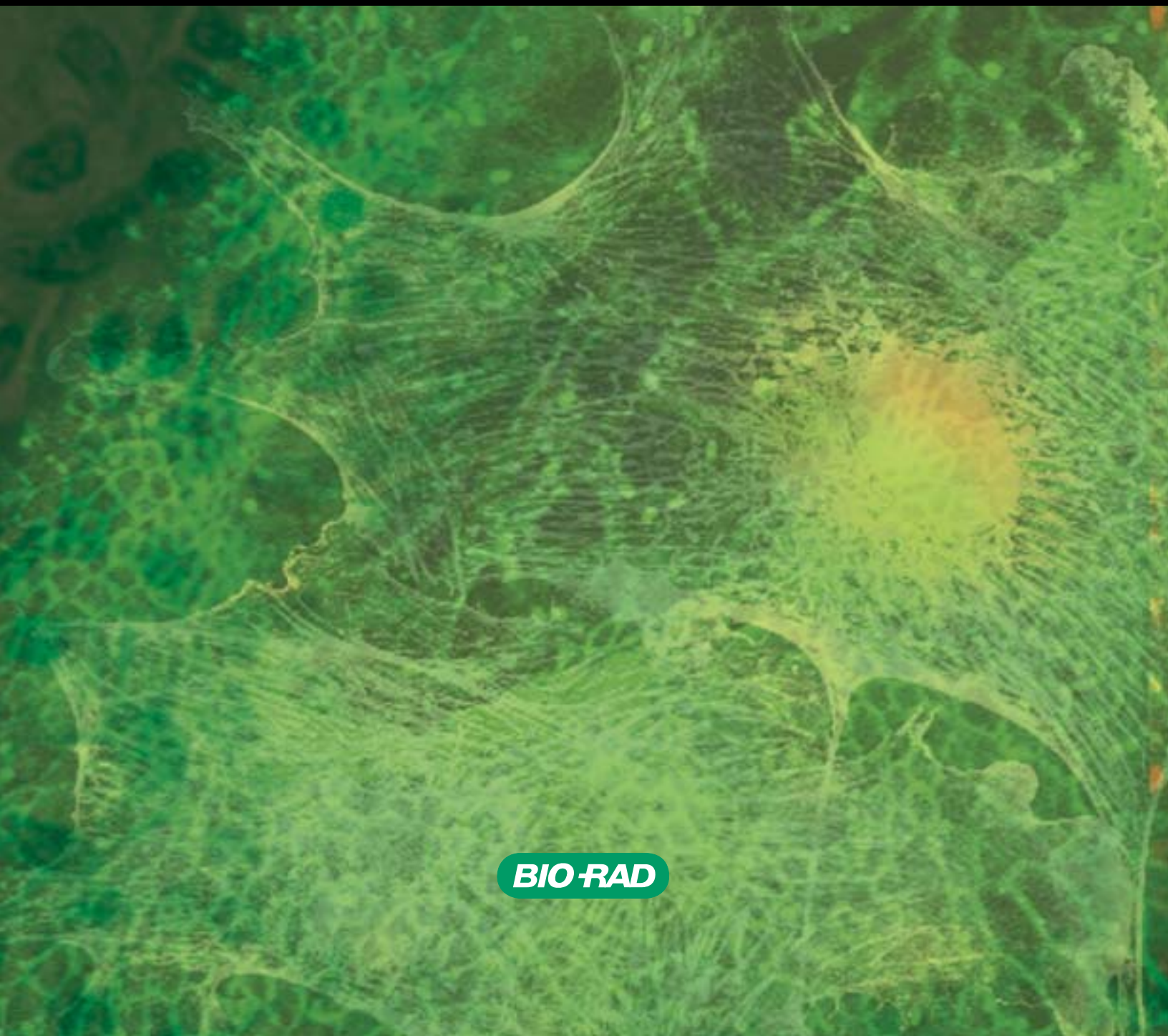


2-D Electrophoresis

Tools for Rapid, High-Resolution Protein Separations



BIO-RAD



Expression proteomics defines patterns of proteins expressed in different biological samples. Bio-Rad's approach to expression proteomics focuses on three technologies: sample preparation, two-dimensional (2-D) electrophoresis, and imaging and analysis.

Resolution of Complex Mixtures in Two Dimensions

2-D electrophoresis is one of the most powerful protein separation techniques available. It has the ability to resolve complex mixtures of thousands of proteins simultaneously in a single gel. In the first dimension, proteins are separated by isoelectric point (pI), while in the second dimension, they are separated by molecular weight. Standardization of this technique has simplified the process and improved gel-to-gel reproducibility.

Depending on the experiment, requirements for resolution, throughput, and speed may vary. For example, when sample preparation conditions are being developed, speed is more important than resolution or throughput. Resolution is more important for analyzing complicated proteomes, whereas throughput is important when many samples must be run.

Bio-Rad addresses these varying requirements by offering choices for all components of the 2-D process, including IPG strips, gels, and electrophoresis systems. Mini systems allow speed during the initial phases of experimentation and screening, while large systems provide maximum loading capacity and area for separation when resolution is important.

First-Dimension Separation

The PROTEAN® IEF System

The PROTEAN IEF system ensures rapid, reproducible first-dimension separations, whether you're screening an entire proteome or searching for a specific protein. You can tailor your strategy to your sample using convenient ReadyStrip™ IPG strips, available in a wide range of pI ranges and strip lengths for maximum flexibility.

Second-Dimension Separation

Maximum Speed

Mini Gels — Mini-PROTEAN® 3 System

This compact system is designed for speed, and includes the two-gel Mini-PROTEAN 3 cell and the high-throughput Mini-PROTEAN 3 Dodeca™ cell. Setup is fast and simple, facilitating rapid sample optimization, method development, and targeted protein analysis. Choose from precast gels in a wide range of polyacrylamide percentages to optimize separation for your sample.

Speed/Resolution

Midi Gels — Criterion™ System

Bio-Rad's Criterion midi gel system is an excellent choice when you need both speed and resolution. You can quickly check experimental results in a Criterion cell or answer complex biological questions with the high-throughput Criterion Dodeca cell. Criterion precast gels provide resolution comparable to a large format gel but run fast enough to let you generate 2-D data from your sample in a single day; they're available in a wide range of polyacrylamide percentages in both standard and extended shelf-life formulations.

Maximum Resolution

Large Gels — PROTEAN II and PROTEAN® Plus Systems

For the highest-resolution separations, or to accommodate larger protein loads, choose from large format cells that are compatible with 17 cm (PROTEAN II XL cell and PROTEAN II XL multi-cell) or 24 cm IPG strips (PROTEAN Plus Dodeca cell). Whether your sample requires maximum flexibility or maximum throughput, these cells meet your needs for reproducible high-resolution results. Precast Tris-HCl gels are available that fit each of these cells.

Visualization

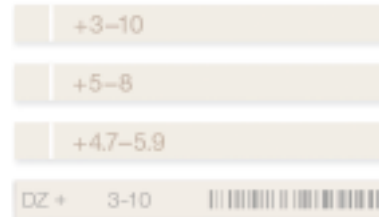
Staining

After 2-D electrophoresis, choose from a variety of reliable stains for protein detection.

Stainers

New Dodeca stainers are designed for reproducible staining of up to 12 gels at a time. Bio-Rad also offers accessory products to facilitate handling of large or fragile gels during staining.

First-Dimension Separation



ReadyStrip IPG strips are preprinted to indicate anode end (+) and pH range; in addition, a bar code is printed on the 24 cm strip.

PROTEAN IEF System

PROTEAN IEF Cell

Unbeatable Performance for First-Dimension Separation

- Optimized for first-dimension IEF
- Simple, reproducible, and efficient separations
- Integrated cup loading ability for resolution of proteins at extreme pH ranges

Cup Loading Tray

Improved Resolution by IEF at Extreme pH Ranges

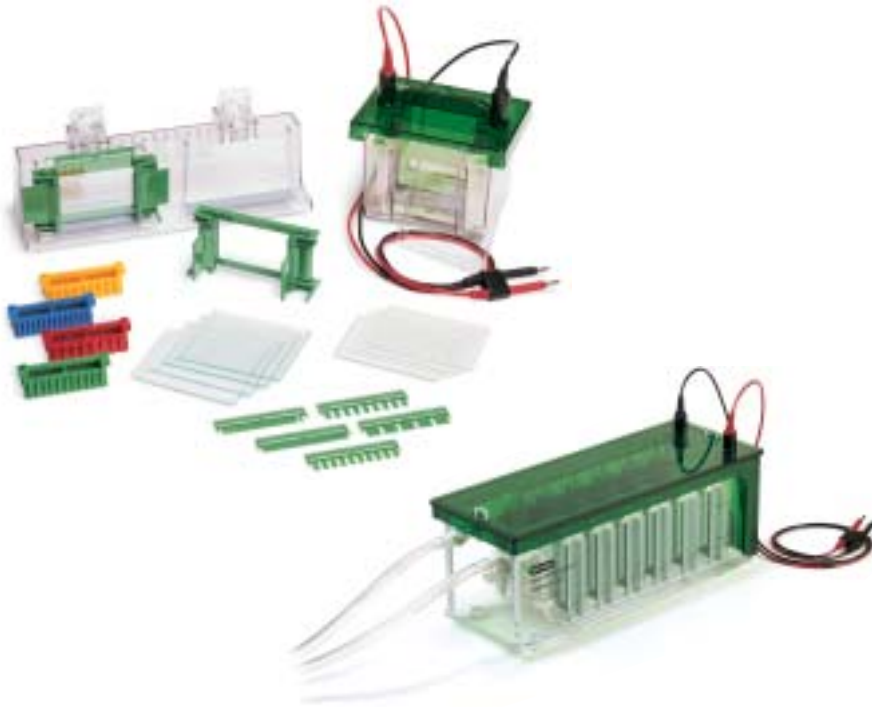
- Cup loading expands the range of applications for first-dimension IEF using the PROTEAN IEF cell
- Sample loading method optimizes resolution of proteins that have pIs at extreme pH ranges

ReadyStrip IPG Strips

The Highest Resolution Over the Broadest pH Range

- Easy-to-use strips that yield high-quality, reproducible separations
- Available in 7, 11, 17, 18, and 24 cm lengths, all with micro, narrow, and broad pH ranges

Second-Dimension Separation



Example

Application: In-line quality control evaluation, where the next step in manufacturing is waiting on the results of the 2-D test.

Challenge: Searching for changes of a few proteins in a specific molecular weight and pI range, where only a few samples are to be run and the results are needed as early as possible.

Need: Rapid, reproducible separations.

Recommended approach: The fastest 2-D results can be obtained with the Mini-PROTEAN 3 cell.

Mini 2-D Gel Electrophoresis System

Mini-PROTEAN® 3 System

Facilitates Fastest 2-D Results

- Accommodates 7 cm IPG strips
- Capacity to run up to 12 gels simultaneously to accommodate high-throughput needs
- Versatility — both handcast and precast gel options
- Enhanced reproducibility of second-dimension separation with cooling coils that prevent overheating and stirbars that maintain uniform temperature
- Easy assembly, facilitated by a newly designed clamping frame

- Convenient buffer draining via the built-in quick-connect drain port
- Compact footprint that saves benchspace
- Accessory products that facilitate other applications
- 1-D configuration also available

For accessories see Related Products.

Second-Dimension Separation



Example

Application: Separation of protein interaction complexes or immunoprecipitation experiments, where there are hundreds of proteins and a large number of samples to process.

Challenge: Analysis of changes in protein patterns with a subset of proteins in the sample and many samples to run.

Need: Rapid separations with high-throughput gel processing.

Recommended approach: For the optimal combination of resolution, speed, and gel capacity, try the Criterion Dodeca system with its extra-wide precast gels.

Midi 2-D Gel Electrophoresis System

Criterion System

The Best Combination of Speed and Resolution

- Accommodates 11 cm IPG strips
- Capacity to run up to 12 gels simultaneously to accommodate high-throughput needs
- Precast gels with 12-month shelf life and room temperature storage
- Built-in cooling coil that attaches to an external refrigerated circulator to prevent overheating and ensure the highest resolution
- Stirbar capability that maintains uniform buffer temperatures for reproducible runs
- Locator slots to slide the gel cassettes into place without alignment hassles or bulky clamps

- Leak-free design — the patented upper buffer chamber is integrated into the gel cassette
- A cassette opener built into the cell for easy gel access in a single step
- Convenient buffer draining via the built-in quick-connect drain port
- Compact footprint that saves benchspace
- 1-D configuration also available

For accessories see Related Products.

Second-Dimension Separation



	Precast Gel Options	Handcast Gel Options	Sample Application	Maximum # of Gels Run
PROTEAN II*				
Multi-cell	Yes	Yes	17 cm IPG strips	6
XL cell	Yes	Yes	17 cm IPG strips	2
PROTEAN Plus	Yes	Yes	18 and 24 cm IPG strips	12

* PROTEAN II system can also be configured to accommodate 1-D applications.

Example

Application: A screening project to identify statistically significant changes in protein patterns among many patient samples and controls over a time course of disease progression.

Challenge: Monitoring protein expression changes for all proteins in a project with complex samples and many gels to run.

Need: High-resolution separations and high-throughput gel processing.

Recommended approach: For the maximum resolution and throughput required by a large 2-D project, use either broad-range or narrow-range 24 cm ReadyStrip IPG strips and PROTEAN Plus precast gels in the PROTEAN Plus Dodeca cell.

Large 2-D Gel Electrophoresis Systems

PROTEAN II System

A Flexible Fit for Extreme Versatility

- High-resolution separation — 17 cm precast gels and IPG strips
- Application flexibility — ability to reconfigure between 1-D and 2-D options
- Gel capacity flexibility — run 2, 4, or 6 gels at one time depending on your needs; start with 2-gel capacity with flexibility to expand to 6 using the multi-cell option

PROTEAN Plus System

The Approach for Ultimate Resolution

- Largest format available for the best resolution — 24 cm precast gels and IPG strips
- Dedicated high-throughput system; bar coding on precast gels and IPG strips
- Enhanced reproducibility due to simultaneous multi-gel runs
- Capacity to run 12 gels at a time

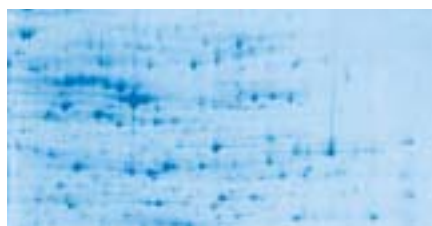
For accessories see Related Products

Visualization

SYPRO Ruby



Coomassie Blue



Silver



Staining Options

Protein Stain	Sensitivity	Linear Range	Cost	Imaging System Requirements	Mass Spectrometry Compatibility
Bio-Safe™ Coomassie G-250 stain	5–10 ng	2 orders of magnitude	++	Densitometer	+++++
Coomassie Blue R-250 stain	10–25 ng	2 orders of magnitude	+	Densitometer	+++++
Silver stain kit (Merril method)	0.5–1 ng	1 order of magnitude	+++	Densitometer	Not compatible
Silver Stain Plus™ kit	0.5–1 ng	1 order of magnitude	+++	Densitometer	++
Dodeca silver stain	0.5–1 ng	1 order of magnitude	+++	Densitometer	+++
SYPRO Ruby protein gel stain	0.5–1 ng	3 orders of magnitude	+++++	Fluorescent imaging system	++++

Choices for Protein Visualization

Proteins vary in their interaction with stains, and a protein spot that can be seen in a gel using one staining protocol may not be visible when a different stain is applied. Therefore, it is important to evaluate the efficacy of multiple stains with each new sample and select the best. The most popular gel stains are Coomassie Blue R-250 and colloidal Coomassie Blue G-250. These stains are less sensitive than other protein stains but interact uniformly with all proteins. Silver stains are more sensitive; however, they have a

limited dynamic range and do not bind to all proteins uniformly. The dye emerging as the favorite for proteomics applications is SYPRO Ruby. Demonstrating sensitivity comparable to silver stains but with a dynamic range of 3 orders of magnitude, this dye can help you accurately quantitate protein changes between treated and control samples.

Stainers



Stainer Compatibility With Different Gel Sizes

	Gel Size (W x L)	Gel Format
Large Dodeca stainer	25.6 x 23 cm	PROTEAN Plus precast
	25 x 20.5 cm	PROTEAN Plus handcast (require one attachment per tray)
Small Dodeca stainer	20 x 20.5 cm	PROTEAN Plus handcast
	18.5 x 20 cm	PROTEAN II XL handcast
	18.3 x 19.3 cm	PROTEAN II XL precast
	16 x 20 cm	PROTEAN II xi handcast
	16 x 16 cm	PROTEAN II xi handcast and precast
	13.3 x 8.7 cm	Criterion (up to 24 gels, require one attachment per tray)

High-Throughput Stainers

Dodeca Stainers

The Dodeca stainers facilitate staining multiple gels at once to ensure high-quality, consistent results. These stainers accommodate up to 12 large format gels simultaneously. The Dodeca stainers feature a shaking mechanism integrated into the design, eliminating the need to purchase a separate shaker. The patent-pending shaking design allows gentle, consistent, and

thorough staining. Dodeca stainers also include a shaking rack that allows all 12 gels to be easily managed as a single unit. The Dodeca stainers are compatible with Bio-Safe Coomassie stain, Coomassie Blue R-250 stain, SYPRO Ruby protein gel stain, and the new mass spectrometry-compatible Dodeca silver stain kit.

Precast Gels

Availability of 2-D Gel Types for Precast Gel Systems Based on Application

Gel Types	Criterion	Ready Gel	PROTEAN II	PROTEAN Plus	Application	Sample Buffer	Running Buffer
Bis-Tris	•				SDS-PAGE for small to large proteins	XT	XT MOPS or XT MES
Tris-acetate	•				SDS-PAGE for large proteins Native PAGE	XT Native	XT Tricine Tris/glycine
Tris-HCl	•	•	•	•	SDS-PAGE Native PAGE	Laemmli Native	Tris/glycine/SDS Tris/glycine
Tris-Tricine	•	•			SDS-PAGE for peptides, small proteins	Tricine	Tris/Tricine/SDS



Mini Gels

Ready Gel® Precast Gels

These gels can be run in less than an hour. They accommodate 7 cm IPG strips and are compatible with both the Mini-PROTEAN 3 cell and the Mini-PROTEAN 3 Dodeca cell. In addition to a wide range of polyacrylamide gels with the traditional Tris-HCl buffer formulation for SDS-PAGE, Ready Gel precast gels are available in buffer formulations suitable for peptide analysis and other applications.

Midi Gels

Criterion Precast Gels

Designed for the Criterion and Criterion Dodeca cells, Criterion gels are longer and wider than standard mini gels. They accommodate 11 cm IPG strips for SDS-PAGE, or up to 26 lanes of samples per gel for 1-D applications. Criterion gels are available in a wide range of polyacrylamide percentages and gradients with the traditional Tris-HCl formulation. For even more options for protein separation, extended shelf-life gels are available in Tris-acetate and Bis-Tris buffer formulations. Formulations are also available for other applications.

Large Gels

Bio-Rad offers two types of precast gels for large format cells.

PROTEAN II Precast Gels

For the PROTEAN II cell and multi-cell, PROTEAN II Ready Gel Tris-HCl precast gels are available with an IPG well to accommodate 17 cm IPG strips. Slightly smaller gels are available for 1-D applications.

PROTEAN Plus Precast Gels

For the high-throughput PROTEAN Plus Dodeca cell, PROTEAN Plus Tris-HCl gels accommodate 24 cm IPG strips. These gels contain an embedded bar code for sample tracking.

Related Products



Key

1. Multi-casting chamber
2. ReadyPrep 2-D starter kit
3. AnyGel stands
4. Premixed buffers

Buffers, Reagents, and Other Tools

ReadyPrep™ 2-D Starter Kit

This complete set of reagents to perform 2-D gel electrophoresis under highly controlled conditions allows you to focus on technique and provides a solution for validating your 2-D system.

Premixed Buffers for Gel Casting

Premixed buffers are made with Bio-Rad's electrophoresis-purity reagents and are quality controlled to ensure reproducible results.

Preparative Electrophoresis Tools

The Rotofor® cell performs liquid-phase IEF and is a powerful complementary first-dimension

separation tool for large, hydrophobic, or other proteins that are poorly resolved by traditional IEF. The Model 491 prep cell performs preparative-scale, high-resolution separation of proteins by continuous-elution gel electrophoresis.

Multi-Casting Chambers

Simultaneously cast up to 12 gels to fit our different gel formats. Gradient gels are cast through a bottom filling port to ensure reproducibility. The PROTEAN Plus multi-casting chamber has hinged spacer plates to allow easy alignment of large gels during casting.

Gradient Formers

Use Bio-Rad's gradient formers to pour linear, concave, or convex exponential acrylamide gradients for optimal separation of proteins of interest.

AnyGel™ Stands

These stations for docking and prepping gels safely hold any size gel cassette. Ideal for hand casting, loading IPG strips, or transitioning from IEF to a Dodeca cell, these stands give you the third hand you need.

Gel Clip

The gel clip facilitates handling of large gels without tearing.

Support



Research and Development

Bio-Rad's expression proteomics R&D team develops ideas into reliable research tools. By continuing to make 2-D electrophoresis a more reproducible and robust technology, R&D helps customers to focus on research, rather than perfecting techniques. Bio-Rad welcomes your suggestions for improving 2-D electrophoresis or other expression proteomics tools.

Global Technical Support

Bio-Rad has over 30 years of experience in 2-D technology. Our worldwide technical support staff is highly trained, and can advise you on how to obtain good results.

Application Support

Bio-Rad's expression proteomics experts offer field support to customers worldwide. Each specialist has a solid understanding of the technology and research experience that will help you find solutions to your experimental needs.

Sales Support

Bio-Rad's trained, knowledgeable customer support staff operates worldwide. They can help you choose the best system to fit your particular needs.

For more information, contact your local Bio-Rad sales representative or visit us on the Web at www.expressionproteomics.com

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