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BSCP

BIOMEDICAL SCIENCE
CAREERS PROGRAM

Keynote Speaker

George M. Church

GEORGE M. CHURCH, PHD, A GENETICS professor at Harvard Medical School (HMS) and professor of health sciences and technology at Harvard University and the Massachusetts Institute of Technology (MIT) who helped start the Human Genome Project in 1984, will deliver the keynote address at the New England Science Symposium on Saturday, April 11, 2015. Church has co-authored more than 300 papers and 60 patents, co-founded nine companies and is considered a pioneer in the field of personal genomics and synthetic biology.

Most recently, intellectual property related to genome-editing technology Church helped optimize — the CRISPR-Cas9 system — was licensed to Editas Medicine in Cambridge, Massachusetts, a company that is working on transforming gene-editing technology into therapeutic application.

The CRISPR phenomena, “clustered regularly interspaced short palindromic repeats,” was discovered in E.coli in 1987. In 2013, scientists in Church’s lab at Harvard as well as teams at the Broad Institute and the University of California Berkeley showed that it could be harnessed to edit genes in human cells. Since then hundreds of labs have shown that it works in essentially every organism tried.

This work has led to wider adoption of the technique and to the promise that it can be used in a variety of ways to treat diseases in humans by repairing the genes that cause them. In fact, companies have been founded for just that purpose. According to Church, Phase I clinical trials, the first stage of human testing, are less than three years away. He estimates that full approval could take 5 to 10 years.

Scientists in Church’s lab at Harvard are applying the technique to reversing the damage of muscular dystrophies and aging. Egenesis, a life sciences company of which he is a co-founder, is working on using it for organ transplants and humanizing pig genes so that their organs can be transplanted into people without immune rejection.

Though CRISPR-Cas9 is a gene repair technique, Church says the wide range of potential applications show that “everything has a genetic component, even if it seems like the cause is environmental.” He cites AIDS, which he describes as “almost entirely environmental” in the way it is acquired, as an example. He believes CRISPR-Cas9 will be able to treat the disease by deleting gene receptors from the T-cells of AIDS patients or possibly prevent it by doing the same in high-risk individuals.



GEORGE M. CHURCH, PHD

To Church, his interest in genetics was a natural progression of a love for animals and medicine when he was young (with a physician father), and looking to combine his interests in math, computers and biology. “Genetics was one of the few fields where I could do that,” he says.

The scientist graduated from Duke University in two years, with BA degrees in chemistry and zoology. He began graduate studies at Duke but transferred to Harvard, receiving a PhD in biochemistry and molecular biology in 1984. He helped start the Human Genome Project with his

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SPECIAL THANKS TO

Mintz, Levin, Cohn, Ferris, Glovsky and Popeo, P.C.
and the Massachusetts Medical Society
for their support of this newsletter





News from the Board

BSCP Appoints Three New Members

AT ITS DECEMBER 2014 MEETING, the BSCP Board of Directors appointed three new members, Rafael E. Luna, PhD, Dennis A. Dean II, PhD, and Maria C. Carles, PhD. Luna and Dean are former BSCP students.

Rafael Luna has been an instructor in the department of biological chemistry and molecular pharmacology at Harvard Medical School (HMS) since August 2014. He received a PhD in biological sciences from Louisiana State University in 2004 and was a research fellow at Morehouse School of Medicine the following year. He was a research fellow at HMS from 2005–2014. Luna was a BSCP student beginning in 2006 and became a BSCP student advisor in April 2014. He was a panelist at the Biomedical Science Careers Student Conference in 2008 and 2014. He has also been active with the

New England Science Symposium (NESS), serving as a poster presenter in 2007, a panelist in 2013 and a planning committee member in 2009, 2010, 2013 and 2014.

Dennis Dean has been a research fellow in the sleep epidemiology and sleep and cardiovascular medicine programs in the Division of Sleep and Circadian Disorders Department of Medicine and Neurology at Brigham and Women's Hospital since 2011. He received a PhD in biomedical engineering and biotechnology from the University of Massachusetts that same year. Dean was a BSCP student starting in 2008 and has been a BSCP student advisor since April 2014. He was a panelist at the Biomedical Science Careers Student Conference in 2012. He was also an oral presenter at the 2011 NESS, and a third place Ruth and William Silen, MD, award winner that year.

He was a poster presenter in 2008 and a planning committee member in 2014.

Maria C. Carles is a professor in the department of natural sciences at Northern Essex Community College. She received a PhD in biomedical sciences and immunology from Northeastern University, Bouve College of Pharmacy and Health Sciences in 1998 and was an NIH Pre-doctoral fellow from 1993–1996. During her undergraduate years in Panama, she was a research fellow for the World Health Organization, WHO Collaborating Center for Drug Quality Control at the University of Panama, and an Exxon research fellow in the molecular biology laboratory at the Smithsonian Tropical Institute Panama City, Panama. Carles attended the 2014 Evening of Hope fundraiser and will be a BSCP student advisor.

Words from Our Students

Following are excerpts of emails sent to Lise Kaye from attendees of BSCP-sponsored events in 2014:

My name is Lianne Wachira — I was a BSCP participant a couple of years ago and wanted to send a special thank you.

The mentors assigned to me gave me the final inspiration I needed to pursue a career in medicine from a non traditional background — now I am a medical student at St. George's University and loving the whole experience.

Sometimes we need someone else to believe in us and tell us that we can make it — to put away past disappointments and failures and just go for it — That is what Dr. Keith Crawford [BSCP student advisor] did for me. He was able to read beyond my “brave and confident face” — that I was struggling and afraid. He encouraged me to give the MCAT one more try and I did, and now I'm on my way — working hard to achieve my dream.

So thank you Lise Kaye — and the whole BSCP board for what you have done for students like me. Hopefully I will get a chance in the future to be of service through BSCP and return the favor...

— *Lianne Wachira*
St. George's University School of Medicine

My name is William Dugan and I attended the BSCP Skills Workshops at Harvard this past Saturday. I just wanted to send a quick email your way to say thank you so much for everything. I know that you played a major role in coordinating the event and I thought you should know that the experience was really quite transformative. In fact, I feel like the program has redirected the course of my life.

Thanks so much again for everything!
— *William Dugan*
Quinsigamond Community College

...I wanted to sincerely thank you and all the organizers for arranging the BSCP conference. I was humbled and privileged to be among great scientists and mentors most of which I still stay in touch till today. Importantly, I wanted to sincerely thank you and everyone because as a result of the BSCP conference, I was awarded an academy fellowship at the National Institutes of Health (NIH). With the great networking available, I was able to share my experiences and I was exposed to great opportunities such as earning an internship at the NIH.

Once again thank you, and I will be more than willing and humbled to share this great experience in the next BSCP conference with other attendees of the great value and “realistic” impact of this conference. [See related story, page 3.]

— *Jacob Fobtung, Academy Fellow 2014–15*
National Human Genome Research Institute (NHGRI) National Institutes of Health

Where Are They Now?

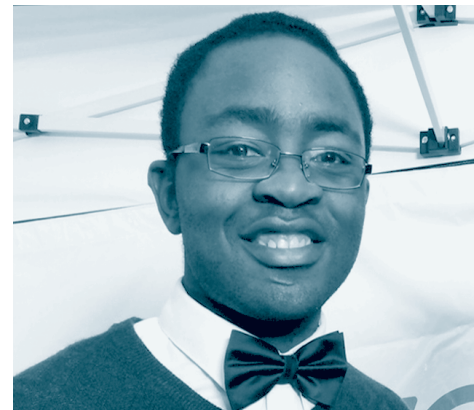
Jacob Fohtung

AFTER FIVE AND A HALF YEARS, Jacob Fohtung had had enough of Wisconsin. Though he had more or less adjusted to the climate, which had been a shock when he first arrived as a college freshman from his home in Cameroon, West Africa, he was anxious to move forward in his career. And it was still awfully cold. He found the 2014 Biomedical Careers Student Conference through a Google search, which also led him to the New England Science Symposium. In April of last year, he booked a one-way ticket to Boston and has never looked back.

Fohtung is currently an Academy Fellow in the National Human Genome Research Institute (NHGRI) at the National Institutes of Health (NIH), and he maintains that he owes it all to his attendance at the BSCP conference. In one of the career workshops, he sat in the front row and

asked a question of Sharon Milgram, PhD, director of the NIH's Office of Intramural Training & Education. After answering it, she suggested that he see her after the workshop ended. Milgram told Fohtung about the NIH Academy Fellows Program, intended for those interested in addressing health disparities in their careers. She suggested that he apply and told him to contact her after he had completed his application. He did, and within a few short weeks he had been accepted.

Fohtung explains that health care is in his blood. He grew up in Cameroon, one of eight children whose father is a physician and mother is a pharmacist. He and his siblings routinely visited their father's office and watched him interact with patients. "You made sure you had to do something in medicine," he says. "You could see the effect, with three of my



JACOB FOHTUNG

siblings now physicians." He was the last of the eight to come to the United States. Today they are scattered around the country, with one sister living in Germany with her husband.

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GEORGE CHURCH

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doctoral advisor, Walter Gilbert, PhD. He was one of the first employees at Biogen Research Corporation (now Biogen Idec), then pursued postdoctoral research in California before joining the faculty at Harvard Medical School in 1986. He is a director of the U.S. Department of Energy Center on Bioenergy Technology at Harvard and director of the National Institutes of Health National Human Genome Research Institute Center of Excellence in Genomic Science, which is also at Harvard.

Church says this is an ideal time for any students interested in genetic engineering, because, "The playing field is relatively flat and open to newcomers." There is also a human element to the discipline that he says is harder to find in some other areas

of scientific study. "Different parts of the world have different genetic components," he explains. "People who become research subjects are more expert in their traits, populations and environments than the scientists. Scientists need the general

public to help them with their work. That appeals to some young students. They get to interact with people, not just stay in their labs with chemicals."

And help develop new ways to save lives.

GEORGE CHURCH'S NOTABLE HONORS

Dr. Church was elected to the National Academy of Sciences in 2011 and the National Academy of Engineering in 2012. He is a member of the Research Advisory Board of SENS Research Foundation.

- 2011 Bower Award and Prize for Achievement in Science of the Franklin Institute
- 2010 Triennial International Steven Hoogendijk Award
- 2010 Mass High Tech All-Star Award, for work in genetics
- 2009 American Society for Microbiology Promega Biotechnology Research Award
- 2008 Newsweek Magazine "Power of Ideas" in Medicine (for the Personal Genome Project)
- 2006, 2005 Scientific American Top 50 ("The \$100 Genome" in 2006, "Designing artificial life" in 2005)



SAVE THE DATES

New England Science Symposium

Saturday, April 11, 2015
Harvard Medical School

For fellows and medical/dental/
graduate/college/community college
students

Evening of Hope

Thursday, April 30, 2015
The Westin Copley Place

Reminder

Please remember to update your contact information and post your resume at www.bscp.org. Click on "Update/Submit Your Information," then enter your information under "Current and Former BSCP Participants."

For more information, please contact
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or (617) 432-0552.

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JACOB FOHTUNG

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The 23-year-old NIH Fellow majored in biology at Marquette University, thinking he might go on to medical school or graduate school in public health. After graduation, he worked part-time as a chemistry tutor at the Milwaukee Area Technical College and a medical scribe for the Aurora St. Luke's Medical Center. He also volunteered in the laboratory of Richard Robinson, PhD, in the microbiology and molecular genetics department at the Medical College of Wisconsin. On weekends, he volunteered as a receptionist at the school's Columbia St. Mary's Saturday Clinic for the Uninsured.

The current crisis in West Africa cemented Fohtung's decision to focus on public health. He plans to study for a PhD in the field and will return to West Africa, where he hopes to help "restructure the [health care] system," which he describes as "so bankrupt, health care providers cannot do much."

Now, in addition to his fellowship, he is the U.S. representative for Africa Health Research Organization, a Ghana-based international group that raises money, leads scientific studies to promote better health treatment and promotes volunteerism in Africa. He is also co-founding NetInHealth with a childhood friend, Nkwate Ebenezer, who is studying at

MIT, which he describes as "LinkedIn for health care." NetInHealth is a social media platform intended to facilitate communication among people in health care who are interested in improving local and global health.

Fohtung's fellowship will end in August and he is considering his next move, which will not be as rash as purchasing a one-way ticket. One option is to pursue a second year at the NIH while continuing to develop his start-up. He has also been accepted into a Master's program in public health at Hofstra University and may begin that, possibly while continuing at NIH. Whatever he decides, public health care will be the ultimate beneficiary.