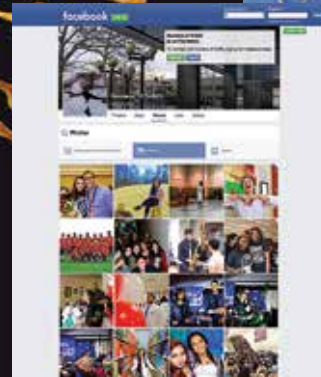
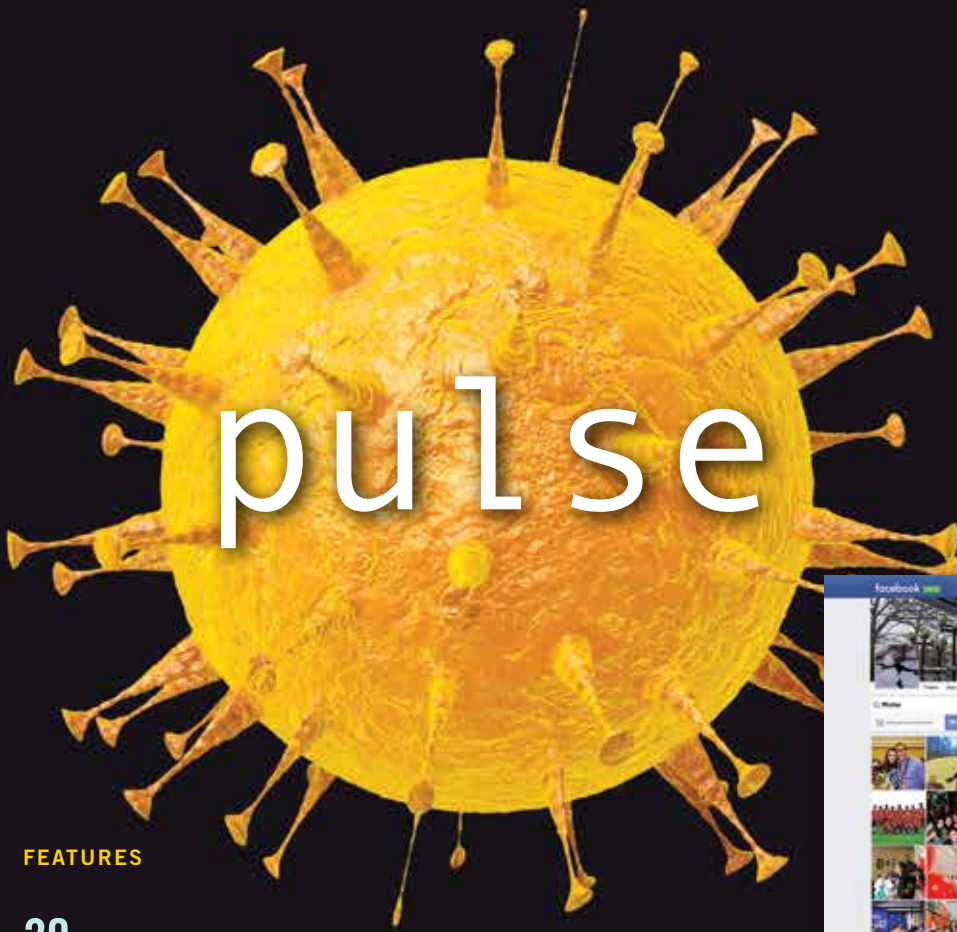


pulse

High Tech Wonder
3D Printing Aids Heart Repair





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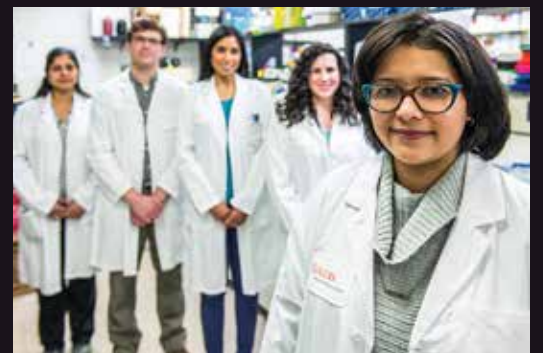
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Up-and-Coming Research Leaders

AIMEE BEAULIEU

Finding Pieces to the Immune Puzzle

BY MARYANN BRINLEY

Aimee Melissa Beaulieu, PhD, fell in love with the unsolved mysteries of science when she was a college student at Colgate University. “I got involved in a chemistry lab during a summer program and with that first taste of bona fide research, I loved it. I absolutely loved it...the investigation of it...the puzzle solving...the real excitement of chasing down answers.”

The newest Rutgers New Jersey Medical School Chancellor Scholar, Beaulieu describes herself as a cellular immunologist who is “very interested in how the cells of the immune system protect against infection and promote wound healing in the aftermath.” She arrived in the Department of Microbiology, Biochemistry and Molecular Genetics on October 1, 2015, and calls her position in the Center for Immunity and Infection (CII), a division of the Institute of Infectious and Inflammatory Diseases (i3D) “an incredible opportunity with great support that allows me to explore interesting and riskier, cutting-edge areas of lymphocyte biology.” Her path to this career point has been “long but not necessarily straight,” she laughs.

After graduating from Colgate in 2000, she took a position at Pfizer as a medicinal chemist in a group interested in the mechanisms of the inflammatory process and diseases like arthritis. “That is where I got turned on to immunology and became fascinated, driven by basic curiosity about how the immune system works, how it causes

disease and protects against disease.”

Three years later, in 2003, she went back to school for a PhD at Cornell University. “I wanted to focus on immunology because this is the thing that fascinates me the most.” As a doctoral student, she studied the “most lethal human bacteria, *Mycobacterium tuberculosis* (TB), and it was pretty exciting to work with this pathogen, given its devastating role in human health.”

After earning that PhD in 2009 in immunology and microbial pathogenesis, she did two post-docs at Memorial Sloan Kettering Cancer Center in New York where she discovered new regulatory pathways involved in anti-viral immunity by Natural Killer (NK) cells. These days her focus is on that subset of immune cells, “the lymphocytes we don’t usually consider when we think of the immune system, not the T or B cells,” but those NK cells, as well as the newly discovered innate lymphoid cells (ILCs), that function at the interface of innate and adaptive immunity. In addition to defense against viruses and certain types of cancer, “we know that innate lymphocytes are very important for maintaining barrier functions in the body under natural conditions as well as after infection in places like the gut, the lung and the skin.” Right now, she has a project studying influenza in the lungs, trying to understand how NK and innate lymphoid cells defend against it and promote healing. “A lot of what we know about the immune system



originated in the context of infectious disease but any knowledge we gain in one setting always informs another,” she explains.

Beaulieu is the recipient of numerous honors and awards including two National Institutes of Health/ National Institutes of Allergy and Infectious Disease (NIH/NIAID) Training Awards, and more recently, an

NIH/NIAID K22 Career Transition Award. Back at Colgate, she even won the Baldwin Greek Prize. “Yes, I was studying chemistry but also ancient Greek of all things,” she says. She is a member of the Society of Natural Immunity and the American Association of Immunologists, and her most recent publication in *Nature Immunology*, “The transcription factor *Zbtb32* controls the proliferative burst of virus-specific NK cells responding to infection” exemplifies the current research focus of her lab.

“There are all kinds of pathogens we are always fighting off and certainly malignancy seems to be part and parcel of normal tissue growth. Our immune system is constantly weeding it out. It is really amazing what we don’t see and what never really comes to the point of being symptomatic but it’s definitely there,” Beaulieu says. “The reality is: the more we learn, the more we realize that our bodies are very busy.”

Even the commute from New York to New Jersey, which can be “long,” she laughs, especially on the way home from Newark to the upper east side of Manhattan, doesn’t dim her enthusiasm. “This NJMS Newark research group is so brilliant, with such high-energy. My fit couldn’t be more perfect. I absolutely love it.” ●

ELYON OBAMEDO

Humans of NJMS

BY EVE JACOBS

What does it mean to be a “human” of NJMS? The answer seems to be evident. But for Elyon Obamedo, second year medical student and budding photographer, the extended family of Rutgers New Jersey Medical School (NJMS) was in need of a better way to connect to one another and he had a vision of how to do that.

Photography speaks to him in a way that words do not. “Pictures are the conversation you would have if you already knew a person—really knew them,” he explains. “You see people’s raw emotions, their vulnerabilities.”

Elyon’s parents emigrated from Nigeria to Lewisham, England, where Elyon was born, and then settled in New Jersey with their four children in 1996 when Elyon was 2 1/2-years old. His father, a computer

network engineer and pastor, and mother, a registered nurse, founded the Ministry of the Word International and House of Prayer on Broad Street in Newark about 20 years ago. It’s thriving and his father has become the full-time pastor there.

Elyon says his parents always valued education, but never pressured their children. “I learned to read when I was very young. My father and I always read together,” he remembers. Elyon did not need pressure to excel. He graduated from Union High School with a 4.2 average in biology. Additionally, he had a talent for art, so considered a career in architecture, but ended up graduating *magna cum laude* from Rutgers College, Newark, with a major in biology and a minor in chemistry.

It was his four-year stint as a runner

and hurdler for the Rutgers–Newark men’s track & field program that introduced him to the profession of medicine. “I worked with a trainer for many years and came to understand the body as a system, a whole,” he says. “Then I was injured severely enough that I couldn’t run and couldn’t perform. I got to see the helping side of sports medicine.”

In addition, his father’s words increasingly made good sense to him: “He said to ‘choose a noble and respectable field. If you’re rich and successful, no one will remember that. Do something that impacts and helps other people.’”

Doctoring seems to fit the bill; and orthopedics or some facet of sports-related medicine is high on Elyon’s current list. “But I’m keeping an open mind,” he says.

His “open mind” and artistic eye are at the heart of the Humans of NJMS Website that he created about a year ago. With a brand-new DSLR camera in-hand, Elyon started taking pictures—lots of pictures—in 2013. He taught himself to use the camera and found that he loved the art of picture-taking. He took pictures of people running, people laughing, people ruminating, the same person from many different angles. And what he started to see through his lens were raw emotions—what he calls “immediacy”—that were often not evident in everyday life.

“Diversity,” he says. “In Newark, we’re all about diversity—diversity of cultures, diversity of backgrounds, diversity of beliefs, diversity of emotions.”

Elyon sees the camera as a tool for letting people open up about their vulnerabilities. “It’s a way to establish two-way communication that is not bundled in bureaucracy,” he says. “The photos find the gems of interactions and capture something essential.”

Now that the Website is established and has 372 “likes,” Elyon is recruiting others to work on it with him. His goal is to make it a club of “like-minded students.”

“It’s about resonance—knowing you’re not alone in whatever you’re struggling with whether you’re a student or a patient,” he



says. “It’s about getting to know people better—all kinds of people.”

Heather Wurtz

Heather Wurtz is one of the faces you see on Humans of NJMS. She and Elyon have become friends, unlikely friends. He’s 23, just starting out; she’s 40-something, married and a mother of three. She’s from Minnesota; he’s from New Jersey. He’s African American; she’s white. He’s been in school most of his life; she took a 13-year break. The list goes on and on. But they are both second-year students at NJMS and both are seeking something beyond their professional training.

Her father was a neonatologist who, she remembers, was “passionate” about his work. Her mother was admitted to medical school, but did not attend. “She supported her young family,” says Heather. “My childhood was great. We did a lot of biking and hiking.”

Heather was a psychology major at Grinnell College in Iowa—the alma mater of both her parents and her mother’s two sisters—and was on the swim team. It was where she met her husband. With an eye on medical school, she stayed on another year to work and take courses. Over the next two years, she moved to North Carolina, got married, and then moved to California, where she worked, took courses, prepared for the MCAT (Medical College Admission Test), and applied to medical schools. But it was not to be.

Her mother had a recurrence of metastatic breast cancer in 1999, and Heather decided the time was not right to begin such an arduous course of study. Over the next several years, her husband finished his PhD in organic chemistry at Cal Tech and they had their first child, Alexander. They then relocated to Switzerland for two years, where her husband did a postdoc and they had their second child, Lilly. The family returned to the U.S. in 2004, and had another daughter, Anna, in 2006. Meanwhile, Heather’s mother did well for 11 years before she died of her disease.



(I) Heather Wurtz smiles for photographer Elyon Obamedo; (bottom) The Humans of NJMS Website features life—in all its variety—at the medical school.

Elyon Obamedo, founder of the Humans of NJMS Website says: “The camera is a way to establish two-way communication that is not bundled in bureaucracy. The photos find the gems of interactions and capture something essential.”



Heather says she always figured she would go back to school when the children were older, but she had more or less given up on the idea of doctoring. When her youngest child started first grade, she figured it was “now or never.”

“But I thought I was too old to start medical school. I thought that ship had sailed,” she says. It took a couple more years of college-level science classes, and a Princeton Review course, to prepare once again for the MCATs and to present a convincing case to the medical school admissions offices. “I took biochemistry, genetics, cell biology, the first semester of organic chemistry, microbiology, and I did very well.”

Everything fell into place—great MCAT scores, excellent marks, a supportive husband, and an admissions team at NJMS that recognizes the value of building an incoming class of talented individuals with diverse backgrounds. Passion for doctoring is high on their list of what counts most.

Heather joined the class of 2018, along with Elyon, who recognized they were

simpatico despite their obvious differences. Heather says she sometimes feels like a parent to the students—her oldest child is 16 now. But she concedes that the other students don’t treat her any differently.

Anatomy class—where teams of students actually face mortality, many for the first time—is frequently the place that first-year students make their deepest connections. Elyon and Heather were part of an anatomy study team and discovered new aspects of their humanity together. “He got to know me pretty well—and I got to know him,” she says.

As both struggle through the end of year two and contemplate their future lives as physicians, Heather and Elyon share the knowledge that for them what really counts is beyond the massive volume of information they have struggled to store in their brains. It’s in the faces of those who will look to them in the future for excellent medical care and empathy, and also in the faces of all of the “humans” with whom they share their daily lives at NJMS. ●

OUT OF THE (WHEEL) CHAIR

Karen J. Nolan approaches her life as a senior research scientist in the Human Performance and Engineering Laboratory at Kessler Foundation with an infectious enthusiasm. Spend a few minutes talking with her and you also sense frustration. That may be normal for any professional working with patients who have suffered strokes, traumatic brain injuries, or paralysis. The statistics (in the millions annually) and outcomes (often less than perfect) for these personal disasters are disheartening.

BY MARYANN BRINLEY

Nolan has studied all kinds of tools, techniques, and technologies from neuro-prosthetic interventions and ankle-foot orthotics to virtual reality with the goal of getting people up and walking. But, she admits, “Patients can get stuck in the chronic stage, never really getting back to a healthy, fully independent life.” This is a woman who earned her PhD in biomechanics and anatomy from the University of Toledo and completed a fellowship in biomechanics and outcomes research in 2007 from the University of Medicine and Dentistry of New Jersey, is recognized internationally in the field of motor rehabilitation, and can speak with real knowledge about things like metatarsal pressure in hemiplegic gait. So why does she get frustrated? “Because what we want for patients is healthy walking,” she says.

Lately, the Ekso GT, a wearable robotic exoskeleton made by Ekso Bionics, is cause for optimism in her lab. “This is a very exciting area of research for us.” She is just beginning her second clinical trial of the motorized, bionic backpack with leg sections that stretch down the outside, strapping at the thigh, below the knee, and at the foot. “We have been incredibly fortunate in the last 18 months to have received considerable grant funding for this technology. I like to do randomized, organized, clinical trials that are very translational...going right to the patient and clinician,” she explains. She considers it part of her job “to really change the world of rehabilitation, to implement technology that is meaningful” and will make a difference. In January, the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) allotted Kessler \$2 million, with \$1 million going to Nolan to continue what she started in a pilot study of 62 inpatients who had suffered acute strokes.

By focusing on the safety, feasibility and the efficacy of using this remarkable robot in the first trial, Nolan’s multi-disciplinary team got “great data on whether it could actually be implemented in a clinic. I could have taken the robot into the lab and done gait analysis on patients, studying their muscle activation, their loading patterns, how it really affected the mechanics of walking,” she says. That’s the sort of thing she loves. But practically speaking, certain questions needed to be answered first. Could a physical therapist use the Ekso GT in an appropriate block of time? Would patients like it? Is it safe? Is it an effective tool to use for recovery? “Honestly, I wasn’t sure if someone who had just had a stroke would be happy getting strapped into a robot,” she states. They were. In fact, patients using the Ekso GT felt more balanced, stronger, and were better at independent walking even later when not wearing the robot.



The answers she and her team got were so positive that the new trial aims to include 98 acute stroke survivors. Nolan, who is an associate professor in the Department of Physical Medicine and Rehabilitation at Rutgers New Jersey Medical School, a clinical research scientist at Children's Specialized Hospital, and also a faculty member in biomedical engineering at the New Jersey Institute of Technology, will be able to investigate fully the "clinical outcomes, the neuro-physiological effects, the mechanics of walking, the kinematics, muscle activation, and loading parameters," as well as how patients do in the long term. How will this technology, when used in the early stages of recovery—within a week after a stroke when the injured brain is the most pliable—affect recovery? "We really need to know what is happening at the level of the legs as well as how the brain is responding," she explains. "How is this device affecting the signals going on in the brain and how can it

be mechanically adjusted to enhance the recovery process?" The grant also allows follow-up for five years with data collection at points along the way.

Wearing the exoskeleton provides upright postural support. "I've been in it and it feels good," Nolan says. You stand up straight and balanced—with motors at the hips and knees, and adjustable springs at the ankles that are important for loading the foot. Even when the motors are decreased or powered off, the device will lift the weight of itself without pulling, so the lower limbs don't feel heavy. Each side can also be programmed separately to allow for more or less help in cases of hemiplegia or one-sided weaknesses. "What we have seen in



Taking steps using the Ekso exoskeleton

"In rehabilitation medicine, there is a lot of technology emerging really fast.

We provide the evidence for what works." —KAREN J. NOLAN



our work is that the Exoskeleton provides more step practice." Because of the physical assistance of the robot, the patient can take more steps than a therapist could manually offer in a given block of time. "This just speaks to all the neuro-plasticity research about dosing and getting as much as possible in early recovery. The theory I am exploring is whether all this early intervention gait training in the correct plane of movement can get people up walking faster and correctly with better quality" on their own, Nolan explains.

"Unfortunately, in the inpatient setting after a stroke, the goal is just to get the patient up and walking. So they get up and start walking, but with compensation strategies and assistive devices to help with muscle weaknesses and range of motion," Nolan says. "We provide braces, pharmacological interventions, different compensation devices, and different technologies, but we never really get the patient to that healthy, independent place...with full quality of life."

Getting patients unstuck is the goal of her group. "We've got engineers, health scientists, biomechanics, physiatrists, neurologists, and physical therapists," Nolan says proudly. "And, of course we have patients. It takes open-minded learning to see how these devices can make a difference. In rehabilitation medicine, there is a lot of technology emerging really fast. We provide the evidence for what works." And she adds, "What I always say is that you can teach technique but you can't really teach someone to be enthusiastic. The team that I work with is incredibly enthusiastic." ●