



**2010 European Amino Acid Derivatives
Product Line Strategy Award**





Frost & Sullivan's Global Research Platform

Frost & Sullivan is entering its 50th year in business with a global research organization of 1,800 analysts and consultants who monitor more than 300 industries and 250,000 companies. The Company's research philosophy originates with the CEO's 360 Degree Perspective,* which in turn serves as the foundation of its TEAM Research** methodology. This unique approach enables us to determine how best-in-class companies worldwide manage growth, innovation and leadership. Based on the findings of this Best Practices research, Frost & Sullivan is proud to present the 2010 European Product Line Strategy Award in the amino acid derivatives market to Genzyme Pharmaceuticals.

Significance of the Product Line Strategy Award

Key Industry Challenges Addressed by Product Innovation Strategies

The market for high-quality amino acid derivatives (AADs), particularly for innovative, value-adding peptide synthesis building blocks, is far-off from saturation, as evident from its dynamic growth in the last few years. Despite the economic downturn, the market for bioactive peptides used in pharmaceutical research and the cosmetic industry showed growth, albeit at a reduced rate. In discovery, demand for peptides continues to rise at a somewhat slower pace, particularly for peptide libraries used in drug screening, target validation, epitope mapping, and structure-activity studies. In such encouraging growth conditions, the key challenge is in manufacturing peptide molecules of ever increasing sequence length and structural complexity at acceptable costs. Peptides with such protein-like properties are prepared via solid support (solid phase peptide synthesis, SPPS) using amino acid derivatives with orthogonal protecting groups for the amino function (Fmoc) and side chain functionalities (t-Bu, Boc, Trt etc).

The challenges associated with SPPS are highly technical in nature. The choice of amino acid derivatives is dependant on process peculiarities, equipment availability and targeted purity level for the crude peptide product. Advanced amino acid derivatives, such as threonine and serine derived pseudoproline or isoacyl building blocks, play a critical role in solid phase synthesis of complex and long peptide sequences by preventing secondary structure formation and thus product aggregation during chain elongation. This factor is key to synthesis success and crude peptide purity. Such peptide aggregation effects can dramatically influence the physico-chemical properties of a growing peptide sequence, rendering standard synthesis protocols unsuitable for scale-up. Associated technical challenges caused by insufficient solvation of the peptide-polystyrene complex ultimately affect kinetics and efficiency of residue coupling and Fmoc deprotection reactions. Low synthesis yields and complex impurity profiles with numerous side products and truncated sequences can require multiple chromatographic purification cycles and low overall product yield. Furthermore, increasing regulatory pressure on peptide API manufacturers to reduce or eliminate process impurities require the use of new building blocks that help alleviate problems associated with low solvation effects during peptide synthesis. The use of secondary structure-disrupting pseudoproline dipeptides has been proven to be very effective in improving solvation/solubility properties during peptide synthesis.

A comprehensive AAD product line which includes value-adding building blocks, large-scale production capabilities, strong emphasis on product quality and consistent application performance is key to addressing these challenges.

Key Benchmarking Criteria for Product Line Strategy Award

For the Product Line Strategy Award, the following criteria were used to benchmark Corden Pharma Switzerland’s performance against key competitors:

- Breadth of Product Line
- Size of Addressable Customer Base
- Impact on Customer Value
- Impact on Market Share
- Breadth of Applications/Markets Served
- Product lines are compared with Customer Base Demands

Best Practice Award Analysis for Corden Pharma Switzerland, formerly Genzyme Pharmaceuticals

The Decision Support Matrix, shown in the Figure below, illustrates the relative importance of each criterion for the Product Line Strategy Award and the ratings for each company under evaluation. To protect the interests of the award recipient’s competitors, we have chosen to refer to them as Competitor 1 and Competitor 2.

Decision Support Matrix for Product Line Strategy Award

<i>Measurement of 1–10 (1 = lowest; 10 = highest)</i>						
	Breadth of Product Line	Size of Addressable Customer Base	Impact on Customer Value	Impact on Market Share	Product lines are Compared with Customer Base Demands	Weighted Rating
Relative Weight (%)	25%	15%	25%	15%	20%	100%
Corden Pharma Switzerland	8	8.5	8.5	9	8.4	8.4
Competitor 1	7	7	7.5	7	7	7.1
Competitor 2	6.5	6	7	7	6.6	6.6

Criterion 1: Breadth of Product Line

Based on its expertise in amino acid derivatives, Corden Pharma Switzerland, formerly Genzyme Pharmaceuticals, has been meeting customer requirements through stringent quality control and technological innovation in the scale-up production of a broad line of amino acid derivatives and building blocks including unnatural amino acids. Some of the key products in its product line are pseudoproline, alanine derivatives, di-amino acid derivatives, and amino dicarboxylic acid derivatives. The company is continuously involved in expanding its product line to suit diverse needs of peptide synthesis and pharmaceutical companies.

The Exclusive Manufacturing Process of Corden Pharma Switzerland

Corden Pharma Switzerland draws upon a pool of proprietary manufacturing processes to support and extend its AAD product line while optimizing scalability, production yields and purity. The company employs efficient and versatile enamide synthesis routes and asymmetric catalytic hydrogenation technologies for amino acid production. The enamides are prepared from glycine derivatives and appropriate aldehydes either by the Erlenmeyer or the Wittig-Horner reactions. Finally, the hydrogenation products are derivatized with standard protecting groups for off-the-shelf delivery or as material with no further custom specifications required. Furthermore, the company has unchallenged expertise in the manufacture of pseudoproline dipeptides and in the scale-up production of aryl ring substituted phenylalanine derivatives using pinacolylboron chemistry. This kind of technology leadership provides Corden Pharma Switzerland the ability to maintain a wide portfolio of products which can be supplied at competitive prices. Most other manufacturers in this market are incapable of providing this kind of cost advantage.

Criterion 2: Size of Addressable Customer Base

The market for therapeutic peptides was estimated at over \$13 billion in 2008. Although Corden Pharma Switzerland competes with many large multinational, local, and regional companies, its long-standing expertise, wide product portfolio, brand name, reputation for quality products, and highly customised services are some of the key factors that have helped the company to achieve a level of customer satisfaction that is industry best with significant customer retention rates. Moreover, being a pioneer in the large-scale production of AADs suitable for GMP peptide manufacture, Corden Pharma Switzerland maintains a long-standing reputation as a reliable supplier of high-quality products.

In addition, the company has a track record of successfully completed projects with key pharmaceutical companies in the lines of peptide synthesis route selection, manufacturing process development, scale-up and GMP production of custom peptide-based drug substances. Offering peptide manufacturing services to the industry, in addition to off-the-shelf and customized building blocks, were instrumental in forming Corden Pharma Switzerland's credibility and market penetration. Meeting customer's quality and price expectations consistently over many years is an important success factor for Corden Pharma Switzerland's amino acid business. Finally, the ability to produce a wide range of amino acid derivatives and novel building blocks using proprietary technologies and flexible production equipment constitutes a strong strategic position for the future business development of Corden Pharma Switzerland.

Criterion 3: Impact on Customer Value

Corden Pharma Switzerland, formerly Genzyme Pharmaceuticals, is reputed for its extensive knowledge in the field of developing scaleable processes for the manufacture of amino acid derivatives. These amino acids are of high optical purity and suitable for the GMP production of peptide and peptidomimetic active pharmaceutical ingredients (APIs). The company's manufacturing capabilities are seamlessly integrated through effective supply chain management to facilitate multi-ton quantities per annum. A business model emphasizing technology leadership, reliability and superior customer service are highly regarded by Corden Pharma Switzerland's business partners.

As the world leader in manufacturing innovative pseudoproline dipeptides, Corden Pharma Switzerland's serine and threonine derived pseudoprolines address SPPS challenges associated with low solvation effects during the synthesis of long and difficult peptide sequences. Most importantly, the pseudoprolines are coupled to growing peptide chains using standard procedures, and are compatible with most common synthesis strategies and chemistries. The performance characteristics of pseudoprolines have been widely commended by the industry and academia.

Pseudoprolines are an important tool in enhancing the efficiency of peptide synthesis. Having been a traditionally high-cost raw material hampered their wider use in peptide synthesis and large-scale production in the past. To overcome this challenge, Corden Pharma Switzerland teamed with Neuland Laboratories to develop economical manufacturing processes for the multi-kg production of 28 high-quality pseudoproline dipeptides at the lowest possible cost. The right combination of performance, quality and price for pseudoprolines has added immense value to its customers.

Criterion 4: Impact on Market Share

The market for amino acid derivatives is highly fragmented in terms of the number of products and suppliers, including competition from Asian manufacturers. By virtue of offering both usual and novel peptide building blocks in consistent quality, of highest purity and at competitive prices, Corden Pharma Switzerland continues to maintain its position in the marketplace for over 20 years as a pioneer in the large-scale production of pseudoprolines with a complete pseudoproline product offering. Many peptide producers prefer to deal with a single source supply for their various amino acid needs. Therefore Corden Pharma Switzerland's comprehensive product line for short-term delivery at competitive prices, supported by reliable customer service, is key to maximizing market share.

Criterion 5: Product Lines Compared with Customer Base Demands

Peptides are synthesized by sequential coupling of appropriately protected residues to eventually form a long peptide chain with the desired biological activity. With this in mind, Corden Pharma Switzerland's amino acid derivatives and advanced peptide building blocks are produced under the most stringent quality criteria in order to guarantee efficient peptide synthesis processes and consistent outcomes as required for the GMP production of peptide APIs. Furthermore, Corden Pharma Switzerland's product line matches diverse needs of solid phase and solution phase peptide synthesis.

Revived interest in peptide drug discovery worldwide generates a constant flow of novel sequences often carrying unusual and sometimes structurally complex residues. Corden Pharma Switzerland is well positioned to custom produce such residues according to the quality specifications put forth by its customers.

The CEO 360 Degree Perspective™ - Visionary Platform for Growth Strategies

The CEO 360 Degree model provides a clear illustration of the complex business universe in which CEOs and their management teams live today. It represents the foundation of Frost & Sullivan's global research organization and provides the basis on which companies can gain a visionary and strategic understanding of the market. The 360 degree perspective is also a “must-have” requirement for the identification and analysis of best-practice performance by industry leaders.

The 360 degree model enables our clients to gain a comprehensive, action-oriented understanding of market evolution and its implications for their companies' growth strategies. As illustrated in the Figure below, the following six-step process outlines how our researchers and consultants embed the 360 degree perspective into their analyses and recommendations:

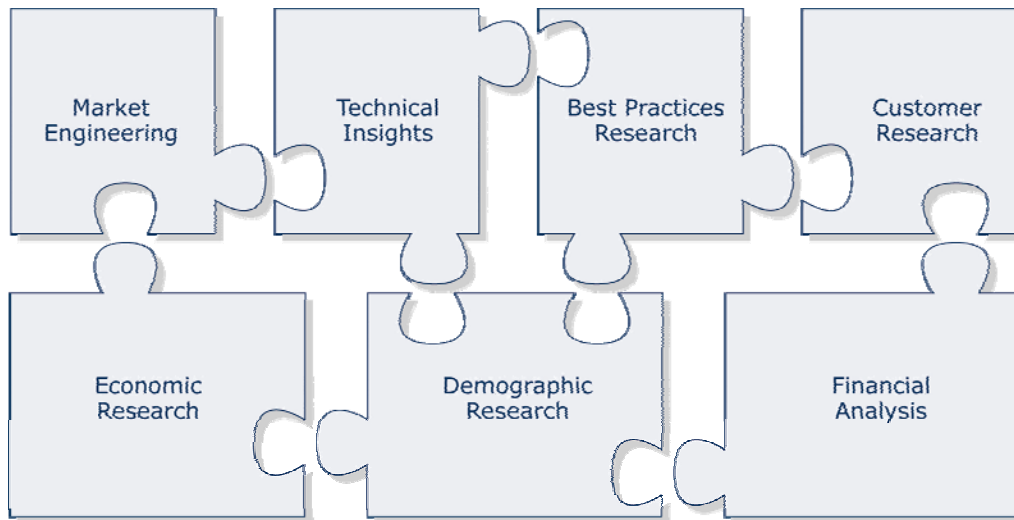
How the CEO's 360 Degree Perspective Directs Our Research Process



Critical Importance of TEAM Research

Frost & Sullivan’s TEAM Research methodology represents the analytical rigor of our research process: it offers a 360 degree view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan’s research methodologies. Our experience has shown over the years that companies too often make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Frost & Sullivan contends that the successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices and demographic analyses. In that vein, the letters T, E, A and M reflect our core technical, economic, applied (financial and best practices) and market analyses. The integration of these research disciplines into the TEAM Research methodology provides an evaluation platform for benchmarking industry players and for creating high-potential growth strategies for our clients.

Benchmarking Performance with TEAM Research



Frost & Sullivan’s 10-Step Process for Identifying Award-Recipients



About Corden Pharma Switzerland

Corden Pharma Switzerland is a premier supplier of lipids, amino acid derivatives, pseudoproline dipeptides, peptides and custom small molecules. The company, formerly Genzyme Pharmaceuticals, was purchased in March 2011 by International Chemical Investors Group (ICIG) to join their pharmaceutical subsidiary Corden Pharma. Corden Pharma Switzerland was formed in 1986 as Genzyme Pharmaceuticals after Koch Laboratories, a UK based supplier of industrial fine chemicals shifted its focus to pharmaceuticals (mainly lipids) and was acquired by Genzyme Corporation. In 1994, Genzyme Pharmaceuticals acquired Sygena AG, a manufacturing facility that added amino acid and peptide manufacturing capabilities. This facility based in Liestal, Switzerland later became the cornerstone for all activities related to Genzyme Pharmaceuticals. Now, as Corden Pharma Switzerland, the company is a full-fledged supplier of products, materials and services to the pharmaceutical and biotechnology industries.



About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best in class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages almost 50 years of experience in partnering with Global 1000 companies, emerging businesses and the investment community from 31 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.

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