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Precision Medicine Update

October 9, 2015

AMDM's 2015 IVD Focus Meeting

Los Gatos, California

Alberto Gutierrez, PhD

Office of In Vitro Diagnostics and Radiological Health, FDA

1

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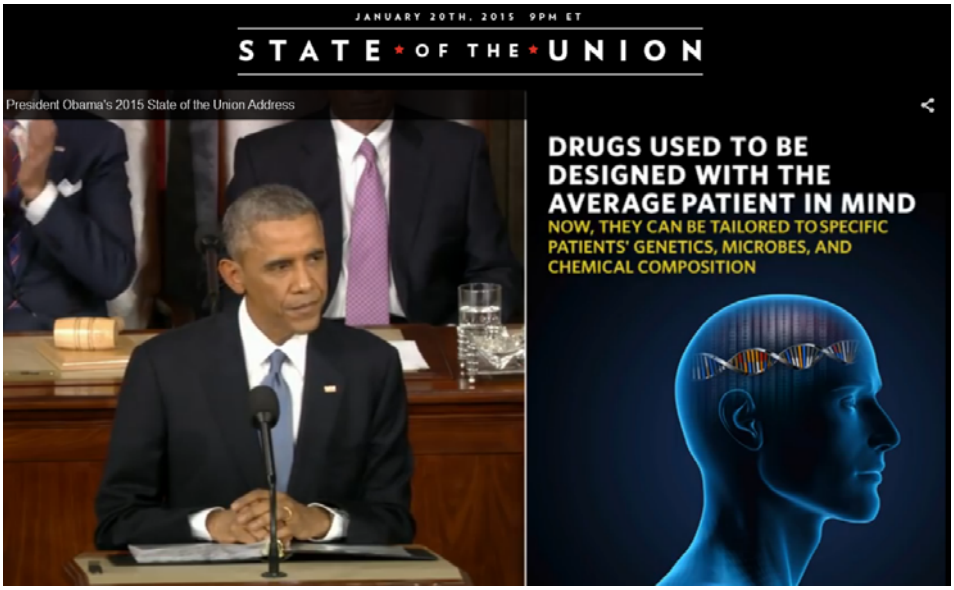

"Doctors have always recognized that every patient is unique, and doctors have always tried to tailor their treatments as best they can to individuals. You can match a blood transfusion to a blood type — that was an important discovery. What if matching a cancer cure to our genetic code was just as easy, just as standard? What if figuring out the right dose of medicine was as simple as taking our temperature?"

- President Obama, January 30, 2015

2

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"And that's why we're here today. Because something called precision medicine … gives us one of the greatest opportunities for new medical breakthroughs that we have ever seen."

President Barack Obama
January 30, 2015

3

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The President's Precision Medicine Initiative (PMI)

To enable a new era of medicine through research and technology that empowers patients, researchers, and providers to work together toward development of individualized treatments.

4

PMI Objectives

- More and better treatments for cancer
  - Identify genomic drivers of cancer in order to develop new, more effective treatments
- Development of a million person voluntary national research cohort
  - A patient-powered research effort that leverages existing research and clinical networks
  - Development of interoperability standards and privacy protections to enable data exchange
- Commitment to protecting privacy
- Regulatory modernization
  - Streamline regulatory processes for Next Generation Sequencing technologies
  - Advance the development of high quality, curated databases to support regulatory decisions
  - Enable patient access to their own health information and the software needed for its safe and accurate analysis
- Public-private partnerships
  - Development of needed infrastructure to expand cancer genomics knowledge and to launch the voluntary research cohort

5

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Precision Medicine Initiative: Timing is Everything

- **Advances in our understanding of disease**
  - Data science and bioinformatics advances
  - Better technologies for biomedical analysis
  - Large-scale genome-based research cohorts
  - Sequencing continues to get cheaper and faster
  - Availability of new data – microbiome, diagnostics, and sensor data

- **Clinical applications based on genomics and other biomarkers are now available and being used in the care of patients**

- **Public is Becoming a Partner in Clinical Care and Research**

6

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Precision medicine – Tailoring Health Care to Each Patient

- The right treatment
- The right patient
- The right time

7

Success of Precision Medicine Requires:

- ***Safe and accurate diagnostic tests*** that reliably identify individual variation
- ***Learning health systems*** that enable researchers and clinicians to learn from and inform the patient experience
- ***Development of targeted therapies*** that are more efficacious or have less deleterious side effects for specific individuals
- ***Updated research and regulatory policies*** that catalyze the development of new treatments while protecting patients

8

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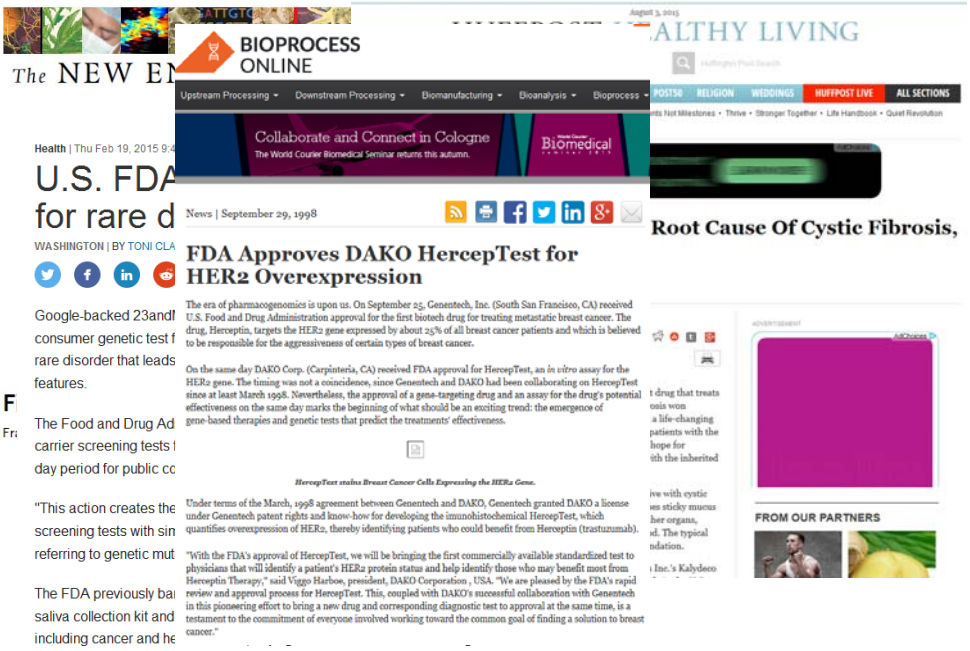
FDA – A Long History of Enabling Precision Medicine



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Health | Thu Feb 19, 2015

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WASHINGTON | BY TONI CLA

Google-backed 23andM
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BIOPROCESS ONLINE

Upstream Processing | Downstream Processing | Biomanufacturing | Bioanalysis | Bioprocess

Collaborate and Connect in Cologne
The World Courier Biomedical Seminar returns this autumn.

News | September 29, 1998

FDA Approves DAKO HercepTest for HER2 Overexpression

The era of pharmacogenomics is upon us. On September 25, Genentech, Inc. (South San Francisco, CA) received U.S. Food and Drug Administration approval for the first biotech drug for treating metastatic breast cancer. The drug, Herceptin, targets the HER2 gene expressed by about 25% of all breast cancer patients and which is believed to be responsible for the aggressiveness of certain types of breast cancer.

On the same day DAKO Corp. (Carpinteria, CA) received FDA approval for HercepTest, an *in vitro* assay for the HER2 gene. The timing was not a coincidence, since Genentech and DAKO had been collaborating on HercepTest since at least March 1998. Nevertheless, the approval of a gene-targeting drug and an assay for the drug's potential effectiveness on the same day marks the beginning of what should be an exciting trend: the emergence of gene-based therapies and genetic tests that predict the treatments' effectiveness.

HercepTest stains Breast Cancer Cells Expressing the HER2 Gene.

Under terms of the March, 1998 agreement between Genentech and DAKO, Genentech granted DAKO a license under Genentech patent rights and know-how for developing the immunohistochemical HercepTest, which quantifies overexpression of HER2, thereby identifying patients who could benefit from Herceptin (trastuzumab).

"With the FDA's approval of HercepTest, we will be bringing the first commercially available standardized test to physicians that will identify a patient's HER2 protein status and help identify those who may benefit most from Herceptin Therapy," said Viggo Harboe, president, DAKO Corporation , USA. "We are pleased by the FDA's rapid review and approval process for HercepTest. This, coupled with DAKO's successful collaboration with Genentech in this pioneering effort to bring a new drug and corresponding diagnostic test to approval at the same time, is a testament to the commitment of everyone involved working toward the common goal of finding a solution to breast cancer."

ALTHY LIVING

POST50 | RELIGION | WEDDINGS | HUFFPOST LIVE | ALL SECTIONS

Root Cause Of Cystic Fibrosis,

FROM OUR PARTNERS

9

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FDA – A Long History of Enabling Precision Medicine

- **23 companion diagnostics cleared or approved**
- **50 biomarkers used in targeting 147 approved drugs***
  - Cystic Fibrosis, Cancer, Cholesterol, Psychiatric, Pulmonary, Infectious Diseases, etc.
- **More than 60 approved/cleared human nucleic acid based tests****
- **More than 24 Guidances issued since 2005**

*http://www.fda.gov/Drugs/ScienceResearch/ResearchAreas/Pharmacogenetics/ucm083378.htm
**http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/InVitroDiagnostics/ucm301431.htm# and http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/InVitroDiagnostics/ucm330711.htm

10

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Next Generation Sequencing and Precision Medicine

- The human genome is composed of about 3 billion bases, and each individual carries millions of genetic variants.
- Next generation sequencing (NGS) is a technology that can rapidly and cheaply determine the entire sequence of an individual's genome.
- Next generation sequencing (NGS) tests are critical for precision medicine, because they have an unprecedented ability to identify variation.

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Precision Medicine Initiative: Modernizing FDA Regulation of Genomic Laboratory Tests

Traditional testing

Next generation sequencing

12

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Barriers to Precision Medicine

Traditional clinical studies not possible because the number of patients with a given variant is usually too small.

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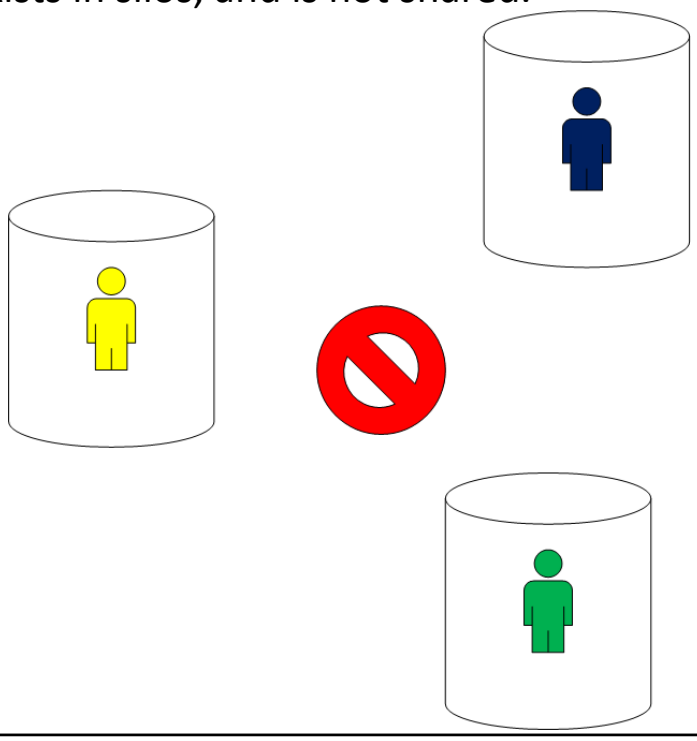
Barriers to Precision Medicine

A lot of data exists in silos, and is not shared.



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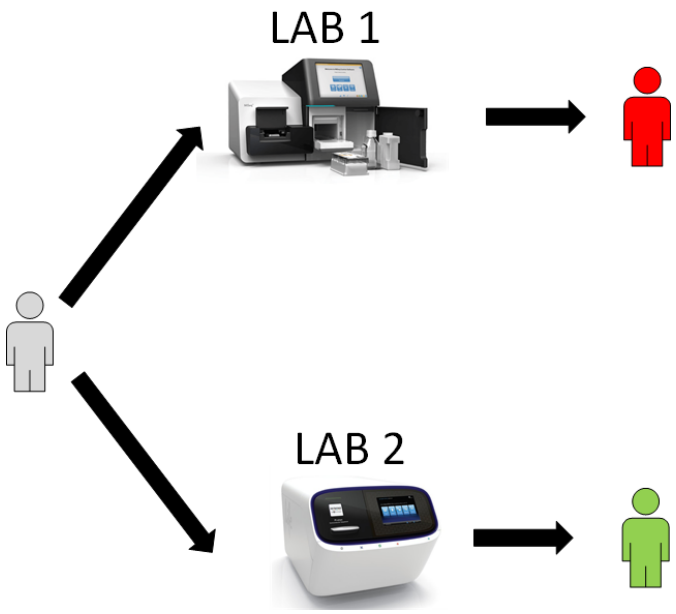
Barriers to Precision Medicine

Different labs may produce different results from NGS.



Precision Medicine Initiative - FDA

Vision: Implement new regulatory policies to promote research and accelerate the translation of precision medicine technologies into treatments that *benefit patients*.

- **Near Term:** Implement standards and shared resources that will enable the development of knowledge for research and patient decision making
- **Longer Term:** Implement standards-based regulation of diagnostic tests that will ensure that the tests patients receive provide accurate, reproducible, and meaningful results

Precision Medicine Initiative: Modernizing FDA Regulation of Genomic Laboratory Tests

- **Need to ensure that the information that patients receive from NGS tests is accurate and relevant to their condition (analytically and clinically valid)**
- ***Differences in data volume and interpretation call for a new regulatory approach*** **that will ensure that patients and providers are able to make treatment decisions based on accurate test results**

17

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Precision Medicine Initiative: Modernizing FDA Regulation of Genomic Laboratory Tests

- **New regulatory strategies for next generation sequencing**
  - Develop and implement ***standards to ensure quality***
  - Develop ***open-source tools*** to help test developers meet standards
  - Promote translation and innovation to advance precision medicine by adopting a ***flexible, dynamic regulatory system***

18

Precision Medicine Initiative: Enabling Discovery and Knowledge Generation

- **Development of high-quality, publicly available databases**
  - Create a ***data commons*** for a variety of sources of information
  - Enable the clinical ***interpretation*** of genomic test results
  - Support the success of the PMI by ensuring that the highest ***quality data*** is used for future research and patient care

19

precisionFDA

- **Advancing the accuracy and reproducibility of NGS**
  - Crowd-sourced, cloud-based platform
  - Will provide tools and open access resources
  - Will allow the community to test, pilot, and validate approaches to NGS

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precisionFDA - Innovating Today for a Healthier Tomorrow

Patient Safety / Access to Clinically Meaningful Tests

Traditional Biomarkers

Enabling Research and Development of Effective and Reliable Technologies and Therapies

Cloud-based Resources and Tools

Clinical Phenotyping

21

Goals for FDA Regulatory Oversight of NGS

- Protect patient safety by assuring genomic test quality
- Promote translation and innovation to advance precision medicine by adopting a flexible regulatory system
- Support the success of the PMI by ensuring the quality of the data used for future research

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Direct to Consumer Testing

- Protect patient safety by assuring test quality
- Assure accuracy of tests
- Assure users are provided with truthful and meaningful data

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Questions?

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24