

TReND-CaMinA: A Low-Cost and Open-Source Teaching Initiative to Promote Computational Neuroscience and Machine Learning in Africa

Saray Soldado-Magraner¹, Joana Soldado-Magraner², Gabriela Michel³, Tom George^{4,5}, Emmanuel Marquez-Legorreta⁶, Artemis Koumoundourou^{7,8}

1. University of California Los Angeles, 2. Carnegie Mellon University, 3. HHMI Janelia Research Campus, 4. Mila-Quebec AI Institute, 5. Sainsbury Wellcome Centre UCL, 6. Utrecht University, 7. VIB-KU Leuven CBD, 8. TReND in Africa.

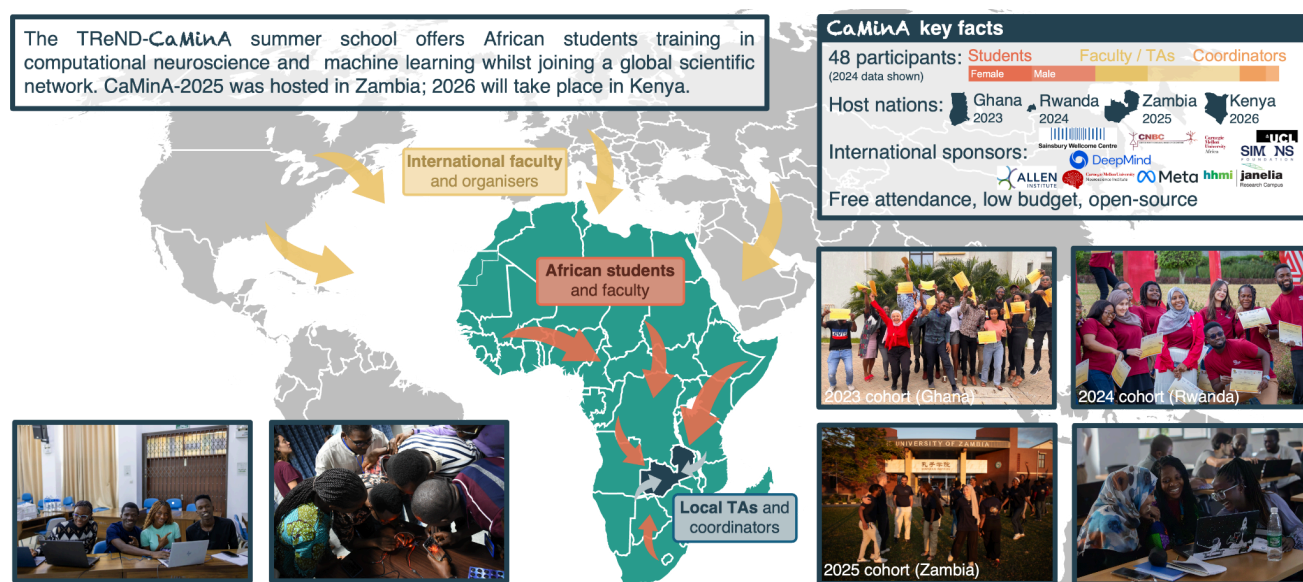


Fig 1: TReND-CaMinA visual abstract. Summary (top-left), key statistics and sponsors (top-right) and photos.

TReND-CaMinA is a residential summer school with the goal of accelerating Africa's emergence onto the global scientific stage by educating young African researchers in computational neuroscience and machine learning—two cost-effective and modern research fields. With successful past editions in Ghana (2023), Rwanda (2024) and Zambia (2025), the *CaMinA* is run in partnership with *TReND in Africa*, a globally-renowned NGO, promoting African development through education.

We are committed to accessibility by (i) making our course free to all attending students, (ii) rotating the host country in order to seed local research hubs and (iii) publishing all materials in order that our blueprint may be copied. TReND-CaMinA is exceptionally cost effective, with a total budget of 60,000USD—far cheaper than a confocal microscope—and has been funded entirely through donations from leading institutions in academia and industry.

Across three courses we received 1982 applications, demonstrating an overwhelming demand for our initiative. Data suggests students benefit greatly from our course; many go on to secure prestigious entry to advanced international schools, win competitive travel grants, and/or progress to higher education programmes, indicating that the course is beginning to meet its goals of training and network-building in Africa. Through teaching, we aim to foster a more skilled and competitive African society that brings development to the continent and more diverse perspectives to the global scientific landscape.

Introduction

Neuroscience, despite its origins in Africa^[1], is a field dominated by non-African researchers^[2]. There are many reasons for this including a lack of funding, a lack of training programmes, and sub-critical network size^[3] at the country and continental level, collectively leading to a self-perpetuating “brain-drain”^[4]. Furthermore, *experimental* neuroscience is a particularly expensive pursuit with new microscopes costing hundreds of thousands of dollars, and new institutes costing hundreds of millions, creating an often insurmountable barrier to entry.

This global imbalance is not only a problem for Africa, which has one of the world's largest and youngest populations of aspiring scientists^[5], but also for the global neuroscientific community that misses out on contributions and perspectives that could enrich and diversify the scientific domain. Unlike experimental neuroscience, *computational* neuroscience and the related field of machine learning are often not as expensive. Given the right training, little more than a laptop and access to open-source datasets can be enough to start making progress^[6]. Furthermore, these fields are multidisciplinary with the potential to spur progress in related areas from medicine to robotics and are of growing importance to the global economy.

As such, we propose that **introductory-level training programmes in computational neuroscience and machine learning are a cost-effective means to accelerate Africa's emergence onto the global scientific stage**. Here we present one such effort.

Our Strategy: TRENDCaMinA

We are a group of six junior research trainees from across the world. By partnering with TRENDC^[7]—a globally-renowned NGO committed to promoting sustainable African development through higher education and scientific innovation—we founded the course in Computational Neuroscience and Machine Learning in Africa (TRENDCaMinA), an annual, residential, two-and-a-half-week summer school.

Our primary goals are:

1. **Training:** To train a new cohort of African researchers in computational techniques.
2. **African Network:** To establish a lasting pan-African network of junior researchers.

3. **International connections:** To forge global partnerships which support the flow of researchers to and from Africa.

The course brings together 20 African students from diverse backgrounds and 20 teachers (African and non-African neuroscience and ML experts at various career stages, all volunteers) for a program structured around three key pillars:

1. **Teaching:** Theoretical and hands-on teaching sessions
2. **Projects:** Supervised group research projects using open-datasets.
3. **Lectures:** Inspirational guest lectures from academic and industry leaders.

To encourage replication, all our materials are made publicly available on [Github](#) and, upon completion, students join an alumni network where opportunities are shared and career support is provided. Our project is inspired by related schemes like the *Imbizo*^[8] and *Neuromatch*^[9], but is tailored exclusively for African students, teaches at a more introductory level and rotates location on a yearly basis in the hope of seeding multiple hubs in computational neuroscience and machine learning.

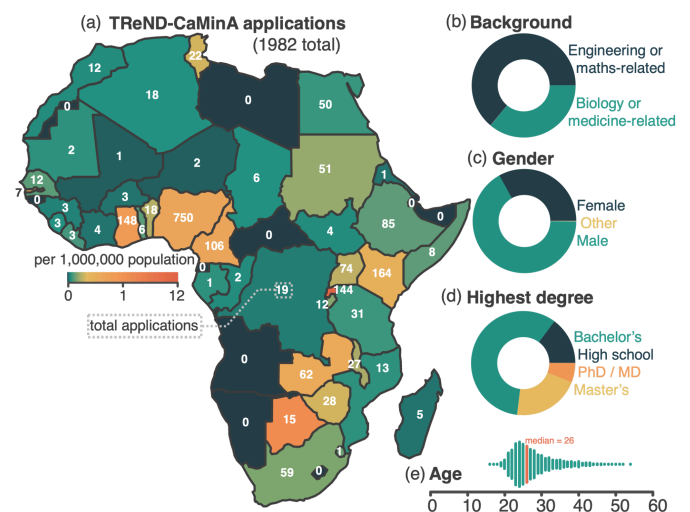


Fig 2: Application statistics to TRENDCaMinA across all years. Biases in applicant country, background and gender are corrected for in our selection process.

Cost-Effectiveness and Financial Model

Each course operates on a constrained budget of ~60,000USD—a small amount compared to comparable courses such as the *Imbizo* (~150,000USD^[10])—which covers all costs for the selected students including tuition, international travel, accommodation and meals. **Importantly, this means the course is offered at no cost to the students.** This is made possible through a hybrid funding model. Direct costs are covered by grants and donations from institutions in the Global

North. This is supplemented by the significant in-kind contribution of teaching, voluntarily provided by both local and international lecturers, and teaching space, provided by the local university. Furthermore, international instructors typically fund their own travel to the course through their home institutions, a crucial and non-trivial source of funding from the Global North.

In order to continue this project into 2026 and 2027 we are projecting a required budget of \$132,000 (Table 1). Starting this year we will hold \$5,000 in reserve for a “Support fund” used to enable alumni attendance to international courses and conferences. We believe this will act as a significant multiplier on our impact by allowing the most motivated students to progress faster.

Expense	2024/2025 average	2026 (Kenya)	2027
Student flights	\$15,500	\$18,000	\$18,000
Accommodation	\$24,000	\$25,000	\$25,000
Food	\$9,000	\$10,000	\$10,000
Misc. and social	\$6,500	\$8,000	\$8,000
Support fund	\$0	\$5,000	\$5,000
Total	\$55,000	\$66,000	\$66,000
Total / student	20 students \$2,750	22 students \$3,000	22 students \$3,000

Table 1: TRENDCaMinA budget breakdown.

Applicant Selection

We invite applications through broad posting across our social media platforms and the extensive TRENDCaMinA mailing list. The selection process begins with automatic filtering to remove applications with incomplete documentation or insufficient responses. A rapid, blind review is then conducted, with each application receiving two independent scores based on predefined metrics. High-scoring applications proceed to an in-depth review (where recommendation letters will be studied), and the top candidates are selected for an offer. In the final selection stage, we actively correct for potential biases to ensure our pool of selectees is balanced across the following criteria: gender, technical backgrounds (engineering, mathematics, physics) versus biological/medical backgrounds, and broad geographic distribution across Africa.

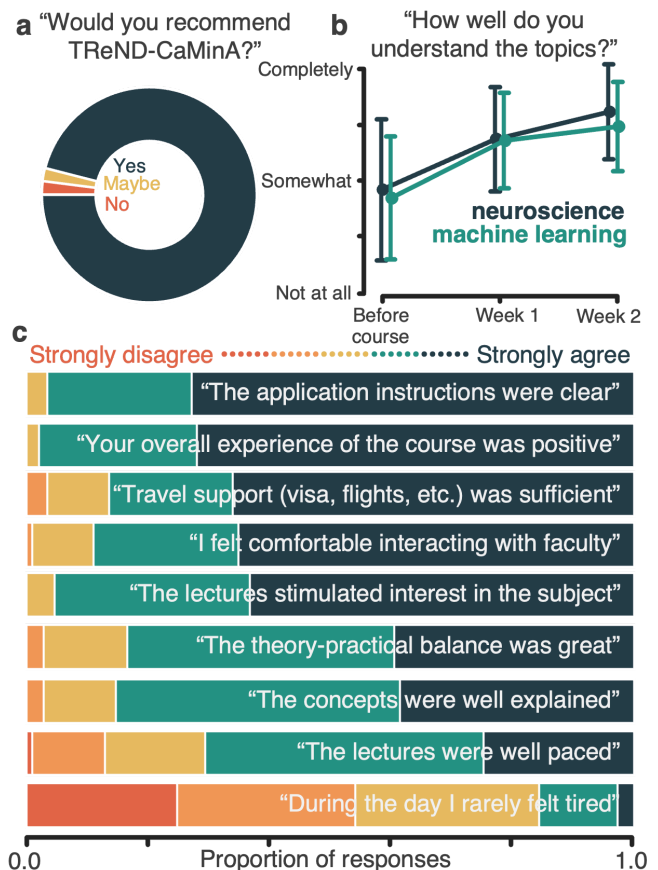


Fig 3: Student feedback on the TRENDCaMinA course.

Progress & Impact

TRENDCaMinA is designed to provide an academically accessible entry point for students who feel unprepared to apply for more advanced international schools (*Imbizo*, *Neuromatch* etc.) or PhD programmes. A very enthusiastic response has confirmed the demand for this approach: so far, across three cycles, **we have received 1,982 applications for 60 places**. Our applications are broadly distributed across Africa (Fig. 2), but, nonetheless, skew around past course locations (Ghana [3.2x continental average], Rwanda [11.4x] and Zambia [2.3x]) as well as countries listing English as an official language [1.8x].

Student perceptions, collected via an in-course survey, were overwhelmingly positive (Fig. 3). Almost all the **participants praised the clarity of the application process and the standard of travel support**. Similarly, nearly all students reported that the course **topics taught were interesting, relevant, and well-balanced** between theoretical and practical components. **Students felt comfortable interacting with faculty** and valued the instructors' efforts to make challenging material accessible. The key area identified for improvement related to pacing and fatigue; some **students noted feeling tired during the day and reported that the lecture delivery was too**

fast-paced (a tension inherent in providing good quality teaching which covers significant ground).

The most significant measure of our impact lies in the subsequent success of our alumni. In a one-year follow-up survey **88% of students stated that the course had helped their careers**, and that they felt highly empowered to continue research in computational neuroscience and machine learning. In line with this, **64% of students went on to participate in at least one other related course, workshop or conference**.

Following the 2023 course, **six of our alumni were accepted into the prestigious Imbizo summer school** from nine who applied, a 67% success rate that represents nearly a third of that year's entire African cohort. However, even these successes are fragile: **five 2024 alumni were awarded the competitive COSYNE student travel award**, but three could not secure visas to attend. This powerfully highlights why **in-continent training is a non-negotiable step toward equity in global science**. Some students have gone on to set up their own meetings or workshops^[11-14], citing TReND-CaMinA as inspiration.

Summary of 2025 and plans for 2026

The 2025 TReND-CaMinA course was successfully hosted at the University of Zambia in Lusaka, bringing together 20 highly motivated students and an exceptional faculty, including Professors Kimberly Stachenfeld (Columbia), Ronald Dale (HHMI-Janelia), Byron Yu (CMU), and Dean Buonomano (UCLA), Dr. Albert Njoroge Kahira (AstraZeneca) and many more. Despite minor logistical challenges, such as an initially unreliable internet connection—a common hurdle for scientific teaching in Africa—the course proceeded successfully. Our Teaching Assistant team was particularly strong, with many agreeing to return

next year and take on larger coordination roles for future editions. **The 2026 course will be hosted at the Dedan Kimathi University of Technology**, near Mt. Kenya. This location, a three-hour drive from Nairobi, marks our first course in a rural African setting, an exciting new development.

Conclusion

Addressing the systemic barriers that limit African participation in global science is a task that no single initiative can solve alone. However, our experience with TReND-CaMinA demonstrates that targeted, community-driven efforts can yield impact with relatively modest resources, serving as a proof-of-concept for a scalable, shareable and cost-effective model. Looking to future editions we aim to expand support by establishing internship opportunities for our alumni within our global network and to provide an internal budget for conference and travel expenses. We invite partners to join us in scaling this proven model.

References

[1] Russell, V. A. Notes on the recent history of neuroscience in Africa (2017). [2] Maina et al., Two decades of neuroscience publication trends in Africa (2021). [3] Besharati et al., Accelerating African neuroscience to provide an equitable framework using perspectives from West and Southern Africa (2023) [4] Dei et al., What is to be done? A look at some causes and consequences of the African brain drain. (2002). [5] Ashford, L. S. Africa's youthful population: Risk or opportunity (2007) [6] Akil et al. Neuroscience Training for the 21st Century (2016) [7] Baden et al. TReND in Africa: Toward a Truly Global (Neuro)science Community (2020) [8] Currin et al. Think: Theory for Africa (2019) [9] van Viegen et al. Neuromatch Academy: Teaching Computational Neuroscience with Global Accessibility (2021) [10] Estimated from Imbizo webpage FAQs stating a budget of \$5500 per student. [11] BioRTC Computational Neuroscience Course (2025) [12] NeuroAspire Summer School (2025) [13] Next-Gen NeuroSchool 2025 [14] Advancing computational neuroscience through collaborative learning: a 5-day webinar

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