

# Harnessing Enzyme Evolution for Tomorrow's Biotech Innovations

**BASF**

We create chemistry

Enzymes are central to driving innovation in biotechnology, playing a critical role in processes from industrial applications to drug development. As the biotech industry evolves, so too must the enzymes that support it. Enzyme evolution is key to developing the highly specific, stable, and efficient enzymes needed for these advancements.

BASF is leading this charge, leveraging over 30 years of expertise in enzyme technology. Our commitment to innovation ensures that we are not only meeting the current needs of our partners, but also anticipating future challenges. Through advanced enzyme evolution, we enable our partners to innovate more effectively and achieve their goals.

## The Challenges in Enzyme Evolution

### Multi-Parameter Enzyme Optimization

Achieving the necessary specificity, catalytic activity, process stability, production cost-efficiency, and reliable supply of recombinantly produced enzymes capable of addressing high regulatory burdens and crowded IP landscapes can pose a significant challenge. Off-the-shelf enzymes and natively produced enzymes often lack the precision required to meet the needs of an increasing demand for more sophisticated catalysis or are not stable or cost efficient enough to be viable products. These challenges require cutting-edge evolution and screening techniques, and years of experience identifying and optimizing multiple parameters to develop enzymes that meet these specific needs.

*"Most enzyme engineering service providers do not have the end-to-end expertise needed to assess product candidates and their variants for production and market feasibility early on, thus risking the path from discovery and evolution to impactful, scalable solutions"*

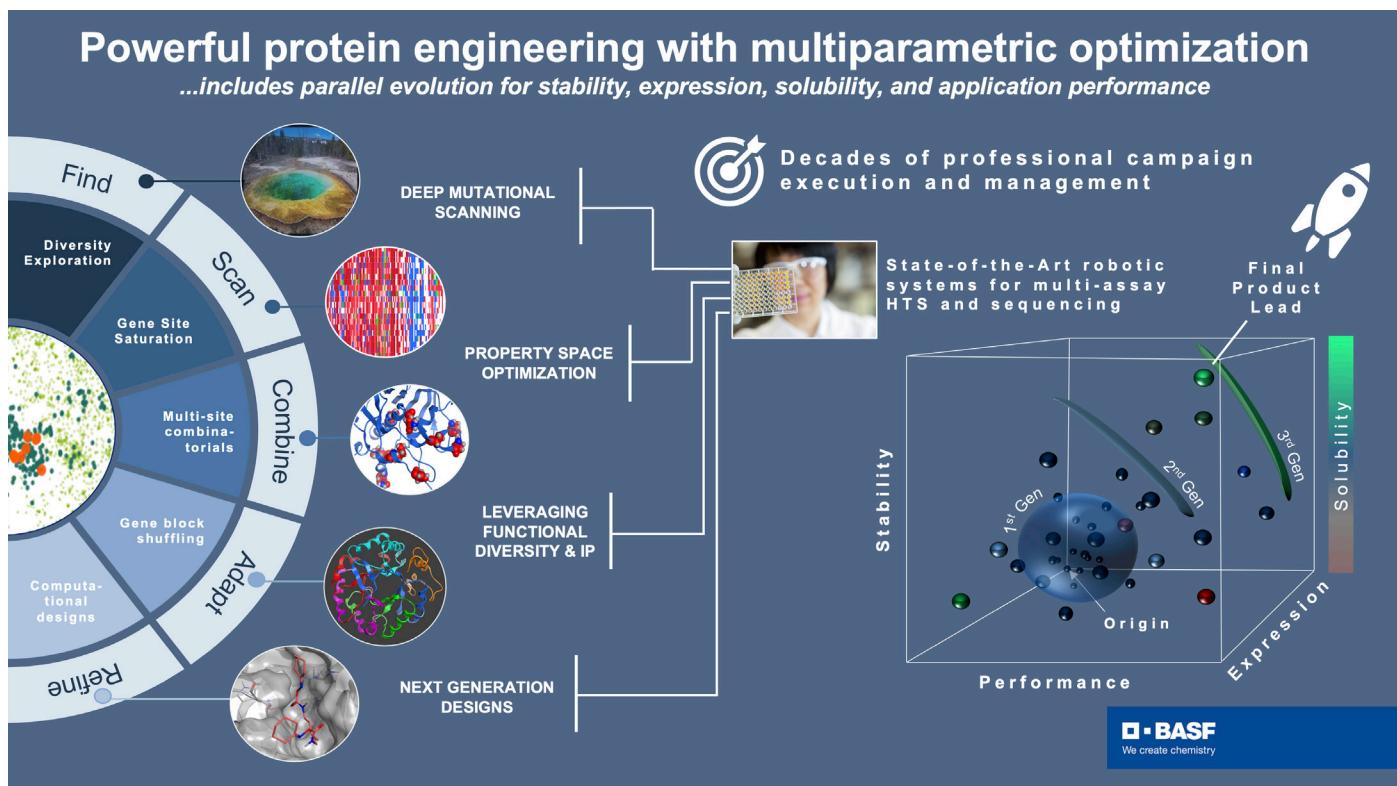
– Dr Adrienne Davenport, Managing Director

### Activity and Specificity

The last decade has witnessed a surge in the potential for enzymes to play a role in industrial applications and therapeutics. For industrial applications, the growing pressure to develop sustainable products has increased the focus on developing biobased products through biocatalysis or fermentation, and re-cycling polymer waste through enzymatic degradation. At the same time, human therapeutics are expanding beyond traditional small molecules to include biological therapeutics, gene therapy and antibody-drug conjugates, all of which require enzymes as processing aids or directly in the therapeutic application. The ability to effectively discover and design novel enzyme sequence diversity and functionality will prove a critical capability needed to realize the potential of enzymes in these new applications.

### Solubility and Stability

Enzyme solubility and stability are crucial for their functionality and can be increasingly impactful when producing enzymes at large scale. Poor solubility can limit efficiency, while instability under varying conditions, including production, formulations, shelf-life, and use in applications can compromise performance. Advanced engineering techniques and the ability to evolve for multiple parameters simultaneously are required to optimize these properties without sacrificing activity or specificity.



## IP Navigation

When developing alternative or next-generation enzymes in existing markets, enzyme candidates require high specificity and efficiency in a manner that provides differentiation, while navigating a large and complex landscape of intellectual property. The ability to diversify sequence space while maintaining or increasing the effectiveness or cost basis of enzyme products is required to continue to develop solutions to market needs.

## Cost-Effective Production

When developing enzyme products, it is essential to “begin with the end in mind” and clearly understand production cost targets for a successful outcome. This requires expertise in production process optimization, fermentation, and DSP (Downstream Processing) optimization. Additionally, early screening for these parameters during enzyme development, alongside a solid understanding of enzyme structure and catalytic function, is critical.

## BASF's Solutions in Enzyme Evolution

### Innovative Technologies and Expertise

BASF utilizes advanced technologies and decades of experience to address the complex challenges in enzyme evolution and product development. Our comprehensive enzyme evolution platform encompasses access to significant proprietary enzyme diversity as starting points; multiple directed evolution approaches enabled by our high-throughput automation; deep expertise in computational design; data-science-driven machine learning, and decades of experience evolving and screening for multiple parameters simultaneously. This platform, coupled with our proven production strain engineering and process development optimization expertise provides end-to-end capabilities for developing custom enzymes tailored to our partners’ precise needs. This holistic approach has allowed us to deliver innovative, highly effective, profitable enzyme solutions time and time again.

*“Our team has more than 500 years of combined experience evolving and developing enzyme products for numerous industrial and life science market applications,” said Dr Adrienne Davenport, Managing Director. “Our extensive expertise ensures that we are asking the right questions along the product development cycle, ensuring success for our customers.”*

Dr Michael Liszka, Principal Scientist, added: *“By ensuring our technical experts understand our customers’ needs, we can design highly effective high-throughput screens. We’re constantly adapting our screening platform to respond to new evolution targets brought to us by customers and to incorporate the latest technologies that can improve our screening efficiency and effectiveness.”*

### Collaborative Approach

At BASF, we believe that the best enzymes come from collaboration of diverse expertise to meet innovation and commercial objectives. We work closely with our partners to develop tailored enzyme solutions, leveraging our global network and the vibrant biotech ecosystem in San Diego.

Dr Michael Liszka, Principal Scientist, said: *“With our broad experience in commercializing products, we can provide expert guidance to customers throughout the development pipeline from sequence discovery to scale-up and production. Our integrated services, from discovery to production, ensure that every step of the process is aligned with our partners’ goals, resulting in successful and timely outcomes.”*

## Why Partner with BASF?

BASF offers world-class expertise and comprehensive biotechnology R&D services, making us the ideal partner in enzyme evolution. Our approach combines deep technical knowledge with a commitment to innovation, ensuring that we deliver solutions that enhance product performance and accelerate time-to-market.

Innovation is at the heart of everything we do at BASF. We are dedicated to continuous improvement and development, supporting our partners through every stage of their journey. By choosing BASF, partners gain access to the latest technologies and a team committed to driving their success.

Partner with BASF to harness the power of enzyme evolution. Contact us to learn more about how we can support your biotech innovations and drive your success. Please scan the QR code below to visit our website or reach out directly to our team for more information.



We can help you meet your goals! Scan the QR code to learn more about the BASF Bioservices team or contact us at [bioservices@bASF.com](mailto:bioservices@bASF.com).

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