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"In a World Where…"

So begins a famous phrase from the world of movies. These words begin the previews for many films, but perhaps most often those that belong to the genres of science fiction or fantasy. Dr. Bland's guest this month is Michael Snyder, PhD, who is the Director of the Stanford Center of Genomics and Personalized Medicine at Stanford University. It is Dr. Snyder who mentions a film in his discussion with Dr. Bland, and he does so as context for explaining the work in 'omics—genomics, proteomics, transcriptomics—that is taking place right now in his lab as well as in labs around the world. *Gattaca*—a film that perhaps meets criteria to qualify as science fiction AND fantasy—was released in 1997. It is a movie about genetics, and more specifically about a society where life expectancy and disease risk are ascertained at birth through genetic testing. Science fiction and fantasy? In 1997, yes. In 2013? No.

This issue begins with the interview.

Researcher of the Month

Michael Snyder, PhD
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Michael Snyder is the Stanford Ascherman Professor and Chair of Genetics and the Director of the Center of Genomics and Personalized Medicine. Dr. Snyder received his PhD training at the California Institute of Technology and carried out postdoctoral training at Stanford University. He is a leader in the field of functional genomics and proteomics, and one of the major participants of the ENCODE project. His laboratory was the first to perform a large-scale functional genomics project in any organism, and has launched many technologies in genomics and proteomics. Seminal findings from the Snyder laboratory include the discovery that much more of the human genome is transcribed and contains regulatory information than was previously appreciated, and a high diversity of transcription factor binding occurs both between and within species. He has also combined different state-of–the-art "omics" technologies to perform the first longitudinal detailed integrative personal omics profile (iPOP) of a person and has used this to assess disease risk and monitor disease states for personalized medicine.

Personalized omics profile, or iPOP. It is described as an analysis that combines genomic, transcriptomic, proteomic, metabolomic, and autoantibody profiles from a single individual, and Dr. Snyder's lab is the first to do it in comprehensive fashion. What makes this story even more compelling is that Dr. Snyder himself is the single individual being studied. Dr. Bland and Dr. Snyder first discuss how far the field of genetics has come in the last decade, particularly in the area of better analysis and understanding of the noncoding regions of genes. Following this, Dr. Bland invites Dr. Snyder to tell the story of his personal 'omics and how his research is driving discoveries that will inform and move forward the field of personalized medicine. Dr. Snyder, and the data he is willing to share with the world, embodies the study of one individual's genome in real time. He reveals things he expected (i.e. known health risks from family history) and things he didn't (namely, a high risk to type 2 diabetes, and his development of the condition during his study). His personal data was analyzed regularly in his healthy state, but more frequently during times of illness (which, courtesy of his two young children and the germs they shared with him, was more often than average). The result has been a number of interesting publications, as well as a lecture that is available for viewing on YouTube and highly recommended by Dr. Bland.

What is the future direction of Dr. Snyder's research? Will the plot of *Gattaca* become our reality? No, that is not the case. But Dr. Snyder sums up his view this way: "We want to be very predictive about both the combination of our genetics and our environmental lifestyles that will make things very predictive about possible outcomes, and that way we'll be able to manage health care much, much better."

Issue Synthesis: Bees, Pesticides, and Human Health

To complement his discussion with Dr. Snyder and to illustrate how this work may connect to global issues of human health, Dr. Bland begins a conversation about bees. It has been well-documented that there is a crisis in the world of beekeeping: Colony Collapse Disorder. The implications of this crisis have far-reaching consequences, and Dr. Bland quotes some sobering facts and statistics that were outlined in a recent editorial in *Science* magazine titled "The Road to Pollinator Health":

- 71 of the 100 crops that provide 90 percent of human food are pollinated by bees
- The estimated value of these crops is more than 200 billion dollars annually
- Honey bees contribute to over 17 billion dollars of the US national economy and are vital to keeping fruits, nuts, and vegetables available in the food supply

How do the bees relate to the study of 'omics? Dr. Bland explains: "These molecules that are potentially jeopardizing bee viability and our food production are the same molecules that we get exposed to. Now, admittedly, maybe at low levels, but they can be bioconcentrated in the food chain if they are considered persistent organic pollutants. They are part of the chemical soup in which we live. They are part of our chemical topology, which then influences genes and how they are expressed, and how they produce proteins, and how those proteins work, and how cells function, and ultimately when you put all those cells together into tissues, and organs, and organ systems, how our body works." Dr. Bland goes

on to revisit the topic of persistent organic pollutants (POPs), referring to the research of Dr. David R. Jacobs (interviewed for FMU in August 2010) and his collaborator, Dr. Duk-Hee Lee.

Dr. Bland also discusses the issues of immunotoxicology and neurotoxicology. He discusses a recent article—also published in *Science*—titled "Paths From Pesticides to Parkinson's," as well as historic research focused on xenobiotics and human health.

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