

## GDCB's nurturing environment creates stellar scientists tackling global issues

After earning doctorates from Iowa State University (ISU) in 2021, six graduates affiliated with the Department of Genetics, Development and Cell Biology (GDCB) are moving forward in their careers. Some of these new alumni continue their research on aging and plant breeding, while others develop and improve cancer detection.

Ian Braun and Mark McHugh earned their doctorates in spring 2021, while Yosia Mugume, Emmanuel Nsamba and Urminder Singh received their doctorates in summer 2021. Mark Bouska received his Ph.D. in the fall.

### **Nsamba studies mechanisms of chromosome segregation**

A postdoc at Stanford University under the direction of Department of Development Biology Chair Anne Villeneuve, Nsamba's research involves "Investigating mechanisms of meiotic chromosome segregation."

Nsamba said, "Failure to execute meiosis correctly results in abnormal numbers of chromosomes in gametes, called aneuploidy, and is associated with numerous genetic disorders, pregnancy loss and infertility. My research aims to identify and characterize components of meiotic



*Emmanuel Nsamba*

***GDCB alumni springboard into careers in critical areas that include studies on plant biology, aging, cancer detection, and cutting-edge discovery research.***

chromosome segregation machinery, with a focus on error-prone oocyte meiosis, which accounts for the largest portion of human reproductive disorders."

Nsamba's interest in science began in high school as he explored understanding the biology of life and the environment. "Additionally, there were threats to life while growing up, such as high mortality rates, and my community was grappling with food insecurity and malnutrition due to low returns from agriculture, a major source of livelihood in Uganda," he said.

Nsamba was introduced to genetics, and his journey toward a Ph.D. began. Nsamba said, "The multidisciplinary genetics and genomics program at ISU was the best fit for graduate school through its diversity in courses, research facilities, and renowned faculty."

His major professor at ISU was GDCB Associate Professor Mohan Gupta, and his major was genetics.

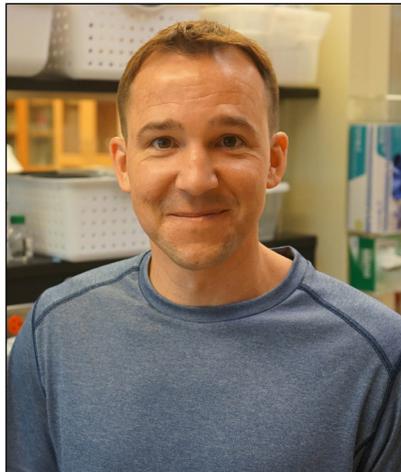
Nsamba said his future research ambitions "embody using genetic principles to inform medicine, particularly cancer."

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## **Bouska works to cure aging**

In January, Bouska began a postdoctoral research position at the University of South Dakota Department of Basic Biomedical Sciences in Dr. Xuejun Wang's lab. His research is on the "regulation of the proteasome to promote cardiovascular injury recovery."

Bouska pursued his Ph.D. in molecular, cellular and developmental biology at ISU after teaching biology and physiology at West Monona High School in Iowa. "When I showed the students the statistics for the top 10 leading causes of death, I realized that almost all are due to lifestyle choices



*Mark Bouska*

or a lack of proper preventative medical screening. However, the one thing that still has no cure is old age itself." Bouska read several papers that revealed there is a molecular basis of aging that is linked to development.

While at Iowa State, Bouska conducted research in the lab of GDCB Assistant Professor Hua Bai. "Genetic analysis of spermatogenesis and aging in *Drosophila*" was the title of Bouska's defense.

Bouska said about his research at ISU, "Humanity has finally reached the point in which we have all of the biotechnological tools and understanding to cure aging itself. I felt the molecular, cellular and developmental biology program would provide me with a better grasp of the technical aspects that I needed to develop the cure, and it just so happened that ISU had that very program."

## **Singh working to improve cancer detection**

A bioinformatics scientist in the Bioinformatics R&D division at Illumina in San Diego, Calif., Singh works closely with the oncology, software and assay group at the company.

Singh said, "My role is to support, improve and develop cancer detection and diagnostics pipelines. Our group

also contributes to IVD [in vitro diagnostics] submissions for FDA approval." Illumina is "a leading developer, manufacturer, and marketer of life science tools and integrated systems for large-scale analysis of genetic variation and function," per company information.



*Urminder Singh*

While earning his Ph.D., Singh majored in bioinformatics and computational biology and studied under the direction of GDCB Professor Eve Wurtele. "I became interested in studying computational biology as a computer science student when I was trying to find a challenging problem for my research thesis," Singh said.

"I developed algorithms for the analysis of bacterial whole genome sequences. After that, I got interested in studying human genomics," Singh said.

## **Mugume's research focuses on lipid biosynthesis in plants**

A postdoc at Michigan State University in the lab of Christoph Benning, Mugume is continuing his research on plants. He is studying "the mechanisms of lipid transfer between different chloroplast membranes, the coordination of lipid biosynthesis between the endoplasmic reticulum and the chloroplast, and its regulation."



*Yosia Mugume*

The research's goal is to better understand the process of synthesizing lipids in plants. "This can guide efforts

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to breed plants that produce lipids that can be used for various purposes, including production of biofuels. This research will also help us to understand how chloroplast membrane lipid derived signals coordinate biotic and abiotic stress signals.”

While at ISU, Mugume majored in genetics. His major professor was Walter E. and Helen Parke Loomis Professor of Plant Physiology Diane Bassham.

Mugume began his path to a Ph.D. in genetics because he wanted to gain knowledge in plant breeding and work with other scientists to produce improved crops to create food security for his country, Uganda. “After my rotation with Dr. Bassham, I became interested in cell and molecular biology because it helped me to understand different pathways and underlying mechanisms that control different aspects of plant growth.”

### **Braun data engineer at Critical Path Institute**

Braun is a data engineer at the Tucson, Ariz., based Critical Path Institute (CPI). CPI is a nonprofit organization described as “a catalyst for innovation that accelerates the path to a healthier world.” It is in a public-private partnership with the U.S. Food and Drug Administration.



*Ian Braun*

Regarding projects he is working on as a data engineer, Braun said, “The general topic is working towards creating knowledge graphs to help researchers make discoveries from diverse sets of medical data.”

The GDCB alumnus was a bioinformatics and computational biology major at Iowa State. His major professor was Carolyn Lawrence-Dill, a professor in the departments of Agronomy and GDCB. Lawrence-Dill is currently associate dean (research and discovery) in the College of Agriculture and Life Sciences.

Braun’s interest in biology increased when he was an undergraduate, and he “wanted to explore further how computer science was advancing that field.”

### **McHugh’s research works to improve drug efficacy**

McHugh continues his research as a postdoctoral research associate in ISU’s Biomedical Sciences Department under the direction of Distinguished Professor Richard Martin.



*Mark McHugh*

“My research focuses on exploring the molecular and cellular pharmacology of

parasitic nematode (*Brugia malayi*) ion channels for the improvement of anthelmintic drug efficacy to delay the onset of drug resistance,” the GDCB alumnus said.

While pursuing his Ph.D., his co-major professors were College of Liberal Arts and Sciences Associate Dean Jo Anne Powell-Coffman (GDCB professor) and Martin.

Whether continuing their research, improving scientific tools, or helping researchers make discoveries from medical data, GDCB’s 2021 graduates are moving forward in their careers.

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