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PEOPLE & IDEAS

Gabriel Muhire Gihana: A candle loses nothing by lighting other candles

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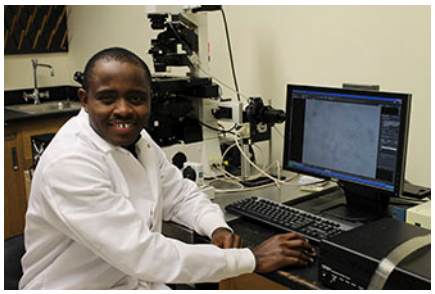
Gihana investigates how cells coordinate their shape and polarity with chromosome segregation.

At the end of high school in Rwanda, Gabriel Muhire Gihana scored among the top students on national tests that determine university placements. As a result, Gihana won a fully funded college scholarship provided by a partnership between the Rwandan government and the California Baptist University (CBU). But he wouldn't have finished primary school and reached high school if not for the efforts of his aunt and uncle, who adopted him at the age of five after both his parents died. Financial hardship nearly derailed Gihana's progress through high school, but the principal saw his grades and hard work and sought sponsors to cover the tuition fees. Without these people, Gihana says he would not be where he is today and their help has inspired him to help others.

Working with Dennis Bideshi at CBU ignited Gihana's enthusiasm for cell biology, and he recalls Bideshi's inspirational lectures where he "would feel as if walking down the electron chain in a mitochondrium witnessing ATP synthesis, or sitting by a ribosome witnessing protein synthesis from the RNA message." But Bideshi made it clear that scientists had a lot to learn about how cell biological processes function normally and during disease, inspiring Gihana to consider a career in research. Gihana was selected for the Massachusetts Institute of Technology Summer Research Program, where he worked with Matthew Vander Heiden investigating the metabolic changes induced in pancreatic cancer cells by inflammation.

Graduating top of his class in 2013, Gihana joined the biology graduate program at Indiana University Bloomington and is in the final year of his thesis work with Soni Lacefield. Gihana first explored how cell polarity is coordinated with nuclear division during a unique type of cell division called return to growth, whereby yeast cells that have initiated meiosis are induced to switch back to mitosis through nutritional manipulation. The findings were published in 2018 in *JCB* (1) and revealed that yeast cells returning to growth differentially regulate cyclin-dependent kinases to ensure genome stability and maintain proper cell morphology. Planning to continue research as a postdoc, Gihana is interested in studying the molecular connections between cell polarity and cell division in cancer cells. We contacted Gihana to find out more about his scientific journey.



Gabriel Muhire Gihana looking at budding yeast cells on a Nikon TiE microscope. Photo courtesy of Terri Greene.

When did you first become interested in science?

I became fond of science in high school. I attended an outstanding and highly selective school with competent teachers. However, like other schools in the country at the time, school supplies were very limited and we were too poor to afford them. My senior class shared a single biology textbook, and if a rare textbook was available at 3 am, you would have to wake up at that time. I remember reading for several hours a night by candlelight. Despite all the challenges, I enjoyed physics and chemistry, but biology became my favorite. I vividly recall the lectures about plant and animal cells, what they are and how they function. Cells sounded like intricate and highly effective machines, and I wanted to know more about them. One sunny day, my biology teacher came to class carrying onions, and I was very excited after he announced that he was going to show us plant cells. After positioning a tiny microscope in a well-illuminated corner, he gently secured the slide on the microscope and tilted the mirror to reflect sunlight through the specimen. He bent over to look through the eyepieces and took his time adjusting the focus knobs. Suddenly in his deep voice, the teacher exclaimed, "voilà!" We took turns to look at the cells. It was an unforgettable moment, the day I fell in love with cells and microscopes.

What first drew you to study mitosis?

Cells do a lot of fascinating things, but I would argue the most important and intricate one is mitosis. As I looked at textbook cartoons of a dividing cell in high school, my mind was blown away. I was astonished by the order and the precision of mitotic events, but left increasingly curious. I wondered how chromosomes condense and how chromosomes faithfully align in metaphase and segregate toward opposite poles of the cell. Mitosis is fundamental to the development and survival of all multicellular organisms, and errors can be deleterious and deadly. What could be more beautiful than seeing a mammalian cell controllably and efficiently splitting in two, with its histones and microtubules highlighted with distinctive fluorescent markers? When I first saw such a movie, I wanted to shoot

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The Lacefield lab. Front (left to right): Gisela Cairo Baza, Annie MacKenzie, Olivia Ballew, and Soni Lacefield. Back (left to right): Gabriel Muhire Gihana, Janardan Gavade, Connor McKey, and Christopher Puccia. Photo courtesy of Jane Newman.

some myself; there was a captivating beauty to it, and the attraction was irresistible.

What kind of approach do you bring to your work?

The difficulties and challenges I endured in childhood and high school taught me to work hard, as this was my only hope for a better life. I had to succeed; there were no other options. I still bring this attitude to my work today. I try not to give up on things I have the time and resources to do, even if they are difficult. For instance, if there is an experiment barely related to my project but I have time, I will do it anyway, and such experiments have led to pleasantly surprising results. I try to constantly remind myself of my limits and weaknesses, which allows me to seek help when I need it and realize when I could be of help to someone else. I love working together with others and believe there is often something to learn from somebody, anybody.

We'd love to hear more about why you set up Afrisnet. What are its goals?

When I started graduate school, I was the only African student in my department, and there had not been any African students in a long time. I wanted to know why, and the graduate office told me it was difficult to reach out to African students, and those who did apply were often severely unprepared. I teamed up with an African colleague, Vincent Mwumvaneza, who had observed a similar lack of African students in his civil engineering graduate program at the University of Illinois at Urbana Champaign. We both had interacted with college students in Rwanda and knew they lacked information about graduate schools in the US and thought this was probably a problem in other African countries as well.

We teamed up and started Afrisnet as a platform to provide information to African students and assist them in the preparation and application to graduate schools in the US or other developed countries. By waving tuition and providing financial assistance to graduate students, several US graduate programs in STEM present a rare opportunity for higher education. We started Afrisnet to make African students aware of and help them take advantage of this opportunity. Our website (https://afrisnet.org/) contains information about graduate schools in the US, and we use the site as an outreach and networking platform. In addition, we engage graduate students, professors, and professionals around the world who show interest in helping expose African students to modern research facilities and practice.

There are many ways that scientists, including cell biologists, can contribute to Afrisnet's cause. For instance, graduate students and postdocs in the US have offered to directly connect with students in African colleges and assist them with graduate school applications or finding a research internship. They are also helping us create course modules to educate African students about research, and some professors provide us with counsel and advice. Because we have an overarching goal of contributing to the development of research and scholarship in Africa, we are also seeking to foster research collaborations between researchers in Africa and those in developed countries. As Afrisnet grows, there will be more projects that we can undertake, and I am looking forward to seeing them unfold and bear fruit.

"By starting Afrisnet, we have offered one way to ease networking and collaborations, and we are inviting more scientists, Africans in particular, to join our network."

How do you envisage the current and future climate for scientific research in African countries?

Unfortunately, Africa is desperately lagging behind in scientific research (2, 3), and this is due to multiple factors, including lack of funding, researchers, and research infrastructure. There are, however, promising efforts being made to improve research volume and quality by both African and international entities that aim to train more African students through PhD programs and fund competent researchers based in Africa (4, 5). I think these efforts need to be accompanied by a stronger political will to mobilize and support Africans in research across the continent. There is currently a push toward the application of new technologies in several African countries, and this is a positive endeavor. However, I would argue that Africans need to also generate and own knowledge, be it in technology or other fields. New knowledge can only be generated through innovative research. In addition, establishing strategic research collaborations with scientists in developed countries will help speed up research development in Africa.

What impact does research experience abroad provide for African students and their home countries?

Many Africans have gained doctoral degrees and research experience abroad and secured prestigious jobs in different countries around the world. In fact, some have become successful scientists and professors in fields ranging from mathematics and physics to geography and astronomy. They work at NASA; they're at Boeing. You'll find them at Microsoft and Apple, and leading major projects at Google and elsewhere. However, very few of them go back to Africa. I would imagine this is due to lack of funding and infrastructure, and they are probably concerned that if they return, their research ambitions will be hampered. It is understandable. In any case, I believe that Africans trained at competent institutions abroad will and should play a critical role in the development of research in Africa. I would like to emphasize that the time is now for these Africans to at least start connecting with one another so they can bring together their talents and expertise for the sake of their home continent. By starting Afrisnet, we have offered one way to ease networking and collaborations, and we are inviting more scientists, Africans in particular, to join our network.

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