Electrophoresis

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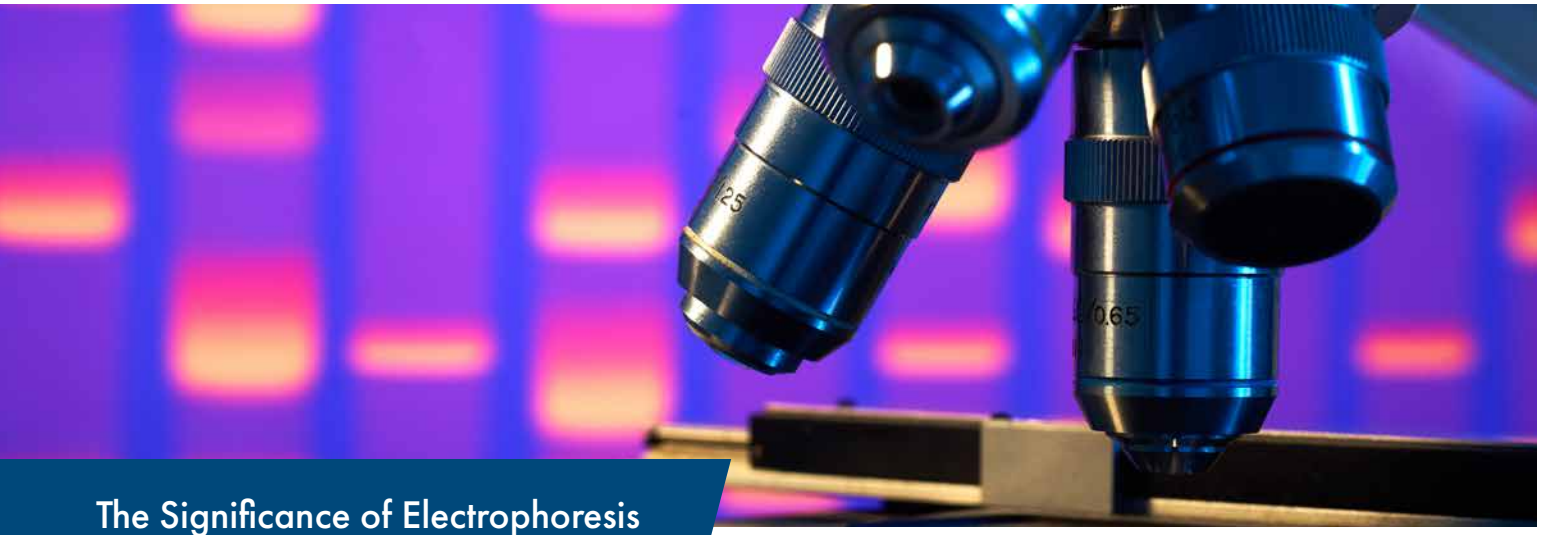


The Significance of Electrophoresis

When trying to visualize the invisible world of molecules, we are all too often confronted by abstract theory. Without the powerful molecular separation tools of today, molecular biology would be a science conceivable only on a theoretical level and revealed by only the most arcane and exhausting experimental methods. The unique barcode-like graphic patterns that electrophoresis and related techniques generate have provided us a window into the world of the unseen. Information gleaned by these methods has been crucial in developing applications at the forefront of biology and medicine, such as cancer detection, diseased tissue detection and markers of genetic dysfunction.

Using an affordable gel electrophoresis system, researchers and students alike can participate in cutting edge technology. Students can now design and execute experiments to sequence genetic nucleotides using inexpensive lab equipment and reagent kits such as those available through MP Biomedicals. The advent of such versatile and affordable systems has revolutionized gel electrophoresis, allowing scientists in all fields to rapidly make new discoveries regarding that which was once only theoretical observation.

Separation Techniques: Chromatography vs. Electrophoresis

The separation of individual molecular entities from a mix of related molecules is a key investigative technique for the modern biological researcher. The two most widely used molecular separation technologies in biotechnology today are chromatography and gel electrophoresis.

Chromatography is the controlled separation of substances based on their unequal natural diffusion rates through a common fluid medium. Electrophoresis is the separation of different substances through a gel artificially driven by the application of an electrical potential across the gel. Both the strength of the electrical driving force across the gel and the resistance of the gel to molecular migration can be regulated to optimize the resolving power of the electrophoresis process.

Chromatography works best in two general areas: the separation of small molecules or in large batch processing. Chromatography typically uses large samples and can separate only twenty or so related molecular groups at a time.

Electrophoresis, on the other hand, excels as an analytical tool when used to separate macromolecules ranging in size from 20 to 2,000 kDa. The technique is so powerful that a researcher using an optimal gel plate can employ less than a thousandth of a gram of starting material to separate hundreds, even thousands of different molecular types from a single sample.

Electrophoretic Principles

Electrophoresis is a simple process involving the movement of charged molecules in solution by applying an electrical field across the mixture. Molecules migrate through the matrix dependent upon their charge, shape, and size. The subunit molecules of DNA, RNA, and proteins are charged. DNA and RNA are typically negatively charged and thus are repelled by the negatively charged cathode and attracted to the positively charged anode. Proteins are different because they are composed of amino acids. Some amino acids are positively charged, some are negatively charged and some are neutral. The net charge of the protein is determined by the types and amounts of amino acids of which it is composed.

The first principle of electrophoresis is that **charged molecules can be driven through a medium in an electrical current**. An obvious corollary for this is, for any given macromolecule, the higher the charge, the greater the force (or speed) of migration, while the lower the charge, the lesser the force (or speed) of migration.

In addition to electrical charge, consideration must be given to the medium through which the macromolecules pass. As an example, acrylamide can be formed into a cross-linked fibrous gel. A 3% gel is 97% liquid, so the cross-linked fibers are very loose and the spaces between them (pores) are very large. Thus, both small and large molecules can easily sieve through the gel matrix. Conversely, a gel that is 30% acrylamide has very closely packed cross-linked fibers and the pores are very small. Large molecules cannot pass through the gel, but finely tuned separations of small molecules can be achieved.

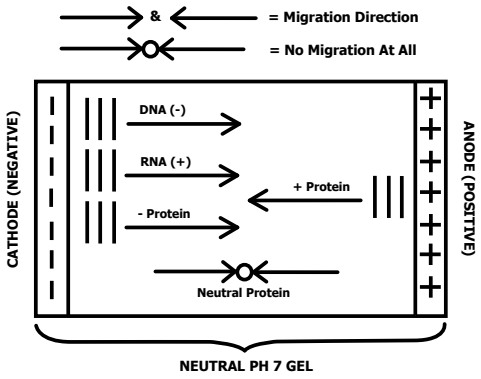


Figure 1.

A gel acts as a frictional retarding force to electrical charge driven molecule migration force. Therefore, the second principle of electrophoresis is the **carrier medium acts as a frictional retarding force to electromotively driven migration**. Consequently, the pore size of the gel can be adjusted to fine-tune the frictional retarding force to a given molecular size range.

Forces that *push* the molecules include:

Electromotive Force
The volts put out by the power supply; the higher the voltage, the faster the molecules go.

Molecular Charge
The more charges a molecule has, the more it will be forced to move in an electrical field.

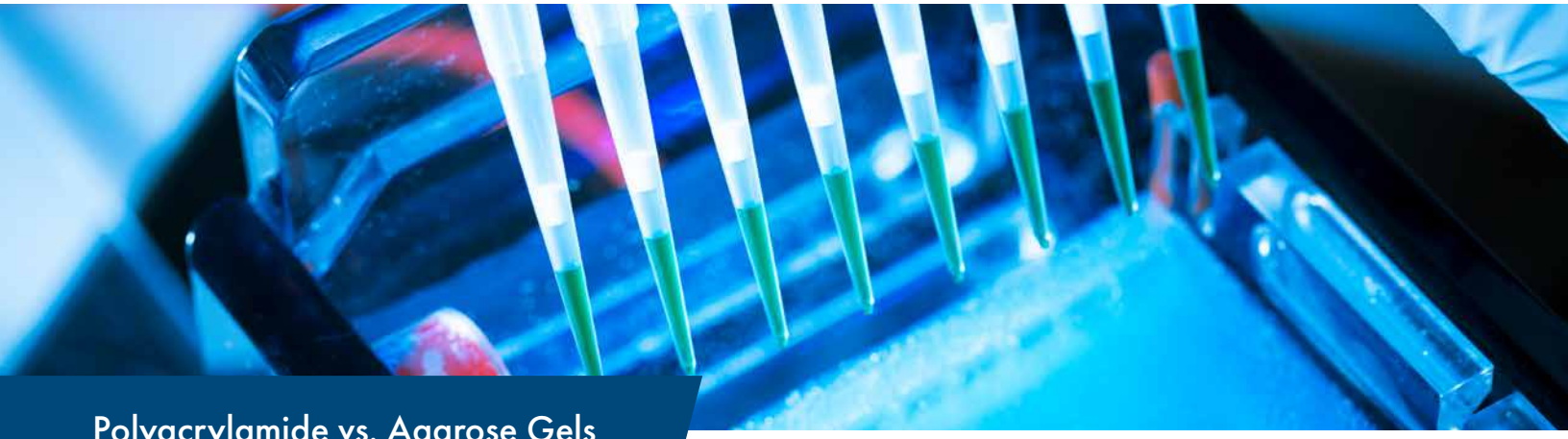
Forces that *retard* migration include:

Frictional Coefficient of the Carrier Medium
This can be controlled by adjusting the pore size of the medium. Large pores produce low friction and small pores create high friction.

Mass of the Molecule
The bigger the molecule, the more push it takes to get it moving.

When a mixture of molecules, each with its own charge and size, is electrophoresed in a medium (gel), they will all travel at different speeds. When the run is stopped and the gel is stained, there will be many bands, but one will not know the size or charge of any given molecule because they have been separated on the basis of a combination of both size and charge. However, if the charge to mass ratio could be made constant in a given frictional medium (gel), the molecules would separate on the basis of size alone. Conversely, if an electrical gradient could be established throughout the gel and the frictional retarding force of the gel rendered insignificant, then the molecules could be separated on the basis of charge alone. This is the basic principle of **Polyacrylamide Gel Electrophoresis (PAGE)** and its various applications using gradient and 2D gels.

Electrophoresis



Polyacrylamide vs. Agarose Gels

The two most commonly used stabilizing media for making electrophoresis gels are agarose and polyacrylamide.

Agarose is a natural colloid mixture of highly purified complex polysaccharides extracted from *Rhodophyceae* agar, a family of common red algae. Agarose polysaccharides melted in aqueous buffer polymerize upon cooling to form alternating linkages that transform the material into a porous gel. The gel's agarose concentration is the main determinate of its pore size. Higher concentrations of agarose create more cross-linking hence smaller average pore sizes for increased resistance to the movement of macromolecules across the gel. Gelling temperature and melting temperatures can be important where the recovery of antibodies and nucleic acids is required. Control of gelling and melting temperature is also determined by agarose concentration and by the species of *Rhodophyceae* algae used.

Agarose gels are relatively fragile and can be easily damaged during handling. They tend to have a large pore size and are used primarily to separate very large molecules with molecular masses greater than 2,000 kDa, including nucleic acids, large proteins, protein complexes, and with pulsed field techniques, up to chromosome and equivalent sized pieces greater than 5 x 10^6 base pairs long. Agarose gels can be run faster than polyacrylamide gels, but their resolution is inferior in that their bands tend to be broad, fuzzy and spread far apart. This is a result of pore size, which cannot be fine-tuned. Additionally, as agarose is a naturally occurring material, there can be variations from batch to batch which may affect pore sizes, the separation process and band definition. While agarose gels are useful in specific applications, polyacrylamide gels offer greater versatility and more sharply defined banding patterns.

Acrylamide, on the other hand, is a synthetic chemical and can be manufactured consistently from batch to batch. Gels made from polyacrylamide are physically stronger than those prepared from agarose. Polyacrylamide gel electrophoresis (PAGE) is based on gels formed by long chains of covalently cross-linked acrylamide monomers. Polymerization employs purified acrylamide monomer, a cross-linker and an initiator to generate free radicals, often with the addition of an accelerator. The structure of the gel is secured by the cross-linker. The most commonly used cross-linking agent is N,N'-methylene-*bis*-acrylamide (commonly referred to as bis). Other cross-linkers exist which impart useful specialized characteristics such as gel solubilization for sample recovery after electrophoresis.

The dual effects of total solids content (%T) and the ratio of acrylamide monomer to "bis" cross-linker (%C) determines the separation characteristics of the gel by regulating pore size. The total solids content (%T) is a function of the ratio of the sum of the weights of acrylamide monomer and cross-linker in solution, stated as % w/v. Thus, the pore size decreases as the %T increases. The value of %C equals weight/weight percent as a calculation of the total cross-linker weight divided by the sum of monomer and cross-linker weights. As a result, 5% cross-linking creates the smallest pore sizes. The pore size increases above and below 5%. Typically, gel polyacrylamide concentration ranges from 3% to 40%, and the monomer-to-cross-linker ration ranges from 19:1 to 37.5:1, producing pore sizes suitable for the resolution of particles in the 5 to 2,000 kDa range.

Ratio of Polymer to Gel Volume vs. Concentration

Ratio	Concentration (%T)	Application
0.033:1	0.033/1=3%	Large Target Proteins
0.10:1	0.1/1=10%	Medium Target Proteins
0.40:1	0.4/1=40%	Small Target Proteins

$$\text{Polymer Concentration (\%T)} = \frac{\text{Acrylamide + Cross-linker}}{\text{Total Volume of Gel}} \times 100$$

Ratio of Monomer to Cross-linker vs. Concentration

Ratio	Concentration (%C)	Application
19:01	1/20=5.0%	DNA Sequencing
29:01:00	1/30=3.3%	DNA & Protein
37.5:1	1/38.5=2.6%	Protein Separation

$$\text{Cross-linker Concentration (\%C)} = \frac{\text{Cross-linker}}{\text{Acrylamide + Cross-linker}} \times 100$$

Example: 30% Acrylamide/Bis Solution, 29:1
This gel would be a 30% polyacrylamide polymer gel which consists of 30% w/v of acrylamide plus bis. The polyacrylamide portion of the gel would have been formed from 29 parts acrylamide monomer and 1 part bisacrylamide crosslinker. The %C value is 3.33% which identifies this gel as suitable for DNA or protein separation.

Traditionally, a basic understanding of concentrations has been relevant to the user in order to obtain optimal electrophoresis results through matching gel character to that of the target molecule being resolved. For samples containing multiple targets with varying molecular weights, the rule-of-thumb has been to select a gel which will center the bands of interest within the working area of the gel, avoiding the gel extremities. Usually, gradient gels offer the best performance in this area.

Gradient vs. Single Percentage Gels

Single percentage gels consist of one formulation across their entire running length and are the simplest gels to produce. They are called "single percentage" because the acrylamide concentration remains uniform across the gel. Single percentage gels are commonly used for samples containing a narrow range of protein sizes. In theory, they produce the best resolution of closely sized proteins. In cases where the results are not easily anticipated, single percentage gels are often out of range and, therefore, do not function as reliable general-purpose gels.

A traditional gradient gel contains multiple percentage gels of gradually in decreasing pore size along the direction of the run. It is an array of many different single percentage gels stacked end to end, but taking up the space and running time of a single gel. The broad range of a gradient makes it a good choice as a general-purpose gel and excellent choice for ranging an unknown sample in minimal time and expense. Gradient gels are ideal for samples having a wide range of molecular weights. These gels yield results of a wider range of size resolution and with tighter bands than uniform concentration gels.

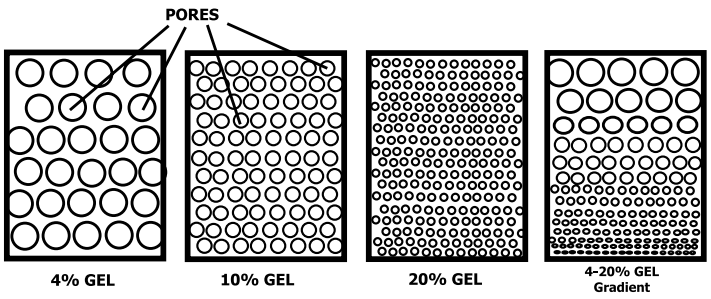


Figure 2.

In a typical run, a gel is installed into the gel tank, which is then connected to a power supply to apply the appropriate voltage across the gel. Samples are loaded onto one side of the gel using a micropipette or microsyringe. The sample is loaded into wells created by a special comb inserted at the top of the gel. Once the sample is applied, the power is turned on and separation begins. Since different species of molecules will move at different velocities, distinct bands at different positions in the gel matrix can be detected upon completion of the separation. A tracking dye can be applied to visualize the separation of the sample during the run.

Electrophoresis

Basic Gel Types Utilized

Tris-Borate-EDTA (TBE) Gels	Primarily used for native (double-stranded) DNA separations and DNA footprinting. Double-stranded DNA sorts itself strictly by size (molecular weight or length).
TBE-Urea Gels	Primarily used for denatured (single-stranded) DNA and RNA separations. Useful for DNA fingerprinting, short DNA sequencing (~50 bases), DNA or RNA purification and end label primer analysis. Usually separates based on size alone.
Tris-Glycine Gels	1. When used without SDS or 2-mercaptoethanol these gels are primarily employed to separate native protein. These proteins are often functional. Typically separates by a combination of charge and mass. 2. When used with SDS, separates proteins containing free polypeptides and peptides joined by disulfide bridges. Proteins are denatured and usually non-functional. The SDS overwhelms the protein's charge with negative charge, so charge to mass ratio is effectively constant and separation occurs on the basis of size alone. 3. When used with SDS and 2-mercaptoethanol, the charge to mass is constant, so the gel separates individual polypeptides by molecular weight. Each peptide comes from a single mRNA, which in turn comes from a single DNA gene.
Tris-Tricine Gels	Specialty gel used with SDS and 2-mercaptoethanol to separate very small polypeptides, usually in the 2,000–15,000 MW range. A key gel for most proteomics applications.
DNA Sequencing Gel	Very large and very thin TBE-Urea gels that are used to separate denatured single-stranded DNA to less than single base length resolution. They are most often used for DNA sequencing, but sometimes used for very high-resolution DNA fingerprinting and footprinting.
2D PAGE gels	Used to separate complex polypeptide mixtures. 2D gels are run first to separate strictly on the basis of their electrical charge (pH), then run again in a second dimension to separate based on their size (molecular weight). 2D PAGE has become the workhorse of proteomics and genomics.

Given the above techniques, electrophoresis is an extremely valuable tool for analysis of many fundamental life processes. From DNA sequencing, to protein substructure, to RNA gene transcription and translation, to functional proteomics, electrophoresis is the technique of choice and in many cases still the best method to achieve the desired results. MP Bio is pleased to offer a full showcase of Ultra Pure and Electrophoresis Grade reagents for all your sample preparation and electrophoresis applications.

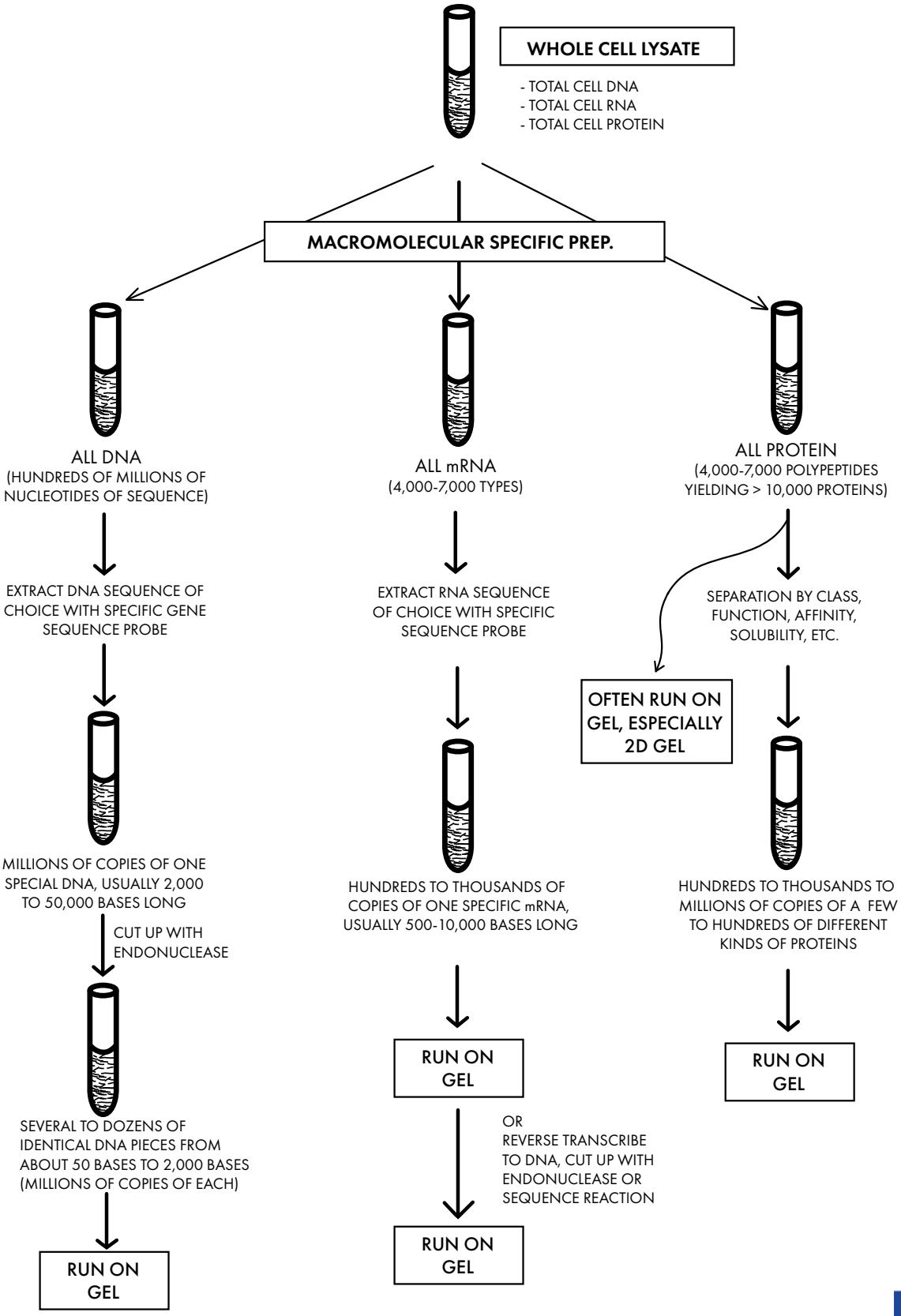

WHOLE CELL LYSATE
- TOTAL CELL DNA
- TOTAL CELL RNA
- TOTAL CELL PROTEIN
MACROMOLECULAR SPECIFIC PREP.
ALL DNA
(HUNDREDS OF MILLIONS OF NUCLEOTIDES OF SEQUENCE)
EXTRACT DNA SEQUENCE OF CHOICE WITH SPECIFIC GENE SEQUENCE PROBE
MILLIONS OF COPIES OF ONE SPECIAL DNA, USUALLY 2,000 TO 50,000 BASES LONG
CUT UP WITH ENDONUCLEASE
SEVERAL TO DOZENS OF IDENTICAL DNA PIECES FROM ABOUT 50 BASES TO 2,000 BASES (MILLIONS OF COPIES OF EACH)
RUN ON GEL
ALL mRNA
(4,000-7,000 TYPES)
EXTRACT RNA SEQUENCE OF CHOICE WITH SPECIFIC SEQUENCE PROBE
HUNDREDS TO THOUSANDS OF COPIES OF ONE SPECIFIC mRNA, USUALLY 500-10,000 BASES LONG
RUN ON GEL
OR
REVERSE TRANSCRIBE TO DNA, CUT UP WITH ENDONUCLEASE OR SEQUENCE REACTION
RUN ON GEL
ALL PROTEIN
(4,000-7,000 POLYPEPTIDES YIELDING > 10,000 PROTEINS)
SEPARATION BY CLASS, FUNCTION, AFFINITY, SOLUBILITY, ETC.
OFTEN RUN ON GEL, ESPECIALLY 2D GEL
HUNDREDS TO THOUSANDS TO MILLIONS OF COPIES OF A FEW TO HUNDREDS OF DIFFERENT KINDS OF PROTEINS
RUN ON GEL

Figure 3.

Electrophoresis Reagents

Polyacrylamide Gel Electrophoresis

Polyacrylamide gel electrophoresis is a widely used technique for identification and isolation of peptides, proteins, DNA, RNA and many other biomolecules. Polymerization of acrylamide crosslinked to the comonomer, N,N'-methylene-bis-acrylamide (bis) forms a clear, stable gel. Since this is a free-radical polymerization, it requires an initiator, typically ammonium persulfate, and a catalyst, typically N,N,N',N'-tetraethylmethylenediamine (TEMED). By changing the concentrations of acrylamide and bis, one can control the amount of crosslinking and hardness of the gel, as well as controlling the size of the pores within the gel. Since the pore sizes determine which molecules are able to migrate through the gel, controlling the pore sizes allows one to exclude certain size molecules and isolate others by their rate of migration. As the percentage of acrylamide in the gel increases, the pore sizes within the gel get smaller, thus excluding larger molecules from migrating through the gel. Commonly utilized acrylamide concentrations vary between 3% to 20%. Polyacrylamide gels generally have smaller pore sizes than agarose gels and are more effective in separating peptides, nucleic acids, small proteins and DNA fragments. As the pore sizes can be readily manipulated by concentration changes of the acrylamide, the variety of molecules that can be separated ranges in size from 5 to 300 kDa.

Acrylamides

Description	Size	Cat. No.
Acrylamide, Electrophoresis Grade 99+%. A purified acrylamide ideal for most general electrophoresis applications. Works well for separation of small proteins less than 250 kDa, nucleic acids and peptides.	100 g	04814340
	250 g	04814343
	500 g	04814346
	1 kg	04814349
Acrylamide, Ultra Pure Purity >99.9% Acrylic acid content <0.001%. Highly purified for superior gel formation for sensitive small molecule applications. Allows clear gel formation for best resolution, reproducibility and unmatched performance.	100 g	04814320
	250 g	04814232
	500 g	04814326
	1 kg	04814329
LiquAcryl™, 40% solution Bisacrylamide free. A 40% (w/v) solution of ultra pure acrylamide in specially prepared deionized water.	500 mL	04800800

Cross-Linking Reagents

N,N′-methylene-*bis*-acrylamide (*bis*-acrylamide, or simply Bis) is the comonomer cross-linking agent prevalently used in PAGE procedures. MP Bio offers a choice of Ultra Pure 99.9% *bis*-acrylamide and an Electrophoresis Grade *bis*-acrylamide with 99+% purity, suitable for most PAGE applications, as well as a convenient pre-mixed solution. The choice of cross-linking reagent enables control of the pore sizes, clarity and hardness of the gel and typically renders it water insoluble.

Description	Size	Cat. No.
N,N′-Methylene-*bis*-acrylamide, Ultra Pure Purity: 99.9%. Highly purified for crosslinking with acrylamide to make superior PAGE gels for critical electrophoresis applications. May be used in UV scanning gels due to its optical clarity.	10 g	04800171
	25 g	04800706
	50 g	04800173
	250 g	04800175
N,N′-Methylene-*bis*-acrylamide, Electrophoresis Grade, 99+% Purity: 99+%. A specially purified bis-acrylamide for crosslinking with acrylamide to make high resolution PAGE gels for nucleic acid electrophoresis applications.	25 g	02195316
	100 g	
	250 g	
LiquaBis™, 2% Solution A 2% solution of N,N′-methylene-bis-acrylamide in specially prepared deionized water, ready-to-use for PAGE gel formation.	500 mL	04800801

Premixed Acrylamide Powders

Description	Size	Cat. No.
Acrylamide/Bisacrylamide, 19:1, Powder A premixed powder containing 19 parts acrylamide to 1 part bis-acrylamide, optimized for sequencing gel preparation and nucleic acid separation.	30 g	04800655
	200 g	04800656
Acrylamide/Bisacrylamide, 29:1, Powder A premixed powder containing 29 parts acrylamide to 1 part bis-acrylamide, optimized for preparing sequencing gels and protein DNA gels.	30 g	04800657
	200 g	04800658
Acrylamide/Bisacrylamide, 37.5:1, Powder A premixed powder containing 37.5 parts acrylamide to 1 part bis-acrylamide, optimized for preparing protein separation PAGE gels.	30 g	04800659
	200 g	04800660

Electrophoresis Reagents

Premixed Acrylamide Solutions

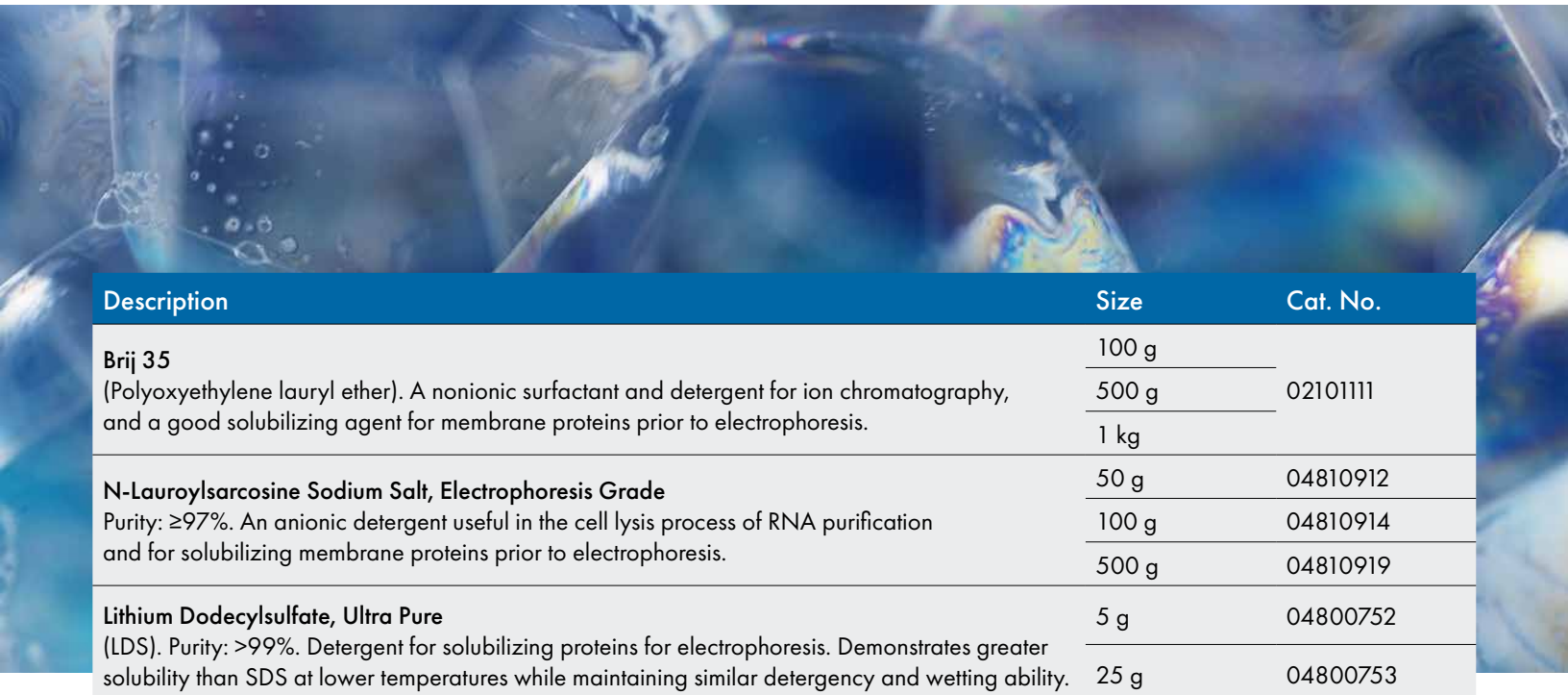
Description	Size	Cat. No.
Liqui-Gel™, 19:1, 40% Solution A premixed 40% (w/v) solution containing 19 parts ultra pure acrylamide (38%) to 1 part bis-acrylamide (2%), ready-to-use for preparing protein gels.	500 mL	04800802
Liqui-Gel™, 29:1, 40% Solution A premixed 40% solution containing 29 parts ultra pure acrylamide (38.67%) to 1 part bis-acrylamide (1.33%), ready-to-use for preparing protein DNA gels.	500 mL	04800803
Liqui-Gel™, 37.5:1, 40% Solution A premixed 40% solution containing 37.5 parts ultra pure acrylamide (38.96%) to 1 part bis-acrylamide (1.04%), ready-to-use for preparing nucleic acid gels.	500 mL	04800804

Initiators of Polymerization

Description	Size	Cat. No.
Ammonium Persulfate, Electrophoresis Grade Purity: 99%. A purified polymerization catalyst used with TEMED for PAGE gel formation. Ammonium persulfate also acts as a buffer between pH 8 and 9 in the gel formation process.	25 g	04802811
	100 g	04802829
Ammonium Persulfate (Ammonium peroxydisulfate). Purity: ≥98%. A purified polymerization catalyst used with TEMED for PAGE gel formation.	100 g	02190556
	250 g	
	500 g	
N,N,N′,N′-Tetramethyl-ethylenediamine, Electrophoresis Grade (TEMED). Purity: >99%. Widely used catalyst for polyacrylamide gel formation. Acts as a free radical stabilizer with ammonium persulfate to promote acrylamide polymerization. Microchips containing oligonucleotides and proteins immobilized within gel pads have been prepared using TEMED.	10 mL	04805613
	25 mL	04805614
	50 mL	04805615
N,N,N′,N′-Tetramethyl-ethylenediamine (TEMED). Purity: ≥98%. Widely used catalyst for polyacrylamide gel formation. Acts as a free radical stabilizer with ammonium persulfate to promote acrylamide polymerization. Microchips containing oligonucleotides and proteins immobilized within gel pads have been prepared using TEMED.	25 mL	02195516
	50 mL	
	100 mL	

Detergents and Solubilizers

The size and shape of molecules compared to the pore size determines the amount of migration through a gel. Smaller molecules move more quickly, while larger molecules typically travel much slower. In addition to size, shape or conformation of a molecule can be the basis for separation of certain molecules. Many large molecules, like DNA and RNA, have complex shapes, including coiling and varying charges, which can affect the rate of migration in the gel. Consequently, it is often advantageous to treat these samples prior to electrophoresis in order to minimize the effects of supercoiling and/or ionic charges. A number of reagents are available to prepare samples before electrophoresis and greatly improve the chances for a successful separation. These reagents are commonly referred to as detergents, or solubilizers, as they disrupt hydrogen bonds, uncoil DNA and RNA, denature proteins and solubilize large molecules. They are used as additives to sample solutions prior to sample loading. MP Bio is pleased to offer a broad selection of detergents and solubilizing reagents for all types of sample preparation prior to electrophoresis.



Description	Size	Cat. No.
Brij 35 (Polyoxyethylene lauryl ether). A nonionic surfactant and detergent for ion chromatography, and a good solubilizing agent for membrane proteins prior to electrophoresis.	100 g	02101111
	500 g	
	1 kg	
N-Lauroylsarcosine Sodium Salt, Electrophoresis Grade Purity: ≥97%. An anionic detergent useful in the cell lysis process of RNA purification and for solubilizing membrane proteins prior to electrophoresis.	50 g	04810912
	100 g	04810914
	500 g	04810919
Lithium Dodecylsulfate, Ultra Pure (LDS). Purity: >99%. Detergent for solubilizing proteins for electrophoresis. Demonstrates greater solubility than SDS at lower temperatures while maintaining similar detergency and wetting ability.	5 g	04800752
	25 g	04800753
2-Mercaptoethanol Purity: ≥98%. A strong reducing agent that cleaves disulfide bonds and protects enzymes from catalytic site inactivation. Useful for solubilizing proteins prior to electrophoresis.	25 g	04806443
	100 g	04806444
	500 g	04806445
Sodium Dodecyl Sulfate, Ultra Pure Purity: ≥99%. An anionic surfactant that denatures and solubilizes proteins for electrophoresis. Also useful as an aid in cell lysis during DNA extraction and for dispersing and suspending nanotubes.	25 g	04811033
	50 g	04811036
	100 g	04811034
	500 g	04811032
Triton® X-100 A nonionic detergent and surfactant for solubilizing membrane proteins. Useful in lysis buffers for DNA extraction and for reducing surface tension of aqueous solutions during immunostaining.	100 mL	04807423
	500 mL	04807426

Electrophoresis Reagents

Reducing Agents

Many proteins are difficult to electrophorese due to disulfide linkages and tertiary protein folding. Use of a reducing agent prior to electrophoresis can reduce and eliminate these disulfide linkages, easing the separation process. Typically, a thiol, such as SDS, is used to reduce disulfide linkages in the sample buffer before electrophoresis. In addition to SDS, proteins may also be heated briefly in the presence of a reducing agent, such as dithioerythritol (DTE), dithiothreitol (DTT) or 2-mercaptoethanol, which further denatures the proteins by reducing disulfide linkages.

Description	Size	Cat. No.
1,4-Dithioerythritol, Electrophoresis Grade (DTE). Purity: ≥99%. Quantitatively reduces disulfide bonds and maintains thiols in a reduced state. Utilized in 2-D electrophoretic analysis of proteins and immunoglobulins.	5 g	04808376
DL-Dithiothreitol, Electrophoresis Grade (DTT, Cleland's Reagent). Purity: ≥99.5%. Protective agent for sulfhydryl groups and quantitatively reduces disulfides. Widely used reducing agent to pre-treat proteins before electrophoresis.	5 g	04856126
	25 g	04856127

Stains and Tracking Dyes

Most proteins are predominantly colorless and are quite difficult to see in the gel. During electrophoresis, their migration through the gel cannot be easily observed and followed. Consequently, it is common to utilize stains and dyes which allow observation of the progression during electrophoresis, and to visualize them afterward.

Description	Size	Cat. No.
Bromophenol Blue A tracking dye for alkaline and neutral buffer systems. It is used as a tracking dye in DNA, RNA (agarose) and protein (polyacrylamide) gel electrophoresis. Bromophenol blue migrates at approximately the same rate as 300-500 bp DNA in agarose gel and at the buffer front in protein polyacrylamide gels.	10 g	04805732
Coomassie Brilliant Blue G, Electrophoresis Grade (Brilliant Blue G). A general protein stain following electrophoresis. A useful dye for SDS gels, as it readily stains proteins with minimal background color.	10 g	04808274
Coomassie Brilliant Blue R, Electrophoresis Grade (Brilliant Blue R). Most commonly used stain in protein electrophoresis. A fast acting, sensitive dye which can be used on SDS gels, IEF gels and standard PAGE gels.	10 g	04821624
	25 g	04821616
	100 g	04821636
Ethidium Bromide Purity: 98%. The most commonly used nucleic acid stain for PAGE or agarose gel electrophoresis. The fluorescence of EtBr increases 21-fold upon binding to double-stranded RNA and 25-fold on binding double-stranded DNA so that destaining the background is not necessary with a low stain concentration (10 µg/mL).	5 g	04806113
Stains-All, 95% Cationic dye that stains proteins and nucleic acids. Stains different colors on bands of RNA (bluish purple), DNA (blue) and proteins (red).	5 g	04800128

Buffer Components

Due to the electrical current employed during electrophoresis, buffering the charges generated and controlling the pH can be critical. From gel preparation, to sample processing, pH control, or blotting and transfer procedures after electrophoresis, use of buffers is essential. Using the right buffers at the highest quality are paramount for accurate, consistent results.

Description	Size	Cat. No.
Boric Acid, ACS Reagent Grade, 99.5% (Boracic acid; Orthoboric acid). Widely used to make TRIS-Borate-EDTA (TBE) buffers. pK_a = 9.23 at 20°C.	25 g	02191411
	100 g	
Ethylenediaminetetraacetic Acid, Electrophoresis Grade, 99.5+% (EDTA). Commonly used chelator in many electrophoresis buffer systems. EDTA chelates magnesium, calcium and iron ions, diminishing their reactivity, but keeping them in solution.	500 g	04800682
	1 kg	04800683
	5 kg	04800684
Glycine, Electrophoresis Grade, 99.5+% (Aminoacetic acid). Common amino acid widely used to prepare TRIS-Glycine buffers. pK_a = 9.8 at 20°C.	1 kg	04808822
	5 kg	04808831
Tricine, Electrophoresis Grade, 99% [N-(trishydroxymethylmethyl)glycine]. A zwitterionic Good's buffer for preparing TRIS-Tricine buffers. pK_a = 8.15 at 20°C.	25 g	04807410
	100 g	04807413
	250 g	04807416
Tris(hydroxymethyl)aminomethane, Electrophoresis Grade, 99.5% (TRIS base). Purity: 99.5%. Widely used zwitterionic Good's buffer for preparation of many different electrophoresis buffers. pK_a = 8.06 at 20°C.	100 g	04823011
	500 g	04823012

Ready-made Buffer Solutions

MP Bio's ready-made buffer solutions offer convenience, reproducibility and worry-free electrophoresis. Avoid weighing and dissolving toxic and harmful chemicals and pH adjustments. Simply dilute the concentrated buffer to your desired volume and your gel is ready to run!

Description	Size	Cat. No.
10X TAE Buffer Premixed liquid 10X concentrate. Contains 0.4 M TRIS base, 0.4 M Acetate, 10 mM EDTA, pH 8.0. Used in agarose electrophoresis for separation of nucleic acids, DNA and RNA. Has lower buffer capacity than TBE but double-stranded DNA runs faster in TAE buffer.	1 L	04822471
50X TAE Buffer Premixed liquid 50X concentrate. Ideal for separating DNA and RNA in agarose gel electrophoresis.	1 L	11TAE50X01
10X TBE Buffer TBE buffer maintains the structural integrity of nucleic acids and is more suitable for their size analysis. TBE has a greater buffering capacity and will give sharper resolution. TBE is better suited for high-voltage (>150 V) electrophoresis because of its higher buffering capacity.	1 L, 5 L	11TBE10X02
	1 L, 4 L	04816721
TBE Modifier Mixture TBE Modifier is a proprietary mixture of concentrated salts for removing DNA from TBE-buffered gels: 0.5 volume of TBE Modifier and 4.5 volumes of NaI are added to 1 volume of agarose gel.	15 mL	111001403
10X Tris-Glycine Native Running Buffer Contains 0.25 M TRIS base, 1.92 M Glycine, pH 8.5. Provides excellent separation of native large molecular weight proteins on TRIS-glycine polyacrylamide gels.	1 L	04822521

Electrophoresis Reagents

Make Your Own Buffer Solutions Cookbook

The following are recommended recipes for preparing the most commonly used buffers in electrophoresis applications. Whenever possible, MP Bio strongly recommends using Ultra Pure reagents and water when preparing them.

Tris-Glycine Native Running Buffer

Format:	Shelf-life:	pH:
500 mL of 10X solution	**1 year** at room temperature	**8.3**

Component	1X Concentration	Quantity for 10X solution
Tris	25 mM	29.0 g
Glycine	192 mM	144.0 g
Deionized water (ultra pure)	—	to 1.0 L

Tris-Glycine Native Sample Buffer

Format:	Shelf-life:	pH:
20 mL of 2X solution	**1 year** at 4°C	**8.6**

Component	1X Concentration	Quantity for 2X solution
Tris HCL	100 mM	4 mL of a 0.5 M sol.
Glycerol	10%	2 mL
Bromophenol Blue	0.0025%	0.5 mL of a 1% sol
Deionized water (ultra pure)	—	to 10.0 mL

Tris-Glycine Native Transfer Buffer

Format:	Shelf-life:	pH:
500 mL of 25X solution	**1 year** at room temperature	**8.3**

Component	1X Concentration	Quantity for 25X solution
Tris	12 mM	18.2 g
Glycine	96 mM	90.0 g
Deionized water (ultra pure)	—	to 500 mL

Tris-Glycine-SDS Running Buffer

Format:	Shelf-life:	pH:
500 mL of 10X solution	**1 year** at room temperature	**8.3**

Component	1X Concentration	Quantity for 10X solution
Tris	25 mM	29.0 g
Glycine	192 mM	144.0 g
SDS	0.1%	10.0 g
Deionized water (ultra pure)	—	to 1.0 L

Tris-Glycine-SDS Sample Buffer

Format:	Shelf-life:	pH:
20 mL of 2X solution	**1 year** at 4°C	**6.8**

Component	1X Concentration	Quantity for 2X solution
Tris HCl	63 mM	2.5 mL of a 0.5 M sol.
Glycerol	10%	2 mL
SDS	2%	4 mL of a 10% (wv) Sol.
Bromophenol Blue	0.0025%	0.5 mL of a 1% Sol.
Deionized water (ultra pure)	—	to 10.0 mL

Tris-Tricine-SDS Running Buffer

Format:	Shelf-life:	pH:
500 mL of 10X solution	**1 year** at room temperature	**8.3**

Component	1X Concentration	Quantity for 10X solution
Tris pH 8.3	100 mM	121.0 g
Tricine	100 mM	179.0 g
SDS	0.1%	10.0 g
Deionized water (ultra pure)	—	to 1.0 L

Tris-Tricine-SDS Sample Buffer

Format:	Shelf-life:	pH:
20 mL of 2X solution	**1 year** at 4°C	**8.45**

Component	1X Concentration	Quantity for 2X solution
Tris HCl, pH 8.45	450 mM	3 mL of a 3.0 M sol.
Glycerol	12%	2.4 mL
SDS	4%	0.8 g
Coomassie Blue G250	0.0025%	0.5 mL of a 1% sol.
Phenol Red	0.0025%	0.5 mL of a 1% sol.
Deionized water (pure water)	—	to 10.0 mL

TBE Running Buffer

Format:	Shelf-life:	pH:
1000 mL of 5X solution	**1 year** at room temperature	**8.3**

Component	1X Concentration	Quantity for 5X solution
Tris	89 mM	54.0 g
Boric acid	89 mM	27.5 g
EDTA (free acid)	2 mM	2.9 g
Deionized water (ultra pure)	—	to 1.0 L

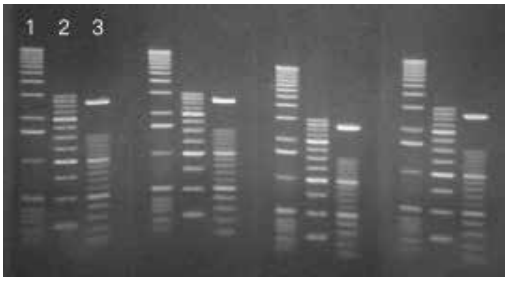
Agarose Powders for Electrophoresis

Basic Agarose Premier

Cost-friendly agarose for daily gels and standard analysis. This agarose has high gel strength even at low concentrations. It is ideal for routine and rapid separation of DNA and RNA fragments.

Recommended for:

- Separation of nucleic acid fragments from 250 bp to 23 Kb
- PCR product analysis
- Preparation of plasmids
- Screening, cloning and blotting techniques



First-Agarose Agarose 1 Agarose 2 Agarose 3

Lane 1: 1 kb Ladder
Lane 2: 250 bp Ladder
Lane 3: 100 bp Ladder

Description	Size	Cat. No.
Basic Agarose Premier	100 g	11AGAF0100
	500 g	11AGAF0500

Agarose Standard (low EEO)

The optimal agarose for analytical and preparative purposes. Agarose Standard is a very low electroendosmosis agarose (EEO) and is advised for sharp resolution of nucleic acid fragments greater than 1000 bp.

Recommended for:

Nucleic acid analytical and preparative electrophoresis	Northern and Southern blotting	Protein electrophoresis such as radial immunodiffusion

Description	Size	Cat. No.
Agarose Standard	100 g	11AGAH0100
	500 g	11AGAH0500

Why use MP Bio's agarose?

- Highest quality and purity
- Certified molecular biology grade
- High resolution gels
- Absence of restriction enzyme inhibitors
- Efficient Southern and Northern transfers

Agarose Powders for Electrophoresis

Agarose High Resolution

The perfect agarose for small DNA fragments. Agarose High Resolution is an intermediate melting and gelling point agarose with twice the resolution capabilities of routine agarose and presenting superior sieving characteristics. Ideal for DNA fragments under 1000 bp.

Recommended for:

- PCR product analysis
- Small DNA fragments generated by restriction enzyme digestion
- DNA fragments used in mutation analysis
- Separation of very low size DNA fragments (down to 20 bp)

Description	Size	Cat. No.
Agarose High Resolution	25 g	11AGAR0025
	50 g	11AGAR0050

Agarose Multipurpose or High Gel Strength Agarose

This is the highest gel strength available especially designed for a wide range of molecular biology techniques.

Recommended for:

- Separation of nucleic acid fragments (DNA or RNA)
- PCR product and oligonucleotide separation
- Separation of high molecular weight DNA (chromosomes or fragments of genomic DNA up to 50 kb) by means of "Pulse Field Gel Electrophoresis" (PFGE)

Description	Size	Cat. No.
Agarose Multipurpose	100 g	11AGAP0100
	3 x 100 g	11AGAP0300

Agarose Low Melting Point

This Agarose has finer sieving characteristics than standard agaroses. The low melting temperature enables nucleic acid recovery without denaturation or damage. The agarose will remain in a liquid state at 37°C, allowing for gel manipulations without prior DNA purification, such as:

- Enzyme digestion
- DNA labelling
- Random priming
- PCR
- Sequencing
- Ligation
- Nick Translation

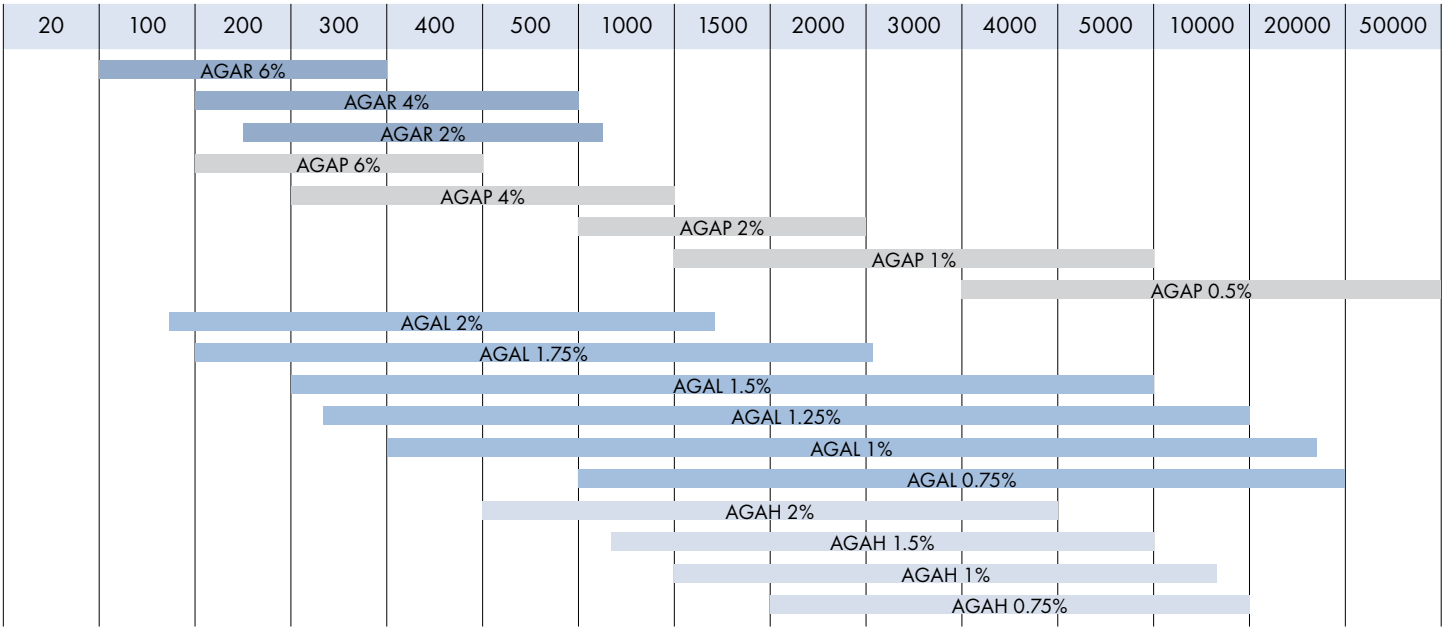
Recommended for preparative electrophoresis of DNA/RNA fragments greater than 1000 bp.

Description	Size	Cat. No.
Agarose Low Melting Point	50 g	11AGAL0050

Agarose Technical Information

	Basic Agarose Premier	Standard Agarose	Agarose Low Melting Point	Agarose Multipurpose	Agarose High Resolution
Gelling temperature (1.5 % gel)	36 ± 1.5°C	36 ± 1.5°C	26 ± 2°C	36 ± 1.5°C	35 ± 2°C (3% gel)
Melting temperature (1.5 % gel)	88 ± 1.5°C	88 ± 1.5°C	65.5 ± 2°C	88 ± 1.5°C	80 ± 2°C (3% gel)
Gel strength (1%)	≥ 1000 g/cm^2	≥ 1200 g/cm^2	> 300 g/cm^2	≥ 1800 g/cm^2	≥ 1500 g/cm^2 (3% gel)
Gel strength (1.5%)	≥ 2200 g/cm^2	≥ 2500 g/cm^2	≥ 500 g/cm^2	≥ 3200 g/cm^2	≥ 600 g/cm^2
EEO	N/A	0.05-0.13	≤ 0.12	≤ 0.12	≤ 0.12
DNase/RNase free	Yes	Yes	Yes	Yes	Yes
Application	• PCR product analysis • Preparation of plasmids • Blotting techniques	• PCR product analysis • Preparation of plasmids • Blotting techniques	• Preparative electrophoresis of DNA/RNA	• Nucleic acid fragments • PCR products and oligonucleotides • Chromosomes or fragments of genomic DNA • Pulse Field Gel Electrophoresis	• PCR product analysis • Restriction enzyme digestion analysis • Mutation analysis

Separation Range for MP Agaroses



Electrophoresis Instruments

Instruments for Horizontal Gel

Agarose gel electrophoresis is most commonly done horizontally in a submarine mode whereby the slab gel is completely submerged in buffer during electrophoresis. The buffer used in the gel is the same as the running buffer in the electrophoresis tank, which is why electrophoresis in the submarine mode is possible with agarose gel.

Agarose gel is a three-dimensional matrix formed of helical agarose molecules in supercoiled bundles that are aggregated into three-dimensional structures with channels and pores through which biomolecules can pass[1]. The 3-D structure is held together with hydrogen bonds and can therefore be disrupted by heating back to a liquid state.

Selection of appropriate gel equipment is important to acheive the correct electrophoresis process.

MiniCuve Electrophoresis Unit

Create mini-gels yourself with MP Bio MiniCuve. The MiniCuve 8 x 10 cm electrophoresis unit is machined from a solid block of acrylic to eliminate the possibility of leaks or breakage. Another advantage of this construction is the unit is relatively heavy and therefore stable on the bench, helping to prevent spillage. Equipped with stainless steel and gold-plated electrical connectors, the MiniCuve comes complete with lid, gel tray and connecting wire.

Safe operation is ensured by specialy shielded banana plugs (male and female) and safety lid. The electrodes are well protected against damage. No breakage when cleaning. Small buffer volume is required–only 100 mL.

- Completely leak-proof
- Low buffer volume
- Weighted and stable to avoid spillage
- Several combs sizes available
- Casting gel tray kits

Casting Tray

No more need for adhesive tape when casting agarose gels using the new gel casting tray from MP Bio. These casting trays are made of Plexiglas and incorporates a specially designed seal to prevent spillage. They accomodate up to six gel trays at a time, or two for the dual. Just place the required number of gel trays into the casting device, pour the agarose solution, let it cool and your gel is ready. Delivered with or without gel trays.

Description	Cat. No.
MINICUVE 8.10 ELECTROPHORESIS	11INSE1100
Gel Tray for MiniCuve	11INSE1204
Gel Tray - Blue Colored Base	11INSE1204B
Casting Tray for 6 Gels w/o Gel Trays	11INSE1208
Casting Tray Duo for 2 Gels	11INSE1211

Description	Cat. No.
Analytical 12-Tooth Comb 3 x 1 mm	11INSE1202
Analytical 12-Tooth Comb 3 x 2 mm	11INSE1206
Analytical 9-Tooth Comb 5 x 1 mm	11INSE1201
Analytical 9-Tooth Comb 5 x 2 mm	11INSE1205
Preparative Comb 60 mm x 1 mm	11INSE1203
Preparative Comb 60 mm x 2 mm	11INSE1207

[1] Sambrook, J.; Russell, D. Chapter 5, protocol 1. *Molecular Cloning - A Laboratory Manual 1 (3rd ed.).* Cold Spring Harbor Laboratory Press: New York, 2001; p. 5.4.

Pipettes and Tips

Supertip-96/Superpack-96

Our pipette tips are manufactured from high quality raw materials and precision-molded using state-of-the-art equipment. Attention to detail and quality control results in a perfect fit, with perfectly formed flash-free orifices and non-wettability in the final product. These pipette tips are manufactured from virgin, non-wettable polypropylene material to reduce fluid retention and optimize instrument performance. All presterilized filter tips are certified RNase-free, DNase-free, pyrogen-free and trace metal-free. These tips give superior results, optimal yield and minimal sample loss compared to inferior pipette tips.

Description	Size	Cat. No.
SUPERTIP-96, NS 5-300 µL	1000/bag	0977987C2
SUPERTIP-96, NS 5-300 µL	10x96/box	0977987H2
SUPERPACK-96, Sterile 5-300 µL	10x96/box	0977988H2

Multichannel Pipette, Adjust

Multichannel pipettes with adjustable nozzles are utilized for quickly transfering liquids from one format to another. They are ideal for genomic, proteomic, tissue culture and cell culture applications such as drug screening or enzyme assays. Multichannel pipettes accurately and consistently transfer small amounts of liquids for multiple samples using a single device. Easy to calibrate and maintain using the included calibration tool. MP Bio Pipettor has a lightweight, ergonomic design with a tip ejector.

Description	Cat. No.
8-CH PIPETTE, ADJUST, 0.5-10 µL	09D7771000
8-CH PIPETTE, ADJUST, 5-50 µL	09D7771100
8-CH PIPETTE, ADJUST, 50-300 µL	09D7771200
12-CH PIPETTE, ADJUST, 0.5-10 µL	09D7771300
12-CH PIPETTE, ADJUST, 5-50 µL	09D7771400
12-CH PIPETTE, ADJUST, 50-300 µL	09D7771500

Single Channel Pipette, Adjust/Fixed

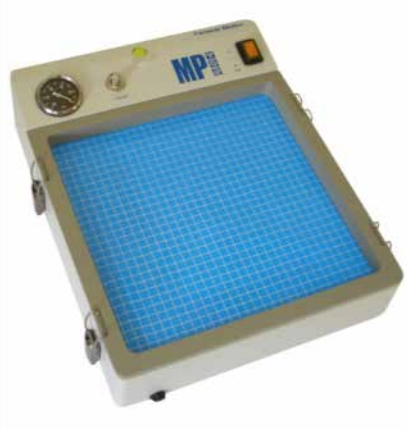
Pipette with adjustable or fixed nozzles to quickly transfer liquids from one format to another. Ideal for genomic, proteomic, tissue culture and cell culture applications such as drug screening or enzyme assays. Easy to calibrate and maintain using the included calibration tool. MP Bio Pipettor has a lightweight, ergonomic design with a tip ejector.

Description	Cat. No.
SINGLE CHANNEL PIPETTE, ADJUST, 0.1-2.5 µL	09D7773000
SINGLE CHANNEL PIPETTE, ADJUST, 0.5-10 µL	09D7773100
SINGLE CHANNEL PIPETTE, ADJUST, 5-50 µL	09D7773300
SINGLE CHANNEL PIPETTE, ADJUST, 20-200 µL	09D7773500
SINGLE CHANNEL PIPETTE, 5 µL	09D7773800
SINGLE CHANNEL PIPETTE, 10 µL	09D7773900

Electrophoresis Instruments

Blotting: Vacuum Blotter

Today's molecular biologists demand fast and reliable results and publication-quality data. The Vacuum Blotter is built to fulfill these requirements by quickly and efficiently transferring DNA or RNA onto a suitable membrane, such as Positive Nylon membrane.



The MP Bio Vacuum Blotter provides precise and stable vacuum during blotting procedures. With transfer efficiency close to 100%, excellent and reproducible results are guaranteed in less than one hour without any additional handling. Depurination, denaturation and neutralization can be carried out in the blotting unit without any additional handling of the gel. Instant unit assembly by mean of catches (no screws). Easy clean up without removing the vacuum blotter. Because of the built-in pump, the Vacuum Blotter saves space and offers a very large transfer area of 28 x 28 cm for large gels or several mini gels.

Description	Cat. No.
Vacuum Blotter 220V - 50 Hz Delivered with 2 plastic masks	11INSB8100
Vacuum Blotter 110V - 60 Hz Delivered with 2 plastic masks	11INSB8101
Plastic masks 28 x 28 cm (one set of five)	11INSB8302

Cassettes and Screen for Molecular Biology

Autoradiography Cassettes

Specially selected for molecular biology applications, our cassettes are designed for use at temperatures as low as -80°C. The high-quality materials used in manufacturing these cassettes ensure outstanding durability. The precise registration of the components result in evenly distributed pressure and sharper image.

The special slide lock is designed for trouble free use at temperatures as low as -80°C. The locking mechanism is recessed and cannot be opened accidently. The lacquered aluminum lid, anodized aluminum frame and coated bottom are shock-proof and score resistant. Besides the format listed, non-standard formats are also available. Please call for pricing and availability.

Intensifying Screens

For improved sensitivity and sharper resolution.

Description	Size	Cat. No.
Autoradiography Cassette 13 x 18 cm	1 cassette	11INSC0100
Autoradiography Cassette 18 x 24 cm	1 cassette	11INSC0101
Autoradiography Cassette 24 x 30 cm	1 cassette	11INSC0102
Autoradiography Cassette 30 x 40 cm	1 cassette	11INSC0103
Autorad. Cassette 35 x 43 cm (14 x 17 in)	1 cassette	11INSC0106
Autoradiography Cassette 20 x 40 cm	1 cassette	11INSC0107
Autorad. Cassette 20 x 25 cm (8 x 10 in)	1 cassette	11INSC0119
Intensifying Screens 13 x 18 cm	1 pair	11INSC0304
Intensifying Screens 18 x 24 cm	1 pair	11INSC0305
Intensifying Screens 24 x 30 cm	1 pair	11INSC0306
Intensifying Screens 30 x 40 cm	1 pair	11INSC0307
Intensifying Screens 35 x 43 cm	1 pair	11INSC0310
Intensifying Screens 20 x 40 cm	1 pair	11INSC0314
Intensifying Screens 20 x 25 cm (8 x 10 in)	1 pair	11INSC0321

Nylon Membranes for Hybridization

Positive Membrane Roll

The intrinsic positive charge of this membrane ensures higher sensitivity and superior results even after multiple reprobing. Unlike other positively charged membranes, Positive is designed and produced specifically for blotting. The proprietary manufacturing method does not involve post-casting treatment steps, resulting in greater lot-to-lot reproductibility. The membrane retains its positive charge from pH 3 to pH 12.

Description	Size	Cat. No.
Positive Membrane Roll	3 x 0.3 m	11MEMP0001
	3 x 0.2 m	11MEMP0002

PVDF Membrane

PVDF membrane is naturally hydrophobic polyvinylidene difluoride membrane developed for use in protein transfer and immobilization procedures. The PVDF membrane is a pure, white microporous solid phase support which undergoes strong hydrophobic interaction with a wide range of proteins. Immobilized proteins can be used directly for protein sequencing or amino acid analysis and can be visually detected with all common staining reagents, including Coomassie blue, amido black, ponceau S and colloidal gold.

Description	Size	Cat. No.
PVDF Membrane	3 x 0.3 m	11MEMV0001

Neutral Membrane Roll

Neutral Membrane is manufactured specifically for nucleic acid blotting applications under strictly controlled conditions. Users benefit from excellent sensitivity and batch-to-batch reproducibility. The surface groups are comprised of 50% amine and 50% carboxyl groups, giving a hydrophilic surface with an isoelectric point of pH 6.5.

Description	Size	Cat. No.
Neutral Membrane Roll	3 x 0.3 m	11MEMN0001
Neutral Membrane Disk	50 x 82 mm	11MEMN0011
	50 x 132 mm	11MEMN0012

Antigens for Electrophoresis

High Quality Secondary Antibodies from Cappel™

Secondary antibodies generally bind to primary antibodies to amplify signals for detection and quantification of target antigen during immunoelectrophoresis. To maximize signal, the secondary antibody must have specificity to interact with the primary antibody species and isotype. In addition, a secondary antibody is usually conjugated with a reporter enzyme molecule or fluorophore. MP Bio offers a wide variety of secondary antibodies without conjugation or with enzyme/fluorescence dye conjugation from multiple immunoglobulins, including human, rabbit and mouse. Enzyme (alkaline phosphatase (AP) or horseradish peroxidase (HRP)) conjugated antibodies are suitable for immunoelectrophoresis, blot immunostaining, cell/tissue staining and fluorescence-activated cell sorting.

- High specificity for primary antibody species and isotypes
- Multiple pre-conjugations for sensitive detection
- Various fragments
- High purity
- Validated by thousands of publications since the 1960's

Antibodies to Human Immunoglobulins

Conjugate	Host	Fraction	Size	Cat. No.
FITC	Goat	IgG	2 mL	0855077
HRP	Goat	IgG	2 mL	0855215
None	Goat	F(ab')2	2 mL	0855049
None	Goat	Affinity Purified	2 mg	0855070
FITC	Rabbit	IgG	2 mL	0855145
FITC	Goat	F(ab')2	2 mL	0855180
HRP	Goat	IgG	2 mL	0855220
AP	Goat	Affinity Purified	1 mL	0859289
None	Goat	F(ab')2	2 mL	0855053
None	Goat	Affinity Purified	1 mg	0855071
None	Goat	Affinity Purified F(ab')2	2 mg	0856961
HRP	Goat	F(ab')2	2 mL	0855246
None	Goat	Affinity Purified F(ab')2	2 mg	08670181
FITC	Goat	IgG	2 mL	0855148
HRP	Goat	IgG	2 mL	0855224
None	Goat	IgG	5 mL	0855017
None	Goat	Affinity Purified F(ab')2	1 mg	0856960
FITC	Goat	IgG	2 mL	0855153
FITC	Goat	Affinity Purified	2 mg	0855199
None	Goat	Affinity Purified	2 mg	0855074
FITC	Goat	IgG	2 mL	0855156
FITC	Goat	F(ab')2	2 mL	0855186
AP	Goat	Affinity Purified	1 mL	0859284
FITC	Goat	IgG	2 mL	0855158
FITC	Goat	F(ab')2	2 mL	0855188
HRP	Goat	IgG	2 mL	0855233
FITC	Goat	IgG	2 mL	0855159

Antibodies to Rabbit Immunoglobulins

Conjugate	Host	Fraction	Size	Cat. No.
None	Goat	IgG	5 mL	0855622
FITC	Goat	IgG	2 mL	0855676
HRP	Sheep	IgG	2 mL	0855677
HRP	Goat	Affinity Purified	2 mL	0855689
AP	Goat	Affinity Purified	1 mL	0859298
None	Goat	Affinity Purified	2 mg	0855642
FITC	Goat	F(ab')2	10 mg	0855658
None	Goat	Affinity Purified F(ab')2	2 mg	08670391
HRP	Goat	Affinity Purified	2 mL	0855691

Antibodies to Mouse Immunoglobulins

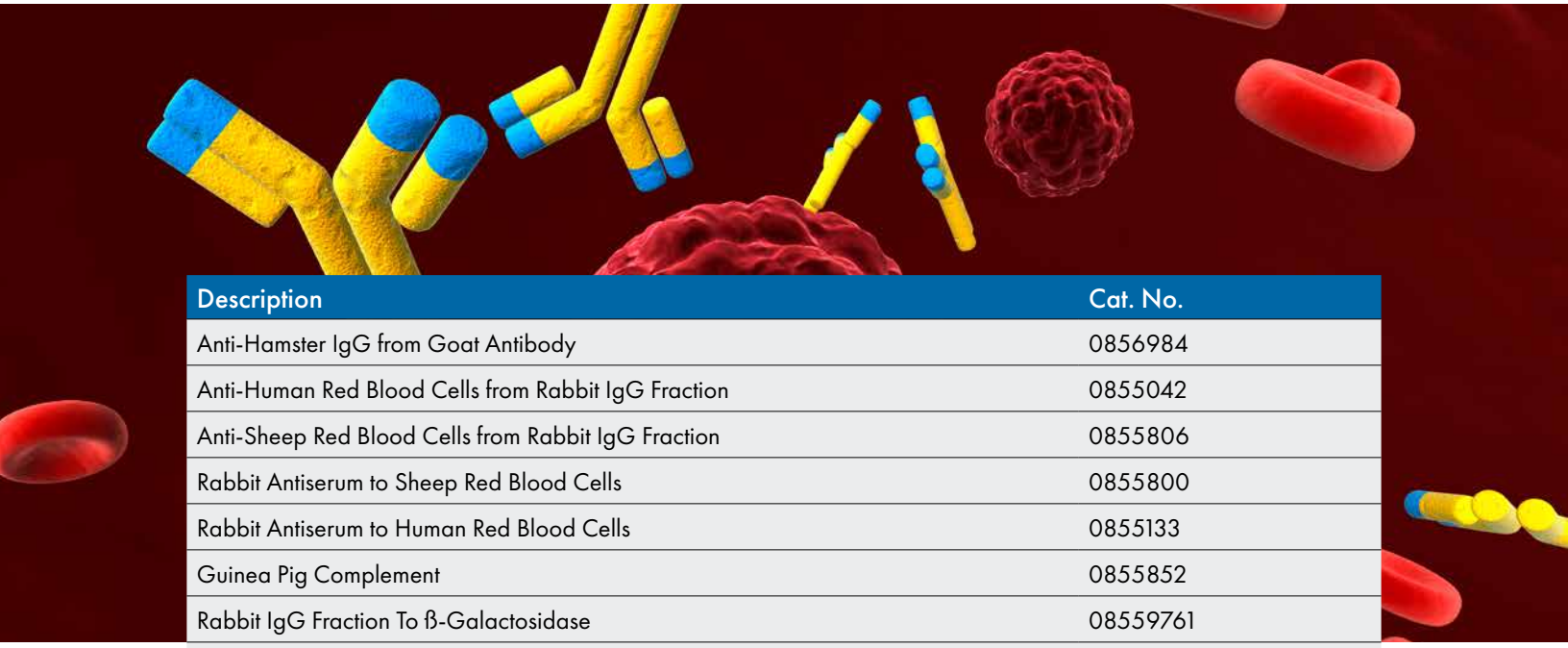
Conjugate	Host	Fraction	Size	Cat. No.
None	Goat	Antiserum	2 mL	0855435
None	Rabbit	Antiserum	2 mL	0855436
None	Goat	Affinity Purified	2 mg	0855479
None	Goat	Affinity Purified	2 mg	08670281
None	Goat	Affinity Purified F(ab')2	2 mg	0855487
FITC	Goat	IgG	2 mL	0855493
FITC	Sheep	IgG	2 mL	0855495
FITC	Goat	Affinity Purified	2 mg	08672281
HRP	Goat	IgG	2 mL	0855550
HRP	Goat	Affinity Purified	2 mL	0855563
AP	Sheep	Affinity Purified	1 mL	0859293
Biotin	Goat	Affinity Purified	2 mL	0855587
None	Goat	Affinity Purified	2 mg	0855482
HRP	Goat	Affinity Purified	2 mL	0855566
AP	Goat	Affinity Purified	1 mL	0859297
FITC	Goat	IgG	2 mL	0855499
FITC	Goat	Affinity Purified F(ab')2	2 mg	0855526
Rhod	Goat	Affinity Purified	2 mg	0855540
HRP	Goat	IgG	2 mL	0855556
HRP	Goat	Affinity Purified F(ab')2	2 mL	0855576

Antigens for Electrophoresis

Specialized Polyclonal Antibodies for Immunoelectrophoresis

Polyclonal antibodies represent a population of antibodies that are produced by different B cell clones within the body by the immune response of an immunized animal. They are a collection of immunoglobulin molecules that react against a specific antigen, recognizing different epitopes within the antigen and binding the antigen with varying affinities. These features of polyclonal antibodies prove to be advantageous over monoclonal antibodies in immunoelectrophoresis due to their strong binding capacity to multiple epitopes. However, due to large variation during production and procedures, polyclonal antibodies are not always offered with such high quality. With over 30 years of expertise serving the antibody research community, MP Bio offers a large range of high quality specialized polyclonal antibodies with various host and targets, ensuring:

- **Superior overall affinity to antigen**
- **Robust sensitivity of detection**
- **High tolerance to changes, such as pH or buffer**
- **Trusted quality – validated by thousands of scientific publications**



Description	Cat. No.
Anti-Hamster IgG from Goat Antibody	0856984
Anti-Human Red Blood Cells from Rabbit IgG Fraction	0855042
Anti-Sheep Red Blood Cells from Rabbit IgG Fraction	0855806
Rabbit Antiserum to Sheep Red Blood Cells	0855800
Rabbit Antiserum to Human Red Blood Cells	0855133
Guinea Pig Complement	0855852
Rabbit IgG Fraction To ß-Galactosidase	08559761
Rabbit anti-GFP	08687361
Chicken anti-GFP	08687391
Goat IgG Fraction to Human Albumin	0855028
Rabbit IgG Fraction to Human Albumin	0855029
Anti-Glucagon Polyclonal from Rabbit	0811184
Goat IgG Fraction to Hamster IgG	0855397

Nucleic Acid Purification

DNA and RNA Gel Extraction Kits

Simplify your research with the most flexible choice of kits for purification of DNA and RNA from gels.

3 easy steps: bind, wash and elute	Reproducible DNA and RNA quality	Isolate fragments of up to 300 kb

Application	Kit Name	DNA/RNA Size Range	Format
DNA purification from TAE buffered agarose gels	GeneClean®	200 bp–20 kb	Silica slurry
DNA purification from TAE and TBE buffered agarose gels	GeneClean® II	200 bp–20 kb	Silica slurry
DNA purification from TAE and TBE buffered agarose gels, also designed for radio-labeled DNA	GeneClean® III	200 bp–20 kb	Silica slurry
DNA purification from TAE and TBE buffered agarose gels	GeneClean® SPIN Kit	200 bp–300 kb	Silica slurry plus SPIN filter
DNA purification from any type of agarose gels	GeneClean®Turbo Kit	100 bp–300 kb	Silica-embedded membrane in SPIN filter
Small DNA fragment, oligonucleotide purification from TAE buffered agarose and acrylamide gels	MERmaid SPIN Kit	10 bp–200 bp	Silica slurry plus SPIN filter
RNA purifcation from agarose and acrylamide gels	RNaid Kit	75 bases–10 kb	Silica slurry
	RNaid SPIN Kit	75 bases–10 kb	Silica slurry plus SPIN filter

Nucleic Acid Purification

GeneClean®

Cat. No. 111001200, 200 preps

- Purification of DNA fragments of 200 bp to 20kb
- Glassmilk silica slurry allows flexibility of reaction size and volume
- Isolation of DNA from TAE buffered agarose gels and solution

GeneClean® II

Cat. No. 111001400, 300 preps

- Purification of DNA fragments of 200 bp to 20 kb
- Glassmilk silica slurry allows flexibility of reaction size and volume
- Isolation of DNA from TAE and TBE buffered agarose gels and solution

GeneClean® III

Cat. No. 111001600, 600 preps

- Purification of DNA fragments of 200 bp to 20 kb
- EZ-Glassmilk silica slurry is easier to resuspend than the original Glassmilk
- EZ-Glassmilk silica slurry allows flexibility of reaction size and volume
- Isolation of DNA from TAE and TBE buffered agarose gels and solution
- Purification of labeled DNA with ease

GeneClean® Turbo Kit

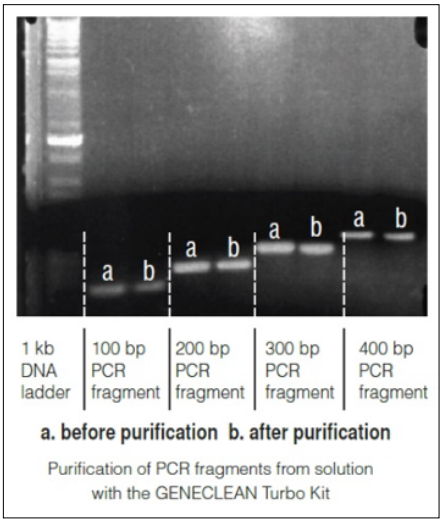
Cat. No. 111102200, 50 preps
Cat. No. 111102400, 100 preps
Cat. No. 111102600, 300 preps

- Purification of DNA fragments of 100 bp to 300 kb
- Isolation of DNA from TAE and TBE buffered agarose gels, PCR reactions and other enzymatic solutions
- Time savings by performing all steps with spin columns
- Purification of larger fragments due to less manipulation of bound DNA
- No carry over of silica slurry into the final DNA solution

GeneClean® SPIN Kit

Cat. No. 111101200, 50 preps
Cat. No. 111101400, 100 preps
Cat. No. 111101600, 300 preps

- Purification of DNA fragments of 200 bp to 300 kb
- Glassmilk silica slurry allows flexibility of reaction size and volume
- Isolation of DNA from TAE and TBE buffered agarose gels and solution
- Time savings by performing all steps in SPIN filters
- Purification of larger fragments due to less manipulation of bound DNA
- No carry over of silica slurry into the final DNA solution



Purification of PCR fragments from solution with the GENECLEAN Turbo Kit

MERmaid SPIN Kit

Cat. No. 111105200, 25 preps
Cat. No. 111105600, 150 preps

- Purification of DNA fragments of 10 bp to 200 bp
- Glassfog silica slurry allows flexibility of reaction size and volume
- Isolation of dsDNA or oligos from TAE buffered agarose or acrylamide gels and solutions
- Time savings by performing all steps in SPIN filters
- No carry over of silica slurry into the final DNA solution

RNaid SPIN Kit

Cat. No. 111107200, 200 preps

- Purification of RNA fragments from 75 bases to 10 kb
- RNAMATRIX silica slurry allows flexibility of reaction size and volume
- Isolation of RNA from agarose or acrylamide gels and solutions
- Time saving by performing all steps in SPIN filters
- No carry over of silica slurry into the final RNA solution

RNaid Kit

Cat. No. 111007200, 200 preps

- Purification of RNA fragments from 75 bases to 10 kb
- RNAMATRIX silica slurry allows flexibility of reaction size and volume
- Isolation of RNA from agarose or acrylamide gels and solutions

Optimize your Molecular Biology Workflow with our Complete Solution

LYSIS

EXTRACTION & PURIFICATION

PCR

ELECTROPHORESIS

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7X™ Ready-to-use Detergent

Does your detergent leave behind residue like bacteria, microbial debris and fluorescence? Cited in over 8,000 scientific publications, 7X detergent from MP Bio has been highly recommended for use in a variety of applications, ranging from lab maintenance to industrial cell culture. Scientists, lab technicians, and biotechnologists around the world have been using this product for over 65 years to ensure that high degree of cleanliness necessary in any lab.

- Effective, water-soluble and eco-friendly cleaning solutions
- Does not etch to glass or plastic labware
- Nontoxic for tissue and cell cultures
- Eliminates interfering fluorescence residues for flow cytometry
- No need for pH adjustment
- Easy and safe to use, no gloves required
- Concentrated – 1 gallon can make up to 100 gallons of cleaning solution

Description	Size	Cat. No.
7X Cleaning Solution	1 gal	097667093
7X Cleaning Solution	4 x 1 gal	097667094
7X-O-Matic Solution, Machine Wash	4 x 1 gal	097667494
ES 7X Cleaning Solution, Environment-Safe	4 x 1 gal	097667194
ES 7X Cleaning Solution, Environment-Safe	1 gal	097667193

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In addition to our extensive portfolio of reagents for Electrophoresis, MP Bio also offers a complete collection of general and niche life science products. Drawing on years of manufacturing and laboratory experience, our diverse array of products cover the areas of molecular biology, biochemistry, immunology, cell biology, fine chemicals, and diagnostics. Our comprehensive workflow solutions are suitable for a variety of research applications and we remain a leader in sample preparation.

MP Bio is dedicated in providing the best possible reagents, kits and services so researchers and scientists can achieve the same results, every time. We support our customers through exceptional customer service and technical support and afford scientists with a wealth of products, tools, and resources. As your partner in research, MP Bio is a one stop destination for quality products, reliable services, and innovative solutions.

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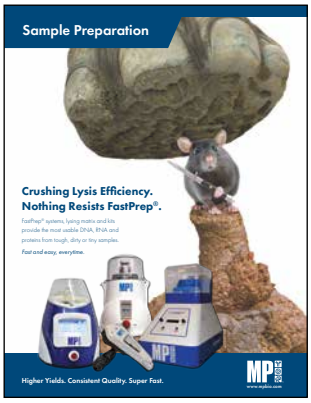

Sample Preparation

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