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BioCoR is a national resource focused on advancing the science, technology and practice of preservation. We are dedicated to developing biopreservation protocols, improving preservation and storage technologies, establishing standards and guidelines and training individuals and institutions in the science and technology of biopreservation.

For more information, visit our BioCoR website at www.biocor.umn.edu, or contact us at biocor@umn.edu.

Automating preservation

By John Fink, Brooks Life Sciences

Automation was first adopted in industry and often used for applications consisting of one of the three Ds: dirty, dull or dangerous. These robots removed people from jobs that were neither high skill nor safe. Soon after this, automation use grew to include high skill, repetitive applications such as welding and painting where robots were programmed to replicate exactly what the human would do.

As robot technology improved, speed and throughput increased and became another driver for automation as robots were able to perform many tasks not only more accurately than humans, but also faster. In areas where labor rates were high, automation was implemented to reduce headcount and

labor costs. Today most high volume, high precision manufacturing plants have automation throughout their facilities.

Automation made its way into life science labs in the form of bench top instruments for liquid handling and temperature control. The repetitive and precision required for liquid handling was a natural fit for automation and automated liquid handlers quickly replaced handheld pipettes. As the number of scientific experiments increased, automation was further adopted to move samples (i.e. microplates) between automated instruments. For example, compound storage and high-throughput screening assays are dominated by large, automated systems that move microplates between storage, liquid handling, and temperature control and detection instruments.

Automation also reduces variability and this allows scientists to control and adjust inputs to determine output effects. For example, automatic adjustments of reagent additions and temperatures can easily be controlled and monitored via automation, whereas done manually would be difficult and error prone. Lab automation can also give assurances that a process is controlled and compliant.

Specific to cryopreservation of biological samples, automation is not widely used today and there are no continuous-flow automation solutions available. Preparing biological samples for freezing first requires a cryoprotective agent to be added and robotic liquid handlers can do this. Controlled freezing can be done in a passive device, where samples are placed in a specialized container, then into an -80°C ULT freezer and there cool at approximately -1°C/min. Alternatively, samples can be placed in an automatic controlled rate freezer, which lowers the temperature at specific rates over time according to a program. After controlled freezing the samples go into cryogenic storage, which is normally a liquid nitrogen (LN2) vapor freezer.

Automation options are available for cryo storage, but the vast majority of cryo storage is manual LN2 freezers. Manual LN2 freezers perform well at keeping sub -150°C environments (some even maintain -190C) to protect samples from warming above Tg of -135°C (glass transition temperature of water). The storage temperature is only one aspect of sample safety. When a new sample is stored or a stored sample retrieved, an entire rack must be removed from the LN2 freezer and this can expose 1,000+ adjacent "innocent" samples to the ambient environment. If performed quickly the innocent samples will not cross Tg, but if the rack is left out of the freezer for too long the innocent samples risk crossing Tg. This presents a risk of manual LN2 storage; innocent exposures are not controlled, monitored or logged.

With automated cryogenic freezers the storage and retrievals and innocent exposures are controlled, monitored and recorded so researchers can be certain their valuable samples are safety below Tg throughout the entire storage life. Prior to functional use, biological samples must be thawed in a controlled manner. Often this is done by a heated surface, water bath or ambient exposure over time, but some new products are available now that automate, control and monitor the rate and properties of thawing.

As discussed there are automation products available for the preparation, freezing, storage and thawing of biological samples, but no end-to-end solution exists that connects, controls and manages the entire cryopreservation process. Without precise controls between process steps there is risk that variables, such as time or temperatures, will change from day-to-day or user-to-user. Since cryopreserved samples are sensitive to temperature changes, this introduces risk to the post thaw viability and functionality of the biological samples.

Robotics and automation are commonplace throughout industry and are found in nearly every laboratory today, but automation for cryopreservation is still new and not widely adopted. As cryopreservation automation solutions innovate and become more economical they will become more widely used to perform, fill process gaps and precisely manage and control the entire cryopreservation

process.

Production Assistance for Cellular Therapies

National Institutes of Health's National Heart, Lung, and Blood Institute (NHLBI) announced the renewal of the Production Assistance for Cellular Therapies (PACT) initiative. This initiative supports the development of novel cell therapy products. Different sites make up the PACT network and include:

- The Center for Cell and Gene Therapy, Baylor College of Medicine
- The Center for Biomedicine and Genetics, City of Hope
- The Interdisciplinary Stem Cell Institute Cellular Manufacturing Program, University of Miami
- The Moffitt Cancer Center and Research Institute
- The University of Minnesota, Molecular and Cellular Therapeutics

For more information on the program, visit www.pactgroup.net.

The program has the potential to significantly improve the preservation of cell therapies in addition to the work on development of cell therapy products.

Reminders

- The University of Minnesota is still looking for participants in the cell therapy training grant Visit the Hematology Workforce Training Program website at celltherapy.umn.edu to learn more. Please send us an email hemework@umn.edu if you are interested in the training grant or have questions about the program.

- Spread the word and forward this email. Encourage others to sign up for the BioCoR newsletter. Please email us at biocor@umn.edu if you would like to sign up for the newsletter.

Upcoming meetings

Learn more about preservation and its different applications at upcoming meetings.

ISBiotech Spring Meeting
March 6-8, 2017
Washington, D.C.

ISCT Annual Meeting
May 3-6, 2017

London, Great Britain

ISBER Annual meeting
May 9-12, 2017
Toronto, Ontario, Canada

Society for Cryobiology
July 20-24, 2017
Hefei, China

Please notify us at biocor@umn.edu if there is a meeting that should be listed in the newsletter.

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