

IGS

INSTITUTE FOR GENOME SCIENCES

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Greetings Colleagues,

As we welcome the start of 2020, we're marking a new year and a new decade for us here at UMB. Before shutting the door on 2019, I'd like to recognize everyone at IGS for a noteworthy year. By all measures – the level of extramural funding, the growth in interdisciplinary research, the collective peer-reviewed publications, our contributions to the growth in graduate and medical education and our core facilities' expansion in equipment and output – all of these accomplishments have been truly outstanding and worth acknowledging.

In our 2020 Vol. 1 issue, we profile and share a few recent successes with you:

- ➔ Several of our faculty have introduced new software tools, which have been developed to meet the needs of specific user communities is profiled on [\(pg.3\)](#)
- ➔ We profile LUCA Biologics, a new venture started by Jacques Ravel, PhD, our Associate Director, Genomics and the first company that has launched based on IGS-generated research, on [\(pg.6\)](#)
- ➔ Emmanuel Mongodin, PhD, received a four-year award from the National Heart, Lung and Blood Institute, continuing his productive collaboration with Dr. Bromberg, MD, PhD, Professor of Surgery and Microbiology and Immunology at UMSOM. Their award titled "Immunological and Functional Consequences Triggered by the Gut Microbiota Regulate Alloimmunity and Cardiac Transplant Outcome" is detailed on [\(pg.6\)](#)
- ➔ Timothy O'Connor, PhD, was one of six new recipients of the very competitive NIH Genomic Innovator Awards. He will receive five-years' funding to identify genomic variants that exist in specific ancestry populations. More details on [\(pg.10\)](#)
- ➔ We recognize three students who have recently won awards, as well as Michael Sikorski, an MD/PhD student in David Rasko's lab [\(pg.8\)](#) for his work on global health
- ➔ Lastly, we congratulate our faculty who have been recently promoted and who have won awards for their service [\(pg.11\)](#)

Please don't hesitate to contact any of us at IGS to discuss your needs and concerns.

Happy 2020!



Claire M. Fraser, PhD

- Dean's Endowed Professor in the School of Medicine
- Professor of Medicine, Microbiology and Immunology Director
- Institute for Genome Sciences University of Maryland School of Medicine

IGS Expands Development of Software Tools to Various Communities



Since its launch in 2007, IGS has been firmly committed to providing bioinformatics analysis tools and resources to the research community. Initially, IGS provided several resources for the analysis of prokaryotic genomes under the Analysis Engine project as well as the Pathema Bioinformatics Resource Center. Over the years, the bioinformatics analytical tools and pipelines that IGS has made available to the community has grown considerably in number and versatility. With increased multi-disciplinary collaborations, new pipelines and tools have been developed in the areas of human genomics, infectious diseases, pathogen populations, systems biology, host-microbe interactions, protein sequence analysis and transcriptome analysis. This is reflected in the expanded research tools section on the IGS website.

Anup Mahurkar, Executive Director, Software Engineering and IT, explains, “Since IGS first launched, we have developed informatics tools in numerous areas of omics applications to meet our research needs. There are

several reasons for this trend: costs for complex sequencing have come down, investigators are now generating increasingly large data sets and at the same time, we at IGS are learning more about the needs of different communities, so our tool development is becoming more focused to specific communities.”

An example of one tool is **gEAR – gene Expression Analysis Resource**. Joshua D. Orvis, Lead Bioinformatics Software Engineer, developed gEAR working with Ronna Hertzano, MD, PhD, Associate Professor of Otorhinolaryngology and IGS Affiliate Faculty at UMSOM, originally to support her analytical research needs and that of a consortium she works with, and ultimately for the global research community.

“Dr. Hertzano’s lab needed to visualize gene expression data from different structures and cell types in the ear as well as to compare data she generated to that of other laboratories. In addition, she needed novel methods to share and disseminate expression data pre- and post-publication. Importantly, the

tool had to be useful to the broader research communities and should not require knowledge in programming,” explained Mahurkar.

gEAR employs a web-based interface that provides users with the ability to examine expression data and carry out comparative analyses. The tool was recently enhanced to support single cell RNA-seq data visualization and analysis. The infrastructure developed for gEAR has been leveraged to create other visualization and analysis portals for other projects, including the **IGS Genome Center for Infectious Diseases (GCID)** and **Neuroscience Multi-Omics (NeMO)** projects.



(From left) Ronna Hertzano, MD, PhD and Anup Mahurkar

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IGS is a strong supporter of sharing and reusing tools across projects. The Institute is committed to following an open source model of tools development and enjoys collaborating with other groups to make use of tools developed elsewhere for IGS project needs. For example, IGS used the **NCI Genomic Data Commons** infrastructure to build data portals for the **Human Microbiome Project** and the **Neuroscience Multi-Omics (NeMO)** archive. Sharing infrastructure across centers and projects is an efficient means of developing resources proven to be of value to the community.

Here are some of the tools developed by IGS faculty and research staff recently made available on IGS website:

Andrew Neuwald, PhD,

Professor of Biochemistry and Molecular Biology and IGS Faculty at UMSOM, develops and applies computational approaches for protein sequence/structural analysis. He aims to identify sequence and structural determinants of protein function and to thereby better understand how proteins work at the molecular level. He recently developed several new tools: **Structurally Interacting Pattern Residues' Inferred Significance (SIPRIS)**, which identifies networks of structurally interacting protein residues likely responsible for functional specificity; **Statistical Tool for Analysis of Residue Couplings (STARC)**, which assesses the correspondence between sequence correlations and residue-to-residue 3D-contacts; **Deep Analysis of Residue Constraints (DARC)**, which concurrently characterizes residue



Andrew Neuwald, PhD

couplings, protein subgroup-specific patterns, and correlations among patterns, structure, and couplings; and **Search Procedure for Analysis of Residue Constraints (SPARC)**, which assesses the biological relevance of protein structures based on statistical criteria.

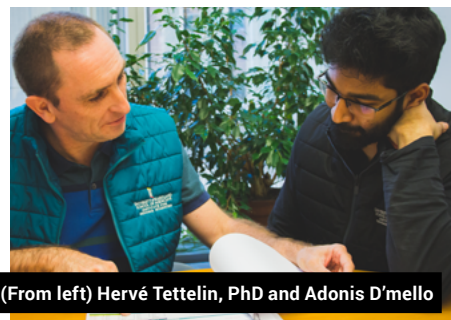
Jacques Ravel, PhD, Professor of Microbiology and Immunology and IGS Faculty at UMSOM, and Associate Director, Genomics, IGS, and Bing Ma, Research Associate in the Department of Microbiology and Immunology and IGS, released **VIRGO**, a comprehensive human vaginal non-redundant gene catalog. Leveraging a curated reference database of genes encoded by members of a target microbiome can facilitate metagenomic and metatranscriptomic data analyses. The Ravel Lab has developed **VIRGO**, an easily accessible suite of tools to comprehensively characterize the structure and function of vaginal datasets.

Hervé Tettelin, PhD, Professor of Microbiology and Immunology and IGS Faculty at UMSOM, released **ReVac**, a new tool that aggregates decades of his research – specifically in vaccinology. Dr. Rino Rappuoli and Dr. Tettelin were pioneers in reverse vaccinology, an innovative process whereby an entire pathogenic genome can be screened using bioinformatics approaches to find novel protein candidates for vaccine development. Dr. Rappuoli is currently Chief Scientist & Head of External Research and Development (R&D) at GlaxoSmithKline (GSK) Vaccines. **ReVac** was developed by Adonis D'mello, a doctoral candidate in the Tettelin lab. It is a reverse vaccinology pipeline that features a set of tools to identify and prioritize novel vaccine candidates in whole genome sequence data. Because proteins are so complex and because investigators may want to identify

proteins with specific properties, the pipeline allows users to accurately identify potential vaccine candidates with specific desirable features.

“Our **ReVac** tool gives researchers a ‘jumpstart’ for their work,” explains Dr. Tettelin, “they can prioritize the most promising vaccine candidates, so, instead of hundreds of proteins, they could start with twenty, which helps them work more efficiently.”

As IGS investigators continue their multi-disciplinary collaborations, more tools will be introduced.



(From left) Hervé Tettelin, PhD and Adonis D'mello

MORE INFORMATION

<https://www.medschool.umaryland.edu/profiles/Hertzano-Ronna/>

<https://www.medschool.umaryland.edu/CIBR/CORE/IRC/>

<https://www.medschool.umaryland.edu/profiles/Tettelin-Herve/>

<https://www.medschool.umaryland.edu/profiles/Neuwald-Andrew/>

VIRGO
virgo.igs.umaryland.edu

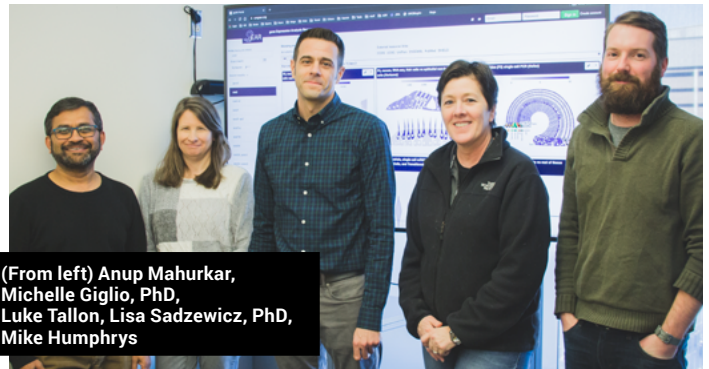
Maryland Genomics: High-throughput Sequencing and Analysis Services at IGS

The Genomics and Informatics Resource Centers (GRC/IRC) were established as part of IGS in 2007 to serve as the high-throughput sequencing and analysis cores supporting IGS investigators, their collaborators, University of Maryland researchers, and scientists around the world. Since that time, the GRC and IRC have contributed to hundreds of research projects and supported hundreds of investigators worldwide. A third IGS core, the Microbiome Services Laboratory (MSL) was established in 2018 to provide a complete range of microbiome characterization services, including high-throughput DNA and RNA extraction, microbiome 16S rRNA gene amplicon profiling, metagenomics and metatranscriptomics, as well as associated complex analyses. Many projects now utilize the services of multiple IGS cores. Though coordination between the cores has always been strong, we determined that deeper integration of our services would improve project coordination, streamline communication between cores and customers, and enable us to better serve the research community. To that end, IGS established **Maryland Genomics**.

"We are really excited to integrate our well-established services as Maryland Genomics," said Luke Tallon, GRC Scientific Director. "Most of our growth comes from word of mouth and referrals. Providing our customers with a single, streamlined portal to our wide array of services will provide better clarity and customer-service."

Maryland Genomics represents the integrated core services of IGS, including high-throughput sequencing, microbiome profiling, data analysis, and pipeline development. Senior scientists at Maryland Genomics were early pioneers in the field of genomics more than 25 years ago, and remain at the cutting edge of genomic technology development and bioinformatics analyses. We are supported by and leverage the innovation developed by IGS faculty, who are leading genomic scientists.

Our service portfolio continues to grow. We have expanded our DNA and RNA extraction capabilities with new robotic systems that support high-quality extraction for all sequencing applications across a wide range of sample types. Our sequencing services continue to include multiple short-read and long-read platforms. We are a PacBio Certified Service Provider and early-access beta site for their newest technologies. We were among the first five sequencing centers worldwide to provide services using their new Sequel II System, the first highly-accurate long-read platform to offer



(From left) Anup Mahurkar, Michelle Giglio, PhD, Luke Tallon, Lisa Sadowicz, PhD, Mike Humphrys

"With the integration of our services under Maryland Genomics, we will be better able to serve each of these vitally important researchers."

– Dr. Claire Fraser

affordable high-quality whole human genome sequencing. Our six short-read platforms range from the lowest throughput Illumina iSeq to the powerful high-throughput Illumina NovaSeq 6000, capable of sequencing 48 human genomes in less than two days. Our full suite of analysis pipelines combined with a 3000-core compute cluster and 4 petabytes of data storage supports the work of more than 40 bioinformatics engineers and analysts.

"Our customers are a combination of researchers from all of the professional schools on our UMB campus and all over the world," explained Claire Fraser, PhD, Director of IGS.

If you're interested in learning more, contact us.

MORE INFORMATION

<http://www.igs.umaryland.edu/services/cores.php>

<https://marylandgenomics.com/>



LUCA Biologics, the First IGS Venture, Launches to Improve Women's Health

Longtime microbiome researcher, Jacques Ravel, PhD, Professor of Microbiology and Immunology and IGS Associate Director for Genomics at UMSOM, has co-founded a new company, LUCA Biologics, which launched in August 2019.

LUCA Biologics is based on a series of breakthrough discoveries by Dr. Ravel that have shaped our current scientific, technological, and regulatory understanding of the microbiome applied to women's health. Research into the microbiome, the trillions of bacteria, viruses and fungi that live in the human body, is becoming a larger force in the development of therapeutics in many areas. Applied to women's health, therapeutics targeting the vaginal microbiome may have an effect on urinary tract infections (UTI's) and bacterial vaginosis (BV), the most common vaginal disorder among reproductive-aged women that is also a risk factor for preterm birth and the acquisition of sexually transmitted infection. His research has generated a large collection of beneficial bacteria found in the vagina in healthy women. Multi-omics approaches were used to characterize these bacteria and the environment they were isolated from, which provided a rationale for using them as a drug to restore optimal vaginal microbiota.

"There is an urgent need for innovation in women's health," Dr. Ravel said. "While our research started with metagenomic sequencing to generate large comparative data sets, the application of modern omics technologies has now afforded us a comprehensive level of understanding of the vaginal environment. We are translating our findings into safe, effective and FDA-approved live biotherapeutic drugs to treat widespread conditions that stigmatize and devastate millions of women each year. This include urinary tract infections, LUCA's first target disease".

"We have an opportunity to make a true impact in women's health and translate breakthroughs in microbiome science into innovative therapeutics," said Luba Greenwood, JD, LUCA Biologics CEO.

LUCA Biologics is the first company to launch out of Seed Health, a microbial sciences accelerator, and it is the first commercial venture to launch from the Institute of Genome Sciences. Seed Health, led by CEO Raja Dhir, who is also LUCA's co-founder, has what it calls a foundry model, where it partners with leading scientists to provide capital investment, consulting on regulatory and intellectual property issues, and promotes clinical trials through academic partnerships.

Researchers Continue Investigating Microbiota Links to Organ Transplant Outcomes



(From left) Emmanuel Mongodin, PhD, Jonathan S. Bromberg, MD, PhD

Emmanuel Mongodin, PhD, Associate Professor of Microbiology and Immunology and IGS faculty at UMSOM, received a four-year, \$2,314,936 award from the National Heart, Lung and Blood Institute, which began July 15, 2019.

The award titled "*Immunological and Functional Consequences Triggered by the Gut Microbiota Regulate Alloimmunity and Cardiac Transplant Outcome*" is a continuation of a productive collaboration between Dr. Mongodin, PhD and Dr. Jonathan S. Bromberg, MD, PhD, Professor of Surgery and Microbiology and Immunology at UMSOM.

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Chronic rejection has been a critical and lasting problem in organ transplantation. Despite intense research over the past 20 years, researchers have struggled with the factors needed to improve the long-term organ rejection rate that can occur after five to eight years following transplantation. Antibiotics, immunosuppressive drugs and surgical techniques and other factors have improved but the transplant rejection rate has remained perplexingly high.

Dr. Bromberg has transplanted hundreds of organs over the course of his career and has never stopped thinking about the variables that might influence long-term rejection rates. In 2014, when significant data was published about the Human Microbiome Project, he wondered if the gut microbiome could play a role in transplant rejection by controlling the recipient immune response, and he began collaborative research with Dr. Mongodin.

Drs. Mongodin and Bromberg published an influential study in the *Journal of Clinical Investigation Insight* in October 2018 demonstrating a causal relationship between the presence of certain microbes and transplant outcomes. Their study was the first to identify specific bacterial species that could affect whether a heart transplant is rejected and how quickly it could happen.

“We learned that specific shifts in the compositions of the gut microbiota can affect organ transplant outcomes significantly,” said Dr. Mongodin. “More importantly, we demonstrated a causal relationship between the gut microbiota and rejection, not just observing a change, which was a major step forward.”

The link between chronic rejection in the transplanted heart and the microbiome is the immune system. Certain bacteria in the gut microbiome can trigger pro- or anti-inflammatory signals, and these signals can in turn affect how the immune system responds to the transplanted organ.

With this award, the investigators will be “dissecting” the immunological response to pinpoint the cascade of events – the cells involved, and identify signals within the lymphatic system, among others.

“Now, we are studying the immunological cascade of events and the molecules produced by the gut bacteria that might control this cascade. We are also looking for the specific cell types in different organs that are implicated. With an improved

knowledge of the steps leading to chronic rejection, we will be in a much better place to design an eventual microbiome-based therapeutic solution,” said Dr. Mongodin.

In addition, as the investigators continue their research, they hope to identify biomarkers in the gut microbiome that could serve as diagnostics for improved long-term allograft outcomes. But ultimately, the research will be leveraged to design innovative treatments to prevent the rejection at certain steps.

“With a better understanding of the molecular pathways connecting the gut microbiome with transplant outcomes, it may be possible to mimic the effect with drugs or microbiome-based biologics,” said Dr. Mongodin.

“This is a great example of translational research,” said E. Albert Reece, MD, PhD, MBA, Executive Vice President for Medical Affairs at UM Baltimore and the John Z. and Akiko K. Bowers Distinguished Professor and Dean, University of Maryland School of Medicine. “As we learn more about these microbes, we have the potential to change long-term rejection rates in heart transplants.”

MORE INFORMATION

<https://insight.jci.org/articles/view/121045>

<https://www.medschool.umaryland.edu/profiles/Mongodin-Emmanuel/>

<https://www.medschool.umaryland.edu/profiles/Bromberg-Jonathan/>



Global Research, Collaborating Across Oceans



Michael Sikorski, PhD

Michael Sikorski has enjoyed many global research opportunities at UMB within a relatively short time. Now in his fourth year of the dual MD-PhD program in Molecular Microbiology & Immunology at the University of Maryland, Baltimore, Michael's interests are aligned with medical research and global health.

While completing his bachelor's degree in bioengineering at the University of Maryland, College Park, Michael excelled in biomaterials and polymer science in the Kofinas Lab. Those early bench-side experiences and his time studying abroad, helped Michael to return to Madrid, having earned a year-long Fulbright scholarship and concurrent Whitaker International fellowship, to work with the Tissue Engineering and Regenerative Medicine Group at la Universidad Carlos III de Madrid. Around this time, he had applied to UMB's MD program and was accepted with deferred admission in order to complete the scholarships. While communicating from abroad with various faculty at UMB, Michael was eventually introduced to Myron (Mike) Levine, MD, DTPH, the founding director of the Center for Vaccine Development and Global Health (CVD), and a World Health Organization consultant who is a globally respected expert in enteric infections and vaccines.

After his year working on engineered skin scaffolds in Madrid, Michael began medical school in search of a structured research opportunity. With Michael's Spanish language skills, he connected with the CVD-Chile, through which he discovered

an opportunity to join Dr. Levine's team with an upcoming two-year typhoid carrier study in Santiago, Chile. During the spring break and summer of his first year, Michael was off to Santiago to support surveillance research with a web-based data capture system across four metropolitan hospitals and the Chilean Institute of Public Health as part of Dr. Levine's new grant in Chile.

"I've been surprised and pleased at the variety of UMB's options for international field work in global health," explained Michael. "Dr. Levine was extraordinarily supportive of students and fellows spending substantial time abroad. He understood the value. Not all universities have that culture."

When Michael returned from Chile, he applied for and earned an available seat in the MD-PhD dual degree program. He began to complete several research rotations. After hearing an exciting lecture taught by David Rasko, PhD, as part of a molecular epidemiology course, Michael pursued a fourth rotation (most students only do three rotations), with the Rasko Lab at the Institute for Genome Sciences.

"The work that Dr. Rasko is doing is so significant for global health," explained Michael. "He shared his story about the 2011 EHEC outbreak in Germany. It is fascinating how he is using basic science with modern tools to have public health impact."

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Again, Michael's fortuitous timing and experience led to another global health opportunity in 2018 as he began helping Dr. Levine with a grant to expand typhoid fever surveillance in the small Pacific island nation of Samoa, a portion of which would focus on applying robust genomic tools to greatly enhance epidemiological models. Dr. Levine was building on a 2013 invitation by the Ministry of Health of Samoa to help address endemic typhoid fever. This collaboration, supported by the Bill & Melinda Gates Foundation, became the "Samoa Typhoid Fever Surveillance Initiative." The main hospital in Samoa had begun the standard practice of freezing *Salmonella* Typhi bacteria from sick patients and sending them abroad for genomic sequencing, in case the isolates were resistant to antibiotics. It was here that an ideal opportunity was identified for Michael to support the surveillance initiative through genomics research.

One area of genomics research is called "genomic epidemiology" which involves comparative genomics applied to the microbes isolated from clinical samples (blood or stool) from patients or sometimes to environmental isolates from sewers or contaminated surface waters. Genomic epidemiology makes use of the assumption that two highly similar bacterial genome sequences from a particular time are more likely to be from a common source than two bacterial isolates with dissimilar genome sequences.



Gathering samples



Field work in Samoa

Under the co-mentorship of Dr. David Rasko at IGS and Dr. Myron Levin at the CVD, Michael is designing a thesis project centered on genomic epidemiology to help elucidate some of the patterns of transmission of endemic typhoid fever in Samoa and to support the Samoan Ministry of Health in outbreak detection, chronic carrier detection, and monitoring for antimicrobial resistance patterns.

With the support and supervision from IGS and CVD, in addition to the multi-national teams, isolates are collected, sampled, sequenced, and analyzed. Michael is discovering that today's MD-PhD students interested in global health can be collaborating across oceans and making a significant difference in public health research.

MORE INFORMATION

<http://www.igs.umaryland.edu/labs/rasko/>

<https://www.medschool.umaryland.edu/profiles/Levine-Myron/>

Timothy O'Connor, PhD, Receives NIH Genomic Innovator Award



The National Institutes of Health's (NIH) National Human Genome Research Institute (NHGRI) announced that genomics scientist, **Timothy O'Connor**, PhD, Assistant Professor of Medicine and IGS Faculty was one of six new recipients of the NIH Genomic Innovator Awards. The awards provide funding to support early career researchers studying genome biology, genomic medicine, technology development, and societal implications of genomic advances. Dr. O'Connor will receive \$500,000 per year for five-years to identify genomic variants that exist in specific ancestry populations.

In a recent study, published in the journal *Nature Communications*, Dr. O'Connor was part of a team that conducted a genome-wide meta-analysis that culled data from those of African ancestry and mapped new areas on chromosomes containing genes related to asthma risk. He also served as lead investigator on a study published in March in the journal *Cancer* that characterized more than 1,000 cancer cell lines by their ancestry, finding that the vast majority were of European or East Asian ancestry with very few cell lines of African American ancestry. Hispanic and South Asian

ancestries were almost entirely absent across all cell lines. He and his UMSOM colleagues noted that the finding called for the need to rectify the ancestral imbalances in sequenced cell lines to effectively study various form of cancer that occur in different ethnic populations due to genetic variations.

"Dr. O'Connor's award demonstrates an important recognition for the School of Medicine and IGS as leading the field of human genomics, especially in providing an in depth analysis of ethnic differences in common diseases like cancer and asthma," said UMSOM Dean **E. Albert Reece**, MD, PhD, MBA, who is also the Executive Vice President for Medical Affairs, University of Maryland and the John Z. and Akiko K. Bowers Distinguished Professor. "These important research findings have yielded great insights, but they have also raised many questions that still need to be addressed."

Unlike more traditional NIH research grants, the Genomic Innovator Awards allow for flexibility in research pursuits by providing funding to investigators who already have outstanding records of productivity. It enables them to pursue

new directions as they arise without the need to submit new grant applications. This program contributes to the ongoing NIH effort to accelerate scientific innovation by promoting stable funding to investigators, prompting improved productivity and facilitating flexible, ambitious and creative research.

Dr. O'Connor has been active with several international consortia that are examining broader questions about human genomics. He is working with the **Trans-Omics for Precision Medicine (TOPMed)** consortium that is part of the NIH's broader Precision Medicine Initiative, which aims to provide disease treatments tailored to an individual's unique genes and environment. His aim is to develop tools and methods that can be used across layers of data in order to improve the analysis of one of the largest sequencing initiatives, as TOPMed involves more than 140,000 human genomes.



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“One of the greatest benefits of this award is that it gives me the latitude to do innovative research, and I will be able to expand my role in TOPMed and other consortia,” explained Dr. O’Connor. “I want to use multi-omics data, such as rare genomic variation, metabolomics, and transcriptomics, to investigate systems biology questions, including how these processes impact human health and disease.”

Dr. O’Connor was recruited to UMSOM and IGS in 2013 from the University of Washington. He earned his PhD in Evolutionary Genetics from the University of Cambridge, England in 2011. His laboratory explores the effects of evolution and population structure on the genomic architecture of disease and other phenotypes in order to better understand the origin of phenotypic diversity. He and his colleagues are developing new

algorithms and statistics to apply to interdisciplinary biological problems. They rely on next-generation sequencing and aim to explain phenotypic differences among given populations, including Hispanic Americans and the Old Order Amish.

MORE INFORMATION

<https://www.medschool.umaryland.edu/profiles/OConnor-Timothy/>

Congratulations

IGS congratulates the following IGS faculty for their accomplishments:

- **Julie Dunning Hotopp, PhD**, IGS Faculty, was promoted to the rank of Professor of Microbiology and Immunology.
- **Hervé Tettelin, PhD**, IGS Faculty, was promoted to the rank of Professor of Microbiology and Immunology.
- **Lynn Schriml, PhD**, Associate Professor of Epidemiology and Public Health and IGS Faculty was awarded tenure.
- **David A. Rasko, PhD**, Professor of Microbiology and Immunology and IGS Faculty at UMSOM, has been elected to Fellowship in the American Academy of Microbiology. This is the honorific leadership group within the American Society of Microbiology.
- **Michelle G. Giglio, PhD**, Associate Professor of Medicine and IGS Faculty at UMSOM, was honored during UMB’s Founders Week as UMB’s 2019 Public Servant of the Year.



(From left) Julie Dunning Hotopp, PhD, Hervé Tettelin, PhD, Lynn Schriml, PhD, David A. Rasko, PhD, Michelle G. Giglio, PhD

Michelle Giglio, PhD, Founder's Week Public Servant Award

By Lou Cortina, UMB

Michelle G. Giglio, PhD, Associate Professor of Medicine and IGS Faculty at UMSOM, grew up with a sense of fairness and a love of science. For more than a decade, she's combined those two traits to impact the lives of countless youths in the community surrounding the University of Maryland, Baltimore (UMB) and beyond. Dr. Giglio is passionate about promoting STEM (science, technology, engineering, and math) education to underserved students in Baltimore, and that's a major reason she was chosen as UMB's 2019 Public Servant of the Year.

Also the academic and outreach coordinator at IGS, Dr. Giglio believes that if young students from underserved city neighborhoods are exposed to a variety of science projects and the expansive range of science careers, they can find avenues to pursue their interests and follow their dreams.

"I grew up with a strong sense that things should be fair, that everyone should be treated equally, and everyone deserves the same opportunities in life," says Dr. Giglio, who has been at IGS since 2007. "In reality, things are often not fair. I see our University right next to neighborhoods that are facing difficult challenges — the two exist in completely different worlds. I want to help build a bridge between those worlds."

Giglio has been busy in her bridge-building activities. In 2014, she was invited to participate in the UMB President's Outreach Council to help shape scientific programs for visiting students. When UMB launched the **CURE Scholars** Program in 2015, she was an early advocate and volunteered her time

with the mentoring pipeline initiative, which prepares middle and high school students in West Baltimore for careers in research, STEM, and health care.

Dr. Giglio led a two-week, genomics-centered program for the CURE Program's first summer camp in 2016 and has hosted weeklong programs in each of the past three summers. With creativity and energy, she developed full days of activities, including interactive games that got the rising seventh-graders excited about science. In 2018, she started a program called the Maryland Microbiome Project that brings STEM events to high school students throughout the city. "The students spent a full day at IGS, carrying out experiments. They engaged in actual field work, collecting soil samples that were analyzed by IGS. They were doing real science," Dr. Giglio says.

"I have known Michelle for more than 18 years, and since IGS launched in 2007, I have seen how her interest in empowering underserved students in downtown Baltimore has expanded," says Claire M. Fraser, PhD, Director of IGS and the Dean's Endowed Professor at UMSOM. "Michelle's work with STEM educational outreach goes above and beyond anything that could be reasonably expected of our faculty. It is work that is done outside of her faculty responsibilities, and not part of any metrics for faculty promotion and tenure. She is truly passionate about the need to expose these children to scientific concepts and the beauty of science."

At IGS, Dr. Giglio's work involves analyzing sequence data to try to understand how changes in an



organism's DNA or environment lead to changes in any observable trait of the organism (such as disease state, behavior, etc.). Her group also is working to standardize the way data is captured across the research community so that finding, searching, and using the huge volumes of data being generated is made easier for all researchers.

Born and raised in Frederick, Md., she earned an undergraduate degree in biology from the University of Maryland, College Park and her PhD in molecular biology and genetics from Johns Hopkins University School of Medicine. As a teacher, she is essentially self-taught, a fact that makes her educational outreach efforts all the more impressive.

"Michelle has no formal training in how to teach young children, but she has not only developed many programs for students to spark their interest in science, her programs are well-received by the students and their teachers," Dr. Fraser says. "Because she is passionate

Continued on page 13

about helping youths enjoy and retain science, she has given her programs much thought and creative energy.”

Former executive director of the CURE Scholars Program Robin Saunders, EdD, MS, has seen the fruits of Dr. Giglio’s thoughts and energy firsthand. She praises her CURE summer camp initiative for its engaging, interactive games and describes the professor as “an inspirational host.”

“Dr. Giglio is creative, energetic, and passionate about developing full days’ worth of scientific curriculum for our scholars,” Saunders says. “Keeping young people entertained and interested in indoor programs during the summer weather is not easy. But Dr. Giglio keeps them engaged. She never talks down to their age and has created ways to explain complex topics such as DNA sequencing and molecular biology to middle school children.

“People like Dr. Giglio are vital to the success of our program. She is committed to our program and to investing her time and creativity into seeing our CURE Scholars continue to succeed.”

Dr. Giglio says the content and curricula for her programs continually evolve as she strives to ensure that the students learn while having fun. “When I hear the kids ‘ooh’ and ‘ahh’ as they see DNA they’ve just isolated, or when their eyes light up

as they share a poster about a favorite species they’ve been researching, I know I’ve succeeded.”

It’s all part of her bridge-building mission, and with her efforts, Dr. Giglio also is building hope.

“I hope to send a message to the kids I work with that they have options, that they have choices,” Dr. Giglio says. “I want them to know they can follow their dreams, and I want to show them there are resources out there to help them reach their goals.”

MORE INFORMATION

<https://www.medschool.umaryland.edu/profiles/Giglio-Michelle/>

<https://www.umaryland.edu/cure-scholars/>

IGS Graduate & Medical Students Selected for ICTR Award

Sarah Robbins, an Epidemiology doctoral student in the Brotman Lab, Bernadine Monari, a Molecular Medicine doctoral student in the Ravel Lab, and Olivia Martin, MD, in the Fraser Lab, all at IGS, were selected for the highly competitive Institute for Clinical and Translational Research (ICTR)/ Clinical and Translational Science Award (CTSA) TL1 Pre-Doctoral Clinical Research Scholar award, which began September 1, 2019.

One of the strengths of Sarah Robbin’s application was her specific research interest in clinical research in women’s health and the epidemiology of reproductive tract infections. She will continue her dissertation work in Dr. Rebecca Brotman’s laboratory.

Bernadine Monari’s research aims to improve clinical care for transgender people by studying the vaginal microbiota and the effect of hormonal therapy on vaginal health. This is a research project they will continue in Dr. Jacques Ravel’s laboratory.

Olivia Martin is a third-year general surgery resident physician working in Dr. Claire Fraser’s lab. They are investigating the role of the gut microbiome in traumatic brain injury and its associated clinical complications.



Bernadine Monari



Olivia Martin, MD



Sarah Robbins

PUBLICATION LIST

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