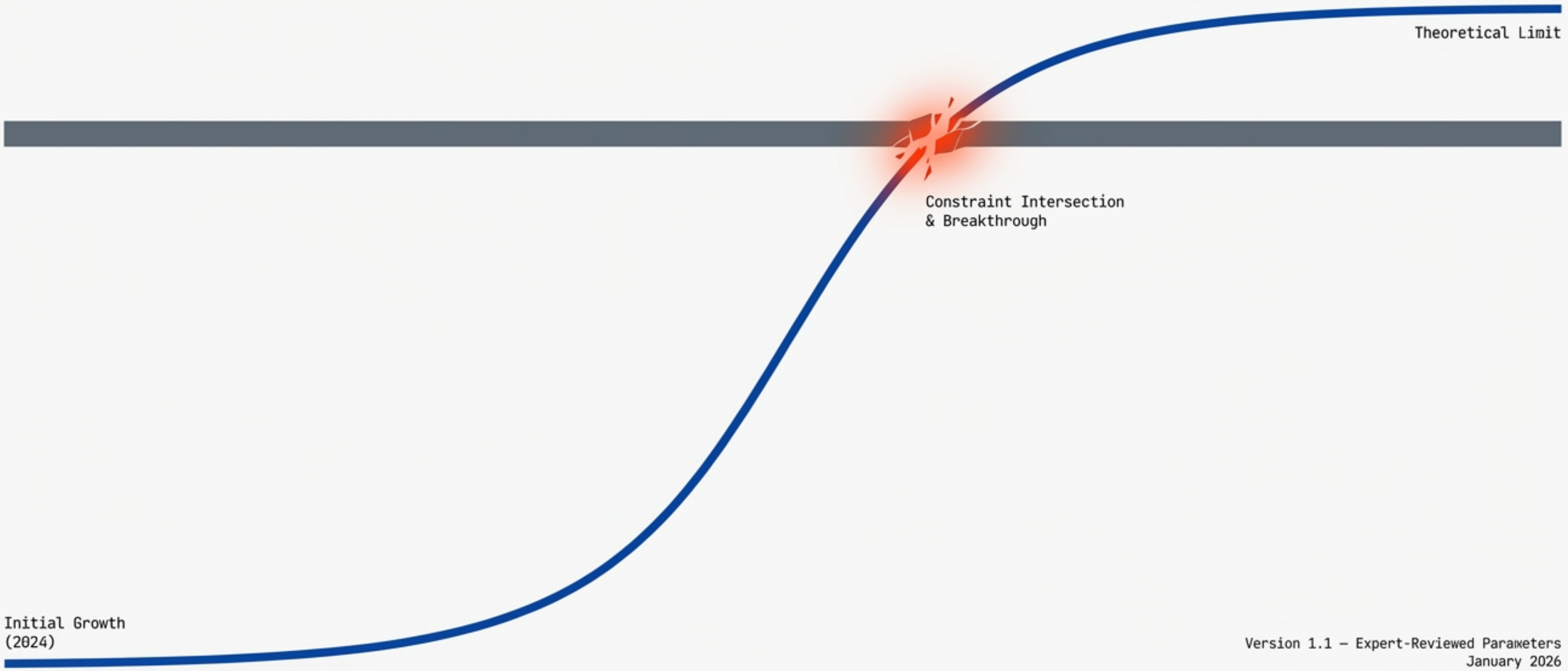
The Physics of Acceleration

A Quantitative Model of AI in Biological Discovery (2024–2050)



Version 1.1 – Expert-Reviewed Parameters
January 2026

We are currently moving at the speed of biology, not technology.

10–15 Years
Discovery to Market

$2.6 Billion
Cost per Drug

95% Failure
Discovery to Approval

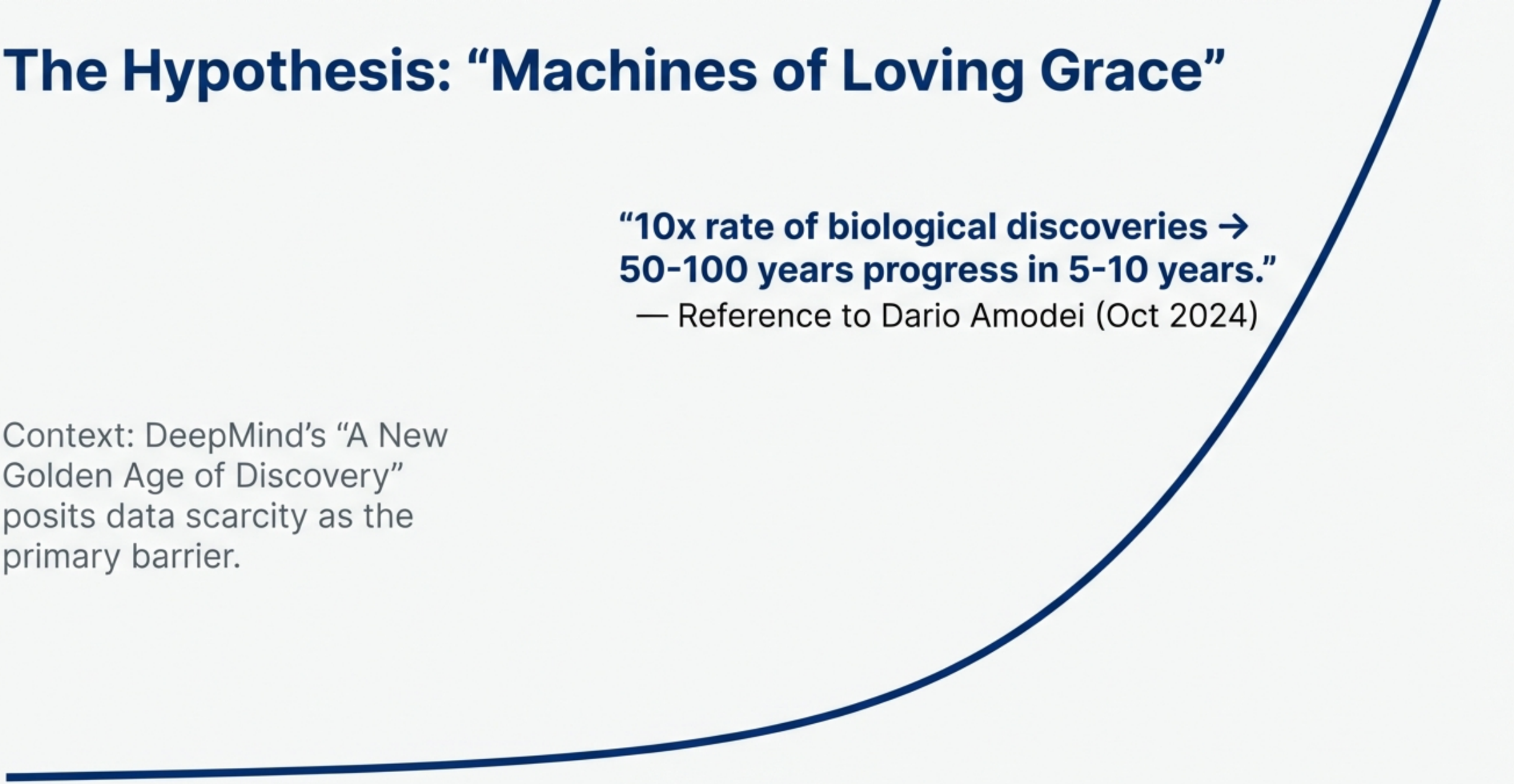
Source: Tufts CSDD, FDA CDER Annual Reports 2015-2023

The Hypothesis: “Machines of Loving Grace”

“10x rate of biological discoveries → 50-100 years progress in 5-10 years.”

— Reference to Dario Amodei (Oct 2024)

Context: DeepMind’s “A New Golden Age of Discovery” posits data scarcity as the primary barrier.



THE CORE QUESTION: Can silicon solve biology?

The 10-Stage Pipeline: Silicon vs. Carbon

Blue = Computational Stages (High AI Leverage)

Blue = Computational Stages (High AI Leverage)

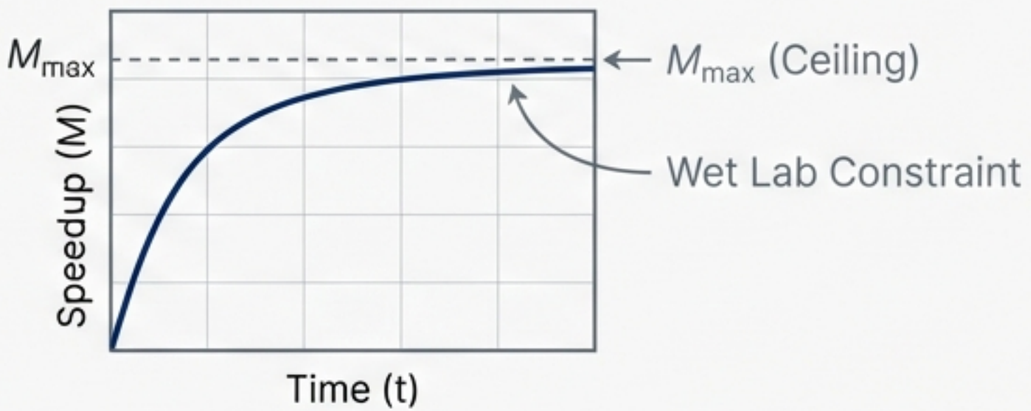
Grey/Red = Physical Stages (Low AI Leverage)

The Mathematics of Diminishing Returns

Exponential AI Capability Growth ($A \to \infty$)

$$M_i(t) = 1 + (M_{max} - 1) \cdot (1 - A(t)^{-k})$$

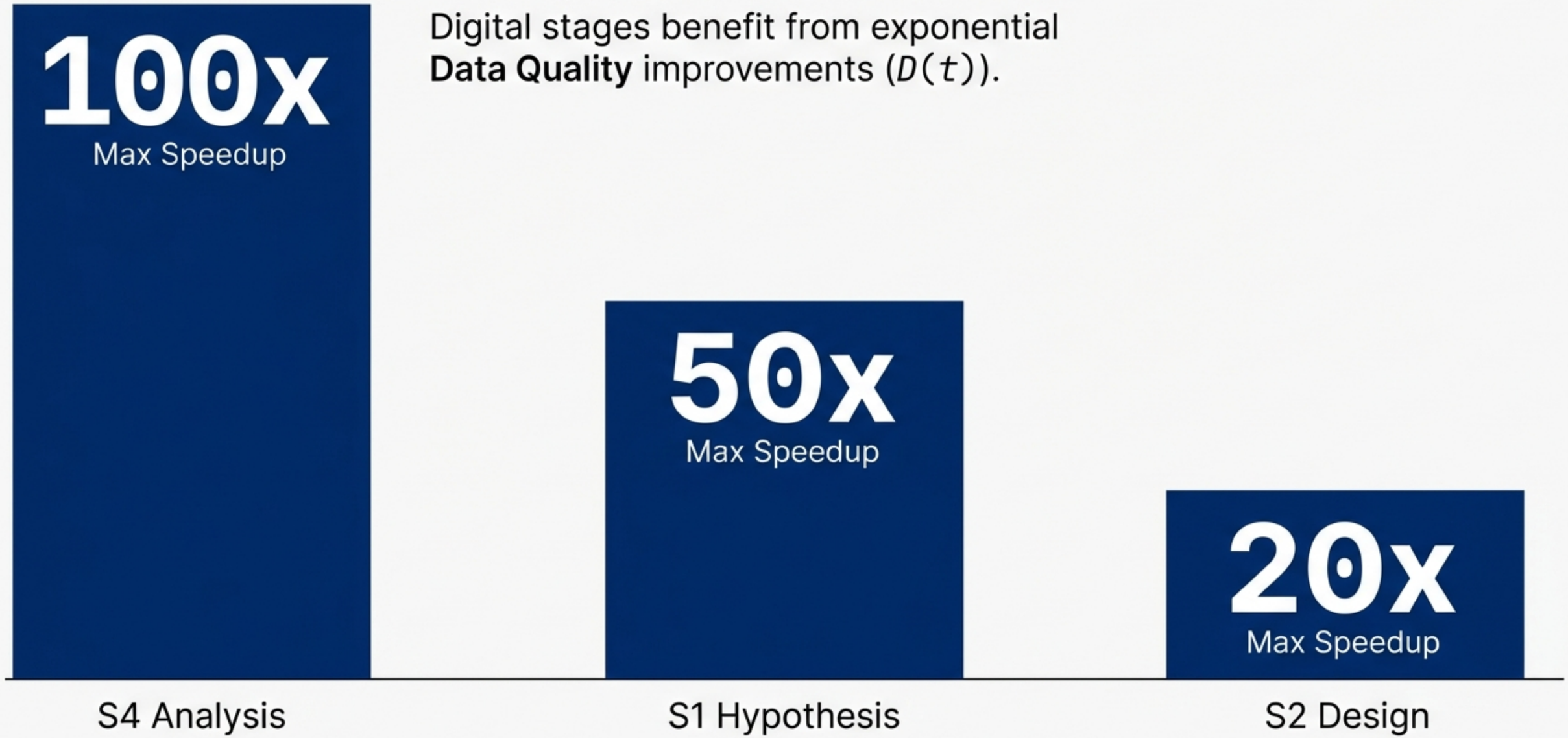
Realized Speedup (Capped by M_{max})



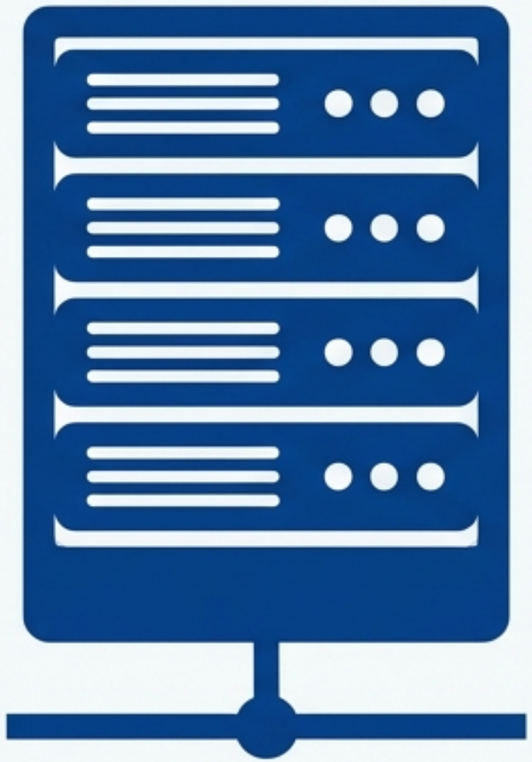
Even with infinite intelligence, a mouse study takes weeks. The wet lab creates a hard ceiling (M_{max}) that math cannot break.

Silicon Velocity: Where AI is Unstoppable

Digital stages benefit from exponential **Data Quality** improvements ($D(t)$).



The Phase II Wall: Where Reality Wins



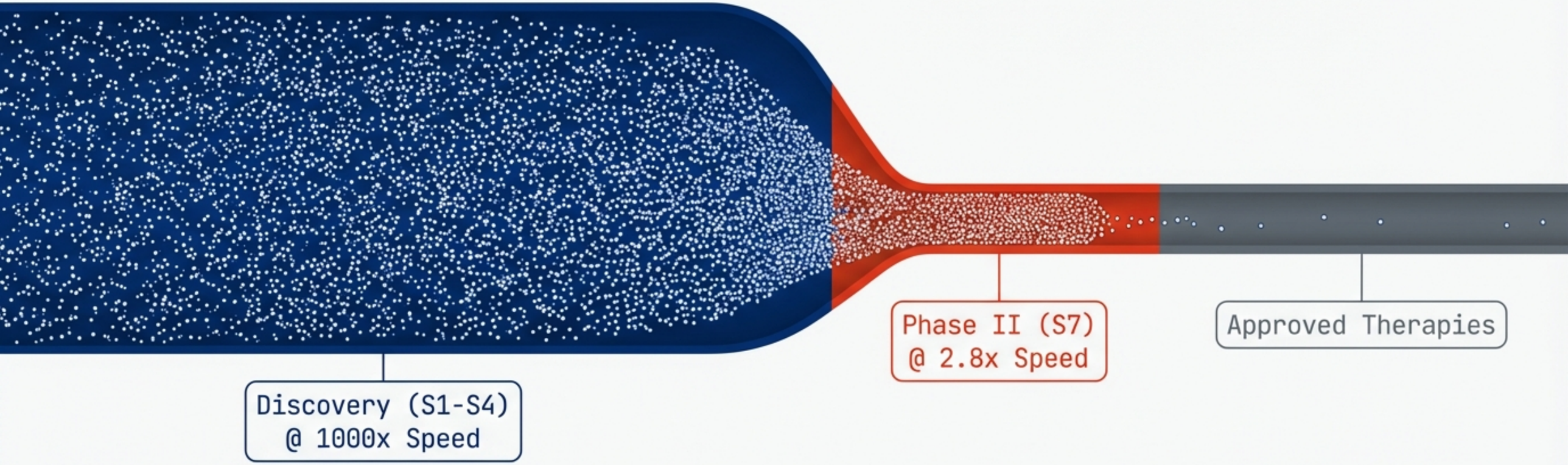
S4 Analysis:
100x
Speedup

S7 Phase II Trials

- Human Biology (Metabolic rates)
- Safety Observation Windows
- Patient Enrollment Limits

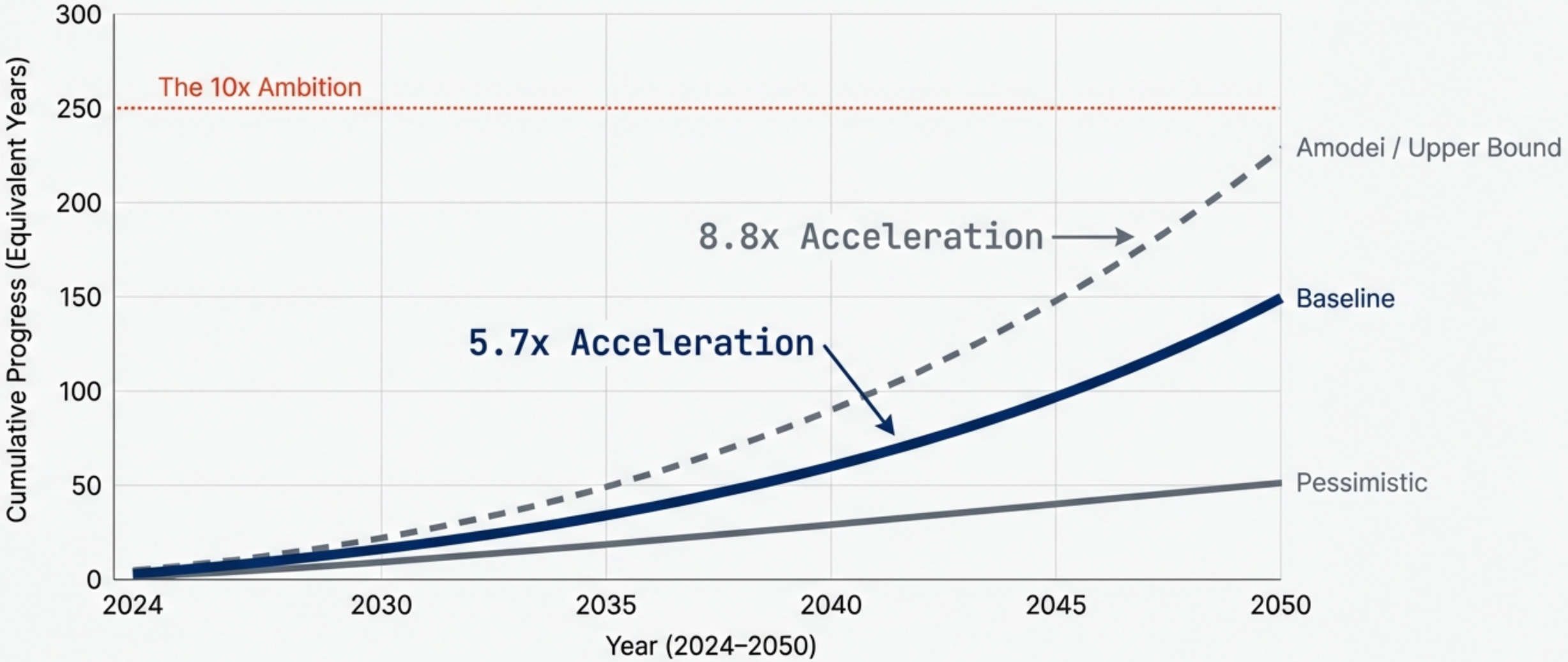
We are replacing a discovery bottleneck with a clinical bottleneck.

The Throughput Trap



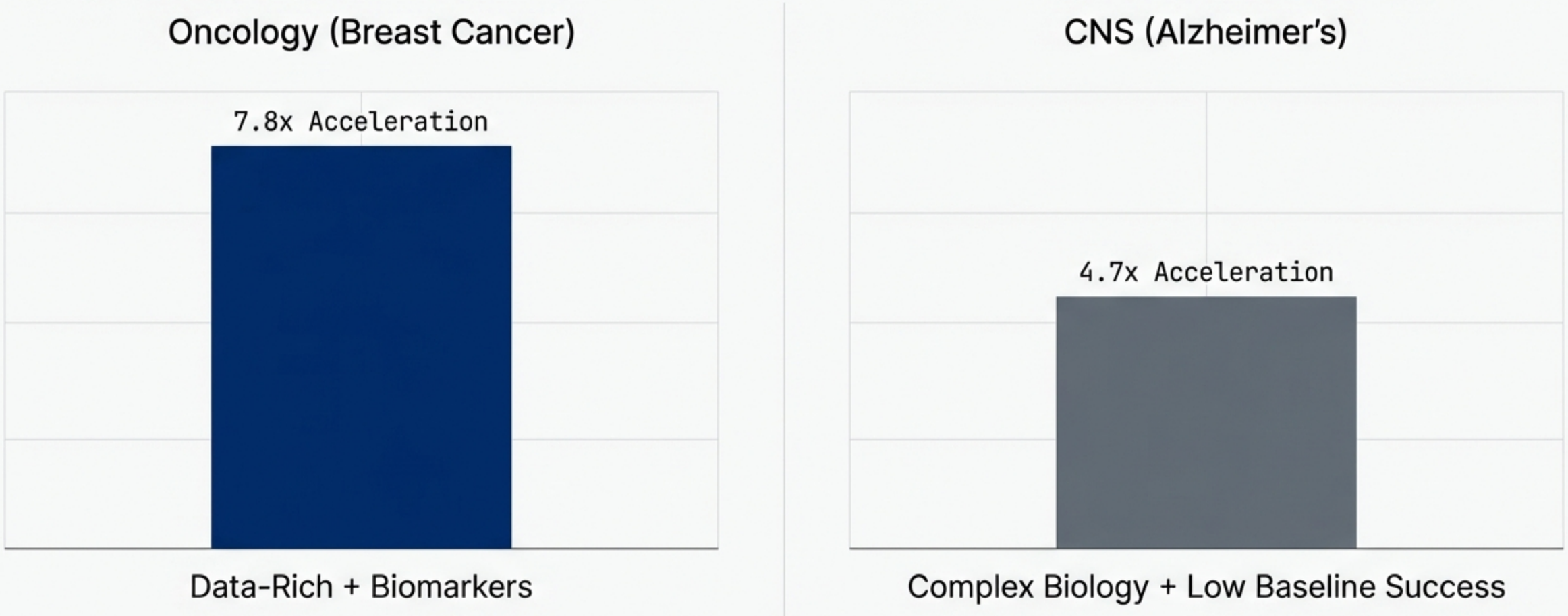
A 1000x faster discovery engine just creates a 1000x larger waiting room at Phase II.

Forecast 2024–2050: Radical, But Not Infinite



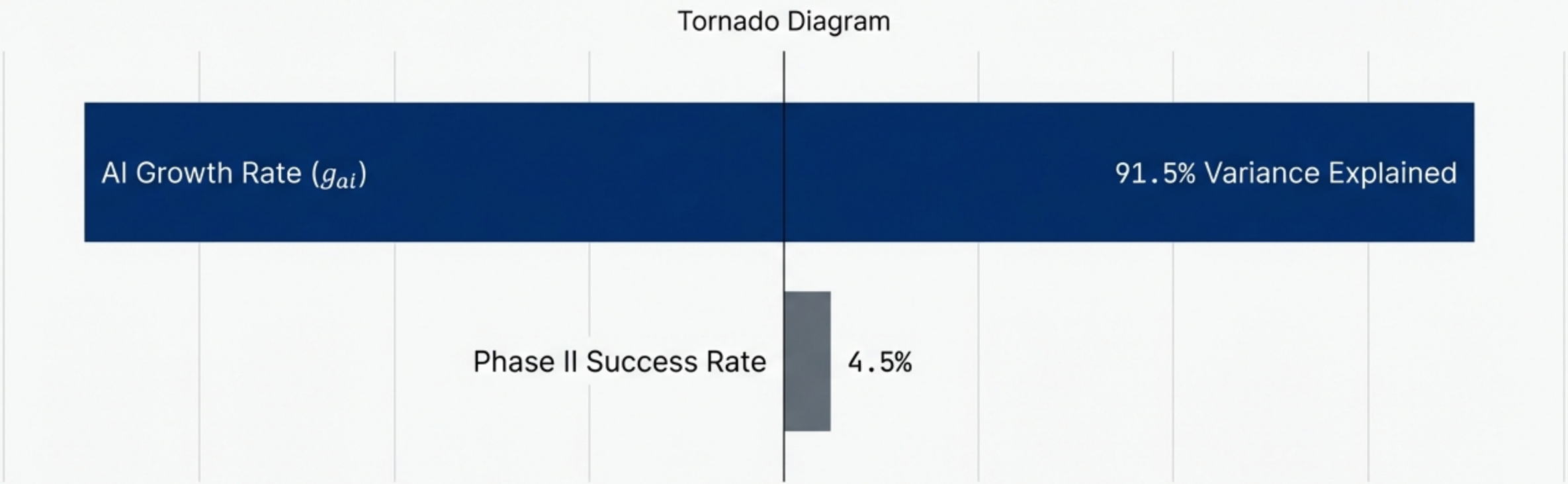
Our Baseline (5.7x) is transformative, but physics applies the brakes on the ‘50 years in 5 years’ ambition.

The Inequality of Cures



AI loves data-rich diseases; it struggles with complex biological mysteries.

The Cost of Uncertainty



The biggest risk to the timeline isn't the biology—it's whether the AI keeps getting smarter.

80% Confidence Interval: 3.4x – 9.2x Acceleration

Breaking the Bottleneck: Policy ROI

AI Research Investment:

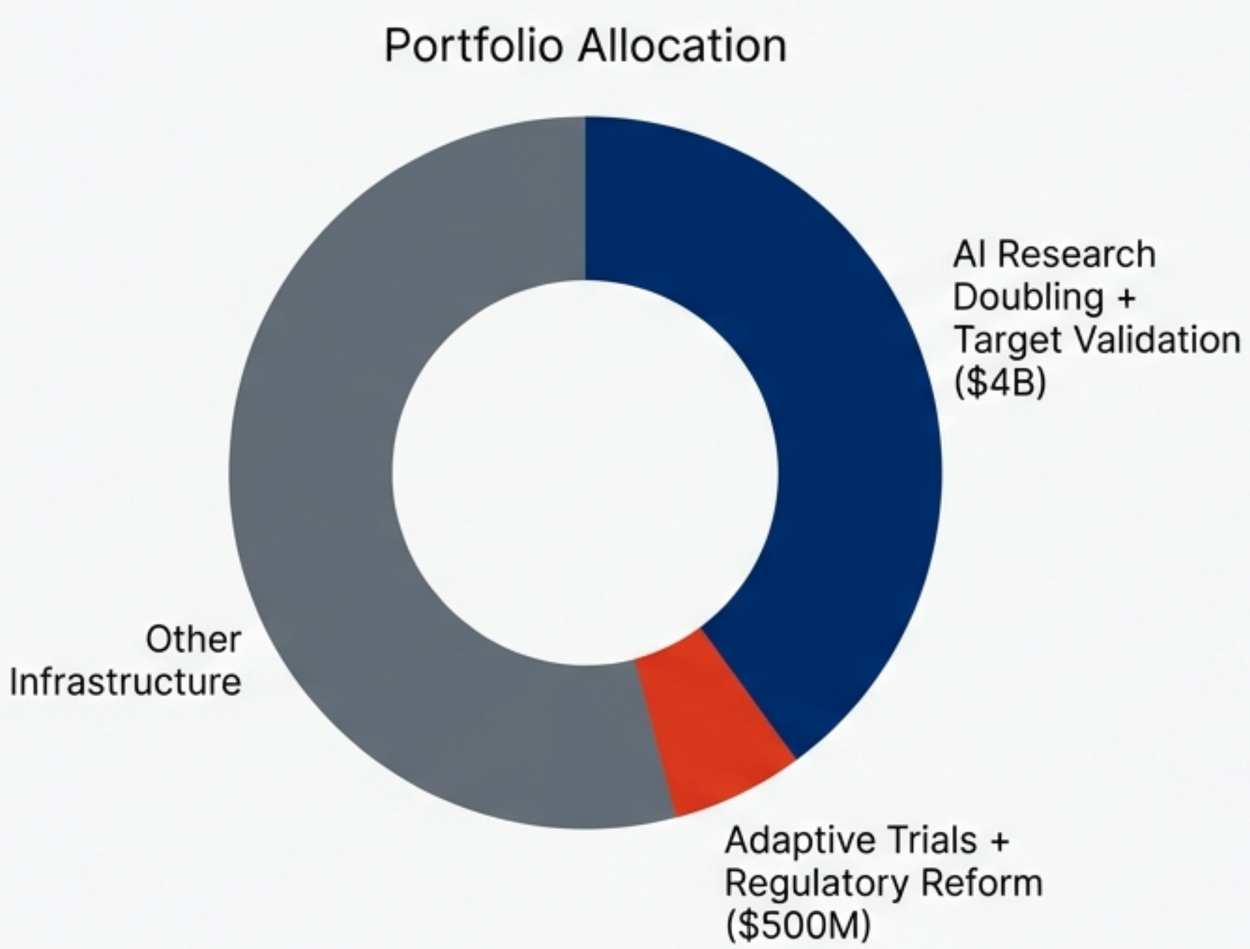
$3B cost

Regulatory Reform:

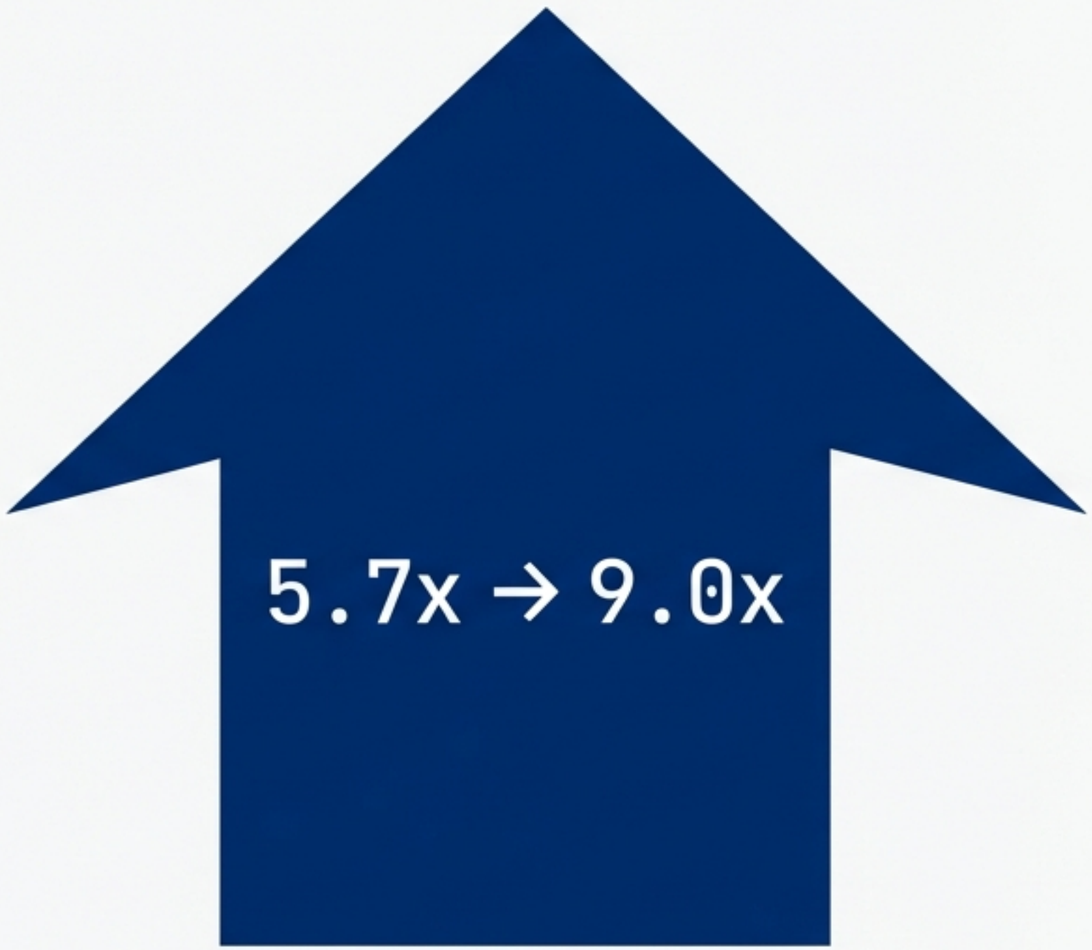
$200M cost

The highest ROI isn't buying more GPUs.
It's changing how we run trials.

The $10 Billion Strategic Portfolio



Portfolio Allocation



Baseline vs. Portfolio Acceleration

Rigor & Validation

15-Expert Review Panel

Statistical, Domain, & Economic Review

FDA Validated

Calibrated against 2015-2023 Data

Monte Carlo Verified

N=10,000 Simulations

Model calibrated against Paul et al. (2010), Wong et al. (2019), and historical FDA datasets.

The Human Variable

+75 New Therapies

Above Baseline by 2050

1.84 Billion
Beneficiaries
(Pandemic Preparedness)

72 Million
Beneficiaries
(Alzheimer's Advancements)

AI is the engine. Policy builds the road. We need both to reach the destination.