Monoclonal Antibody Process Development

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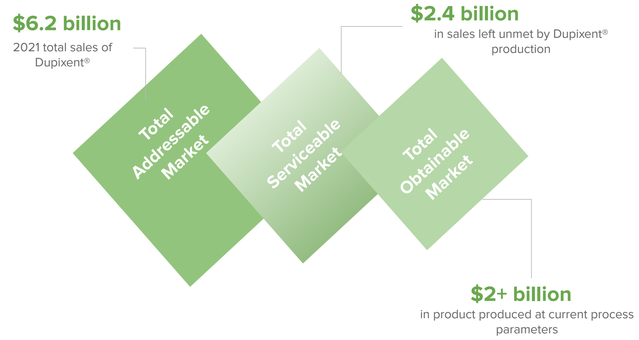
Introduction

- Analyzed demand of monoclonal antibodies in the immunotherapy industry has increased and also challenged the ability to be produced on a mass-global scale
- Observed other representative mAbs on market and analyzed Dupixent and their market performance
- Created a process for a biosimilar mAb in the pharmaceutical space

Motivation

- Over 160,000 people living with the disease eosinophilic esophagitis (EoE), a condition resulting in the prolonged inflammation of the esophagus
- Unmet market demand of 540,000 doses, with the sole competitor and producer being Sanofi (in partnership with Regeneron)
- Versatility of product enables its use for other conditions like eczema and asthma



Process Flow Diagram and Description

Inoculum Expansion → N-2 Stage Bioreactor → N-1 Stage Bioreactor → N-Stage Bioreactor with Alternating Tangential Flow → Depth Filtration → Protein A Affinity Chromatography+ Viral Inactivation → Cation Exchange Chromatography → Anion Exchange Chromatography → Viral Filtration → Ultrafiltration/ Diafiltration

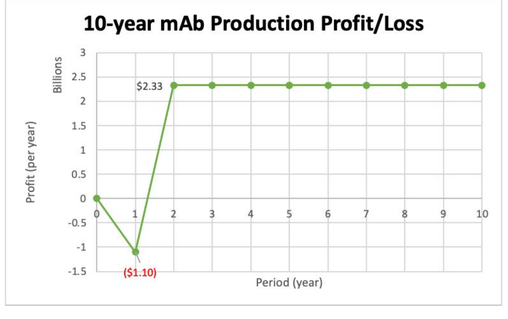
Upstream Goals and Important Process Parameters

- Growing cells to high densities in bioreactors that increase in volume
- N-Stage Bioreactor is a perfusion style bioreactor that produces much higher cell concentrations and thus titer
- CHOlean media for all steps prior to N-Stage Bioreactor
- TCX10D media for N-Stage Bioreactor

Downstream Goals and Important Process Parameter

- Depth Filtration separates the mAb from the CHO cells that were used to produce the product
- All three chromatography steps serve as capture, intermediate purification, and polishing steps
- Viral Inactivation and Viral Filtration are two distinct methods for reducing the amount of viable viruses present
- Ultrafiltration is used for final product concentration and diafiltration is used to exchange the buffer in solution to a buffer needed for final product formulation as well as helping with molecule stability

Financial Analysis



Safety and Risk Assessment

- Potential Chemical Hazards
  - Buffers / Media
  - Cleaning Chemicals
- Physical Hazards in Operation
  - < 40 psi Pressure
  - < 35 C Temperature
- Environmental Impact
  - Waste Streams Generated
  - Water Usage

Conclusions

- Through the analysis of this project in terms of its feasibility, margin of error, and the potential ROI, the team would recommend that the sponsor company pursues the proposed production.
- Even in the most costly production year, successful operation of this process at current projections has an ROI of over 24x in its first production year alone.
- Not only can the sponsor company capitalize on this opportunity and gain market share and favorable financial returns, the sponsor company can also enrich the lives of those in need of the mAb.