Scalability: The Key for Biosimilar Manufacturing

Dr. Cyrus Karkaria
President, Biotechnology
Lupin Limited

When we think of medical breakthroughs, we often picture scientists in labs, complex molecules under microscopes, and the relentless pursuit of cures. Yet, behind every vial of biologic therapy lies another kind of breakthrough — one that happens not in the clinic, but on the manufacturing floor. And when it comes to biosimilars, this invisible engine of innovation is where the real battle for access and affordability is being fought.

Over the years, biologics have reshaped the treatment landscape for many chronic and life-threatening diseases. Their precision, efficacy, and potential for personalized care have steadily outpaced traditional small molecule drugs. But biologics are also notoriously expensive. And that cost is not just a function of science; it's deeply rooted in the way these therapies are developed.

From the moment a biologic begins its journey in a cell bank vial to the point it reaches a patient's hands, the process is intricate, expensive, and time-consuming. Companies developing biologics must overcome clinical equivalence requirements, complex regulations, lengthy development cycles, and high capital and operating costs. The result? Delayed access and significant financial strain on both patients and health systems.

Where Scale Meets Access

Let's consider the bigger picture. In the U.S. alone, the FDA has approved over 70 biosimilars across various therapies, with the global biologics market pegged at over USD 350 billion by 2030. Despite that, a single dose of some biosimilars can still cost patients anywhere between USD 300 and 5,000. Why? Because the cost of goods (COGS) for biosimilars continues to hover between USD 50 and 500 per gram.

To change this reality, we need to think beyond labs and clinical studies. We need to think at scale.

Scaling up manufacturing — efficiently and smartly — is not just an operational strategy. It is a moral imperative. When done right, scale brings down fixed costs, improves process consistency, and significantly reduces the cost per dose. At 10,000-liter bioreactor scale, the fixed cost burden drops dramatically compared to a 1,000-liter setup. That's the kind of cost dynamic that moves the needle for healthcare access.

A Case for Smarter, Not Just Bigger

While scale matters, how we scale matters even more.

The traditional fed-batch model has served the industry well, but it is increasingly being challenged by more agile and high-yield approaches like perfusion-based continuous manufacturing. With this mode, not only can we increase output 5 to 10 times over, but we can also maintain a more stable and controlled environment for cell growth, leading to consistent product quality.

Combine this with innovations in continuous chromatography — especially using multi-column setups for critical steps like Protein A capture — and we have got a process that is not just efficient, but also cleaner and more predictable.

Importantly, process characterization and scale-down modeling must go hand in hand with scaling up. Regulatory agencies want assurance that products remain consistent across sites, scales, and time. That means every manufacturer must invest in understanding the critical process parameters and quality attributes of their product from the start.

Speed, Flexibility, and Market Realities

There's another dimension we cannot ignore — speed to market.

In a world where every month of delay can cost lives, modular manufacturing holds great promise. Centralized drug substance production paired with decentralized drug product filling allows for logistical agility and reduced supply chain costs. This model also supports tailored approaches for local regulations, pricing norms, and patient needs across geographies.

But none of this works unless manufacturers align science with smart economics. For instance, perfusion systems at medium scale (1,000–5,000 L) employing single-use technologies offer a great middle ground — high throughput without the capital intensiveness of traditional setups. Moreover, building modular facilities designed for plug-and-play process shifts can further reduce both time and cost.

Making Every Gram Count

At the heart of biosimilar affordability lies a simple truth: we must do more with less.

That means investing in high-yield cell lines with specific productivity exceeding 40 mg/million cells/day. This would involve reducing the dependency on expensive off-the-shelf media by switching over to cost-effective proprietary nutrient media and feeds — to be prepared using commercially available individual components. Enhancing the reuse life of expensive resins beyond 300 cycles is as important as extracting out the last drop of juice from sugarcane. It even means challenging established norms — like exploring safe and validated reuse practices for otherwise single use items like filters or finding a continuous mode of utilizing a consumable to maximize output per unit.

When manufacturers take such steps, the impact goes beyond margins. It extends to patients in remote villages in India, seniors in Europe choosing medication without the need to forego groceries, and children in Latin America whose medical conditions can now be treated early.

Lupin's Commitment: From Molecule to Market

At Lupin, we've seen this journey firsthand.

Our development of the biosimilar etanercept, used in the treatment of rheumatoid arthritis, is a case in point. From building the manufacturing process from scratch to navigating the clinical landscape and collaborating globally for commercialization, we engineered every part of the supply chain with scalability, compliance, and cost in mind.

Today, Lupin's flexible modular facilities can support various upstream and downstream modes — whether it is fed-batch or perfusion, single-use or stainless steel. This adaptability is essential as we expand our biosimilar portfolio and meet the growing global demand for affordable biologic therapies.

The Road Ahead

Biosimilar manufacturing is not just about regulatory approvals and technical capability. It is about unlocking hope — scaling up science to scale down suffering.

The goal of achieving a COGS of under USD 10 per gram may no longer be a fantasy. With high-throughput processes, next-gen analytics, and a culture of scientific innovation, it is within reach. But it requires every player in the ecosystem — industry, regulators, healthcare providers — to reimagine what is possible.

At the end of the day, biosimilars must do more than just mimic the originator. They must lead the way — towards a future where healthcare is not just effective, but equitable as well. ■