pH Flexibility
Expands Robustness and Reproducibility

- High Efficiency
- Excellent Lifetime
- pH Stable 1-12
Setting the Standard for pH Method Development

Gemini columns are rugged reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations.

- Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity
- Expect longer column lifetime with patented TWIN-NX™ technology
- For analytical and preparative separations of basic and acidic compounds

TWIN™ (Two-In-One) Technology

Gemini C18 and C6-Phenyl

During the final stage of silica manufacturing a unique silica-organic layer is grafted to create a completely new composite particle. Since the internal base silica is unaltered by this manufacturing process, the particle retains its mechanical strength and rigidity along with excellent efficiency, while the silica-organic shell protects the particle from chemical attack.

Second-Generation TWIN-NX Technology

Gemini NX-C18

TWIN-NX technology uses an improved patented organo-silica grafting process which incorporates highly stabilizing ethane cross-linking. These organic groups are evenly incorporated into the grafted layers on the silica surface while maintaining a pure silica core. This not only provides resistance to high pH attack, but also maintains the high efficiency and mechanical strength of a silica particle.
Gemini NX-C18 Tested for Extreme Durability in Changing Mobile Phase pH

- pH stable 1-12 for durability
- Consistent performance in both volatile and non-volatile buffers
- High sample loading capacity for metabolite identification and preparative purification

Gemini NX-C18

- pH Stability: 1.0 – 12.0
- Particle Size: 3 µm, 5 µm, and 10 µm
- Phase: C18
- Application: Small molecules, basic compounds
- Strength: Most durable pH stable particle
- Pore Size (Å): 110
- Surface Area (m²/g): 375
- Carbon Load %: 14
- End Capping: TMS

How It Works

Gemini NX-C18
Ethane Cross-Linking
Resists High pH Attack

- Multi-Point Ligand Attachment Resists Low pH Ligand Cleavage
- vs.
- Standard Silica
Silica Dissolution

Gemini NX-C18

- High sample loading capacity for metabolite identification and preparative purification

Column Efficiencies Maintained in High pH Testing for 20 Cycles

Stable Efficiencies After Exposure to 10,000 Column Volumes of High and Low pH Buffers

Retention Times of Four Probes Maintained in Neutral pH Testing for 20 Cycles

Retention Times Maintained After Exposure to 10,000 Column Volumes of High and Low pH Buffers

Column Used:
- Column: Gemini 5 µm NX-C18
- Dimensions: 150 x 4.6 mm
- Part No.: 00F-4454-E0

Phenomenex | WEB: www.phenomenex.com
Polar Bases (Antihistamines) in Formic Acid

Conditions for all columns:
- Dimensions: 150 x 4.6 mm
- Mobile Phase: 
  - A: 0.1 % Formic Acid in Water
  - B: 0.1 % Formic Acid in Acetonitrile
- Gradient: 
  A/B (90:10) to (50:50) in 10 min
- Flow Rate: 1.5 mL/min
- Temperature: Ambient
- Detection: UV @ 210 nm

Sample:
1. Pyrilenamine
2. Tripelennamine
3. Chlorpheniramine
4. Brompheniramine
5. Chloropyramine
6. Diphenhydramine
7. Loratadine

Comparative separations may not be representative of all applications.
Hydrophobic Basic Drugs at Low pH (pH 2.7)

Hydrophobic Bases (Diltiazem, Promethazine) in Formic Acid Columns:
- Gemini 5 µm NX-C18
- XBridge 5 µm C18
- ZORBAX 5 µm Extend-C18
- Hypersil GOLD 5 µm C18

Conditions for all columns:
- Dimensions: 150 x 4.6 mm
- Mobile Phase: A: 0.1 % Formic Acid in Water
  B: 0.1 % Formic Acid in Acetonitrile
- Gradient: A/B (95:5) to (5:95) in 10 min
- Flow Rate: 1.0 mL/min
- Temperature: Ambient
- Detection: UV @ 254 nm
- Sample: 1. Diltiazem
  2. Promethazine

Comparative separations may not be representative of all applications.
Performance in Volatile Buffers

With the widespread adoption of LC/MS and LC/MS/MS techniques, column performance in volatile buffers is critical.

Mixtures of Acids, Neutrals, and Bases in Formic Acid (pH 2.7)

Columns:
- Phenomenex Gemini 5 µm NX-C18
- Waters® XBridge® 5 µm C18
- Agilent Technologies® ZORBAX® 5 µm Extend-C18
- Thermo Scientific® Hypersil GOLD® 5 µm C18

Conditions for all columns:
- Dimensions: 150 x 4.6 mm
- Mobile Phase: A: 0.1 % Formic Acid in Water
  B: 0.1 % Formic Acid in Acetonitrile
- Gradient: A/B (95:5) to (20:80) in 8 min, Hold for 2 min
- Flow Rate: 1.5 mL/min
- Temperature: Ambient
- Detection: UV @ 254 nm

Sample:
- 1. Pyridine
- 2. Guanidine
- 3. Sulfathiazole
- 4. Triprolidine
- 5. Benzyl alcohol
- 6. Nortriptyline
- 7. Phenol
- 8. 3-Methyl-4-nitrobenzoic acid
- 9. Methylsalicylaldehyde
- 10. Hexanophenone

Comparative separations may not be representative of all applications.
Performance in Non-Volatile Buffers

Gemini was engineered to be the column of choice for pharmaceutical scientists who work with difficult sample mixtures and harsh mobile phase conditions. The consistent performance and rugged phase will provide simplified method development and long column lifetimes.

**Mixtures of Acids, Neutrals, and Bases in Potassium Phosphate (pH 2.5)**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Conditions for all columns:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gemini 5µm NX-C18</td>
<td>Dimensions: 150 x 4.6mm</td>
</tr>
<tr>
<td>XBridge 5µm C18</td>
<td>Mobile Phase: A: 20 mM Potassium Phosphate pH 2.5</td>
</tr>
<tr>
<td>ZORBAX 5µm Extend-C18</td>
<td>B: Acetonitrile</td>
</tr>
<tr>
<td>Hypersil GOLD 5µm C18</td>
<td>Gradient: A/B (95:5) to (20:80) in 8 min, Hold for 2 min</td>
</tr>
<tr>
<td></td>
<td>Flow Rate: 1.5 mL/min</td>
</tr>
<tr>
<td></td>
<td>Temperature: Ambient</td>
</tr>
<tr>
<td></td>
<td>Detection: UV @ 254 nm</td>
</tr>
</tbody>
</table>

| Sample                  |  |
|-------------------------|  |
| 1. Pyridine              | 6. Phenol |
| 2. Quinidine             | 7. Nortriptyline |
| 3. Sulfathiazole         | 8. 3-Methyl-4-nitrobenzoic acid |
| 4. Triprolidine          | 9. Methylsalicylaldehyde |

Comparative separations may not be representative of all applications.
- Increased loading and retention of basic compounds
- Silica efficiency and mechanical strength
- pH stable 1–12 for durability

Chromatographic Comparisons

Tricyclic Antidepressants at Neutral pH

Conditions for all columns:
- Dimensions: 150 x 4.6 mm
- Mobile Phase: 20 mM Phosphate buffer, pH 7.0/ Acetonitrile/ Methanol (30:35:35)
- Flow Rate: 1.5 mL/min
- Detection: UV @ 254 nm
- Sample: 1. Nortriptyline
  2. Imipramine
  3. Amitriptyline
  4. Clomipramine

Batch-to-Batch Reproducibility

Extended Column Lifetime

The TWIN™ Technology engineering of Gemini provides stability and increased column lifetime. Whether used under isocratic or gradient conditions, Gemini out-performs and outlasts pH stable columns. This is illustrated below.

Lifetime and Efficiency Comparison

*Efficiency and lifetime comparison based on average of two columns each run in parallel.

Columns fail after 50% loss in efficiency.

Comparative separations may not be representative of all applications.
Enhanced Performance for Aromatic Compounds

Sulfa Drug Application

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Pursuit 5 µm Diphenyl</th>
<th>Gemini 5 µm C6-Pheny</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_s$,1</td>
<td>1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>$R_s$,2</td>
<td>9.8</td>
<td>16.0</td>
</tr>
</tbody>
</table>

Conditions for all columns:
- Dimensions: 150 x 4.6 mm
- Mobile Phase: 0.1 % Formic Acid in Water/Methanol (70:30)
- Flow Rate: 1.0 mL/min
- Temperature: Ambient
- Detection: UV @ 254 nm
- Sample: 1. Sulfathiazole
  2. Sulfamerazine
  3. Sulfamethoxazole

Reproducible Phenyl Phase

Aliphatic Acid Application

Conditions for all columns:
- Column: Gemini 5 µm C6-Phenyl
- Dimensions: 150 x 4.6 mm
- Part No.: 00F-4444-E0
- Mobile Phase: 20 mM Phosphate buffer, pH 2.5/Methanol (97:3)
- Flow Rate: 1.0 mL/min
- Temperature: Ambient
- Detection: UV @ 220 nm
- Sample: 1. Tartaric Acid
  2. Malic Acid
  3. Lactic Acid
  4. Acetic Acid
  5. Citric Acid
  6. Propionic Acid

Low Bleed Phenyl Phase

Conditions for all columns:
- Dimensions: 150 x 3.0 mm
- Mobile Phase: A: 0.1 % Formic acid in Water,
  B: 0.1 % Formic acid in Acetonitrile
- Gradient: 5% B to 95% B in 10 min, then hold 95% B for 2 min
- Flow Rate: 0.6 mL/min
- Temperature: Ambient
- MS Detection: ESI + ion mode,
  M/Z 100-700

Comparative separations may not be representative of all applications.
Axia Packing Technology

Axia packed preparative columns involve a single axial compression step unlike conventional packed preparative columns. The ideal column bed density is custom calculated and automated for each specific media and column size. Computer control of the entire process ensures both proper bed density and column uniformity every time.

During the Axia packing process, the packing piston is locked in place, eliminating any decompression and then recompression of the media sorbent, thus maintaining media and column bed integrity. This solves common lifetime and performance problems associated with conventional packing processes for preparative columns.

Axia Technology vs. Traditional “OBD” Prep Column Packing

Traditional Slurry Packing

Traditional slurry packing processes, like the Waters® OBD™ (Optimum Bed Density) column packing approach, involve the column being removed from the column packing station once it is packed.

Several potential problems with this packing method are:

- Variability in column performance due to increased number of manual operations required for assembly
- Potential silica media damage during recompression
- Level of process control is based on traditional slurry packing technology

Conventional Packing Process Involves:

Compression → Decompression → Recompression → Final Column

Diagram from Waters Corporation U.S. Patent No. 7,399,410
Axia packed columns produce uniform media bed with intact particles

The highly tuned patented process and hardware eliminates potential decompression ensuring bed stability and optimal packing density.

The media found on the inlet frit of the Axia packed column shows no signs of damage unlike the media found on inlet frit of traditionally packed prep columns.

Traditional packed preparative columns produce non-uniform media beds with sheared and crushed particles

Decompression and then recompression during packing can damage the media and lead to increased column-to-column variability, flow disturbances, and decreased column lifetimes.

Dramatically improve sample resolution, productivity and performance of any preparative column media with Axia column hardware and packing technology. Axia packed prep column offers the opportunity for longer lifetime, higher loading and increased throughput.

<table>
<thead>
<tr>
<th>Packing Material</th>
<th>Particle Size (µm)</th>
<th>Pore Size (Å)</th>
<th>Surface Area (m²/g)</th>
<th>Carbon Load (%)</th>
<th>pH Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gemini C18</td>
<td>3, 5, 10</td>
<td>110</td>
<td>375</td>
<td>14</td>
<td>1.0-12.0</td>
</tr>
<tr>
<td>Gemini C6-Phenyl</td>
<td>3, 5</td>
<td>110</td>
<td>375</td>
<td>12</td>
<td>1.0-12.0</td>
</tr>
<tr>
<td>Gemini NX-C18</td>
<td>3, 5, 10</td>
<td>110</td>
<td>375</td>
<td>14</td>
<td>1.0-12.0</td>
</tr>
</tbody>
</table>

Comparative separations may not be representative of all applications.

*SEM of Axia inlet frit
*SEM of Waters® OBD™ inlet frit

Dramatically improve sample resolution, productivity and performance of any preparative column media with Axia column hardware and packing technology. Axia packed prep column offers the opportunity for longer lifetime, higher loading and increased throughput.
Separating basic compounds at higher pH levels produces dramatic changes when compared to low pH conditions. At pH 10.5, the basic compounds become neutralized and are more hydrophobic. The retention for the uncharged basic compounds increases providing an increase in separation along with superior peak shapes.

Tip:
If you want longer Gemini NX-C18 Axia packed column lifetimes, request technical note: TN-1138 Increase Column Performance and Lifetime in Peptide and Protein Purification using Aggressive Wash Conditions

Our Phenomenex Gemini and Luna Axia packed columns are the workhorses in our lab. These columns exhibit outstanding performance for challenging separations while also handling a high workload for standard separations. Longevity has also been excellent with some columns lasting 2 years or more. Dependability is so important in my line of work and these columns never disappoint!!

-Major Pharmaceutical Company, USA
Kinetex EVO C18: Superior Core-Shell Upgrade

- Higher sensitivity and efficiency without increase in backpressure
- Superior peak shape for bases
- Greater cost savings

The unique organo-silica layer of ethane cross-linking found within each Kinetex EVO C18 particle creates a highly inert surface which provides the additional benefit of better peak shape for bases. With the combination of rugged pH stability from 1-12 and the core-shell performance advantage, you can easily replace old hybrid silica columns and gain immediate method improvements without increasing backpressure!

When Compared to Waters® XBridge® C18:

- Phenomenex Kinetex 5 µm EVO C18
  - Pressure: 143 bar
  - What an increase in sensitivity and peak shape!

- Waters XBridge 3.5 µm C18
  - Pressure: 364 bar

- Waters XBridge 5 µm C18
  - Pressure: 171 bar

Comparative separations may not be representative of all applications.

For Ordering Information and to Learn More about the Kinetex Family visit: www.phenomenex.com/Kinetex
Protect your Columns from Contaminants

- Extends HPLC column lifetime
- Won’t alter chromatography
- Compatible with virtually all HPLC columns
- Easy to determine when to change cartridge
- Simple to use

How Does It Work?

The SecurityGuard analytical cartridge holder (patented) directly fingertightens into virtually any manufacturer’s column with a female/inverted endfitting. Contaminants are retained by an inexpensive disposable cartridge instead of damaging your valuable HPLC column investment.

Increases HPLC Column Lifetime, Guaranteed!

Simply replace SecurityGuard cartridges instead of your expensive HPLC columns. In this graph, once the expired SecurityGuard cartridge was replaced, the pressure immediately dropped and the column performance was restored allowing for extended column use.

Accelerated lifetime test using endogenous biomolecule matrix on a reversed phase C18 column, 5µm, 50 x 4.6mm with SecurityGuard C18 cartridges. Backpressure values represent additional backpressure contributed by SecurityGuard.

See it in Action!
Visit: www.phenomenex.com/securityguard
## Ordering Information

### 3 μm Microbore, Minibore and MidBore™ Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard™ Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 1.0</td>
<td></td>
</tr>
<tr>
<td>20 x 2.0</td>
<td></td>
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<tr>
<td>30 x 2.0</td>
<td></td>
</tr>
<tr>
<td>50 x 2.0</td>
<td></td>
</tr>
<tr>
<td>100 x 2.0</td>
<td></td>
</tr>
<tr>
<td>150 x 2.0</td>
<td></td>
</tr>
<tr>
<td>50 x 3.0</td>
<td></td>
</tr>
<tr>
<td>100 x 3.0</td>
<td></td>
</tr>
<tr>
<td>150 x 3.0</td>
<td></td>
</tr>
<tr>
<td>4 x 2.0*</td>
<td></td>
</tr>
</tbody>
</table>

- **C18**
  - 00B-4439-A0
  - 00D-4439-A0
  - 00F-4439-A0
  - 00G-4439-A0
  - AJ0-8368

- **C6-Phenyl**
  - 00A-4443-A0
  - 00B-4443-A0
  - 00D-4443-A0
  - 00F-4443-A0
  - 00G-4443-A0
  - AJ0-8368

- **NX-C18**
  - 00B-4453-A0
  - 00M-4453-A0
  - 00A-4453-A0
  - 00B-4453-A0
  - 00D-4453-A0
  - 00F-4453-A0
  - 00G-4453-A0
  - AJ0-8367

### 3 μm Analytical Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard™ Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 x 4.0</td>
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</tr>
<tr>
<td>30 x 4.6</td>
<td></td>
</tr>
<tr>
<td>50 x 4.6</td>
<td></td>
</tr>
<tr>
<td>100 x 4.6</td>
<td></td>
</tr>
<tr>
<td>150 x 4.6</td>
<td></td>
</tr>
<tr>
<td>250 x 4.6</td>
<td></td>
</tr>
<tr>
<td>4 x 3.0*</td>
<td></td>
</tr>
</tbody>
</table>

- **C18**
  - 00M-4439-B0
  - 00D-4439-B0
  - 00F-4439-B0
  - 00G-4439-B0
  - AJ0-7596

- **C6-Phenyl**
  - 00A-4444-B0
  - 00B-4444-B0
  - 00F-4444-B0
  - 00G-4444-B0
  - AJ0-9156

- **NX-C18**
  - 00B-4453-E0
  - 00M-4453-E0
  - 00A-4453-E0
  - 00B-4453-E0
  - 00D-4453-E0
  - 00F-4453-E0
  - 00G-4453-E0
  - AJ0-8368

### 5 μm Minibore and MidBore Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard™ Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 x 2.0</td>
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<tr>
<td>50 x 2.0</td>
<td></td>
</tr>
<tr>
<td>150 x 2.0</td>
<td></td>
</tr>
<tr>
<td>250 x 2.0</td>
<td></td>
</tr>
<tr>
<td>50 x 3.0</td>
<td></td>
</tr>
<tr>
<td>100 x 3.0</td>
<td></td>
</tr>
<tr>
<td>150 x 3.0</td>
<td></td>
</tr>
<tr>
<td>250 x 3.0</td>
<td></td>
</tr>
<tr>
<td>4 x 2.0*</td>
<td></td>
</tr>
</tbody>
</table>

- **C18**
  - 00A-4435-B0
  - 00D-4435-B0
  - 00F-4435-B0
  - 00G-4435-B0
  - AJ0-7598

- **C6-Phenyl**
  - 00A-4444-B0
  - 00D-4444-B0
  - 00F-4444-B0
  - 00G-4444-B0
  - AJ0-9156

- **NX-C18**
  - 00B-4454-B0
  - 00D-4454-B0
  - 00F-4454-B0
  - 00G-4454-B0
  - AJ0-8368

### 5 μm Analytical Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard™ Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 x 4.6</td>
<td></td>
</tr>
<tr>
<td>50 x 4.6</td>
<td></td>
</tr>
<tr>
<td>100 x 4.6</td>
<td></td>
</tr>
<tr>
<td>150 x 4.6</td>
<td></td>
</tr>
<tr>
<td>250 x 4.6</td>
<td></td>
</tr>
<tr>
<td>4 x 3.0*</td>
<td></td>
</tr>
</tbody>
</table>

- **C18**
  - 00A-4435-E0
  - 00D-4435-E0
  - 00F-4435-E0
  - 00G-4435-E0
  - AJ0-7596

- **C6-Phenyl**
  - 00A-4444-E0
  - 00D-4444-E0
  - 00F-4444-E0
  - 00G-4444-E0
  - AJ0-9156

- **NX-C18**
  - 00B-4454-E0
  - 00M-4454-E0
  - 00A-4454-E0
  - 00B-4454-E0
  - 00D-4454-E0
  - 00F-4454-E0
  - AJ0-8368

### 5 μm Semi-Prep Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 x 10</td>
<td>10/pk</td>
</tr>
<tr>
<td>250 x 10</td>
<td>10/pk</td>
</tr>
<tr>
<td>10 x 10</td>
<td>10/pk</td>
</tr>
</tbody>
</table>

- **C18**
  - 00F-4435-N0
  - 00G-4435-N0
  - AJ0-7598

- **C6-Phenyl**
  - 00A-4444-N0
  - 00D-4444-N0
  - AJ0-9156

- **NX-C18**
  - 00B-4454-N0
  - 00G-4454-N0
  - AJ0-8368

### Axia™ Packed Preparative Columns (mm)

<table>
<thead>
<tr>
<th>Phases</th>
<th>SecurityGuard Cartridges (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 x 21.2</td>
<td>15 x 21.2*</td>
</tr>
<tr>
<td>150 x 21.2</td>
<td>15 x 30.0*</td>
</tr>
<tr>
<td>250 x 21.2</td>
<td>15 x 30.0*</td>
</tr>
<tr>
<td>50 x 30</td>
<td>15 x 30.0*</td>
</tr>
<tr>
<td>75 x 30</td>
<td>15 x 30.0*</td>
</tr>
</tbody>
</table>

- **C18**
  - 00B-4435-P0-AX
  - 00D-4435-P0-AX
  - 00F-4435-P0-AX
  - 00G-4435-P0-AX
  - AJ0-7846

- **C6-Phenyl**
  - 00B-4444-P0-AX
  - 00D-4444-P0-AX
  - 00F-4444-P0-AX
  - 00G-4444-P0-AX
  - AJ0-9156

- **NX-C18**
  - 00B-4454-P0-AX
  - 00M-4454-P0-AX
  - 00A-4454-P0-AX
  - 00B-4454-P0-AX
  - 00D-4454-P0-AX
  - 00F-4454-P0-AX
  - 00G-4454-P0-AX
  - AJ0-8370

- **10 μm**
  - 00C-4436-P0-AX
  - 00D-4436-P0-AX
  - 00F-4436-P0-AX
  - 00G-4436-P0-AX
  - AJ0-8371

- **10 μm**
  - 00B-4436-U0-AX
  - 00D-4436-U0-AX
  - 00F-4436-U0-AX
  - 00G-4436-U0-AX
  - AJ0-8371

- **NX-C18**
  - 00B-4455-P0-AX
  - 00M-4455-P0-AX
  - 00A-4455-P0-AX
  - 00B-4455-P0-AX
  - 00D-4455-P0-AX
  - 00F-4455-P0-AX
  - 00G-4455-P0-AX
  - AJ0-8371

**Guarantee**

If Gemini analytical columns do not provide at least an equivalent separation as compared to a competing column of the same particle size, similar phase and dimensions, return the column with comparative data within 45 days for a full refund.
pH Flexibility

Expands Robustness and Reproducibility

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  auinfo@phenomenex.com

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  anfrage@phenomenex.com

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  beinfo@phenomenex.com

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  info@phenomenex.com

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  f: +33 (01) 30 09 21 11
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