Machine Learning for Precision Antimicrobials

We turn phage-bacteria matching from a biological bottleneck into a solvable data problem.

Antimicrobial resistance (AMR) demands a shift from broad-spectrum antibiotics to precision antimicrobials

The AMR Crisis

1.3M deaths in 2019
Up to 10M deaths/yr by 2050

source: WHO / Lancet GRAM

The current model drives the crisis

Broad-spectrum treatment

↓

Microbiome-wide selection pressure

↓

Resistant bacteria survive, multiply & spread

↓

Escalating AMR crisis

The next paradigm: Precision antimicrobials

- Target the pathogen, not the ecosystem
- Match the treatment to the bacterial threat
- Adjust therapy as resistance evolves

AMR requires treatments that are as adaptive as bacteria.

Nature already has a precision weapon: phages

Phages kill bacteria with extreme specificity — but finding the right match is the bottleneck

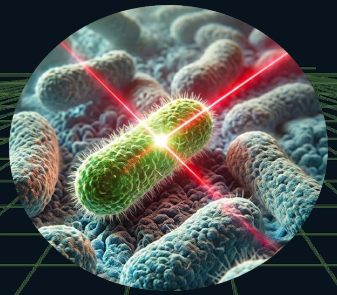
Phages are natural bacteria killers

Phages are viruses that infect and kill bacteria.

They are nature's built-in bacterial control system

Phages kill with laser precision

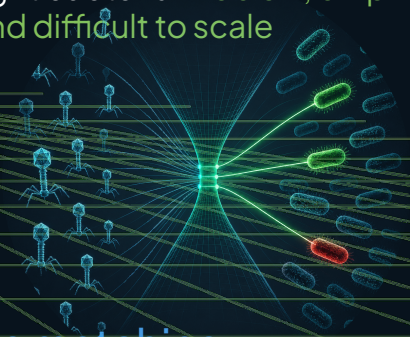
Unlike broad-spectrum antibiotics, phages can target specific bacterial strains while sparing non-target bacteria and much of the microbiome



Specificity creates a matching bottleneck

Each phage only works against a limited range of bacterial targets.

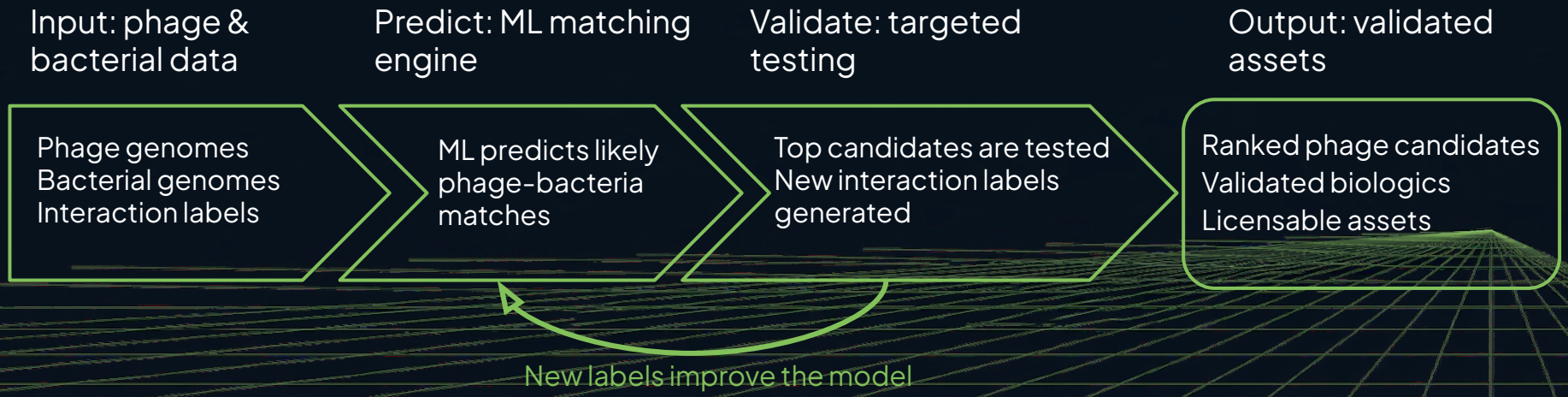
Finding the right phage for the right bacterium is slow, empirical, and difficult to scale



The promise of phages is precision. The challenge is matching

Phagestack turns phage matching into a predictive data problem

From empirical screening to ML-guided precision antimicrobial discovery



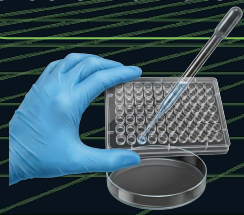
A self-improving data loop for precision antimicrobials

Juicer turns wet-lab bottlenecks into scalable data generation

Our patent-pending automation concept makes phage purification and characterization repeatable, faster, and ML-ready

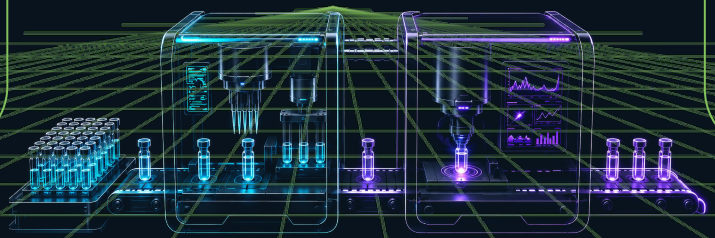
The wet-lab bottleneck

Purification and characterization are essential, but manual workflows are too slow and inconsistent to generate the validated interaction data needed for predictive matching



Juicer automation

Patent-pending automation concept for repeatable phage purification and characterization generating standardized data for ML training



Why Juicer matters

Generates proprietary training data

Reduces cost and time per validated match

Converts lab work into repeatable data production

The Juicer turns wet-lab validation into a scalable data engine

Next step: apply the full precision phage value chain

Validation in pilots with strategic aquaculture and clinical partners

The value chain

From target to validated treatment concept:

- Predict the match
- Purify & characterize
- Test in real use cases
- Feed outcomes back into the model

Two pilot tracks

Aquaculture
Fast-cycle non-pharma AMR use case

Clinical
Medically relevant translational use case

What we validate

Prediction quality
real-use-case performance

Workflow repeatability
purification to characterization

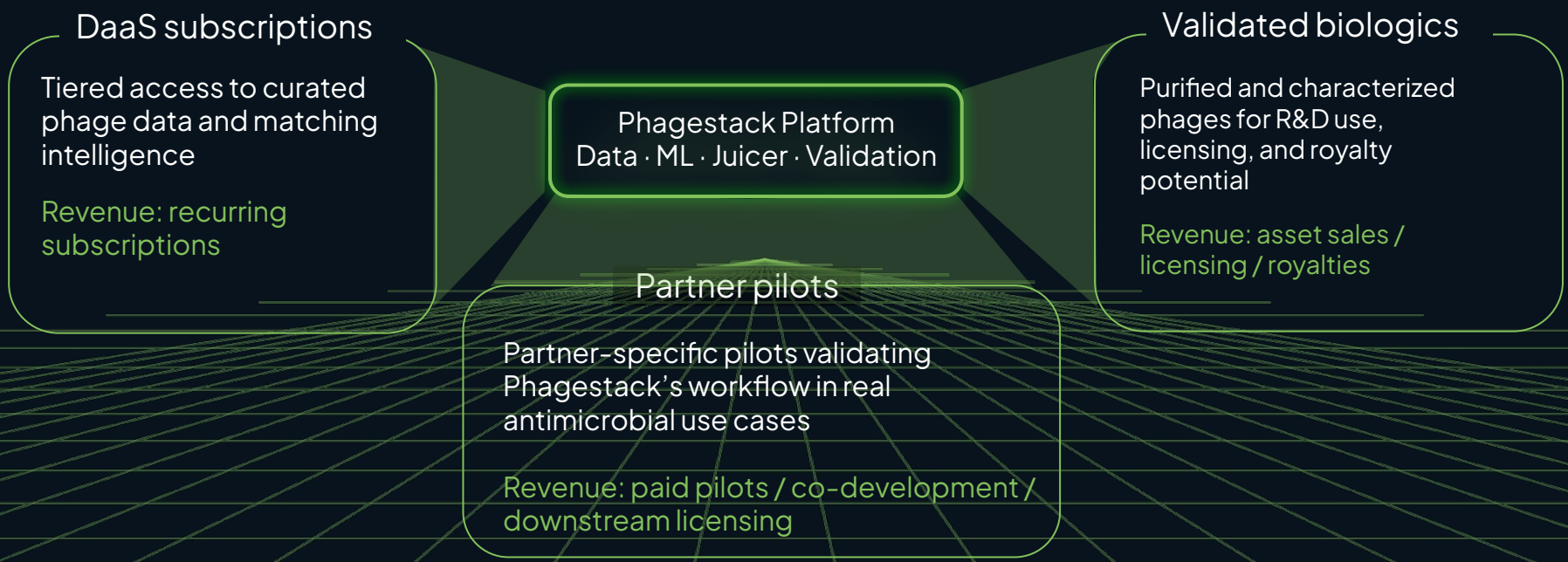
Market applicability
across antimicrobial segments

Commercial relevance
with strategic partners

From prediction engine to validated precision phage applications

One platform, multiple revenue streams

Prediction, data, and phage assets form an integrated business model



Competitive edge: full-stack, scalable, impact-driven

Therapeutic developers

Single-product bets

Phageguard, Innophage, PhageLux, Proteon

Service & biologics providers

Custom work, limited scalability

PrecisionPhage, PhageLab, Phagos

AI & data players

Prediction without validation loop

Locus Biosciences, BiomX

Why Phagestack is different

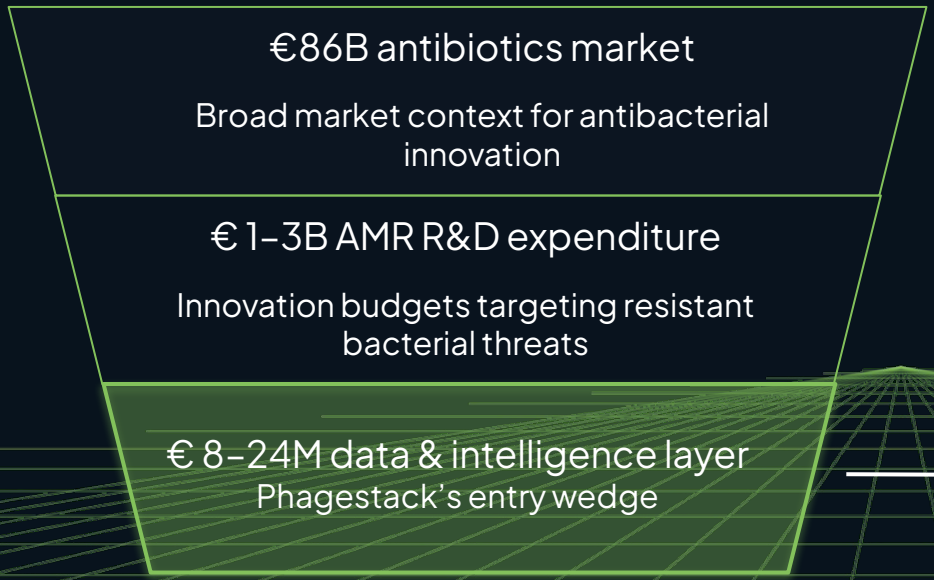
Full-stack platform
Data + ML + validation + biologics

Learning advantage
Every validation improves prediction

Scalable impact
Supports multiple developers across sectors

Market entry through the AMR intelligence layer

A focused data-and-validation wedge into the global antibiotics and precision antimicrobial market



Beachhead validation

Aquaculture pilot

Clinical pilot

Real-use-case proof → commercial entry

Start with intelligence budgets → validate through pilots → expand into precision antimicrobials

Sources: https://www.marketsandmarkets.com/Market-Reports/ai-in-biotechnology-market-91793150.html ; https://www.grandviewresearch.com/industry-analysis/antibiotic-market

Built, protected, partnered — now ready for POC execution

Core platform assets are in place; the next milestones convert technology into real-use-case evidence and commercial entry

Next inflection: prove prediction, validation, and commercial entry in real use cases

Building the precision phage infrastructure layer

Phagestack combines phage biology, data engineering, ML, and automation to make precision antimicrobials scalable

Leadership team:

Dr. Ewald Fernbach, CEO
Biotech production
Commercial leadership

Dr. Jonas Fernbach, CSO
Phage biology
Bioinformatics & AI

Robert Faber, COO
Operations & delivery
Customer execution

Investment ask: €2M staged round

Use of funds:

Execute aquaculture + clinical pilots
Build Juicer prototype
Expand proprietary interaction data
Benchmark prediction performance
Convert pilotss into paid partnerships & licensing

Scientific Advisors:

Prof. Vincent Fortuin (TU-Munich) - AI, Probabilistic ML
Prof. Martha Clokie (U-Leicester) - Phage microbiology, AMR

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