WHY THE PHARMACEUTICAL INDUSTRY IS ADOPTING PERSONALIZED MEDICINE NOW

1st Translational Medicine Summit

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CoverTheUninsured
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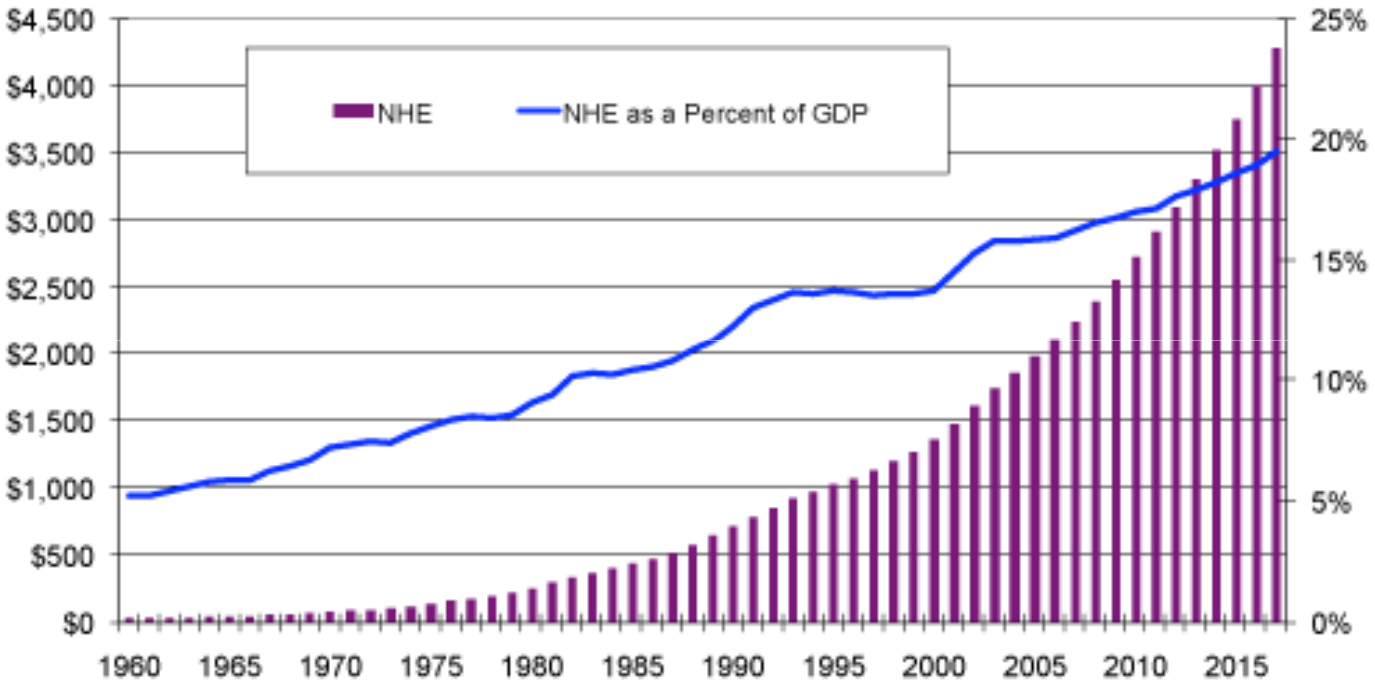
WORLD ECONOMY
healthcare costs in the US

National Health Expenditures (NHE),
Aggregate and Share of Gross Domestic Product (GDP), 1960-2017



Distribution of National Health Expenditures, by Type of Expenditure, 1960-2017

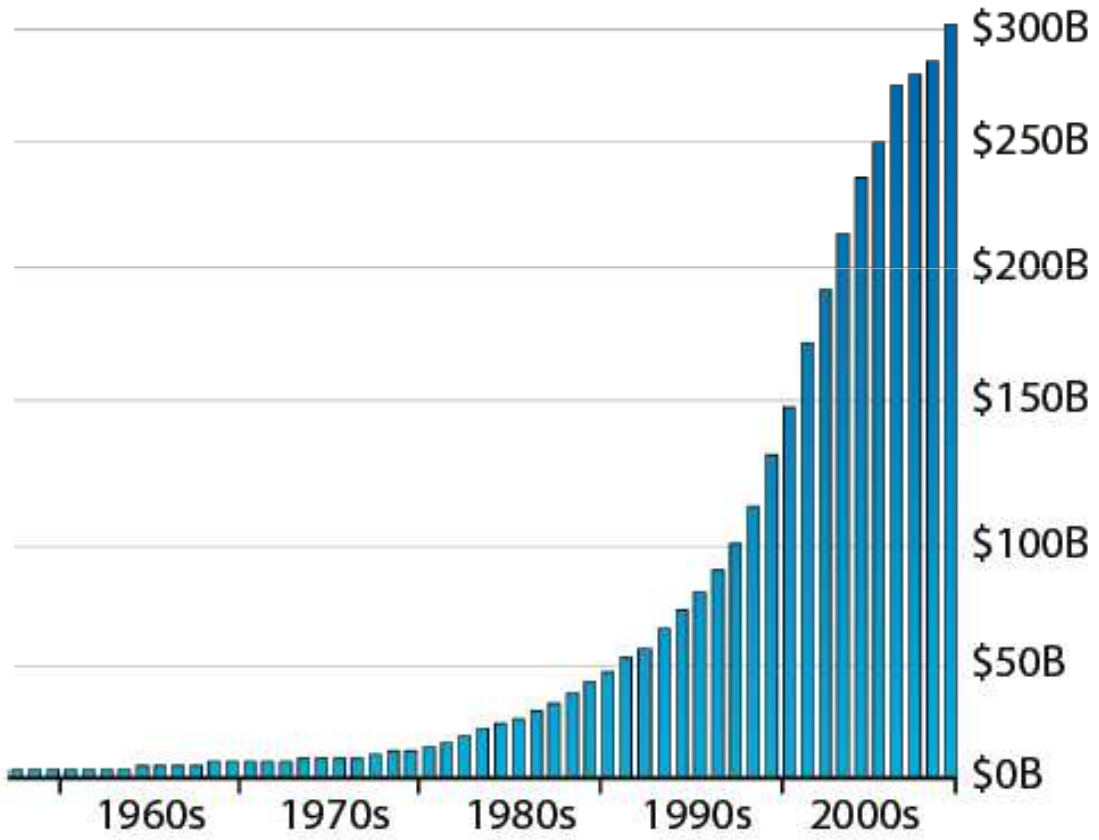
Healthcare costs could rise to as much as $ 4.3 trillion in 2017, representing 20% of GDP and 37% in 2050 !!!!!!

Prescription Drug Costs

- In many countries costs of drugs have increased at a faster pace than global healthcare costs.
- Two main reasons:
  - Shift from acute to chronic treatments
  - High price for recently launched products in particular the new biologicals
- Although this is partially compensated by the increasing number of generic drugs.

Prescription drug costs in the US

- Topol (2010) and IMS Market Prognoses $372 billion in 2016

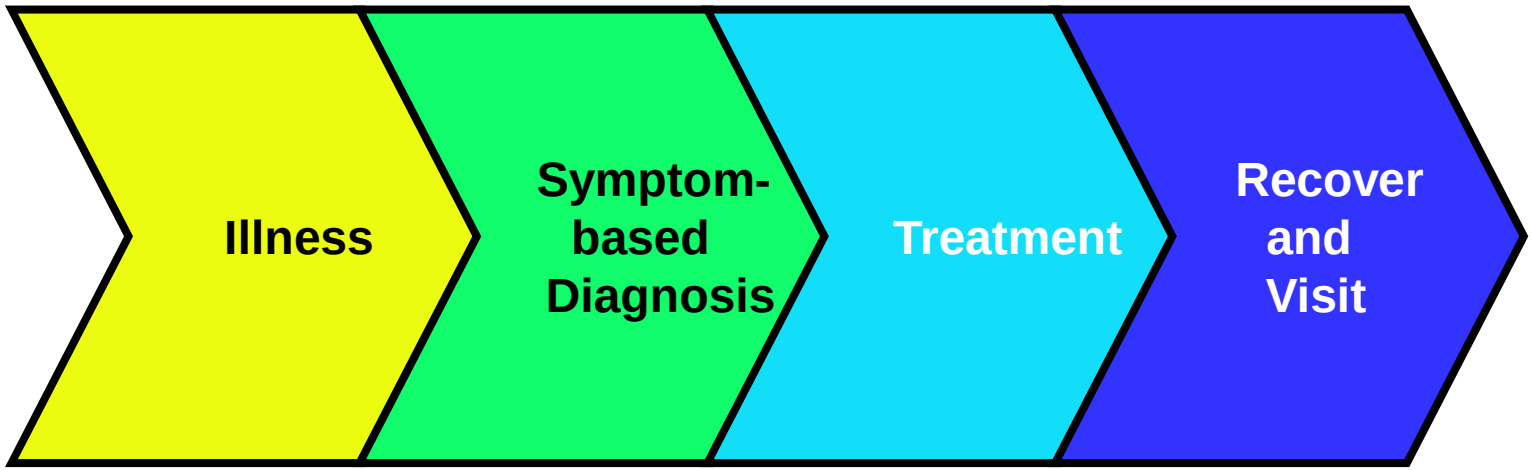


The current healthcare model

. Costly and not always effective

. Most drugs only work in 1/3 of patients

. Level of side effects still too high (iatrogenic factors)



The Blockbuster Model

- A blockbuster is a drug which generates at least US$ 1 billion worldwide sales.
- A blockbuster used to be a drug which generates a moderate clinical benefit for a large population of patients with a chronic disease
- The blockbuster model cannot be the sole and unique model to treat patients and has clearly shown its limits over the recent years

The Blockbuster Model

Rare diseases

- Success in rare diseases was achieved in spite of conventional risks factors such as:
  - Absence of validated surrogate biomarker
  - No clearly validated development path
  - Requirement to prove clinical outcomes

Rare Diseases

Lessons learned from Rare Diseases

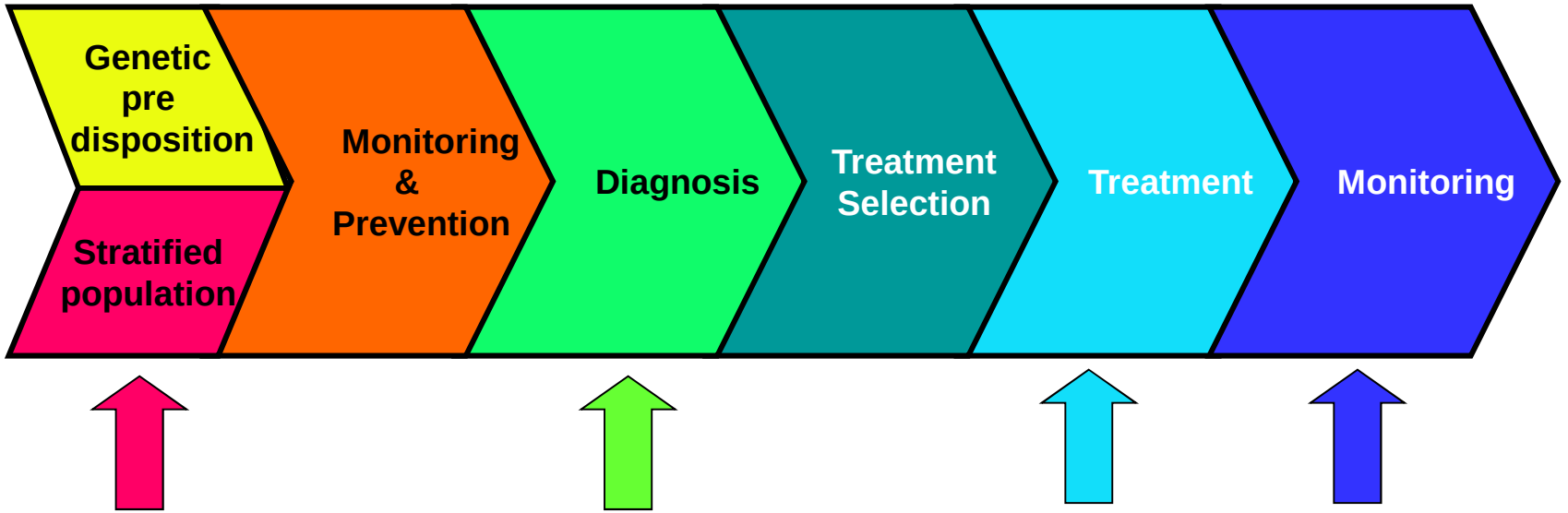
- Current success drivers could apply to larger diseases in a “Personalized Medicine” approach
  - Target patient population with high unmet medical need and low or non-existent standard of care
  - Typically homogenous patients and often genetically defined
  - Underlying causes of disease often well defined
  - Relevance of therapeutic intervention clearly apparent
  - Good to excellent relationships with patient associations and care givers

Personalized Medicine: From Empirical to Science-Based

- The “personalized medicine” intends to discover, develop and commercialize drugs which provide a large clinical benefit to a targeted population of patients and which not only addresses symptoms but progressively becomes a disease modifier approach.
- Translational medicine is a discipline where drug and biomarker discovery and development are tightly integrated.
- The presentation will focus on how the pharmaceutical industry is currently changing its paradigm in order to improve the overall healthcare outcomes.

The healthcare model of the future

Future Model: a Personalized Medicine Approach

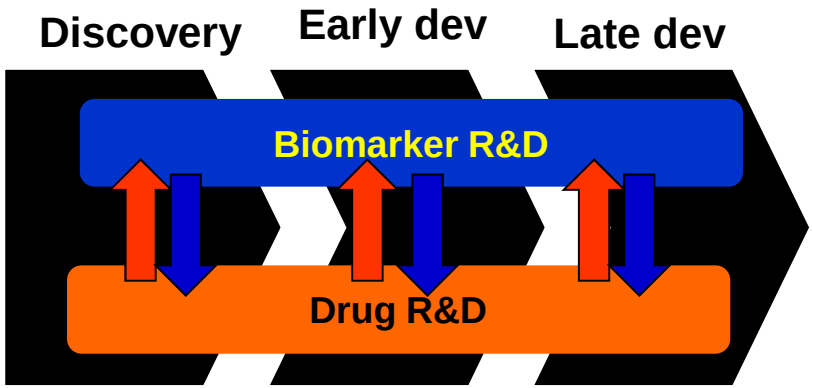


Specific Biomarkers or Biosignatures for identification, diagnosis and prognosis of disease

Should provide better patient outcomes and safer treatments

Translational Medicine: Biomarker and Drug research

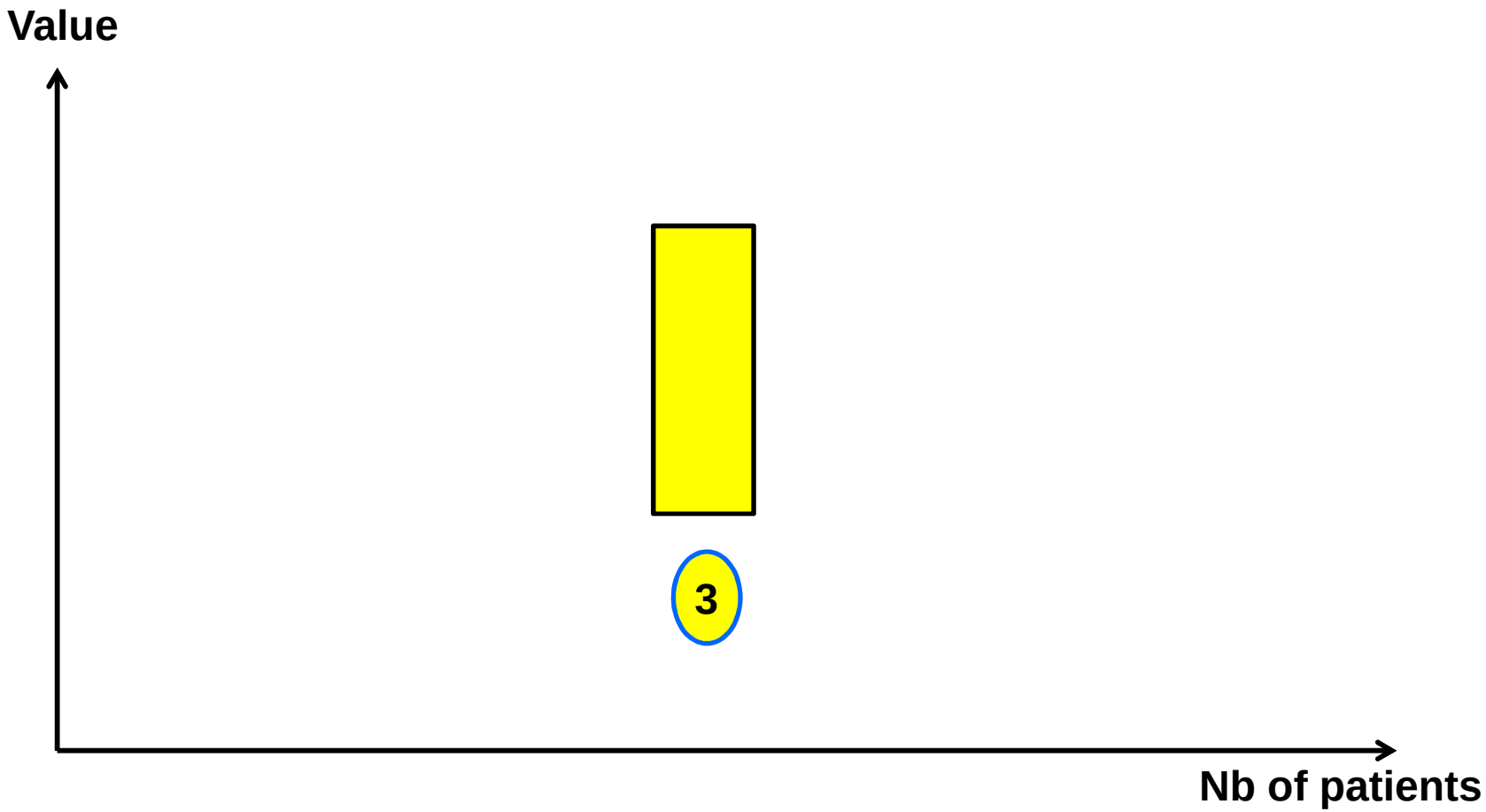
Translational medicine, drug and biomarker discovery and development to be tightly integrated



Personalized Medicine
The three big attractions

- Drugs specifically matched to patients are likely to be more effective.
- The risk of major adverse events should decline.
- Healthcare systems would not have to spend substantial money on ineffective drugs.

The Personalized Medicine Model



Need for Personalized Medicine in Cancer

Top 15 Selling Oncology Drugs

- Generated **$26.4B** in sales in 2006
- Produced average Response Rate of **35%**

→**FAILED in the 65%** of Non-Responders

High Failure Rate

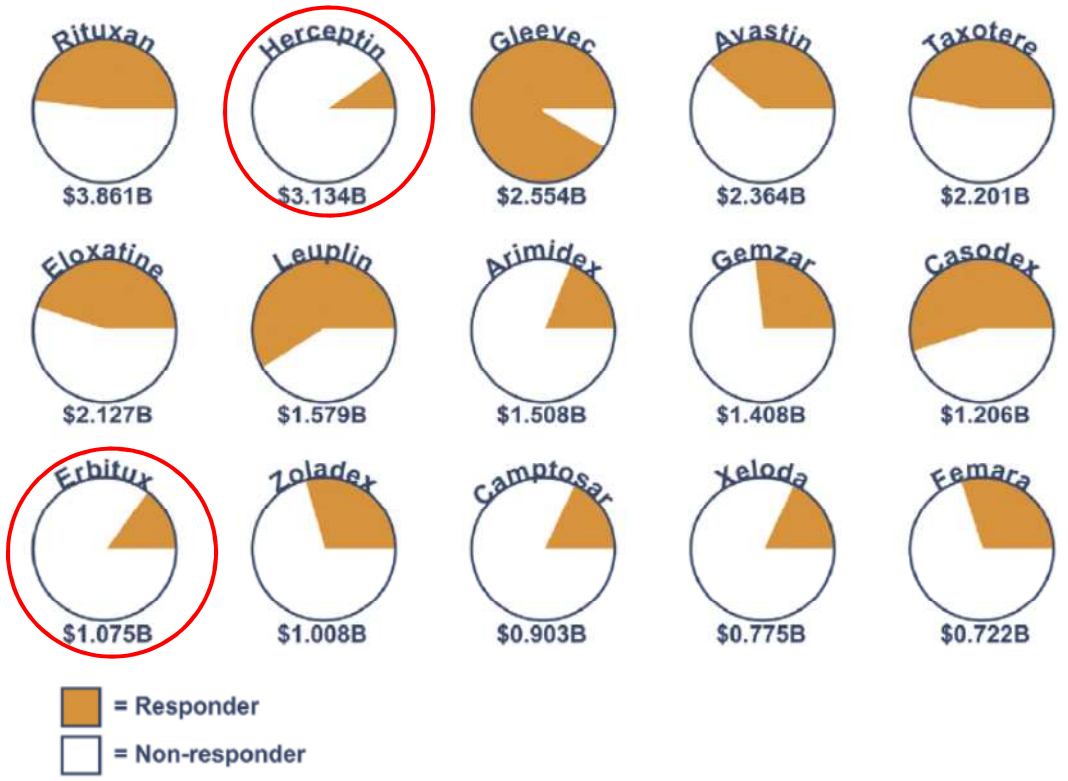
- Results in toxicity with no benefit
- Wastes precious time before trying potentially effective treatment

Biomarkers

- Identify which patients may benefit
- Particularly well-suited for matching targeted therapies to the 'right" patients

→**Her2 test for Herceptin**

→**KRAS test for Erbitux**



Drug Discovery Today, 2009

Need for Personalized Medicine in Cancer

- Plexxikon and Roche showed that 81% of metastatic melanoma patients with a B-RAF activating mutation responded to treatment with PLX4032 (NEJM August 2010). **Zelboraf was approved by the FDA on August 17, 2011**

- Crizotinib from Pfizer blocks the action of a gene called anaplastic lymphoma kinase or ALK, that is present in an estimated 3% to 5% of lung cancer tumors, primarily those that occur among patients who do not smoke. (NEJM October 2010)

Personalized Medecine
A business opportunity for diagnostics

- Spurred by new technologies and growth in emerging regions, the world market for *in-vitro* diagnostics (IVD) is expected to **grow 6% annually** to nearly $70 billion in 2015

- Technological advances, specifically those in device miniaturization, wireless, data digitization and the internet, form a technical **convergence** that will permit diagnostic tests and devices to maintain a central role in disease management.

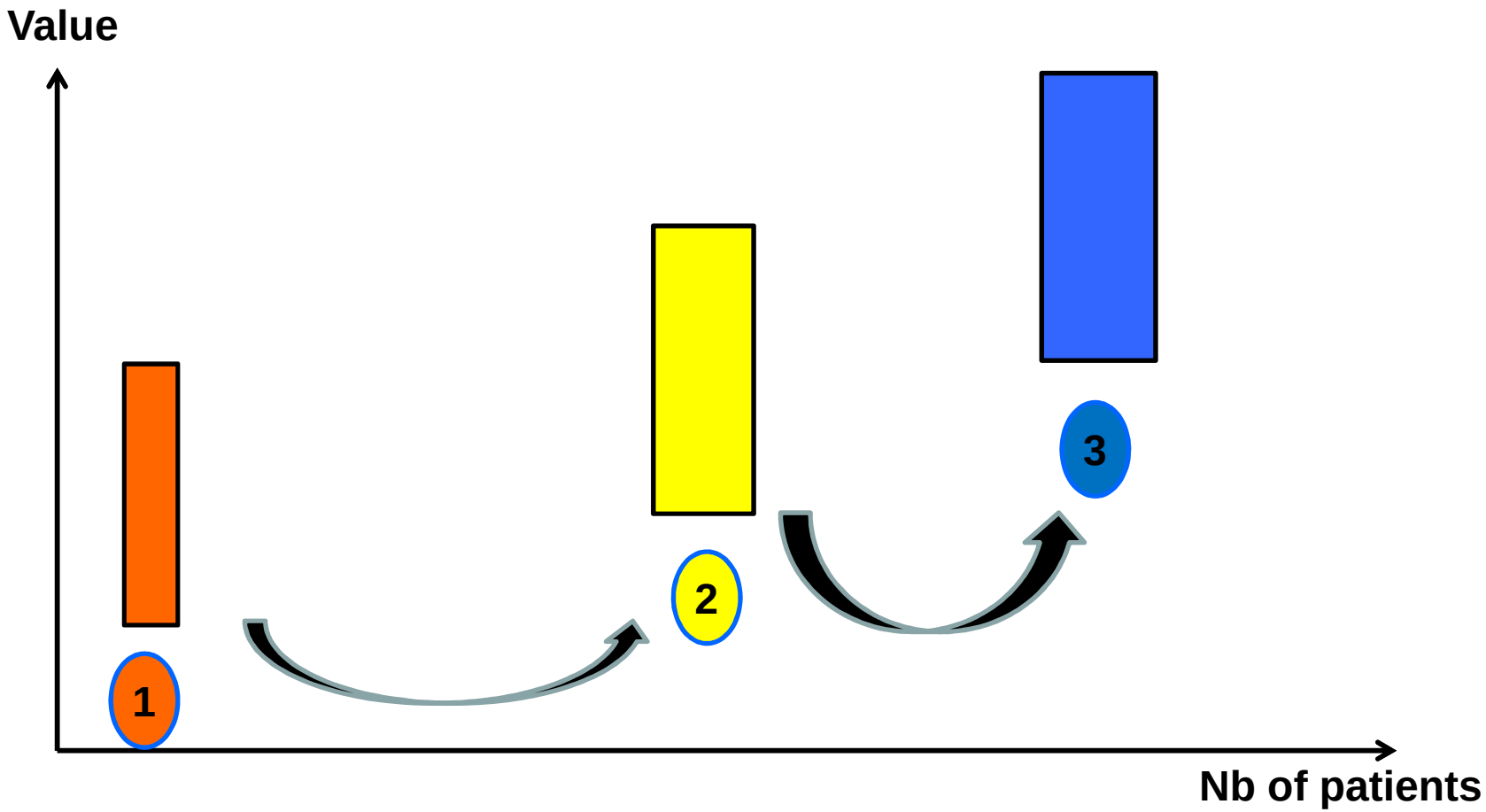
Personalized Medecine
A business opportunity for diagnostics

- More than 60% of Roche's pipeline drugs will come paired with companion diagnostics, Severin Schwan,the company's CEO Severin claimed.
- He also told investors that the company's long-term plans are heavily focused on targeted treatments, and Roche's large in-house diagnostics division is responsible for more than 200 companion diagnostics projects.
- Roche's pipeline boasts treatments for cancer, Alzheimer's and schizophrenia, most of which will be coupled with diagnostic assays when they reach the market.
    - Basle, September 6, 2012

Personalized Medecine
A new business opportunity

- The US FDA approves Amgen's Vectibix as a frontline treatment for metastatic colorectal cancer (CRC) alongside Qiagen's Therascreen KRAS test as companion diagnostic that can determine which patients are most likely to benefit from the drug.
- These simultaneous Rx/Dx approvals are the result of regulatory actions that began five years ago, after researchers first presented data showing that CRC patients with KRAS gene mutations in codons 12 or 13 would not respond to already approved EGFR-inhibiting monoclonal antibodies such as Vectibix and Erbitux.
  - May 22, 2014

Precision Medicine: The Paradigm of the Future



Potential New Domains

- Asthma-Allergy
- Metabolic diseases
- Some CNS diseases
- Other areas with recent major failures

Translational Medicine: The Conclusion

- Translational medicine constitutes a novel paradigm whereby scientists and physicians should succeed in:

TRANSFORMING NOVEL BIOLOGICAL TARGETS INTO HIGH VALUE CLINICAL AND HEALTHCARE OUTCOMES.

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