



IGS NEWSLETTER

WINTER 2014



UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE
INSTITUTE FOR GENOME SCIENCES

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Greetings Colleagues,

In this issue of our newsletter, we've highlighted a few of our activities that demonstrate our passion for shaping the future of science and its impact on society.

In November, we were honored to be part of the School of Medicine's first "Accelerating Innovation and Discovery in Medicine (AccelMed)", a day-long scientific symposium, starting with a keynote presented by Francis Collins, MD, PhD, the director of the National Institutes of Health (see pg 2 for more details). One of the themes of this AccelMed event was "team science", and as we look ahead, 2014 promises to be a year of expanded opportunities for IGS faculty members and staff to be part of innovative collaborations.

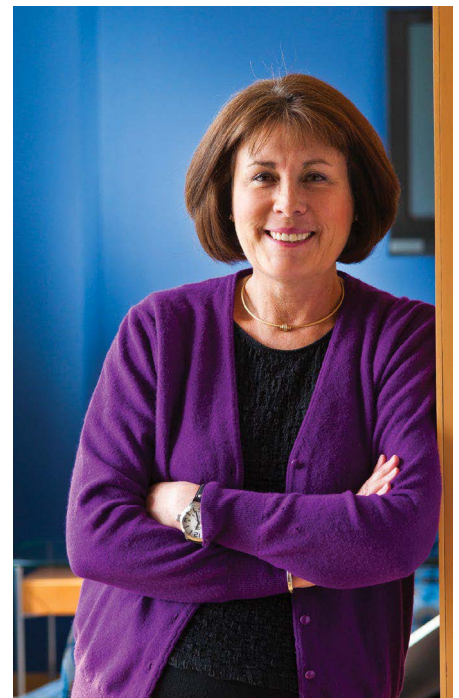
We feature several UMB collaborations in this issue to highlight the utility of genomics as an analytical tool and as a new approach to advance clinical practice. Examples of these novel partnerships include Drs. Schriml and Terrin's work with their cell biology consortium (pg 4), and Drs. Ravel and Regan's work on preterm births (see pg 4). The ground-breaking research programs being carried out by IGS faculty members are enabled by the "end-to-end" capabilities of our sequencing and bioinformatics Core facilities (see pg 2).

Systems biology is a major area of our growth at IGS. Systems Biology integrates disparate data types (omics data) to construct predictive models of complex biological systems. We are continuing to build programs centered on applying systems biology in the area of the human microbiome and infectious diseases. Systems biology is an interdisciplinary science, and we are leveraging UMB expertise to integrate technological and computational tools with the clinical research.

We have several public events and seminars coming up this spring, including our second annual Frontiers in Genomics lecture that will be given by Dr. Martin Blaser in May. We welcome your visits and your questions. We hope that learning more about our work and our goals will inspire you about the applications of genomic research.

Claire M. Fraser, PhD

*Professor of Medicine and Microbiology and Immunology
Director, Institute for Genome Sciences
University of Maryland School of Medicine*



FESTIVAL OF SCIENCE

New School of Medicine Initiative

The UM School of Medicine's new initiative, "Accelerating Innovation and Discovery in Medicine," (ACCEL-Med), celebrates scientific discoveries that impact human health – the vision of Dr. E. Albert Reece, Dean of the UM School of Medicine.

On November 22, 2013, SOM hosted a full-day symposium, attended by an external scientific advisory council of internationally-recognized scientific leaders and medical entrepreneurs. Francis Collins, MD, PhD, director of the National Institutes of Health, gave the inaugural keynote address. IGS was honored to present a quick cross-section of exciting new genomics research. After Claire Fraser summarized many of the IGS collaborations launched across UM campus, **David Rasko** spoke about "Application of High Throughput Sequencing to Genomic Epidemiology." Next, **Rebecca Brotman** presented "The Vaginal Microbiome and Women's Health: Implications for Clinical Translation." **Timothy O'Connor** presented "Human Population Genomics with Next-Generation Sequencing."



MORE INFO

[Click here](#) for more information about the day's program and the ACCEL-Med initiative

The Genomics Resource Center

(GRC)

Large-scale sequencing and data analysis serves as the basis for the interdisciplinary collaborations developed by IGS faculty. The GRC's growing reputation for high-quality and cost-effective sequencing and analysis services has enabled the expansion of these collaborations in new directions.

Recent advances in the Pacific Biosciences (PacBio) single-molecule, long-read technology have returned us to an era



Our **strength** is not just our deep history and experience in sequencing and genomics, but our end-to-end service level from the **initial project** consultation through to **publication**, including all of the informatics **in close collaboration with the IGS Informatics Resource Center (IRC)**," GRC Scientific Director, Luke Tallon, says. **"That's what sets up apart from other cores.**



where the generation of complete microbial genome sequences is commonplace. As early adopters of PacBio technology, and through early access to new protocols and advances, the GRC has been at the forefront of this new wave of microbial genome sequencing. In November, PacBio profiled the strengths that GRC brings to the research community. Read about it [here](#) and [here](#).

One of the newest large projects at the GRC will use this new technology advance. The GRC was awarded a two-year contract by the U.S. Food and Drug Administration (FDA) to sequence and analyze microbial pathogens in support of the development and expansion of a comprehensive, curated

database of pathogen genome sequences and associated metadata. FDA will use this database to evaluate and validate sequencing-based in vitro diagnostic tools. In collaboration with FDA, NCBI, and the IGS Informatics Resource Center (IRC), and using both Illumina and PacBio sequencing platforms combined with customized genome assembly and analysis software pipelines, the GRC will deliver fully sequenced, assembled, and annotated genome sequences and epigenomic profiles for more than 550 pathogen isolates.

For more information about the GRC, our platforms, services, and projects, please visit [our website](#) and the [GRC blog](#).



GRADUATE EDUCATION

New Genome Biology Courses

The Molecular Genetics, Genomics, and Bioinformatics track of the Molecular Medicine Graduate Program, led by Dr. Scott Devine, has been renamed the Genome Biology track. This name better reflects the research interests of faculty members in the track and the new curriculum. The track includes four courses:

- Current topics in Genome Biology
- Genomics and Bioinformatics
- Programming for Bioinformatics
- Genetics and Genomics of Model Species and Humans

The curriculum has been extensively revised and updated through these four core courses that are required by all

graduate students in the Genome Biology track. Students learn a range of topics spanning bioinformatics and genomics through a blend of lectures and hands-on instruction. Dr. Devine and faculty leaders within the track are exploring the development of additional elective courses that would provide more advanced training options in this area. [View curriculum](#)

Profile: Rebecca Brotman, PhD

**Rebecca Brotman, PhD, MPH,
SOM Assistant Professor,
Department of Epidemiology &
Public Health, received three recent
honors related to her research in
women's health.**

She received the 2013 North American Menopause Society (NAMS) New Investigator Award, presented at the Society annual meeting for her abstract titled "The association between vaginal microbiota, menopause status and signs of vulvovaginal atrophy." Dr. Brotman was also selected for the young investigator award by the Infectious Diseases Society for Obstetrics and Gynecology (IDSOG). The award was given at their annual conference for her talk on "A Longitudinal Study of the Vaginal Microbiota and Human Papillomavirus Detection."

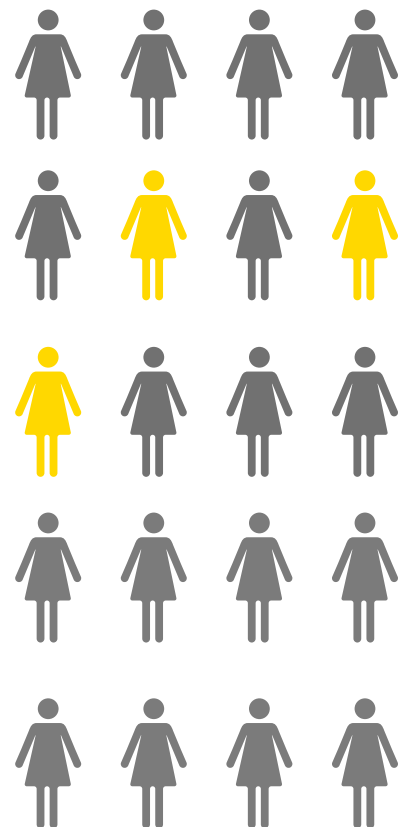
Her paper on menopause generated interesting press online:

<http://www.prevention.com/health/health-concerns/probiotics-may-help-vaginal-atrophy-symptoms>

<http://www.medscape.com/viewarticle/812521>

Dr. Brotman also was recognized with the GenomeWeb Young Investigator Award in 2013:

<http://www.genomeweb.com/genomeweb-feature-eighth-annual-young-investigators>



CHARACTERIZING THE EFFECTS OF FECAL MICRO- BIOTA TRANSPLANTATION

Florian Fricke, PhD

W. Florian Fricke, PhD, SOM Assistant Professor of Microbiology and Immunology, and Sudhir Dutta, MD, Director of Gastroenterology at Sinai Hospital in Baltimore, have been studying the long-term effects of treating patients suffering from recurrent *Clostridium difficile* infection (RCDI) with fecal microbiota transplantation (FMT). Their study findings were published in **PLOS ONE**.

Applying new genomic tools and bioinformatics analysis to this patient group provides new insights into events at the microbiota level that could explain how antibiotic treatment, the most common cause of CDI, is linked to the disease and how successful treatment with FMT returns patients to a normal healthy state. Dr. Dutta is a gastroenterologist whose clinical work and research focuses on new treatments for CDI and inflammatory bowel diseases. Dr. Fricke is a microbial genomicist who develops and applies bioinformatics methods to study microbial communities of the gastrointestinal tract and their interaction with the human host. Their innovative collaboration of applying genomics and bioinformatics methods to clinical patient care is helping pave the way for the development of more personalized, microbiota-targeted therapies in the future.

[Fricke faculty page](#)

NHLBI PROGENITOR CELL BIOLOGY CONSORTIUM

**Michael Terrin, MD and
Lynn Schriml, PhD**

In 2009, **Lynn Schriml** PhD, SOM Assistant Professor, Epidemiology and Public Health, and IGS Bioinformatics, together with **Michael Terrin** MDCM, MPH, SOM Professor, Epidemiology and Public Health, and Medicine, combined their bioinformatics and epidemiological expertise to create a new center. Funded through the National Heart, Lung and Blood Institute (NHLBI), the Progenitor Cell Biology Consortium's Administrative Coordinating Center's purpose is to identify and characterize progenitor cell lines.

The Administrative Coordinating Center, led by Dr. Terrin, has been successful in launching the consortium's web site and data archive, coordinating activities across the nine research hubs, funding PCBC Pilot Studies, Stem Cell and Skills Development Committee training programs, Jump Start awards, and 19 Ancillary and Collaborative Studies. In 2012, the PCBC Bioinformatics Core was established by NHLBI to foster cell line analysis and make the cell line characterizations conducted by the PCBC Cell Characterization Core available to the PCBC consortium and ultimately, the larger scientific community. Dr. Schriml leads the metadata development efforts within the Bioinformatics Core.

"Many medical advances can be anticipated from the increasing cooperation among bench scientists and experts in Bioinformatics; the IGS is living proof of this expectation. Working with Dr. Schriml, the IGS and our colleagues, who are global Bioinformatics experts, has been invaluable to the PCBC. I look forward to creating more new biomedical knowledge with this collaboration and others that are in the future for all of us," said Dr. Terrin.

[Click here](#) for additional background on the consortium.

APPLYING GENOMICS TO PRENATAL HEALTH CHALLENGES

Jacques Ravel, PhD

Jacques Ravel, PhD, Associate Director Genomics, has several novel multi-disciplinary research collaborations underway that leverage his strong links with clinician-scientists. Dr. Ravel's work is focused on women's health, and his pioneering longitudinal studies of the dynamics of the vaginal microbiota pairing clinical and epidemiological factors with genomic analysis, have led him to expand his research program on pre-term birth.

Preterm birth (PTB) is the leading cause of infant mortality and incurs billions of dollars per year in health costs. PTB is thought to originate from complex demographic, biological, genetic and behavioral factors. By applying genomic analysis of the vaginal microbiota to longitudinal and clinical studies, he has assembled a collaborative team to explore the impact of diet during pregnancy on birth outcome and the microbiome. He and his team hope to identify tractable modifiable behaviors.

Dr. Mary Regan from the UM School of Nursing is a co-PI with Dr. Ravel on a new NIH-funded study about the effect of diet on prematurity, outcomes and a women's microbiome.

Dr. Ravel is also collaborating with Dr. Michal Elovitz on research about the interaction between the vaginal microbiome and cervical immunity in women who deliver at term and those who deliver preterm. Dr. Elovitz is an Associate Professor of Obstetrics and Gynecology at the University of Pennsylvania School of Medicine.

Dr. Ravel's group recently published on this topic: Romero et. al. *Microbiome* 2014 2:4

[Ravel faculty page](#)

Collaborations with ILRI in Kenya **Battling an African Cattle Killer**

- Joana Carneiro da Silva, PhD



The IGS is involved in a large international public-private partnership to improve vaccinology solutions to the control of East Coast fever (ECF) in Africa. This effort is funded largely by the Bill & Melinda Gates Foundation, and is led by the International Livestock Research Institute (ILRI) in Nairobi, Kenya. ECF is a tick-borne disease caused by the protozoan parasite *Theileria parva*. Over one million cattle die of ECF each year in sub-Saharan Africa, resulting in annual losses that exceed US\$300 million, with a devastating impact on local farmers. Dr. Vish Nene, former IGS Associate Director and now at ILRI, is the project director. The genomics component of the project is led by Dr. Joana Carneiro da Silva, an Assistant Professor, Microbiology & Immunology. In addition to ILRI and IGS, other organizations in the ECF Consortium include the United States Department of Agriculture, Washington State University, **GALVmed**, the **Roslin Institute**, the **Royal Veterinary College** and the **Institute of Tropical Medicine in Antwerp**. The first phase of the project started in the fall of 2013 and will last for four years.

IGS STEM

and Educational

Outreach

Activities

Michelle Giglio, PhD



The Institute continues our STEM and educational outreach programs – sponsoring interns, speaking to school groups and promoting science education.

In fall 2013, volunteers led by Michelle Giglio, PhD, hosted a day of genomics for the Center for Talented Youth. Middle-schoolers and their parents came to IGS for a day of hands-on workshops, including a program on Microbiome Analysis presented by Dr. Emmanuel Mongodin, the Comparative Genomics of Pathogens, presented by Dr. Michelle Giglio, and Dr. Joana Carneiro Da Silva, who presented a workshop on Human Variation / Personalized Genomics. The curious and motivated youngsters came here from across the mid-Atlantic region and thoroughly enjoyed their program.

See [here](#) for more about IGS STEM and educational outreach.

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