

BioPredX and Protposer

Predictive Biology to Accelerate Protein Innovation

AI-guided protein engineering for
biotechnology and agriculture

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Session: Public-Private Partnership in Plant Research (Biovegen)
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1 Developing better proteins is still **slow** and **expensive**

Proteins drive innovation



Industrial enzymes



Plant biotechnology



Biopharmaceuticals

Protein engineering market

2.6B → 7.6B
2023 2030

16.2% CAGR
(2024–2030)

Source: Grand View Research, 2024



Growing demand

Experimental bottleneck

Need for **prediction**

Traditional workflow



Design



Build

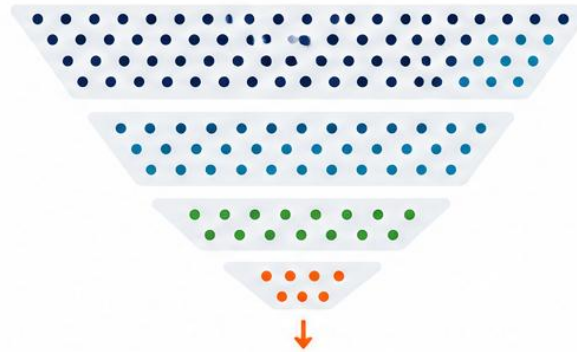


Test



Repeat

Millions of possible variants



Few successful variants
(1–5%)



Huge sequence space



Slow



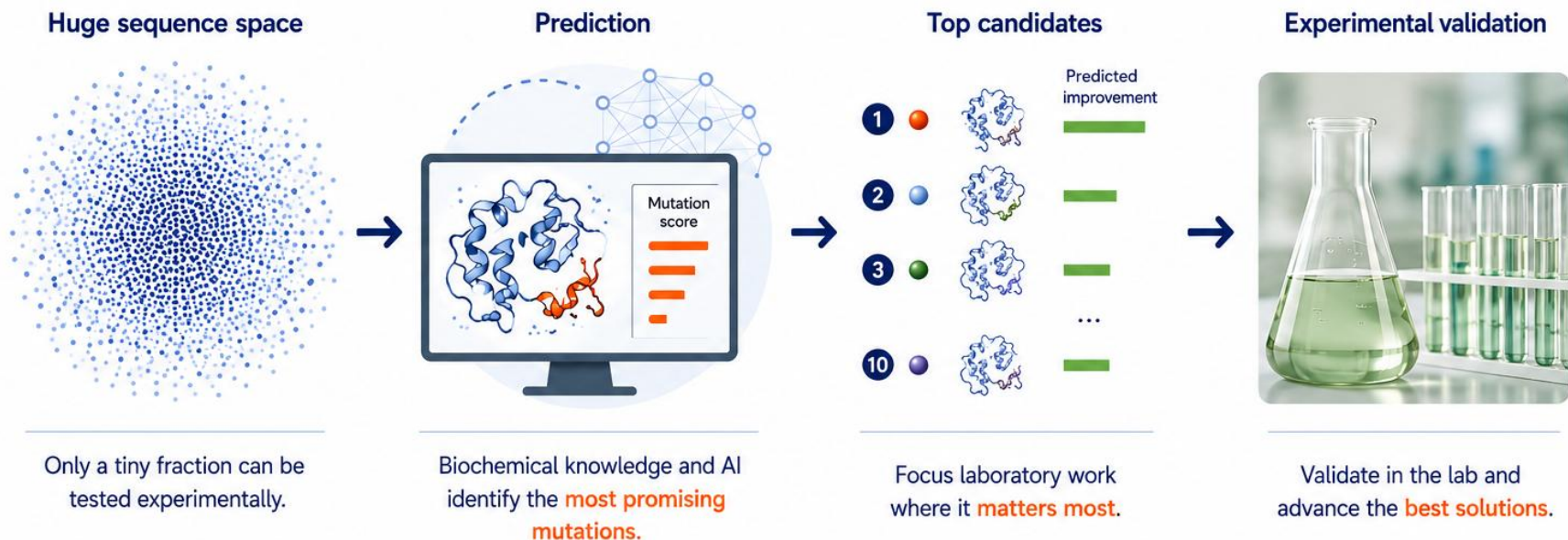
Expensive



Low success rate

2 Why prediction is needed

From an immense search space to **few high-value candidates**



Focus

on the variants that matter



Time

faster decisions and development



Cost

fewer experiments, lower costs



Success

higher hit rate, better proteins



Prediction does not replace experiments— **it makes them worth doing.**

3 BioPredX

Predictive biology for biotechnology and precision medicine

1

Scientific knowledge

Biochemistry, structure, evolution,
and biological data



2

Predictive models

AI and machine learning
powered by biochemical knowledge



3

Decision-support tools

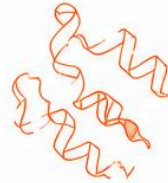
Accurate, interpretable
and easy to use



4

Industrial applications

Faster development, lower cost,
higher success rate



Protein engineering (Protposer)

Design of more stable, functional
and efficient proteins



Genetic diagnosis (GlobalPred)

Interpretation of genetic variants
with structural and biological context



Explainable AI

Transparent and trustworthy models
for real-world decision making

We **transform** biochemical knowledge
into **predictive technologies** with real impact.

4

The protein stability problem

Why protein instability **limits** biotechnological applications

Many proteins used in biotechnology are **not naturally stable** under real-world conditions.

Loss of stability under real-world conditions



Heat



Proteases

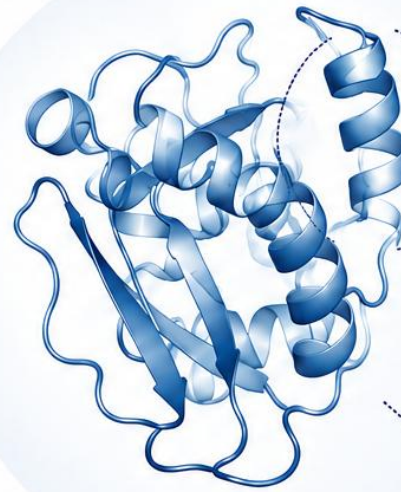


Storage



Processing

Poor stability translates into **loss of activity, low yields, high costs and limited real-world impact.**



Native functional protein



Thermal inactivation

Loss of activity at high temperatures



Proteolytic degradation

Rapid breakdown in biological systems



Aggregation

Formation of inactive aggregates



Reduced yields and efficiency

Lower production and higher costs



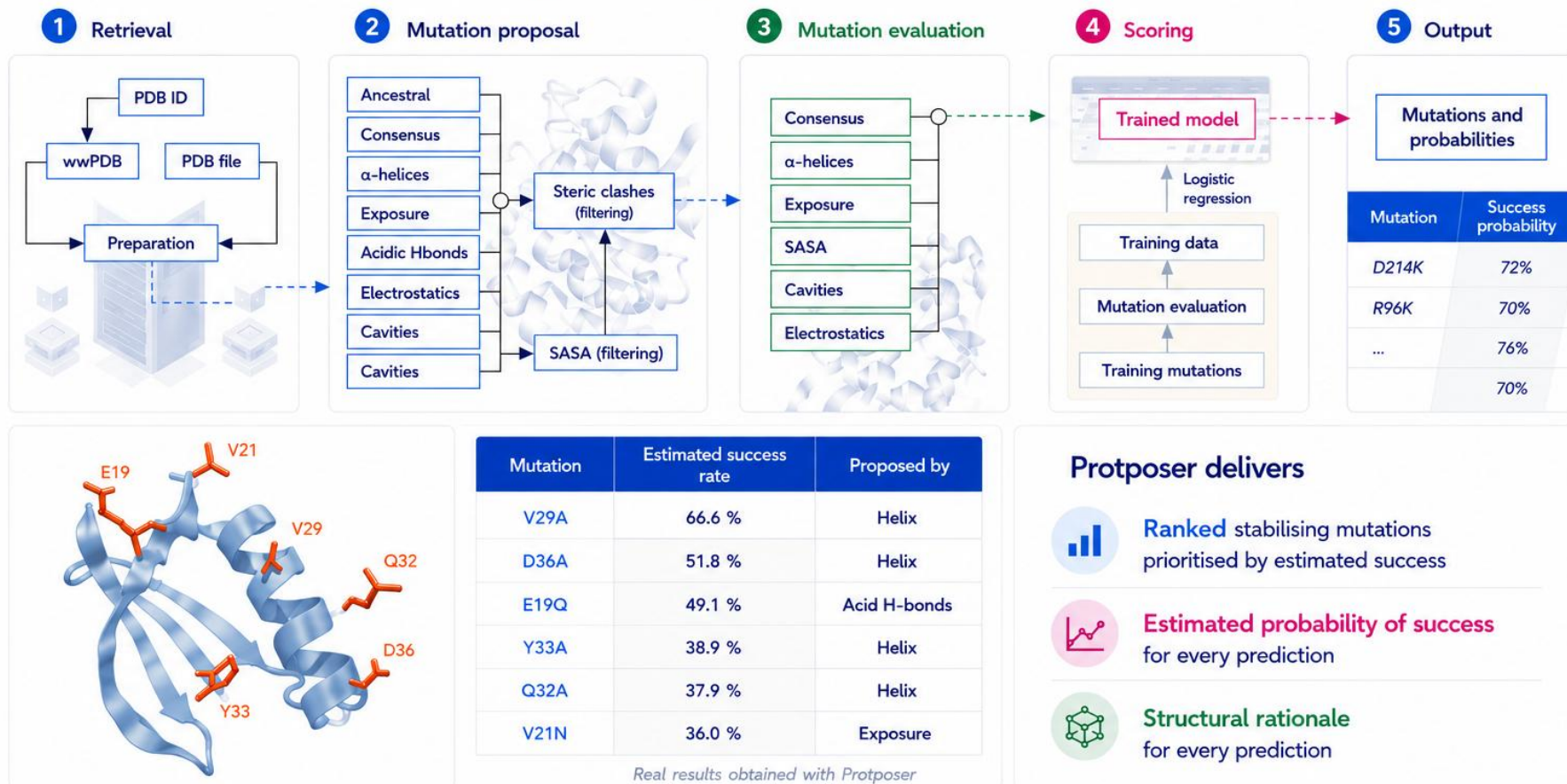
Short shelf-life

Limited storage stability and field performance

Improving protein stability is key to **unlocking the full potential** of biotechnology in agriculture, industry and health.

5 Protposer: AI-guided protein stabilisation

From protein structure to **experimentally actionable mutations**



Protposer transforms thousands of possible mutations into a short list of **experimentally actionable** candidates.

6

Why Protposer works

Explainable AI **powered by biochemical knowledge**

Protposer integrates complementary sources of information and a machine learning model trained on curated data to estimate the probability of success of each mutation



Evolution

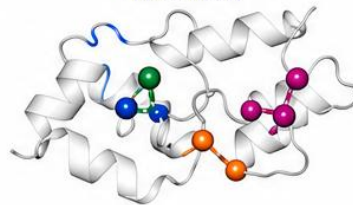
Conservation and co-evolution reveal functionally important positions

Human	... V D E K L I R Q A ...
Mouse	... V D E R L I R Q A ...
Yeast	... I D Q K L V R E A ...
E. coli	... T D E K I I R E A ...
Archaea	... V D E R I I K Q A ...



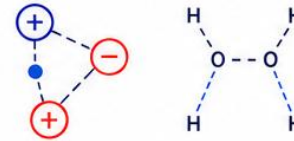
Structure

3D environment, contacts, exposure, cavities and steric effects



Biophysics

Electrostatics, hydrogen bonds, solvation and energetic contributions



Machine learning

Logistic regression model estimates the probability of success for each mutation



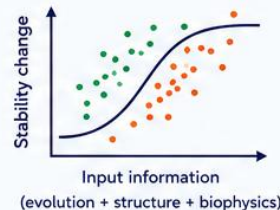
Protposer

Integrated information → Logistic regression model → **Probability of success**

TRAINING PROCESS



Large and curated databases of experimentally measured stability changes



Logistic regression learning

The model learns the relationship between input information and experimental stability changes



Mutation	Estimated success rate (probability)
V29A	66.6 %
D36A	51.8 %
E19Q	49.1 %
...	...
V21N	36.0 %

By combining evolution, structure and biophysics with a model trained on curated stability data,

Protposer provides interpretable predictions you can trust.

7 Protposer in action

From prediction to **experimentally validated** stability gains

Protposer delivers accurate predictions that translate into **measurable stability gains**.

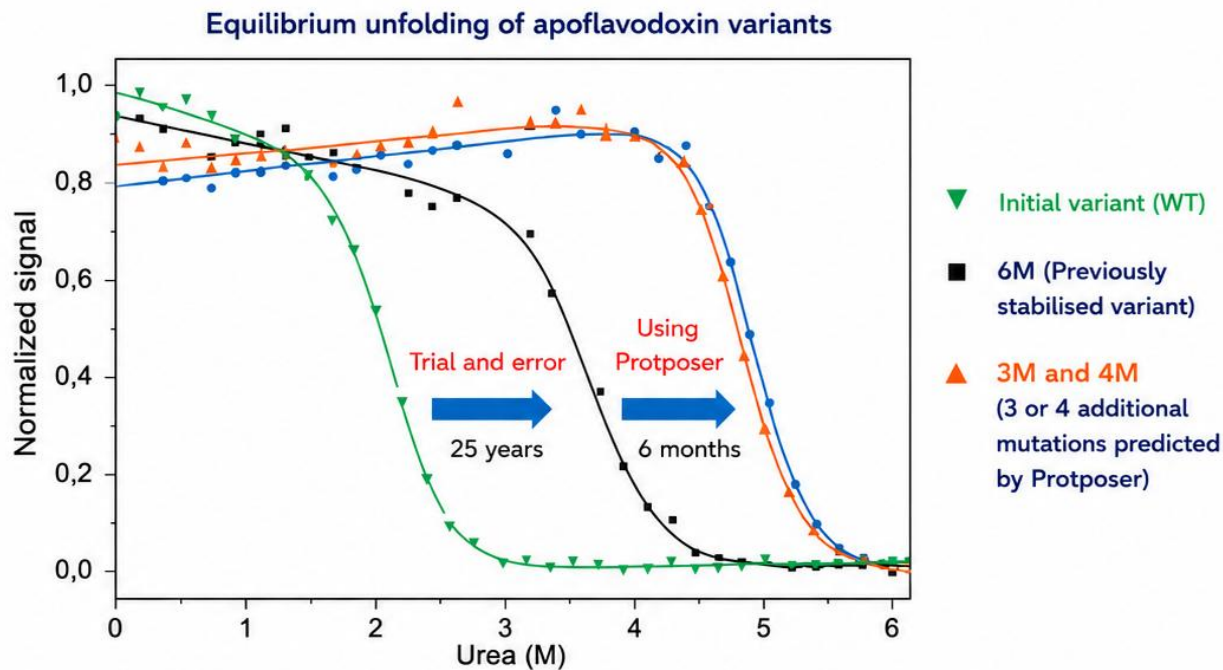
Experimental validation

Apoflavodoxin: a highly optimised protein platform

3 or 4 mutations guided by Protposer

Designed to explore additivity and push stability limits

Up to **+8.6 °C** increase in T_m



Protposer achieves **in months** what historically took decades.

Results from Hidalgo-Toledo *et al.* (2025). *Protein Thermostabilization with Protposer: Pushing the stability limits of a Highly-Stabilized apoflavodoxin.*

8 Applications in plant biotechnology

Engineering protein stability for **sustainable crop innovation**

Protposer enables **protein stabilisation** for next-generation plant biotechnology.



More robust enzymes

Phytases, xylanases, cellulases and chitinases for harsh industrial and field conditions.



More stable recombinant proteins

Plant-made antibodies, vaccines and growth factors.



More effective protein biostimulants

Harpins and signalling proteins for improved stress tolerance.



Proteins for NGT and gene-edited crops

Bt toxins, EPSPS, transcription factors and disease-resistance proteins.



Better stability



Better performance



Stronger crops



Sustainable agriculture

9 Collaboration opportunities

Partner with BioPredX to **solve today's challenges** and **create the proteins of tomorrow**

We offer two complementary ways to work together.



1. Protposer cloud licences

Use our AI technology to engineer more stable proteins.

- ✓ Secure cloud access. No installation.
- ✓ Predict and prioritize stabilizing mutations with state-of-the-art AI models.
- ✓ Flexible plans for teams and organizations.
- ✓ Continuous updates and expert support.



Better decisions. Faster.
More stable, effective proteins.



2. Company collaboration projects

Beyond Protposer to solve your specific challenges in plant biotechnology.

We develop and apply **predictive AI models** and tools for:

- ✓ Enzyme performance and stability
- ✓ Biostimulant and elicitor optimization
- ✓ Recombinant protein production in plants
- ✓ NGT-edited traits and protein function
- ✓ Other properties and phenotypes



Innovative solutions tailored to your needs.
Accelerate impact in agriculture and beyond.



Proven technology

Validated with real experimental data.



Faster innovation

Reduce screening time and focus on what works.



Sustainable impact

Stronger proteins for agriculture and industry.



Long-term partnership

Flexible, transparent and focused on your goals.

Predict. Stabilize. Transform.



Protein stability matters

The foundation of function, efficiency and resilience.



AI makes it possible

Advanced predictive models to design and optimize more stable proteins.



Solutions for real impact

From enzymes to biostimulants and next-generation crops.



Stronger together

Collaborate with BioPredX to solve today's challenges and build the future.

BioPredX
PREDICTIVE BIOLOGY

AI-powered predictions
for more stable proteins
and a more sustainable
future in plant
biotechnology.



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Smarter biology starts here