Information Exchange and Data Transformation (INFORMED) Initiative

and the Role of Real World Evidence in Regulatory Science

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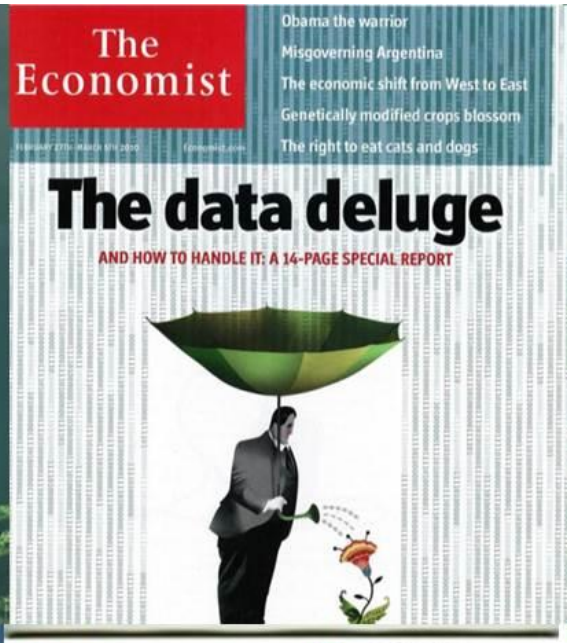
Disclosures: None

The views in this presentation are my own and do not necessarily reflect the policies of FDA


significance
statistics making sense
BIG DATA
SPECIAL ISSUE
DATA AND THE CITY
WHO ARE YOUR FACEBOOK FRIENDS?
MEET THE DATA FAMILY
THEIR EVERY MOVE RECORDED.

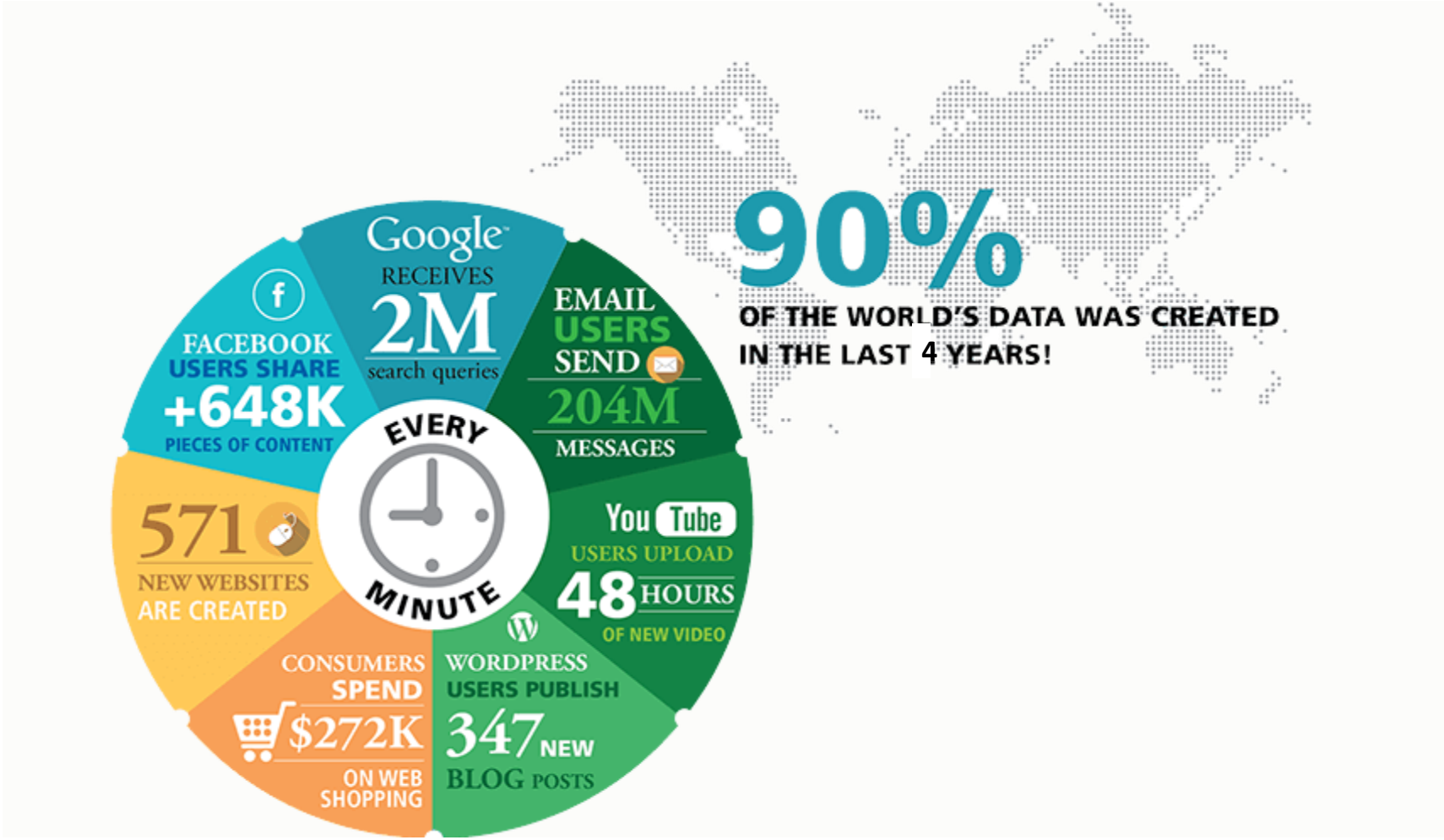

The Economist
Obama the warrior
Misgoverning Argentina
The economic shift from West to East
Genetically modified crops blossom
The right to eat cats and dogs
The data deluge
AND HOW TO HANDLE IT: A 14-PAGE SPECIAL REPORT


4 September 2008 www.nature.com/nature £10
THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE
nature
THE BITER BIT
Viral infections for viruses
TROPICAL CYCLONES
The strong get stronger
BLACK HOLE PHYSICS
A new window on the Galactic Centre
BIG DATA
NATUREJOBS
Minnesota musings


POPULAR SCIENCE
THE FUTURE NOW
THE CONTROL CENTERS
Using Data to Feed the World, Solve Cold Cases, Battle Malware, Predict Our Fate
OFFICER ALGORITHM
Can a Crime Be Prevented Before It Begins?
NEW WAYS OF SEEING
A Gallery of Extraordinary Infographics
PLUS
Juan Enriquez Reprograms Life
James Gleick Unsplits the Bit
AND
Lawrence Weschler Questions the Cloud
SPECIAL ISSUE
DATA IS POWER
HOW INFORMATION IS DRIVING THE FUTURE

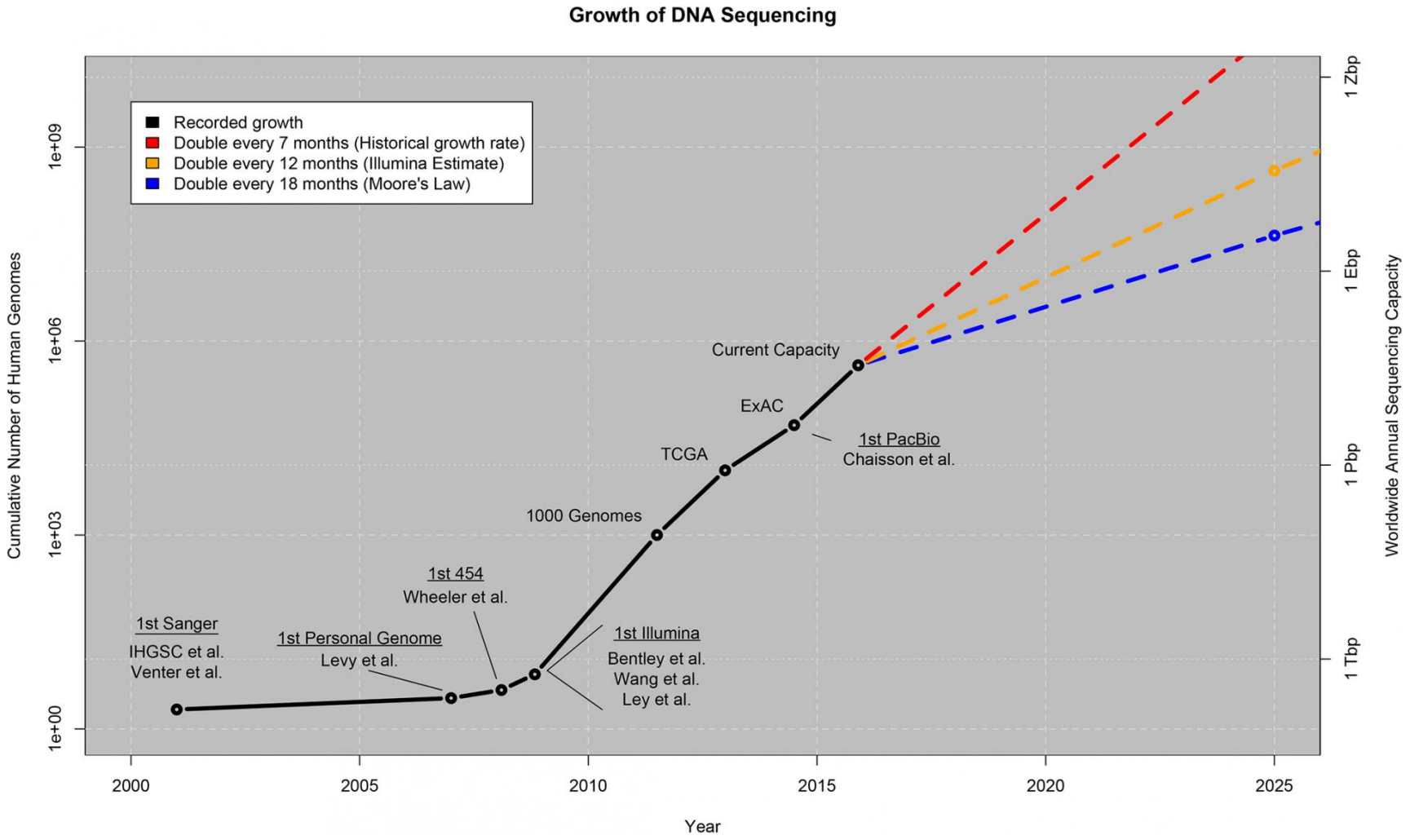

Harvard Business Review
The True Measures Of Success
10 Rules for Managing Global Innovation
What Ever Happened To Accountability?
GETTING CONTROL OF BIG DATA
How vast new streams of information are changing the art of management


GOVERNMENT'S BUSINESS MAGAZINE
MARCH/APRIL 2013
Government Executive
Does Government Ever Really Change?
Five Ways Women Get Ahead
BIG DATA
HOW IT'S MAKING AGENCIES SMARTER



About 3 quintillion bytes of data per day

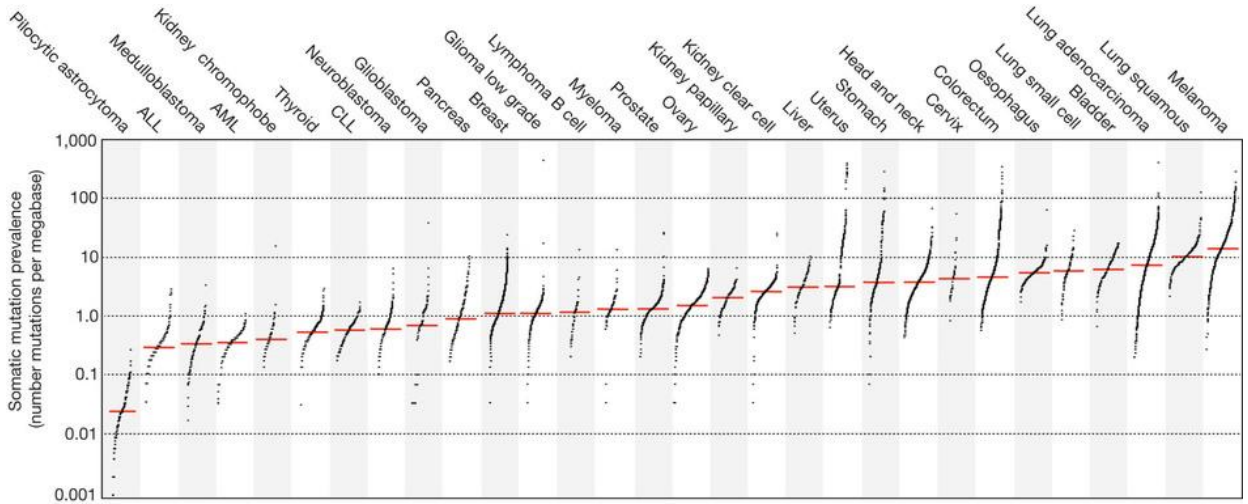
Big data pipeline in biomedicine



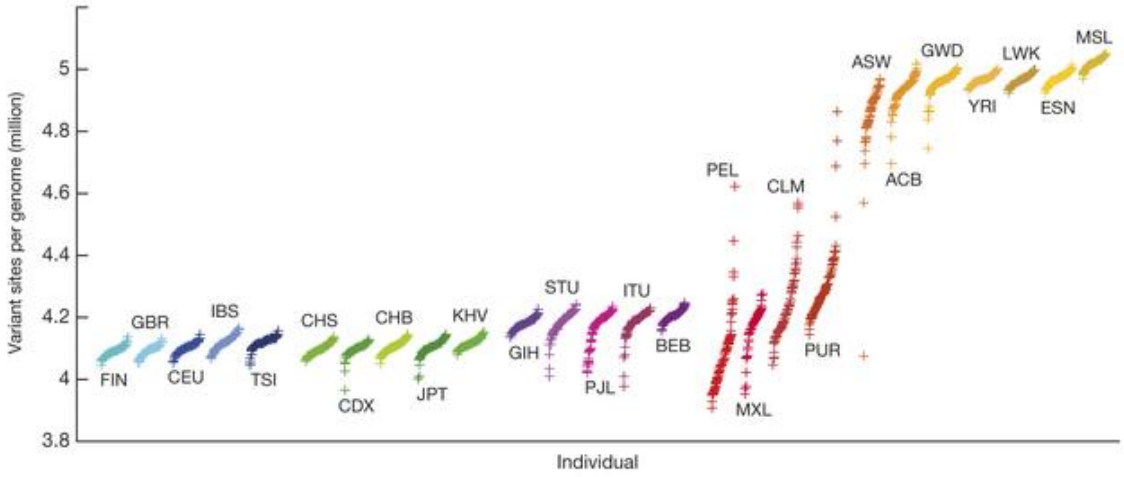
Stephens ZD, et al. PLoS Biol. 2015 Jul; 13(7): e1002195

Large amount of diversity

Tumor

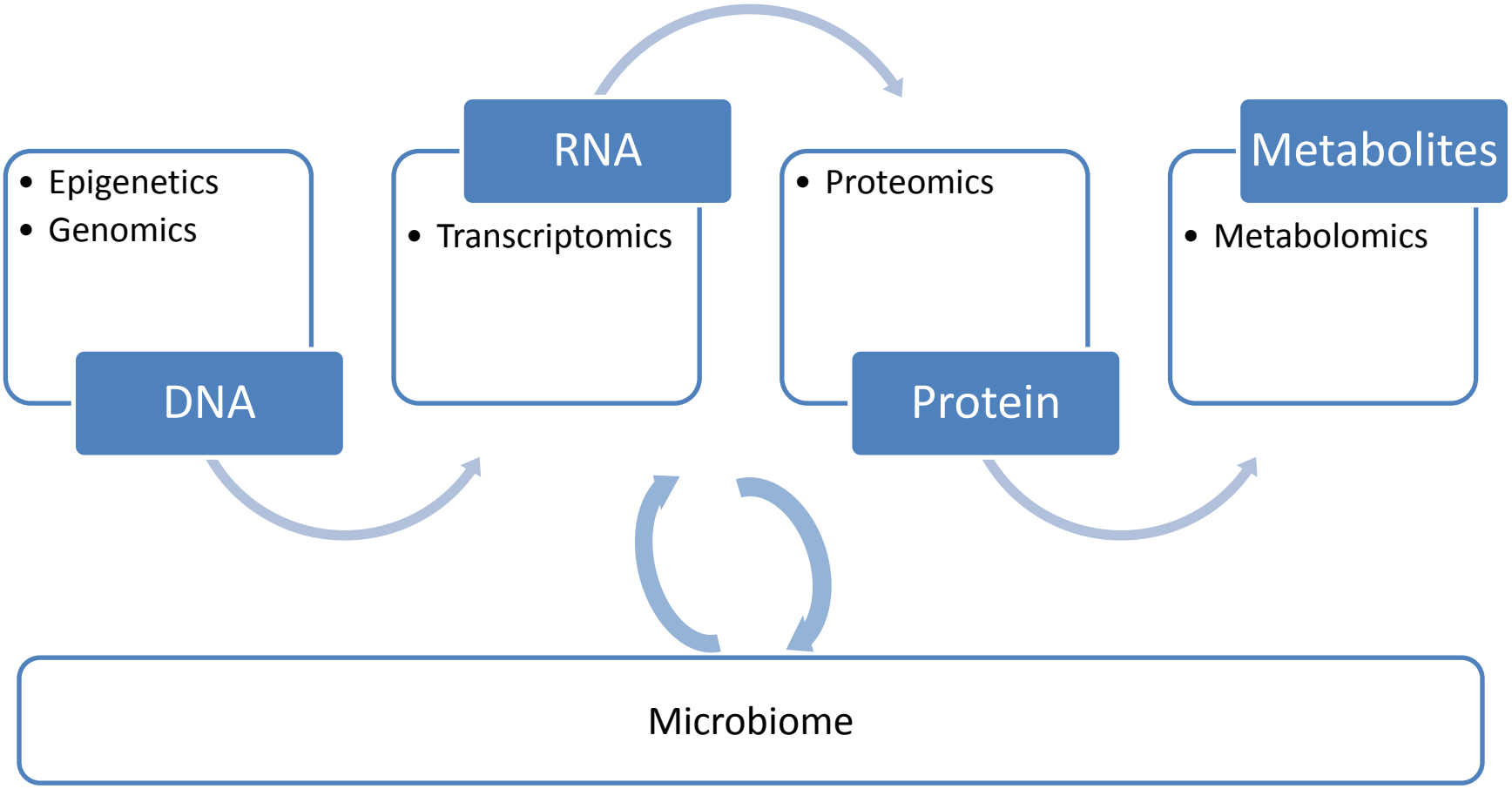


Individual

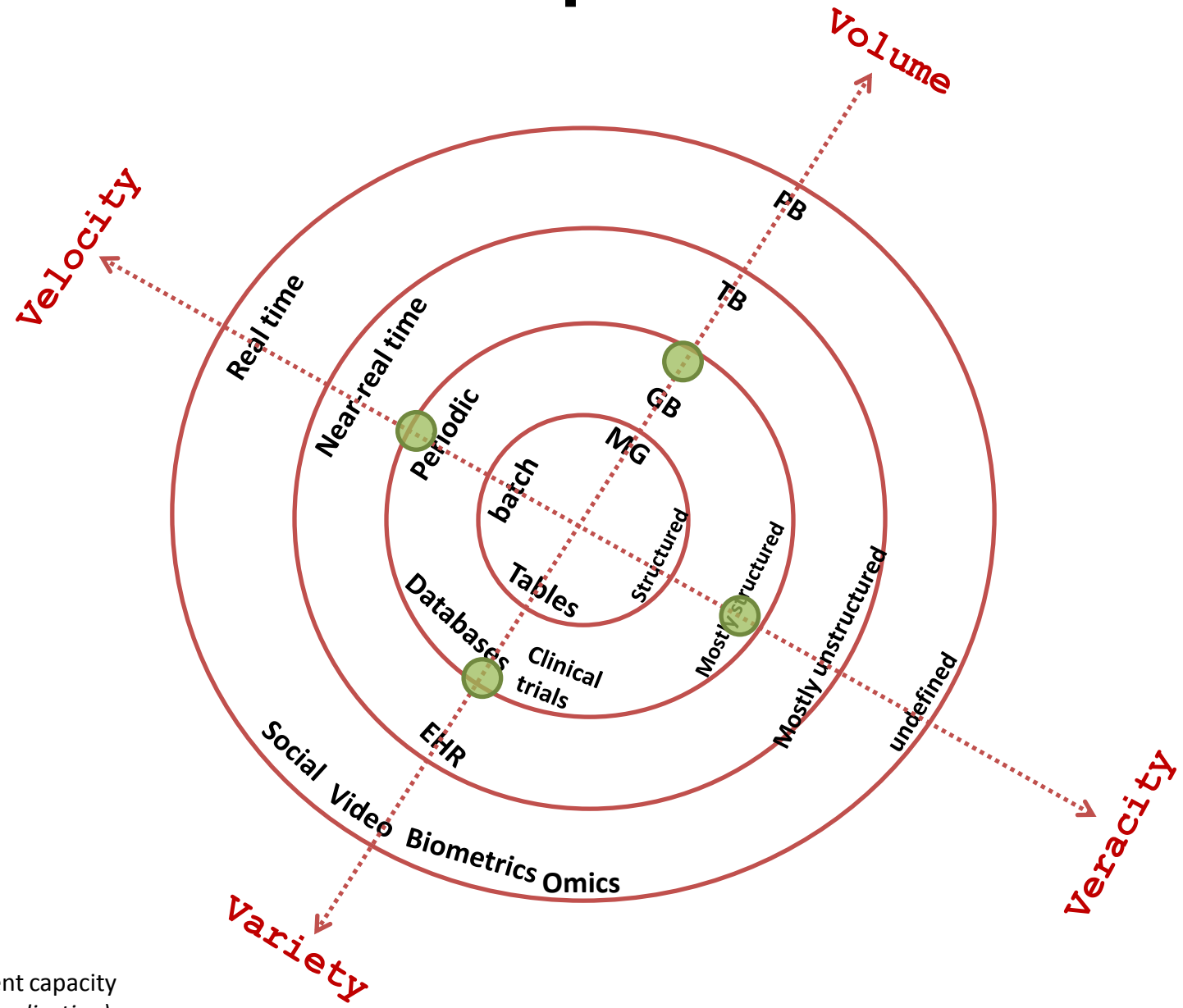


Alexandrov LB, et al. Nature. 500, 415–421 (22 August 2013)
The 1000 Genomes Project Consortium. Nature 526, 68–74 (01 October 2015)

Multiomics

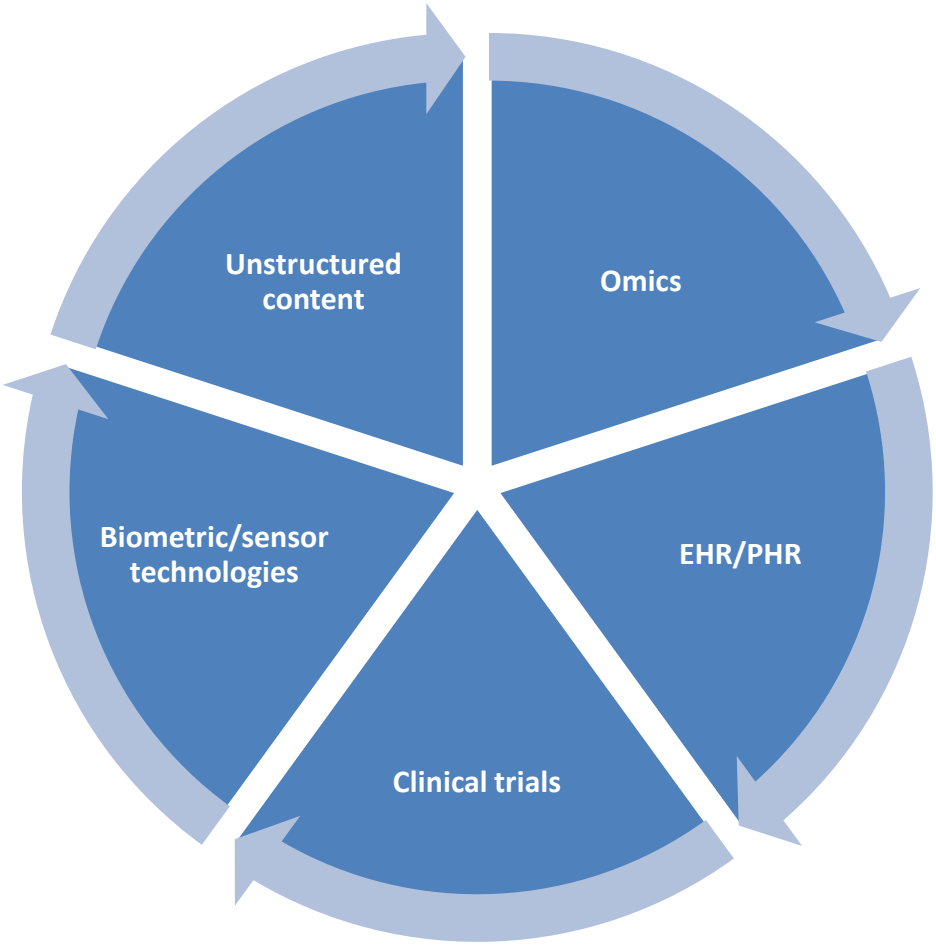

• Epigenetics
• Genomics
DNA
RNA
• Transcriptomics
• Proteomics
Protein
Metabolites
• Metabolomics
Microbiome

The expanding universe of big data in the biomedical enterprise



Current capacity
(generalization)

Must focus on breaking siloes



Why?

We are nearing the limits of siloed approaches

"Driver" mutations in non-small cell lung cancer (NSCLC):

	Adenocarcinoma	Squamous-cell carcinoma
EGFR	5–15%*	<5%†
ALK	5–15%	<5%
HER2	<5%	0
BRAF	<5%	0
KRAS	>15%	<5%
PIK3CA	<5%	<5%
AKT1	0	<5%
MAP2K1	<5%	0
MET	<5%	<5%

2010

Pao W, et al. Lancet Oncol. 2011 Feb;12(2):175-80.

	Frequency
Mutations	
KRAS	32·2%
EGFR	11·3%
NF1	8·3%
BRAF	7·0%
MET exon 14 skipping	4·3%
RIT1	2·2%
ERBB2	1·7%
HRAS, NRAS, MAP2K1	1·7%
Translocations	
ROS1	1·7%
ALK	1·3%
RET	0·9%
Amplifications	
MET	2·2%
ERBB2	0·9%

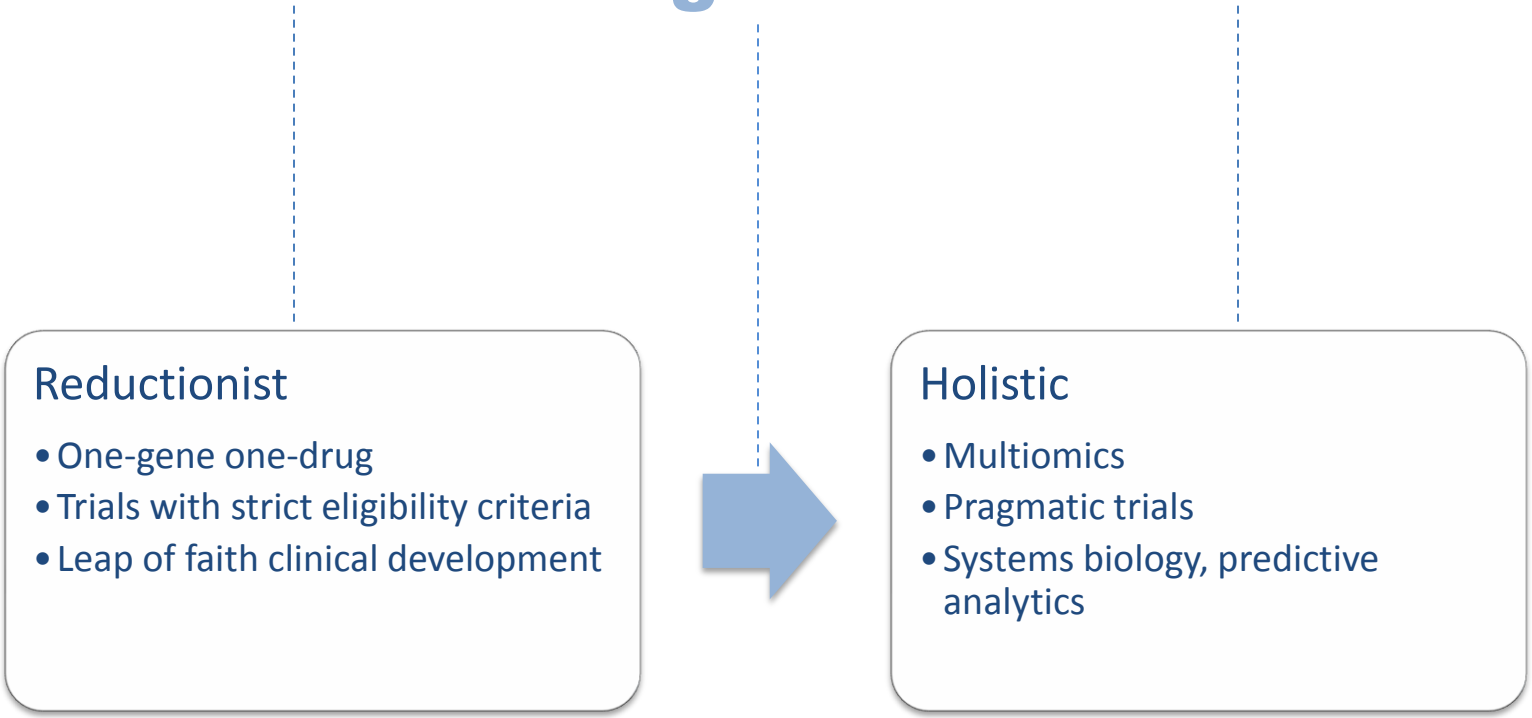
2015

Devarakonda S, et al. Lancet Oncol. 2015 Jul;16(7):e342-51.

NSCLC: 2016

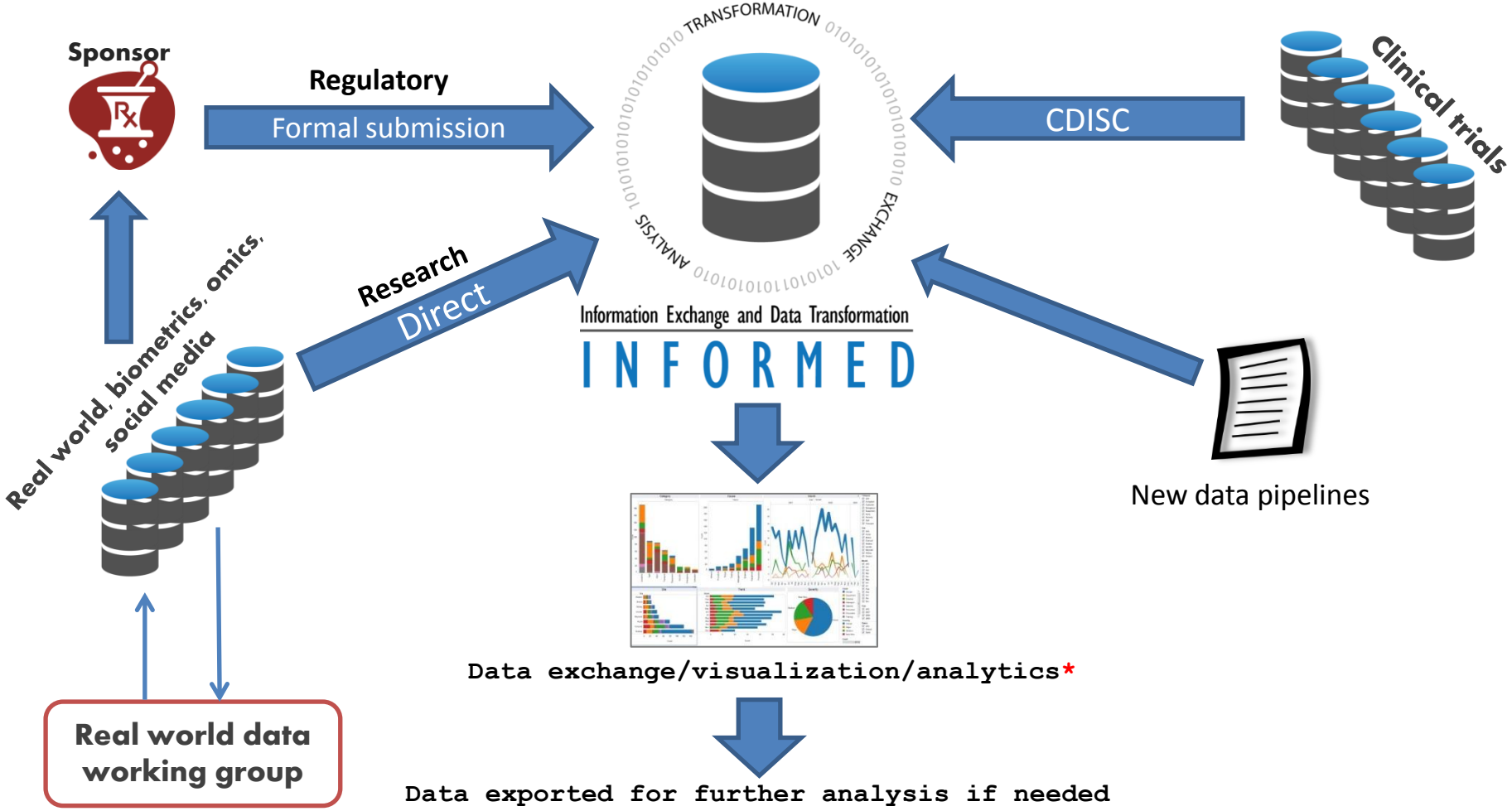
Gene	Alteration	Frequency in NSCLC
AKT1	Mutation	1%
ALK	Rearrangement	3–7%
BRAF	Mutation	1–3%
DDR2	Mutation	~4%
EGFR	Mutation	10–35%
FGFR1	Amplification	20%
HER2	Mutation	2–4%
KRAS	Mutation	15–25%
MEK1	Mutation	1%
MET	Amplification	2–4%
NRAS	Mutation	1%
PIK3CA	Mutation	1–3%
PTEN	Mutation	4–8%
RET	Rearrangement	1%
ROS1	Rearrangement	1%

Siloed data→ Big Data → Smart Data



Information Exchange and Data Transformation (INFORMED)

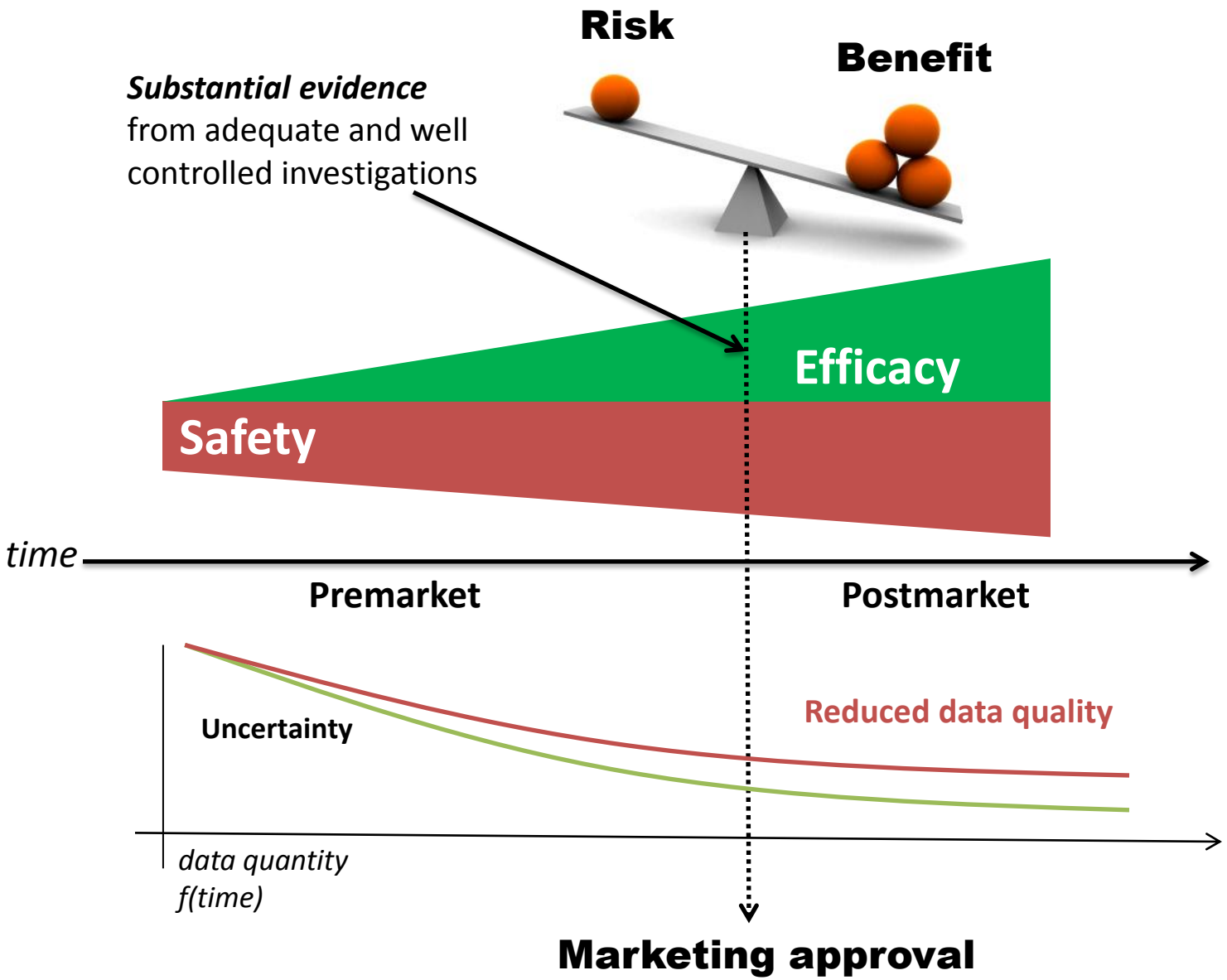
A holistic approach to oncology regulatory science and big data analytics



*Technology and software development

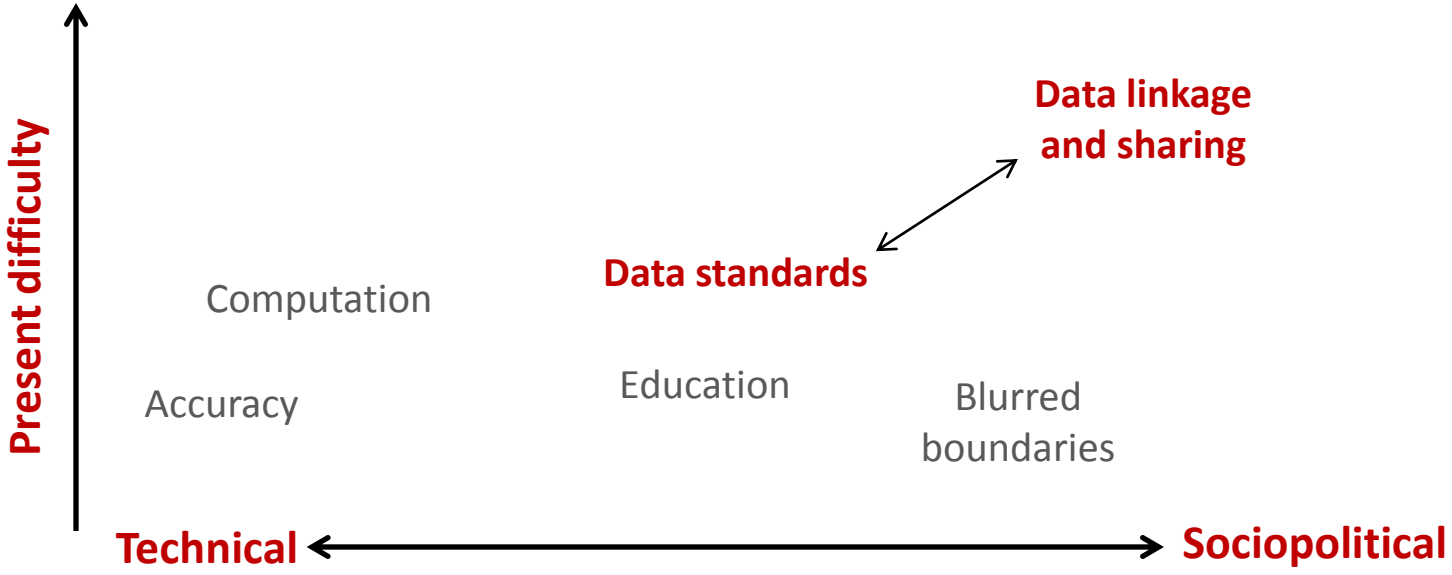
Uncertainty management

- Using novel pipelines of high quality data in regulatory decision making can reduce uncertainty
  - RWE
  - Patient reported
  - Biometrics (wearables, implantable, etc)


Risk
Benefit
Substantial evidence
from adequate and well
controlled investigations
Efficacy
Safety
time
Premarket
Postmarket
Uncertainty
Reduced data quality
data quantity
f(time)
Marketing approval

Challenges

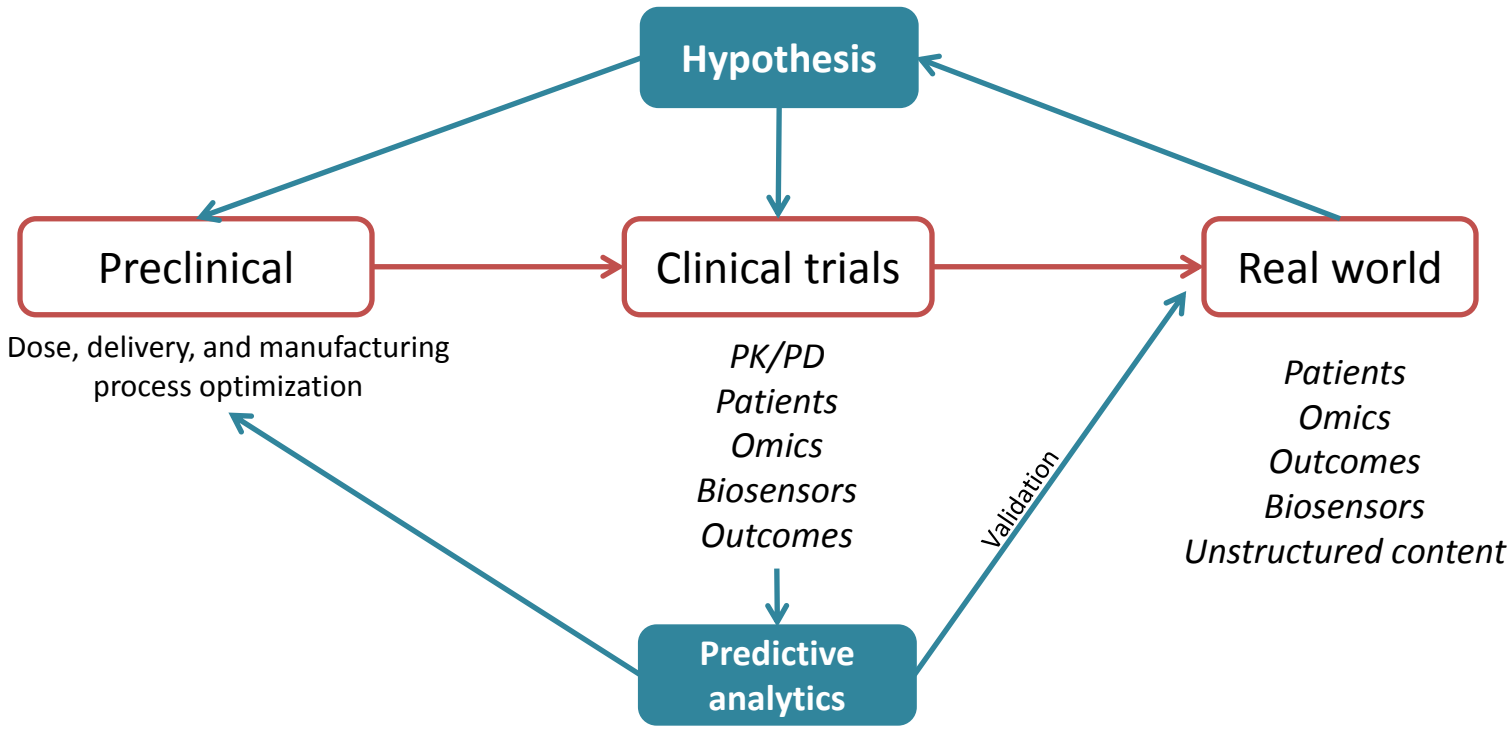
More than just technology



Adapted with modification from Kohane IS. Science. Vol. 349 no. 6243 pp. 37-38

Avoid data standards proliferation

Big picture: today

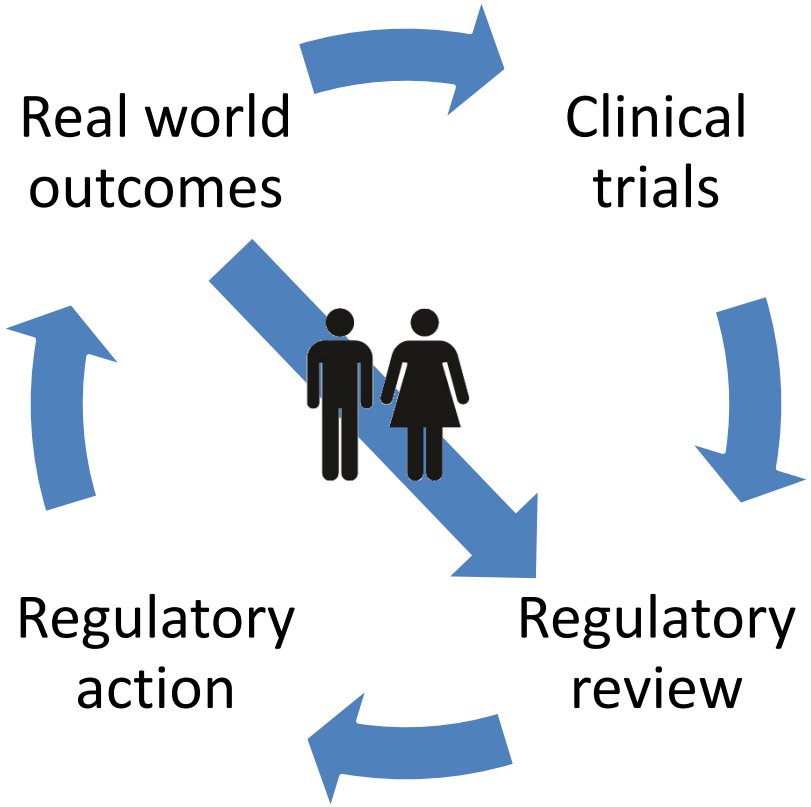


Bigger picture: tomorrow

The learning health system (IOM)

A system where science, informatics, incentives, and culture are aligned for continuous improvement and innovation

Discovery as a product of the healthcare delivery experience

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