USING REAL-WORLD SIMULATIONS TO TRAIN THE BIOMANUFACTURING WORKFORCE

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MODULARIZED PAT ONLINE TRAINING PLATFORM TO ACCELERATE WORKFORCE INNOVATION IN BIOPHARMACEUTICALS MANUFACTURING

Northeastern University, Boston, MA

Type:
Academic Research Institution

Participating Organizations:
Massachusetts Institute of Technology, Genentech, Merck & Co., Inc., Janssen, Sartorius

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INDUSTRY NEED

There is an enormous demand for biomanufacturing workforce development, both at the academic level and to keep the current workforce up to date with new technologies and skills. Hands-on training is slow, expensive, and insufficient to meet the needs of the rapidly growing biopharmaceuticals industry. Investigators at Northeastern University and the Massachusetts Institute of Technology collaborated to develop more flexible, scalable, and cost-effective approaches to biomanufacturing workforce training.

SOLUTION

The team turned to the concept of a "digital twin," a computer program that uses real-world data to re-create processes—in this case, biopharmaceutical manufacturing—as virtual simulations. The digital twin approach allows users to explore realistic variations in the biopharmaceutical manufacturing process and test solutions to problems safely and inexpensively in a virtual environment. Simulations are run and the results analyzed within much shorter timeframes than real-world experiments. The digital twin platform also powerfully demonstrates how a small error in one part of the process can propagate through the entire process.

To apply a digital twin platform to workforce training, the team worked closely with industry partners to understand their specific training needs and develop case studies. The industry partners provided real-world data that was fed into the digital twin platform to create simulations with realistic levels of variability and uncertainty. The entire process—from the bioreactor to the purification columns—was recreated virtually, along with an interactive interface and data visualizations similar to that used in industry. The team also developed lesson plans for using the simulation to learn about troubleshooting, risk analysis, and process control.

OUTCOME

By allowing trainees to learn in a virtual environment, the digital twin makes it possible to train more people, train them better, and at a lower cost. It can be applied to any number of biomanufacturing processes. The platform components are open, and manufacturers can feed their own data into the digital twin to tailor the simulations to their specific workforce training needs.

The digital twin software and the lesson plans have already been introduced in workshops and are currently being integrated into courses at both Northeastern and MIT and used to develop a modeling course at MIT for a new degree program with a focus on biomanufacturing. All the materials are available upon request through the project principal investigators at the Biopharmaceutical Analysis Training Lab (BATL) at NEU and Bioprocess Data Analytics and Machine Learning at MIT.

> *"The digital twin platform facilitates large-scale workforce development on end-to-end bioprocessing in a low-cost virtual environment."*

This project was developed with an award from the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and financial assistance from the U.S. Department of Commerce, National Institute of Standards and Technology (70NANB17H002).