

## Life Sciences

### Clinic to Commercialization

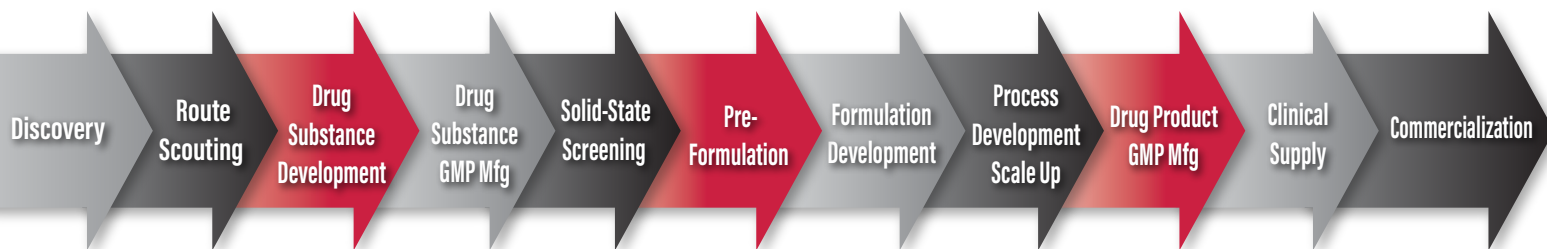
#### API

#### Services

- Discovery
- Medicinal Chemistry
- Parallel Chemistry
- Computational Chemistry
- Route Scouting
- Process Research and Development
- Metabolites, Stable Label, and Impurity Synthesis
- Process Safety Investigation
- Process Scale Up
- Analytical Method Development and Validation
- ICH Stability Studies
- Solid Form Screening and Selection
- Crystallization Process Optimization
- GMP Production

#### Technology

- Flow Chemistry
- Chiral Resolution Technologies
- Catalyst Screening
- Salt Screening
- Polymorph Screening
- Synthesis of Linkers and Labels
- Chromatographic Purification
- Ion Exchange Chromatography
- Ultra- and Nanofiltration
- Short Path Distillation
- Peptide Development and Manufacture
- Single Crystal X-ray Diffraction
- High Throughput and High Resolution X-ray Diffraction



#### Drug Products

#### Services

- Powder Flow and Compaction Analysis
- Preformulation
- Formulation Development
- Process Development and Scale Up
- Analytical Method Development and Validation
- ICH Stability Studies
- cGMP Manufacture
- Packaging and Labeling
- Clinical Logistics

#### Technology

- Real Time Dissolution Profiling
- Nanosuspensions
- Amorphous Solid Dispersions
- Lipid Based Formulations
- Oral Solid Dosage
- Liquid Filled Capsules
- Coated Multi Particles

#### Enzymatic Technology

- Enzyme supply from a library of over 20,000 strains
- Enzyme Engineering (Random / Semi-rational Design)
- Route Design, Enzyme Screening, Process Optimization, Scale up
- Commercialization in FDA Inspected Plant(s)

#### Hydroxy Amino Acid Kit

- Boc-(2S,3S)-3-hydroxypiperidine-2-carboxylic acid
- Boc-(2S,4S)-4-hydroxypiperidine-2-carboxylic acid
- Boc-(2S,5S)-5-hydroxypiperidine-2-carboxylic acid
- Boc-(2S,3R)-3-hydroxypiperidine-2-carboxylic acid
- Boc-(2S,4R)-4-hydroxypiperidine-2-carboxylic acid
- Boc-(2S,5R)-5-hydroxypiperidine-2-carboxylic acid

#### Biosynthesis

- Fermentation
- Asymmetric reduction
- Hydroxylation
- Hydration
- Resolution

#### Organic Synthesis

- Asymmetric synthesis
- Azide chemistry
- Heterocyclic chemistry
- Cryogenic reactions
- Oxidation
- Sugar chemistry

#### Process Technology

- Modeling
- Process simulation
- Process optimization
- Process control
- Separation technology

#### Chromatography Technology

- SMB separation
- Chiral separation
- Large Scale Chromatography

## Global Services and Products

### Select Manufacturing Capabilities

- Benzene (Large Scale)
- **Biocatalysis**
- Bromination
- Chiral Synthesis
- Chlorination
- Chromatography
- Cryogenic (-80°C)
- **Cyanation**
- Distillation
- Energetic Chemistry
- Enzymatic Screening and Engineering
- **Flow Reactor** (-100° to 300°C, 300 Bar)
- Fluorination
- Grignard Reaction
- High Pressure
- High Temp (200°C)
- **Hydrogenations (300 Bar)**
- Natural Product Extraction
- Organometallics
- Oxidation (H<sub>2</sub>O<sub>2</sub> & MnO<sub>2</sub>)
- Ozonolysis
- Phosgenation
- Silane Chemistry
- Sodium Metal
- Sulfur Chemistry



### HPAPI Capability

#### Europe - to 10ng/m<sup>3</sup>

- Current batch size 10 g to 2 Kg
- New unit (2020) Batch size 5 to 30 Kg

#### Asia - to 100 ng/m<sup>3</sup>

- Batch size 10 g to 20 Kg
- Reactors up to 1,000 L

### Particle Engineering

- Spray Drying
- Micronization

### Drug Product Analysis

- Particle Characterization (Chemical Imaging and Mapping)
- Analytical Method Development
- Screening, Selection, Characterization and scale up of Polymorphs, Salts, and Cocrystals

### China, India, Europe, and USA

- Manufacturing sites inspected



### Pilot & Commercial Facilities

- US, European and Asian assets
- Custom Contract and Toll Manufacturing
- FDA inspected facilities and DMF filing
- Stainless steel, glass lined and Hastelloy™ reactors up to 14,000 L
- Cryogenic synthesis (-80°C)
- High temperature (to 200°C)
- **Hydrogenation (up to 300 bar)**
- Process Safety Studies — Reaction Calorimeters, DSC, Adiabatic Calorimeter
- Stability testing — according to ICH guidelines

### Fermentation Development & Engineering, Scale Up, and Manufacture

- CHO and E. coli based
- Preparation of cell bank
- Strain improvement
- Pilot Facilities to 1,000 L
- Commercial Scale 15,000 to 255,000 L

### Precious Metal Catalysts

- Refining
- Fabrication
- **Recovery**

### Specialty Ingredients

- Antifoams in fermentation crystallization wastewater
- Special oils
- Emulsifiers
- Flocculants

### APIs & Excipients

- Di-Pac® Tablet Excipient
- Egg Yolk Phospholipid
- Granulated Sugars NF
- Guar Gum NF
- Colloidal Silica
- Cytarabine USP
- Heparin Sodium USP
- Heparin Lithium and Salts
- Tranexamic Acid USP
- Vitamin D Analogs

### Import, Logistics & Warehousing

#### Logistics Expertise Import and Export

- Over 45 years experience

#### Warehousing Service

- GMP warehousing — NJ, MA, IN, NV & CA