

## Jeffrey Bland, PhD, and Patrick Hanaway, MD: Taking the Omics Revolution to the Street

Interview by Craig Gustafson

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**Patrick Hanaway, MD**, is chief medical education officer for The Institute for Functional Medicine (IFM) Medicine and its 2015 conference, which will be held May 28-30, 2015, in Austin, Texas. Dr Hanaway is a board-certified family physician with his medical degree from Washington University and residency training at the

University of New Mexico. He is currently on loan from IFM, working under the leadership of Mark Hyman, MD, as the medical director of the Center for Functional Medicine at the Cleveland Clinic. He is involved in developing the clinical model, supporting comparative effectiveness research, and promoting education change at the medical school, residency programs, and CME programs at the Cleveland Clinic.

Dr Hanaway is on the executive committee for the newly formed American Board of Integrative Medicine and is past president of the American Board of Integrative Holistic Medicine. He co-founded *Family to Family: Your Home for Whole Family Health* with his wife in Asheville, North Carolina. He has been initiated as a Marakame (Shaman) by the Huichol people in the Sierra Madres of Central Mexico. Dr Hanaway teaches extensively on holism and systems medicine in its many applications. His interests are in the continued development of health care delivery models that learn from traditional medical systems and promote research to demonstrate improved value in patient outcomes per dollar. Dr Hanaway teaches on the clinical application of nutritional biochemistry, with an emphasis on digestion, immunology, mitochondrial function, and wellness.



**Jeffrey S. Bland, PhD, FACN, FACB**, is the founder and president of the recently established Personalized Lifestyle Medicine Institute, a nonprofit organization whose mission is to transform health care. He is also the chairman/CEO of KinDex Therapeutics. Dr Bland has been an internationally recognized leader in the nutritional medicine field for more than 30 years.

He established the internationally respected Institute for Functional Medicine (IFM) in Washington State to train health practitioners globally in the application of nutritional and functional medicine and currently holds the title of chairman emeritus. A nutritional biochemist and registered clinical laboratory director, Dr Bland is a former professor of biochemistry at the University of Puget Sound in Tacoma, Washington, and he was director of nutritional research at the Linus Pauling Institute of Science and Medicine in Corvallis, Oregon. Dr Bland has authored 5 books on nutritional medicine for the health care professional and 5 books on nutrition and health for the general public. He is also the principal author of more than 120 peer-reviewed research papers on nutritional biochemistry.

**Integrative Medicine: A Clinician's Journal (IMCJ):** The theme for the Institute for Functional Medicine's 2015 Annual International Conference is "The Omics Revolution: Nature and Nurture." Dr Bland, please describe your perspective of what the omics revolution is.

**Dr Bland:** I think the omics revolution represents a major threshold transition in health care. Prior to the deciphering of the human genome, there was belief that once we knew the code of life in our genome, we would answer all the questions related to the origins of disease. What has actually happened as a consequence of the deciphering of the human genome is almost the exact opposite of what we expected.

What we really learned is that rather than diseases being locked, as hardwired parts of our genome, these characteristics that are included within our genes are responding to our environment, lifestyle, diet, activity patterns, and stress; they are actually altering how the genes are expressed. This changes our model of health care from what I call a *deterministic model*, in which it has been assumed, at least for the last 100 years since we started to build medicine on the genetic principles of Gregor Mendel, that we had these dominant and recessive traits that were locked in our genes and we had no ability to change them. The assumption is that medicine was there to save us from bad genes and that there was nothing we could do about it other than heroic intervention.

With these new discoveries, however, we now recognize that, although the genes remain fixed to a great extent, the way they are expressed is very dramatically based upon the lifestyle and the environment of the individual. Therefore, it

has opened the doors to a new form of health care. It is less there to fix us when we are broken and more there to understand how we unlock those genetic characteristics in individuals that will lead to long-term healthy living. So we are watching a transition from a disease-centric system to a wellness-centric system occur underneath our feet, based upon the omics revolution.

**IMCJ:** That is quite a paradigm shift, especially considering the organizations, the institutions, and the industry that have grown up around the previous model. So, the conference, then, is an effort to align doctors with this new paradigm with the potential to optimize wellness?

**Dr Bland:** Yes. I think that any great paradigm shift of this nature, going back to recent examples such as the discovery of the origin of infectious disease at the turn of the last century, occurs in society at 2 levels—one of which is enlightened early adopters in the biomedical community who start understanding these discoveries and becoming affiliates to the new model. Simultaneously, within society, early adopters within the general population recognize that these new discoveries are going to both change the course of living and offer something that they are interested in. So this bottom-up and top-down drive characteristic of the seekers of new information, when it has stickiness and it has the gravity of authenticity, ultimately becomes infective. It starts to replicate itself and grow from the top down and from bottom—the consumer—up to create a cultural revolution. That is how the discovery of infectious disease ultimately changed medicine and developed immunotherapy and antibiotics, which became the standard of care in what we call *modern medicine*.

In the 21st century, I think the same thing is occurring. There is an enlightened group of early adopters in the biomedical area who understand that the omics revolution is here to stay and it is more than just a bunch of lab tests. It is really a shifting paradigm about how we see health and disease. Simultaneously, a larger and growing group of health care consumers are recognizing that their disenfranchisement from medicine, which has occurred as a consequence of this disease-centric model, is now being replaced by the opportunity to engage in and be part of this new model—this wellness-focused model that is asking not, “How do you get sick?” but, “How do you keep well?” I think that these 2 driving forces are going to change the future of the way disease is managed and health care is promoted.

If you ask me how long this will take, my answer would reflect that the doubling time of information in the biomedical area today is something like 3 to 4 years. For the first time in human history, there is a democratization of access to that information because of the Internet, which allows entry to people who have need to know, whether they are in the fraternity of medicine or not. This is a very dramatic cultural shift that is breaking down the guilds of the old ages, the medical societies, and the people who control information, and making it accessible now to

whoever has a desire to find it. I think that will accelerate the transformation of this change in health care.

My prediction is that we are talking about a period within a decade, not 50 years, which is the normal length of time it takes to create a big shift in mentality in health care.

**IMCJ:** The omics revolution touches so many different areas, as it explains how your body interacts with your lifestyle, your diet, and how you move at a subcellular level. Since that type of epigenetic interaction can be expressed in nearly any system of the body, how do you get your arms around that and then communicate it to doctors in a way that they can grab hold of and put to use clinically?

**Dr Bland:** I believe that this occurs in stages, as is common in all transitions or transformation of information within society. The first wave, I believe, in the omics revolution is related to the omics of oncology, and we are starting to see more and more application of omics in virtually every major cancer treatment center now in the United States. People’s cancers are now being genotyped to see what specific mutations in the genes have occurred so that they will end up getting an individualized or personalized cancer treatment based upon their own unique form of malignancy.

It was not even 30 years ago when cancer was thought of as being one disease. Now we recognize that it is really *cancers*, and each person has—no matter what the name of their cancer is—a unique genetic molecular configuration that has resulted in their cancer, for which the sensitivity of that particular form of their cancer may be different for certain drugs than other people who have the same form of cancer but do not have the same genetic mutation that relates to that cancer. So the beachhead of where the omics revolution is being applied by medicine is in the area of omic oncology—genomic-related oncology—and personalizing cancer care with various drugs, such as Herceptin and some of the inhibiting drugs that are now being produced.

The second wave, which is coming very close behind that first wave, is neonatal screening. There has been a tremendous number of articles published recently in the medical research press—the clinical press—talking about how we will be moving away from the old method of assessing fetal abnormalities—so-called genetic metabolism diseases of infants, or inborn errors of metabolism that lead to diseases such as hemophilia or Wilson’s disease, or Gaucher’s or Fabry’s or phenylketonuria. Rather than the techniques that were used invasively before, we are going to be able to measure fetal cells present in the blood of the pregnant women, do genotyping of them to see if there are any genetic aberrations that might relate to expression of Down syndrome or PKU, and do it at such an early stage that decisions can be made as to whether that pregnancy is desired to go to term.

The implications of this are profound because, once again, it will raise the visibility of genomic testing and its clinical application to another level of understanding. We

are already seeing that kind of visibility appearing in adult testing for things such as the *BRCA-1* and *BRCA-2* genes—the whole Angelina Jolie phenomenon that is on the cover of *Time* magazine, as it relates to breast cancer risk and incidence in later life, and ovarian cancer and how that can be tracked to these very significant mutations of specific genes that are involved in DNA repair. So, I think the second wave is going to be screening of neonates and neuroscreening fetuses to look for any aberrations.

The third wave, which is the more complex wave, but the one that has the greatest potential positive impact on society, is to start looking at people who are born apparently healthy and observe their aging process: What are the genetic characteristics that they carry that lead them to either specific environmental and lifestyle sensitivities or to certain strengths in their genotype that will allow them to—with modification of how they are living and personalized lifestyle intervention—live healthy, highly productive, and disease-free lives?

I think that third wave is more complex because there are so many variables at play that relate to how our genes are translated into how we look, act, and feel. This field is rapidly advancing at a rate that is truly remarkable using integrative omics, in which the genomic information is coupled with the proteomic information, which is coupled together with the metabolomic information, which is coupled together with the phenomic information—how a person looks, acts, and feels. That complex big-data set can then be analyzed using new computing power and new algorithms to start to tease out certain patterns in a person's overall perspective that will allow a personalized program to be developed that will minimize the relative risk for disease and maximize the opportunity for high-level performance.

That I think is the big payoff in the broader social system because now that system could be applied, hopefully cost effectively given the decreasing cost of these analyses, across a wide range of people to lower the burden of chronic illness and to improve the ability of people to live up to their human, genetic potential. That, I think, is the wildcard that will transform health care in the next 20 years.

**IMCJ:** You mentioned early adopters, specifically the group that comes from the bottom—the consumer—pushing for some of this revolution. Would you say that one important segment of those early adopter consumers is the high-level athletes? It seems that in many cases, as they are looking for that edge, that optimal performance, that athletes often times are more receptive to these ideas than the mainstream. Is their acceptance significant in advancing the revolution?

**Dr Bland:** Absolutely, yes. I think that is one good indication of a cut of the cohort of our population that is very interested in maximizing performance and finding those competitive-edge areas that will allow their genetic potential to be fully expressed in their performance. There is another area that I think is coming up very quickly that could rival that: intellectual performance.

We now have a number of new neurological tools for evaluating performance—you have probably seen these on the Internet—all sorts of memory tests, reaction tests, computing tests, and logic tests, where a person can improve their skill by practicing. These neurological brain-teaser stress tests which are now available on smart phones and on wearable devices and on people's PCs, tablets, and portable devices, are all going to give people benchmarks about their intellectual performance and ways that they can use the information from the omics revolution to create programs that will improve how they think, their memory, their creative ability, and their ability to be successful at tasks that require central nervous system, brain-muscular function. So, I think it is a combination of both athletic performance and intellectual performance that is really going to drive this revolution to the consumer.

**IMCJ:** Dr Hanaway, how do you plan to break this down and communicate it to the doctors at the conference in May?

**Dr Hanaway:** Our approach this year is to actually focus on the cohort of people who are familiar with the omics revolution—people who have been a part of Functional Medicine and have been looking at these kinds of issues for the past 10, 15, or 20 years. We have got a great cast of presenters who will help us with that.

First, we are breaking the program down into 2 major categories. There are plenary sessions, which are going to give cutting-edge background in the areas of genomics, proteomics/ metabolomics, and the microbiome. We will discuss how these three areas interact and work together and where the significant research is within each.

Then, we will have 16 small-group sessions, 4 tracks with 4 different sessions where people can actually break these concepts down to practical clinical applications. We will look at the gene-environment in relationship to detoxification. We will be looking at breast cancer and heart disease and methylation; and we will be looking at the genomics of prenatal planning. We will be talking specifically about what omics means in culinary genomics: That is, how do we apply a truly personalized approach to deeply customize nutritional advice for individuals? So it goes from the very broad view of seeing the transformational change that Dr Bland has been talking about, and then working with more than 1000 clinicians to describe how we do this in clinical practice.

**IMCJ:** Take just one of the examples that you both have mentioned: prenatal omics. With some of the research that is coming out which describes epigenetic factors that can be passed down through 2 generations, doesn't that open up a tremendous opportunity to influence health by taking a look at where the mother and father are at and getting them omicly optimized before conception?

**Dr Hanaway:** Indeed. Last year our Linus Pauling Award winner was Randy Jirtle, PhD, one of the fathers of

epigenetics, who helped us to more deeply understand that gene-environment interaction that Dr Bland has been talking about for 30-plus years. He brought this concept into the research in a way that has been broadly recognized by scientists around the world: The gene simply encodes for a way to be able to think and yet genetic expression really is the most fundamental level at which the genotype gives rise to phenotype. We will discuss how epigenetic influences are evaluated in preconceptional care and in prenatal care. We are going to see, through one of our presenters, that we can actually modify prenatal gene expression with patients who have had a negative outcomes in previous births. This happens when we look at both undernutrition and overnutrition and how we apply the appropriate tools—both macronutrients and micronutrients—to incorporate genomic assessment into the clinical process with expectant parents. This is not theoretical. We have clinicians using these tools in practice at this time and yielding beneficial outcomes in patients who may have had poor outcomes previously, when these tools were not applied.

**IMCJ:** So the goal of the conference, then, is to expedite the transformation of ‘omics’ in the minds of clinicians from a theoretical hypothesis to a concrete tool of clinical value?

**Dr Hanaway:** Absolutely. We want clinicians to be able to move from the big-picture view of systems biology and how we put these pieces together to the practical reality of “How do I help this individual who is in front of me?” The prevalence of more complex chronic disease is increasing; we see health care costs exploding. We now see the beginning of the possibilities through research like N of 1 trials, the 100K Project, and the Pioneer Project that Dr Bland is involved with. We will have presenters talking about the specific tools that facilitate a true systems biology approach and make it relevant for fundamental behavioral change to improve the health of individuals. Dr Bland, could you speak to that?

**Dr Bland:** This project that Dr Hanaway is talking about was started a year ago at the Institute for Systems Biology under the stewardship of Lee Hood, MD, PhD, who would be arguably considered as one of the top scientists in the genomics revolution field. He is credited as the inventor of 5 of the principal instruments that were used for deciphering the human genome. His institute initiated this pilot project with 105 participants for the year, me being one of them, in which we had our full genome analyzed, we had our microbiome analyzed quarterly, and we had a complete nutritional evaluation done 4 times during the year. We had a variety of phenotypic tests done and over 200 different analytes were analyzed at 4 different times. We had our fitness monitored: We all wore FitBits, and that went up to the cloud and we had our blood pressures also go up to the cloud. We had our sleep patterns go up to the cloud. We had our dietary data analyzed, with a standard food questionnaire that was assessed every 3 months. All these data points, which

represent—for each of us—over a million data points for the year, are being digested by a big-data software informatics program that gives rise to understanding how these things cluster so that we will see what may be the most important directives that come out of this that can be actionable points and can help individuals to develop personalized programs.

Over the course of that year, each time we had a data retrieval from one of these sets of analyses, we had our own personal health coach who was a trained, master-of-science person who was very good at understanding the communication needed to talk about the results of these tests and these data across a wide range of different backgrounds. Not all of these 105 people are scientifically trained or fluent. A majority of them are just people who were interested in being part of the program but did not necessarily have a medical background.

So, we got coaching each quarter from our individual coach so we could tune-up our program based on what we learned. Then, the trajectory of change over the course of the year could be measured. The results of that work, then, are the groundwork for which a larger trial will be recruited. Starting in 2015, there will be 1000 individuals. Then, from that, the objective is to go to 100000 individuals, so that this becomes the 21st-century Framingham study in which rather than talk about disease risk factors, we are going to talk about health and wellness factors. Once aggregated from a larger group of people, the data will start to show us where the nodes are—the places where the greatest changes in outcome can occur in health by specific sets of information and specific actionable interventions.

So this is a remarkable example of how we take this esoteric concept of omics and translate that down to the ground where that can make a difference in a person’s life. I can say, having been to the meetings of the 105 participants that occur every quarter, the kinds of “aha!” experiences that people are having in this program are dramatic, and the way that it is affecting their health is quite dramatic, as well. You can really see people performing better, sleeping better, experiencing higher energy, losing weight, and getting rid of diabetes. It is really translating, at the street, into a growth function. I think this is an example of how you take very complex information and get it distilled down so it can become usable by individuals who are aspiring to live long healthy lives.

**IMCJ:** So, in summary, at the conference attendees will not only get a chance to learn about the background of the ‘omics’ revolution and talk about the theory, but will discuss strategies for clinical practice and get up to date on the different projects in progress that will impact medical practice in the next 5, 10, 15, and 20 years.

**Dr Hanaway:** I think that the “omics” revolution is here, and the amazing thing about it is that we don’t have to wait for 5, 10, 15, or 20 years. It is this year. It is already happening. We are using these tools, today. It is not just a concept; it is practice.