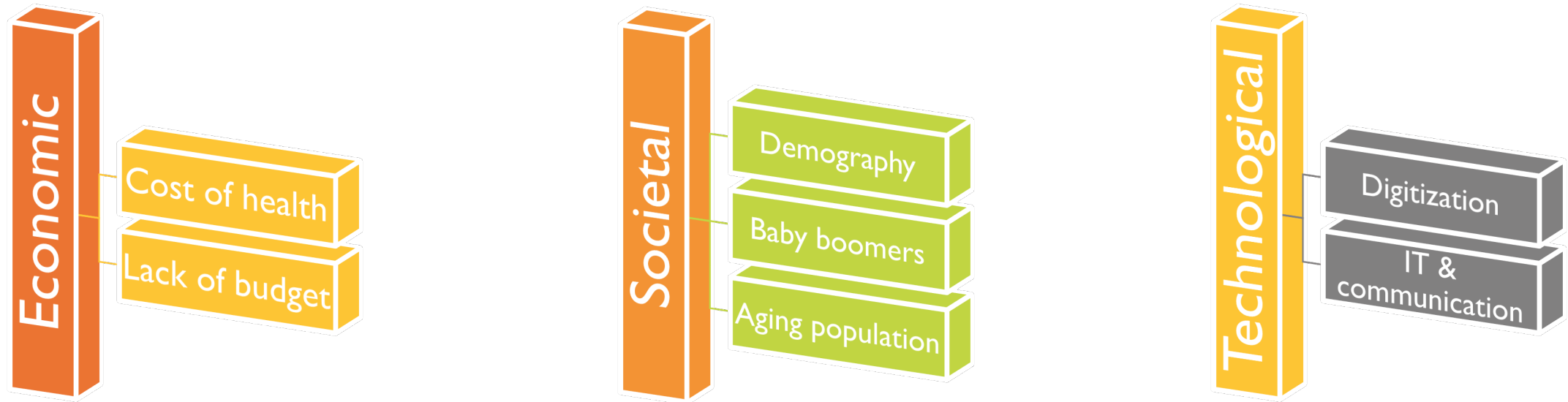


Personalized
medicine:
*Toward innovative
solutions to meet
healthcare challenges*

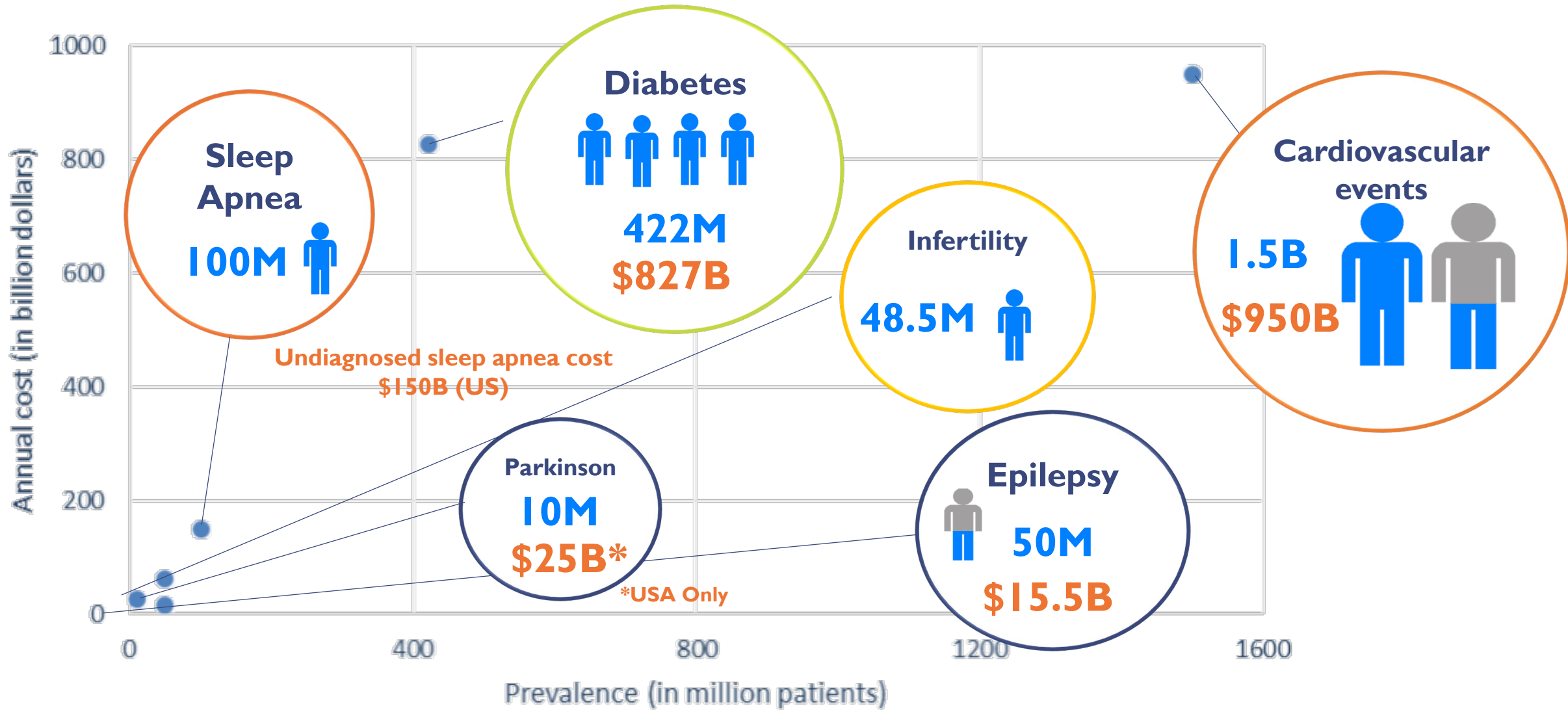
Speaker: Jérôme Mouly

The global transformation of healthcare



Healthcare sector is currently transforming thanks to the convergence of several key parameters: economic, societal and technological.

PREVALENCE & COST OF CHRONIC DISEASES

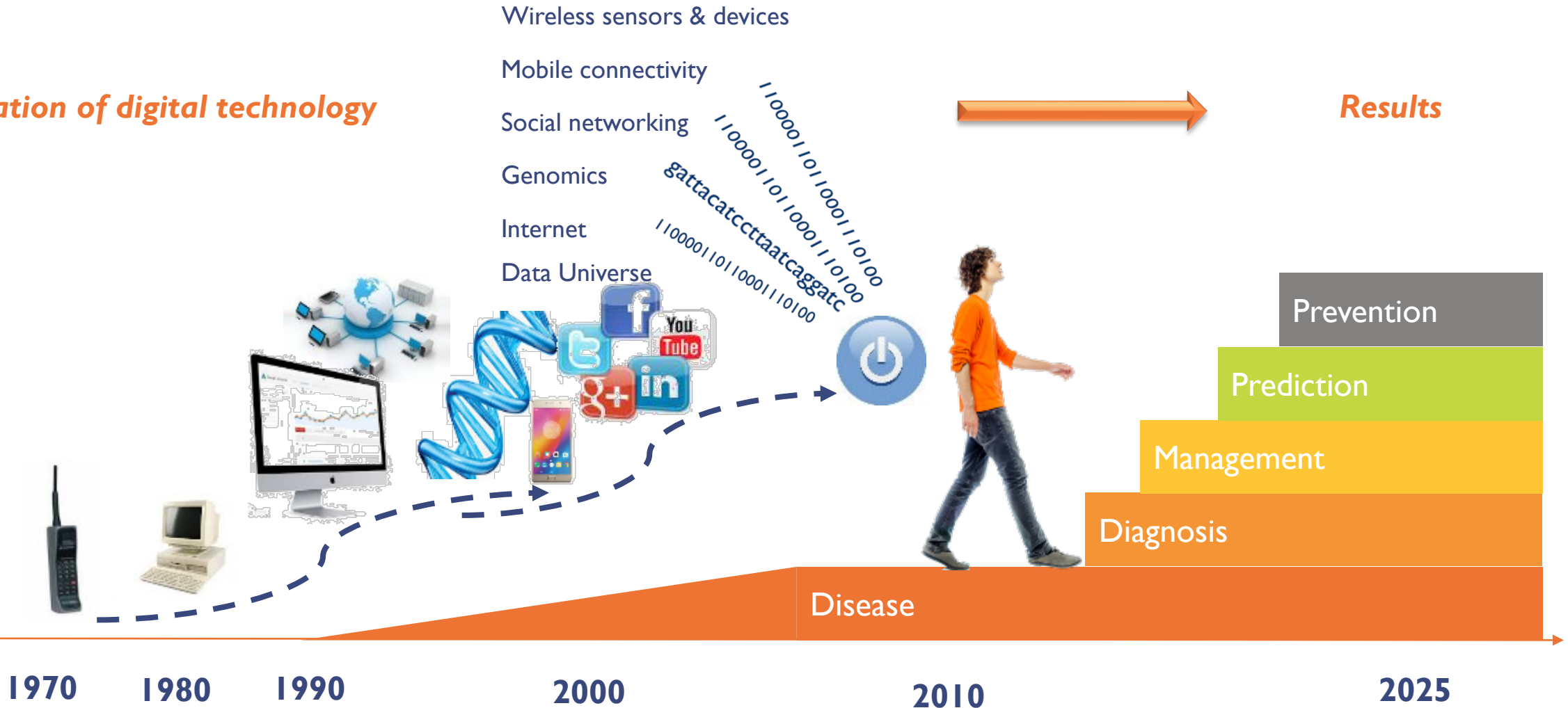


Source: Reports from World Health Organization

CONVERGENCE OF DIGITAL TECHNOLOGIES

Drivers and impacts

Acceleration of digital technology



1970

1980

1990

2000

2010

2025

Evidence-based
medicine



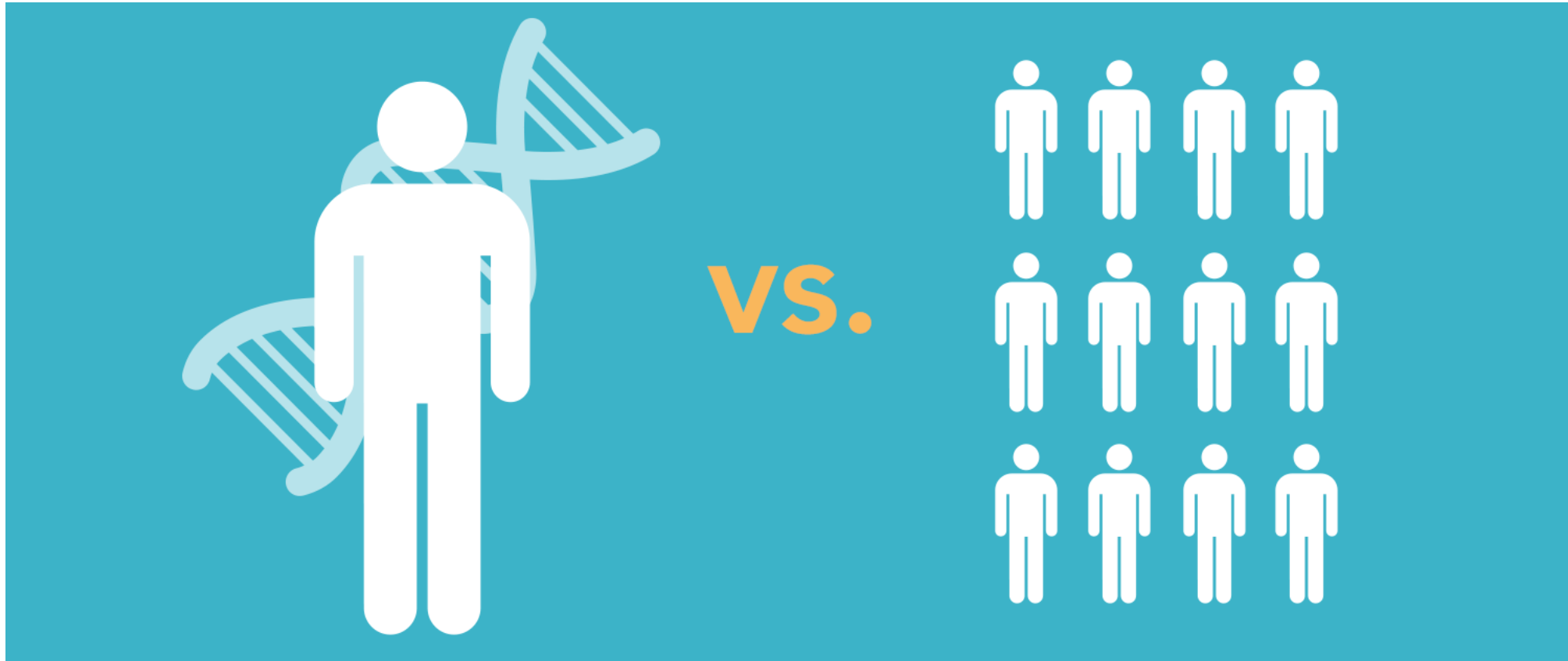
4P Medicine

Predictive

Personalized

Preventive

Participative

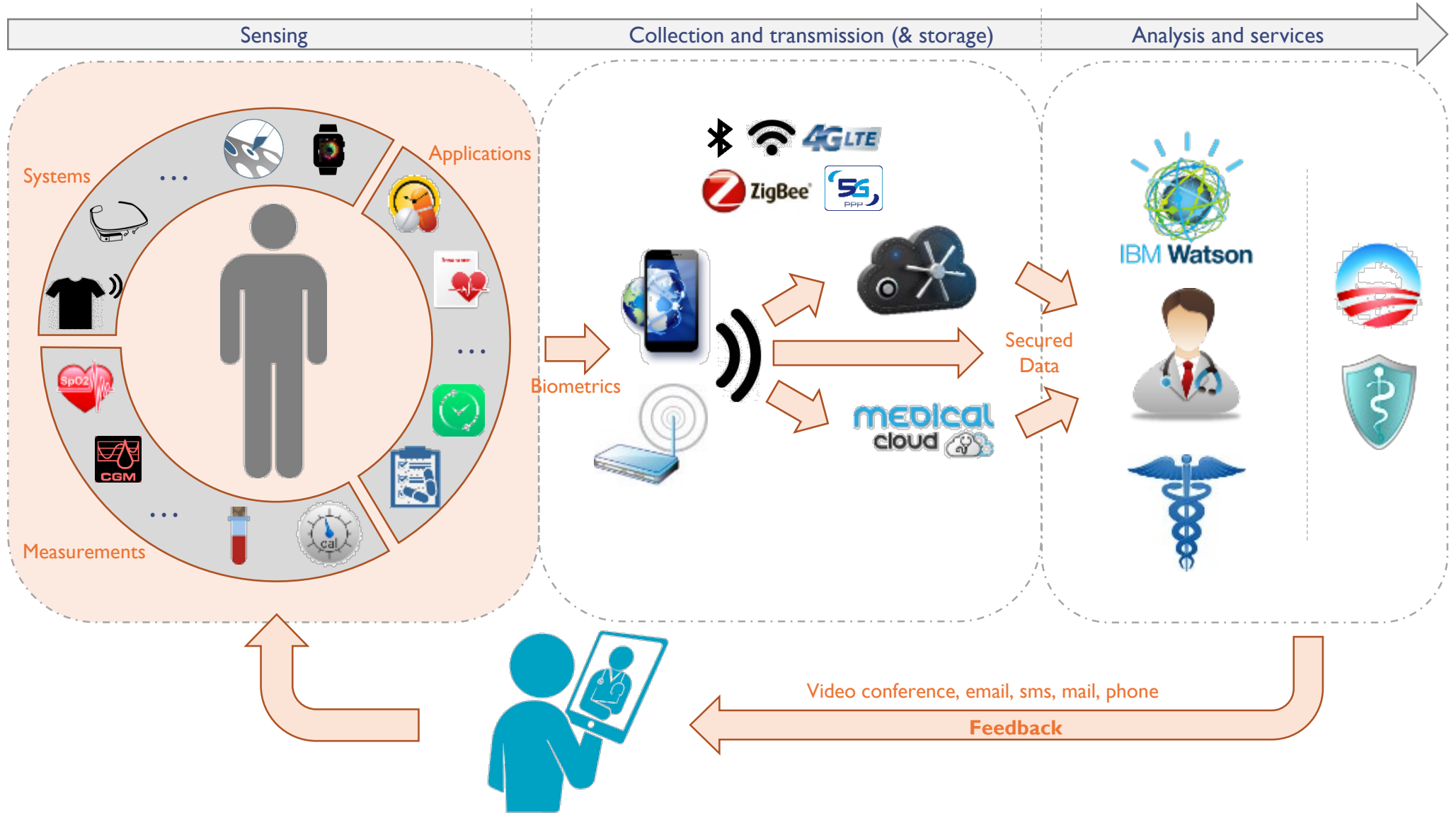


Personalized medicine is a move away from a "one-size fits all" approach to the treatment and care of patients

A NEW PATIENT CENTRIC APPROACH



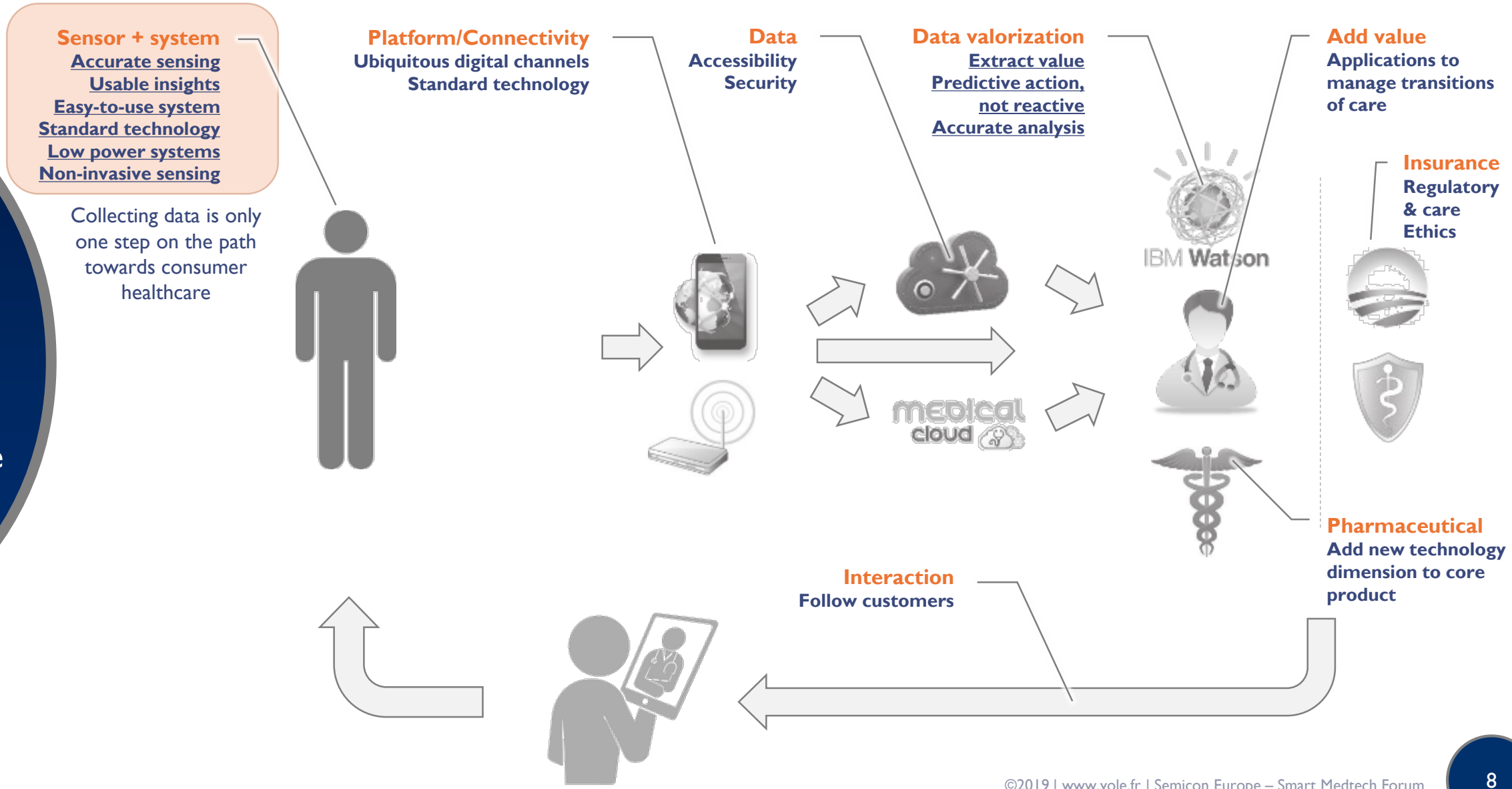
Micro-technologies are expected to provide strong value for consumer healthcare.



THE CHALLENGES OF THE PATIENT CENTRIC APPROACH



The success of this new market depends on how the industry manages the challenges.



- **Disruptive diagnostic solutions**
- Innovative drugs
- Smart delivery



Picture: Oxford Nanopore (GridION chips)



Connected medical devices



Wearables



NGS and DNA sequencing



Liquid Biopsy

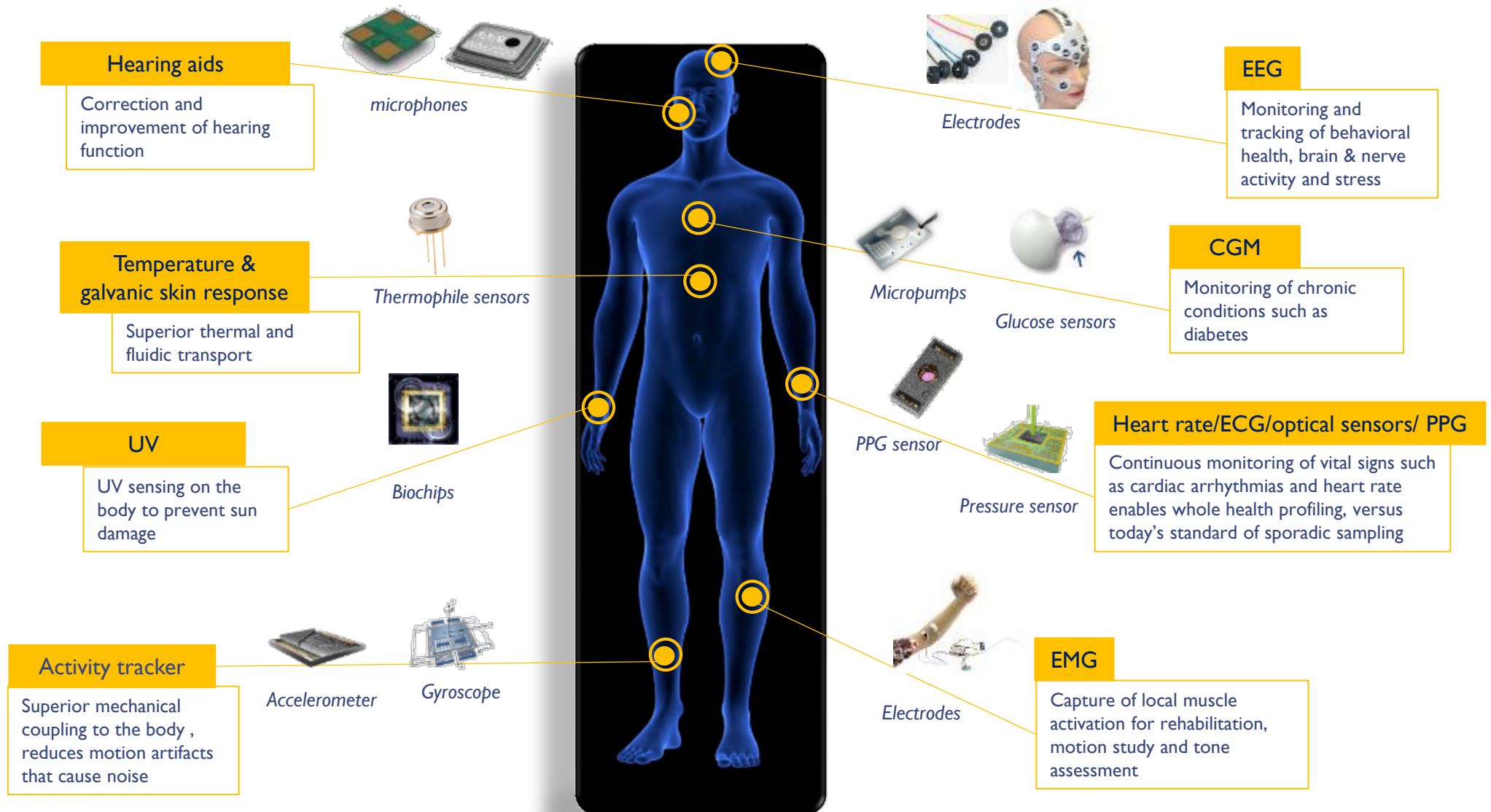


AN INCREASING NUMBER OF CONNECTED MEDICAL DEVICES AND WEARABLES

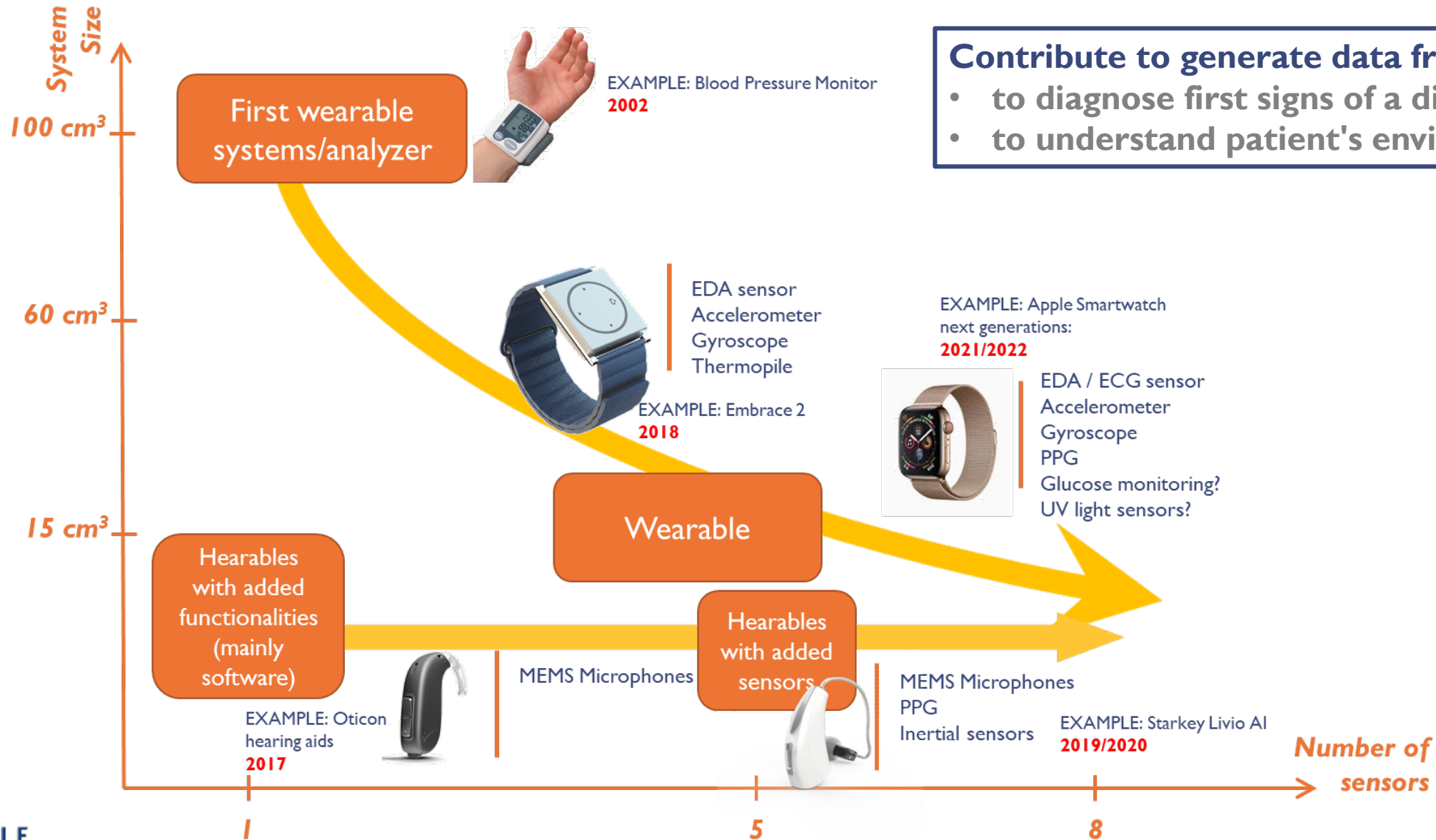


* Non exhaustive list of products

BRIDGING THE GAP BETWEEN MEDICAL SECTOR AND MICROELECTRONICS



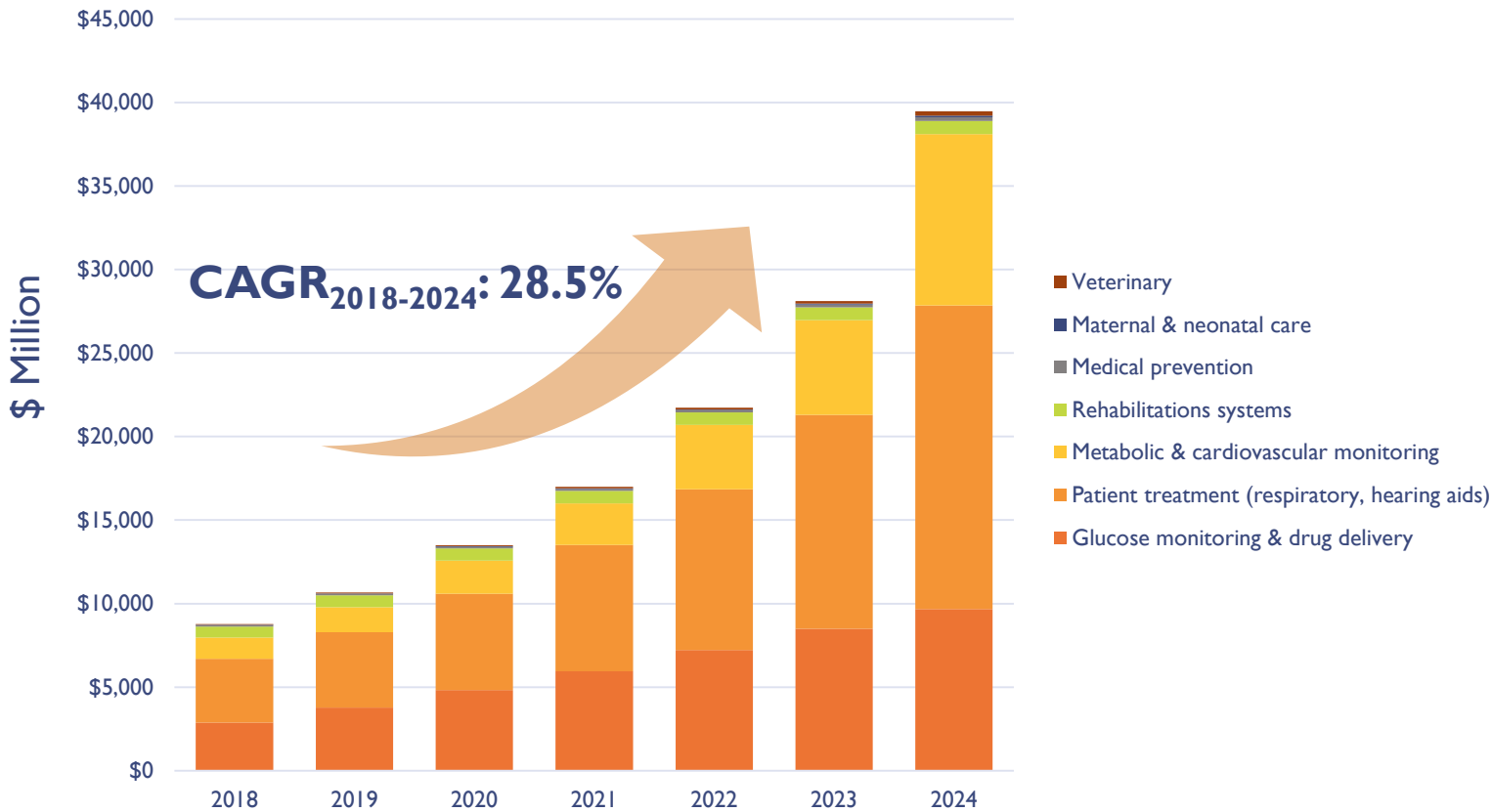
INTEGRATE MORE AND MORE SENSORS...



Contribute to generate data from a patient:

- to diagnose first signs of a disease
- to understand patient's environment

MEDICAL WEARABLE GLOBAL MARKET FORECAST 2018-2024

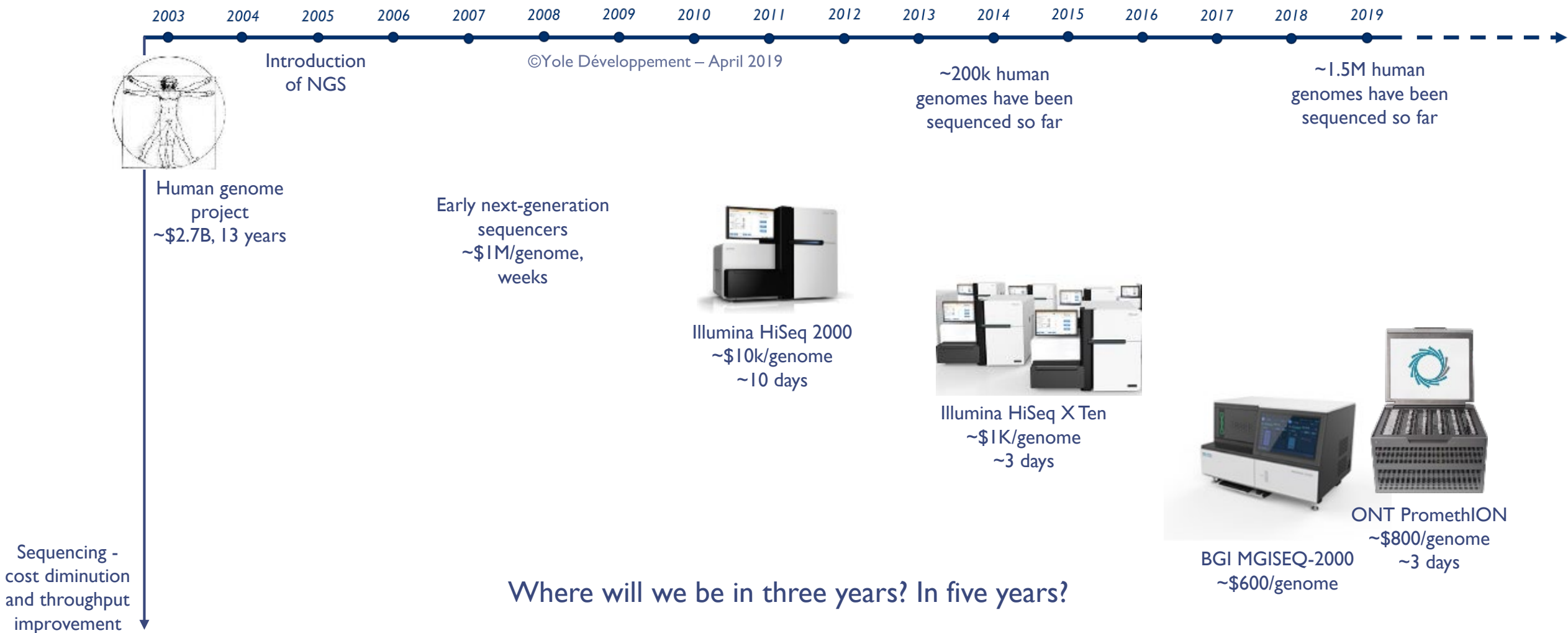


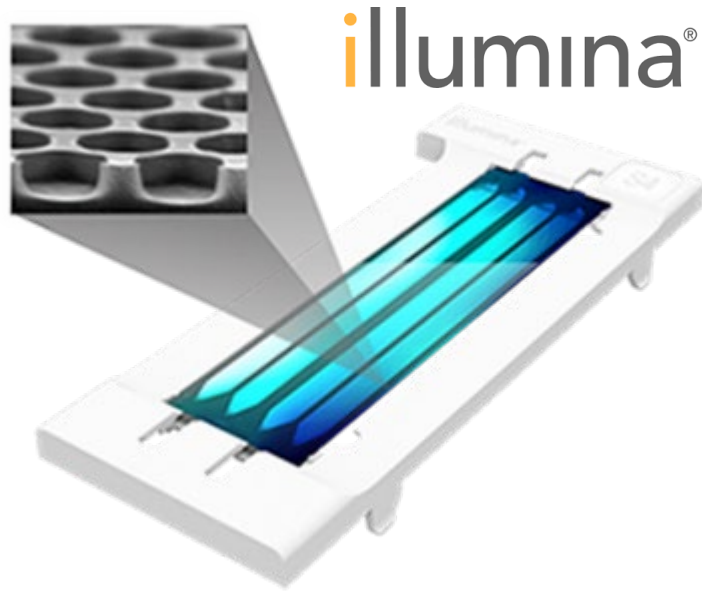
- **A global growth of 28.5%**
- **Higher revenues in chronic diseases:**
 - **Diabete**
 - **Respiratory**
 - **Neuro-degenerative diseases**
 - **Cardiovascular**



NEXT GENERATION AND DNA SEQUENCING

Powerful tools for personalized medicine





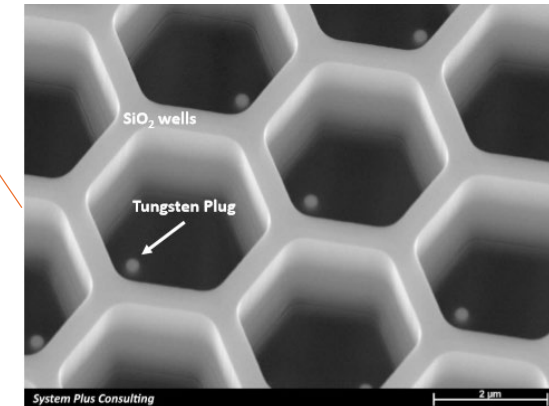
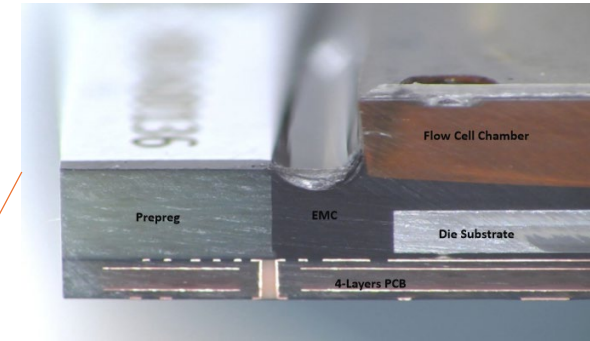
NovaSeq series – based on glass

ThermoFisher
SCIENTIFIC

ion torrent
S M A O X Q +



Ion torrent chip series – based on Silicon



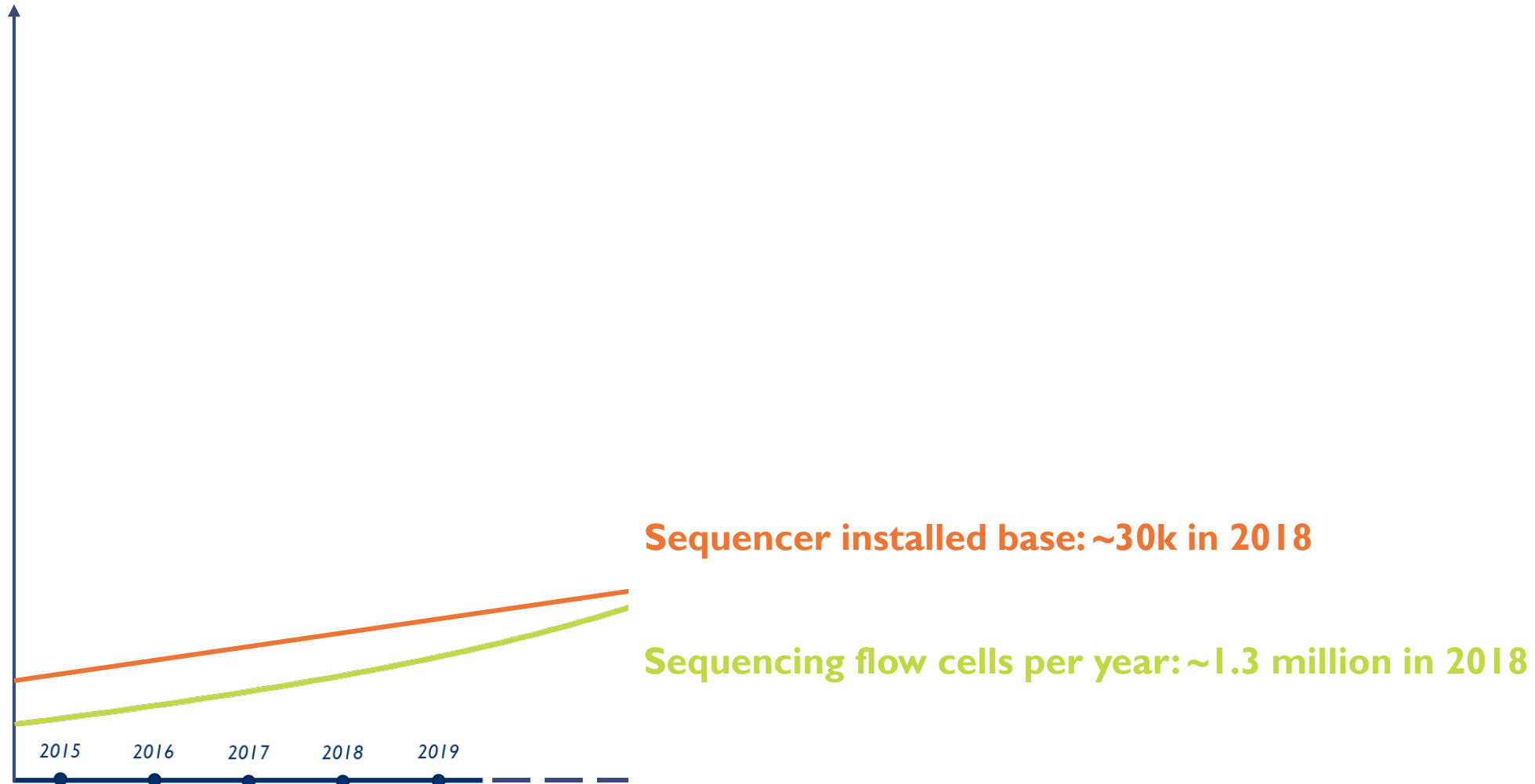
Ion torrent 520 – Details of the structure; Source: System Plus consulting

Key requirements for next generation flow cells:

- Increase throughput / number of wells
- Decrease the price of the device → cheaper sequencing procedures

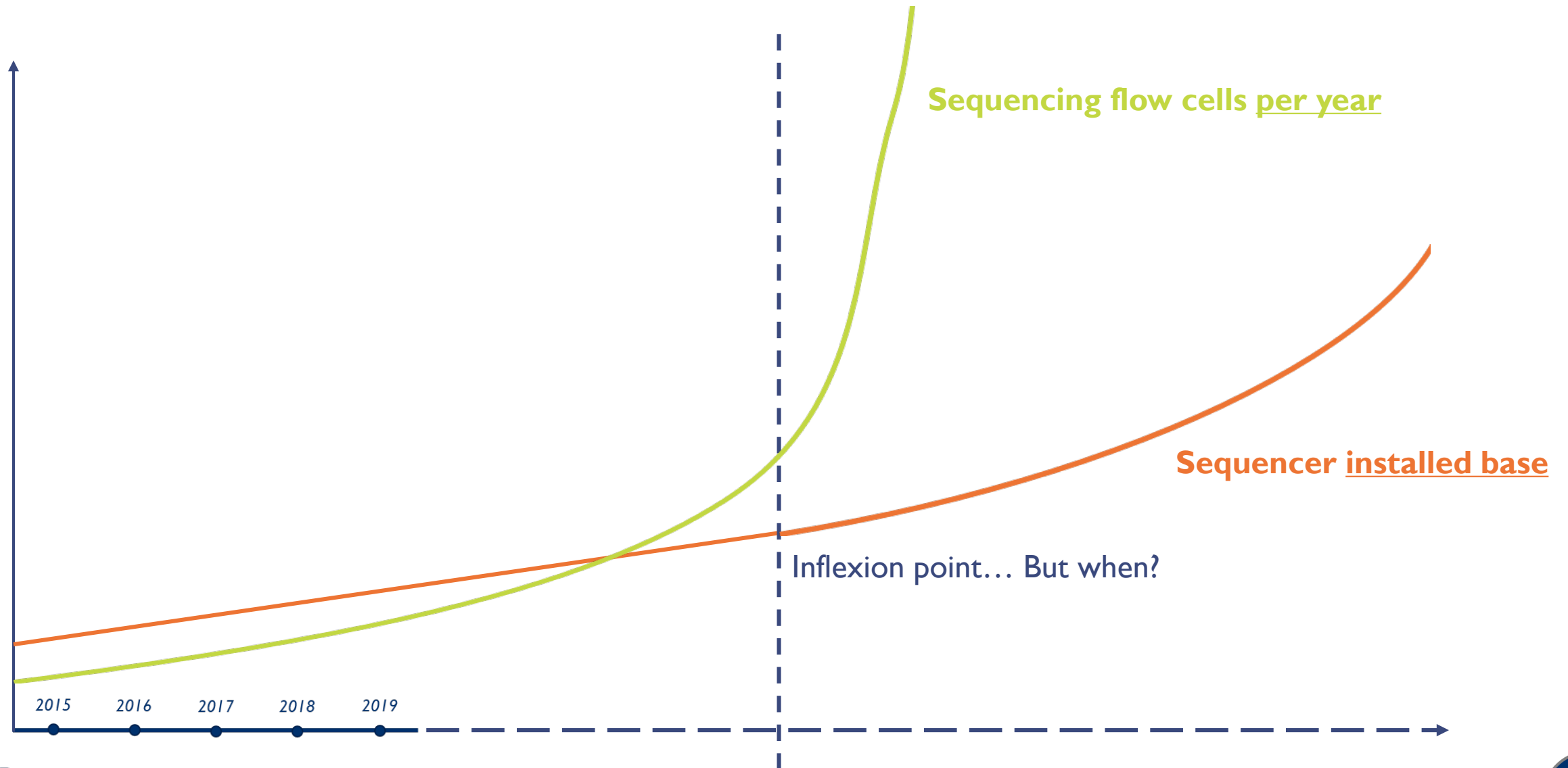
AND WHAT'S NEXT?

We're only at the very early days of sequencing...



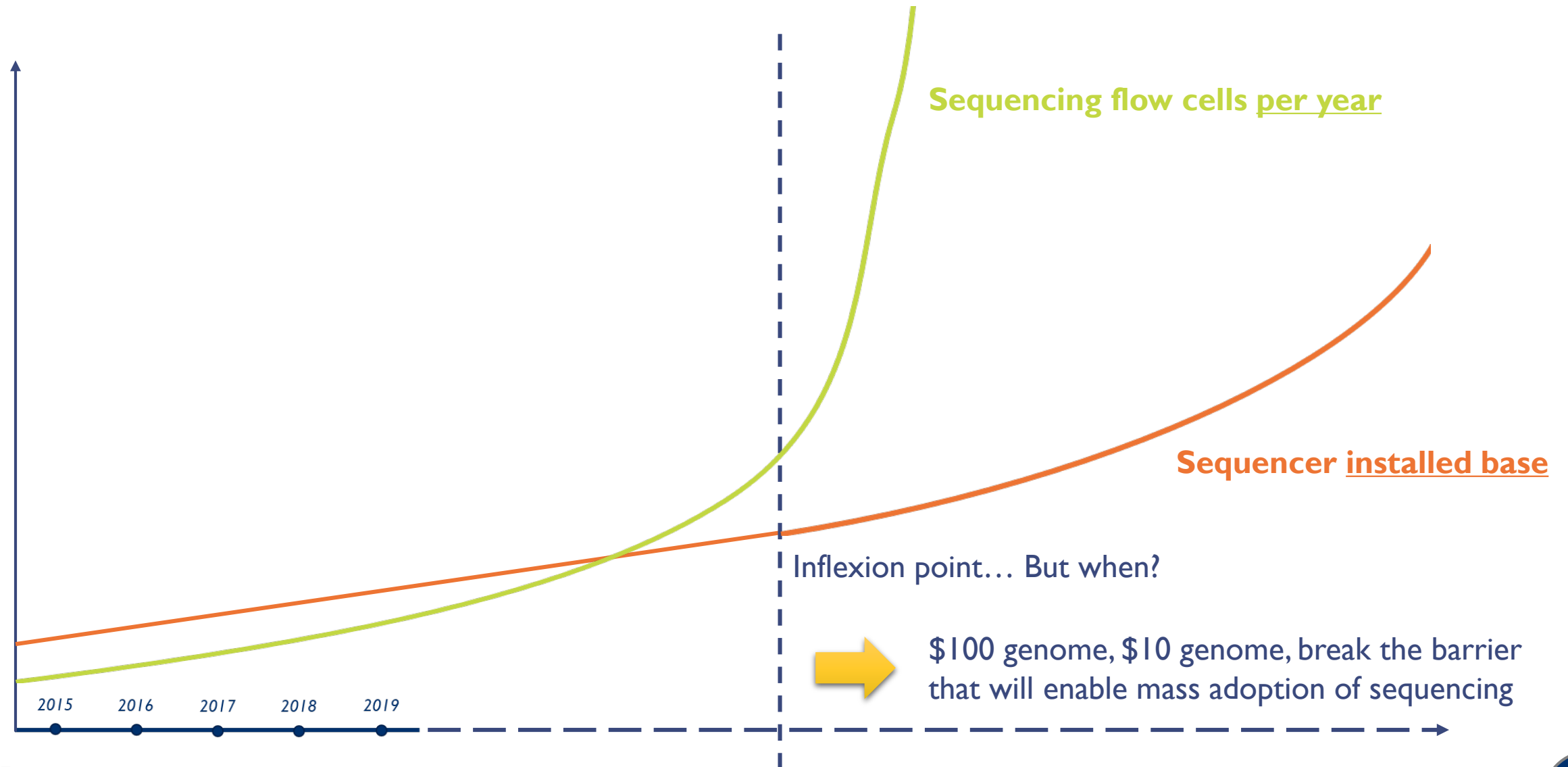
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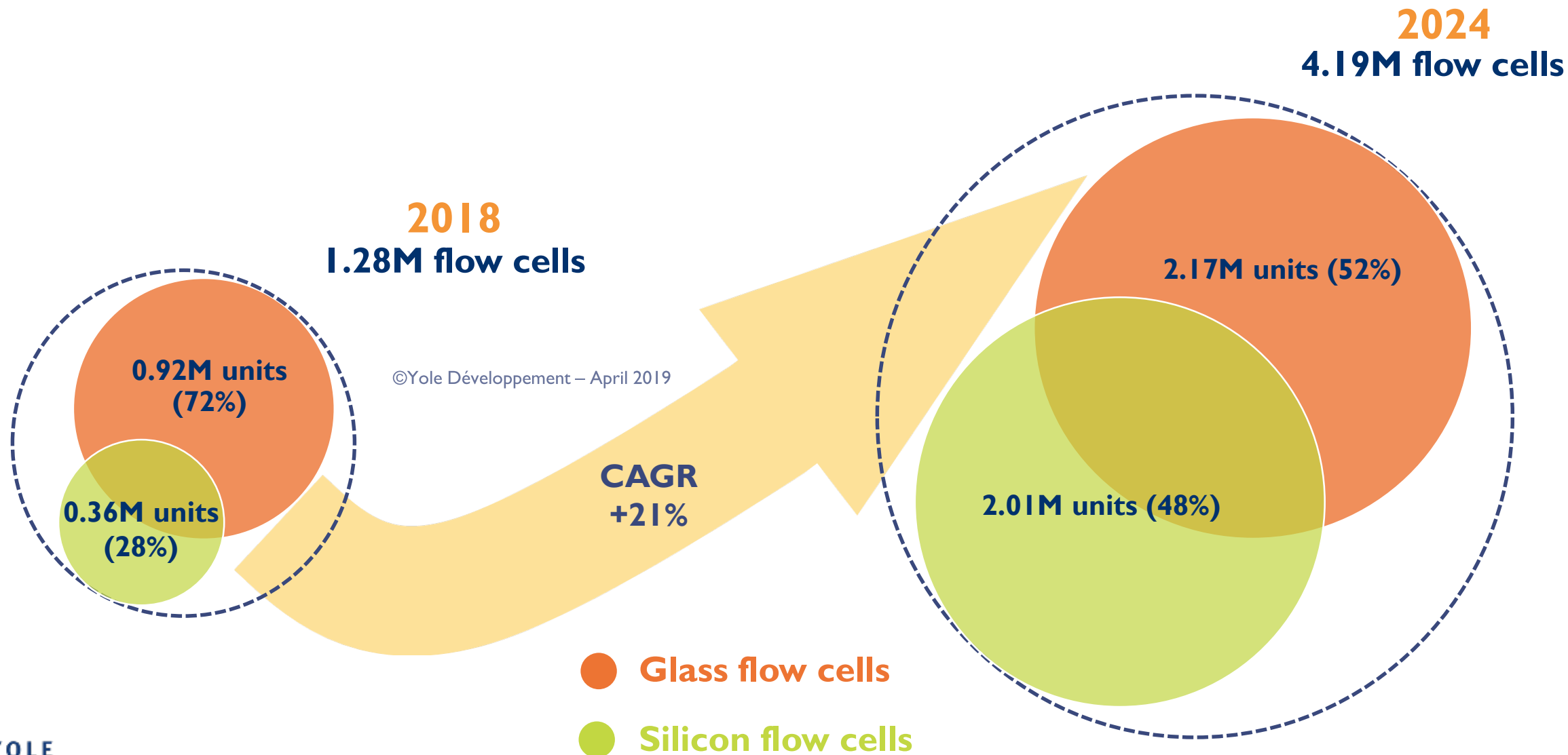
AND WHAT'S NEXT?

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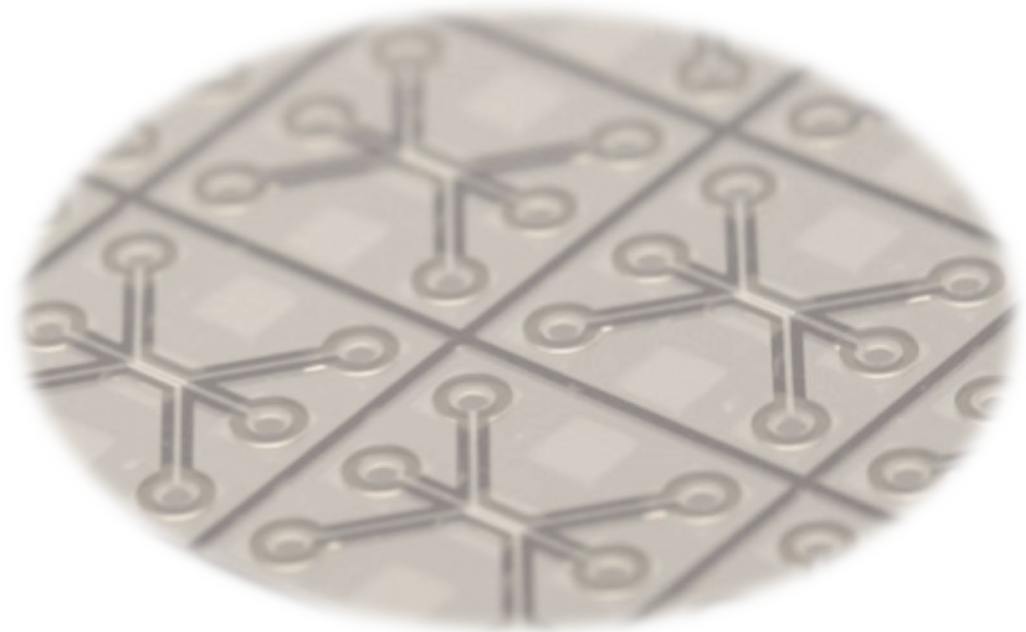


MARKET DATA AND FORECASTS, MARKET SHARE

Number of sequencing flow cells, per material



- Disruptive diagnostic solutions
- **Innovative drugs**
- Smart delivery

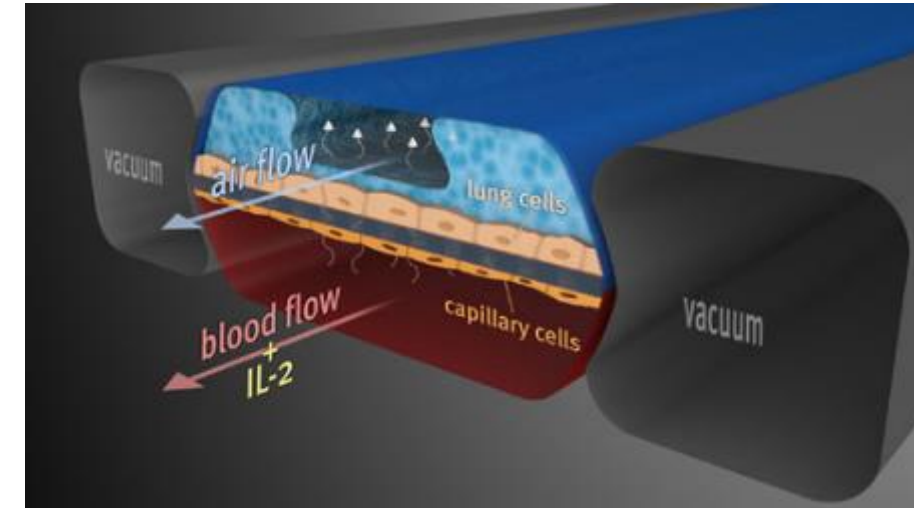
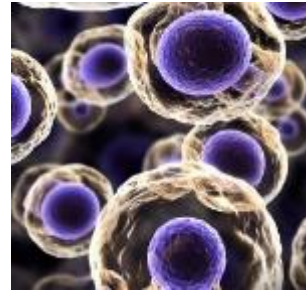


Picture: Mimetas – OrganoPlate 3-lane (details)



A combination of microtechnology...

... and biology

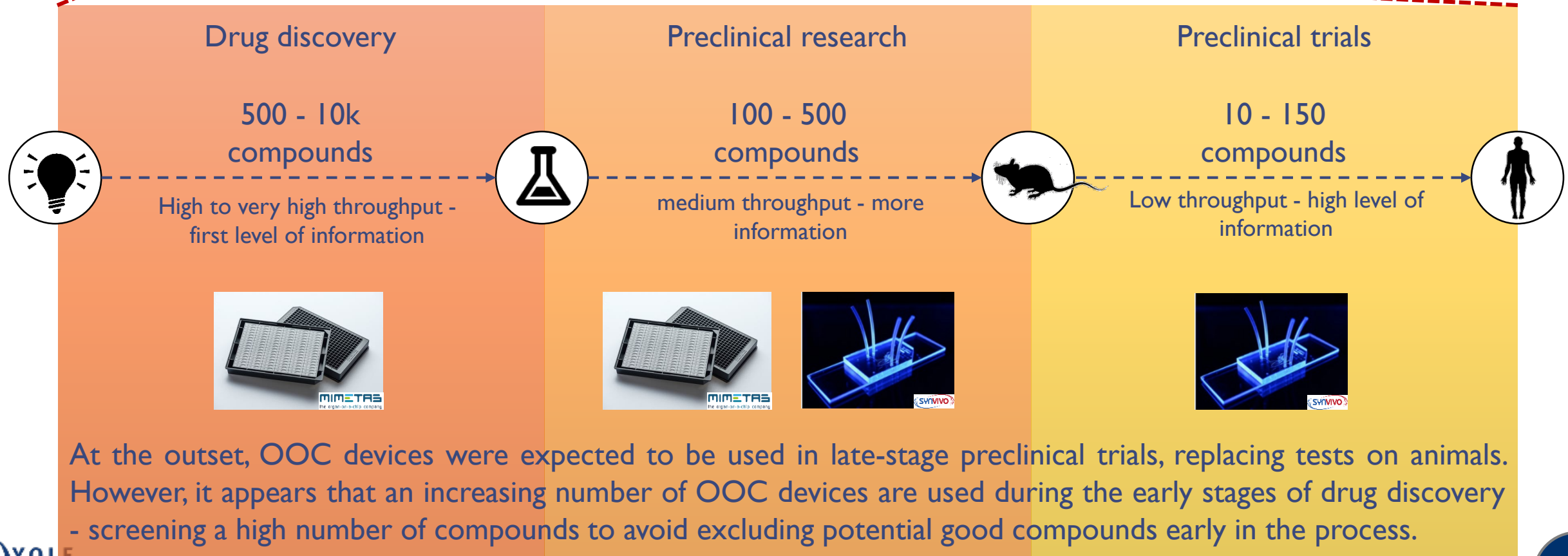
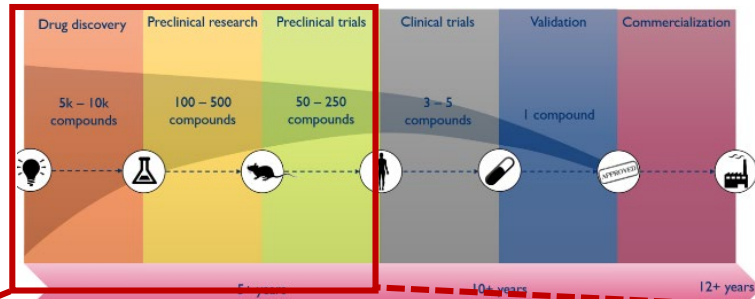


Lung-on-a-chip model developed at the WYSS Institute

Organs-on-chips represent the convergence of several areas of research:

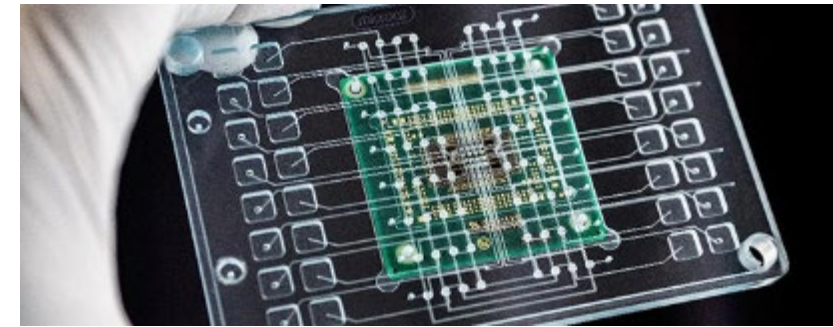
- Microfluidics
- Microfabrication
- Tissue engineering
- Stem-cell biology (providing easy access to non-malignant human cell lines and patient-specific stem cells, enabling creation of general human models and patient-specific models)

DIFFERENT OOC TYPES FOR DIFFERENT DRUG DEVELOPMENT STAGES

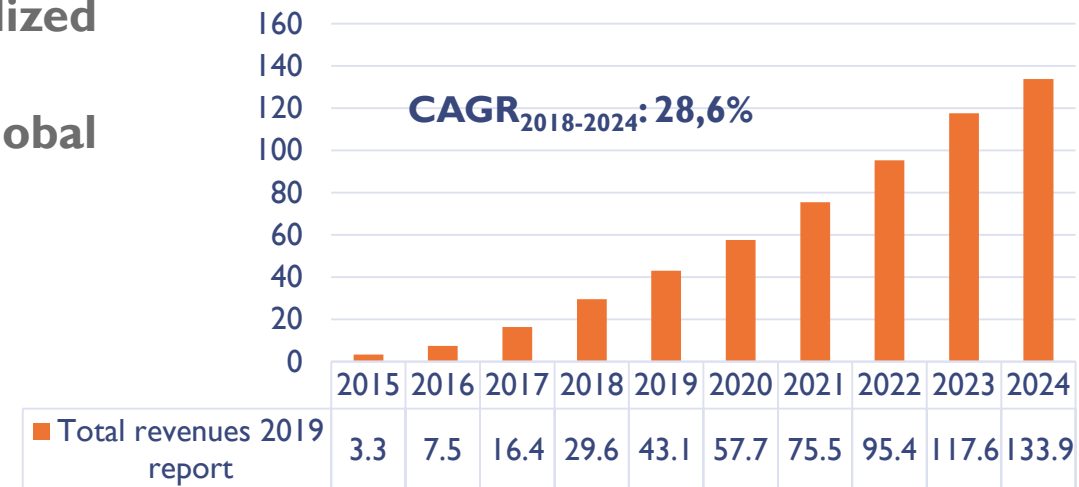




- **Current interest in Organ on Chips is to reduce clinical trial time and save money**
 - Toxicity, side effects
 - Efficacy testing
 - Disease mechanism models
- **Next challenges:**
 - Patient's cells on chip to develop personalized medicine for cancer and chronic diseases
 - Body on chip – connecting several organs for a global understanding



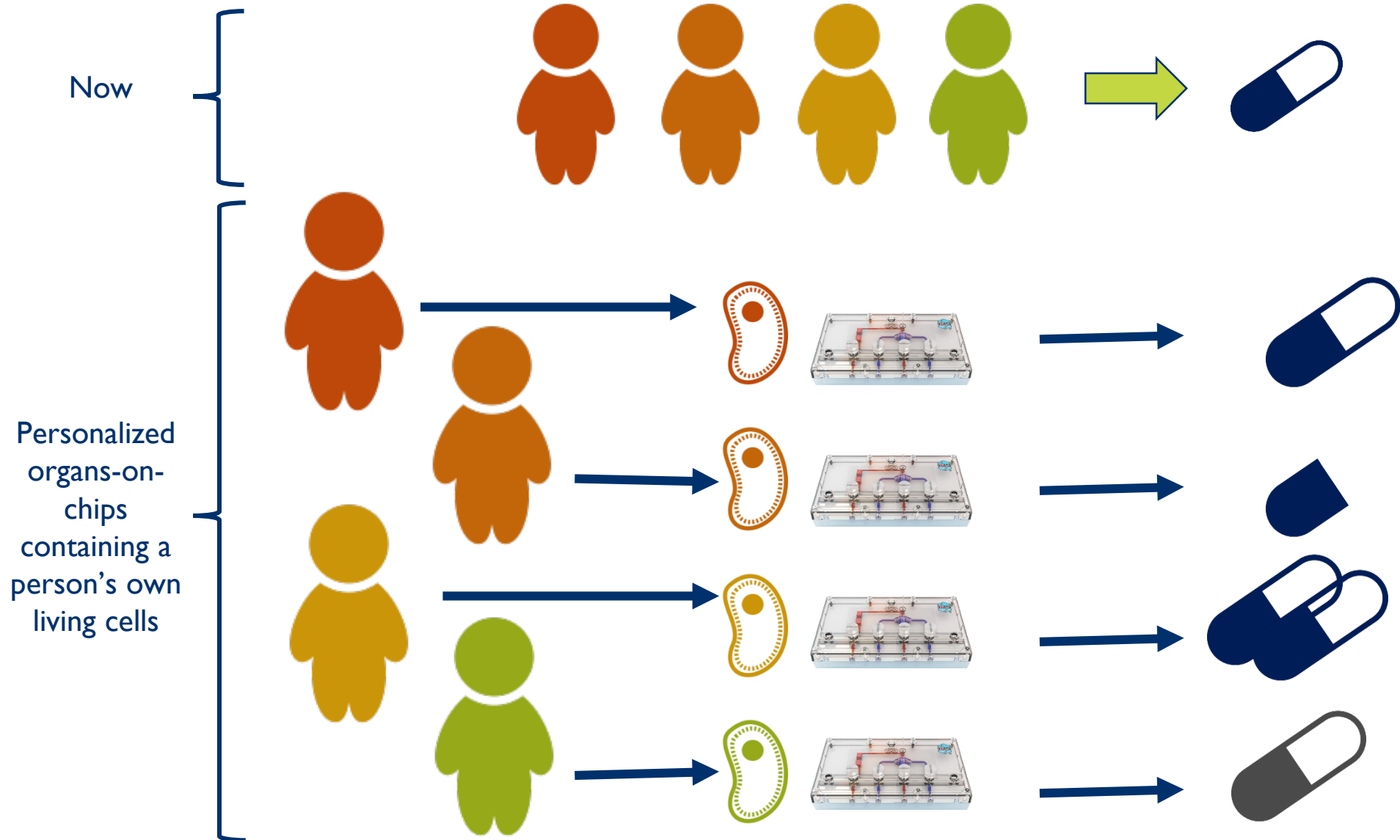
Organs-on-Chips devices market (in \$M)



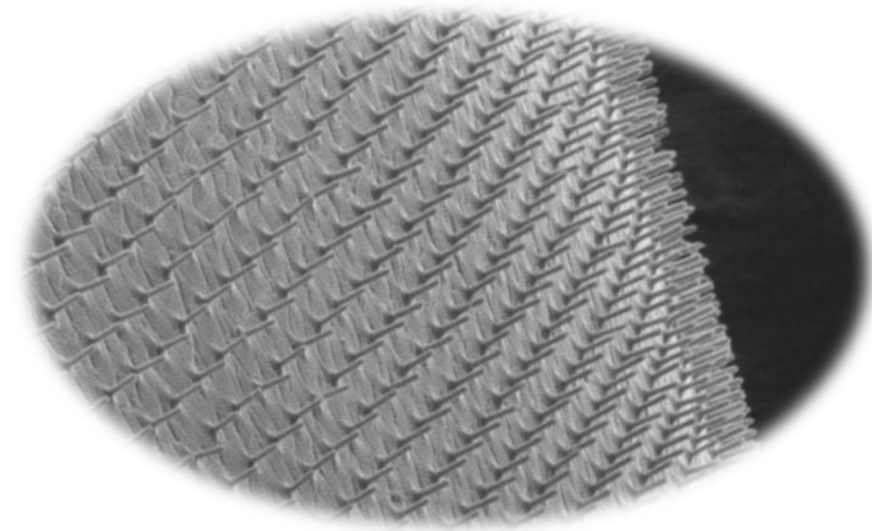
INNOVATIVE DRUGS – PREDICTIVE MODELS AND ANALYTICAL TOOLS

Organ-on-chips

Individually tailored organs-on-chips with a patient's own cells, allowing biology to be predicted on a person-by-person basis



- Disruptive diagnostic solutions
- Innovative drugs
- **Smart drug delivery**

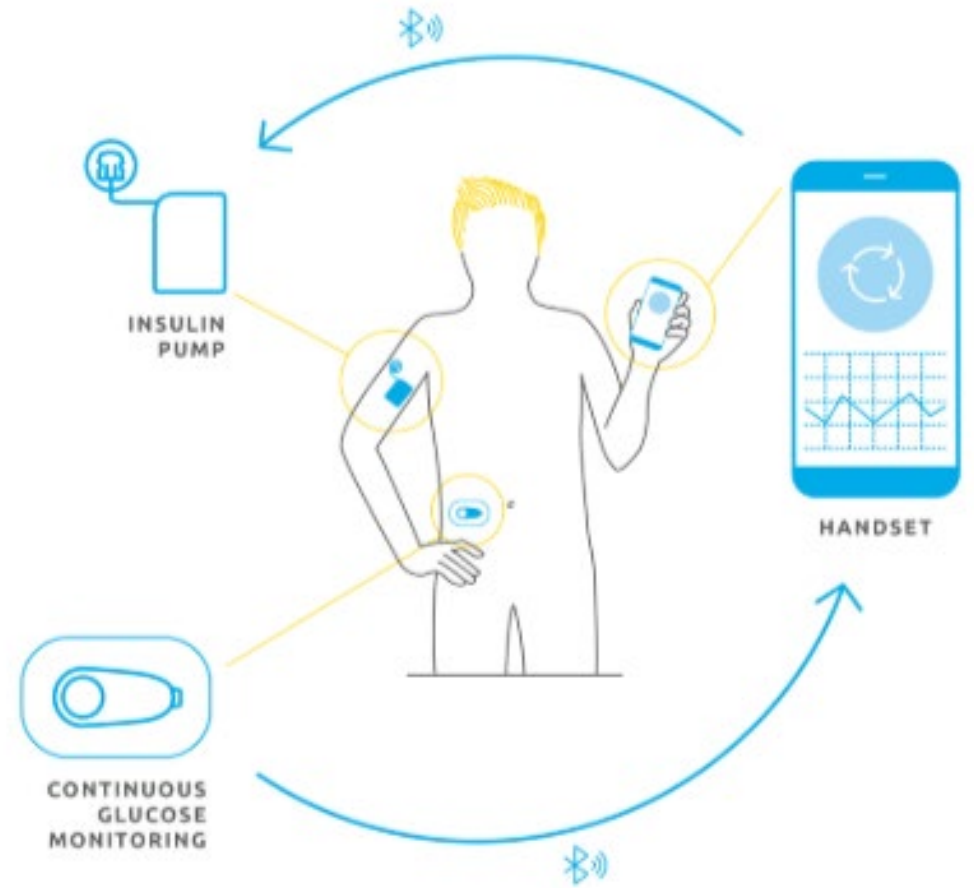


Picture: Purdue University – Biopatch for precision drug delivery

SMART DRUG DELIVERY – EXAMPLE OF DIABETE



More than 1 in 10 Americans will have diabetes in 2025

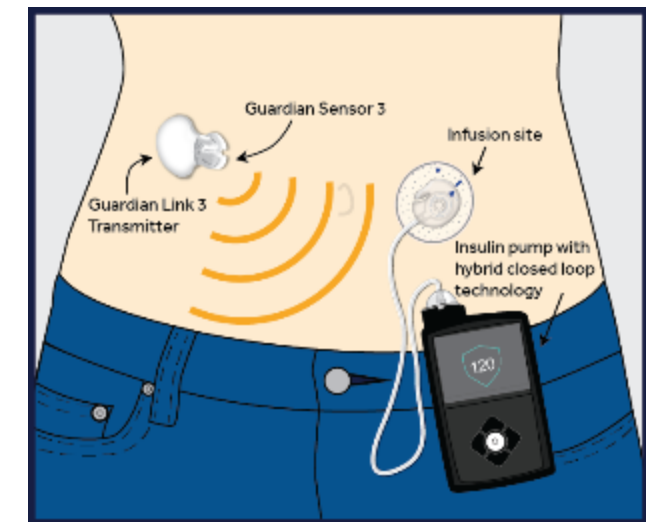


© Diabeloop 2019

Source: Diabeloop



- **MiniMed 670G from Medtronic → First hybrid closed-loop system approved by the FDA**
- **Commercially available**
- **Adjusted drug delivery from the sensor, on the basis of user information**
- **What about AI?**
- **Final goal → Closed-loop system "artificial pancreas"**

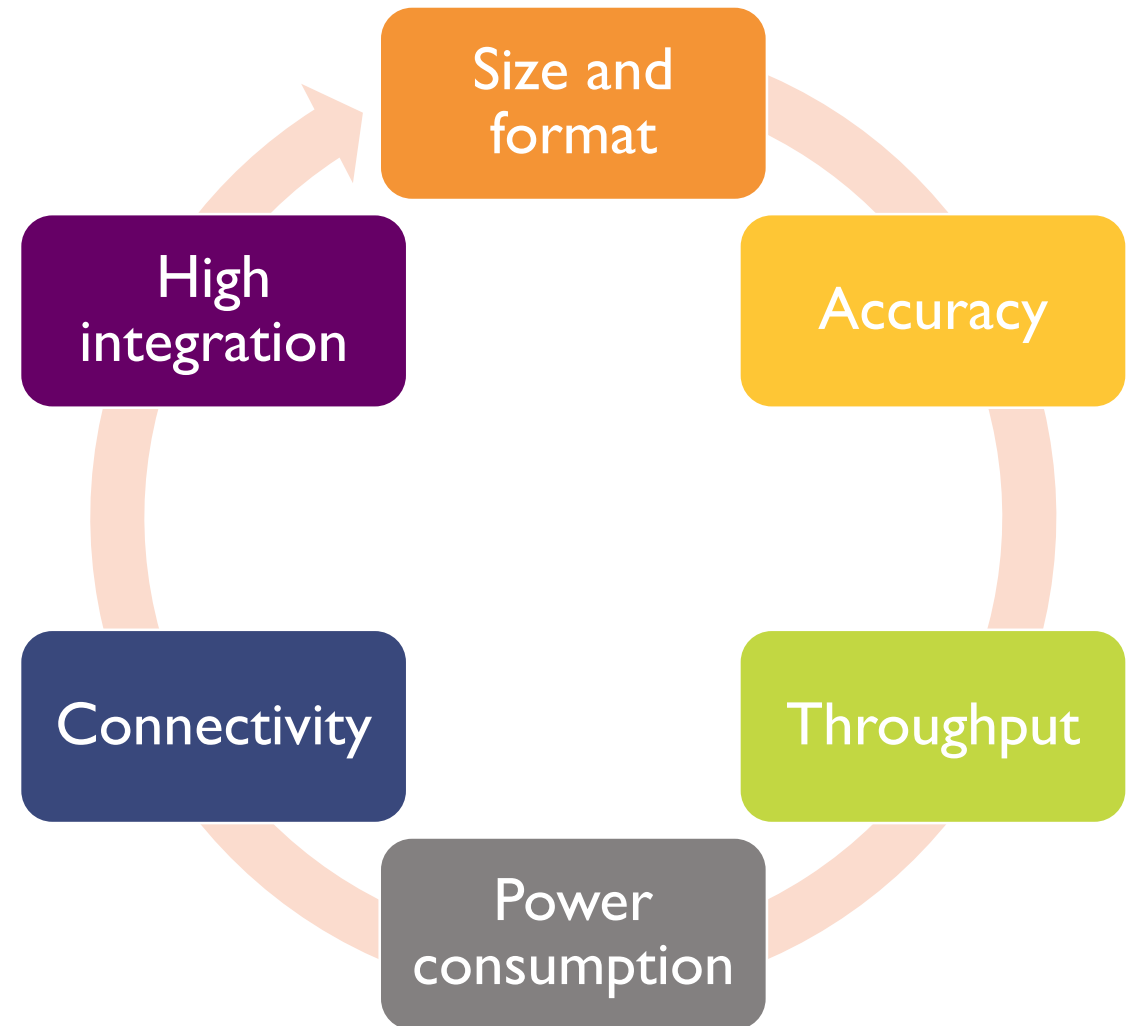


Source: Medtronic

PERSONALIZED MEDICINE CHALLENGES...

...meeting microtechnologies solutions

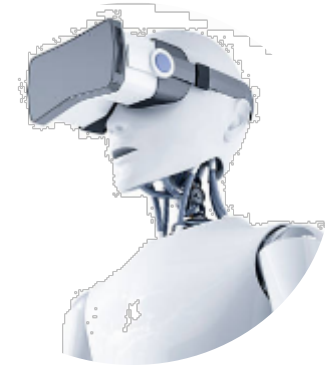
- Personalized medicine impact the medical sector at different level
- The major challenge is to adapt medication and way to deliver it to **EACH** patient, in a cost effective way
- Micro-technologies latest development allow precise, accurate, reliable generation of data
- Requirement of the healthcare organizations to reduce cost of disease should democratize the use of this kind of solutions
- Serial manufacturing processes will be a key factor to decrease cost of these solutions





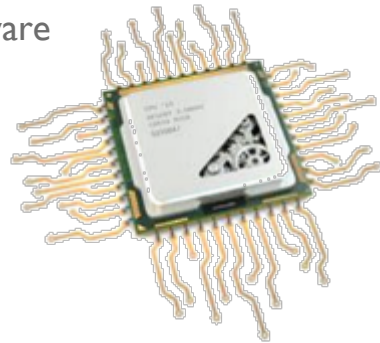
Photonics & Sensing

- Photonics
- Lighting
- Imaging
- Sensing & Actuating
- Display



Semiconductor & Software

- Semiconductor Packaging and Substrates
- Semiconductor Manufacturing
- Memory
- Computing and Software



Power & Wireless

- RF Devices & Technologies
- Compound Semiconductors & Emerging Materials
- Power Electronics
- Batteries & Energy Management

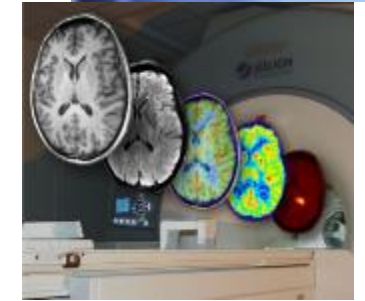
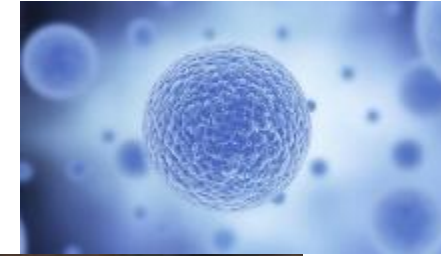
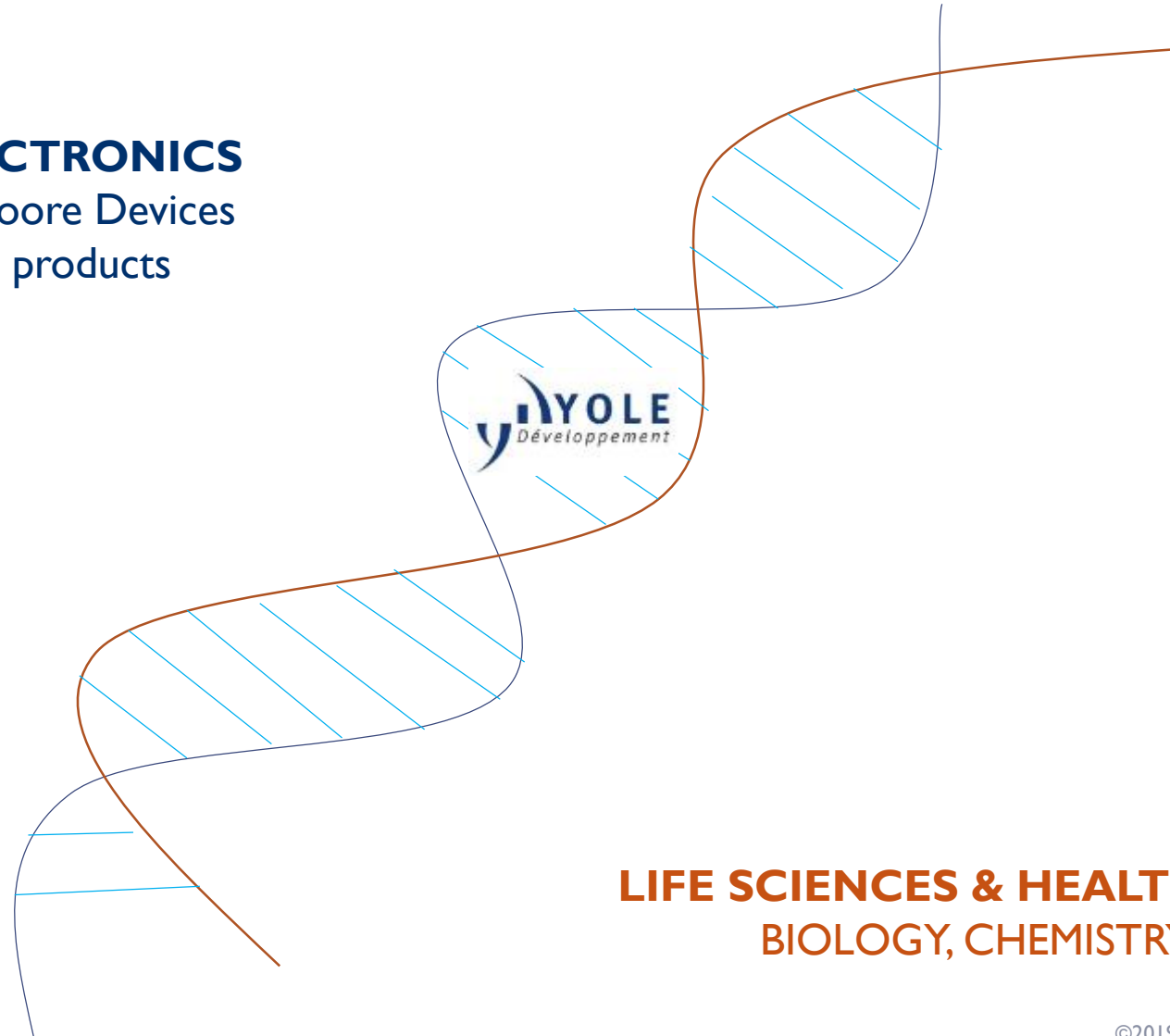
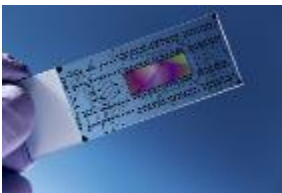
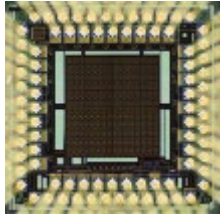


FIELD OF EXPERTISE IN LIFE SCIENCE & HEALTHCARE

Our DNA: combination of two different worlds

MICROELECTRONICS

More than Moore Devices
& derived products



LIFE SCIENCES & HEALTHCARE BIOLOGY, CHEMISTRY

SEVERAL COMPANIES TO SERVE YOUR BUSINESS

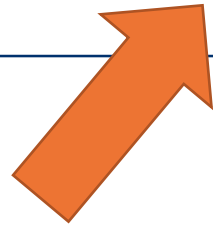


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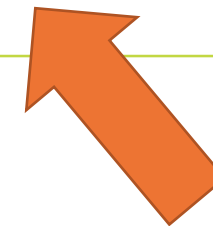


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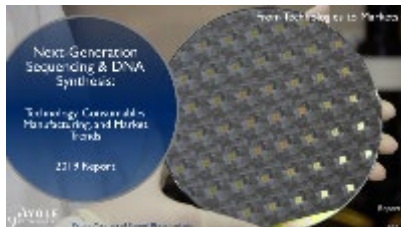
Some slides from this presentation have been taken from the following reports:



Medical Wearable market and technology report
Released in March 2019 – More info on www.i-micronews.com
200+ slides report



Organ-on-Chips market and technology report
Released in October 2019 – More info on www.i-micronews.com
220+ slides report



Next Generation Sequencing and DNA synthesis report
Released in April 2019 – More info on www.i-micronews.com
230+ slides report



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