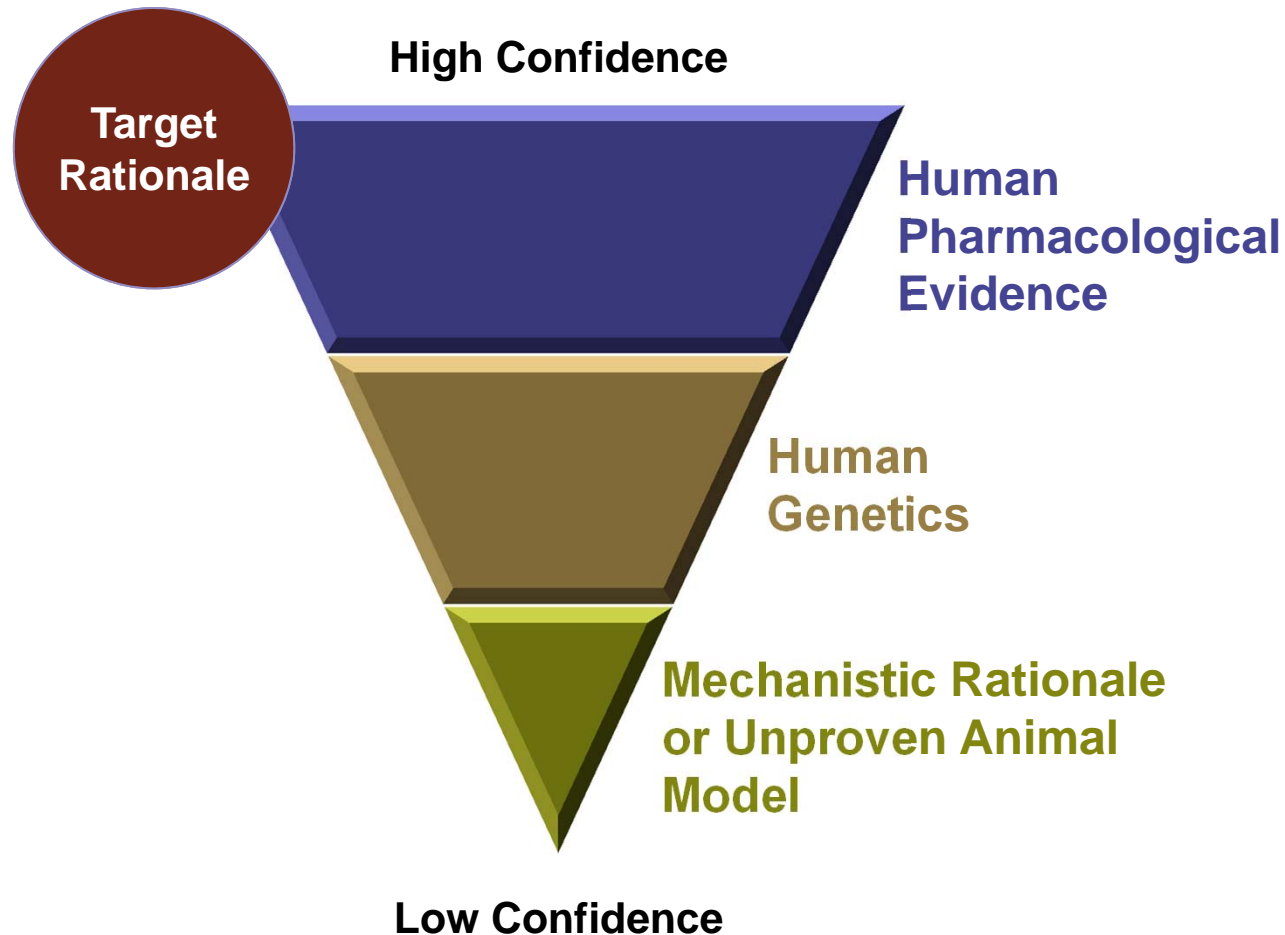

Convergence des Sciences de la Santé et du Big Data - Impact sur l'Industrie Pharmaceutique

Aurélie Grienberger

The Most Important Decision We Make

Choice of Target



The PARADOX

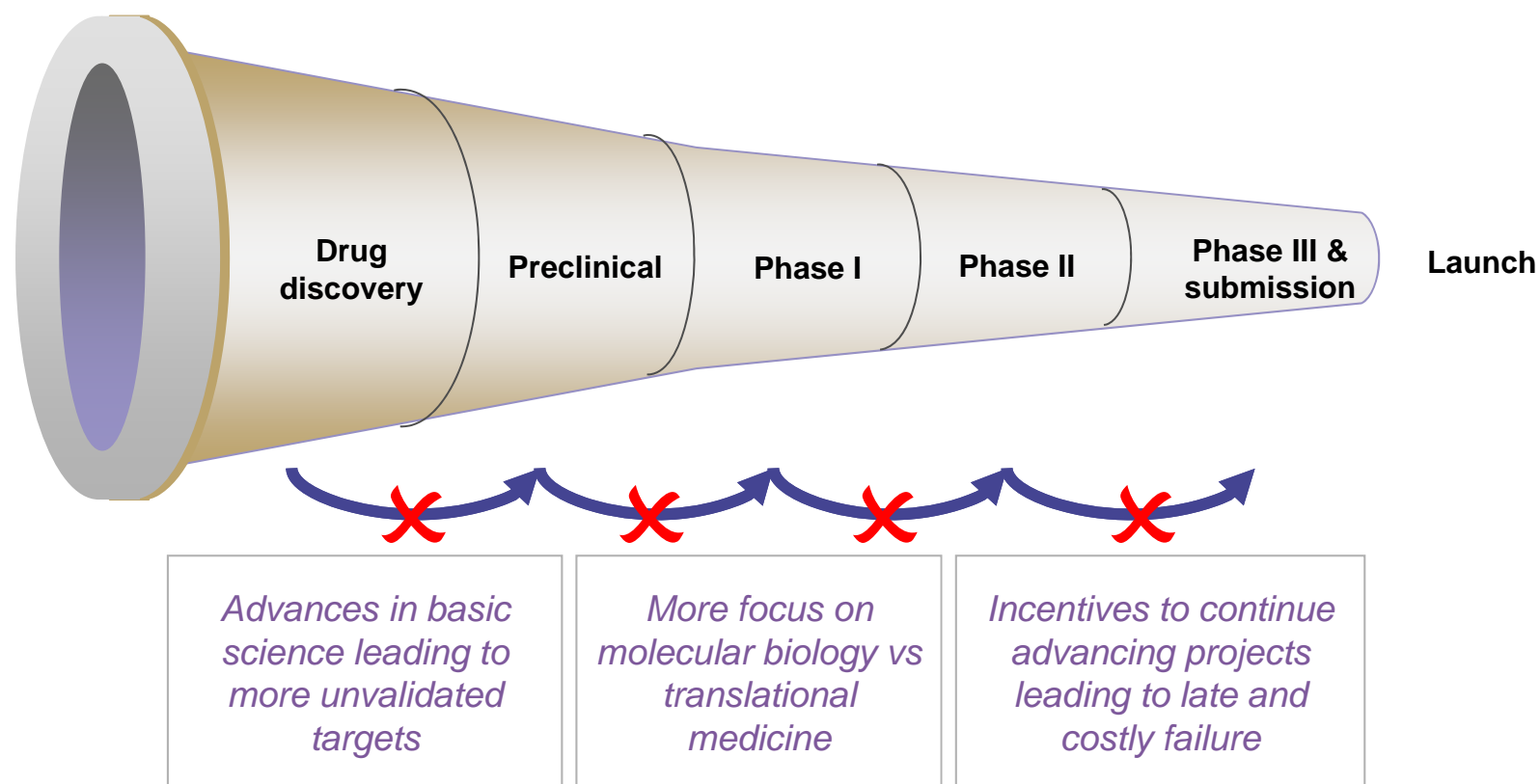
In spite of remarkable scientific progress, **our capacity to translate those advances into health benefits** has decreased

The number of biological targets has dramatically increased thanks to **progress made in the field of genomics**

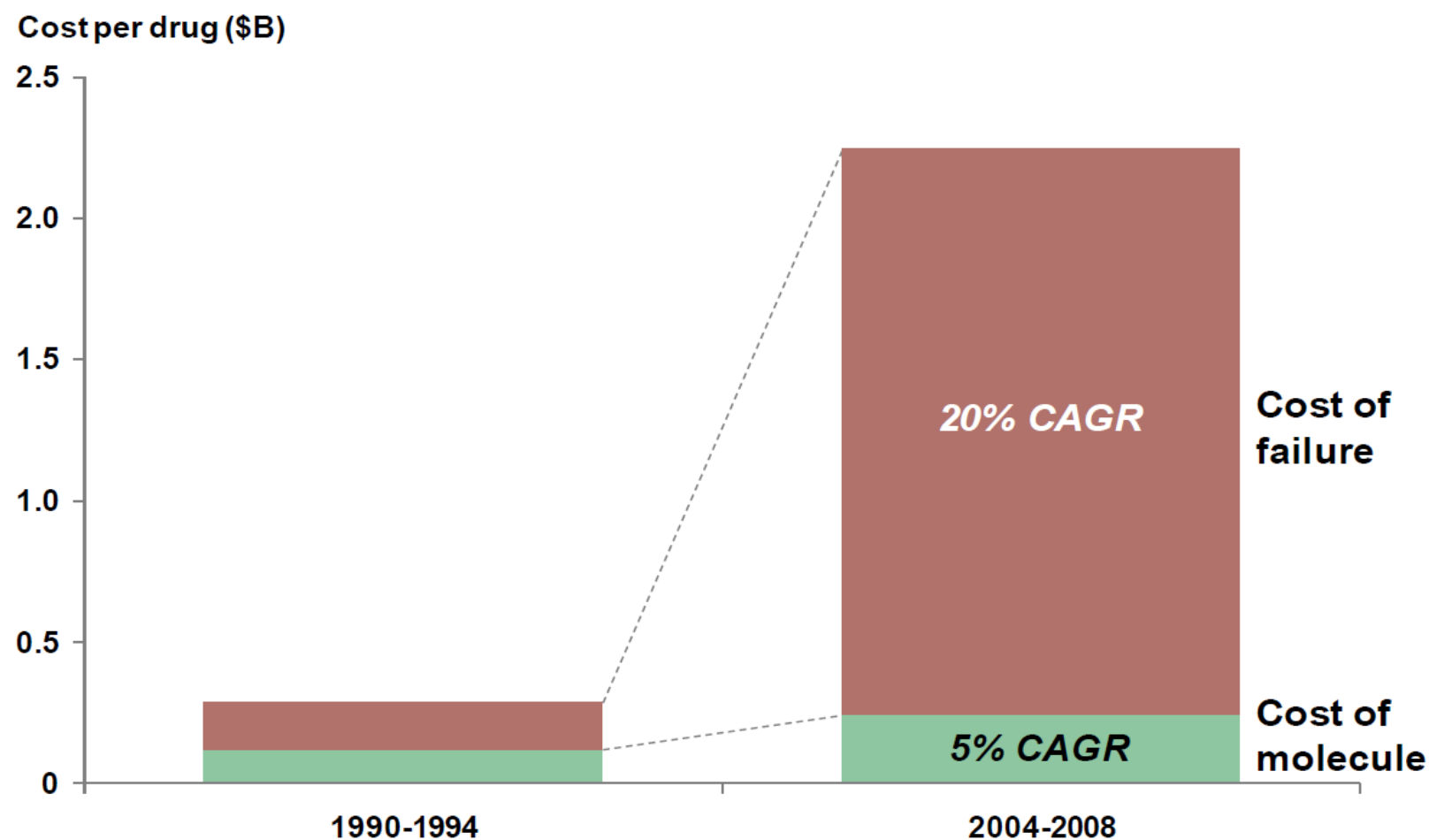
In the biopharmaceutical sector **success rate has dropped** from 1/8 to 1/14 and **the length of development has doubled**



It is a **SEARCH** problem



It is a **NOISY** problem



Source: The Boston Consulting Group

In a bigger storm

● Patient needs

- Acute to chronic
- Personalized
- Generics

● Payer driven market

- Differential medical value
- Rise of formularies
- Payment restrictions
- Price controls

● Regulation

- Regulatory burden
- Safety thresholds
- Postmarketing requirement
- Longer R&D cycles

● Science

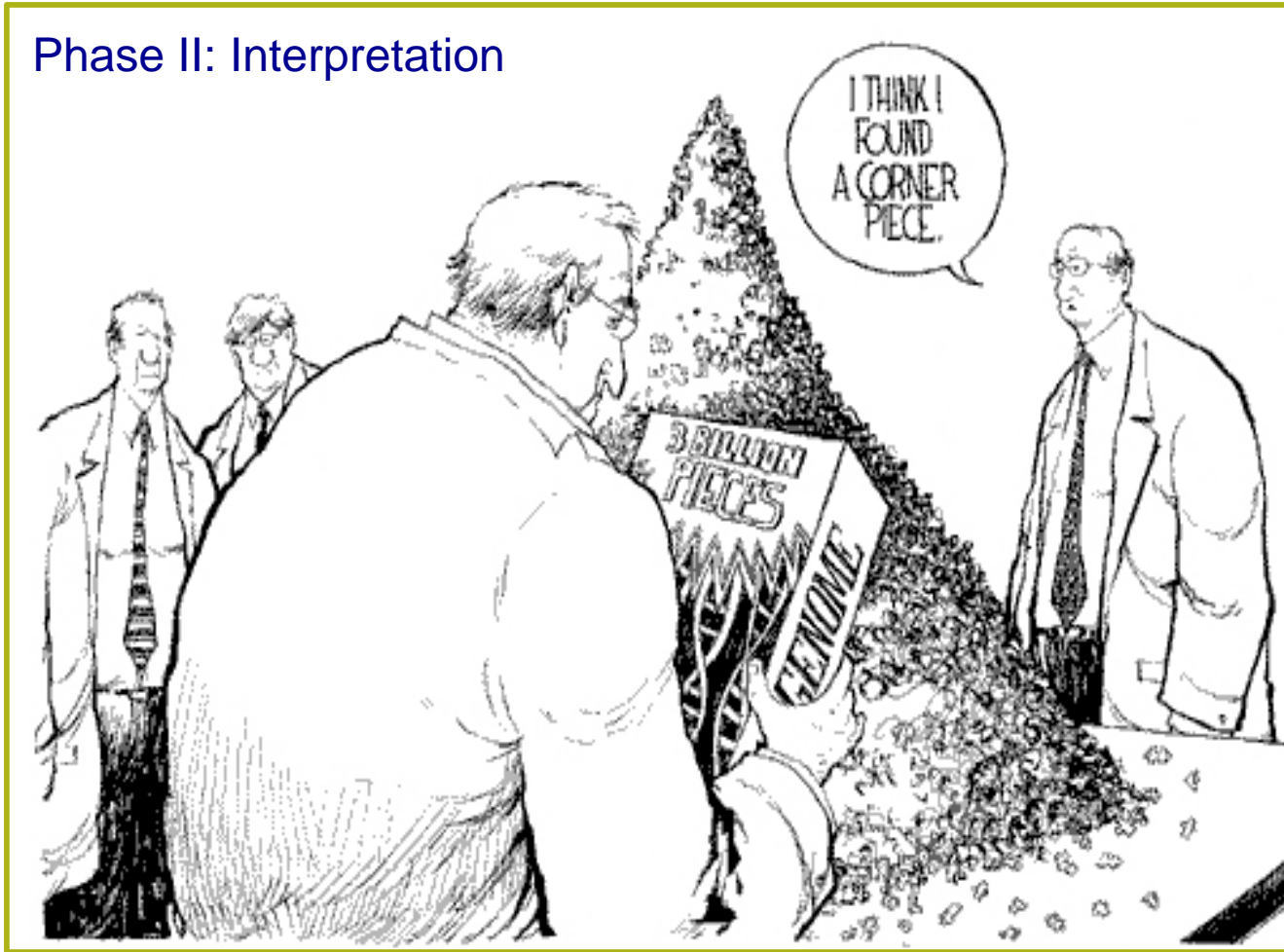
- Low predictability in humans
- Low success rates
- Low overall efficiency

Its About the Human Biology – So let's start There!

- Disease Relevance – need systems to access or collect patient/population data and materials to define medical need
- The human disease and how it is/will be treated must guide even early development
- The capacity to develop, use and interpret phenotypes, signatures and markers that are pragmatic and integral to all levels of discovery, development and commercialization
- Start with the patient/population and work backwards until you fall onto the target

Phase I: Sequence Human Genome

Phase II: Interpretation

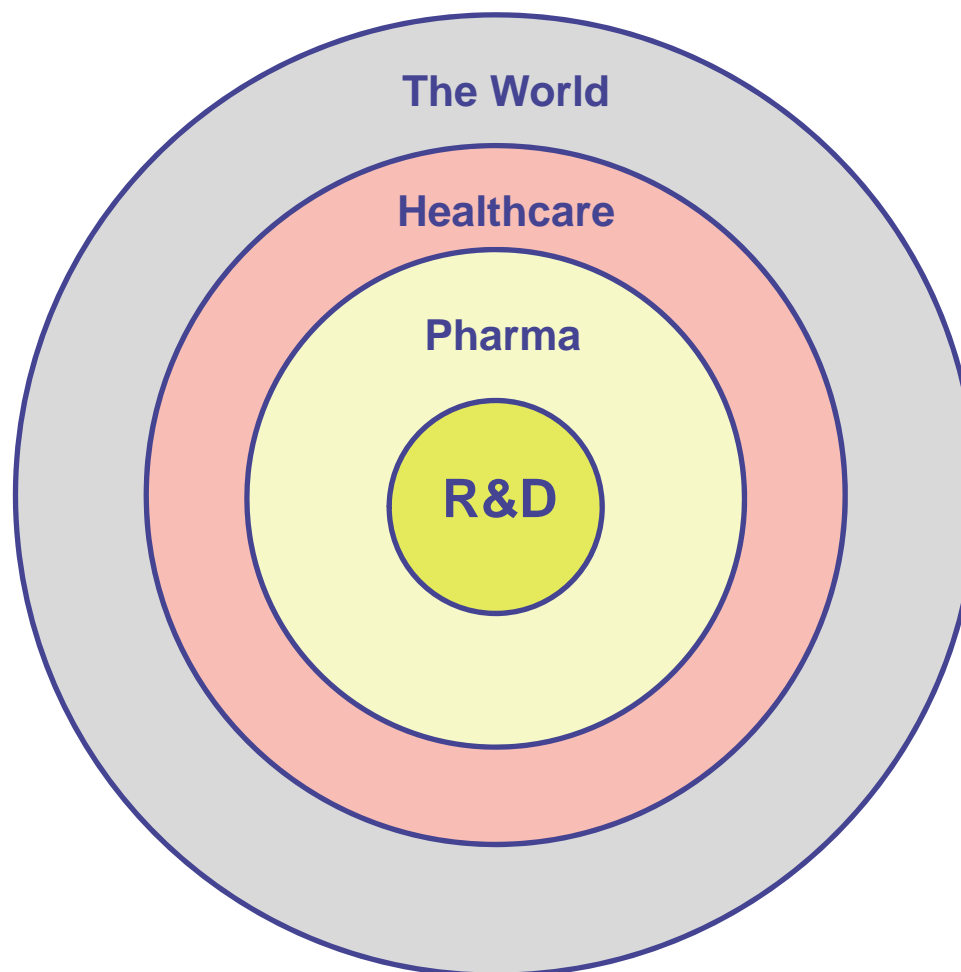




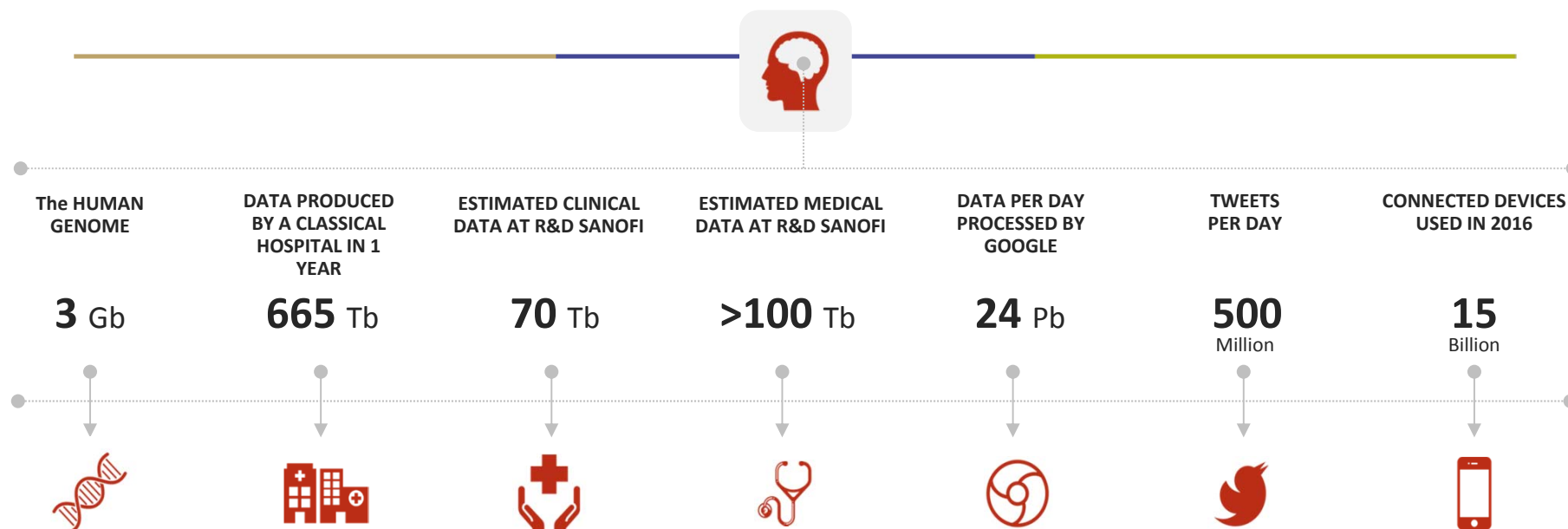
What do we mean by Big Data?

What is it?

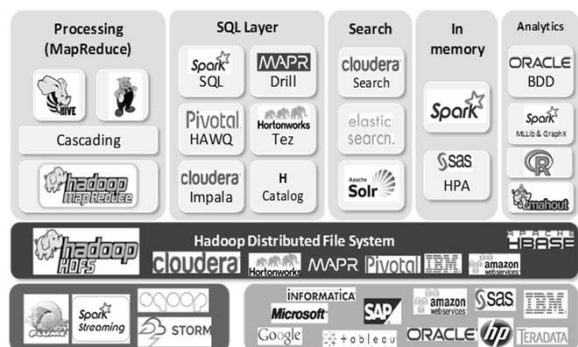
- **All** of the data, not just a sample
- **Real World** data, not just research output
- Collected in **Real Time**
- Collected for one purpose **being used for another purpose**
- **Structured and unstructured**
- **Multiple formats** – images, audio, text...
- Curated & uncurated (**messy**) data



Big Data is a reality

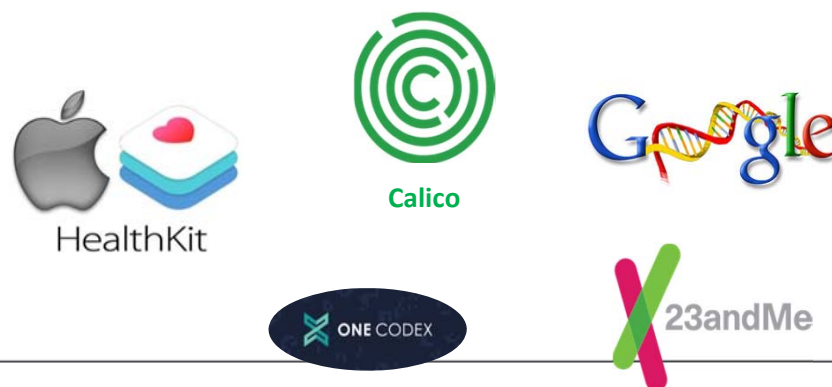


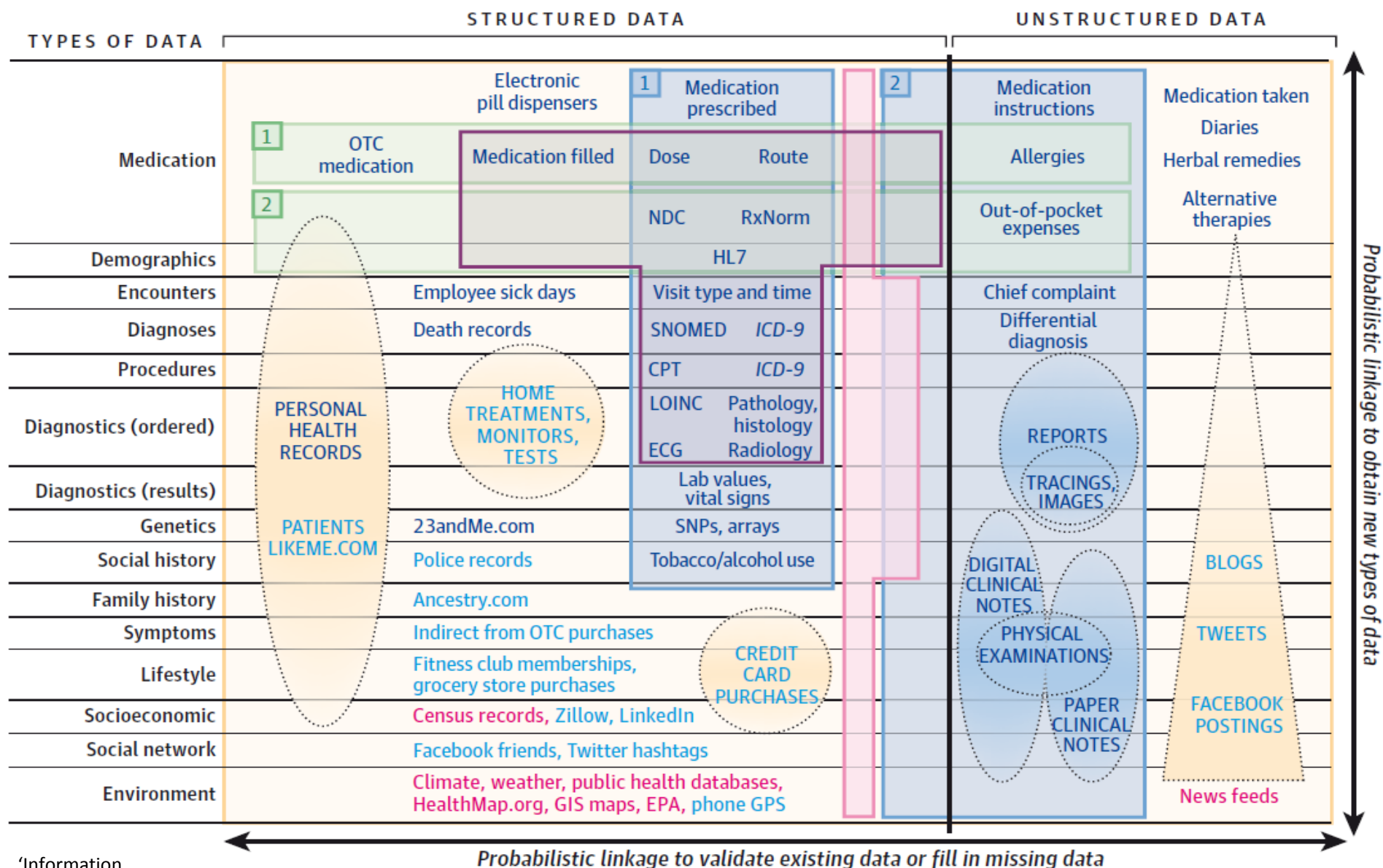
Big Data Technology ecosystem overview



SANOFI

Companies are moving into that space in healthcare





'Information Sources That May be Linked to an Individual for Use in Health Care'
Weber, Mandl, and Kohane; *JAMA* June 25, 2014, p. 2480

Examples of biomedical data

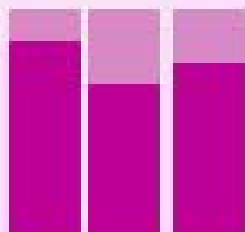
- 1 2 Pharmacy data
- 1 2 Health care center (electronic health record) data
- Claims data
- Registry or clinical trial data
- Data outside of health care system

Ability to link data to an individual

- Easier to link to individuals
- Harder to link to individuals
- Only aggregate data exists

Data quantity





VOLUME

THE AMOUNT OF DATA GENERATED
BY ORGANISATIONS OR
INDIVIDUALS



VELOCITY

THE FREQUENCY AND SPEED
AT WHICH IT IS GENERATED,
CAPTURED AND SHARED



VARIETY

THE NEW TYPES OF DATA
GENERATED



VERACITY

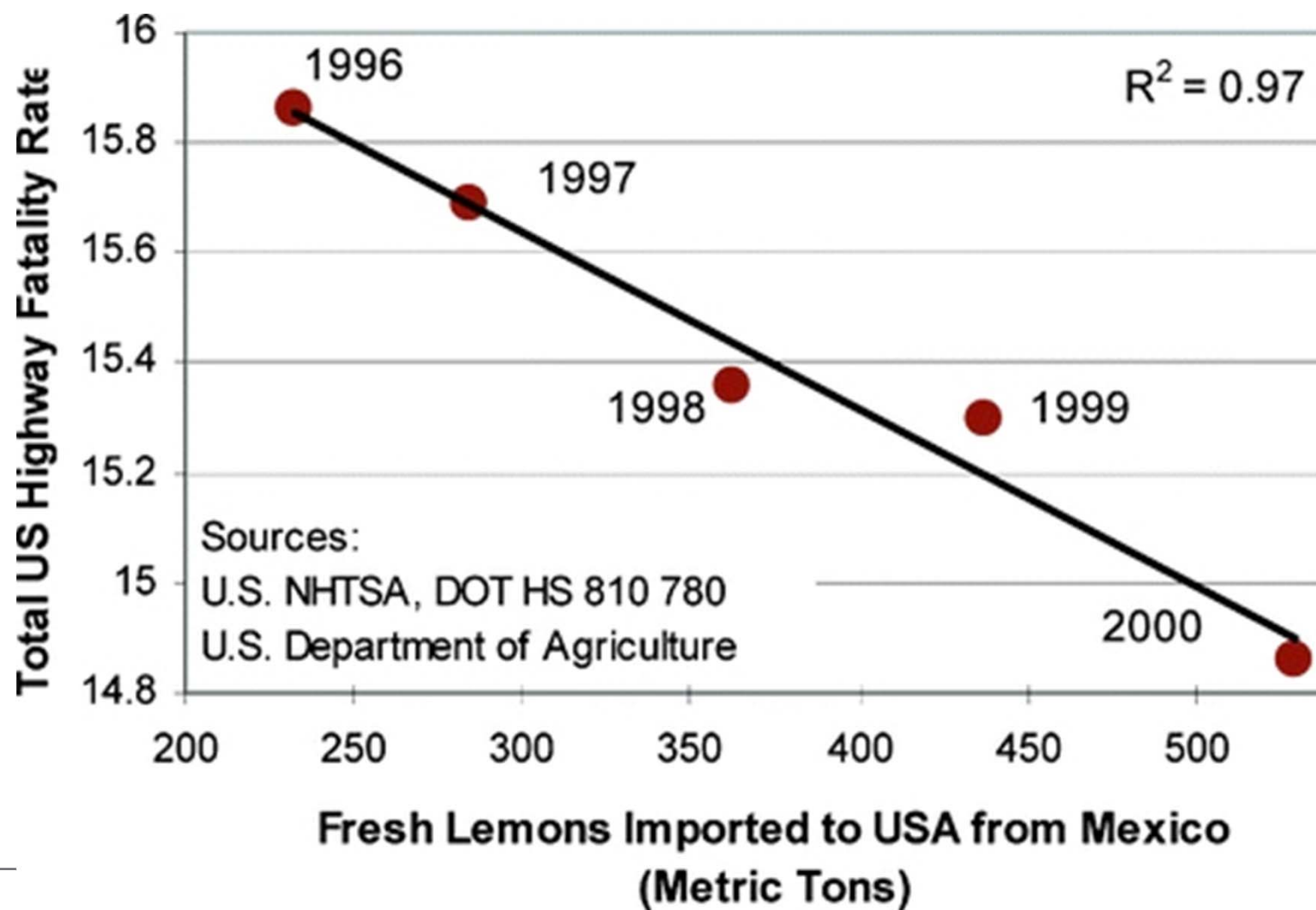
TO WHAT EXTENT CAN WE
TRUST THE DATA AND THE
OUTPUT?



VALUE

HOW CAN WE ENSURE A
RETURN ON INVESTMENT?

Mexican Lemons Prevent Highway Death



Big Data: the talk of the town!

Critical importance of predictive analytics.

google.org Flu Trends

[Google.org home](#)

[Dengue Trends](#)

Flu Trends

Home

Select country/region

[How does this work?](#)

[FAQ](#)

Explore flu trends around the world

We've found that certain search terms are good indicators of flu activity. Go to estimate flu activity. [Learn more »](#)



Flu activity

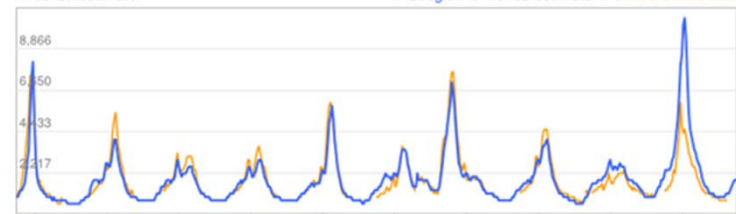
Intense
High
Moderate

Historical estimates

See data for: United States

United States Flu Activity

Influenza estimate



United States: Influenza-like illness (ILI) data provided publicly by the [U.S. Centers for Disease Control](#)

Do you know what's 'in store' for your customers?

Macy's enhances its customers' online shopping



Challenge

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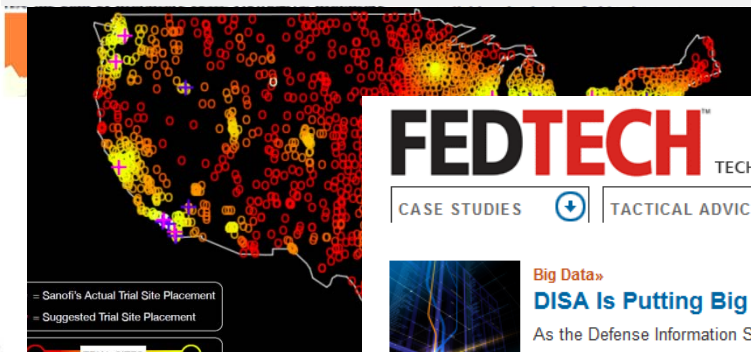
Toward Personalized Care Management of Patients at Risk - The Diabetes Case Study

Hani Neuirth, Michal Ozery-Flato,
Jonathan Laserson, Michal Rosen-Zvi
Machine Learning and Data Mining group
IBM Research
Mount Carmel, Haifa, 31905, Israel
{hani, ozery, ljon, rosen}@il.ibm.com

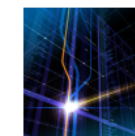
Jianning Hu, Martin S. Kohn,
Shahram Ebadollahi
Healthcare Transformation group
IBM Research
IBM T.J. Watson Research, Hawthorne, NY
{jyhu, marty.kohn, ebad}@us.ibm.com

ABSTRACT

Localot Trial Site Placement For Future AS Studies



FEDTECH TECHNOLOGY INSIGHTS FOR LEADERS
CASE STUDIES | TACTICAL ADVICE | RESOURCES

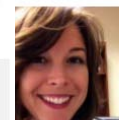


Big Data»

DISA Is Putting Big Data to Work

As the Defense Information Systems Agency loads more data into its analytics cloud, it aims to ensure that users can easily glean intelligence. [more »](#)

TECH 2/16/2012 @ 11:02AM | 2,389



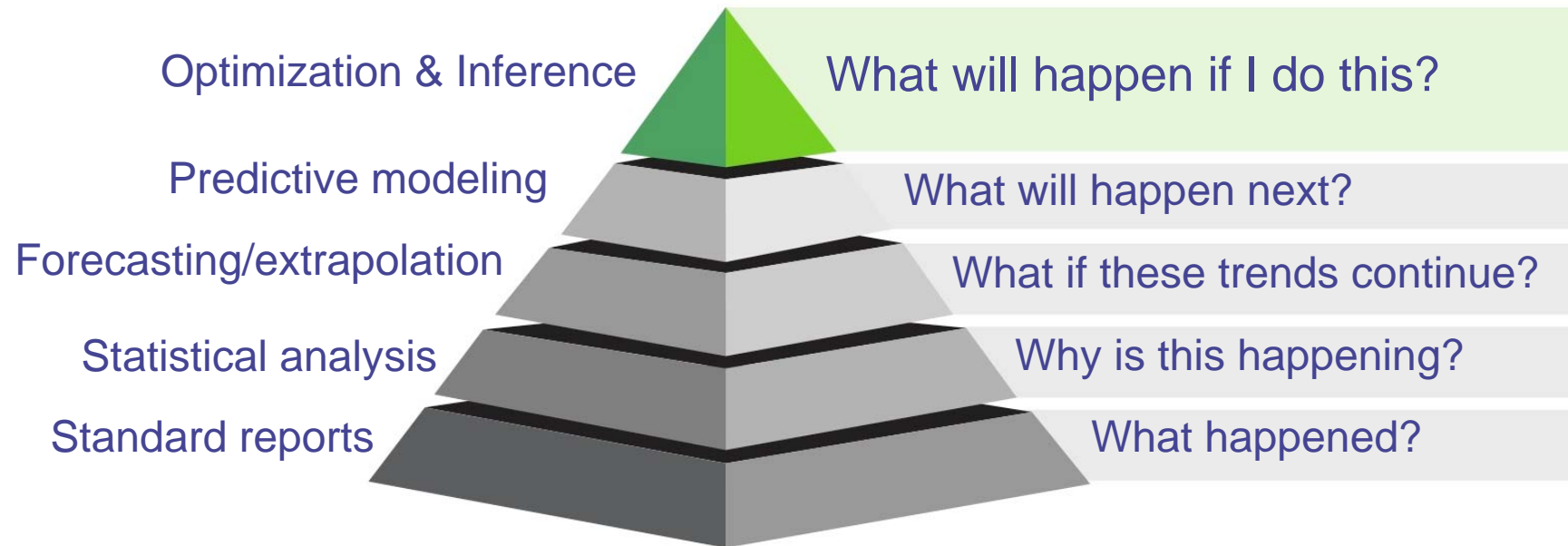
How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did

334 comments, 173 called-out + Comment Now + Follow Comments

Every time you go shopping, you share intimate details about your consumption patterns with retailers. And many of those retailers are studying those details to figure out what you like,

The Strategic Value of Big Data Analytics

Its not just about volume or speed, its about what it can tell you



The Perfect Opportunity

Interventions



Massive increase in number and cost of interventions

Machine Learning



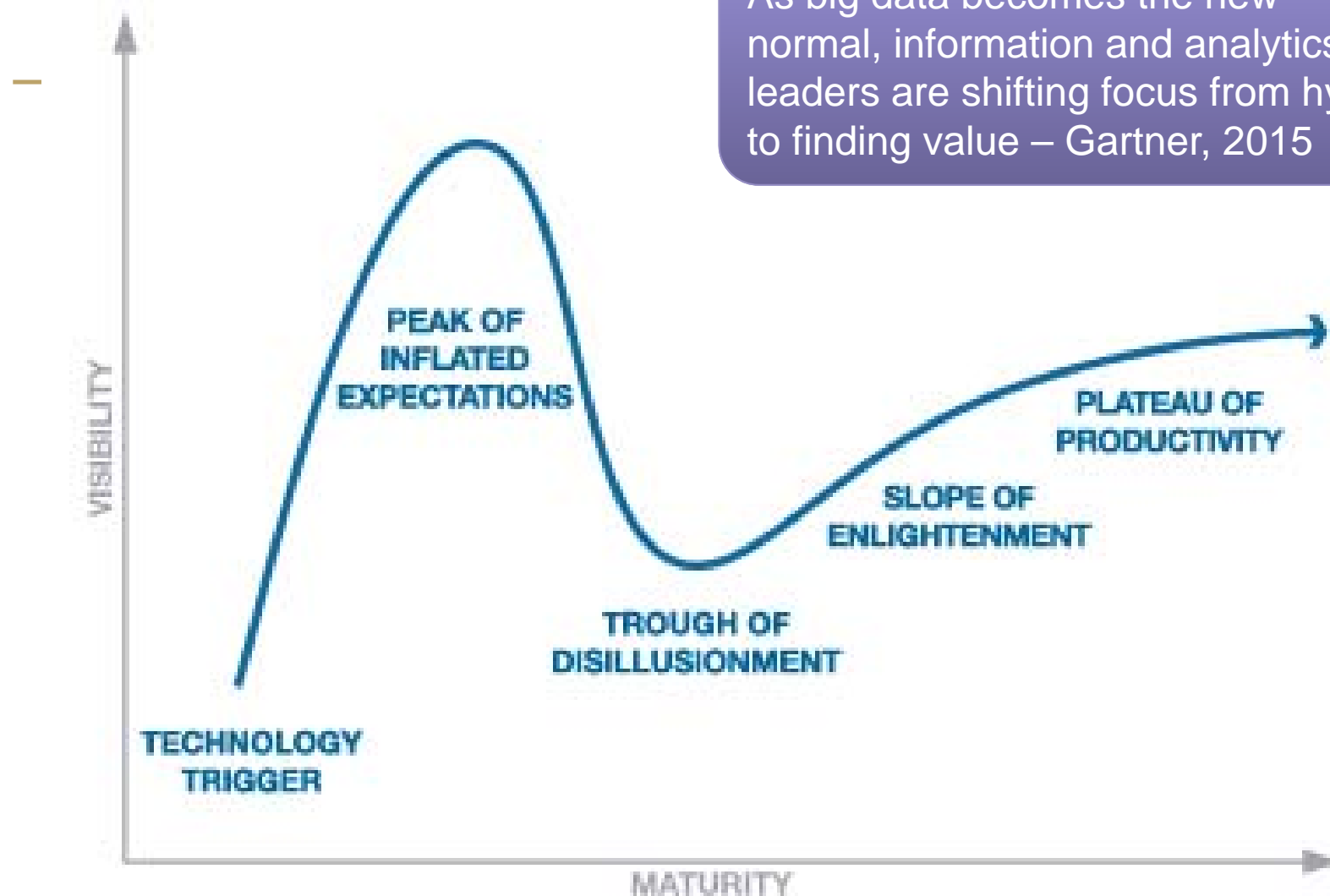
Breakthroughs in machine learning & cloud computing

Data

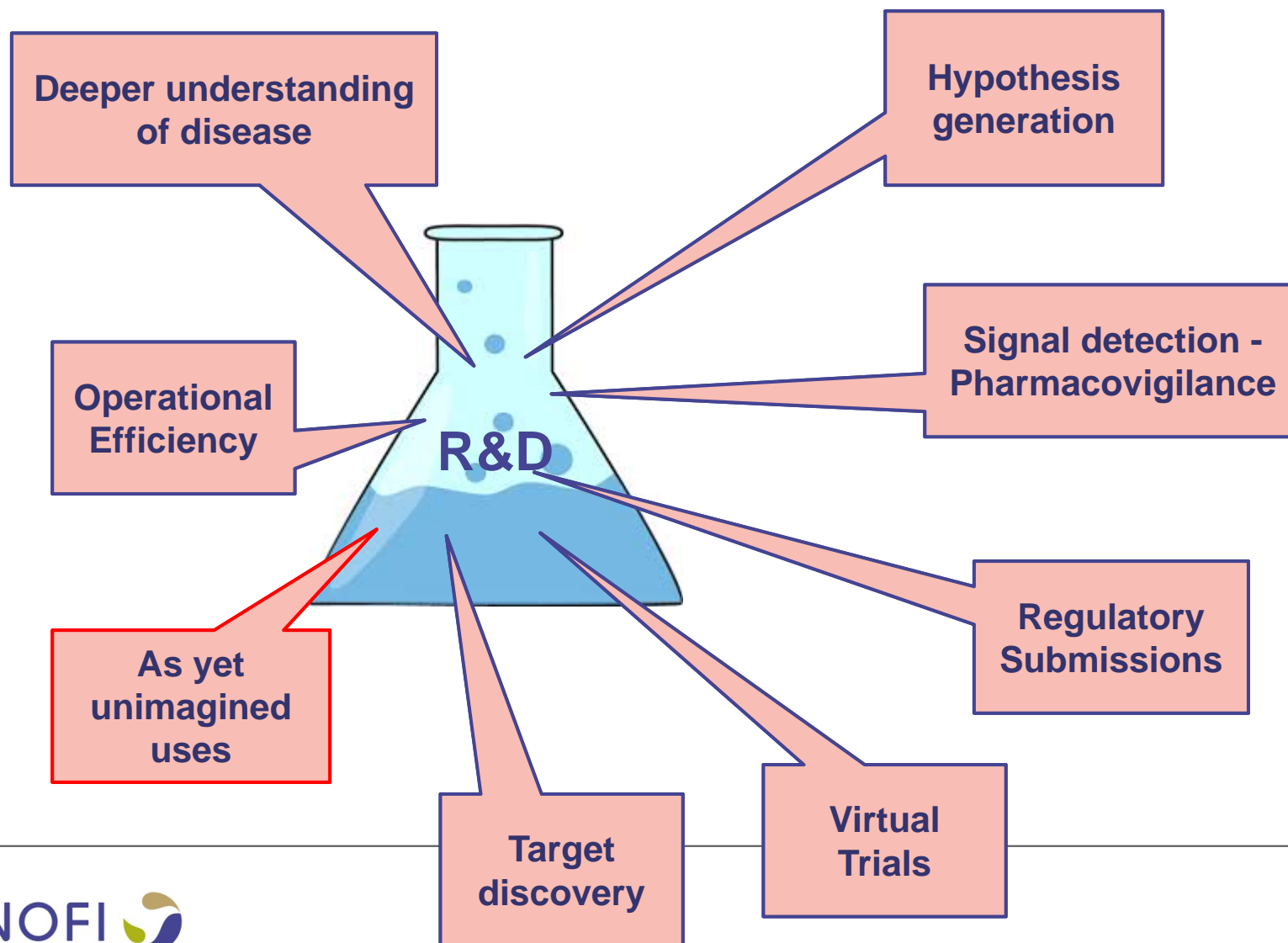


Exponential increase in data and investments to leverage it

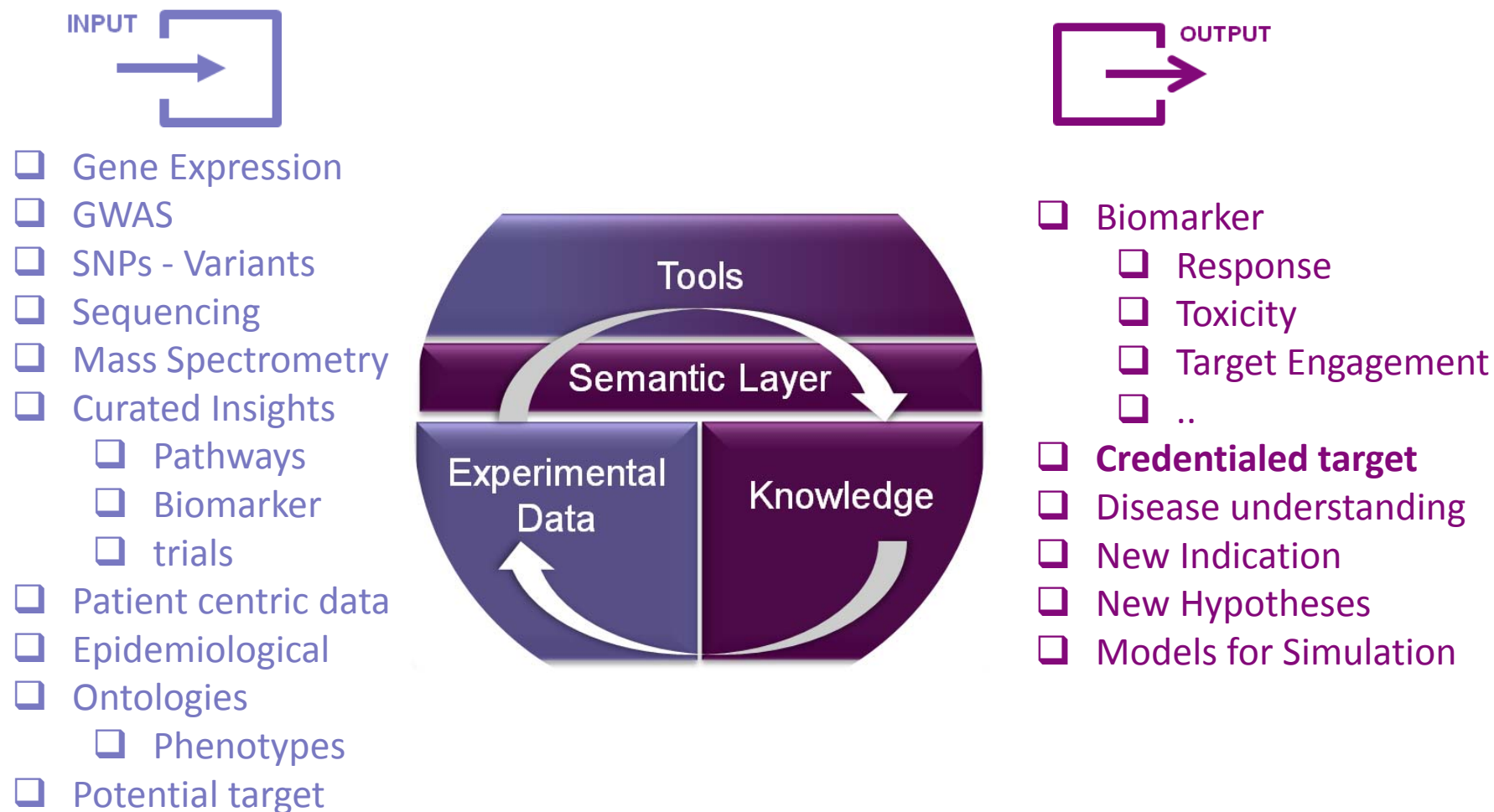
As big data becomes the new normal, information and analytics leaders are shifting focus from hype to finding value – Gartner, 2015



“Big Data” has great potential for R&D

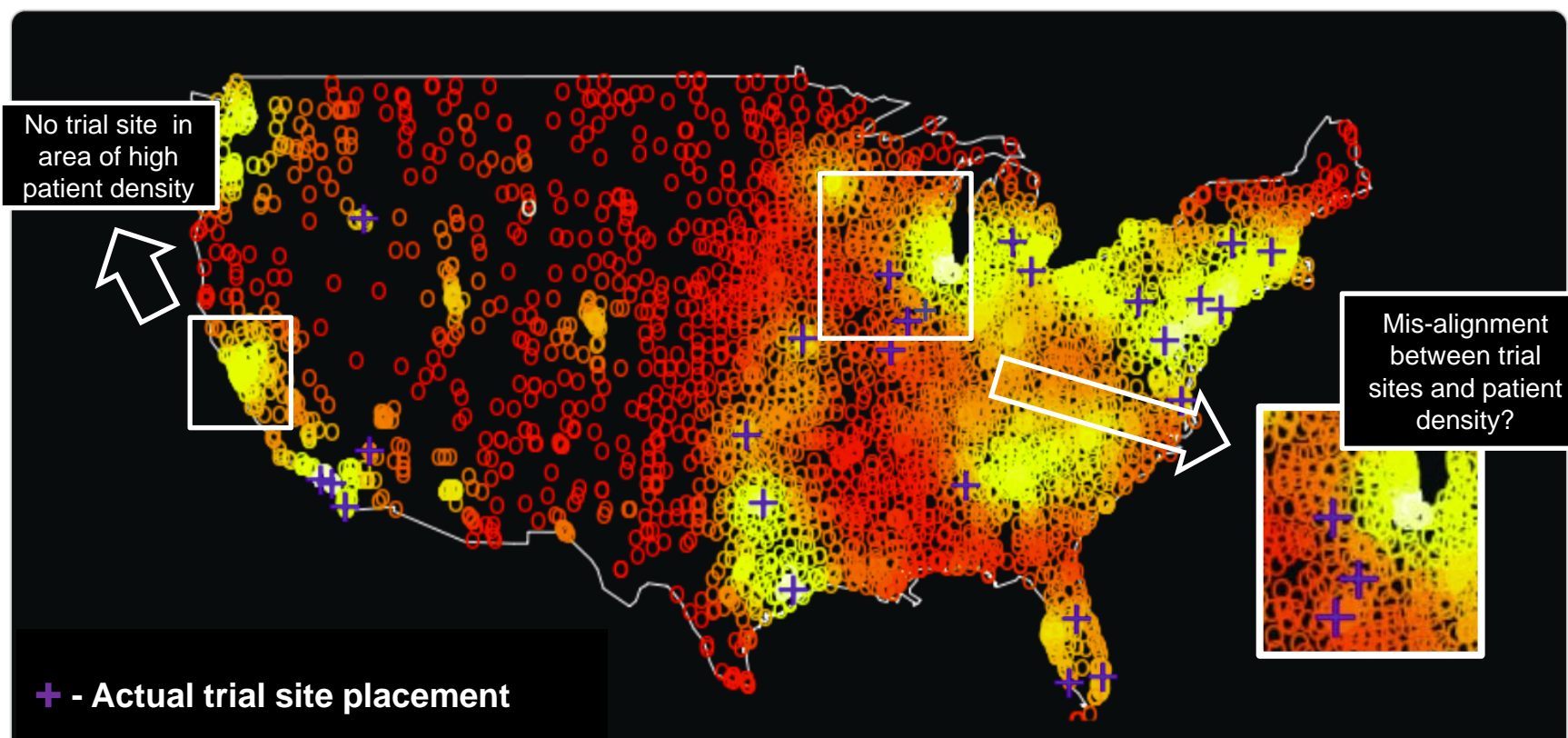


Sanofi's TM4P project in Translational Science:



Big Data Opportunities: running trials where the patients are

Patient Heat-map based on publicly-available information



Sanofi R&D Big Data Initiative



Start pilot projects with clear scientific or medical value



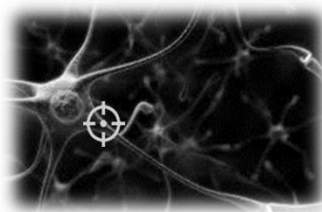
Use these pilots to build first common capabilities



Build partnerships for implementation

6 Main Opportunity Areas Identified

**Target identification and
credentialing**



**Clinical Trials
Simulation**



**Pre-clinical Simulation
and prediction
(Chemistry,
Toxicology...)**



**Predictive Pharmaco-
Vigilance & Safety**



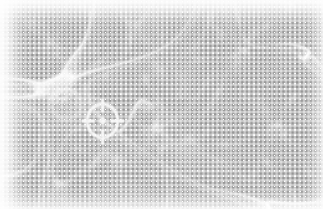
Patient stratification



**Real-World / Patient data
for integrated care**

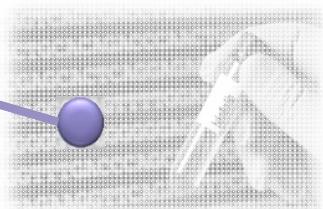


First projects cover a wide spectrum of areas



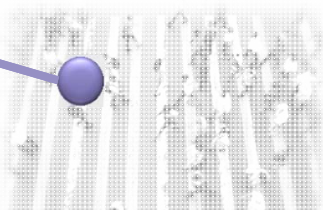
Improve the quality of Clinical Trial Simulation predictions and decisions by using hospital, real word payor and clinical study data

Develop methods to predict developmental and reproductive toxicity outcomes, by building a library of mechanistic “pathways of toxicity”



Assess the real ability of identifying relevant early signals from Patient forum data on 3 of our marketed products

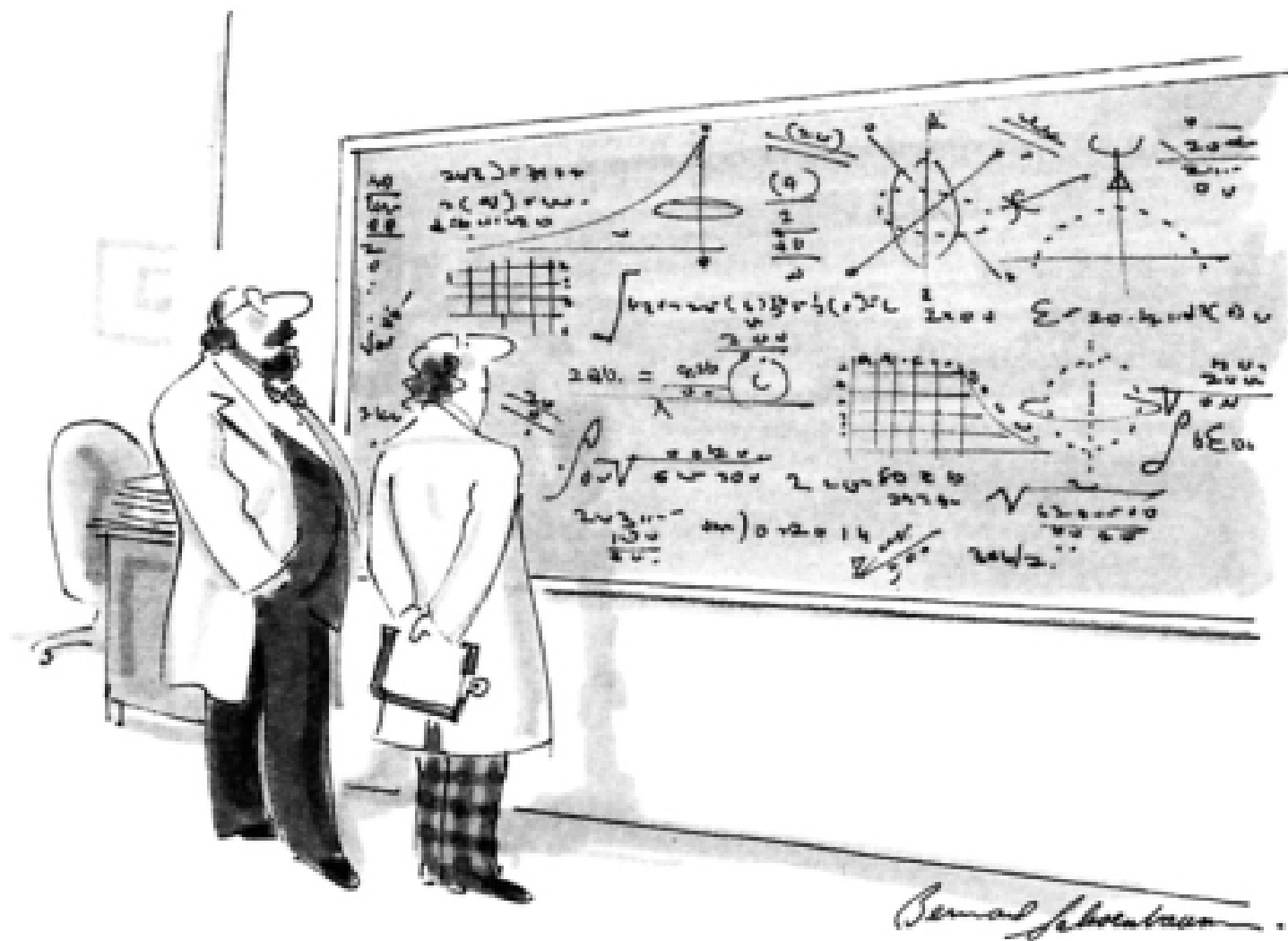
Discover novel differentially expressed genes between subpopulations and select the most appropriate populations for our clinical trials



Sanofi-Google partnership

Baseline Study

A systems biology study of human health and the transition to disease



"Oh, if only it were so simple."

Big Data Policy to be addressed

- **Boundary Challenges**
 - Data standards & harmonization
 - Data localization
 - Access to non-public data (owned by others, particularly governments)
- **Confidentiality Challenges**
 - Individual Privacy and Data Confidentiality
 - Patient consent
 - Special considerations for genomic data
- **Regulatory Challenges**
 - Regulatory use of big data
 - Use of big data in submissions

Making use of Big Data – Are we ready change our mindset?

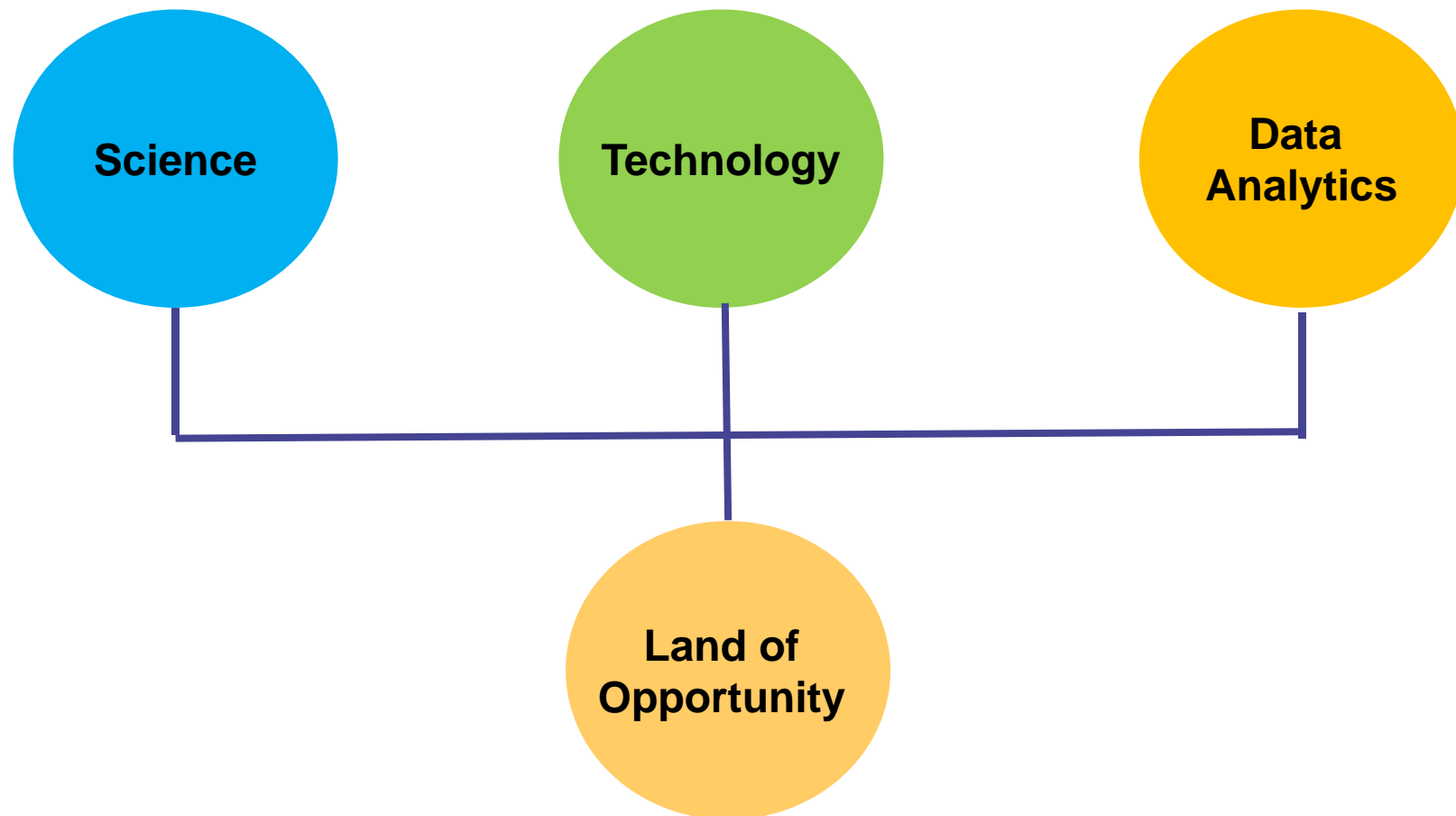
- Can we learn to start with the data, not the hypothesis?
- Are we comfortable with knowing there is a correlation without necessarily understanding the causality -- knowing 'what', not 'why'?
- Can we learn to change the tires on a moving car? Making good use of real-time big data demands analysis in motion.
- Are ready explore approaches that examine the whole population and not a controlled samples?
- How do we bring mathematics and engage mathematicians in our work?
- Are some big data tools and analytics pre-competitive?

Not so fast! It's not without risk.....

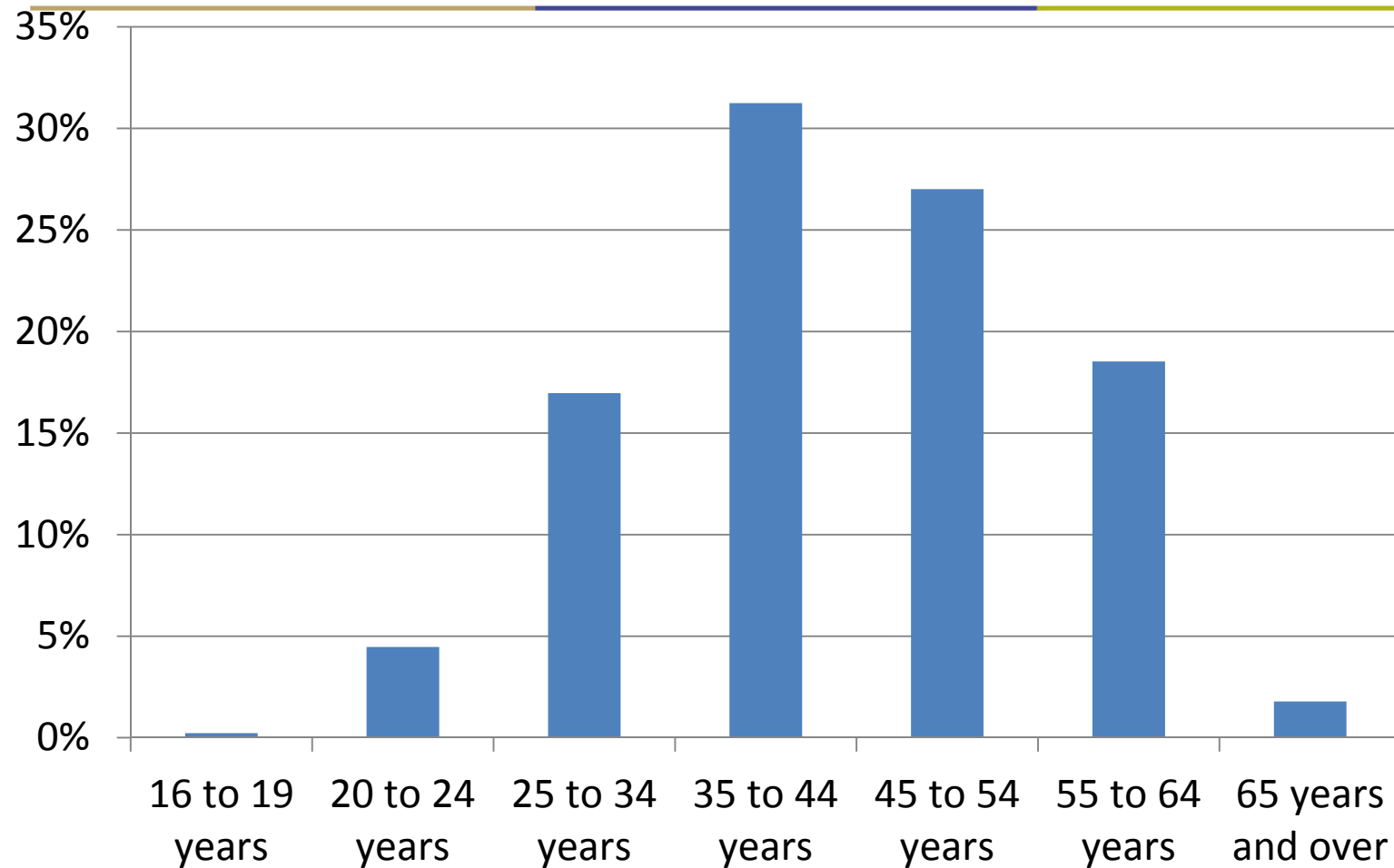
- Doesn't tell us which correlations are meaningful
- Risk of spurious correlations because of the magnitude of the data
- Rarely succeeds as a wholesale replacement for scientific enquiry
- Tools can be easily gamed
- Lack of accepted methodologies
- Can give scientific-sounding solutions to very imprecise questions
- Falls short when trying to analyze things that are not common
- Concerns about misuse of data about us and our products



Convergence: New Frontier



Part of the solution will come from generation shift



Preparing for the transformational tidal wave

“Big data will deliver transformational benefits to enterprises within two to five years, and by 2015, will enable enterprises adopting this technology to outperform competitors by 20% in every available financial metric.”

Gartner, 2012

Preparing for the transformational tidal wave

We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run

"Big data will deliver transformational benefits to enterprises within two to five years, and by 2015, will enable enterprises adopting this technology to outperform competitors by 20% in every available financial metric."

Gartner, 2012

The future is here, it's just not evenly distributed
William Gibson