Agilent Seahorse XF Live-Cell Metabolism Solutions for Stem Cell Research
Cellular age and origin, in addition to donor variability, protocol differences, growth rates and media choices all contribute to inconsistent reprogramming and/or differentiation efficiencies. Metabolic energy utilization, characterized before and after cell fate changes occur, identifies the metabolic phenotype and enables researchers to predict and confirm cell function, revealing actionable reprogramming and differentiation potential.

Cellular metabolic phenotyping measures the cell's energy requirement and pathway preference for readying the transition between undifferentiated and differentiated states. Metabolic switching occurs rapidly as cells transition from quiescent to pluripotent and/or from pluripotent to differentiated.

**Seahorse XF Technology:**
- Live cell
- Real-time
- Label-free
- Dynamic injection ports
- Measures oxygen consumption and glycolytic rates simultaneously

Seahorse XF technology enables reliable measurements that predict, monitor, and track cell fate transitions. Discover how these metabolic measurements can be used as indicators to minimize inefficiencies and improve differentiation and reprogramming approaches. Routine assays make identifying cell phenotype and cell transitions easy. What's more, the metabolic phenotyping analysis that Seahorse XF delivers provides the tools and knowledge to customize your approach, and push the conventional boundaries of stem cell research through the development of new assays.

Seahorse XF Technology simultaneously measures rates of oxidative metabolism and glycolysis using label-free methods on live cells, in real-time.

"iPSCs and their differentiated counterparts are metabolically distinct and these metabolic parameters are important for stem cell identity."

- Dr. James Ryall, University of Melbourne, Australia
Reprogramming Efficiency is Improved with Increased Glycolysis and Oxidative Phosphorylation

Metabolic phenotype can be a leading indicator for reprogramming efficiency
- Enhance reprogramming efficiency by modulating both the glycolytic and mitochondrial pathways.
- Measure gain of pluripotency
- Connect metabolic state with cellular identity

Metabolic reprogramming precedes changes in gene expression, and is required for efficient reprogramming

Hybrid Cellular Metabolism Coordinated by Zic3 and Esrrb Synergistically Enhances Induction of Naive Pluripotency.

Determine Differentiation Potential by Distinguishing Naive and Primed Stem Cells

Quality Control Your Cells
- Evaluating pluripotent stem cell metabolic signatures reveals when to bank iPS cells or when to begin differentiation
- Energy pathway prevalence determines a cell’s readiness for differentiation
- Calculating the timing and efficiency of the metabolic switch is essential for improving gene targeting effectiveness

The metabolome regulates the epigenetic landscape during naive-to-primed human embryonic stem cell transition.
Monitor Metabolic Switching Events Underlying Differentiation Progression

Cell Fate Transitions
- Spare Respiratory Capacity defines cell’s propensity to differentiate
- Measure Glycolytic rates to determine proliferation and self-renewal ability
- Determine the commitment stage based on the metabolic switch

Confirms Differentiation


Differentiating hepatocytes switch to an oxidative phenotype

Disease Modeling

Measure Functional Performance and Model Relevance

Optimize Disease Models
- Compare somatic, origin, pluripotent intermediate, and differentiated cells
- Modulate metabolism to improve functional outcome
- Standardize assays for cellular characterization

Genetic Defect

Normal Model

Gene Editing

Spontaneous Chromosomal Aberration

ES Cells

Somatic Cells

Reprogramming

Pluripotent Stem Cell with a Genetic Defect

Metabolic Characterization

Obesity, Diabetes, and Metabolic Disorder Research

Hepatic Research

Cardiovascular Research

Hematopoietic Research

Neurobiology Research

Cancer Research

Seahorse XF Analyzers

Seahorse XF Analyzers simultaneously measure the two major energy pathways of the cell — mitochondrial respiration and glycolysis — in live cells using label-free, solid-state sensor cartridges in a microplate format. They work with many cell types, including primary cells, cell lines, suspension cells, as well as islets, spheroids, and isolated mitochondria.

The patented design makes it all possible

Seahorse XF Cell Culture Microplates are tissue culture treated and plate reader compatible.

Sensor probes gently lower to create a transient microchamber, allowing rapid, real time measurement of changes in both oxygen and proton concentrations in the extracellular medium.

The microplate well requires a small number of cells, 10-20 fold fewer cells compared to conventional respirometers.

Seahorse XF Analyzers utilize patented transient microchambers which enable sensitive, precise, and label-free metabolic measurements of live cells in real time.

Inert optical microsensors measure rates of oxygen consumption and extracellular acidification simultaneously, without addition of dyes.

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Seahorse XF Assays and Kits

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<th>Assay</th>
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| XF Cell Mito Stress Test     | Mitochondrial function and spare respiratory capacity | Low SRC indicates pluripotency  
High OXPHOS indicates differentiation |
| XF Glycolytic Rate Assay     | Glycolysis utilization and capacity to compensate for energy demand | High glycolytic capacity indicates pluripotency and proliferation |
| XF Mito Fuel Flex Test       | 3 major fuel oxidation pathways: glucose, glutamine, and fatty acids (pathway dependence) | Removal of glutamine prompts cells to differentiate |
| XF Cell Energy Phenotype Test| Measures glycolysis and OXPHOS simultaneously (pathway preference) | Energy map can easily distinguish differentiated versus stem cell populations  
Switch is essential for successful differentiation |
**Measure What's Important to Your Cell**

With over 20,000 genes, 200,000 proteins and thousands of pathways, you can't measure everything in a cell at once, but you can measure what provides the energy that drives them—metabolism.

Agilent Seahorse XF technology detects changes in cell bioenergetics in real-time, providing a window into the critical functions driving cell signaling, proliferation, activation, toxicity and biosynthesis.

Move beyond analyzing what your cells are, and reveal a clearer picture of what they do.

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**Agilent Seahorse Wave Software**

Wave, the primary Seahorse software program, enables the transformation of raw kinetic data into powerful results. Wave provides preloaded templates and protocols for each Seahorse XF assay kit, reducing time for assay design, as well as several analysis views and export options that facilitate Seahorse XF data analysis and interpretation.

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**Learn More**

More about stem cells  
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Bibliographies citing Seahorse XF data on stem cell research  

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