



# Chiral Stationary Phases

## Chiral Chromatography

Chirality has become vitally important in the pharmaceutical, chemical and agricultural industries.

The differences that make compounds chiral can produce critically different pharmacological effects in biological systems. As a result, demand for stereoselective separation techniques and analytical assays to evaluate the enantiomeric purity of chiral compounds has increased.

Chiral chromatography has become a necessary tool—not only for the analytical determination of enantiomeric purity, but also for the isolation of pure enantiomers.



Regis Technologies is proud to be a leader in chiral separations that serves both the analytical and preparative needs of chromatographers and researchers worldwide. Regis offers three different classes of Chiral Stationary Phases (CSPs):

- Pirkle-Concept
- ChiroSil®, Crown Ether
- Protein-based

Regis manufactures a complete line of Pirkle Chiral Stationary Phases and columns at its pharmaceutical manufacturing facility. Columns range from analytical to preparative in size. A line of protein-based chiral stationary phases is also available. All products meet rigorous manufacturing and quality control specifications before release.

### Pirkle Stationary Phases

In 1980, Regis Technologies along with Professor William Pirkle of the University of Illinois, introduced the Pirkle Chiral Stationary Phases. These Chiral Stationary Phases offer many advantages:

- Enantiomer separation on a wide variety of compound groups
- Column durability resulting from covalent phase bonding
- Ability to invert elution order
- Availability of analytical- to preparative-sized columns and bulk packing material
- Universal solvent compatibility

### Enantiomer Separation

Regis manufactures 9 Pirkle CSPs. These can separate a wide variety of enantiomers in numerous compound groups. Examples include:

- Aryl Propionic Acid Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
- Agricultural Compounds
- Natural Products
- $\beta$ -Blockers
- Many Pharmaceuticals

Additional examples of enantiomer separations can be found in the Regis Chiral Application Guide or on our Web site at [www.registech.com/chiral](http://www.registech.com/chiral). Our Web site is updated monthly with new applications and current chiral events.



# Chiral Stationary Phases

## Chiral Chromatography

### Column Durability

The Pirkle CSPs are covalently bonded to the silica, providing excellent column durability. Covalently bonded phases assure long-lasting columns and offer added benefits for preparative columns. Our covalently bonded preparative columns are longer lasting than their coated preparative column counterparts because noncovalent coatings can leach off. Additional benefits include the columns' capacity to tolerate sample overload.

### Ability to Invert Elution Order

An important advantage of the Pirkle CSPs is the ability to invert elution order by using the same type of CSP, but with the opposite absolute configuration. As a result, it is possible to have the trace enantiomer elute before the major—a desirable feature for enantiomeric purity determinations. For preparative separations it is beneficial to elute the desired component first.

### Analytical and Preparative-Sized Columns

All of Regis' Pirkle HPLC columns are available in both analytical and preparative sizes. Since all chiral stationary phases are manufactured on-site, Regis can pack special or custom-sized columns quickly and easily.

### Universal Solvent Compatibility

Choice of mobile phase is not a limitation with the Pirkle HPLC columns. They are compatible with most mobile phases. The pH of the mobile phase, however, must be between 2.5 and 7.5. Both normal-phase and reversed-phase modes can be used, although normal-phase is most common. For normal-phase separations, the classic mobile phase is a binary or ternary mixture of a hydrocarbon and a modifier, usually an aliphatic alcohol.

Typical uncharged organic modifiers include ethanol, isopropanol and butanol. Under reversed-phase conditions, water-alcohol mixtures, or aqueous phosphate buffers with charged organic modifiers are also employed.

Supercritical Fluid Chromatography (SFC) utilizing carbon dioxide is now a proven technique for the separation of enantiomers using Pirkle CSPs.





# Chiral Stationary Phases

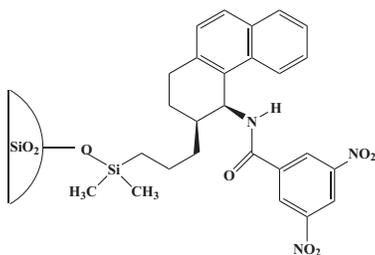
## Pirkle Chiral HPLC Columns

### Whelk-O® 1

#### Analytical to Preparative Columns

The Whelk-O 1 is useful for the separation of underivatized enantiomers in a number of families including amides, epoxides, esters, ureas, carbamates, ethers, aziridines, phosphonates, aldehydes, ketones, carboxylic acids, alcohols and non-steroidal anti-inflammatory drugs (NSAIDs). This  $\pi$ -electron acceptor/ $\pi$ -electron donor phase exhibits an extraordinary degree of generality. The broad versatility observed on the Whelk-O 1 column compares favorably with polysaccharide-derived chiral stationary phases.

In addition, because Whelk-O 1 is covalently bonded to the support, the phase is compatible with all commonly used mobile phases, including aqueous systems — a distinct advantage over polysaccharide derived chiral stationary phases. Other advantages include column durability, excellent efficiency, ability to invert elution order and excellent preparative capacity.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica</b>			
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	786101
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	786102
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	786105
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	786201
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	786202
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	786205
<b>Spherical Kromasil® Silica</b>			
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	780101
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	780102
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	780103
(S,S)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 50.0 mm i.d.	780104
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	780201
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	780202
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	780203
(R,R)-Whelk-O 1	5 $\mu\text{m}$ , 100Å	25 cm x 50.0 mm i.d.	780204
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(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	786615
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	786625
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 21.1 mm i.d.	786635
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 21.1mm i.d.	786645
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	786702
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 50.0 mm i.d.	786703
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 50.0 mm i.d.	786704
(S,S)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 30.0 mm i.d.	786716
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(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 4.6 mm i.d.	786515
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 10.0 mm i.d.	786525
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 21.1 mm i.d.	786535
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 21.1 mm i.d.	786545
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 30.0 mm i.d.	786708
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	25 cm x 50.0 mm i.d.	786709
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 50.0 mm i.d.	786710
(R,R)-Whelk-O 1	10 $\mu\text{m}$ , 100Å	50 cm x 30.0 mm i.d.	786713



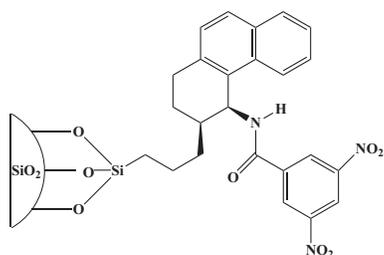
# Chiral Stationary Phases

## Pirkle Chiral HPLC Columns

### Whelk-O® 2

#### Analytical to Preparative Columns

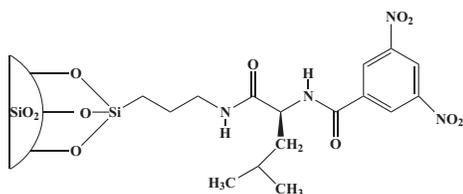
Our newest addition to the Whelk-O line of chiral stationary phases is the Whelk-O 2. The Whelk-O 2 is the covalent trifunctional version of the Whelk-O 1. The Whelk-O 2 retains the same chiral selector but incorporates a trifunctional linkage to the silica support. In most cases, the enantioselectivity remains the same as that obtained with the Whelk-O 1. Whelk-O 2 was designed to improve the resistance of the stationary phase to hydrolysis while using strong organic modifiers such as trifluoroacetic acid. The Whelk-O 2 is ideal for preparative separations since the material is bonded on 10 µm, 100Å spherical Kromasil silica. This allows the preparative chromatographer to perform method development on an analytical column and immediately scale up to larger diameter columns.



### Leucine

#### Analytical and Semi-Preparative Columns

The π-acceptor leucine CSP is based on 3,5-dinitrobenzoyl leucine, covalently bonded to 5 µm aminopropyl silica. Columns derived from either L- or D-leucine are available. This phase demonstrates enhanced enantioselectivities for several classes of compounds, including benzodiazepines.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Kromasil® Silica</b>			
(S,S)-Whelk-O 2	10 µm, 100Å	25 cm x 4.6 mm i.d.	786415
(S,S)-Whelk-O 2	10 µm, 100Å	25 cm x 10.0 mm i.d.	786425
(S,S)-Whelk-O 2	10 µm, 100Å	25 cm x 21.1 mm i.d.	786435
(S,S)-Whelk-O 2	10 µm, 100Å	50 cm x 21.1 mm i.d.	786445
(S,S)-Whelk-O 2	10 µm, 100Å	25 cm x 30.0 mm i.d.	786721
(S,S)-Whelk-O 2	10 µm, 100Å	25 cm x 50.0 mm i.d.	786722
(S,S)-Whelk-O 2	10 µm, 100Å	50 cm x 50.0 mm i.d.	786723
(S,S)-Whelk-O 2	10 µm, 100Å	50 cm x 30.0 mm i.d.	786736
<b>Spherical Silica:</b>			
(R,R)-Whelk-O 2	10 µm, 100Å	25 cm x 4.6 mm i.d.	786315
(R,R)-Whelk-O 2	10 µm, 100Å	25 cm x 10.0 mm i.d.	786325
(R,R)-Whelk-O 2	10 µm, 100Å	25 cm x 21.1 mm i.d.	786335
(R,R)-Whelk-O 2	10 µm, 100Å	50 cm x 21.1 mm i.d.	786345
(R,R)-Whelk-O 2	10 µm, 100Å	25 cm x 30.0 mm i.d.	786727
(R,R)-Whelk-O 2	10 µm, 100Å	25 cm x 50.0 mm i.d.	786728
(R,R)-Whelk-O 2	10 µm, 100Å	50 cm x 50.0 mm i.d.	786729
(R,R)-Whelk-O 2	10 µm, 100Å	50 cm x 30.0 mm i.d.	786732

Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
D-Leucine	5 µm, 100Å	25 cm x 4.6 mm i.d.	731054
D-Leucine	5 µm, 100Å	25 cm x 10.0 mm i.d.	731254
D-Leucine	5 µm, 100Å	25 cm x 21.1 mm i.d.	731354
<b>Spherical Silica:</b>			
L-Leucine	5 µm, 100Å	25 cm x 4.6 mm i.d.	731041
L-Leucine	5 µm, 100Å	25 cm x 10.0 mm i.d.	731241
L-Leucine	5 µm, 100Å	25 cm x 21.1 mm i.d.	731341



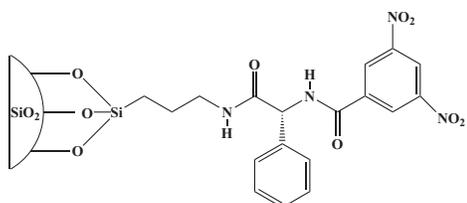
# Chiral Stationary Phases

## Pirkle Chiral HPLC Columns

### Phenylglycine

#### Analytical and Semi-Preparative Columns

Phenylglycine, a  $\pi$ -acceptor chiral phase, is based on 3,5-dinitrobenzoyl phenylglycine, covalently bonded to 5  $\mu\text{m}$  aminopropyl silica. Phenylglycine columns are available in both L- and D-configurations. This CSP resolves a wide variety of compounds containing  $\pi$ -basic groups, including: aryl-substituted cyclic sulfoxides, bi- $\beta$ -naphthol and its analogs,  $\alpha$ -indanol and  $\alpha$ -tetralol analogs, and aryl-substituted hydantoins.

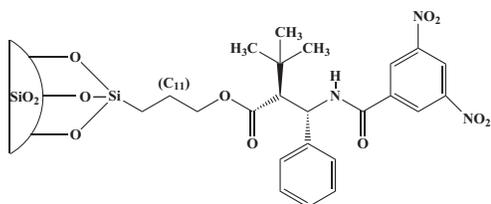


### $\beta$ -Gem 1

#### Analytical and Semi-Preparative Columns

$\beta$ -Gem1 is a  $\pi$ -acceptor chiral stationary phase and is prepared by covalently bonding N-3,5-dinitrobenzoyl-3-amino-3-phenyl-2-(1,1-dimethylethyl)propanoate, to 5  $\mu\text{m}$  silica through an ester linkage.

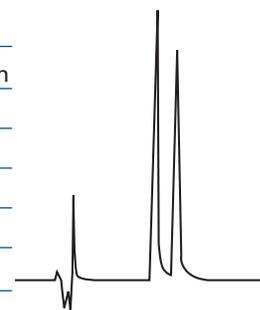
In many cases, this chiral phase considerably outperforms its widely used analog, phenylglycine. It can separate anilide derivatives of chiral carboxylic acids, including nonsteroidal anti-inflammatory agents.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
D-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731021
D-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731221
D-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731331
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L-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731024
L-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731224
L-Phenylglycine	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731334

### 1-Naphthylureaphenethylamine

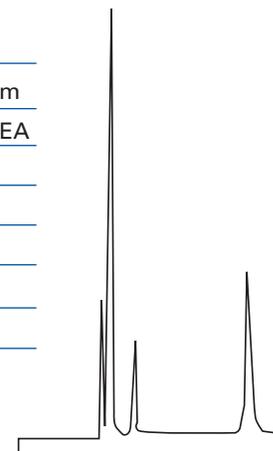
Column:	D-Phenylglycine	4.6 mm x 25 cm
Mobile Phase:	30% EtOH/Hexane	
Flow Rate:	1 ml/min	
Detection:	UV 254 nm	
Run Time:	10 min	
$k'_1$	2.37	
$\alpha$	1.22	



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
(R,R)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731043
(R,R)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731243
(R,R)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731343
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(S,S)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731029
(S,S)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731229
(S,S)- $\beta$ -GEM 1	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731329

### Tofisopam and its Conformers

Column:	(R,R)- $\beta$ -Gem 1	25 cm x 4.6 mm
Mobile Phase:	(70/30) Hexane/Ethanol + 0.1% TEA	
Flow Rate:	1.0 mL/min	
Detection:	UV 254 nm	
Run Time	25.0 min	
$k'_1$	2.66	
$\alpha$	3.13	





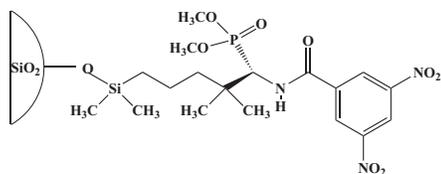
# Chiral Stationary Phases

## Pirkle Chiral HPLC Columns

### $\alpha$ -Burke 2

#### Analytical and Semi-Preparative Columns

The  $\alpha$ -Burke 2 phase is derived from dimethyl N-3,5-dinitro-benzoyl--amino-2,2-dimethyl-4-pentenyl phosphonate covalently bound to 5  $\mu\text{m}$  silica. This  $\pi$ -acceptor chiral stationary phase is particularly valuable in the HPLC separation of  $\beta$ -blocker enantiomers, an important class of cardiovascular drugs whose enantiomers often exhibit differing pharmacological activities. The  $\alpha$ -Burke 2 has been specifically designed to separate the enantiomers of  $\beta$ -blockers without chemical derivatization. In addition, it also resolves the enantiomers of many compounds separated on  $\pi$ -acceptor Pirkle type chiral stationary phases.

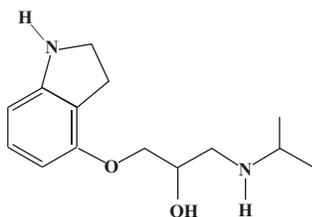


### Pirkle 1-J

#### Analytical and Semi-Preparative Columns

The Pirkle 1-J column is the latest in a series of CSPs from the research laboratories of Professor Pirkle. This new CSP contains an unusual  $\beta$ -lactam structure which significantly alters its molecular recognition properties. The Pirkle 1-J is useful for the direct separation of underivatized  $\beta$ -blocker enantiomers.

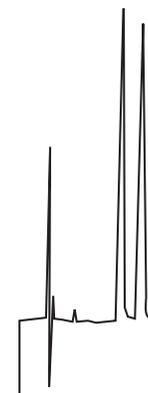
It can also be used for the separation of the enantiomers of arylpropionic acid NSAIDs, as well as other drugs.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
(S)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	735037
(S)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	735237
(S)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	735238
(R)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	735035
(R)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	735235
(R)- $\alpha$ -Burke 2	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	735236

#### Metroprolol

Column:	$\alpha$ -Burke 2 25 cm x 4.6 mm
Mobile Phase:	(85/10/5) $\text{CH}_2\text{Cl}_2/\text{EtOH}/\text{MeOH}$
Flow Rate:	1.0 mL/min
Detection:	UV 254 nm
Run Time	13.0 min
$k'_1$	2.66
$\alpha$	1.28



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
(3R,4S)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731044
(3R,4S)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731244
(3R,4S)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731344
(3S,4R)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	731045
(3S,4R)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	731245
(3S,4R)-Pirkle 1-J	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	731345

#### Prindolol

Column:	(3R, 4S)-Pirkle 1-J 25 cm x 4.6 mm
Mobile Phase:	(80/20) $\text{CH}_2\text{Cl}_2/\text{EtOH}+0.04\text{M}$ Ammonium Acetate
Flow Rate:	1.0 mL/min
Detection:	UV 254 nm
Run Time	11.0 min
$k'_1$	1.56
$\alpha$	2.06





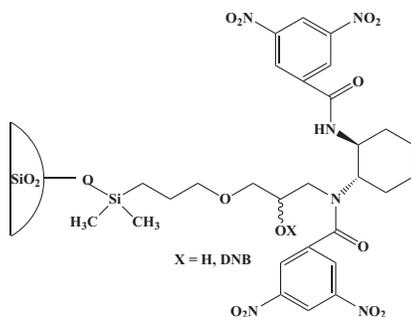
# Chiral Stationary Phases

## Pirkle Chiral HPLC Columns

### DACH-DNB

#### Analytical to Preparative Columns

The innovative DACH-DNB CSP was designed by Italian chemist, Professor Francesco Gasparrini with Dr. Villani and Dr. Misitiati, Rome University "La Sapienza." The DACH-DNB CSP, which contains the 3,5-dinitrobenzoyl derivative of 1,2-diaminocyclohexane, has been found to resolve a broad range of racemate classes including amides, alcohols, esters, ketones, acids, sulfoxides, phosphine oxides, selenoxides, phosphonates, thiophosphineoxide, phosphineselenide, phosphine-borane, beta-lactams, organometallics, atropisomers and heterocycles.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
(S,S)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	788201
(S,S)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	788202
(S,S)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 30.0 mm i.d.	788204
(R,R)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	788101
(R,R)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	788102
(R,R)-DACH-DNB	5 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 30.0 mm i.d.	788104
<b>Spherical Kromasil® Silica</b>			
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	788301
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	788302
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	788203
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 30.0 mm i.d.	788701
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 50.0 mm i.d.	788702
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	50 cm x 50.0 mm i.d.	788705
(S,S)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	50 cm x 30.0 mm i.d.	788715
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 4.6 mm i.d.	788401
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 10.0 mm i.d.	788402
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 21.1 mm i.d.	788103
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 30.0 mm i.d.	788707
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	25 cm x 50.0 mm i.d.	788708
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	50 cm x 50.0 mm i.d.	788709
(R,R)-DACH-DNB	10 $\mu\text{m}$ , 100 $\text{\AA}$	50 cm x 30.0 mm i.d.	788712

### Fluazifop-butyl

Column: (S,S)-DACH-DNB 25 cm x 4.6 mm

Mobile Phase: (95/5) Hexane/IPA

Temperature: 20° C

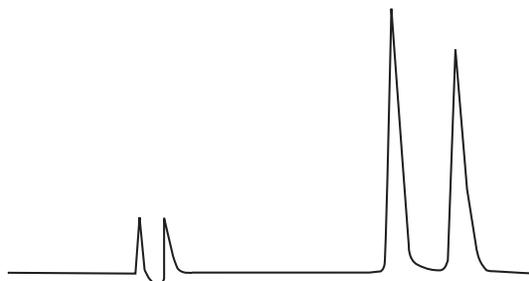
Flow Rate: 1.0 mL/min

Detection: UV 254 nm

Run Time 18.0 min

$k'_1$  4.70

$\alpha$  1.15





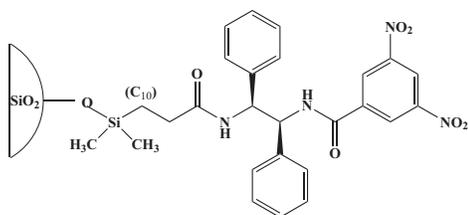
# Chiral Stationary Phases

## Pirkle Chiral HPLC Columns

### ULMO

#### Analytical to Preparative Columns

The ULMO chiral stationary phase was developed by Austrian researchers Dr. Georg Uray, Dr. Wolfgang Linder and Dr. Nobert Maier. The ULMO CSP is based on a 3,5-dinitrobenzoyl derivative of diphenylethylenediamine. This CSP has a general ability to separate the enantiomers of many racemate classes and is particularly good at separating the enantiomers of aryl carbinols.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
(S,S)-ULMO	5 µm, 100 Å	25 cm x 4.6 mm i.d.	787100
(S,S)-ULMO	5 µm, 100 Å	25 cm x 10.0 mm i.d.	787101
(S,S)-ULMO	5 µm, 100 Å	25 cm x 30.0 mm i.d.	787103
(R,R)-ULMO	5 µm, 100 Å	25 cm x 4.6 mm i.d.	787200
(R,R)-ULMO	5 µm, 100 Å	25 cm x 10.0 mm i.d.	787201
(R,R)-ULMO	5 µm, 100 Å	25 cm x 30.0 mm i.d.	787203
<b>Spherical Kromasil® Silica</b>			
(S,S)-ULMO	10 µm, 100 Å	25 cm x 4.6 mm i.d.	787300
(S,S)-ULMO	10 µm, 100 Å	25 cm x 10.0 mm i.d.	787301
(S,S)-ULMO	10 µm, 100 Å	25 cm x 21.1 mm i.d.	787102
(S,S)-ULMO	10 µm, 100 Å	25 cm x 30.0 mm i.d.	787701
(S,S)-ULMO	10 µm, 100 Å	25 cm x 50.0 mm i.d.	787702
(S,S)-ULMO	10 µm, 100 Å	50 cm x 50.0 mm i.d.	787703
(S,S)-ULMO	10 µm, 100 Å	50 cm x 30.0 mm i.d.	787715
(R,R)-ULMO	10 µm, 100 Å	25 cm x 4.6 mm i.d.	787400
(R,R)-ULMO	10 µm, 100 Å	25 cm x 10.0 mm i.d.	787401
(R,R)-ULMO	10 µm, 100 Å	25 cm x 21.1 mm i.d.	787202
(R,R)-ULMO	10 µm, 100 Å	25 cm x 30.0 mm i.d.	787707
(R,R)-ULMO	10 µm, 100 Å	25 cm x 50.0 mm i.d.	787708
(R,R)-ULMO	10 µm, 100 Å	50 cm x 50.0 mm i.d.	787709
(R,R)-ULMO	10 µm, 100 Å	50 cm x 30.0 mm i.d.	787712

### Vapof

Column: (R,R)-ULMO 25 cm x 4.6 mm

Mobile Phase: 100% Methanol

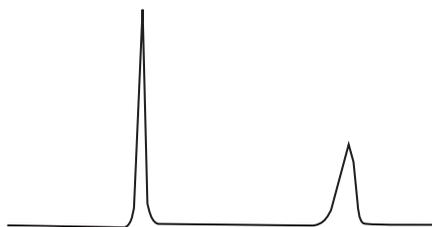
Flow Rate: 1.5 mL/min

Detection: UV 254 nm

Run Time 13.0 min

k'<sub>1</sub> 1.74

α 3.37





# Chiral Stationary Phases

## Protein-Based Chiral Stationary Phases

### Protein-Based Chiral Stationary Phases

Regis carries a line of protein-based chiral columns manufactured by ChromTech LTD. These include:

- Chiral AGP-( $\alpha$ -glycoprotein)
- Chiral CBH-(cellobiohydrolase)
- Chiral HSA-(human serum albumin)

For additional product information and a Protein-Based Stationary Phase Application Guide, please contact Regis at [sales@registech.com](mailto:sales@registech.com).

### Chiral AGP

#### *Micro, Analytical and Semi-Preparative Columns*

Chiral AGP is the second generation chiral selector based on the  $\alpha_1$ -acid glycoprotein ( $\alpha_1$ -AGP) as the chiral stationary phase. The AGP has been immobilized on spherical, 5  $\mu\text{m}$  particles. The Chiral AGP column is typically used in the reversed-phase mode, where it can be used for the resolution of an extremely broad range of chiral compounds, such as amines, (primary, secondary, tertiary and quaternary ammonium), acids, esters, sulphoxides, amides, and alcohols. The enantioselectivity and the retention can easily be regulated by the pH of the mobile phase, the buffer concentration and the nature and concentration of the organic modifier.

Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
Chiral AGP	5 $\mu\text{m}$	10 cm x 2.0 mm i.d.	732196
Chiral AGP	5 $\mu\text{m}$	15 cm x 2.0 mm i.d.	732197
Chiral AGP	5 $\mu\text{m}$	5 cm x 4.0 mm i.d.	732198
Chiral AGP	5 $\mu\text{m}$	15 cm x 4.0 mm i.d.	732199
Chiral AGP	5 $\mu\text{m}$	10 cm x 4.0 mm i.d.	732200
Chiral AGP	5 $\mu\text{m}$	5 cm x 2.0 mm i.d.	732201
Chiral AGP	5 $\mu\text{m}$	5 cm x 3.0 mm i.d.	732203
Chiral AGP	5 $\mu\text{m}$	10 cm x 10.0 mm i.d.	732301
Chiral AGP	5 $\mu\text{m}$	15 cm x 10.0 mm i.d.	732302
Chiral AGP	5 $\mu\text{m}$	1 cm x 3.0 mm i.d. guard	732300



# Chiral Stationary Phases

## Protein-Based Chiral Stationary Phases

### Chiral CBH

#### *Micro, Analytical and Semi-Preparative Columns*

Cellobiohydrolase (CBH) is a stable enzyme which has been immobilized onto 5  $\mu\text{m}$  spherical silica particles. The column is used in reversed-phase mode and is effective for the separation of enantiomers of basic drugs from many compound classes. The retention and the enantioselectivity can be regulated by changes in pH, buffer concentration and the nature and concentration of organic modifier.

Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
Chiral CBH	5 $\mu\text{m}$	10 cm x 4.0 mm i.d.	732350
Chiral CBH	5 $\mu\text{m}$	15 cm x 4.0 mm i.d.	732351
Chiral CBH	5 $\mu\text{m}$	5 cm x 4.0 mm i.d.	732352
Chiral CBH	5 $\mu\text{m}$	10 cm x 2.0 mm i.d.	732353
Chiral CBH	5 $\mu\text{m}$	15 cm x 2.0 mm i.d.	732354
Chiral CBH	5 $\mu\text{m}$	10 cm x 10.0 mm i.d.	732355
Chiral CBH	5 $\mu\text{m}$	15 cm x 10.0 mm i.d.	732356
Chiral CBH	5 $\mu\text{m}$	1 cm x 3.0 mm i.d. guard	732358

### Chiral HSA

#### *Analytical and Semi-Preparative Columns*

With the Chiral human serum albumin (HSA) column, the enantiomers of many carboxylic acids and amino acids can be resolved directly, without derivatization. Enantioselectivity and retention can be regulated by changing the mobile phase composition, pH, buffer concentration and/or nature of the organic modifier. HSA has been immobilized onto 5  $\mu\text{m}$  spherical silica particles. The surface chemistry of the silica and the method of immobilization provide a stable chiral separation material.

Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
Chiral HSA	5 $\mu\text{m}$	10 cm x 2.0 mm i.d.	732202
Chiral HSA	5 $\mu\text{m}$	15 cm x 2.0 mm i.d.	732238
Chiral HSA	5 $\mu\text{m}$	15 cm x 4.0 mm i.d.	732239
Chiral HSA	5 $\mu\text{m}$	10 cm x 4.0 mm i.d.	732240
Chiral HSA	5 $\mu\text{m}$	5 cm x 4.0 mm i.d.	732241
Chiral HSA	5 $\mu\text{m}$	5 cm x 3.0 mm i.d.	732242
Chiral HSA	5 $\mu\text{m}$	5 cm x 2.0 mm i.d.	732243
Chiral HSA	5 $\mu\text{m}$	10 cm x 10.0 mm i.d.	732341
Chiral HSA	5 $\mu\text{m}$	15 cm x 10.0 mm i.d.	732342
Chiral HSA	5 $\mu\text{m}$	1 cm x 3.0 mm i.d. guard	732340



# Chiral Stationary Phases

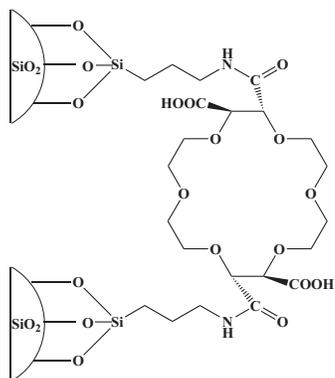
## Crown Ether Phase

### ChiroSil®

#### Analytical to Preparative Columns

The ChiroSil® RCA(+) and SCA(-) chiral stationary phases were developed by RStech Corporation in Daejeon, South Korea. This phase is prepared by a covalent trifunctional bonding of (+) or (-)-(18-Crown-6)-tetracarboxylic acid as the chiral selector. The covalent bonding ensures universal solvent compatibility and allows operation under ambient conditions. Columns are available in both enantiomeric forms to allow the scientist to invert elution order by simply switching columns.

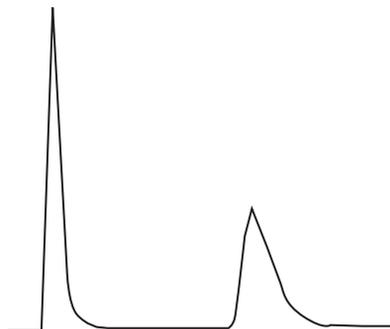
This chiral stationary phase is the choice for the separation of amino acids and compounds containing primary amines on the analytical or preparative scale.



Product	Particle Size	Column Dimensions	Catalog #
<b>Spherical Silica:</b>			
ChiroSil® SCA(-)	5 µm, 100Å	15 cm x 4.6 mm i.d.	799101
ChiroSil® SCA(-)	5 µm, 100Å	25 cm x 4.6 mm i.d.	799102
ChiroSil® SCA(-)	5 µm, 100Å	25 cm x 10.0 mm i.d.	799106
ChiroSil® SCA(-)	5 µm, 100Å	25 cm x 21.1 mm i.d.	799105
ChiroSil® SCA(-)	5 µm, 100Å	25 cm x 30.0 mm i.d.	799107
ChiroSil® RCA(+)	5 µm, 100Å	15 cm x 4.6 mm i.d.	799001
ChiroSil® RCA(+)	5 µm, 100Å	25 cm x 4.6 mm i.d.	799002
ChiroSil® RCA(+)	5 µm, 100Å	25 cm x 10.0 mm i.d.	799006
ChiroSil® RCA(+)	5 µm, 100Å	25 cm x 21.1 mm i.d.	799005
ChiroSil® RCA(+)	5 µm, 100Å	25 cm x 30.0 mm i.d.	799007

### Phenylglycine

Column:	ChiroSil® RCA(+) or SCA(-) 15 cm x 4.6 mm
Mobile Phase:	(70/30) CH <sub>3</sub> OH/H <sub>2</sub> O +10 mM H <sub>2</sub> SO <sub>4</sub> and 0.1% TEA
Flow Rate:	1.0 mL/min
Detection:	UV 210 nm
Run Time	13.1 min
k' <sub>1</sub>	3.14
α	2.60



To request a copy of the Chiral HPLC Application Guide containing additional Chiral Applications contact us by phone, **800.323.8144 ext. 662** **847.967.6000 ext. 662** or e-mail, [sales@registech.com](mailto:sales@registech.com)