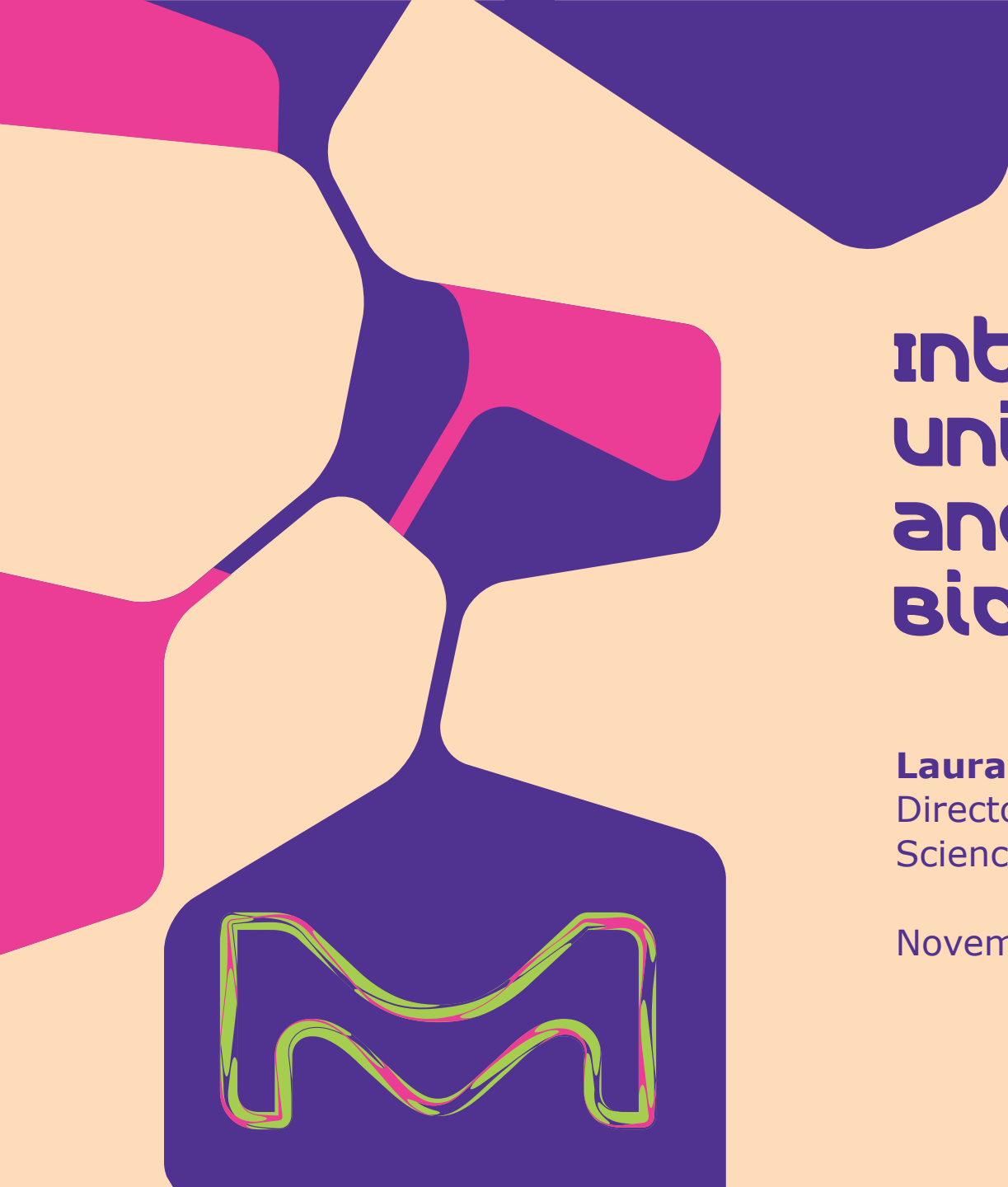




intersecting paths: uniting MOORE'S LAW and Biology Through BIOCONVERGENCE

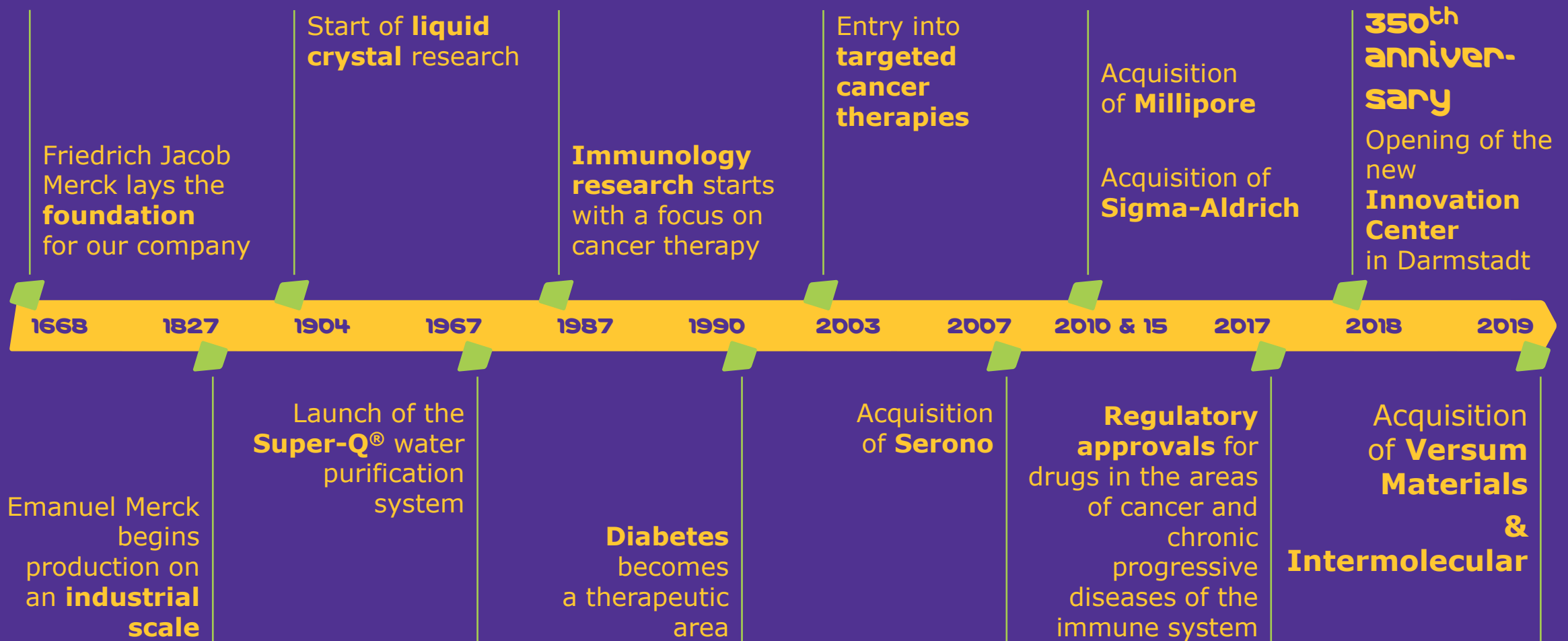
Laura Braeuninger-Weimer

Director Technology Scouting & Enablement
Science and Technology Office

November 2023 SemiCon Europe

MERCK

over 350 Years of curiosity





science
is at the
heart
of everything we do

MERCK

THE HUMAN BODY

1.5 GB

Human genetic code

15 trillion

Body cells with DNA

=23 ZB

DNA data





HUMAN BODY

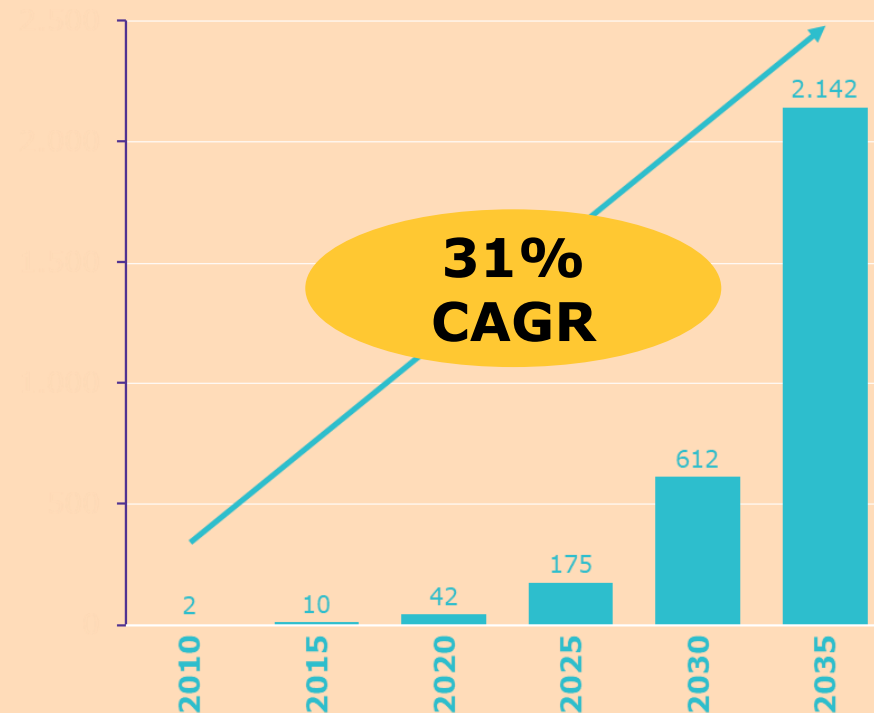
23 ZB

VS. GLOBAL DATASPHERE BY 2035

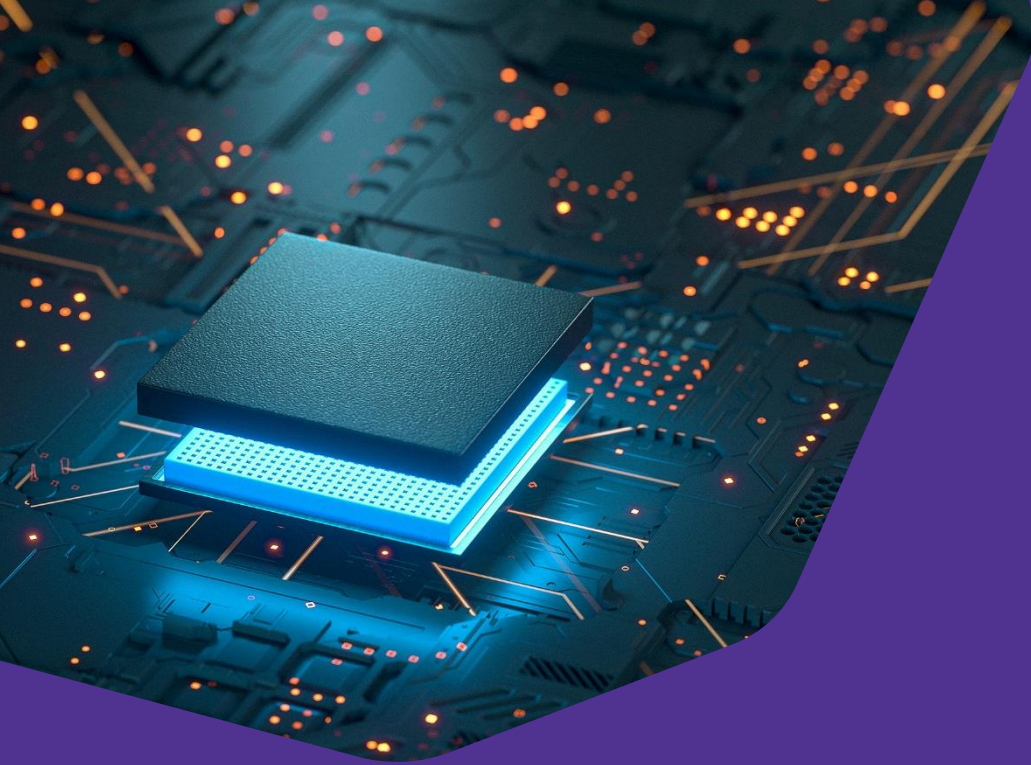
>2000 ZB

Data explosion

Analysis: Global Data Volume Projections



1,000 Zettabytes are 1 Yottabyte (YB) which is as much information as there are atoms in 7,000 human bodies!



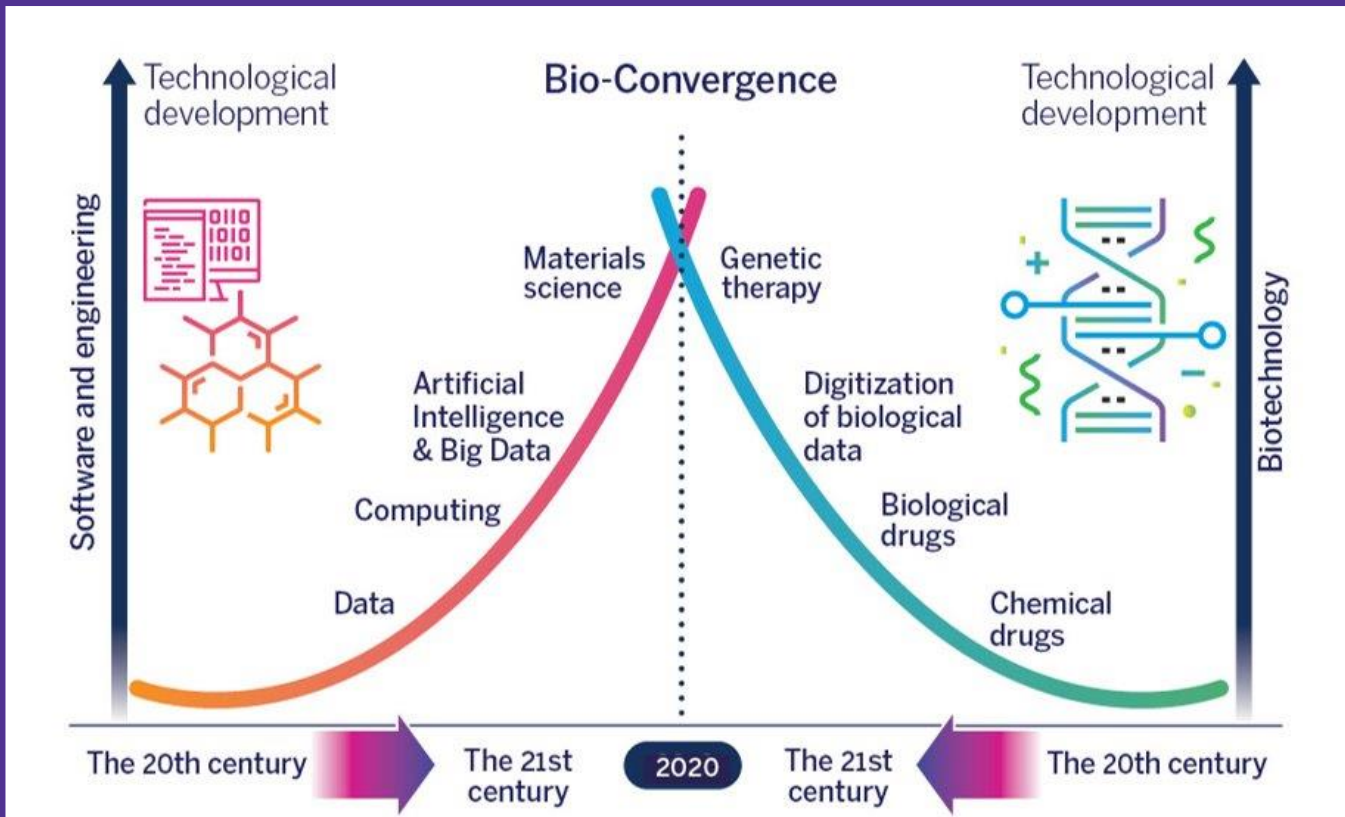
**MERGING
TECHNOLOGY**

with
BIOLOGY



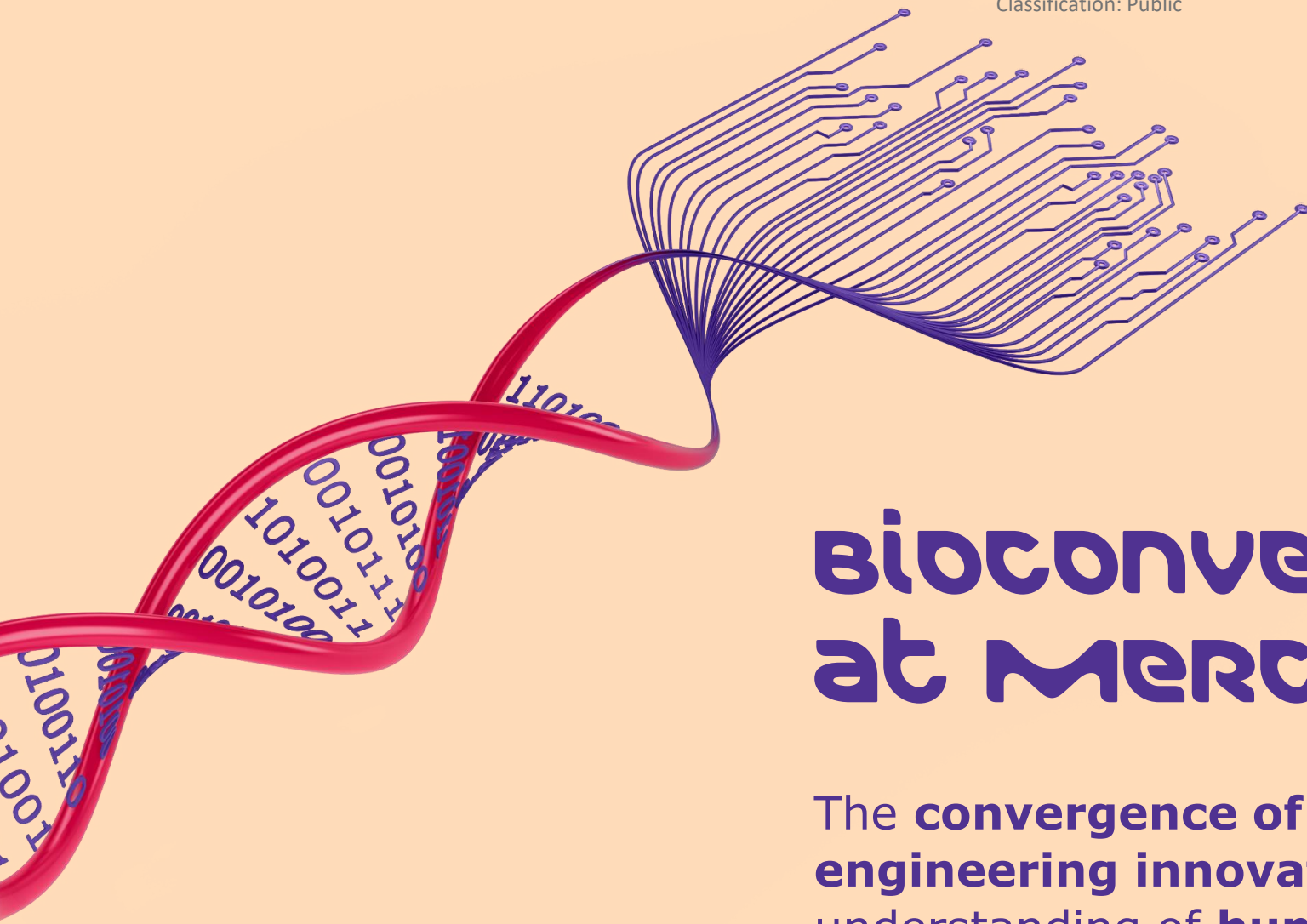
Across sectors, advancements in
engineering, biology and medicine
create a new industry
– fueled by data & digital

*"Rapid genome sequencing is one of the reasons that multiple **COVID-19 vaccines** were developed so quickly."*



*"**Bio-convergence** is the future of human health, a future that promises targeted, **transformative healthcare**, cures for illnesses, and hope for better, more accessible care worldwide."*

Source: <https://innovationisrael.org.il/en/reportchapter/bio-convergence>, quotes from BICO (<https://bico.com/bio-convergence/>)



BIOCONVERGENCE at MERCK

The **convergence of digital, biotech and engineering innovations** to advance the understanding of **human biology** and enable the **future of transformative healthcare** – to better serve our customers and patients.

Transformative Healthcare

And the role of bioconvergence



Prevention and **prediction** of disease

Improved efficacy i.e., patient more likely to receive a medicine delivering a clinical benefit

More efficient development of **novel medicines**

Reduces **hospitalization**

We are at
the sweet spot
of converging technologies

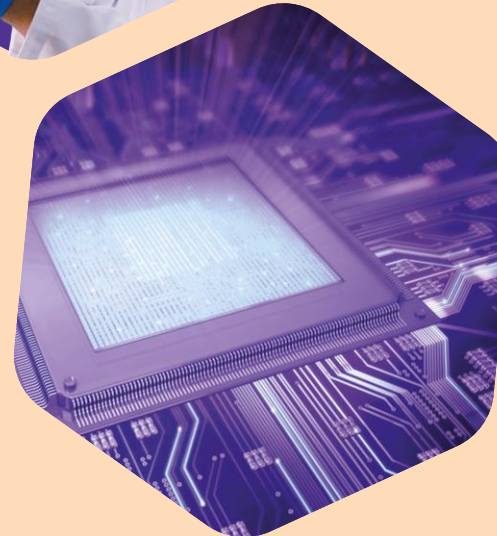


A global specialty innovator in Healthcare

delivering personalized treatments for serious diseases and enable people to achieve their dream of becoming parents.

A diversified industry leader in Life Science

providing scientists and researchers with lab materials, technologies and services to make research and biotech production simpler, faster and safer

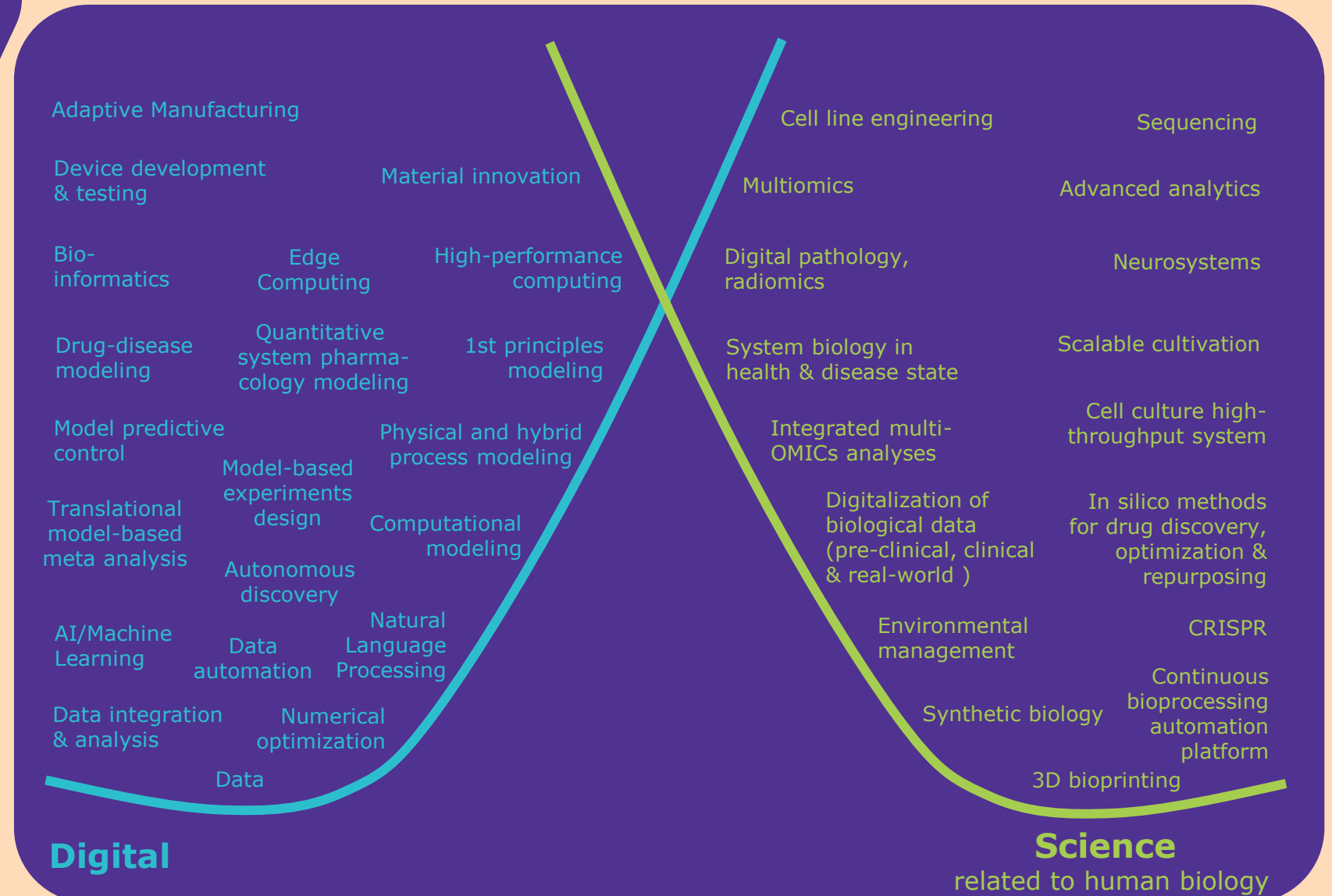


A leading player in Electronics

uniquely positioned to serve and enable the electronics industry to cater the ongoing data explosion

Manifold competencies

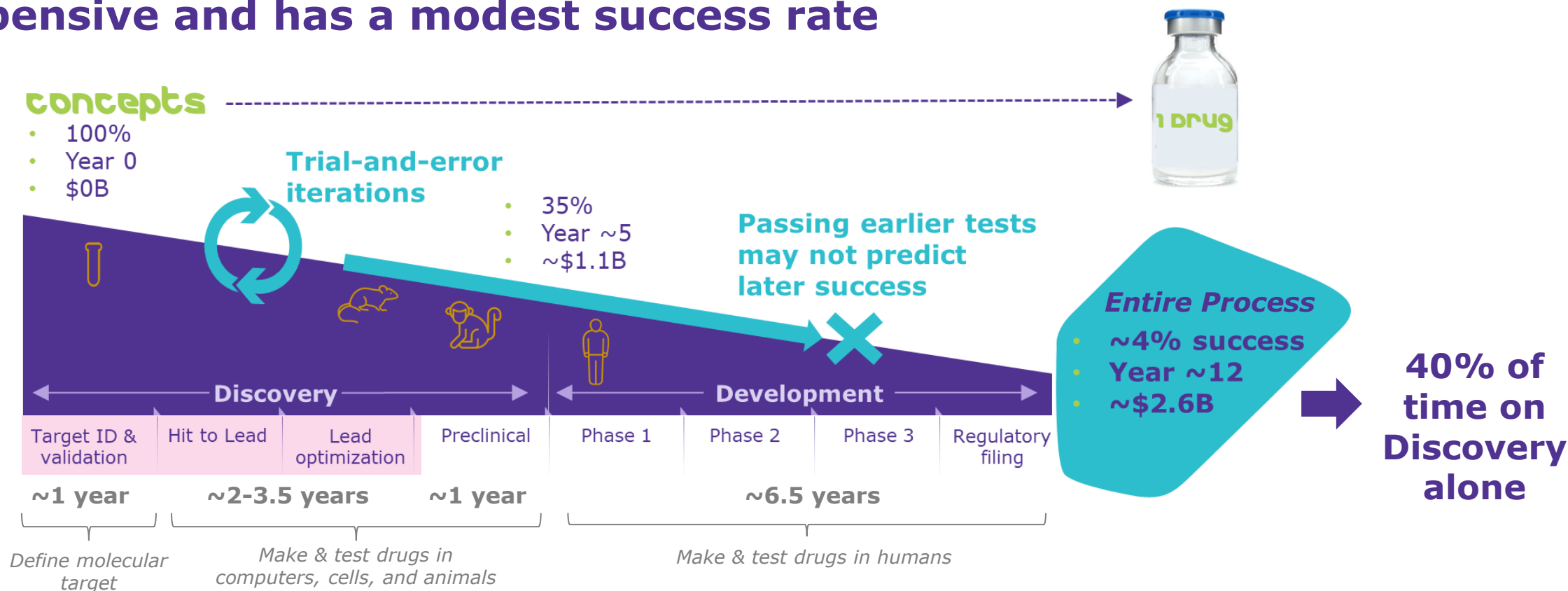
in converging
digital & scientific
innovation



* Non exhaustive overview of competencies

Customer's pain points

Traditional drug discovery and development is time consuming, expensive and has a modest success rate



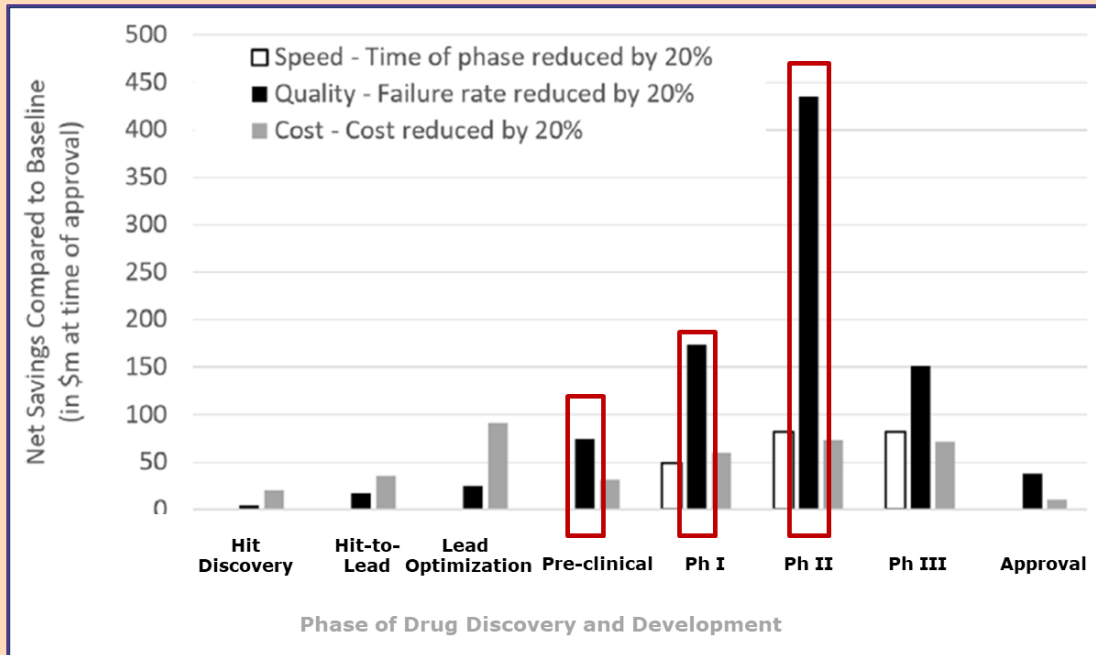
Needs in Drug Discovery

- ✓ Reduce timelines
- ✓ Increase in "hit rate"
- ✓ Increase success rate

- ✓ Increase accessible chemical space
- ✓ Improve processes for synthesis
- ✓ Increase target space – beyond small mol inhibition

Reimagining Drug Discovery

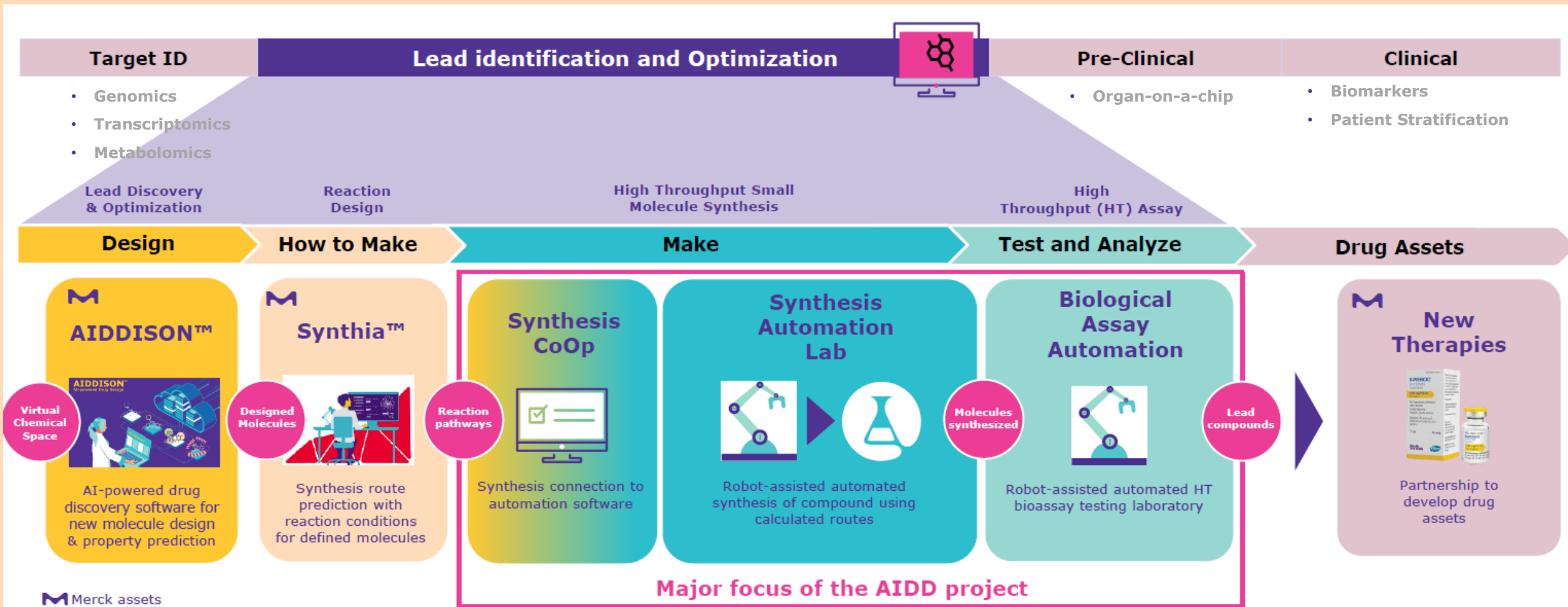
to improve the quality of drug development



The **QUALITY** of a compound taken forward has the greatest impact on the success of a project

Adapted from Bender and Cortès-Ciriano (2021) Drug Discovery Today 26, 2: 511
<https://doi.org/10.1016/j.drudis.2020.12.009>

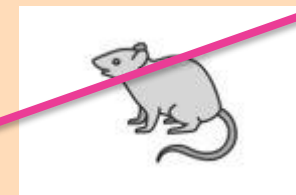
Converging AI and automation to quickly identify and make higher quality drug candidates



Reimagining drug testing using human organs on a chip to greatly improve Tox and Efficacy translatability from pre-clinical into the Clinic
...while also greatly improving animal welfare



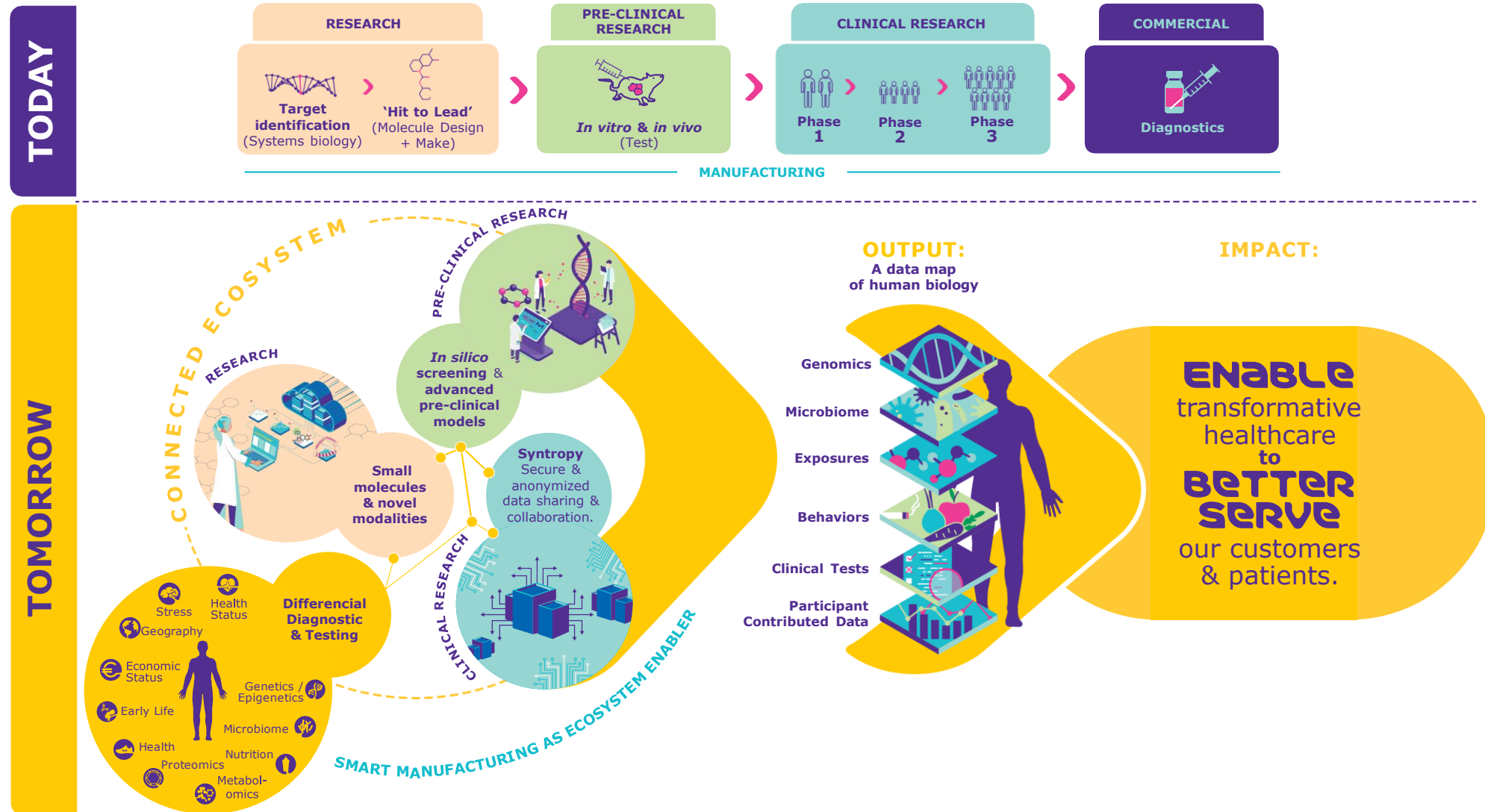
Next Generation drug discovery & development is replacing animal models with advanced Human Microphysiological Systems (MPS)



Safety testing by predictive in-silico modelling and multi-organ-on-a-chip organoid models reducing need for animal testing

How? Connected, digital HC future - powered by converged technologies

A digital ecosystem of Merck and partners to deliver transformative healthcare solutions to patients and healthcare systems faster



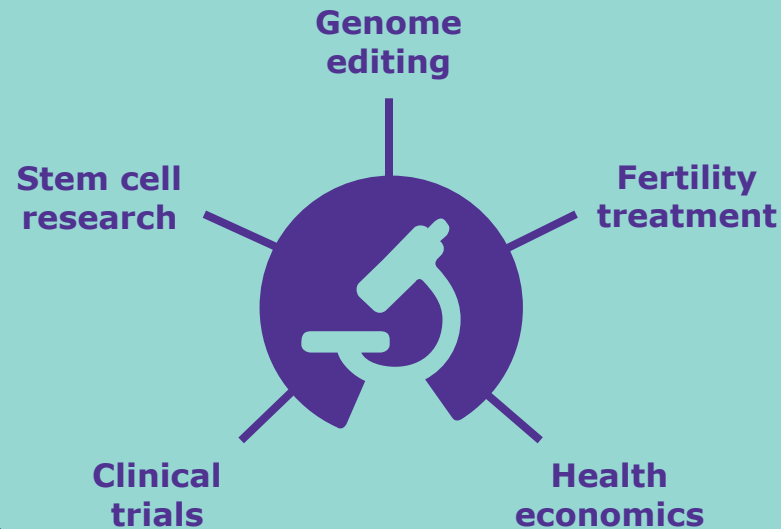
ACTING RESPONSIBLY

SOUND AND ETHICAL
FRAMEWORKS AND STANDARDS

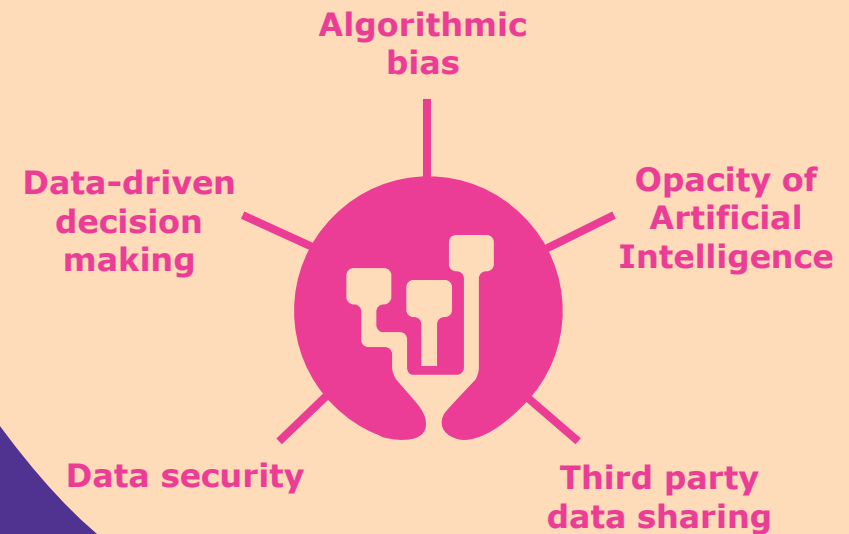


Rigorous ethical standards are a hallmark of Merck's long history of industry leadership

Bioethics



Digital Ethics





Merck