some sense is foreign to Africa."

Kira Düsterwald

Kira at the beach.

Kira Düsterwald is an aspiring clinician-scientist at the University of Cape Town and a Mandela Rhodes Foundation scholar. She is studying towards her MSc in Neuroscience concurrent to the completion of her medical degree. With a natural knack for numbers, and as a former participant in Math Olympiads, she also finished the equivalent of a mathematics degree during her medical studies. Part of the Raimondo Lab, Kira works on computational models of the cellular mechanisms underlying chloride homeostasis. She has broad interests in public health and social justice, and is part of the Student's Health and Welfare Centres Organisation (SHAWCO) team that sends out student-run clinics to under-serviced communities.

"I first picked up on computational/theoretical neuroscience because its problems, like those in many Olympiads, looked easy to understand yet difficult to solve, and it seemed a serendipitous mix of my interests in mathematics and medicine. I have luckily been able to explore neuroscience in a lab at UCT, but because the work in my lab is mostly experimental and there is limited neuroscience research in general in Africa, I had not been exposed formally to the field - until #isiCNI! The school was a great introduction to concepts in computational neuroscience that I knew very little about, including machine learning and approaches to problems. More importantly, I got to meet people who are interested in developing the field in our continent. This was pivotal in giving me a sense of what I need to know and do to pursue computational neuroscience alongside medicine, Emery Brown being a fantastic example of an anaesthetist-statistician-computational-neuroscientist. I am now confident that I will strive to train abroad, with the goal of practising medicine and studying/teaching computational neuroscience in Africa later, knowing that there is a system of friends and established scientists who support computational neuroscientists from Africa."

Phumlani Khoza

Phumlani (right) with André and Gift.

Phumlani Nhlanganiso Khoza is an Associate Lecturer and PhD candidate in Computer Science & Applied Mathematics at the University of the Witwatersrand, South Africa. He is interested in developing tools to probe complex systems, aiming to apply the principles of computational neuroscience and machine learning to the development of neuroprosthetics. After working as data analyst for a bank in Johannesburg he returned to science to obtain a Master's degree in computer science. Phumlani previously worked on unstructured data analytics domains to support an asynchronous protocol for continuous electroencephalogram (EEG) labeling using commercial-grade EEG sensors to further the feasibility of affordable EEG-based brain-computer-interface technology.

"The main reasons for applying to be part of the Imbizo were to meet people who have research interests that are roughly aligned to mine, and to obtain insights from what they have learnt through performing their research. Without attending the Imbizo, it would've been quite difficult to have an encounter with this community, since there currently is no active research community that is operating at the intersection of computational neuroscience and machine learning in South Africa (this situation is going to change). I have both academic and entrepreneurial aspirations, and both of these aspirations require that I develop a deep understanding of machine learning, primarily. The main benefit I derived from attending the Imbizo was getting first-hand exposure to current developments in computational neuroscience and neural network inspired machine learning. I was primarily interested in the ideas presented by Emery Brown, Tim Vogels, and Tim Lillicrap. This proved to be particularly helpful in shaping the research direction for my PhD work. On a more long-term perspective, there's the possibility of research collaboration between the people I met and myself."

Ryan Sweke

Ryan at his recent PhD defense.

Ryan Baruch Sweke is a Ph.D. Student in theoretical physics, as a member of the Centre for Quantum Technologies at the University of KwaZulu-Natal in South Africa. After completing undergraduate and honours degree's at the University of Cape Town in applied mathematics and physics, a fascination with the underlying physical nature of information and computation led Ryan to an M.Sc. in quantum computing. This work continued into Ryan's current Ph.D. work, in which he is concerned with constructing algorithms which would allow for the efficient simulation of complex quantum systems on both universal quantum computers and alternative quantum information processing devices.

"The benefits of attending the Imbizo have been immediate and profound, in many different ways. I first applied to attend the Imbizo as a result of long term interest in computational neuroscience, which was sparked by both a fundamental fascination with questions of how the brain works, as well as my underlying interest in the physical nature of information and computation. The first and primary benefit of the Imbizo has been the broad picture understanding of contemporary theoretical neuroscience, and its wealth of open questions, which I have managed to obtain. Furthermore, the process of obtaining this broad picture understanding, facilitated by both the incredible faculty and students of the Imbizo, has kindled within me a strong desire to understand the answers to the plethora of open questions which currently exist, as well as a true passion for the methods of computational neuroscience. I am now particularly interested in the both the application and development of "top-down" computational neuroscience, as taught to us by Máté Lengyel, as well as the related interface between deep/machine learning (particularly reinforcement learning) and biological learning which I had the opportunity to discuss at length with both Tim Lillicrap and Surya Ganguli, amongst others. In particular, as a student at the end of his Ph.D., I am now at a position in which I feel it might be possible to change career directions, and as a result of my experience at the Imbizo I am very strongly considering applying for post-doctoral positions in computational neuroscience. In addition, another massive benefit of attending the Imbizo has been the close relationships I have managed to develop with all of the fellow students and faculty. In particular, I feel like these relationships constitute a strong and active support network which has already proved extremely useful for both academic and personal guidance. Finally, a huge benefit of attending the Imbizo was that it was extremely fun - The sense of camaraderie, enthusiasm and dedication amongst the students and faculty was palpable, and it was highly enjoyable to have the opportunity to be part of such an environment. Overall, I can honestly say that the Imbizo was one of the best scientific experiences that I have ever had, I feel extremely privileged to have had such an opportunity, and it has illuminated for me a true passion which may very possibly change the direction of my academic career."

Fatima Hussein

Fatima exploring Table Mountain with her peers.

Fatima Yussuf Hussein lives in Mogadishu, Somalia. She did her undergraduate work at the Shendi University in Sudan, and graduated with a Bachelor's in Science, focused on Physics and Maths. She continued her postgraduate studies in Mathematical Sciences at AIMS South Africa, where she received a Master's in Applied Maths. While her course work focused on quantum physics and mathematics she is interested in think more creatively about how to apply her knowledge to the real world, maybe even how the brain works. She is currently applying to graduate schools and still dreams of a career in science.

"Quite honestly, I am not sure I will pursue neuroscience. It seems too far removed from what I started with, quantum physics, and there is definitely no neuroscience in Sudan or Somalia. But that doesn't mean the Imbizo was a waste for me. In fact, neuroscience has always been a dream for me, and maybe I can help bring neuroscience to Sudan, or Somalia in the future. What's more, the Imbizo has helped me to understand what science is and how the scientific method works as a universal tool, no matter what the question is. For now, I would like to be part of a good scientific research group, conducting research that integrates different scientific disciplines. I want to participate in developing science in the African continent also through teaching and mentoring young promising students in African institutes. My favourite thing at the Imbizo was the experience to interact with a totally open minded, international community, talk about science and look at the ocean, all at the same time."

The class of 2017 at the gala dinner.

Kay Ayodele

Kay at class.

Kayode Peter Ayodele is a Senior Lecturer at the Department of Electronic and Electrical Engineering, Obafemi Awolowo University, Nigeria. His background is in control and instrumentation. After his Ph.D. he developed a particular interest in modelling and analyzing of neurophysiological processes and signals. His current research includes development of brain-machine interfaces with reduced subject training times, development of EEG-based biomarkers for the diagnosis and management of schizophrenia, and EEG-based diagnosis and management of epilepsy. His honors include a MIT iLab Junior Research Fellowship (2011), a MIT sub-grant of the Carnegie Corporation "Realizing the Potential of iLabs in Sub-Sahara Africa" grant schem (2006 - 2011), and the MIT - Total Empowering the Teachers Fellowship (2013). Kay was a co-author of the IEEE Education Society Theodore L. Batchman Outstanding paper of the year 2015.

"Coming to computational neuroscience from a background in electrical engineering, I quickly ran into two problems. First, my lack of formal training in neuroscience was making it hard to formulate and exchange ideas with potential collaborators in the health sciences. Secondly, I ran into a Catch-22, where lack of publications in the area made it harder to secure funding and attract collaborators, which in turn made it hard to do the work needed to get publications. I saw the Imbizo as a great opportunity to address both problems, and so it prove. Looking back, I am impressed by how much ground was covered in three weeks, from synaptic structure and modelling to large scale neuronal networks, along with complementary treatments of higher-order brain function and algorithms. The differences in the approach, and indeed, personalities of the instructors somehow helped to make the process feel less overwhelming. For me, two instructors stood out, representing as they did, two contrasting styles. Máté Lengyel's information-packed classes dispelled some important misconceptions for me, and I usually left Tim Vogels's talks with interesting, often out-of-the-box ideas. For me, the Imbizo has opened a door of tremendous opportunities. I am currently discussing with a researcher I met at the Imbizo about developing specific projects and proposals for a collaboration on epilepsy spanning sub-Saharan Africa. I have already, with collaborators from a nearby teaching hospital, formed what, to the best of my knowledge, is the first computational neuroscience research group in Nigeria."

Lungile Mtetwa

Fatima and Lungile catching some big air.

Lungile Victoria Mtetwa is a part-time Master's student at the University of the Witwatersrand (Wits) and has been an Analytics Consultant at IBM South Africa for the last four years. Her background is in Computational and Applied Mathematics, in which she completed her honours degree at Wits. Lungile has always been interested in merging mathematical techniques with medicine. Her Master's research aims to use machine learning techniques in the mathematical modelling of the human brain in order to identify structures of the sub-cortical region. These methods will be applied to 3D brain MRI for automated segmentation. She aims to use her MSc. degree as a gateway to a career in Computational Neuroscience. Lungile is passionate about the development and support of women in STEM in Africa and is an active volunteers for "GirlCode ZA", an organisation that aims to create sustainable communities that foster women's continued engagement in improving their technology skills.

"The Computational Neuroscience Imbizo was an intellectual light bulb switched on for me. As I started my career in Analytics, I realized Neuroscience had become a dream deferred, so I decided to pursue a Master's degree with an application in Neuroimaging. The Computational Neuroscience Imbizo has given me foundational concepts of Neuroscience which I did not have coming into the school. The faculty was incredible, their varied background and experience gave me exposure to different research areas in computational neuroscience. I was inspired by Dr. Emery Brown's unique career path as an Anaesthesiologist / Neuroscientist, as it shows there are many different ways to navigate a career in Neuroscience. I am most grateful for the network of exceptionally talented young individuals in this field who attended the course and who consistently share updates from Neuroscience schools from around the world - this is an invaluable benefit of the school. Exploring Computational Neuroscience is not a far-fetched dream anymore."

Next page: Climbing Lion's Head Mountain for sunset.
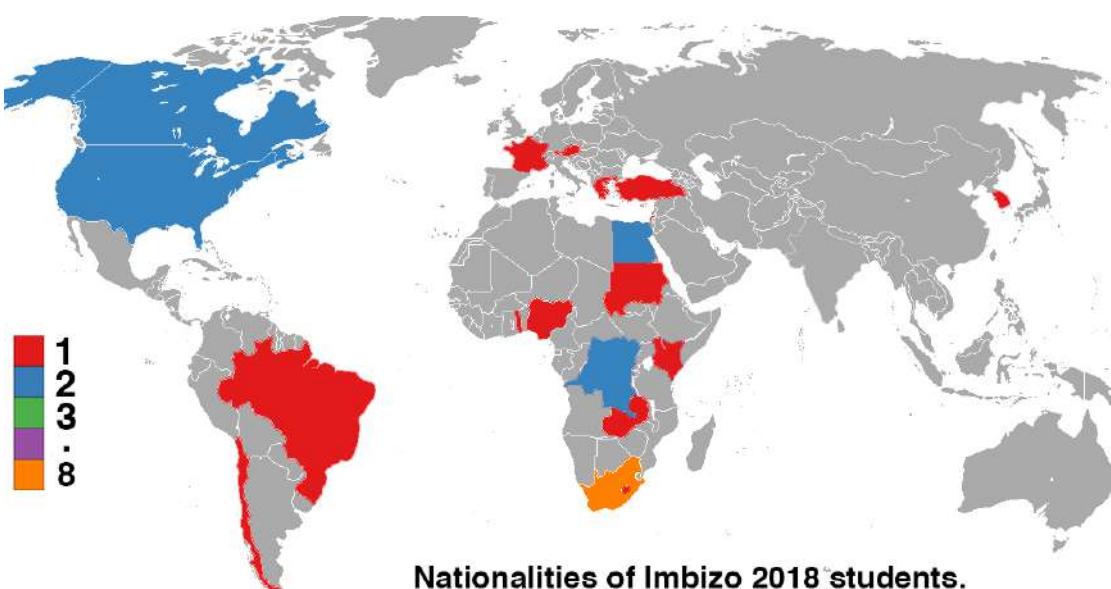
The Class of 2018
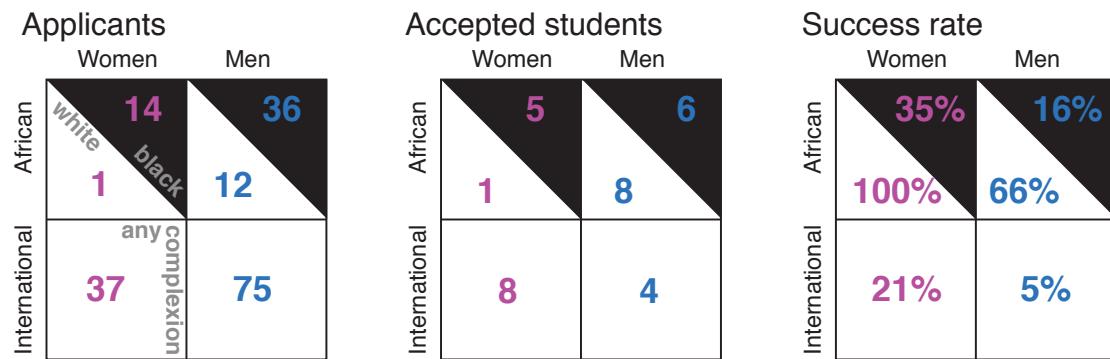
Origins

We aimed for similar composition as in 2017. We received 170 applications, with approximately 70 from Africa. We admitted 19 African and 12 intercontinental students (see chart blow). The number of African applications was lower than in 2017, and we were a bit nervous that we had depleted the applicant pool. However, the 2018 applications were generally of a high standard. We assumed that we had to still work on visibility and we continue to work on expanding our circles in future years.

Nationalities of Imbizo 2018 students.

Distribution of gender and ethnicity

Again, we aimed to create a diverse student body. We separated the applicant pool along two axes: intercontinental or African applicants and male or female applicants. As such, the applicant pool comprised of: 48 (36 black / 12 white) African men, 75 intercontinental men, 15 (14 black / 1 white) African women, and 37 intercontinental women. (We did not ask for information regarding religion or sexual orientation). We evaluated each group separately through different assessors, and initially allotted roughly equal numbers of studentships to these four groups. Because of the uneven distribution of applicants in the four groups, we had to adjust the final numbers slightly, and ended up with the final roster below.

Applicants

	Women	Men
African (white / black)	14 / 1	36 / 12
International (any complexion)	37	75

Accepted students

	Women	Men
African	5 / 1	6 / 8
International	8	4

Success rate

	Women	Men
African	35% / 100%	16% / 66%
International	21%	5%

Levels of education

Similarly to the previous year, the student body consisted mostly of graduate students, at Masters or PhD level, but we also had some postdocs, and a young P.I. in 2018.

The lecture hall just before students arrive.

Student roster

The following two pages contain the complete roster of our students.

Samar Ahmed Mahmoud Abbass

Hiba Abuelgasim Fadlelmou

Mohammed J. M. Aburidi

Einola Akin Akinboboye

Nick Kayokwa Chibuye

Ionatan Kuperwajs

Ana Cláudia Costa da Silva

Stella Dong

Michael Ferreira dos Santos Pereira

Ernst Grunow

Jordan Guerguiev

David Karpul
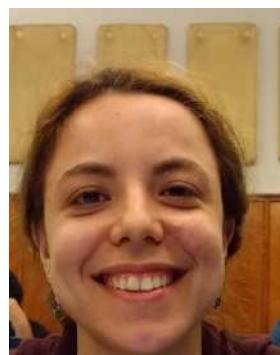
Young Wook Lyoo

Liemiso Mpota

George Obiero

Margarita Pitsiani

Jasmine Poirier

Dean Rance

Andrea Rodriguez

Samson Olayinka

Emily Shobana Muller
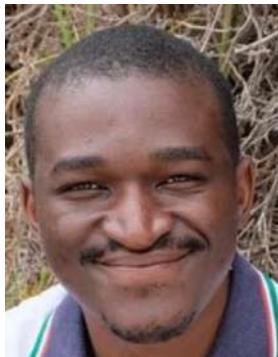
Mohamed Gomaa
Mohamed Sobeeh

Azote Somiealo

Mpassi Mahinga Désirée
Taliane

Patrick Tenga

Charline Tessereau

Gönül Uludağ

Morné Valentyn

Alexander von
Klemperer

Stiaan Wiehman

Bettina Wützl

Student case studies - "What did the Imbizo do for you? "

The next section features a closer look at some of our students, and their responses to what they particularly enjoyed at the Imbizo.

Somiealo Azote

Somiealo on a beautiful day at signal hill

Somiealo Azote wants to apply mathematics and physics to understand and solve problems of biological cell mechanics, such as cancer development and metastasis formation. After an MSc. from the African Institute for Mathematical Sciences (AIMS), Senegal, and an internship in a biophysics laboratory (LIPhy) in Grenoble, France, where she used computational models to understand transmigrating animal cells, she works on her PhD in Biophysics at Stellenbosch University, South Africa. For her PhD thesis, she focused on the computational modelling of eukaryotic cell actin cytoskeletal networks during branching. Her tools include methods from graph theory, statistical and continuum mechanics. She investigates the contributions of cytoskeletal networks to the mechanical properties and stability of cells and tissue. For her Postdoc she would love to use the computational and theoretical models she has developed during her PhD (and at the Imbizo) to investigate the mechanics, structures and morphology of nerve cells in the brain.

"The 2018 IBRO-SIMONS Computational Neuroscience Imbizo was an amazing experience for me. It has been for me an opportunity to meet and interact with some of the best specialists of the fields of neuroscience who came from all over the world to share their knowledge with students, who also came from all over the world with diverse backgrounds . The school has broadly covered many subjects including biophysics, data analysis, and artificial intelligence. These were covered in detail, enabling a newbie like me to follow and understand most of the course. The passion and motivating way in which most of the lecturers and tutors were delivering their courses led me fall in love with computational neurosciences. I still carry the spirit of the place with me, the intensity and hunger for learning, in seeking to understand one of nature's mysteries: how the brain works; this spirit I will always carry. I can not forget the warmth of personalities, the bewildered faces during difficult lecturers, and the happy faces and the smiles during dinners. In short I can only say the school has been amazingly exciting and enriching. The cultural diversity of the school is also has been a plus."

Hiba Abuelgasim Fadlelmoula Abdelrahman

Hiba trying out some local fashion

Hiba Abuelgasim Fadlelmoula Abdelrahman is a Ph.D. student in the Department of Neurophysiology, graduate school of Medicine, Kyoto University in Japan. Hiba is a Sudanese medical doctor graduated with honors from the University of Khartoum, Sudan in 2011. She got a master of public health degree from the department of health informatics at Kyoto University in 2014. She then joined the Department of Neurophysiology to pursue a career in Neuroscience, bringing together clinical,laboratory and community approaches. Hiba's research focuses on traumatic brain injury and its neuropsychological consequences. Hiba enjoys social and volunteer work. She is the president of the African Association in Kyoto and member of different societies and organizations.

"...Imbizo 2018 was indeed a great experience and one of a kind. It was not only about computational neuroscience, but it was about the very essence and purpose of science which is human communication, inclusion of all, diversity in all ways, innovation, and creativity. The school provided the best environment in which scientists coming from different backgrounds from all over the world can communicate together, interact and relate to each other. In Imbizo 2018, I have learned the principles and applications of computational neuroscience from the pioneers of this new field. However what was even more inspiring is the multidisciplinary approach and the collective effort to bridge the gap between different fields in neuroscience and other disciplines to come to a place where we can understand the human brain in a better way. Therefore, during Imbizo I felt the urge to spread this vision in my country Sudan. Two months later in March 2018, in collaboration with TReNDs Africa and University of Khartoum, I held three days outreach activities to advocate and stimulate multidisciplinary research and education in the field of Neuroscience in Sudan and in Africa. The advocacy events were very successful. We were able to engage stakeholders and scientists together with the community. We created a network that will be the foundation of a multidisciplinary neuroscience research center in Sudan and East Africa. Therefore, Imbizo 2018 doesn't only inspired me as an African scientist but also inspired more than 200 African researchers and scientists who attended our advocacy activities in Sudan."

Jordan Guerguiev

Jordan, right, chatting about roach legs.

Jordan is a graduate student at the University of Toronto Scarborough, Canada. He studied mathematics and physics in his undergraduate years, with a weakness for the brain. He completed his Ph.D. in computational neuroscience in 2017. Jordan's work attempts to bridge the gap between machine learning and computational neuroscience by developing a theoretical model for how deep learning could be implemented in the brain. While his academic strengths primarily lie in mathematics and machine learning, he has been most interested in applying knowledge from these fields to the problem of understanding the brain. After completing his doctorate degree, Jordan intends to focus further on machine learning research.

"It was an incredible privilege to attend the isiCNI 2018 Imbizo. The three weeks turned out to be one of the most unforgettable and fulfilling experiences that I have ever had. Tim, Joe, Alex, Peter and Emma brought to us some of the greatest minds in neuroscience, who gave great lectures that spanned the field of computational neuroscience. Moreover, the tutorials run by the tutors provided very useful elaboration on some of these topics. As a learning opportunity for a student in computational neuroscience, this imbizo was really special. Perhaps even more important and fulfilling was the opportunity to meet some incredible people in my field, both the faculty and the students at various stages in their careers. This was a once-in-a-lifetime opportunity to create strong and lasting friendships with other students from across the world. For me, one of the most important benefits of attending the imbizo was to be able to take a break from the breakneck pace of research and focus on building meaningful personal connections with others, which can be very easy to lose sight of in academia. I really look forward to seeing others from the imbizo again and potentially collaborating in the future. Ultimately, I will never forget the beautiful location of this imbizo in Cape Town, the amazing people that I was able to meet and the incredible experience that we shared."

Kayokwa (Nick) Chibuye

Kayaokwe leads the troops to dinner.

My name is Kayokwa N Chibuye and I am currently concluding a master's degree in computer science at the University of Cape Town, South Africa with a focus on Human Computer Interaction (HCI). My work focuses on the use of cross-language mapping to support speech recognition for low-resource languages. This is in turn to be used to develop small-vocabulary voice driven interfaces to facilitate human-computer interaction. This is motivated by multilingual societies such as most African countries and countries such as India in which text-based interfaces might not be very beneficial to their rural communities because they are often oral cultures. I also possesses a computer science bachelor's degree, with a bias in Software Engineering, which I obtained from the University of Zambia in 2013. My interests also include natural language processing, spoken language technology, music and linguistics.

"Being part of the 2018 IBRO SIMONS Computational Neuroscience Imbizo in Cape Town, South Africa was an amazing experience. I found the knowledge very enriching as well as inspiring, especially the stories that the faculty members shared regarding their journeys in computational neuroscience. For a person with a background in computer science, the subject matter discussed during the school was challenging as well as exciting, allowing me to explore what it would entail to pursue further studies in the Computational Neuroscience. However, filling the knowledge gaps and seeing where my background fit was all the more rewarding and motivating. The social activities were phenomenal and through them, I was afforded the opportunity to know the students and faculty members better, the connections made through these events are invaluable to my career. One of the biggest highlights was trying to learn how to swim under the instruction of very dedicated volunteers, going to the beach in the morning whenever it was possible before class began. The cultural events helped me understand South African culture and history more in spite of staying in the country for over two years. All in all, the Imbizo was a life changing experience for me. I went to the summer school knowing almost nothing about computational neuroscience and now I feel I not only understand its core components but can also identify sensory-motor neuroscience as something I would like to pursue for my PhD."

Emily Shobana Mueller

Emily and Liemiso.

Emily is a pan-african problem-solver dedicating her time to unpacking real-world problems using data analysis. She completed her BSc in Mathematics at Southampton University before coming back to Africa where she continued her mathematical studies at AIMS, South Africa. After completing a course-work masters, she wanted to further pursue a research career and found a particular interest in modelling humans. After a research project in social networks she decided to take a more empirical and objective perspective of behaviours from the individual building blocks of the human brain. After the imbizo, Emily began her research masters which uses machine learning to make individual level predictions of outcome for comatose patients using high density EEG and other objective biological parameters. Emily enjoys science communication and you can tune into her podcast @superpositionZA on twitter.

"I simply googled computational neuroscience and South Africa and the very first page to appear was the isiCNI in my home town, of all places! I couldn't believe it! The weekly synopsis presented on the website could not have prepared me for the depth of information we covered during the 3 weeks at the isiCNI. The first lecture was mind blowing from Byron Yu showing us his lab monkey learning how to reach for a reward using a robotic arm and only his thoughts! We continued to explore the experimental aspect with our own dancing cockroaches and the information and innocent scientific curiosity just kept flowing. I have a million favourite things about isiCNI but here I will mention just two. People and Position. Position and people. Every day you would sit next to somebody new, a new conversation, a new skill-set, a new continent, a new institute and outlook. A conversation about the forefront of research and what is possible on the African continent. An honest conversation about the challenges we face and a joining together in how they can be addressed. Each position we step into communicated to our peers. Each person a potential friend, collaborator and colleague. What remains is the lingering sentiment that the Imbizo was the best summer school ever."

Alexander von Klemperer

Alex improving his coding skills.

Alex is a medical doctor and aspiring neuroscientist from South Africa. He received his medical training from the University of Cape Town. He worked as a junior doctor at Chris Hani Baragwanath hospital before a community service year at Klerksdorp district hospital. He received a neuroscience masters degree from Oxford University where he is currently a DPhil candidate in neuroscience in the lab of Colin Akerman. His research interest is in cortical circuits, in particular how neuronal circuits recruit excitation and inhibition differently. He is fascinated by theoretical neuroscience and the computational tools that can inform and guide experimental research. He remains passionate about clinical neurology in a resource constrained settings such as South Africa and hopes to bring the tools and skills he has gained during his studies back to South Africa as a clinician scientist.
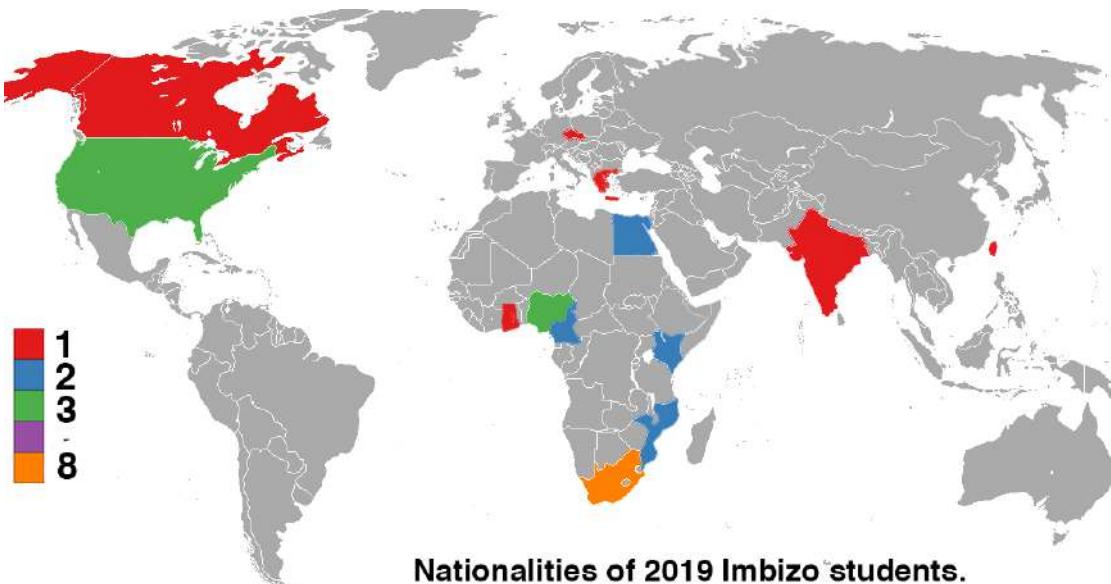
"I feel very lucky to have attended the 2018 IBRO SIMONS Computational Neuroscience Imbizo in Cape Town. Whilst I am currently completing a PHD in neuroscience in the UK, I remain committed to the development of both experimental and computational neuroscience in South Africa. I found the isiCNI to be an incredibly enriching experience in a number of ways. The course dealt with a broad range of topics that spanned both broad overarching principles of neuroscience and intricate implementational details, all offered by world class experts on their subject matter. Particularly memorable were the lectures by Larry Abbott, one of the authors of the first seminal textbook on theoretical neuroscience. Following the course I have found the lectures on balanced networks and excitation/inhibition balance in neural networks by Tim Vogels to be particularly useful in my own experimental work. However the principles and ideas that I was introduced to throughout the course have all continued to shape my thoughts. Throughout the course we were also provided with excellent practical tutorials that built off the concepts discussed in lectures. These tutorials were particularly useful for me as I had not had as much coding experience as some of the other attendee's prior to the course. What made the ISCINI particularly meaningful to me was its setting in South Africa. Neuroscience research remains a fledgling field in Africa, so it was an incredible experience having a course of this quality aim to further develop skills on the continent. I met and developed friendships with a number of students from across Africa, all of whom are equally passionate about neuroscience. It is ultimately my plan to continue my research in South Africa and I feel that this network of young African neuroscientists will be the most valuable aspect of the course for me moving forwards. "

The Class of 2019

Origins
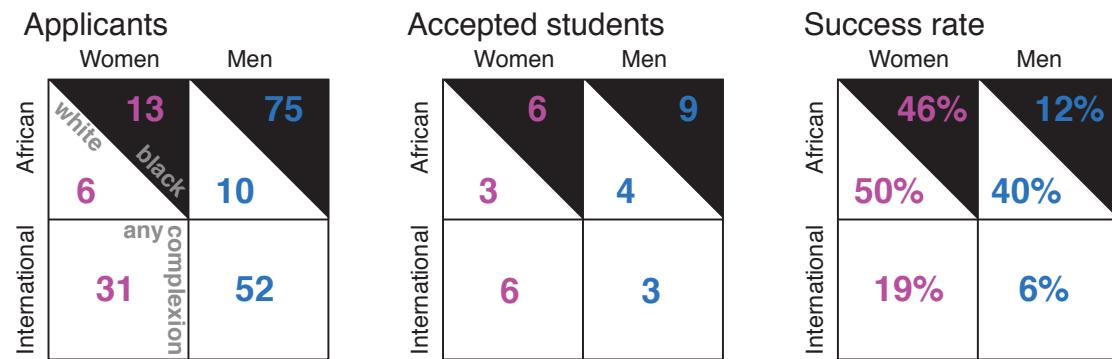
For the 2019 Imbizo we received 187 applications. Among them 104 applications from Africa, soothing our worries of depleted applicant pools with many qualified candidates. The presence of Google's Indaba Project[1] had a perceivable effect on the quality of the applications. Additionally, word-of-mouth began to bring us new applications as well. We admitted 22 African and 9 intercontinental students. Notably, for the first time we had candidates who cancelled after acceptance. We had to fill spots on short notice and opted for local students over those with potential travel or visa issues. This lead to a somewhat smaller group of intercontinental students.

Nationalities of 2019 Imbizo students.

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[1]The google http://www.deeplearningindaba.com initiative offers 3 day / 500 participant intense immersion workshops to bring machine learning and deep learning to Africa

Distribution of gender and ethnicity

As in previous years, we aimed for a diverse student body. We separated the applicant pool along two axes: intercontinental or African applicants and male or female applicants. As such, the applicant pool comprised of: 85 (75 black / 10 white) African men, 52 intercontinental men, 19 (13 black / 6 white) African women, and 31 intercontinental women. (We did not ask for information regarding religion or sexual orientation). We evaluated each group separately through different assessors, and initially allotted roughly equal numbers of studentships to these four groups. Because of the uneven distribution of applicants in the four groups, we had to adjust the final numbers slightly, and ended up with the final roster below.

Applicants

	Women	Men
African	white 13 / black 6	75 / 10
International	any complexion 31	52

Accepted students

	Women	Men
African	6 / 3	9 / 4
International	6	3

Success rate

	Women	Men
African	46% / 50%	12% / 40%
International	19%	6%

Levels of education

As in previous years the Imbizo hosted MSc students, entry level and more advanced graduate students, and a few postdocs.

The CCFM Lecture Hall, with a new coat of paint in 2019.

Student roster

The following two pages contain the complete roster of our students.

Mai Gamal Abdelhamed	Sadiq Adedayo	Laetitia Agola	Joseph Baafi
Daniel Barabasi	Taliesin Beynon	Sebastian Bodenstein	Katerina Capouskova
Cephas Chiundidza	Chris Fourie	Monsurat Gbadamosi	Dylan Geldenhuys
Roy Henha Eyono	Shelly Jones	Wambui Kariuki	Tai-Ying Lee

Nancy Lubalo

Mamuku Mokuwe

Eslam Mounier

Daniel Musundire

Tosin Olayinka

Ioanna Pandi

Jacob Portes

Dhairyya Singh

Chloe Sole

Samuel Sowole

Alain Tene

Bahareh Tolooshams

Ineke van der Berg

David van Niekerk

Marjorie Xie
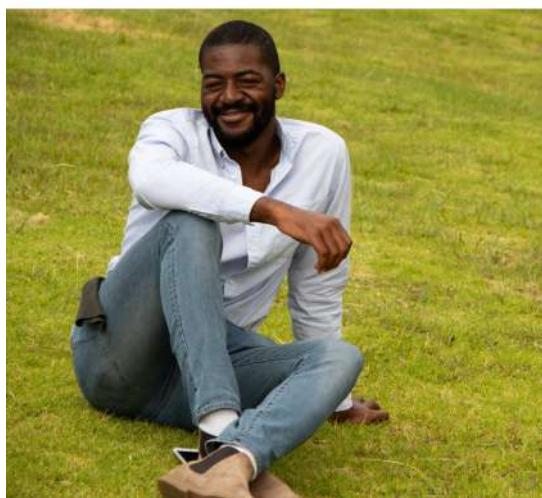
Student case studies - "What did the Imbizo do for you? "

The next section features a closer look at some of our students, and their responses to what they particularly enjoyed at the Imbizo.

The class of 2019.

Roy Henha Eyono

Roy is currently pursuing his MSc in Computer Science with focus on Machine Learning at the University of the Witswatersrand in Johannesburg, South Africa. His work focuses on learning methods for the credit assignment problem in artificial neural networks. Prior to his MSc, he completed an internship at Amazon Web Services in Cape Town as a Software Development Engineer and I obtained his BSc. (Hons) at the University of Cape Town in Computer Science. He is involved in science education in my home country of Cameroon, where I host workshops on Machine Learning. I am passionate about science in Africa and would definitely like to continue this in my own capacity.

"The Imbizo has been an eye-opening experience. I learned a lot about computational neuroscience, and also had the opportunity to interact with the field via conversations with world-leaders as well as through project work. Beyond computational neuroscience, the Imbizo made me appreciate the world of academia, as the Imbizo presented us the rare opportunity to interact closely with many prominent researchers in the field. This, in part, motivated me to further consider a career in research in the near future. It was a great privilege to be a part of this initiative, it really gave me that added confidence moving forward in my pursuit for a PhD. I can't thank the organisers enough for this experience, it was arguably my most memorable experience in research to date."

Katerina Capouskova

Katerina, explaining.

'Katerina received her first MSc. in Philosophy of Science from the London School of Economics and Political Science, UK. Being primarily interested in Philosophy of Cognitive Science, she continued with MSc. in Neuroscience at King's College London, UK. As computational/theoretical neuroscience seemed to her like the best approach to understanding 'how the brain works' and appeared best connected to philosophical inquiry, she realized the importance of to acquiring coding skills. After completing a Data Science Bootcamp (General Assembly) in San Francisco, she landed a job as a Machine Learning Research Assistant in a satellite image analysis start-up called Spaceknow.com. This furthered her data science expertise. Currently she is pursuing her Ph.D. degree in Computational Neuroscience in Gustavo Deco's laboratory at Universitat Pompeu Fabra in Barcelona, Spain.'

"The Imbizo has provided me with the most immersive academic experience of my life. And the academic part of Imbizo was not even the most personally challenging and enriching part! The Imbizo gave me an opportunity to visit Africa for the first time and learn about its amazing cultural and natural diversity. I have met many inspiring colleagues and I hope for extensive collaborations in the future. From a scientific perspective, I learned a lot about the computational neuroscience research happening worldwide and about state-of-the-art machine learning techniques that are biologically inspired, presented by Blake Richards and Tim Lillicrap. This exposure seems crucial for my further career development, as doing a Ph.D. in Europe does not provide us with advanced course work and the focus of our laboratory is very narrow. So the Imizo broadened the potential of my research. Tim Vogel's original soft skills presentation was very beneficial, especially for students like me, who are in large labs and thus do not get that much personal attention. Hopefully, I also contributed to the scientific debate and the cultural 'pell-mell'. I cannot be grateful enough for my involvement in such a unique gathering."

Eslam Mounier

Eslam Mounier is a research and teaching assistant in the Computer and Systems Engineering department at Ain Shams University in Cairo, Egypt. He is currently working towards his M.Sc. degree. He works in the field of visual prosthesese, which aims to restore functional vision for the visually impaired. This involves dealing with extracellular recordings, data analysis and developing computational neuroscience models. Eslam is now very interested in deep learning (DL) techniques and wants to explore different DL techniques to build better computational models in neuroscience. Eslam's next goal is to pursue a Ph.D. in Computational Neuroscience.

Eslam, left, with Dylan, visiting penguins.

"Joining the 2019 I was a life changing experience. In honesty, the amount of knowledge I gained was far more than I expected. The faculty and the tutors have made such a great effort in order to cover most of the topics related to computational neuroscience as well as showing us the most recent advances in the field. Coming from an engineering background, I really enjoyed a lot the lectures that covered neuroscience essentials such as: what is a neuron?; neuron structure; different neuron types; how neurons communicate; different brain areas and their functionalities. I also got to enrich my knowledge in machine learning, reinforcement learning and data analysis.

In addition to the lectures, We had a lot of fun! Cape Town is a wonderful city. We got to visit beautiful places, took a lot of photos and made cool memories. Everyone in the school was super cool. I am so happy with the friendships and connections I made.

I have to say that the school organization was flawless. Everything was very well organized, this includes travel, accommodation, lectures, food and the wonderful tours. In the end I would like to thank the faculty, tutors, organizers and the funders who made this opportunity possible for all of us."

Dhairyya Singh

Dhairyya, at the Botanical Gardens.

Dhairyya Singh received his B.A. and advanced diploma in Psychology and Computer Science from Ashoka University, India. He got interested in neuroscience as an undergraduate and worked in a variety of labs. He worked in Dr. Kristen Lindquist's affective neuroscience lab at the University of North Carolina, Chapel Hill on neuroimaging meta-analyses, then in Dr. Kaveri Rajaraman's neuroethology lab, at Ashoka University, studying zebrafish numerical cognition. He also interned in Dr. Garga Chatterjee's cognitive neuroscience lab at the Indian Statistical Institute, developing a large-scale behavioural genetics study. He is now looking to start his Ph.D. and hopes to help bridge the theory and experimental neuroscience by combining both approaches in his work.

"Attending the 2019 IBRO-SIMONS Computational Neuroscience Imbizo has opened an entirely new world of learning for me. Before coming to Muizenberg, my understanding of neuroscience was restricted to the biology and I was deeply interested in experimental systems and cognitive neuroscience. At the Imbizo I began to develop an appreciation for theoretical neuroscience and the manner in which computational tools can be used to gain a deep understanding of brain function. They allow us to approach questions that remain experimentally intractable. I also now see the deep value of computational neuroscience in not just modelling to explain existing experimental work, but also actively generating hypotheses for future experiments. Thanks to the intense immersion at the summer school where I was able to start developing a deep understanding of theoretical concepts and modelling, I am now committed to pursuing computational neuroscience in conjunction with my experimental interests and exploring how they might inform each other. All the learning, however, would not have been as exciting without all the amazing people I was able to meet at the Imbizo. I am going to cherish the friendships that I developed here forever. I am exceedingly grateful to IBRO and the Simons foundation for making the Imbizo possible, and the Imbizo organizing committee for giving me the opportunity to participate. Thank you!"

Adedayo Sadiq Adewale

Sadiq with Jacob, shoulder to shoulder.

I am currently studying Biomedical Engineering (Biomechanics) at the University of Ibadan, Nigeria. This is a step on my path to Neuroengineering. As a high school student, my desire had been to learn how machines are designed and built. This propelled me to study Mechanical Engineering at Ladoke Akintola University of Technology, Nigeria for my undergraduate. I became interested in the brain, its functionality and how to improve its functionality to help those in need. I'd love to work on nervous signal processing and its applications in Brain Computer Interfaces. I love discussing science with my siblings (a microbiologist and a chemical engineer in the making), also mechanical manufacturing with my dad who is a fellow mechanical engineer. I enjoy cooking, eating (of course!!!), swimming, ocean surfing as well as football.

"Its such a pleasure to be able to give a brief overview of my Imbizo experience and I must admit it was the best 2 or 3 weeks of my life. It all started in a grand style when I finally got my application submitted for the school, I wasn't expecting much from it but of course gave my best in the application. Although I was faced with a lot of difficulties getting the visa sorted, I am proud to say that I had the best experience. The science was very challenging and quite confusing and I appreciated the fact that it put me on my toes. I want to learn more about the human brain. It increased my passion to know how the 3 pounds fat in the skull directs one's entire being.

The extracurricular activities are not to be forgotten. From the early morning swimming classes, which gave me chance to learn swimming, to my first ever ocean surf. I was amazed by the interactions between the faculty, the tutors and the students. Everyone interacted like equals, without oppression or anyone appearing to be a figure above anyone else, that is a feeling so new to me. Especially to see top names, usually etched in glass, lowering themselves to listen to the very little sense I can make. All the faculty members were super, but I like to mention just a few of them. Tim Vogels taught me a lot. He inspired me and would corner me to build that confidence in me. You probably wouldn't know how much that meant to me, but I hope to be able to showcase that confidence in the nearest future. Joe, oh man, who would believe that such a vibrant professor would be so passionate to play beach soccer with his students! He's ever accommodating and helpful. Dora Angelaki, such a motherly figure, she will forever be special and I appreciate her presence. Peter Latham, a very funny man. He postulated that Joe will be getting his Nobel prize by 2049 and I hope that will happen. Another notable part: the South Africans. Some of the nicest people I've ever encountered in my entire life.

In all, isiCNI 2019 was such an eye opener, both about computational neuroscience and life. It taught me to believe in myself more and to know that those in leading universities are not made of gold, a strong indication that I can be like them. It also gave me my first ever trip out the borders of my Motherland. Thank you Imbizo committee, IBRO & Simons Foundations and South Africa. You have all made a great contribution into my making."

Chris Fourie

Chris (left) on a walk by the beach.

Chris is a medical doctor having studied at the University of the Witwatersrand (Wits) in Johannesburg. After graduating he spent a couple years abroad in Germany and Austria, learning the language and taking part in engineering courses at the University of Salzburg to help bolster his quantitative background. He is currently enrolled in the Computer Science Masters by coursework at Wits, being a member of the RAIL Lab and supervised by Dr. Benjamin Rosman. His research interests are at the intersection of Theoretical Neuroscience, Machine Learning and Biological Computation, with a focus on how they might inform one another. He has a passion for community and education, supervising the South African Medical Students Association (SAMSA). Additionally he hopes to one day play a role in automation around primary healthcare in developing economies, especially in Africa.

"Waking up to a sunrise on Muizenberg beach, making a decision between beach yoga or grabbing a surfboard, having neuroscientists from Harvard or UCL out with you in the waves before a full day of intense lectures and tutorials is not the start to a typical day - unless you are at the Imbizo.

After leaving medical school, where there was no accessible concept of 'theoretical neuroscience' nor exposure to machine learning, I embarked on a multi-year excursion trying to understand the landscapes of various research fields. I hadn't even realised the mix of these two disciplines explicitly exists and that it is absolutely awesome.

The Imbizo was an amazing introduction to a community I have been looking to join. The environment provided was rapid fire, high pressure learning with intimate expert support. The overall candor gave me a great encouragement that this subject matter is the most important thing I could be working on.

There was an emphasis on collaboration, with the formation of professional and personal bonds being integral to the process. Deep exposure to the spectrum of researchers lives from fledgling post-grad to Professor at MIT, from Cameroon to Greece, helped me reflect on and formulate my own self image as a researcher. Being able to badger individuals from the Blue Brain Project or Deep Mind with questions while casually meandering along the seaside was an absolute treat. Not knowing 'what one does not know' has been one of the largest hurdles in my journey towards finding a meaningful and interesting research direction. The Imbizo not only clearly showed me what I don't know – but also what I would like to know. It's helped provide direction and a supportive community to help me pursue that.

Wambui (Fridah) Kariuki

Wambui did her undergraduate in Biochemistry from the University of Nairobi, with a Major in Molecular Biology and Biotechnology. She is now working on completing her Masters in Bioinformatics at Jomo Kenyatta University of Agriculture and Technology, Nairobi. This has brought her to the world of programming. The amount of data in life sciences means machine learning is crucial to the future of the field. Interacting with computational neuroscientists has reintroduced her to her earlier passions of mathematics and biophysics. Wambui hopes to continue in these directions for her future studies.

"The 2019 Imbizo was an amazing experience for me on so many levels. I applied to the Imbizo with both confidence and worry but at the end it was the confidence that took the day. Academically, it opened me to options I did not know I could pursue and revived some old interests which I had shelved. I was also able to interact with lots of brilliant people and fun people making not just people I would like to collaborate with in research but friends I'd like to keep for a lifetime. The school gave me the chance to dive right into machine learning (something I have been putting off for quite a while due to some sort of fear) but as I write this now, I have made some great progress. It also gave me the confidence to follow the path that I would like to take and the knowledge that in research no question is really stupid. I enjoyed the lectures (even those where I understood nothing) and the tutorials as well. I also benefited greatly from learning from my fellow schoolmates and sharing any knowledge I have with them. I enjoyed the talks during lunch and dinner and especially one long talk I had with Tim Vogels (Thanks Tim, that chat will go a long way for me). The school was one of the best experiences of my life and the best way to start a defining year for me. I hope that it continues for a long time as this is an experience that is needed for more students especially from Africa to make the connections, acquire the resources and improve our overall confidence. Thanks."

Next page: Boomslang Walk in Kirstenbosch Botanical Gardens.

The powerhouse and engine of the Imbizo. Our six tutors, from left to right in the above picture: Merav, Nassi, Bill, Alex, Eszter, and Sina.

Alex Antrobus

Alex is a Doctoral student in the Gatsby Computational Neuroscience Unit at University College London. He studied physics and applied mathematics at the University of Cape Town, before completing a six month internship at the Blue Brain Project, helping him transition to computational neuroscience. Alex's interest is in how network level dynamics contribute to computations being performed by the nervous systems. His current work focus on models of learning in recurrent neural networks: how learning affects the connectivity and dynamics of the network, which learning rules are stable, and whether different learning rules leave different 'signatures' in the connectivity and dynamics of the networks.

William Podlaski

Bill Podlaski is a graduate student at the Centre for Neural Circuits and Behaviour, University of Oxford, working with Professor Tim Vogels. Before that, he studied a BSc in biological sciences at Cornell University, where his first exposure to neuroscience was in rodent electrophysiology. He then transitioned to computational neuroscience through a master's degree in computer science at the École polytechnique fédérale de Lausanne. He is currently interested in understanding how neural network dynamics and architectures influence the computations done by a neural circuit. He also maintains an interest in more biophysically detailed neuron models.

Athanasia Papoutsi

Athanasia Papoutsi used to be a postdoctoral fellow in the Computational Biology Lab of Yiota Poirazi in Greece. She received her bachelor degree in Biology from the University of Athens and then moved to Crete, where she completed with distinction the Brain and Mind Master program. During her PhD studies she investigated the role of dendritic integration in the prefrontal cortex function using biophysically detailed computational models. After a NeuroCure visiting PostDoctoral fellowship in Humboldt University, Berlin, she is currently using a mixture of

Alex in action at the Imbizo 2017.

computational and electrophysiological techniques to study dendritic integration and neuronal function.

Merav Stern

Merav Stern is a postdoc at the University of Washington, Seattle. She received her PhD from the Interdisciplinary Center for Neural Computation at Hebrew University while collaborating with Columbia University's Center for Theoretical Neuroscience. Merav is interested in information processing. She seeks to identify brain areas that alter their activity during the course of learning a visually-guided behavioral task, to characterize these changes, and to assess for each brain area the intrinsic (local) changes versus alterations in external influences from other cortical areas. Known as an outstanding student, she excelled at the challenging task of adding a theoretical aspect to the study of the neural networks activity, and in fact her postdoctoral work will consist of beginning a new collaboration between a theoretical group of researchers at the University of Washington and experimental lab scientists at the Allen Institute for Brain Science in Seattle.

Sina Tootoonian

Sina Tootoonian is a research associate at the Gatsby Computational Neuroscience Unit at University College London. After studying electrical and computer engineering at the University of British Columbia in Vancouver, Canada, he completed a PhD in Computation and Neural Systems at the California Institute of Technology, where he carried out data analysis and modelling of the insect olfactory system. Following his PhD he was a research associate at the Computational and Biological Learning Laboratory at the University of Cambridge, where his research focused on a theoretical explication of the insect olfactory system as performing a probabilistic inference computation. His current research at the Gatsby Unit focuses on the vertebrate olfactory system.

Eszter Vertes

Eszter Vértes is currently a PhD candidate working with Professor Maneesh Sahani at the Gatsby Computational Neuroscience Unit at University College London. Previously, she obtained her MSc

Emma and the Teaching Team 2018.

degree in Life Science and Technology from École polytechnique fédérale de Lausanne (EPFL). She is interested in how the brain is able to deal with uncertainty while processing complex stimuli. She is studying how neural circuits learn the statistical structure of the environment and how they use this knowledge for interpreting new incoming sensory information. Her PhD work also investigates what neural representations of uncertainty are best suited for learning and performing biologically relevant computations. She maintains a keen interest in probabilistic machine learning.

Katharina Wilmes

Katharina Wilmes is a postdoctoral fellow in the Clopath Lab at Imperial College London. During her joint PhD at the Theoretical Biology, Humboldt University of Berlin and the Bernstein Center for Computational Neuroscience in Berlin, she studied how dendritic inhibition can gate excitatory plasticity in a switch-like manner by targeting dendritic signals. Prior to that, she studied Cognitive Science (BSc) at Osnabrück University, and Brain and Cognitive Sciences (MSc) at the University of Amsterdam. Her research seeks to understand the cellular and circuit mechanisms that underlie the regulation of learning in the brain. She is currently investigating the interaction of interneurons with principal neurons in functional microcircuits and how synaptic plasticity and stimulus processing are modulated during learning.

Friedemann Zenke

Friedemann studied physics at the Rheinische Friedrich Wilhelms University in Bonn, Germany and at the Australian National University in Canberra. He received his PhD in the laboratory of Wulfram Gerstner at the Ecole Polytechnique Fédérale de Lausanne (EPFL) where he studied the interaction of synaptic and homeostatic plasticity in spiking neural network models. He then joined the laboratory of Surya Ganguli at Stanford University as a postdoctoral fellow where he used machine learning approaches to explore the role of complex synaptic dynamics for learning and memory in the brain. He currently continues this line of research as a Sir Henry Wellcome fellow in

the Vogels and Waddell labs at the University of Oxford. He is interested in biologically plausible learning and memory in (spiking) neural networks, using tools from deep learning, dynamical systems and control theory. He is also the author of an open source high-performance spiking neural network simulator, Auryn.

Slightly better for the wear: Tutor Selfie at the end of the Imbizo 2019.

Agostina Palmigiano

Agostina is a postdoctoral fellow at the Center for Theoretical Neuroscience, Columbia University. She completed a Licentiate degree in Physics at the University of Buenos Aires/Quilmes University before starting a PhD in Theoretical Neuroscience at the Max Planck Institute for Dynamics and Self Organization, where she graduated summa cum laude. She is interested in oscillatory networks representing synchrony in the brain and how this impacts information processing in the brain. She also has background interests in delayed dynamical systems, information theory, and attention.

Callie Federer

Callie Federer is a PhD candidate in Computational Bioscience at UC - Colorado Anschutz Medical Campus working with Joel Zylberberg. Her undergraduate work was in computer science and biology, and she spent a few years doing cancer research in her undergrad career and in beginning of her graduate work before switching over to computational neuroscience. Her first project in computational neuroscience was on a biologically plausible model of working memory. Currently she works on computer vision, evaluating how closely it resembles mammalian vision and drawing inspiration from mammalian vision to achieve better results in computer vision.

Grace Lindsay

Grace Lindsay is a postdoc at the Center for Theoretical Neuroscience at Columbia University, where she also obtained her PhD under the supervision of Ken Miller. Before that she received a Bachelor's degree in Neuroscience from the University of Pittsburgh and spent a year as a research fellow at the Bernstein Center for Computational Neuroscience in Freiburg, Germany. Her current

Project time.

research centres on building functional models of neural circuits in order to connect neural & behavioural data, and she is particularly interested in sensory processing and attention.

Richard Pang

Rich Pang is a graduate student in the Computational Neuroscience Center at the University of Washington, working with Professor Adrienne Fairhall in the Physiology and Biophysics Department. Before moving into neuroscience Rich attained a B.S. in physics at the University of Wisconsin–Madison. Seeking novel applications for the quantitive skills he had developed as an undergraduate, he found new enthusiasm in using the language and methods of mathematics to understand the structure and function of neural systems. Rich is currently interested in implementations of working memory systems in biologically realistic neural network models, and in particular how they might store and retrieve relational information structures.

Chris Currin

Christopher Currin is a doctoral student at the University of Cape Town with Dr Joseph Raimondo. He started by studying a BSc with majors in biochemistry, computer science, and psychology with the goal of pursuing neuroscience. He started his graduate career as an electrophysiologist but shifted focus to computational modelling, where he has found his passion. His current interest is in biophysical modelling of chloride ion dynamics in dendrites, neurons, and epileptic networks to further understand short-term inhibitory ionic plasticity. He is also interested in machine learning and the relationship(s) between AI and the brain.

Faculty

We aimed to recruit 12 lecturers (plus three directors) for three weeks, focusing on gender balance and diverse ethnicity, as well as broad expertise. While we feel that while we generally had a very high quality faculty, we can still do better in recruiting women and non-white lecturers.

Larry Abbott (2017 - 2018)

Larry Abbott is a physicist-turned biologist who uses mathematical modelling to study the neural networks that are responsible for our actions and behaviors. Abbott's 1977 thesis work at Brandeis University was in the area of theoretical elementary particle physics. He then worked in theoretical particle physics at the Stanford Linear Accelerator Center and, later, at CERN. He became an assistant professor in the physics department at Brandeis in 1979, received tenure in 1982, and became a full professor of physics in 1988. Abbott began his transition to neuroscience research in 1989 and moved to the Biology Department at Brandeis in 1993. He held both the Nancy Lurie Marks and Zalman Abraham Kekst chairs in neuroscience. While at Brandeis, Abbott in collaboration with Eve Marder developed the dynamic clamp, a technique that has now become a standard tool of experimental electrophysiology. In 2005, Abbott joined the faculty of Columbia University where he is now the William Bloor Professor of Theoretical Neuroscience and co-director of the Center for Theoretical Neuroscience.

Dora Angelaki (2019)

Dora Angelaki is a full Professor at the New York University Center for Neural Science. She received her PhD from the University Of Minnesota College Of Science And Engineering, and went on to advanced training at the University Of Texas Medical Branch and the University Of Zurich. Before NYU, she held faculty positions at the University of Mississippi Medical Center, Washington University, Baylor College of Medicine, and Rice University. Her research focuses on understanding how multi-sensory information flows between subcortical and cortical brain areas, as well as the spatial navigation, decision-making and episodic memory circuits, and how internal states modulate this information flow. She uses innovative approaches to explore and understand neural dynamics and network coding of multi-sensory and multi-modal information at multiple stages of processing

under diverse naturalistic and perceptual contexts related to navigation, planning and perceptual decisions. She is interested in the neural implementation of canonical neural computations, and how they go astray to result in sensory, motor, memory and cognitive deficits in diseases like autism and schizophrenia. Her goal is to use this knowledge to understand computational principles of disease, to inspire artificial systems, to aid the development of prosthetics and other tools for understanding and treating deficits of sensory coding, spatial orientation, cognition and action.

Peter Latham is starting the very first lecture of the inaugural Imbizo.

Demba Ba (2019)

Demba Ba received the B.Sc. degree in electrical engineering from the University of Maryland, College Park, MD, USA, in 2004, and the M.Sci. and Ph.D. degrees in electrical engineering and computer science with a minor in mathematics from the Massachusetts Institute of Technology, Cambridge, MA, USA, in 2006 and 2011, respectively. In 2006 and 2009, he was a Summer Research Intern with the Communication and Collaboration Systems Group, Microsoft Research, Redmond, WA, USA. From 2011 to 2014, he was a Postdoctoral Associate with the MIT/Harvard Neuroscience Statistics Research Laboratory, where he developed theory and efficient algorithms to assess synchrony among large assemblies of neurons. He is currently an Assistant Professor of electrical engineering and bioengineering with Harvard University, where he directs the CRISP group. His research interests lie at the intersection of high-dimensional statistics, optimization and dynamic modeling, with applications to neuroscience and multimedia signal processing. Recently, he has taken an keen interest in the connection between neural networks, sparse signal processing, and hierarchical representations of sensory signals in the brain, as well as the implications of this connection on the design of data-adaptive digital signal processing hardware. In 2016, he was the recipient of a Research Fellowship in Neuroscience from the Alfred P. Sloan Foundation.

Emery Brown (2017)

Emery Neal Brown is an American statistician, neuroscientist and anesthesiologist. He is the Warren M. Zapol Professor of Anesthesia at Harvard Medical School and at Massachusetts General Hospital (MGH), and a practicing anesthesiologist at MGH. At MIT he is the Edward Hood Taplin Professor of Medical Engineering and professor of computational neuroscience the Associate Director of the Institute for Medical Engineering and Science, and the Director of the Harvard-MIT Health Sciences and Technology Program. Brown is one of only 19 individuals who has been elected to all three branches of the National Academies of Sciences, Engineering, and Medicine, Brown is also the first African American and first anesthesiologist to be elected to all three National Academies.

Adrian Fairhall is always popular.

Adrienne Fairhall (2018 - 2019)

Adrienne Fairhall is an Associate Professor in the Department of Physiology and Biophysics, and director of the UW Computational Neuroscience Program. She is a recipient of the Burroughs Wellcome Fund Career Award and was a McKnight Scholar in the Neurosciences. She received her training in Physics from the Australian National University and the Weizmann Institute of Science, and is currently unlocking secrets in neuroscience. She works closely with experimental labs to study everything from single neurons to foraging mosquitoes.

Ila Fiete (2019)

Ila Fiete is an Associate Professor of theoretical neuroscience at the MIT Department of Brain & Cognitive Sciences. She received her PhD in physics at Harvard University, under the supervision of Sebastian Seung, then did a brief postdoc at the Kavli Institure for Theoretical Physics in Santa Barbara before moving to the Universtiy of Texas at Austin in 2008, and then to MIT in 2018. She works on the mechanisms underlying memory, integration, error correction, and prediction in the brain, at the circuit level. She uses theoretical and computational modeling techniques, and performs quantitative data analysis to tackle mechanistic and function-related questions. Her recent efforts fall at the nexus of dynamics, coding, and function, and in particular how each influences the other.

Surya Ganguli (2017)

Surya began his academic career as an undergraduate at MIT, triple majoring in mathematics, physics, and EECS, and then moved to Berkeley to complete a PhD in string theory. There he worked on theories of how the geometry of space and time might holographically emerge from the statistical mechanics of large non-gravitational systems. After this, he chose to pursue the field of theoretical neuroscience, where theories could be tested against experiments. After completing a postdoc at UCSF, he has recently started a theoretical neuroscience laboratory at Stanford. He and his lab now study how networks of neurons and synapses cooperate to mediate important brain functions, like sensory perception, motor control, and memory.

Michael Häusser (2018 - 2019)

Michael Häusser is Professor of Neuroscience at University College London and a Principal Research Fellow of the Wellcome Trust. He received his PhD from Oxford University under the supervision of Julian Jack. He subsequently worked with Bert Sakmann at the Max-Planck-Institute for Medical Research in Heidelberg with Phillipe Ascher at the École Normale Superieure in Paris.

He established his own laboratory at UCL in 1997 and became Professor of Neuroscience in 2001. His group is interested in understanding the cellular basis of neural computation in the mammalian brain using a combination of experiments and theory, with a special focus on the role of dendrites. His group has also helped to pioneer several new optical approaches for probing the function of neural circuits in the intact brain.

Dinner with faculty is a highlight....

Peter Latham, Co-Director (2017 - 2019)

Peter Latham was a physicist for a large portion of his career (undergrad at UC San Diego, grad at UC Berkeley and postdoc at the University of Maryland), but in 1996 he switched to theoretical neuroscience. After 1.5 years at NIH and 6 at UC Los Angeles, in 2004 he became a faculty member at the Gatsby Computational Neuroscience Unit, UCL, where he has been ever since; he is now a full professor. He uses techniques from physics and machine learning to understand how biologically realistic networks carry out computations, with a focus on probabilistic inference and synaptic plasticity.

Timothy Lillicrap (2017 - 2019)

Timothy Lillicrap received an Hon. B.Sc. in Cognitive Science & Artificial Intelligence from the University of Toronto and a Ph.D. in Systems Neuroscience from Queen's University in Canada. He moved to the University of Oxford in 2012 where he worked as a Postdoctoral Research Fellow. In 2014 he joined Google DeepMind as a Research Scientist and became a Senior Research Scientist in 2015. His research focuses on machine learning for optimal control and decision making, as well as using these mathematical frameworks to understand how the brain learns. He has developed new algorithms for exploiting deep neural networks in the context of reinforcement learning, and new recurrent memory architectures for one-shot learning problems. His recent projects have included applications of deep learning to robotics and solving games such as Go.

Máté Lengyel (2017 - 2018)

Máté Lengyel is a Reader in Computational Neuroscience at the Department of Engineering, University of Cambridge, and at the Department of Cognitive Science, Central European University, Budapest. Máté's interests span a broad range of levels of nervous system organisation, from sub-cellular and cellular through circuit and systems to behaviour. He studies these phenomena from computational, algorithmic/representational and neurobiological viewpoints. Computationally and algorithmically, he uses ideas from Bayesian approaches to statistical inference and reinforcement learning to characterise the goals and mechanisms of learning in terms of normative principles and behavioural results. Máté obtained his MSc and PhD at the Eötvös Loránd University, followed by a post-doctoral research fellowship at the Gatsby Computational Neuroscience Unit, UCL, and a

visiting research fellowship at the Collegium Budapest Institute for Advanced Study. He has been awarded an Investigator Award by the Wellcome Trust, and more recently a Consolidator Grant by the European Research Council.

Athanasia Papoutsi (2019)

In previous years Athanasia was a popular tutor in Muizenberg, but in 2019 she was awarded a Hellenic Foundation for Research and Innovation Research grant and a NARSAD Young Investigator Grant, both as an early career investigator. Hence, she returned to the Imbizo as a lecturer. When she is not busy teaching computational and electrophysiological techniques to study dendritic integration and neuronal function, or giving swimming lessons to our students, she is beginning to build her own group at the Foundation for Research and Technology-Hellas (FORTH) in Crete, Greece.

Panayiota Poirazi (2017 - 2018)

Panayiota Poirazi is a Director of Research at the Institute of Molecular Biology and Biotechnology (IMBB), Foundation for Research and Technology-Hellas (FORTH). She received her Bachelor in Mathematics with honors from the University of Cyprus in 1996. She received her Master and Ph.D. in Biomedical Engineering (Computational Neuroscience) also with honors in 1998 and 2000, respectively, from the University of Southern California in Los Angeles. From 2001-2004 she worked as a postdoctoral/Marie Curie fellow first in the Biomedical Science Research Center 'Alexander Fleming' in Athens, Greece (2001-2002) and then in the IMBB-FORTH (2002-2004), where she has been a Principal Investigator since 2004. Her work focuses on the role of dendrites in learning and memory via the use of computational models. She has received several awards for academic excellence, including the EMBO Young Investigator award in 2005, two Marie Curie fellowships (2002 and 2008), a Starting Grant from the European Research Council (ERC) in 2012 and the "Manolis Christofides" Young Cypriot Investigator award in 2014. She is a member of AcademiaNet: a European portal for outstanding women scientists since 2013 while in 2014 & 2015 she represented the ERC at the World Economic Forum, Annual Meeting of the New Champions as a Young Scientist. She joined the Young Academy of Europe in 2015 and was the chair of the

...but so is surfing with them (in this case with Blake Richards)

FENS-Kavli Network, a young academy of outstanding European Neuroscientists for 2015-2017.

Joseph Raimondo, Co-Director (2017 - 2019)

Joseph Raimondo is a cellular neuroscientist with a medical degree from the University of Cape Town. He received a DPhil in neuroscience from the University of Oxford where he studied as a Rhodes Scholar. He currently leads a research group at UCT where he holds a Newton Advanced Fellowship. His laboratory investigates cellular mechanisms underlying epilepsy and inhibitory signalling in the brain, with a focus on epilepsy syndromes relevant to the African context. A career ambition of his is to help develop African capacity in cellular neurophysiology and computational neuroscience.

Misha Tsodyks was part of week 2 in 2018, 2019 & 2020(!).

Srikanth Ramaswamy (2017 - 2019)

Srikanth Ramaswamy is an in silico neuroscientist working at the Blue Brain Project in Switzerland. His research is dedicated to understanding the mechanisms that regulate activity states of neocortical microcircuitry in the healthy and diseased brain. He graduated from the National Institute of Engineering in Mysore, India with a first class Bachelor's degree in electrical and electronics engineering in 2002. In 2003, he received a British Chevening scholarship by the Foreign and Commonwealth Office, UK for a Master's in electrical power engineering at the University of Strathclyde in Glasgow, which he completed with commendable mention in 2004. During his Master's, he developed a keen interest in neuroscience and won a fellowship by the Fundacíon BBVA in 2005 to work with Profs. Gonzalo de Polavieja and Pablo Varona at the Universidad Autńoma de Madrid to perform single unit recordings and calcium imaging in Leech motor neurons. In 2006, he joined the Blue Brain Project at the École polytechnique fédérale de Lausanne (EPFL) as one of its first scientific team members and began his Ph.D. thesis under the supervision of Prof. Dr. Henry Markram. His PhD. thesis focused on modelling synaptic interactions between neocortical neurons, and validating the model against experimental data. After his PhD., he undertook a brief postdoctoral stint with Prof. Richard Frackowiak, at the University of Lausanne Hospital, where he worked on modelling synaptic mechanisms in psychiatric disorders. In 2014, he was appointed as a senior tenured neuroscientist in the Blue Brain Project, where he leads efforts in understanding the neuromodulatory mechanisms that regulate neocortical network states. In 2015, he received the EPFL "Prime spéciale" in recognition of outstanding contributions to establishing a facility for data-driven in silico reconstructions of neocortical microcircuitry.

Rajnish Ranjan (2017)

Dr. Rajnish a computer science graduate, a curious software engineer got curious enough about the brain and drifted towards neuroscience. He completed his PhD in neuroscience from EPFL, Switzerland. He has worked for many years in neural simulation before moving to experimental

neuroscience. Currently he is the Section Manager of Membrane Systems group in the Simulation Neuroscience Division in the Blue Brain Project, Switzerland. The goal of his group is to identify the distribution and biophysical properties of different ion channels expressed across the cell membrane. His team has developed a workflow to systematically characterize ion channel biophysics. The workflow consists of cloning individual ion channels from rat brain to generate cell line library and make use of automated patch-clamp technique to screen the biophysics of each ion channel. His team has also developed a web-based wiki-like resource Channelpedia (www.channelpedia.net) to share experimental and modelling data with the neuroscience community.

Blake Richards (2018 - 2019)

Since January 2014, Blake has been an Assistant Professor at the University of Toronto in the Department of Biological Sciences (Scarborough) with a cross-appointment to the Department of Cell and Systems Biology. His "LincLab" laboratory explores the neurobiology of learning and memory from a computational perspective, with the ultimate goal of "cracking" the learning algorithms of the brain. In 2016, he became an Associate Fellow of the Canadian Institute for Advanced Research in the Learning in Machines and Brains Program. From October 2011 to December 2013, he was a Banting Postdoctoral Fellow in the laboratory of Dr. Paul Frankland at SickKids Hospital, where he studied the impact of memory consolidation on statistical learning. From 2007 to 2010, he had a Welcome Trust studentship, and completed his Doctorate at the University of Oxford in the Department of Pharmacology with Dr. Colin Akerman, where he explored visual plasticity in early life. He also did his Master's at the University of Oxford in the Department of Physiology, Anatomy and Genetics with Dr. Ole Paulsen, studying voltage bistability in neocortical dendrites. Before his graduate studies, he worked as a programmer and research analyst in magnetic resonance imaging at the Centre for Addiction and Mental Health and Sunnybrook Hospital from 2004-2006. He is originally from Toronto, where he received his Bachelors degree in Cognitive Science and Artificial Intelligence from the University of Toronto in 2004.

Andrew Trevelyan lectures on neural diseases.

Andrew Trevelyan (2019)

Andrew Trevelyan is a Professor at Newcastle University and studies how the brain regulates its activity levels. Specifically, he is interested in the neocortex and hippocampus, which are the parts of the brain concerned with higher cognitive function. These are also the parts of the brain that are susceptible to epileptic activity, and a major part of his research involves trying to understand how and why epileptic seizures occur. His laboratory uses many different experiment techniques in their research, including cellular and network electrophysiological recordings, optogenetics, microscopy, and computational simulations.

Misha Tsodyks (2018 - 2019)

Misha Tsodyks received his Ph.D. degree in Theoretical Physics from the Landau Institute of Theoretical Physics in Moscow. He then held various research positions in Moscow, Rome, Jerusalem and San Diego, before joining the Weizmann Institute of Science in Rehovot, Israel, in 1995, where he became a full professor in 2005. Misha Tsodyks worked on a wide range of topics in computational neuroscience, such as attractor neural networks, place-related activity in hippocampus, mathematical models of short- and long-term synaptic plasticity in the neocortex, population activity and functional architecture in the primary visual cortex and perceptual learning in the human visual system. His research benefited from close collaborative links that he established with experimental neuroscientists during different stages in his career, among them Amiram Grinvald, Henry Markram, Bruce McNaughton and Dov Sagi. He held long-term visiting positions in the Institute of Advanced Studies in Delmenhorst, Ecole Polytechnique Federale de Lausanne, Frankfurt Institute of Advanced Studies, UC Santa Barbara, CNRS Paris and Columbia University.

Tim Vogels, Co-Director (2017 - 2019)

Tim Vogels is a Sir Henry Dale Fellow and Associate Professor at the University of Oxford. He is a member of the Centre of Neural Circuits and Behaviour, Oriel College, and the European FENS Kavli Network of Excellence. After studying physics at Technische Universität Berlin he obtained his PhD in neuroscience at Brandeis University and did postdoctoral work at Columbia University and the École polytechnique fédérale de Lausanne (EPFL). As a computational neuroscientist, he builds conceptual models to understand the fundamentals of neural systems at the cellular level. His lab is interested in the interplay of excitatory and inhibitory activity in neuronal networks and how these dynamics can form reliable sensory perceptions and stable memories. He has contributed to our understanding of how intricate temporal dynamics can emerge from simple excitation-inhibition balance, and how inhibitory synaptic plasticity can help to shape this balance.

Daniel Wolpert (2017)

Daniel Wolpert is a Professor of Engineering and a Royal Society Research Professor. He read medicine at Cambridge before completing an Oxford Physiology DPhil followed by a postdoctoral fellowship at MIT. He then joined the faculty at the Institute of Neurology, UCL and moved to the Cambridge University in 2005. In 2012 he was elected a Fellow of the Royal Society (FRS) and made a Wellcome Trust Senior Investigator. His research interests are computational and experimental approaches to human sensorimotor control.

Byron Yu received the feedback highest scores for his lectures.

Byron Yu (2017 - 2019)

Byron Yu received the B.S. degree in Electrical Engineering and Computer Sciences from the University of California, Berkeley in 2001. He received the M.S. and Ph.D. degrees in Electrical Engineering in 2003 and 2007, respectively, from Stanford University. From 2007 to 2009, he was a postdoctoral fellow jointly in Electrical Engineering and Neuroscience at Stanford University and at the Gatsby Computational Neuroscience Unit, University College London. He then joined the faculty of Carnegie Mellon University in 2010, where he is an Associate Professor in Electrical & Computer Engineering and Biomedical Engineering and the Gerard G. Elia Career Development Professor. Byron Yu's research is at the intersection of neuroscience, engineering, and machine learning. He is broadly interested in how large populations of neurons process information, from encoding sensory stimuli to driving motor actions. To address basic scientific questions about brain function, his group develops and applies 1) novel statistical algorithms, such as dimensionality reduction and dynamical systems methods, and 2) brain-computer interfaces.

Ila Fiete and Demba Ba enjoy the Gala dinner with students in 2019. Relief shows in the faces of Tim Vogels and Joseph Raimondo when the first Imbizo finished without a hitch in 2017.

Next page: Hiba Abuelgasim Fadlelmou and Einola Akin Akinboboye chasing bugs.

Organisation, Location, Room & Board

The Imbizo took place in Muizenberg Beach, South Africa, about 60km south of Cape Town, situated where the shore of the Cape Peninsula curves round to the east on the False Bay coast. It is considered to be the birthplace of surfing in South Africa. It shall also become the birthplace of Computational Neuroscience in Africa.

Muizenberg Beach on False Bay. Red 'X' marks the location of the lecture hall

Local Organiser - Emma Vaughan

Emma Vaughan joined the organisational team in late 2017, and quickly became an integral part. As a Muizenberg Resident, her experience in local and international conference management ensures every little detail is thought-out, planned and in place long before students and faculty arrive at the Imbizo. No task is too big or small. Emma takes initiative to ensure the imbizos run smoothly and everyone is taken care of. She's there from start to finish and is always on hand to assist, whether that means organising a birthday cake or band-aid. Emma is passionate about this little piece of paradise in the South Peninsula and she loves sharing it with the Imbizo.

Last night 2018: Emma Vaughan smiles brightly in the front.

Lecture Hall

Lectures, tutorials, and project time took place in the lecture hall of the CCFM, a christian radio station that doubles as a church on Sundays. The locale was modest but functional, seating 40 people with ease, supplying power and (somewhat rudimentary) wifi internet (see below).

From left to right: Lecture hall, Stoked Backbackers and Soul Surfer Hostel, and Blue Bottle Guest House.

Accommodation

Accommodation has proven to be a winning formula right from the start, and we changed very little over the past three years. Aside from a few complaints about the train track nearby, all our needs

are met and super-seeded.

Student accommodation

Student accommodation is located only 30 meters from the lecture venue, at the "Stoked Backpackers". Students share rooms with between 2 and 5 students. A few students and all the tutors were accommodated at "African Soul Surfer" a second nearby backpackers. The "Stoked" with its covered roof deck overlooking the sea, sandy and shady dining area, and 'chill-out' room serves as the main social hub for the duration of the Imbizo.

Faculty accommodation

Faculty were accommodated at the "Blue-Bottle Guesthouse" which is a short walk and a flight of 100 stairs through blossoming vegetation away. The view from the guest-house more than makes up for the walk, and we hope this will be one of the many reasons faculty may wish to return for future iterations of the school.
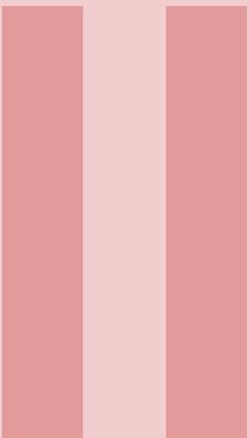
Board and Catering

All breakfasts and half of the dinners were hosted in the garden "Stoked Backpackers", which offered a private area for the students and faculty to socialise and relax. Lunches were picnic style and could be enjoyed where-ever faculty or students chose. Popular options were either to eat on the beach to allow for postprandial swims and football, or to take lunch back to the venue to squeeze in a few precious moments extra work on a school project. For several evenings a week, dinners were hosted at local restaurants. Tuesday dinners were at the Brass Bell, which involved an enjoyable 20 minute coastal walk to Kalk Bay. Other restaurants visited included Oven Baked pizzeria, Blue Bird Garage Food Market and Tigers Milk. The very festive gala at the end of the School was hosted at Live Bait, another restaurant with sweeping views over the ocean.

The Stoked hostel staff, fully on board with the Imbizo mission, in Imbizo 2018 shirts.

II Feedback, improvements and comments.

Feedback

During each Imbizo, the students were asked to give anonymous feedback on a weekly basis. They reviewed things like experiences with faculty members, content and structure of the academic week, food quality and recreational activities, etc. At the end of the Imbizo, they are also asked broader questions on quality of accommodation, lecture venues and school administration. Ratings were done between 1 (terrible) and 10 (excellent). They were also given the opportunity to specify things they would change / comments on their experience. The feedback gathered from 2017 to 2019 is summarised below, split into topical sections.

Academic feedback

Students were asked to rate the quality of their academic experience each week. We asked them to rate the overall quality of the lectures, the relevance to the school, quality of the scientific content and the teaching efficacy. Figure 1 explore this data, summarised across the three weeks of the school. Students could also comment on what topics they would have liked more or less of. A summary of these comments, with some representative examples, appear below for each week. Students could also rate individual faculty on their lectures and teaching performance. These numbers are also presented below.

Imbizo 2017

Week 1: neural anatomy and higher-order brain function

Students were generally happy with the content of week one, though there were several suggestions that more information about bridging the gap between computational algorithms and biological implementation might be appreciated. Bayesian analysis was used quite frequently in this week and several students suggested a slower introduction to using Bayes Theorem may have been useful. It was also suggested that receiving some educational materials before the school might be useful.
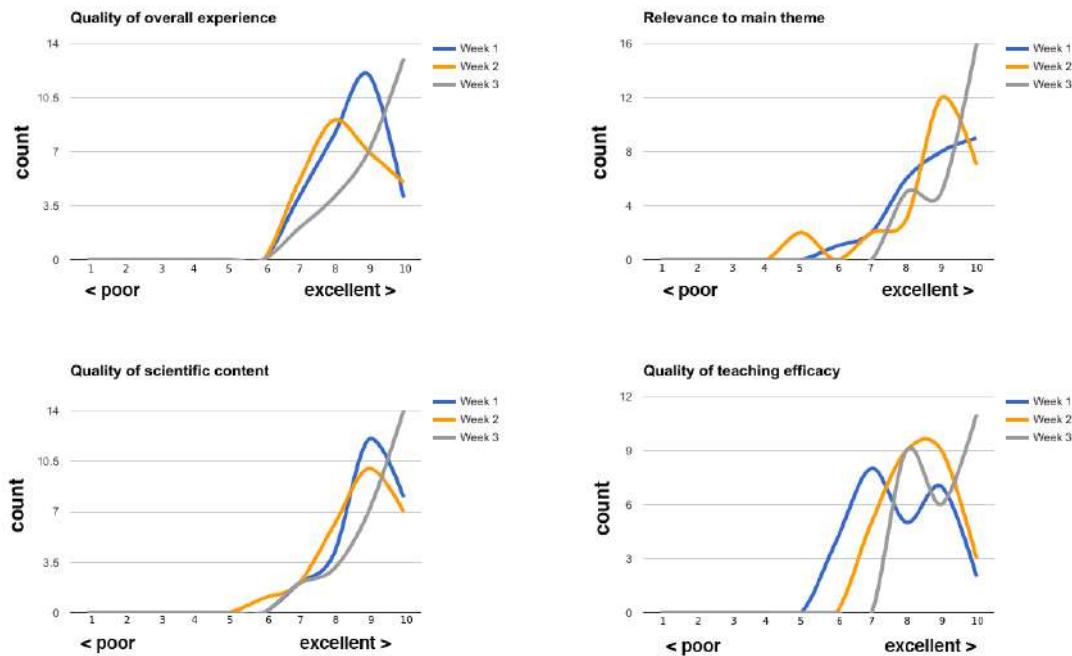
Figure 1: Summary of 2017 academic experience feedback across weeks.

Sample of anonymous student comments on academic content of week 1:

"Maybe [more] *basic Bayesian statistics... I felt like I needed more time to absorb that."*

"I would have liked more examples of bridging the gap between the algorithmic and the implementational level."

"[I would have liked more of] *the basic physiologican basis of bayesian inference and data processing from that"*

"Topics were great. I like the top-down approach. In general though: Materials or links to materials regarding background to content or to learn more about the content. Perhaps even providing background material BEFORE the lecture that would help in understanding the lecture. But not sure how effective that would be..."

Week 2: biophysics, plasticity & machine learning

Week 2 had 5 faculty members which meant students had ample opportunity to engage with faculty and hear a range of opinions. It also meant a high turnover rate in lecturers - most speakers speaking for only 1 morning. This meant students hear from a diverse range of opinions and but makes achieving continuity in content a little more difficult. There was a stronger focus on basic neuro-cellular biology, which was welcomed by several students, providing a basis for the rest of the week. Suggested additions included more focus on synaptic plasticity and more focus on the intersection of neuroscience and machine learning. A visual summary of the faculty ratings for week 2 appears in the top-right plot of fig. 2.
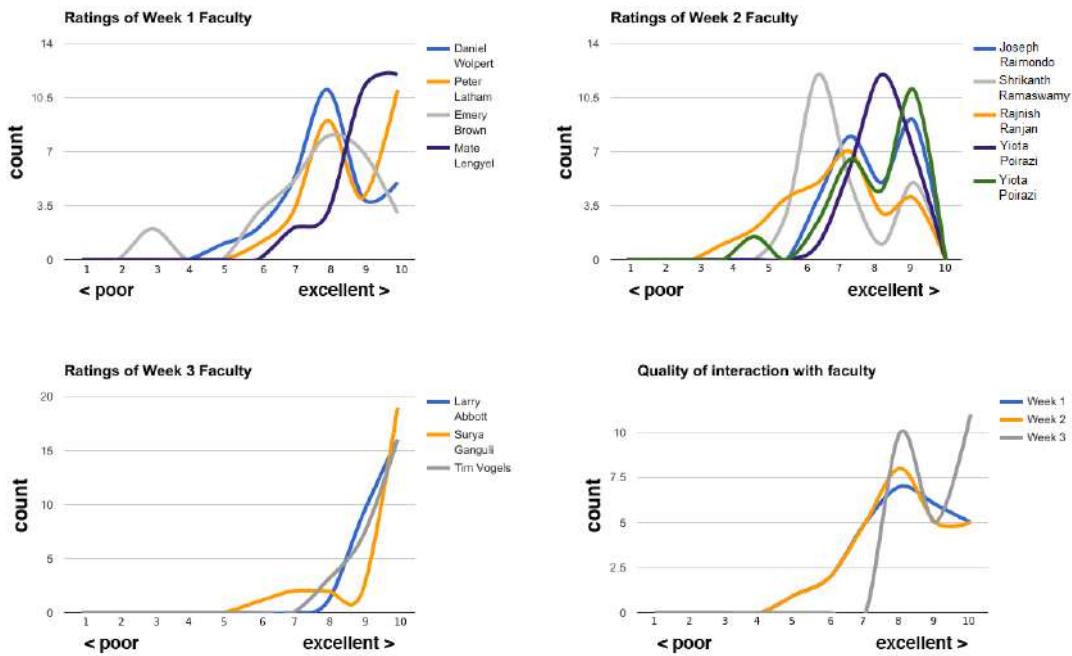
Figure 2: Visual summary of feedback on faculty

Sample of anonymous student comments on academic content of week 2:

"[I would have liked more] *Plasticity on a more theoretical or modelling level*"

"*Everyone talked a bit about neural plasticity, but it would be nice to have one or even two lectures that systematically start from biophysical processes of plasticity to modelling techniques and the impact of plasticity for neural function.*

"*Very cool introduction to state-of-the-art machine learning methods presented in a very comprehensible way and a lot of enthusiasm from his side.*"

"*Good coverage of complex research. Enjoyed both very biological and computational aspects. ... Appreciated the debate at the end of lecture that was insightful and well-behaved.*"

"*I really really enjoyed the ML content. I would have liked more discussion of the links between ML and learning in Biological systems.*"

"*Everything was awesome!*"

Week 3: Network dynamics and spiking systems

Week three had 3 faculty, meaning students had extensive exposure to individual lecturers and faculty had ample time to introduce and build upon their teaching content. Some content in this week was somewhat mathematically "heavy" and perhaps revealed the necessity of providing adequate time/preparatory material on these topics. This week faculty varied the structure of their lecture times, between 2 sessions of 90 minutes each and 3 sessions of sixty minutes each. Students were asked to comment on which they preferred. Just over 70% of students preferred the two-90-minute session structure.

Sample of anonymous student comments on academic content of week 3:

"Fantastic week - really really enjoyed it."

"[I would have liked more]Underlying mathematics in the way that Ganguli explained information theory and entropy. That was absolutely amazing."

"[I would have liked] a brief introduction on the relationship between the dynamical systems modelling paradigm and the "network modelling" paradigm. For example, why would we want to solve

the eigenvalue problem in the context of Tim's work. I don't think all of the topics can be introduced in this way, simply because there's not enough time during the school. It would be cool to get references before the school on "primers" so that the advanced concepts (i.e. one of the reasons for attending the school) can be absorbed quicker."

"It was nice to have a lecture on statistical data analysis, but I think the topic deserves at least two lectures."

Imbizo 2018

Week 1: Overview and higher-order brain function

Week one was widely popular among the students. Particularly Byron Yu's teaching was highly ranked. All the ranking of faculty can be seen in fig. 3. There were a few requests for more introductory mathematics and neuroscience content. The students were also asked to rate the tutorials. Overall these received a good rating. Particularly the tutorials given by the more senior teaching assistants were most highly ranked. The overall rankings of tutorials appear in fig. 4.
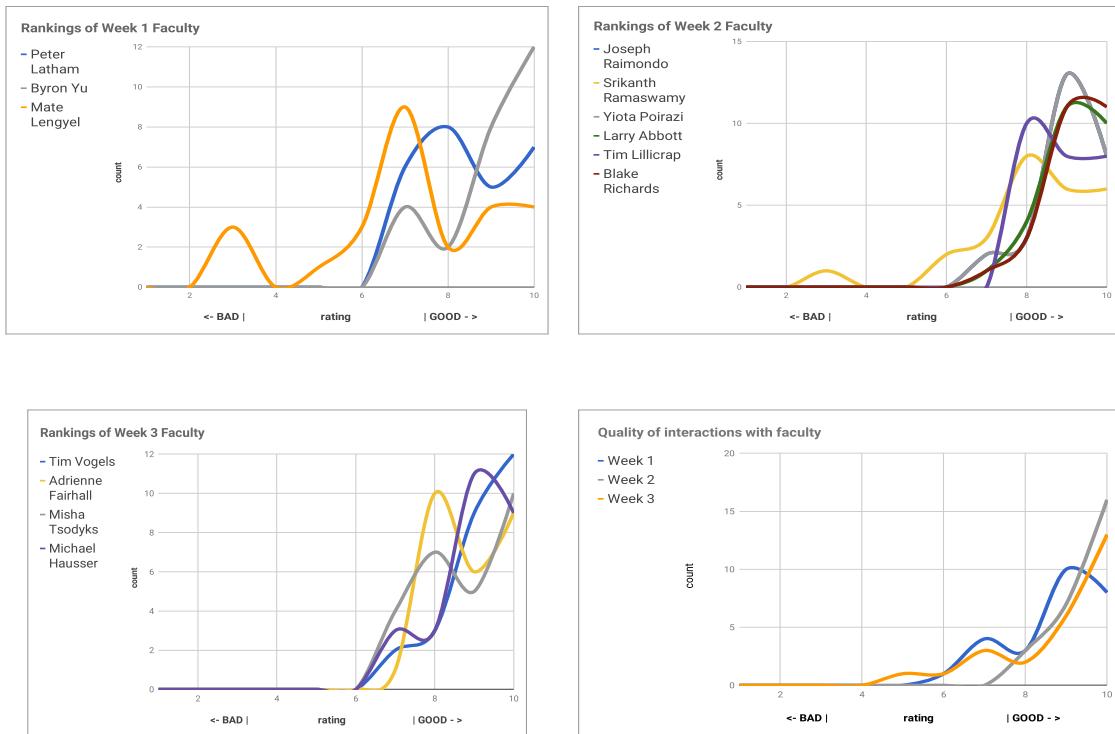

Figure 3: Summary of academic faculty feedback across weeks.

Sample of anonymous student comments on academic content of week 1:

" Everything was great!"

"[I would like]*more introductory time to relevant Maths topics."*

"[The Sunday outing was] *fun, but got back early. Could've stayed out longer and seen more things in the Cape Town area, considering it was our only day of the week to do so*"

Week 2: biophysics, plasticity & machine learning

Week 2 again had 5 faculty members, giving ample opportunity to engage with faculty and hear a range of opinions. The focus was neuro-cellular biology with a somewhat tangential discussion of machine learning. Incidentally, dendritic mechanisms have recently become an important part of new biophysical models of deep learning. This week provided the perfect atmosphere to introduce this. There were vary few complaints about the content! Some suggestions were more cellular morphology and dendritic computation. We also had a more sociological Wednesday guest speaker. She discussed various issues pertaining to how local people deal with issues of sacred spaces and South Africa's colonial history.
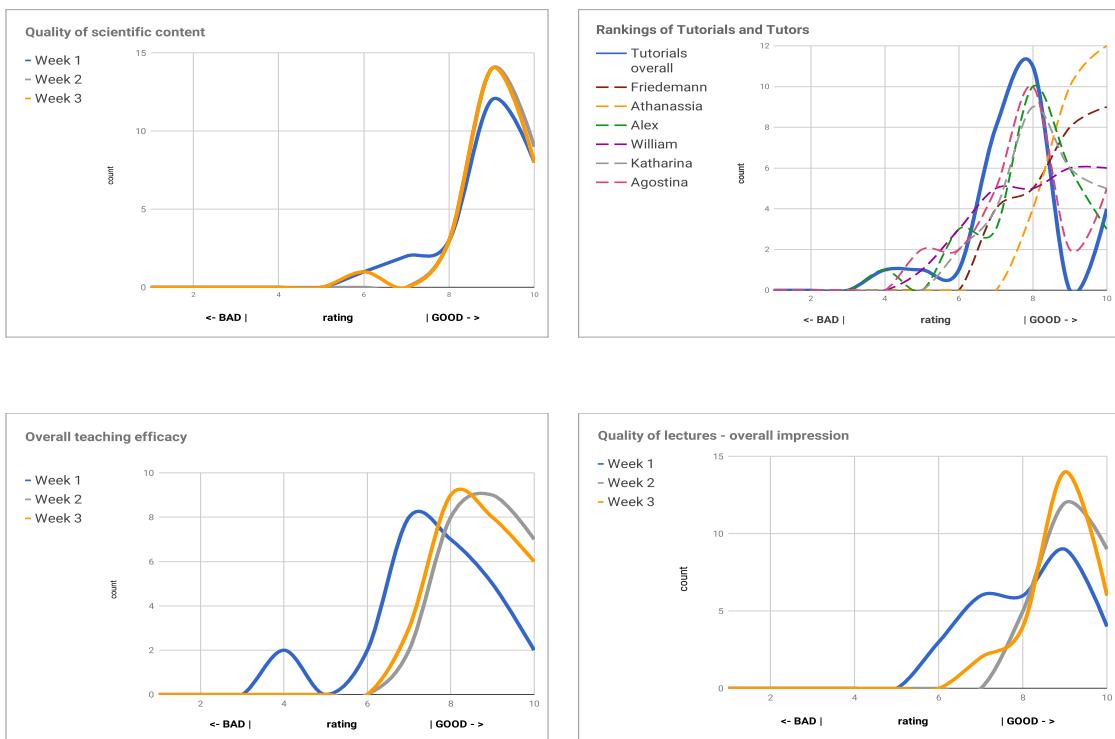
Figure 4: Visual summary of 2018 feedback on scientific experience, lecture quality and tutorials.

Sample of anonymous student comments on academic content of week 2:

"I loved every lecture here."

" [I would have liked] more information about the history the speaker assumed we knew everything."

"[The STEM in Africa discussion was]*Very informative, and falls in-line with motivating Africans to engage in CompNeuro*."

"[Blake Richards was]*Extremely interesting yet understandable. Great interactions outside of lectures too.*"

"[Larry Abbott was] *Just AWE-*

SOME :)))))))"

"[I would have liked]*A Cape Town University visit*"

Week 3: Algorithms, Networks and Spiking Computations

In contrast to week 2, week 3 had relatively senior faculty. The lectures were overall considered high quality (see fig. 4). For the first time, we also held a gender separated *Gender in Science Lunch.* This was generally rated highly, and most students either recommended doing it again. Students were also asked to give feedback on their tutors' performance. These were mostly good to excellent, with the senior tutors again being particularly strongly rated.

Sample of anonymous student comments on academic content of week 3:

"*The whole thing would fall apart without them.* [the tutors.]"

"*...room arrangement is not that great. for example, we have 5 people in our room. using bathroom and coming in and out at night are sometimes problems for us. ... can we be given some information such as abstract to us before the lectures? maybe we can arrange time to talk to faulty? like lunch time or after dinner? ... I really appreciate this opportunity since I met so many great people and had learned a lot here! Thank you all!*"

"*I'd just like to say thank you, once again, for the hard work on the part of the tutors. They have the hardest job of everyone,..*"

"*may be we should start lectures one hour later at 10 am instead of*

9 am because most of us wake up early for workout session or swimming then they came fastly to take breakfast then went to lectures very tired. one hour may be enough to take rest before lectures. thank you so much"

"*That was truly wonderful: from the attention you took in the selection process of the attendee and faculty to the organisation (Thank you Emma!!), to the scientific content of the summer school, everything was so great! Thank you :) And I know it's probably hard to find female computational neuroscientists and that you probably tried very hard, but it could be great to get closer to 50/50 ratio of female/male in the faculty.*
I hope isicni can keep going for many years to come!"

Imbizo 2019

The overall experience the students had across the weeks was very positive. With all weeks having an average rating between 8 and 9. It was clear the faculty was well-chosen for their quality of interactions with the students with high scores for the weeks. These positive interactions were facilitated by the intimately arranged seating plan and including the faculty in the weeks' extra activities such as the penguin trip and walking to dinners. From the feedback scores, the faculty presented well to the diversity of students to understand, and that the content was clear and useful. Judging by the overall feedback on faculty and their interactions with the students, it is unsurprising that most of the individual faculty were rate quite highly. Highlighted faculty for each week were Byron Yu in week 1, Blake Richards in week 2, and Demba Ba in week 3. Many of the faculty had

been invited back from previous years due to their good ratings, and this trend will continue, given some natural revolving of course with newcomers such as Andrew Trevelyan and Athanassia.

It should also be noted that while Athanassia was a faculty member this year, she had been a tutor in previous years. Luckily she returned as she was especially engaging with the students. This was exemplified by her leading swimming lessons for the students at a nearby tide pool each morning while she was in Muizenberg.

Week 1: Biophysics, Plasticity and Neural Recordings

Week 1 had 6 faculty members, with a new speaker per day and each tutor giving their tutorial in the afternoons. This meant the first week was packed with new faces and content. Some students felt there was a lot of content, but overall they were happy with the quality. The students appreciated starting with biophysics, but some though more basic brain anatomy and physiology would help them understand the content better. There was already a lot to cover and digest, so one suggestion would be a primer before the school like with the mathematics. Although feedback from 2018 indicate the students would have liked more focus on synaptic plasticity, this year some seemed to be confused by all the types of synaptic plasticity. The highlight lecturer for week 1 was Byron Yu who talked about Brain-Computer Interfaces.
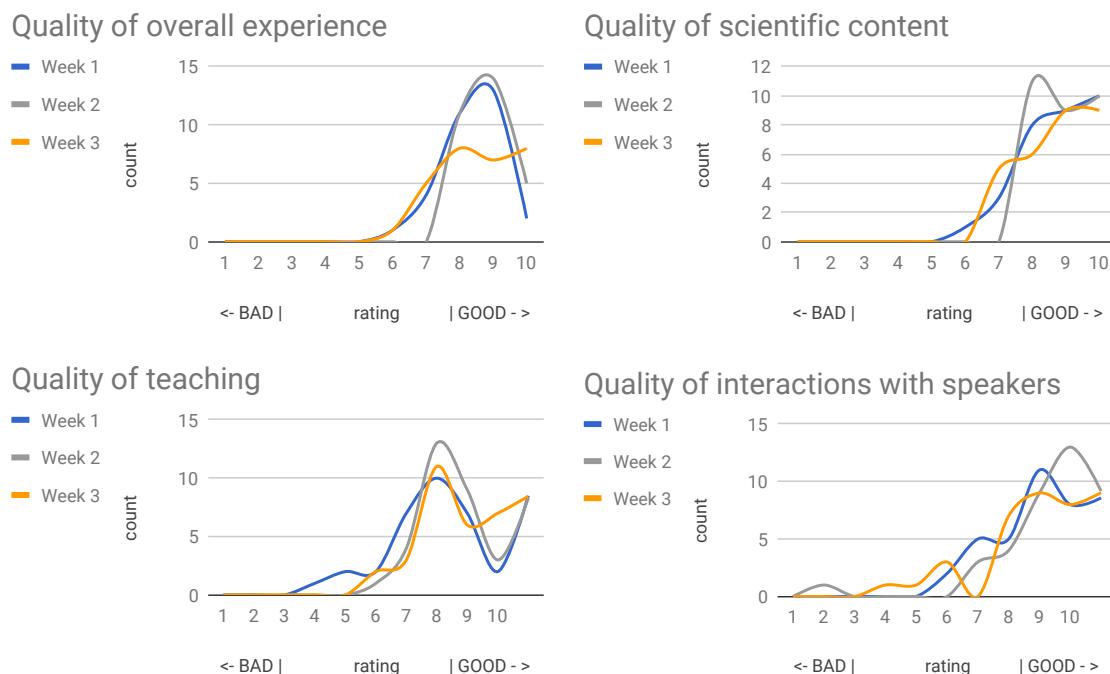
Figure 5: Summary of 2019 academic experience feedback across weeks.

Sample of anonymous student comments on academic content of week 1:

"There was a great variety of topics, it is hard to say what more I would have liked to cover, perhaps 6 months from now retrospectively I would be able to say once I have become more familiar with the field, that is, this would be a good question for the alumni as well "

"In my opinion, Byron was by far the best speaker - he spoke clearly and precisely, focused on the fundamentals (going from the general to specifics), and delivered at a speed that allowed interesting discussion throughout the lecture. I learned so much from his lecture! "

Week 2: Network Dynamics and Machine Learning

Week 2 again had 5 faculty members, this time with particularly diverse backgrounds - Misha Tsodyks, who did some of the earliest influential work in neural network dynamics, to Tim Lillicrap and Blake Richards, who are pushing the boundary of how Machine Learning can guide neuroscience. The week tried to develop the connection between neuroscience and machine learning, first by examining how neural circuits might compute and then looking at home artificial neural networks compute. This grew into an active and passionate discussion between students and faculty about how similar deep neural networks really are, or are not, to the brain. This type of lively debate is a key learning component at the Imbizo. A visual summary of the faculty ratings for week 2 appears in fig. 6.
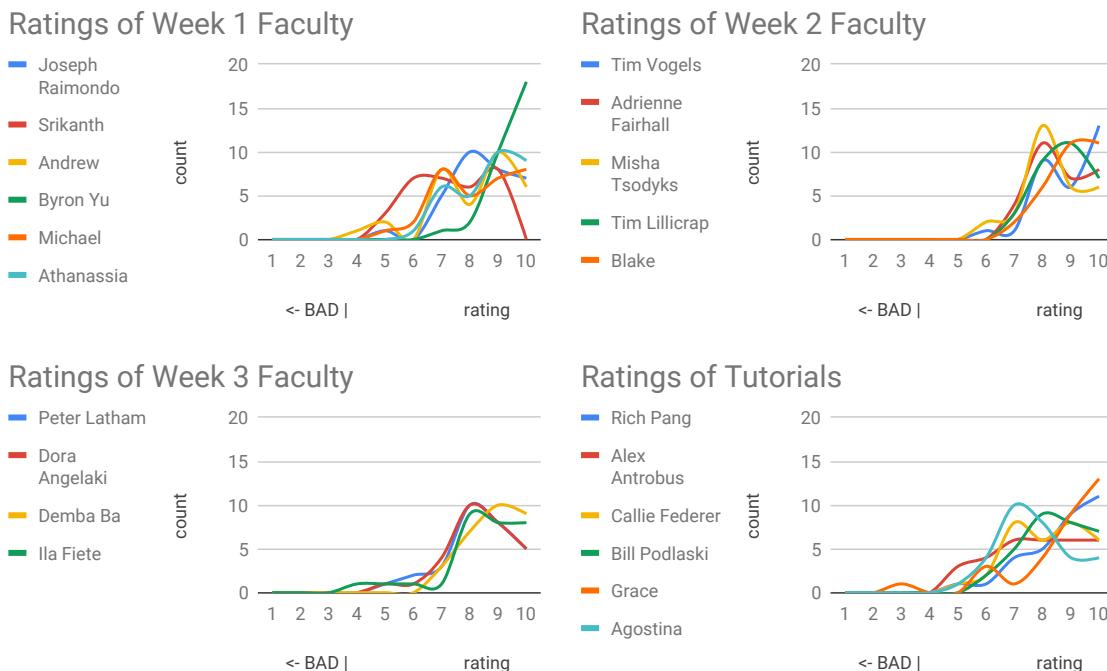
Figure 6: Visual summary 2019 of feedback on faculty.

Sample of anonymous student comments on academic content of week 2:

" *I was happy with what was covered. This was my favourite week*"

" [I would have liked more] *comparing choices of different machine learning algorithms/methods*"

" [I would have liked more] *Brain imaging, MRI etc.*"

" *I really appreciated Tim Vogels' presence in the course. I felt encouraged to participate more and was inspired to make the most out of my interactions with the lecturers and students. I think Tim's scientific lectures were really interesting and a good transition between week 1 and week 2. I especially appreciated his soft skills talk.*"

Week 3: Higher Level Function, Motor Control & Decision Making

Week three had 4 faculty members, meaning students had extensive exposure to individual lecturers and faculty had ample time to introduce and build upon their teaching content. Some content in this week was somewhat mathematically "heavy" and perhaps revealed the necessity of providing

adequate time/preparatory material on these topics. Demba Ba was unique in 2019 for doing a purely whiteboard lecture, which was well-received among the students as it made going through his math-heavy talk more digestible.

Sample of anonymous student comments on academic content of week 3:

"The whiteboard portion [of Demba Ba 's talk] was on par with Byron Yu's lecture in terms of clarity. The powerpoint portion was too fast. "

"this week's lectures are overall harder to understand, could potentially make the level lower..."

"Perhaps more experimental and current work would be good, to see the full picture."

"Could have given us schedule more in advance. Some of the math materials are not very relevant."

Administrative and general feedback

Students were asked to provide anonymous feedback on general properties of the school: how it was structured, the accommodation and eating arrangements, venue location what they liked and disliked and whether they had any suggestions. In general this feedback was very positive, with students enjoying their accommodation. These are things we had learnt from before and made a point to improve (see part II). The inclusion of **Emma Vaughan** as principle event organiser in 2018 significantly improved our interaction with our service providers and has lead to a more consistent interaction with them, in turn leading to better service and consistent improvement.

Sample of anonymous student comments on administration and general school experience:

"I really enjoyed the course. I especially appreciated the conversations I had with the professors and students. This was partly made possible by the arranged seating assignments for meals and unstructured project time."

"Conditions in different rooms are very different. Some had amazing rooms and view, some... well, not so much. But food was good :) Not enough salads and vegetables, though. Especially during lunch."

"amazing. very clean, 30s to lecture hall/beach, very good food, amazing view"

"Can't really comment on soul

surfer except for the bar/ chill-out area, which was kind of nice for working and playing pool. Staying at Stoked Backpackers was great. I had a very nice room, the personnel was extremely friendly and cooperative. The view from the terrace is amazing and it was really nice to hang out in the loft. The train is quite loud, but it didn't really bother me."

"Thank you for the opportunity to be part of this amazing community. You might not understand the magnitude and impact this has on my research education and career. Thank You, Asante Sana."

Morning Activities

Summer schools are very intense and work-oriented with the imbizo being no exception. Occurring spontaneously in 2017 and continuing the trend in 2018 and 2019, some tutors, students, and even
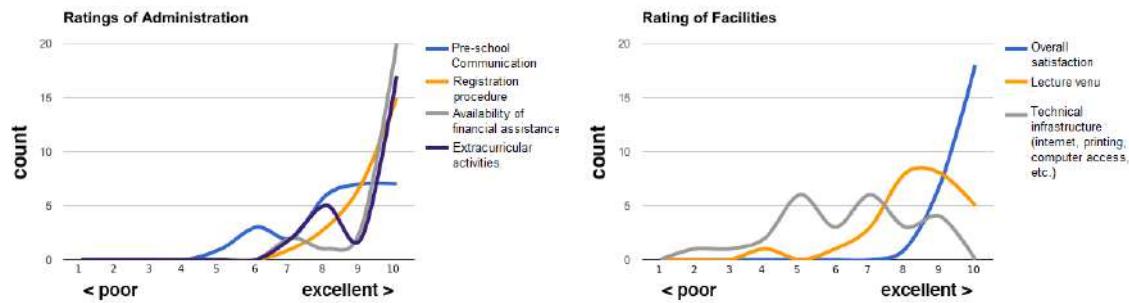
Figure 7: Summary of 2017 feedback for administration, infrastructure, and tutors.

faculty have initiated extra activities in the mornings to promote mindfulness through yoga, exercise on the beach, and also learning a new skill - swimming! In 2019, we wanted to see how impactful these morning activities have been by asking how many students participated. The activities were consistently run throughout the school. Even the swimming lessons, which started with the faculty member Athanassia, continued by being student-driven with support from some tutors. It seems the activities were well attended and clearly played an important role for many of the students.
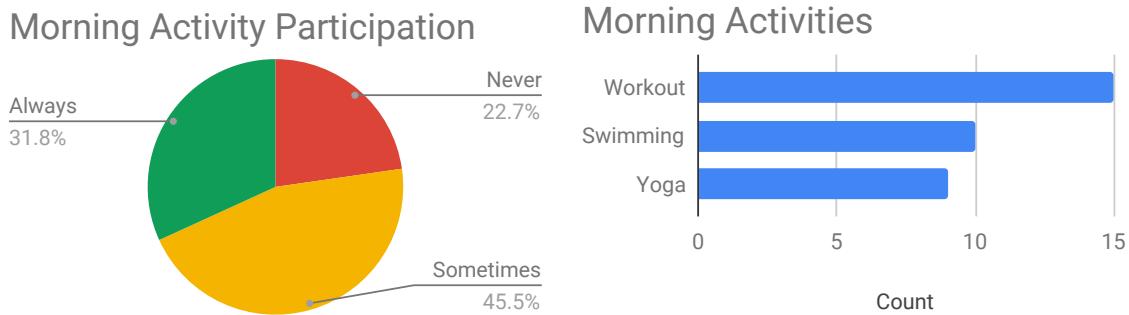
Figure 8: Visual summary of student participation in the student and tutor-lead morning activities during 2019

Emma Vaughan joined the Imbizo Management team, adding organisational skill, heart & soul.

Alumni

At the time of writing, we had successfully hosted three IBRO-Simons Computational Neuroscience Imbizos. We are slowly reaching the stage where we can start asking how this "Imbizo experience" has effected the lives of the students who pass through. In the below section, we give some update news from some of our 2017 alumni, to see how the Imbizo has effected their lives and careers.

Abib Duut - Imbizo'17

Abib and his tutor, Eszter, *IMBIZO 2017*

The Computational Neuroscience Imbizo has opened a whole new world of scholarship, mentorship and for me; and I am ever grateful of being part of it in 2017. I recently returned from Germany to Ghana, after an exciting one year

Masters in computational neuroscience and machine learning - a direct result of being a part of the Imbizo 2017. The Imbizo provided me with access to information, a broad overview and preliminary research experience in the field of computational neuroscience, helping me qualify for the position in Germany. My research skills have definitely advanced and now feel more confident about my chosen field for for PhD studies: theoretical machine learning. One summer, some of the Imbizo2017 alumni met up in in Berlin for a "mini-reunion". It was such a delight I didn't have any family in Europe, so life could get really lonely and even depressing. The conversations and giggles with friends who I once shared a room with, just a few months before, reminded me of "Imbizo spirit". In addition, the somewhat chilly month Cape Town prepared me a little for the very chilly winters in Germany!

I am really delighted to have been a part of the School in 2017. My Imbizo peers have become my family, it has opened doors of opportunity for me, and boosted my confidence in my academic work. As I continue to be apart of this family, I hope to share future experiences and support future generations of the Imbizo - to extend this life changing endeavour. Thanks greatly!

Kira Düsterwald - Imbizo'17

Kira at her graduation

Since Imbizo 2017 I have finished my Masters (in computational neuroscience) and medical degrees at the University of Cape Town. The contacts and exposure from the Imbizo made a big difference in the opportunities that I could apply for: I was able to attend summer schools like the Deep Learning Indaba, for which I would never have even considered applying without the machine learning basis taught at the isiCNI, and the Woods Hole Methods in Computational Neuroscience Course. The Imbizo helped me get into and maximise my learning at the latter school, which is dominated by US-based scholars. Thanks to the Imbizo, I had already met some of the faculty and felt better prepared for the course material. I have learned a lot from these schools, which are vital given the lack of formal training in comp neuro in South Africa. I was able to publish my MSc work in eLife, thanks to the collaborative experimental-theoretical environment in the Raimondo Lab. This year, I started my internship as a medical doctor in Port Elizabeth. Clinical medicine will be my focus for the next few years, after which I plan to pursue a PhD in computational/theoretical neuroscience, hopefully abroad. In general, I wholeheartedly attribute my Imbizo experience to my continuation of the clinician-scientist pathway in neuroscience. It also allowed me to make excellent friends and contacts along the way!

Sicelukwanda Zane - Imbizo'17

Sicelukwanda (right) being awarded the prize for best poster at the Deep Learning Indaba 2018.

The [project work at the] Computational Neuroscience Imbizo was my first research experience. I was also introduced to deep reinforcement, by Timothy Lillicrap, as well as information theory and probability. The summer school served as a catalyst and gave me the topic I wanted to pursue in my MSc. It also gave me access to an amazing network of professionals and researchers in the domain.

During my MSc I worked with DDPG, a deep reinforcement learning algorithm for continuous environments, and extended the algorithm to multi-task scenarios in robotics. I was able to present this work at the Deep learning Indaba where I was awarded a travel prize to NeurIPS 2017 in California. The experience was beyond my expectations and would not have been possible had it not been for the Imbizo. As an added bonus i saw Surya Ganguli, one of the Imbizo speakers, which was awesome. I came back from NeurIPS with a different outlook on what quality research looks like and I got to meet notable researchers and students from all over the globe.

Last summer I had the opportunity of presenting at the Black in AI workshop at NeurIPS 2018. My work was one of eight submissions from a pool of 250+ submissions. The presentation was well received and led to an invitation to "This Week in Machine Learning and AI", a well-known machine learning podcast series, which hosted me on their show.

My Imbizo experience coupled with other efforts to increase inclusivity in ML allowed me the opportunity to interact with possible PhD. supervisors and research labs to do a PhD in transfer learning and robot learning. I'm currently preparing the applications.

I appreciate the work done by the Imbizo and have not only seen the impact that it has had on my life but also in the lives of the peers that I met at the summer school.

Luke Taylor - Imbizo'17

My time at the Imbizo gave me a good overview over the field of artificial intelligence and neuroscience. I met lots of driven and passionate people, many of whom have remained invaluable contacts to this day. In addition, I was fortunate enough to be introduced to the field of reinforcement learning, which has played a big part in my life ever since.

As part of my undergraduate thesis I worked to adapt reinforcement learning algorithms to certain non-stationary environments using a bayesian selection approach. This algorithmic extension was shown to empirically outperform the popular Deep Q-Network published by Deep-Mind. After my undergraduate I enrolled for an applied mathematics honours at UCT. Being a modular degree, I tailored it to focus on reinforcement learning. My thesis aimed at developing a low cost robot and training it using reinforcement learning, work I presented at the Deep Learning Indaba in 2018. Having completed my honours degree I now seek to enrol in a masters in neuroscience and am in the process of applying to various universities overseas.

I would link many of these amazing opportunities to the Imbizo. The Imbizo introduced me to reinforcement learning, provided amazing contacts that have helped me with reference letters and helped me develop a deeper interest in the field of neuroscience. I am happy to report I will be going to Oxford for a Masters.

Kayode Ayodele - Imbizo'17

When I attended the Imbizo in 2017, I was extending a research interest in machine learning and computational neuroscience. The Imbizo has impacted both my teaching and research. While I still primarily focus on the engineering aspect of problems, the Imbizo fundamentally improved my knowledge of models and techniques in computational neuroscience. This has changed how I conceptualise problems and improved my work with researchers from the health sciences. We collaborate on epileptic seizure detection, stroke neurorehabilitation and brain machine interfaces research. A group that started with me and a single neurologist in the Department of Medicine now has close to a dozen researchers in Ile-Ife and Ibadan, along with a very close collaborator in Australia, and a number of graduate students. We have already presented preliminary results of our first few studies at conferences, and I expect the quantity and impact of our research to increase as the community grows. I was also able to lead the development of a Biomedical Engineering curriculum, co-hosted by my department and the College of Medicine. The curriculum is currently being processed for approval by my university. I have encouraged three students and a colleague to apply for subsequent Imbizos, and two have been accepted. I have always hoped that the lasting legacy of the Imbizo, as it concerns me, would be the rapid growth of a computational neuroscience community in Nigeria with participation from engineers/physical scientists and life scientists. I am happy that progress towards that goal is happening.

The Future: Improvements and Changes

As each Imbizo draws to an end, we ask students, tutors and faculty about the improvements they would like to see. Below is a list of their answers and items that we've implemented thus far.

Implemented changes.

Pre-school study materials were provided one month before the 2018 Imbizo, following suggestions from the 2017 group. This effectively amounted to the Introduction to Maths you need to know tutorial (tutorial 1 at isiCNI2017) being re-structured into a pre-school learning tutorial. The contents of this tutorial were further amended and extended for 2019 - to include a separate tutorial on basic neuroscience (produced principally by Rich Pang) and some introductory Python programming skills. The material was also released earlier to the 2019 group (2 months before the Imbizo). Going forward, it would be good to send this content shortly after the acceptance notifications.

Centralising student accommodation . Following feedback from the 2017 group, we opted to house all students in one facility for 2018.
However, in 2019 we reverted to a semi-split accommodation arrangement for students. Having tried this in 2017, and then centralised all accommodation in 2018, we concluded from student feedback that having all students in Stoked Backpackers was just a little too cramped.

Improved internet access. A key direction for improvement into Imbizo 2018 was improving internet access at the venue. Major progress was made in this regard by our host venue, CCFM, who had a new internet line installed for the lecture venue and opened up a new network specially for our purposes. This significantly improved internet access.

Course Structure . In both Imbizo 2017 & 2018, a comment raised by students was the ordering of the weeks. In 2017 and 2018 we began with Week 1 having a fairly high-level cognitive content. Some students said that this was sometimes difficult to follow as they had not been thoroughly acquainted with the underlying biophysical information – cellular and synaptic

level. In 2019, we resolved this issue, beginning with biophysics and cellular level content in week 1 and building through network level neuroscience and machine learning, before covering theories of cognition and computation, as well as some philosophy of neuroscience, in week 3.

[Scientific soft skills]: It was noted that many students want to also hear about how to prepare for grant applications, interviews and grad-school. W thus expanded the lecture time on Soft skills, and offer additional one-on-one training and advising students on the core scientific skills of preparing and mastering interviews and applications. This is particularly useful for African students who wish to apply for academic programs abroad. We will continue to improve this facet of the course.

Gender and ethnic diversity in Neuroscience To address the issues pertaining the ongoing imbalance of power and status allocated along lines of gender and ethnicity in neuroscience, we created the 'Gender in Science Lunch", and the 'Diversity Lunch'. Both are informal events in week 2 &3. In week 2, male and female students and instructors separately discuss the status quo of gender and race based discrimination in science. Discussions are led by faculty and summaries of the conversations are recorded and exchanged between the two groups afterwards, and the ability to speak freely and without worry to offend facilitates a lively and often very educational discussion on many topics. In week three the discussion is continued but as one group. With the help of our trusty tutors we are still calibrating the event for best procedures.

Cultural exposure International and African students alike felt that conversations about the legacy of colonialism, the de-colonial project and current affairs could have been more guided. We noted that amongst students and faculty frequent topics of conversation related to Africa, it's place in the world, the challenges it faces, the history of colonialism and race-relations both on the continent and globally. In 2018 we started to host speakers (e.g. our Wednesday evening sessions) from outside of computational neuroscience (when we could attract them with backgrounds in social activism), who can explore some of these important topics with students.

Future changes to implement

R **Improve pre-school preparatory material:** It has become clear that preparatory material is essential to raising the quality of the student experience at the Imbizo. This is something the 2019 Teaching Assistants have already expressed explicit interest in doing.

R **Provide an extra tutorial on Bayesian statistics** Many students felt that material on Bayesian statistics was unfamiliar and difficult. For the next iteration of the school we will plan an introductory tutorial on Bayesian methods.

R **Access and use of high-performance computing resources.** Some Imbizo students are pushing beyond the capacity of their personal machines during their research projects! We hope to support their research better by gaining access to high performance computing facilites.

(R) **Journal club demonstration:** It has been suggested that having 'mock journal club' presentations could push student to improve their scientific reasonaing, speaking and analytic skills.

(R) **Schedule restructuring - a multi-project system:** The 2019 teaching assistants really put a lot of thought into how the school experience may be improved for students. One thing they noted was the difficulty students had both with choosing project topics, gaining sufficient knowledge from tutorials coping with the stress of projects. Callie Federer suggested perhaps having students do week-long mini-projects (in groups) rather than one principle project. They could then present just one of these 'mini-projects' as their final project.

(R) **Continued funding for Academic exchanges:** Students and faculty raised the lack of funding for PhD student exchanges and travel grants as a major obstacle for African students to participate in international neuroscience events and conferences. We continue to identify ways that we can make such funding available for Imbizous, our alumni.

Long-term future & blue skies.

The Imbizo is here to stay. We believe there is a long term future for the Imbizo and for Computational Neuroscience in Africa. To guarantee the survival and growth of both, we must make long-term plans.

(R) **Director turn-over** We have already had substantial turn-over of faculty and tutors but we have not shuffled the board of directors. A mechanism is needed for what happens when directors step down.

(R) **3rd party funding.** We are currently funded through the graces and generosity of IBRO and the Simons Foundation. While there is not sign of waning support from our funders, it would be good to create a list of potential funders for increasing cost or other eventualities.

(R) **Administrative Support:** So far, the Imbizo is often running on ad-hoc planning, creative solutions and the energy and goodwill of the organisational team. To make the the Imbizo sustainable, it will be beneficial to think about a long-term, paid administrator who will take ownership and guarantee stability when the directorship changes.

(R) **A physical home:** We are dreaming of a physical location to give the imbizo a permanent home. This may come in the form of a buy-in into existing infrastructure, like in Woods Hole, USA, or though the establishment of (or incorporation into) an umbrella institute such as AIMS, or the new Neuroscience Institute at UCT.

(R) **A franchise of Imbizos:** To reduce the administrative cost of a single course, and to expand the spectrum of courses, it may be beneficial to create Imbizos for other subjects and species, e.g. a Drosophila Imbizo, an Imaging Imbizo, etc.

Final Comments

Below are some of comments from students across the years after they finished the IBRO-Simons Computational Neuroscience Imbizo.

2017

"I really feel EXTREMELY privileged and lucky to have had this chance. I learned an incredible amount, and I'm leaving with a gigantic amount of motivation."

"Great school, truly awesome and a game-changer for my research. Faculty, tutors and students were all great. I think the people made the school, but the quality of content was excellent."

"The school has been a great experience for me, And I would add that It was the greater school I ever attend. Big thank you to the organisers. It was a big privilege to be part of this great advanture. I enjoyed every part, from lectures to social activity"

"This has been beyond amazing in so many ways. I can't stop thanking the isiCNI committee for making this happen and letting me be a part of it."

"We have said this many times, but I think Alex Antrobus did a fantastic job running things. Of course Tim Vogels and Joe Raimondo were also fantastic; I like that they have different styles. Tim's ability to be a little more in-your-face led to what I thought to be the most enjoyable classroom exchange during the program."

2018

"If I am to rate isiCNI2018, I will give 95%, thanks to the organizers and sponsors."

"Incredible experience. Thank you so much for the opportunity!! "

"Really most of what I have to say is positive feedback, this is such a great summer school. It has helped me to such a great extent with my work and will have a huge impact on the opportunities and decisions I find and make in the future. Honestly, I am in awe of the experience so I am finding it difficult to find suggestions or complaints but if I do think of something I will be sure to let you know."

"No words can explain how much i am happy of being a part of this school, million thanks to everyone

shared and supported this event. I suggest we could spend more time with focusing i details of the content, and do more sessions on how to reach degree grants. Thanks A Lot"

"That was truly wonderful: from the attention you took in the selection process of the attendee and faculty to the organisation (Thank you Emma!!), to the scientific content of the summer school, everything was so great! Thank you :) And I know it's probably hard to find female computational neuroscientists and that you probably tried very hard, but it could be great to get closer to 50/50 ratio of female/male in the faculty.
I hope isicni can keep going for many years to come!"

2019

"It has been an adventure and it exceeded my expectations in every way. "

" Thank you for the opportunity to be part of this amazing community. You might not understand the magnitude and impact this has on my research education and career. Thank You, Asante Sana. "

"This school is amazing and life changing"

"This has been an absolutely life changing experience and my interest in computational neuroscience has been fuelled and inspired by all the people I have met and things I have learned. "

"Perhaps more experimental and current work would be good, to see the full picture"

"Love you guys sooooooo much!!!! This has been one of the most interesting things I have ever done - I felt like the work done during this last 3 weeks were utterly important!"

"I have to thank you, guys! You are the best. I loved it."

"I think Emma, Alex, and Chris did an amazing job - thank you so much for this experience!"

"Life changing."
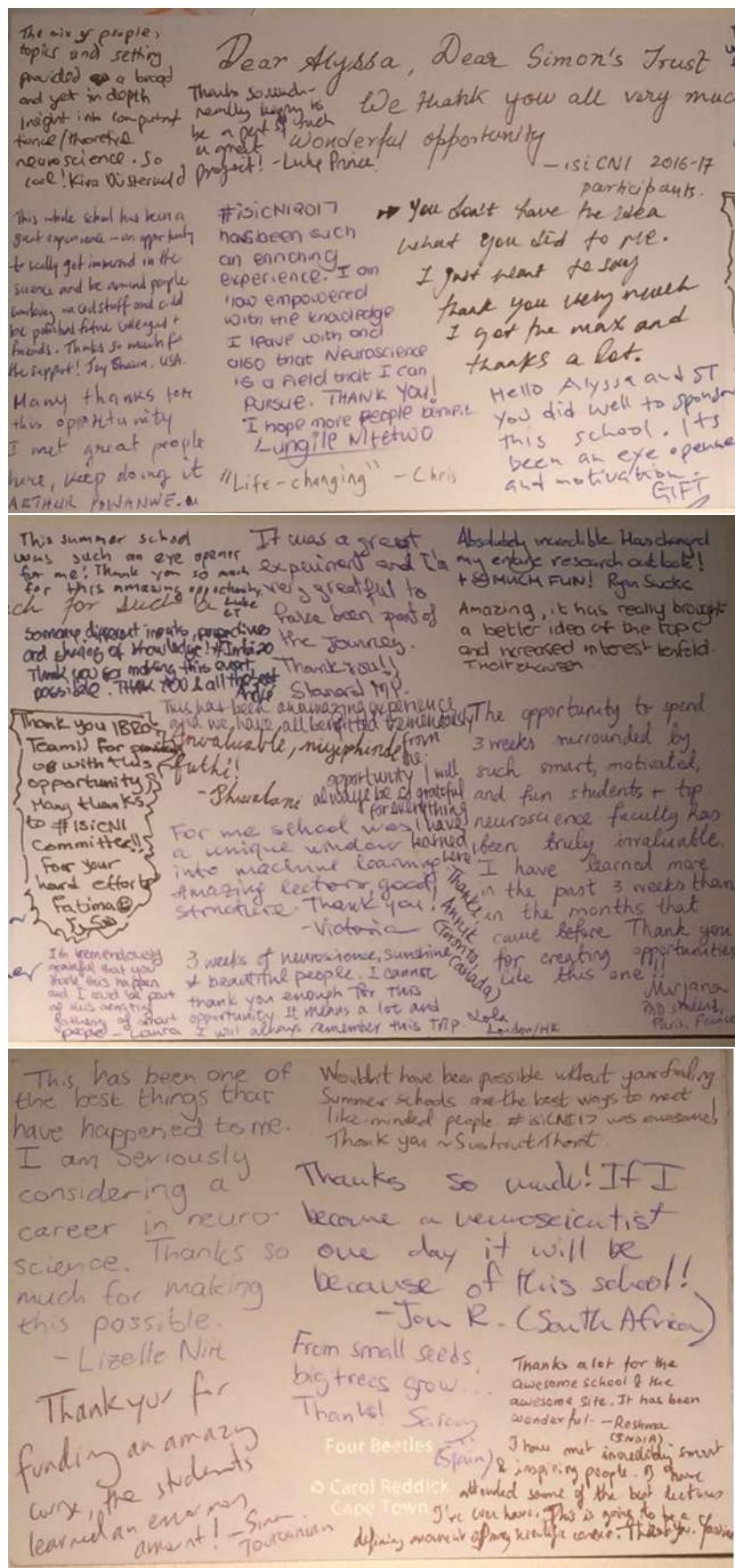
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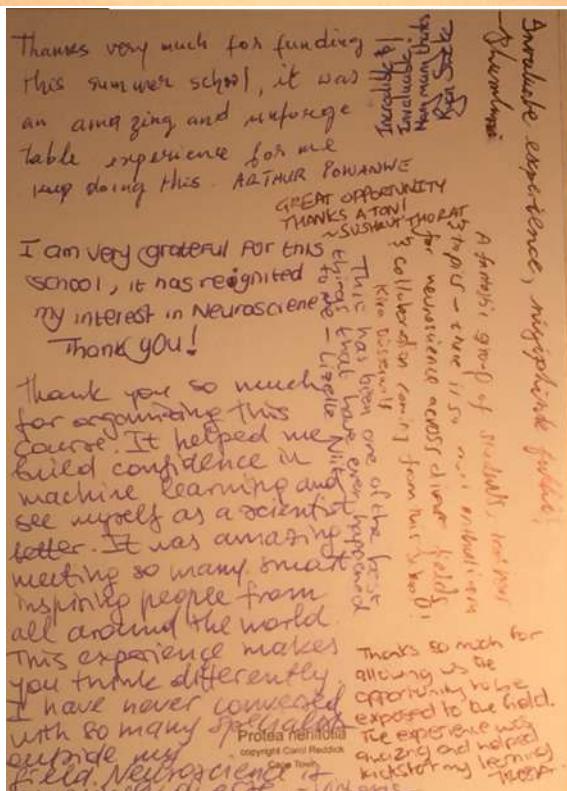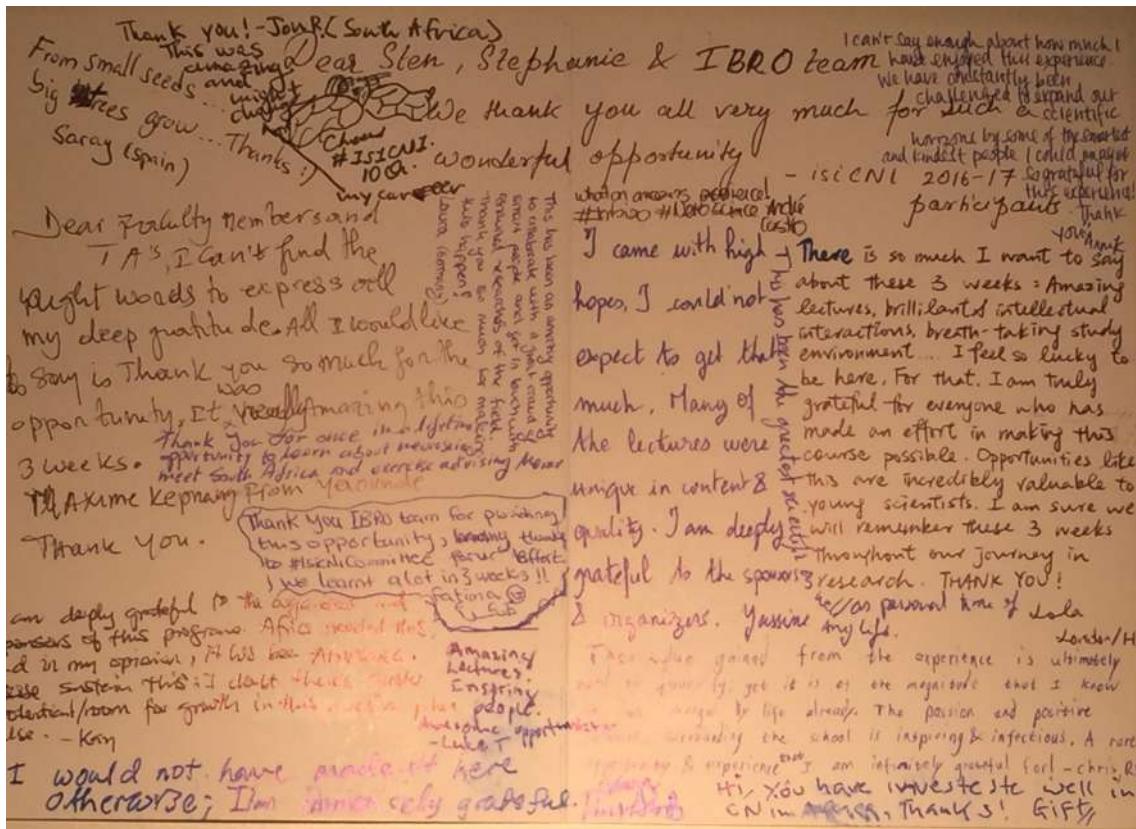
We wanted to take this opportunity to thank our funders, the Simons Foundation, IBRO, and the Wellcome Trust. Your financial support, and your faith in us made this possible. Thank you. Below you will find photographs of the "Thank You" cards the students prepared for the two main funding bodies, the Simons Foundation and IBRO.

From the feedback we received, it's fair to assume most students were very happy.

The mix of people, topics and setting provided a broad and yet in depth insight into computational / theoretical neuroscience. So cool! Kira Düsterwald

This whole school has been a great experience — an opportunity to really get immersed in the science and be amongst people working on cool stuff and could be potential future colleagues + friends. Thanks so much for the support! Jay Bhasin, USA.

Many thanks for this opportunity I met great people here, keep doing it ARTHUR POWANWE. M

Dear Alyssa, Dear Simon's Trust
Thanks so much — really happy to be a part of such a great project! - Luke Prince.

We thank you all very much Wonderful opportunity
— isiCNI 2016-17 participants.

#isiCNI2017 hasbeen such an enriching experience. I am now empowered with the knowledge I leave with and also that Neuroscience is a field that I can pursue. THANK YOU! I hope more people complete Lungile Ntetwo

"Life-changing" — Chris

You don't have the idea what you did to me. I just meant to say thank you very much I got the max and thanks a lot.

Hello Alyssa and ST You did well to sponsor this school. Its been an eye opener and motivation GIFT

This summer school was such an eye opener for me. Thank you so much for this amazing opportunity for such a ...

It was a great experience and I'm very greatful to have been part of the journey. Thank truly! ... Stanard MP.

Absolutely incredible Has changed my entire research outlook! + SO MUCH FUN! Ryan Sucke

Amazing, it has really brought a better idea of the topic and increased interest tenfold. Thok ...

Thank you ISRO Team!) for ... us with this opportunity Many thanks to #isiCNI Committee!! For your hard effort Fatima ...

This has been an amazing experience and we have all benefitted tremendously ... invaluable, ... Futhi!

The opportunity to spend 3 weeks surrounded by such smart, motivated, and fun students + top neuroscience faculty has been truly invaluable. I have learned more in the past 3 weeks than in the months that came before. Thank you ... for creating opportunities like this one!!! Mirjana PhD student, Paris, France

opportunity I will always be grateful for everything - Shwetani

For me school was a unique window into machine learning here Amazing lectures, good structure. Thank you! - Victoria (Canada)

I'm tremendously grateful that you think this happen and I could be part of this amazing Portugal ... people — Laura

3 weeks of neuroscience, sunshine + beautiful people. I cannot thank you enough for this opportunity It means a lot and I will always remember this trip Lola London/HK

This has been one of the best things that have happened to me. I am seriously considering a career in neuro-science. Thanks so much for making this possible. — Lizelle Nirt

Thank you for funding an amazing ... the students learned an enormous amount! — Sim-Toutounian

Wouldn't have been possible without your funding. Summer schools are the best ways to meet like-minded people #isiCNI17 was awesome! Thank you ~ Sustruct Thorot.

Thanks so much! If I become a neuroscientist one day it will be because of this school!! — Jon R. (South Africa)

From small seeds, big trees grow... Thanks! Safeer Four Beetles (Spain) Carol Reddick Cape Town

Thanks a lot for the awesome school & the awesome site. It has been wonderful — Reshma (INDIA). I have met incredibly smart & inspiring people. I have attended some of the best lectures I've ever have. This is going to be a defining moment of my scientific career. Thank you. Yasin

Students' Thank-You card for the Simons Foundation 2017.

Students' Thank-You card for IBRO 2017.

Students' Thank-You card for IBRO & the Simons Foundation 2018.

Students' Thank-You card for the Simons Foundation 2019.

Students' Thank-You card for IBRO, 2019.

Sharing thoughts and a chairs.

Summary

In the words of one of our faculty,

> *"This Imbizo is like summer schools used to be, some 20 years ago. It feels like something is moving. People come thirsty, motivated, enthusiastic, and maybe a bit naïve. They work hard and they play hard, and they leave with their hearts and minds changed. It feels like this has a large impact on their lives."*

Despite the little time that has passed since the first Imbizo, we can already report on consequences of the course (see above). For example, one of our students has successfully applied for a "smart start" graduate program in neuroscience in Germany. Two other African students of ours have started working on a computational neuroscience initiative in South Africa, and yet another pair have begun a collaboration between Nigeria and South Africa. International collaborations have also been born, with one Canadian student and a South African student currently collaborating on a research project.

In other words, the IBRO Simons Computational Neuroscience Imbizo has made a difference. It's filling a void for African neuroscience and begins to deliver on its promise to serve as the bridgehead and glue for a growing community. We daresay the inaugural Imbizo has been a tremendous success. We would like to thank everyone who made the Imbizo possible: The faculty, the tutors, and of course the funding agencies who had faith in us.

After three successful years we have all the infrastructure in place to settle into a routine, and continue the summer school as an annual event. Many of our faculty are on board and excited to return to Muizenberg in coming years. We hope our funders will also extend their support to future iterations of the Imbizo for the benefit of neuroscience in Africa and beyond.

Sincerely,

.   Peter Latham   Joseph Raimondo   Tim Vogels

2017

2018

2019