3M Science. Applied to Life.™

How Can Drug Platforms Keep Up With Complex New Molecules?

By Alexei Voloshin, 3M Biopharmaceutical Purification

Drug production platforms initially emerged as an efficiency enabler. But, as therapies have grown in complexity, some platforms have lost viability. Regardless of whether a manufacturer philosophically views adapting a platform and process to one another as an alteration of the platform, the process, or both, the choice is largely situational and benefits from the insight of an adept technology partner.

When people say "platform" in this context, they generally are referring to something designed specifically to manufacture drugs based on a monoclonal antibody (mAb) scaffold. mAbs offer advantages in terms of their capability to target specific entities within the body and to trigger a specific response. mAbs share many common chemical and physical characteristics, so the R&D and the manufacturing platform can accommodate an entire product candidate pipeline without significant changes. This combination of attributes speeds up the development, plus enables rapid and efficient scalability during manufacturing.

As drug developers have become more adventurous, modifying molecules to affect different mechanisms in the body, as well as treating expanded sets of clinical indications, the drug candidate modality set has expanded significantly — beyond the small protein and monoclonal scaffold. This excursion has dictated a need to adapt existing platforms as well as create new ones.

That adaptation and innovation process is primarily based on the physical and chemical properties of the candidates, from stability in various conditions to basic differences in structure, as well as differentiation in inherent characteristics compared to the contaminant background. So, every product is evaluated relatively early in process development to determine whether it is an "on the platform" or an "off the platform" candidate. That determination guides the candidate's development and manufacturing.

"3M embraces the alignment of our culture with that of customers who — in the name of innovation — pursue high-risk initiatives with a goal of accomplishing truly disruptive outcomes."

A common variation of the established mAb platform is that of "mAb-like" or "mAb-adjacent" molecules — heavily modified mAb scaffolds that include Fc-Fusion proteins, bi-specific mAbs, tri-specific mAbs, and multi-valent mAbs. Utilizing these scaffolds, about 80% of candidates may be considered "on the platform" (and 20% "off the platform") due to their unique characteristics. However, some organizations might have clinical pipelines where barely half their current products fit their current platform and half require deviation, meaning they must adapt the platform as much as they use it as-is. For example, a certain purification unit operation may only be effective under specific

conditions that make it unsuitable for some candidates due to their biochemical stability, so the purification strategy and its implementation must be adapted to exclude such a step.

Again, organizational choices will primarily be based on their candidate pipeline, business objectives, and ability to execute through technology and human expertise. As drug manufacturers' choices expand to more complex drug modalities — such as nucleic acids, lipid particle systems, large viruses and VLP, and cells — the industry is continually challenged to create completely new platforms to tackle unique challenges.

As Avril Vermunt, Senior Director of Manufacturing Sciences and Technology at EQRx, noted during a Bioprocess Online Live event, "We have to be taking pieces of the platform that serve us for the additional complexity and more urgency instead of blindly saying 'everything is going to the platform.'"

The 3M Advantage

3M is, fundamentally, a material science company and, as such, our expertise focuses on materials and differentiated, high-value solutions based on those materials. In modern drug production processes, materials usually dictate the ability to separate product from contaminants based on various differences between the two.

The 3M™ Harvest RC Chromatographic Clarifier, 3M™ Emphaze™ AEX Hybrid Purifier, and 3M™ Polisher ST represent our acknowledgement that the industry is set in many of its processes, but its modalities have expanded and become increasingly complex. Drug makers must address a variety of modalities while continuing to operate efficiently (i.e., minimizing cost, embedding sustainability, building in scalability, etc.). To accomplish this, it is necessary to reinvent how physics and chemistry are utilized within these separation technologies.

In the cases of 3M™ Harvest RC Chromatographic Clarifier and 3M™ Emphaze™ AEX Hybrid Purifier, their primary paradigm-shifting characteristic is the use of synthetic, functionalized fiber in lieu of wetlaid paper-like filtration media, using particle charge (rather than particle size) to separate biopharmaceutical from contaminants. This provides much more precise, predictable separation and better scalability, plus the ability to accommodate a wider range of modalities compared to legacy technologies.
3M™ Polisher ST, meanwhile, utilizes guanidinium (Gu)

chemistry for anion exchange; its ligand technology is the embodiment of the 3M chemistry know-how. This anion exchange chemistry is designed to function across a much wider range of process conditions compared to similar legacy technologies.

Final Thoughts

3M embraces the alignment of our culture with that of customers who — in the name of innovation — pursue high-risk initiatives with a goal of accomplishing truly disruptive outcomes. The COVID-19 pandemic proved disruptive products can be propelled to market safely and quickly. Similarly, our customers are not only looking for a like-minded technology partner, but one with the expertise to help their vision become reality.

Noted Gene Lee, Ph.D., Chief Technical Officer of AltruBio, during the aforementioned Bioprocess Online Live event: "The platform is just a starting point, it's a tool. From that starting point, you can transform it into a process that can work for most molecules."

The industry, in general, and 3M, in particular, have developed powerful toolkits to enable delivery of more complex drugs and therapies. If a sponsor has access to those toolkits, the definition of interplay between a process and a platform does not matter. The most important question is one of capability: Do we, or our technology partner, have the overarching capability to solve our problems?

Additional Resources

- 3M™ Harvest RC Chromatographic Clarifier Single-Stage Chromatographic Purification For Recombinant Protein Therapeutic Manufacturing
- The Next Frontier In Downstream Processing With The 3M™ Polisher ST
- Quantification Of 3M™ Emphaze™ AEX Hybrid Purifier Value In mAb Manufacturing Process

About The Author

Alexei Voloshin is the Global Head of Bioprocess Science at 3M Separation and Purification Sciences Division. He is responsible for product application strategy and manages technology projects, collaborations, and alliances around the globe. Alexei brings more than 15 years of experience in bioprocess development, as well as technical, operational, and business knowledge in the biotechnology space. Alexei earned his Ph.D. in chemical engineering from Stanford University and a bachelor's in chemical engineering and B.S. in computer science from University of Minnesota Twin Cities.

Before joining 3M, Alexei led the molecular diagnostics program at Theranos, Inc. He is also a founding member of TheraOne Inc., a startup company focused on front line cancer immunotherapy. Before TheraOne, Alexei was an early member of Sutro Biopharma Inc., a company focused on development of novel biologics and bioprocesses, where he was responsible for technology strategy and process development. He has authored a number of publications and presentations dealing with novel bioprocesses and their applications to making advanced bio-therapeutics.

About Us

The 3M biopharmaceutical business is a subset of the 3M Separation and Purification Sciences Division which utilizes cutting edge 3M material science that pushes the boundaries of purification, filtration, and separation to support production, processes that change lives, and deliver quality solutions where it matters most.

3M biopharmaceutical purification solutions work to optimize your processes, applying our biopharma experience, material science and proprietary technologies to help you develop highly effective purification solutions. Our solutions are designed for upstream and downstream processing. These solutions are focused on 3M innovative technologies for the development and manufacturing of recombinant proteins including mAbs, vaccines, and therapeutic plasma proteins.

Our biopharma and materials science expertise can help you improve in-process purity, increase the yield of your product and lower manufacturing costs – so you can focus on bringing life-saving treatments to trial and market.

Visit us at 3M.com/bioprocessing

About 3M

At 3M, we apply science in collaborative ways to improve lives daily as our employees connect with customers all around the world. With over 60,000 products in our portfolio, 3M brands deliver science-based performance and extraordinary outcomes across almost any industry you can imagine. Learn more about 3M's creative solutions to global challenges at www.3M.com.

Technical Information: The technical information, guidance, and other statements contained in this document or otherwise provided by 3M are based upon records, tests, or experience that 3M believes to be reliable, but the accuracy, completeness, and representative nature of such information is not guaranteed. Such information is intended for people with knowledge and technical skills sufficient to assess and apply their own informed judgment to the information. No license under any 3M or third-party intellectual property rights is granted or implied with this information.

Product Selection and Use: Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. As a result, end-user is solely responsible for evaluating the product and determining whether it is appropriate and suitable for end-user's application, including completing a risk assessment that considers the product leachable characteristics and its impact on drug safety, conducting a workplace hazard assessment and reviewing all applicable regulations and standards. Failure to properly evaluate, select, and use a 3M product and appropriate safety products, or to meet all applicable safety regulations, may result in injury, sickness, death, and/or harm to property.

Warranty, Limited Remedy, and Disclaimer: Unless a different warranty is expressly identified on the applicable 3M product literature or packaging (in which case such express warranty governs), 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ARISING OUT OF A COURSE OF DEALING, CUSTOM, OR USAGE OF TRADE. If a 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability: Except for the limited remedy stated above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential (including, but not limited to, lost profits or business opportunity), regardless of the legal or equitable theory asserted, including, but not limited to, warranty, contract, negligence, or strict liability.

3M Purification Inc.
3M Separation and Purification Sciences Division
400 Research Parkway, Meriden, CT 06450 USA

Phone 1-800-243-6894 1-203-237-5541
Web 3M.com/bioprocessing

70-2016-0387-8 Rev. A