iCOP™: Illuminating the Black Box

First in a Series of Application Notes on the integrated Cellular Platform
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Bioprocess Optimization currently relies on data derived mainly from the culture environment leaving the biological component, the cell, as a "black box". It must be presumed that the data collected about the culture environment infers the current state of the cells and many assumptions must be made to infer the cells' metabolic activity. For production, this method is not proactive nor preventive but prognostic at best. In contrast, the integrated Cellular 'Omics Platform (iCOP) provides a workflow that is primarily driven by biological (cellular) knowledge accumulated from a Systems Biology approach.

Implementation of iCOP is an iterative process in which experiments are designed to answer a specific bioprocess related question. The workflow is characterized by two main phases: a data phase and an integration phase, each comprised of three steps. The generation of an empirically based novel hypothesis reinitiates the cycle leading to continuous process improvement. The greatest value in iCOP is the ability to produce useable results with immediate impact.

Data Phase Explained

The first step in the data phase is defining the project and hypothesis while taking into consideration and accounting for all vital parameters. The ArrayXpress team will work with you to define a list of prioritized goals.

Next, assessment of the existing public, proprietary, and the client's internal data is performed and gaps determined. The goal is to identify existing capabilities and avoid duplication while maximizing resource allocation. All data obtained in this phase is deposited in a client specific database.

The last step in the phase is data gathering. ArrayXpress utilizes state-of-the-art 'Omics technologies to generate new data. All data generated in this phase is added to the client specific database with the proprietary pre-existing dataset for data analysis and integration.

Integration Phase Explained

From the initial steps of data analysis through differential expression to pathway analysis and network reconstruction, data analyses are conducted using ArrayXpress' expertise and proprietary statistical and bioinformatics pipelines.

Datasets are visualized using customized tools to display a system-wide snapshot of the data, with the option to further explore the data at particular points of interest, such as regions identified by differential expression that are correlated to specific metabolites or pathway.

Each iteration of iCOP provides solutions to very specific challenges that can be immediately translated into short-term process improvements. Additionally, the iCOP platform provides a longer-term solution to an overarching cellular or process engineering strategy.

Putting it together

By implementing the iCOP platform, the contents of the "black box" are illuminated. iCOP provides a roadmap to success, integrating the collection, storage, analysis, mining and visualization into one platform so you can actually see results and not just produce data. From a single iteration of iCOP there are actionable results, as well as providing a platform for longer-term goals.

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