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# Human Technopole: Advancing Health through Molecular Life Science Research

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# Human Technopole's vision

To promote human health and well-being through an **interdisciplinary approach to human biology**



Research aimed at developing **personalised approaches** to tackle human diseases

# A world-class centre for life science research

Hire **1000 scientists** exclusively via international calls, following transparent hiring processes. Most PIs will be offered a **fixed-term** contract.

A large-scale national research infrastructure:  
55.000 m<sup>2</sup> of which 35.000m<sup>2</sup> of **interdisciplinary laboratories**.

**State of the art facilities** shared and available to external users where possible

A **collaborative network** with national research and clinical partners by sharing technologies, methods and data

Industrial collaboration and consultation, supporting **technology transfer**

# Our initial lines of research



**Genomics** – to uncover complex mechanisms governing gene expression



**Neurogenomics** – to uncover mechanisms of neuronal structure-function and neuro-development particularly applying to the study of neurodegenerative disease



**Computational biology** – to bring computation and bioinformatics approaches to study disease-associated biological processes



**Structural biology** – to gain precise knowledge of macromolecules and understand how they function



**Data science (CADS)** – to develop original research at the intersection of computer science, math, statistics, A.I. and socioeconomic science

# HT's scientific leadership

## STRUCTURAL BIOLOGY



**Alessandro Vannini**  
ICR (London, UK)



**Gaia Pigino**  
MPI-CBG (Dresden, DE)

## COMPUTATIONAL BIOLOGY



**Florian Jug**  
CSBD (Dresden, DE)



**Francesco Iorio**  
WSI (Cambridge, UK)

## NEUROGENOMICS



**Giuseppe Testa**  
UniMi-IEO (Milan, IT)



**Nereo Kalebic**  
MPI-CBG (Dresden, DE)

## GENOMICS



**Piero Carninci**  
RIKEN (Tokyo, JP)

# State-of-the art equipment

**Cryo-EM user facility** for high resolution molecular structure determination.

A **genomics facility** to develop, set up and implement essential technologies: DNA/RNA sequencing, support large scale studies by HT researchers and nationwide screening initiatives.

Data storage and high performance computing to manage **petabytes** to **exabytes** of scientific data.

Opportunity for **combined database** of medical- and bio-informatics resources.

**Infrastructures to be shared and available to external users where possible**

# Short-term scientific VISITOR programme

Offered to scientists interested in visiting Human Technopole

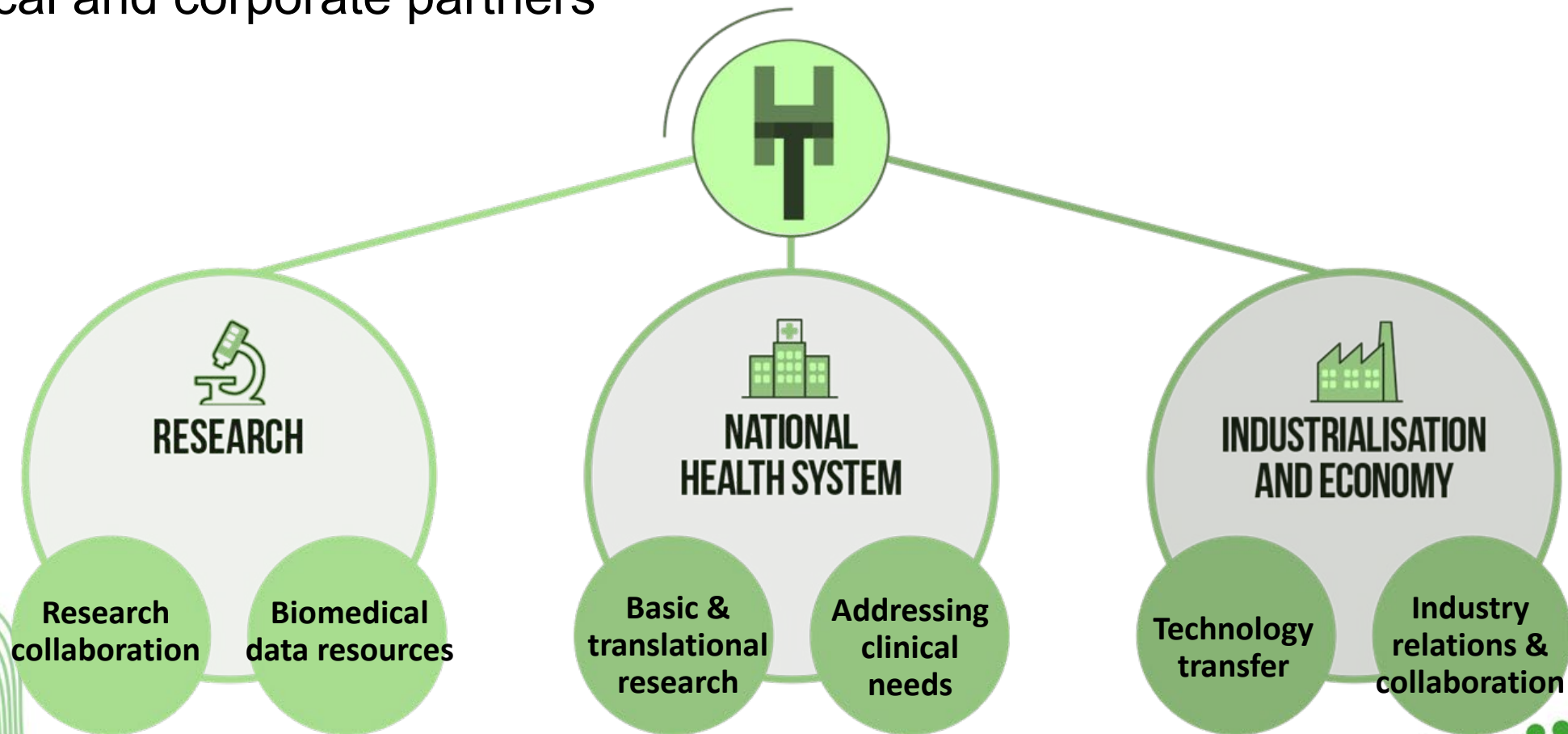
Transparent selection on the basis of project-based applications

Open to: undergraduate students, PhD students, postdoctoral fellows, group leaders, technicians

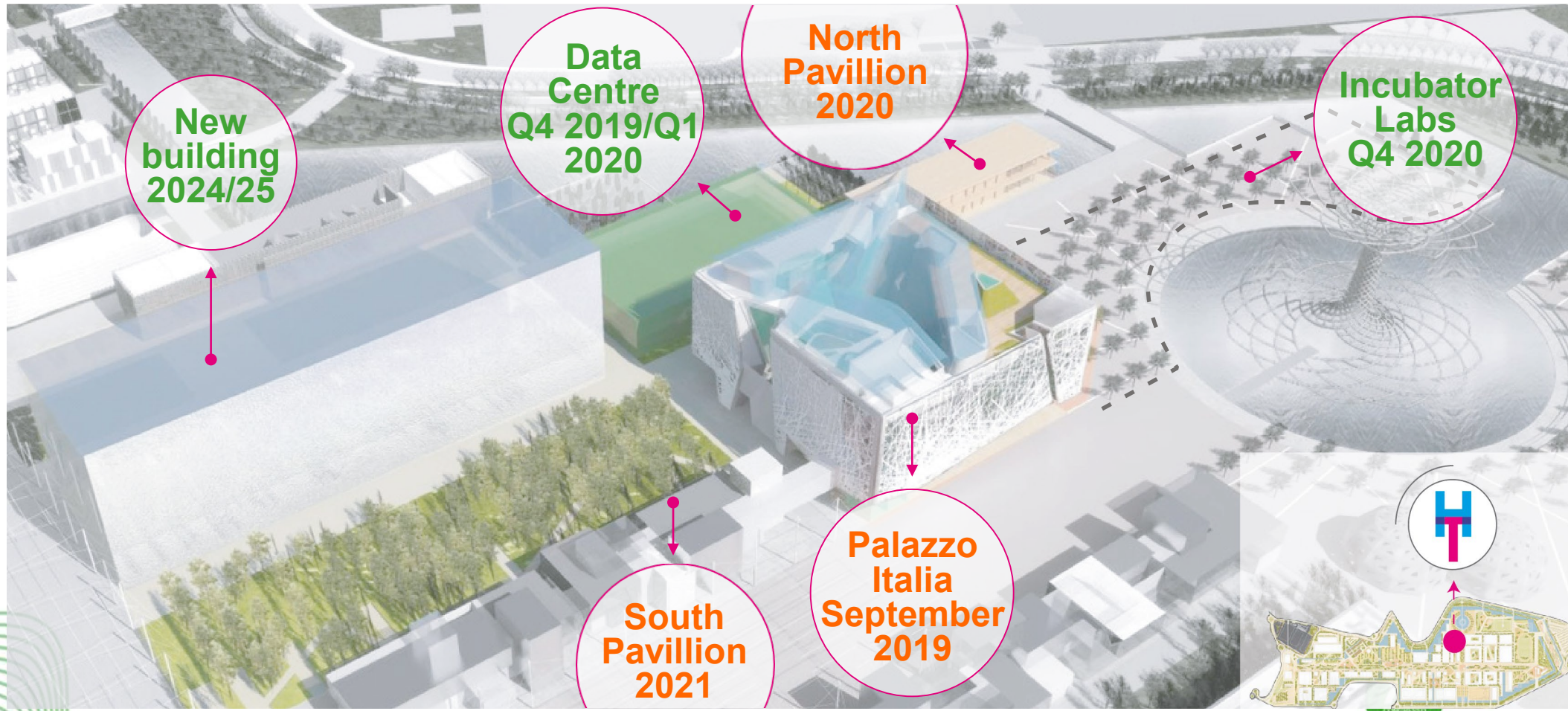


# Network building

Fostering a **collaborative network** with national and international research, clinical and corporate partners



# Human Technopole campus: a large scale national research infrastructure



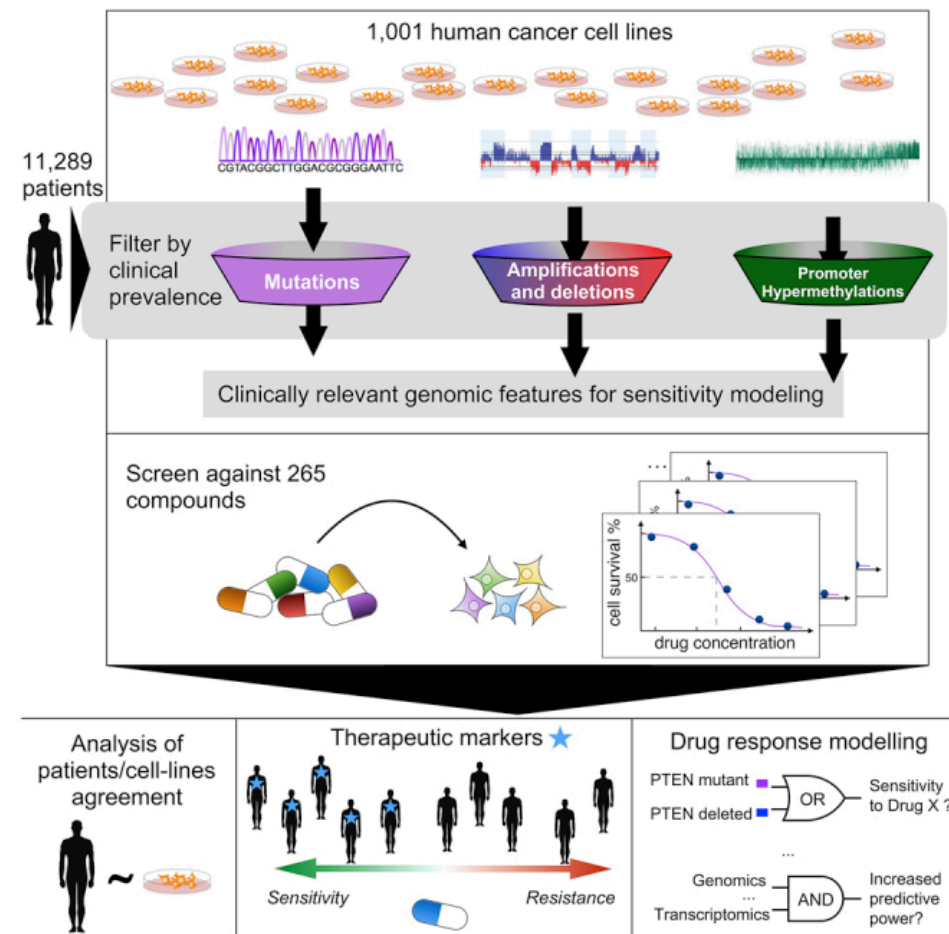
# Advancing health through basic research (I)

## Computational Pharmacogenomics in Cancer (I)

Using information derived from cancer genomes to guide the development/application of novel therapies

- Integration of molecular data (*i.e.* genomic alterations) of > 11,000 tumors and >1000 human cancer cell lines
- Measure response of cancer cell lines to 265 anti-cancer drugs
- Identify/predict combinations of alterations that sensitize to drugs using computational modelling and machine learning

→ Resource for identifying therapeutic options for selected cancer sub-populations



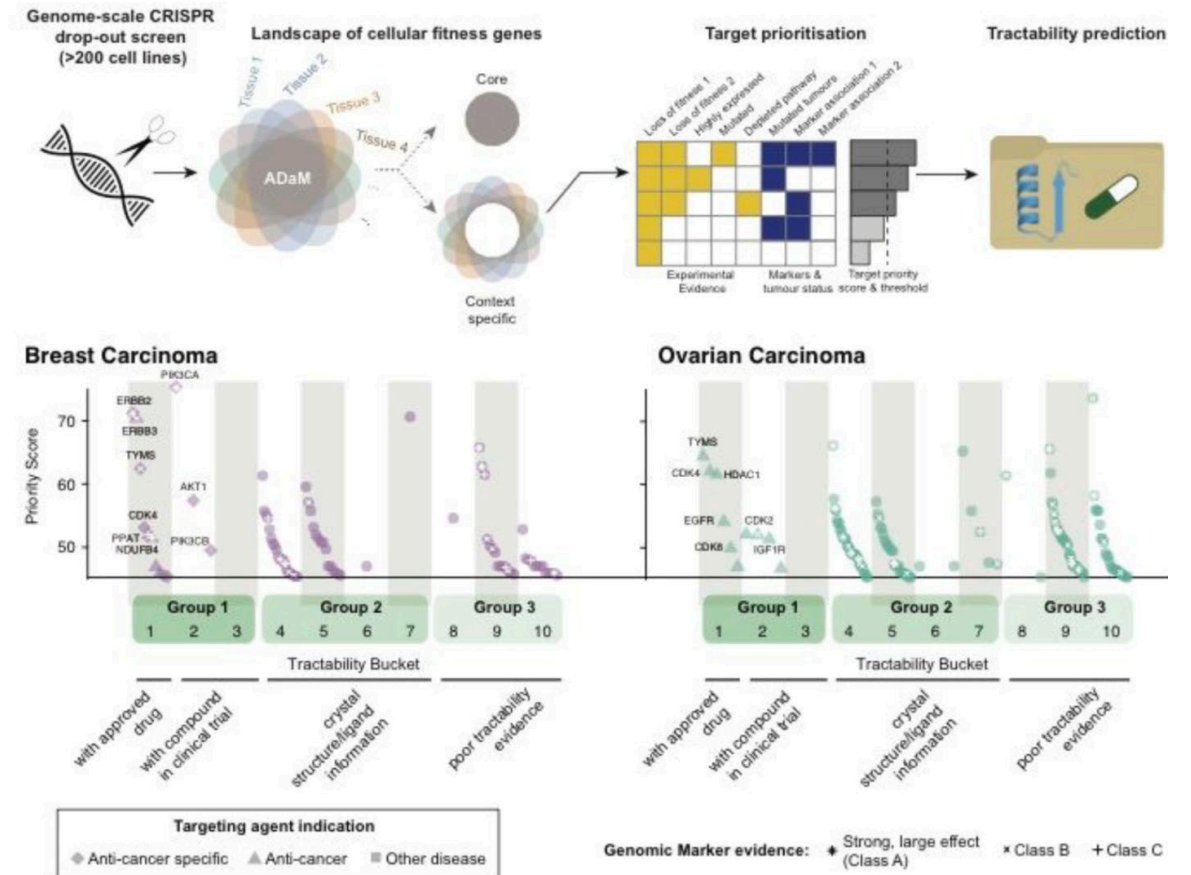
# Advancing health through basic research (II)

## Computational Pharmacogenomics in Cancer (II)

Prioritization of therapeutic targets using CRISPR-Cas9 screens

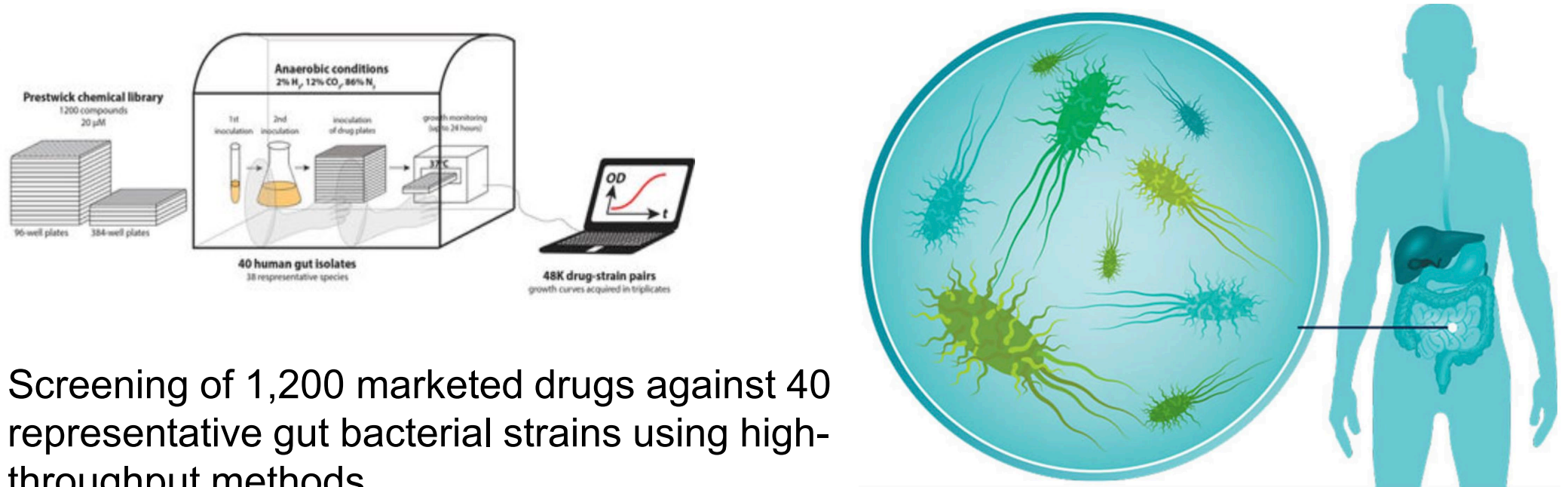
- Genome-scale CRISPR-Cas9 screens in 324 human cancer cell lines from 30 cancer types
- Develop an data-driven framework to:
  1. prioritize candidates for cancer therapeutics in defined tissues and genotypes
  2. suggest specific new targets

→ Computational method to inform initial stages of drug development



# Advancing health through basic research (III)

## Impact of non-antibiotic drugs on the human gut microbiome



Screening of 1,200 marketed drugs against 40 representative gut bacterial strains using high-throughput methods

24% of drugs with human targets inhibit growth of bacteria in the human gut



## Integrative structural biology of the genome – Analysis of RNA Pol III gene transcription

**RNA Pol III**

**TFIIB**

**TFIIC**

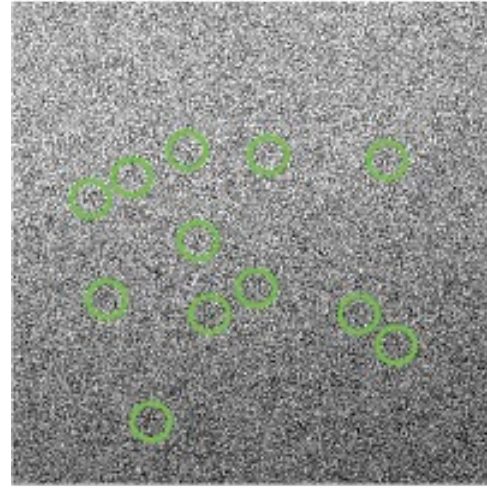
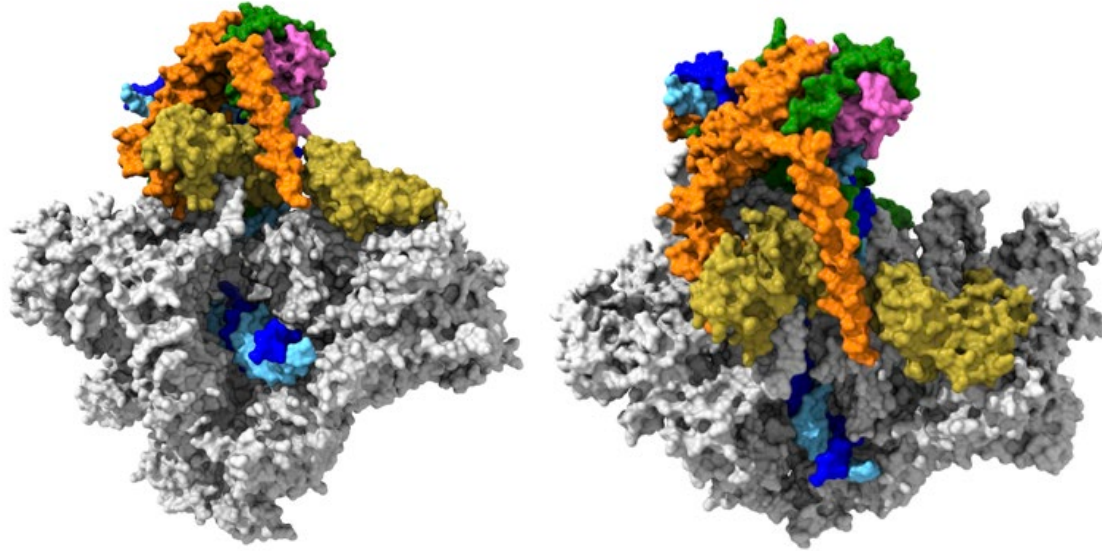
**tRNAs**

(5s rRNA, U6, 7SL, Y-RNA, V-RNA, ...)

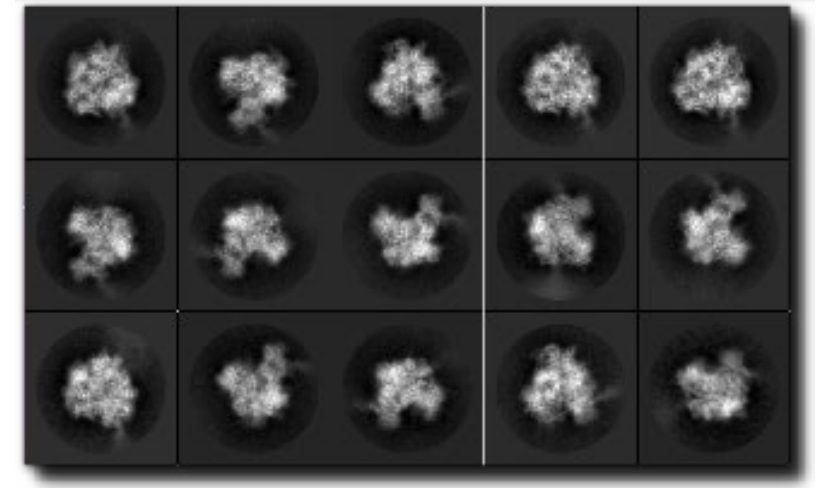
26 subunits (~1.5 MDa)

# Advancing health through basic research (IV)

## Cryo-EM enables visualization of RNA Pol III gene transcription



Cryo-EM micrograph



2D classification

- Several states/intermediates resolved at high resolution (3–4 Å)
- Molecular basis of class III gene transcription revealed
- Structural scaffold for developing novel anticancer drugs

# The context of Human Technopole



