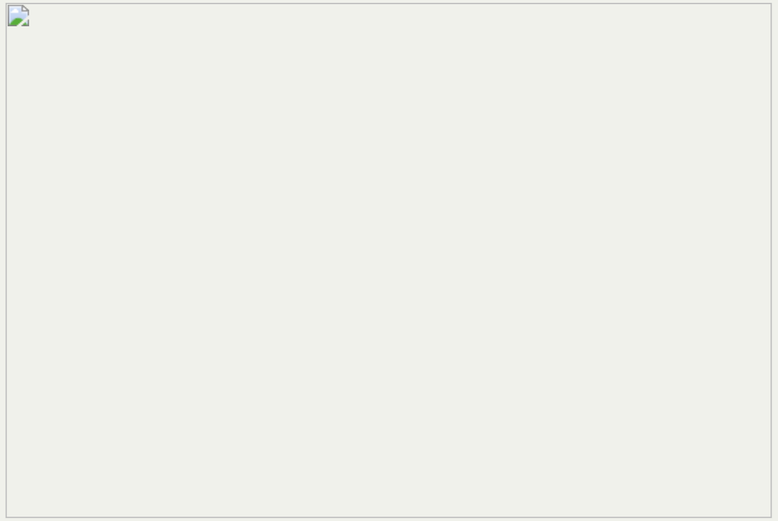
Rapid Evaluator Talk

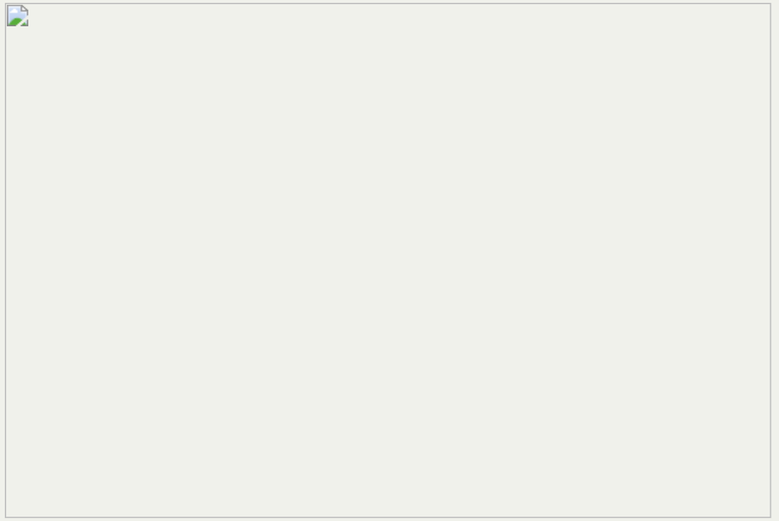
July 8, 2025

Will Patrick

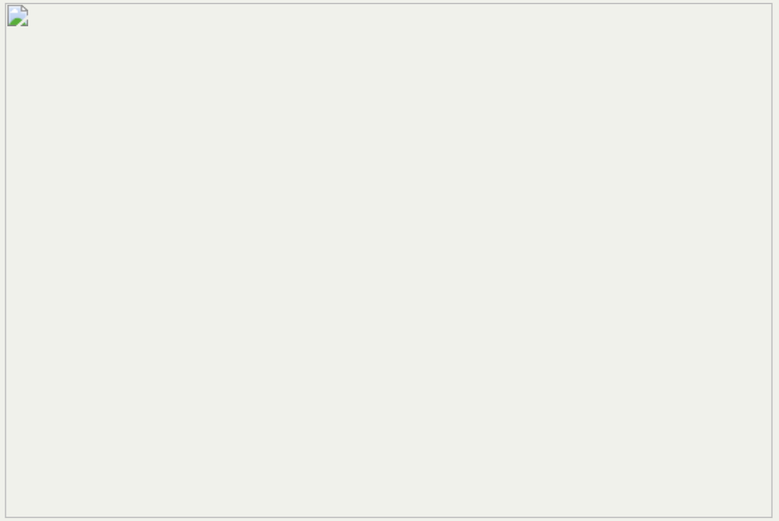
Career Highlights



X
Rapid Evaluator
2011-2013



MIT Media Lab
Research Assistant
2013-2015



Culture Bio
CEO and Co-Founder
2016 - 2025

Culture Biosciences

Traction

- Used by >100 biotech companies
- ~$10M annualized revenue
- >$30M revenue / yr expected by '27

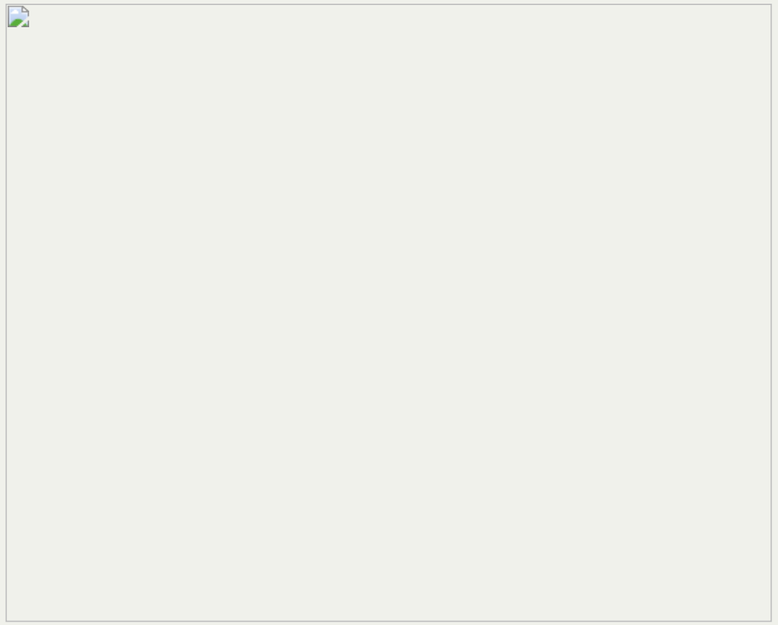
Company building

- Raised $100M
- Hired 100+

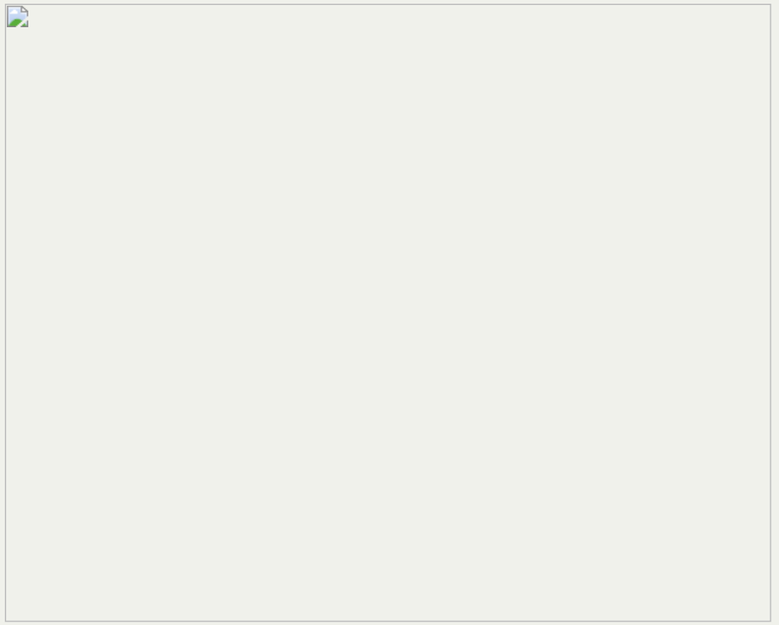
Service

Stratyx250

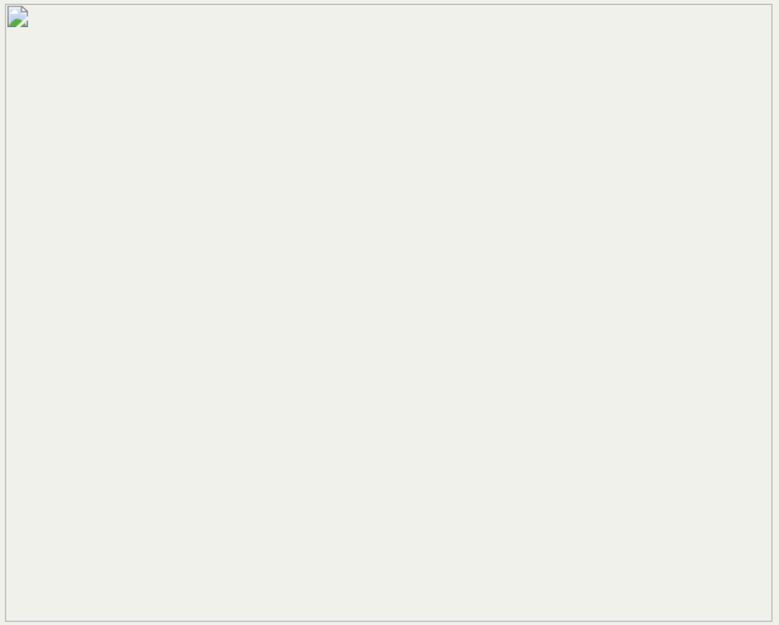
Personal Life



Family



Community Building



Creative Projects

Family

Will

Rachel

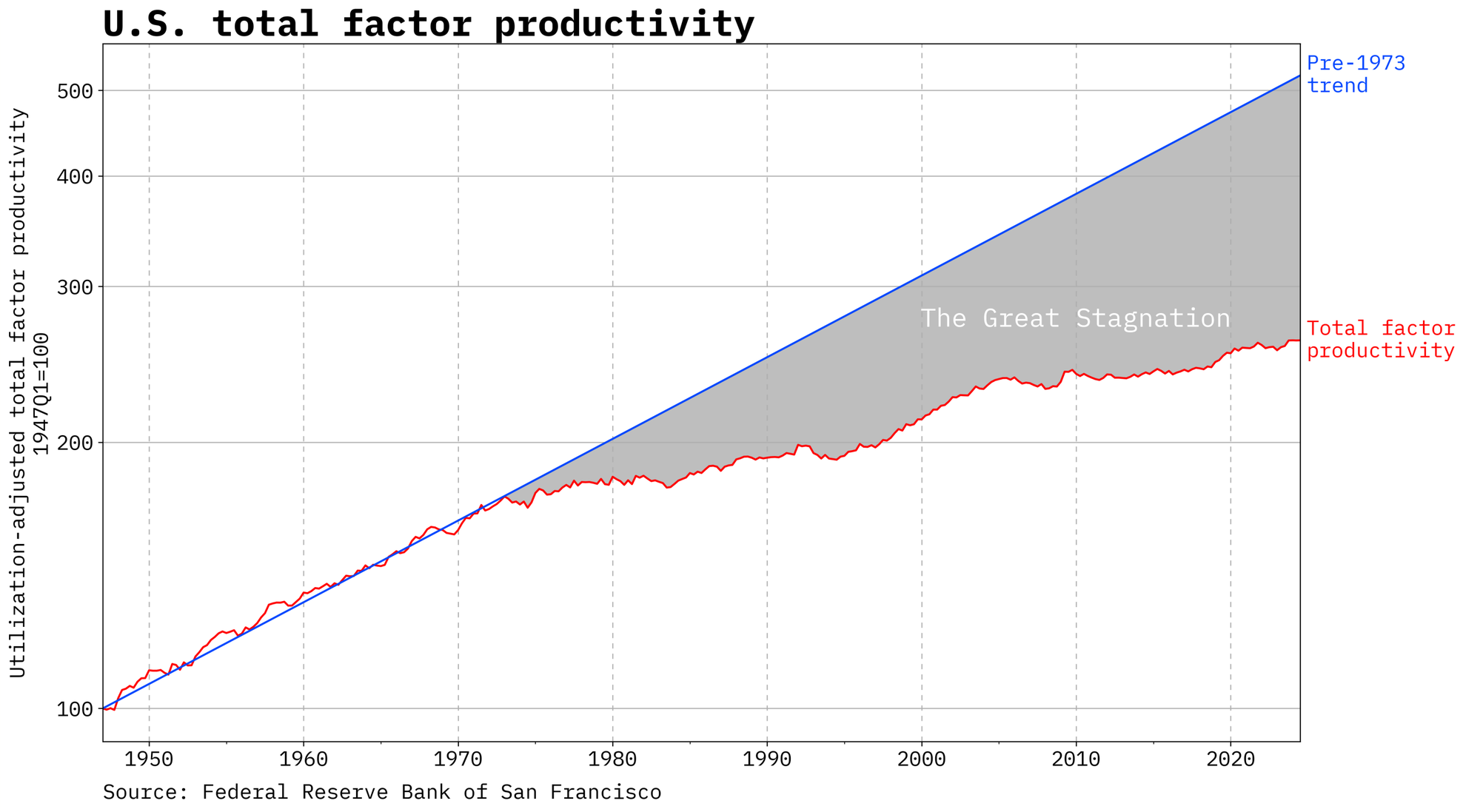
Jasper (3)

Mae (1)

What motivates me?

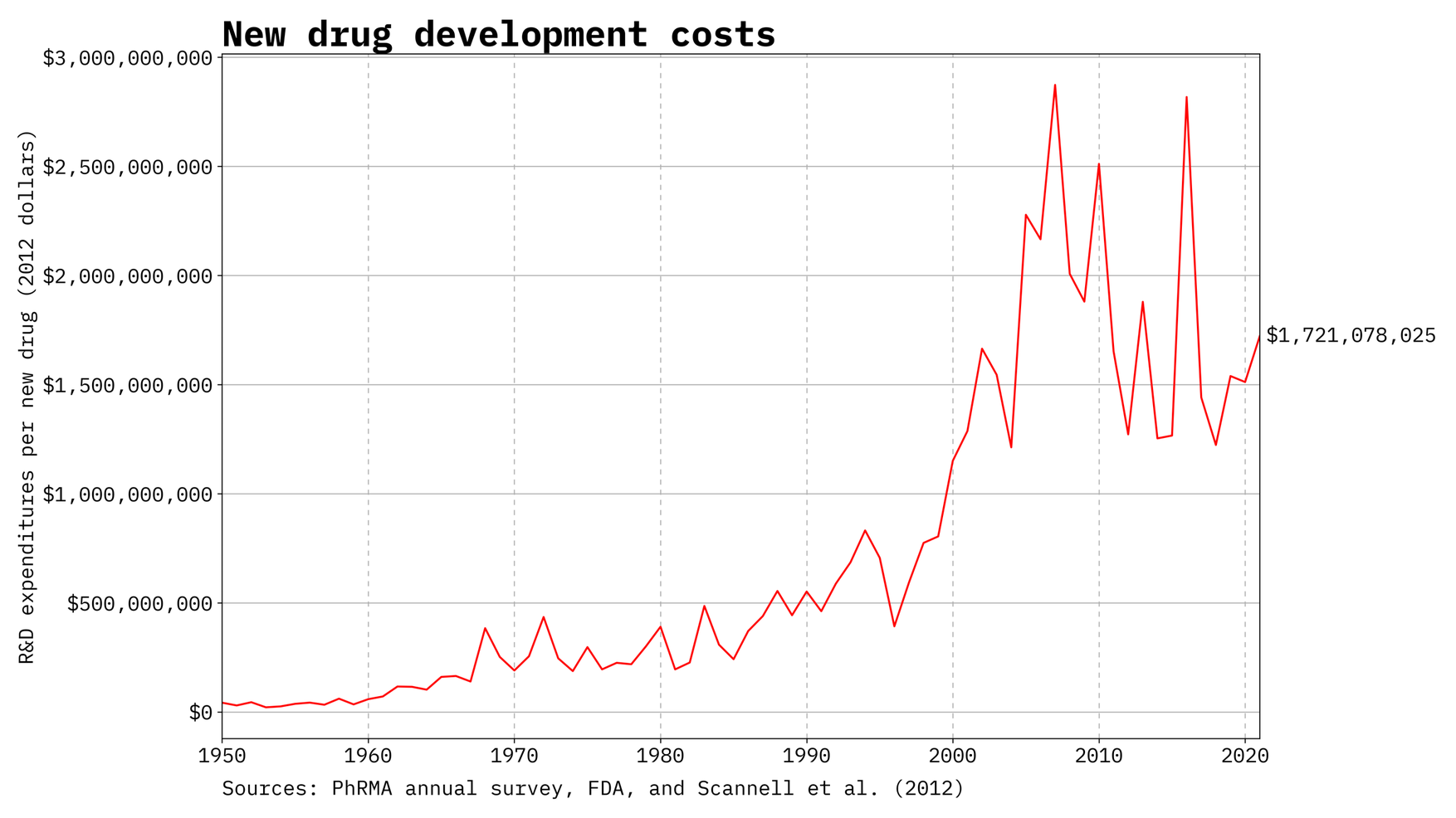
Helping solve big problems

How can we increase productivity?



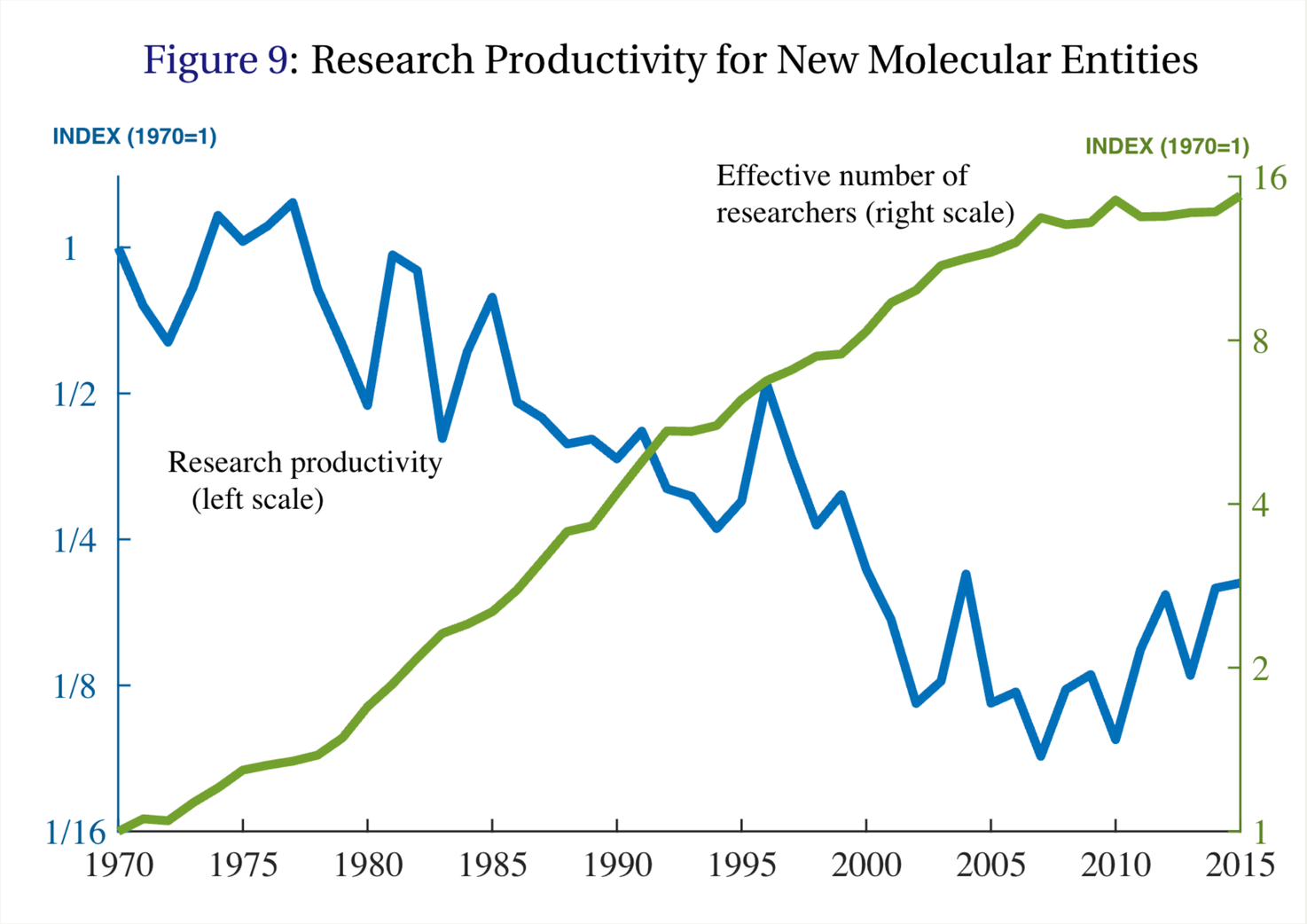
Source: www.elidourado.com

How can we increase productivity of biotech R&D?



Source: www.elidourado.com

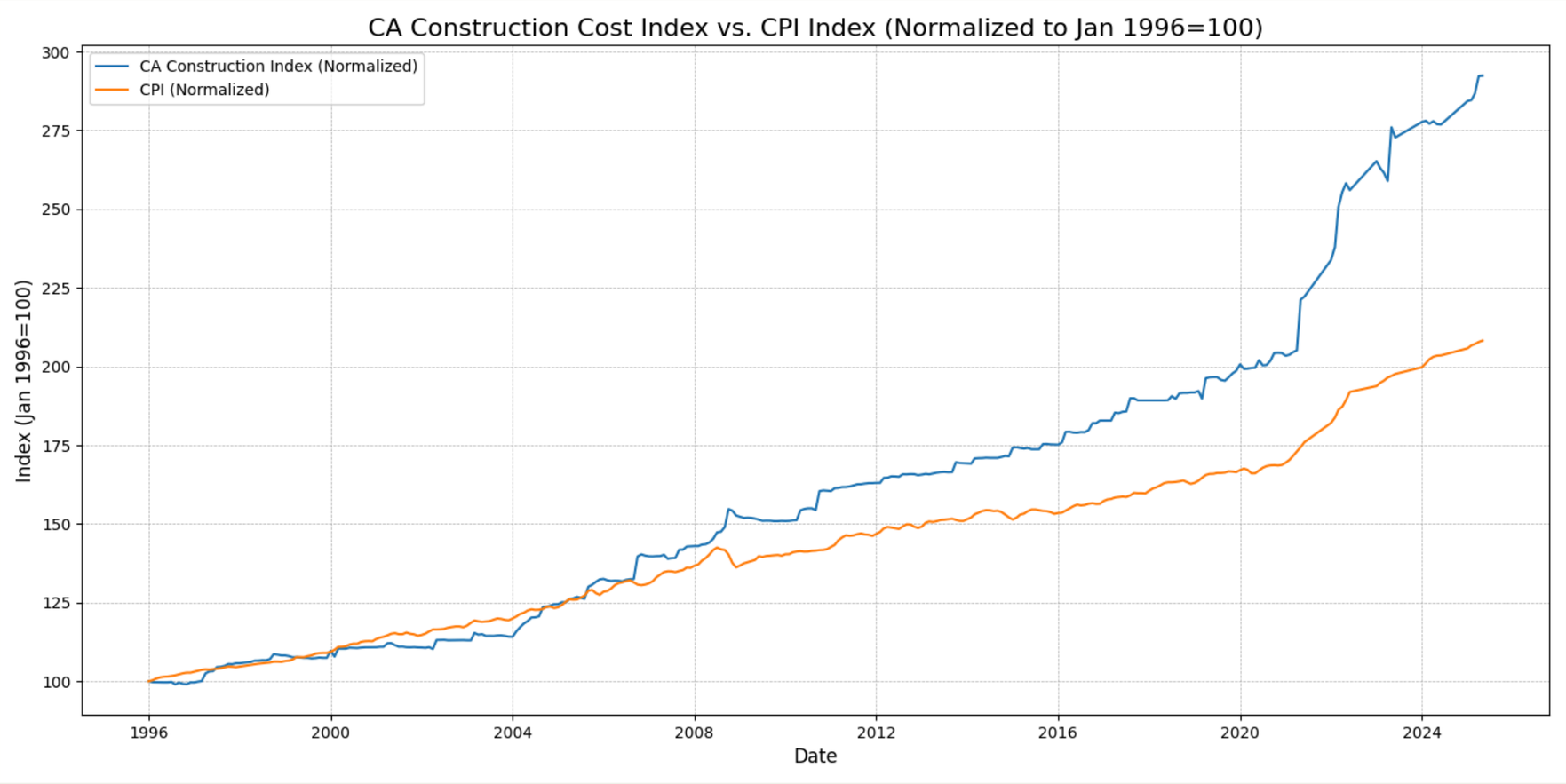
How can we make researchers more productive?



Data show that ~8X more researchers per new drug in 2015 than 1970

From: Bloom et al (2017)

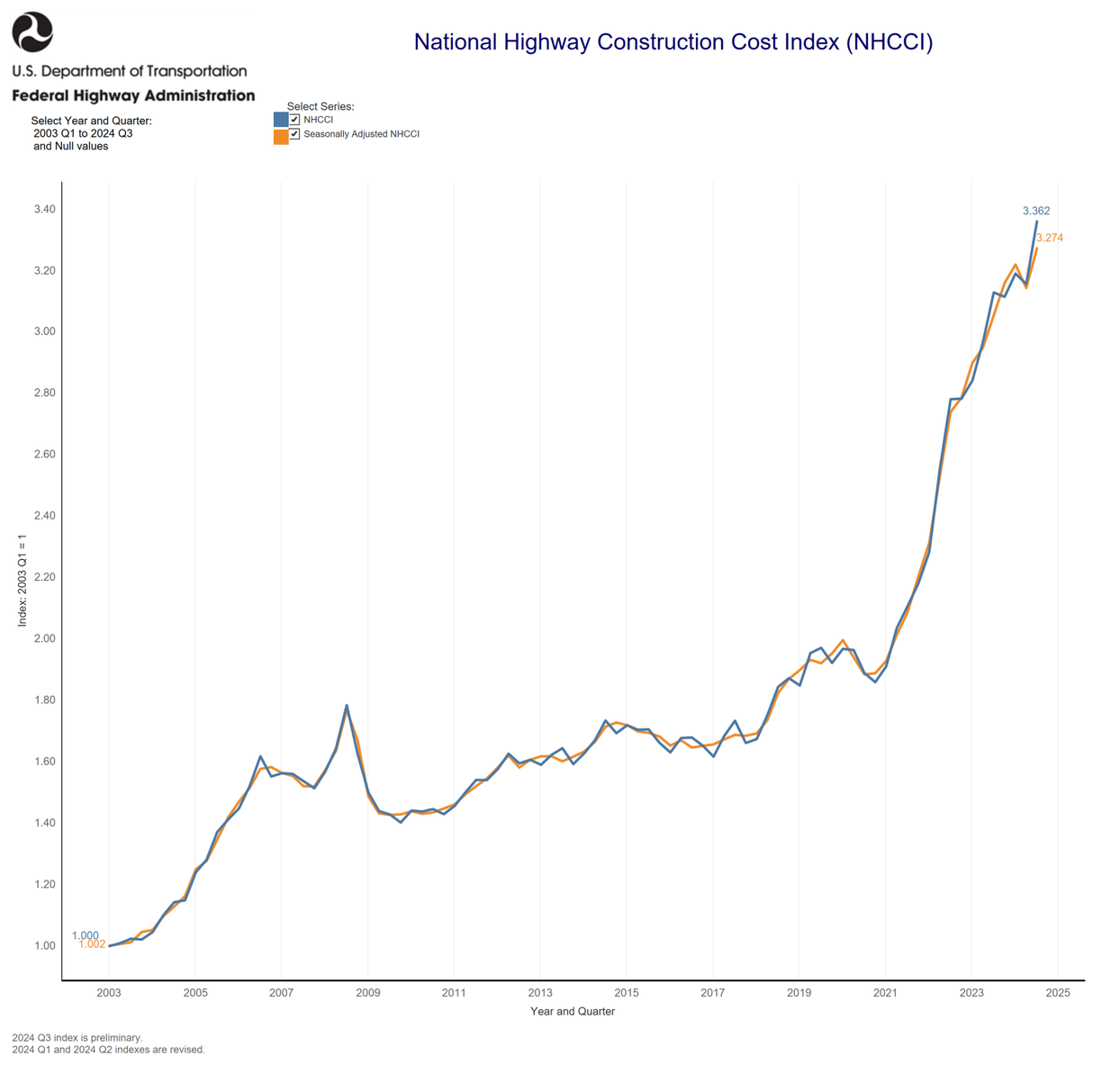
How can we lower housing costs?



California building construction Costs have increased ~80% adjusted for inflation in last 30 years

Data Sources: California Construction Cost Index, Bureau of Labor Statistics

How can we make infrastructure cheap?



Highway Construction Costs have increased >3X since 2000

Source: National Highway Construction Cost Index, US DOT (NHCCI)

Why Come Back to X?

Build moonshots with awesome people

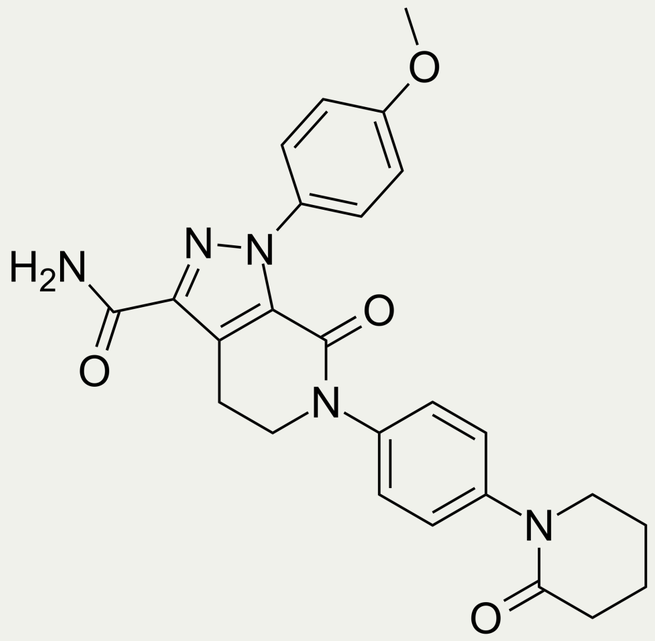
The Moonshot

A Self-Driving Biologics Factory

Evaluation

1. If successful, it will be a huge business
2. Technically possible within 5-10 years

Biologics are the future of therapeutics



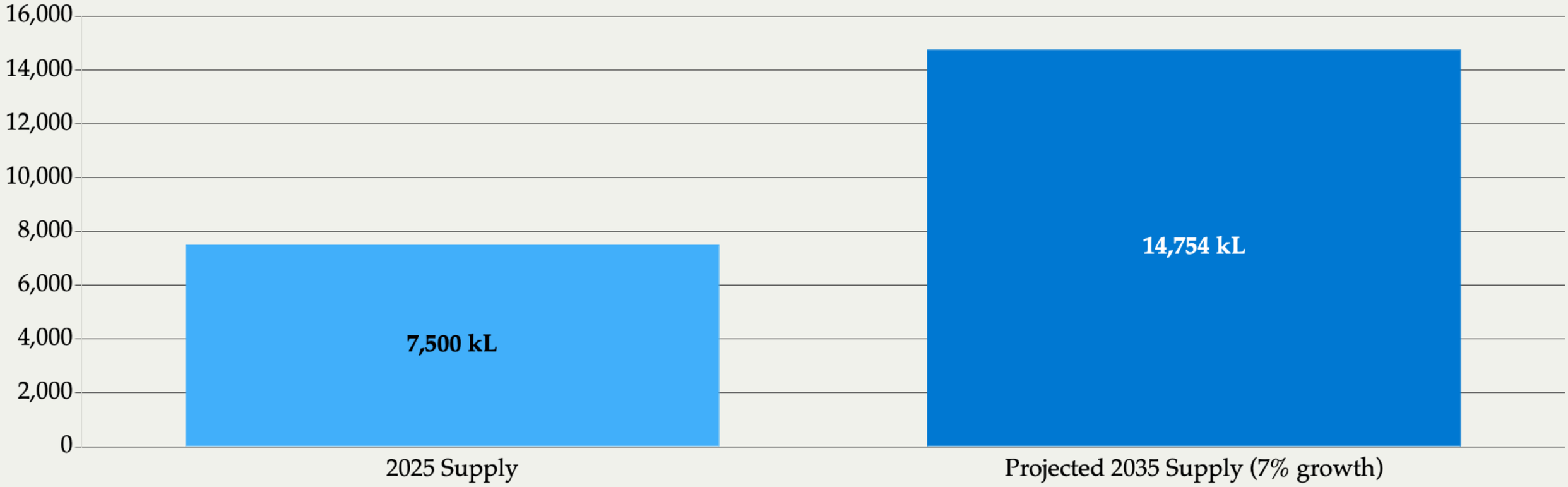
Apixaban

Molecular weight: ~460 Da

Adalimumab (Humira)

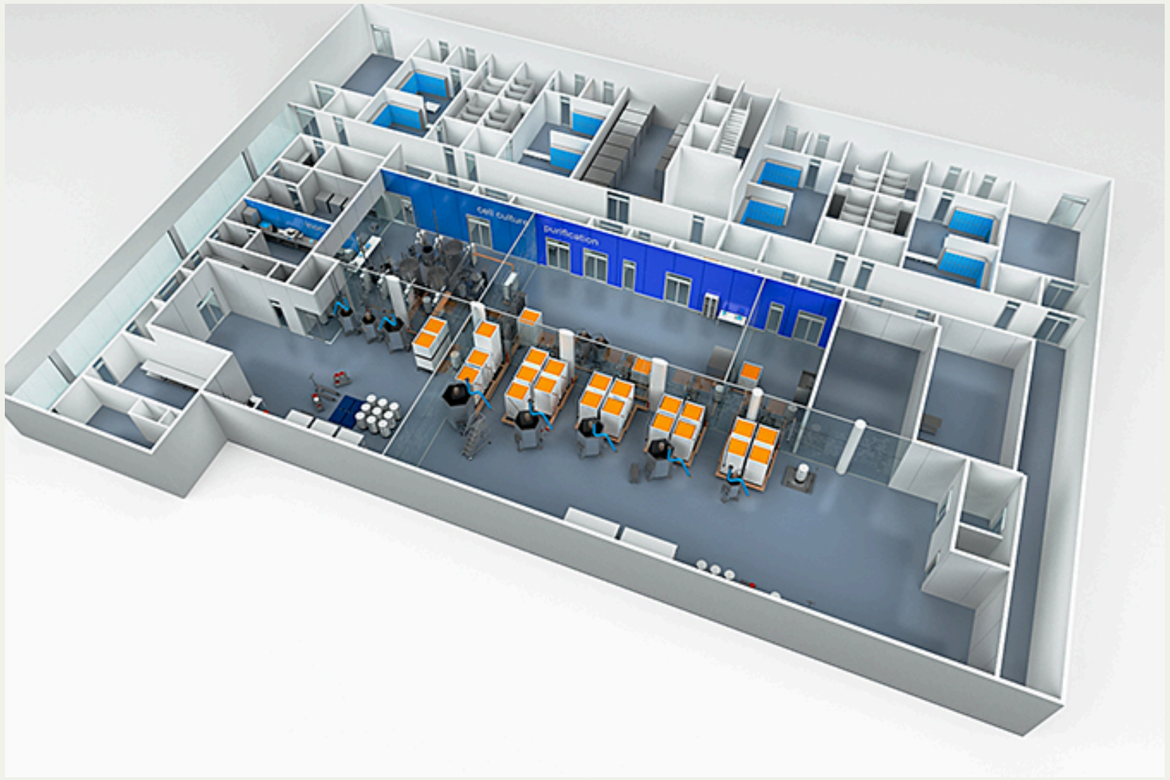
Molecular weight: ~148,000 Da

Biologics production volume[1] must double in the next 10 years to keep up with demand



[1] Specifically, mammalian cell culture production, which is the leading method for producing biologic therapeutics.

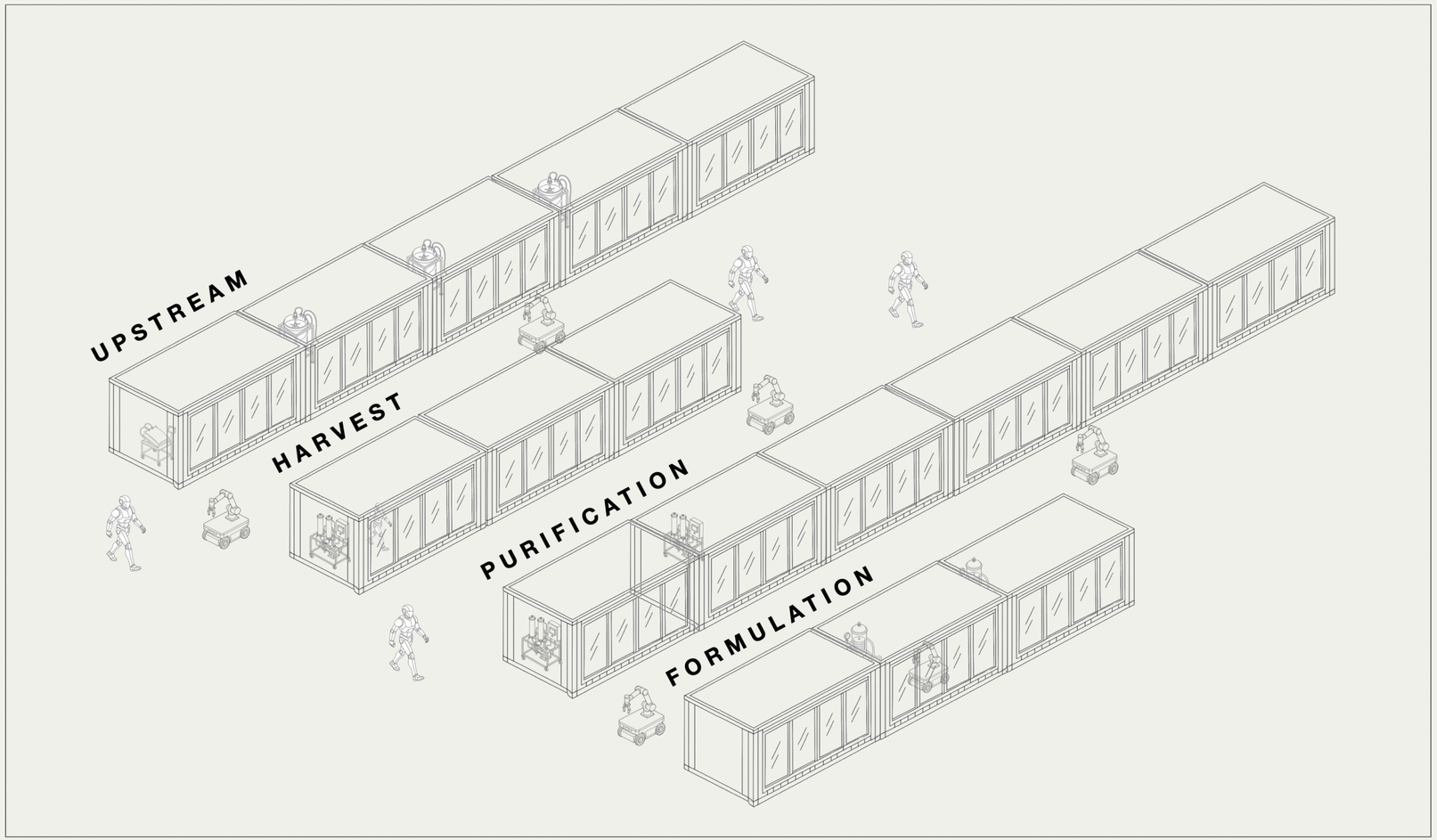
However, factories are expensive ($500M–$1B) and labor intensive to operate.



Substantial cleanroom layouts

Trained technicians required

A self-driving factory can scale to meet global needs



Features:

Eliminate clean rooms

Site anywhere

Eliminate lost batches

Impact:

Reduce opex by ~30%

Lower construction hard costs by ~40%

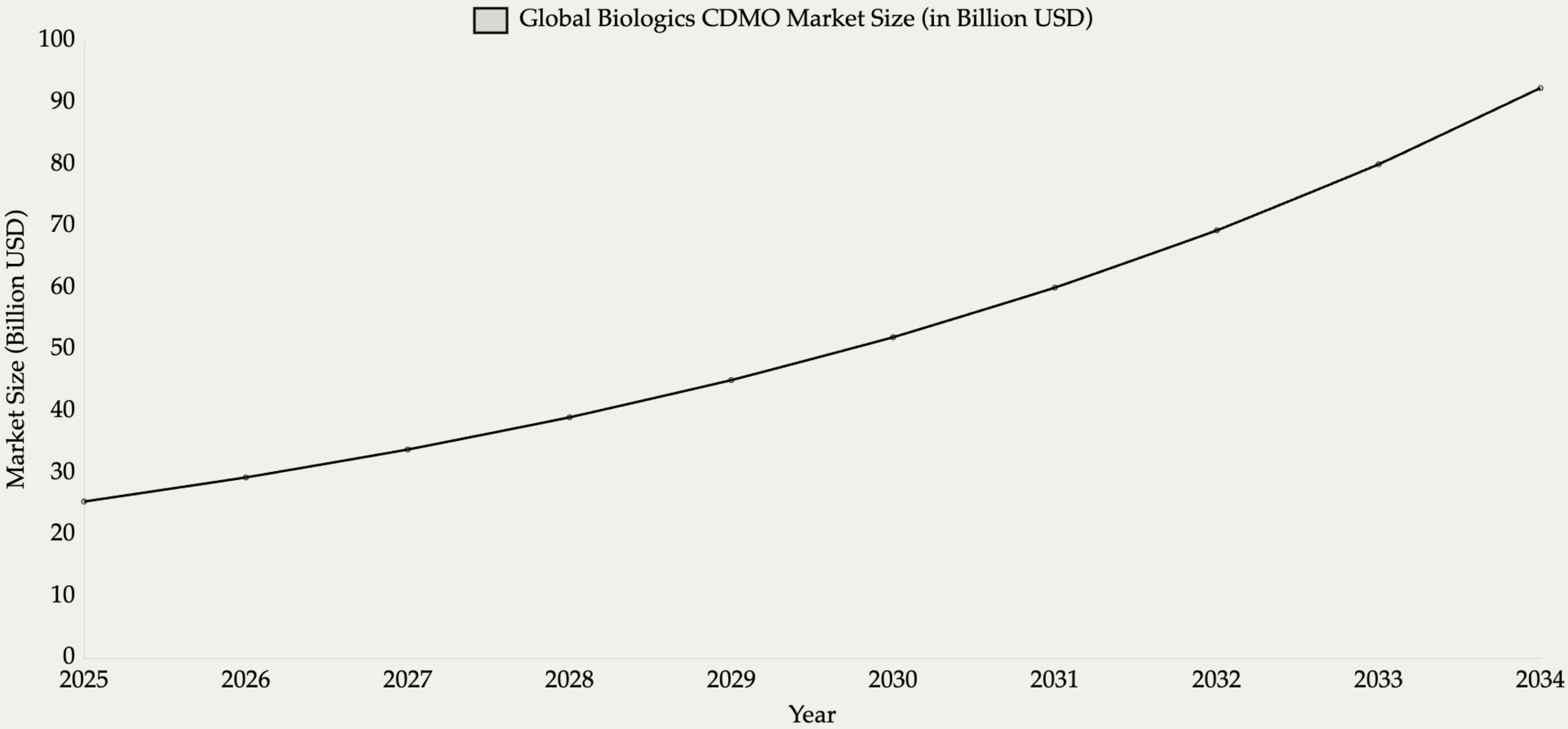
The opportunity is to create a TSMC for biologics

Market Opportunity

- $25B+ market today
- Growing >15% annually
- Fragmented: Largest player has <15% share

How We Win

- Capital-efficient; easier to scale.
- Cheaper production for customers
- Higher margin



Source: Precedence Research (7)

Real Estate Cost Analysis

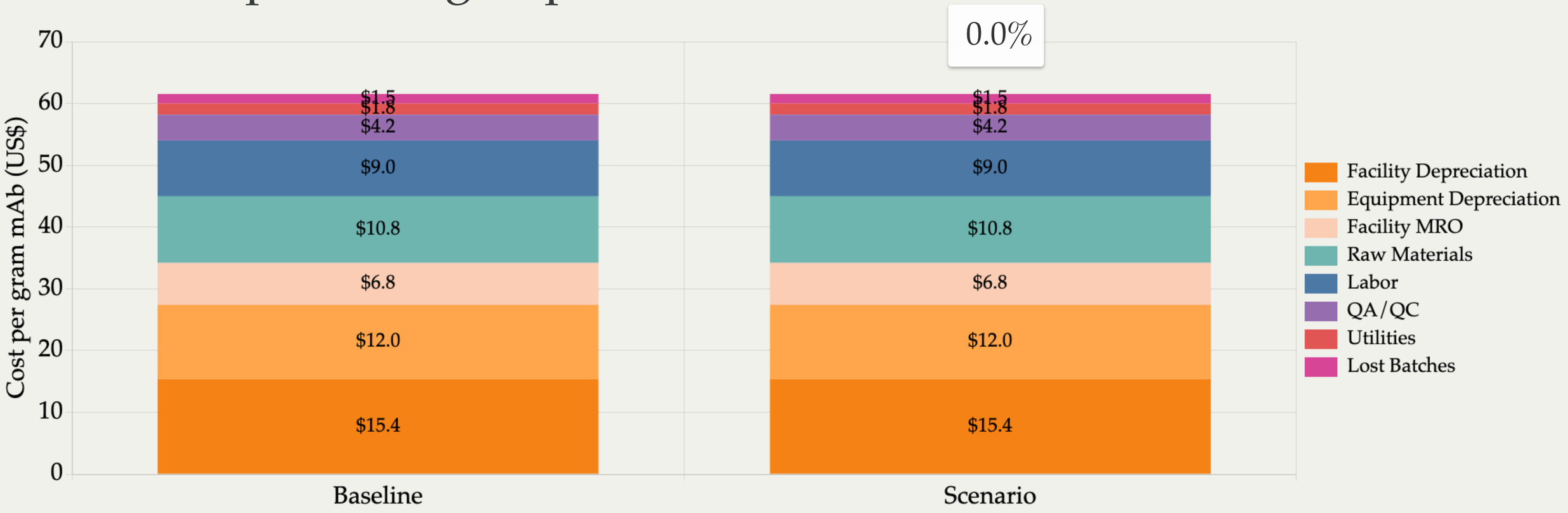
Eliminating clean rooms can reduce construction hard costs by >40%

Area	**Clean-room grade**	**Avg hard cost (sq-ft)**	**Sq-ft % of total for avg GMP facility**	**Sq-ft % for Self-driving GMP facility**
Core GMP operations	Grade C (ISO 7)	$1,250	40%	0%
Corridors, lab	Grade D	$500	20%	60%
G&A Space: Office, warehouse, utilities	Unclassified	$300	40%	40%
Blended Average Cost ($/sq-ft)		**$720**		**$420**

Source: Cushman & Wakefield (6)

COGS Analysis

Much cheaper biologics production



Labor: 0%

Facility cost: 0%

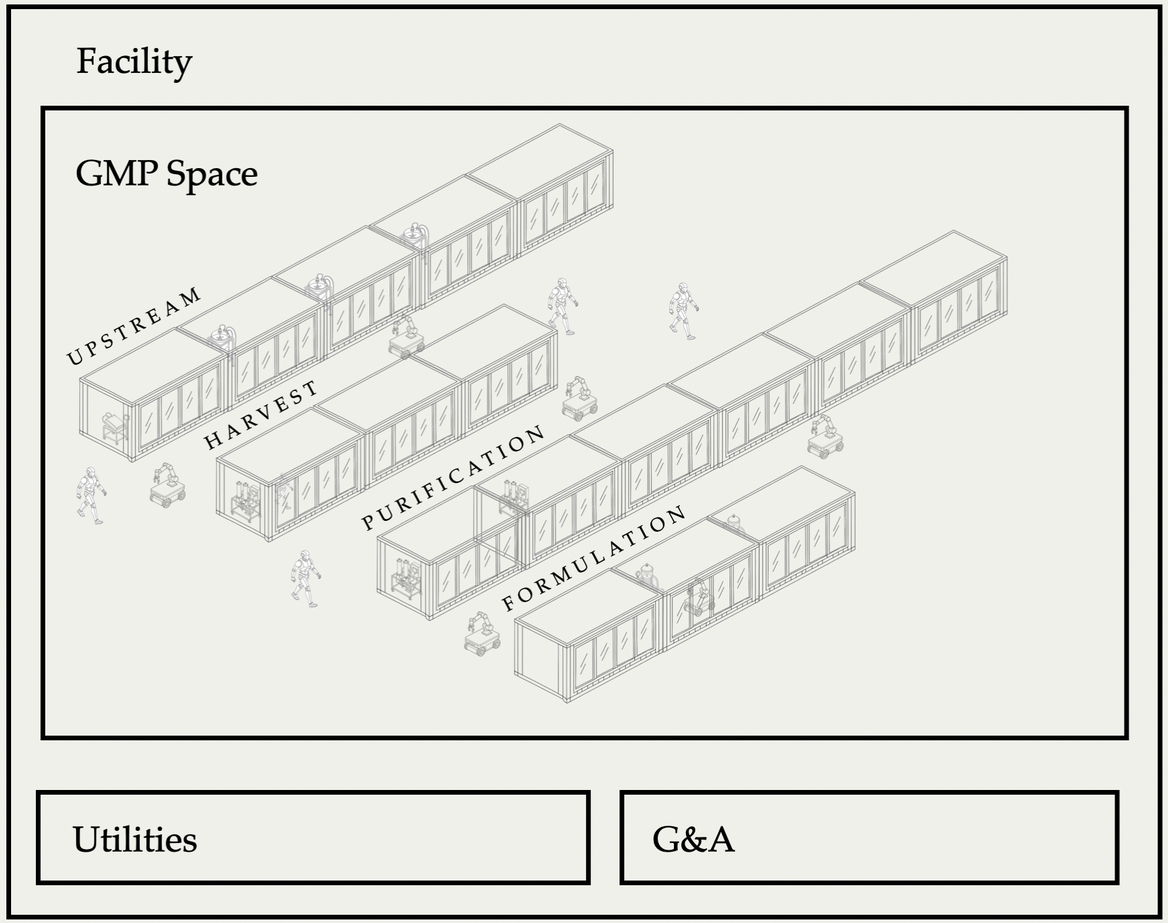
☐ Low-cost Site

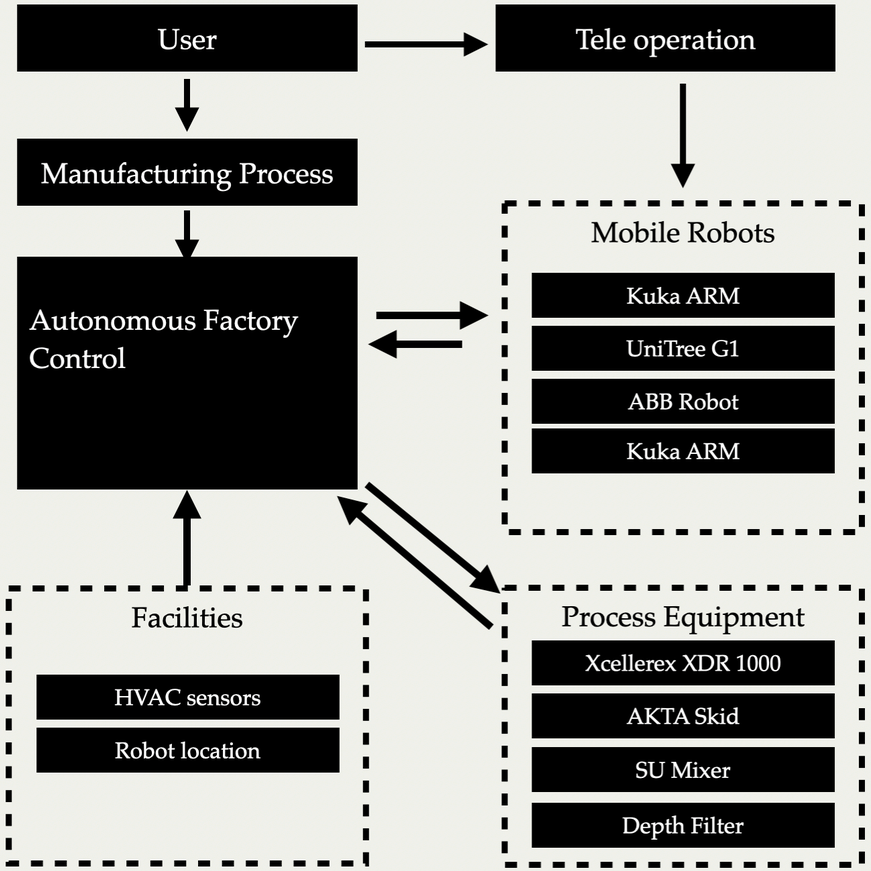
☐ Eliminate Contamination

View Assumptions

How it works

Robotics + Pre-Fab Pods + Autonomous Control





Breakthrough Tech

Automating all unit operations using mobile robots

Robot Platforms


Kuka AMR


UniTree G1


MiR Mobile CoBot


Apptronik Humanoid

~10-15 unit operations

~10-100 unique "actions" required per unit operation

Unit operations & actions are different per process

Execution must be responsive to live mfg process

Upstream

Cell growth and protein production


Media Prep


Seed Train


N-1 Bioreactor


Production Bioreactor

→

Harvest

Cell removal and initial capture


Harvest / Clarify


Protein A Capture

→

Purification

Product purification and concentration


Viral Inactivation


CEX Column


AEX Column


UF/DF

→

Formulation

Final drug substance preparation


Formulation Tank


Sterile Filter

Tasks

Each unit operation requires 25-100 individual robotic tasks


Media Prep


Seed Train


N-1 Bioreactor


Production Bioreactor


Harvest/Clarify


Protein A Capture


Viral Inactivation


CEX Column


AEX Column


UF/DF

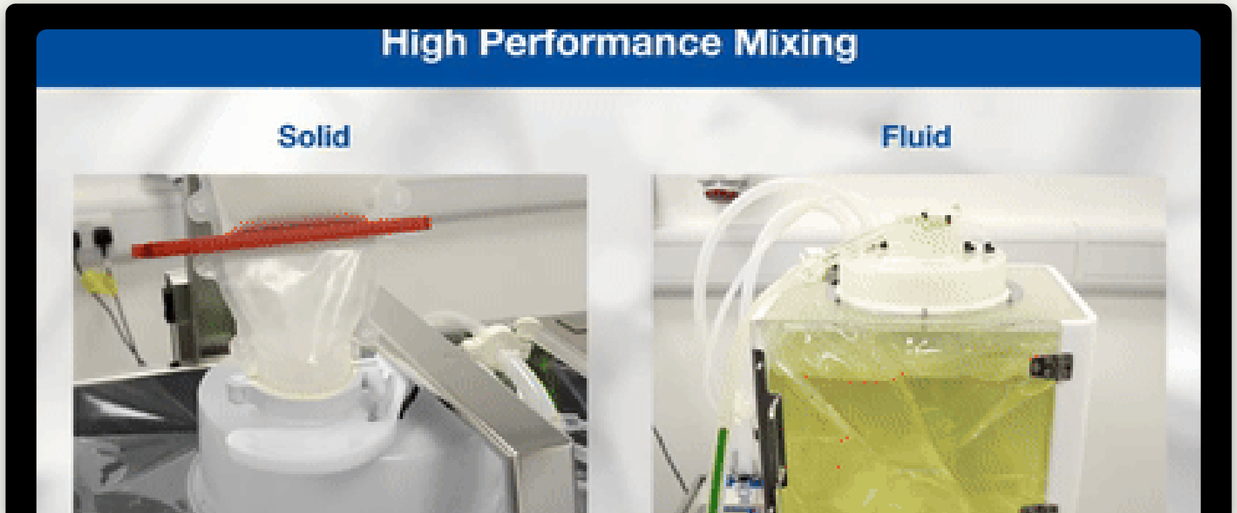

Formulation Tank

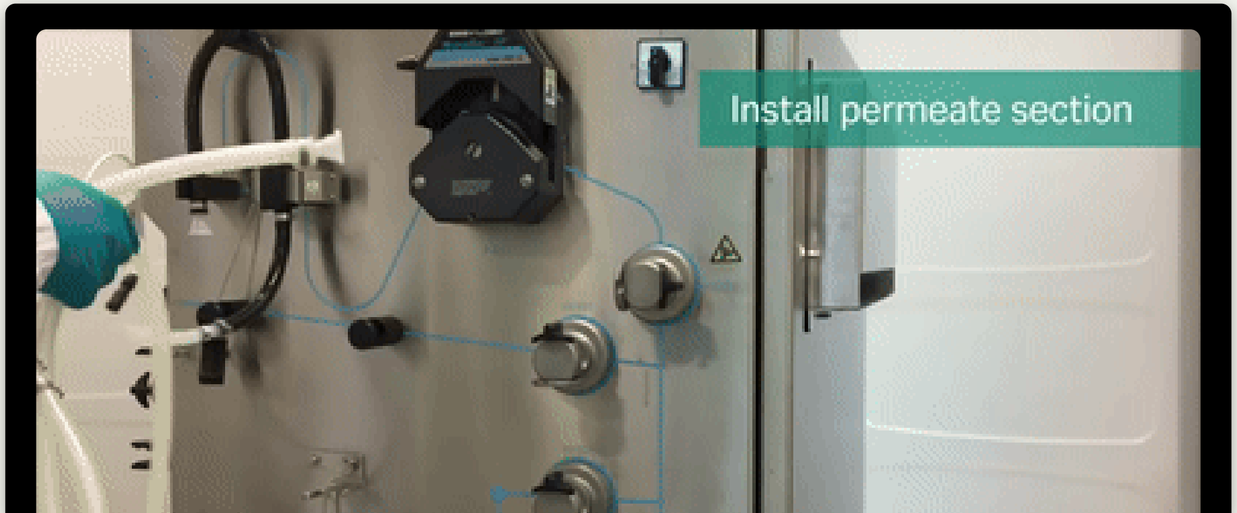

Sterile Filter

Example Tasks

Preparing for probe insertion

Inserting probe





Task Analysis

Tasks have different difficulty levels and can be grouped into similar categories


Media Prep


Seed Train


N-1 Bioreactor


Production Bioreactor


Harvest/Clarify


Protein A Capture


Viral Inactivation


CEX Column


AEX Column


UF/DF


Formulation Tank


Sterile Filter

Show Difficulty

Show Types

Model

For 1 of n tasks:

Connect the probe into the single-use reactor through the port

Autonomous Factory Control

Task

Robot:

Sensors

Vision-Language-Action Model

Robot motor control

Xcellerex XDR 1000

86% success rate

Training:

Task-specific data:

1000s of demonstrations

Simulation-based data

Fine-tune model

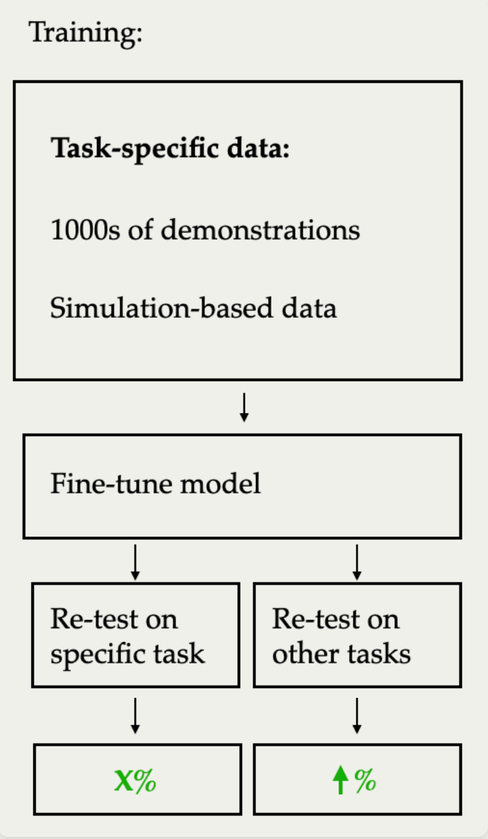
Re-test on specific task

Re-test on other tasks

99%

↑%

Training



Example Approach:

Each month:

1. Real world data on subset of tasks (~25)
2. Collect simulation data on all tasks
3. Fine-tune model on data
4. Test on 25 tasks & 10 other tasks

Questions:

1. Rate of learning from demonstrations? How different per task?
2. Rate of learning from simulation? Any way to improve?
3. How much transfer learning between tasks?

Once we better understand these questions, we can understand if this problem is tractable.

Simulation

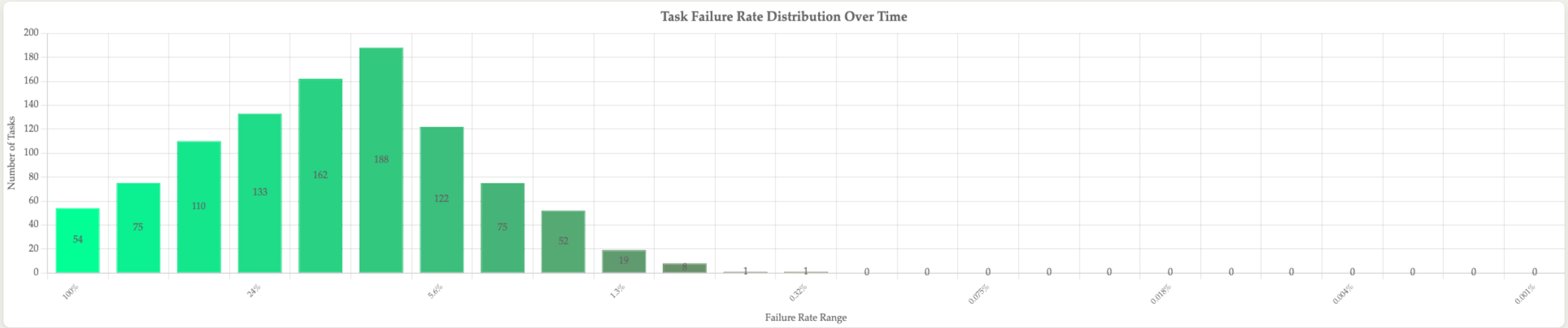
Simulation Parameters

Learning Rate (α) — 0.8
How quickly tasks improve

Simulation Efficiency — 0.10
Sim vs real-world learning

Transfer Learning Rate — 0.010
Improvement spread to other tasks

Initial Difficulty (σ) — 3.0
Spread of initial difficulty



CURRENT DAY	MEAN FAILURE RATE	TASKS UNDER 0.5% FAILURE RATE	PROGRESS
Day 0	18.107%	2 (0.2%)	0.0%

Next Day | Run to End | Reset | Assumptions

So, you're saying there's a chance?

Why is this possible?

- Known, built environment
- Discrete, known tasks
- Tele-op should work for failing tasks
- Can build "automation-friendly" systems to make hard tasks easier

Why not?

- Tasks require too much dexterity
- Too many difficult tasks to learn
- Transfer learning doesn't work because tasks are highly varied

What's Next

Rapid Evaluation

Goal: Too early for this application? Or, just the right time?

Timeline: 0 - 3 months

Step	Description
Modeling	Forecast improvements to capex, opex, and margins
Customer Validation	Interview 5-10 potential customers to validate value prop and gauge partnership interest.
Automation Assessment	Build unit operation task list and assess difficulty
Task Forecasting	Consult literature/experts to forecast possibility & timeline to automate tasks
Simulation	Develop factory simulation to study feasibility and challenges
Team Development	Identify key talent and build initial pipeline.
Create Project Plan	Create phase 1 plan for first 12 months of project

Thank You

Q&A on Moonshot proposal

AI Mechanical Engineer

Mechanical design is 10-100x slower than software. What if it wasn't?

Current Reality

- Weeks Requirements → CAD
- Weeks CAD → Simulation/Testing
- Weeks Analysis → Manufacturing

Total: 3-6 months per design iteration

AI Mechanical Engineer

- Hours Natural language → CAD
- Hours Automated simulation & analysis
- Hours Manufacturing-ready outputs

Total: Days per design iteration

Market Opportunity

- **$30B+ CAD/CAE market**
- **5M mechanical engineers** globally
- "Cursor for mechanical engineers"

Breakthrough Required

- **Spatial reasoning** advances
- **Engineering datasets** & benchmarks
- **Verifiable rewards** for RL training

What Becomes Possible

- **Mass customization**
- **Design democratization**
- **Rapid prototyping** at scale

Sources

1. Dourado, E. (2020). www.elidourado.com
2. Bloom, N., Jones, C. I., Van Reenen, J., & Webb, M. (2017). Are Ideas Getting Harder to Find? NBER Working Paper No. 23782.
3. California Department of General Services. (2024). California Construction Cost Index.
4. U.S. Bureau of Labor Statistics. (2024). Consumer Price Index.
5. U.S. Department of Transportation. (2024). National Highway Construction Cost Index.
6. Cushman & Wakefield. (2025). Life Sciences U.S. Fit-Out Cost Guide 2025.