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DNA Microarrays:
A Market Update

Biocompare Surveys and Reports
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Report Introduction

The 2006 DNA Microarray Report is composed of a market overview and an introduction to the 2006 DNA Microarray Survey, which contains questions about the DNA microarray systems and related applications that researchers are using. The report also includes a discussion of the survey results and conclusions and recommendations drawn from both the market analysis of DNA microarrays and the survey data. In addition, a new feature, industry dialog, presents an interview with an expert in DNA microarrays and rounds out this comprehensive report offering.

The market overview describes the use of DNA microarrays in the life science research arena to examine gene expression and single nucleotide polymorphisms (SNPs), as well as to characterize entire genomes. DNA microarrays have also found applications in drug discovery, including lead compound optimization, toxicity studies, and the screening and monitoring of patient data during clinical trials.

The first report of the use of DNA microarrays came in 1991, with the publication of the chemical synthesis of oligonucleotides on glass chips by Fodor et al.[1] This author went on to develop the first DNA microarray and founded the company Affymetrix, still the major industry leader of microarrays and associated reagents today. Currently, Affymetrix brings in well over $350 million in microarray-related revenue annually. Other companies have since joined in the hunt for market share, including Agilent, GE Healthcare, and Illumina. But at present, these three companies combined only account for just over one-third of Affymetrix's microarray sales.

Custom arrays are becoming more popular among scientists and have brought other companies into the microarray arena. NimbleGen joined with Affymetrix to provide a flexible photolithographic Maskless Array technology, which is advantageous for the production of custom arrays. Invitrogen acquired Xeotron Corp, a producer of custom arrays, to make forays into the microarray market. DNA microarrays currently bring in yearly revenues of nearly $450 million, growing at almost 11% annually. Microarray scanners and readers also contribute to this figure, with a compound annual growth rate that is predicted to approach almost $1 billion by 2010.

The advances in various technologies have spurred interest in DNA microarrays and their applications. Better instrumentation, higher throughput, and lower cost continue to draw more users from a variety of scientific disciplines. The expanding use of nucleic acid microarrays has provided a needed boost for clinical diagnostics, biodefense, forensics, and agriculture, areas outside the traditional domain of the life sciences. Advances in biochips, a chip assay format, are predicted to boost microarray revenues even higher, with an average annual growth rate predicted to top $5.3 billion by 2009. Such anticipated growth will open the door for other innovative companies to share in the market.

1. Fodor SP et al, "Light-directed, spatially addressable parallel chemical synthesis", Science 251(4995): 767-73, 1991.

Market Overview

DNA microarrays first appeared on the life science scene in February 1991. It was then that the journal Science published the paper "Light-directed, spatially addressable parallel chemical synthesis"[1]. Having detailed the technology for synthesizing oligonucleotides on a tiny glass chip, Stephen P.A. Fodor, Ph.D., the paper's first author, went on to create the first DNA microarray, which he eventually named the GeneChip. In 1992, Dr. Fodor founded Affymetrix. The company launched the first commercial DNA microarray in 1994. In the fiscal year ending in December 31, 1995, the company brought in revenues of $4.6 million[2]. During the next fiscal year, revenues were $12.0 million[3]. Nine years later, during the fiscal year ending December 31, 2005, Affymetrix's revenues are at nearly $368 million[4].

This revenue growth has been brought about because of the fact that nucleic acid microarrays have found many uses. Basic research labs use microarrays to examine gene expression and single nucleotide polymorphisms, characterize genotypes and compare whole genomes[5]. While drug discoverery labs have found microarrays efficient tools for lead optimization, toxicity prediction, screening patients for clinical trials and monitoring their progress.

Right Place, Right Time

The arrival of the DNA microarray couldn't have come at a more optimal time. During the late 1980s, gene sequencing efforts were beginning to gain steam with improved methods and the introduction of the first automated sequencer by Applied Biosystems Group (Foster City, Calif.), which is now part of Applera Corporation (Norwalk, Conn.). By the early 1990s, researchers began examining the sequenced genes and their functions, thus launching the genomics era. Microarrays liberated researchers from the tedious process of studying gene sequences individually. By providing the capability to simultaneously screen thousands of oligonucleotides, microarrays quickly became a standard tool for studying gene expression.

"DNA microarray products are quickly becoming integral tools for both pre-clinical and clinical research," said Jessica Shah, industry manager at Frost & Sullivan. "Furthermore, the power of microarray technologies is just beginning to be explored in the diagnostics arena, where they will be crucial for making therapeutic decisions."

With such potential, many companies have joined the fray with their own brand of nucleic acid microarrays. Now, leading companies include Agilent Technologies Inc (Palo Alto, Calif.), GE Healthcare Bio-Sciences (Little Chalfont, UK), Illumina Inc (San Diego, Calif.)[6], according to Cambridge Healthtech Advisors. However, the combined sales of these three companies equate to just over a third of Affymetrix's sales. In fact, the microarray giant accounts for more than half of all microarray units sold. Affymetrix also leads in instruments for microarray readers and other related accessories. Whereas Agilent reports placing its microarray instruments with 400 customers, Affymetrix has placed more than 1,000 instruments.

Market Overview (continued)

The microarray giant also dominates in the areas of licensing, marketing and distribution deals[7], according to Kalorama Information. In regards to R&D alliances, Affymetrix shares the distinction of being most active with Agilent and CombiMatrix Corp (Mukilteo, Wash.).

NimbleGen Systems Inc (Madison, Wisc.) joins Affymetrix and Agilent as having catalogs with the broadest selection of arrays[8]. These three companies also lead the pack in terms of custom arrays, which are slated for major growth. In 2004, Affymetrix moved to secure its position in custom arrays by partnering with NimbleGen, whose photolithographic Maskless Array Synthesis technology enables flexibility, which is advantageous in producing custom arrays. During the same year, Invitrogen Corp (Carlsbad, Calif.) entered the market with its acquisition of Xeotron Corp (Houston, Texas), which also specialized in custom arrays.

Rewarding Returns

Such alliances and acquisitions demonstrate the vitality of the nucleic acid microarray market. In 2005, DNA microarrays brought in revenues of $446.8 million[9], according to Frost & Sullivan. The compound annual growth rate of 10.9 percent should bring in revenues of $532.1 million by 2012.

On the global level, gains in the commercial market and continued need for scanners and readers will fuel a CAGR of 6.7 percent from 2003 to 2010[10], resulting in revenues of $937 million by 2010. Alternately, BCC Research estimates that the global market will exceed $1 billion in 2007, with an average annual growth rate of 13.4 percent from 2002 to 2007[11]. Microarrays themselves will account for $744 million with an AAGR of 11.7 percent. Reagents and other relevant materials, with an AAGR of 18.8 percent, will account for about $275 million.

Part of the growth reflects the acknowledgement that homebrewed microarrays yield results that lack the reproducibility and standardization required for comparison.

“Scientists traditionally using homebrew methods are moving towards commercial technology for higher sensitivity results,” Shah said.

Several companies offer suites of products and accessories to support the end to end use of microarrays from preparation to analysis. Items include reagents for sample preparation, probe labeling and hybridization, devices for hybridization and scanning and data analysis software. These packages help to eliminate the variability that can occur both during the multi-step microarraying process as well as the variability that can from experiment to experiment.

“Manufacturers are spending considerable time and effort cross comparing their products to industry standards, which includes quantitative PCR and other microarray platforms,” Shah said.

The custom array market is also drawing more researchers from their institution’s core labs. New

Market Overview (continued)

technologies have enabled companies to more easily produce custom arrays, making them more affordable. Advances in technology are also attracting new customers who are drawn to microarrays as a result of better instrumentation, increased throughput and/or decreasing costs. On the other hand, revenues may face threats from the dwindling budget of the National Institutes of Health, a decreasing focus on genomics, the relatively high cost of microarray technology and the barriers in receiving approval from the U.S. Food and Drug Administration[12].

For Better and For Worse

Interest in the new types of nucleic acid microarrays are helping to offset these challenges. High density arrays can display entire genomes on one chip. Splice variant microarrays display cDNA from differently spliced mRNA. Arrays for comparative genomic hybridization allow researchers to compare numbers of gene copies. The discovery of microRNA's importance in gene regulation has companies offering them for screening on arrays. And, Agilent's ChIP-on-chip provides a platform for chromatin immunoprecipitation to examine regulatory regions on the genome.

Augmenting sales are customers outside life science research. Nucleic acid microarrays are finding increasing utility in biodefense, clinical diagnostics, forensics, environmental sciences and agriculture[13]. Expanding use of nucleic acid microarrays will help them to maintain dominance in the realm of miniaturized chip assays[14]. In 2004, nucleic acid microarrays accounted for $650 million of the $1.4 billion revenues of the total U.S. array market, according to Kalorama Information.

However, expanding applications for the chip assay format, also known as biochips, are beginning to accumulate. While the total chip assay market will grow at an AAGR of 30.5 percent through 2009, the market for nucleic acid microarrays will grow at 20 percent[15]. At that time, the total market is estimated to generate revenues of $5.3 billion. Nucleic acid microarrays will bring in $1.3 billion. From 2009 to 2014, growth for nucleic acid microarrays will decrease to 14.6 percent with increasing interest and selection in other types of arrays, including those for protein, tissue, cells, carbohydrates and small molecules.

"There is little doubt that these technologies will be enormously important and the market will expand," said Kenneth G. Kruhl, Ph.D., author of the Kalorama report. "The real questions for the industry are 'How fast will the market expand?', and perhaps more important, 'When will the expansion take place?'".

Great Prospects, Grand Plans

The chip format also faces competition from the popularity of bead-based assays, with Illumina, Luminex Corp (Austin, Texas) and Quantum Dot Corp (Hayward, Calif.) as notable players[16]. Microarrays based on 96-well microplates have also gained a large following. Companies will continue to offer arrays representing certain disease areas and cell or tissue types for an increasing number of organisms.

Market Overview (continued)

Microarrays hold great potential for penetrating the $20 billion in vitro diagnostics industry[17] and supporting the burgeoning area of pharmacogenomics, which aims to not only improve diagnoses, but also treatment decisions. But these possibilities await efforts to characterize and validate genomic signatures for specific conditions and susceptibilities. Then, such approaches face the many hurdles of the FDA before reaching the marketplace.

1. Fodor SP et al, "Light-directed, spatially addressable parallel chemical synthesis", Science 251(4995): 767-73, 1991.
2. Affymetrix Inc, "Affymetrix, Inc. Reports 1996 Year End Financial Results" (press release), January 27, 1997.
3. Ibid.
4. Affymetrix Inc, Form 10-K for period ending December 31, 2005, Filed March 9, 2006.
5. Rubenstein K, "Microarrays: Technologies, Applications, Markets", Cambridge Healthtech Advisors Advances Life Sciences Reports, November 2004.
6. Ibid.
7. Krul KG, "Markets in Analytical Chip Technology: Gene, Protein, Tissue, Cell, and Microbiological Microarrays, 2nd ed.", Kalorama Information, June 1, 2005.
8. Rubenstein K.
9. "U.S. DNA Microarray Markets", Frost & Sullivan, February 28, 2006.
10. "Strategic Analysis of World DNA Microarray Markets", Frost & Sullivan, March 1, 2004.
11. "DNA Microarrays and Their Materials", BCC Research, January 2004.
12. "U.S. DNA Microarray Markets".
13. "U.S. DNA Microarray Markets".
14. Krul KG.
15. Ibid.
16. Rubenstein K.
17. Ibid.

Industry Dialogue

Biocompare spoke to Kevin Meldrum, genomics marketing director at Agilent Technologies, Inc (Palo Alto, Calif.). Offering gene analysis products since 1994, Agilent is now positioned among leaders in the nucleic acid microarray market.

1. What is Agilent's approach to the microarray business?
Our goal is to provide a complete solution. We have liquid chromatography to separate complex mixtures of small molecules and proteins. We have microfluidic chips for liquid chromatography, which can integrate with the front end of our mass spectrometers. We also have reagents for sample preparation. For software to analyze results, we acquired Silicon Genetics (Redwood City, Calif.) last year and have been steadily expanding this bioinformatics platform. With microarrays, we've been branching out beyond the gene expression space into areas including DNA methylation, microRNA, comparative genomic hybridization and ChIP-on-chip (chromatin immunoprecipitation-on-a-chip). We recently signed a marketing alliance with ExonHit Therapeutics Inc. (Gaithersburg, Md.), for alternative splicing technology. We're now putting a lot of energy into the printing process for microarays and in situ synthesis. By building the probe on the slide, we offer a lot of flexibility to build all the different types of arrays. Driving toward higher spot density, we can print four arrays on same piece of glass. So, for the price of one piece of glass, you get four arrays.

2. How important is this type of economical pricing?
Price is an important market dynamic. It's allowed us to draw many customers who once made their own microarrays. Researchers or core facilities traditionally construct cDNA arrays. That requires a tedious process of producing clones, which depends on having the sequence of a specific organism. But many organisms haven't been sequenced. Until that happens it's not practical to make your own microarrays. One of our strengths is inkjet printing technology, along with flexible design tools that make it easy for us to make custom products. We don't have the overhead of creating photolithographic masks. Once we complete the probe design then we shoot it to the fabrication. It's like printing a document on your home inkjet printer.

3. What other factors are driving growth?
Biomarkers. Right now, researchers are using microarrays to look for biomarker signatures. Once they're determined, then microarrays can be used for predictive toxicology and pharmacogenomics. This goes hand in hand with the NIHs big initiative in translational medicine and getting drugs into the clinic faster. New applications, such as CGH, ChIP-on-chip, microRNA, are also driving growth. People are recognizing that gene expression alone doesn't provide a complete picture of what's going on in biology. These new applications are complementary techniques and provide a more comprehensive view of the relationship of various genes and other molecules. Many customers are interested in doing a CGH experiment in conjunction with a gene expression experiment. This allows them to correlate the effect on gene expression with changes in the genome, genetic aberrations, deletions and/or duplications. People run a chIP-on-chip experiment against a particular transcription factor to see where it binds on the genome and then correlate that with gene expression.

Industry Dialogue (continued)

4. Sounds like a great strategy. Why aren't all researchers using it?
The intimidating mounds of data. Right now, you may spend a week designing and executing an experiment, but spend three months analyzing the data. The answer lies in smarter data analysis tools to quickly and efficiently pull out the important biology. This is a big reason for Agilent's purchase of Silicon Genetics.

5. Are there other barriers to increasing your customer base?
Getting people comfortable and familiar with microarrays. Many researchers are physicians who are accustomed to more traditional pathology techniques involving microscopes and immunoassays. We need to bring them up to speed on what microarrays can do well and what they can't do. Cost can also be a barrier. Vendors like Agilent can reduce the total cost of experiments to open the market. For example, we recently launched a microarray subscription program which removes a financial barrier to running microarray experiements. If a lab commits to purchasing a certain number of microarrays per quarter, Agilent provides the scanner, reagents, training and support at no additional cost. The first stage in microarray adoption is when the homebrew market starts using commercial products. Then, as we move further down the pipeline of doing clinical testing, the patient population becomes much larger, and costs of running patient samples becomes more important. New formats for products, such as higher density arrays, also decrease costs. When this happens, more of the cost will be associated with sample preparation.

6. How do you see microRNA arrays growing and influencing the microarray market?
It's still fairly early stage in that people are still discovering new microRNAs. We have a project at Agilent focused on protocols and designs for microarrays to detect microRNAs. Customers are asking us for tools to map the presence and quantity of microRNAs in various samples. They want us to update biological content with the number and types of microRNAs on the microarrays on a continuous basis as the numbers of microRNAs continue to increase.

7. Can these new offerings and applications fend of competition from other technologies? Bead technologies are certainly competitive to traditional planar microarrays. But, I don't see a significant cost advantage. You'll find that the costs are fairly equivalent. As the printing technology becomes more sophisticated and we can print smaller amounts of nucleic acids on the slide, microarrays will be able to leverage cost.

8. But will you be able to maintain sensitivity and specificity?
Yes. At Agilent, we have a distinct advantage today because we use 60mer probes, which are longer than others. You get better sensitivity and specificity. As we move forward with the technology, we have a lot of flexibility in optimizing probe length and won't be limited to just 60 mer. On the other side, reagents to detect hybridization are changing. Some users are moving from fluorescent probes to chemiluminescence. There may be a migration to other detection techniques for additional sensitivity. So, it's the combination of the base technology for designing and constructing the microarray and the method you use to detect binding.

Industry Dialogue (continued)

9. Does that mean that Agilent customers won't be able to compare their data with researchers who use microarrays from other companies?
No. People in the industry are working to standardize the way the data is analyzed and interpreted. For instance, one of the big variables in data analysis are the algorithms used to interpret raw data. Various technologies and different algorithms result in different answers. So, there's a big effort devoted to algorithm development and comparative studies to shed light on the accuracy and specificity of various platforms.

10. What can we expect from Agilent in the near future?
We'll be rolling out our new web portal eArray. It will let you take a genome sequence and design a custom array for it. More and more, people want arrays for unique organisms that they're working with. This makes it hard to design standard products for organisms. We flip that upside down and make it easier to design custom arrays. You'll probably be seeing more whole genome arrays because researchers are saying that they're afraid of missing something when they run samples.

Survey Introduction and Methodology

The 2006 DNA Microarray Survey is designed to provide vendors of DNA microarray systems with a better understanding of how their products are used in the research environment and how their company rates among survey participants. Data were gathered from questions regarding how often nucleic acid microarrays are used in the survey participant's research, their goals and applications for nucleic acid microarrays, the current microarray facility that is used, the major commercial vendors that come to mind in relation to DNA microarrays, the organisms studied using arrays, how many microarrays are hybridized per week and if that number is expected to change, the specific brands of microarray reagents that are used, the types of dyes and arrays that are used, unmet needs for custom array production, challenges to the use of pre-spotted arrays, plans to use miRNA arrays, what equipment is used to process microarrays, descriptions of scanners and commonly used scanner resolution, descriptions of the microarray analysis software, future purchasing plans, and the attributes that might cause one to switch to a new microarray platform.

The 2006 DNA Microarray Survey consisted of 30 questions. Of these, 20 included "other" as an answer choice and 2 were open-ended. Four questions were used for demographic information. The survey was administered on-line from May 1st-11th, 2006, and the data gathered, tabulated, and presented here.

Appendix I: Questionnaire

1. **Please characterize how often you use nucleic acid microarrays in your research or work?**
   - Frequent use – daily
   - Regular Use –once or twice a week
   - Occasional Use –once or twice a month
   - I do not use nucleic acid microarrays – exited from survey

2. **For which of the following are you using nucleic acid microarrays? (check all that apply)**
   - Basic Research
   - Diagnostics
   - Genomics
   - Drug Discovery
   - Other (please specify)

3. **Which best describes your current nucleic acid microarray facility?**
   - My lab performs microarray experiments with our own reagents and equipment
   - My lab performs some of the steps and a core facility performs some
   - My lab uses a core facility for all steps of the microarray process
   - My lab is the microarray core facility
   - Other (please specify)

4. **For which of the following applications are you using microarrays? (check all that apply)**
   - Gene discovery
   - Disease diagnosis
   - Pharmacogenomics
   - Toxicogenomics
   - Genotyping (SNP detection)
   - Comparative Genome Hybridization (CGH)
   - Other (please specify)

5. **When you think of commercial DNA microarray, which three companies immediately come to mind? (please fill in as many as you can)**
   Company 1 _____
   Company 2 _____
   Company 3 _____

6. **What organisms do you study in your microarray experiments? (check all that apply)**
   - Rat
   - Bacteria
   - Human
   - Plant
   - Mouse
   - Yeast
   - Drosophila
   - Other (please specify)

7. Please estimate how many microarrays you hybridize per week.

- Less than 10
- 10 – 20
- 21 – 50
- 51 – 70
- 71 - 100
- More than 100

8. How do you expect the total number of arrays hybridized to change over the next 12 months?

- Increase by > 50%
- Increase by 10 – 25%
- No change
- Decrease by 10% - 25%
- Decrease by > 50%
- Increase by 25% - 50%
- Increase by 1% - 10%
- Decrease by 1% - 10%
- Decrease by 25% - 50%

9. Which of the following do you use to prepare your target for microarray experiments?

- RNA isolation kits
- cDNA labeling kits
- RNA amplification kits
- Fluorescent dyes
- Fluorescent nucleotides
- Other (please specify)

10. Which brand of RNA isolation kits do you use? (check all that apply)

- Agencourt
- Agilent Technologies
- Ambion
- Applied Biosystems
- Arcturus
- Bio-Rad
- Clontech
- GE Healthcare (formerly Amersham Biosciences)
- Gentra Systems
- Invitrogen
- Miltenyi Biotec
- Qiagen
- Roche Applied Science
- Stratagene
- Takara Mirus Bio
- Other (please specify)

11. Which brand of cDNA labeling kits do you use? (check all that apply)

- Affymetrix
- Agilent Technologies
- Ambion
- Enzo Life Science
- GE Healthcare (Amersham Biosciences)
- Invitrogen
- PerkinElmer
- Qiagen
- Roche Applied Science
- Stratagene
- SuperArray Bioscience
- Other (please specify)

12. Which brand of RNA amplification kits do you use? (check all that apply)

- Affymetrix
- Ambion
- Arcturus
- Enzo Life Science
- GE Healthcare (Amersham Biosciences)
- Genisphere
- Invitrogen
- KREATECH Biotechnology
- Other (please specify)

13. Which of the following fluorescent dyes do you use? (check all that apply)

- CyDyes
- Alexa dyes
- Fluorescein
- Rhodamine
- Other (please specify)

14. Which best describes the array types you use? (please choose only one)

- Commercially available pre-spotted arrays only
- Arrays spotted in-house or in a core facility only
- Both commercially available pre-spotted arrays and arrays spotted in-house

15. Which of the following commercial array types do you use? (check all that apply)

- Whole genome arrays
- SNP microarrays
- Pathway-specific arrays:
  - Apoptosis
  - Cancer
  - Cell Cycle
  - Cytokine
  - Signal Transduction
  - Stem Cell
  - Toxicology
- Common Diseases
  - Other (please specify)
- Other (please specify)

16. Is there a model organism or particular pathway for which you cannot find a commercially available pre-spotted array?

- Yes
- No

If yes, please list the organism or pathway below.

17. Which brand of commercially available pre-spotted arrays do you primarily use?

- Affymetrix
- Bio-Rad
- Clontech
- Eurogentec
- GE Healthcare (formerly Amersham Biosciences)
- Illumina
- Jivian Biologics
- Miltenyi Biotec
- Nimblegen
- Qiagen
- Sigma-Genosys
- SuperArray
- Takara Mirus Bio
- Other (please specify)

18. In your opinion, what is the biggest challenge when using pre-spotted arrays?

- Poor quality control
- Lot to lot variability
- High Cost
- Other (please specify)
- Backorders
- Availability of arrays for my model organism
- Availability of arrays for a particular pathway

19. Are you currently using miRNA arrays?

- Yes: For less than 3 months
- Yes: Between 6 – 12 months
- No: But plan to in the next 12 months
- Yes: Between 3 – 6 months
- Yes: For more than 12 months
- No: Do not plan to at all

20. Which of the following do you use to process your microarrays?

- Microarray hybridization chambers
- Microarray slide washer station
- Microarray dryer
- Automated hybridaztion/washing/drying station
- A core facility or service does all my array processing

21. What brand of automated hybridization station do you use?

- Affymetrix
- Amersham Biosciences (now GE Healthcare)
- Miltenyi Biotec
- Other (please specify)

22. Which best describes your microarray scanner?

- Our lab owns the microarray scanner we are using
- Our lab shares a microarray scanner with a few other labs
- We use a core facility to scan microarrays
- Other (please specify)

23. What brand of microarray scanner do you use?

- Affymetrix
- Agilent Technologies
- Alpha Innotech
- Bio-Rad
- Genetix
- GE Healthcare (formerly Amersham Biosciences)
- Molecular Devices
- PerkinElmer
- Other (please specify)

24. What resolution do you most commonly use when scanning microarrays?

- Less than 5µm
- 5µm
- 10µm
- 15µm
- 20µm
- 25µm
- More than 25µm
- Other (please specify)

25. Which best describes your microarray analysis software?

- Analysis software that came with my scanner
- Third party software
- A core facility/service/someone else does the data analysis

26. Which of the following do you plan to purchase in the next 12 months?

- Microarray analysis software
- Automated hybridaztion/washing/drying station
- Microarray scanner
- Microarry processing and analysis services
- Pre-spotted arrays – whole genome
- RNA purification kits for target preparation
- Pre-spotted arrays – pathway specific
- cDNA labeling kits for target preparation
- Automatic microarray printer

27. Select the top three attributes that might cause you to switch to a new microarray platform. (choose only three)

- Quality of Oligonucleotides
- Length of Oligonulceotides
- Selection process of probes for each gene
- Amount of sample required
- Number of probes per microarray
- Size of spots
- Sensitivity
- Ability to customize arrays
- Detection chemistry
- Selection of catalog microarrays
- Better Technical support/Customer service
- BioInformatics/Analytics software
- Price per microarray
- Other (please specify)

Demographic Questions

1. In which type of institution do you work?

- Academic
- Pharmaceutical
- Private Research
- Other (please specify)
- Biotechnology
- Government
- Clinical Diagnostic Testing

2. Which title best applies?

- Professor/Instructor
- Business Development Director/Manager
- Department Head
- Account Manager
- Staff Scientist
- President/CEO/Owner/VP
- Postdoctoral Fellow
- Lab Manager
- Consultant
- Process Engineer
- Research Director/VP of Research
- Technician
- Graduate Student
- Principal Investigator
- Lab Director/Chief Scientist
- Procurement Manager
- Research Associate
- Other

3. Which of the following are your key areas of research or work?

- Bioinformatics
- Genomics/Genetics
- Drug Discovery
- Marketing/Sales
- Bioengineering
- Purchasing
- Microbiology/Virology
- Cell Biology
- Administration
- Pharmacology/Toxicology
- Neuroscience
- None of the Above
- Immunology
- Diagnostics/Pathology
- Biochemistry
- Molecular Biology
- Proteomics
- Other (please specify)

4. Which best describes your purchasing authority?

- Authorize
- Recommend
- Evaluate
- No Purchase Role

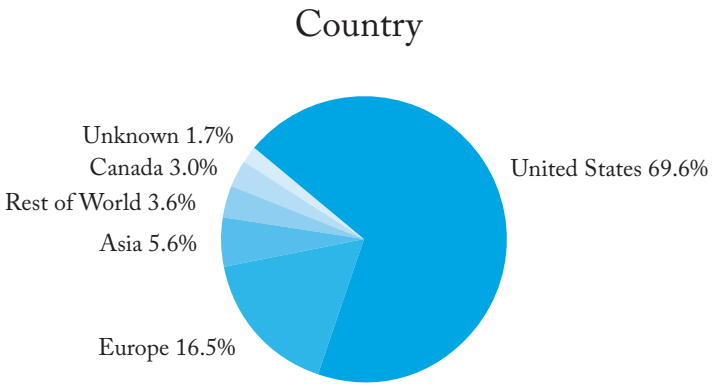
Appendix II:
Presentation of Survey Data

Demographic Survey Data

Country

73% of survey participants are from the United States and Canada; 17% are from Europe; 6% are from Asia.
N=303

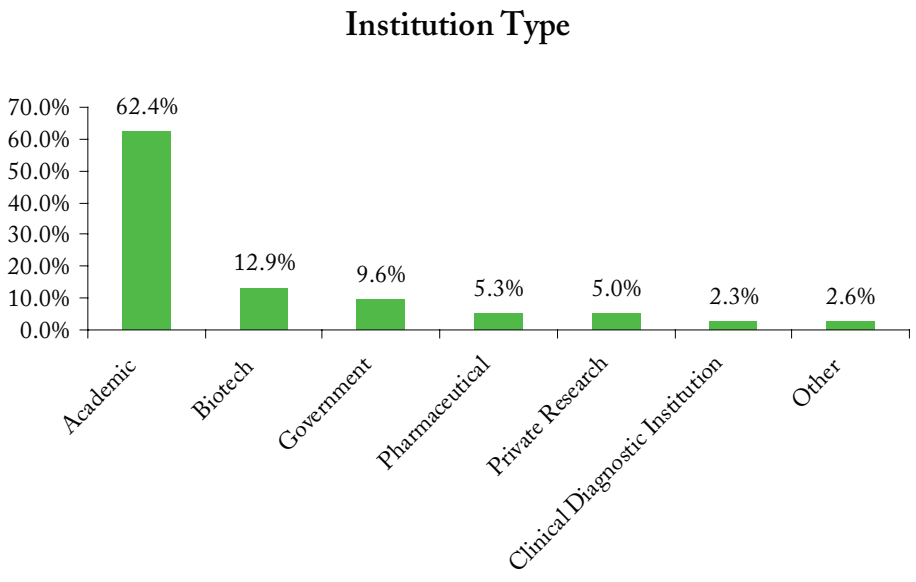
Country	Frequency	%
United States	211	69.6%
Europe	50	16.5%
Asia	17	5.6%
Rest of World	11	3.6%
Canada	9	3.0%
Unknown	5	1.7%



What is your Institution Type?

62% of survey participants are from academia; 28% are from biotech, pharmaceutical or government institutions.
N=303

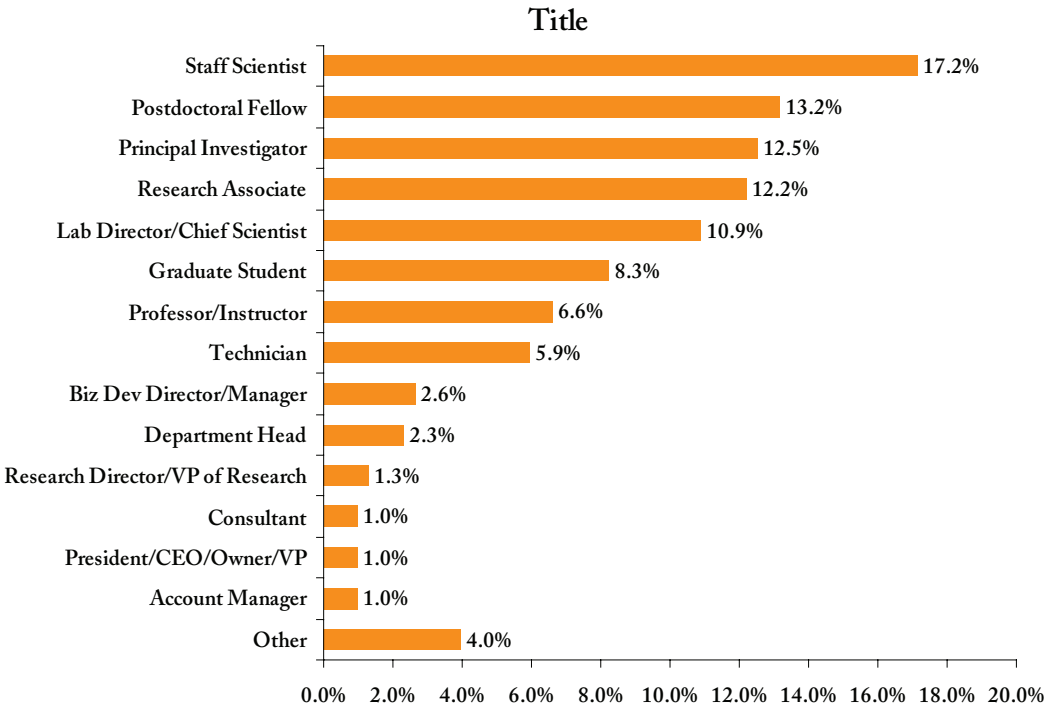
Institution Type	Frequency	%
Academic	189	62.4%
Biotech	39	12.9%
Government	29	9.6%
Pharmaceutical	16	5.3%
Private Research	15	5.0%
Clinical Diagnostic Institution	7	2.3%
Other	8	2.6%



Which title best applies?

69% of survey takers work at the bench*.
N=443

Institution Type	Frequency	%
Staff Scientist	52	17.2%
Postdoctoral Fellow	40	13.2%
Principal Investigator	38	12.5%
Research Associate	37	12.2%
Lab Director/Chief Scientist	33	10.9%
Graduate Student	25	8.3%
Professor/Instructor	20	6.6%
Technician	18	5.9%
Biz Dev Director/Manager	8	2.6%
Department Head	7	2.3%
Research Director/VP of Research	4	1.3%
Consultant	3	1.0%
President/CEO/Owner/VP	3	1.0%
Account Manager	3	1.0%
Other	12	4.0%



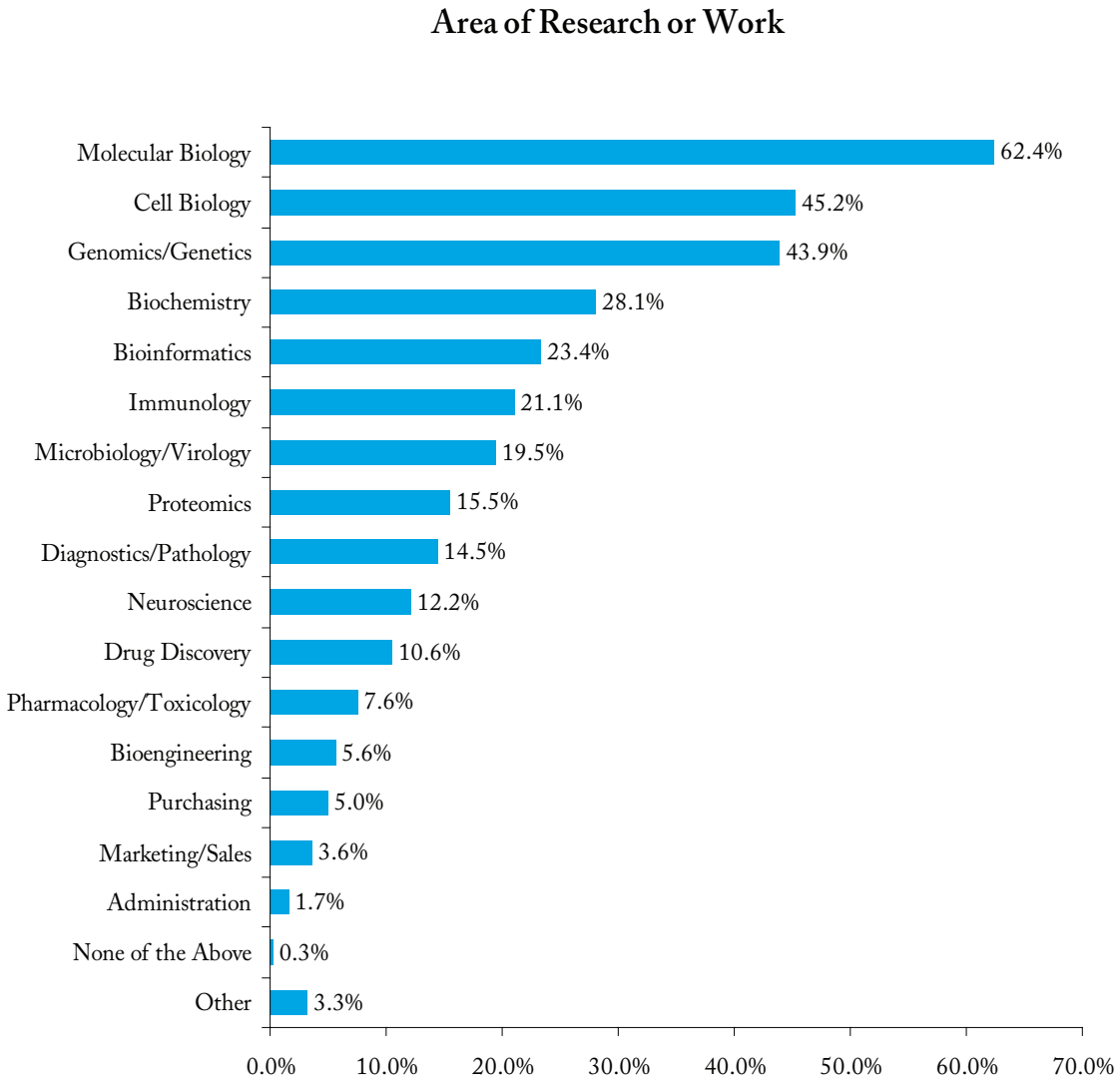
*Includes: Postdoctoral Fellow, Staff Scientist, Graduate Student, Research Associate, Principal Investigator, Technician.

Which of the following are your key areas of research or work? (check all that apply)

The survey audience is primarily involved in molecular biology (62%), cell biology (45%), and genomics/genetics(44%).
N=303

Research Area	Frequency	%
Molecular Biology	189	62.4%
Cell Biology	137	45.2%
Genomics/Genetics	133	43.9%
Biochemistry	85	28.1%
Bioinformatics	71	23.4%
Immunology	64	21.1%
Microbiology/Virology	59	19.5%
Proteomics	47	15.5%
Diagnostics/Pathology	44	14.5%
Neuroscience	37	12.2%
Drug Discovery	32	10.6%
Pharmacology/Toxicology	23	7.6%
Bioengineering	17	5.6%
Purchasing	15	5.0%
Marketing/Sales	11	3.6%
Administration	5	1.7%
None of the Above	1	0.3%
Other	10	3.3%

Which of the following are your key areas of research or work? (check all that apply)



Which best describes your purchasing authority?

89% of survey participants either authorize or recommend purchases.
N=303

Purchasing Authority	Frequency	%
Authorize	149	49.2%
Recommend	122	40.3%
Evaluate	24	7.9%
No purchase role	8	2.6%