

## Enhancing Biofuel Production through Engineered Versatile Peroxidases

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## Overview

The growing need for sustainable biofuel alternatives is challenged by the difficulty of breaking down lignin, a major component of plant biomass. Versatile Peroxidases (VPs) are enzymes naturally capable of degrading lignin, but their structural complexity makes them difficult to produce at scale. This technology presents a suite of engineered VPs with enhanced stability and activity that can be efficiently expressed in yeast, offering a practical and scalable solution for lignin processing and potentially an array of different compounds with applications across various industries.

## Applications

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- Biofuel production from lignocellulosic biomass
- Production of valuable aromatic compounds (e.g., vanillin) from lignin monomers for use in the food and fragrance industries
- Bioremediation of environmental pollutants and food detoxification
- Bleaching in the paper manufacturing and textile industry processing and textile industry processing, including oxidative dye treatments
- Diagnostic and biosensing tools using colorimetric peroxidase substrates (e.g., ABTS, DMP)
- Industrial biocatalysis under harsh pH, temperature, and oxidative conditions

## Differentiation

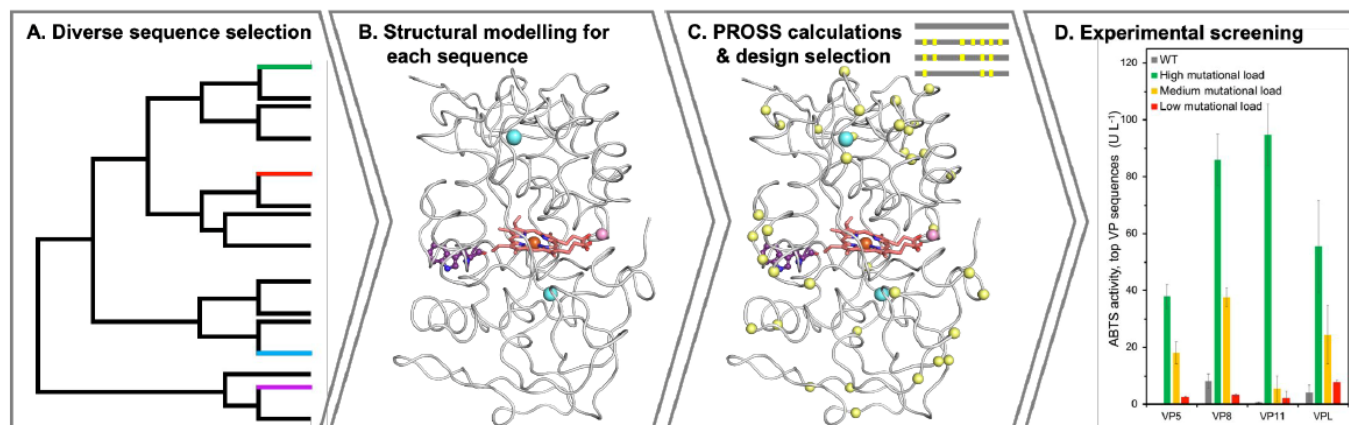
- High expression yields in yeast
- Enhanced enzyme stability under industrial conditions
- Broad substrate specificity
- Enables the use of enzyme consortia for efficient lignin degradation

## Development Stage

Four of 36 engineered VPs were successfully expressed in yeast, with three showing diverse activity, stability across pH and temperature conditions, and industrial potential.

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Workflow for computational enzyme optimization combining deep learning-based structure prediction, one-shot PROSS stability design, and experimental screening, resulting in recombinant VPs with high stability, activity, and efficient expression in yeast.

## References

.Barber-Zucker S, Mindel V, Garcia-Ruiz E, Weinstein JJ, Alcalde M, Fleishman SJ. Stable and Functionally Diverse Versatile Peroxidases Designed Directly from Sequences. *J Am Chem Soc.* 2022;144(8):3564-3571. doi:10.1021/jacs.1c12433

## Patent Status

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