1. Record Nr. UNINA9910646198203321 Autore Reetz Manfred T Titolo Enzyme Engineering: Selective Catalysts for Applications in Biotechnology, Organic Chemistry, and Life Science Pubbl/distr/stampa Newark: ,: John Wiley & Sons, Incorporated, , 2023 ©2023 9783527836871 **ISBN** 9783527350339 Descrizione fisica 1 online resource (402 pages) Altri autori (Persone) SunZhoutong QuGe Lingua di pubblicazione Inglese **Formato** Materiale a stampa Livello bibliografico Monografia Cover -- Title Page -- Copyright -- Contents -- Preface -- About the Nota di contenuto Authors -- Chapter 1 Introduction to Directed Evolution and Rational Design as Protein Engineering Techniques -- 1.1 Methods and Aims of Directed Enzyme Evolution -- 1.2 History of Directed Enzyme Evolution -- 1.3 Methods and Aims of Rational Design of Enzymes -- References -- Chapter 2 Screening and Selection Techniques -- 2.1 Introductory Remarks -- 2.2 Screening Methods -- 2.3 Selection Methods -- 2.4 Conclusions and Perspectives -- References -- Chapter 3 Gene Mutagenesis Methods in Directed Evolution and Rational Enzyme Design -- 3.1 Introductory Remarks -- 3.2 Directed Evolution Approaches -- 3.2.1 Mutator Strains -- 3.2.2 ErrorProne Polymerase Chain Reaction (epPCR) -- 3.2.3 Whole Gene Insertion/Deletion Mutagenesis -- 3.2.4 Saturation Mutagenesis as a Privileged Method: Away from Blind Directed Evolution -- 3.2.5 DNA Shuffling and Related Recombinant Gene Mutagenesis Methods -- 3.2.6 Circular Mutation and Other Domain Swapping Techniques -- 3.2.7 SolidPhase

Combinatorial Gene Synthesis as a PCRIndependent Mutagenesis Method for Mutant Library Creation -- 3.2.7.1 Introductory Remarks -- 3.2.7.2 The Sloning Approach to SolidPhase Gene Synthesis of a Mutant Library: Comparison with the Respective Molecular Biological Saturation Mutagenesis Library -- 3.2.7.3 The Twist Approach to Solid

Phase Gene Synthesis of a Mutant Library: Comparison with Molecular Biological Saturation Mutagenesis Library -- 3.2.8 Computational Tools and the Role of Machine Learning (ML) in Directed Evolution and Rational Enzyme Design -- 3.2.8.1 Introductory Remarks -- 3.2.8.2 Designing Mutant Libraries and Estimating Library Completeness -- 3.3 Diverse Approaches to Rational Enzyme Design -- 3.3.1 Introductory Remarks.

3.4 Merging Semirational Directed Evolution and Rational Enzyme Design by Focused Rational Iterative SiteSpecific Mutagenesis (FRISM) -- 3.5 Conclusions and Perspectives -- References -- Chapter 4 Guidelines for Applying Gene Mutagenesis Methods in Organic Chemistry, Pharmaceutical Applications, and Biotechnology -- 4.1 Some General Tips -- 4.1.1 Rational Design -- 4.1.2 Directed Evolution -- 4.2 Rare Cases of Comparative Directed Evolution Studies -- 4.2.1 Converting a Galactosidase into a Fucosidase -- 4.2.2 Enhancing and Inverting the Enantioselectivity of the Lipase from Pseudomonas aeruginosa (PAL) -- 4.3 Choosing the Best Strategy When Applying Saturation Mutagenesis -- 4.3.1 General Guidelines -- 4.3.2 Choosing Optimal Pathways in Iterative Saturation Mutagenesis (ISM) and Escaping from Local Minima in Fitness Landscapes -- 4.3.3 Systematization of Saturation Mutagenesis with Further Practical Tips -- 4.3.4 Single Code Saturation Mutagenesis (SCSM): Use of a Single Amino Acid as Building Block -- 4.3.5 Triple Code Saturation Mutagenesis (TCSM): A Viable Compromise When Choosing Optimal Reduced Amino Acid Alphabets in CAST/ISM -- 4.4 Technoeconomical Analysis of Saturation Mutagenesis Strategies -- 4.5 Generating Mutant Libraries by Combinatorial SolidPhase Gene Synthesis: The Future of Directed Evolution? -- 4.6 Fusing Directed Evolution and Rational Design: New Examples of Focused Rational Iterative SiteSpecific Mutagenesis (FRISM) -- References -- Chapter 5 Tables of Selected Examples of Directed Evolution and Rational Design of Enzymes with Emphasis on Stereo and Regioselectivity, Substrate Scope and/or Activity -- 5.1 Introductory Explanations -- References -- Chapter 6 Protein Engineering of Enzyme Robustness Relevant to Organic and Pharmaceutical Chemistry and Applications in Biotechnology -- 6.1 Introductory Remarks.

6.2 Rational Design of Enzyme Thermostability and Resistance to Hostile Organic Solvents -- 6.3 Ancestral and Consensus Approaches and Their StructureGuided Extensions -- 6.4 Further Computationally Guided Methods for Protein Thermostabilization -- 6.4.1 SCHEMA Approach -- 6.4.2 FRESCO Approach -- 6.4.3 FireProt Approach --6.4.4 Constrained Network Analysis (CNA) Approach -- 6.4.5 Alternative Approaches -- 6.5 Directed Evolution of Enzyme Thermostability and Resistance to Hostile Organic Solvents -- 6.6 Application of epPCR and DNA Shuffling -- 6.7 Saturation Mutagenesis in the BFIT Approach -- 6.8 Iterative Saturation Mutagenesis (ISM) at Protein-Protein Interfacial Sites for Multimeric Enzymes -- 6.9 Conclusions and Perspectives -- References -- Chapter 7 Artificial Enzymes as Promiscuous Catalysts in Organic and Pharmaceutical Chemistry -- 7.1 Introductory Background Information -- 7.2 Applying Protein Engineering for Tuning the Catalytic Profile of Promiscuous Enzymes -- 7.3 Applying Protein Engineering to P450 Monooxygenases for Manipulating Activity and Stereoselectivity of Promiscuous Transformations -- 7.4 Conclusions and Perspectives -- References --Chapter 8 Learning Lessons from Protein Engineering -- 8.1 Introductory Remarks -- 8.2 Additive Versus Nonadditive Mutational Effects in Fitness Landscapes Revealed by Partial or Complete Deconvolution -- 8.3 Unexplored Chiral Fleeting Intermediates and

Their Role in Protein Engineering -- 8.4 Case Studies Featuring Mechanistic, Structural, and/or Computational Analyses of the Source of Evolved Stereo and/or Regioselectivity -- 8.4.1 Esterase -- 8.4.2 Epoxide Hydrolase -- 8.4.3 Enereductase of the Old Yellow Enzyme (OYE) -- 8.4.4 Cytochrome P450 Monooxygenase -- 8.4.5 Analysis of Baeyer-Villiger Monooxygenase with Consideration of Fleeting Chiral Intermediates.

8.5 Conclusions and Suggestions for Further Theoretical Work -- References -- Chapter 9 Perspectives for Future Work -- 9.1 Introductory Remarks -- 9.2 Extending Applications in Organic and Pharmaceutical Chemistry -- 9.3 Extending Applications in Biotechnology -- 9.4 Patent Issues -- 9.5 Final Comments -- References -- INDEX -- EULA.