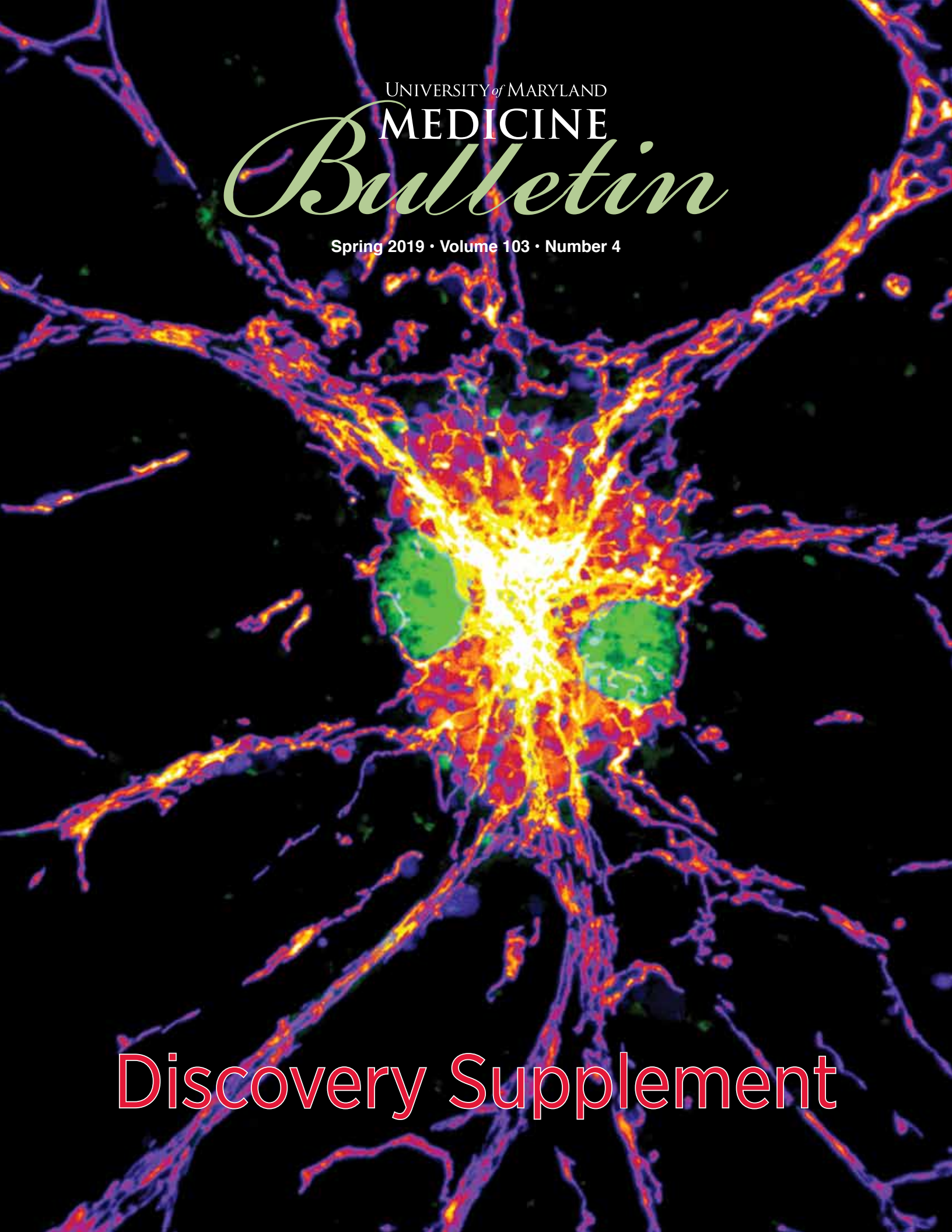
UNIVERSITY of MARYLAND
MEDICINE
Bulletin
Spring 2019 • Volume 103 • Number 4



Discovery Supplement

HEALTH SCIENCES RESEARCH FACILITY III

HSRF III

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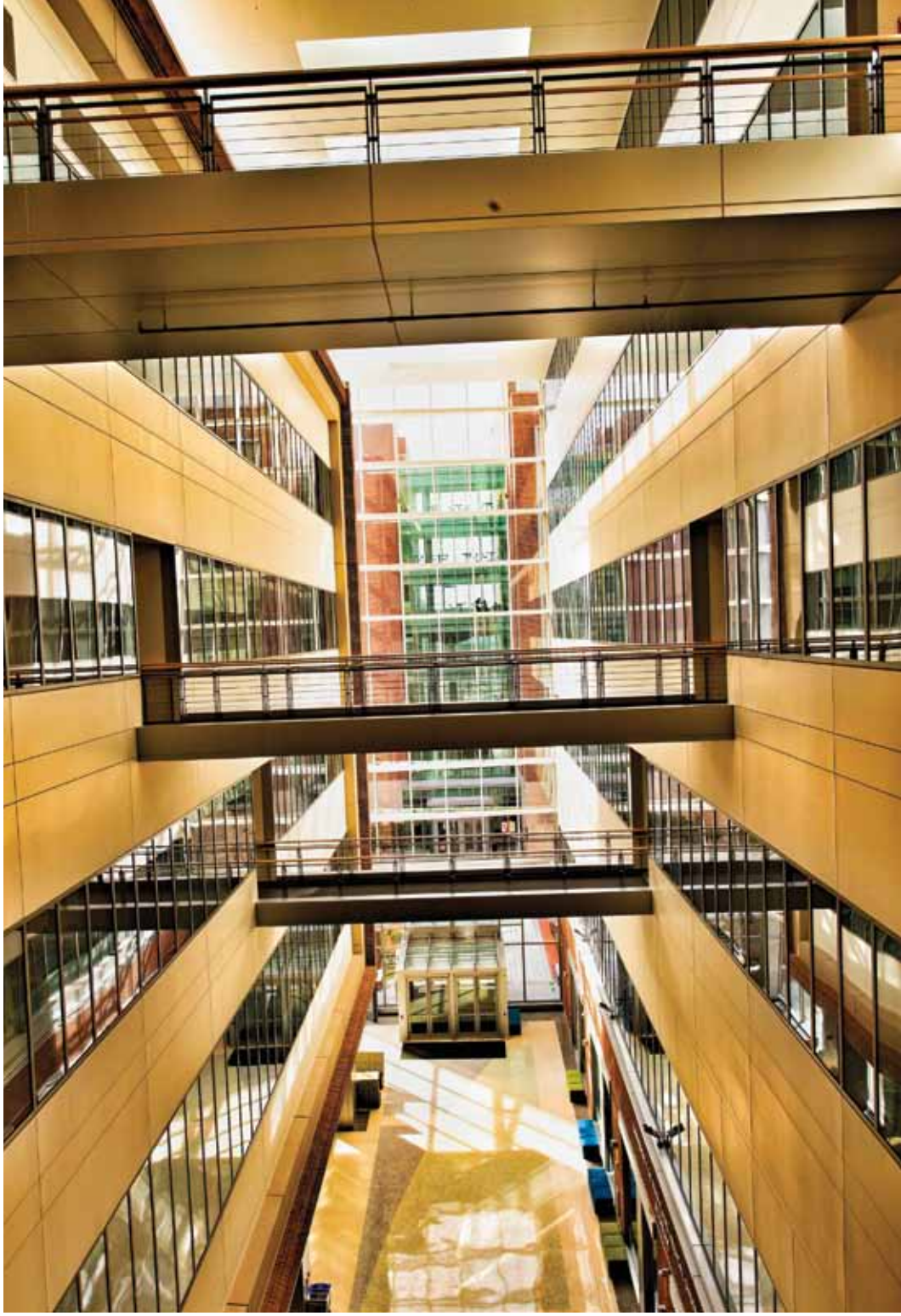

[430,000]

Total square feet, the largest academic building in the University System of Maryland.

[3,000]

New jobs created.

[$6]

Billion in economic impact.

[20%]

Increase in research and academic facilities to 2.5 million square feet.

[400]

Scientists, physicians, lab technicians and staff.

[750]

People capacity central atrium, serving as a collaborative hub to host leaders in science and medicine, and gatherings of faculty, staff, alumni and students.

[10]

Stories of glass rise above 670 W. Baltimore Street.

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Research Growth

2018 brought the completion of HSRF III and record-breaking research grants and contracts for the School of Medicine.

on the COVER

*Mitochondria in glial cells from the brain, imaged by **Sai Sachin Divakaruni, PhD**, in the lab of **Thomas Blanpied, PhD**, associate professor of physiology (pictured). The lab conducts studies of the brain using advanced cellular imaging technology, working in collaboration with the department of pharmacology in HSRF III*

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The University of Maryland *Medicine* ***Bulletin***, America's oldest medical alumni magazine, is produced by the Medical Alumni Association of the University of Maryland, Inc., with support from the University of Maryland School of Medicine and the University of Maryland Medical System. This Discovery Supplement was developed by the University of Maryland School of Medicine with permission of the Medical Alumni Association.

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Taking on the Most DEBILITATING DISEASES

The University of Maryland School of Medicine has surged forward in recent years to achieve a place among the upper echelon of biomedical research institutions in the nation. Indeed, it would have been difficult to imagine 50 years ago that in 2019 the school would rank in the top 10 in the nation among public medical schools, with nearly $550 million in total research funding.

It has been a fully collaborative effort over several decades, involving outstanding and dedicated faculty, staff, students, alumni, board members as well as benefactors, legislators and many others to reach this level of prominence in biomedical research.

Now that we have had the historic opening of our new Health Sciences Research Facility III (HSRF III), in many ways, our work has just begun. **Consider: of the nearly 60 million deaths worldwide last year, more than half were due to the top 10 causes: ischemic heart disease, stroke, lower respiratory infections, chronic obstructive pulmonary disease, lung cancer, diabetes, Alzheimer's disease, diarrheal disease, tuberculosis and road injuries. Reducing the burden of these diseases and chronic conditions have posed significant challenges to the biomedical community. At the same time, increases in travel, trade and connectivity, urbanization, pervasive poverty and climate change are all contributing to fueling more disease outbreaks around the world in the future.**

Academic medical centers have long been at the forefront of providing the very best health care, because they focus on a tripartite mission of research, education and clinical care all for the benefit of patients. In addition, because academic medical centers are often located in urban areas, they are a crucial source of services for underserved populations and provide vital treatments for trauma and critical care patients.

The University of Maryland School of Medicine has consistently and relentlessly persisted, against all odds, to advance solutions to the toughest problems, from cancer, to heart disease, to HIV/AIDS, to opioid addiction, to drug-resistant infections diseases, to health disparities. At a time of most urgent need, the School is leading the way in answering this call through its commitment to discovery-based medicine.

In this respect, we are excited to partner with the Medical Alumni Association in developing this Discovery Supplement to the *Bulletin* magazine. In this issue we welcome our readers inside our monumental new health sciences research facility, where breakthroughs and discoveries are being made every day that will lead to cures for these most debilitating diseases.

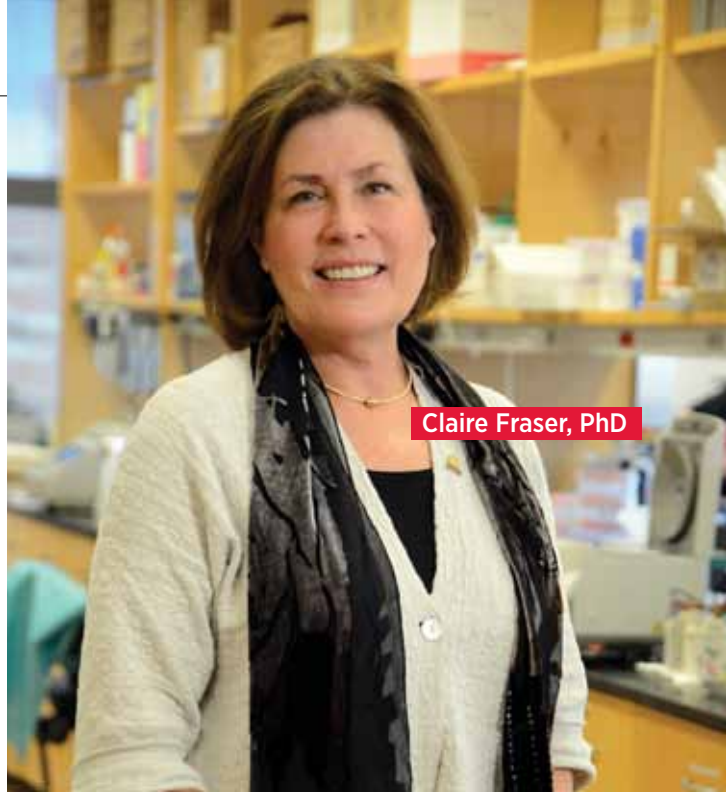
E. Albert Reece, MD, PhD, MBA
Executive Vice President for Medical Affairs, UM Baltimore
John Z. and Akiko K. Bowers Distinguished Professor
and Dean, University of Maryland School of Medicine

HS RF III

UNIVERSITY of MARYLAND SCHOOL OF MEDICINE

A Look Behind the Glass

Bringing THE Genome Revolution *to* LIFE



Claire Fraser, PhD

When Claire Fraser, PhD, the Dean's Endowed Professor, became the first scientist to map the complete genetic code of a free-living organism, she forever changed microbiology and launched a new field of study — microbial genomics. Nearly 10 years later, when the Human Genome Project was finally completed, it launched a revolution in how scientists approached the study and treatment of the most complex human diseases. Fraser, director of the University of Maryland Institute for Genome Sciences (IGS), is now leading a team of genome scientists in battling these diseases with the most advanced weapon: data. Using extensive data analysis, they are uncovering why certain genetic variations and differences in gene expressions will make an individual more susceptible to certain diseases. In addition, IGS researchers have made key discoveries into the important role microbes, or the human microbiome, play in immune system responses, mental health and our ability to fight deadly infections.

Fraser has advanced her extensive research on the gut microbiome to the next level, with new research exploring the proteins produced by the gut microbial community — the so called metaproteome. In a new study published in February, she chose to investigate patients with Crohn's disease to determine whether there are common patterns in the metaproteomes of these patients, and how the proteins produced by the gut microbiome changed over time. In the study, she discovered that each patient's metaproteome was distinct from each other, and that each patient's microbiome changed over time. Fraser and her team found that by mapping the proteins into groups and matching the groups to specific metabolic pathways, the metabolic activities of the microbiome within an individual were relatively stable. "Because many of these microbial products are bioactive, it is important to understand how they change over time and with disease," she says. "We are at the beginning of really understanding the human microbiota. These kinds of investigational studies provide critical information that will lead to future translational studies."

Emmanuel F. Mongodin, PhD, associate professor of microbiology and immunology, and associate director of genomics at IGS, is studying the relationship between the gut microbiome and a transplanted heart. His recent study made the key discovery that manipulating the gut microbiome influences the success of organ transplantation. In particular, he discovered that a specific bacterial species, called *Bifidobacterium pseudolongum,* reduced inflammation and fibrosis, promoted an immune-suppressive environment, and prolonged survival of the transplanted heart tissue. The researchers also identified bacteria that were associated with inflammation and poor survival of the transplant. Mongodin's study reveals that directed alteration of the gut microbiome may improve the success of organ transplants.

Mongodin has also collaborated with a team of researchers on a new study that evaluated the impact of irrigation water on the bacteria found on crops of radishes and kale. The study found that even though pathogenic microbes were detected in the irrigation water, these pathogens were not detected on the crops. Mongodin found that most of the changes in microbial communities that were related to water irrigation occurred in the soil rather than on the produce. This research is guiding appropriate strategies to focus on other potential sources of contamination.

Emmanuel Mongodin, PhD

Democratizing DATA

Owen White, PhD

Unlocking the key to some of the most serious diseases such as cancer, cardiovascular disease and metabolic disorders can now be achieved through the analysis of large genomic data sets, or "big data" as it is popularly known. Making big data available and useful for the research community has become the raison d'etre for bioinformaticists at the medical school. Owen R. White, PhD, professor of epidemiology and public health, and associate director for the IGS, leads a team of scientists, programmers and software engineers who develop tools, pipelines and databases for organizing, annotating and working with these large data sets. The team has played a critical role in analyzing, storing and distributing data for two of the most significant national health initiatives currently taking place: the BRAIN Initiative, which is the largest undertaking ever to understand the human brain function: and the Human Microbiome Project, which is cataloging, for the first time, microbes in and on the human body to better understand how these contribute to human health and disease.

"These resources are critical to enabling scientists around the world to use the huge amounts of data to make discoveries that not only connect genetics to brain development and the establishment of synaptic circuits, but to provide the tools needed to usher in the era of personalized medicine based on individual genetics and metagenetics," White says.

But, he adds, future success will depend on broader access. "Scientific progress ultimately relies on unconditional access to genomic data that is hosted in open and accessible repositories," says White. His team of Maryland researchers recently received a $4 million grant from the National Institutes of Health to establish the critical mechanisms to make genomic data available in cloud-based computing systems. The availability of these large amounts of data means that researchers worldwide can now use data to explore many other aspects of human health. This approach is critical in designing the best interventions and treatments. Democratizing data will revolutionize health care by linking genetic variation and gene expression to disease susceptibility, and by enabling personalized therapeutic strategies, he says.

Jacques Ravel, PhD

Unlocking Secrets *of the* Microbiome

A closer look at the microbes in our bodies has helped researchers better understand the causes behind a wide range of health issues: conditions such as premature births and mental health disorders; how nutrients are absorbed and processed; and an individual's susceptibility to infections and diseases. Researchers at the medical school have uncovered key findings about these unique communities of microbes, called the microbiome, that live within and on us. Jacques Ravel, PhD, professor microbiology and immunology, and associate director for genomics at the IGS, studies the microbiome of the female reproductive tract, including how the vaginal microbiome influences a woman's susceptibility to sexually transmitted diseases and HIV. In a new study this year, Ravel reported the first completed genomic sequencing of a strain of vaginal bacteria called *Lactobacillus crispatus*. In the study, he found that *L. crispatus* are considered "good" bacteria. They are associated with reduced risk of infection by sexually transmitted diseases and lower incidence of complications during pregnancy. Ravel's lab is currently conducting research into how changes in the vaginal microbial community contribute to premature birth. As part of IGS, the Ravel lab provides microbiome analysis services ranging from characterizing the microbial composition of samples to supplying bioinformatic expertise. Through his own research efforts and by supporting other Maryland researchers, Ravel is making key contributions to understanding how our microbiomes are unique, contribute to disease pathology, and can be leveraged to prevent or treat disease.

Finding CLUES *to* Infectious Disease

David Rasko, PhD

The second leading cause of death in the world is caused by diarrheal diseases from bacteria such as *Escherichia coli (E. coli)*. These bacteria are widespread, but they have a devastating impact on millions of the world's most vulnerable populations — namely, children under the age of five years old. IGS researcher David A. Rasko, PhD, professor of microbiology and immunology, is leading a project to understand the interactions between the microbiome and pathogenic *E. coli* and *Vibrio cholerae.*

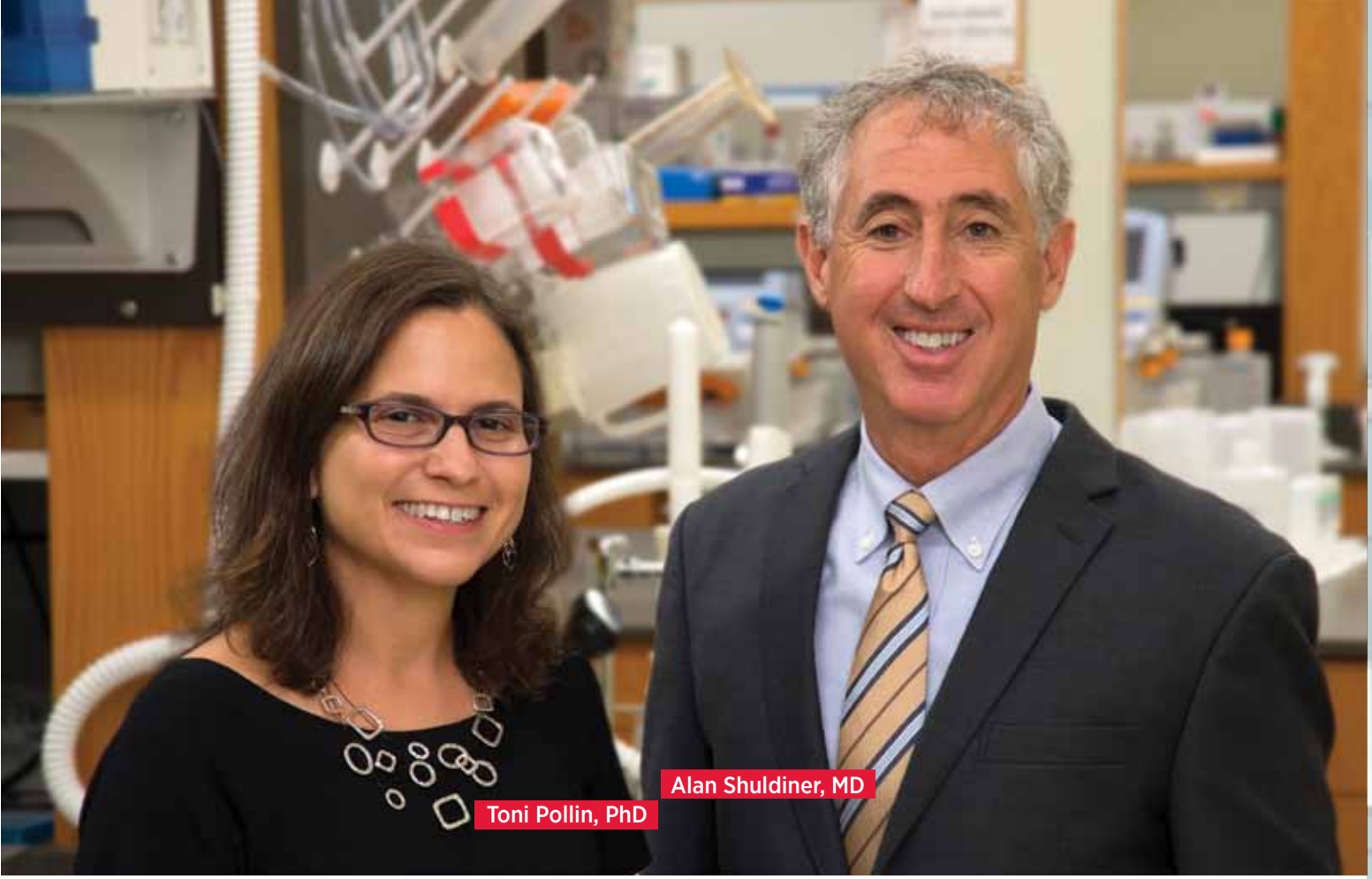
This research involves exposing the human subjects to these virulent bacteria, collecting samples and tracking the changes in the gut microbiome over the course of the infection using genomic analysis techniques. The outcomes of these studies will inform how individual microbiome variation affects the progression and resolution of the infection, reveal how the populations of pathogenic bacteria change as they pass through the gastro-intestinal tract, and provide information that can be used to develop therapeutic strategies to treat these life-threatening infections.

Rasko's recent discoveries play a key role in understanding how antibiotic resistance hampers effective treatment of bacterial infections. In his research, he completed the sequencing of a circular piece of DNA, called a "plasmid," in a strain of diarrhea-causing *E. coli.* With this information, Rasko's lab was able to determine how this plasmid contributed to the ability of this bacterial strain to cause disease. Further analysis of the presence of the genes on this plasmid in other *E. coli* strains, and in other types of diarrhea-causing bacteria, provide clues to how antibiotic resistance spreads among bacterial populations. In another study, Rasko is working to determine whether an antibiotic used to prevent a serious eye infection in Tanzanian children under three years old causes an increase in resistant or severe *E. coli* strains. Encouragingly, the research found that the antibiotic did not increase the proportion of resistant or disease-causing *E. coli,* indicating that the antibiotic treatment to prevent eye infections and blindness did not place the children at higher risk for developing antibiotic-resistant diarrhea.

Genetics *at the* HEART of Personalized Medicine

Understanding genetic differences is critical to influencing patient outcomes and combating top killers such as metabolic disease and cardiovascular issues. Medical school researchers have found that genetic differences create hazards and opportunities for patients. Some genetic variations increase a person's chance of getting a disease or not responding well to treatment. Other variations make a person more resistant to disease or limit adverse effects of medications. The University of Maryland Program for Personalized and Genomic Medicine (PPGM) in HSRF III seeks to understand how genetic differences influence patient outcomes. This personalized approach toward medicine has changed clinical practices in medicine, with a better understanding of an individual's susceptibility to deadly conditions such as cardiovascular disease, depression and diabetes.

While diseases like diabetes and cardiovascular disease are widespread, understanding why some individuals are more susceptible than others is a major step toward combatting these major killers. Led by Alan Shuldiner, MD, the John L. Whitehurst Endowed Professor in Medicine and associate dean for personalized & genomic medicine, researchers in the PPGM have made seminal discoveries into how genetic variation contributes to metabolic disease, osteoporosis, and cardiovascular disease. Through his decades-long work of studying a unique population — the Old Amish Order in Lancaster, Pennsylvania — the PPGM has just completed genomic data for more than 7,000 individuals from this population and collected more than 1.5 million bar-coded clinical samples, which are stored in the school's automated biorepository. This research has already changed clinical practice in cardiology. Ongoing research, such as a study on the genetic basis of a cause of sudden cardiac death, will lead to new discoveries with high translational impact.



Toni Pollin, PhD, associate professor of medicine, a human geneticist and board-certified genetics counselor, uses analytical tools to identify genes and genetic variants involved in susceptibility, response to treatment and preventive intervention for diseases such as type 2 diabetes.

With the increase in childhood obesity has come an increase in childhood diabetes. Diabetes in children is often type 1 diabetes, which is caused by the loss of cells that produce insulin. However, a small proportion can be caused by mutations in specific genes that compromise the release of insulin or the response to insulin. In these monogenic forms of diabetes, treatments other than insulin may be necessary. Pollin and Shuldiner are part of a study that performs genome sequencing on overweight children in a program called Treatment Options for Type 2 Diabetes in Adolescents and Youth (TODAY).

The study, which identifies the frequency of patients with this rare monogenic form of diabetes, will help determine which monogenic forms of diabetes require a different treatment strategy. Pollin is focused specifically on identifying patients with maturity-onset diabetes of the young, a form of monogenic diabetes. She says that identifying which patients may have monogenic diabetes, and who should receive genetic testing, is important for devising appropriate treatments and managing the lifelong disease.

Braxton Mitchell, PhD, MPH

Collaboration: *the* PATH *to* Treatment

Recent advances have made it possible to determine the role of specific genetic variations in genetic diseases in large-scale genome-wide analyses. In HSRF III, the researchers in the program for personalized and genomic medicine tackle the analysis of the large amount of data collected through their many clinical studies.

"Because we let the variants (genetic mutations) guide what to study, this leads to the need for many collaborators. HSRFIII really facilitates these interactions," says Braxton Mitchell, PhD, MPH, professor of medicine.

The research typically takes one of two paths. By analyzing a large amount of genomic data, researchers identify genetic mutations that influence disease susceptibility. Patients can then be screened for the presence of the variant and appropriate treatments decided. Another path is the observation of a particular clinical profile, such as an atypical EKG or an unusually low amount of circulating cholesterol, and then identifying genetic variations associated with that profile. Either path requires the expertise of bioinformatics and big data scientists, as well as the "dry" lab spaces in HSRF III.

Customizing PATIENT Medications

Just as genetic information helps create customized treatment plans, pharmacogenomics leverages genetic information to match the optimal medication to the patient. PPGM researchers Amber Beitelshees, PharmD, MPH, assistant professor of medicine, is collaborating with Simeon I. Taylor, MD, PhD, professor of medicine, to study how genetic variation affects the response to a new type of medicine for type 2 diabetes. This new inhibitor reduces blood sugar by increasing the excretion of glucose in the urine. Although the drug is also cardioprotective for some patients, it causes life-threatening infections in others. Beitelshees and Taylor are studying genetic variation in the Amish population, and response to this drug in healthy people, to discover the genetic basis for differences in the response to this drug.

Amber Beitelshees, PharmD, MPH

In addition to studying diabetes, Beitelshees has made several key discoveries related to how genetic variation influences the response to blood pressure medications. Currently, with various options for the treatment of hypertension, matching patients to the ideal treatment is often done by trial and error. As part of a new study called Pharmacogenomic Evaluation of Antihypertensive Responses (PEAR), Beitelshees analyzed the expression of 34 genes for differential response to thiazide diuretics. The results identified differences in the expression of three genes — *FOS, DUSP1,* and *PPP1R15A* — associated with the ability of thiazide diuretics to reduce blood pressure. In another published paper from the PEAR study, Beitelshees reported the association of small RNA molecules (called microRNAs) in the circulation with the response to beta blockers, another drug used to treat hypertension. Together, these discoveries move treatment of high blood pressure, which persists as one the leading causes of death, closer to personalized treatment based on genetics and genetic markers.

Simeon Taylor, MD, PhD

How **Experience** ALTERS Brain Development

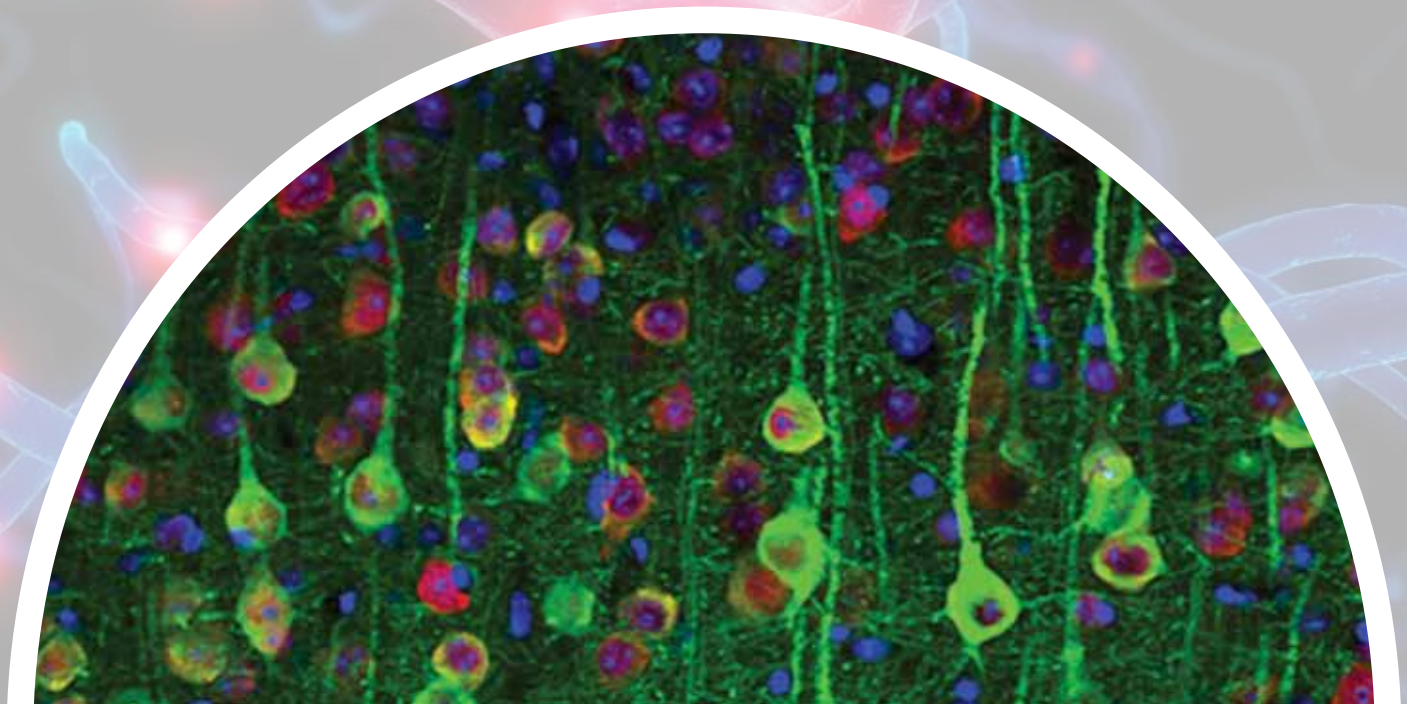
Understanding how genetic makeup, combined with life experiences, can shape a child's brain development is critical in tackling disorders such as schizophrenia and other mental health diseases. Brain development affects the risk for a wide range of neuropsychiatric disorders, including autism spectrum disorder, depression, post-traumatic stress disorder and addiction. Recent research by Tracy L. Bale, PhD, professor of pharmacology, and director of the University of Maryland Center for Epigenetic Research in Child Health & Brain Development (CERCH), has shown that even experiences of the parents before conception and experiences during pregnancy can impact brain development.

Tracy Bale, PhD

Bale leads research being conducted in HSRF III into how stress at particular periods — prior to conception, during development in utero, during early childhood and during maturation from child to adult — affects brain development and ultimately mental health.

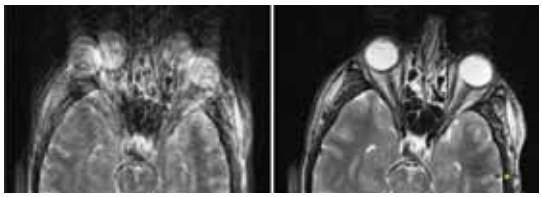
A major focus of the research is on epigenetic modifications, which are natural chromosomal or genetic alterations that happen throughout life. Such modifications control gene expression and occur in neurons and other cells in the brain, as well as in sperm. Environmental conditions and experience change the epigenetic modifications in some cells. For example, Bale discovered that stress of the father before conception alters the epigenetic modifications in sperm, which alters brain development. Her lab also performs pioneering research into how epigenetic changes in the placenta make female offspring less vulnerable than male offspring to the detrimental effects of maternal stress during pregnancy. Understanding how genes interact, how genes are regulated and how neuronal circuitry is influenced by the environment and experiences at all stages of life will lead to better strategies for preventing and treating mental health conditions and psychiatric diseases.

The understanding of how epigenetics influences brain development provides key insights into how the environment and experience of the parents and the child contribute to neurological development, mental health, and neuropsychiatric disease. Such knowledge will lead to prevention strategies and therapeutic options for conditions ranging from addiction to autism spectrum disorder.



Imaging the Adolescent Brain

Imaging technologies continue to advance and revolutionize diagnosis and treatment of diseases from Alzheimer's to cancer. The University of Maryland Center for Advanced Imaging Research (UMCAIR) houses the latest in imaging equipment in HSRF III. The new center also features the research of two highly-acclaimed scientists: Thomas Ernst, PhD, professor of diagnostic radiology and nuclear medicine; and Linda Chang, MD, MS, FAAN, professor of diagnostic radiology and nuclear medicine and vice chair of faculty development in the department.



A challenge in imaging patients is that even breathing causes distortion of the images. Ernst is developing motion correction techniques to improve the resolution of images from patients.

The center and its faculty are part of a multisite clinical research project, the Adolescent Brain Cognitive Development (ABCD) study, to understand the development of the adolescent brain. The center's researchers have enrolled more than 600 children, who will complete activities and interviews, have brain imaging performed and have biospecimens collected every other year from age nine through 19. With this data and results from more than 11,000 participants across the country, the researchers will gain critical insight into how genetics, culture and environment influence neurocognition, mental health, social behavior and emotional function.

Specifically, the project will lead to the development of national standards defining brain development of youth from 10 to 20 years old. With this information, researchers and clinicians will have a baseline of data from which to begin to understand how the brain changes from late childhood through early adolescence and puberty into early adulthood. Furthermore, the findings will be used to learn about changes in the brain that are associated with resiliency to stress and those that represent risk factors for susceptibility to mental health issues and substance abuse.

In addition to participating in the ABCD study, Chang is conducting research on how HIV injures the brain and how drugs of abuse, including tobacco, marijuana and amphetamines, alter brain structure. In a recent study using imaging technology, Chang and Ernst found changes in the brains of HIV-positive patients that were associated with the increased perception of pain. Specifically, they discovered that four of the twelve regions were altered and were associated with higher pain scores. According to Chang, understanding the regions of the brain involved will guide how doctors treat HIV-associated pain.

With new technology ranging from a scanner that collects both MRI and PET images simultaneously to a focused ultrasound machine guided by magnetic resonance imaging, UMCAIR is at the leading edge of transforming medical practice through technological innovation.

Linda Chang, PhD

Thomas Ernst, PhD

Charles Hong, MD, PhD

More Top Scientists Coming to Maryland

As the University of Maryland School of Medicine eclipses $550 million in total research funding and expands its research and academic space to more than 2.5 million square feet, the School has begun to recruit teams of top scientists from leading medical schools and academic medical centers across the country — including the University of Chicago, the University of Pennsylvania, Northwestern University, Vanderbilt University and the Children's Hospital of Philadelphia.

Through the Special Trans-Disciplinary Recruitment Award Program, or "STRAP Initiative" as it is known, Maryland has attracted 15 teams of scientists, bringing more than $30 million in National Institutes of Health research funding. The recruitment initiative continues through 2019 with additional candidates from across the U.S. already identified.

New STRAP teams of scientists, now located in HSRF III, are studying a range of complex diseases:

Tracy L. Bale, PhD, professor of pharmacology, psychiatry and director of the center for epigenetic research in child health & brain development, is studying stress modeling and neurodevelopment;

Linda Chang, MD, MS, professor of diagnostic radiology and nuclear medicine, is studying brain development and biology, and addiction;

Thomas Ernst, PhD, professor of diagnostic radiology and nuclear medicine, is conducting research in magnetic resonance and spectroscopy;

Charles C. Hong, MD, PhD, professor of medicine, is studying drug discovery and development, cardiovascular genetics, pluripotent stem cells and chemical biology.

Additional teams of top scientists recruited to the School include:

Anna Birukova, MD, professor of medicine, is studying lung injury, cytoskeletal changes, inflammation and vascular biology;

Konstantin Birukov, MD, PhD, professor of anesthesiology, director of the lung biology research program and associate chair of basic science research in the department of anesthesiology, is conducting research on lung injury and vascular biology;

Masahiro Iwamoto, PhD, professor of orthopaedics, is focusing on connective tissue repair, developmental biology of bone and cartilage and heterotopic ossification;

Motomi Enomoto-Iwamoto, DDS, PhD, associate professor of orthopaedics, is studying skeletal development and function, cell signaling, osteoarthritis, cartilage and tendon repair;

Li Qun Zhang, PhD, professor of physical therapy and rehabilitation science, is conducting research on joint rehabilitation robotics, neurological disorders and musculoskeletal injuries;

Xuefang Cao, PhD, associate professor of microbiology and immunology, is focusing on graft vs. host disease, ovarian cancer and T cell immune response;

Zhongjun Jon Wu, PhD, the Peter G. Angelos Professor of Entrepreneurial Surgical Sciences, is investigating artificial organ development, hemodynamics and cardiovascular disease;

Raymond Regan, MD, professor of emergency medicine, is focusing on drug discovery and development, cardiovascular genetics, pluripotent stem cells and chemical biology;

Yang Liu, PhD, professor of surgery and director of the division of immunotherapy in the University of Maryland Institute of Human Virology, is studying experimental therapy in cancer and autoimmune diseases, cancer genetics and cancer stem cells;

Pan Zheng, PhD, professor of surgery, is conducting research on signal transduction in hematopoietic stem cells in aging, TSC-mTOR and tumor immunology;

Liqing Justin Yu, MD, PhD, professor of medicine, is investigating fatty liver disease and lipid metabolism.

Alumni Focus

On the Forefront of Research & Discovery

Alice Zhang, MD

'18

TAKING GENOME RESEARCH INTO FAMILY PRACTICE

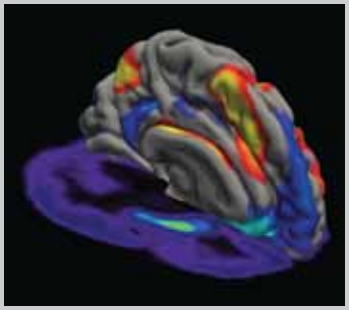
Dr. Zhang has incorporated genetic medicine into family practice. In her first year of medical school, she took a clinical genomics course that involved a trip to the Amish Research Clinic in Lancaster, Pennsylvania. This inspired her interest in genetic medicine, which she wanted to combine with a career in family medicine. In her residency at Lancaster General, she is doing just that. The Clinic for Special Children in Strasburg, Pennsylvania, has been so successful in treating children with genetic diseases that many are growing into adults. Maryland has continued to support her clinical training even after she graduated. She reached out to Toni I. Pollin, PhD, in PPGM to learn more about how patients pay for primary care and the role of the primary care doctor in recommending and incorporating genetic counseling into patient care. Through this collaboration with Pollin, Zhang is learning how to bring genetic medicine into primary care, using the Amish community as a starting point.

Joshua L. Roffman, MD

'01

DISCOVERING EARLY INTERVENTIONS FOR NEUROPSYCHIATRIC DISEASE

Dr. Roffman was inspired by his experience in the University of Maryland Combined Accelerated Program in Psychiatry (CAPP) to pursue clinical research. He found CAPP to be "remarkable, providing a wonderful training experience." He performed this research at the Maryland Psychiatric Research Center on the in-patient research unit. Through this program, he had the unique opportunity to spend meaningful time with patients with severe mental illness who were not taking any medication for their disease, because they were in the "washout" period of a clinical trial. Since most clinical trials no longer have this so-called washout phase, Roffman says it was a rare experience to see severe psychosis first hand. Seeing the problems that exist in untreated patients with severe psychosis left an indelible mark. While a medical student, he also worked with Dr. Adrienne Lahti to gain first-hand experience using imaging data from schizophrenic patients. These experiences contributed to Roffman's current research on psychosis. Convergent research from many places has shown the importance of prenatal life in the subsequent risk for schizophrenia, indicating that very early brain development may be the best time to intervene. He considers understanding and treating neuropsychiatric disease to be similar to understanding and treating cardiovascular disease: "Both the modifiable and nonmodifiable risk factors are important to consider in cardiology and in psychiatry." Roffman, a board-certified psychiatrist, is an associate professor at Harvard Medical School. At Massachusetts General Hospital, he is co-director of both neuroscience and psychiatric imaging and is director of the Brain Genomics Laboratory.



Roffman's lab combines genetics, epigenetic analysis and state-of-the-art imaging to investigate neuropsychiatric disease with an emphasis on prenatal factors in schizophrenia.

HSRF III

Robert R. Redfield, III, MD, FACS

'06

PERSONALIZING TRANSPLANTATION OPTIONS

Dr. Redfield, a *magna cum laude* graduate, is the Berkman Family Transplantation Professor of Surgery at the University of Wisconsin School of Medicine and Public Health. The training environment at Maryland and being surrounded by people devoted to research encouraged him to imagine a better medical landscape and "believe in the possible." He has taken this attitude into clinical practice and research into transplantation medicine, where he specializes in kidney and pancreas transplants. The biggest obstacles in transplantation are lack of organs for transplant and poor long-term survival for patients that do receive a transplant. One focus of his research is how recipients develop antibodies against the transplanted organ with the goal of developing strategies to prevent their generation or reduce their abundance, and thus prevent or delay rejection. Another major area of investigation leverages advances in genetic engineering with CRISPR-Cas9 technology to create humanized pigs that can be used for many medical applications, including xenotransplantation. This research will help overcome both of the major obstacles in transplantation.

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UNIVERSITY of MARYLAND
MEDICINE
Bulletin

Spring 2019