BioTechniques In Focus

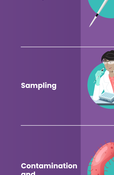
PHCbi

Why, when and how should you continuously monitor cell metabolism?

In the fields of cancer, stem-cell research, immunology and process development for cell-based formulation manufacturing, understanding the metabolic state of cells is a factor of ever-growing importance in the development and analysis of cell cultures.

In this infographic, we explore why, when and how to conduct continuous metabolic monitoring.

Why should you continuously monitor cellular energy metabolism?



Continuous monitoring of cell culture metabolites provides real-time metabolic information, improving on traditional, labor-intensive periodic monitoring methods and helping to provide a more comprehensive insight into cell metabolism. But what are the key differences between these two approaches?

Periodic sampling versus continuous monitoring

	Periodic sampling	Continuous monitoring
Principle	Traditional methods rely on manual periodic or endpoint sampling of cell culture media to determine metabolite concentration at that time point.	Continuous monitoring allows researchers to collect real-time, continuous metabolic measurements without disturbing the cell culture.
Sampling	Manual periodic sampling of the cell media is required.	No sampling is required.
Contamination and damage risk	There are higher risks of contamination and damage to cells in traditional monitoring because researchers are required to handle the cell culture during experimentation [1].	Because there is no need to sample and the cell culture remains undisturbed during experimentation, the risks of contamination and damage are low.
Time commitment required	Manual sampling means that researchers have to be 'on call' to sample the cell culture media at the necessary time points, causing inconvenience.	Once continuous monitoring is set up, researchers can leave the cell cultures in the incubator as metabolic data is being collected automatically.
Data gaps	Researchers only have access to the metabolic measurements taken at the time points sampled, leading to significant gaps in data.	Continuous monitoring can collect metabolic measurements every minute, providing data to determine metabolic rate data every 15 minutes.
Cost efficiency	Due to higher risks of contamination and damage to expensive cell lines, manual sampling has the opportunity to be less cost efficient.	Due to the lower risks of contamination and damage to expensive cell lines, continuous monitoring is more cost efficient.

When can continuous monitoring benefit your research?

Use continuous monitoring for:

Regenerative medicine purposes: metabolite analysis can help ensure that developing organoids display human-like metabolic activity.

Therapeutic development: metabolite analysis of cell cultures can indicate how they respond to the administration of therapeutic candidates.

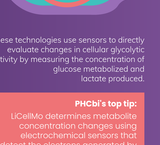
Disease modeling: metabolic analysis of specially designed cell cultures can provide an insight into the metabolic perturbations associated with diseases, highlighting the potential to target these metabolic pathways.

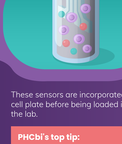
Insights into cellular processes: metabolic analysis can reveal the differentiation state of cells.

How can you continuously monitor cellular metabolism?

Emerging technologies can facilitate the continuous live-cell monitoring of glucose and lactate in mammalian cell cultures.

PHCbi's top tip:
One such solution for this approach is PHCbi's Live Cell Metabolic Analyzer (LiCellMo™).



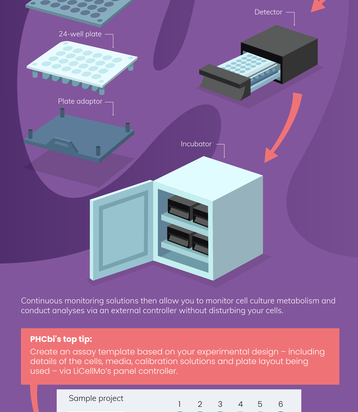


These technologies use sensors to directly evaluate changes in cellular glycolytic activity by measuring the concentration of glucose metabolized and lactate produced.

PHCbi's top tip:
LiCellMo determines metabolite concentration changes using electrochemical sensors that detect the electrons generated by enzymatic reactions of glucose and lactate.

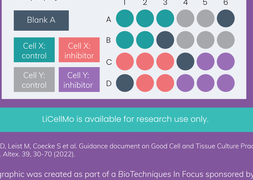
These sensors are incorporated into a module that is fitted to a plate adaptor and cell plate before being loaded into a detector and placed into an incubator in the lab.

PHCbi's top tip:
Autoclave plate adaptors and ensure the sensor module is at room temperature before placing it on your 24-well plate.



Continuous monitoring solutions then allow you to monitor cell culture metabolism and conduct analyses via an external controller without disturbing your cells.

PHCbi's top tip:
Create an assay template based on your experimental design – including details of the cells, media, calibration solutions and plate layout being used – via LiCellMo's panel controller.



LiCellMo is available for research use only.

[1] Pamies D, Leist M, Coecke S et al. Guidance document on Good Cell and Tissue Culture Practice 2.0 (GCCP 2.0). Altex. 39, 30–70 (2022).

This infographic was created as part of a BioTechniques In Focus sponsored by PHC Corporation of North America.

BioTechniques In Focus

PHCbi