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Paradigms in biochemical engineering: tools and strategies for tailoring bioseparation

Abstract: Downstream bioprocessing and purification steps are critical to the production of any biopharmaceutical drug product. Removing both process and product related impurities to ascertain that a drug product meets the regulatory requirements is necessary to ensure safety while maintaining efficacy. With advances in molecular biology and upstream productivity, it is likely that downstream processing will continue to dominate production costs, of which 60% may be attributed to chromatography steps alone.

While platform processes for downstream purification of monoclonal antibody (mAb) based therapeutics exist, there is a vast opportunity to develop robust, efficient, scalable and cost-effective strategies for purification processes associated with gene therapy vectors. This presentation will summarize my research efforts in the field of biochemical engineering and bioseparation processes, and demonstrate their relevance towards a variety of products including enzymes, therapeutic proteins, and gene therapy vectors. First, a brief description of the strategies used to streamline bacterial recombinant production and purification of a novel antifungal peptide using engineered cell lines and a chemical cleavage resistant fluorescent protein will reinforce the concept of system-level engineering using modern biochemical engineering tools. A specific discovery and optimization project targeted at the development of an affinity-based purification of a low titer, therapeutic protein of interest (Butyrylcholinesterase) from impure mixtures will then be described. Finally, the presentation will conclude with a discussion of tools and strategies used to address downstream challenges in the field of gene therapy, the production of gene therapy vectors in particular, because highly efficient downstream processes are required to isolate these materials.

Dr. Rudra Palash Mukherjee was born in West Bengal, India, in 1988. He received a B.Tech degree in Chemical Engineering from the National Institute of Technology at Durgapur, India in 2011 and a Ph.D. in Chemical Engineering from the University of Arkansas in 2016, where he worked with Prof. Robert Beitle to develop a platform for downstream purification of recombinant proteins and peptides using a novel engineered cell line and mutant green fluorescence protein. He pursued postdoctoral training at Biomanoufacturing Training and Education Center (BTEC) in NC State University with Prof. Ruben Carbonell, where he identified and developed new affinity ligands for the purification of biotherapeutic enzymes from complex mixtures. Dr. Mukherjee currently works as a Senior Scientist at Pfizer’s Gene Therapy Purification Process Development group at Morrisville, NC to develop robust, efficient, scalable strategies for improving purification process performance for gene therapy vectors. Dr. Mukherjee was chosen as a Finalist for the Millipore Bioseparations award (2016) and received the Outstanding Graduate Student Award from the Department of Chemical Engineering at the University of Arkansas (2016).

A proud Razorback, Rudra considers Fayetteville, AR his home away from home in the USA.