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BPI Theater at BIO 2025

Day One: Global Supply Chain, Capacity, Access, and Affordability of Biopharmaceuticals

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Introduction

The BPI Theater at BIO 2025: Day One

Cheryl Scott

At the Biotechnology Innovation Organization's (BIO's) annual convention in Boston this past June, BioProcess International presented a two-day theater program on biomanufacturing in the exhibit hall — the latest installment of a decade-long partnership between our publication and the industry organization. Hosted by *BioProcess Insider's* Josh Abbott, day one (Tuesday, 17 June 2025) focused on global supply-chain management and manufacturing capacity by exploring industry case studies, technology transfer strategies, finance, and manufacturing efficiencies.

This eBook presents material from the opening day of the BPI Theater, delivering valuable insight into the industry's need to develop and maintain robust global supplies. The day began with a comprehensive overview of supply-chain complexities, highlighting best practices for maintaining integrity, quality, and brand protection through real-world examples and benchmarking data. A series of case studies rounded out the morning by demonstrating how continuous manufacturing can lower costs and collaborative efforts can minimize delays even in critical situations.

Tuesday afternoon featured Abbott's interviews with industry leaders from Rentschler, Repligen, and Samsung Biologics. Sessions followed on manufacturing efficiencies achieved through implementation of continuous processing and advanced chromatography resins. The day culminated with two panel discussions: one examining strategic considerations in domestic and overseas manufacturing and another addressing the increasingly challenging fundraising landscape in biotech.

Day two (Wednesday, 18 June 2025) went on to examine new technologies in development and production, regulatory landscapes, and agile manufacturing, with special attention given to emerging modalities such as gene therapy. Look for detailed reporting on that day's program in our second BPI Theater eBook later this month.

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Navigating the Complexities of Global Biopharmaceutical Supply Chains

Alanna Benamy (manager of member engagement, Rx-360)

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Global biopharmaceutical supply chains continue to evolve amid geopolitical turmoil and cybersecurity threats. Alanna Benamy argued that such concerns underscore the necessity of supply-chain integrity. She spoke on behalf of Rx-360, a pharmaceutical supply-chain consortium established in 2009 after adulterated heparin products killed 81 people. In response to that tragedy, drug companies and industry suppliers joined forces for benchmarking supply-chain data, reporting product deviations, and preventing contamination events. Benamy explored emerging needs and opportunities for biopharmaceutical supply chains.

She described supply-chain integrity as encompassing all activities from raw-materials sourcing through fill–finish, storage, transport, administration, and destruction of medical waste. By performing extensive auditing and establishing an unbroken chain of custody, drug manufacturers can assure stakeholders that biological products will be authentic, safe, efficacious, and of the requisite quality. Good-practice frameworks have laid a critical foundation for ensuring integrity, with good manufacturing practice (GMP) covering the quality of ingredients, components, and processes; good storage practice (GSP) serving to prevent product degradation; and good distribution practice (GDP) addressing transport needs.

Benamy highlighted five keys to supply-chain integrity. Of particular importance are means for ensuring an unbroken chain of custody and product traceability. She noted that US regulators are taking significant steps in those respects through new interoperability standards in the Drug Supply Chain Security Act (DSCSA), which went into effect for large-scale manufacturers in May 2025. Biomanufacturers should examine both internal means for adulteration prevention and external quality standards. Rx-360 recommends accordance with EU regulations, which at present are the most robust globally. Finally, biomanufacturers must consider physical and digital security measures.

Supply-chain failures can compromise patient health — e.g., through release of lots that lack active pharmaceutical ingredients

(APIs) or harbor contaminants. Subsequently, regulators will exact harsh penalties. For instance, manufacturers paid fines of US$500 million for GMP violations in the heparin adulteration case. Investors, payers, and consumers will level other economic consequences, too. But maintaining the integrity of biopharmaceutical supply chains is easier said than done considering their high complexity, nonlinearity, and interoperability. Added difficulties come from raw-material quality limitations, lack of supply-chain traceability, geopolitical and economic disruptions, and regional regulatory differences.

Benamy recommended that biomanufacturers mitigate such risks by engaging with suppliers — e.g., by conducting additional audits and implementing supplier-assessment questionnaires such as those available for free on the Rx-360 website. Increased engagement can help to prevent exploitation from bad actors.

Advanced technologies likewise offer opportunities for protecting supply-chain integrity. Many drug companies are leveraging Internet of Things (IoT) devices, sensors for real-time monitoring, and artificial intelligence (AI)–based analytics to improve supply-chain visibility. Benamy observed that such technologies have enabled Amazon and other companies to establish centralized oversight of sales, inventory, and distribution functions. Biopharmaceutical products certainly cannot be manufactured and distributed according to Amazon's business model, she continued, but advanced technologies now enable a "control-tower approach" to biopharmaceutical supply-chain management, with centralized systems monitoring production activities, cold-chain logistics, transport coordination, and demand forecasting. Alongside systems for proactive quality monitoring, emerging technologies could help to improve manufacturing processes and patient outcomes alike.

Maintaining the **INTEGRITY** of biopharmaceutical supply chains is easier said than done considering their high complexity, nonlinearity, and interoperability.

The Power of Fully Connected Continuous Manufacturing

Driving Down mAb Costs to US$40 per Gram

Shilpa Gadgil (vice president, head of process and analytical development, and head of CDMO development, Enzene)

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Expensive manufacturing processes continue to impede patient access to therapies based on monoclonal antibodies (mAbs). Enzene's Shilpa Gadgil pointed out that mAbs produced in conventional fed-batch processes cost US$180–500 per gram, bringing treatment prices to about $10,000 annually. But in India, where the average annual income is below $18,000, many patients cannot afford such treatments. New manufacturing technologies will be critical to increasing mAb access.

Gadgil pointed out that fixed costs for utilities, facility and equipment maintenance, employee salaries, and amortization contribute significantly to mAb cost of goods (CoG). Traditional fed-batch facilities raise several difficulties for reducing CoG. For instance, they require large footprints, extensive bioreactor systems and seed trains, standalone unit operations, and numerous hold tanks. Intensified platforms — e.g., with continuous perfusion and discrete unit operations downstream — provide some cost relief but still involve considerable capital investment.

Enzene seeks to reduce mAb CoG using its EnzeneX platform for fully connected continuous manufacturing (FCCM). The platform features a perfusion bioreactor connected to an Alternating Tangential Flow (ATF) filtration technology (Repligen) for cell-culture harvest and clarification. The ATF system connects directly to equipment for continuous protein A affinity capture, low-pH viral inactivation, and polishing chromatography steps. The platform requires only one hold tank: in advance of steps for nanofiltration and ultrafiltration/diafiltration (UF/DF).

The EnzeneX platform raises several advantages over fed-batch processes, Gadgil said. By leveraging perfusion cell culture, it operates at smaller scales but with higher cell densities and viabilities, improving productivity per liter of media. Continuously processing small volumes of clarified harvest enhances capacity use for expensive protein A resins. Shortened residence times

increase both product quality and consistency across batches. And the platform provides for both seamless scalability and flexibility for specific product requirements.

Gadgil presented case studies demonstrating FCCM's effectiveness. One case involved an unstable multispecific protein. Fed-batch processing for the program resulted in cell-viability issues. Enzene scientists converted the 50-L fed-batch process to a 20-L FCCM process, thereby improving viability levels, increasing cell density from 12 million to 65 million cells/mL, and boosting yield from 3 g to 27 g. The team transferred the process for good manufacturing practice (GMP) operation in six months. In case studies with conventional mAbs, the EnzeneX platform achieved nearly tenfold increases in volumetric productivity — e.g., 46 g/L compared with 5 g/L in fed-batch mode — while decreasing CoG by an average of 50–60% and by as much as 80%.

Gadgil's company intends to enhance productivity further with its EnzeneX 2.0 platform. It features high-titer cell lines, enhanced expression vectors, and improved transgene designs, with resulting processes exhibiting titers of 7–10 g/L, cell viability of >90% over 30 days of culture, and good control of metabolites. Those values correspond to volumetric productivity of 60 g/L and production costs as low as $40/g of mAb. Beyond cost reduction, the platform could reduce carbon emissions by up to 50% compared with traditional manufacturing approaches.

Gadgil reports that Enzene already is manufacturing adalimumab, bevacizumab, and cetuximab biosimilars at a site in Pune, India, using its FCCM technology. Currently, that site offers commercial bioreactor sizes of 200 and 500 L, with plans to implement a 2000-L process. Enzene also intends to clone its 200-L and 500-L capabilities at a new facility in Hopewell, NJ (US), which should come online by the third quarter of 2025 and receive regulatory inspection early in 2026.

In case studies with conventional mAbs, the platform achieved nearly **TENFOLD** increases in volumetric productivity while decreasing CoG by an average of 50–60%.

Recovering from a CMC Worst-Case Scenario

Accelerating Technology Transfer

Sven Lee (senior vice president of business development strategy), **Charles Capron** (scientist), and **Pratima Cherukuri** (cell and gene therapy scientific strategy and CMC executive) of Bionova Scientific

Lee, Capron, and Cherukuri demonstrated Bionova Scientific's evolution from a company focused on process development (PD) to a full-service contract development and manufacturing organization (CDMO) with plans for further growth bolstered by parent company Asahi Kasei. Lee reported that Bionova's operation in Fremont, CA, comprises a 55,000-ft^2 facility for mammalian-cell PD, a 57,000-ft^2 plant that focuses on good manufacturing practice (GMP) production, and a 22,500-ft^2 warehouse for cold storage. To those sites, Bionova has added a plasmid-production facility, which opened early in 2025 in The Woodlands, TX; plans are underway to expand GMP manufacturing capacity in Fremont by as much as fourfold.

Walking attendees through the Fremont sites' capabilities, Capron explained that Bionova offers end-to-end services starting with cell-line development (CLD). Of particular note is that the company has begun licensing ATUM's proprietary transposon-based gene-delivery system. Thus, customers can expect accelerated development timelines and cell lines with increased stability and robustness. Other upstream PD capabilities include >20 small-scale bioreactor stations, high-throughput miniaturized bioreactors, and culture systems that support both fed-batch (3–200 L) and perfusion modes. Capron shared that, in a recent case, Bionova significantly improved a customer's preestablished upstream process, increasing bioreactor titers by 41% during initial screening and an additional 16% during optimization.

For downstream development, Bionova leverages design-of-experiments (DoE)–based screening with access to chromatography resins and membrane technologies from multiple vendors. The company's analytical-services team works closely with its quality control (QC) function using identical instruments in both PD and GMP settings to enable seamless method transfer across its Fremont sites. The GMP facility features fully single-use Flex

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Sven Lee (senior vice president of business development strategy, Bionova Scientific)

Factory technology from Cytiva, expediting product changeovers and reducing downtime.

Capron presented other case studies demonstrating Bionova's capabilities. One case involved PD for a difficult tetravalent, trispecific fusion protein. Several factors complicated the project, including the molecule's aggregation propensity and sensitivity to low pH and pressure levels, as well as low cell-culture productivity. The customer also required a fast timeline to GMP manufacturing. Bionova established a robust process for that molecule, especially through optimization of downstream processing — e.g., through implementation of affinity chromatography for monomer enrichment and mixed-mode chromatography to eliminate species of high and low molecular weight.

Capron's second case study showcased a rapid technology transfer from another manufacturer. At hand was a complex therapeutic that exhibited significant stability issues. Thus, downstream steps were particularly difficult for that program. The customer also had a demanding timeline for GMP manufacturing. By working closely with stakeholders, Bionova completed facility fit assessment, process optimization, and manufacturing transfer within just two months.

Cherukuri shifted the presentation to Bionova's new plasmid facility, which should be GMP ready by 30 August 2025. The site's services include plasmid design assistance, strain development using IS3 insertional-sequence–free bacteria for high productivity, PD and analytical development, QC testing, and formulation development. The facility can produce plasmids at research, high-quality, and GMP grades for a broad range of scales, and it is developing a drug master file (DMF) to support customers' regulatory filings. The Woodlands site also features opportunities to leverage technology partnerships. Cherukuri highlighted her company's work with Syenex for lentiviral-vector plasmid systems that provide transduction efficiencies tenfold higher than those of conventional systems.

Charles Capron (scientist, Bionova Scientific)

Pratima Cherukuri (cell and gene therapy scientific strategy and CMC executive, Bionova Scientific)

Improving Manufacturing Efficiencies with Advanced Chromatography Resins

Aaron Moulin (field application scientist, Purolite Resins, part of Ecolab)

On the first day of the BIO Convention, Ecolab announced the launch of its latest affinity-chromatography product: the Purolite Praesto AP+50 protein A resin. Moulin characterized the resin as Ecolab's response to an industry need for downstream process-intensification technologies. "Especially with more second-generation molecules and biosimilars coming through the pipelines," he explained, "it's important to have efficient, fast, and cost-effective processes for purifying antibodies." His presentation demonstrated how the new resin can improve downstream-process economics while providing the same or better performance compared with leading legacy resins.

The Praesto AP+50 resin features a caustic-stable protein A ligand (developed in collaboration with Repligen) functionalized to a 50-µm jetted bead. Across common residence times, the resin provides superior dynamic binding capacity (DBC) compared with leading legacy products. Moulin highlighted the AP+50 product's impressive performance at shortened residence times — e.g., three (rather than six) minutes. Such properties raise significant opportunities for process intensification.

Performance testing demonstrated the resin's technical equivalence to other marketed resins. The AP+50 resin matched or bested competitors in terms of yield, host-cell protein (HCP) reduction, and residual protein A leaching when tested with industry-standard buffers and processes. That equivalence enables the AP+50 resin to be implemented with minimal changes to current platform processes — and with potential for improving process outcomes.

The resin exhibits excellent alkaline stability, maintaining >80% of initial DBC after 100 cycles with 0.1 M NaOH cleaning. Capacity remains high even after more aggressive cleaning regimens (e.g., with 0.5 M NaOH). Despite having smaller beads (50 µm) than other resins, the AP+50 product offers good pressure-flow properties, achieving flow rates of 350 cm/h at 10-cm bed height and about 200 cm/h at the industry-standard 20-cm bed height.

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The resin's superior mass-transfer kinetics enable several process-intensification strategies — e.g., multicolumn parallel-batch processing, periodic countercurrent chromatography (PCCC), simulated moving bed (SMB) methods, and rapid-cycling approaches. Moulin presented several modeling scenarios comparing the performance of the AP+50 resin and a leading legacy product, thereby demonstrating significant economic benefits through a breadth of implementation approaches.

In the simplest case, reducing bed height from 20 to 10 cm while doubling flow rate maintained comparable binding capacity while reducing total resin costs by 80% and increasing process productivity by 90%. Moulin also described an approach involving variable loading velocity, with faster flow for the first 80% of loading followed by slower flow for the final 20%. Compared with standard loading using the AP+50 resin, the dual-loading strategy increased DBC to 84%, reduced buffer use by 21%, and improved productivity by 79%. Other strategies included maintaining residence time while leveraging increased binding capacity and reducing column diameter while increasing bed height. Each strategy offered distinct advantages for resin-cost reduction, productivity improvement, buffer use, and processing time.

Moulin emphasized that the Praesto AP+50 resin's flexible implementation enables users to optimize process economics beyond simply increasing antibody binding. By enabling reductions in resin use, buffer consumption, and processing time, the platform supports economical and environmentally sustainable purification processes, ultimately helping companies to bring therapeutics to market more quickly and at more reasonable prices than have been possible.

Several modeling scenarios compared resin performance and demonstrated significant economic **BENEFITS** through a breadth of implementation approaches.

Accelerating Development for Next-Generation Bioconjugates and Bispecifics

From Lead-Candidate Design to Manufacturing

Campbell Bunce (chief scientific officer, Abzena)

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Abzena's Campbell Bunce highlighted significant growth in next-generation biologics development, with >800 bispecific antibodies (bsAbs) entering development over the past year and notable increases in both antibody–drug and antibody–oligonucleotide conjugates (ADCs, AOCs) over the same period. That surge reflects the biopharmaceutical industry's push for increasingly diverse and complex therapeutics. Yet drug companies still find themselves under mounting pressure to accelerate development timelines. Based on his company's experience as a global contract development and manufacturing organization (CDMO) that has ushered complex candidates from conceptualization through good manufacturing practice (GMP) production, Bunce outlined three strategies for expediting development.

First, he emphasized the importance of robust developability assessment in derisking programs. Such assessments address fundamental questions about whether candidates can be produced in the appropriate form and at the needed scale ("Can we make it?") and whether they will perform as expected ("Does it work?"). Finding the answers takes designing, producing, and purifying multiple constructs to test their manufacturability, binding, function, immunogenicity, safety, and potency. Using a bispecific T-cell engager as an example, Bunce demonstrated how comparing different configurations — e.g., 2:2 homodimers, 2:1 heterodimers, and 1:1 heterodimers — across such parameters enables selection of candidates with the highest probabilities of success.

Bioconjugates raise particular concerns for developability assessment. For instance, AOCs require conjugation of two biomolecules, one with a high net-positive charge and the other with a high net-negative change. Thus, such products typically feature only one or two oligonucleotide (oligo) payloads per antibody. Site-directed conjugation to native or engineered cysteines often serves as the attachment strategy, although Bunce

reported that some developers are working on candidates that undergo enzymatic conjugation. For AOCs, developability assessment must account for concerns such as inter-AOC strand hybridization, undesired hairpin formation, diastereomers, and misaligned annealing. Understanding sequence characteristics and optimizing reaction conditions are critical for successful development.

Bunce's second strategy called for leveraging robust, adaptable technologies and process platforms. He highlighted his company's AbZelectPRO cell-line development (CLD) platform, which combines ProteoNic's 2G UNic vector technology for transgene codon optimization with a Chinese hamster ovary (CHO)-K1 host cell line to provide consistently high yields across molecule types, including monoclonal antibodies (mAbs), antigen-binding fragments (Fabs), and complex bispecifics. Abzena adapts established ADC platforms to accommodate novel bioconjugated payloads — e.g., leveraging strong ion exchangers to remove unconjugated oligos and charge variants during AOC purification.

The third development recommendation was to shorten the critical path to GMP manufacturing and investigational new drug (IND) filing. Bunce described how CLD could be initiated during lead-candidate selection, using stable pools to advance analytical, downstream, and formulation development simultaneously. Such an approach truncates development timelines significantly, especially when using stable-pool material for toxicology studies. For an accelerated approach to succeed, Bunce cautioned, scientists must ensure consistency in material across stable pools, clones, and bioreactors. Abzena's AbZelectPRO platform is designed to provide high consistency in product quality attributes across those stages.

By implementing robust developability assessment and leveraging platform technologies, Bunce concluded, Abzena can help customers bring complex, next-generation biologics to IND filing rapidly while maintaining quality and increasing the probability of program success.

Cell-line development could be initiated during lead-candidate selection, using **STABLE POOLS** to advance analytical, downstream, and formulation development simultaneously.

A Panel Discussion on Strategies for Success in

Navigating Funding Challenges in Biotechnology

Moderator: **Elaine Haynes** (chief executive officer, Kalocyte)

Panelists, left to right: **Audrey Greenberg** (venture partner, Mayo Clinic); **Cassidy Cantin** (associate partner and nondilutive funding expert, Latham Biopharm Group/Sia Partners); and **Marrio Barro,** (head of infectious diseases, RA Capital)

For a discussion of financing strategy, moderator Elaine Haynes of Kalocyte invited three funding experts: Audrey Greenberg of the Mayo Clinic Cassidy Cantin of Latham Biopharm Group (Sia Partners), and Mario Barro of RA Capital.

Haynes described her company as a biotechnology startup developing an artificial red–blood-cell substitute that remains shelf stable in a dry format for up to two years. The product is reactivated with sterile water in a closed system, for which the company has received US Defense Advanced Research Projects Agency (DARPA) funding to address the challenges of blood's high perishability and type specificity.

When asked about motivations for joining the panel, Greenberg highlighted the dynamic nature of the current environment, with rapidly advancing science accelerated by artificial intelligence (AI) and complex geopolitical and capital conditions. Cantin noted the unique challenges facing biotechnology today compared with previous years, and Barro emphasized the importance of maintaining focus on science and data despite market noise. He said that RA Capital continues to invest based on such fundamentals.

Nondilutive Funding

Nondilutive financing funds companies without taking ownership or equity in them. Founders thus retain full control and decision-making power. Common examples of nondilutive funding include grants, tax credits, and certain types of loans.

Cantin shared her experience helping clients raise over US$2.5 billion. She acknowledged recent disruptions in US government funding, noting that after initially believing that President Trump's second administration would maintain similar

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funding patterns to those in his first term, she was surprised by a complete halt in funding. She emphasized the importance of diversified funding strategies and alignment with federal government priorities. Yet Cantin expressed optimism about agencies such as the Advanced Research Projects Agency for Health (ARPA-H) investing in revolutionary science, and she advised companies to use downtime for networking and preparation.

Barro added that nondilutive funding provides valuable external validation for investors but cautioned companies against becoming dependent on it. He stressed that companies should be prepared to proceed without such funding and should ensure that any nondilutive funding aligns with their core mission rather than distracting from it.

Haynes noted her company's success in securing funding from the US National Institutes of Health (NIH), the US Department of Defense (DoD), and DARPA, but emphasized that nondilutive funding alone is insufficient. Companies must supplement with money from investors, foundations, and other sources.

A Volatile Environment

On the impact of regulatory shifts, Greenberg explained that reimbursement forms the foundation of every financial model in biotechnology. She noted that small changes in Medicaid reimbursement rates can influence valuation models significantly. Despite current challenges, she expressed optimism about positive momentum at the US Food and Drug Administration (FDA) regarding fast-track approvals and platform-process designations, which could accelerate returns and improve valuations. She emphasized the need for positive public statements from regulatory agencies to attract investors back to the sector.

Cantin described recent changes at US Health and Human Services (HHS) as "scary," noting that government policy shifts can eliminate previously funded research areas. She suggested that when government funding retreats from certain research areas, public markets must step in. That requires companies to be clear in articulating their science and return on investment (RoI) potential.

Barro highlighted difficulties currently faced by the infectious-disease sector, including uncertainty about vaccine regulation following the removal and replacement of the entire staff on the Centers for Disease Controls (CDC) Advisory Committee on Immunization Practices (ACIP). He revealed that some investors have abandoned vaccine investments entirely due to regulatory uncertainty. But he emphasized that companies must help investors understand risks and regulatory pathways, noting that

Barro highlighted difficulties currently faced by the infectious disease sector, including uncertainty about **VACCINE** regulation. He revealed that some investors have abandoned vaccine investments entirely due to regulatory uncertainty.

organizations with data and imminent inflection points currently are prioritized for investment.

When asked how companies can communicate their value proposition to investors effectively, Barro stressed the importance of clearly explaining risk and regulatory pathways. Cantin advised focusing on core objectives rather than being distracted by tangential nondilutive-funding opportunities. She likewise emphasized the need for clear messaging about risks and adaptation strategies. Greenberg recommended having team members with successful fundraising experience, communicating personal passion behind the science, and developing compelling narratives supported by data, team expertise, and strategic partnerships. She noted that milestone-based financing arrangements are now common, requiring companies to demonstrate their ability to reach value inflection points.

Cantin added an important reminder about the human impact of life-science work: "We're changing people's lives. You're going to let a mom hold a baby an extra night. You're going to clear up someone's respiratory disease."

Artificial Intelligence

On AI, Greenberg described Mayo Clinic's partnership with global hospital systems to create redacted patient data sets for efficacy analysis. She highlighted opportunities to expedite discovery and reduce animal testing through AI and synthetic data, as the FDA recently encouraged (**1**). She also noted that a full transition from paper-based to electronic records in cell and gene therapy (CGT) will enable more prominent AI applications throughout the associated value chain.

Barro shared that RA Capital strongly encourages all team members to become AI experts, using available tools for company analysis and evaluation. He advised biopharmaceutical companies to leverage AI as an unbiased tool for evaluating their own programs. "About 10 years ago when I was at Sanofi, we developed an AI program to select influenza-vaccine strains. One thing it told us was that our thinking was biased toward our own science. The AI actually corrected our clinical-development plan."

Emerging Trends

The panel also explored emerging investment trends. Greenberg identified gene editing (projected to be a $9 billion market), organs-on-chips technology, multiomic analyses, and advancing analytical methods as promising areas. She noted that AI increasingly will converge with such technologies. With the initial

Greenberg recommended having team members with successful fundraising experience, communicating personal **PASSION** behind the science, and developing compelling narratives supported by data, team expertise, and strategic partnerships.

public offering (IPO) market effectively closed, she observed, mergers and acquisitions (M&A) are increasing as large pharmaceutical companies holding significant capital make early partnerships with smaller innovators — a valuable complement to venture capital.

Cantin expressed interest in the potential of GLP-1 drugs (see box, right) beyond weight loss, potentially addressing chronic diseases (e.g., of liver and kidneys). She noted that reducing obesity-related chronic diseases also could diminish Medicare costs significantly over the long term.

Audience Engagement

In response to an audience member's question, Cantin confirmed a shift from NIH toward DoD funding and expressed concern about losing NIH's vital role in early stage research and innovation. She remained cautiously optimistic that funding will loosen up in the coming months.

Regarding investment syndication trends, Barro explained that larger funds typically invest in late-stage companies requiring $50–100 million, whereas earlier rounds remain the domain of smaller funds with higher risk tolerance. Haynes added that targeting relatively new funds that don't have large existing portfolios can be advantageous because many established firms must focus on supporting existing investments during tight funding periods.

When asked how to reinvigorate life-sciences investment, Barro emphasized the importance of public communication in support of organizations such as No Patient Left Behind, and educational efforts to explain the economics of drug development. Cantin stressed the need for clear communication without buzzwords when educating policymakers who often have limited time.

Addressing the challenge of life sciences receiving less investment than trendy technology industries, Greenberg identified several factors that might help: lowered interest rates, an industry-wide push for shortened development timelines ("currently $2 billion over 15 years to commercialize a drug"), and regulatory improvements such as platform designations and global harmonization. She encouraged patience and collaboration in the current environment.

All four panelists emphasized the importance of partnerships. Greenberg noted that venture capitalists can help fill funding gaps where NIH isn't investing, although they can't address the entire need. She described Mayo Clinic's strategic partnerships using institutional funds to invest in technologies, tools, services, and

GLP-1 Drugs

Glucagon-like peptide 1 (GLP-1) is a naturally occurring hormone that plays a critical role in regulating blood sugar, appetite, and digestion. It helps our bodies release insulin, which lowers blood sugar levels, and also slows down stomach emptying, which can help to prevent blood-sugar spikes. Additionally, GLP-1 can promote feelings of fullness, which can assist in weight loss.

The GLP-1 market is growing rapidly as such drugs are adopted for both diabetes and obesity treatment. Some projections estimate the market capitalization to reach US$100 billion or more by 2030. Such growth is fueled by rising obesity rates, strong clinical efficacy of drugs such as semaglutide and tirzepatide, and increased health awareness.

AI. Greenberg expressed an interest in personalized "*n* of 1" medicine, in which treatments are tailored to individual genetic profiles and manufactured at bedside scale.

Cantin emphasized that successful development requires an ecosystem of contract development and manufacturing organizations (CDMOs), contract research organizations (CROs), and other forms of clinical support. She stressed the importance of finding trustworthy partners with shared values who provide ongoing support beyond favorable pricing.

Barro described his firm's efforts to foster collaboration among companies with complementary solutions that might otherwise compete, creating combined approaches that exceed the sum of their parts. He gave examples of connecting platform-technology companies with antigen developers in the vaccine sector, ultimately creating improved products through investment in collaborative approaches.

Haynes concluded with her mentor's advice to "keep the main thing the main thing," emphasizing that in biotechnology, science remains the central focus to be supported by diverse funding strategies and collaborative partnerships.

Reference

1 Hough S. Paradigm Shift? FDA Removes Animal Testing Requirements. *TIDES Global* 18 April 2025; https://lifesciences.connectmeinforma.com/community/tides/articles/paradigm-shift-fda-removes/details.

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A Panel Discussion on Biomanufacturing

In Country or Off Shore

For a discussion on approaches to deciding between in-country (United States) and off-shoring of biomanufacturing, moderator Josh Abbott (editor of *BioProcess Insider*) brought together three industry experts: two from contract manufacturing organizations (Sundar Ramanan of Enzene and Lisa Rivera of SK pharmteco) and one industry consultant (Dawn Ecker of BioProcess Technology Group).

Moderator: **Josh Abbott** (editor, *BioProcess Insider*)

Panelists, left to right: **Sundar Ramanan** (chief quality officer, Enzene); **Lisa Rivera** (vice president of marketing communications, SK pharmteco); and **Dawn Ecker** (managing director of bioTRAK database services, BioProcess Technology Group, part of BDO USA)

Setting the Stage

Ramanan opened the discussion with a presentation leveraging Google's Gemini artificial intelligence (AI) agent to analyze the top 25 pharmaceutical companies, excluding contract development and manufacturing organizations (CDMOs). Results revealed that about half of drug-company revenue is allocated to cost of goods (CoG, 27%) and research and development (R&D, 20%). Ramanan emphasized the tradeoffs of time, cost, and quality, noting that the latter serves as a "nonnegotiable" fulcrum against which time and cost are balanced. He explained that speed typically takes precedence in early development stages, whereas cost considerations become more important as programs advance.

Ramanan identified several key drivers influencing manufacturing location decisions, including economic factors such as tax incentives, government policies mandating local manufacturing for national-security reasons, intellectual-property (IP) concerns, market dynamics (supply-chain reliability, diversification, dual manufacturing, and sourcing), regulatory compliance, and risk mitigation. He also highlighted the importance of a location's life-science ecosystem: "I can build manufacturing in the middle of Wyoming, but no one's going to go work there. If you want to be an R&D focused company, then you need to be in a city like Boston, where there are strong academic institutions."

Ramanan contrasted traditional inshore–offshore decision-making with what he termed "our evolving world." With

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advancements in telecommunications such as 5G and 6G Internet standards, "we can talk to someone live anywhere in the world today." That has increased R&D contributions from emerging markets. Enzene exemplifies that evolution as it develops continuous-manufacturing technology in India while building a manufacturing facility in the United States. Rather than choosing between in-country or offshoring options, Ramanan advocated for a "geography-agnostic" approach. "Because we have a single quality system that can be global in a digitized world, the answer is 'yes, and.'"

Strategic Drivers for US Manufacturing

When asked about the biggest strategic drivers for keeping biomanufacturing in the United States, Dawn Ecker emphasized the importance of providing medication to patients locally: "Local manufacturing limits geopolitical risk." She pointed to recent geopolitical issues as evidence of the need for domestic manufacturing capabilities.

Lisa Rivera argued that manufacturing location should be determined by specific circumstances: "There is a time and place, and there are specific reasons [for why] you would manufacture in the United States. And there are specific reasons or motivations or types of products for which it makes no sense." She cited generic drugs as an example for which US manufacturing would not be practical and stressed the importance of developing realistic strategies aligned with company needs and government policies.

Ramanan distinguished between commercial manufacturing and R&D/clinical-materials production. With some 10,000 clinical trials underway in the United States — and the industry's emphasis on accelerating clinical testing — he argued that manufacturing closer to research centers makes sense. For commercial manufacturing, he agreed with Rivera that considerations differ based on scale and other factors. And he noted that advanced therapies often require proximity to patients through hospital systems, making localized and regional manufacturing essential.

Balancing Cost and Risk

When asked about the business case for offshoring, Rivera identified high-volume, low-risk products as ideal candidates: "It makes sense to keep those where they are affordable, where you know you're never going to be able to compete." She noted that US manufacturing tends to focus on critical medicines as defined by a Biden-administration executive order listing "essential medicines" prioritized for supply-chain resilience.

Rather than choosing between in-country or offshoring options, Ramanan advocated for a **"GEOGRAPHY-AGNOSTIC"** approach. "Because we have a single quality system that can be global in a digitized world, the answer is 'yes, and.'"

Ramanan challenged the assumption that offshoring inherently increases risk, particularly given modern technological applications including digitization. He referenced the US Food and Drug Administration (FDA) database of warning letters to support his position and emphasized that the industry's primary purpose is serving patients. "We need to embrace technology. And then we ask what is the right fit for us," he said, rejecting the traditional cost–quality dichotomy as outdated. He argued that with quality as the priority, technology can address contamination-control risks (the main cause of batch failure) while ensuring data integrity and reliability.

Quality Control and Regulatory Compliance

Regarding quality control (QC) and regulatory compliance differences between domestic and overseas manufacturing, Ecker observed a shift: "When I first started tracking global manufacturing, it really was only the United States and Europe consuming and manufacturing biologics. And that's definitely changing." She highlighted global efforts toward regulatory harmonization through initiatives such as the Pharmaceutical Inspection Co-operation Scheme (PIC/S) and the International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH). Ecker is optimistic that "eventually we all will be under the same quality system."

Rivera cautioned that although the industry is "aiming toward a global quality system, we're not there yet." She emphasized the importance of operational readiness, and preparedness for facility inspection to sell drugs in the American market.

Ramanan described the situation as "a gradient over time" with "a conscious effort to converge." He acknowledged that the FDA and European Medicines Agency (EMA) currently provide a "gold standard" but noted that "the gap between them and the rest of the world is closing fast."

Hidden Operational Risks

When asked about hidden operational risks in offshoring beyond supply-chain delays, Ramanan acknowledged that people naturally fear the unknown but argued that risks can be eliminated systematically, regardless of location: "As long as one evaluates objectively from a systems perspective — [one that] is harmonized and globalized — and people can speak the same language, have similar systems in place with adequate depth and accuracy, then you can eliminate the risk." He emphasized the role of modern digital technologies in risk management.

Rivera identified technology-transfer costs and supply-chain oversight difficulties as key **HIDDEN RISKS,** referencing the COVID-19 pandemic: "We all went through COVID, and we all know how that ended."

Rivera identified-technology transfer costs and supply-chain oversight difficulties as key hidden risks, referencing the COVID-19 pandemic: "We all went through COVID, and we all know how that ended."

Ecker agreed that offshoring introduces some risks, particularly for companies new to manufacturing: "We see the fear of the unknown quite a bit with some of our clients who are new to manufacturing. 'If I were to take my molecule, the only one my company has, and have it manufactured far away, I won't be close enough to know what's going on or be fully involved in the process.'" However, she noted that such concerns apply to outsourcing generally, regardless of location.

Ramanan emphasized the importance of robust vendor-management systems with quality audits as part of decision-making, noting that "most companies do that these days."

US Policies and Incentives

When asked whether US policies and incentives are sufficient to make American manufacturing competitive with those of Asia or Europe, Rivera responded directly: "No, we're not there yet." She noted that policies can change every four to eight years depending on the administration in power. The current administration, she explained, wants the drug industry to shift manufacturing back to the United States, and is encouraging companies to engage through agencies such as the Administration for Strategic Preparedness and Response (ASPR) and the Biomedical Advanced Research and Development Authority (BARDA).

Rivera outlined what the industry needs from government programs: a guaranteed volume of manufacturing, a guaranteed contract, and guaranteed incentives for workforce development. She highlighted the latter as particularly crucial: "You can have all the systems in the world, but you still need people." That requires incentives for companies to collaborate with local universities and organizations on training programs. "A war for talent can be a huge hurdle."

Ecker strongly agreed: "The government needs to help us if they really want us to reshore. Companies are spending eye-watering amounts on these huge facilities and big R&D centers, but who's going to operate them? To me, that's a huge issue."

Ramanan added that specific knowledge is required for operating in good manufacturing practice (GMP) environments for clinical and commercial manufacturing. The need for a GMP-adept employees is "usually understated across the globe." He advocated for investment in training qualified workforces and suggested that as politics

Rivera outlined what the industry needs from government programs: a **GUARANTEED** volume of manufacturing, a guaranteed contract, and guaranteed incentives for workforce development.

change globally over time, investments in innovation can mitigate their influence: “Technology can be a great neutralizer.”

Structuring Government Incentives

Asked how governments should structure incentives to avoid creating overcapacity or market inefficiencies, Rivera recommended tying funding to key performance indicators: “Tie it to timeline, output, quality, and workforce impact.” As a CDMO representative, she noted that her company encourages US legislators to incentivize innovator companies for manufacturing in the United States.

Ecker pointed out that about 70% of the 411 approved biopharmaceuticals on the US market are manufactured by contract partners, many off shore, and that about half of mammalian-cell-based products would need to be reshored if the government required in-country manufacturing. She suggested that, in such a scenario, many companies would turn to contract manufacturers rather than building their own capacity.

Rivera observed that the current US administration has focused primarily on small-molecule drugs: “Just a few weeks ago, there was a request-for-information call for manufacturing 28 critical medicines, and not one biologic was on that list.” She noted that 85% of the identified critical medicines are small molecules.

Ramanan expressed confidence in market forces, stating that worldwide demand for biologics is strong: “Allow industry to respond to the market, allow capital to flow, and the system will find an equilibrium.”

Future Prospects

Looking ahead five years, Ecker predicted stability in manufacturing distribution: “We’ve been monitoring [capacity] for almost 20 years. Asia really has come up with manufacturing. But when you look at what’s being built now, it’s fairly even around the world.” She didn’t anticipate a significant increase in new facilities but suggested that expansions were more likely, noting that “it is relatively kind of tough for a new CDMO to enter the market now.”

Rivera agreed and emphasized the importance of innovation. “We need to continue to invest in innovation so that the United States doesn’t lose its leadership in life sciences. There’s a risk of not investing enough to improve manufacturing processes.” She highlighted her company’s work with simulated moving-bed chromatography to achieve 99.3% purity of APIs [active pharmaceutical ingredients] while recycling 99.6% of process solvents, thus reducing time and cost in downstream processing.

Ramanan predicted growth in both US domestic and overseas manufacturing over the next five years, driven by global need even as **BIOSIMILARS** enter the market.

Ramanan predicted growth in both US domestic and overseas manufacturing over the next five years, driven by global need even as biosimilars enter the market. He noted that many biologics currently use relatively outdated technology at very large scales: "That is definitely not the way to go, and we expect the rest of the world to follow what we are doing [at Enzene]: continuous manufacturing and process intensification. Innovation in manufacturing, that's where we see the trend going."

Ecker agreed that new facilities are likely to be smaller than facilities have been historically, but cautioned, "I don't think we'll be able to get rid of stainless steel yet — not until we get rid of all of those older legacy products with the older processes."

Ramanan acknowledged the industry's fear of converting from traditional fed-batch to continuous biomanufacturing but expressed confidence that "the knowledge to convert will come, and others will see it too eventually."

The discussion concluded with observations about recent industry trends, with Ecker noting that several companies — mostly CDMOs — have made billion-dollar investments to expand capacity with 20,000-L production reactors. Ramanan characterized that as a traditional approach to cost competition through massive scale but argued that "scale becomes irrelevant with new technologies." He drew a parallel to C-terminal modifications of protein and peptide structures, which were widely discussed in the early 2000s but have become "irrelevant" as knowledge of monoclonal antibodies (mAbs) has advanced. He expressed optimism that increasing comfort with such molecules will help the industry embrace new technology.

Ecker agreed that new facilities are likely to be **SMALLER** than facilities have been historically, but cautioned, "I don't think we'll be able to get rid of stainless steel yet — not until we get rid of all of those older legacy products with the older processes."

BioProcess Insider Interview

Samsung Biologics

Already known as a biomanufacturing powerhouse with 784,000 L of mammalian-cell production capacity across five plants in Songdo, South Korea, Samsung Biologics is branching out into other aspects of drug development. In particular, the company hopes to make a splash in drug discovery and preclinical assessment. At the 2025 BIO Convention, representatives launched Samsung Organoids services for therapeutic-target validation, lead-candidate selection, and related activities.

Kevin Sharp said that the platform of patient-derived organoids "allows for better understanding of molecule candidates" and their effects in tumor microenvironments. Gaining such information during discovery and preclinical evaluation enables "a streamlined clinical process to achieve faster timelines for investigational new drug (IND) filings."

Samsung Bio likewise is expanding into antibody–drug conjugates (ADCs). Early in 2025, the company opened a facility for ADC development, clinical manufacturing, and commercial production. The site features two 500-L production lines, and the company is investing in capabilities for fill–finish and other activities to enable end-to-end solutions. Meanwhile, Samsung Bio is partnering with developers such as LigaChem Biosciences to initiate ADC programs while establishing capabilities for mRNA and multispecifics.

Sharp also reported on the April 2025 opening of Plant Five, highlighting Samsung Bio's efforts to digitalize operations and automate logistics and manufacturing. Such work should allow operators and scientists "to focus on quality operations" while streamlining their work. Moreover, digitalization will enable the company to provide customers with real-time process data.

Further capacity growth is possible, as well. BioCampus Two, which houses Plant Five, has room and funding for expansion. By 2032, Samsung Bio could offer 1.3 million L of capacity. And Sharp did not rule out movement beyond South Korea: "We are actively evaluating different opportunities there. It could be in the form of, maybe, a site acquisition or even a greenfield facility. So we're keeping all of our options open."

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Kevin Sharp (executive vice president, head of sales and operation, Samsung Biologics)

BioProcess Insider Interview

Rentschler Biopharma

In January 2025, Rentschler announced its departure from cell and gene therapy (CGT) manufacturing, a move marked by discontinuation of operations at its facility in Stevenage, UK. Although closing the plant was a difficult decision, CEO Benedikt von Braunmühl explained, "market development showed that we would not have the traction we expected a couple of years ago," when his company acquired the site from the CGT Catapult. Rentschler now has committed to expanding its core capabilities for manufacturing protein/antibody drug substances.

von Braunmühl highlighted developments at Rentschler's facility in Milford, MA. Over the past year, the Milford team has ushered a new production line through engineering and good manufacturing practice (GMP) runs. The site also has provided manufacturing services for its first customer. Now, the facility will ramp up capacity for new clients. Having facilities on-line in both Germany and the United States will provide valuable flexibility, von Braunmühl noted: "Sometimes we're transferring projects from Germany to the United States; sometimes we're getting new clients into the US site. With all the geopolitical discussion right now, we're in a good position to offer both sites to all our clients."

When asked about customer trends, von Braunmühl reported growing numbers of emerging biotechnology companies bringing their own products into commercial phases. Historically, small companies have pursued development into phase 2 studies, then sold their assets to larger organizations. But over the past few years, >60% of Rentschler's small-biotechnology customers have pursued commercialization. One possible explanation for the shift, he said, is that new biologics tend to be designed for small patient populations. Blockbuster drugs require extensive resources for patient recruitment, but more-modest programs can identify sufficient patient numbers through partnerships with treatment centers. Thus, small enterprises are finding that they have enough resources for early commercial activities.

Sensing such shifts, Rentschler seeks to provide individualized, end-to-end solutions for small programs. The company is leveraging strategic partnerships to close gaps in service, as evidenced by its collaboration with Vetter Pharma for drug-product manufacturing.

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Benedikt von Braunmühl
(chief executive officer, Rentschler Biopharma)

BioProcess Insider Interview

Repligen

Repligen relishes its role as a relatively small technology innovator, said its CEO, Olivier Loeillot. The company prides itself on having been at the forefront of industry initiatives for bioprocess intensification and process analytical technology (PAT). To continue in its strong tradition of research and development (R&D), Repligen seeks not only to give comprehensiveness to current product portfolios, but also to bring a "real focus on new modalities."

The company's recent acquisition activity exemplifies those commitments. This year, Repligen purchased 908 Devices' portfolio of desktop PATs. "Combined with the right bioreactors or, potentially, process-intensification systems," Loeillot said, those PATs could help customers to find out "what is really happening in their bioreactors and then improve their yields even further." He also highlighted the acquisition of Tantti Laboratories, a Taiwan-based company that uses in-mold polymerization and microfluidics to create micro- and nanoporous biomaterials. Tantti's integration opens up intriguing possibilities for bioseparations, including development and manufacture of novel purification technologies for viral vectors and other emerging modalities.

Loeillot reflected that the biopharmaceutical industry is sorely in need of such innovations. Despite significant technological advancement, biologics still take five to 10 years for development, clinical study, and commercialization — at an average cost of US$1 billion. "That's far too long, far too expensive, especially with what's going on with the macroeconomic side," he said. Moreover, drug companies no longer have the luxury of handling only one or two families of large-volume, large-revenue products. Now, developers must juggle several lower-volume products of sometimes very different formats, even including cell and gene therapies.

Repligen's role in that ecosystem is to set up customers with equipment that enhances and expedites development. "You don't need the same cell-culture media . . . and resin to manufacture an AAV9 as you need to manufacture a monoclonal antibody," Loeillot remarked. Bringing sensitive, broadly applicable analytical technologies into advanced-therapy manufacturing will help developers to find out as early as possible which materials and processes will be best for their products.

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Olivier Loeillot (chief executive officer, Repligen)