Enzyme Guide for Biocatalysis

Bringing Biocatalytic Processes from Early Idea to Industrial Scale

Aminoverse enables players in the chemical industry to onboard more cost-efficient and sustainable manufacturing by delivering the right enzyme and process. With its proprietary symbiosis of wet lab work, state-of-the-art in-silico modelling, and data-driven AI, the Dutch start-up company founded in 2020 removes bottlenecks in enzyme science like long lead times or uncertain research outcomes. David Schönauer, founder and CEO of Aminoverse, shares insights into the motivation behind the company, the unique value that its enzyme services and products bring to the industry, and provides an outlook into the company's future.

David Schönauer, Founder and CEO, Aminoverse

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CHEManager: Why are enzymes valuable tools for solving industrial challenges?

David Schönauer: Enzymes are steadily revolutionizing industry by delivering economic and environmental benefits at metric ton scale. Economically, enzymes make processes more efficient, cut energy use, raw material costs, and waste, which directly boosts profitability or enables new products. Their innately high regio- and stereoselectivity ensures precise reactions and purer molecules.

> *"Enzymes are steadily revolutionizing industry by delivering economic and environmental benefits at metric ton scale."*

With broad substrate and reaction spectra, enzymes adapt to virtually all chemical targets. Unlike metal catalysts, enzyme catalysts can be tuned to the reaction of interest to obtain >99% yields and ee values, or enhance operational stability under harsh conditions. Finally, enzyme immobilization allows the recycling of the biocatalyst and thus reduction of cost of goods; crucial for the production of compounds with a value below 100 $/kg.

Ecologically, enzymes foster greener chemistry under mild conditions, reduce hazardous chemicals and energy consumption, and align perfectly with evolving regulations.

Which kind of services does Aminoverse provide?

D. Schönauer: We aim to be a turn-key solution provider, supporting customers from initial idea to industrial application. We only need information about the intended application/production process and the chemical reaction. The final result is a working enzymatic process and enzyme supply up to high kg scale. All steps in between are also available as a standalone service, like identifying the right enzyme, defining suitable production conditions, or optimizing the biocatalyst by enzyme engineering. Some customers also rely on us only for the development of robust assays, or the supply of off-the-shelf enzyme kits for immediate hit screening.

How does your technology impact R&D projects?

D. Schönauer: Our service offering is centered around three AI-augmented workflows: EnzyNAV AI, EnzyMAP AI, and EnzyREC AI. EnzyNAV AI is our intelligent guide for enzyme discovery. It leverages bioinformatics, metagenomics, and computational chemistry to navigate through more than 4 billion enzyme sequences and structures to find promising candidates for the reaction of interest.

Additionally, we also make sure that the selected enzymes are free of 3rd-party IP.

Once a suitable enzyme is identified yet displays unsatisfactory performance, we employ EnzyMAP AI and EnzyREC AI to optimize it further. EnzyMAP AI highlights the enzyme regions with the highest improvement chances by predicting the functional effects of every possible point mutation across the enzyme. This allows us to effectively map the enzyme's entire fitness landscape, reducing the need for wet lab screening by up to 80%, cutting project costs. Global enzyme leaders like BASF, Novonesis, and IFF optimize enzymes via this holistic approach.

> *"Our off-the-shelf enzyme kits allow our customers to test enzymes within days and thus make time-sensitive decisions during route scouting as fast as possible."*

Eventually, EnzyREC AI recombines beneficial mutations to design stable, highly functional enzymes, avoiding unstable or unproducible novel enzymes.

Together, these three platforms bring precision, speed, and significantly reduce risk and cost in enzyme application while reducing time-to-market of the biocatalytic process altogether.

Why does Aminoverse offer products in addition to its R&D services?

D. Schönauer: Our off-the-shelf enzyme kits allow our customers to test enzymes within days and thus make time-sensitive decisions during route scouting as fast as possible. This facilitates internal budgeting, since early "successes" advance the project to the next stage and unlock more budget for further development—especially in organizations in which biocatalysis still plays a minor role and managers fight an uphill battle.

What will be the next steps to develop the company?

D. Schönauer: We aim to become the go-to partner for everything about enzymes. We're continuously refining our AI algorithms, streamlining our wet lab workflows, and expanding our enzyme kits, to serve more industries, faster. A major milestone on the horizon will be the shift from optimizing existing enzymes to designing them entirely from scratch, called de novo design. Once we deem it robust and suitable enough, our customers will be able to directly benefit from the increased development speed that will unlock more business cases which previously could not be pursued.

All About Enzymes

Aminoverse is committed to transforming enzyme science from the lab bench into practical, industrial solutions. Starting with the end in mind, Aminoverse consults on the feasibility of enzymatic solutions, offers cutting-edge research services and sees itself as a temporary extension of the customer's R&D team.

As a contract research organization (CRO), Aminoverse strives to minimize the risk in research and make sure innovation is not held back by the enzyme or its application. Starting with the exact reaction or process goals, the multidisciplinary team finds enzyme candidates with the desired functionalities and optimizes their performance and stability through advanced enzyme engineering.

The start-up also builds and manages enzyme libraries, providing access to a wide range of tailored biocatalysts. Equally important, the team develops robust assays for precise characterization and validation. And finally, Aminoverse scales up enzyme production to deliver reliable, high-quality solutions ready for industry.

What truly sets Aminoverse apart is its integrated approach. The enzyme experts bring together wet lab experiments and practical testing with state-of-the-art in silico tools and their own machine learning platforms. This synergy moves them beyond slow, trial-and-error steps. Instead, the team designs enzymes that are more effective, faster to develop, and environmentally sustainable. The biotech CRO merges data, science, and technology to unlock enzyme potential in a smarter way.

The client-centric business model is straightforward and transparent: fee-for-service, with clients keeping full IP rights and no royalties. Aminoverse fosters close collaboration through weekly updates and open communication. This close partnership ensures every project stays on track, adapts quickly when needed, and reaches the common goal: developing enzymatic processes that truly make a difference.

- Aminoverse B.V., Nuth, The Netherlands
  www.aminoverse.com
  www.linkedin.com/company/aminoverse/

AMINOVERSE
EXPLORING ENZYME INNOVATION

Milestones & Roadmap

As an enzyme-dedicated CRO, Aminoverse enables customers to maximize profitability, minimize cost, and enable greener manufacturing by establishing and enhancing enzyme-based production processes and products. The team excels in two areas: discovering the right enzyme and designing the optimal enzyme by integrating wet lab, biophysics, and cutting-edge AI. The unique approach leverages three AI-augmented platforms: EnzyNAV AI to find the best enzyme candidate, EnzyMAP AI to pinpoint the best mutations, and EnzyREC AI to design superior enzymes. This strategy increases success chances by 10-fold and reduces R&D spend by up to 75%.

Aminoverse tunes the enzyme's substrate preference, regio- and stereoselectivity and operational stability under various pH, temperatures, and solvent conditions. Customers benefit from full IP ownership. With experience across more than 30 enzyme classes, the Dutch start-up company served over 50 global companies across pharma, flavors & fragrances, and agrochemicals, as highlighted on the website and in testimonials.

With a team of 20 interdisciplinary professionals the start-up company reached profitability 3.5 years after its inception, without VC funding. This reflects the team's commitment to relentlessly pushing the boundaries of enzyme innovation in a sustainable, long-term-oriented way, placing customer-benefit over pure-growth mindset.

Milestones

2020
- Aminoverse established in Nuth, The Netherlands, with 200 m² wet lab

2021
- Product-based business: Launch of Aminoverse's hydroxylation enzyme kits

2022
- ML-guided services: Successful application of EnzyMAP AI in client project
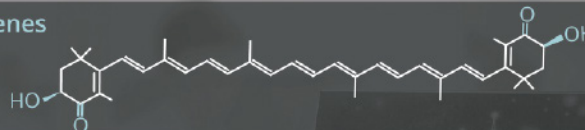
2023
- Break-even

2025
- Additional enzyme panels, advanced AI platforms, and over 50 different clients
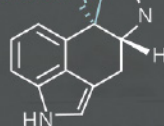
Roadmap

2025
- Diversification of ready-to-use enzyme panels
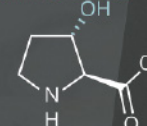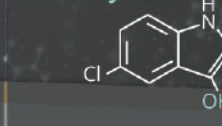- Set-up of a platform for de novo enzyme design

Aminoverse supports customers from enzyme ideas to industrial biocatalytic scale by combining wet lab, in silico design, and proprietary machine learning.
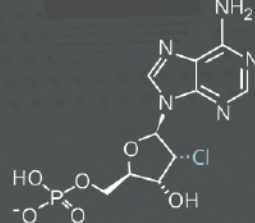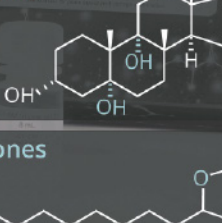
Potential products from the Aminoverse off-the-shelf enzyme kits to facilitate time-sensitive decisions during route scouting.