SYSTEMS BIOLOGY APPROACH IN THE DEVELOPMENT OF CHEMICALLY-DEFINED MEDIA FOR PRODUCTION OF PROTEIN THERAPEUTICS IN CHINESE HAMSTER OVARY CELLS

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Cell culture medium plays a critical role on mammalian cell growth, protein expression and quality. Typical cell culture medium formulations consist of >50 components which include amino acids, vitamins, trace metals, lipids and proteins. Chinese Hamster Ovary (CHO) cells that produce biotherapeutics are propagated in specific cell culture media to ensure robust productivity and product quality.

Systems biology has been applied to multiple areas of biological research to gain a better understanding of disease origins and to identify potential new drug targets. Although CHO cells are simpler systems, they share similar biochemistry and cellular pathways. Therefore, leveraging the systems biology knowledge from animal systems and applying these strategic systems biological tools to bioprocess development can be valuable in gaining better understanding of CHO cell culture performance, optimizing cell culture media, and subsequently resulting in better control of the overall production processes.

In this presentation, we will present several case studies of various 'omics tools applied to (1) optimize cell culture medium formulation for improve cell growth and productivity via metabolomics, (2) understand effects of medium components on cellular gene expression via transcriptomics, and on product quality via glycomics, and (3) identify potential cellular protein targets that are affected by stress imposed during production process via proteomics.   The development of a statistical model that aims to highlight key metabolites and a machine learning model that identifies significantly important genes which are involved in monoclonal antibody production will also be discussed.