



2001/2002 MSPPSA SERIES

# ELECTROPHORETIC EQUIPMENT & REAGENTS

AN ANALYSIS OF  
MARKET SIZE & GROWTH,  
MARKET SHARE,  
PURCHASE PLANS &  
SUPPLIER ASSESSMENT FOR THE  
U.S. LIFE SCIENCE RESEARCH MARKET

*A Multi-Client Report*

by  
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San Carlos, California

March 6, 2001

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# I. BACKGROUND

## A. SURVEY OBJECTIVES

The purpose of this survey was to provide the management of our client companies with an analysis of the current U.S. market for electrophoretic equipment (including protein and nucleic acid electrophoretic gel chambers and power supplies) and gel media (including ready-made gels as well as media for hand-cast gels). This represents the attitudes of a cross section of researchers who utilize gel electrophoresis of in their work.

The surveying was blind, with no reference made to any clients for the survey. To encourage respondents to express themselves freely and without bias, the survey was anonymous, and made frequent use of open-ended questions.

At the beginning of the survey, respondents were asked whether or not they currently analyzed protein or nucleic acid samples by electrophoresis in their work. Those answering negatively were requested to back out of the survey as they were not qualified to continue. Those answering positively were asked to specify the electrophoretic techniques they currently performed. These were selected from a comprehensive list of 12 options including SDS-PAGE, native PAGE, urea PAGE, electrofocusing, 2-D electrophoresis, electroblotting, DNA/RNA submarine, manual DNA sequencing, mutational analysis, preparative electrophoresis, pulsed field techniques and an 'other' option for techniques not represented on this list.

Respondents were then directed to a series of detailed audit questions. They were first queried about the electrophoretic chambers they have purchased in the last 5 years. Specifically, researchers were asked to itemize the brand, model, number of instruments, the year acquired and the type of gel chamber (either mini PAGE, PAGE, IEF, blot or prep) used for protein electrophoresis. This was immediately followed by a detailed audit in which researchers were asked to provide comparable information regarding nucleic acid electrophoresis chambers they had purchased in the last five years. These instruments were classified into any one of the following five categories: submarine, sequencing, pulsed field, SSDP or DGGE.

Next, respondents were queried about the power supplies they had purchased in the last 5 years. In particular, respondents were asked to specify the brand, model, quantity, year of acquisition, maximum voltage and purpose (either nucleic acid or protein separation) for all recently purchased power supplies.

Respondents were also asked to indicate whether they plan to purchase any new electrophoresis instrumentation in the coming 12 months. For those answering positively, the brand(s) and model(s) under consideration were also requested. In addition, researchers indicated whether there were any

brands of electrophoresis instrumentation which they wouldn't buy, and if so, to specify the offending brand and the reason for dissatisfaction.

The section on electrophoretic instrumentation ends with a request for respondents to identify the top ranked manufacturer from a list of eight major instrument manufacturers according to five different criteria. These are easiest to use, most reliable quality, best value for money, highest versatility and best service and support.

The next series of questions relates to respondent's usage of ready made gels. Researchers were queried whether they used ready-made gels for some or all of their work and what proportion this represented. Respondents who answered negatively were directed to skip to Question #12. Those answering positively were directed to a detailed audit question in which the brand, type of gel, percent monomer, consumption (in gels per month) and the approximate cost per gel for all PAGE, SDS-PAGE, gradient PAGE, electrofocusing, DNA PAGE and sequencing gels.

Respondents who are not currently using ready-made gels, and therefore must be pouring their own gels, were then asked to describe the reasoning behind their decision and whether they expected to start using these within the next 12 months. They were then asked to specify which form of gel media product they usually purchase (premixed liquid, premixed powder or unmixed powder) and to provide detailed audit data. They were specifically requested to provide the brand and product name, the consumption (in packages per month), the volume per package and the approximate price per package for all acrylamide, acrylamide/bis mixtures or agarose they usually purchase.

Brands of electrophoresis gels and media which would not be purchased were also identified along with an explanation of the reason for the respondent's dissatisfaction. Finally, respondents selected the top ranked electrophoretic gel and media supplier from a list of 11 major suppliers with regards to the following four key criteria: value for money, consistent quality, high resolution, fast delivery, application support, and width of product range.

All user-respondents were also asked a question regarding the forecast percent change in their use of ready-made and hand-cast gels over the coming twelve months. The single demographic screen used to characterize respondents was the type of organization and the electrophoretic techniques presently used.

Major objectives of the survey were to estimate the present size of this market and to determine the present market share for major electrophoretic instrumentation and gel categories, based upon the projected unit and dollar volume of a comprehensive list of electrophoretic instrumentation and gel media. These include a separate evaluation of electrophoretic chambers for either protein or nucleic acid separation, power supplies, as well as ready-

made and consumables for making hand-cast gels, and to measure the market's projected near-term growth rate. Finally, a key objective was to identify the leading instrument manufacturers and consumable suppliers in terms of units sold and estimated dollar spend.

The audit should permit the evaluation of our clients' present market positions, identify marketing strengths and weaknesses, and suggest strategies to develop or improve sustainable competitive advantage.

This report is the second 2001/2002 study in a growing series of market research analyses that began in 1993. We plan to continue the series, adding titles and alternating between U.S. and international markets, depending upon our clients' suggestions and support.

Topics in the U.S. series to be published in 2001/2002 include:

Electrophoretic Instrumentation & Reagents  
Molecular Biology Reagent Systems, Vol. 2

This series also includes the following reports covering international markets:

Densitometers & Image Analysis in Europe  
DNA Sequencing in the Far East.

The 2000/2001 series covered the following three reports:

U.S. DNA Amplification  
U.S. Molecular Biology Reagent Systems, Vol. 1  
Molecular Biology Reagent Systems, Vol. 1 in the Far East.

In the 1999/2000 series, we have released three reports examining the following markets. These are:

Microplate Equipment in Europe  
DNA Sequencing in the U.S.  
Monoclonal Antibodies in the U.S.

The following nine titles have been released in the series for 1998/1999:

Cell & Tissue Culture in the U.S.  
Cytokines & Growth Factors in the U.S.  
DNA Amplification in the Far East  
DNA Sequencing in Europe  
Electrophoretic Gel Media in Europe  
HPLC in the Life Sciences in the U.S.  
Molecular Biology Reagent Systems, Vol. 1  
Molecular Biology Reagent Systems, Vol. 2 in the Far East

Protein Expression Systems in the U.S.

The following titles have been released in the U.S. series for 1997/8:

DNA Sequencing  
Molecular Biology Reagent Systems, Vol. 1  
Molecular Biology Reagent Systems, Vol. 2  
Molecular Diagnostics.

Clients are reminded that additional copies of any of these reports that have been purchased in the past are available at a modest cost. Please contact us for further details. Those wishing to know publication dates for any of these reports, or wanting to read summaries of the 72+ reports in this series are invited to visit our Web site at: [www.phortech.com](http://www.phortech.com).

## B. SURVEY METHODOLOGY

E-mail invitations to take part in the survey were sent to a selected cross-section of life science researchers from our panel of over 5,000 US life science researchers. After selection for appropriate areas of interest, invitations were sent to a random selection of 1,056 U.S. members of the panel who have been in contact with us in the last year. Customized e-mail invitations to the web site survey were sent to selected individuals on several occasions throughout November 2000.

Each participant received an e-mail invitation including the web address of the survey and a unique validation code.

To improve response rates, respondents were able to select from a choice of five prizes for completing the survey. These were a laser pointer, a AAA mini Maglite flashlight, a full pound of Starbucks coffee, a \$5 gift card good towards any purchase at Barnes & Noble or a custom designed tee-shirt.

By the close of the survey on November 29, 2000, we had received 414 responses. After removing duplicate responses and non-users, there were a total of 409 valid responses which translates to an 38.7% response rate. This substantially exceeded our expectations.

We did not observe any survey fatigue in this questionnaire, and felt that respondents spent considerable time explaining their positions on the open-ended questions. We have no reason not to believe that the survey is representative of the entire U.S. population of electrophoresis gel users.

Based upon 409 responses, the overall statistical results presented in this report are accurate to within  $\pm 4.8$  percentage points at the 95% confidence level. In cases where we only calculate the percentage of the 181 respondents currently using ready-made gels, the statistical results are accurate to within  $\pm 7.3\%$ . Where we calculate the percentage of the 325 respondents that currently use hand-cast electrophoretic gels, the results are accurate to  $\pm 5.4\%$ .

In our experience, 95% confidence levels are appropriate primarily for scientific experiments. Most business people making decisions are content to be right more often than they are wrong. In this case, a 65% confidence level, (in which you would be right twice as often as you would be wrong) is appropriate. Conveniently, 65% confidence levels are nearly exactly one half the size of the 95% level, thus our 65% levels would be  $\pm 2.4\%$  for all respondents and  $\pm 3.6\%$  for all ready-made gel users, and  $\pm 2.7\%$  for researchers pouring their own gels.

According to the binomial distribution theory, these values are valid when the measured event has about a 50% probability. When the measured event is considerably more rare than this, the corresponding confidence intervals get smaller. On the other hand, these confidence intervals are valid for answers based upon the complete pool of respondents. When analyzing data for a group that includes only a small segment of respondents, the answers are less certain and confidence intervals are correspondingly larger.

In this report, we will calculate more exact individual confidence intervals when appropriate. In our comments, we will note whether given differences are significant at either the 65% or 95% level. To aid our clients in determining the appropriate confidence interval for various combinations of sample size and measurements, we have created the following table. Just read the closest percentage on the left and find the closest sample size column. The intersection will show the confidence interval for that combination. For example, a measured 35% value with a sample size of 200 has a 95% confidence interval of  $\pm 6.6\%$ .

**95% Confidence Intervals for Various Percentages & Sample Sizes**

Percent	n=10	n=20	n=50	n=100	n=200	n=500	n=1000
5%	$\pm 13.5\%$	$\pm 9.6\%$	$\pm 6.0\%$	$\pm 4.3\%$	$\pm 3.0\%$	$\pm 1.9\%$	$\pm 1.4\%$
10%	$\pm 18.6\%$	$\pm 13.1\%$	$\pm 8.3\%$	$\pm 5.9\%$	$\pm 4.2\%$	$\pm 2.6\%$	$\pm 1.9\%$
20%	$\pm 24.8\%$	$\pm 17.5\%$	$\pm 11.1\%$	$\pm 7.8\%$	$\pm 5.5\%$	$\pm 3.5\%$	$\pm 2.5\%$
35%	$\pm 29.6\%$	$\pm 20.9\%$	$\pm 13.2\%$	$\pm 9.3\%$	$\pm 6.6\%$	$\pm 4.2\%$	$\pm 3.0\%$
50%	$\pm 31.0\%$	$\pm 21.9\%$	$\pm 13.9\%$	$\pm 9.8\%$	$\pm 6.9\%$	$\pm 4.4\%$	$\pm 3.1\%$
65%	$\pm 29.6\%$	$\pm 20.9\%$	$\pm 13.2\%$	$\pm 9.3\%$	$\pm 6.6\%$	$\pm 4.2\%$	$\pm 3.0\%$
80%	$\pm 24.8\%$	$\pm 17.5\%$	$\pm 11.1\%$	$\pm 7.8\%$	$\pm 5.5\%$	$\pm 3.5\%$	$\pm 2.5\%$
90%	$\pm 18.6\%$	$\pm 13.1\%$	$\pm 8.3\%$	$\pm 5.9\%$	$\pm 4.2\%$	$\pm 2.6\%$	$\pm 1.9\%$
95%	$\pm 13.5\%$	$\pm 9.6\%$	$\pm 6.0\%$	$\pm 4.3\%$	$\pm 3.0\%$	$\pm 1.9\%$	$\pm 1.4\%$



# II. DEMOGRAPHIC SEGMENTATION

## QUESTION 0.

### **Question:**

On the survey, we asked several questions allowing us to classify respondents according to the type of samples currently analyzed by electrophoresis and the source of the electrophoretic gels.

### **Rationale:**

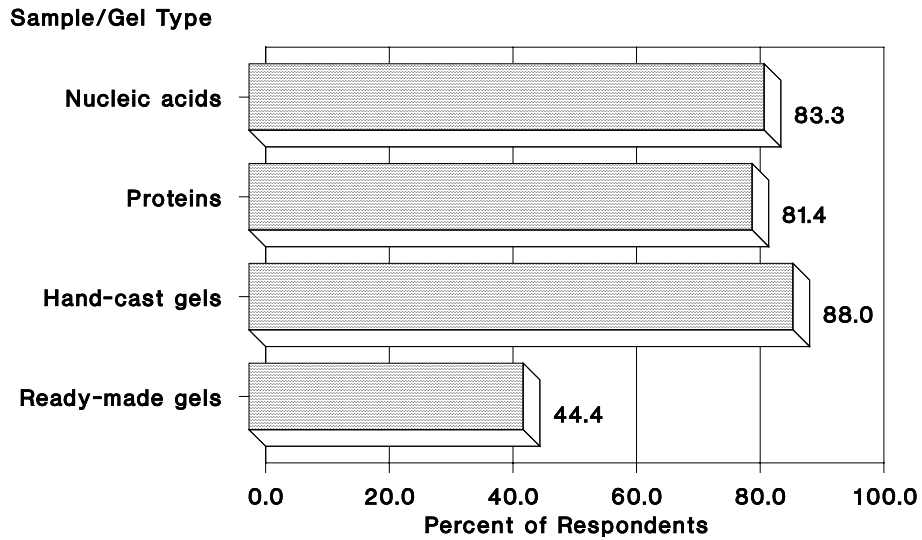
Here we will characterize each respondents' usage first according to the two main types of samples, proteins or nucleic acids. Similarly, each researcher will also be classified according to the type of gel used to perform these separations, that is, either ready-made gels or hand cast gels. We would expect there to be a considerable degree of overlap between the two classes of samples and types of gels.

### **Results:**

Identifying the respondents in each category required examination of the several questions in the survey. For example, respondents using protein electrophoresis either provided a detailed description of their protein electrophoresis gel chamber, currently perform electrofocusing (from Question #2) or indicated in the power supply audit that they are using a power supply for the separation of proteins. Similarly, the slightly smaller group of researchers separating nucleic acids either indicated that they use a power supply for the separation of nucleic acids, are performing either DNA/RNA submarine or manual DNA sequencing, or described a nucleic acid gel chamber in Question #4. The identification of ready-made gel and hand-cast gel users was somewhat simpler, either those providing information in the appropriate audit or those indicating usage in the associated questions just prior to each audit question. Using these parameters, we have been able to identify the sample type(s) for 398 of the 409 respondents, and the gel type for 405 respondents.

At the top of the next page, we present a horizontal bar graph showing the distribution of respondents over these four categories.

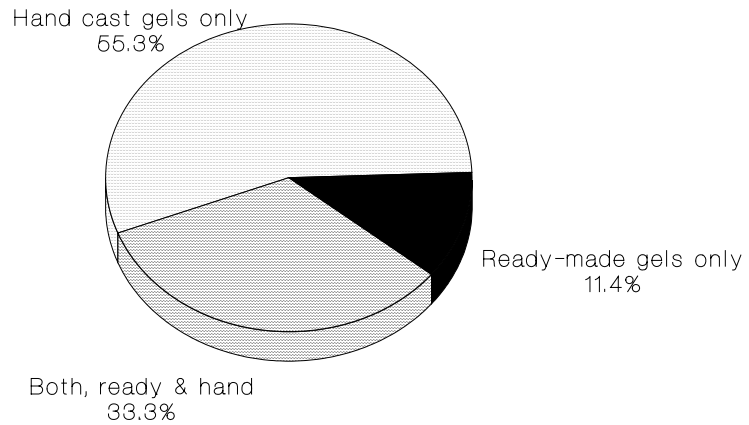
## Respondents' Electrophoretic Separations Types of Samples & Types of Gels 2000/2001 US Electrophoretic Equip/Media



Each classification is well represented by the respondents to this survey with an equal number separating nucleic acids and proteins. Hand cast gels, however, is used by exactly twice as many respondents as ready-made gels.

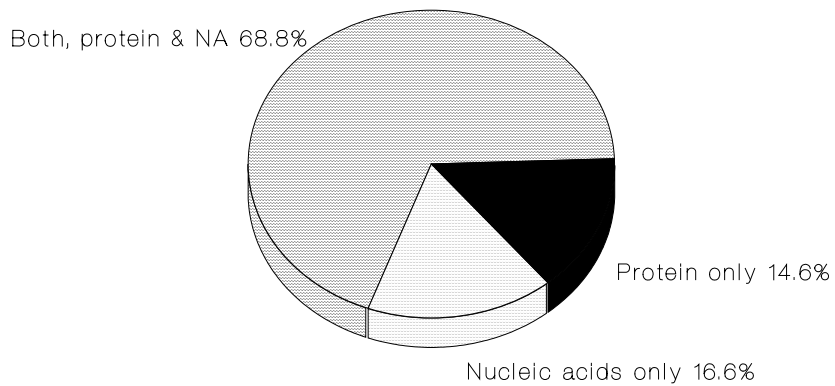
Lastly, we examine these two characteristics, the types of gels consumed and samples run, separately in order to determine the proportion of researchers using just one or both of the options available to them. As seen in the pie chart at the top of the next page, most respondents are using hand-cast gels only. At the bottom of the page, the companion graph depicting the samples separated, by far, the largest proportion of researchers are working with both nucleic acids and proteins.

### Segmentation of Electrophoresis Users Ready-Made vs. Hand Cast Gels 2000/2001 US Electrophoresis Equip/Media



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### Segmentation of Electrophoresis Users Protein vs Nucleic Acid Separations 2000/2001 US Electrophoresis Equip/Media



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## QUESTION 18.

### **Question:**

How would you best describe your organization: Academia, Hospital/med school, Industry, Government agency, or Private research foundation?

### **Rationale:**

This is one of our standard demographic questions, designed to identify the location of respondents which are, in this case, performing electrophoresis of protein or nucleic acid samples. We will examine the distribution of all respondents as well as those using ready-made gels. The responses to this question define our grouping for each organization. Further in the report, we use this in conjunction with the responses to other questions to identify trends by organization type.

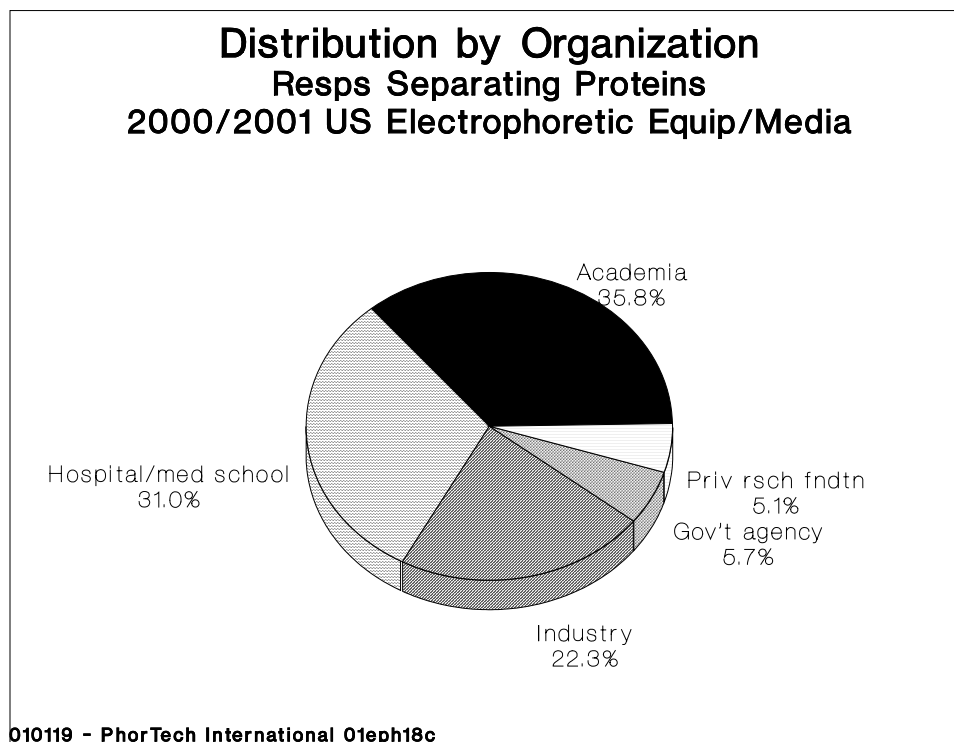
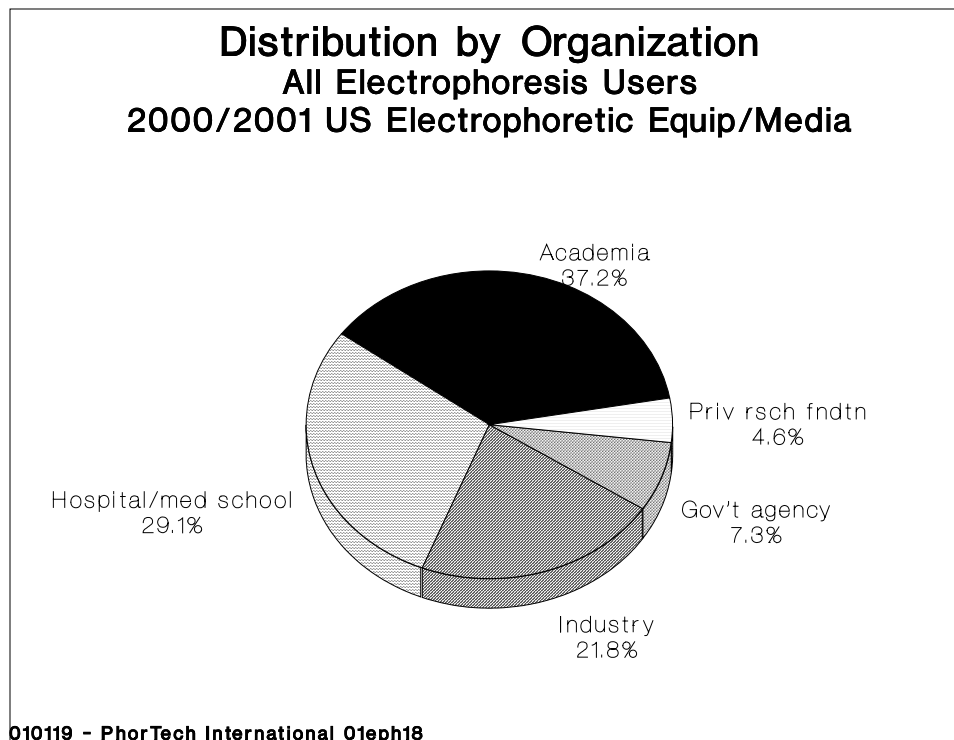
### **Results:**

Before presenting the results, some editing of the data was required for consistency. The largest number of edits involved researchers located at medical schools who identified themselves as academic/university. These are now all classified as a hospital or medical school. In addition, Veteran's Administration Medical Centers have been grouped under government and all organizations with a .org extension on their email address have been identified as private research foundations.

The resulting shares of the 409 respondents answering this question is depicted in the pie chart found at the top of the next page.

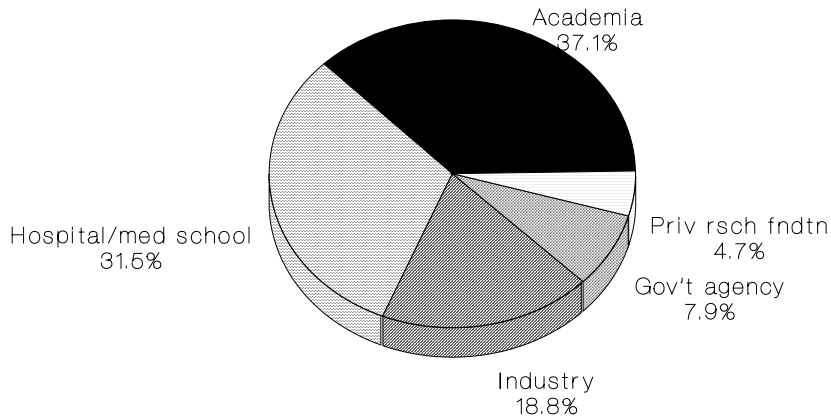
Just over one third of our electrophoresis users are located in an academic setting while slightly fewer are working in a hospital or a medical school. Respondents from the industrial sector make up one in five of the respondent pool with very few, totaling one in eight combined, working in a government agency or private research foundation.

Next, we examine the comparable distribution of respondents working with proteins or nucleic acids. At the bottom of the next page, the location of the 332 respondents separating protein samples by electrophoresis is depicted.



There is no significant difference between the two pie graphs, indicating that researchers performing protein electrophoresis are not any more or less likely to be found in any one organizational segment. At the top of the next page, are the comparable results for the 340 researchers separating nucleic acids.

**Distribution by Organization  
Resps Separating Nucleic Acids  
2000/2001 US Electrophoretic Equip/Media**

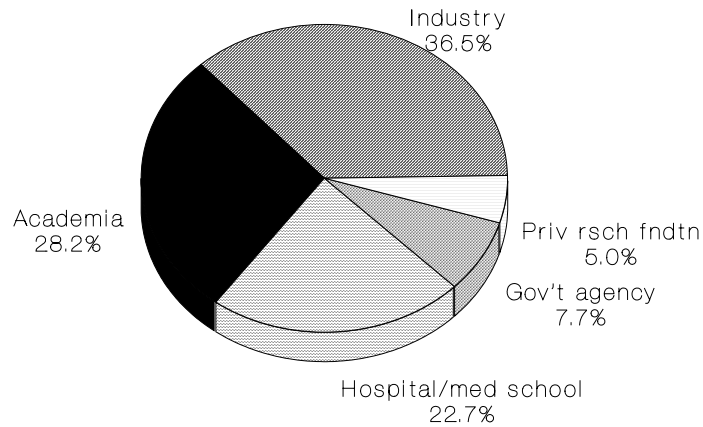


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Again, there is no significant difference between the results for this group and all respondents to the survey.

Below, we examine the location of the 181 respondents currently purchasing ready-made gels.

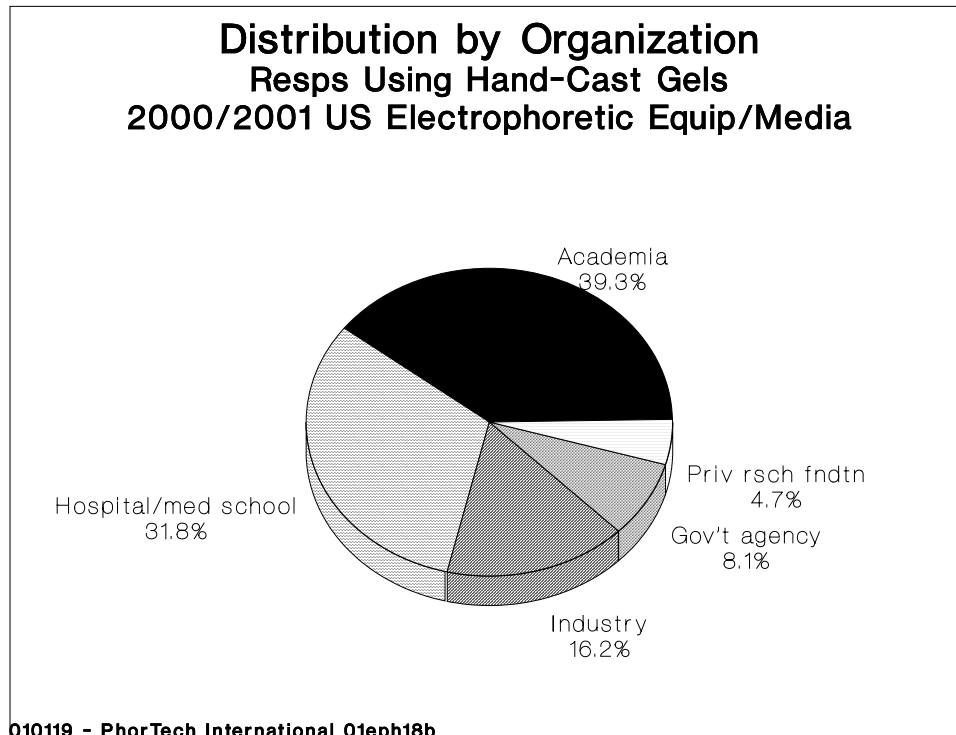
**Distribution by Organization  
Resps Purchasing Ready-Made Gels  
2000/2001 US Electrophoretic Equip/Media**



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This is notably different with 74% of all industrial researchers using ready made gels to fulfill at least some of their gel requirements. This is significantly greater than the comparable 47% of government workers or similar proportion of foundation researchers purchasing these gels. For respondents in the academic sector, 34% percent reported purchasing gels, identical to that for respondents located in hospitals or medical schools.

The final pie chart showing the location of the 359 researchers casting their own gels by hand is very similar to the original graph. Again, this would imply that at least some of electrophoresis gels continue to be hand-cast in each of our organizational segments.



## QUESTION 2.

### Question:

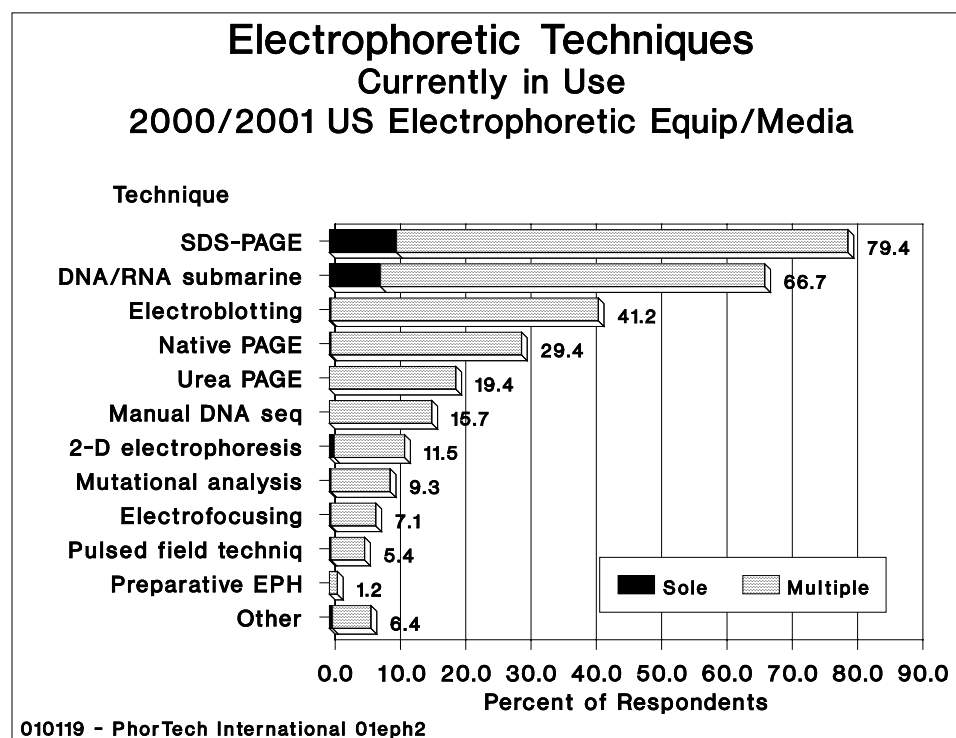
Which electrophoretic techniques does your group presently use (*Please check all that apply*): SDS-PAGE, Native PAGE, Urea PAGE, Electrofocusing, 2-D electrophoresis, Electroblothing, DNA/RNA submarine, Manual DNA sequencing, Mutational analysis, Preparative, Pulsed field techniques, or Other: \_\_\_\_\_?.

### Rationale:

With this question, we begin to analyze current popularity of various electrophoretic methods. We believe that the eleven categories provide a comprehensive list of the most common techniques currently in use with an open-ended option provided for respondents to include any which were not included.

### Results:

The 408 respondents who answered this question report over a hundred different combinations of the eleven techniques listed on the survey. A total of 84 respondents, equivalent to 20.6%, use a single technique while multiple responses varied from two techniques up to a single researcher using all ten techniques listed. The proportion of respondents using each technique is shown in the following horizontal bar graph. Sole mentions are shaded black and multiple mentions are represented using a hatched pattern.



SDS-PAGE and DNA/RNA submarine separations are used by a majority of the respondents. Fully 40% are performing electroblotting, approximately three times the number performing manual DNA sequencing or 2-dimensional electrophoresis. At the other end, the least common techniques are preparative electrophoresis, pulsed field techniques and electrofocusing.

The 22 verbatim descriptions of 'Other' techniques not itemized on the survey are presented below.

#### Verbatim Description of 'Other' Electrophoretic Techniques

Agarose  
Agarose GE  
Automated DNA sequencing  
Automated DNA sequencing  
Automated DNA sequencing  
Automated DNA sequencing and fragment analysis  
Automated genotyping  
Capillary  
Capillary electrophoresis  
CE  
Cellulose acetate  
DGGE  
DNA digestion analysis  
DNA sequencing by machine  
EMSA gels  
Fluorescent sequencing  
Genotyping microsatellites  
Long Ranger in ABI 377 system  
Mobility gel shift assays  
REMSA  
TBE PAGE  
Urea NEPHGE

Apart from six mentions for automated sequencing, and a single additional mention for fluorescent sequencing, three for capillary electrophoresis and two mentions specifically identifying agarose gels, the remainder cover a diverse range of applications, as well as variations on the traditional polyacrylamide gel electrophoretic gel, such as TBE PAGE.

#### **Analysis:**

The list of techniques have been modified slightly and expanded from eight options in our earlier 1995 survey of the U.S. market to the current list of 11. In that previous survey, the proportion of U.S. researchers using five of the six techniques appearing on both surveys were virtually identical. These techniques include SDS/PAGE, DNA submarine gels, electroblotting, 2-D electrophoresis and pulsed field techniques. Only electrofocusing, reportedly used by 13.3% of the respondents in 1995 has now dropped to half that

number despite the fact that the overall percentage of researchers separating proteins was the same. Our examination of the European market in 1997/98 yielded an increased number of researchers using electrofocusing, 2-dimensional electrophoresis and pulsed field techniques accompanied by a ten percentage point drop in the usage of the two most common techniques, SDS-PAGE and DNA submarine gels. Despite this, SDS-PAGE and DNA submarine gels have consistently placed first and second while electroblotting has jumped from fourth to its current third place standing.

Finally, while 'DNA sequencing' was included as an option on previous surveys, we were not able to make any direct comparisons with the more limited option listed on this survey which specified manual sequencing, rather than the more expensive automated procedure.

