Article

Cell culture

Carve a path to success

Driving antibody therapeutic innovation with next generation cell culture solutions

In 1986, the first monoclonal antibody (mAb) therapy was approved by the United States Food and Drug Administration (FDA), paving the way for a healthcare revolution. By recognizing and binding to specific cell-surface targets, mAbs allow for the precise and targeted treatment of diseases across many therapeutic areas, including oncology, immunology, and hematology [1]. As a result, several previously difficult-to-treat conditions now have treatments in the pipeline or on the market.

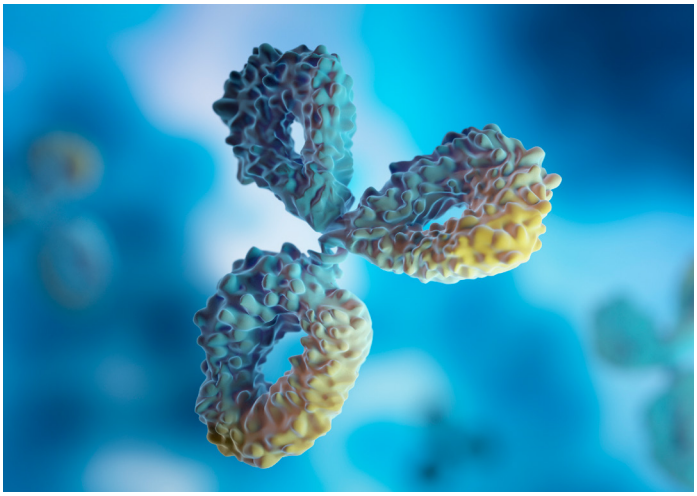
Since then, the industry has made great advances in antibody engineering, leading to increased safety and efficacy, as well as huge improvements in process efficiency. Understanding the immunomodulatory properties of antibodies is also continuing to grow. Taken together, these developments are driving growth of a new generation of antibody-based therapeutics [1], with potential to further broaden the scope of treatments.

A shift toward targeted therapies

The biopharmaceutical industry has witnessed a shift from broad-spectrum treatments to highly targeted therapies, primarily in response to the growing realization that many diseases are often heterogeneous, especially those in oncology, hematology, and immunology. For instance, tumors in different patients may express distinct combinations of antigens, which makes one-size-fits-all treatment approaches less effective.

Another significant driver is the push for therapies with reduced side effects and greater safety profiles. Unlike traditional small molecule drugs, which often affect both diseased and healthy tissues, targeted therapies can selectively bind to specific cell markers, minimizing damage to surrounding healthy cells. This specificity not only enhances efficacy but also reduces off-target toxicity, a critical factor for patients undergoing long-term treatments.

In light of this shift toward more highly targeted treatments, traditional mAb therapies may be limited in their ability to treat diseases involving multiple targets or intricate immune pathways. However, in recent years, new antibody-based modalities have emerged to fill this gap.



A new generation of antibody therapeutics

Next-generation antibody formats, such as bispecific antibodies, antibody fragments, and antibody-drug conjugates, are helping to address the challenges of treating complex diseases by reducing off-target effects. Three key modalities hold significant potential for advancing disease treatment, each with a distinct mechanism for enhancing therapeutic precision and efficacy:

- **Bispecific antibodies (BsAbs)** bind two targets simultaneously, meaning they can create multiple physiological or anti-tumor responses. Their synergistic or cooperative features may also produce more significant treatment effects [2].
- **Antibody fragments** are smaller sections of antibodies engineered to target specific disease markers. These fragments work by binding directly to target proteins, offering enhanced tissue penetration and potency due to their compact size [3].
- **Antibody-drug conjugates (ADCs)** are typically composed of a monoclonal antibody covalently attached to a cytotoxic drug via a chemical linker, combining the specific targeting of a mAb with the therapeutic effect of the attached drug [4].

However, developing advanced antibody therapeutics can pose unique upstream bioprocessing challenges, especially during cell culture medium optimization. Unlike traditional mAbs, which benefit from well-established manufacturing protocols and optimized medium formulations, next-generation therapeutics require more tailored approaches.

As production of advanced antibodies places increased metabolic stress on cells, higher levels of nutrients are required in medium formulations to sustain cell health, productivity, and therapeutic consistency. The intricate structure of advanced antibodies makes maintaining consistency particularly challenging, as meeting the associated critical quality attributes—which are heavily influenced by the cell culture environment—can be complex [5].

Each type of advanced antibody also poses its own specific challenges: ADCs require optimal conditions to support both the antibody and linker stability [4], while BsAbs need conditions that support efficient folding and correct assembly of dual-binding sites [6]. Due to their smaller size and unique structure, antibody fragments demand medium conditions that promote high expression and stability while enabling efficient secretion [3]. This can necessitate extensive medium screening and customization, adding to development time and costs.

The role of high-quality media and feeds

Achieving consistency in advanced antibody production requires robust upstream process development, especially as the field of next-generation antibody therapeutics continues to evolve. While there is a lack of dedicated medium and feed formulations specifically tailored for advanced antibody formats, existing high-performance medium and feed platforms developed for traditional mAb manufacturing offer a strong foundation. These established platforms can also serve as excellent starting points for further optimization and can be customized to meet the unique requirements of complex antibody therapies.

These developments are driving growth of a new generation of antibody-based therapeutics, with huge potential to further broaden the scope of treatments.

Driving high performance through collaboration

Selecting the right medium supplier is also essential for biotech companies aiming to efficiently progress through early development stages and successfully commercialize their advanced antibody therapeutic.

An effective medium provider should offer high-performance medium solutions that enhance productivity and maintain consistency across production scales. This is vital to help developers accelerate the transition to commercial production and achieve optimal performance, both now and into the future.

Tailored support and experience are equally critical from a medium supplier. Biotherapeutic developers should look for comprehensive medium development services and analytics, with medium screening and rapid prototyping capabilities to support the development of optimized media and feeds. Dedicated field teams can further aid process development and troubleshooting, providing on-site support to help biotechs navigate the complexities of optimizing their workflows.

Finally, a collaborative and communicative approach is vital for successful process development. A medium supplier that actively shares insights and knowledge about the latest industry advancements and innovations can help foster a productive and cooperative long-term relationship. By prioritizing collaboration, biotechs can leverage a wealth of knowledge to stay ahead of the curve, ultimately enhancing their ability to meet the demands of clinical and commercial manufacturing of next-generation therapeutics.

Unlocking the potential of next-generation antibody therapeutics

The development of advanced antibody therapeutics offers new possibilities in treating complex diseases. However, with their intricate molecular structures and the high metabolic demands this places on cells, high-quality cell culture media and feeds are critical for supporting consistency, yield, and therapeutic efficacy.

For biotech companies, working with a trusted medium supplier offering access to tailored solutions and extensive support should be prioritized. A strong, collaborative relationship enables companies to address early development hurdles while helping to ensure quality and scalability, setting the stage for successful process development.

Elevate your cell culture processes Carve your path to success

Collaborate with a trusted pioneer of bioprocessing innovation to support the development of your next-generation antibody therapeutic.

Our Gibco™ portfolio of cell culture solutions can help you streamline development and production, with a wide range of off-the-shelf, high-performance media and feeds. Designed to optimize product titer and quality, our media and feeds are also an ideal starting point for further customization.

You can also access our comprehensive range of Gibco™ Media by Design services to support the development of a tailored workflow solution that meets your unique requirements. Our dedicated, global team of bioproduction professionals can work with you at every stage to provide in-depth technical knowledge and trusted insights, including process optimization and troubleshooting support.

Learn more about how our extensive portfolio of cell culture products and services can help you carve a path to success at thermofisher.com/performance

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