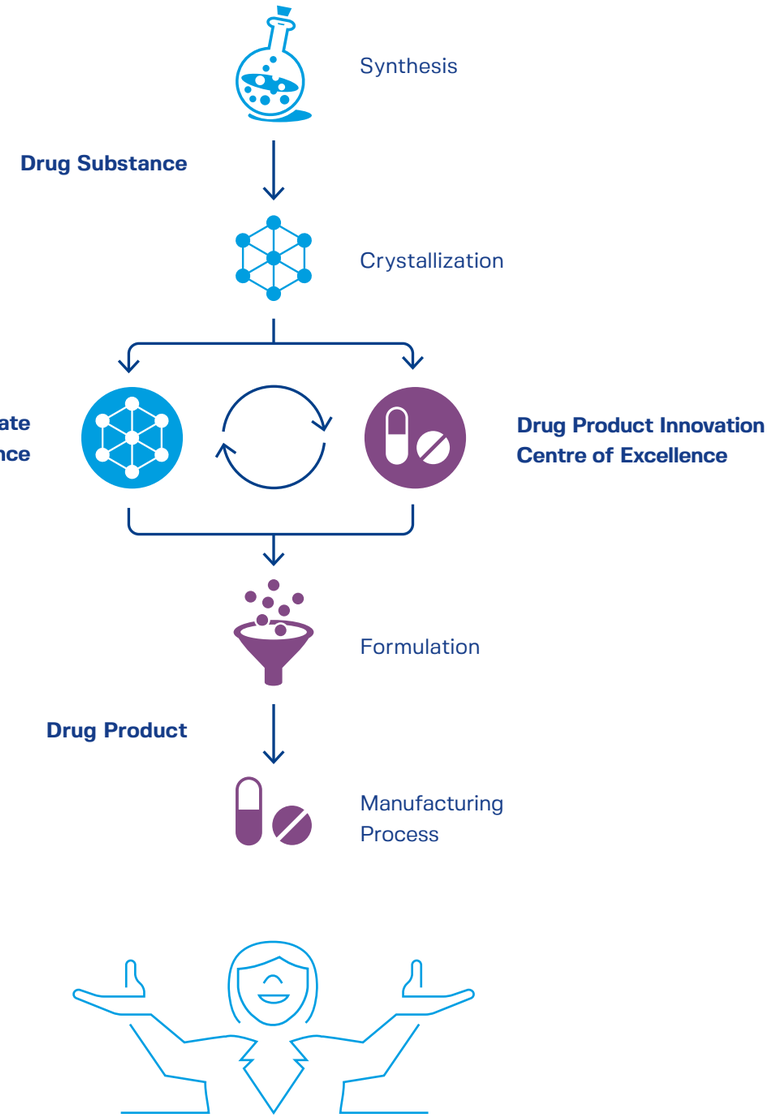
Corden Pharma

Early Phase

Drug Product Services

Hot melt extrusion development at CordenPharma Plankstadt (DE)



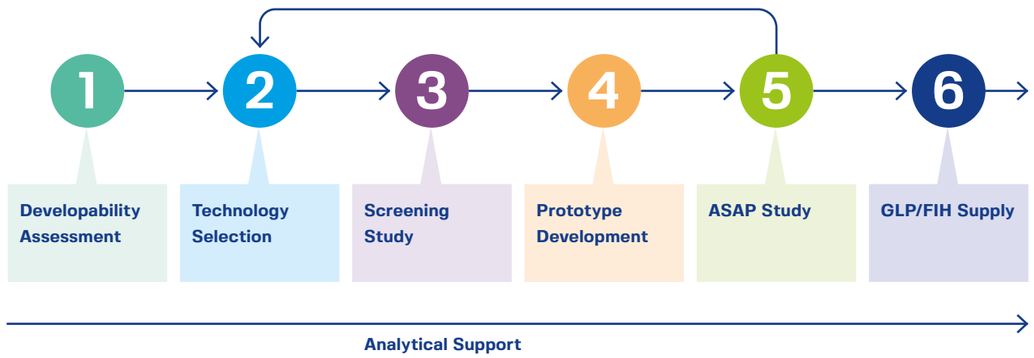
CordenPharma's Drug Product Innovation Centre of Excellence offers early phase formulation development and manufacturing services for Oral Solid Dose (OSD) drug products, including Bioavailability Enhancement technologies. In collaboration with our Solid State Centre of Excellence, we provide integrated API and drug product services, ensuring a continuous feedback loop between identifying the best API form required for a drug product formulation that provides sufficient absorption / solubility, stability, and processability.

First-in-Human (FIH) OSD Capabilities

Getting a product into FIH clinical Phase I studies in a flexible, fast, and efficient manner is important. CordenPharma offers an initial developability assessment that includes API profiling and technology selection (conventional, bioavailability enhancing) followed by a screening study (excipients, polymers, etc.), phase-appropriate formulation development, and prototype preparation. Utilizing the Accelerated Stability Assessment Program (ASAP) for stability, CordenPharma is able to identify the best prototype to manufacture and advance into FIH quickly.

Early Phase FIH Capabilities

- Integrated DS and DP Development
- Developability Assessment
- Screening Studies
- Formulation Challenges
- GLP Supply
- FIH Supply
- ASAP and Accelerated Stability Programs
- Analytical Support



XRPD for solid state analysis at CordenPharma Plankstadt (DE)

Bioavailability Enhancement

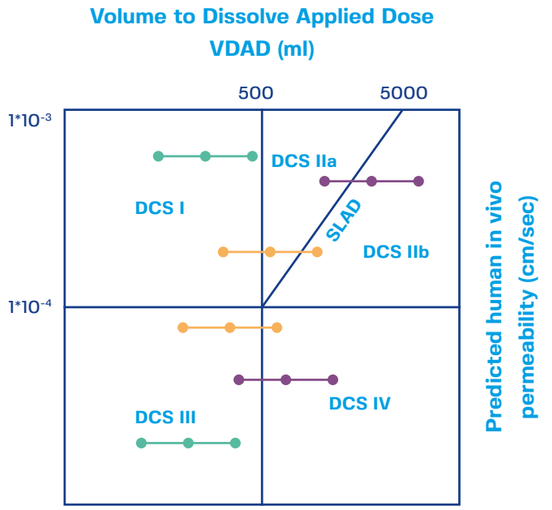
Solubility is one of the key attributes of a drug candidate and one of the biggest challenges in drug development. Approximately 70-90% of New Molecular Entities (NMEs) in today's drug pipeline are poorly soluble, which complicates delivery and results in poor bioavailability. The majority of these NMEs are DCS Class IIa / IIb and IV, which exhibit low bioavailability due to solubility-limited (IIb) absorption, dissolution rate-limited (IIa) absorption, or permeability limitations (IV).

As a part of CordenPharma's Early Phase Drug Product Innovation Centre of Excellence, bioavailability enhancement capabilities are available for addressing formulations containing solubility- or permeability-challenged APIs. In addition, we have enabling technologies that can solve solubility-induced absorption issues as well as access to a portfolio of Lipids Excipients for SEDDS / SMEDDS, Nanocrystals, and Liposomal formulations that can resolve permeability issues.

Small-scale spray dryer at CordenPharma Plankstadt (DE)

Nanomill development at CordenPharma Plankstadt (DE)

DCS = Developability Classification System
SLAD = Solubility Limited Absorbable Dose
VDAD = Volume to Dissolve Applied Dose

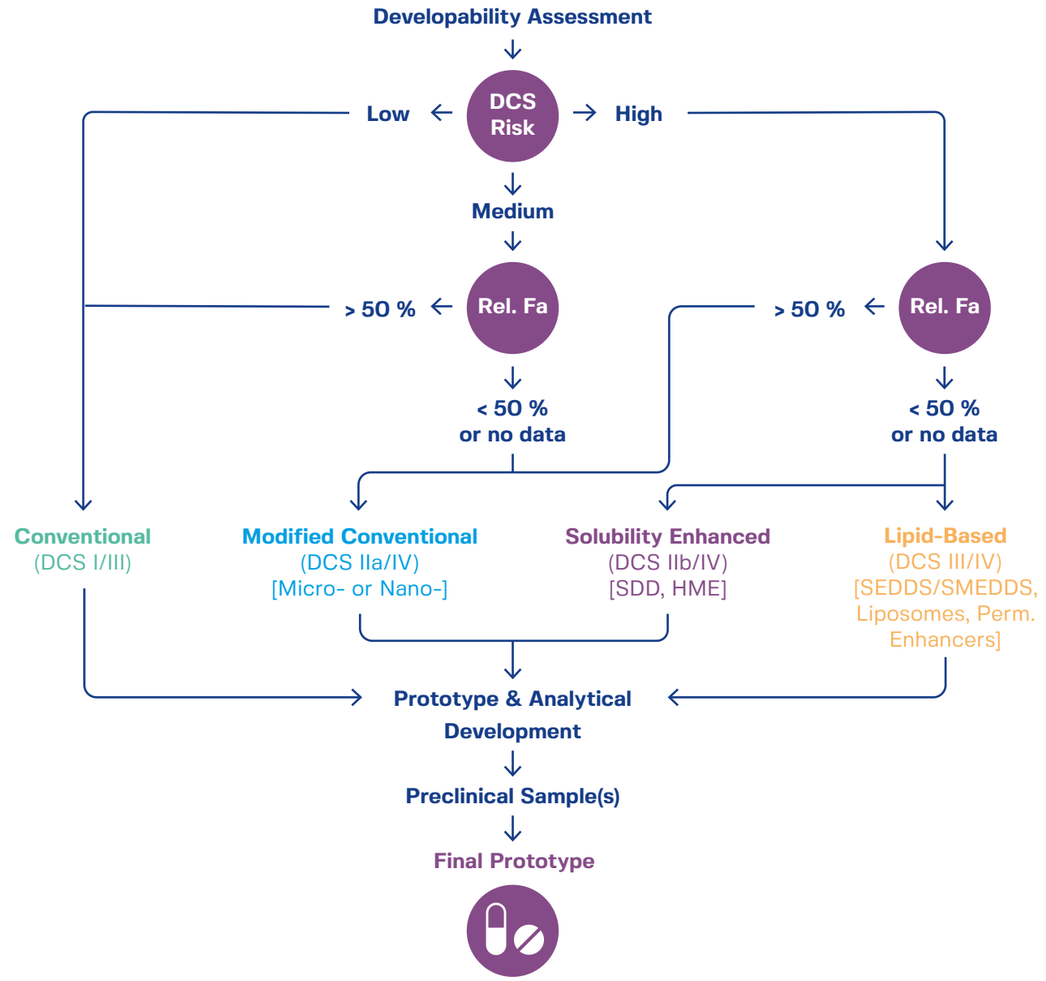


Formulation Technologies

- Conventional (wet granulation, melt granulation, dry granulation, direct compression)
- Compression simulator
- Micronization (air jet milling)
- Nanomilling (wet ball milling)
- Amorphous solid dispersions (spray drying, hot melt extrusion, drug layering, and co-precipitation)
- Lipid-based systems (SEDDS/SMEDDS, nanocrystals, permeability enhancers, liposomes)

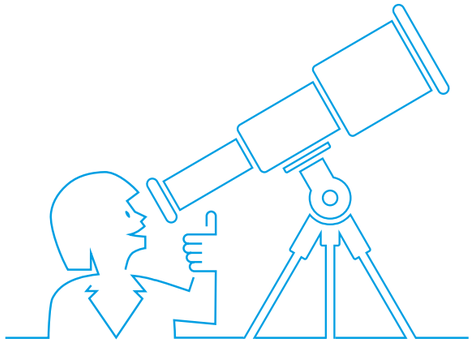
Prototype Development Decision Tree

During the Developability Assessment, a risk assessment is performed utilizing available data including dose, hygroscopicity, solubility, solid state properties, particle size distribution, and permeability. A DCS risk factor is applied and is based on the dosage range. If the intended dosage is medium or high, an in vivo risk factor (Rel. Fa) is applied. This risk factor is a determination of the relative fraction absorbed in systemic circulation after oral administration. CordenPharmas's early phase formulation development team uses these two risk factors and the decision tree below to suggest which type of prototype formulation strategies should be targeted during initial development. Efficient screening procedures allow for a scientifically sound formulation selection based on a very small amount of API, even if a different technology needs to be assessed.



Accelerated Stability

Are you interested in predicting the stability of your API or Drug Product in less than 4 weeks? ASAP stability programs are a time-saving approach that can project the degradation rate of your product at room temperature conditions from just a select number of accelerated / stressed high temperature testing samples.



- De-risk decisions
- Predict chemical stability, shelf-life
- Support dosage form and packaging selection(s)
- Reduce costs
- Shorten development timelines
- 20-35 Samples, 6-8 Conditions, 2-3 Weeks
- Results are accepted by most regulatory authorities
- No formal ICH study is required for FIH

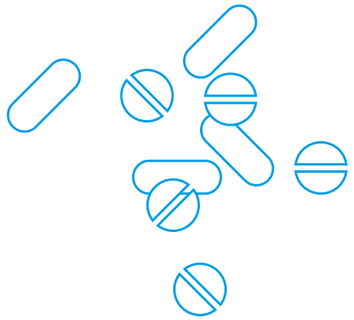
Air jet mill development at CordenPharma Plankstadt (DE)

FIH cGMP Manufacturing

After the preclinical investigation is complete, the selected prototype(s) will be developed to the final dosage form intended for clinical supply. A rapid transfer of the selected prototype(s) to our small-scale cGMP facilities is enabled by a phase appropriate risk-based approach. One challenge in FIH studies may be in identifying the appropriate dosage range. Some of the dosage forms outlined below are flexible with regards to final dosage strength. Capsules can easily be filled with different volumes or quantities of API, powder/granules, pellets, or minitablets. CordenPharma's encapsulation technology can ensure that different dosage strengths are available «on demand» during the clinical study. In parallel, phase appropriate analytical methods will be qualified to ensure they are suitable for use in releasing all materials.

FIH OSD Dosage Forms

- API / Powder / Granules / Pellets-in-Capsule
- API / Powder / Granules-in-Bottle (for reconstitution)
- Liquids / Solutions / Suspensions
- Tablets / Minitablets



Dissolution bath at CordenPharma Plankstadt (DE)

CordenPharma
International

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Peptides


Oligonucleotides


Lipids &
Carbohydrates


Injectables


Highly Potent
& Oncology


Small Molecules