# Metabolic Engineering - Microbial Fermentation

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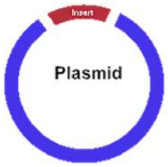
Desired Product from any Natural Source – Plants/insects/Animals, etc

Genetic material

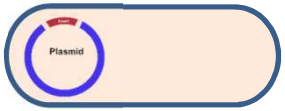
Gene

Insert

Vector




Suitable Expression In microbes




Fermentation

Product from microbial Fermentation

## Metabolic Engineering - Microbial Fermentation

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- Product from natural source – metabolic engineered organism
  - Protein
  - Small molecules (antibiotics, other active ingredients)
  - lipids
  - Sterols
  - Vitamins

- Microbial fermentation process
  - sustainable production compared to extraction from plants/animals
  - easy to scale up
  - better product quality
  - Vegan /Organic certification

- Metabolic Engineering
  - Modification of metabolic pathway
  - Direct the system to produce the desired product with less impurities
  - Faster and efficient system to generate product
  - Rational approach
  - Improved product Quality / Yield

# Metabolic Engineering - Microbial Fermentation – Capabilities

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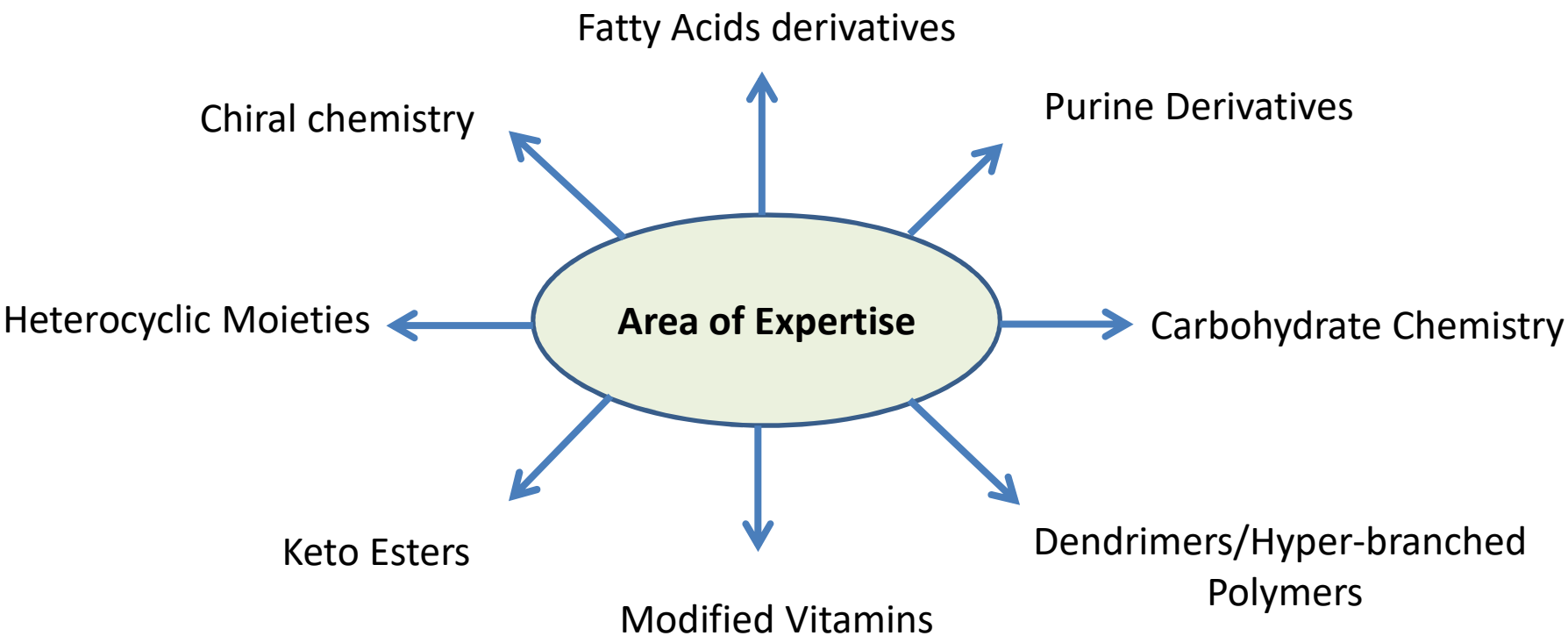
- Metabolic Engineering

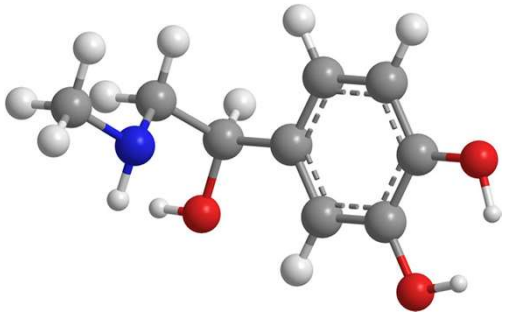
  - Analysis of Metabolic pathways
  - Isolation of genes
  - Cloning
  - Protein Expression & Purification
  - RNAi for gene inhibition
  - Gene knockout – CRISPR-CAS9
  - Random Mutagenesis / Site Directed Mutagenesis
  - Screening of mutated organisms for active producers

- Fermentation

  - Media Optimization
  - Culture Maintenance
  - Optimization of fermentation conditions
  - Study of batch / fed batch fermentation
  - Scale up from shake flask to lab fermenters to pilot scale and subsequently to production
  - Process validation and tech transfer

# Synthetic Organic Chemistry



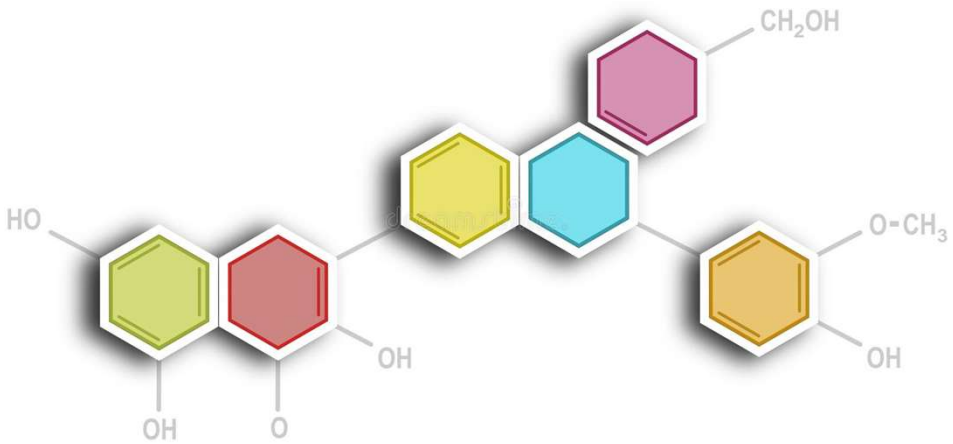



## Synthetic Organic Chemistry capabilities

- Acylation, Deacylation – Anhydrides, Acyl halides
- Chlorination, Bromination – PCl5, POCl3, Thionyl chloride, Triphosgene, Liq.Bromine, HBr
- Hydrogenation – 20 kg/cm2 – raney nickel, palladium catalysts
- Transesterification / Hydrolysis of fatty acids – Synthetic / Enzymatic
- Reduction reactions – Sodium borohydride, LAH, Hydrogen hydride, Syn hydride
- Microbial biotransformations / Enzymatic catalysis – immobilized and native reactions
- Grignard reactions

- Downstream purification of fermentation metabolites – small molecules

- Herbal extraction and purification



# Formulation Development

**Our Purpose**: We accelerate access to affordable medicines

## Our Promises:

- Bringing expensive medicine within reach
- Addressing unmet patient needs
- Helping patients manage disease better
- Enabling and helping our partners ensure that our medicines are available where needed

**Our Strategic Choices:**

- First-to-market, tough-to-make products
- Differentiated formulations for unmet medical needs
- Value-added services for patients and customers

-

# Formulation Development Capabilities

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## Oral powder
- Sachets,
- PFOS
- Nutraceuticals

## Oral solid dosage forms
- Tablets,
- Capsules
- Bilayer tablets
- Tablet in Capsule

## Liquid dosage forms
- Syrup,
- Suspension,
- Emulsion
- Powder for Oral suspension

## Effervescent formulations
- Tablets
- Powders

**Formulation Development**

## Semi-solid dosage forms
- Cream,
- Ointment,
- Gel & Balm
- Roll on

## NDDS
- Liposomal preparations
  Injectable & Liquid preparations
- Fast melt formulations
- Gastro retentive drug delivery
- Modified Release formulations
- Solubility/Bio-availability enhancement

## Topical – Medical sanitizer
- Hand sanitizer
- Hand wash
- Surface disinfectant

## Nutraceuticals & Herbal formulations
- Tablets
- Capsules
- Liquids
- Powders
- Sports supplements

# Analytical Research and Development

Our analytical development team has experienced Analyst for development of analytical methods for different type of Dosage forms, Team supports development of formulations ranging from Liquid dosage forms to Solid dosage forms of Nutraceuticals & Herbal Formulations and Pharmaceutical formulations.

Driving scientific excellence through Development of Novel Analytical Methods for NDDS Molecules/ Formulations

Development and Validation of Methods by
Wet chemical analysis

Development and Validation of Methods by
HPLC/UHPLC/ GC-HS/ UV/ AAS/ ICP MS

Adhering Quality Management Systems (QMS) as per Regulatory requirement.

QUALITY MANAGEMENT SYSTEM

# Analytical Research and Development Capabilities

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Method Developement (Assay, Dissolution, CU, RS, Residual solvents and Elemental impurities)

Preformulation Studies

Developmental of Different Dosage form

Solubility Studies

Method Verification

Raw Material and Excepient testing

**Core competency**

Multimedia Dissolution Profile

Photostability studies

Reference/Market Product Evaluation

Stability testing

Method Validation /Transfer

Forced Degradation