



Biomanufacturing Innovation

Industry wants more innovation, but can suppliers meet customers' needs?

The biopharmaceutical industry has a voracious appetite for new technologies that increase productivity and improve performance, a point confirmed by BioPlan Associates' annual survey on bioprocessing trends and innovation (1).

BIOPROCESSING INNOVATIONS IN DEMAND

When asked about average budget changes from 2009–2012, those surveyed reported the highest budget increases were for new technologies to improve efficiencies and costs for downstream production (an average 6.4% increase) and for upstream production (an average 6.0% increase). For new products, the largest portion of respondents cited disposable bags and connectors (40.0%), followed by probes and sensors, (36.1%), chromatography products (32.2%), bioreactors (31.7%), and purification products (28.9%) (see Figure 1). Much of the interest in improved sensors, bioreactor, purification, and other equipment involves single-use applications. Only 10% of respondents wanted new stainless-steel equipment. In services, upstream process-development services topped the list.



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The survey showed that a common cause for dissatisfaction with current single-use bioreactors, liners, and other equipment is they are not robust enough. Single-use equipment is still not adaptable to the more extreme mixing, heat, and other conditions involved with most microbial systems (e.g., *E. coli* and yeast).

When asked to rate the factors responsible for creating bioprocessing improvements in the past

12 months, the largest portion (72.6%) cited "overall better control of processes," followed by "improved downstream production operations," and "use of disposable/single-use devices."

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VENDOR'S FOCUS ON R&D

To evaluate how well vendors' R&D match industry needs, the BioPlan survey asked about budget changes in 2012. Vendor respondents reported an average 1.9% increase in basic R&D for product development, a 2.4% increase for hiring new staff, a 4.3% gain in sales budgets, and a 3.4% uptick in capital-equipment purchases.

Survey data show vendors concentrating much of their R&D on improved and new single-use equipment (see Figure 2). The largest portion (46.2%) report working on bioprocess development/optimization services and bioprocess modeling, followed by disposable/single-use bioreactors and consumables, single-use bags and films, filtration, and chromatography products. Other examples of vendor R&D include: animal-free media components; bioreactor control; chromatography alternatives to Protein A; cell-line optimiza-

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tion; sensors and probes; culture-media optimization services; alternative mammalian-cell expression systems; monitoring systems; culture-media supplements; controller systems; impurities detection; bacterial expression systems; lyophilization; testing/assay services (e.g., raw materials, glycosylation, viral clearance, cell lines); and packaging materials.

BIOPROCESSING INNOVATIONS TRENDS

Several major trends have contributed to improved bioprocessing in the past decade. Legacy expression systems from the 1980–1990s, such as Chinese hamster ovary systems, yeasts, and *E. coli* have shown improvements in process yield (2). Mammalian-cell culture yields over 10 g/L are expected, and mammalian expression systems thoroughly dominate as classic microbial, including *E. coli* and yeast systems, are being displaced for in-house systems. Cell-line engineering and product-specific expression optimization are rather common in supporting higher yields and better product quality, particularly as off-patent high-yield cell lines go off patent and become more widely available.

Preclinical, clinical, and other precommercial manufacturing is dominated by single-use/disposable equipment. Single-use equipment is on the verge of being adopted for commercial manufacture (3).

Major advances in sensors, automation, and process control have been made for improving quality control, such as single-use sensors and sensors for new analytes. Also, manufacturing systems can now be modeled, which facilitates process and facilities design and removes bottlenecks.

Figure 1: Select new product and service areas of interest, 2010–2012.

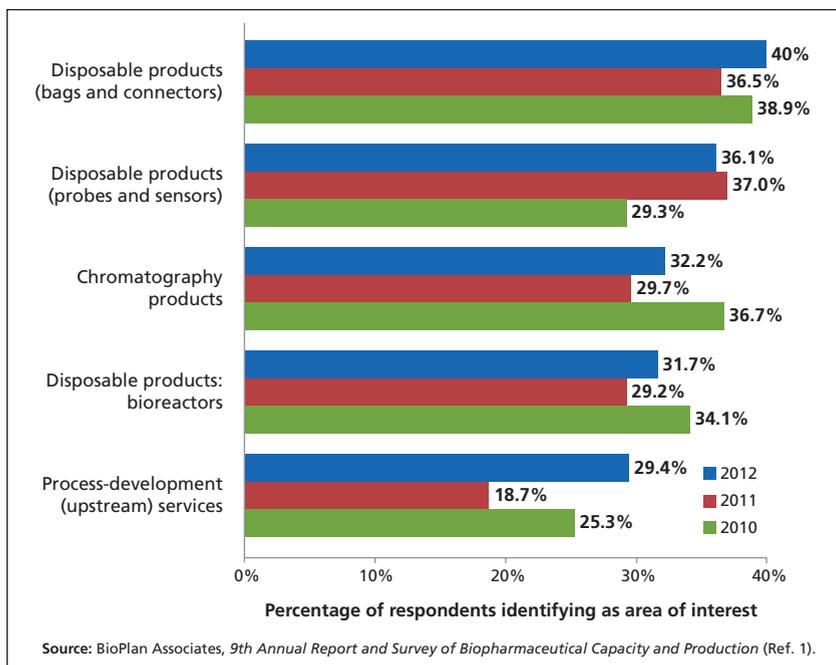
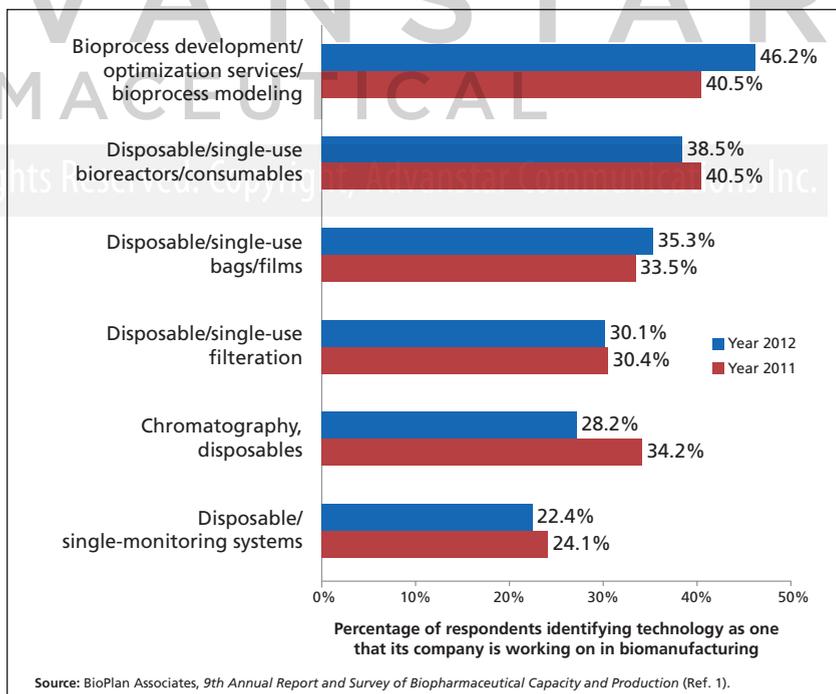


Figure 2: The top six new technologies being worked on by vendors, 2010 – 2012.



REFERENCES

1. BioPlan Associates, 9th Annual Report and Survey of Biopharmaceutical Manufacturers (Rockville, MD, April 2012), www.bioplanassociates.com.
2. BioPlan Associates, *Biopharmaceutical Expression Systems* (Rockville, MD, 2008).
3. Biotechnology Information Institute, www.biosimilars.com, accessed May 11, 2012. ♦

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