



Data is the New Black

or

How the Fourth Industrial Revolution is Changing Healthcare

or

Diagnostics is an Information Business with a Wet Lab on the Side

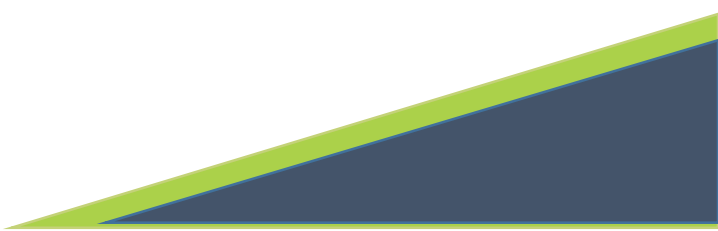
Mara G. Aspinall

CEO, Health Catalysts Managing Director, BlueStone Venture Partners

Director – Abcam plc, Allscripts, Blue Cross Blue Shield Arizona, Castle Biosciences, GenePeeks, 3Scan, Orasure

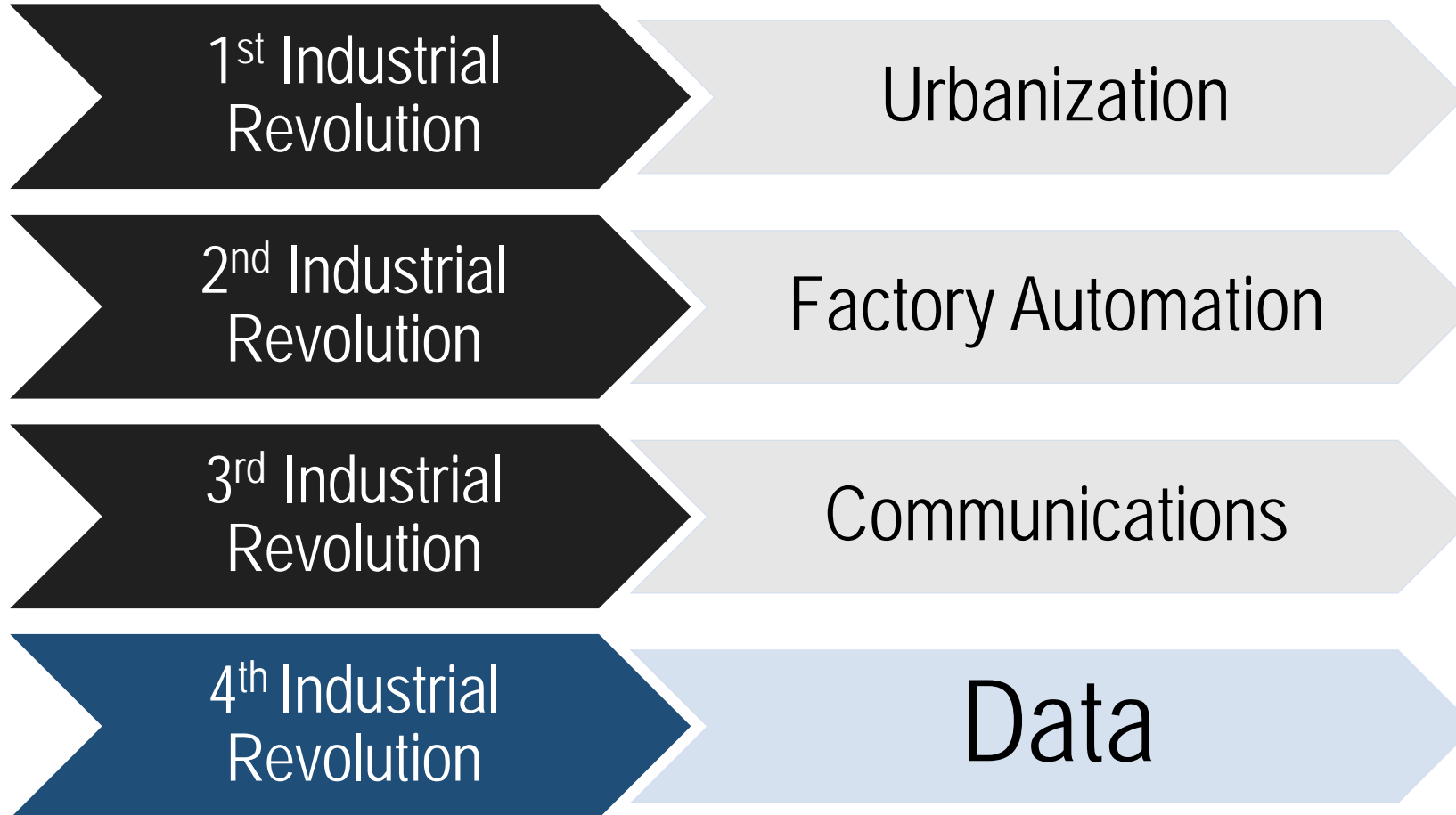


Agenda: 4 – 5 – 6

- **4th Industrial Revolution**
 - **Diagnostics 5.0**
 - **6 Strategies for Improvement**
- 

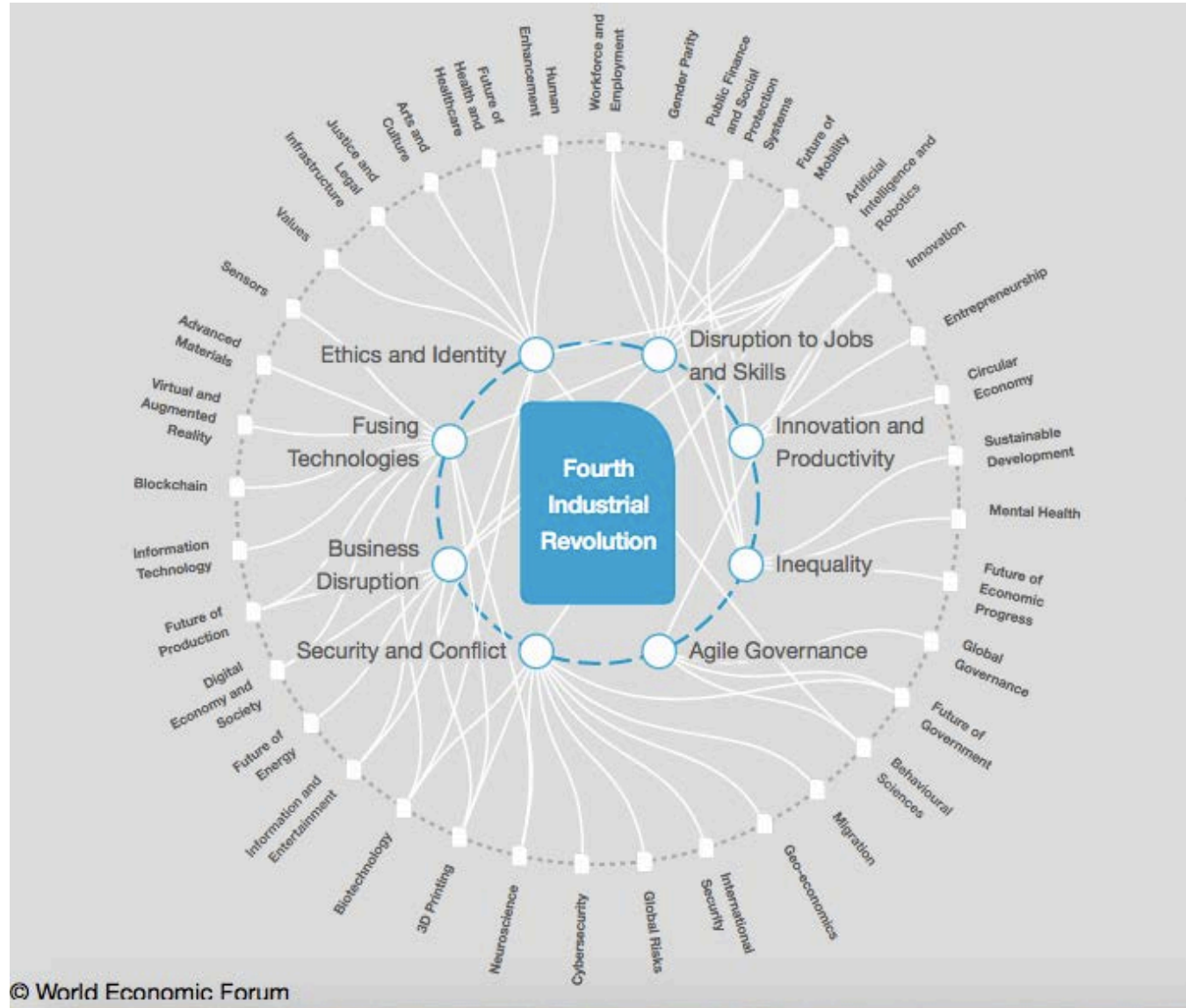


The Industrial Revolutions



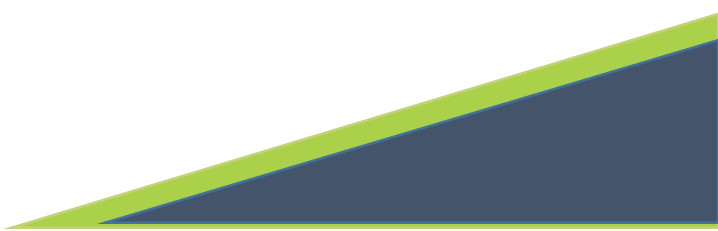


4th Industrial Revolution: Digital Economy





4th Industrial Revolution: Healthcare

- 1. Artificial intelligence and machine learning
 - 2. Internet of things and connected devices
 - 3. Blockchain and distributed ledger technology
 - 4. Autonomous and urban mobility
 - 5. Drones and tomorrow's airspace
 - 6. Precision medicine
 - 7. Digital trade and cross-border data flows
- 



Data, Data, Everywhere

- Investment

- Dollars Flowing
- Start-Ups Growing

- Acquisitions

- Data Value High
- Lab Value Low

- Regulation

- Mobile Apps
- Personalized Medicine
- Virtual Clinical Trials

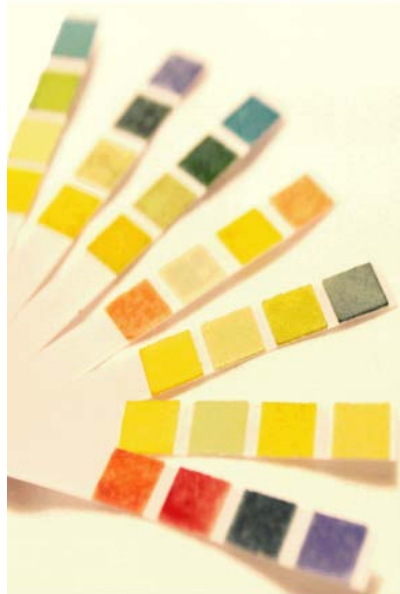
Multiple *Mostly Accurate* Data Points better than **One *Very Accurate* Data Point**



Diagnostics has made great strides



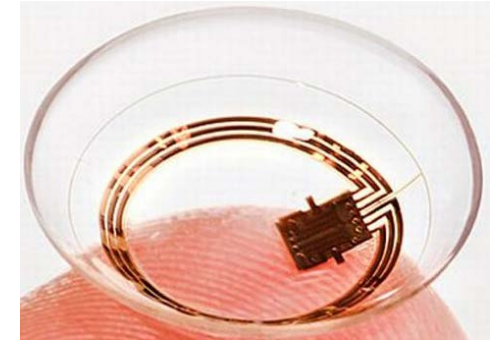
Constantine tastes patients' urine



Urine Test Strip



Blood Glucose Meter



Contact Lens Glucose Meter





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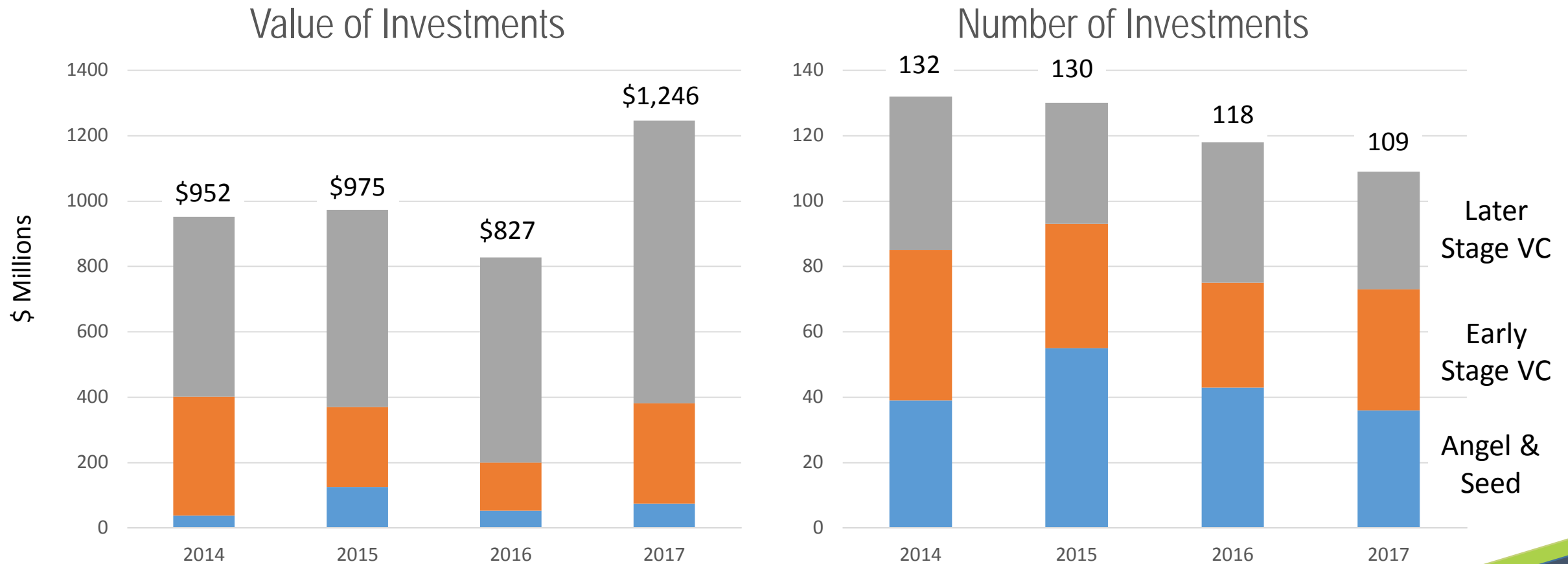
- Regulation

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Multiple *Mostly Accurate* Data Points better than **One** *Very Accurate* Data Point



Diagnostics Venture Capital Investments



Source: PitchBook data 2014-2017 in
Health Catalysts Diagnostics Year in Review



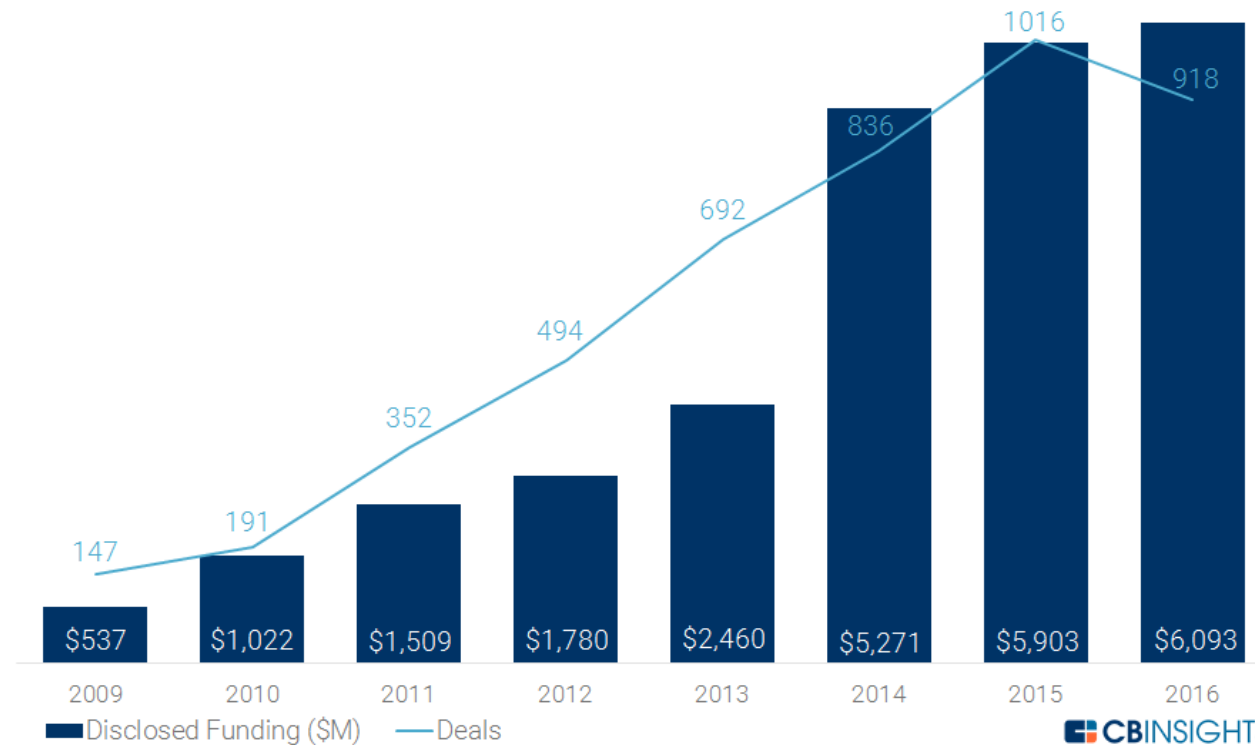
Health Informatics Deals Lead the Growth

“ Investors continued to ramp up their deals to companies aiming to use digital solutions to remedy pain points in the healthcare system. ”



DIGITAL HEALTH ANNUAL GLOBAL FINANCING HISTORY

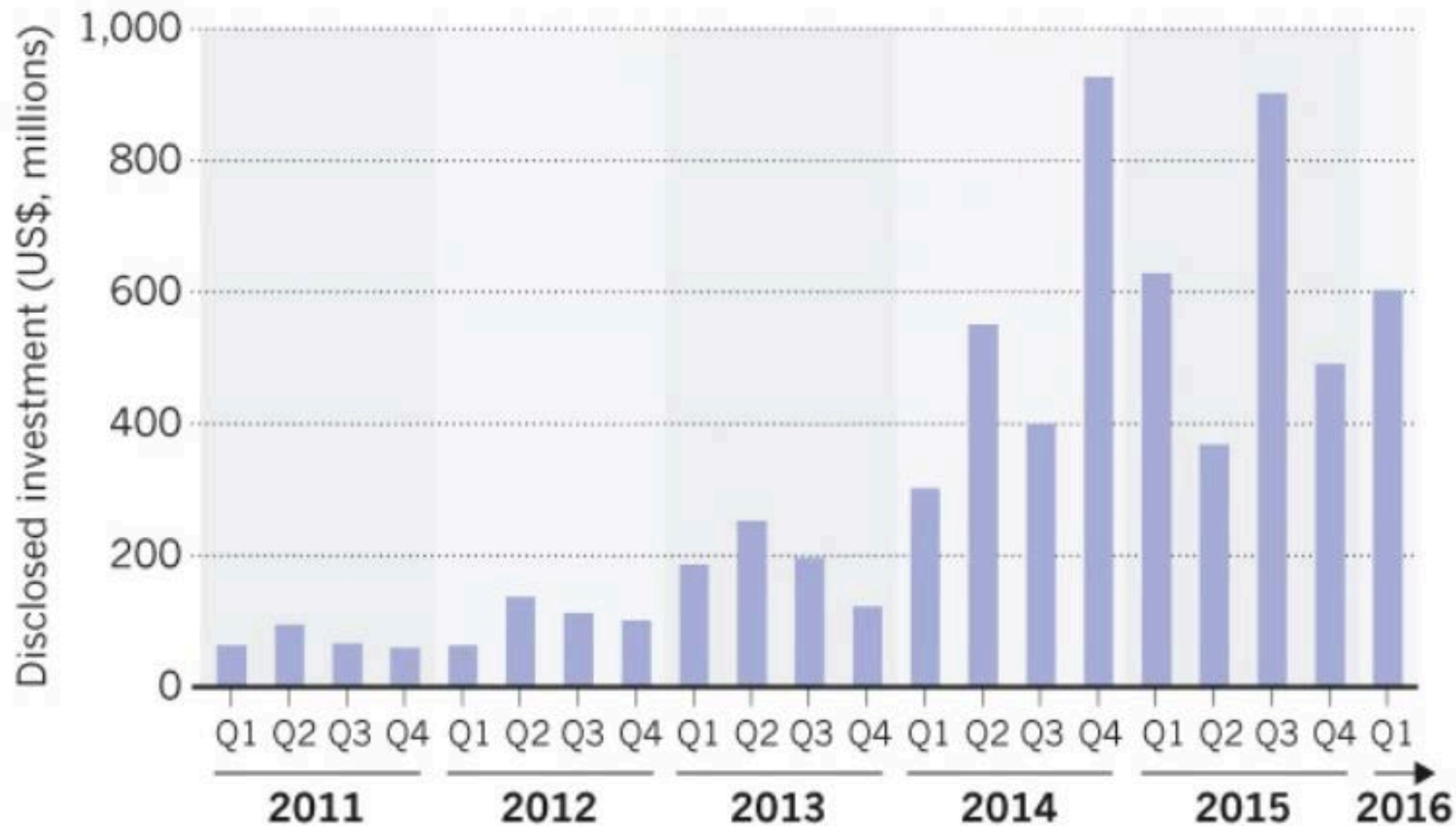
2009 - 2016



Sources: Brookings and CB Insights



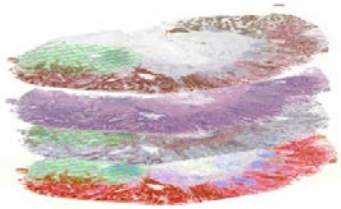
Artificial Intelligence also Surges Forward



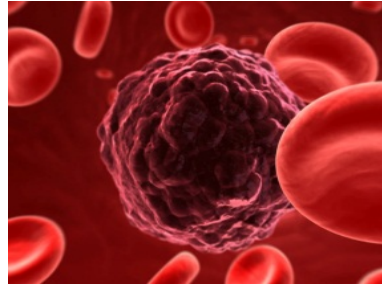
Source: Nature: "There is a blind spot in AI Research", October 13th, 2016



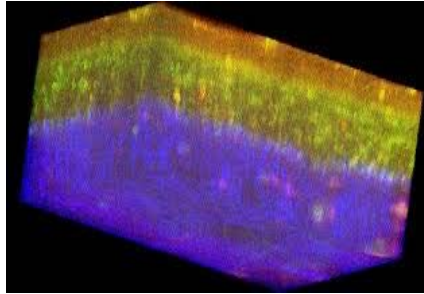
Diagnostic Tech \$ shift away from MDx to Data Related



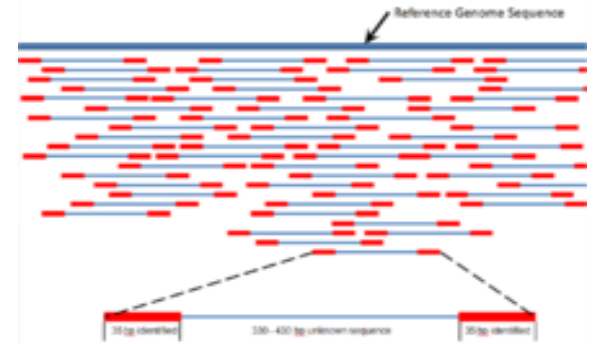
Computational Pathology



Liquid Biopsy



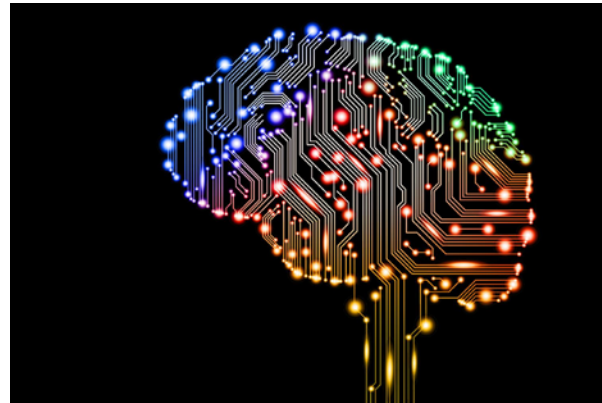
Medical Optics



Next Generation Sequencing



Wearables: incl. Consumer Dx



Artificial Intelligence



Data Integration



Data, Data, Everywhere

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Multiple *Mostly Accurate* Data Points better than **One *Very Accurate* Data Point**





FDA Actions

A. Mobile Apps

- A. Clearance of *reSET*
- B. Clearance of *Kardia Band*
- C. Clearance of *Personal Genome Service - Personal Health Risk*

B. Personalized Medicine

- A. *Keytruda*
- B. *Universal CDx Gene Panels*

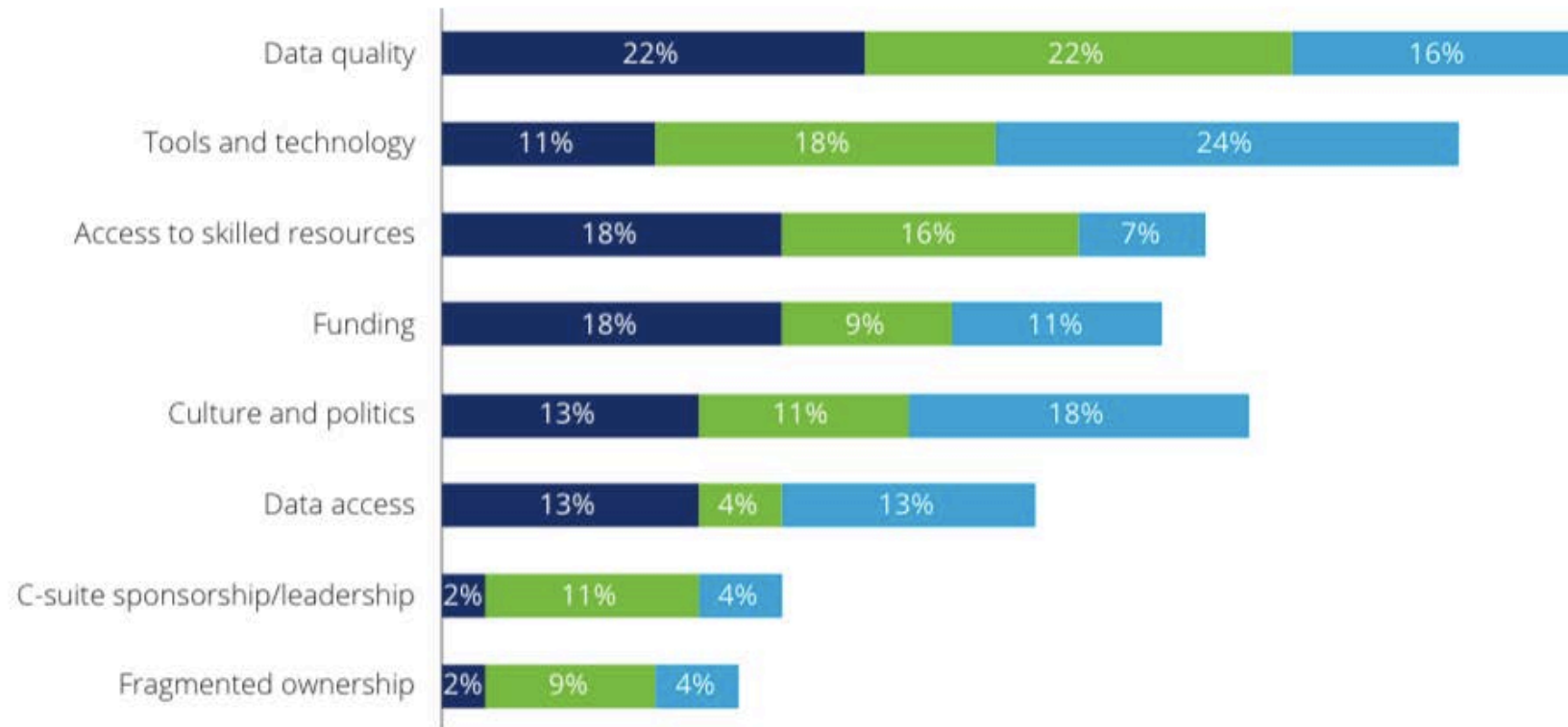
C. Tech Enabled Clinical Trials

- A. Block Chain
- B. Artificial Intelligence Analysis
- C. BioSimulation
- D. Digital Token Payments



Barriers to using Data and Data Analytics

Top 3 barriers to analytics investments and implementation efforts*



- Ranked #1
- Ranked #2
- Ranked #3



While health care is entering the era of big data, insurance companies remain in the dark.



Agenda: 4 – 5 – 6

- **4th Industrial Revolution**

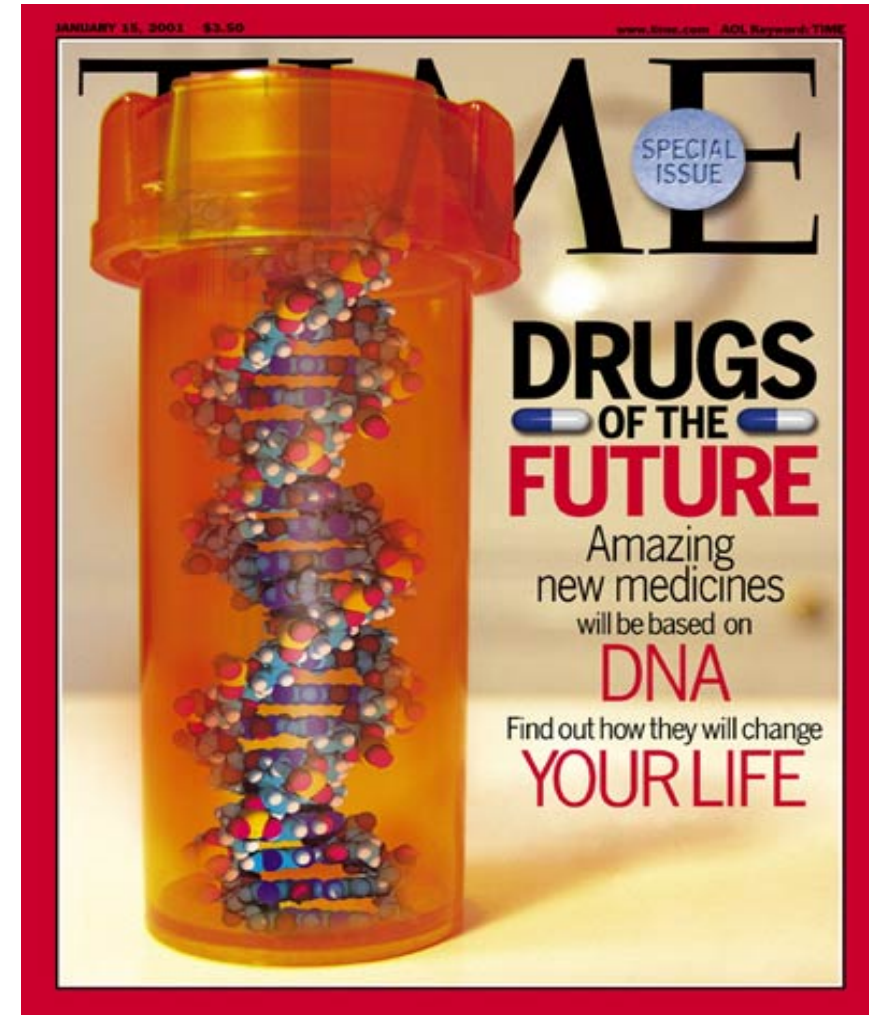
- **Diagnostics 5.0**

- **6 Strategies for Success**





Diagnostics in the Background Today





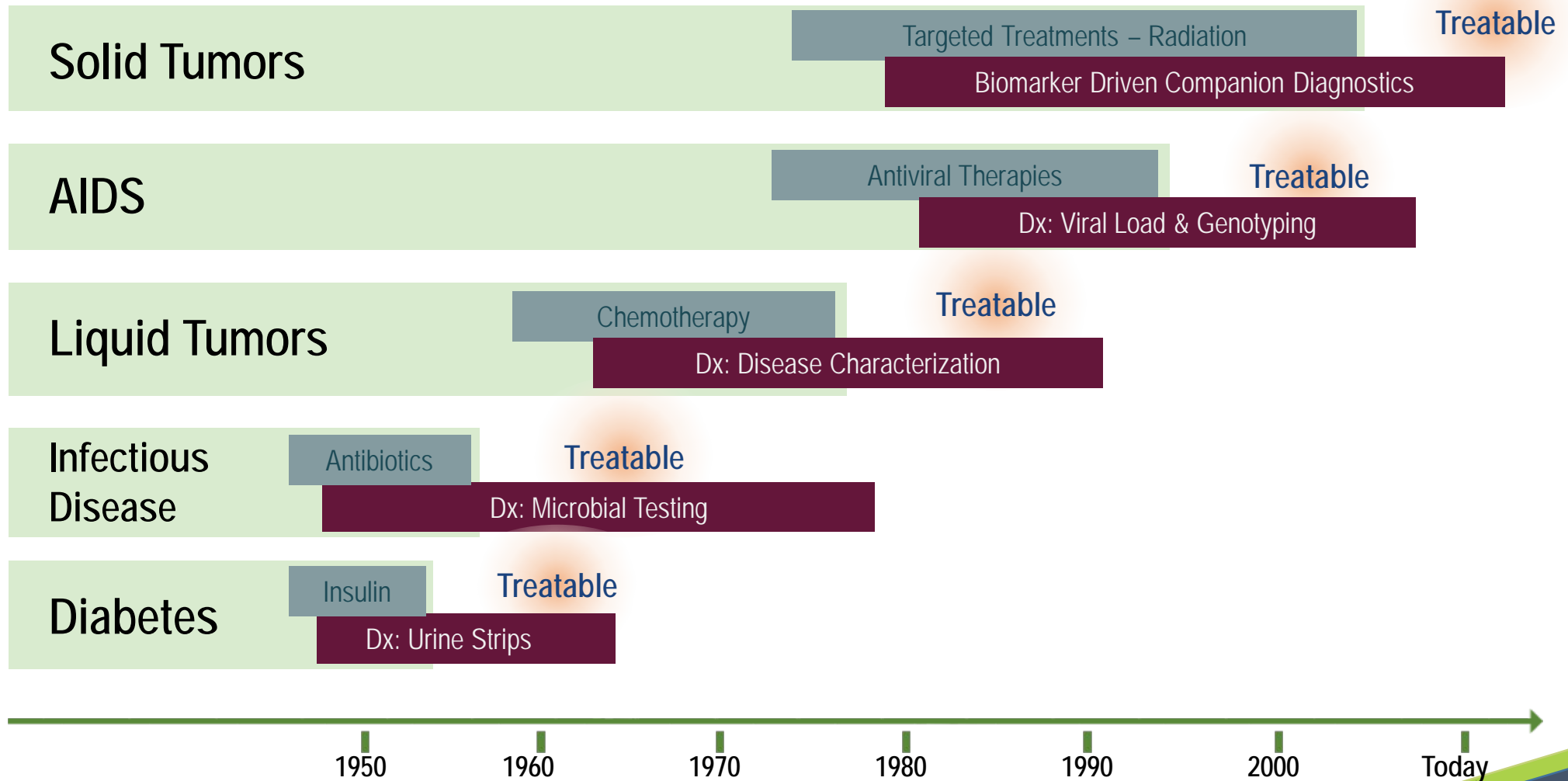
It is all about the drug but...

YOUR NAME
HERE →



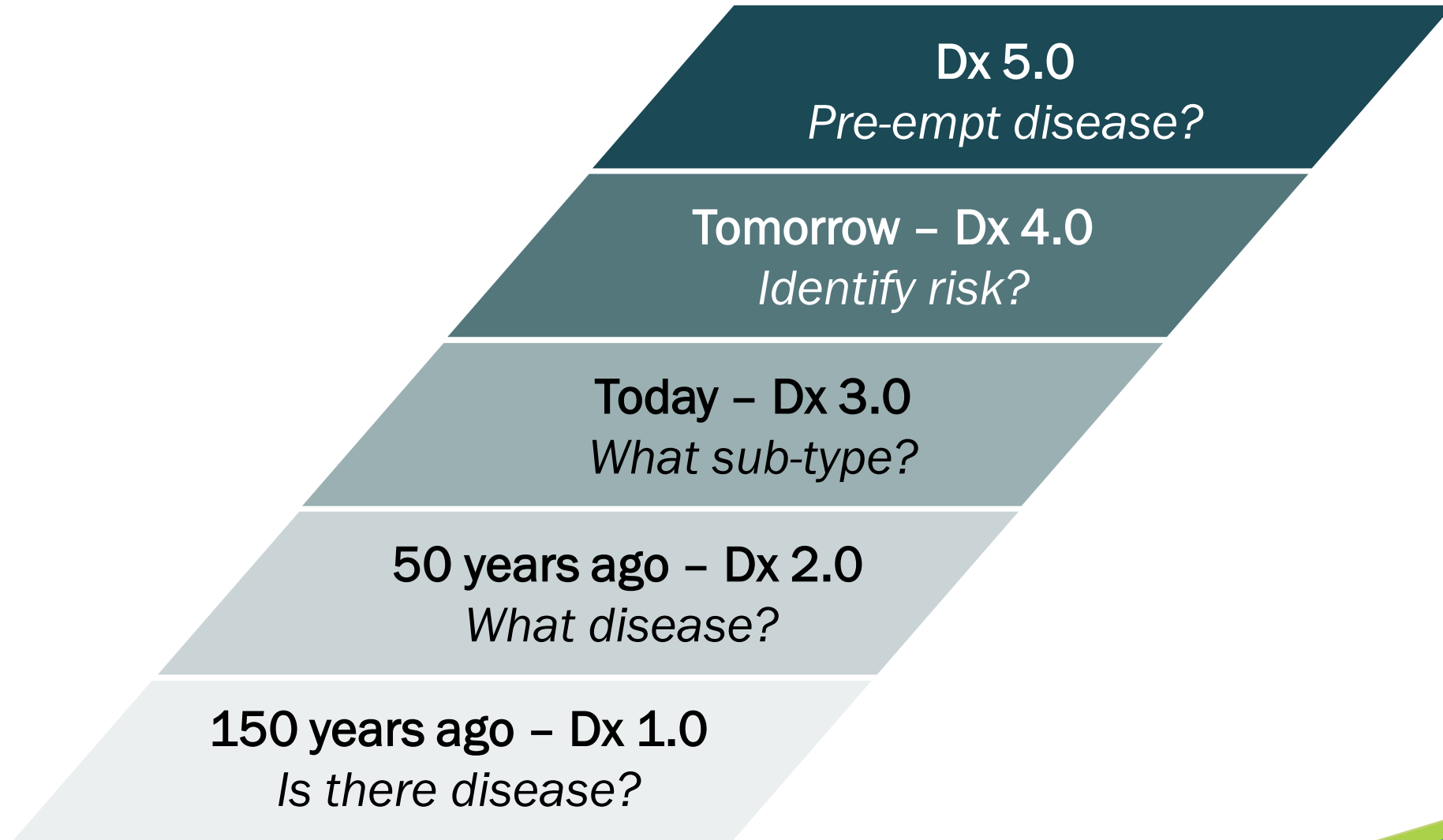


Diagnostics Bridge Theory to Therapy



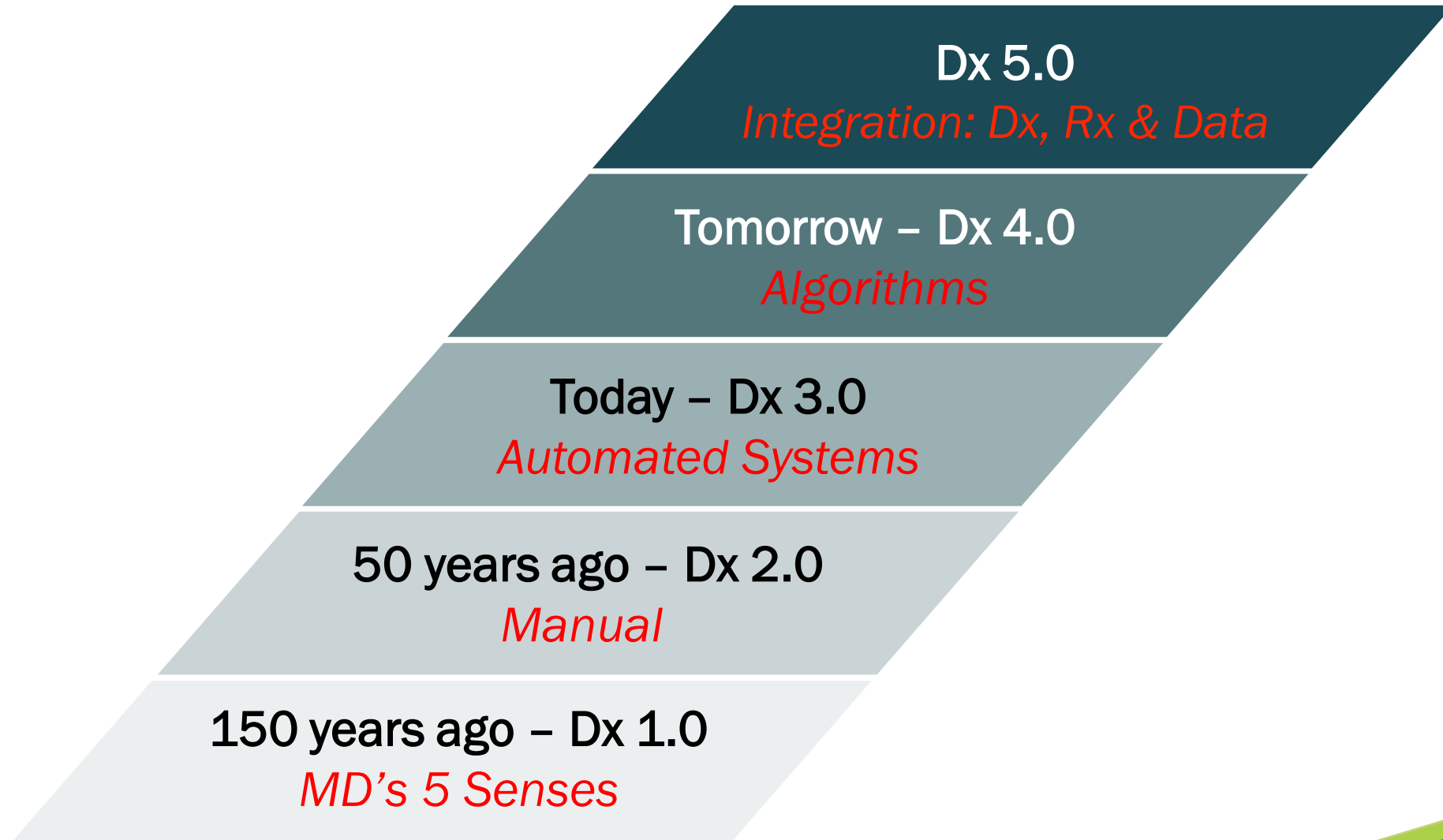


Diagnostic Questions: Dx 1.0 to Dx 5.0



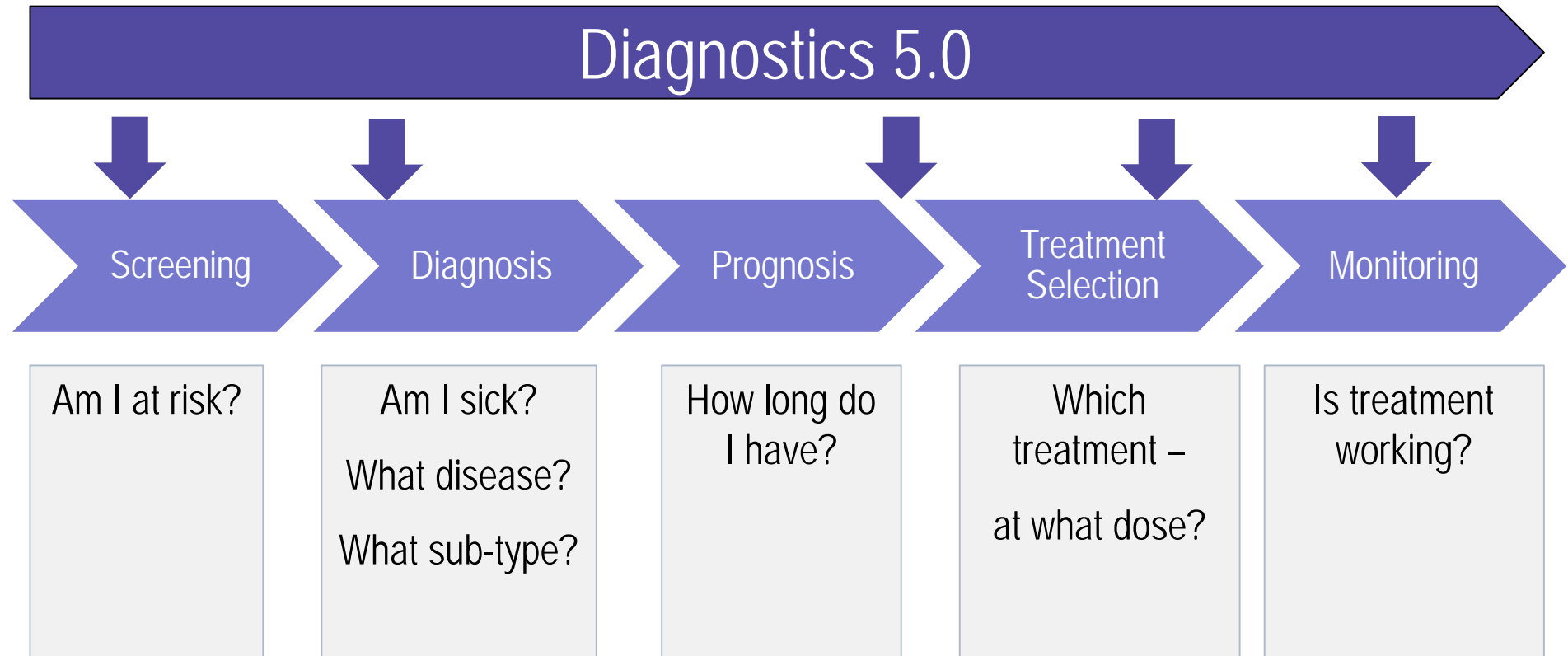


Diagnostic **Tools**: Dx 1.0 to Dx 5.0





Dx 5.0 is Not Just for Diagnosis



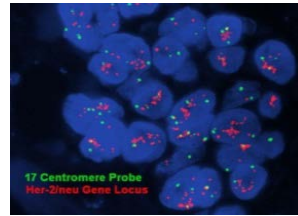
The So What? Test



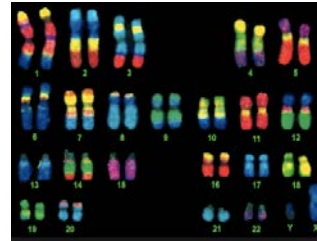
Dx 5.0 is Technology Agnostic



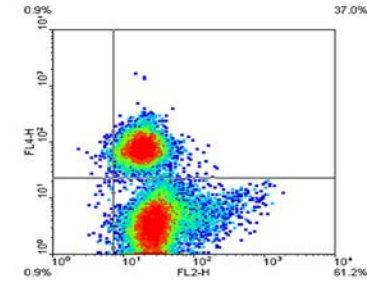
Clinical Chemistry



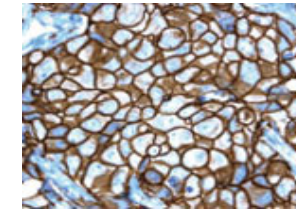
FISH/ISH



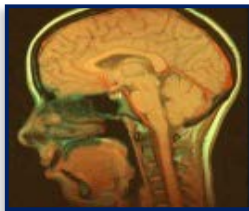
Cytogenetics



Flow Cyto



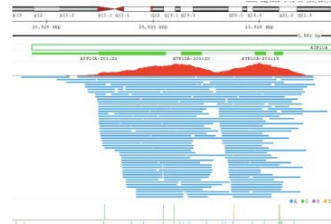
IHC / ICC



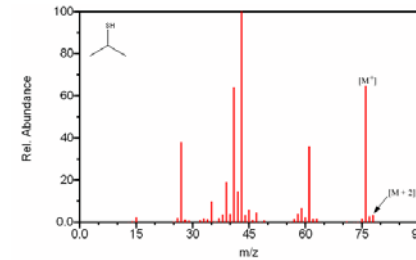
Imaging



Immuno Assay



NGS



Mass Spec



PCR

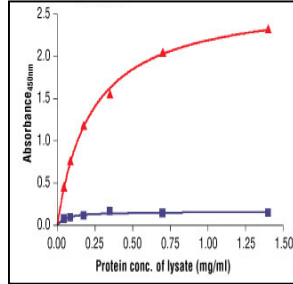




Dx 5.0 is Technology & Data Integrated



Patient History



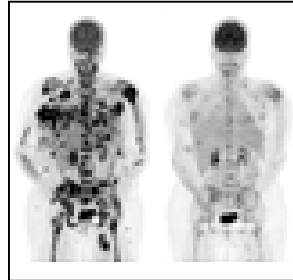
Clinical Dx



NGS



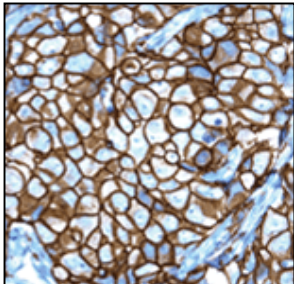
Consumer Apps



Imaging



Clinical Trials



**Tissue
Diagnostics**



**Drug
Interactions**



POC Dx

Integrated
summary
of patient
data

Emergence
of the Data
Interpreter



Dx 5.0 Needs Clinical Algorithms

Diagnostics 4.0 & 5.0 entails :

- Too much data to do anything else
- Multiple Technologies and Multi-Analytes Integrated
- Little time and less patience from MDs
- Companion Diagnostics – but the “next gen” of CDx must tackle combination therapy



Dx 5.0 Core Principles

Diagnostic Lab Technologies sooner or later become broadly available

Recent (and future) advances in Diagnostic Technology create more information that any human can absorb and/or process

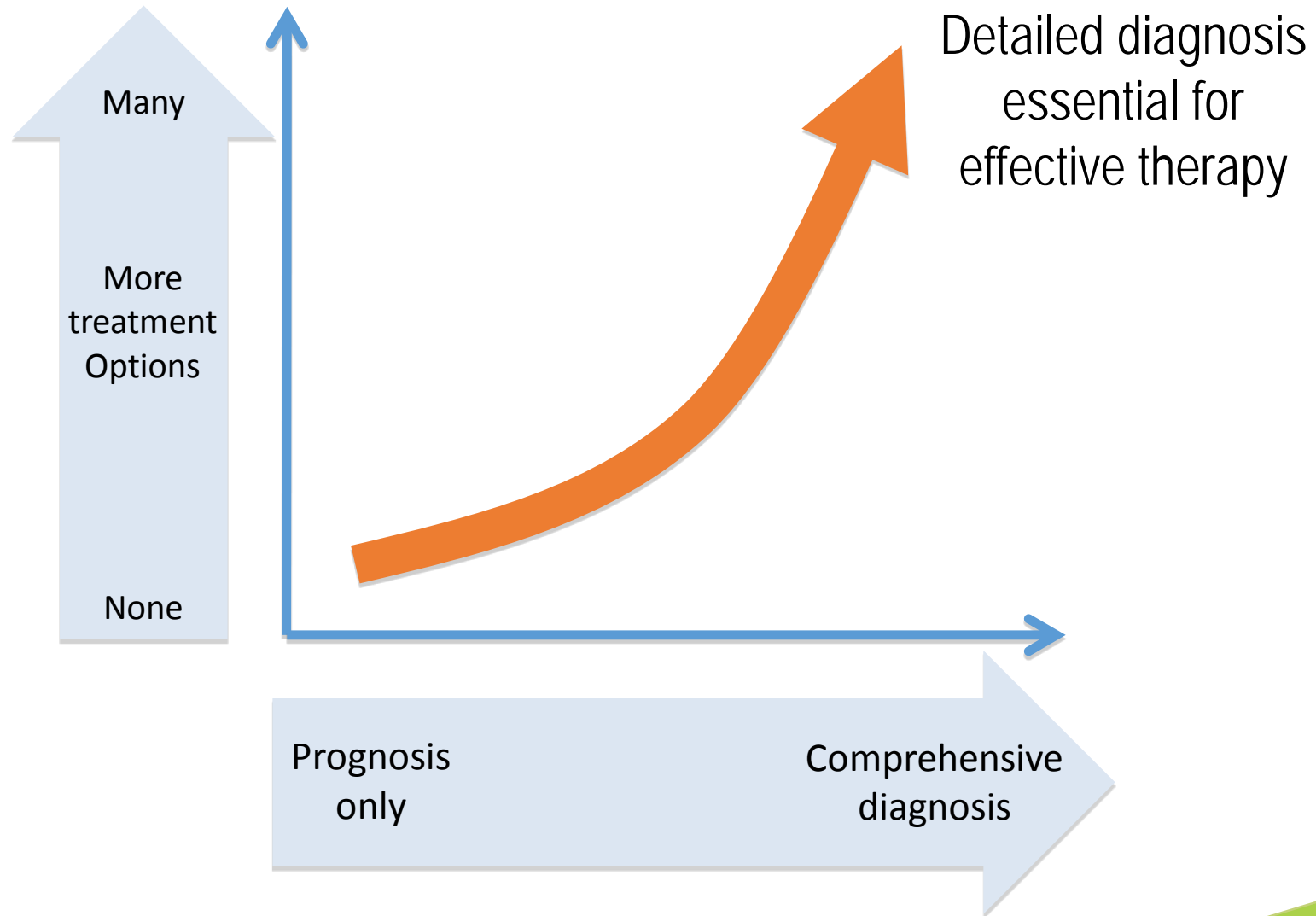


**Diagnositics is an Information Business
with a Wet Lab on the Side**





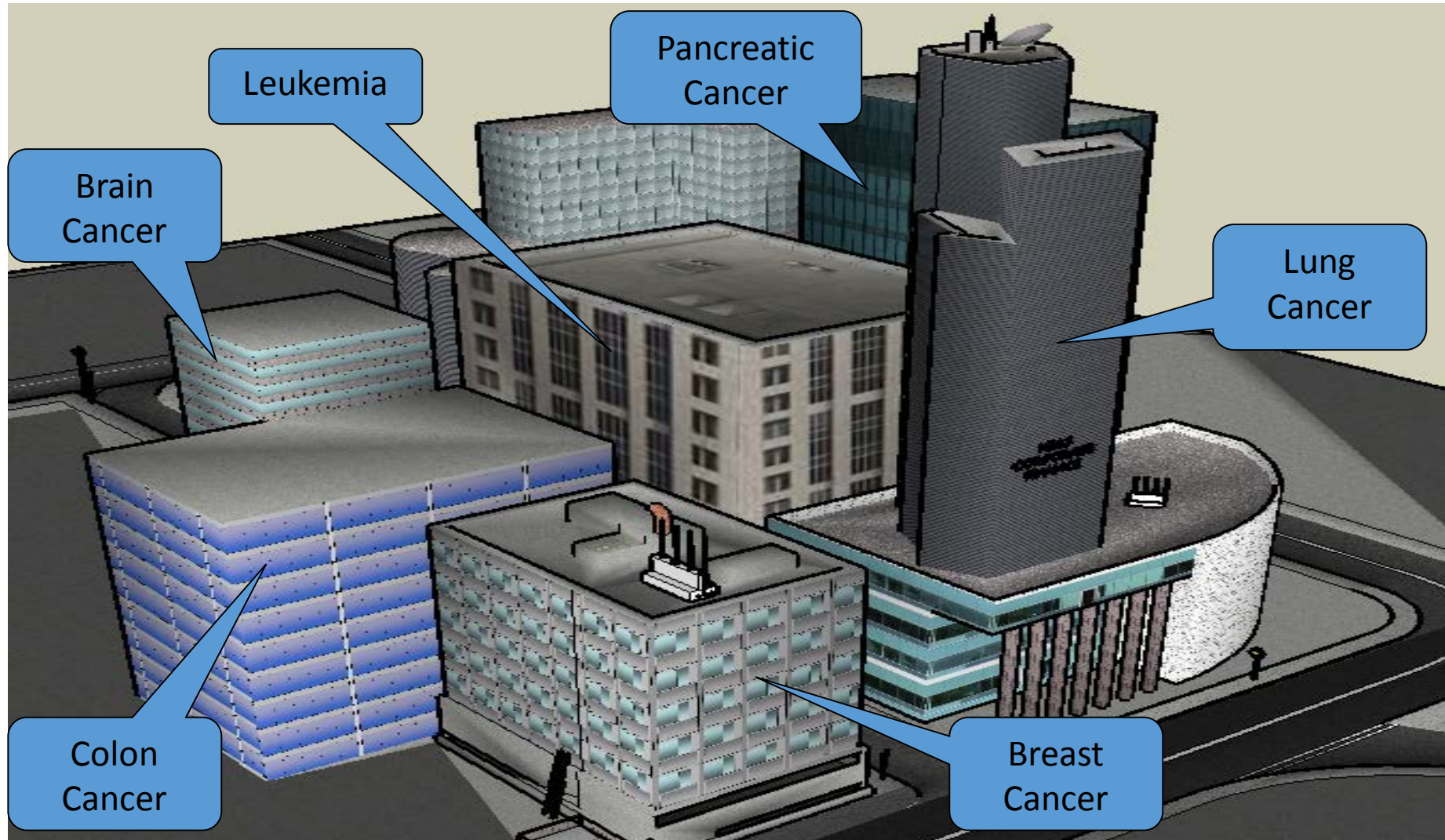
Dx 5.0 Needs Therapeutics





Hospitals Today

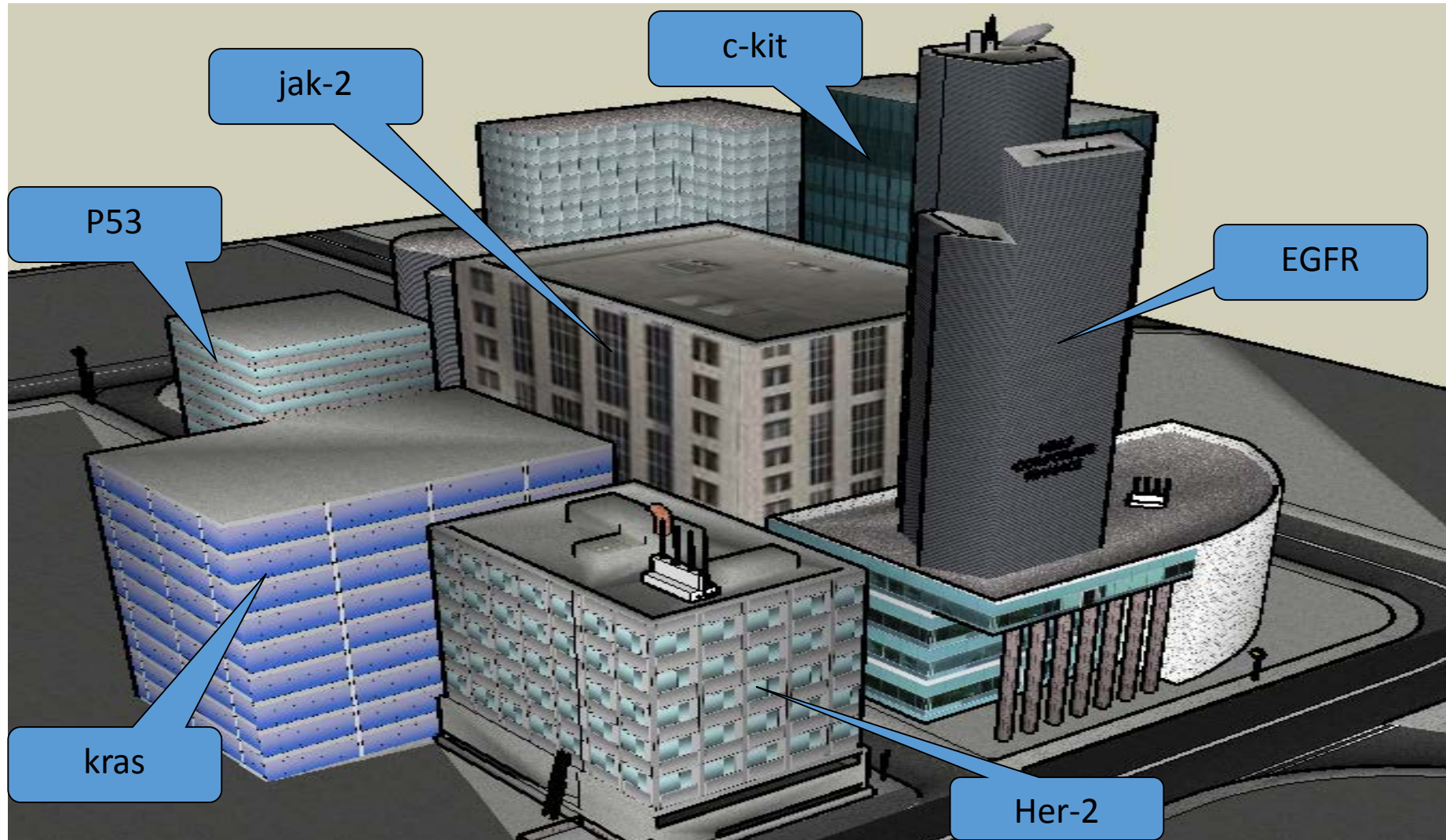
Organ-Based Treatment Paradigm





Hospitals in the Future

Mechanism-Based Treatment Paradigm





FDA News Release

FDA approves first cancer treatment for any solid tumor with a specific genetic feature

For Immediate Release May 23, 2017

The U.S. Food and Drug Administration today granted accelerated approval to a treatment for patients whose cancers have a specific genetic feature (biomarker). This is the first time the agency has approved a cancer treatment based on a common biomarker rather than the location in the body where the tumor originated.

Keytruda (pembrolizumab) is indicated for the treatment of adult and pediatric patients with unresectable or metastatic solid tumors that have been identified as having a biomarker referred to as microsatellite instability-high (MSI-H) or mismatch repair deficient (dMMR).



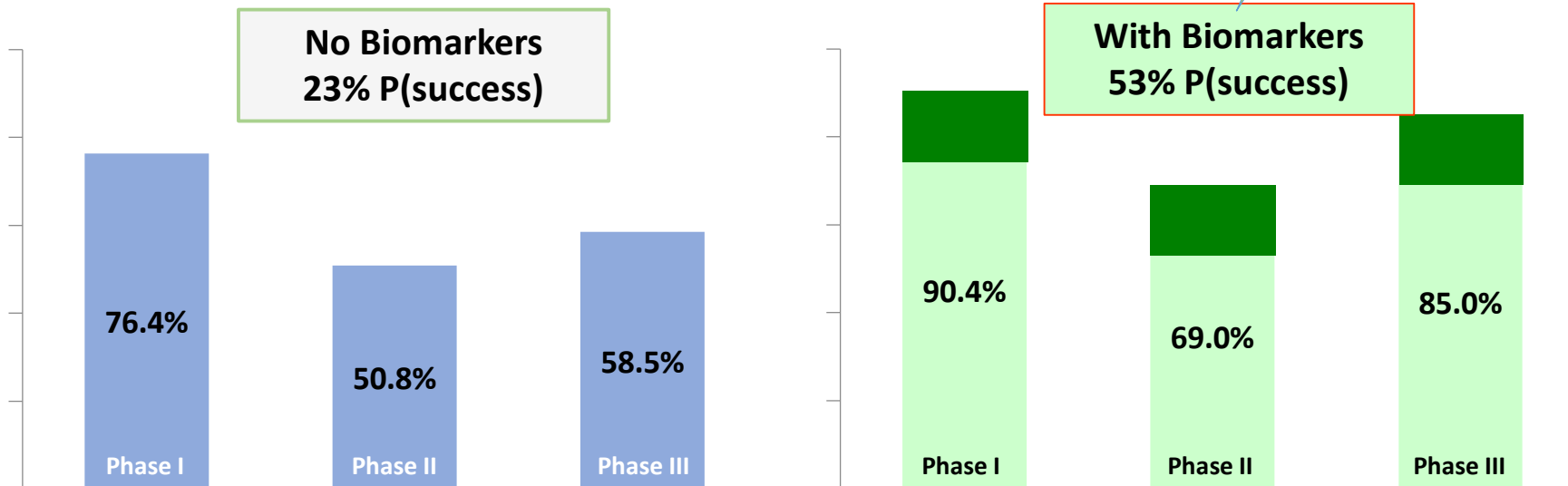
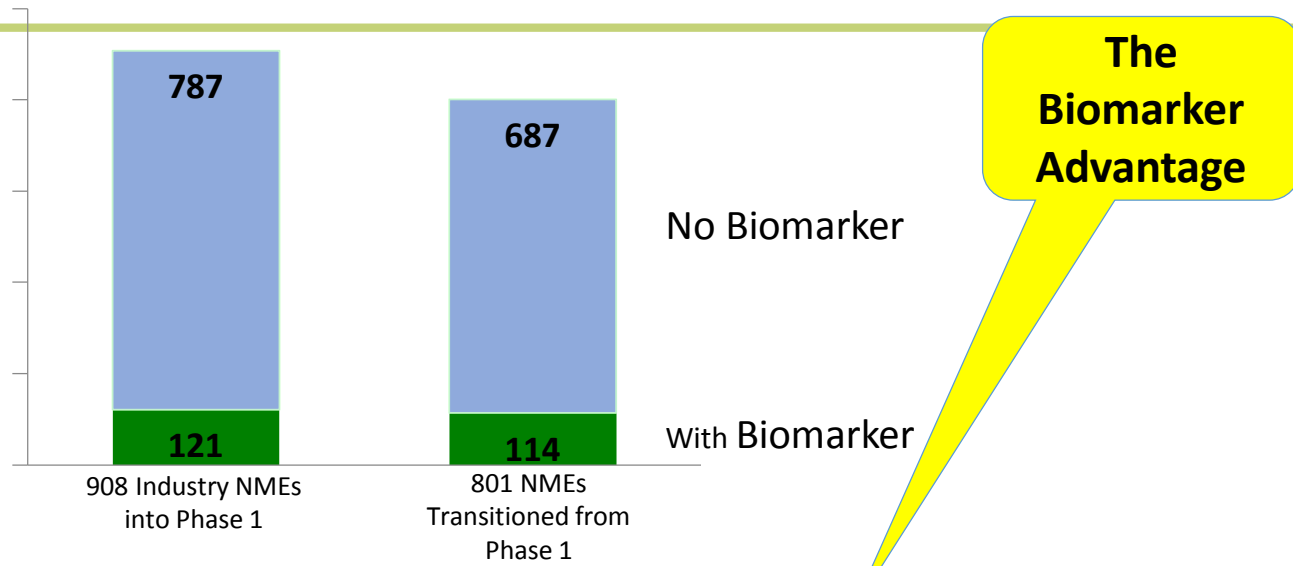
Proving the Efficacy of Combination Therapy with Data Molecular Analysis for Therapy Choice – MATCH Trial

- Objective
 - Assess response rate and progression-free survival following treatment chosen based on presence of specific mutations in patient tumors.
 - Pretreated solid tumors and lymphomas
- Unprecedented Numbers
 - 200 actionable mutations / amplifications / translocations
 - 20 treatment arms
 - 40 pharmaceutical firms



Dx 5.0 Needs Biomarkers for Drug Development Success

Oncology
NME's
1999-2008





Paradigm Shift

Past & Today

We have a
Drug



Find me
Patients

Today & Tomorrow

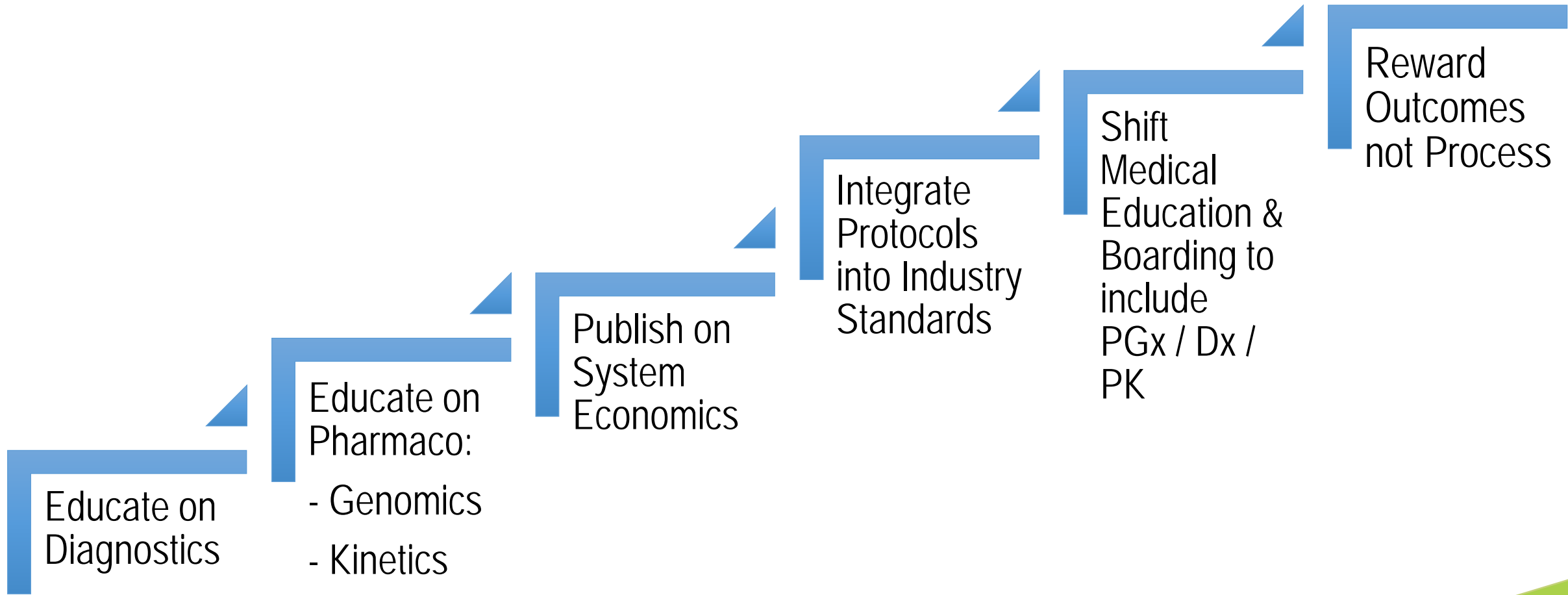
We have **A**
Patient



Find me
Drugs



Create the Future: 6 Steps



Mission

- **Educate healthcare executives** to understand and appreciate Diagnostics in clinical medicine and scientific research
- **Educate students** to be active and impactful members of the healthcare and life science communities through coursework and exposure to industry
- Shape Diagnostic policy worldwide through research and partnerships with industry
- Establish the field of Diagnostics as an independent discipline, distinct yet integral to drug development

Curriculum

- Science of Diagnostics
- Technology of Diagnostics
- Economics of Diagnostics
- Application of Diagnostics

Program Overview

- Masters Degree: One Year Online
 - 30 course credits
 - Applied Project / Field Work
- Student Body
 - Mid Career Executives in Healthcare / Life Sciences
 - Science undergrad majors interested in bioscience careers
- Student Enrollment
 - Class of 2015: 24
 - Class of 2016: 47
 - Class of 2017: 71
 - Class of 2018: 102



Thank you

Mara G. Aspinall

mara.aspinall@healthcatalysts.com