2024
Innovation China Conference
创新中国研讨会
Shanghai, China | 29 April 2024

SEIF INNOVATION
Shanghai Emerging Industries Foundation
上海战略新兴产业发展基金会

CM Venture Capital

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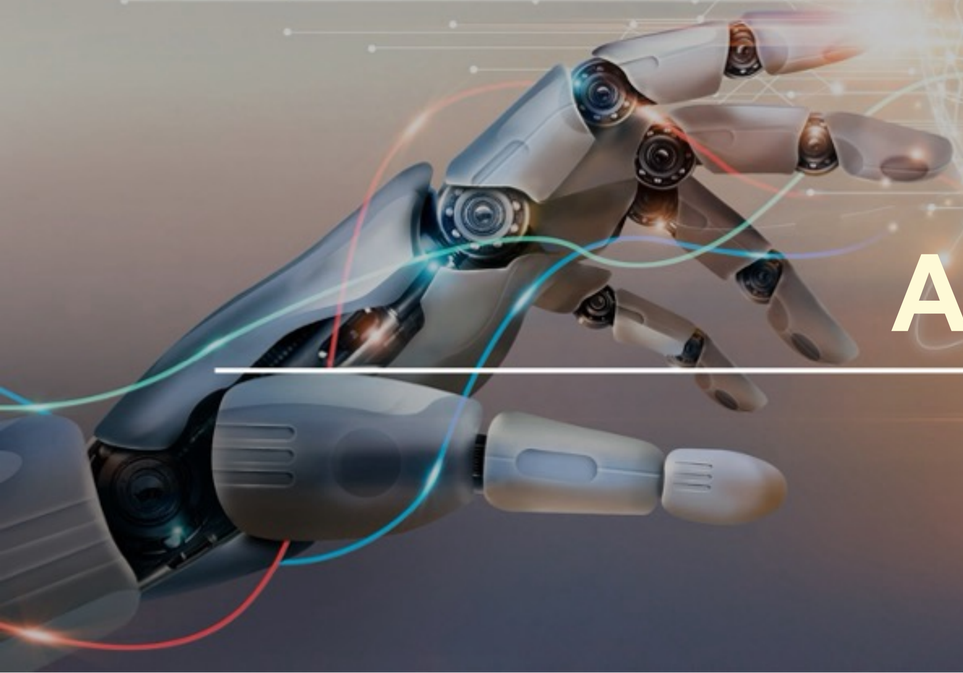
# A.I.+

AI + Materials 材料 | AI + Industrials 工业 | AI + New Energy 新能源

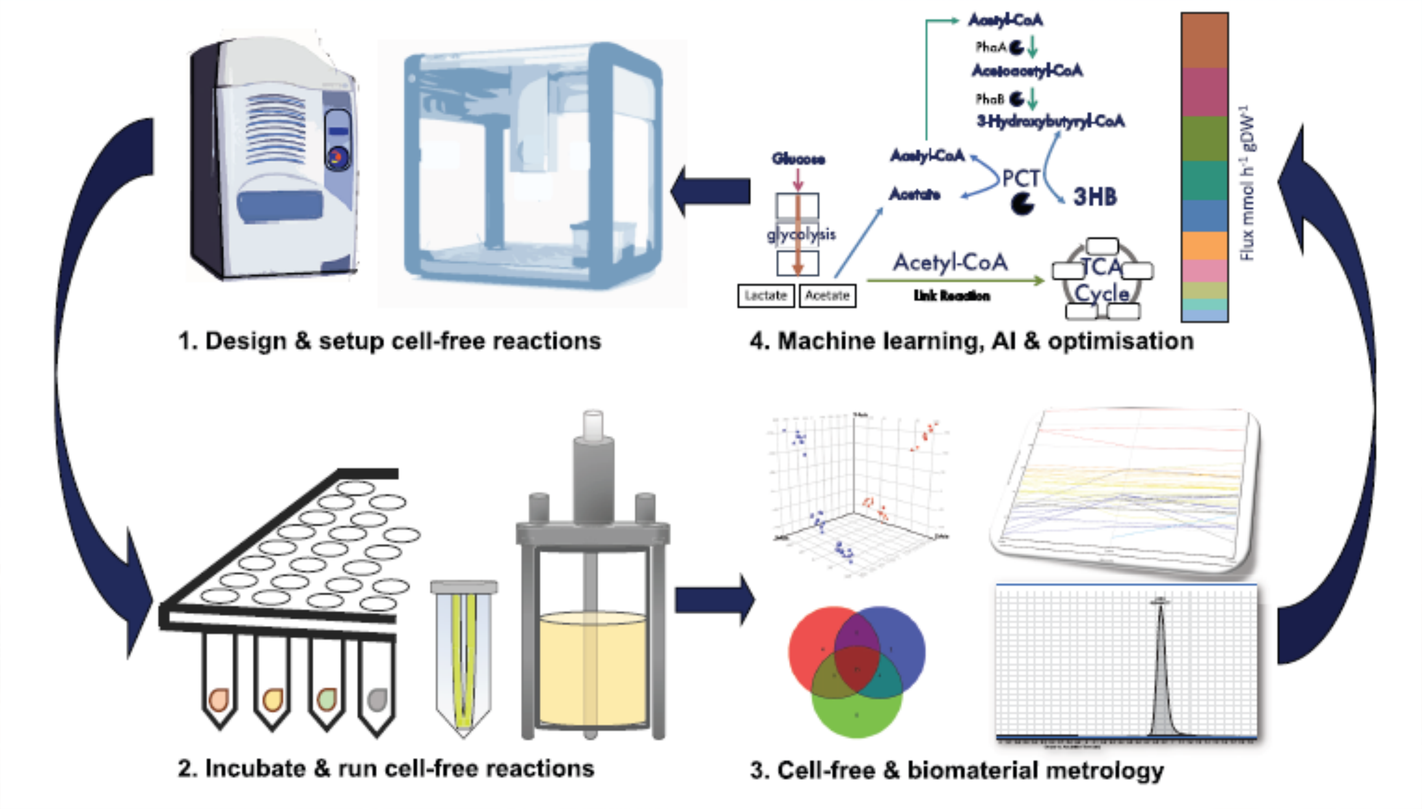


# AI for Materials

CM Venture Capital

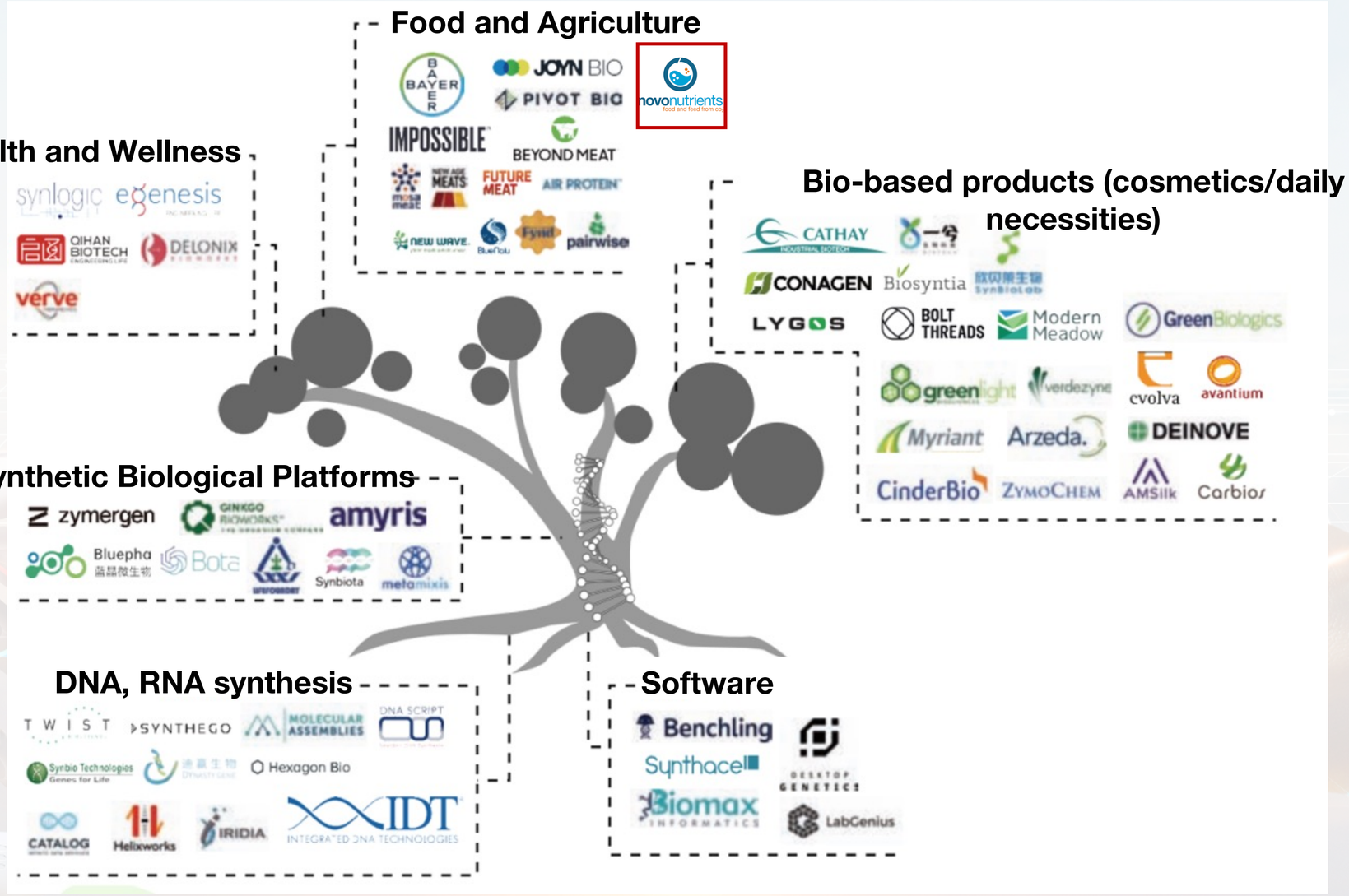
# The Design > Build > Test > Learn cycle in synbio





# Synbio has many startups in the West

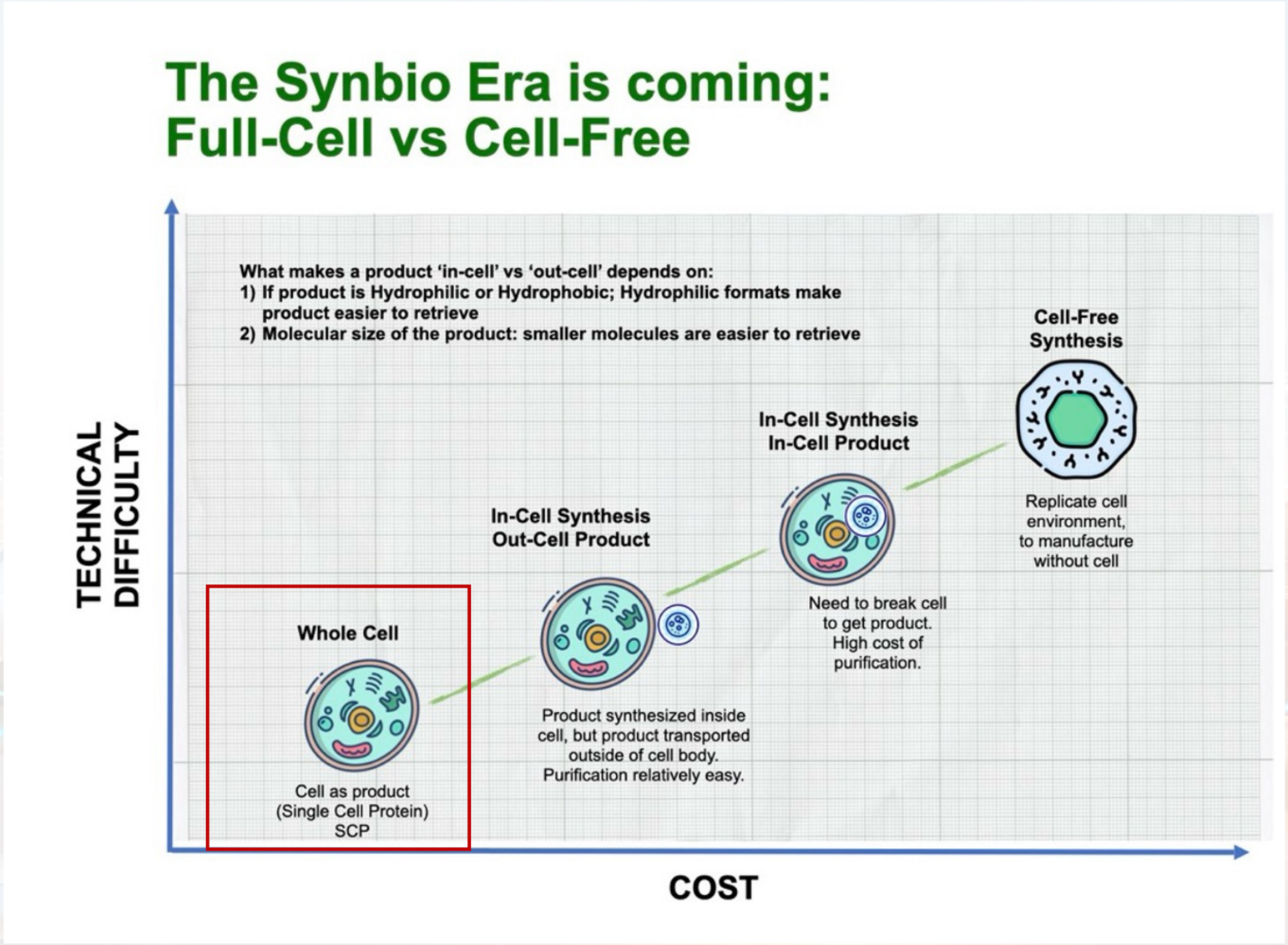




# Synbio itself has levels of TRLs*

*Technology Readiness Level





# Chinese startups landscape

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>5 years

food

Medicine

Daily chemical

Platform

products

<5 years

food

Medicine

Daily chemical

Enzymaster 酶赛

GSH 古特新生

Leadsynbio 引航生物

Readline 瑞德林

Viablife 唯铂莱

Bota

柯泰亚 Cataya

和晨生物 hechen bioworks

BioCatSyn 百升盛

华恒生物

INGIA 盈嘉合生

Changingbio

VACHT

Abiochem Create Impossible Bioworks

EDIGENE 博雅辑因

巨子生物 GIANT BIOGENE

华理生物 HUALI BIO-TECH

SiYOMiCRO 中科欣扬

创健医疗 TRAUTEC

jland 聚源生物

益唯森 YI WEI SEN

VEMINSYN 未名拾光

DMT 德默特

PAMiL BIOTECHNOLOGIES

衍微 EVOLYZER

SYNCERES BIOSCIENCES

金坤生物 JINKUN BIOTECH

SynMetabio

MicroCyto 微元合成生物

Biocretech

优信合生 U-SYNBIO

Zetapharmax

PROTOGA 元育生物

合生科技

Biosysen

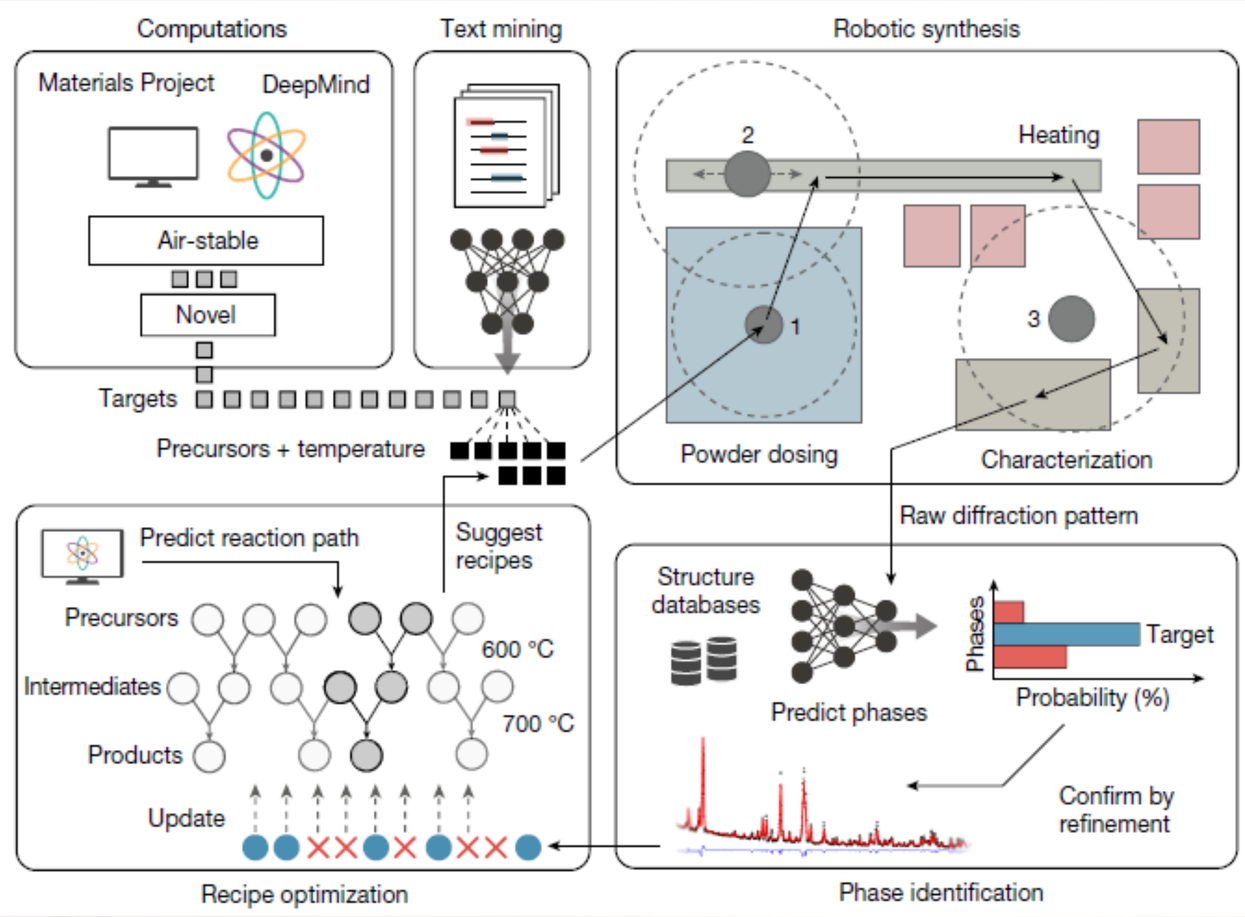
ExoRNA

CellX

芝诺科技 ZENO

# Materials discovery has similar Design > Build > Test > Learn cycle



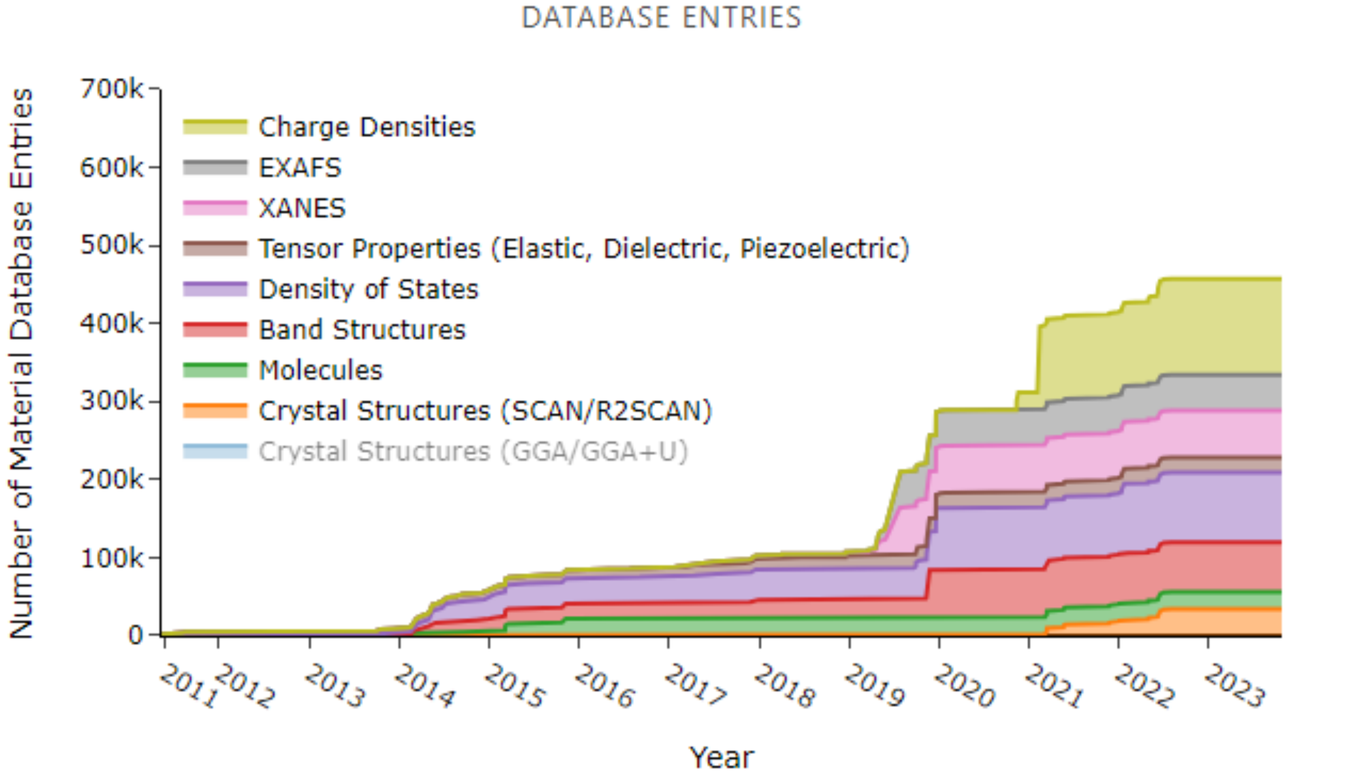



Source: "An autonomous laboratory for the accelerated synthesis of novel materials", Nature Vol 624 December 7 2023

# The Materials Project (US) started in 2011



The Materials Project
materialsproject.org



# But the discovery of new materials remains challenging




"...an order-of-magnitude expansion in stable materials known to humanity"

## Artificial Intelligence Driving Materials Discovery? Perspective on the Article: Scaling Deep Learning for Materials Discovery

Anthony K. Cheetham* and Ram Seshadri*

Cite This: https://doi.org/10.1021/acs.chemmater.4c00643

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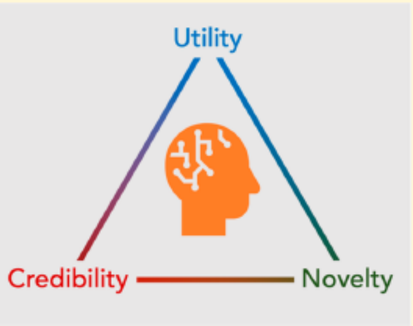
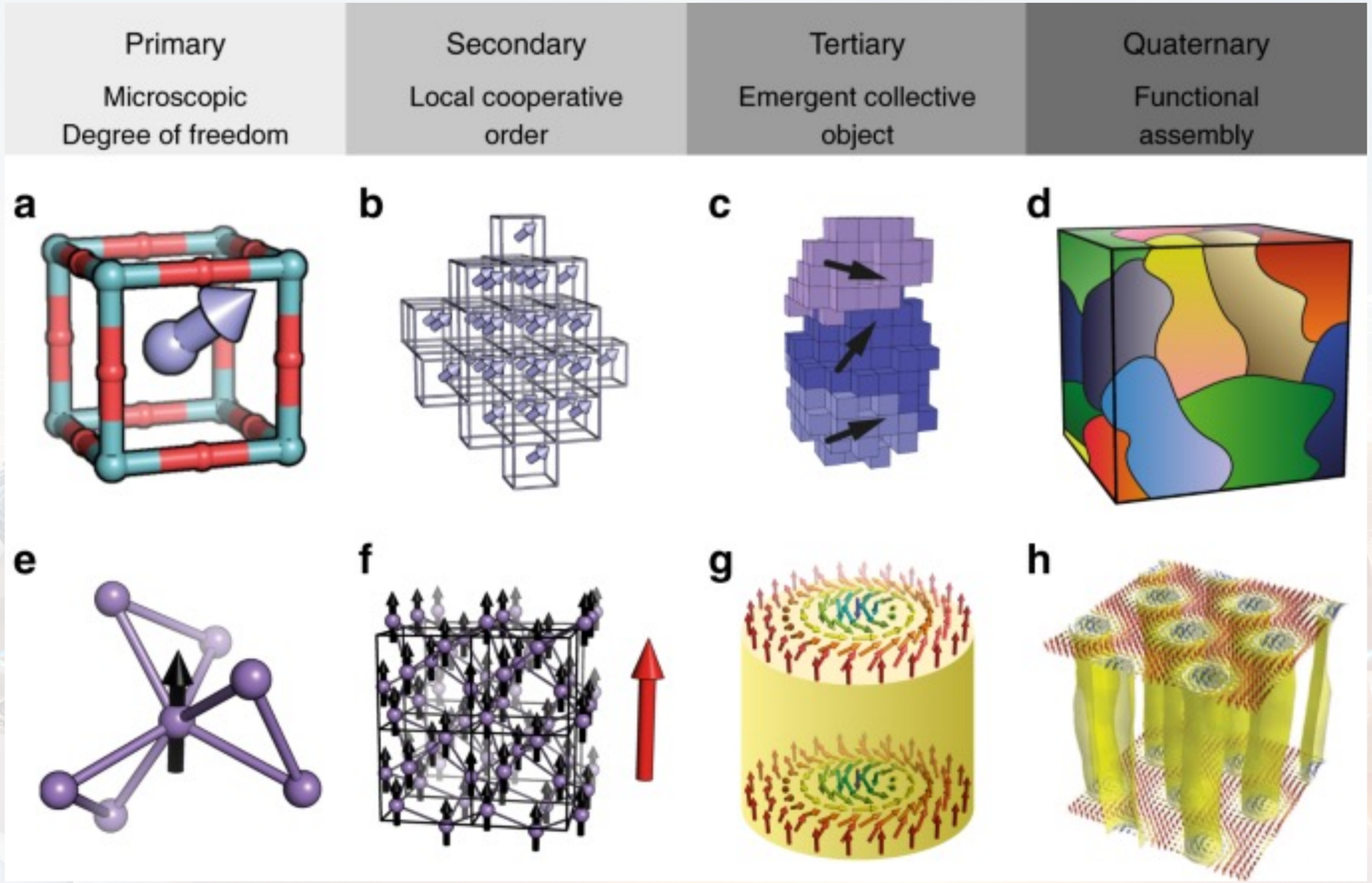
ABSTRACT: The discovery of new crystalline inorganic compounds—novel compositions of matter within known structure types, or even compounds with completely new crystal structures—constitutes an important goal of solid-state and materials chemistry. Some fractions of new compounds can eventually lead to new structural and functional materials that enhance the efficiency of existing technologies or even enable completely new technologies. Materials researchers eagerly welcome new approaches to the discovery of new compounds, especially those that offer the promise of accelerated success. The recent report from a group of scientists at Google who employ a combination of existing data sets, high-throughput density functional theory calculations of structural stability, and the tools of artificial intelligence and machine learning (AI/ML) to propose new compounds is an exciting advance. We examine the claims of this work here, unfortunately finding scant evidence for compounds that fulfill the trifecta of novelty, credibility, and utility. While the methods adopted in this work appear to hold promise, there is clearly a great need to incorporate domain expertise in materials synthesis and crystallography.



# From micro to macro adds layers of modeling complexity



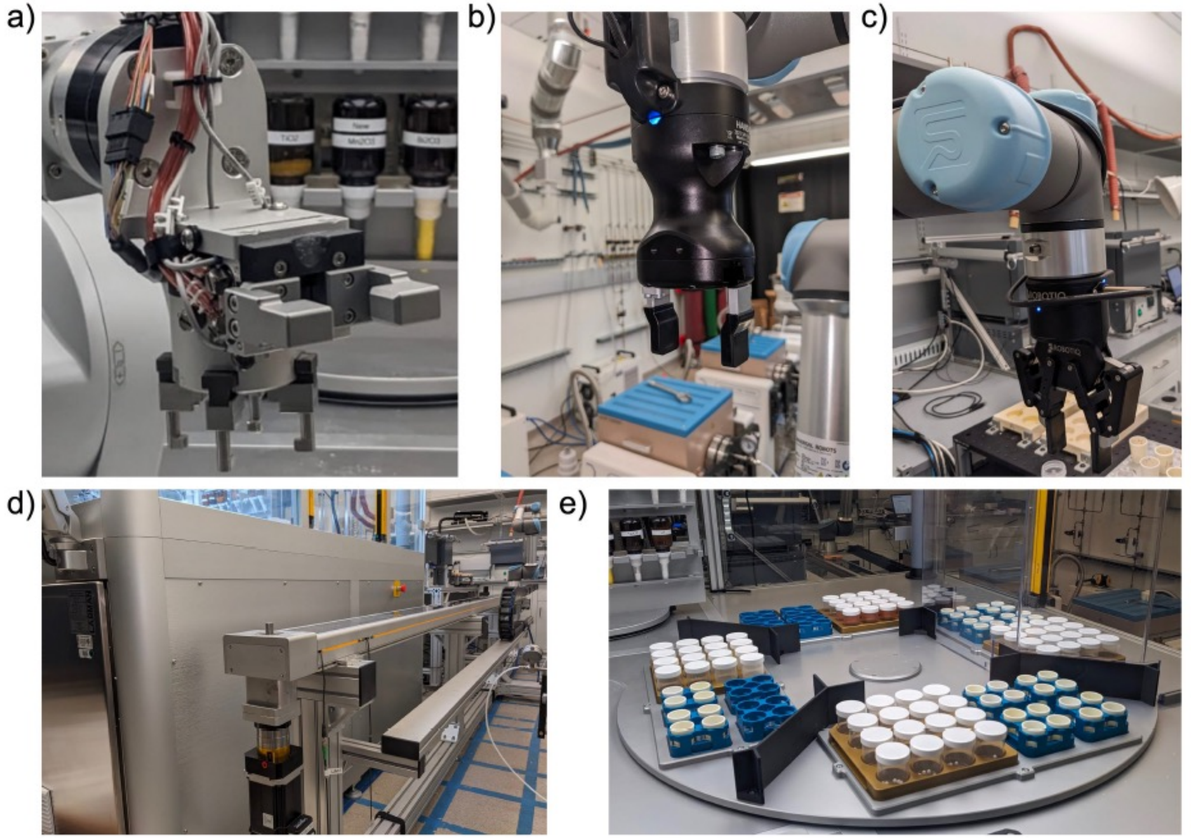



Source: "Opportunities and challenges in understanding complex functional materials" Nature Communications 1 October 2019

# High throughput / rapid experimentation is also challenging



A-Lab, a facility at Berkeley Lab where artificial intelligence guides robots in making new materials.
Photo credit: Marilyn Sargent/Berkeley Lab




**Extended Data Fig. 2 | Robotic installations for sample transfer in the A-Lab.** Grippers on the UR5e robotic arms that are used for sample preparation (**a**), loading/unloading of crucible racks to/from the box furnaces (**b**) and sample retrieval and characterization (**c**). **d**, Linear rail used to increase the working envelope of the robotic arm that loads/unloads crucible racks to/from the furnaces. **e**, Carousel used to organize and move samples in the sample preparation station.

**Source: "An autonomous laboratory for the accelerated synthesis of novel materials", Nature Vol 624 December 7 2023**

# The first US startup in AI+ materials was founded in 2013

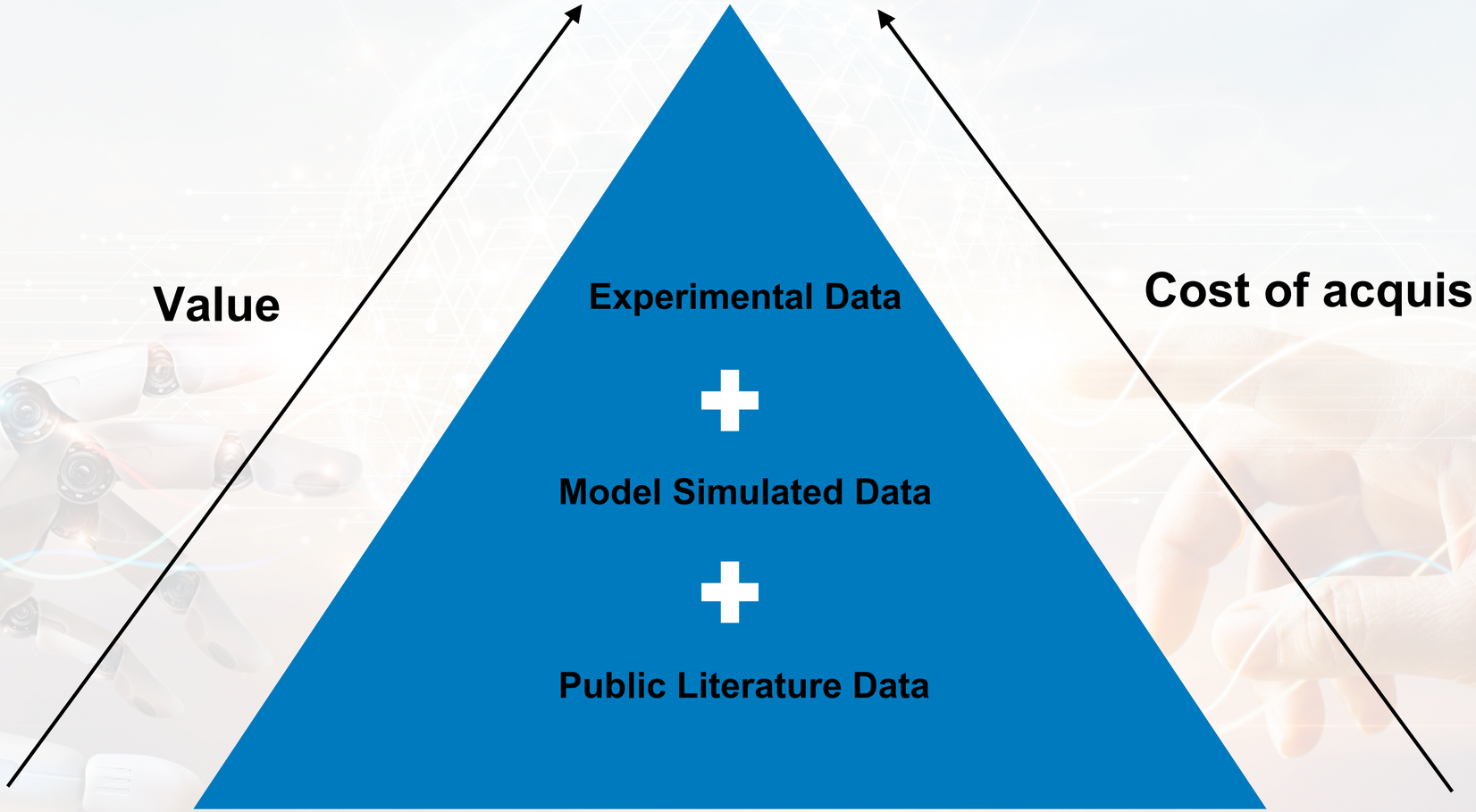


CITRINE INFORMATICS

**Founded 2013**

# High quality data remains the #1 challenge
# - The most valuable is also the most costly





# 2nd biggest challenge – finding good application in a long value chain

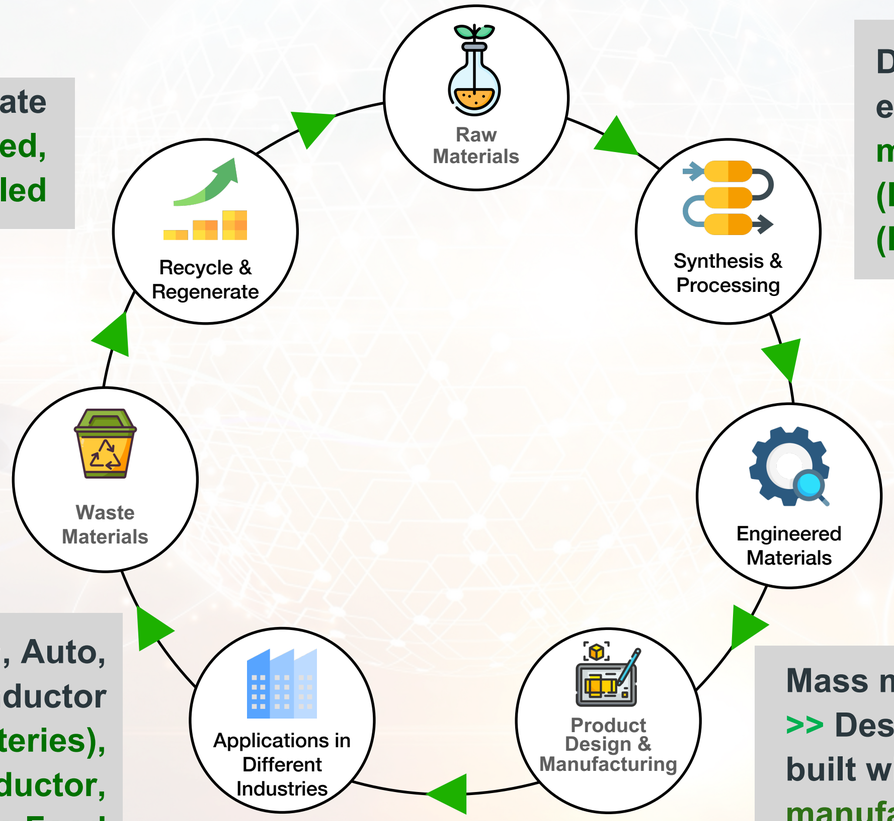


Petro- and other natural resources
>> Renewable Resources
(e.g. Bio & Synthetic Bio)

Low recycle rate
>> Reused, Regenerated, Recycled & Up-cycled

Disposal or discharged
>> Waste Valorization (CO2 to material, waste to energy)

Oil & Gas, Ag, Construction, Auto, Electronics, Semiconductor
>> Hydrogen, EV (batteries), Wide Bandgap Semiconductor, Health, Alternative Food




Discovery by trial & error, lots of environment damage >> Discovery by machine learning, less carbon (Decarbonization), use of clean energy (Electrification)

Properties & Cost
>> New material & new processes with lower carbon footprint

Mass manufacturing at lowest cost
>> Design for recyclability, built with less materials (additive manufacturing), Automation (Robotics)

# Currently more platform companies than product companies in AI+Materials

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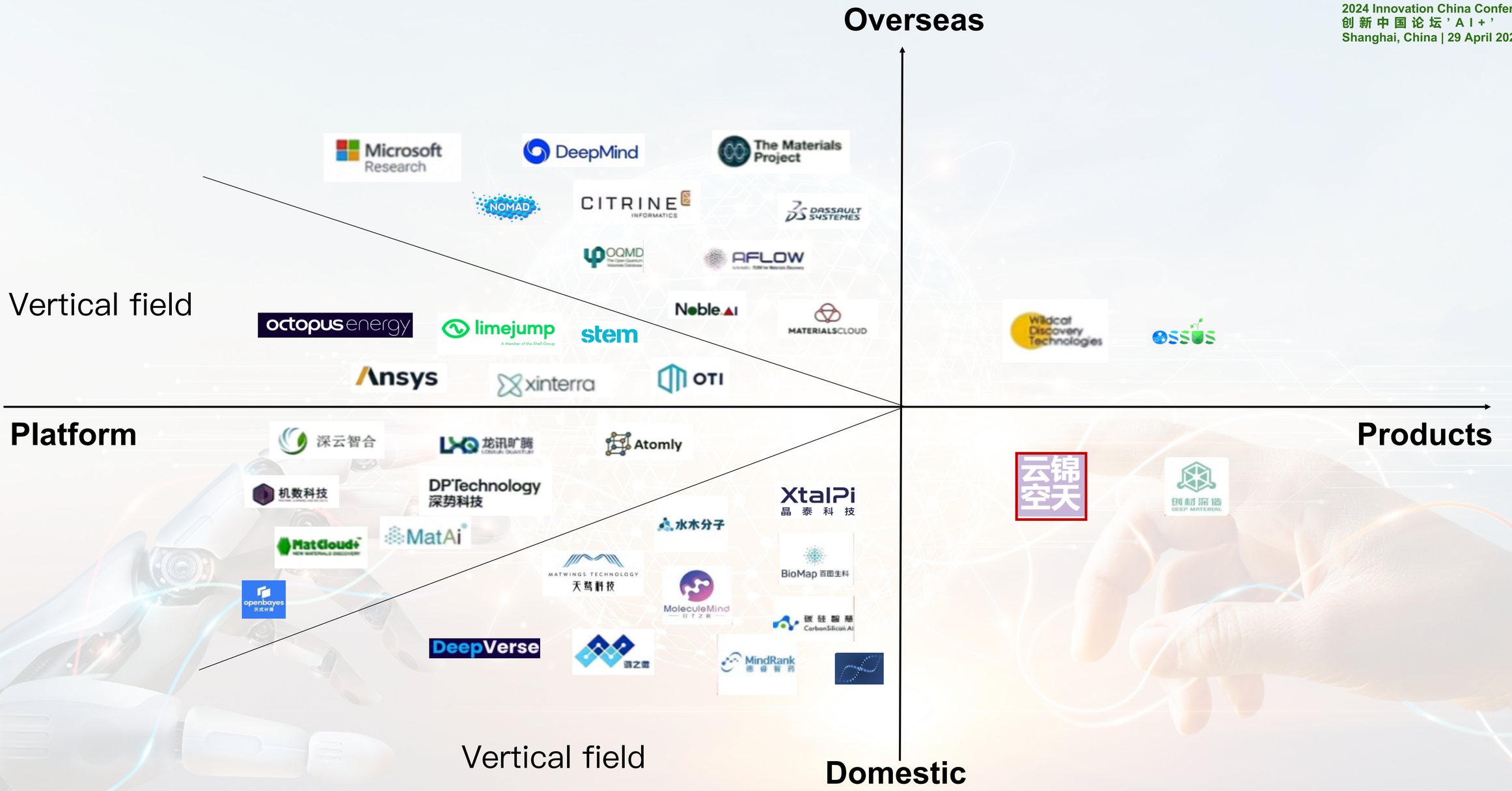
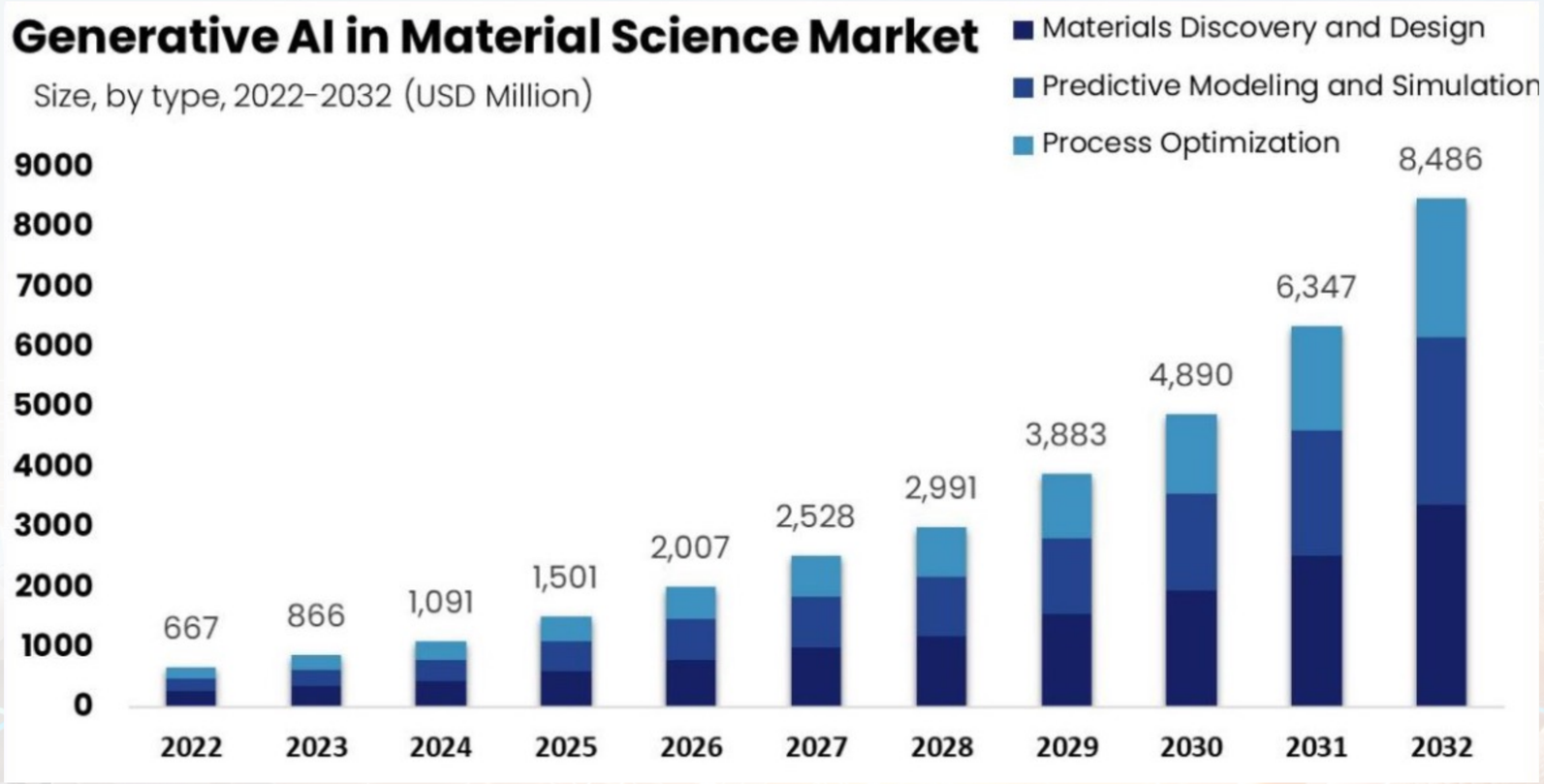


# AI + Materials is expected to grow at CAGR of ~30% to $ 8.5 B USD by 2032






Source: MarketResearch.biz report "Generative AI in Material Science"