PERSONALIZED MEDICINE COALITION

EDUCATION +ADVOCACY

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Vol. 1

Strides in Physician Education: Incremental Yet Promising

PERSONALIZED MEDICINE is an exciting and powerful field, offering new tools for providing better care to patients. But part of the challenge with any medical advance is how to actually get it to patients—how to convince doctors to adopt it in their practice.

Medical institutions around the U.S. have been experimenting with ways to teach physicians about personalized medicine. After all, a physician does not have to have been practicing for long for all of the advances made in genomics and genetics in recent years to be completely new.

Some institutions are offering lectures, courses, or conferences on genomics and topics in personalized medicines. Others are integrating pharmacogenomic alerts into their electronic medical records, (EMR) making it automatic for people who prescribe drugs to stop and think about personalizing treatment. Still others are introducing personalized medicine to students who are still in medical school.

Cleveland Clinic

When the people at the Center for Personalized Healthcare at the Cleveland Clinic set out to educate doctors on personalized medicine,

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IN THIS ISSUE

PMC's Progress

BY EDWARD ABRAHAMS

The Personalized Medicine Coalition recently issued its annual report, which, in addition to documenting the financial health of the organization, provided an opportunity to define personalized medicine and explain the role of PMC. Personalized medicine, we contend, "represents a paradigm shift in the way we think about medicine."

But paradigm shifts, especially in medicine, do not happen just because the science or enabling technologies suggest they should. They occur because society encourages new ways of organizing the best ways to achieve desired goals.

We contend that both patients and the health system benefit from improved clinical care and increased value when we make investments in personalized medicine. These include research as well as incentives to encourage co-development of therapeutic and diagnostic products by providing clear regulatory pathways to market, payment, and a willingness to try new products in a "learning health care system" that examines evidence and makes adjustments as it is developed.

As this newsletter points out, these are large opportunities.

Earlier this the year, PMC issued a landscape analysis, *Pathways for Oversight of Diagnostics*. For the first time in one place, the white paper defines the different and evolving regulatory environments pertaining to personalized medicine products and services. It provides a common understanding of the current regulatory system, and builds a platform upon which a consensus on the best way to regulate personalized medicine diagnostics might be established. As we know, this is no small task given multiple and intertwined regulatory structures that currently exist, never mind the competing stakeholders that must work together if patients are going to benefit.

In addition to encouraging regulatory reforms that accelerate the development of personalized medicine products, our plans for 2013 include outlining the evidentiary pathways that underpin reimbursement policies and continuing PMC's educational efforts so that all sectors of society, including policymakers, are more willing to embrace the changes we believe that will allow them to develop.

On April 17 PMC, along with **BIO**, will host a *Solutions Summit: Evidence, Coverage and Incentives* in Washington, D.C. that brings together payers, providers, patients, and industry to discuss potential solutions regarding the conundrum of the nature of and level of evidence that payers and providers require to make decisions—and which also encourages the innovation from which patients and the health system benefit.

In keeping with the maturation of the Coalition, PMC has moved to new offices near Dupont Circle in Washington, D.C. We have also re-branded the organization with a new look, exemplified in this newsletter. Based on the themes of focus, organization, and change, our new logo is designed to convey strength and purpose.

We invite you to join us, and participate in our efforts throughout the year to define the paradigm shift we call personalized medicine.

But paradigm shifts... do not happen just because the science or enabling technologies suggest they should.

PCORI Seeks Applications for Advisory Panels

THE PATIENT-CENTERED Outcomes Research Institute (PCORI) began inviting applicants for its first four Advisory Panels as part of its ongoing effort to engage a broad range of health care stakeholders as partners while it develops a research agenda. PCORI is seeking patients, caregivers, clinicians, researchers, other members of the health care community and the general public to serve on advisory panels for "Assessment of Prevention, Diagnosis, and Treatment Options; Improving Healthcare Systems; Addressing Disparities; and Patient Engagement." Charters for each panel, including the scope of work for panelists, are available on the PCORI website. Continuing PMC's engagement with PCORI, Amy Miller, PMC Vice President, Public Policy has applied to serve on the Assessment of Prevention, Diagnosis, and Treatment Options Advisory Panel.

PMC Submits Public Comments to CMS on Draft Coverage with Evidence Development Guidance

PMC has submitted comments to CMS regarding its Draft Guidance, "Draft Guidance for the Public, Industry, and CMS Staff Coverage with Evidence Development in the context of coverage decisions." PMC urged CMS to:

- adopt the principles included in the 2006 CED guidance document.
- ensure that review of evidence and decisions about evidence development are clearly explained and transparent.
- clarify the role of the Agency for Healthcare Research and Quality ("AHRQ") in the application of CED.

You may view PMC's full comment letter on our website.

New FDA Guidance on Clinical Pharmacogenomics

FDA has released new guidance, "Clinical Pharmacogenomics: Premarket Evaluation in Early-Phase Clinical Studies and Recommendations for Labeling." The guidance provides recommendations on when and how genomic principles should be considered and applied in early-phase clinical studies to address questions arising during drug development and regulatory review. View the Guidance Document on PMC's website.

First "Breakthrough Therapy" Drugs are Personalized Medicine

The Food and Drug Administration Safety and Innovation Act (FDA user-fee reauthorization legislation) included a provision that allows sponsors to request that a new drug be designated as a "Breakthrough Therapy." That designation results in closer communication and potentially faster approval for drugs that treat a serious condition and preliminary clinical evidence shows that it may demonstrate substantial improvement over available therapies. The first drugs to receive this designation have been personalized medicine therapies, including Kalydeco (ivacaftor) for the treatment of a rare form of cystic fibrosis that is effective for patients with a specific mutation in the Cystic Fibrosis Transmembrane Regulator (CFTR) gene. In addition, **Novartis** announced in March 2013 that its investigational compound LDK378 received Breakthrough Therapy designation for the treatment of patients with anaplastic lymphoma kinase positive (ALK+) metastatic non-small cell lung cancer (NSCLC) who had progressed during treatment with, or were intolerant to, crizotinib.

The Food and Drug Administration Safety and Innovation Act (FDA user-fee reauthorization legislation) included a provision that allows sponsors to request that a new drug be designated as a "Breakthrough Therapy."

Regulation: Pathways for Oversight of Diagnostics

BY AMY MILLER, VICE PRESIDENT, PUBLIC POLICY

No issue divides PMC members more than how diagnostic products should be regulated. Depending on their respective business models, they are either advocates for more FDA oversight or against it; but most agree that the current system would benefit from greater certainty and clarity.

Recognizing that to make advances in the field, particularly in crafting policies to incentivize investment in personalized medicine, PMC recognized that it needed to establish a baseline of common knowledge before tackling the tougher challenge of developing a consensus regarding what would be the best regulatory policy to encourage innovation and protect patients.

When we started the effort, we decided to write a landscape analysis, which would define the field for personalized medicine advocates and policymakers in government. Our goal was to provide an overview so that all stakeholders could share a common understanding of the current system.

Our discussions started with leaders in different trade associations telling us in advance that they not only disagreed on the best path forward, they also "might not agree on the facts." Nevertheless, all of PMC's members recognized the need to define a common ground. The resulting document is one we are proud.

Personalized Medicine Regulation: Pathways for Oversight of Diagnostics, written with assistance of **Hogan Lovells** LLP, examines the laws and regulations that govern personalized medicine tests and services in the United States, including those within FDA and CMS. It also explores the significant differences that divide the personalized medicine community regarding how diagnostics should be regulated and the multiple proposals that have been crafted to address the problem.

Those comfortable with the current environment—and there are a few—ask why changes are necessary.

The fact of the matter is that FDA has stated its intention to actively regulate laboratory developed tests (LDTs), though it has yet to do so. That uncertainly makes many investors hesitant to invest in personalized medicine. FDA argues that LDTs are being used in unprecedented ways that were unforeseen when the agency decided not to actively regulate them some thirty years ago. Pharmaceutical companies, which invest in the co-development of diagnostics along with new therapeutics, are anxious about the quality of LDTs that often follow FDA-cleared kits into the market for the same intended use. Finally, diagnostics are used for drug selection, dosing, and avoidance, leading some, along with FDA, to argue that because the drugs are FDA reviewed, so too should the companion diagnostics.

There are strong counter points to these contentions, notably concern

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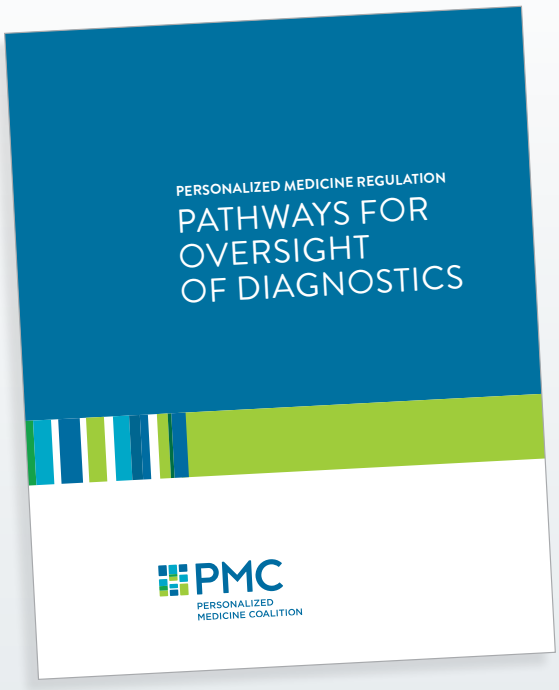
about market access to testing and the cost of development of relatively inexpensive diagnostics, including for small populations. Those who oppose stronger regulation say that it will delay advancements in diagnostics that improve patient care. They also contend that FDA is unprepared to assume a new assignment in the current resource-constrained environment.

Pathways for Oversight of Diagnostics outlines these arguments. It will serve as a baseline to compare current and new policy proposals, whose goal, in PMC's view, should be to create the least burdensome and most well-defined regulatory system necessary to support the growing field of personalized medicine, even if at present the stakeholders do not agree how best to get there.

Many believe that legislative changes are coming. At PMC's February public policy meeting, Elizabeth Jungman, Senior Health Policy Advisor, Majority Health Policy Office, U. S. Senate HELP Committee, stated that only consensus solutions have any chance at all in this Congress. Yet if nothing is done, it is likely, she said, that FDA will regulate LDTs as medical devices, even though that might not be the preferred or best solution.

While PMC's members might not agree on all the facts, they do agree that personalized medicine is a fast-moving field that needs a predictable and clear regulatory environment—which meets the needs of patients, doctors, innovators, and the science driving it.



PERSONALIZED MEDICINE REGULATION

PATHWAYS FOR OVERSIGHT OF DIAGNOSTICS

While the potential benefits of personalized medicine health care are straightforward—knowing what works, knowing why it works, knowing whom it works for, and applying that knowledge to address patient needs—the intervening variables that determine the pace of personalized medicine's development and adoption are far more complex. Among those variables are the laws and regulations that govern personalized medicine products and services used in clinical practice.

Download a copy by visiting personalizedmedicinecoalition.org

Strides in Physician Education In Personalized Medicine

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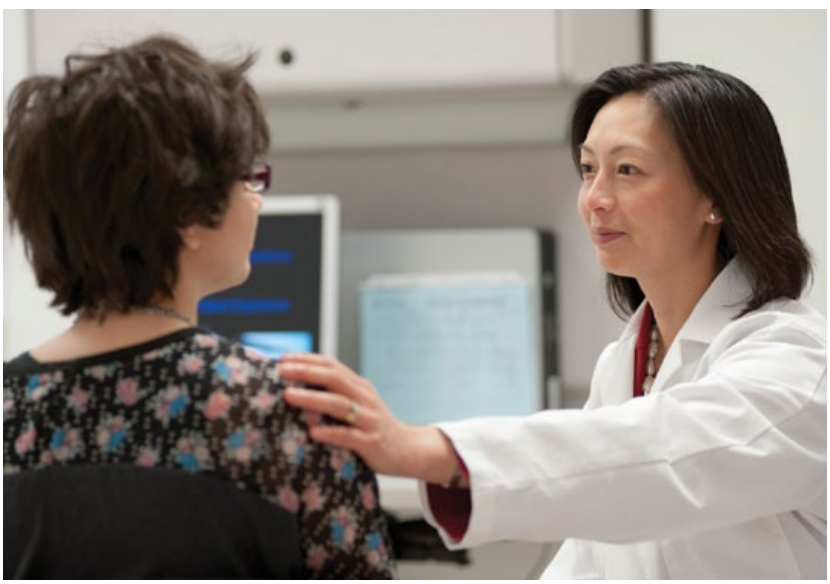
they conducted a study to ask primary care providers about their interest in personalized medicine. Most weren't very interested in learning more.

"The concept was not well embraced by many of our physicians because there weren't really applications they were using in their regular practices," explained Kathryn Teng, M.D., the director of the Center for Personalized Healthcare.

Oncologists have been using personalized medicine for a while, in the form of tumor genetics, and Teng says pediatricians are used to thinking about their patients' genomes, since they see a lot of genetic disorders. But that leaves a lot of others. "Our charge was to get personalized medicine to the general practitioner," she says.

There's a potential pitfall in lecturing physicians about personalized medicine, Teng points out. Treating patients as individuals is already an important value for most health care workers—so there's a risk that efforts to educate physicians about personalized medicine will look a lot like telling them they're doing their jobs wrong. "We had to be very careful in communicating to our physicians and clinicians so they wouldn't get defensive," she says.



Kathryn A. Teng, M.D. FACP, Director, Center for Personalized Healthcare, Cleveland Clinic.

Teng started her educational campaign by spending a year focused on a very familiar personalized medicine tool: family history. According to the evidence in the scientific literature, Teng says, "Family history is still the most valuable genetic tool we have." Teng visited journal clubs and gave presentations at grand rounds about family history. Her family history talk was also incorporated into the residency curriculum and medical school curriculum.

In the second year, Teng moved on to pharmacogenomics—a more challenging topic, because it's different in every specialty. Each year the Cleveland Clinic also holds a summit for clinicians. In the second year, the center was able to offer continuing medical education (CME) credit, which persuaded a large number of general practitioners to attend. Offering CME credit, Teng says, communicates to physicians that they're going to learn things that they can actually use.

The next summit will introduce topics like nutrigenomics and environmental genomics, Teng says. "These are things coming down the pike, which I think will impact clinical practice."

Teng thinks the campaign is working. "I hope that people will understand what personalized health care is," she says. "I think we're getting there, slowly."

El Camino Hospital, Mountain View, CA.

El Camino Hospital

In 2008, leaders at El Camino Hospital in Mountain View, California, wanted to persuade physicians to adopt personalized medicine. So they put a lot of effort into building a website with good content on personalized medicine. "We spent two years trying to drive our doctors to the site, but they just wouldn't go there," says Lynn Dowling, executive director of the hospital's Genomic Medicine Institute. It just didn't work; physicians barely looked at it.

"But every time we would have an invited speaker in to talk about genomics," Dowling says, "we would sell out." The physicians were interested in the content, she realized. The problem was just the way it was being delivered. At the end of a busy day in the office, she concluded, doctors don't want to spend more time in the office, reading through a website; they want to go across the street, have dinner with their colleagues, and get CME credit for learning something new.

So Dowling and her colleagues contracted with the Genetic Alliance and the National Coalition for Health Professional Education in Genetics to develop a course for their physicians.

The result was a 10-month course, with one two-hour evening workshop a month. Each class had only about 20 minutes of lecture. In the rest of the time, physicians broke in small groups to talk about cases.

The first course was a pilot, with about 35 doctors from about 15 different specialties. The hospital plans to repeat the class for more doctors with privileges at the hospital.

After the last class, in July 2012, Dowling noticed a small group of physicians huddled in the corner. They didn't want the education to end—so they organized a monthly case conference that has been going ever since. Participants bring in a case from their own practice that they think is interesting or an enigma, to discuss with the group.

"The barriers to education, lots of times, are just making it convenient for the doctors," Dowling says.

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And not all physicians are equally enthusiastic about adopting personalized medicine. For example, cardiology has some of the oldest known pharmacogenomic associations. But many cardiologists say they still haven't seen enough evidence to convince them that making changes in drug dosing will make a difference in patient outcomes.

"Right now, for the doctors, it's all about clinical utility," Dowling says.

Mayo Clinic

Some medical centers are working on getting information on personalized medicine to doctors just when they can use it—when they're prescribing a drug to a patient, for example.

At the Mayo Clinic, the goal is to get every physician to use personalized medicine in their practice, says Carolyn Rohrer Vitek, who manages the education program at Mayo's Center for Individualized Medicine. The center looks for ways that physicians can use individualized medicine and develops programs that help that happen.

One way is with alerts in the EMR system. For example, abacavir is an AIDS drug that causes severe reactions in some people. People with certain genetic variants are more likely to have a bad reaction. If a physician tries to prescribe abacavir, the EMR pops up an alert. The alert links to more information about the genetics of abacavir reactions, and also gives the name and pager number of an expert at Mayo who the prescriber can call for advice.

Like other institutions, Mayo tried providing general education on genomics—but found that it didn't help change how physicians practiced. Instead, Mayo has put together a system that will give clinicians online content in short, manageable chunks.

Carolyn Rohrer Vitek, eduction program manager in Mayo's Clinic for Individualized Medicine, collaborates in the development of interdisciplinary genomic curriculum for residents.

Mayo also offers a genomics curriculum to medical students and has graduate school courses in epigenomics and bioinformatics.

Vitek points out that topics like pharmacogenomics and epigenomics are so new that most doctors practicing today wouldn't have learned about them in college or even medical school. Fortunately, you don't need to understand every detail of the last couple of decades of genomic research to prescribe abacavir appropriately. With Mayo's physician education program, Vitek says, "It's our goal to understand not what people think they need to know but what they

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actually need to know," she says.

As part of the more formal education on personalized medicine, Mayo will hold its second Individualizing Medicine Conference in Rochester, Minnesota this fall. The conference focuses on how advances personalized medicine affect patient care. "Our primary focus is: how do we make this meaningful to physicians? How do we use this to improve patient outcomes?" Vitek says.

Vanderbilt University Medical Center

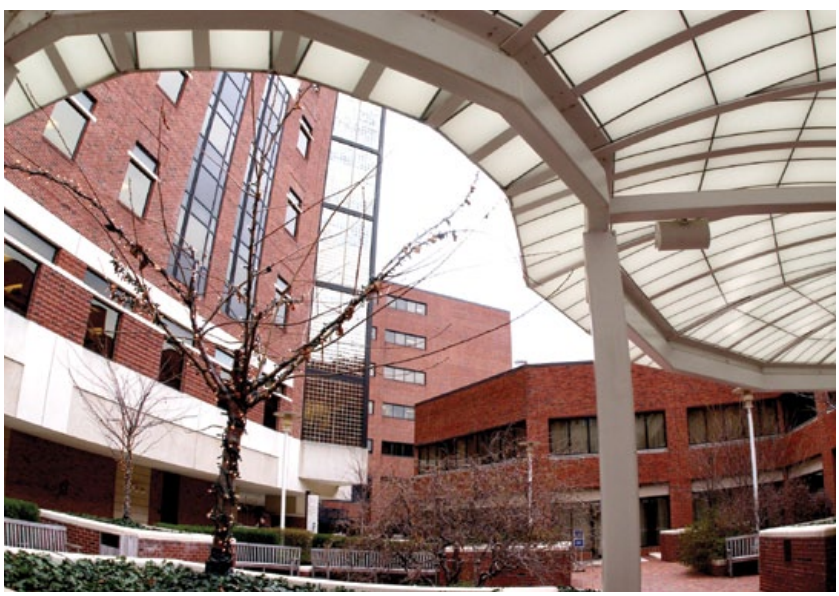
Vanderbilt University Medical Center also uses EMR alerts to let physicians know they're prescribing a drug with a genetic interaction. Its program also goes one step further, trying to identify patients who are likely to need drugs that have genetic interactions—before they even get a prescription.

For example, clopidogrel, also known as Plavix, is prescribed to prevent blood clotting in people with cardiovascular disease. Some people have a gene variant that prevents a liver enzyme from converting the drug to an active form; these patients may need an alternative drug.

The PREDICT program has developed informatics tools to flag patients for genotyping who are likely to require clopidogrel in the near future. The test results are stored in the patient's EMR. Then, when a Vanderbilt provider prescribes clopidogrel—whether it's the next week, months later, or after years of clopidogrel-free living—the system alerts them if the patient has been genotyped and another treatment is recommended.

When patients are "flagged", they are genotyped on a multiplexed platform that includes variants in 32 different genes; only specific variants implemented in PREDICT are stored in the EMR, but the others are available when new drug-gene pairs are added. In operation since 2010, the PREDICT program now displays pharmacogenetic variant data in almost 12,000 patients and covers clopidogrel, warfarin (Coumadin), simvastatin (Zocor), tacrolimus (Prograf), and 6-mercaptopurine (Purinethol), a drug used in children with acute leukemia. Other drugs are in the pipeline

The clinician doesn't have to know anything about the science behind the drug-gene interactions to prescribe those drugs in a genotype-guided manner. "Most providers don't have time to do that," says Erica Bowton, Ph.D., the program manager for personalized medicine with Vanderbilt



Vanderbilt University Medical Center, Nashville, TN.

University Medical Center. "That's why we try to make the recommendations as straightforward as possible."

But if the clinicians want more information, it's available. The EMR alert links to more information on the PREDICT website, mydruggenome.org.

University of Utah

The University of Utah Program in Personalized Health Care is reaching clinicians even earlier: when they're still students. A few years ago, people who were interested in personalized medicine started getting together on Monday nights for lectures with pizzas, beer, and soda. That lecture series evolved and is now in its second year as a formal 2-credit-hour graduate-level course.

Last year there were about a dozen students, says Joshua Schiffman, M.D., who directs the course. "We had really lively discussions because we had people from all backgrounds—public health, clinicians, pharmacists. Everyone brings their own perspective," Schiffman says. Each lecture is given by a different speaker, covering a swath of personalized health care—and the speakers come back to hear other people's lectures. This year there are 30 students, including undergraduates and physicians who work in the community, who can earn CME credit for the course.

(L) Brandon M. Welch, M.Sc., (R) Joshua D. Schiffman, M.D., Medicial Director High Risk Pediactric Cancer Clinic University of Utah.

Schiffman himself is a pediatric hematologist-oncologist who runs a translational genomics laboratory; so he's used to thinking about tumor genetics and genomics. Through working with the Personalized Health Care program, though, he says he's broadened his definition of personalized medicine: "The right medicine for the right patient at the right time. And then also, after taking this course, I would say, at the right cost."

This year, for the first time, students at the University of Utah can also get a graduate certificate in personalized health care, http://healthsciences.utah.edu/phc/

Vanderbilt University Medical Center also uses EMR alerts to let physicians know they're prescribing a drug with a genetic interaction. Their program also goes one step further, trying to catch patients who are likely to need drugs that have genetic interactions—before they even get a prescription.

education/certificate.php. The certificate is awarded to people who take the lecture course and a selection of other relevant courses. The idea is that students who get the certificate will establish a foundation for future research and practice in personalized health care.

Ohio State University

Future clinicians are getting an education in personalized health care at Ohio State University, too, covering what the university calls "P4" medicine: medicine that is predictive, preventive, personalized, and participatory. "People define personalized medicine as molecular or genetic," says Clay Marsh, M.D., the executive director of OSU's Center for Personalized Health Care. "We also focus on exercise, food, stress, sleep, happiness, social networks—and then use the tools of genetics, genomics, cardiomics, and data analytic tools under the hood."

In their first or second year, medical students can apply to the P4 Scholars summer program. It's a combination of lab and lecture, and each student also works on a project in personalized medicine. These projects have ranged from making an instructional video on how to pick healthy food to designing a fitness program for medical students or working with the Columbus department of health. There's also a P4 curriculum for medical students and one for undergraduates, covering everything from genetics to coaching for behavioral change.

The scope is intentionally broad—and meant to bring a whole new way of thinking about medicine to budding doctors. "We see personalized medicine as just medicine, but done better," Marsh says.

Eighth Annual Personalized Medicine Coalition Conference

2012 Leadership in Personalized Medicine Award

Remarks by Randal W. Scott, Ph.D.
Wednesday, November 28, 2012

Following is an excerpt from an acceptance speech by Randal W Scott, PhD., Founder, Genomic Health Inc.; and current Chairman and CEO, InVitae Corporation, who received PMC's 2012 Leadership in Personalized Medicine award. The award is given annually at the Personalized Medicine Conference at Harvard Medical School to recognize an individual whose contributions in science, business and/or policy have advanced personalized medicine.

It is an honor to win this award and I would like to thank the Personalized Medicine Coalition and recognize the outstanding team at **Genomic Health**, including Joffre Baker, our Chief Scientist; Steve Shak, our Chief Medical Officer; and Kim Popovits, our CEO.

I'm excited about the future of personalized medicine and appreciate this opportunity to share my vision. To do so, I would like to first reflect on the history of genomics and the development of powerful accelerating forces that are now driving unprecedented change in genomic medicine.

I was involved in the race to sequence all the protein-coding genes in the Human Genome at Incyte in the 1990s when I read a book by Andy Grove called *"Only the Paranoid Survive"*. That book completely changed my outlook on the future of genomics. The book describes how Moore's Law changed the computer industry. As I was reading the book, I thought, "this is exactly what's going to happen in biotech." It was apparent, even in the 1990s, that someday everyone would be able to have access to their personal genome at low cost—just like personal computers.

But the real value of the personal computer wasn't captured until the mid-1990s when use of the Internet expanded and Metcalfe's Law came into play. Metcalfe's Law is the principle that the utility of a network goes up with the square of the number of users. Thus the power of computing, and by analogy, the power of genomics, increases dramatically as more people share information in a common network. Moore's Law and Metcalfe's Law represent exponential forces driving the information age—and the genomic age.

I also reasoned that there is a third accelerating force unique to biotechnology, which I like to call the "law of finite genomes." By this I mean that the genome—and specifically the problem of how genes relate to human disease—is like a finite puzzle. Disease is complex but there are finite contributions of genes to disease that we can begin to define as genetic information accelerates. And like all finite puzzles, each piece of the puzzle that we put into place either leads to a solution or helps to narrow the number of possible remaining solutions.

So by 2000, I was convinced that we were at the dawn of a new era of genomic medicine whereby technology was going to rapidly advance our understanding of disease—when a close personal friend was diagnosed with late-stage colon cancer. My passion for starting Genomic Health came out of that personal experience. At Genomic Health we had great success in leveraging genomic information to improve the quality of

We believe that in the next 10 years health care is going to flip from a world where genetic test are only rarely ordered after symptoms appear, to a world in which everyone has broad access to their genomic information from birth in order to prevent genetic disease.

Randal W. Scott, Ph.D., Founder, Genomic Health; and current Chairman and CEO, InVitae Corporation.

cancer treatment for patients. We also learned a lot about how hard it is to bring oncology products to market. We often heard that our approach would never work, that it was going to be too expensive, that physicians wouldn't adopt it, or that payers wouldn't pay for it. But through all of the debate we stood steadfast on one overriding principle—its not about the system, its about the patient. If we do the science right, we can serve patients and overcome the obstacles.

Genomic Health was an incredible experience—great people doing exciting things in cancer, but it should be obvious that personalized medicine is bigger than just cancer and can be applied to virtually all diseases, both common and rare. During the decade in which I was at Genomic Health, I experienced three personal examples of rare genetic diseases effecting my family. A family member born with galactosemia; an adopted nephew who died of hypertrophic cardiomyopathy; and another family member born with a neurological condition all served as a personal wake up call that genetics is about all of us… we are all related and we can all help participate in solving the puzzle of human disease.

It was those family experiences that led me to leave Genomic Health this year to join with a team of scientist in a new company, InVitae. Our goal at InVitae is to bring the power of comprehensive genetic testing into the real world of clinical practice. We are applying technology to aggregate all the world's genetic tests (i.e. Mendelian-inherited conditions) into a single assay at reasonable cost to the medical system. Further, we plan to apply Metcalfe's Law to help patients and physicians to access and share clinical genetic information in a way that protects the ownership and privacy of the patient while accelerating medical research.

We believe that in the next 10 years health care is going to flip from a world where genetic test are only rarely ordered after symptoms appear, to a world in which everyone has broad access to their genomic information from birth in order to prevent genetic disease—and we believe that once the transition starts, it's going to move very, very fast. Just like low cost computing and the Internet brought on vast changes in the information age, personal genomics and sharing of genetic information will transform the future of health care.

So, with that, I'd like to thank you so much for this award on behalf of all of Genomic Health and InVitae, and I would like to remind all of you that there is no greater field to be invested in than personalized medicine. The coming decades are going to be one of the most exciting periods in the history of humankind, with a chance to alleviate suffering from both rare and common diseases.

Protecting Privacy and Supporting Progress in Whole Genome Sequencing

RAJU KUCHERLAPATI, PH.D. AND LISA M. LEE, PH.D., M.S

IN 1990 the U.S. National Institutes of Health and Department of Energy launched a program to map and sequence the human genome. This effort was joined by other academic institutions around the world and by a private company. In a joint press conference of U.S. President Clinton and U.K. Prime Minister Tony Blair in 2000, it was announced that, together, these groups had successfully mapped and sequenced the human genome. It was estimated that the cost of this was $2.7 billion. The availability of the human genome sequence opened the doors for diverse investigations into the biology of many organisms and human diseases. President Obama, in his 2013 State of the Union address, indicated that the government's investment in genome sequencing has provided nearly 140-fold in returns. Since the time of its completion, the cost of sequencing has declined rapidly and today, sequencing a whole genome costs about $10,000 (as little as $4000 in bulk) and it is anticipated that this cost will decline by at least an order of magnitude in the coming year. Newer technologies likely will result in even further reductions in the cost of sequencing. Coupled with the expanding knowledge of human genome biology and the relatively low cost of sequencing many anticipate that the demand for whole genome sequence will increase rapidly in the next few years.

The prospect of large-scale whole genome sequencing of a large part of our population excites some people and it raises concerns among others.

The Presidential Commission for the Study of Bioethical Issues (Bioethics Commission), commissioned by President Obama in 2009, released a report, *Privacy and Progress in Whole Genome Sequencing* in October 2012 to address some of the ethical issues associated with whole genome sequence technology.

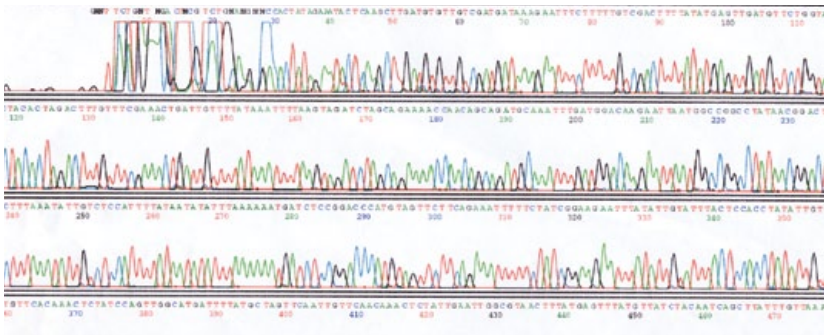
The Commission used five ethical principles to reconcile the important public benefits anticipated from whole genome sequencing and minimize the privacy risks to individuals. Grounded in the ideal of respect for persons, the principles are:

- public beneficence
- responsible stewardship
- intellectual freedom and responsibility
- democratic deliberation
- justice and fairness.

These principles undergird the 12 recommendations that the Bioethics Commission made in the context of encouraging the growth and application of new sequencing technology and social norms related to privacy.

After public input and studying the matter for 18 months, the Commission concluded that in order to realize the enormous medical promise whole genome sequencing holds, individual privacy interests must be secured. Without such assurance, citizens will be less likely to trust researchers and voluntarily supply their personal data for studies that will benefit all of society.

The Bioethics Commission made 12 recommendations that fall into five major topics calling for: 1) policies that ensure privacy of individuals whose sequences are obtained for research or clinical purposes while ensuring promotion of research and clinical use of data; 2) improved data security, allowing access that is supported by policies and infrastructure



The prospect of whole genome sequencing of a large part of our population excites some people and raises concerns among others.

that protect safe data sharing; 3) a fully informed consent process; 4) facilitation of scientific progress through support of integrating whole genome sequence data into health records; and 5) just distribution to the widest possible group of individuals of the medical advances and health benefits resulting from the public investment in genomic science.

The Bioethics Commission specifically urged the federal and state governments to ensure a consistent floor of protections covering whole genome sequence data regardless of how or in which state they were obtained. In addition, the Commission emphasized that people who consent to have their whole genome sequenced also should be asked how their data can be used both immediately and in the future.

The Bioethics Commission also discussed matters regarding incidental findings associated with whole genome sequencing, and suggested that studies be done to address such findings in the context of patient preferences and expectations of individuals contributing samples. Recognizing the complexities of incidental findings in whole genome sequencing, as well as other new technologies such as neuroimaging, the Commission plans to review how the issue will apply in clinical, research, and direct-to-consumer contexts.

Because sequencing can open enormous opportunities, it is critical that we engage a national conversation about the large ethical matters surrounding it. This in turn will help us reap the full benefits of this new technology.

Raju Kucherlapati is the Paul C. Cabot Professor of Genetics and Professor of Medicine at Harvard Medical School and is a member of the Presidential Commission for the Study of Bioethical Issues. Lisa M. Lee is the Executive Director of the Presidential Commission for the Study of Bioethical Issues.

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Personalized Medicine Coalition Elects New Board Member

The Personalized Medicine Coalition is pleased to welcome Julie K. Goonewardene to the Coalition's board of directors.

"Our success in promoting personalized medicine is largely driven by our dedicated and engaged membership as well as an active board. Based on her dedication to moving science from the bench to the bedside, Julie can assist us in advocating for pro-innovation policies that will help patients and improve health care," said William S. Dalton, Ph.D., M.D., CEO M2Gen, director Personalized Medicine Institute at Moffitt Cancer Center, and vice chairman of the PMC.

Ms. Goonewardene currently serves as the public member of the **American Medical Association** (AMA) Board of Trustees, and her nomination to serve on the PMC board was supported by James L. Madara, M.D., Executive Vice President and CEO of the AMA. The AMA is the largest association of physicians and medical students in the United States. Its mission is to promote the art and science of medicine and the betterment of the public health.

"We are pleased that Julie is joining the PMC board and believe her extensive background and expertise in business and health care issues, particularly in the realm of bringing cutting-edge medical research to the bedsides of patients, will serve the PMC board well," said Dr. Madara.

In addition to serving in her current role as an AMA board member, Ms. Goonewardene is the Associate Vice Chancellor for Innovation and Entrepreneurship at the **University of Kansas** (KU), president of the KU Center for Technology Commercialization and a professor of practice in the KU School of Business. Prior to KU, she held various roles at Purdue University. She is an experienced entrepreneur, an author, and frequent speaker on innovation. She earned a B.S with Honors in Management and a Masters in Health Communication from Purdue University.

"I am honored to join the PMC board and work with its exceptional team," Goonewardene said. "PMC has been a leader across the personalized medicine landscape for nearly a decade. I look forward to sharing my experiences and contributing to the development and adoption of personalized medicine."

Julie K. Goonewardene, public member of the American Medical Association Board of Trustees and Associate Vice Chancellor for Innovation and Entrepreneurship, University of Kansas.

PMC has been a leader across the personalized medicine landscape for nearly a decade. I look forward to sharing my experiences and contributing to the development and adoption of personalized medicine.

The Personalized Medicine Coalition requests
your presence at the **9th Annual Luncheon Address** on

THE STATE OF PERSONALIZED MEDICINE

The annual PMC luncheon address at the National Press Club serves as a forum to discuss key issues facing personalized medicine with leaders in health care.

Featuring a keynote address by

Janet Woodcock, M.D.

Director of the Center for Drug Evaluation
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Tuesday, May 21, 2013 • Noon – 2:00 p.m. ET

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To learn more and register, visit:
www.personalizedmedicinecoalition.org

Join us also for an **open house Monday, May 20, 2013**
4:00 p.m.–7:00 p.m. ET at our new headquarters:
1710 Rhode Island Ave., Suite 700 · Washington, DC

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APRIL 10

GenomeWeb: Broad Recommendations for Molecular Testing Could Help Doctors Personalized Lung Cancer Care

CAP, IASLC, and AMP released a document, entitled "Molecular Testing Guidelines for the Selection of Lung Cancer Patients for EGFR and ALK Tyrosine Kinase Inhibitors." PMC lauded the release of the guidelines as a step toward standardizing molecular testing practices in lung cancer treatment. Amy Miller, VP of public policy at PMC, stated, "The guidelines will provide meaningful answers to clinical questions that will ensure a uniform approach to molecular testing for lung cancer which will improve patient care."

APRIL 5

Catalyst

PMC Vice President of Public Policy Amy Miller, guest blogger on the Catalyst, discussed incremental innovation of personalized medicine. Miller contends that for personalized medicine to work, many pieces must be aligned as knowledge builds cumulatively over time.

MARCH 6

GenomeWeb: An Unexpected Collaboration, AMA, McKesson Partner to Clarify Molecular Diagnostic Claim Coding

The American Medical Association and health care information technology firm McKesson announced that they are working together to harmonize their respective coding systems for molecular tests. Amy Miller, VP Public Policy, states, "This is yet another in a series of changes by AMA recognizing that personalized medicine requires the organization to make drastic changes to how they do business and they are doing it."

MARCH 6

Nature: Momentum grows to make "personalized" medicine more "precise"

PMC President Edward Abrahams discussed the current proposal to rebrand "personalized" medicine as "precision" medicine, saying "there's not one iota of difference" between the definitions of "personalized" and "precision" medicine. As researchers move toward a more targeted system of medicine, whatever one calls it; policymakers and the public must also be convinced.

FEBRUARY 24

Personalized Medicine Bulletin: FDA Regulation of Laboratory Developed Test: Benefit or Unnecessary Burden?

A feature piece exploring the nuances of PMC's *Personalized Medicine Regulation: Pathways for Oversight of Diagnostics* explains the current regulatory oversight of diagnostic tests.

FEBRUARY 18

Detroit News: Research Trials at U-M Personalized Cancer Treatment

JANUARY 26, 2013

Pittsburg *Tribune Review*: Institute for Personalized Medicine Established by Pitt, UPMC.

Both the *Detroit News* and the *Tribune Review* discussed their respective local university's new endeavors to advance personalized medicine. Edward Abrahams, PMC President, explained how several research institutions across the country are working to translate personalized medicine into patient care, saying, "It's the latest trend in research in oncology and is reshaping cancer care."

JANUARY 28

Inside Health Policy: Personalized Medicine Group Seeks to Rein In CMS's Use of Evidence Development Guides

Inside Health Policy detailed PMC's letter to CMS regarding its "Coverage with Evidence Development" Guidance Document. It highlighted PMC's statement that the Coalition "is concerned that CMS's intent to apply CED to older existing technologies and services, as well as to new ones, is evidence of an approach that departs substantially from these principles and indicates an interest in expanding the scope of CED in a manner that could impede access to care and restrict the ability of providers to make decisions in the best interest of the individual patient."

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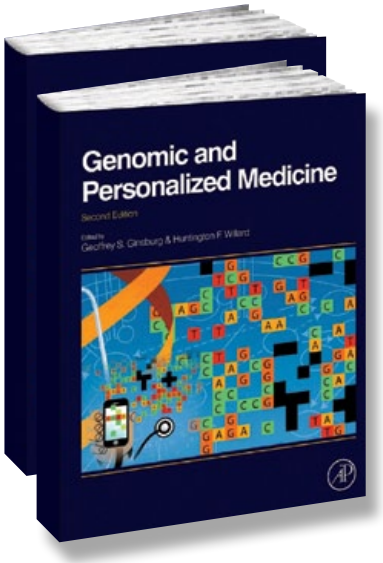

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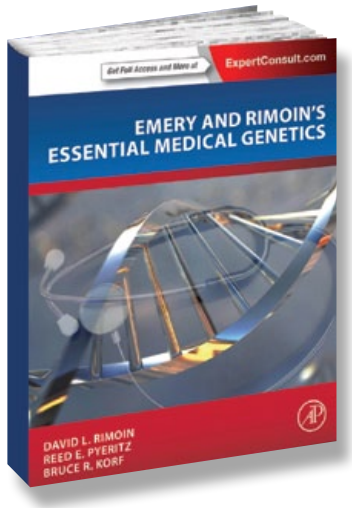

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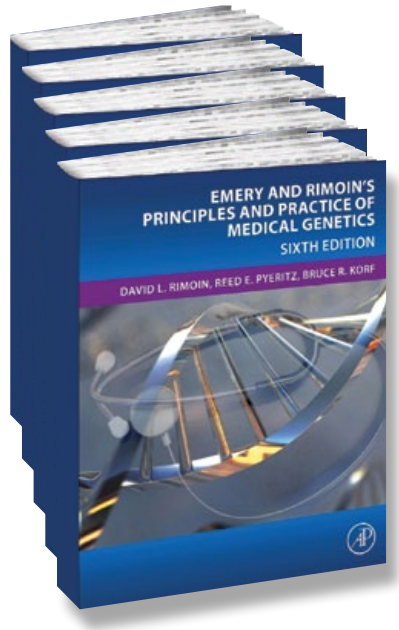

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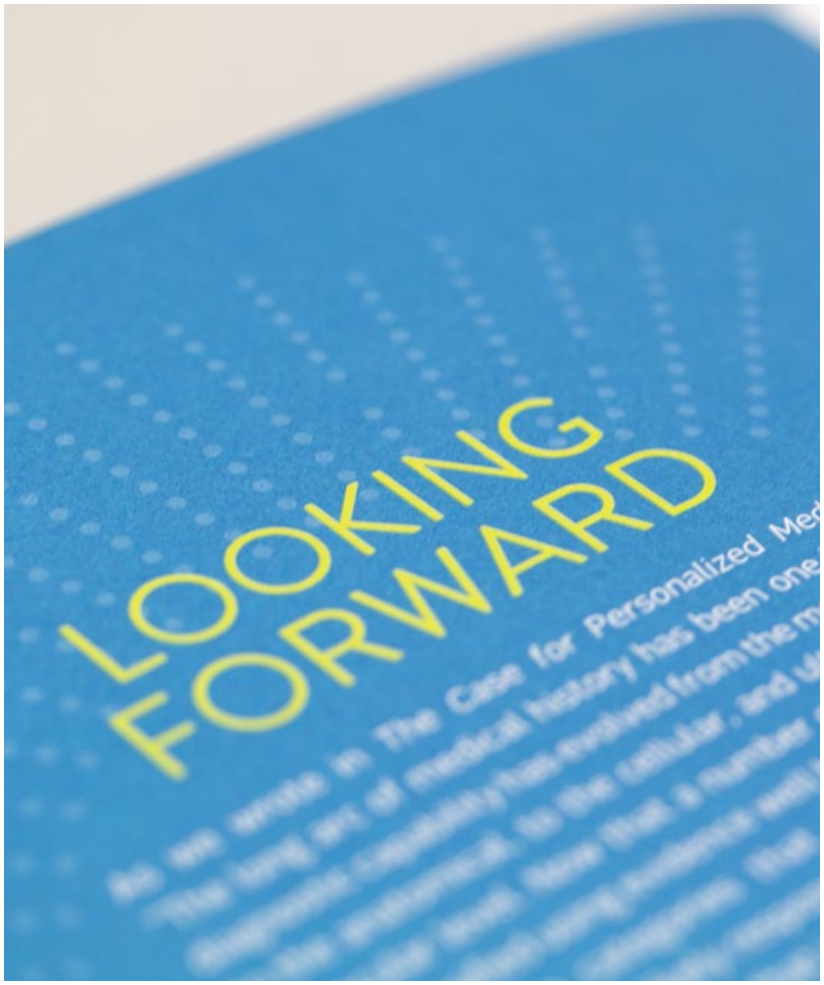

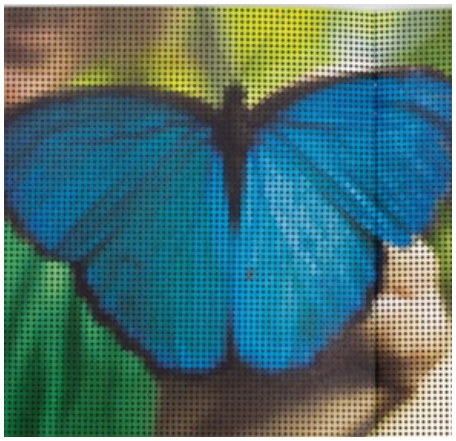

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