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# ASBMB TODAY

THE MEMBER MAGAZINE OF THE AMERICAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY



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AFRICA**



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## EDITOR'S NOTE

# BMB stories from Africa

*By Comfort Dorn*

Just about every day, I need to look up information about an ASBMB member in our membership database. Before I can do a search, I land on a page of pie charts that provide membership demographics. Want to know how many folks in the ASBMB are industry members or between 40 and 49 years old? It knows that.

Among the pie charts is one that sorts by region, which mainly means by continent (though the Caribbean gets its own sliver). Of course, most of the pie is North America — and there's no piece for Antarctica, though I suspect some BMB researchers make it down to McMurdo or other research stations.

The continent with the smallest ASBMB membership slice is Africa.

I first noticed this more than two years ago, and I idly wondered about these members in Africa: Who are they, and what's it like to do research on a continent where many countries are rich in natural resources yet perennially cash-strapped and often politically unstable? I thought it would be great to focus an issue of ASBMB Today on these members. I asked the membership team to send me a list of their names and emails.

But then there was a pandemic, and the world went nuts. For a while, Africa went to my back burner. It simmered there until one of my co-workers helpfully suggested we should schedule that BMB in Africa issue — for

June–July 2022.

So I got an updated list of names and emails. At this point, in late 2021, we had 40 members in African countries: 24 in Nigeria, five in South Africa, four in Egypt, three in Ghana, two in Kenya, and one each in Zimbabwe and Burkina Faso.

I wasn't really sure how it would work, but I sent a little questionnaire to these 40 members, asking if they'd either write us an essay or be interviewed by an ASBMB Today contributor. We also contacted a few U.S.-based members who had moved here from countries in Africa. The results of the responses — plus a couple of fun features — are in these pages.

Our goal here is not to make any sweeping generalizations about science in Africa. It's a huge continent of 54 nations spread across six time zones and almost 12 million square miles with more than 1.2 billion people speaking as many as 3,000 different languages. I'm not qualified to generalize on that scale.

Rather, what we're doing here is what ASBMB Today does best: sharing stories. I've learned a lot from reading these stories. I hope you do too.

**Comfort Dorn** (cdorn@asbmb.org) is the managing editor of ASBMB Today. Follow her on Twitter: @cdorn56.





## Texas award recognizes McLellan's work

**Jason McLellan**, a professor of molecular biosciences at the University of Texas at Austin, has received the Edith and Peter O'Donnell Award in medicine from the Academy of Medicine, Engineering and Science of Texas, or TAMEST. The prize recognizes his contribution to understanding the structure of the SARS-CoV-2 spike protein, which was instrumental to rapid development of vaccines against COVID-19.



MCLELLAN

Working

quickly after the genome of the new coronavirus was reported in January 2020, McLellan's lab used cryo-electron microscopy to determine the first reported structure of the spike protein. The molecule, like other coronavirus spike proteins, undergoes major conformational shifts. Based on earlier discoveries from his lab, McLellan and his team introduced modifications that would stabilize recombinant forms of the protein in a more useful shape for targeting by the immune system, making vaccines more effective. Pfizer, Moderna, Novavax and Johnson & Johnson all used the stabler modification in developing their vaccines, which target the spike protein.

McLellan has studied coronaviruses since 2013. His lab also is exploring vaccine candidates to protect against Nipah virus, respiratory syncytial virus, cytomegalovirus, Crimean–Congo hemorrhagic fever virus and others. McLellan earned his Ph.D. at Johns Hopkins University School of Medicine and did postdoctoral research at the National

Institutes of Health Vaccine Research Center. He was a faculty member at Dartmouth University for five years before moving to UT Austin.

This recent award, conferred by the state's largest interdisciplinary scientific society, was named in honor of major donors to higher education in Texas. It comes with a \$25,000 prize and an award lecture, which McLellan delivered in January. The president of the board of TAMEST said in a statement, "Dr. McLellan's research on stabilizing coronavirus spike proteins has saved countless lives around the world."

## Amacher named Protein Science associate editor

**Jeanine Amacher**, an assistant professor of biochemistry at Western Washington University, recently joined the journal *Protein Science*, which is published by the Protein Society, as an associate editor.



AMACHER

CONTINUED ON PAGE 5

## Outstanding chapter honored

Each year, the American Society for Biochemistry and Molecular Biology honors one of its undergraduate Student Chapters with the Outstanding Chapter Award. This year's winner is the chapter at New Mexico State University, whose faculty adviser is Erik T. Yuhl.

The student members of the New Mexico State chapter are Mohammad Abdel-Hameed Badawy, Autumn Bandy, Gloria Hernandez, Daniel Ibañez IV, Tania Ibarra, Nathan Kleczka, Kayla Moehn, Daniel Montes, Isaac Moreno, Anacristina Muñiz, Clarissa Nuñez, Elena Pearson, Theresa Lukitsch and Fred Serrano.

This award recognizes a chapter that during the previous academic year has demonstrated leadership in their educational activities in the areas of biochemistry and molecular biology, exhibited exceptional commitment to increasing public science awareness, demonstrated interaction with other campus activities and events, and participated in regional and national meetings.



COURTESY OF NEW MEXICO STATE STUDENT CHAPTER

Officers of the New Mexico State University ASBMB Student Chapter are, from left, Theresa Lukitsch (treasurer), Danny Ibañez (president), Mohammad Abdel-Hameed Badawy (secretary) and Clarissa Nuñez (vice president).



## National Academy of Inventors names new fellows

**T**he National Academy of Inventors, a member organization for those who have had patents issued by the U.S. Patent and Trade Office, inducted a new list of academic inventors as fellows in December. The NAI fellows program recognizes the contributions of academic inventors to society and the economy. Five of the 116 new fellows are members of the American Society for Biochemistry and Molecular Biology: Joseph Chappell, Ted Dawson, Anumantha Kanthasamy, Abraham Oommen and Charles Rice.

**Joseph Chappell** is a professor and chair of the pharmaceutical sciences department at the University of Kentucky College of Pharmacy. He is recognized for his research into plant engineering, which includes patents for new ways of producing isoprenoid synthase enzymes (with chimeras of different domains) and sesquiterpene synthase from citrus; he also has patented ways of using cytochrome P450 to produce isoprenoid and terpene compounds.



Chappell earned his Ph.D. in biology at the University of California, Santa Cruz, and was a postdoc at the University of Freiburg and the University of California, San Diego, before he joined the faculty at the University of Kentucky in 1985.

**Ted Dawson** is a professor of neurology at Johns Hopkins University School of Medicine, where he directs the Institute for Cell Engineering. His lab studies the molecular mechanisms of Parkinson's disease, and his patents include biomarkers for the diagnosis of Parkinson's and inhibitors for signaling enzymes involved in Parkin-



son's pathology, including GLP-1R agonists, RIP kinases, immunophilins, PARP1 and LRRK2.

Dawson earned his M.D. and Ph.D. at the University of Utah School of Medicine. He completed a residency in neurology at the University of Pennsylvania before becoming a fellow in neuroscience and a senior clinical fellow in movement disorders at Johns Hopkins, where he became an assistant professor in 1993.

**Anumantha Kanthasamy** is a professor at the University of Georgia who studies the role of environmental neurotoxins and other stressors in the development of Parkinson's disease and other neurodegenerative diseases. He has invented several neuroprotective approaches to block drivers of disease or reduce inflammation, including an inhibitor of Fyn kinase and several modified approaches to inhibiting protein kinase C delta. He also patented a probiotic designed to increase microbiome production of the dopamine precursor L-DOPA.



Kanthasamy earned his Ph.D. in biochemistry at the University of Madras in India and was a postdoc in medicinal chemistry and molecular pharmacology at Purdue University. He was a member of the faculty of Iowa State University from 2002 to 2021 before joining the faculty at the University of Georgia.



**Abraham Oommen** is the founder and chief scientific officer of MatMaCorp, a company that

produces molecular diagnostic devices and techniques that can be used to detect viral and bacterial pathogens as well as mutations or single-nucleotide polymorphisms related to genetic diseases and traits in plants, animals and people.



The company has developed a handheld polymerase chain reaction device for direct detection of pathogens without DNA/RNA purification.

MatMaCorp is Oommen's latest venture; he previously founded a company called GeneSeek, which was bought by the agriculture company Neogen in 2010. He earned his Ph.D. in molecular genetics at the University of Kansas and was a postdoc at the Samuel Roberts Noble Foundation and then worked at LI-COR Biosciences on DNA sequencing instruments before leaving to found GeneSeek.

**Charles M. Rice** is a professor of virology at the Rockefeller University in New York. His research

focuses on hepatitis B and C, among other pathogenic human viruses. His inventions include the development of techniques and cell lines that allow scientists to study hepatitis C virus



and develop antiviral drugs; more recently, he was co-inventor of an approach to use CRISPR to target and eliminate viral sequences from human cells.

Rice earned his Ph.D. in biochemistry at the California Institute of Technology and stayed there for postdoctoral training. For 14 years, he was a member of the faculty at Washington University School of Medicine before moving in 2001 to the Rockefeller University, where for 18 years he was the scientific and executive director for the center for the study of hepatitis C. He received the Lasker-DeBakey Clinical Medical Research Award in 2016 and the Nobel Prize in physiology or medicine in 2020.

## CONTINUED FROM PAGE 3

Amacher's research focuses on the structure of peptide binding domains such as PDZ and SH2, domain families with hundreds of members in the human proteome. Her lab is interested in how interactions between residues in the peptide-binding domain and its target peptide encode distinct peptide binding specificity. Her lab also focuses on position-specific selectivity in bacterial sortases, which covalently modify proteins to attach them to the surface of bacteria. Sortases are used in a number of protein engineering applications and are a therapeutic target for Gram-positive bacteria.

Amacher earned her Ph.D. at

Dartmouth University, where she investigated PDZ domains that regulate the cystic fibrosis transmembrane conductance regulator, or CFTR. She was a postdoc at the University of California, Berkeley, studying E3 ubiquitin ligases and tyrosine kinases before joining the faculty at Western Washington University in 2017. She is also a member of the ASBMB Today editorial advisory board.

## Sung takes over at San Antonio cancer institute

**Patrick Sung**, a professor, interim department chair and associate dean



SUNG

for research at the University of Texas Health Science Center at San Antonio's Long School of Medicine, has taken on another leadership role

there. On March 1, he became the new director of the Greehey Children's Cancer Research Institute. He succeeds interim director Manjeet Rao and former director Peter Houghton.

The institute, founded in 2004, is a group of 18 labs doing research focused on topics related to pediatric



# MEMBER UPDATE

cancers, including cancer genomics, DNA repair, tumor biology and drug development. Research in Sung's lab, which is part of the institute, focuses on DNA damage repair. He studies homologous recombination as a mechanism for repairing double-stranded DNA breaks, focusing on the mechanism of the recombinase Rad51. His lab is known for recapitulating double-stranded DNA repair *in vitro*. Failure of such repair can lead to chromosomal rearrangements that drive the development of cancer; at the same time, cancer cells are unusually adept at repairing DNA damage. Several years ago, Sung's lab found that Rad51 interacts with the well-known BRCA tumor suppressor proteins, suggesting new insights into how BRCA proteins suppress tumor formation.

Sung earned his Doctor of Philosophy degree in biochemistry at the University of Oxford in 1985. He came to the U.S. for a postdoc at the University of Rochester. After starting his faculty career at the University of Texas Medical Branch in Galveston, he worked as an associate professor at UT Health San Antonio before taking a position at Yale in 2003 in the department of molecular biophysics and biochemistry, which he later chaired. He was recruited back to the University of Texas in 2019 as a professor.

Sung has been an associate editor of the *Journal of Biological Chemistry* since 2014. He also is on the editorial board of the journal *Genes & Development* and formerly served on the editorial board of the journal *Molecular & Cellular Biology*.

## Research impact fellowship for Bankston

**Adriana Bankston**, a legislative analyst for the University of California,

has received a 2022 fellowship from Advancing Research Impact in Society, or ARIS, a program supported by the National Science Foundation.



**BANKSTON**

This award, shared with Harinder Singh of the University of California, Irvine, will support a program for training in science policy. The project, titled "Developing the next generation workforce through science policy as a bridge between science and society," will use insights from a course that Bankston and Singh taught at Irvine to develop an educational toolkit for universities and to build a community of practice in science policy and advocacy.

Bankston received her Ph.D. in biochemistry and cell and developmental biology at Emory University and was a postdoctoral researcher at the University of Louisville before becoming a policy and advocacy fellow at the Society for Neuroscience. Today, in addition to her position at UC, she works on numerous initiatives as chief executive officer and managing publisher of the *Journal of Science Policy and Governance* and as a research investigator with the STEM Advocacy Institute. In February, she was part of a panel discussion hosted by the National Academies of Science, Engineering and Medicine's Strategic Council for Research Excellence, Integrity and Trust. She is also an ASBMB Today contributor.

Advancing Research Impact in Society is a project to improve public engagement with science and diversify the research work-

force. Its fellows, selected annually, work on projects that synthesize research to help scientists achieve these goals.

## Order of Alberta for Cyril Kay

**Cyril Kay**, an emeritus member of the ASBMB and emeritus professor at the University of Alberta, has received the Alberta Order of Excellence, the highest honor the government of that Canadian province bestows.

Kay was born in 1931 in Calgary and attended McGill University, where he studied biochemistry. He earned his Ph.D. at Harvard University, working with John Edsall to study the kinetics of bovine



**KAY**

albumin dimerization; he then pursued postdoctoral research at Cambridge University, where he worked on the structures of muscle motor proteins using a variety of techniques, especially circular dichroism.

After returning to Canada in 1958 as a biochemist at the University of Alberta, Kay continued to study muscle motor proteins and also launched a side interest in RNA structures in wheat embryos. He eventually became interested in the structures of a variety of other types of enzymes, glycoproteins and lipid-binding proteins, specifically how binding affected structure and other important attributes of proteins. He published prolifically in the *Journal of Biological Chemistry* and the *Journal of Lipid Research* along with *Science*, *Proceedings of the National Academy of Sciences*, *Biochemistry* and other journals.

Kay's career as a scientific leader

and administrator began when he was asked to co-lead the first protein-focused medical research council group in Canada. He led the group from 1974 into the 1990s, when the Canadian government shifted from supporting medical research council groups to national centers of excellence. He was a founding member of the Protein Engineering Network of Centres of Excellence and later became chair of its scientific advisory board.

Although Kay retired in 1995 after 37 years as a professor, it didn't stick; in 1998, he joined the board of the Alberta Science and Research Authority and soon became vice president of research at the Alberta Cancer Board. He continued to contribute to research administration, and the late 1990s and early 2000s were among his most productive years in terms of research.

## Lemmon named deputy director

**Mark Lemmon**, a professor of pharmacology, molecular biophysics and biochemistry at Yale and co-director of the university's Cancer



LEMMON

Biology Institute, was appointed deputy director of the Yale Cancer Center, a clinical and research institute, in February. Research in Lemmon's lab, which has been part of the Yale Cancer Center since 2015, focuses on receptor tyrosine kinases, or RTKs. These transmembrane receptors include proteins that recognize insulin, epidermal growth factor and other physiologically important signaling molecules. The team is interested in how ligand binding leads

to receptor dimerization and activation and in how the same receptor can bind to and respond distinctly to several different ligands. They also study how mutations to RTKs alter the proteins' structures and signaling and drive a variety of cancers, and what inhibitors might be effective in patients with cancers that show various mutations. Finally, the lab has an interest in RTK-related pseudokinases, some of which can activate signaling through the Wnt signaling pathway.

Lemmon earned his bachelor's degree from Oxford University and his Ph.D. from Yale, where he studied the structural interactions between alpha helices in membrane-spanning proteins. He did postdoctoral research on the structures of lipid-binding pleckstrin homology domains at New York University. Before joining the faculty at Yale, Lemmon was a professor and department chair in biochemistry and biophysics at the University of Pennsylvania's Perelman School of Medicine, where he was on the faculty for 19 years. He is a fellow of the Royal Society.

## Astronaut scholarships for chapter members

Two of the 2021 Astronaut Scholars announced late last year by the Astronaut Scholarship Foundation are ASBMB Student Chapter members: **Qianyun Luo** and **Abigail Sipes**.

Qianyun Luo, who goes by Lexi, is a senior at the University of Wisconsin-Madison majoring in biochemistry and statistics. At Madison, she has worked since her freshman year as a research assistant in an oncology lab, studying tumor cell metabolism. During the summers, she has worked at the University of Texas MD Anderson Cancer Center. She also landed a



LUO

Goldwater Scholarship this year. After she graduates, Luo will join the Medical Science Training Program at the University of Minnesota to pursue an M.D./

Ph.D. with a focus on cancer biology and immunology.

Abigail Sipes, who is from Hawaii, will graduate soon from Purdue University with a degree in biochemistry. During the summers, Sipes has worked as a research assistant in a lab studying tumor progression at the University of Hawaii Cancer Research Center. At Purdue during the



SIPES

school year, she has worked in a plant genetics lab. She also spent one summer as an intern at Bayer Pharmaceuticals. Sipes plans to pursue a Ph.D. in biomedicine, most likely focusing on immune oncology.

Each year, the Astronaut Scholarship Foundation, which was created in 1984 by a group of astronauts from the Mercury 7 missions, makes scholarship awards to about 60 undergraduates in science, technology, engineering and mathematics. The prize includes a \$15,000 scholarship and a conference weekend, complete with a gala.





# Sidney Altman

**S**idney Altman, a molecular biologist who shared the 1989 Nobel Prize for chemistry and was a member of the American Society for Biochemistry and Molecular Biology from 1976 until his retirement in 2014, died April 6 at his home in New Jersey. He was 82.

Altman was born May 7, 1939, in Montreal to Eastern European immigrant parents. His mother, a textile worker, came from Poland, and his father was a grocer from Ukraine, then part of the Soviet Union.

“It was from them that I learned that hard work in stable surroundings could yield rewards, even if only in infinitesimally small increments,” Altman wrote in his Nobel Prize autobiography.

Altman earned a bachelor’s degree from the Massachusetts Institute of Technology, where he played on the ice hockey team, before beginning graduate studies in physics at Columbia University. He left that program after 18 months and later enrolled at the University of Colorado Medical Center to study biophysics with noted DNA researcher Leonard Lerman. Altman’s Ph.D. work focused on the effects of acridines on the replication of bacteriophage T4 DNA.

After stints at Vanderbilt University and Harvard University, Altman went to the Medical Research Council Laboratory of Molecular Biology in Cambridge, England, for postdoctoral work with Francis Crick, who had won a Nobel in 1962, and Sydney Brenner, who would win a Nobel in 2002, among others. He studied the structures of transfer RNAs and nonfunctional tRNA mutants; the research led him to discover RNase P, which processes precursor tRNA into its mature form.

Altman credited that discovery with helping him land a faculty position in 1971 at Yale University, where he remained for the rest of his life. He served as a department chair from 1983 to 1985 and dean of Yale College from 1985 to 1989, an experience that “not only provided me with the opportunity to make many new friends, mostly outside the sciences, but also revealed to me the full panorama of human and academic problems that exist in a university community,” he wrote.

At Yale, Altman continued his studies of ribonuclease P, demonstrating that the enzyme’s RNA subunit was responsible for its enzymatic activity. It was the first known ribozyme, and the idea was somewhat controversial. In a retrospective article published in the *Journal of Biologi-*



*cal Chemistry*, Altman wrote that “many of the rest of the experiments we did for the next 10 years or so were perfectly straightforward from a biochemical point of view. ... What I could not learn from anyone was the complete variety, good to bad, of human reactions to a novel idea: an enzyme had a catalytic RNA subunit.”

Nonetheless, his research at Yale earned Altman the 1989 Nobel Prize he shared with Thomas Cech, a researcher at the University of Colorado, who independently determined that, even in the absence of a protein, RNA molecules could divide themselves into strands.

In addition to the Nobel Prize, Altman received Brandeis University’s Rosenstiel Award in 1988 and the Russian Academy of Science’s Lomonosov Gold Medal in 2016. He was elected a fellow of the American Academy of Arts and Sciences in 1988 and was a member of both the National Academy of Sciences and the American Philosophical Society.

Yale named him a professor emeritus of molecular, cellular and developmental biology in 2014. Although he nominally had retired, Altman’s lab continued its research until 2021, most recently publishing on microbiome sequencing and on anti-sense oligonucleotide inhibitors for RNase P.

According to an article in the *Yale News*, after he won the Nobel Prize, Altman often gave public talks, explaining the challenge of doing science in America — especially for early-career researchers.

Altman is survived by two children, Daniel and Leah, and four grandchildren.

## Sandro Pontremoli

Sandro Pontremoli, a former rector of the University of Genoa and an honorary member of the American Society for Biochemistry and Molecular Biology since 1984, died in June 2021, the ASBMB learned recently. He was 95.



Born January 20, 1926, in Ferrara, Italy, Pontremoli earned a degree in medicine and surgery at the University of Genoa in 1949. He became an assistant in the university's Institute of Physiology, where his research focused on metabolism, lipids and the role of the pancreas.

In 1957, Arturo Bonsignore invited Pontremoli to join the Institute of Biochemistry at Genoa. Bonsignore had been studying enzymes of glycolytic metabolism and became interested in the recently discovered pentose phosphate pathway, which was found to generate NADPH for reductive cell biosynthesis and convert 6-carbon sugars into pentoses, or 5-carbon sugars, for the synthesis of nucleotides and nucleic acids.

Bonsignore sent Pontremoli to the National Institutes of Health to work with Bernard Horecker, the biochemist who had discovered this new metabolic pathway. (Horecker was an ASBMB member from 1947 until his death in 2010, and his work on the pentose phosphate pathway was the subject of a 2005 Centenary Classic in the *Journal of Biological Chemistry*.) This trip to the U.S. marked the beginning of a collaboration that lasted decades, with the two researchers traveling back and forth to each other's labs. Pontremoli accepted a full professorship at the University of Ferrara in 1963 and then moved back to Genoa seven years later. He expanded his work to the study of proteases.

In addition to his research, Pontremoli worked to modernize biochemistry in Italy. He was elected rector, or academic head, of the University of Genoa in 1990 and served in that role for 14 years, opening dialogue with municipal and regional officials and helping to establish the Italian Institute for Technology. He was a member of the Accademia Nazionale dei Lincei, a venerable European scientific institution in Rome, for 30 years.

Giorgio Parisi, president of the Accademia, told an obituary writer (in Italian), "In his long career, (Pontremoli) lived as a protagonist of the glorious biochemistry of the pioneers who discovered the fundamental metabolic pathways, with brilliant intuition strongly linked to chemical knowledge."

## John William Josse

John William Josse, a biochemistry researcher and medical practitioner who joined the American Society for Biochemistry and Molecular Biology in 1963 and was a member for almost 60 years, died Sept. 1 in Seattle, Washington. He was 91.



Josse was born Feb. 20, 1930, in Minneapolis, Minnesota, and attended Pillsbury Military Academy for most of his early education. He then served in the Army until 1949. After being honorably discharged, he attended the University of Iowa on a football scholarship. In the summer of 1950, he met his future wife, Donna Lou Fering. They married in 1951.

Josse transferred to the University of Minnesota in 1951 and subsequently started medical school there. After graduating in 1956, he and Donna moved to Boston for his residency at Massachusetts General Hospital. During that time, they welcomed their daughter Susan and son Paul.

After his residency, Josse studied DNA synthesis with Arthur Kornberg as a postdoctoral fellow at Washington University in St. Louis. Kornberg won the 1959 Nobel Prize in physiology or medicine for isolating the enzyme DNA polymerase. In Kornberg's lab, Josse contributed to the finding that the two chains of the DNA double helix run in opposite directions. When Kornberg moved his lab to Stanford University, Josse followed, and he welcomed his second daughter, Jennifer, while at Stanford.

Josse received a research fellowship to study protein physical chemistry at Johns Hopkins University in the early 1960s. He then moved back to Washington University, serving as a professor and chair of the biophysics and physiology department until 1966. While in St. Louis, he marched for racial equality behind Martin Luther King Jr.

After returning to California, Josse went back to the practice of clinical medicine in San Jose, where he served his patients for 30 years. He then returned to Stanford to support research in Kornberg's lab. He retired in 2007.

According to an obituary, Josse is remembered for his witty sense of humor and his strong work ethic. He had a lifelong love of classical music and was passionate about fitness, running more than 65 marathons when he was over 40.

— Courtney Chandler



## Sampath Parthasarathy

Sampath Parthasarathy, a lipid scientist and cardiovascular researcher at the University of Central Florida, died of pneumonia on Dec. 1, 2020, the American Society for Biochemistry and Molecular Biology learned recently. He was 73.

Born Dec. 27, 1947, in India, Parthasarathy earned his Ph.D. at the Indian Institute of Science in Bangalore and was a post-doctoral fellow at Kyoto University in Japan, Duke University and the University of Minneapolis. He held positions at the University of California, San Diego; Emory University; Louisiana State University and Ohio State University before joining the faculty of the University of Central Florida College of Medicine in 2011. There he held an endowed chair in cardiovascular sciences and served as the associate dean for research. He was also an inventor and held an MBA in technology management.

A recognized expert in lipids, Parthasarathy was credited with the co-discovery, while at UCSD, that oxidized low-density lipoprotein is involved in the initiation and progression of atherosclerosis. The paper on this finding is one of the most cited in atherosclerosis research. He also studied the beneficial effects of exercise and dietary polyunsaturated fats such as sesame oil. He researched both pro- and antioxidants in the context

of multiple inflammatory diseases, including diabetes, endometriosis, Alzheimer's and Crohn's, "always approaching scientific challenges from novel (outside-the-box) perspectives, connecting the dots, and finding parallels that were inconspicuous to others," according to a remembrance in the journal *Arteriosclerosis, Thrombosis and Vascular Biology*.

In addition to being an ASBMB member, Parthasarathy was involved with the American Heart Association, the South Asian Society for Atherosclerosis and Thrombosis, and other societies. He served as editor-in-chief of the journal *Healthcare*, as co-editor-in-chief of the *Journal of Medicinal Food*, and on the editorial boards of numerous other journals, including the *Journal of Lipid Research*. Fondly known as "Dr. Sam," he mentored more than 300 students, postdocs, clinical residents and junior investigators from around the world.

Parthasarathy was preceded in death by his first wife, Kalyani. He is survived by his wife, Linda; sons, Raghuv eer and Bharath Parthasarathy, and their wives; and five grandchildren.



## Henry A. Harbury

Henry A. Harbury, a biochemist, renowned educator and member of the American Society for Biochemistry and Molecular Biology since 1958, died Sept. 18, 2021. He was 93.

Harbury was born Dec. 11, 1927, in the Netherlands. He conducted his graduate studies under Mansfield Clark at Johns Hopkins University, where he researched the oxidation-reduction potentials of horseradish peroxidase. This enzyme now is used in a variety of biochemistry applications, including immunohistochemistry.

Harbury was recruited by Joseph Fruton to the biochemistry department at Yale University. There, he and the graduate students he recruited, including Paul Loach, researched the structure-function relationships of heme proteins, which provided the foundation for many future studies in this field. After Fruton retired, Harbury moved to the University of California, Santa Barbara, in the mid-1960s to join the biological sciences department, where he continued his research on the structure and function relationships of proteins and oxidative enzymes.

Harbury next moved to Dartmouth University, where he served as professor and chair of the biochemistry department from 1972 to 1981 and as president of the medical center starting in 1980. While president, he advocated for the equal admission of women into the student body and into administrative positions, a testament to his lifelong commitment to supporting women in science. He retired from Dartmouth in 1996.

Outside of the lab, Harbury was an esteemed teacher and educator. G.P. Corradin and Alfred Esser, former members of his lab, recall Harbury using lightbulbs and other props to describe the mitochondrial electron transport chain to a captive audience. The late Alfred Gilman, who won the 1994 Nobel Prize in physiology or medicine, wrote that Harbury made "protein chemistry and thermodynamics come to life," and that's what set Gilman down the path of biochemistry.

Harbury is survived by his daughters, Jennifer and Kathy, and his sons, Olin and Alexander.

— Courtney Chandler

# 2022 cohort of NIH MOSAIC scholars

K99/R00 awardees will receive individualized coaching and networking and presentation opportunities tailored to their needs

*By Angela Hopp*

**T**he American Society for Biochemistry and Molecular Biology welcomed five new scholars to the society's second cohort for the Maximizing Opportunities for Scientific and Academic Independent Careers, or MOSAIC, program.

In August 2020, the society received a cooperative agreement with the National Institutes of Health's National Institute of General Medical Sciences to develop and execute a program that will support postdoctoral fellows and new investigators from diverse backgrounds embarking on careers at research-intensive institutions.

In February 2021, the society welcomed seven scholars; in August 2021, the society welcomed another five.

Kirsten Block, the ASBMB's director of education, professional development and outreach, is principal investigator for the program.

"We are excited to establish our second cohort of MOSAIC scholars and look forward to meeting and working with all of them during this important time in their career development," Block said. "In many ways, we have learned as much from our first cohort as they have learned from us. The lessons we have learned in our continued support of our first cohort will strengthen our approach in working with our newest scholars over the next several years. To watch the scholars support each other has been incredibly rewarding, and I am proud of the community of scientists that ASBMB has cultivated through this program."

## Asiya Gusa

Asiya Gusa is a postdoctoral researcher in the lab of Sue Jinks–Robertson at Duke University, where she is studying stress adaptation in the human fungal pathogen *Cryptococcus*.

Gusa was raised in Columbus, Ohio, where she was introduced to research in high school through an apprenticeship program at Ohio State University. She earned a bachelor's in microbiology at Miami University in Ohio in 1999.

She moved to Emory University in Atlanta as a UNCF–Merck fellow to pursue her Ph.D. in microbiology and molecular genetics. There she worked in the lab of June R. Scott on gene regulation and DNA binding of a regulatory protein in *Streptococcus pyogenes*. She earned her doctorate in 2006.

Gusa completed a fellowship in emerging infectious diseases at the Centers for Disease Control and Prevention and was a lecturer, instructor and diversity coordinator for about a decade at several colleges and schools in the South



before joining Duke as a postdoc in 2018. Gusa lives in Durham, North Carolina, with her spouse and two high-school teenagers.

"I look forward to joining a cohort of scholars with a shared interest in making meaningful contributions to science and increasing diversity within the talent pool of researchers. I believe mentorship and peer support are key factors for ensuring success in the pursuit of biomedical research careers," she said.

Her MOSAIC project is titled, "Stress-induced transposon mobilization in the human fungal pathogen *Cryptococcus*."

## Christopher D. Radka

Christopher D. Radka is a postdoctoral researcher in the lab of Charles O. Rock in the infectious diseases department of St. Jude Children's Research Hospital, where he is studying lipid biochemistry.

Radka is a Honduran American raised in Central Florida,





where his family created and still runs a nonprofit called HopeNow Foundation that provides health screenings, runs youth programs, and conducts environmental and humanitarian projects.

Radka earned his bachelor's in biotechnology, molecular biology and microbiology in 2011 at the University of Central Florida. He won entry to the University of Alabama at Birmingham's Equity and Diversity Enhancement Program fellowship and participated in a NASA project that examined the influence of microgravity on protein crystal growth.

During his graduate studies of microbiology and structural biology, Radka was co-mentored by Stephen Aller and Lawrence DeLucas. He earned his Ph.D. in 2017. He also earned two graduate certificates, one in technology commercialization and entrepreneurship and another in education, at UAB.

At St. Jude, Radka is a founding member and co-chair of the Black Employees and Allies Resource Group. He's also a contributor to ASBMB Today. He lives in Memphis with his wife and two children.

"As a product of public education, I am humbled to receive this competitive MOSAIC K99 support to continue my postdoctoral training, and I'm excited to receive the professional development and coaching from the ASBMB MOSAIC program," he said. "The opportunity to be a MOSAIC scholar will amplify my efforts as a principal investigator to promote diversity and inclusion in science, education and career advancement."

His MOSAIC project is titled, "Bacterial anti-inflammatory lipid mediators."

## Chrystal Starbird

Chrystal Starbird is a postdoctoral researcher in the lab of Kathryn Ferguson at the Yale Cancer Biology Institute, where she is studying the structural basis for activation of TAM receptor tyrosine kinases.

Starbird learned to love nature as a kid in Brookline, Massachusetts — so much so that she started a nature club in second grade.

She moved south to the University of North Carolina at Chapel Hill to pursue her undergraduate degree in biology, which she earned in 2008, and then spent a few years working in multiple labs in academia and industry before returning to UNC for a postbaccalaureate program.



She earned her Ph.D. in chemical and physical biology under the direction of Tina Iverson at Vanderbilt University in 2016.

Starbird is co-founder of the Yale Black Postdoctoral Association and Intersections Science Fellows Symposium.

"I am beyond excited to join the ASBMB cohort for the NIH MOSAIC award. I've always dreamed of launching an independent research career following graduate school and my postdoctoral work, and this program will help to make that dream a reality," Starbird said. "Not only will I have funding support but also guidance and mentorship from the ASBMB community. Beyond this, I truly look forward to getting to know all of the postdocs in my cohort and building a community that can support each other as we transition to the next phase of our careers and beyond."

Her MOSAIC project will use structural, biophysical and biochemical approaches to investigate oligomerization in a family of receptor tyrosine kinases and TAM receptors' interactions with co-receptors.

## Kiesha Wilson

Kiesha Wilson is a postdoctoral researcher in the lab of Mitzi Nagarkatti and Prakash Nagarkatti at the University of South Carolina School of Medicine, where she is studying inflammatory diseases and treatments with natural plant products.

A native of West Columbia, South Carolina, Wilson credits a middle school field trip to a local hospital pathology lab with igniting her interest in science.

She earned her bachelor's in microbiology at Clemson University in 2013, during which time she also had a daughter. She did a short stint as an industry microbiologist before matriculating into the University of South Carolina Postbaccalaureate Research Education Program and earning a Ph.D. in biological sciences in 2019.

Wilson volunteers as a mentor for the Science, Mathematics, and Research for Transformation Defense Scholarship Program at the school of medicine and for both the New Hope Leadership Academy and Empowerment Strategies.

"I am elated to be a part of the ASBMB MOSAIC cohort, which includes so many talented and diverse scholars. I fondly anticipate networking with the other MOSAIC scholars, mentors, and ASBMB members, as I



expect there will be a plethora of information to be shared,” she said. “The NIH MOSAIC program will ease the transition from postdoctoral fellow to independent research faculty via financial support, career development and scientific training. As a result, I will become a better scientist, mentor and advocate for STEM education amongst underrepresented minority populations.”

Her MOSAIC project focuses on the role of macrophages in cannabidiol, or CBD, in acute respiratory distress syndrome induced by *Staphylococcus enterotoxin B*.

### Rahel A. Woldeyes

Rahel A. Woldeyes is a post-doctoral researcher in the lab of Wah Chiu at Stanford University, where she is adapting cutting-edge structural biology techniques to accelerate our understanding of the molecular mechanisms leading to cardiovascular diseases.



Woldeyes’ passion for research was ignited as a young child by her desire to understand the cause of her father’s diabetes. This motivated her to pursue biomedical research as a career, and she first earned a bachelor’s degree in biochemistry and chemistry at the University of Minnesota, Twin Cities in 2011. She went on to do her graduate work in the lab of James Fraser at the University of California, San Francisco, as a National Science Foundation graduate research fellow, earning her Ph.D. in 2017.

Woldeyes has experience with mentoring, teaching and outreach to underrepresented students “with the goal of exposing students to biomedical research as a career option and empowering students to pursue their career goals,” she said.

“I’m thrilled to be part of the NIH MOSAIC program. I’m looking forward to building a strong support network with other MOSAIC scholars. I will also use the training and resources provided by ASBMB to further develop my goals as I transition to an independent career.”

Her MOSAIC project is titled, “Cryo-electron tomography to determine crosstalk mechanisms of calcium channels in cardiomyocytes.”

**Angela Hopp** (ahopp@asbmb.org) is executive editor of ASBMB Today and communications director for the ASBMB. Follow her on Twitter: @angelahopp.



## Evolution and core processes in gene expression

July 21–24 | Kansas City, Mo.

This meeting will cover the most recent insights into the cis-regulatory code, how cis-regulatory information is read out by transcription factors, signaling pathways and other proteins, how cellular diversity is created during development and how we can study this problem using cutting-edge genomics technology and computational methods.

**Registration deadline: June 20**

[asbmb.org/meetings-events/gene-expression-2022](https://asbmb.org/meetings-events/gene-expression-2022)



# ASBMB inducts honor society members

*By Tejiri Olafimihan*

**T**he American Society for Biochemistry and Molecular Biology Honor Society (Chi Omega Lambda) recognizes exceptional undergraduate juniors and seniors pursuing degrees in the molecular life sciences at colleges or universities with ASBMB Student Chapters. These students are recognized for their scholarly achievement, research accomplishments and outreach activities.

The honor society inducted 33 new members this year. Meet them here. Learn more about them at [asbmb.org/education](http://asbmb.org/education).

**Emily Adis** recently graduated from the University of Tampa with a major in biochemistry and a minor in Spanish. Her career goal is to improve people's vision as a scientist–ophthalmologist.



**Christopher Baidoo** is a senior at St. Mary's College of Maryland majoring in biochemistry. After graduation in December, he plans to take a gap semester before going to medical school.



**Alex Blatt** is a recent graduate of the University of San Diego majoring in biochemistry with a minor in finance. After earning a Ph.D. in biochemistry at Vanderbilt University, he aims to work in industry research and development.



**Natalie Botros** is a recent graduate of the University of San Diego majoring in biochemistry. Her goal is to become an infectious disease physician.



**Anna Crysler** recently graduated as a biochemistry major from Albion College. After working as a predoctoral research associate, she plans to earn a Ph.D. and then work in academic research or industry.



**Jack Dowling** recently graduated from Ohio State University majoring in biochemistry. He plans to take a gap year and apply to umbrella graduate programs focusing on virology and vaccine development.



**Ronit Gandhi** is a rising senior majoring in biochemistry and mathematics at the University of Nebraska–Lincoln. After graduation, he plans to earn an M.D./Ph.D. dual degree.



**Isabella Gibaldi** is a recent graduate of Wesleyan University majoring in molecular biology and biochemistry. She hopes to work as a primary care physician with a focus on individualized care.



**Dylan Gray** recently graduated from Otterbein University. He plans to earn a master's degree in medical sciences before attending medical school to study sports medicine.



**Jeff Haegelin** is a recent graduate of Wesleyan University majoring in molecular biology and biochemistry. He plans to pursue an M.D./Ph.D. with a focus on oncology, biochemistry or immunology.



# STUDENT CHAPTERS

**Colin Hemme** is a recent graduate of Purdue University majoring in biochemistry. He plans to pursue a Ph.D. in biochemistry at the University of Wisconsin–Madison.



**Jocelyn Hsu** is a recent graduate of Ohio State University with a biochemistry major. She plans to pursue a Ph.D. in cancer biology to become a professor and researcher.



**Rina Jiang** is a recent graduate of Purdue University majoring in biology. She plans to attend medical school in the fall.



**Camden Jones** is a rising senior biochemistry major on the pre-med track at the University of Nebraska–Lincoln. She plans to take a gap year and then attend medical school.



**Sarah Jordan** recently graduated from Grand View University with a double major in biochemistry and biology. She will join the University of Iowa biochemistry and molecular biology Ph.D. program in the fall.



**Emily Kassing** recently graduated from the University of Nebraska–Lincoln as a biochemistry major. She aspires to pursue a career as a family medicine physician.



**Matt Law** recently graduated from the Rochester Institute of Technology with a degree in biochemistry. He plans to enter the graduate biochemistry and molecular biology program at the University of Rochester in the fall.



**Laura Matt** recently graduated from Texas Wesleyan University with a major in biology and a minor in chemistry. She hopes to be accepted into an M.D./Ph.D. program and pursue a career as a physician–scientist.



**Taylor McGee** is a rising senior at Hampden–Sydney College majoring in biochemistry and molecular biology, philosophy and Spanish. After graduation, he wants to pursue a Ph.D. in synthetic biology, biochemistry or immunology.



**Rachel Mojica** is a rising senior at Manhattan College majoring in biochemistry. She is on a pre-med track with the hope of becoming a medical doctor.



**Lillian Nichols** is a recent graduate of Otterbein University. She plans to pursue a Ph.D. in physical inorganic chemistry at Ohio State University.



**Iris Parke** is a rising senior at Marymount Manhattan College double majoring in biomedical sciences and dance. She plans to go to medical school and become a physician–scientist.



**Jesse Pellman** recently graduated from Wesleyan University as a molecular biology and biochemistry major. She plans to work in a lab at the Dana–Farber Cancer Institute before becoming a physician–scientist.



**Emily Reilly** recently graduated from the Rochester Institute of Technology majoring in biotechnology and molecular biosciences. She plans to attend medical school.



**Lauryn Ridley** recently graduated from St. Mary's College of Maryland majoring in biochemistry and biology. She plans to pursue a postbaccalaureate Intramural Research Training Award through the National Institutes of Health and apply to medical school June 2023.



**Jessie Rising** recently graduated from Manhattan College, where she was a biology major and Division I softball player. She has been accepted to Thomas Jefferson University's physician assistant program.



# STUDENT CHAPTERS

**Evan Shelton** recently graduated from Otterbein University. He plans to attend medical school in the fall of 2023 after completing a gap year.



**Alexandra “Lexi” Sherman** recently graduated from Otterbein University with a double major in molecular biology and biochemistry and biology. She plans to attend medical school to become a physician assisting in development of special needs treatment protocols.



**Elaina Stafford** is a rising senior majoring in biochemistry at the Rochester Institute of Technology. After a summer at the Roswell Park Cancer Institute, she plans to pursue a career in pharmaceutical science or medicinal chemistry.



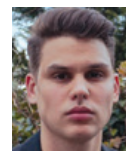
**Keith Sylvestre** is a senior at Stockton University majoring in biochemistry and molecular biology. He plans to attend medical school and possibly specialize in orthopedics.



**Antonieta van den Berg Monsalve** is a recent graduate of Otterbein University majoring in biochemistry and molecular biology. She hopes to gain more research and work experience in preparation for graduate school.



**Luis Vargas** is a recent graduate of Manhattan College majoring in biology. After graduation, he plans to attend medical school with the goal of becoming a neurosurgeon who also performs research.



**Jacob Wellek** recently graduated from St. Mary’s College of Maryland with a major in biochemistry and a minor in Spanish. He plans to do the National Institutes of Health postbaccalaureate Intramural Research Training Award program as a step toward his goal of becoming a health care professional specializing in primary care or anesthesiology.



**Tejiri Olafimihan** ([tolafimihan@asbmb.org](mailto:tolafimihan@asbmb.org)) is the ASBMB’s undergraduate education coordinator.



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ASBMB PUBLICATIONS



# Faith in science

A self-proclaimed ‘geek for God’ works to quell the pandemic in his native land

By Connor O’Hara

**W**hen COVID-19 forced much of the world into lockdown in early 2020, Nicanor Austriaco was on sabbatical in the Philippines, his native country, halfway around the globe from his home in Rhode Island. Although he has spent much of his career studying molecular processes of cell death, he immediately pivoted to help that country’s government forecast and address trends in the pandemic.

Changing course is nothing new for Austriaco, who in 1996 just had completed his Ph.D. in molecular biology when he felt called to the priesthood. In the years since, he has balanced faith and science, living as both a scientific researcher and a Dominican priest in the Catholic Church, and he says his experience as “a geek for God” prepared him for the challenge of the SARS-CoV-2 virus.

## An encounter with God at MIT

Austriaco’s journey has been anything but typical, though he started out on a traditional track for a researcher. Born in the Philippines, he grew up living in Thailand and Malaysia with his parents, who were professors. He came to the U.S. to pursue a bachelor’s degree in bioengineering at the University of Pennsylvania and then did doctoral studies at the Massachusetts Insti-

COURTESY OF NICANOR AUSTRIACO



Since the pandemic began in 2020, Nicanor Austriaco has been working to develop a yeast-based vaccine and help control the spread of COVID-19 in the Philippines.

tute of Technology under Leonard Guarente, working to understand the biology of aging.

“If you had asked me then if I would ever be a priest, I’d have said you’re nuts,” Austriaco said.

Just when he thought he would get serious with his girlfriend and continue his professional development in the field of cancer research, a religious revelation changed his life. An encounter with God during his final year at MIT caused him to change his plans and gave him a deeper understanding of the meaning behind the Catholic life he already was leading.

Austriaco already had accepted a postdoctoral fellowship at University College of London with the Ludwig

Institute for Cancer Research, so he went to London. However, less than a year into this fellowship, he resigned the position to join the Dominican order and returned to the U.S. to attend seminary in Washington, D.C.

After he earned his bachelor’s and advanced degrees in sacred theology and was ordained, leaders of the order sent Austriaco to Providence College in Rhode Island (a Dominican university) to teach and set up a research laboratory. He finished a doctorate in theology in 2015 and now serves as professor of both biology and theology at the college.

Austriaco mentors almost a dozen undergraduate students researching processes of cellular death and studying the pathology of alpha-synuclein

# RESEARCH SPOTLIGHT

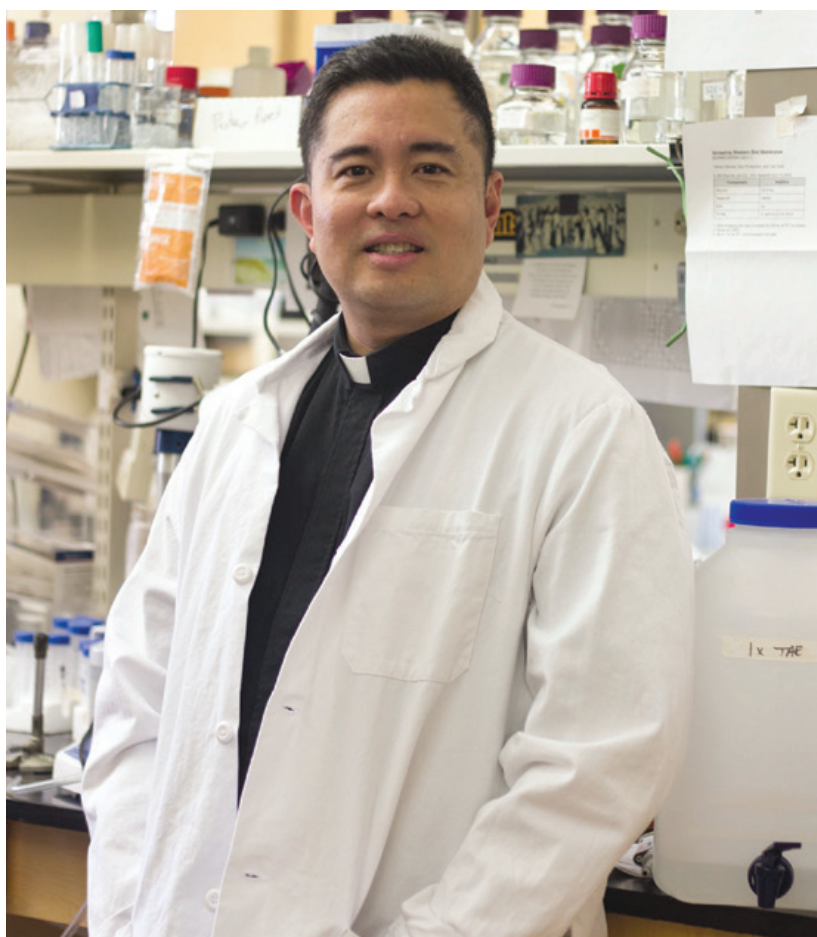
in Parkinson's disease. His lab studies these molecular processes using the common budding yeast *Saccharomyces cerevisiae*, with which he has extensive experience from his time as a doctoral researcher at MIT.

Compared to human cells, budding yeast is an easier model for understanding cellular death, as it has only one homolog of an endoplasmic reticulum–localized calcium channel called Bax inhibitor-1, or BXI1, an anti-apoptotic protein that is upregulated in many forms of cancer. Austriaco and his team take advantage of this amenable nature, genetically altering budding yeast to study the mechanism of BXI1 and its relationship to cell death in yeast and bacteria.

## Pandemic work in the Philippines

Austriaco is also on the faculty at the University of Santo Tomas in the Philippines, where he teaches cell and molecular biology in addition to theological research. While on sabbatical in early 2020, he began helping his country using real-time data to establish epidemiological models that would forecast COVID-19 cases and trends in the pandemic. These models, called DELPHI (short for Dynamic Early warning by Learning to Predict High Impact), initially were developed at MIT, and Austriaco then altered them for the needs of the Philippines. They proved useful in that country's early efforts to understand the virus — so much so that in 2021 the government asked him to be part of the vaccine rollout.

With a significant shortfall of vaccines around the world and limited supply in poorer countries, Austriaco and his teams in both Rhode Island and the Philippines developed a second epidemiological model to



COURTESY OF NICANOR AUSTRIACO

**Nicanor Austriaco, a scientific researcher and a Catholic priest, teaches both biology and theology at Providence College in Rhode Island.**

analyze the geographical distribution of vaccines and develop a nationwide strategy based on the fact that much of the country's population lives in the National Capital Region of Manila and eight other metropolitan areas and that the earliest waves of COVID-19 always began in the capital before spreading throughout the archipelago. The strategy, called NCR+8, was to vaccinate these regions first, thereby indirectly protecting the rural population.

"The Philippines has every single type of vaccine at the moment due to a scraping of the bottom of the barrel," Austriaco said. "It became key to understand who to deploy them to first, and which populations."

The national government of the

Philippines adopted the strategy, and now every adult in the capital is vaccinated. Vaccinating people in the countryside has been more challenging, and population distribution has not been the only issue.

"Only 44% of Filipino families own a refrigerator," Austriaco said. "Imagine what a lockdown for two months was like under these circumstances. ... No student in the Philippines has gone to school for two years."

Families live in multigenerational households, he said, so allowing the young to go out and be exposed to the virus would risk the lives and safety of their elders — "the wealth and memory of our society."

People willingly sacrificed their

personal freedom for the greater good, he said, and Filipinos are resilient. “I guess it helps when you have 20-some hurricanes a year. Their motivation for staying locked down is love, not just simple compliance with public policy.”

## A yeast-based vaccine

Austriaco’s efforts during the pandemic go beyond public health modeling. Using his knowledge of genetic modification of yeast, his research teams are working to develop a vaccine using the probiotic *Saccharomyces boulardii*.

“I came across a paper in November 2020 that discussed using yeast to deploy antibodies into the gut,” he said. “So I thought, if you are able to deploy proteins into the gut using yeast, you should be able to deploy antigens as well. I wondered whether we could genetically engineer *boulardii* so that it would secrete the receptor binding domain of SARS-CoV-2.”

His lab now has the RBD expressed in *boulardii* for the Wuhan, alpha, delta and omicron strains, with other variants to be produced as they are identified. The vaccine candidates, made at Providence College, are being tested in animal models in the Philippines.

“We’re developing an oral vaccine that you can put on the shelf for two years,” Austriaco said. “We are planning to finish the first animal trials by the end of March.”

In recent months, the Philippines has moved the NCR and several other provincial regions to the lowest alert level, allowing many businesses as well as research laboratories to reopen. Despite this, Austriaco and Philippines officials who never have been through the process before still have much to learn about the regulatory

side of developing vaccines.

“The Philippines has never really locally developed a vaccine, so there are learning phases on the regulatory side,” Austriaco said. “The goal is to make the Philippines vaccine-independent for future pandemics.”

For Austriaco, the process is not just about developing a vaccine but also about building new infrastructure and regulatory policy in his homeland. “This is why I am willing to invest whatever it takes,” he said.

Like many other scientists, Austriaco believes the omicron variant paves the way for substantial immunological protection, and he sees a clear trajectory for COVID-19 to move from pandemic to endemic. His passion for learning and his faith have kept him motivated.

“My inspiration for this (work) comes from walking around praying the rosary and seeing the destruction that the pandemic has brought to my people,” he said. “Many have gone from poverty to extreme poverty. All the work that I do is for them, who have no voice. The sooner we get out of this pandemic, the sooner that all of us, in particular my poorest brothers and sisters, can begin to recover their lives.”

He also has a message for the American people: “Appreciate the blessings that you have had. So long as the pandemic persists in the U.S., it is a threat to the Philippines and other poor countries around the world. Let’s all try to have a global perspective that will have us become a part of the global solution.”

**Connor O’Hara** (oharacp@mymail.vcu.edu) is a graduate student in the department of medicinal chemistry at the school of pharmacy at Virginia Commonwealth University. Follow him on Twitter: @oharacp\_vcu.



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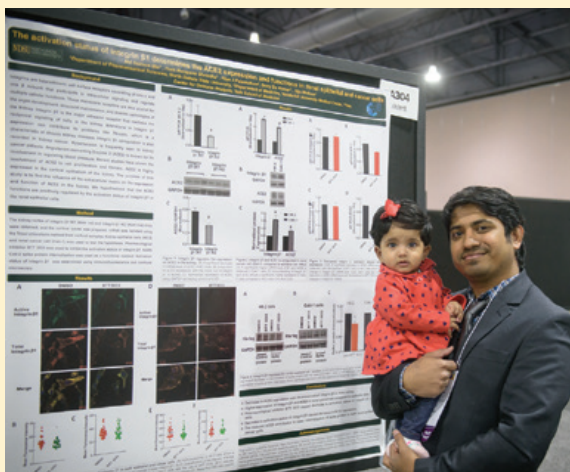






# Scenes from

The American Society for Biochemistry and Molecular Biology held its 2022 annual meeting April 2–5 in the City of Brotherly Love. Here are some scenes from that gathering — the ASBMB’s first in-person meeting since 2019 and its final year as part of Experimental Biology. Turn to page 69 of this issue to read about Discover BMB 2023, the society’s stand-alone meeting scheduled for March 25–28 in Seattle.





# Philadelphia



# Novel eicosanoids from the COX-2 reaction: 5-hydroxy-prostaglandins

By Fumie Nakashima & Claus Schneider

**H**ow are novel bioactive lipids discovered?

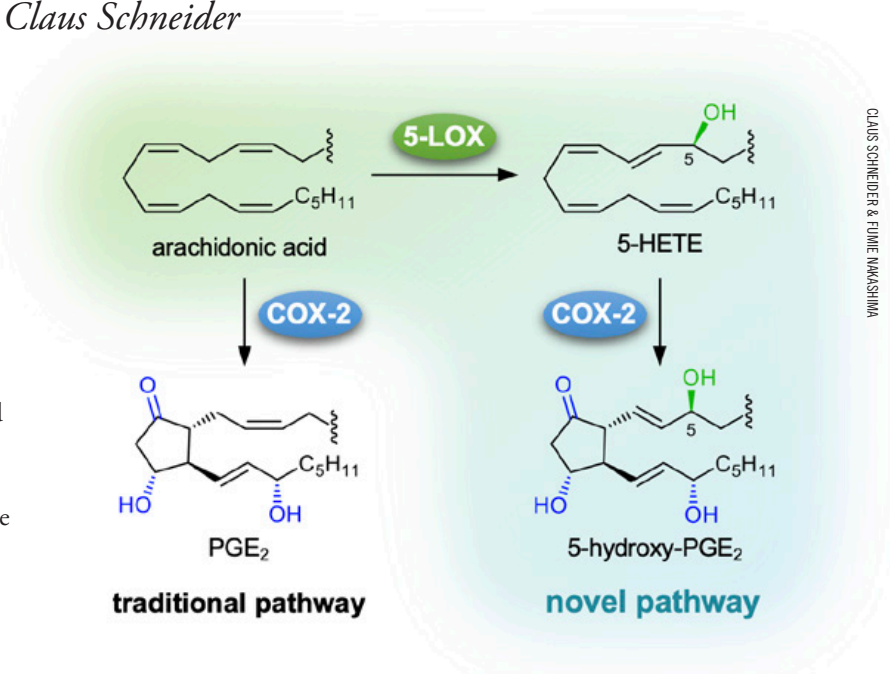
The traditional approach has been to purify and identify the compound that mediates a biologic effect of interest, and in some cases, the novel compound is an eicosanoid, a bioactive lipid derived from oxygenation of arachidonic acid. Prostaglandins were discovered via that route in the 1950s and '60s and then cysteinyl-leukotrienes, the long-coveted slow-reacting substance of anaphylaxis, or SRS-A, in the late 1970s. Prostaglandins mediate pain, fever and inflammation and are targets of nonsteroidal anti-inflammatory drugs like aspirin and ibuprofen. Cysteinyl-leukotrienes are bronchoconstrictors and targets in the treatment of asthma.

Other eicosanoids were discovered before their biologic function was known because they were formed



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**5-Hydroxy-prostaglandins are formed when cyclooxygenase-2 reacts with 5-hydroxy-arachidonic acid, a 5-lipoxygenase metabolite of arachidonic acid. Traditional prostaglandins, like PGE<sub>2</sub>, are formed from arachidonic acid.**

abundantly or detected readily in a biochemical transformation or as products formed from radiolabeled arachidonic acid added to cells and tissues. Lipoxins and other lipoxygenase products are examples of eicosanoids that were identified biosynthetically and structurally prior to knowing their biological function. It took some time before researchers discovered that lipoxins and their eicosapentaenoic acid- and docosahexaenoic acid-derived analogs help resolve inflammation, a role quite different from the proinflammatory prostaglandins and leukotrienes.

Another approach to finding novel eicosanoids is to test novel substrates for known biosynthetic enzymes such

as cyclooxygenases. Ethanolamine and glyceryl prostaglandins were discovered that way. The same approach led to testing whether 5-hydroxyeicosatetraenoic acid, or HETE, the 5-lipoxygenase-derived 5-hydroxy derivative of arachidonic acid, was a substrate for the cyclooxygenase, or COX, enzymes. That made some sense since the 5,6-ene is the only one of the four double bonds of arachidonic acid not involved in the transformation to the endoperoxide prostaglandin H<sub>2</sub>, or PGH<sub>2</sub>. It is shifted to a 6,7 trans-ene in 5-HETE.

In 2006, researchers discovered that 5-HETE was a substrate for COX-2 (but not for COX-1) and yielded an endoperoxide in which the typical



five-membered prostanoid ring was expanded to a seven-membered ring by insertion of molecular oxygen. This was an unexpected product, since the formation of 5-hydroxy-prostaglandins, or 5-OH-PGs, would have seemed more intuitive.

Our recent paper shows that 5-OH-PGE<sub>2</sub> and 5-OH-PGD<sub>2</sub> actually are formed in the COX-2 reaction with 5-HETE. Our lab also found that the enzyme formed 5-OH-PGH<sub>2</sub> as the true enzymatic product, which spontaneously rearranges to 5-OH-PGE<sub>2</sub> and -D<sub>2</sub>, in parallel to a seven-membered endoperoxide that rearranges to hemiketal eicosanoids HKE<sub>2</sub> and HKD<sub>2</sub>.

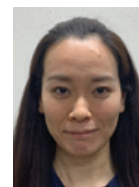
Two aspects of 5-hydroxy-prostaglandins are worth noting. First,

they are much less stable than their traditional prostaglandin counterparts PGE<sub>2</sub> and PGD<sub>2</sub>. While we detected them in a carefully analyzed biochemical reaction, we did not detect them in activated human leukocytes unless the cells were treated with sodium borohydride to reduce the unstable beta-hydroxy-cyclopentanone moiety to the stable 1,3-diol such as that present in PGF<sub>2α</sub> and isoprostanes. Second, their inability to activate traditional prostanoid receptors (all were tested except DP<sub>2</sub>) suggests their biological roles may be unique and distinct from traditional prostaglandins.

Consistent with their biosynthesis combining elements of the pro-inflammatory leukotrienes and prostaglandins, we might speculate

that 5-OH-prostaglandins have a role in inflammation, but researchers do not yet know what exactly that may be. The biological effects of the novel 5-hydroxy-prostaglandins have yet to be discovered.

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**Claus Schneider** (claus.schneider@vanderbilt.edu) is a professor of pharmacology at the Vanderbilt University School of Medicine.



## Upcoming ASBMB events and deadlines

JUNE

JUNE

- Pride Month*
- 20 Gene expression conference regular registration deadline
  - 28 Inside look: Becoming an early-career reviewer at the NIH (webinar)
  - 29 First installment of the "School's out for summer" book club on gender equity (virtual event)

JULY

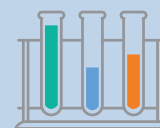
JULY

- Sarcoma Awareness Month*
- 1 Mass spectrometry conference registration deadline
  - 7–10 **O-GlcNAc regulation of cellular physiology and pathophysiology conference**
  - 14 Transcriptional regulation conference oral abstract deadline
  - 20 Second installment of the "School's out for summer" book club on gender equity (virtual event)
  - 21–24 **Evolution and core processes in gene expression conference**

AUGUST

AUGUST

- 1 Transcriptional regulation conference early registration deadline
- 2 Epigenetic regulation conference abstract submission deadline
- 2 Epigenetic regulation conference early registration deadline
- 14–18 **Mass spectrometry in the health and life sciences conference**
- 18 Transcriptional regulation conference poster abstract deadline
- 28 Transcriptional regulation conference regular registration deadline
- 29 Epigenetic regulation conference regular registration deadline



ASBMB

# The fate of genes in differentiation

Transitional chromatin structures facilitate sperm cell production

By *Brian O’Flynn*

**S**perm production through spermatogenesis originates from spermatogonial stem cells, or SSCs, which undergo several morphological and functional transformations in their differentiation. But what is the fate of cells selected for differentiation (producing sperm cells) compared to those chosen for self-renewal (producing more SSCs)? How do these processes affect the structure of their prized genetic cargo? Error in this process can lead to male infertility, so precision is key.

Scientists believe dramatic alterations in 3D chromatin structure occur throughout these processes, but this has never really been pinned down. Yi Zheng, Lingkai Zhang, Long Jin, Pengfei Zhang and colleagues from Northwest A&F University in Shaanxi, China, and Sichuan Agricultural University in Sichuan, China, probe this phenomenon in a recent paper in the **Journal of Biological Chemistry** to uncover exactly how chromatin structure changes.

Exploring chromatin dynamics requires extremely high-resolution data. However, as Zheng said, “With the rapid development of omics techniques, it is now possible to study this topic in much more detail.”

This did not mean things were easy, however.

“We found that this resolution required an input of about 20 million cells,” Zheng said. “This means that hundreds of mice would need to be sacrificed.”

To avoid this, they switched to a

larger model organism — the pig. Even still, sample collection required an abundance of patience — 14 months’ worth. “This took almost a year longer than expected,” Zheng said. “The two rare cell populations (undifferentiating and differentiating spermatogonia) have to be from different ages of pigs (90 days and 150 days, respectively) and be enriched by different, laborious methods.”

Once these samples had been collected, the researchers assembled an advanced bioinformatics pipeline for data analysis, incorporating a new technique, high-throughput chromosome conformation capture, as well as RNA sequencing and chromatin immunoprecipitation sequencing. “As we used a novel bioinformatic technique, learning and building up the pipeline was quite tricky and time-consuming,” Zheng said.

Their patience was rewarded. The data indicated that chromatin architecture was weakened when an SSC was chosen for differentiation. “Spermatogonial differentiation is, in essence, a transitional process that gradually prepares the genome for the subsequent meiotic events,” Zheng said.

Their pursuit of high-resolution data also had the benefit of visualizing how transcriptional regulation functioned during this process. Each scale of chromatin structural variation during differentiation appears to play a discrete role in dynamic gene expression. All this combines to give vital insight into the mechanisms for



**Spermatogonial stem cells undergo several structural changes to begin the process of spermatogenesis. These changes are tied to significant alterations in chromatin structure to prepare it for subsequent steps toward sperm cell production.**

SSC development.

After all this, it seems everyone was won over by the humble pig. “I would like to stress that the value of pigs as a model species is evidently underestimated,” Zheng said. “Pigs share more similarity with humans in terms of anatomy, physiology and genetics than mice, and pigs are increasingly used in translational studies in the hope of moving xenotransplantation to the clinic, as organ sources. I’m committed to establishing a stable, long-term culture system for porcine spermatogonial stem cells.”

DOI: 10.1016/j.jbc.2021.101559

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# Stem cells: Nefarious escape artists of a rare disease

By Sarah May

There is no cure for Niemann–Pick type C1, or NPC1, disease — a progressive neurological condition that often begins in infancy. With early onset, children may live for only five years. One of the first signs of NPC1 disease is a swollen abdomen due to an enlarged liver or spleen. Doctors and researchers do not yet know what causes this, but left untreated, it can be life-threatening.

NPC1 disease is caused by mutations in the NPC1 gene, which encodes a protein that transports cholesterol. In a 2008 study, researchers suggested that hepatic loss of NPC1 induced extramedullary hematopoiesis (the generation of white blood cells from stem cells outside the bone marrow) in the liver. There, the stem cells proliferate and contribute to an enlarged and inflamed liver. However, they found no direct proof of extramedullary hematopoiesis, and effects on the spleen were unclear.

In a recent study published in the **Journal of Lipid Research**, Anouk Groenen, Anouk La Rose and colleagues at the University Medical Center Groningen report that loss of NPC1 in hematopoietic stem cells triggered stem cells to leave the bone marrow and invade the spleen.

It was NPC1's role in cholesterol trafficking, a research focus of their laboratory, that first caught the researchers' attention. NPC1's normal function, which shuts down in NPC1 disease, is to empty out

cholesterol from storage compartments inside the cell.

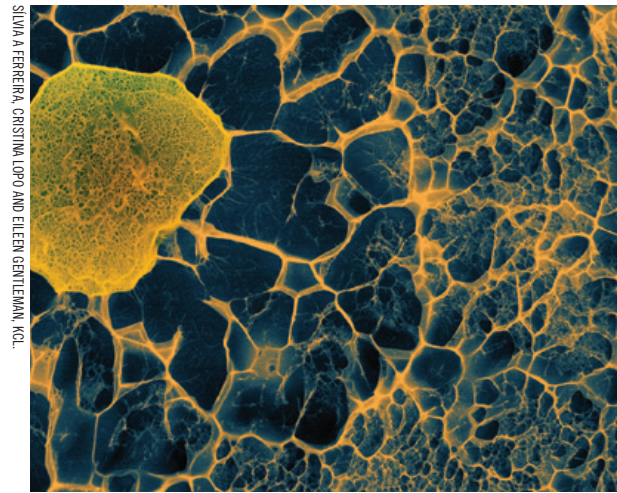
When the team deleted NPC1 from hematopoietic stem cells in mice with high cholesterol, something was obviously happening. They noticed that the bones of these mice were almost white, La Rose said. “We saw that there were almost no stem cells left in the bone marrow and that they had migrated to the spleen, and we were very surprised to see this.”

Hematopoietic stem cells leave the bone marrow in response to a growth factor called granulocyte-colony stimulating factor. If growth factor levels are kept in check, the stem cells stay in the bone marrow where they belong. In the research team's mouse model, growth factor expression went up. It was also higher in NPC1 patients than people without the disease.

“I think this is a first step — to look at the things that we see in the mice, if this also happens in NPC1 patients,” Groenen said.

Next, they would like to see that the hematopoietic stem cells are entering the blood in NPC1 patients, La Rose said. “If we can show that, then it's very likely that, indeed, they also go to the spleen and perhaps the liver in the patients.”

One potential link between loss of NPC1, elevated growth factor and stem cell mobilization is buildup of 7-ketocholesterol. This oxidized form of cholesterol is a



A colored image of a human stem cell (yellow) embedded within a 3D matrix that mimics the bone marrow environment, as captured by cryo-scanning electron microscopy.

main component of oxidized low-density lipoprotein, one of the major cholesterol carriers in the blood.

Previously, a small clinical trial attempted to raise levels of E06 antibodies that neutralize oxidized low-density lipoprotein. It was unsuccessful in raising E06 levels, Groenen explained, and there were no NPC1 patients in the study.

“I think for future studies it will be very interesting to find a way to raise E06 levels in patients,” La Rose said. If successful, this might halt the progression of NPC1 disease. DOI: 10.1016/j.jlr.2021.100167

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# Proteases implicated in ulcerative colitis

By Nivedita Uday Hegdekar

Ulcerative colitis, or UC, is a form of inflammatory bowel disease characterized by chronic and relapsing large intestine inflammation. Genetics account for only a minority of UC cases; hence, to develop treatments, researchers need to understand better the environmental contributions to this condition.

Gut microbes are in perpetual contact with the gastrointestinal tract, so they comprise important but poorly defined environmental variables contributing to UC development. Many studies have reported changes in gut microbiome composition in patients with UC compared to healthy individuals. While that suggests a potential role for gut microbes in UC pathogenesis, researchers have yet to pinpoint the causative microbes and associated bacterial proteins.

Dennis Wolan's lab at Scripps Research is interested in identifying small-molecule activators and inhibiting bacterial enzymes involved in proliferation of human disease. Wolan said he was curious about what bacterial enzymes of the microbiome contribute to UC development.

"Many publications have focused on the role of the microbiome in both health and disease states," he said. "Most of these were focused on the taxonomical and phylogenetic differences in the microbiome. But what about the associated bacterial proteins? What proteins are these

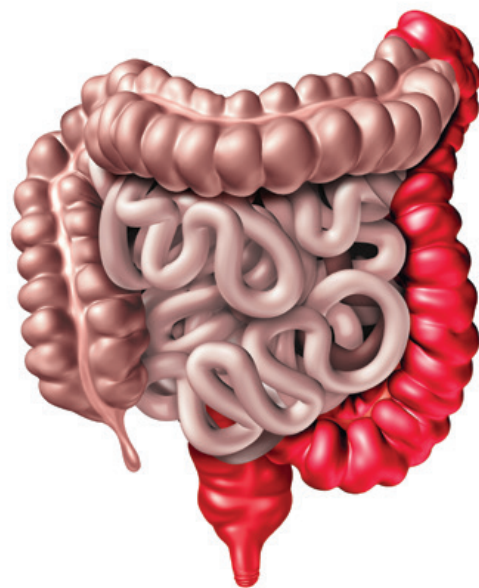
gut bacteria making in disease conditions, and how are these interacting with the human body?"

One protein of interest was serine proteases, a type of proteolytic enzyme that cleaves peptides at the serine amino acid. Researchers long have recognized that they coordinate many physiological processes and play key roles in regulating the inflammatory response. Previous studies have suggested increased proteolytic activity in microbial samples harvested from people with inflammatory disorders such as UC and Crohn's disease.

Peter Thuy-Buon, a graduate student and later a postdoc in the Wolan lab, led a project to study differential protein expression in healthy and UC fecal samples. He and the team described the project in a recent paper in the journal **Molecular & Cellular Proteomics**. In addition to standard mass spectrometry, Thuy-Buon used a small molecular approach called affinity-based proteomic profiling to target and enrich for different types of proteases in the fecal samples.

"We showed that there were 176 discrete host and microbial protein groups differentially enriched between healthy and UC patients," Wolan said. "Furthermore, further enrichment of these proteins showed significantly higher levels of serine proteases in UC patients."

This finding has inspired exciting future research questions. For example, are elevated serine proteases



the driver of UC or merely the effect of UC disease progression?

"There is a lot of exciting work to be done using these findings," Wolan said. "Future molecular studies should focus on how serine proteases might be contributing to UC and whether their levels can be manipulated to modify disease progression."

Functional proteomics has shown the potential role of serine proteases in UC. Future steps will include drug discovery and design of small-molecule regulators of bacterial enzymes.

Wolan said, "Ultimately, the moderation of microbiome distribution in UC via external small-molecule intervention can serve as a foundation for UC prevention and treatment."

DOI:10.1016/j.mcpro.2022.100197

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# From the journals

By Aparajita Banerjee, Isabel Casas & Anju Duley

We offer summaries of papers recently published in the **Journal of Biological Chemistry**, the **Journal of Lipid Research** and **Molecular & Cellular Proteomics**.

## A novel pathway for DNA mismatch repair

One of the major DNA repair mechanisms is the DNA mismatch repair, or MMR, system, which corrects replication errors that make it past the proofreading process during DNA replication. Mutations in several components of the MMR system can lead to cancer initiation and progression in a multistep process involving repression of tumor suppression genes and oncogene activation. In eukaryotes, the MMR system functions both in an exonuclease 1, or EXO1, dependent and independent fashion. While the EXO1-dependent mechanism is well known, researchers do not yet fully understand the EXO1-independent mechanism.

In a recent **Journal of Biological Chemistry** article, Lyudmila Kadyrova of the Southern Illinois University School of Medicine and a team of researchers identified a novel EXO1-independent MMR mechanism in which the enzyme DNA2 plays a key role. DNA2 is both a nuclease and a helicase, which means it can both cut and unwind DNA strands.

The scientists showed that the nuclease activity of DNA2 is able to promote an EXO1-independent MMR reaction via a mismatch excision-independent mechanism involving DNA polymerase delta specifically. They further determined that the helicase activity of DNA2 is not necessary for

its ability to enhance the MMR reaction. In addition, the researchers showed that DNA2 acts in the EXO1-independent MMR reaction by increasing the strand displacement activity of DNA polymerase delta. The authors conclude these results provide a novel mechanism for MMR in an EXO1-independent fashion.

DOI: 10.1016/j.jbc.2022.101831

## How oxysterols affect immunity

The role of cholesterol and related metabolites in immune responses is an interesting area of research since recent studies have suggested their emerging role in immune cell activation and function. Recent developments in lipidomic studies have helped decipher this relationship. Oxysterols are formed by the oxidation of cholesterol or its precursors, and research in recent decades has shown that oxysterols play critical roles in both innate and adaptive immune responses.

In a review recently published in the **Journal of Lipid Research**, William Griffiths and Yuqin Wang from Swansea University Medical School in the United Kingdom discuss the roles of a few oxysterols in the immune response against pathogens. The researchers highlight two oxysterols, 25-hydroxycholesterol and 7-alpha, 25-dihydroxycholesterol, that are involved in various immune responses. Activation of Toll-like receptors triggers the synthesis of 25-hydroxycholesterol by the macrophages to defend against infection by microbial pathogens.

On the other hand, 7-alpha, 25-dihydroxycholesterol is involved in immunology by acting as chemoattractant to lymphocytes expressing G protein-coupled receptors and plays important roles in coordinating the action of various cells in secondary lymphoid tissues.

Researchers are just beginning to understand these roles of oxysterols in immunology. This knowledge will lead to future investigations about their roles in immunology, particularly in autoimmune diseases.

DOI: 10.1016/j.jlr.2021.100165

## Does Alzheimer's affect global proteome turnover?

The rate of protein turnover in cells depends on the rate of protein synthesis and degradation. Depending on the tissue, proteins can have different turnover rates. For example, proteins in mammalian brains have a higher rate (minutes to days) than skeletal muscle proteins (typically weeks). Researchers believe that imbalances in protein turnover are a primary factor in common neurodegenerative diseases such as Alzheimer's. Due to such imbalances, some neuronal proteins misfold and form aggregates that cannot be restored to their native form. Scientists do not yet know if neurodegenerative diseases affect proteome turnover beyond the brain.

In a recent article in the journal **Molecular & Cellular Proteomics**, Byron Andrews

## Limited oxygen in utero has long-term effects

Hypoxia is the state of insufficient oxygen in tissue, and chronic hypoxia refers to long-lasting low oxygen content in the blood. Hypoxia during pregnancy affects more than 2% of the world population, especially people living at high altitudes. It disrupts development of the embryo, which increases the risk of multiple chronic diseases, including diabetes, cardiovascular disease and kidney disease, in adulthood.

In a recent paper in the journal **Molecular & Cellular Proteomics**, Stefan Rudloff at the University of Bern, Andrea Bileck at the University of Vienna and a team of researchers describe the effects of chronic hypoxia on mouse fetal kidneys. By comparing the proteomes of kidneys subjected to hypoxia and kidneys under normal oxygen conditions, they determined that hypoxia causes significant deregulation of proteins related to kidney development, metabolic adaptation and premature aging.

Nephrons are the structural and functional unit of the kidney. Under hypoxic conditions, fewer nephrons form, increasing the risk of renal dysfunction and failure in adulthood. Furthermore, chronic hypoxia causes neutrophils to accumulate at sites of nephron formation, causing the tissue damage and DNA oxidation observed in hypoxic fetal kidneys.

In response to insufficient oxygen, cells try to adjust metabolic pathways by shifting from oxygen-

dependent oxidative phosphorylation to oxygen-independent glycolysis to extract energy from sugars. The researchers observed elevated levels of all 10 enzymes involved in glycolysis in hypoxic fetal kidneys. They found that the protein Klotho, which functions as both an intracellular anti-inflammatory and a systemic anti-aging factor, already was down-regulated in fetal kidneys.

The authors concluded that the steps fetal cells take to survive hypoxia, instead of growing normally, can predispose tissues to faster aging in adulthood. Researchers can use the characteristic biomarkers of this accelerated aging to detect and target human diseases caused by chronic hypoxia.

DOI: 10.1016/j.mcpro.2021.100190

— Anju Duley

at the Medical Research Council Laboratory of Molecular Biology in the U.K. and a team of researchers describe their study of global proteome turnover at different stages of Alzheimer's disease and amyotrophic lateral sclerosis, or ALS, in three transgenic mice models. Healthy mice were used as the control for the experiment.

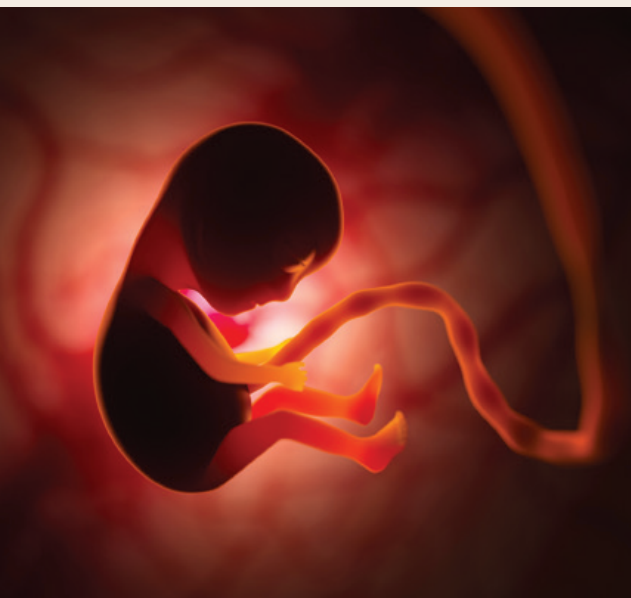
The researchers' results showed an increase in global average protein turnover at a later stage of disease in all three mouse models. This suggests that protein repair mechanisms are increasingly active as the disease progresses. The change in turnover was limited to the proteins of the forebrain, the region affected by Alzheimer's disease. Turnover in serum and liver proteins was unaffected. In contrast to the disease models, global proteome turnover in healthy mice showed a steady decrease with aging. The authors attributed this to the slowdown of protein degradation through autophagy with aging.

DOI: 10.1016/j.mcpro.2021.100192

## The role of a key player enzyme in cell survival

Glutathione peroxidase 4, or GPx4, is an antioxidant enzyme that directly reduces peroxidized phospholipids in the cell membrane. It is also an essential regulator of ferroptosis — nonapoptotic cell death induced by lipid peroxidation. Researchers believe GPx4 cytosolic isoform plays a key part in inhibiting ferroptosis in somatic cells; however, they do not yet understand the role of the mitochondrial isoform, or mGPx4, in cell survival.

In a recent **Journal of Biological Chemistry** article, Kunihiko Azuma of the ophthalmology department at the University of Tokyo and collaborators describe how they studied cell





survival using mice with conditional knockouts, or KOs, for all GPx4 isoforms, which present a cone-rod dystrophylike phenotype.

The authors showed that mGPx4 KO mice lose their cone photoreceptors during maturation, whereas rod photoreceptors persisted through maturation but then gradually degenerated. They also showed that the retina of mGPx4 KO mice presented

increased levels of peroxidized phosphatidylethanolamine esterified with docosahexaenoic acid.

Overall, the researchers write, “mGPx4 is essential for the maturation of cone photoreceptors, but not for the maturation of rod photoreceptors, although it is still critical for the survival of rod photoreceptors after maturation.”

DOI: 10.1016/j.jbc.2022.101824

## When lipid profile meets lipoprotein metabolism

High-density lipoprotein and low-density lipoprotein, or HDL and LDL, act as vehicles to carry cholesterol in the blood. To transport cholesterol between organs of the body, these lipoproteins bind with cholesteryl ester, or CE, the esterified form of cholesterol. The levels

## Great strides in lipidomics

Lipid metabolism plays an important role in keeping a body healthy. Inside all living organisms, intricate networks of biochemical pathways help generate various lipid molecules and control their interactions with other cellular biomolecules. Studying these dynamic processes helps us understand their normal function and how dysfunctionality leads to diseases. The field of lipidomics covers the complete study of lipid biochemistry, spanning from biogenesis to metabolism, using the advanced techniques of mass spectrometry, or MS.

For more than a century after lipids were identified, before appropriate technology was available, structural analysis of lipid molecules and study of their metabolism were extremely challenging. With the invention of advanced techniques, the field has bloomed. In their introduction to a recent thematic review series in the **Journal of Lipid Research**, Xianlin Han of the University of Texas Health Science Center at San Antonio and Richard Gross of Washington University in St. Louis write about advances in lipidomics from the field's beginning in the 1980s to its current state and prospects for the future.

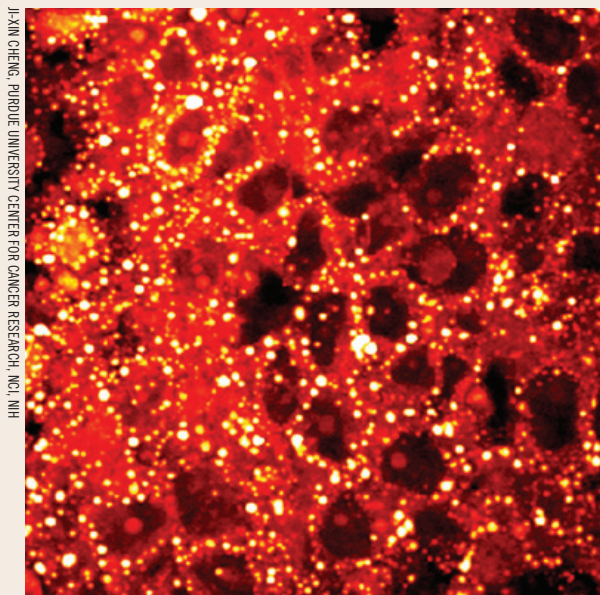
Han and Gross discuss the structural complexities of lipid molecules and their diverse structural and functional roles inside the cells. Historically, various analytical methods including chromatographic techniques, MS using hard ionization techniques, nuclear magnetic resonance and spectroscopic analysis were used to analyze lipid molecules. The advent of soft ionization methods of mass spectrometry in the 1980s revolutionized the study of lipid molecules, as these techniques allowed easy detection and quantification of individual lipid moieties, thereby constituting the foundation of

modern era lipidomics.

Since then, with tremendous growth in the field, researchers have been able to identify and quantify low-abundance lipid molecules, characterize various lipid moieties and their spatial distribution in subcellular organelles, and study the clinical aspects of lipid metabolism. In the future, researchers expect lipidomics to help to decipher cellular processes as an integral part of collective omic technology.

DOI: 10.1016/j.jlr.2021.100164

— Aparajita Banerjee



This label-free stimulated Raman scattering image shows the storage of cholesterol ester in lipid droplets (bright dots) in aggressive human prostate cancer.

## Life-or-death mitochondrial quality control

Apoptosis, or programmed cell death, is a critical process for the homeostasis of cell populations. Disturbances to this mechanism can lead to cancer and other immune and neurodegenerative diseases.

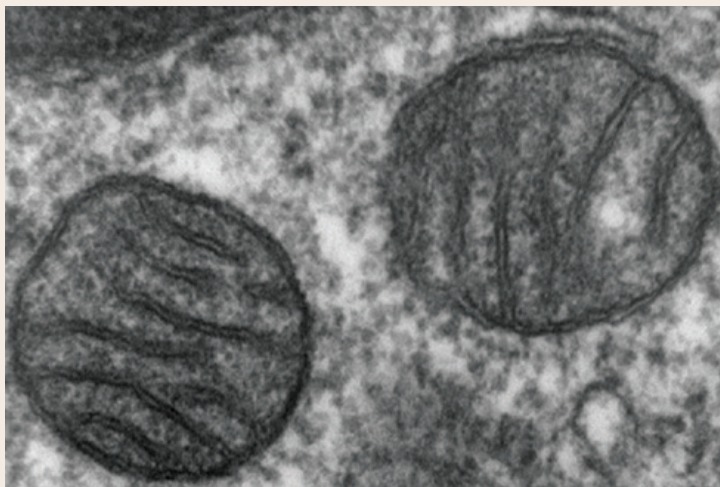
Mitochondrial outer-membrane permeabilization, or MOMP, is a part of the apoptosis pathway that involves mitochondria and is one way apoptosis can be activated. Researchers recently discovered an additional mechanism involving cells that are exposed to weak cell stressors, which can evade MOMP-dependent cell death, and coined the term “minority MOMP.” So far, scientists know little about MOMP uniformity in cells and the frequency of minority MOMP.

In a recent article in the **Journal of Biological Chemistry**, Yulia Kushnareva of the La Jolla Institute for Immunology and collaborators performed an imaging-based phenotypic small interference RNA screen to identify the genes that affect MOMP response in individual cells. They set up this system to quantify three cellular phenotypes based on specific genes fused to fluorescent proteins — apoptotic cells with mitochondria that went through MOMP, nonapoptotic cells with intact mitochondria, and atypical cells with mitochondria.

The authors identified genes that were downregulated, including genes involved in mitochondrial dynamics and mitophagy — mitochondria degradation by autophagy — which increased MOMP diversity within cells. The researchers further determined several genes involved in mitochondrial quality control, or MQC, were essential to post-MOMP survival. The authors conclude that the MQC system is a key player that helps reduce minority MOMP, making this mechanism a potential target to improve the toxic effects of anticancer drugs.

DOI: 10.1016/j.jbc.2022.101835

— Isabel Casas



This transmission electron microscope image of a thin section cut through mammalian lung tissue shows a mitochondrion.

LOUISA HOWARD/WIKIMEDIA COMMONS

of HDL and LDL along with those of cholesterol and triglycerides in the blood are key risk factors of many cardiovascular diseases, so researchers seek to understand the metabolism of these lipoproteins and how they regulate blood cholesterol levels.

In a recent paper in the **Journal of Lipid Research**, Richard E. Morton and Daniel Mihna of the Cleveland Clinic Foundation write that they studied the metabolism of lipoproteins by investigating factors that influence transfer of CE from HDL to LDL. Cholesteryl ester transfer protein, or CETP, transfers CE between HDL and LDL, while apolipoprotein F, or ApoF, inhibits the activity of CETP for selectively transferring CE to LDL. The researchers demonstrated that high blood cholesterol increases the level of ApoF, whereas elevated triglycerides decrease its level. They also found that the fraction of active plasma ApoF that is bound to LDL is increased in people with elevated cholesterol and reduced in people with elevated triglycerides, and they concluded that LDL size causes this difference.

DOI: 10.1016/j.jlr.2021.100166

## Spatial proteomics offer HIV-1 mechanism insights

Cells are composed of organelles, compartments that perform specific tasks. Organelles require specific proteins to function, and a protein’s location within a cell provides valuable information about its function. This protein localization is a strictly regulated process.

To remain undetected by the cellular immune system and continue multiplying, viruses disrupt protein localization, leading to protein inactivation and cell dysfunction. Spatial proteomics provides information about protein localization in

organelles and thus is a promising tool to understand the mechanism of disease progression at a subcellular level. Usual spatial proteomic analysis depends on reference organelle proteome; therefore, it cannot be used if proteins are translocated to different organelles. Researchers have not yet established which method is best to study cell disruptions caused by viral infection.

In a recent article published in the journal **Molecular & Cellular Proteomics**, Aaron L. Oom at the University of California, San Diego, and a team of researchers describe using machine-learning models to analyze protein localization in various organelles in human T lymphocyte cells containing an inducible HIV-1 genome. When these cells multiplied in the presence of an inducer (doxycy-

cline in this case), the viral genome was expressed as well, and the HIV infection disrupted the subcellular localization of proteins.

The researchers analyzed spatial proteomics data of the host cell using three machine-learning models. Performance of these models depends on the organelle, meaning that for a particular organelle, one model performs better than the others. This result suggests that researchers should choose an appropriate machine-learning model to analyze spatial proteomics data of a specific organelle for the study of the HIV-1 infection mechanism. This work serves as a reference for the study of viral infections as well as additional mutants of the HIV-1 genome.

DOI: 10.1016/j.mcpro.2022.100194

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**Isabel Casas** (icasas@asbmb.org) is the ASBMB's director of publications.



**Anju Duley** (anjuduley@gmail.com) earned her Ph.D. in chemistry from the Indian Institute of Technology Kanpur. She is passionate about science communication.



## Transcriptional regulation: Chromatin and RNA polymerase II

Sept. 29–Oct. 2 | Snowbird, Utah

Sessions will cover recent advances and new technologies in RNA polymerase II regulation, including the contributions of noncoding RNAs, enhancers and promoters, chromatin structure and post-translational modifications, molecular condensates and other factors that regulate gene expression. Patrick Cramer of the Max Planck Institute will present the keynote address on the structure and function of transcription regulatory complexes.

### Important dates:

- Aug. 1: Early registration deadline —save \$50 off single room accommodation rate
- Aug. 18: Poster abstract deadline
- Aug. 28: Regular registration deadline

[asbmb.org/meetings-events/transcriptional-regulation](https://asbmb.org/meetings-events/transcriptional-regulation)







# The interplay between epigenetic regulation and genome stability

Sept. 28–Oct. 2 | Seattle

Most meetings on epigenetics and chromatin focus on transcription, while most meetings on genome integrity include little attention to epigenetics and chromatin. This conference will bridge this gap to link researchers who are interested in epigenetic regulations and chromatin with those who are interested in genome integrity.

In addition to the scientific focus, we will promote interactions between two societies. The ASBMB and the Biophysical Society of China will hold this conference together. The first joint conference of the two societies was held in China in 2019.

## Important dates:

- Aug. 2: Abstract submission deadline
- Aug. 2: Early registration deadline
- Aug. 29: Regular registration deadline

[asbmb.org/meetings-events/epigenetic-regulation-and-genome-stability](https://asbmb.org/meetings-events/epigenetic-regulation-and-genome-stability)



## ASBMB BOOK CLUB

# “The No Club: Putting a Stop to Women’s Dead-End Work”

by Linda Babcock, Brenda Peyser, Lise Vesterlund & Laurie Weingart

4 p.m., July 20

Register at [asbmb.org/meetings](https://asbmb.org/meetings).



This book club on gender equity is hosted by the ASBMB Women in Biochemistry and Molecular Biology Committee.



## ASBMB accreditation applications due Sept. 15

Colleges and universities that earn ASBMB accreditation for their bachelor’s degree programs in biochemistry and molecular biology and related disciplines demonstrate a commitment to the highest standards of quality and innovation in education.

Learn more at:  
[asbmb.org/education/accreditation](https://asbmb.org/education/accreditation)







# 600 flavors of home

*By Laurel Oldach*

**A**mbling down a high street in the Observatory neighborhood of Cape Town, South Africa, last year, Paballo Chauke was looking for a restaurant with braaied meat — a grilled cuisine akin to barbecue.

He happened upon a narrow, likely-looking café on a street full of bars and restaurants. Outside, a sign read, in part, “Remember our lives, stories and histories don’t begin in 1488. You come from a time and place most ancient.”



The workers behind the counter struck up a conversation with Chauke. He recognized one of them from social media as proprietor Tapiwa Guzha, a prominent figure in Cape Town’s food scene.

“We laugh,” Chauke said. “We talk like we know each other — and then they sell me ice cream!”

Chauke is lactose intolerant. He was looking for dinner, not dessert. Nonetheless, with a selection of vegan flavors to offer, Guzha made the sale.

Guzha, a plant geneticist turned ice cream entrepreneur, is on a mission to use ice cream to get people talking. By selling flavors inspired by African cuisines, he is looking to stir his customers’ emotions and to catalyze a change in culture.



TAPIWA GUZHA

## Tapi Tapi café

Guzha’s ice cream parlor is called Tapi Tapi, which translates roughly from his native Shona as “yum yum.” The ice creams on the menu vary from one



week to the next. But all his offerings are proudly Afrocentric. One week in March, the lineup included a Kenyan pilau flavor with puffed rice; a sorbet made of sobolo, a hibiscus flower infusion with spice that’s common in Nigeria, Ghana and Cameroon; a vegan rooibos and ginger flavor with biscuit crumbs, meant to evoke dipping coconut biscuits into South African tea; and a peanut butter and pumpkin mix inspired by Guzha’s childhood in Zimbabwe.

These native flavors are not what a typical ice cream parlor in the area sells. Customers, Guzha has said in interviews, sometimes make phone calls from his café to say, “You’ll never believe what I am eating right now.”

But the point is not really the ice cream. “The ice cream is a little conversation starter. It’s a little bribe,” he said in an interview with ASBMB Today. “And then I get you with another side to the conversation.”

Once he has drawn people in, Guzha asks them: Just why is it so unusual, in Africa, to eat African flavors?



Guzha studied at the University of Cape Town and experienced being a Black scientist in a country where — even though 80% of the population is Black — Black scientists remain a minority.

## Arriving in Cape Town

Guzha shot to culinary fame in part due to his unusual background. He earned a Ph.D. in molecular biology and was a postdoc for several years before founding his business.

Educated in Catholic boarding schools in his native Zimbabwe, he recalled a field trip to a research lab that worked on flies. “I remember seeing the fly mounts on the wall, in blue frames, and thinking, ‘Oh, this is so cool,’” he said.

Such experiences, combined with an innate curiosity about the world, inspired a passion for science. In his last year of high school, when Zimbabwean students narrow their focus to just three subjects, Guzha selected biology, chemistry and math. He arrived in Cape Town in 2005 to begin college.

Chance customer Chauke, who now works as a training coordinator at a malaria genomics program in the U.K., started at the University

of Cape Town not long after. He shares with Guzha the experience of being a Black scientist in a country where — even though 80% of the population is Black — Black scientists remain a minority. Chauke described the strange transition from being part of the majority to a campus where lecture halls seemed to hold 50 Black students for every 300 white ones.

“What is going on? Am I in South Africa?” he recalled thinking. “The professors, they’re all white. No one says anything to you — but what it says to your society and subconscious is that you don’t belong here.”

Thanks in part to a student protest movement that peaked in 2015, the University of Cape Town has examined and worked to reform its race relations since the time Chauke and Guzha were students. Still, Chauke said, his impression of academic culture remains, “You assimilate or you fail.”

## Life in the lab

Guzha did well as an undergraduate, staying on for an optional fourth-year honors course with a research component. He was the first honors student to work with Robert Ingle, a plant geneticist who recently had joined the faculty and launched several projects in *Arabidopsis*.

In a 2020 interview with Ghanaian American food podcaster Yorm Tagoe, Guzha was characteristically frank about his choices after graduation: He couldn't find a job. (In 2011, the International Monetary Fund estimated South African unemployment in the wake of the global financial crisis at 24%.) So he stayed on in Ingle's lab to earn a master's degree with stipend support, which went well enough that Ingle encouraged him to upgrade to a Ph.D. track.

Guzha's project was to characterize plants with mutations in two proteins homologous to nematode resistance proteins in another species. The lab suspected they were involved in trade-offs between responding to pathogens and to abiotic stress.

"Some Ph.D.s are quite nice and linear, and they work, and everything goes quite swimmingly," Ingle said. This was not one of them. "There were many setbacks along the way. The phenotypes were quite weak, and sometimes they were inconsistent. ... He had to work hard in the end to get enough data to write it up."

In the meantime, Ingle said, Guzha became the social leader of the lab and the department. He always had numerous projects in the works. He got into cooking and body building. He designed a hoodie for the department, based on popular selection from among several design options, and sold it to his classmates. He was a charismatic teacher and a rigorous grader with junior students. It was

the era of Groupon; he organized lab outings around interesting deals, memorably including a shark cage diving expedition.

## Science careers

Most plant biologists trained in South Africa leave the field eventually, according to Ingle, who did his own training at Oxford. "There are relatively few universities ... and not much of a biotech or agritech industry here," he said. "The vast majority of our students go on and do something different, or go overseas."

Given those demographics and Guzha's eclectic passions and projects, Ingle was surprised when Guzha landed a postdoc in crop biotechnology.

"By the time the Ph.D. was done, I knew I had no interest in academia," Guzha said. "But I did a postdoc as a placeholder while I was trying to figure out what I did want to do. As time went by, I started to value not the scientific process, but the institution of science less and less."

He became uncomfortable working to optimize the growth and yield of global commodity crops such as maize, stevia, tobacco and sugar cane under arid South African conditions. Better-adapted indigenous crops such as millet, sorghum and teff existed — but there were neither funds to study them nor economic demand to support growing them.

Ingle said he finds that critique reasonable. As is the case around the world, most plant biologists in South Africa focus on economically important species. The basic research community is so small, he added, that many scientists choose to study plants of international interest in order to be part of a larger conversation and in hopes of landing foreign funding.

Guzha was also unhappy that his

**Guzha became uncomfortable working to optimize the growth and yield of global commodity crops such as maize, stevia, tobacco and sugar cane under arid South African conditions. Better adapted indigenous crops such as millet, sorghum and teff existed — but there were neither funds to study them nor economic demand to support growing them.**





COURTESY TAPWA GUZHA

Guzha chose the location of his café carefully. In the caption of this 2020 Instagram post, he explained that he wanted his space to be accessible to Black customers and safe for him as an immigrant. The Observatory neighborhood, which is racially diverse, fit the bill.

research findings were inaccessible to ordinary people outside of science; he felt a disconnect between his work and his heritage.

“It’s a really consistent story,” he said. “If you look at finance, law, accounting, fashion, music ... the local perspective, or the quote-unquote native or indigenous perspective, is not particularly important.”

Despite the critique, Guzha said, he does not feel bitter about science or resent the years he spent in the lab. “I enjoyed that chapter. But it served me no longer. So I decided to transition out of it.”

## From hobby to mission

Guzha got interested in ice cream when he was a graduate student after he saw contestants on Top Chef Australia make ice cream using both liquid nitrogen and dry ice.

“The first time I saw it, I was like, ‘Oh! I’ve got access to dry ice in the lab, from deliveries of enzymes or whatever,’” he said. “And that dry ice is really just left alone to sublimate,

and then it disappears.”

After years with an ice cream hobby, he started the business in 2018, making typical flavors. But he needed to find a selling point for his product, which, made by hand in 15-liter batches, is more costly to produce than ice cream made by larger commercial competitors. He tried first making beer and cocktail flavors, looking for a gimmick that would set his brand apart.

In a story he has recounted many times, Guzha describes his moment of revelation: While visiting a Zimbabwean restaurant, he noticed some familiar crunchy snacks from home. He bought a few and mixed them into a batch of ice cream. He told the podcaster Tagoe, “It was the first time I felt like I had created something that was true to me.”

Guzha recognized the power of his creation a few months later at an ice cream tasting on Heritage Day, a holiday celebrating South Africa’s diverse cultures. Many attendees were also Zimbabwean immigrants, though not all of them shared Guzha’s food traditions. As he served a flight of nine ice creams, each with its own connection to an African cuisine, he noticed people talking about the memories each flavor evoked. He saw the impact ice cream could have, and his business became a mission.

## Scientific instinct

Since 2018, Guzha has developed 600 or more flavors inspired by continental cuisines. His ingredients include amaranth greens, yellow plum, baobab, imphepho (licorice) smoke and tamarind.

Ice cream is a complex colloid: a mixture of particles including fat droplets, air bubbles and ice crystals captured in precise ratios in

COURTESY TAPIWA GUZHA



Many of Guzha's recipes use plant extracts, such as this colorful group of cordials distilled from plants native to South Africa's Cape Peninsula.

a viscous matrix of simple sugars, polysaccharides and milk proteins. But when Guzha develops flavors, he now operates by instinct, like a researcher whose protein purification protocol has become second nature.

"Understanding how ice cream is formed — crystallization and formation of ice crystals, and compatible solutes like sugar, and fat content, and how that fits ice formation, and then texture and volatiles — all those things, I don't actively think about them anymore, but they show up a lot when I reflect on a flavor," he said.

His scientific background might come into play when he decides whether to make infusions in milk, water or oil or considers the chemistry behind the flavor profile of a combination of acidic hibiscus with basic baobab. "But primarily, if I'm thinking of a recipe purely from a flavor point of view, it's typically cultural and not so much from a chemical perspective."

The cafe has garnered a lot of interest both domestically and among glossy international cuisine magazines. Sometimes his interviewees are visibly moved by the work Guzha is doing. The host of one

food-themed docuseries, celebrity chef and food writer Karen Dudley, choked up as she said, "What Tapi is really doing is giving people access to his mind: his phenomenal understanding of ingredients, his curation of indigenous African grains and flavors ... I see Tapi as the new, immersed in tradition and knowledge and taking us into a new understanding."

### Proof of concept

All the attention has been good for business, but Guzha's feelings about it are complicated.

Whenever the press writes about Tapi Tapi, he said, "There are parts of the story that reflect the fact that I'm a Ph.D. holder, and they reflect that I'm one of one doing African flavors like this. So it echoes and reinforces the idea that this isn't normal and it takes a kind of exceptional Negro, like a magical Negro to make this happen."

Guzha rejects this message categorically.

He also rejects the title doctor, saying it feels wrong "to speak of

**Ice cream is a complex colloid of fat droplets, sugary syrup, ice crystals and air bubbles. In an Instagram post, Guzha broke down one flavor.**



COURTESY TAPIWA GUZHA

**"In part, Tapi Tapi is focused on rehabilitating the self-esteem of people from the continent about our food practices, as well as our culture and beliefs. I use food because it's universal, people need to eat.**

**So it's a nice tool to get people to listen."**

TAPIWA GUZHA  
TAPI TAPI WEBSITE



## AUTHOR'S NOTE

### Who is Paballo Chauke?

Reporting from nearly 8,000 miles away can be a challenge. I interviewed a few South African scientists, most of whom had heard of Tapi Tapi ice cream even if they hadn't visited the café. I was fortunate when one of them referred me to Paballo Chauke. When I spoke to him, I learned that he had wandered into the shop one day by mistake but finds Guzha's success off of the beaten academic career path deeply affirming.

Chauke, who grew up in a township outside of Pretoria and was the first of his three siblings to go to university, recently moved to England to



work as a coordinator for a malaria genomics training program. His academic background is eclectic: He majored in sociology and environmental geosci-

ence as an undergraduate, earned a master's degree in the U.K. in biodiversity, and returned to Cape Town to pursue a Ph.D. in environmental geographical science.

Chauke called Guzha's career "a whisper in my ear that says, they'll keep calling you different, but be yourself and it'll all make sense one day," he said. "Yes, you've worked in bioinformatics; yes, you've worked in climate change; yes, you're now working in genomic surveillance of malaria. ... The possibilities are endless."



COURTESY TAPIVA GUZHA

Local fruits, seeds and grains are among Guzha's ingredients.

myself as someone who is a vessel of knowledge, because I feel very uninformed and very ignorant," and adding that the title excludes nonacademic life experience. "People conflate it with someone of significance, whatever that means. And I don't agree with the connotations there."

Guzha is impatient with the number of times he's been invited to replicate Tapi Tapi elsewhere in South Africa and across the continent. "Instead of asking me to open a branch in your local neighborhood, go speak to your local ice cream shop and ask them why they are not making African flavors," he said. "The cafe is the initial proof of concept."

Before they met in person at the café last year, Chauke said, he was struck by — and a little incredulous of — Guzha's frank, open online persona. Academic culture, Chauke explained, has long held that scientists must "behave in a certain

way — especially if you're a person of color, if you're queer, if you're first generation."

Shirtless on social media, up-front about the many side projects he still has cooking, which range from visual art and soap making to sex education and advocacy for indigenous plant studies, Guzha broke those rules.

To Chauke, all these facets can be liberating. And as for the Tapi Tapi café, he said, "It's great. It's avant garde. It's open minded. It's futuristic; it's Afro-futuristic. It's eye opening. It's a breath of fresh air. It's lively, it's necessary, it's important, it's needed. It's worthy of being funded. It's a great story to tell. It's representation."

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# 'N\*Gen' brings science to TV sets in Africa

By René Fuanta

At the onset of the COVID-19 pandemic, as schools around the world shut down, parents and teachers began looking for alternate learning platforms. Faced with the challenge of teaching remotely, teachers were among the many professionals who had to pivot.

"N\*Gen" (pronounced "engine"), a science TV show made in Africa for children in Africa, was born to serve that sudden need for science education — combined with engaging entertainment.

Paul Falzone is executive director of Peripheral Vision International, or PVI, a media-focused nongovernmental organization based in New York and Uganda. When the pandemic hit, "We all had to stop and assess. ... How can we be useful?" he said.

PVI started talks with teachers on the ground in Kampala, Uganda, and with science experts, children, media and entertainment houses; "N\*Gen" was created organically from those conversations. TV broadcasters were hungry for content "to show engaging entertaining youth-focused media," Falzone said, and this hunger shaped the program.

"The idea of 'N\*Gen' first emerged in April of 2020," he added, "and by September of the same year, we were on air."

Since it first aired, "N\*Gen" has garnered a lot of attention and interest. With a combined viewership of over 10 million by the end of Season One, the show has aired on the Africa Channel, Discovery Education (as a special feature in August 2021), Akili Kids TV, and other streaming platforms including Sensical TV and Demand Africa. Viewership has expanded from Uganda to other countries including Kenya, Tanzania, Nigeria, the United States and South Africa.

With its second season concluded and a third in the works, this revolutionary TV series, in addition to teaching scientific concepts, has raised awareness of women and girls in science. The producers deliberately select and highlight



Hosts Stephanie Wanjiku Muchuri and Shirleen Ichengi Nanjola, known on the show as Nnena and Jiji, sign off each episode with N\*Gen's signature call to action: "Let's ask, let's learn, let's love! And don't forget to make it fun!"



"Think of nature as a puzzle; every animal has a place in that puzzle." Conservation expert Eva Kimani explains the concepts of habitats, food chain and species extinction to children visiting the Ol Pejeta Conservancy, a wildlife sanctuary in Kenya.

women and mothers in scientific roles stereotypically occupied by men.

"We are showing women scientists not as something that can be achieved but as something that has been achieved," Falzone said.

On this show, representation matters — women are seen teaching and discussing scientific principles, and women also work behind the scenes. Some of them have reached out to other women to become involved. Joy Kiano, a biochemist and molecular biologist, got involved with "N\*Gen" after talking to Gosia Lukomska, the executive creative director of PVI. Kiano was brought in first as an educational consultant and now serves as the global ambassador of PVI. She describes her decision to join the team as a no-brainer.

In its first season, "N\*Gen" covered topics including digestion, space, fossils, the origin of mountains and the water cycle.

The digestion lesson takes the audience on the same journey our food takes — from the buccal cavity to the generation and expulsion of fecal matter. The teachers clearly highlight how different food components — carbohydrates, proteins and fats/lipids — are digested. The lesson on space introduces children to Earth's solar system and geophysics, with a primer on space travel. The lesson on mountains explores the theory of plate tectonics — the formation of ranges, continents and other geographical features.

Each lesson is related to an everyday profession and ends with a sequence of questions on the topic of

the day dubbed a "brain booster."

Season Two is starkly different from Season One, which was shot for the most part in the studio. Focused on climate change and its impact on ecosystems, Season Two was filmed outdoors. Children interact with scientists in the field as they make real-time observations on topics such as marine life, silverback gorillas and butterfly populations.

Kid-friendly humor is used to make educational points. For example, in the episode on forests, one of the children on the show claims, "Trees give us oxygen, and we give them farts."

Here's an excerpt from the Season Two butterfly episode:

**Entomologist:** Without insects, we will not be here.

(She opens up a cabinet containing butterflies of the Papilio family. The children explode in laughter at the name Papilio jacksoni.)

**Child:** Is it Michael Jackson?

**Entomologist:** No, but it is named after someone called Jackson. Entomologists like myself study and even name them.

(The conversation continues for a while.)

**Child:** If (all the) insects die, will we also die too?

**Entomologist:** Actually, yes. Now scientists are very sure.

**Child:** What can we do to protect insects?

**Entomologist:** The best way of saving the insects is to protect their habitat, just like we protect our homes. To protect insects, it needs all of us. It needs ...?

**Children:** All of us!

Although the show has been successful, the "N\*Gen" production

team has faced significant challenges. For Kiano and the team, filming under the constant threat of a COVID-19 lockdown was not trivial. With the possibility of airport closures, crew members feared they might not be able to return home if filming had to be extended.

In one instance, a crew member “did not want to be stranded outside Nairobi County and needed to get back to her family in South Africa,” Kiano said. With meticulous planning, the team was able to get around this — no team member was stranded.

The makers of “N\*Gen” also encountered bureaucracy and toxic culture, Kiano said. When they approached scientists in government organizations and asked for specific individuals — mostly women — to appear on the show, some senior male officials attempted to hijack the project from their junior female colleagues. “We had to step in and find an alternative route,” Kiano said.

This alternative route sometimes meant a last-minute change in an episode’s theme and restructuring its content. For example, Kiano and her team had to switch from talking about endangered species to human-wildlife conflicts due to difficulties in finding a suitable host, which were heightened by tightened COVID-19 restrictions.

“Where we could not get enough experts on endangered elephants because of imminent lockdown, we focused on women rangers at a wildlife conservancy en route to Nairobi,” Kiano said.

Appealing directly to scientists to appear on the show was also a challenge. Kiano’s team sent a trove of emails to scientists seeking their participation and was met, for the most part, with silence. They got one or two responses for every 20

emails they sent. And among those few responses, finding experts who could make their research palatable to children was another challenge.

“We found that what works best was when the scientist was a parent,” Kiano said. Experts who were parents had a great rapport with the kids.

While the ground team was preparing for production and seeking volunteers, an elephant loomed in the room: money. Falzone and his team sought out donors and partners to support this initiative. They also “closed some programs down, shifted money around and were able to pivot quickly and be nimble,” he said.

Today, “N\*Gen” has a rapidly growing list of partners and funders, positioning the program to be not only a pan-African phenomenon but a global one.

To the communities reached, “N\*Gen” is a beacon of edutainment. It breaks the mold of traditional science education in Africa, exposing the younger generation to a fun, lively, interactive learning environment with children who share their skin color, accent and background.

Educational television programs can have a drench effect (impressive and dramatic) or a drip effect (slow and cumulative) on the audience. When asked about the future and impact of “N\*Gen,” whether its effect will be a drip or drench, Falzone said, “We are confident that “N\*Gen” will have both the drip and drench effect on audiences around the world.”

To the communities reached, “N\*Gen” is a beacon of edutainment. It breaks the mold of traditional science education in Africa, exposing the younger generation to a fun, lively, interactive learning environment with children who share their skin color, accent and background.



JAMES MBIRI

A black and white colobus monkey is spotted by the children as they explore an indigenous forest in Western Uganda in the “Forests” episode of N\*Gen’s second season.

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# BMB in AFRICA

On the following pages are the stories of 16 members of the American Society for Biochemistry and Molecular Biology. Some have written their own personal essays; others are profiled by ASBMB Today contributing writers. They range from undergraduate students to professors and department chairs. They are men and women, old and young, from Nigeria, South Africa, Uganda, Cameroon, Zambia, Ghana and Kenya. All were born, grew up and learned to love science in Africa.



# Parallel tracks: A nutritional biochemistry vision

James Ntambi promotes health education in East Africa — from rural villages to university labs

By Renae Crossing

**W**hile speaking of scarcity and excess, James M. Ntambi has a generous demeanor, like a host offering second helpings. Multiple times in a recent interview, after answering a question, he shared more:

“One small thing I didn’t tell you before ...”

Ntambi grew up and attended college in Uganda and then moved from Kampala to Baltimore after winning a Fulbright scholarship to do graduate work at Johns Hopkins University, where today he is an adjunct professor. He was studying a parasite threatening horses and cattle for his Ph.D. and already developing a connection to the American Society for Biochemistry and Molecular Biology. (He now serves on the ASBMB Council.)

“My first two major publications as a graduate student were actually in the *Journal of Biological Chemistry*,” he said.

His plan was to return to Uganda when he finished his degree.

“The chair of the department of biological chemistry approached me (and said), ‘I hear you are going back to Africa,’” Ntambi said. The chair made an offer: How about a postdoctoral fellowship?

Offers to that effect have repeated themselves over Ntambi’s 35-year academic career — but they haven’t stopped him from returning to Uganda.

In fact, he’s made a point of it.

## In community clinics, something clicked

As a professor at the University of Wisconsin–Madison for the last three decades, Ntambi teaches nutritional biochemistry and global health. When visiting villages in rural Africa as part of the Uganda Program he started, UW faculty and students “saw things they would never have expected,” he said. “Malaria, of course,” in low-income settings, but also diabetes and hypertension.



James Ntambi, who is originally from Uganda, teaches nutritional biochemistry and global health at the University of Wisconsin–Madison.

His students were there to learn how conditions related to nutrition are diagnosed. For a severe protein deficiency called kwashiorkor, “What do these kids look like?”

But the visits reflected a change that has been growing worldwide since Ntambi moved to the United States.

It’s called “the double burden” of malnutrition, recently reported on in the *Lancet Global Health*. Even in remote areas, malnutrition in many forms now is seen alongside diet-related noncommunicable diseases (such as diabetes and hypertension) within households or communities. Some people even experience both kinds of disease during their lifetime.

“We see undernutrition and overnutrition,” Ntambi said.

As in the United States, trends are evidence of systemic change. Social drivers and availability are factors. Globalization, highly processed foods and working lifestyles all contribute to what the World Health Organization calls a “nutrition transition.” Plus, older people are more likely to have noncommunicable diseases, and economic prosperity





University of Wisconsin-Madison study abroad students and young Ugandan mothers participate in a pediatric nutrition clinic in the summer of 2019 at the Lweza–Mukono Center for Community Health Initiatives.

often signals a shift from infectious disease to noncommunicable disease.

## Combating the double burden

Ntambi wanted to use his biochemistry background in community settings, not only in a lecture theater or lab. “You begin to address these issues, when you come back here, more effectively,” he said.

After running community clinics, he began to apply his biochemistry background on the ground.

“The idea was to follow up these diseases that could be prevented,” he said — for example, by advising a person with elevated blood sugar on dietary changes before they became “fully diabetic.”

Ntambi’s efforts in East Africa, especially a nongovernmental organization he helped to create, are akin to global responses to the double burden. According to the WHO, nutrition education is among a suite of approaches that offer double returns, reducing wasting, stunting and deficiency of micronutrients, as well as Type 2 diabetes, cardiovascular disease and cancer.

Community education was Ntambi’s vision, and it made excellent use of his expertise; over his career, the scientist has published more than 200 scientific papers on biochemistry and nutrition.

And that postdoctoral fellowship he took all those years ago? It was, in fact, in lipid metabolism.

## Applying a scientific research track

Ntambi’s favorite gene is SCD1. It helps the body process dietary carbohydrates, gathering that energy into monounsaturated fatty acids for storage. How? The SCD1 gene has instructions to make a protein called stearoyl-CoA desaturase. That protein (an enzyme) converts fatty acids palmitate and stearate into the most common fatty acids in triglycerides (palmitoleate and oleate, respectively). Ntambi and a team of researchers found that when one has plenty of leptin, a hormone that makes one feel full, the body makes less SCD1. As a result, the body makes less fat and tends to lose weight.

Ntambi found that genetically altered mice unable to make the SCD1 protein didn’t make much fat even when given a carbohydrate-rich diet. A paper on this was cited over 1,000 times, and Ntambi then moved on to how different tissues are involved: skin, liver, adipose, muscle, intestine, heart and brain.

“This is a very good example of a diet–gene interaction,” Ntambi wrote.

## Combating the brain drain

Ntambi is aware of not only the nutritional double burden but also the brain drain in Africa. He sees too few resources for basic research back home, and he is working to change that.

A decade ago, inspired by initiatives in economics and public health, Ntambi and others (including Richard Deckelbaum, a pediatric gastroenterologist at Columbia University) laid the groundwork for excellence in biochemistry and nutrition research in East Africa through an initiative for Ph.D. students.

It’s called the African Nutritional Sciences Research Consortium. There’s good news and bad news. With no shortage of ideas, this endeavour is not unlike the double burden: plenty alongside scarcity. “Funding ... COVID ... Everything is in place,” Ntambi said.

“The basic principle remains: Build local capacity. Produce graduates locally. Avoid the brain drain.”

**Renaë Crossing** (renaecrossing@gmail.com) is a writer and former teacher. She holds a first-class master’s degree in life science from the Hong Kong University of Science and Technology and a first-class master’s in teaching from the University of Melbourne. Follow her on Twitter: @renaecrossing.





# A biochemist for global change

By Victor Nweze

**M**y mother was 35 years old when she died in 2007. She developed an acute pyogenic liver abscess, and I remember her lying in a hospital bed in Lagos State, Nigeria, with a bloated abdomen, looking weak and pale. Despite several therapeutic interventions, she could not survive once a drug-resistant and hypervirulent bacteria, *Klebsiella pneumoniae*, invaded her body.

I was just 10 years old then and wasn't sure about my future. Like many of my friends, I wanted to be a medical doctor, inspired by the movie "Gifted Hands" about the U.S. neurosurgeon Ben Carson.

As a teenager, I did some research and learned that beta-lactamase and carbapenemases were the proteins most responsible for the drug resistance and hypervirulence of that bacteria. As a result, I decided to become a biochemist with a research interest in antibiotic resistance and drug discovery. My goal is to save lives worldwide.

Science brings wonderful memories of my mum — like eating her delicious melon soup — and this ignites my zeal. I conduct drug discovery experiments using natural products from local plants such as the climbing shrub *Chasmanthera dependens*, the neem tree *Azadirachta indica* and the almond tree *Prunus dulcis*.

At the peak of the pandemic in 2020, I found that the glycoside quercetin-3-O-rutinoside from *P. dulcis* inhibited the spike glycoprotein of the SARS-CoV-2 virus. This may alter the protein conformation and prevent viral internalization through the molecular interaction with angiotensin-converting enzyme-2 of the alveoli in the lungs.

Doing real science anywhere comes with challenges, but conducting research in Africa has peculiar difficulties that can discourage our attempts; hence I often feel like a frustrated and disabled scientist even though I'm brainy.

One challenge is the lack of stable electricity. Some time ago, I conducted a chain experiment on the drug release of a drug-loaded liposomal formulation using an electrical magnetic stirrer hot plate for 12 hours at two-hour intervals of buffer collection and replacement at an equal volume of 5 milliliters. At exactly 1:10 a.m., without any warning, the electricity shut down. This altered the constant revolution — I had to hand-stir with a spatula for three hours while sweating profusely in the dark

and being attacked by female *Anopheles* mosquitoes. My day was wasted, I felt enervated from the stirring and I could have gotten malaria. I had to cancel the experiment while I awaited the moment when the electricity would turn on again, hoping my research wouldn't be interrupted by another sudden power outage.

Another difficulty is insufficient research funds. When I was

working on my undergraduate research thesis, I felt excited to be doing my first study in the lab and worried about funding the research. No research grants were available, and as a student, I did not have sufficient money for my thesis work in the lab, which cost more than 500,000 Nigerian naira (over \$1,000). I needed to buy chemicals from Sigma, devices such as bucket centrifuges and magnetic stirrers, and a few expensive reagents. So I enlisted a few of my colleagues from my institution to share some costs (we all have to pay for most of our own research supplies); however, this depended on us needing similar supplies for our research.

In the face of such challenges, I've never wanted to quit. These experiences prove my passion for one day having a scientific impact, and they have shaped me into a hardworking, resilient biochemist for global change.



**Victor Nweze and his mother at an event in Lagos State, Nigeria, when he was 2 years old. She died when he was 10.**

COURTESY OF VICTOR NWEZE

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# ‘Life happens – but we keep pushing’

By *Martina G. Efeyini*

**W**hen Adaude Amalunweze was 17, she started her own business buying and reselling used books to pay for her college education. She grew up in a poor neighborhood in Nsukka, a town in Enugu State, Nigeria, the oldest of seven children. She worked hard in school; did well in science, art and literature; and eventually decided to study science.

“Growing up in Africa, there are lots of questions, a lot of day-to-day activities, experiences you have, and you are curious as to why things happen the way they do,” she said. “I believe every child wants to make an impact.”

But making an impact can be difficult.

“As a first-generation student, attending college was draining financially, mentally, and emotionally,” she said. “My parents worked entry-level jobs to see us through high school and earned barely enough to put food on the table for me and my other siblings.”

Amalunweze experienced cultural discrimination that

avored boys’ education over girls, but she did not let that stop her. Although she did not meet the requirements to study medicine, she was determined to stay on the path of science and decided to study biochemistry at the University of Nigeria Nsukka.

## Educating the community about malaria

After graduating from college, Amalunweze volunteered for a malaria and polio eradication group. She distributed insecticide-treated nets and anti-malarial drugs and offered advice on how to minimize mosquito exposure.

“In some rural areas in Nigeria, malarial fever is not seen as a serious ailment as poor families don’t visit hospitals when they have fever,” she said. “Some take traditional herbal medicine, chloroquine or some special type of meals.”

Sometimes these remedies work, and people survive. In other instances, people die. According to the World Health Organization, about 93% of all malaria infections occur in sub-Saharan Africa. While volunteering, Amalunweze realized she wanted to do research, so she joined a laboratory that focused on the interaction of malaria with human hemoglobin. Her master’s research in protein chemistry and enzymology also focused on malaria.

After earning her master’s in 2015, Amalunweze got a job at the largest cement producer in sub-Saharan Africa, Dangote Cement Plc. She was put in charge of ensuring the plant met Nigerian industrial quality standards and overseeing the company’s productivity and profitability.

She earned a number of professional certifications, and her career was going well, but the job became monotonous, and she realized it was time to make a change.

She wanted more work–life balance and to get closer to her goal of earning a doctoral degree abroad. With her hectic work schedule, working and doing

**Adaude Amalunweze once educated rural Nigerians about malaria and polio. Now, she works to raise awareness about COVID-19.**





a Ph.D. would not be an option. So when a teaching job came up, she took it. She hoped teaching would give her time to have an impact on the lives of young people and eventually earn her Ph.D. By now, she said, she thought she'd have been admitted into a Ph.D. program — but she hadn't factored in a worldwide pandemic.

“Then, the pregnancy happened, and the baby came along,” she said. “So far, it has been a beautiful experience. Life happens, but we keep pushing.”

## Influencing others positively

Amalunweze works as a lecturer at the School of Applied Sciences at the Federal Polytechnic Oko in southeastern Nigeria, designing courses and teaching materials for undergraduates, delivering lectures, evaluating students' coursework, organizing seminars, and supervising research activities.

“Currently I'm supervising about 20 students and their project work, which requires teaching and coaching as well as mentoring them, not just in their studies, but also in their social life and day-to-day activities,” she said. “It's been quite interesting and fun, nonetheless. I really look forward to doing more so as to

influence more lives positively.”

She described the challenges of being a new mother, living apart from her husband who works several miles away, and learning how to juggle a family and a career. It is not easy, but she does it.



COURTESY OF ADAUDE AMALUNWEZE

**Amalunweze and a colleague prepare sanitizer for distribution to prevent the spread of COVID-19.**

“Can you imagine being in the kitchen, carrying a baby, doing my work, having to attend to my students?” she said. “It makes you a master at multitasking. Not everybody can do that actually.”

“So, I really hope that we keep supporting each other as women and we keep doing our best, not giving up.”



**“I want my story and position to uplift others, such that my achievements will inspire other younger females or other women in STEM to keep pushing and to keep reinventing themselves. It is so powerful and so important for a young woman growing up to see women who look like them in high-power positions. In a world filled with bias against the female gender, being successful women today requires you to work twice as hard as men in your field to achieve your dreams.”**

ADAUDE AMALUNWEZE

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# A phage agent of change

By Brian O'Flynn

Scientific research is defined by the scientific method: make an observation, ask a question, form a hypothesis, design and carry out experiments based on the hypothesis, analyze and report results.

Within this central idea, a clear divide — between theory and experimentation — separates well-funded research institutions in the U.S., Europe and a number of Asian nations from institutions in Africa and South America that have a fraction, or none, of this funding. As the demand for cutting-edge research tightens its grip on funding sources, the ability of trainees at all levels to experience modern, practical research becomes restricted to countries with the strongest financial support of sciences.

Young researchers like Tolulope Odusele now are standing up to seek reform.

Odusele developed his love for biology and chemistry early on. “In Nigeria, when you find an inquisitive child, it’s a no-brainer for them to go into the sciences,” he said.

He opted to attend the University of Ibadan in southwestern Nigeria to study biomedical laboratory science, eager to expand both his knowledge and his practical abilities.

In his second year, Odusele realized something was lacking. He noticed that his undergraduate courses were based heavily in theory, with little practical experience. “Many of

**The members of the Ibadan Bacteriophage Research Team, aka SEA-PHAGES—UI, are, from left to right, Oluwasegun Daramola, Tolulope Odusele, Toba Oyebamiji, Benjamin Adediran, Comfort Omolola, Temitayo Iyede and Roqeeb Adedeji.**



TOLULOPE ODUSELE

the concepts with regard to cellular genetics or microbial genomics were not available for hands-on experimentation,” he said. “We just had to learn about concepts like the model of transcription and translation, cellular processes, and such. It was really all about theoretical knowledge — just

having to pass exams.”

This weighed on Odusele, who feels that the key to success is a strong practical course to accompany what is learned in class. “Many undergraduates just get to be a part of biomedical sciences at the theoretical level and never really get to appreciate how these concepts contribute to a broader, holistic sense of learning,” he said.

“That is one of the major limitations to biochemistry and molecular studies in Nigeria and many universities in sub-Saharan Africa.”

While students in Africa graduate with a solid foundation of knowledge, Odusele said, their limited practical experience is “not really in tandem with the evolving scientific drive in Western countries.”

A breakthrough came for him in his third year when he reached the clinical portion of his course, structured to focus on tropical medicine and disease-causing microorganisms in the region. During this time, Odusele was introduced to a program called SEA-PHAGES, short for Science Education Alliance–Phage Hunters Advancing Genomics and Evolutionary Science.

A bacteriophage, or simply phage, is a virus that exclusively targets bacteria. Researchers estimate that roughly  $10^{31}$  types exist in the world. Their natural antibiotic tendencies make them appealing as possible therapies to tackle the ever-growing list of multidrug-resistant bacteria.

The SEA-PHAGES program, founded by the Howard Hughes Medical Institute, aims to turn the identi-



fication and characterization of this essentially unlimited number of novel phages into a multinational educational endeavor, with the primary goal being to improve retention of undergraduate students in the sciences, technology, engineering and mathematics.

In 2018, SEA-PHAGES' 11th year, the University of Ibadan became the second institution in Africa to join the program. "This was the first time evolutionary sciences and genomics was really brought to the undergraduate level," Oduselu explained, "so it was a very rough start."

He embraced the project through its growing pains and was appointed leader of the Ibadan bacteriophage research team. "The bulk of my research experience in molecular studies and transcriptomic analysis has come from this," Oduselu said. "It was an opportunity that is quite rare for undergraduates over here in Nigeria and in many African universities."

Phage research in the context of antibiotic resistance is particularly relevant to Nigeria and Africa as a whole. More than half of all deaths in the World Health Organization African Region, which covers most of the continent, are caused by communicable diseases that are treated by antibiotics, according to Matshidiso Moeti, the WHO regional director for Africa.

Through his work with SEA-PHAGES, Oduselu said, he has become very aware of this. "I guess I now see myself as an agent of change, who found a very early opportunity to become aware of the problem and explore as much as possible."

He hopes to continue his research in microbial genomics after graduation; however, he is facing a crossroad as he weighs his options of how to achieve this.

"Prior to the Ibadan Bacteriophage Research Team, very little was done on bacteriophages in Nigeria," he said. He now is looking overseas to continue his education but said he plans to return. "It all still boils down to just learning, having the right research exposure, and bringing it back to Nigeria and Africa."

Research limitations in Nigeria are deep-rooted. According to UNESCO, gross expenditure on research and development in Nigeria accounts for just 0.1% of the country's gross domestic product — just over \$800,000. This is far below the recommended 1%. By comparison, the U.S. comes in at 2.7% of GDP, just shy of \$500 million.

"If we do not take financial responsibility for our own research, it doesn't matter how much international funding any African researcher can get," Oduselu said.

This lack of internal funding is a key reason under-



**Before he joined the SEA-PHAGES program, Oduselu was frustrated by the lack of hands-on lab experience in his undergraduate classes.**

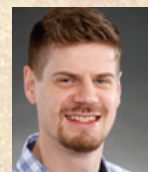
graduate students often miss out on hands-on practical training in biomedical sciences, he explained. And it doesn't end there. "Many postgraduate students must pay for their own research."

African researchers use ingenuity, collaboration and perseverance to excel despite a relative lack of resources and investment. At Ibadan, Oduselu's mentors include George Ademowo, who works on malaria epidemiology and coordinated the framework for introduction of the malaria vaccine into Nigeria; Olubusuyi Moses Adewumi and Adeleye Solomon Bakarey, virologists researching SARS-CoV-2 in Nigeria; and Iruka Okeke, a bacterial geneticist and member of the African Academy of Sciences.

The need for funding does not stop at providing the tools for basic research, Oduselu said; African nations also need to invest in moving this research into a translational industrial pipeline. He is optimistic.

"It's not a destination too far from now," he said, "that scientific research in many African countries is going to meet up with the standards of what is obtainable in the Western countries."

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# A medical student with a community mindset

By Sarah May

As a child, Mustapha Aminu had an inquisitive mind. “I used to play with a radio, and I wanted to find out what was inside — who was the one speaking in the radio,” he said.

Curious about how things worked, he was inspired as a youngster to study science and medicine. Now 25 years old, he is starting medical school at the University for Development Studies in Tamale, Ghana, the same university where he received his undergraduate degree in biochemistry and engaged in community-based research.

Residents of Tamale commonly drink fresh coconut juice and discard the coconut husks in the street. This generates a lot of waste. In his research, Aminu aimed to recycle those husks into something useful, a material called biochar that could be used for soil remediation or wastewater treatment. Biochar is charcoal produced by decomposing biomass (such as coconut husks) at high temperatures in the absence of oxygen.

Aminu collected coconut husk samples from the streets, brought them back to the lab and transformed them into biochar. Although the COVID-19 pandemic kept him from fully characterizing the properties of his biochar, he is hopeful that other students will continue this work, which is necessary before the biochar can be used to treat soil or wastewater.

In addition to his biochar research, Aminu was involved in other community-based projects as an undergraduate. An important mission of the University for Development Studies is to improve the social and economic lives of rural communities in Northern Ghana, the poorest region in the country. First- and second-year university students spend the third trimester living in one of these communities, identifying and working to solve its problems.

“As part of its curriculum, every student is supposed to do that,” Aminu said, “so I think that’s what makes the university special.”

He was assigned to the remote village of Gwollu in the Upper West Region of the country. For two years,

he went to Gwollu, learned what problems the residents faced and reported these back to the university. During his first year, he noticed that the community needed a dam. When he returned the second year, he saw construction work being done on the dam. They also needed a six-unit classroom block, which he later learned was being built.

“We felt very happy that we had been able to impact the community,” he said.

In January 2022, Aminu’s childhood dream of becoming a doctor was about to become a reality — and then university lecturers in Ghana went on strike. The strike lasted for about six weeks, hampering research, teaching and learning, according to Aminu.

Now that classes have resumed, he finally can begin his medical training. Because medical students also participate in community service projects, he will again be able to help solve problems in communities in need. This time, he hopes to serve in the Northern Region of Ghana, the same region where he attends medical school, and have an impact on the communities closest to him.



COURTESY OF MUSTAPHA AMINU

**Mustapha Aminu is a medical student at the University for Development Studies in Ghana.**

**Sarah May** (smay@mcw.edu) holds a Ph.D. in biochemistry from the Medical College of Wisconsin in Milwaukee, where she is now a postdoctoral fellow. Follow her on Twitter: @sarahmayphd.





# Goals blocked by power failures

By Isa Joseph Danladi

**W**hen I was a child, I suffered from marasmic kwashiorkor, a form of malnutrition. My mother had no formal education and didn't understand my symptoms, but someone told her to feed me a mix of crayfish and a local cereal pudding called pap or ogi.

In the twilight of my slow recovery, a nurse at the hospital told my mum she was wasting her time because, in his opinion, she had a "dead child."

That statement motivated my mum to hope against hope that I'd stay alive. And it made me want to become a doctor who could speak more positively than that nurse, even in dire circumstances. I persevered through high school to prove that a negative statement made by a health professional to a patient can be proven false. Today I am alive, healthy and a survivor.

When I was admitted into Kaduna State University, I hoped to study medicine, but I was offered a biochemistry program. I found a quote by a professor saying that biochemistry is "the beautiful bride of modern science," and that made me think I was in the right field.

The late Andrew J. Nok, a biochemistry professor and member of the Nigerian Academy of Science, was a role model, particularly because, like me, he was a native of Kaduna State. He mentored several lecturers in my undergraduate program, and his research on parasitic diseases such as sleeping sickness was a gold standard.

For my final research thesis, I intended to extract lignin from grain husks enzymatically using the fungus *Trichoderma reesei*. This was one of the objectives in my research plan; however, I was unable to procure the fungus from any nearby laboratory. I was pressed for time, and the challenge was never solved; I had to adjust my objectives. I never searched farther for the fungus, and I did not continue my quest of delignification in my research.

It took me some time to understand why laboratories in Nigeria have difficulty procuring essential biological samples and reagents. I finally hit on the issue of power failure. Labs expend scarce funds acquiring samples only to see them ruined and wasted by electrical outages. Studies are compromised, and even scientists who manage to preserve samples cannot be confident in the



Isa Joseph Danladi teaches advanced placement biology/chemistry/psychology to students applying to pre-med programs at U.S. universities.

research outcome.

Power outages are largely a political problem. Political elites make false promises in a bid to gain votes during election season, and aspiring leaders always say they will resolve electrical issues. Unfortunately, they always don't. This is largely because many former civil servants are key private shareholders of the Power Holding Company of Nigeria. Others have invested in the supply, manufacturing and coupling of industrial generators and would lose money if the electricity issue is resolved. It appears that nothing is being done to improve the situation.

This lack of a steady power supply is a vicious drag on research, hampering the storage of biological substances or samples that require freezing or cryopreservation. And while many scientists are willing to run generators, funds and grants aren't easy to come by.

Instead of doing research to find cures for disease, I am now a teacher and a graduate student at Ahmadu Bello University in a master's program in public health epidemiology. I no longer face the challenges of working in a lab.

Many scientists in Africa develop and execute novel research, collecting data to move their work forward. I hope some of my students and I someday will be among them.

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# Coming home to build on a science network

*By Christopher D. Radka*

**A**s the son of a chemist, Erick Strauss was inspired to become a scientist, but when he graduated from the University of Pretoria in 1997, his chosen field of chemical biology was just emerging in South Africa. So the next year, he boarded a plane bound for JFK International Airport and navigated his way to Ithaca, New York, to attend Cornell University, where he pursued his doctorate in chemistry and chemical biology studying coenzyme A biosynthesis.

The trip from Pretoria took more than 36 hours, Strauss recalls, and he needed to take both a bus and a taxi to get from JFK to Ithaca. That harrowing journey

was his first visit to the United States. More than 20 years later, he tells the story of this adventure to encourage his students and trainees to be bold and embrace the adventure of studying science.

After graduating from Cornell with his Ph.D. in 2003, Strauss was looking for a postdoctoral fellowship when a faculty position opened in the Department of Chemistry and Polymer Science at Stellenbosch University, a leading bioscience research institution in South Africa. He applied, and within a few months, he was establishing his independent research program in chemical biology as an assistant professor.

**The three chemical biology research groups at Stellenbosch University enjoy a joint outing. Erick Strauss is third from left.**



COURTESY OF ERICK STRAUSS



After five years, he moved to the biochemistry department at Stellenbosch as an associate professor, another five years later he was promoted to professor, and this year he was named chair of the department.

Strauss' work has received over 2,200 citations, and three of his top 10 most cited works were published in the *Journal of Biological Chemistry* (148, 122 and 80 citations). "My very first publication as an independent researcher was an Accelerated Publication in *JBC*, co-authored with my first grad student," he said. "I was very proud of that achievement."

Administrators at Stellenbosch must have been proud too — they offered him that job.

"At the time, Stellenbosch was on a drive to deepen its research footprint by recruiting faculty with international experience who could contribute to that project and broaden the scope of the work being done there," Strauss said. "I felt that I could have a larger impact



COURTESY OF ERICK STRAUSS

**Erick Strauss on a hike with his family — a favorite pastime.**

coming back to South Africa and using my network to play my role in that project by creating opportunities for my students to attend international conferences and to visit other research groups as part of bilateral exchange programs."

This vision has allowed his stu-

dents to travel to labs in the U.S., Spain, Italy, Australia, the Netherlands and India.

Over the years, Strauss has worked to enhance the scientific network and biochemical training in South Africa. Recently, two postdoctoral fellows from his laboratory participated in the Synchrotron Techniques for African Research and Technology program funded by the United Kingdom's Grand Challenges Research Fund. The START program, as it's called, provided protein crystallography training at Diamond Light Source, or DLS, the United Kingdom's synchrotron facility in Oxfordshire, and streamlined participants' access to DLS as part of an initiative to grow the community of synchrotron researchers in Africa.

Strauss himself participates in XChem, a DLS-based

STEFAN ELS



**Erick Strauss looks at the pipetting robot his team at Stellenbosch University was able to purchase after he received a 2021 Grand Challenge Africa research grant.**

facility that enables drug discovery by using high-throughput crystallography to screen chemical fragments for binders that can be developed into inhibitor leads. As a result of this work, he received a 2021 Grand Challenge Africa research grant that enabled the purchase of a pipetting robot operated on open-source principles.

Strauss aspires to combine high-end instrumentation and expertise bridging structural and chemical biology to provide trainees in South Africa and other African countries with access to up-to-date drug discovery research.

"We see how talent moves from one side of the world to the other, and as avenues open for more global participation, we are eager to see how our burgeoning talent pool impacts the international research scene," he said.

"Africa also offers many other opportunities — clinical studies in groups that have largely been underrepresented, and natural product collections that still remain unexplored — that, with greater visibility, will attract more international collaborative interest. South Africa is positioned to lead those efforts."

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# Nights and days in the lab

By *Oluwaseyefunmi Iyabo Adeniran*

**T**he first family death I witnessed was one of my younger cousins who had sickle cell anemia. It was devastating. A close family friend also suffered from sickle cell, and her crisis episodes were painful for many in our community. As I neared the end of high school, a cousin who was my contemporary was diagnosed with leukemia. He went through a series of treatments and a bone marrow transplant and was in remission for a couple of years before he died. These experiences fuelled my desire to become a scientist researching cures for diseases.

When I first embarked on my Ph.D. in biochemistry, I experienced some financial hardship and was tempted to give up, but with help from the university's postgraduate funds administrator, Jadah Matentji-Masuku, I received a bursary (scholarship) from the National Research Foundation South Africa for one year. I had to pay most of my expenses out of pocket, and I survived on the generosity of some good souls as well as the proceeds from selling African print fabrics, hair extensions, jewellery, snacks and moringa-based products — a side business.

My first scientific research was in the biochemistry department of the University of Ilorin, Nigeria. For my honors degree project, I prepared a feed formulation, which I fed to lab rats. Then my colleagues and I euthanized the rats, removed various organs and measured specific enzymes in the organs. The preparation of the feed went well, but some of us found the euthanizing of the animals unnerving. Properly euthanizing and dissecting the animals was essential for our investigations.

For my master's research at the same university, I had to learn how to breed albino lab rats because the supply was not enough to meet our research needs on campus. I used some of the rats for my own work; others I sold to colleagues.

I was investigating the effect of a generic drug on African sleeping sickness, and sometimes I slept in the lab, on the cold floor in the academic space or on a hard table with books as pillow, because my experiments were either on a 12-hour clock rotation or had to be monitored closely.

I completed my research work ahead of most of my

colleagues and before my course work was over. I don't know if other students had to work through the night — I was mostly alone in the lab monitoring my lab rats and collecting their blood samples.

I moved to South Africa and began to study advanced glycation end-products and medicinal plants. My department laboratory did not have certain resources I needed for my study, and our molecular biology

laboratory was still under construction, so I frequently visited the laboratory at the Tshwane University of Technology, Arcadia–Pretoria, where one of my supervisors was employed.

Sometimes I stayed overnight in my home lab to prepare for an experiment, then took a bus at daybreak to the other lab in the next town so I could complete the next step of my experiment. A spectrophotometer that was key for my research was available on my campus, but the operator's daily shift ended at 4 p.m. Because some of the protocol for my experiment was time-bound, I had to start my preparation at dawn to finish the cycle before 4 p.m.

Isolation of bioactive compounds was not part of my original objective for my Ph.D. program, but I shared lab space with researchers from the chemistry department of my institution, the Sefako Makgatho Health Sciences University. I watched them perform their experiments and sometimes assisted them with their investigation. Olivier Mutendela gave me my first insight into chromatography and isolation, and Isaac Masilela loaned me my first isolation column. Finding relevance to my study, I



COURTESY OF OLUWASEYEFUNMI ADEHIRAN

**Oluwaseyefunmi "Seye" Adeniran found her research niche using phytochemistry to study the composition of medicinal plants.**



decided to incorporate it into my protocol.

My research crossed over into phytochemistry, and I found that my niche was studying the chemical composition of medicinal plants to identify and isolate unique phytochemicals for drug discovery.

My first isolation procedure took me on a six-night no-sleep journey. I manually collected the elutes from the column chromatography set-up, taking about 45 minutes to fill each test tube. I had to stay awake to change test tubes for each collection. Automated prep high-performance liquid chromatography equipment would have done this faster, but that equipment was not available. I manually collected each of the compounds, which were mostly separated by color. Then, with further testing using thin-layer chromatography plates, I isolated some unique compounds and made discoveries that validated my findings. I linked the presence of a compound, a precursor for synthesis of others, to the unique character displayed by one of the plants of interest. Despite the rigor, I fell in love with this aspect of research.

My doctoral journey taught me the importance of collaboration and asking for help. I received that help from multiple departments at my institution and my co-supervisor's institution — specifically, the departments of chemistry, biology, pharmaceutical chemistry and chemical pathology let me use their infrastructure and sometimes provided chemicals I needed for my work. My work also crossed into my institution's virology, microbiological pathology, physiology and pharmacology departments.

I learned to stand on the shoulders of giants, people with years of experience who were willing to help me. I once walked into the office of a school head, the late



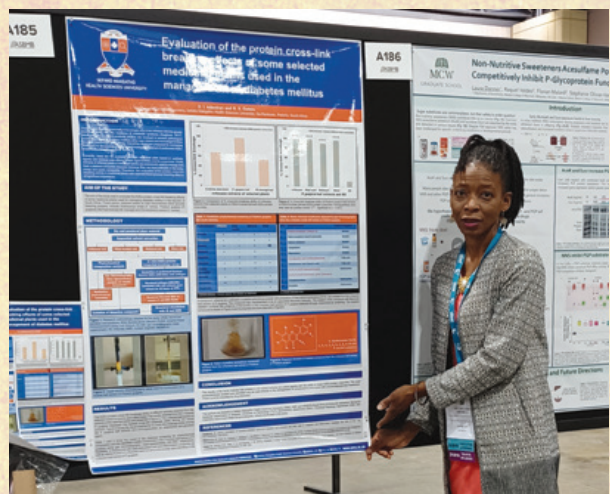
Adeniran, center, with two chemistry graduate students in a lab at Sefako Makgatho Health Sciences University.

Gboyega Adebola Ogunbanjo. He invited me in, we drank tea as I discussed my research with him, and he took time to read the first draft of my thesis literature review and meticulously edit it. That was a huge gift.

At the tail end of my study, my office was allocated to a new staffer and I had no work space. The head of the biology department, P.H. King, offered me the use of the honors students' lecture room. There, I set up a makeshift food bar with tea, coffee and microwavable snacks. I also had a change of clothes and a blanket. I camped overnight when my investigation ran late. In the morning, I'd wash in the ladies' room and finish my day's work before returning home to take my bath and have a proper sleep. I was able to complete the writing of my thesis with the use of this space.

Other, smaller gifts have been no less precious: Friends, family members and acquaintances gave me both financial and material support. I also treasure the times that friends such as my former office neighbour, Chepape Semanya, brought me food and refreshment, just to say "Hang in there."

I recently submitted my Ph.D. thesis for final evaluation. After completion of my doctoral degree, I hope to answer some of the questions that my investigation brought up, as a researcher in academia. I'd like to teach and lecture at a research institution where I can instruct both undergraduate and postgraduate students in the sciences, especially biochemistry.



Adeniran displayed her poster on medicinal plants for diabetes treatment at the 2022 ASBMB annual meeting in Philadelphia.

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# Always in a hurry

My science education in the U.S. and Cameroon

By *René Fuanta*

**G**rowing up, I was fascinated by science. I posed an unending string of questions: Why can't I see plants growing? Why can't humans fly like birds? My older siblings tried to answer me with the knowledge they'd gained in their middle and high school science classes. This only spurred my interest further.

When I was in Form 1 (equivalent of seventh grade in the U.S.), I'd visit my brother at his high school, where he was in the S1 series (one of the science cores in Cameroon's anglophone educational system). We were both in the Bilingual Grammar School, also referred to as Lycée Molyko, in the city of Buea. The huge textbooks and complex mathematical equations on the blackboard intimidated me. Sometimes, the only things I could make sense of were the letters x and y and the numbers 0–9. Other symbols looked like an elongated S or a version of the letter d. I wondered if one day I'd be able to understand them.

My siblings were comfortable solving complex mathematical equations, so I knew with hard work I'd find myself in S1 too. Years passed, and there I was in high school, enrolled in biology, chemistry, pure mathematics with mechanics, further mathematics, and physics. Physics, chemistry and biology were my

**René Fuanta with his older brother Serge, sister-in-law Hilda, niece Favour and nephew Charles.**



COURTESY RENÉ FUANTA



COURTESY RENÉ FUANTA

**René Fuanta in graduate school at Auburn University, about to sample some tasty strawberries at his study bench.**

favorite classes. After high school, I spent three years at the University of Buea as a microbiology major. It was vastly different from high school. The wake-up call was my first exam in general chemistry. I realized I had to buckle down and focus. In 2010, I graduated with a Bachelor of Science and decided to pursue a terminal degree in the U.S.

Crossing the Atlantic and landing in Georgia, I was greeted by warm Atlanta weather. But for the humidity, it felt just like home. Driving from the airport, I looked around and wondered, "Where are all the skyscrapers?" I had hoped my views would be flooded with skyscrapers on the drive to Auburn University. I convinced myself it must be the route the driver took to avoid traffic. Aren't there skyscrapers at every corner in every city in the U.S.?

The shock didn't end there. Arriving on campus the





René Fuanta hosts the Auburn University's African Student's cultural night when he was president of the association.

next day, I was astonished to see how casually dressed the students were. In the culture I was used to, if you're caught dressed in basketball or soccer shorts or shorts way above knee length, you're asked to go home and not return until you've changed your clothes.

The dress code wasn't the only difference. The phrase "free food" always seemed to be in the air and in every ad I read. I couldn't wrap my head around why anyone would have to include that in an ad. In Cameroon, if you invite someone to a meeting or event, it is customary to provide food for them — free. Thus, whenever someone tried inviting me to an event and mentioned free food, I quipped, "I would attend even sans free food."

As a graduate student and a teaching assistant, I learned more about American culture and the educational system. As an undergrad in Cameroon, I'd have one exam that was 30% of my final grade and a cumulative final exam that was 70%. My pals and I would joke that there was very little room for error.

In the U.S., I was introduced to a system with multiple tests and then (maybe) a final exam. In my three undergraduate years, I could never opt out of a final exam — it was 70% of my grade. With multiple exams throughout of the semester, I learned it was possible to skip the final.

My graduate admission letter stated that the Auburn University chemistry program takes about four years to complete. As a new and ambitious grad student, I walked into my graduate advisor's office and told him I planned to be done in three. He ran through a myriad of facial expressions. Then he bit his pen for a second. He was probably saying to himself, "Just you wait — you'll find out."

By my third year of grad school, I was nowhere near graduation. But I had made significant progress and was already a Ph.D. candidate. My ambition and drive paid off. In the fall semester of my fourth year, I had job offers from industries and various academic and research organizations.

Looking back, I don't regret pushing myself to be done in three years. I've always had what I term the sprinter's attitude — run as fast as you can in as short a time as possible and get it done. I am a first-generation faculty member in large part because I'm always in a hurry.

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# Seeing the molecular beauty of life

By *Jessica Desamero*

**W**hen Collins Maina was in secondary school in Kenya, a genetics class piqued his interest in science. He found especially fascinating how certain mutations can be disastrous to the well-being of organisms. And when he took his national exams, he was placed into a biochemistry program, which coincidentally turned out to be a good move for him.

Maina attended South Eastern Kenya University, where he earned his bachelor's degree in biochemistry and molecular biology in November. He said two particularly memorable classes were Biochemistry of Tumors and Biochemical Techniques and Instrumentation.

Not only were these classes interesting, he said, but he also was able to apply what he learned to his own life situation. Learning about the molecular and cellular bases of tumors helped him and his family when his grandfather developed prostate cancer.

"I remember I was the go-to guy for the family when they wanted to sort of analyze and translate the pathologist's reports," he said.

Learning about laboratory techniques in biochemistry was a highlight for Maina because of the physics involved. He was also able to carry and apply some of this knowledge to his career in industry as a medical representative.

In general, Maina said, biochemistry has helped him better understand what life is and how complex it is at the molecular level.

"It's really fun knowing very well that beyond what you see in a person, you see there are a couple of three-letter sequences (codons) that determine who you are, determine the personality, determine so many things in your life — how a mishap in the placement of an amino acid, how a molecule that lacks the right conformation can have very detrimental effects on an organism," he said. "At the basic level they are nothing more than molecules, very beautiful molecules."

Maina values how relatable biochemistry is to real life. "If I don't watch my health currently, I'm expecting to



COLLINS MAINA

**Collins Maina earned his bachelor's degree in biochemistry and molecular biology from South Eastern Kenya University in November.**

develop osteoporosis as I get into my 40s," he said. "And so, it's like reading the future."

While applying to postgraduate programs and reading extensively about various areas of research, Maina has developed a passion for molecular microbiology and is particularly interested in quorum sensing, which involves responding to cell population density via gene regulation. He plans to continue his studies by earning a Master of Science degree, preferably in Canada, the United States, Scotland or New Zealand. He easily excelled in his undergraduate courses, but the high cost of and limited access to good schools make this goal quite difficult. Few research jobs are available in Kenya. Still, he remains hopeful.

Eventually, Maina said, he sees himself completing a Ph.D. program, doing a lot of research and retiring as a lecturer.

"I have so many questions I think I need to answer," he said.

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# Challenging medical inequities

By *Muunda Mudenda*

**W**hen I was growing up in Zambia, I had a teacher who made biology very interesting. One day, he walked into our classroom and said, “The cell is more complex than New York City at rush hour.”

This statement fueled my interest in biochemistry and molecular biology. Years later, in 2015, it motivated me to move to Uganda to earn a bachelor's degree in biochemistry.

I now live in Kenya, where I am pursuing my master's degree in molecular biology and biotechnology as a scholar with the Pan African University Institute for Basic Science, Technology and Innovation. The Pan African University scholarship, funded by the African Union through the African Development Bank with research funds contributed by the government of Japan, enables high-performing students to study for a master's or Ph.D. at one of the PAU institutes in Kenya, Nigeria, Algeria, Cameroon and South Africa.

After I moved to Kenya in 2021, I began searching for a broader community of scientists committed to sharing their scholarly journeys in biochemistry and molecular biology. I found and joined the American Society for Biochemistry and Molecular Biology, making me one of the few ASBMB members in Kenya and Africa.

The ASBMB has given me an opportunity to be a part of a society that encourages young scientists to be high-value professionals. I've been exposed to materials through meetings, webinars and journals that have challenged my understanding of research in my field. I especially enjoy going through the ASBMB journals to learn about the trends in BMB research. The insights I get from these journals help me to add a relevant voice to scientific conversations here.

As a student researcher with the Kenya Medical Research Institute, I am carrying out a research project in vaccinology and adjuvants. My study involves the use of adjuvants to improve robustness of immune response to current vector-based COVID-19 vaccines. My hope is that we will be able to use molecular biology to contribute to the building of a technology platform for future end-to-end vaccine manufacturing in Kenya.

While my primary area of research is vaccinology, I am exposed constantly to other applications of biochemis-

try and molecular biology. Particularly important has been medical diagnostics — the application of biochemistry and molecular biology to improve diagnosis of diseases. Our laboratory also handles research projects that focus on developing diagnostic kits for diseases such as COVID-19, malaria and hepatitis.



**Muunda Mudenda aims to help develop diagnostic technologies to improve the quality of health care in Africa.**

Earlier this year, our laboratory worked on a rapid diagnostic kit for COVID-19. This project was very important because some remote areas of Kenya did not have sufficient COVID-19 testing kits, which made early detection of SARS-CoV-2 infections difficult. Being a part of a lab that develops such interesting medical technologies to solve real-world problems and improve management of diseases in Kenya has expanded my appreciation of biochemistry and molecular biology as applied in medical diagnostics research.

From my experience being involved in such projects, I think the growth of molecular diagnostics research in Kenya, and all of Africa, will help make diagnosis of diseases more accessible and affordable. Currently, high costs of medical diagnosis in Kenya, Uganda and Zambia have resulted in inequalities whereby only the well-to-do can afford diagnostic tools easily. I think advances in medical diagnostics can address such inequalities effectively.

Soon after my Master of Science degree, I hope to join a lab that develops and improves diagnostic technologies.

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# ‘Science is everything’

By Inayah Entzminger

**O**laposi Idowu Omotuyi has traveled the world for his education, and he believes in bringing the knowledge he’s gained back to his home country. His focus, for now, is on metabolic and infectious diseases with a special interest in developing plant-based antivirals.

Born in Ekiti State, Nigeria, Omotuyi was interested in science from a young age. One of his neighbors was a professor whose children were in training for medical lab science. They discussed their work with Omotuyi, kick-starting his fascination with how the world worked.

“In Africa, everything was voodoo until you understood what exactly what was going on,” he said. “That somebody could sit down and explain to me how the cells work, how tissues work, how organs interconnect into systems — that was fascinating.”

After completing his doctorate in biochemistry from the University of Berlin, Omotuyi applied for a Japanese government Ministry of Education, Culture, Sports, Science and Technology scholarship in 2009. Through the program, scientists from all over the world conduct research in Japan. After several stages of interviews,



Omotuyi gives E.S. Bogoro, executive secretary of Nigeria's Tertiary Education Trust Fund, a tour of the Institute for Drug Research and Development at Afe Babalola University.



Olaposi Idowu Omotuyi studied biochemistry in Germany and Japan before returning to Nigeria to teach and do research.

Omotuyi was one of five applicants chosen for a position at Nagasaki University to work toward his second doctoral degree in pharmaceutical science.

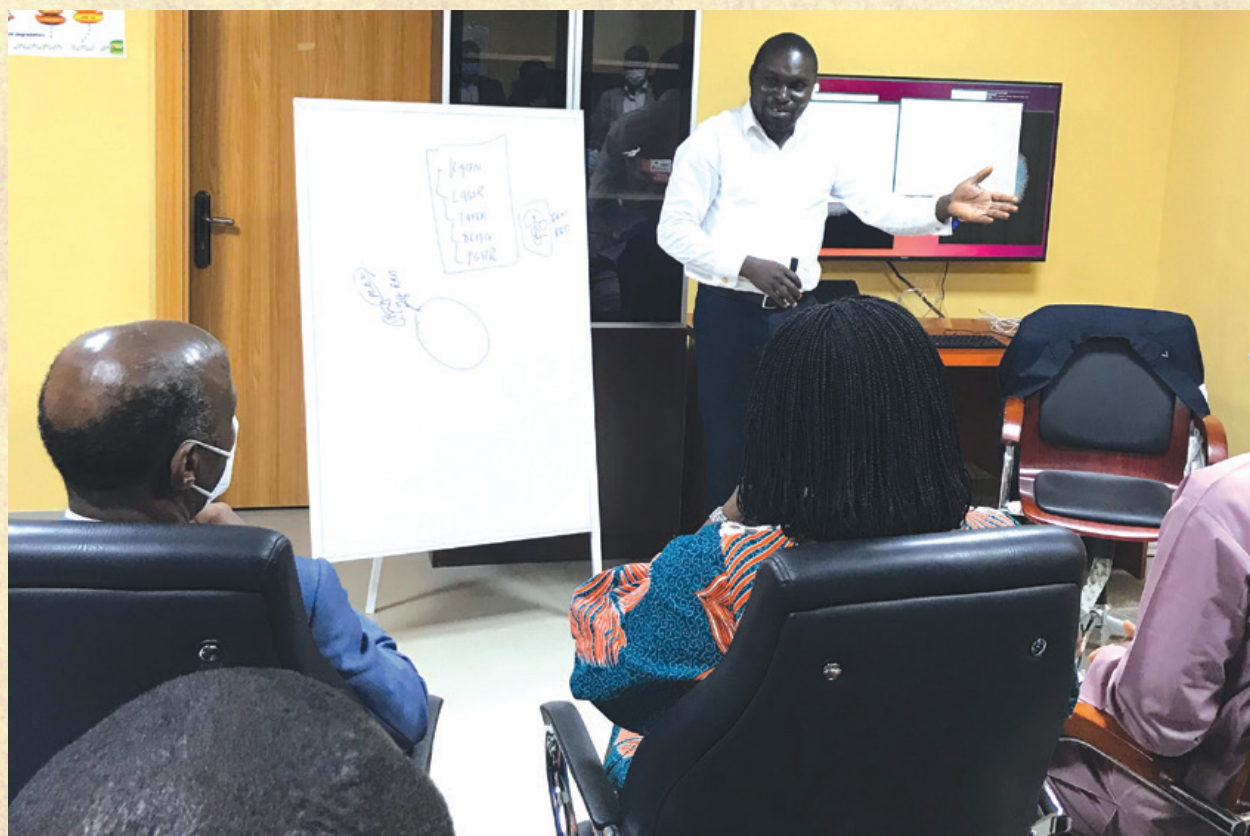
In Japan, in a first-class laboratory and heavy scientific environment, he saw a sharp contrast between an industrialized country and Nigeria. He said he believes some African scientists might be tempted to stay in a country like Japan to do research, while others want to raise the level of science in Africa by returning to their home country. In the end, he chose to bring his skills back to Nigeria.

The science was not the only thing that drew Omotuyi back. For him, being a tutor to undergraduate students first at Adekunle Ajasin University in Ondo State and now as a professor at the College of Pharmacy at Afe Babalola University, Ado-Ekiti, is “an absolute joy.”

“Not only being able to teach this experience, this knowledge to young people, but to be able to help them grow scientifically,” Omotuyi said. “I am really impressed at how they receive it.”

Few Nigerian scientists are able to translate





**Omotuyi, who says he finds teaching "an absolute joy," instructs interns at Afe Babalola University on the analysis of molecular dynamics simulation.**

their research into a product or policy that then is disseminated to a wide population in their country. Omotuyi said he has been fortunate in his networking and in the subject of his research to receive funding from the Afe Babalola University fund for translational research as well as garnering attention from other institutions for partnerships and funding. His lab now is studying both metabolic diseases and infectious diseases such as Ebola and COVID-19, which attracts government attention and resources.

An herbal drug called virudine developed in Omotuyi's lab for the treatment of COVID-19 is undergoing independent investigation at the Nigerian Institute for Medical Research, and another repurposed drug for Lassa virus disease developed in partnership with the National Biotechnology Development Agency in Nigeria is being tested for proof-of-concept clinical trials by the NIMR.

Omotuyi teaches his students the importance of patriotism in their work. In countries like the United States, he sees that scientists apply research to their local environments and local problems, and these local solutions are accepted for international application. But

African scientists end up doing research that benefits other countries instead of their own.

"African scientists who are exceptional at what they do are easily poachable," Omotuyi said.

"The first point of science for me is that (my students) should solve local problems — and in solving them they should be innovative."

Omotuyi said his favorite part of his work is getting to the biochemical details of how novel structures interact with macromolecules like proteins and nucleic acids, both during test tube experiments and in animal research models. But overall, the entire subject of biochemistry is what interests him.

"Science is something for me, like bread and drink, wake, sleep — everything," he said. "Science, and nothing else."

**Inayah Entzminger** ([ientzminger@gradcenter.cuny.edu](mailto:ientzminger@gradcenter.cuny.edu)) is a doctoral student at the City University of New York Graduate Center, researching the positive RNA strand barley yellow dwarf virus.





# ‘Science in Africa – we do it well!’

By *Clementine Adeyemi*

**W**hen doctoral student Folashade Olabinri describes her journey as a scientist, she exudes self-assurance, an easy yet palpable comfort with herself.

Growing up in Nigeria, she had no science role models, but she did have a discerning mother.

“I will always want to know, and most especially, I’m very curious about what is happening to the food we eat,” Olabinri said. “I could remember back then I used to ask my mom, what happens when we eat? Is it that there is a grinder in our stomach that grinds seeds.”

To this, she said, her mother laughed and responded, “It looks like you want to be a scientist.”

Olabinri told her mother, “I don’t even know what it means to be a scientist. ... What I just want to know is what is happening? Why are people getting sick? What happens to the food we eat?”

Her mother advised her to get on the science track, one of three typical tracks for secondary school students in Nigeria, but in school, her questions were not encouraged. “I would think, seeing my curiosity, someone will groom me as a scientist,” she said. However, “I found that teachers want students to cram and repeat what they are taught — I see myself not really liking cramming things. I just like to use my hands to do things and (then) explain what I understand.”

Her grades weren’t perfect, but this did not quench her passion.

“We did not get a lot of science practicals, but when we did, my eyes get enlightened, whether biology or physics,” she said. “Like, wow — so this is it ... science.”

These moments spurred her decision to study biochemistry at the Ladoke Akintola University of Technology. Chemistry was a challenge. “I saw the (chemical) structures and thought, wow,” she said. “Others complained regarding this, but I worked on understanding.”

She succeeded in understanding, earning both bachelor’s and master’s degrees in biochemistry. She’s now a lecturer and pursuing a doctorate at the same university because, she said, “I want to be able to ask more questions and learn more to teach my students better. To see how far I can take the research I’m doing.”

Her undergraduate project centered on assessing toxic-



COURTESY OF FOLASHADE OLABINRI

**Folashade Olabinri’s doctoral studies at the Ladoke Akintola University of Technology focus on the biochemical effect of an herb-based home remedy.**

ity levels of several varieties of a Nigerian staple food, garri, that’s made by grinding cassava and roasting it in a pan for hours. Correct processing is critical to avoid poisoning from the cyanide found in raw cassava.

For her master’s project, Olabinri studied how an extract of a plant also known as a sausage tree for the shape of its poisonous fruit works against cardiotoxicity caused by the anti-tumor medication doxorubicin.

Her doctoral studies focus on the effect of a polyherbal mixture on the inner mitochondrial permeability transition pore as a possible drug delivery conduit, especially in cancer, in Wistar rats. This mixture, known as agbo, is a traditional home remedy in Nigeria, it often is unregulated and is linked to severe kidney dysfunction.

And what does Olabinri want her international colleagues to know about scientific research in Africa?

“Science in Africa — we do it well too!” she said. “The process might not be smooth, but our research is sound and done appropriately.”

**Clementine Adeyemi** (adeyemce@mail.uc.edu) is a Ph.D. biomedical student at the University of Cincinnati. She is passionate about outreach through organizations such as Empowering Female Minds in Stem. Follow her on Twitter: @ClemAdeyemi. Her website is clementine-adeyemi.carrd.co.





# Finding ways to help

By Heather Masson–Forsythe

**“A**s an African, as a Ghanaian, I care about the issues facing us and about trying to come up with better ways to solve them, to find better ways of helping people.”

Richmond Ateko works remotely as an assistant lecturer at the University of Ghana, based in Greater Accra, where he completed his master’s degree in chemical pathology, and simultaneously is completing his Ph.D. in chemical pathology at the University of Cape Town in South Africa.

With a science teacher for a dad, Ateko grew up in a scientific environment. “From an early age, it was science for me — math, English, and the sciences,” he said.

His parents wanted him to be a doctor, but after high school, his grades didn’t quite qualify him to pursue medicine. Instead, he was put on a biochemistry track.

“Now I know that I wouldn’t have enjoyed pure medicine because I find that I thrive better in the health sciences or biomedical research,” Ateko said. “I just had to find my way along the line.”

In addition to the pandemic exacerbating research and teaching difficulties, West Africa faces hurdles that are common on the continent, including difficulty obtaining equipment, funding and visas to attend international research conferences, Ateko said. “This limits the scope and how far we can go when it comes to research.”

Research funding mostly comes from private sources, he added. Some scientists are fortunate enough to get grants from private institutions, but there’s not much government funding for research.

During his undergraduate and master’s-level research, Ateko was focused on diabetes. He learned that for most diabetic patients he met in Ghana, the drugs they needed were quite expensive. His research team was looking for an alternative medication that would be cheaper, safer and more readily available. After some initial research success, however, they were unable to continue due to lack of funds.

“That is the problem,” he said. “Sometimes we carry out research, but it ends up on the shelf.”

In his Ph.D. work, Ateko now studies the prevalence of hyperlipidemia type 3, or dysbetalipoproteinemia, in Ghana. Similar research has been done in South Africa,



COURTESY OF RICHMOND ATEKO

**Richmond Ateko is a Ph.D. student studying the prevalence of hyperlipidemia type 3 in Ghana.**

but researchers do not know how common the disease is in Ghana. This inherited condition disrupts the breakdown of fats and results in a buildup of large amounts of triglyceride-rich lipoprotein remnants in the body. Ateko’s research interests are rooted in trying to find effective and accessible diagnosis and treatment options for incurable diseases.

In addition to his research, Ateko is passionate about teaching, which he has been doing since 2005, when he completed his B.S. in biochemistry. He’s proud that many of his students have gone on to become medical doctors and engineers or to pursue Ph.D.s all around the globe. But for him, it’s important to stay close to his community.

After finishing his Ph.D., Ateko plans to continue his teaching and research. “If I get a chance to travel outside, it would be good, but I will always want to come back home because we need people to help the community,” he said. “I want to stay behind and help.”

**Heather Masson–Forsythe** (heather.forsythe1@gmail.com) completed her Ph.D. in biochemistry and biophysics at Oregon State University. She is passionate about communicating science through writing and dance. Follow her on Twitter and TikTok: @heycurllytop.





# A science journey from beer to TB

*By Ankita Arora*

**C**olin Kenyon's father believed science was important, and he engaged his son in daily conversations about the cosmos, planets and evolutionary biology.

"My language skills weren't wonderful, but there was no question about me going off and doing fine art or anything," Kenyon said. "I was going to do something in the sciences."

His father, an Englishman, was serving in the British army in the Western Desert between Libya and Egypt during World War II when he met and married a South African woman of Lebanese descent, Kenyon said. The couple returned to her hometown of Barkly East in South Africa's Eastern Cape Province after the war and settled there to raise their family.

When he was growing up in South Africa in the 1960s and '70s, only white people had privileged schooling and easy access to higher education, Kenyon explained. "For those of us who lived in remote areas with limited financial resources to spend on education, the only way to do post-graduate study was to get bursaries," he said.

Kenyon received a bursary, a form of college scholarship, from South African Breweries, a major brewer headquartered in Johannesburg, to complete his bachelor's degree and then moved on to do his master's working on optimizing the co-production of small molecules such as ethanol and glycerol during fermentation by the yeast *Saccharomyces cerevisiae*, aka brewer's yeast, at a chemical company called Sentrachem.

From there, he went on to complete his Ph.D. in biochemistry at Rhodes University in Makhanda, South Africa, while working for the chemical company AECL, where his team pioneered the commercial production of L-lysine, an essential amino acid, by fermentation. Lysine is used widely as a feed supplement for livestock and in pharmaceuticals, dietary supplements and cosmetics. The calculated global lysine market was more than \$3 billion in 2020 and is expected to grow at a rate of 5.75% annually.

Now a scientist at the Centre of Excellence for Biomedical Tuberculosis Research and a faculty member at the South African Medical Research Council Centre for Molecular and Cellular Biology at Stellenbosch University, Kenyon works on drug target identification, enzyme reac-

tion mechanisms and rational drug design for TB.

## Love for basic science

As Kenyon neared the end of his Ph.D., Nelson Mandela was released after 27 years in prison, sparking political turmoil in South Africa. At the same time, the Cold War ended when the Soviet Union ceased to exist. These events brought drastic and much-needed political change to South Africa and the country's chemical industry. Kenyon was transferred to South Africa's Council for Scientific and Industrial Research, where he had the perfect opportunity to pursue his interest in more fundamental research focusing on protein reaction mechanisms.

"Protein structure and function fascinated me from when I was an undergraduate," he said. "The question of why enzymes were capable of doing the specific reaction intrigued me."

His prior work on Corynebacteria and glutamine synthetase, an enzyme that is relevant to making amino acids, serendipitously led him to enter tuberculosis research. *Mycobacterium tuberculosis*, the bacterium that causes TB, exports glutamine synthetase, a massive protein with a molecular weight of 660 kilodaltons, into the macrophages. Further, pathogenicity in tuberculosis is linked to this export, making glutamine synthetase from *M. tuberculosis* an excellent target for a rational drug design. While Kenyon was doing this work, he realized that researchers did not understand a lot about the chemistry of adenosine triphosphate, or ATP, and the phosphoryl transfer mechanism.

"I think the pendulum from within the world of cell biology has swung too far away from the fundamental physics of the chemical reactions going on in the cell," Kenyon said. "We understand very little about the energy flux, carbon flux, and mass and energy balances."

He started to work on kinetics and mechanisms of ATP chemistry using glutamine synthetase and other kinases as a model system. This research opened the doors for him to join an international consortium looking into structure-based drug design to develop novel kinase inhibitors specifically targeting the calmodulin-dependent





A scientist at the Centre of Excellence for Biomedical Tuberculosis Research and a faculty member at Stellenbosch University in South Africa, Colin Kenyon works on drug target identification, enzyme reaction mechanisms and rational drug design for TB.

kinase 1 enzyme group, which is implicated in triple-negative breast cancer and other diseases.

## Challenges and rewards

Although South Africa is among the most developed countries in Africa, doing science is challenging. “To do research that is internationally recognized requires money,” Kenyon said, “and for every scientist in South Africa to get that level of funding from the government is next to impossible.”

The government must balance projects investigating quantum mechanics in ATP chemistry against building houses for poor people, Kenyon said. “And we must be careful that we do not leave a significant number of our population behind.”

Science doesn’t happen in isolation, he noted, and as the technology and wealth gap increases, it has consequences in society. “We have to intervene,” he said, “and throwing money at (the tech gap) is not the solution— it’s allowing the scientists within Africa to become relevant, so the teaching needs to be relevant and the degrees that we give are relevant.”

Scientists in developing nations spend a disproportionate amount of time writing grant proposals with a significantly lower success rate than their peers in wealthier countries. “We spend too much time begging people to do our jobs,” Kenyon said. “I don’t know of any profession in the world where people beg to do their jobs as scientists do.”

His greatest reward, Kenyon said, has been training master’s and Ph.D. students from varied backgrounds who have massive differences in quality of primary education and financial stability.

“To have students graduate who can come from very poor backgrounds and create the possibility that they will have significantly better opportunities than their parents ever dreamt of brings an inordinately large amount of joy.”

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# Seeing what I become: An academic journey

By Ademola Adetokunbo Oyagbemi

Starting in secondary school, I developed an interest in biological sciences and a natural love of chemistry, especially organic chemistry. I remember organizing chemistry tutorials for my classmates as a first-year university student. What I love most is relating structure to function — which is biochemistry.

I am the first born of my family, with 11 siblings. My father has four wives, and my mother is the first wife. My parents only attended high school, and I was the first in my family to go to college. As the oldest child, I made up my mind to go to school and make it in life so I could take care of my parents and siblings.

After secondary school, I gained admission to the University of Ibadan, Nigeria, to study veterinary medicine. Though I had wanted to study pharmacy due to my love for chemistry, this seemed like a miracle, because I'd thought I would not be able to complete even my secondary school education due to lack of funds. As fate would have it, my university education was sponsored by one of my father's friends who works with Chevron Texaco Limited in Lagos, Nigeria. I was sponsored from my third year of the six-year doctor of veterinary medicine program. In Nigeria, an undergraduate degree is not required before admission to the DVM program.

I graduated from the University of Ibadan as one of the top 5% in my class. My keen interest in academics spurred me to continue with postgraduate studies in veterinary pharmacology and later biochemistry; I earned two master's degrees.

I took up a Ph.D. program in 2008 at the University of Ibadan College of Medicine and Cape Peninsular University of Technology, Cape Town, South Africa, at the oxidative stress research center, with a special focus on cell signaling as a tool for unraveling molecular mechanisms of action for cardiovascular disease and its complications such as hypertension, renal damage and myocardial infarction.

I joined the academic staff of the department of veterinary physiology, biochemistry and pharmacol-



Ademola Adetokunbo Oyagbemi

ogy at the University of Ibadan as a young lecturer in September 2005, and I now head that department. In the lab, I study the use of medicinal plants, plant-derived products and nutraceuticals for the management of cardiovascular diseases and complications such

as hypertension, renal damage and diabetes mellitus. I also mentor young faculty members to help them shape their career paths and lessen their struggle along the academic ladder.

As a young researcher, I faced challenges including finding the right mentor and like-minded colleagues. It took me time to find a career path in cardiovascular pharmacology and cell signaling. One of my senior colleagues approached me after my Ph.D. to be part of a group starting a lab. That was the beginning, in 2013, of the cardio-renal laboratory, which to date has graduated three Ph.D. students and more than 30 masters and undergraduate DVM students. We have established collaborations with researchers from the United States, South Africa, Botswana, Namibia and Ghana. Eight of my undergraduate students are now in the U.S., and one is in Canada, all in Ph.D. programs.

I tell my young colleagues that there should be no limit to their vision. The academic road might be rough; however, it is what you start seeing from now that you become. I see myself becoming a renowned biochemist in the world and a mentor to up-and-coming biochemists.

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# Discover BMB: A reimagining of our annual meeting

By Karen N. Allen & Craig E. Cameron

For decades, the American Society for Biochemistry and Molecular Biology Annual Meeting has been held as a part of Experimental Biology, which amalgamated us with several other scientific societies. In 2023, we will forge our own path, holding our annual meeting in Seattle. Save the date now: March 25 – 28, 2023. We are excited to share the ideas for our first standalone meeting in many years and some highlights of our scientific program.

## Big changes, better integration

Once leadership has made a decision, such as completely changing the context in which our annual meeting occurs, nothing is sacrosanct. As a solo meeting, we can optimize the timing of our events — making them more accessible with fewer overlaps and better integrating our award sessions.

As we have learned during the pandemic, the value of an in-person meeting is not in the dissemination of scientific information — this can occur in a virtual setting. An in-person meeting enables scientific debate, community building, mentoring and networking. We are working to enhance the impact of our poster sessions with better scheduling and by including a reception with refreshments at the posters, offering more networking opportunities for our younger members.

The Meetings Committee, chaired

by Vahe Bandarian, and the ASBMB staff are hard at work to make the 2023 meeting an exciting gathering that enhances existing connections and catalyzes new and exciting opportunities for collaboration and networking. Stay tuned!

## Programming the hottest trends

We are enthusiastic about our 11 themes, centered on the latest advances and approaches in biochemistry and molecular biology. The focus on metabolism includes sessions on “Biochemistry of Elemental Cycling,” a theme that centers on microbes and our environment, and “Advances in Organismal and Cellular Metabolism,” centering on physiology and disease.

Critical biomolecules of the cell are identified, engineered and harnessed for myriad applications in sessions on “Frontiers in Carbohydrate Synthesis and Recognition,” “Lipid Dynamics and Signals in Membrane and Protein Structure,” and “Regulation of RNA.”

Phase separation and the formation of biomolecular condensates are among the hottest topics in BMB. Their impact is reflected by their presence in multiple sessions. These sessions, providing diverse perspectives using different systems, are “Protein Machines and Disorder,” “Organelles, Mechanisms and Phase Properties of Cellular Quality Control,” and “Cell Signaling—New Tools and Emerging Concepts.”

Over the past five years, artificial intelligence and machine learning, better known as AI and ML, have taken a front seat in our ability to perform and analyze BMB research. The scientific theme “AI and ML in Structural Biology, Drug Design and Systems Biology” highlights the ways in which researchers employ these tools. At the same time, AI and ML can present challenges as underscored in the theme “Bias In, Bias Out in Data Science.” The “Education and Professional Development” session will include talks devoted to the uses of AI in BMB education.

In an upcoming issue of ASBMB Today, you will see the details of these exciting themes from our session organizers. We look forward to sharing with you the reimagining of our annual meeting and the rediscovery of what BMB is all about. See you in Seattle!

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**Craig E. Cameron** (craig.cameron@med.unc.edu) is a professor and chair of the microbiology and immunology department at the University of North Carolina at Chapel Hill and an associate editor of the Journal of Biological Chemistry. Follow him on Twitter: @CameronLabUNC.





# Discover BMB 2023 symposia

The program planning committee for Discover BMB 2023, chaired by Karen Allen of Boston University and Craig Cameron of the University of North Carolina School of Medicine, is assembling a program of symposia for the American Society for Biochemistry and Molecular Biology's March 25–28 meeting in Seattle. Here are the themes and organizers:

## Advances in organismal and cellular metabolism

Nika Danial, Harvard Medical School  
Gary Patti, Washington University in St. Louis

## AI and ML in structural biology, drug design and systems biology

Rommie E. Amaro, University of California, San Diego  
Celia Schiffer, University of Massachusetts Medical School

## Bias in, bias out in data science

Allison C. Augustus–Wallace, Louisiana State University Health Sciences Center New Orleans

## Biochemistry of elemental cycling

Jennifer Dubois, Montana State University  
Sean Elliott, Boston University

## Cell signaling — new tools and emerging concepts

Kevin Gardner, City University of New York  
Jin Zhang, University of California San Diego

## Education and professional development

Margaret Kanipes, North Carolina Agricultural and Technical State University  
Erika Offerdahl, Washington State University

## Frontiers in carbohydrate synthesis and recognition

Xi Chen, University of California at Davis  
Catherine Grimes, University of Delaware

## Lipid dynamics and signals in membrane and protein structure

Michael Airola, Stony Brook University  
Robert V. Stahelin, Purdue University

## Organelles, mechanisms and phase properties of cellular quality control

W. Mike Henne, University of Texas Southwestern Medical Center  
Cheryl Kerfeld, Michigan State University

## Protein machines and disorder

Ivaylo Ivanov, Georgia State University  
Yan Jessie Zhang, University of Texas at Austin

## Regulation of RNA

Daniel Dominguez, University of North Carolina at Chapel Hill  
Stacy Horner, Duke University





# Discover BMB: And the winner is ...

During Experimental Biology 2022 in Philadelphia, visitors to the American Society of Biochemistry and Molecular Biology booth and lounge were invited to vote on their favorite logo for the society's standalone 2023 meeting, now called Discover BMB, to be held March 25–28 in Seattle.

With the promise of fun prizes (who doesn't love T-shirts and magnets?), a total of 607 people voted on their phones using our QR code.

And the winner — by a wide margin — was Option #1.

Look for it on your social media feed to find all the latest news about Discover BMB 2023.

— Sarah Ornstein, ASBMB marketing manager

## THE RESULTS:



OPTION 1: 57.3%



OPTION 2: 25.5%



OPTION 3: 17.2%



## ‘Have faith in that training’

By *Martina G. Efeyini*

**R**aghuvir Sengupta, a postdoc at Pfizer, recently left HP Inc. after working in research and development there for more than five years. He talked to ASBMB Today about being an industry biochemist.

### 1 HP is known for computers and printers. What did you do there?

HP also has an R&D unit called HP Labs that has significant expertise in microfluidics and nanofabrication.

Our team at HP Labs developed a sensor that can be used to detect trace levels of chemicals via surface-enhanced Raman spectroscopy. My role was to determine whether this SERS sensor can be used to detect biological molecules like nucleic acids and metabolites. Some of my work involved detecting metabolites released by bacteria for rapid bacterial identification.

My work at HP moved me away from areas of biochemistry, like enzymology, that I enjoyed and had significant training in. My postdoctoral fellowship at Pfizer now allows me to do research in enzymology and get additional training within an industry setting.

### 2 What was it like working at a tech company’s lab?

It was exciting. My favorite part of being at HP was being able to merge seemingly disparate technologies. For example, we were able to publish a neat paper where we described using an HP printer to dispense picoliter volumes of liquid onto our SERS sensor for quantitative chemical detec-



Raghuvir Sengupta

#### CURRENT POSITION

Postdoctoral fellow at Pfizer

#### CAREER PATH

Ph.D. in biochemistry at Stanford University

#### FIRST JOB OUTSIDE OF ACADEMIA

Biochemist at HP Inc.

#### FAVORITE MOLECULE OR PROTEIN

The tetrahymena self-splicing group I intron. “I spent many years in graduate school and as an undergraduate studying this RNA enzyme (ribozyme). It taught me much of what I know about enzymology and how to conduct scientific research.”

tion. That was a real highlight of my time there.

### 3 I know you just started, but say more about your postdoc at Pfizer.

I will be studying chromatin-modifying enzymes and working toward understanding the specificity of these enzymes and how they are able to modify only certain regions of chromatin and not others. My sense is that this work will help us understand how these enzymes impact global chromatin modification patterns, which might relate to how changes in

these patterns correlate with disease states like cancer.

### 4 How did your graduate experience prepare you for industry?

Graduate training gave me the confidence to learn about new things like SERS sensors at HP or new techniques to understand chromatin-modifying enzymes at Pfizer. Have faith in that training — that you can do it. Connect your work in a way that leads to excitement or progress. In some ways, my time at HP and Pfizer feels similar to my time in graduate school.

In industry, there’s a greater awareness that time is limited. My fellowship at Pfizer is only two years so I need to think about where my work is going. When I was in graduate school, I don’t recall the same sense of urgency I feel now.

### 5 What advice do you give someone considering a career in industry?

Don’t be afraid to reach out to as many people as you can. Set up virtual meetings or get a cup of coffee to learn about what people are doing. I was amazed to learn how willing most people are to meet up and talk about their work and background.

*(This interview has been edited and condensed. Read a longer version at [asbmb.org/asbmbtoday](http://asbmb.org/asbmbtoday).)*

**Martina G. Efeyini** ([mefeyini@gmail.com](mailto:mefeyini@gmail.com)) is a science communicator and STEM education advocate, and a career columnist for ASBMB Today. Follow her on Twitter: [@mefeyini](https://twitter.com/mefeyini).





# CLASSIFIEDS

## Visiting Assistant Professor of Chemistry Wabash College

The Wabash College  
Chemistry Department  
invites applications



for two Visiting Assistant Professor positions – one in the area of Biochemistry and the other in the area of Analytical Chemistry or a related field. The successful candidate must have a commitment to excellence in undergraduate teaching, an appreciation for the broad intellectual community of an excellent liberal arts college, and the ability to work with a diverse student body.

<https://careers.asbmb.org/job/visiting-assistant-professor-of-chemistry/63098863/>

## Open Rank Faculty, Molecular and Cellular Physiology and Chemical Biology University of Virginia

The Department  
of Molecular  
Physiology and  
Biological Physics



at the University of Virginia invites applications for two tenured/tenure-track faculty positions in molecular and cellular physiology and chemical biology. The Department seeks to expand its strengths in cardiovascular, cancer, and other disease related biology with new faculty hires in molecular and cellular physiology of the cardiovascular system and diagnostic or therapeutic chemical biology.

<https://careers.asbmb.org/job/open-rank-faculty-molecular-and-cellular-physiology-and-chemical-biology/62340153/>

## Postdoc in Display Technologies and Protein Engineering Los Alamos National Laboratory

Los Alamos National  
Laboratory (LANL) is a  
multidisciplinary research



institution engaged in science  
and engineering on behalf of national security. Our  
Bioscience Division is seeking outstanding candidates for  
a postdoctoral research associate position.

<https://careers.asbmb.org/job/postdoc-in-display-technologies-and-protein-engineering/62526233/>

## Research Assistant, Dept. of Oncology Lombardi Comprehensive Cancer Center, Georgetown University

This position is  
responsible for  
performing molecular



and cell biology research and general lab management  
in a research laboratory setting. The selected individual  
will work directly with the Principal Investigator and gain  
valuable experience in cutting-edge molecular and cell  
biology techniques (e.g., genome editing, genomics and  
proteomics assays, microscopy) and lab organization.  
In addition to the lab management task, the selected  
individual will also participate in active research projects  
that culminate in publications.

<https://careers.asbmb.org/jobs/view/research-assistant-department-of-oncology/62806181/>

To see a full list of jobs, please visit [careers.asbmb.org](https://careers.asbmb.org)



# SAVE THE DATE



**ASBMB Annual Meeting is now Discover BMB.**  
**#DiscoverBMB**

[discoverbmb.asbmb.org](https://discoverbmb.asbmb.org)

