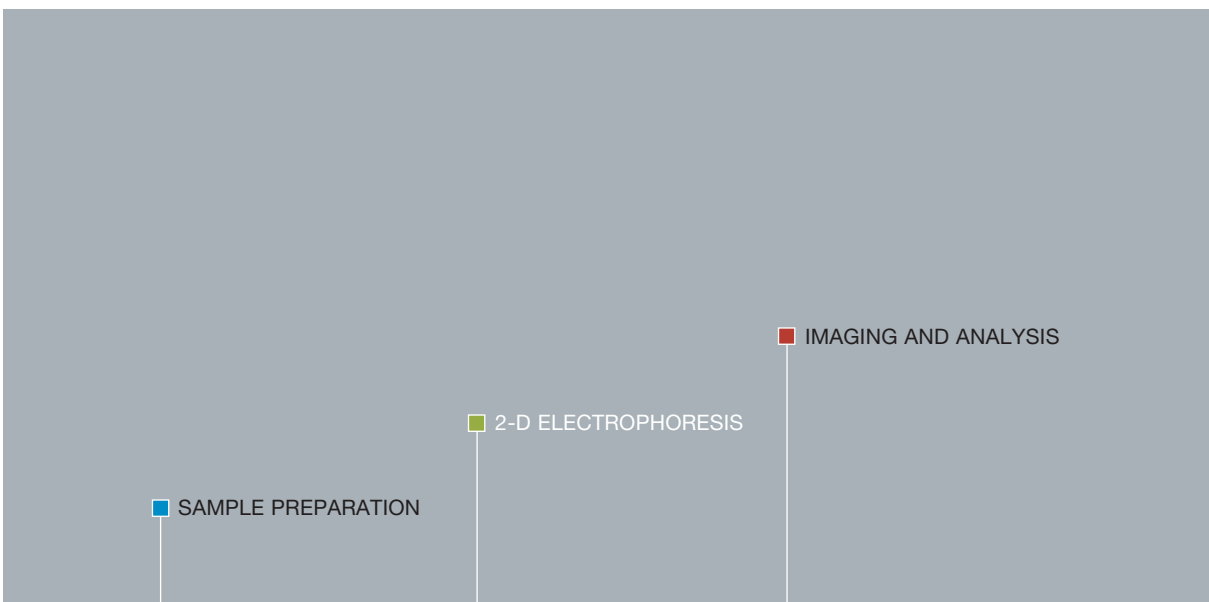


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## 2-D Electrophoresis

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.

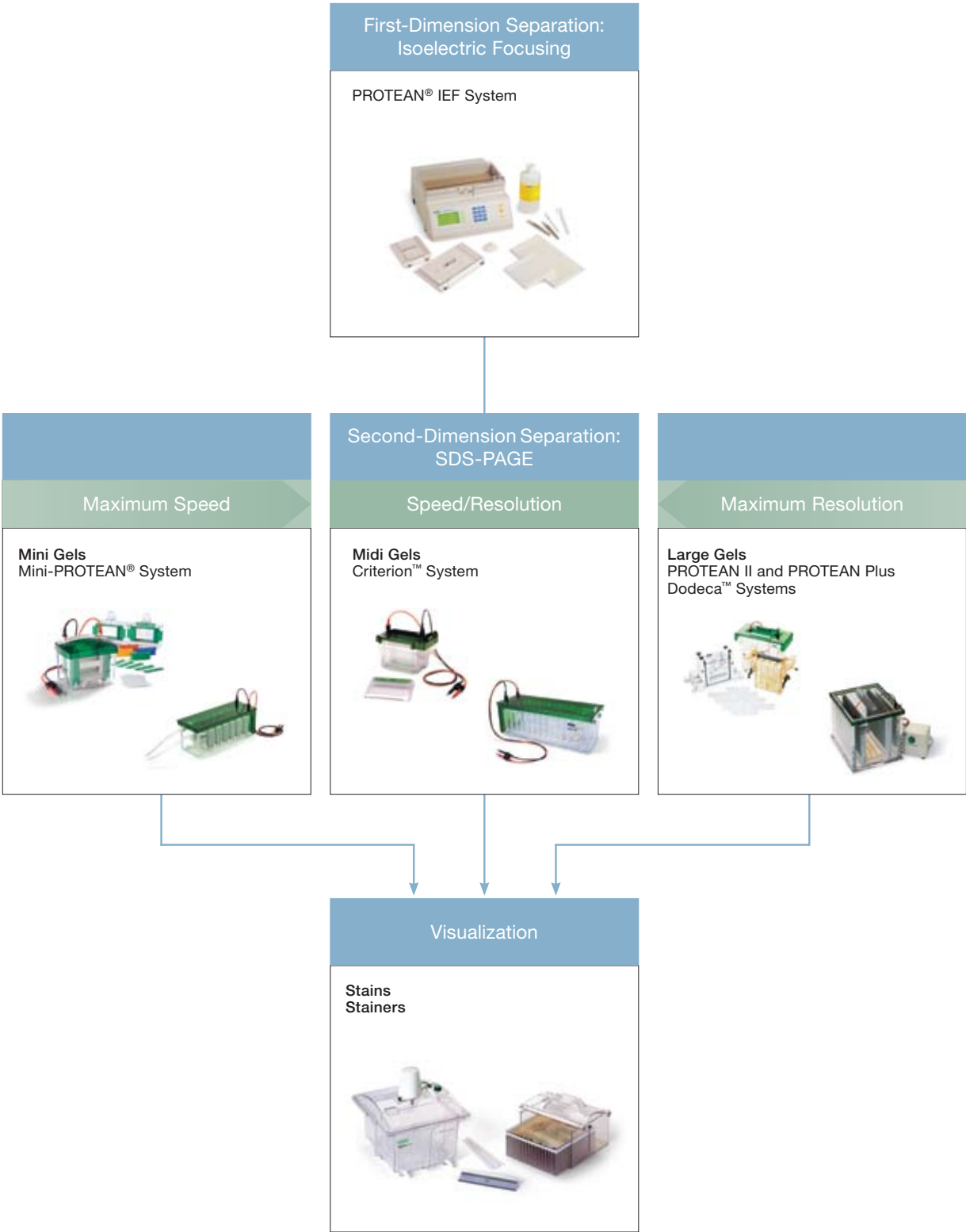
### Resolution of Complex Mixtures in Two Dimensions

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.

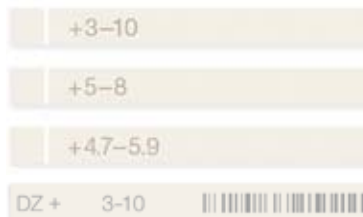
Depending on the experiment, requirements for resolution, throughput, and speed may vary. For example, when sample preparation conditions are being developed, speed is more important than resolution or throughput. Whereas resolution is more important for analyzing complicated proteomes, throughput is 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.

2-D Workflow



## 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

The PROTEAN IEF system ensures rapid, reproducible first-dimension isoelectric focusing (IEF), 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.

### PROTEAN IEF Cell

- Optimized for first-dimension IEF
- Provides simple, reproducible, and efficient separations
- Offers preset methods and real-time editing for maximum flexibility
- Can run up to 24 (7 cm) or 12 (11, 17, 18, or 24 cm) IPG strips simultaneously

### Cup Loading Tray

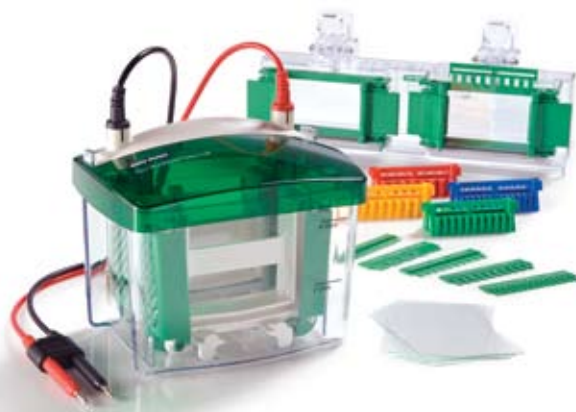
- Expands the range of applications for first-dimension IEF using the PROTEAN IEF cell
- Optimizes resolution of proteins that have pIs at extreme pH ranges

### ReadyStrip IPG Strips

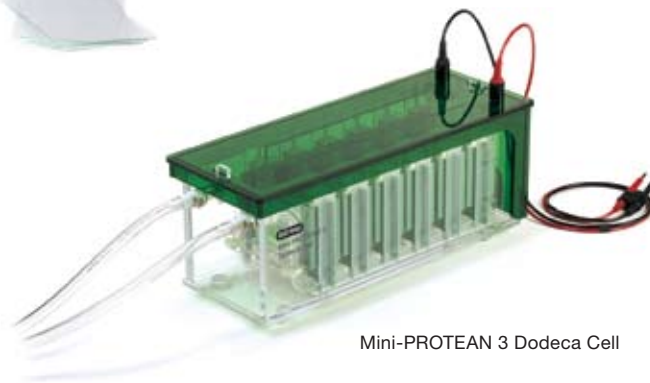
- Easy-to-use strips that yield high-quality, reproducible separations
- Available in 7, 11, 17, 18, and 24 cm lengths, all with micro, narrow, and broad pH ranges

For accessories, see Related Products.

## Second-Dimension Separation



Mini-PROTEAN Tetra Cell



Mini-PROTEAN 3 Dodeca Cell

## Mini 2-D Gel Electrophoresis System

### Mini-PROTEAN System

This compact system is designed for speed and includes the four-gel Mini-PROTEAN Tetra cell and the high-throughput Mini-PROTEAN 3 Dodeca cell (for separation of up to 12 gels). 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.

- Accommodates 7 cm IPG strips
- Accommodates both handcast and Ready Gel® precast gels
- Available complete with combs, plates, and casting accessories for 10-well, 0.75 mm, 1.0 mm, and 1.5 mm thick gels (IPG combs also available)
- Supports other casting modules with specific well type and thickness configurations
- Incorporates cooling units and stirbars to prevent overheating and maintain uniform buffer temperatures for reproducible runs
- 1-D configuration also available

For accessories, see Related Products.

## Second-Dimension Separation



Criterion Cell



Criterion Dodeca Cell

## Midi 2-D Gel Electrophoresis System

### 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 (for 1–2 gels) or answer complex biological questions with the high-throughput Criterion Dodeca cell (for up to 12 gels). Criterion precast gels provide increased resolution over a mini gel system 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.

- Accommodates 11 cm IPG strips
- Precast gels with 12-month shelf life and room temperature storage
- Cooling units and stirbars to prevent overheating and maintain 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
- 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
- 1-D configuration also available

For accessories, see Related Products.



PROTEAN II System



PROTEAN Plus Dodeca Cell

	Precast Gel Options	Handcast Gel Options	IPG Strips	Maximum # of Gels Run
<b>PROTEAN II*</b>				
XL cell	Yes	Yes	17 cm	2
XL multi-cell	Yes	Yes	17 cm	6
<b>PROTEAN Plus</b>	No	Yes	18 and 24 cm	12

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

## Large 2-D Gel Electrophoresis Systems

### PROTEAN II System and PROTEAN Plus Dodeca Cell

For the highest-resolution separations, or to accommodate larger protein loads, choose from large format cells that are compatible with 17 cm IPG strips (PROTEAN II XL cell and 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 for the PROTEAN II system.

### PROTEAN II System

- High-resolution separation — 17 cm IPG strips and precast gels
- 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

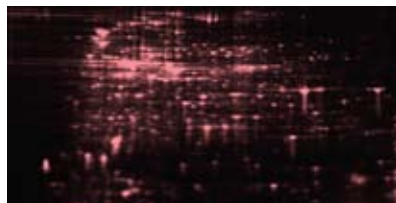
### PROTEAN Plus Dodeca Cell

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

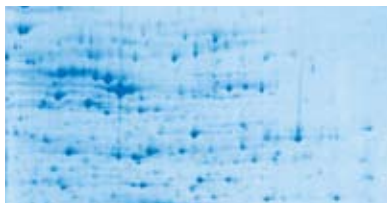
For accessories, see Related Products.

## Visualization

Flamingo™



Coomassie Blue



Silver



## Staining Options

Protein Stain	Lower Limit of 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	1–10 ng	3 orders of magnitude	+++++	Fluorescent imaging system	++++
Flamingo fluorescent gel stain	0.25–0.5 ng	>3 orders of magnitude	++++	Fluorescent imaging system	+++++

## Stains for Protein Visualization

Proteins vary in their interactions with stains. A protein spot that can be visualized 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 stains that generate the best results.

The most popular gel stains are Coomassie Blue R-250 and Bio-Safe Coomassie G-250. These stains are less sensitive than other protein stains, but they interact uniformly with all proteins. Silver stains are more sensitive; however, they have a limited dynamic range and do not react with all proteins uniformly.

The more sensitive Flamingo fluorescent gel stain is ideal for nonspecific visualization and quantitation of proteins in SDS-PAGE gels. It uses an easy two-step protocol that can be completed in as little as 5 hours and does not require destaining. It is ideally suited for use with high-performance laser-based imaging systems, such as the Molecular Imager® PharosFX™ system. Moreover, the steps are not time-sensitive, and the dye will not overstain the gels.





### Stainer Compatibility With Different Gel Sizes

	Gel Size (W x L)	Gel Format
Large Dodeca stainer	25 x 20.5 cm	PROTEAN Plus handcast (requires 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
	13.3 x 8.7 cm	Criterion (up to 24 gels, requires one attachment per tray)

## High-Throughput Stainers

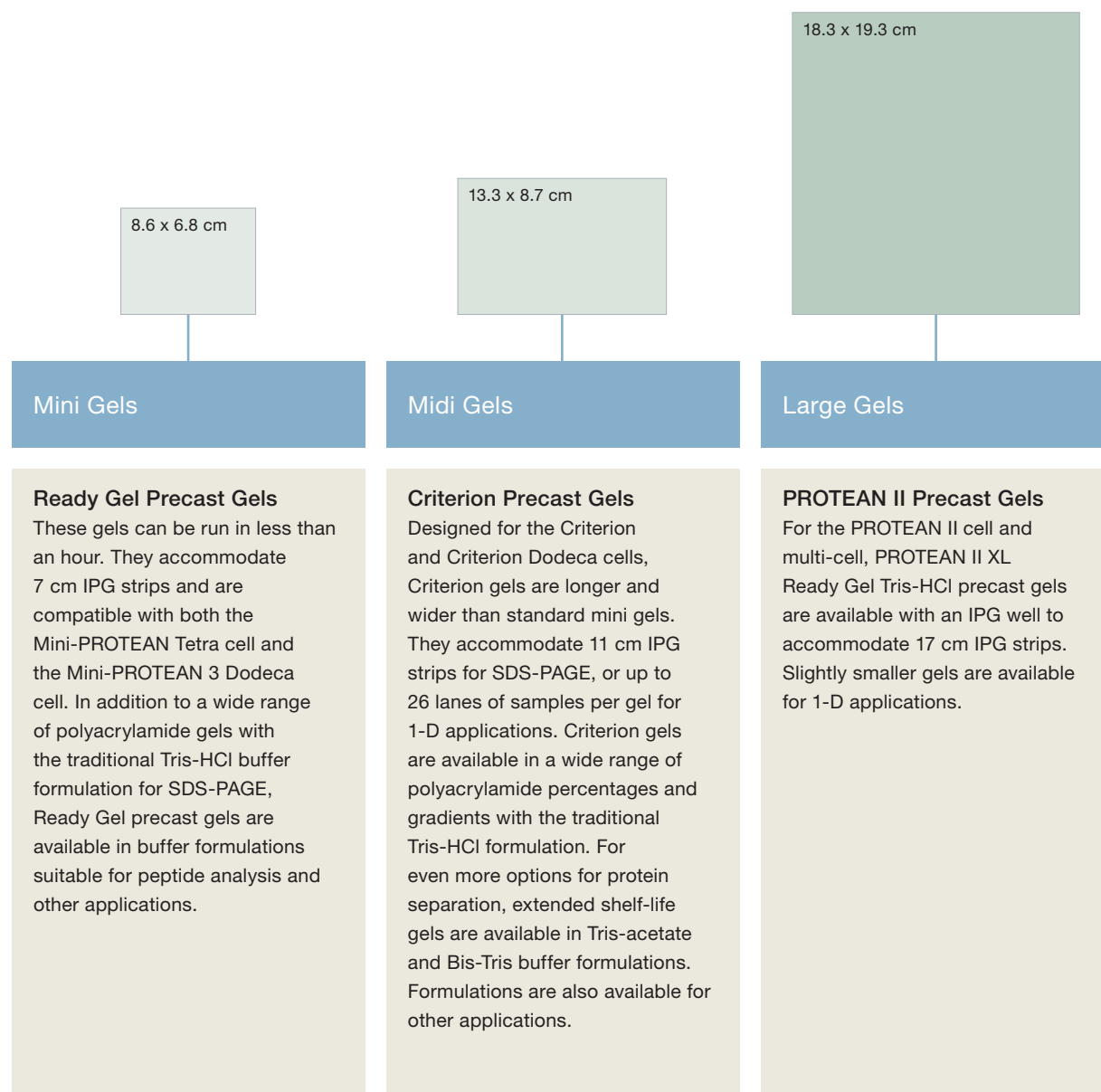
### Dodeca Stainers

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, Flamingo fluorescent gel stain, and the Dodeca silver stain kit.

## Precast Gels

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

Gel Types	Ready Gel	Criterion	PROTEAN II	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



## Related Products



ReadyPrep™ 2-D Starter Kit



Premixed Buffers



Rotorfor® and MicroRotorfor™ Cells,  
Model 491 Prep Cell



Multi-Casting Chambers



Gradient Formers



AnyGel™ Stands

## 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.

### Rotorfor and MicroRotorfor Cells, Model 491 Prep Cell

The Rotorfor and MicroRotorfor cells perform liquid-phase IEF and are powerful complementary first-dimension separation tools

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 optimum separation of proteins of interest.

### AnyGel Stands

These stations for docking and preparing gels safely hold gel cassettes of all sizes. 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



### 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](http://www.expressionproteomics.com)

### 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. They can help with troubleshooting or with advice on suitable tools for sample preparation or other expression proteomics technologies.

### 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.

Purchase of Criterion XT Bis-Tris gels, XT MOPS running buffer, XT MES running buffer, XT MOPS buffer kit, and XT MES buffer kit is accompanied by a limited license under US patents 6,143,154; 6,096,182; 6,059,948; 5,578,180; 5,922,185; 6,162,338; and 6,783,651 and corresponding foreign patents.

Coomassie is a trademark of BASF Aktiengesellschaft. SYPRO is a trademark of Invitrogen Corporation.

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