

**ARE INTEGRATED PROCESSES A SOLUTION LOOKING FOR A PROBLEM TO SOLVE,  
OR A TOOL TO SOLVE THE PROBLEM?**

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Significant advancements in process economics require significant reductions in capital and labor cost, beyond what is currently achieved. In the overall effort to achieve dramatically lower cost, lower labor, and more flexible production facilities; we have systematically identified tools and technologies that will allow for meaningful reductions in capital and labor costs. Integration of continuous and connected operations can be effectively utilized to facilitate very high mass productivity in small footprint facilities. Furthermore, the resulting operations are more amenable to low labor automated operations.

Novartis is advancing a full-scale concept that integrates the process from perfusion culture to continuous capture and through an automated connected-downstream sequence. The process, equipment and facility all play a role in achieving the next-level of productivity and flexibility. This has been demonstrated at full-scale with comparable quality results as a traditional process stream with a fraction of the operations staff. It is intended to share comparison data between integrated-continuous process and a traditional batch process.