



High quality pharmaceutical ingredients for your applications

API – Intermediates – Amino acid as nutrients – Excipients

This brochure highlights Evonik's expertise in pharmaceutical applications and medical nutrition which optimize your existing production processes, speed up your new development processes and reduce time-to-market.

- **Active pharmaceutical ingredients (APIs)** – Range of generic APIs is backed by our track record for quality, reliability and safety.
- **Intermediates portfolio** – Consists of phosphonium salts, benzophenones, boronic acids and amino acid derivatives.
- **Amino acids as nutrients** – With more than 60 years of experience, we provide the highest quality standards and regulatory when it comes to the production of amino acids.
- **Excipients** – We offer a broad range of amino acids with proven efficacy.

We highlight our top class global formulation laboratories and services and far-reaching regulatory assistance. Evonik is backward-integrated for many of the ingredients offered to the pharmaceutical industry.

Our expertise in pharmaceutical ingredients and applications

Evonik offers pharmaceutical ingredients with an unrivaled combination of product choices, quality and reliability. Evonik has an extensive experience in production and regulatory, cutting-edge technology, and a global presence. As a committed partner to the pharmaceutical industry, we are perfectly placed to help you streamline your existing processes and reduce your time-to-market for new products.

The Evonik technology edge

We offer one-of-a-kind expertise and excellence in chemistry, biotechnology and purification technology. We provide a broad spectrum of solutions for medical nutrition and pharmaceutical applications. Moreover, customers benefit from our ability to pair our extensive portfolio of products, services and knowledge

with the comprehensive organic chemistry toolbox of other Evonik units. And equally as important, we continuously reaffirm our commitment to innovation, particularly in biotechnology, by actively supporting internal and external research programs.

Moreover, we are able to fine-tune the degree of purity of our pharmaceutical ingredients to match market and customer-specific requirements. Consequently, we can serve as a one-stop shop for a wide range of applications. And our customers benefit from cost-effective solutions that fulfill the specific imperatives of their industries and processes.

In addition to ingredients, Evonik also provides best in class formulation development services that allow customers to create highly differentiated products that meet the needs of their markets.

Backward integration for greater control and security of supply

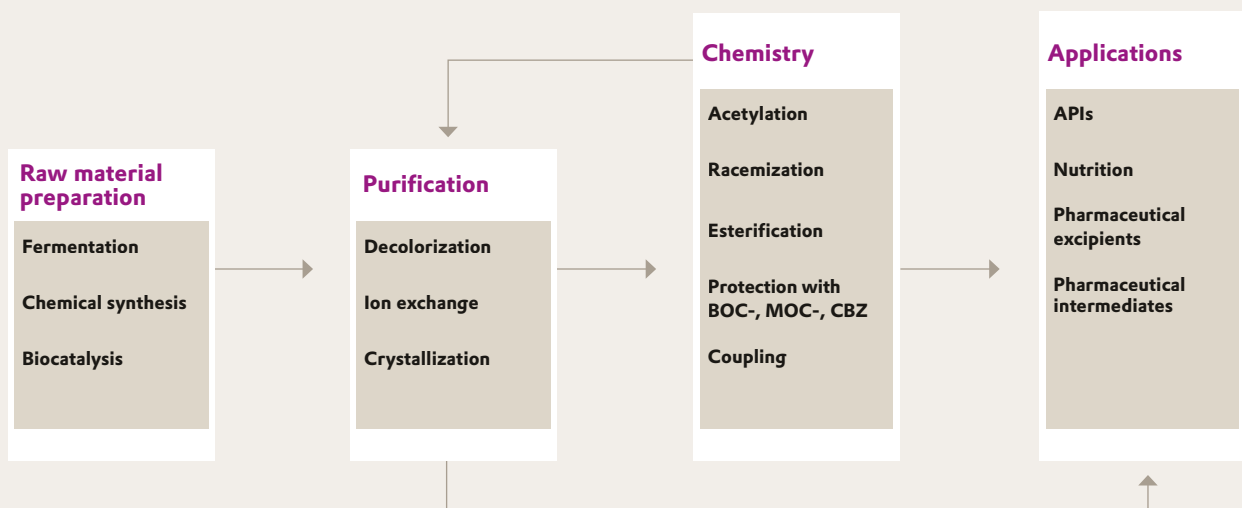
We perform every step of the manufacturing process in-house – from the production of basic amino acids, to chemical derivatization, to GMP-grade purification. The same applies to our supply chain. Having full control over every input into our processes allows us to deliver consistently high-quality products, and to ensure reliable security of supply. Additionally, it means we offer a degree of accountability that is rare in the industry.

For backward integrated products, production sites are qualified and ready to deliver according to specification. We have raw material stock always available to quickly respond to customer needs.

For the other amino acids, we have a tight quality control and approval of suppliers. We have the unique ability to combine upstream and downstream integration with full control of our supply chain – creating the perfect platform for continuous process improvement. In addition our customers benefit from our increased regulatory certainty and information. All product and process data is harmonized and consolidated on Evonik premises. This enables effective evaluations, accelerates approval processes and reduces time-to-market for new products.

Being backward integrated for several products such as amino acids and amino acid derivatives ensures easier drug registrations for our customers.

Process integration of the sensible kind



Active pharmaceutical ingredients (APIs)

Evonik is a supplier of high-quality generic APIs. As a committed partner to the pharmaceutical industry, we are perfectly placed to help reduce your time to market.

Our range of generic APIs is backed by an unrivalled track record for quality, reliability and safety. We can draw on decades of experience, state-of-the-art manufacturing capabilities and a truly global network, so you can be sure of consistently outstanding generic APIs.

Keto acids

Keto acids are used for patients with chronic kidney disease (CKD). Their role is to relieve the build-up of nitrogenous waste and other toxic substances inside the body.

Evonik provides total end-to-end support for your launch of generic Ketosteril® – including five keto acids, other amino acids, and the supply of Eudragit® to complete the formulation. Evonik has an ASMF in place in Europe, and DMFs in various countries that support customer submissions.

Evonik has produced keto acids in Germany for over 30 years, and always maintains stocks of the necessary materials. Moreover, our impurity profiles are class-leading across the industry. This is an important fact, as the medicine has a very high daily uptake (>2g/day).

Amino acids

Many pharmaceutical products make use of amino acids themselves. More than six decades of experience in amino acids, coupled with market-leading API manufacturing know-how, result in a level of flexibility for our customers that is unique in the industry.

API as an example

L-Ornithine-L-Aspartate (LOLA) has been used as an API for liver treatments for many years. Its ability to reduce ammonia levels also makes it ideal as a nutraceutical for the prevention of liver disease – and for sports nutrition, as it enables faster post-workout recovery.

Although **LOLA** finished formulation is mainly available as a standard formulation (i. e. sachets), we have the capabilities to redesign it to address specific customer needs and this also applies to delivery forms. Evonik has extensive expertise in developing different formulations of LOLA such as effervescent tablets, effervescent granules, fast-melt granules, generic granules and chewable tablets. Our formulation know-how can work with your development lab to speed up the product launch into the market.



Chlorhexidine

SOVIDINE™ – Evonik's Chlorhexidine (CHD), is listed as an essential medicine by the World Health Organization (WHO). Thanks to its high effectiveness and outstanding overall compatibility, CHD is suitable for use in both human and animal antiseptics.

In the medical industry, CHD formulations are used for surgical scrubs, to treat wounds, and to disinfect equipment, surfaces and textiles. And in the field of veterinary medicine, CHD is employed as a disinfectant for teat dips and wound dressings.

Evonik has been producing chlorhexidine for over 20 years. SOVIDINE™ products meet the requirements of the latest version of the European Pharmacopoeia, and have been registered and approved for use for the three most common CHD applications: active pharmaceutical ingredients (APIs), cosmetics and biocides.

Evonik was one of the very first manufacturers to register its CHD products with the European Chemicals Agency (ECHA). Correspondingly, Evonik is included in the list of active substance manufacturers under Article 95 of the ECHA Biocidal Products Regulation (BPR).

Controlled substance APIs

Evonik has extensive experience in the production of benzodiazepines, a type of controlled substance API. All customers require permission from their respective authorities for the handling of controlled substances.

Evonik produces Lorazepam which is a tranquilizer used to treat anxiety, insomnia and seizures, and is also employed for sedation. Evonik has a United States DMF, a European CEP, and an ASMF and an ASMF in more than 10 countries. We keep a stock of Lorazepam at all times, and deliver EP and USP-compliant grades of this medication.

Evonik also produces Lormetazepam, a short-acting benzodiazepine used to treat patients with moderate to severe insomnia. Evonik has a European ASMF in place for this medication.



Intermediates

Evonik offers a broad range of intermediates with added value to the pharmaceutical industry. Our intermediate portfolio contains **phosphonium salts, benzophenones, boronic acids, amino acids and amino acid derivatives.**

As a supplier of intermediates used in chemical synthesis, Evonik offers an unrivaled mix of product choices, high quality and reliability.

Evonik has cutting-edge technology and global logistics – streamlining processes and shortening time to market. In addition, we have the capabilities to pair our extensive portfolio of products and services with the comprehensive organic chemistry toolbox of other Evonik units.

Amino Acids and derivatives

Amino acids and their derivatives are used as intermediates and building blocks in the synthesis of many APIs. Specifically, amino acids act as valuable precursor compounds for chiral substances, particularly in the field of pharmaceuticals.

We are able to provide a broad array of amino acids, the entire spectrum of standard derivatives, and custom designed compounds. We also offer a range of non-natural amino acids and derivatives. As a partner to the pharmaceutical industry, Evonik provides unique expertise and experience in production, quality and regulatory matters.



Amino acids as nutrients

Enhancing efficacy and efficiency with REXIM® and REXIVA® nutrients

Evonik is the leading European expert in pharmaceutical amino acids, and amino acid derivatives with a global reach. Amino acids play a fundamental role in our lives. They make up the proteins that, in turn, compose the majority of human and animal tissue. Plus, amino acids are key to ensuring cell growth, repair and maintenance. With this in mind, we take pride in ensuring our amino acid products are of consistently outstanding quality. And this focus on excellence extends to our processes, our services, and the relationships we build with our customers.

In more than six decades of specialization, we have acquired an unparalleled, broad and in-depth understanding of the building blocks of life. Under the REXIM® brand, we've earned a reputation for quality and dependability with the most comprehensive range of readily available, high-quality

amino acids, amino acid derivatives and peptides for medical nutrition applications. REXIM® products enhance intravenous formulations for metabolic disorders, pre- and post-surgery diets and malnutrition treatments.

We have forged strong partnerships with companies that specialize in parenteral and/or enteral nutrition. These partners know they can trust Evonik to deliver essential nutrient compounds that meet the very highest product quality specifications and regulatory standards. However, they also benefit from our ability to couple reliable supply with comprehensive value-added services – something we believe is simply part of the product. Our extensive experience in chemistry, biotechnology and purification technology enables us to meet any product challenge.

Parenteral nutrition

Parenteral nutrition does not just depend on highly soluble amino acid forms. Microbiological purity – including strict endotoxin tolerances – is also vital. As products used for these applications effectively act as active pharmaceutical ingredients (APIs), REXIM® ensures compliance with cGMP (Current Good Manufacturing Practice) regulations, and provides all relevant documentation, such as Certificates of Suitability and Drug Master Files.

Enteral nutrition

For solutions targeted for the gastrointestinal tract, our products can be fine-tuned to meet specific needs across the entire patient age spectrum, from infancy to old age. REXIVA® amino acids and derivatives are of the consistently high quality essential for enteral nutrition applications. REXIVA® products can be employed in formulas for newborn children, in medical diet products that address metabolic ailments, allergies, malnutrition or intense physical stress, and in nutritional formulas intended for elderly patients. Furthermore, amino acids are certified kosher and halal when applicable.



Excipients

Today, medicines are available in many dosage forms including tablets, capsules, oral liquids, topical creams and gels, transdermal patches, injectable products, implants, eye products, nasal products, inhalers and suppositories. Pharmaceutical excipients are substances that are included in a pharmaceutical dosage form not for their direct therapeutic action, but to aid the manufacturing process, to protect, support or enhance stability, or for bioavailability or patient acceptability. They may also assist in product identification and enhance the overall safety or function of the product during storage or use.

Evonik offers a broad range of amino acids with proven efficacy as excipients.

Amino acids can be used **to stabilize the native conformation of proteins**, via a variety of mechanisms such as preferential exclusion, direct protein binding, buffering capacity and antioxidant properties.

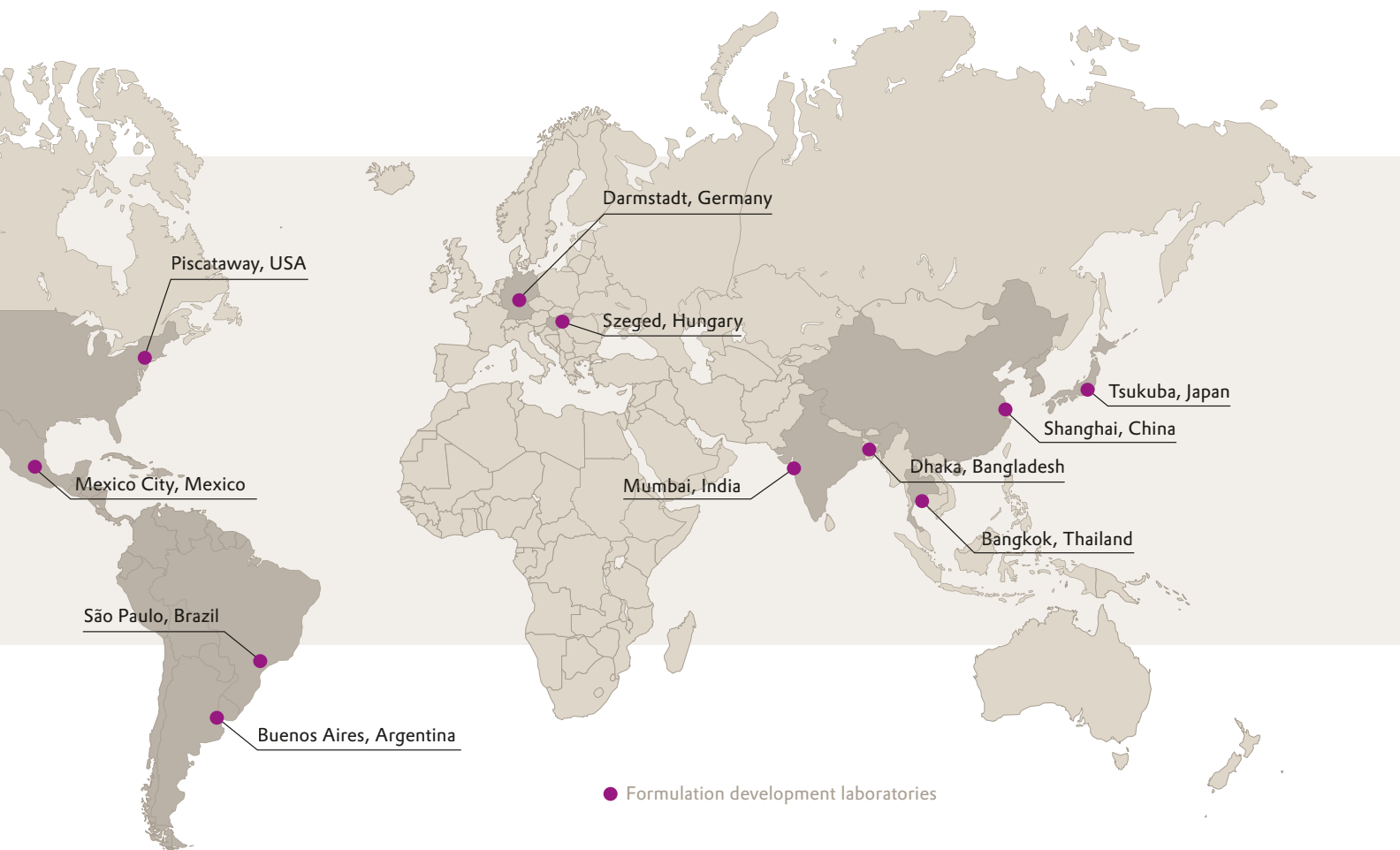
Amino acids as excipients in oral formulations:

- anti-oxidant/preservations
- sweetener
- co-amorphous excipients
- crystallization inhibitors

Amino acids as excipients in parenteral formulations:

- preservation of shelf life of proteins
- crystallization inhibitors
- bulking agent in lyophilized products





Formulation services

Exclusive support to customers in our formulation development laboratories.

Evonik has best-in-class capabilities in finished drug product formulation. Evonik Health Care has over ten formulation development laboratories across the globe.

We can help you improve your formulations with the goal of giving you a clear competitive edge in your final market.

Moreover, we can provide our own formulations for certain products and applications.

Evonik supports your development projects all over the world with 50+ formulation experts in our state-of-the-art equipped laboratories located in several countries such as Germany, the U.S., India, China, Japan and Argentina.

Our development services include all steps from early feasibility studies to large-scale production transfer, including clinical supply manufacturing and scale-up support. To support your quality and development processes, as well as your regulatory submission processes, we provide comprehensive data packages as services to our customers.

Product safety & quality

Quality and product safety are as essential to us as to our customers. We've built our reputation on staying true to that simple and straightforward principle. At Evonik, we maintain the toughest standards whether based on legislation or self-imposed. These standards include selecting only the highest quality raw materials, ensuring excellence in product manufacturing, and providing efficient and reliable order processing. At Evonik we never cut corners. Our customers are always welcome to our facilities to assess and verify our capabilities, as well as our commitment to quality and product safety.

Available certifications

- GMP compliance
- ISO certification 9001
- Hazard Analysis and Critical Control Points-Concept (HACCP) compliance
- High-purity chemical grades and controlled levels of microorganisms and endotoxins
- No chlorinated solvents, preservatives, antioxidants, mycotoxins, aflatoxins, pesticides, hormones, dioxins or cytotoxic compounds
- Non-Genetically Modified Organism (Non-GMO) products
- Kosher and halal certification
- Statements on allergens, residual solvents and Bovine Spongiform Encephalopathy (BSE)/Transmissible Bovine Encephalopathy (TSE) available
- Non-animal origin
- United States Pharmacopeia (USP), European Pharmacopoeia (EP), Japanese Pharmacopoeia (JP) and Food Chemicals Code (FCC) monograph compliant

Audits

- SEDEX* audited plants – when applicable
- Customers and agencies (FDA and ANSM** as examples compliance)

* Supplier Ethical Data Exchange

** Agence nationale de sécurité du médicament et des produits de santé

Regulatory support

In addition to our pharmaceutical ingredients, Evonik customers can count on advice and hands-on support throughout the regulatory approval process to optimize time to market and ensures agency approvals. Here, our experience provides a major head start. Besides ensuring continuous surveillance of evolving global and local legislation, as well as regulatory and cGMP requirements, our regulatory support specialists also author and maintain worldwide registration documentation.

- REACH registration
- Expertise in registration processes worldwide
- Expertise in the specifics of regional regulations
- Proactive implementation of new regulatory requirements
- Creation of Drug Master Files (DMF)
- Creation and maintenance of Certificates of Suitability (CEP)
- Consultancy for regulatory issues
- Services for regulatory affairs



APIs

Products	CAS No
Chlorhexidine Digluconate	18472-51-0
Dimercaprol	59-52-9
Lisinopril Dihydrate	83915-83-7
Lorezapam	846-49-1
Lormetazepam	848-75-9
α -Hydroxymethionine, Calcium salt	4857-44-7
α -Ketoisoleucine, Calcium salt	66872-75-1
α -Ketoleucine, Calcium salt	51828-95-6
α -Ketophenylalanine, Calcium salt	51828-93-4
α -Ketovaline, Calcium salt	51828-94-5
L-Alanine	56-41-7
Alphaketoglutaric acid	328-50-7
L-Arginine L-Aspartate	7675-83-4
L-Asparagine Monohydrate	5794-13-8
L-Aspartic acid	56-84-8
Glycine	56-40-6
L-Isoleucine	73-32-5
L-Leucine	61-90-5
L-Lysine HCL	657-27-2
DL-Lysine Monohydrate	70-54-2
L-Methionine	63-68-3
N-Acetyl-DL-Methionine	1115-47-5
DL-Methionine	59-51-8
L-Ornithine L-Aspartate	3230-94-2
L-Proline	147-85-3
L-Serine	56-45-1
D-Serine	312-84-5
DL-Serine	302-84-1
L-Threonine	72-19-5
D-Tryptophan	153-94-6

Product datasheet

Excipients

Products	CAS No
Alphaketoglutaric acid	328-50-7
DL-Methionine	59-51-8
DL-Serine	302-84-1
Glycine	56-40-6
Glycine HCl	6000-43-7
L-Alanine	56-41-7
L-Asparagine Monohydrate	5794-13-8
L-Aspartic acid	56-84-8
L-Glutamic acid	56-86-0
L-Isoleucine	73-32-5
L-Leucine	61-90-5
L-Lysine HCL	657-27-2
L-Lysine hydrate	39665-12-8
L-Methionine	63-68-3
L-Proline	147-85-3
L-Serine	56-45-1
L-Threonine	72-19-5
L-Tryptophan	73-22-3
L-Valine	72-18-4
N-Acetyl-DL-Tryptophan	87-32-1

Amino acids as nutrients

Product family	CAS No.	Relevant monograph	Currently available
Glycine	56-40-6	EP/USP/JP/FCC	CEP/DMF
Glycyl-L-Glutamine monohydrate	211446-46-7	Not described in monographs	DMF
Glycyl-L-Tyrosine dihydrate	39630-46-1	Not described in monographs	DMF
L-Alanine	56-41-7	EP/USP/JP/FCC	CEP/DMF
L-Alanyl-L-Glutamine	39537-23-0	Not described in monographs	DMF
L-Arginine L-Aspartate	7675-83-4	EP	DMF
L-Asparagine Monohydrate	5794-13-8	EP/NF/FCC	CEP/DMF
L-Aspartic acid	56-84-8	EP/USP/JP/FCC	CEP/DMF
L-Glutamic acid	56-86-0	EP/USP	CEP/DMF
L-Isoleucine	73-32-5	EP/USP/JP/FCC	CEP/DMF
L-Leucine	61-90-5	EP/USP/JP/FCC	CEP/DMF
L-Lysine Acetate	57282-49-2	EP/USP/JP	CEP/DMF
L-Lysine HCL	657-27-2	EP/USP/JP/FCC	CEP/DMF
L-Lysine hydrate	39665-12-8	DAB	DMF
L-Lysine L-Aspartate	27348-32-9	Not described in monographs	N/A
L-Lysine L-Glutamate Dihydrate	5408-52-6	Not described in monographs	N/A
L-Lysine L-Malate	71555-10-7	Not described in monographs	N/A
L-Methionine	63-68-3	EP/USP/JP/FCC	CEP/DMF
L-Ornithine-L-Aspartate	3230-94-2	DAB	DMF
L-Proline	147-85-3	EP/USP/JP/FCC	CEP/DMF
L-Serine	56-45-1	EP/USP/JP/FCC	CEP/DMF
L-Threonine	72-19-5	EP/USP/JP/FCC	CEP/DMF
L-Tryptophan	73-22-3	EP/USP/JP/FCC	CEP/DMF
L-Valine	72-18-4	EP/USP/JP/FCC	CEP/DMF
Magnesium L-Aspartate Dihydrate	2068-80-6	EP	N/A
N-Acetyl-L-Methionine	65-82-7	FCC	N/A

Intermediates

Products	CAS No	Examples of market APIs
DL-Alanine	302-72-7	
L-Alanine	56-41-7	
Alphaketoglutaric acid	328-50-7	
DL-Aspartic acid	617-45-8	
L-Aspartic acid	56-84-8	
L-Glutamic acid	56-86-0	
Glycine	56-40-6	
Trans-hydroxy-L-proline	51-35-4	Meropenem, Fosinopril, Ertapenem
Cis-hydroxy-L-proline	618-27-9	HCV APIs
Boc-L-keto-Proline	84348-37-8	Teneligliptin
L-Leucine	61-90-5	
Moc-L-tert-Leucine	162537-11-3	Atazanavir
DL-Lysine Monohydrate	70-54-2	
L-Lysine 50 %- solution	56-87-1	
L-Methionine	63-68-3	Cobicistat
DL-Methionine	59-51-8	
N-Acetyl-DL-Methionine	1115-47-5	Eflornithin
L-Norvaline	6600-40-4	
L-Ornithine HCl	3184-13-2	
L-Ornithine ethyl ester	4189-46-2	
D-Proline	344-25-2	
L-Alanyl-L-Proline	13485-59-1	Enalapril
L-Proline	147-85-3	Captopril, Lisinopril, Darifenacin, Enalapril, Vildagliptin
DL-Serine	302-84-1	Aktiferrin, Benserazid
D-Serine	312-84-5	Cycloserine, Lacosamide
L-Serine methyl ester HCl	5680-80-8	Ramipril
L-Serine	56-45-1	Nelfinavir

Products	CAS No	Examples of market APIs
L-Homoserine	672-15-1	Cobicistat
D-Tryptophan methyl ester	22032-65-1	Tadalafil
D-Tryptophan	153-94-6	Tadalafil
L-Tryptophan	73-22-3	
L-Valine	72-18-4	
L-Valine methyl ester	4070-48-8	Valsartan, Lopinavir, Ritonavir
L-Norvaline	6600-40-4	Perindopril
1-Methyl-1H-pyrazole-boronic acid pinacole ester	761446-44-0	c-met inhibitor oncology APIs
2-(Bromoacetamido)-2',5-dichlorobenzophenone	5504-92-7	

Special intermediates can be developed exclusively upon request.

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