Sommary :

PART I: Chemical Methods in Asymmetric Synthesis

1.1 Auxiliary-Controlled Asymmetric Synthesis

- Asymmetric Syntheses with Lithiated α-Aminonitriles (SAMP/RAMP and related methods)
- Asymmetric Hetero-Michael Additions (Aza-, Oxa-, and Phospha-Michael additions)
- Asymmetric Electrophilic α-Substitution of Lactones and Lactams
- Asymmetric Nucleophilic α-Aminoacylation and Alkenoylation of Aldehydes
- Asymmetric Synthesis of α-Phosphino Ketones and 2-Phosphino Alcohols

1.2 Transition Metal-Catalyzed Asymmetric Synthesis

- Enantioselective Reactions Catalyzed by Transition Metal Complexes
- Development of Modular Chiral Ligands:
    - Phosphines containing an arenechromium-tricarbonyl moiety (*"Daniphos"* ligands)
    - Phosphaferrocenes and Sulfoximine-based N,N- and P,N-ligands
    - P,C- and N,O-ligands containing a $[2,2]$paracyclophane skeleton
    - Phosphines based on dihydroquinolines (*"Quinaphos"* ligands)
- Catalyst Immobilization: Highly active, reusable hydrogenation and Jacobsen-type epoxidation catalysts in zeolite matrices

1.3 Organotitanium and Organosulfur Chemistry

- Hydroxyalkylation and Aminoalkylation of Sulfonimidoyl-Substituted Allyltitanium Complexes
- Diastereo- and Enantioselective Synthesis of α,β-Disubstituted γ-Nitro and β-Alkoxycarbonyl Methyl Sulfonates

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PART II: Biological Methods & Biocatalysis

2.1 Enzyme Catalysis and Bioorganic Synthesis

- Preparation of Enantiomerically Pure Small Molecules for Drug Process Synthesis
- Applications of Enzyme Biochemistry: Site-directed mutagenesis and directed evolution based on recombinant DNA technology
- Asymmetric Syntheses of Chiral Alcohols using R-specific Alcohol Dehydrogenases
- Aldolases and Related C–C Bond-Forming Enzymes
- Sucrose Synthase I in Carbohydrate Synthesis
- Asymmetric Synthesis of 1,3-Diols and Propargylic Alcohols

2.2 Bioprocess Engineering and Technology Transfer

- Scale-up requirements for stable and highly efficient enzymes
- Development of Enzyme Membrane Reactors (EMRs) for continuous production

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PART III: Applications in Total Synthesis

3.1 Synthesis of Biologically Active Target Molecules

- Asymmetric synthesis of medicinally interesting alkaloids
- Synthesis of pheromones, fragrances, and natural products using combined chemical and biological approaches