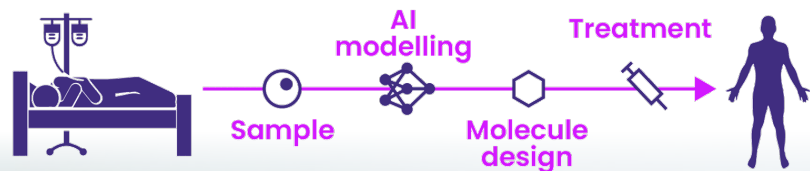


Molecular Design in Medicine

@EPFL



MDM Center

DCI

PTPSP

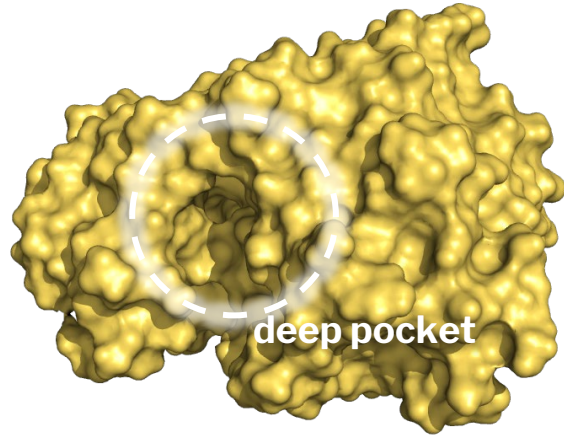
BSF / ACCESS

SwissCat+ /

SYNTHERA

What if we could design any medication society needs ?

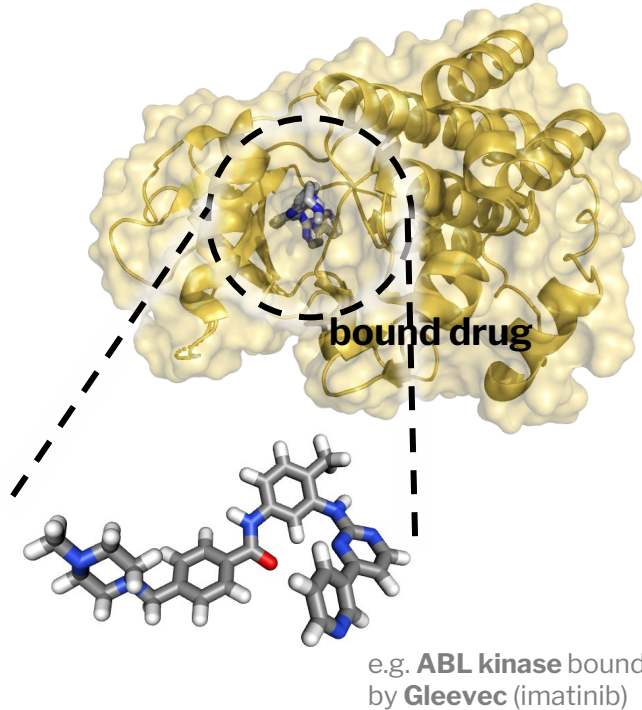
> 95% of drug targets are **proteins**



e.g. **ABL** kinase

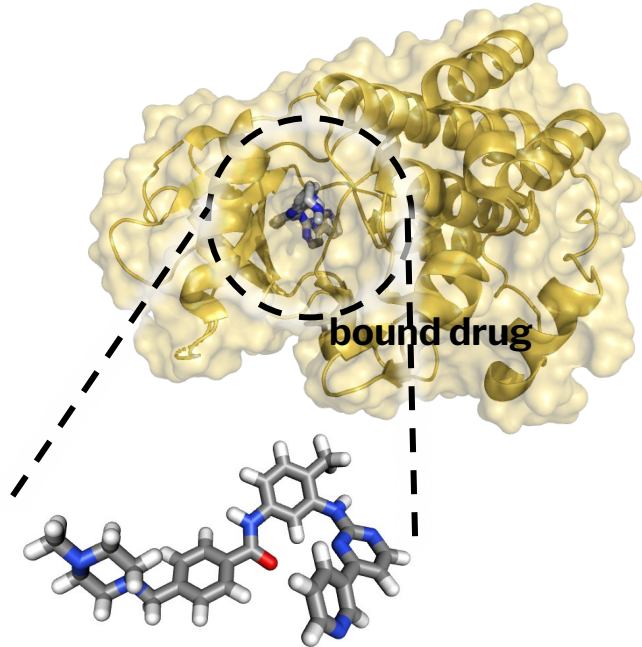
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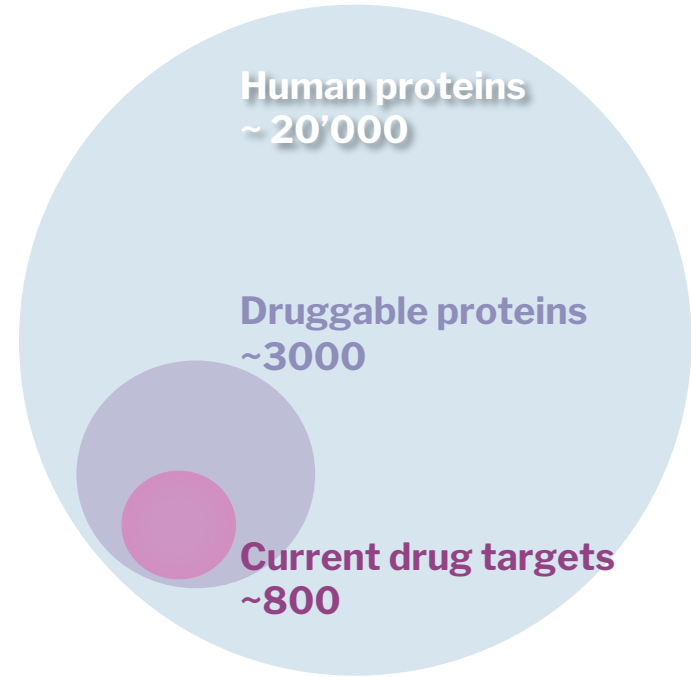


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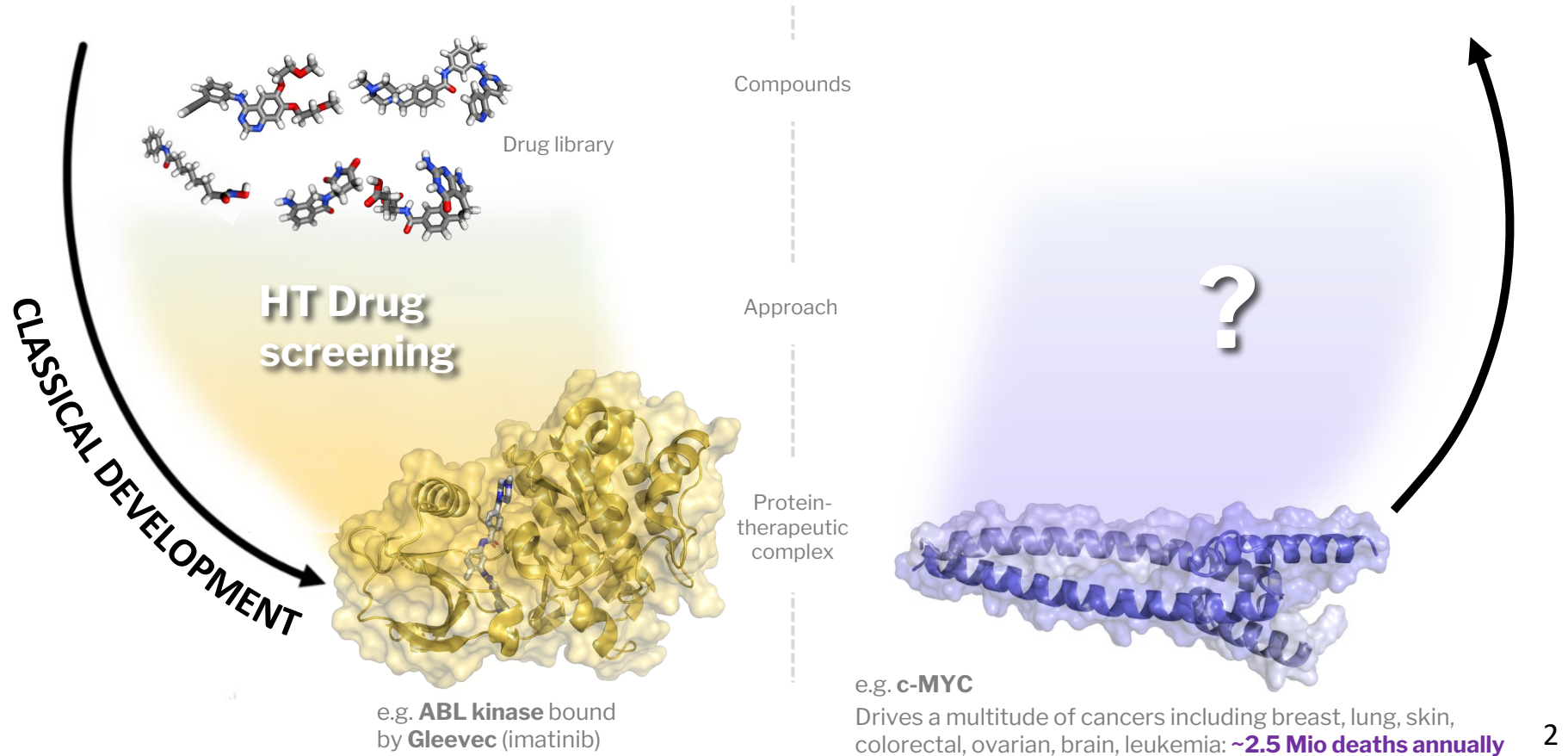


e.g. **ABL kinase** bound
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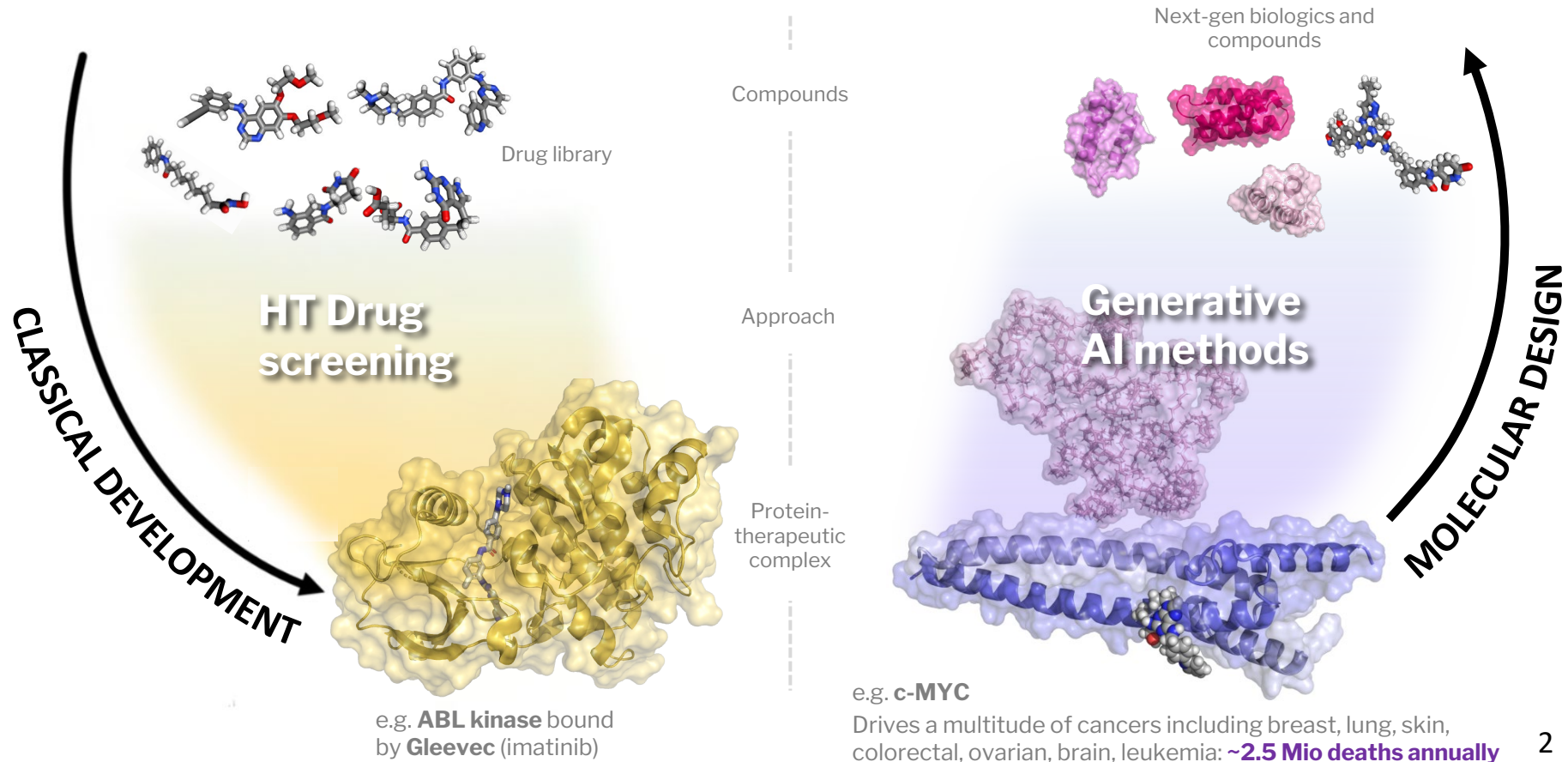


85% Proteome remains 'undruggable'

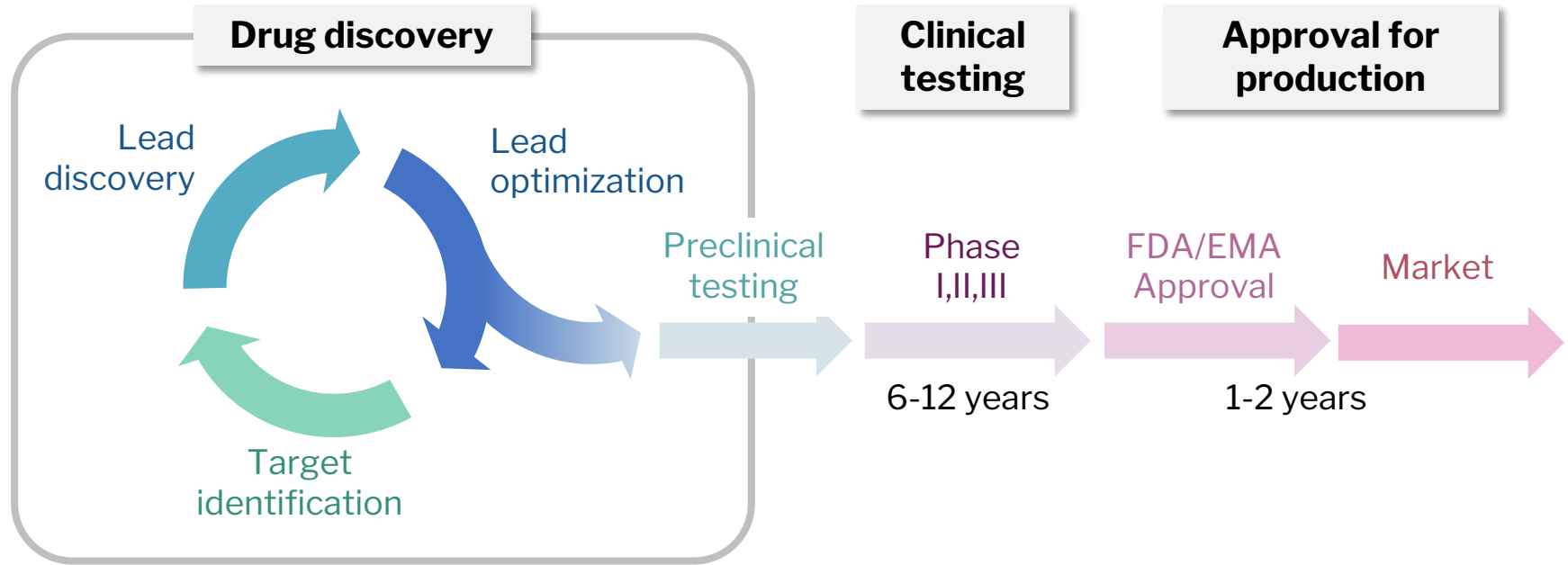
Classical drug development fails for 'undruggable' proteins



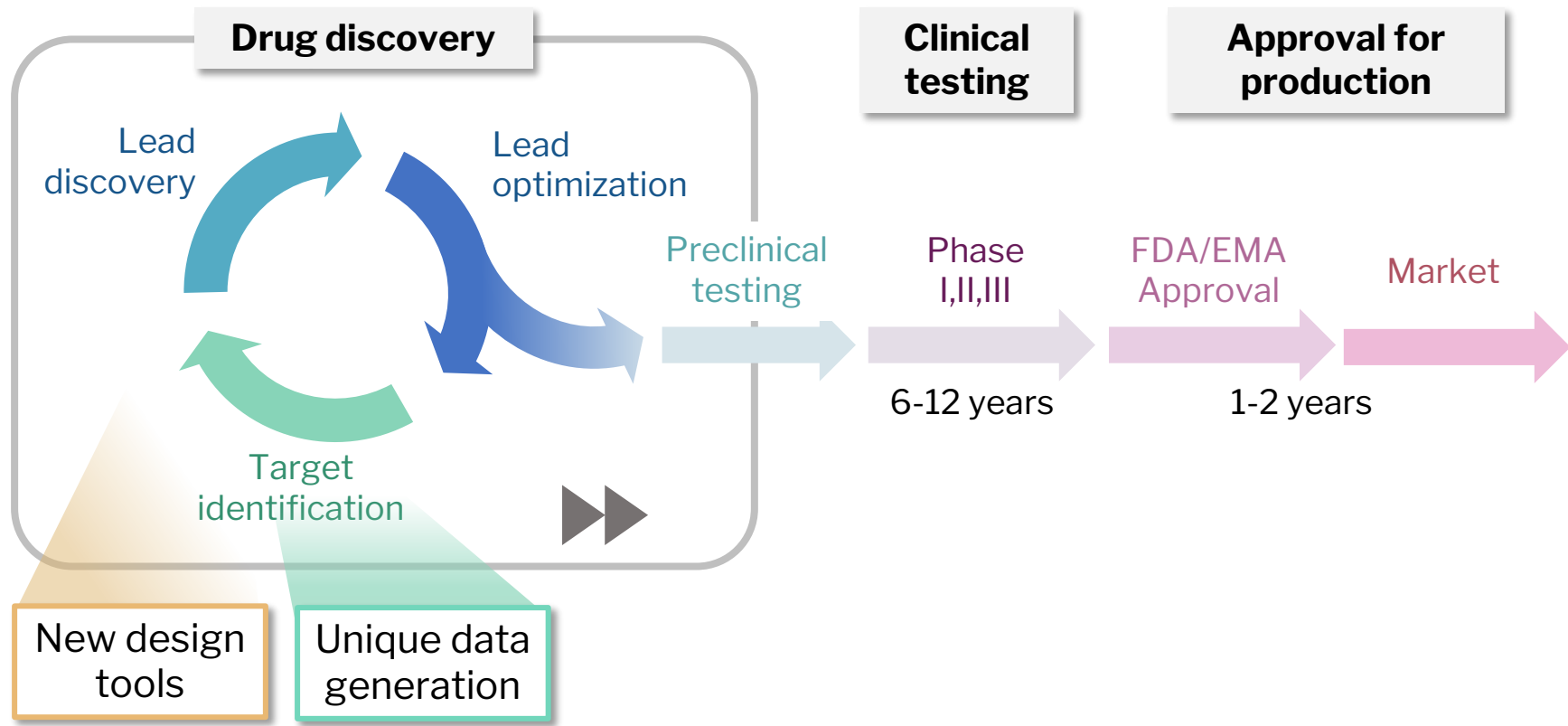
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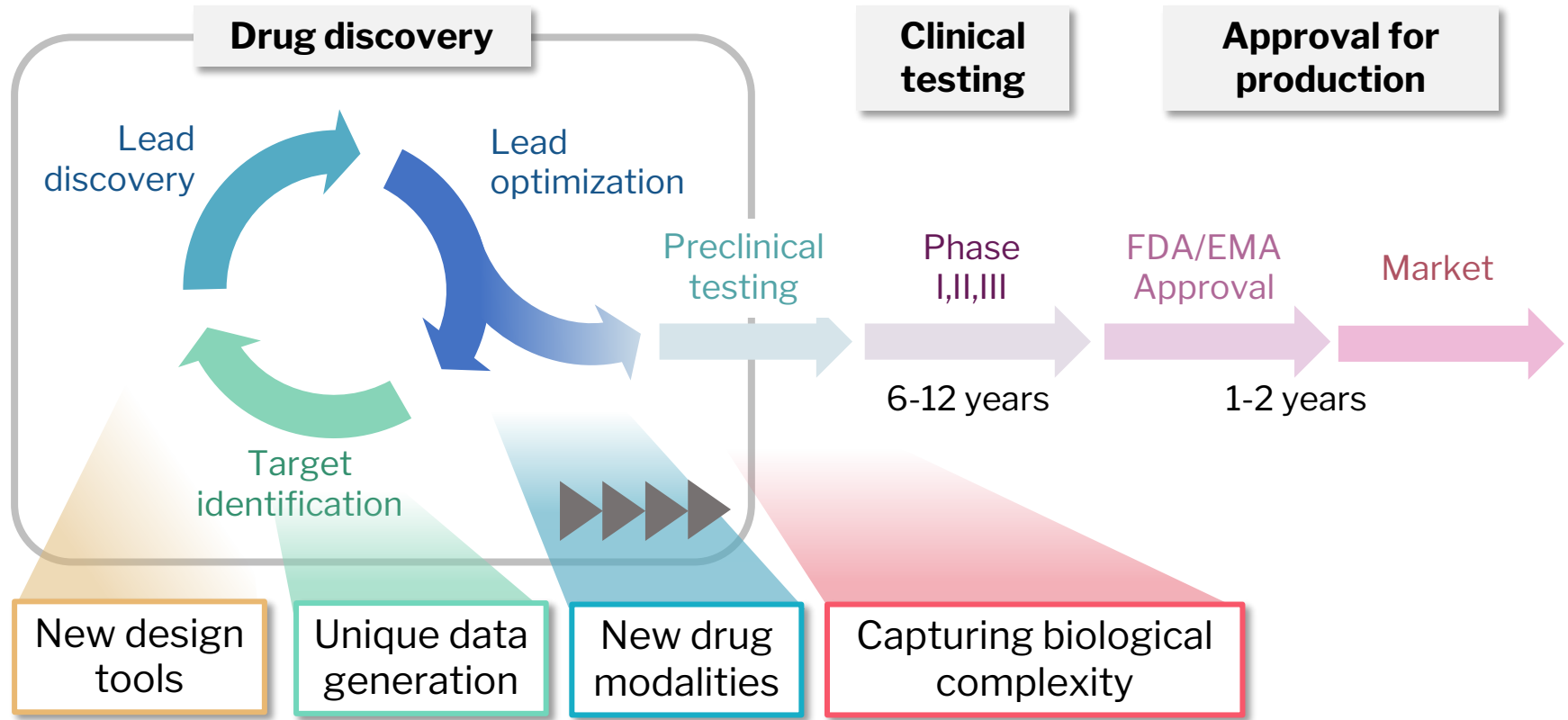
Addressing challenges in drug development



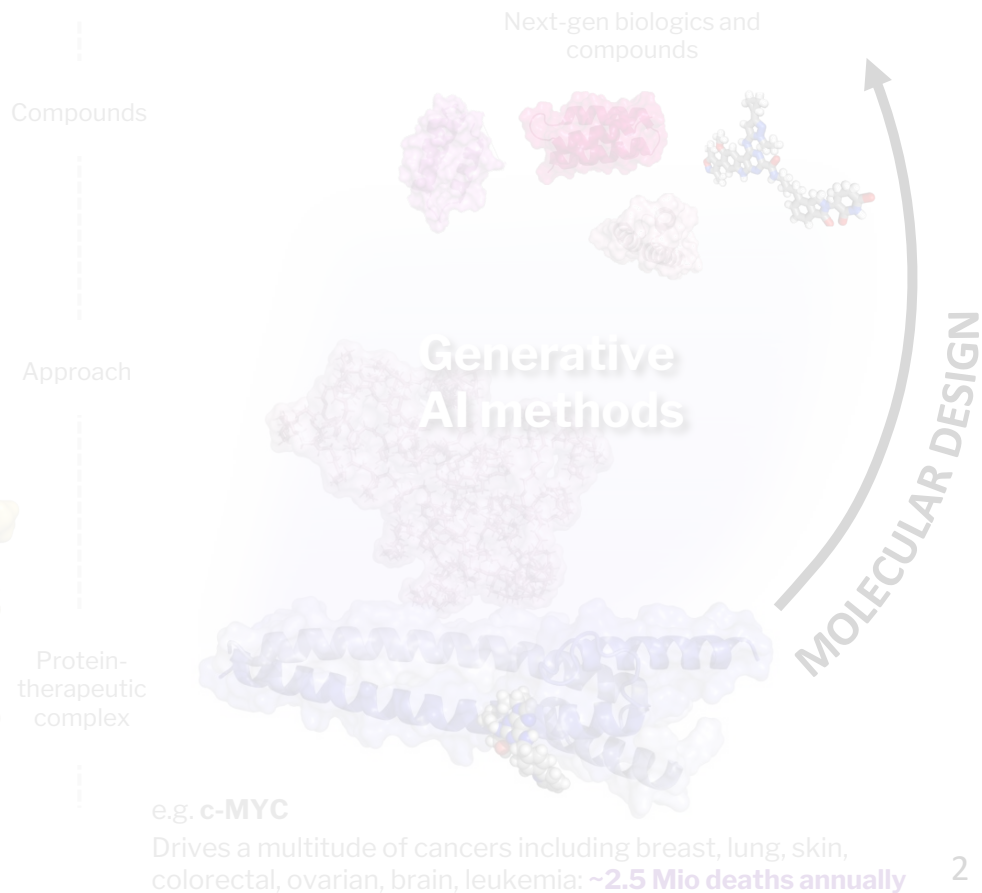
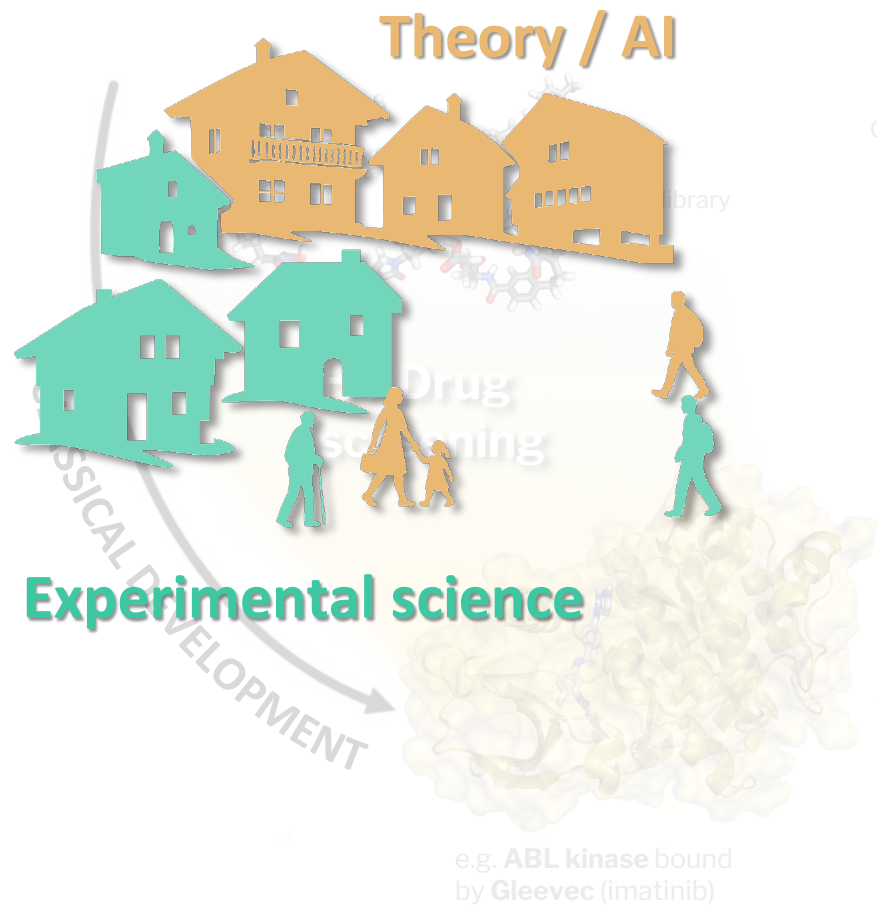
Addressing challenges in drug development: Key contributions from academia **in collaboration with Industrial partners**



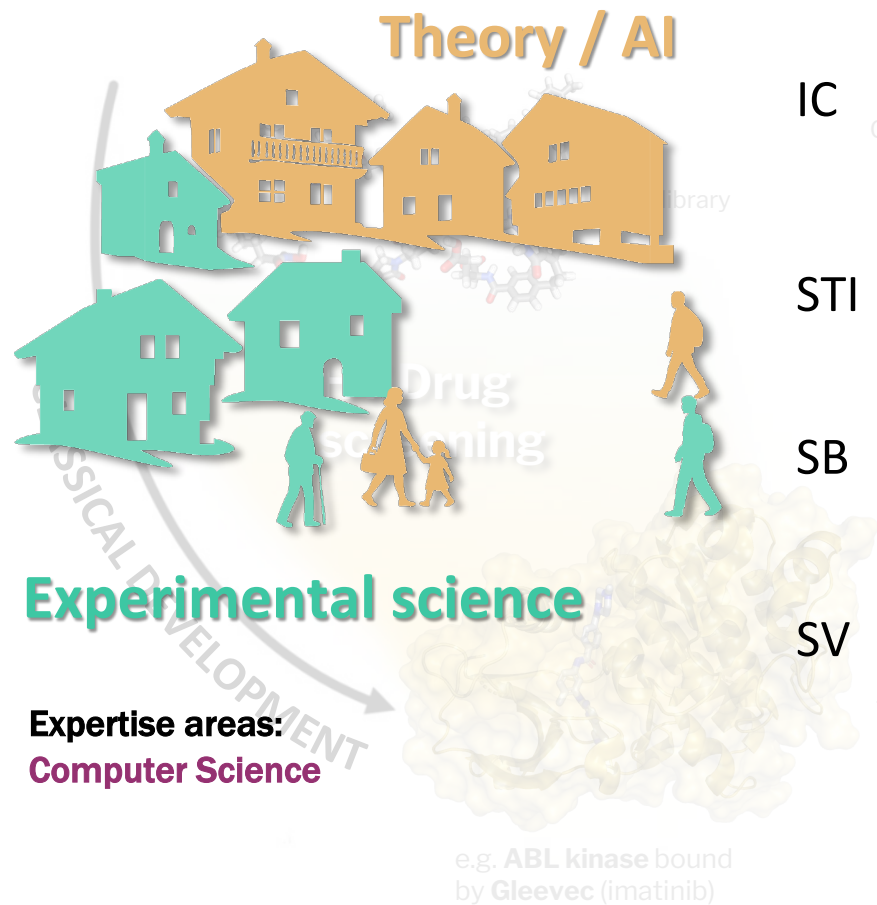
Addressing challenges in drug development: Key contributions from academia **in collaboration with Industrial partners**



It takes a **village**!



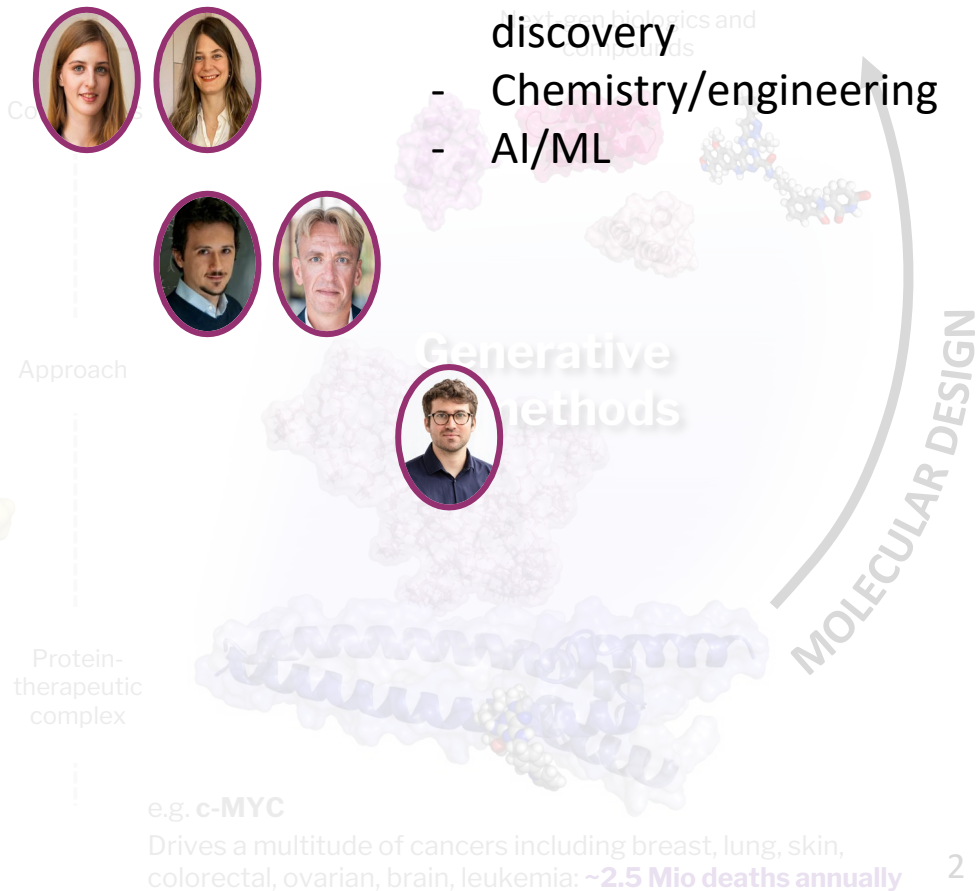
It takes a **village**!



EPFL

Excellent community:

- early-stage drug discovery
- Chemistry/engineering
- AI/ML



e.g. **c-MYC**

Drives a multitude of cancers including breast, lung, skin, colorectal, ovarian, brain, leukemia: **~2.5 Mio deaths annually**

The diagram illustrates the integration of different scientific domains in drug discovery. At the top, 'Theory / AI' is associated with orange house icons and molecular structures. The middle section, 'Drug screening', shows a family walking. The bottom section, 'Experimental science', features a large protein structure. A large grey arrow labeled 'CLASSICAL DEVELOPMENT' curves from the top left towards the bottom right, indicating a traditional progression. The text 'Expertise areas: Computer Science Protein Design' is at the bottom left.

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IC

STI

SB

SV

Protein-therapeutic complex

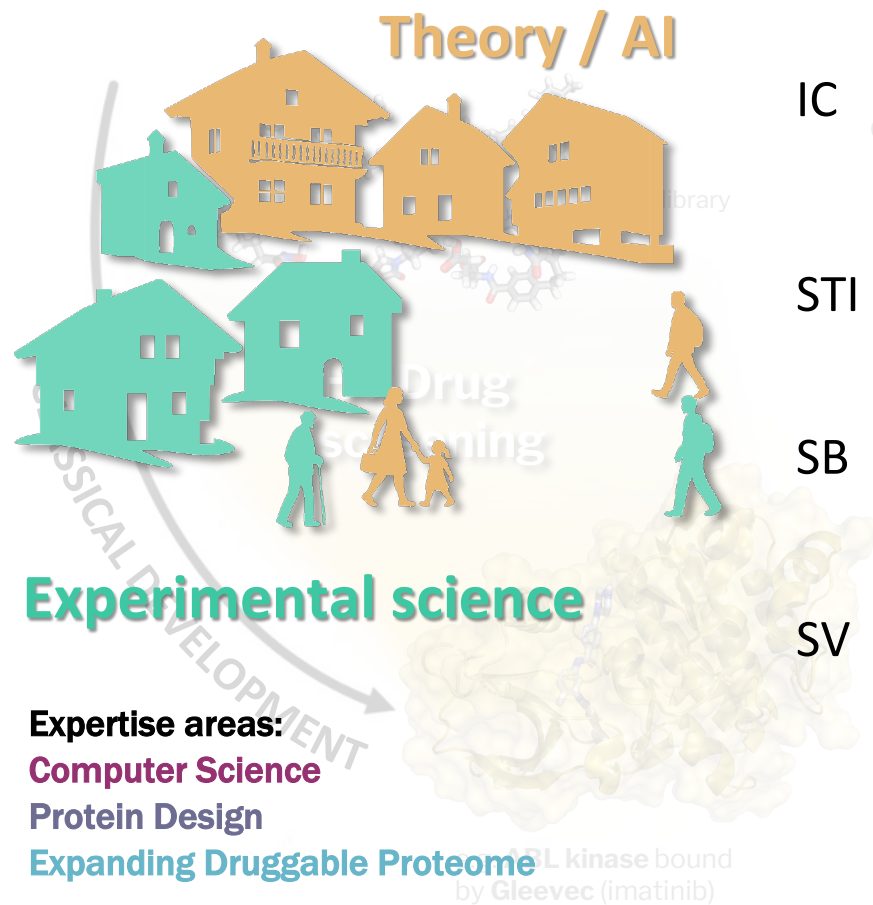
e.g. c-MYC

- early-stage drug discovery
- Chemistry/engineering
- AI/ML

Generative methods

MOLECULAR DESIGN

It takes a **village**!



EPFL

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Expertise areas:

Computer Science

Protein Design

Expanding Druggable Proteome

Small Molecule Chemistry

ABL kinase bound
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It takes a **village**!



Experimental science

Expertise areas:

Computer Science

Protein Design

Expanding Druggable Proteome

Small Molecule Chemistry

High Throughput Biology

by Gleevec (imatinib)

EPFL

IC



STI



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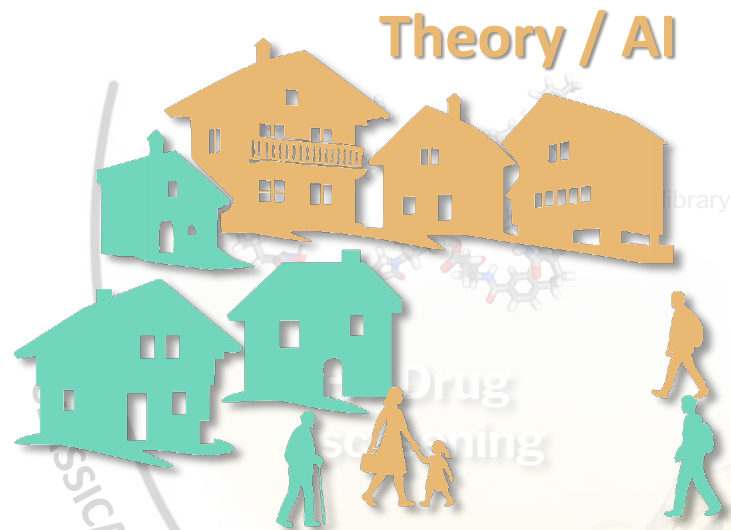
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Theory / AI

Experimental science

Expertise areas:

Computer Science

Protein Design

Expanding Druggable Proteome

High Throughput Biology

Small Molecule Chemistry

EPFL

IC



STI



SB



SV



ETH zürich



PSI

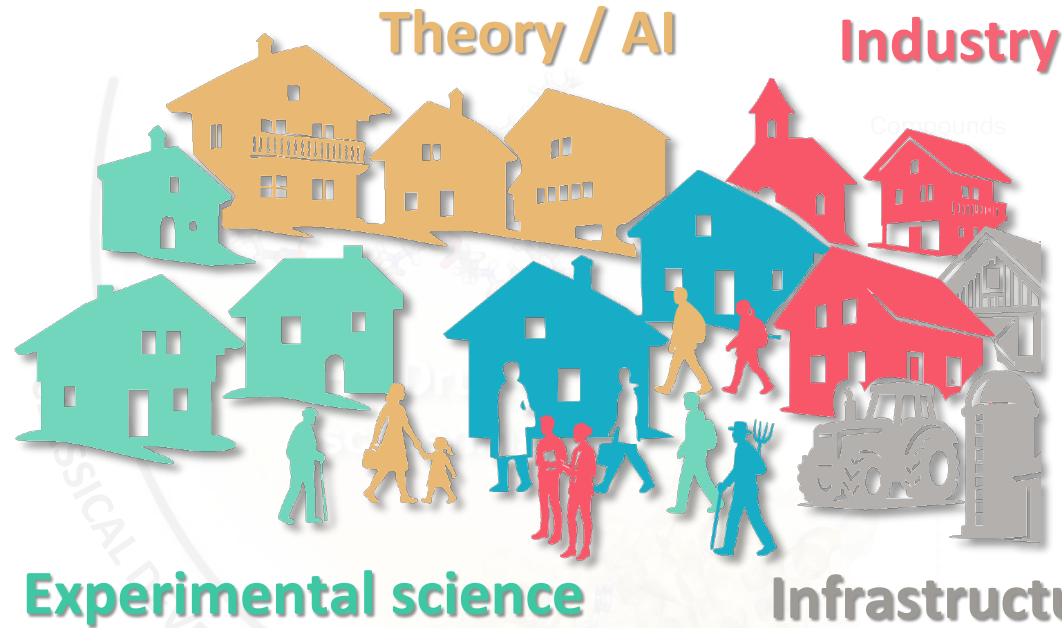


... and beyond our
campus across the ETH
domain

Next-gen biologics and
compounds

MOLECULAR DESIGN

It takes a **village**!



... integrating excellent facilities and **infrastructure**, and **industry collaborations**



ETH zürich

EPFL



DUBOCHET
CENTER
FOR IMAGING

Proteomics / mass spectrometry
Genomics

e.g. ABL kinase bound
by Gleevec (imatinib)

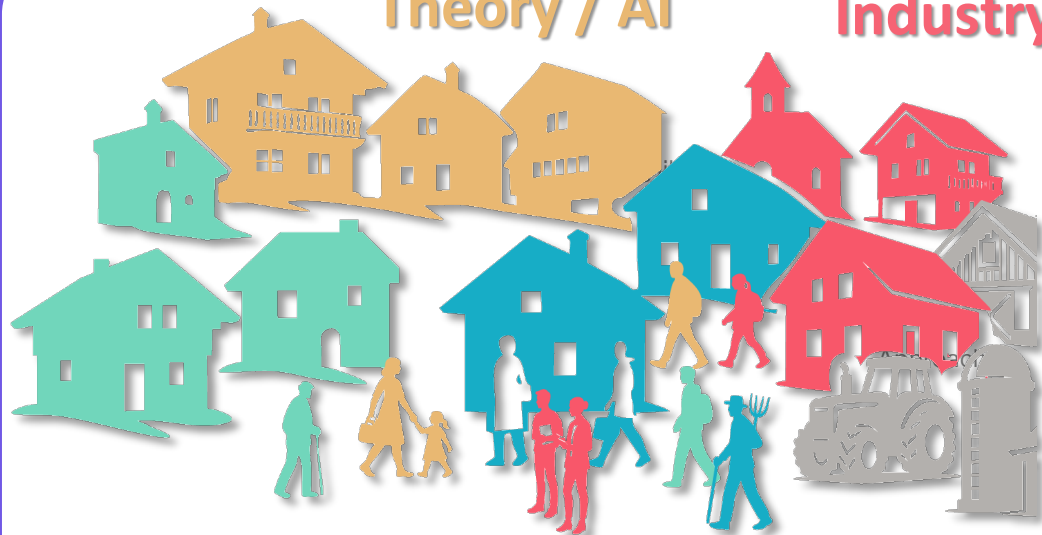
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MDM Center: bring innovation from labs into translational space

Theory / AI

Industry



Experimental science

Infrastructure

EPFL

Center of
Molecular Design
in Medicine

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EPFL



Protein
Production
and
Structure
Core
Facility



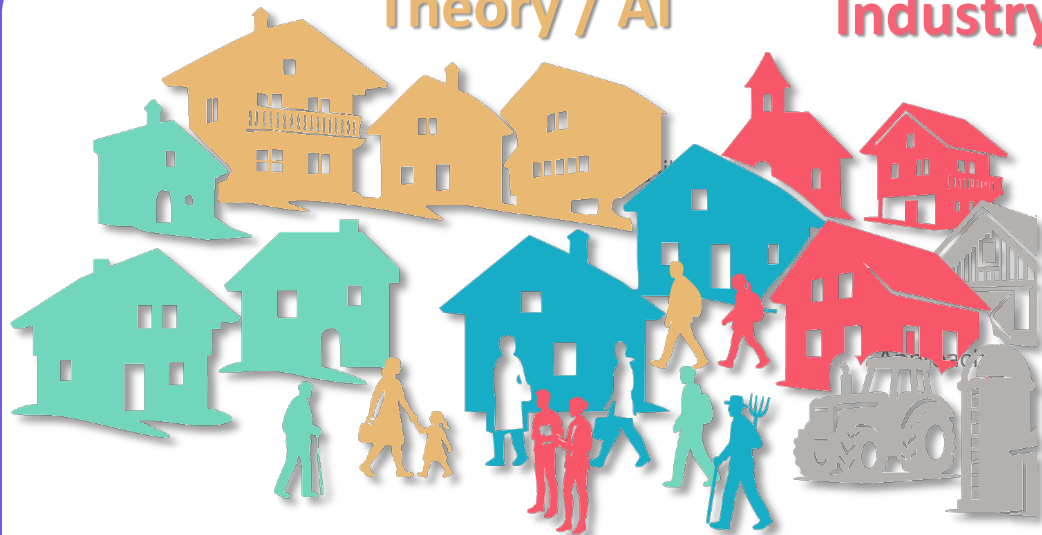
DUBOCHET
CENTER
FOR IMAGING

Proteomics / mass spectrometry
Genomics

MDM Center: bring innovation from labs into translational space

Theory / AI

Industry



Experimental science

Infrastructure

Interdisciplinary, AI-driven molecular design

Integrated academia-industry ecosystem

Transforming drug development

EPFL

Center of
Molecular Design
in Medicine

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ETH zürich

EPFL



Protein
Production and
Structure
Core
Facility



DUBOCHET
CENTER
FOR IMAGING

Center of Molecular Design in Medicine

EPFL/ETH/PSI
Research labs

Research
Teaching
Academic exchange

EPFL/ETH/PSI
Facilities

Protein production
Structural biology
Assay development
Mass spectrometry
Automated Synthesis

Outside experts and
consultants



Med.chem



Pharmacology



Computational drug
Discovery & structure



Local research teams
CROs



Joint Project Teams:
translational focus

Venture/Industry



NOVARTIS
novo nordisk

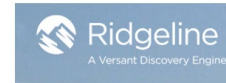
Lonza



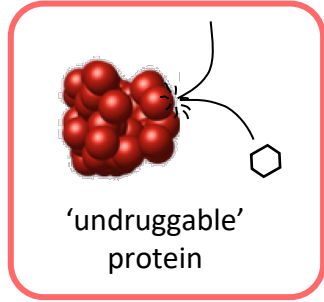
MERCK



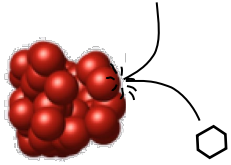
leadxpro



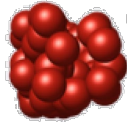
A kickoff project – Molecular proximity reagents



A kickoff project – Molecular proximity reagents



'undruggable'
protein

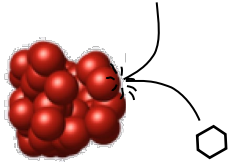


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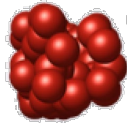


E3 ligase – tagging
proteins for destruction

A kickoff project – Molecular proximity reagents



'undruggable'
protein



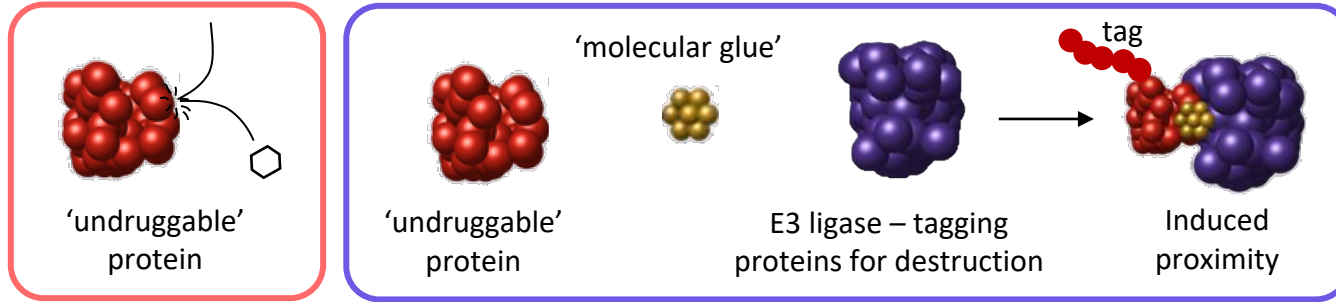
'undruggable'
protein

'molecular glue'

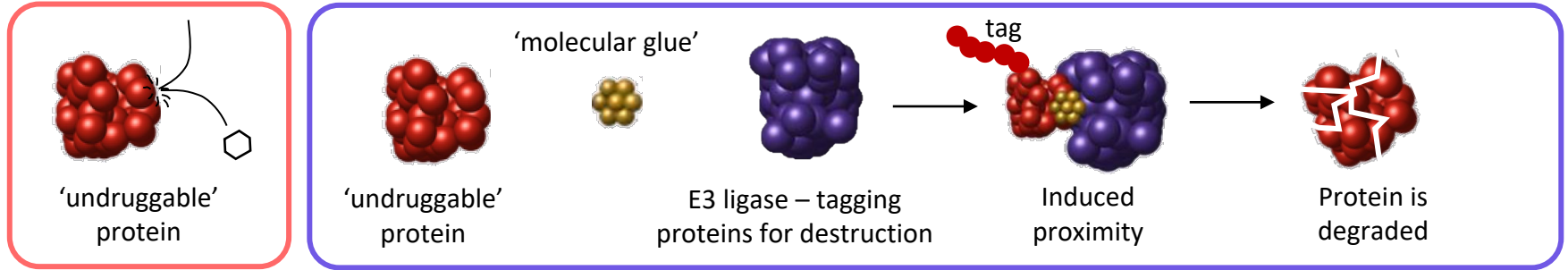


E3 ligase – tagging
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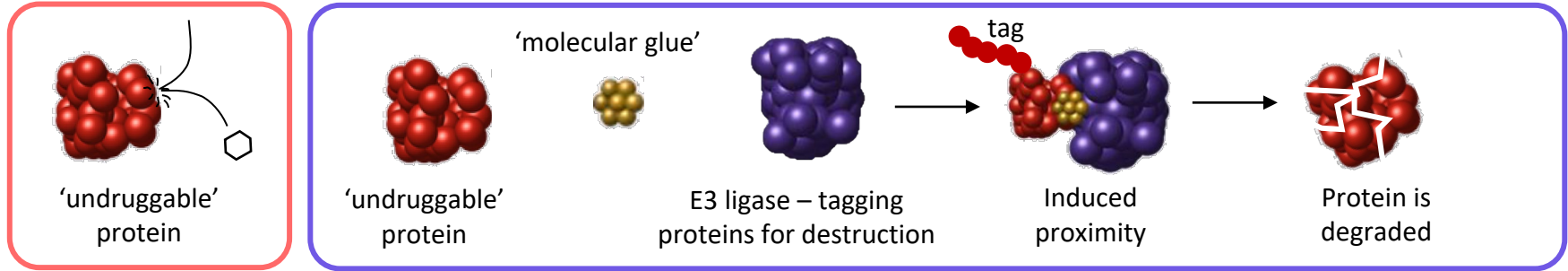
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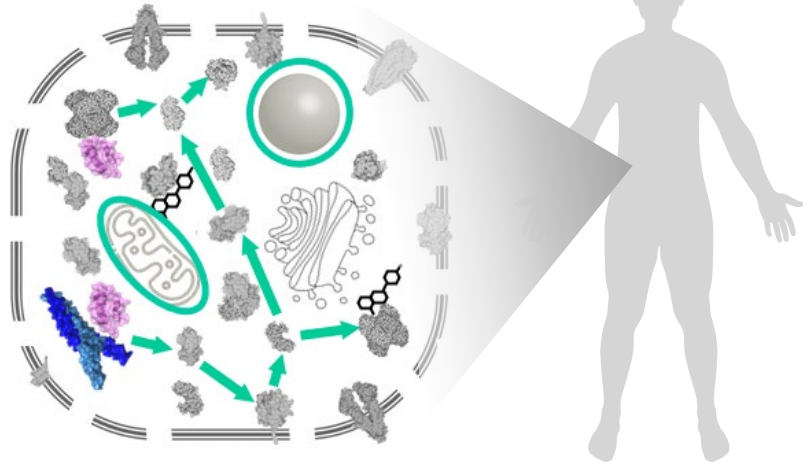
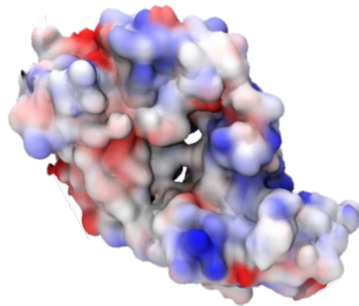
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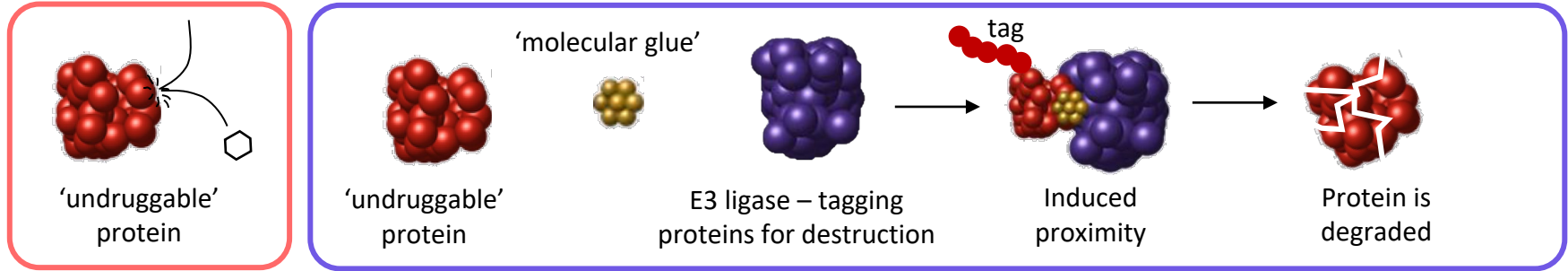
Challenges:

Capturing the **biological complexity**

Identifying **interfaces**



A kickoff project – Molecular proximity reagents

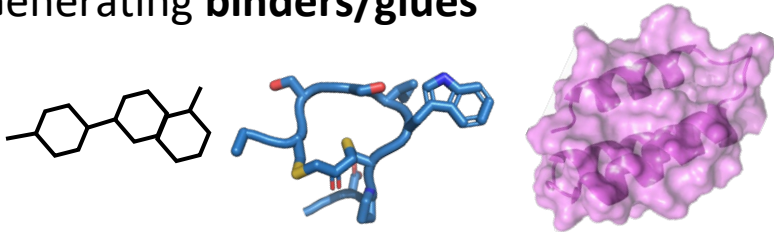


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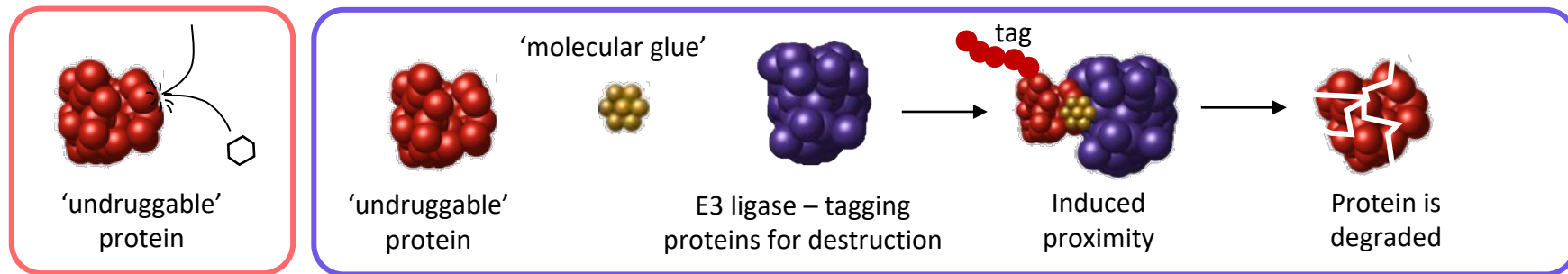
Capturing the **biological complexity**

Identifying **interfaces**

Generating **binders/glues**



A kickoff project – Molecular proximity reagents

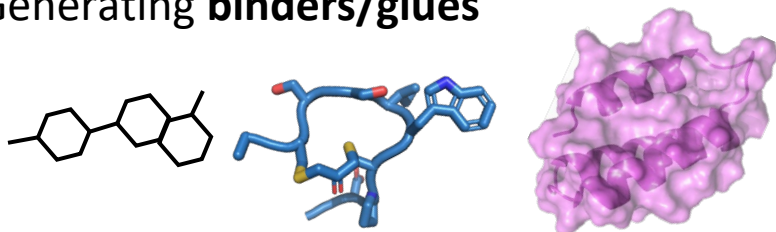


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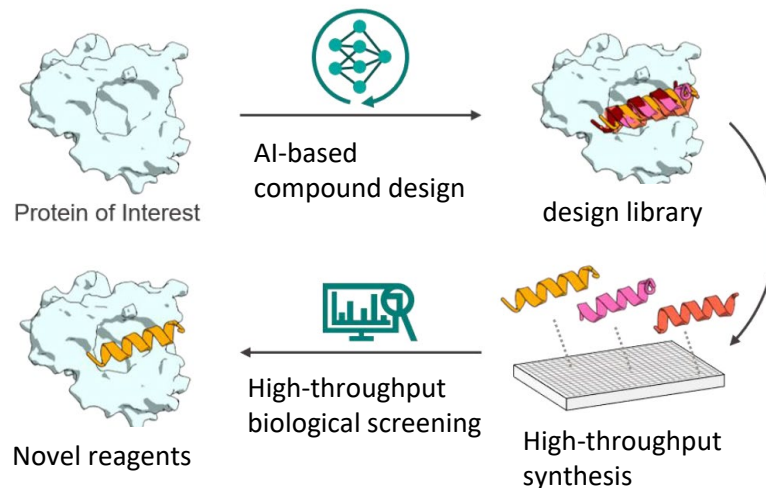
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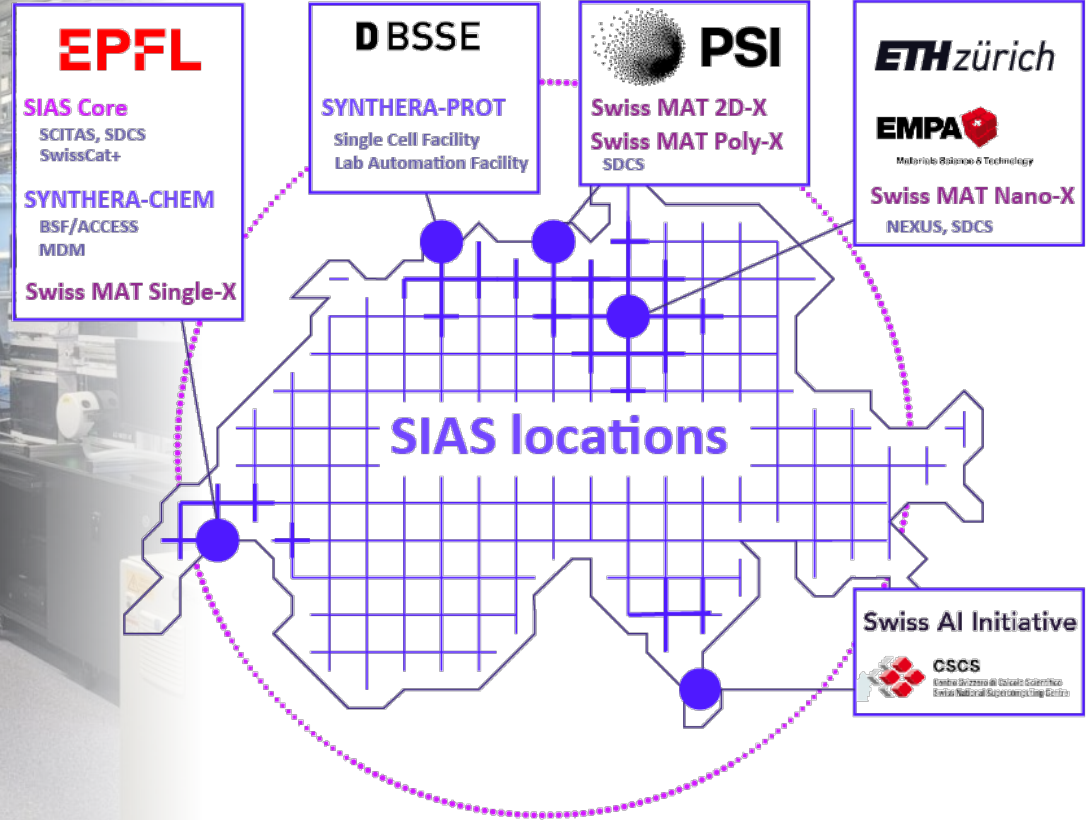
Generating **binders/glues**



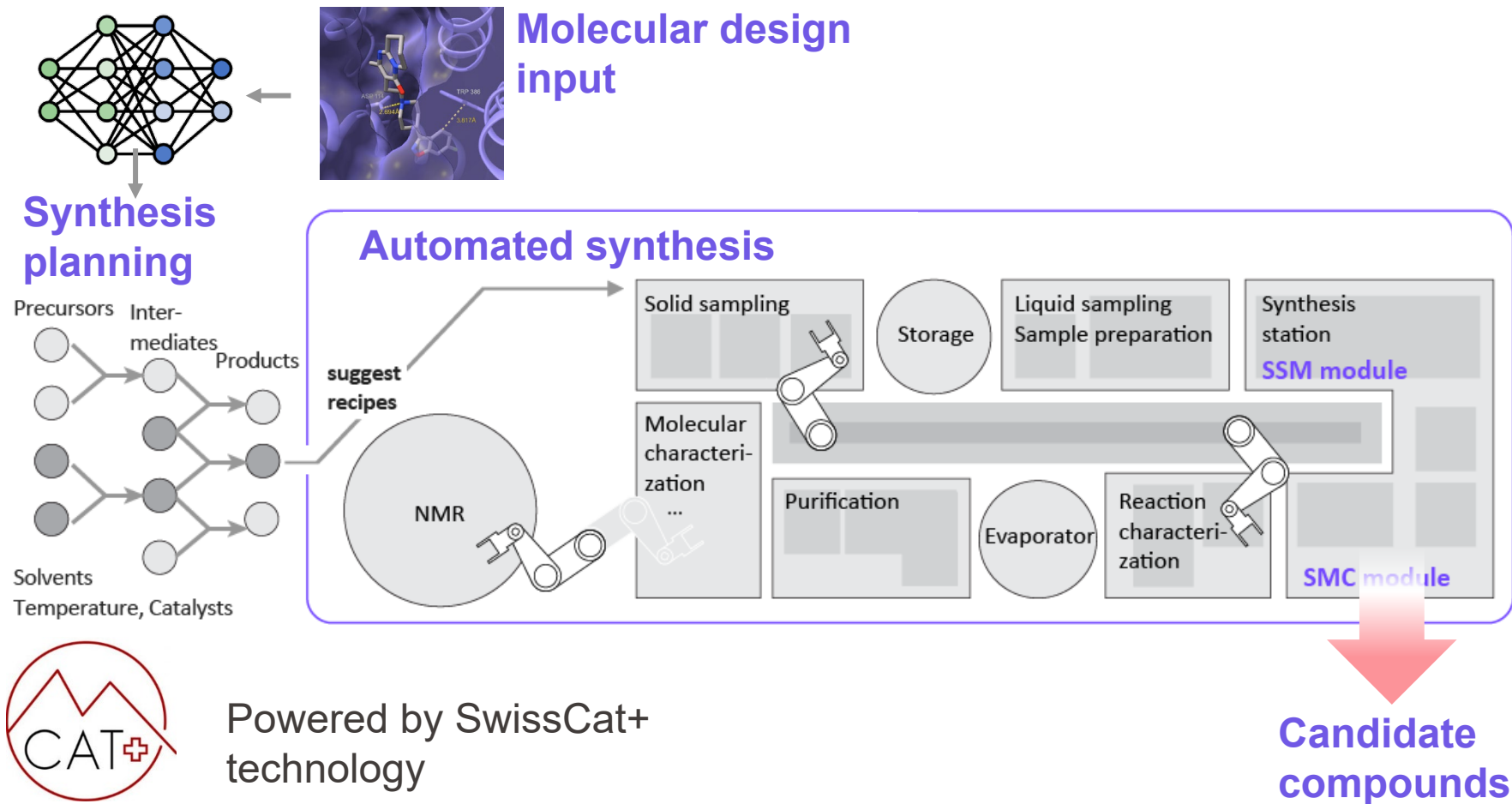
Design pipeline



Key research infrastructure: SIAS – SYNTHERA - SwissMAT



EPFL SYNTHERA – CHEM: Automated chemistry pipeline



A community of early **drug discovery** enthusiasts !

EPFL (and beyond):

- We have **critical mass**
- We want to bring **innovation** out of our lab into **translational space**
- Train the **next generation of innovators**

MDM Center:

- **Translational** focus
- Collaboration with **industry** and **investors**
- Open to all across the **ETH domain** → **Opportunities for expanding the community**

