THE TOXICOLOGY-METABOLISM LINK

Cell Metabolism Assays for Obesity & Diabetes Research

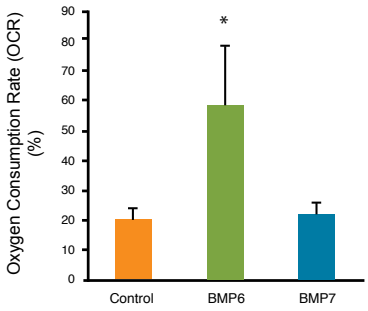
Seahorse Bioscience

A part of **Agilent Technologies**

GOLD STANDARD ASSAYS FOR MEASURING METABOLIC REPROGRAMMING

METABOLISM AND BROWNING

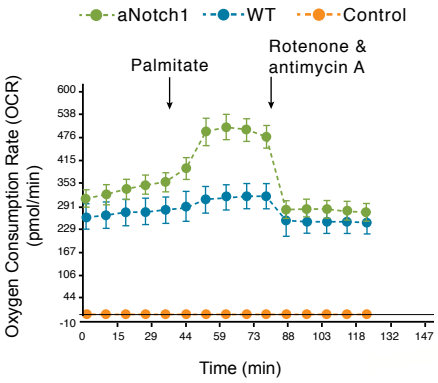
Excess white adipose tissue causes deleterious health effects, while brown adipose tissue is beneficial to overall health. Inducible brown adipocytes, also known as beige, brown-in-white, or brite adipocytes, present a promising treatment for obesity, diabetes, and metabolic disorders. Researchers are using Seahorse XF technology for relevant assay testing conditions and parameters. The Seahorse XF Cell Mito Stress Test measures the key parameters of mitochondrial function: basal respiration, ATP-linked respiration, proton leak, maximal respiration, and spare respiratory capacity. The Seahorse XF Glycolysis Stress Test measures the key parameters of glycolytic function: glycolysis, glycolytic capacity, and glycolytic reserve.



Adipocytes derived from C2C12 cells

Sharma A *et al.*, (2014) PLoS One.

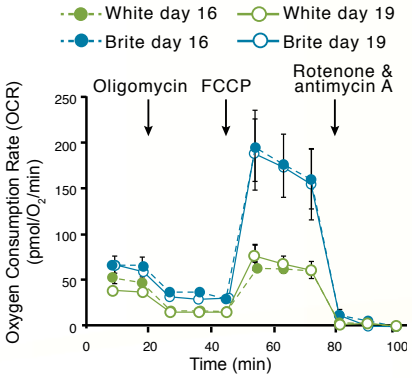
Seahorse XF technology reveals a significant increase in exogenous palmitate oxidation in bone morphogenetic protein 6 (BMP)-stimulated cells.



Murine white adipocytes

Bi P *et al.*, (2014) Nat Med.

Seahorse XF technology reveals Notch signaling inhibition increases fatty acid oxidation.



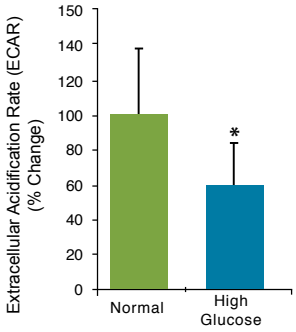
Rosiglitazone-deprived white and brite hMADs adipocytes

Loft A *et al.*, (2015) Genes. Dev.

Seahorse XF Cell Mito Stress Test reveals a link between rosiglitazone stimulation and metabolic profile in hMADs-derived brite adipocytes.

METABOLISM AND SUBSTRATE UTILIZATION

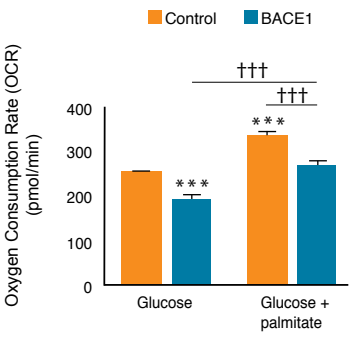
Nutrients are critical to maintaining cellular homeostasis and have a significant effect on metabolism. Metabolic disorders can cause abnormal processing of various nutrients leading to metabolic stress. Seahorse XF technology provides the capability to test, analyze, and understand the collected data.



Bovine retinal pericytes

Trudeau K *et al.*, (2011) Invest Ophthalmol Vis Sci.

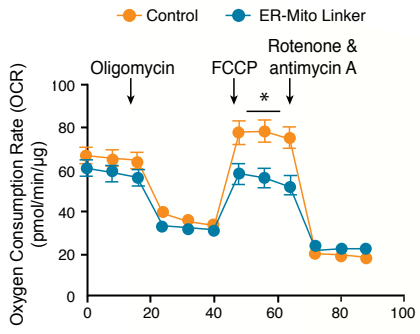
Seahorse XF technology reveals decreased glycolytic activity in response to high glucose.



Murine myoblasts

Hamilton DL, *et al.*, (2014) Diabetologia.

Seahorse XF technology reveals Beta-site APP-clearing enzyme 1 (BACE1)-induced reduction in glucose oxidation.



Murine hepatocytes

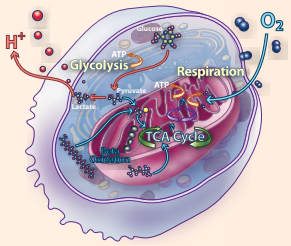
Arruda AP *et al.*, (2014) Nat Med.

Seahorse XF Cell Mito Stress Test reveals an inhibition of spare respiratory capacity due to increased ER-mitochondrial interaction.

THE WORLD'S MOST ADVANCED METABOLIC ANALYZERS

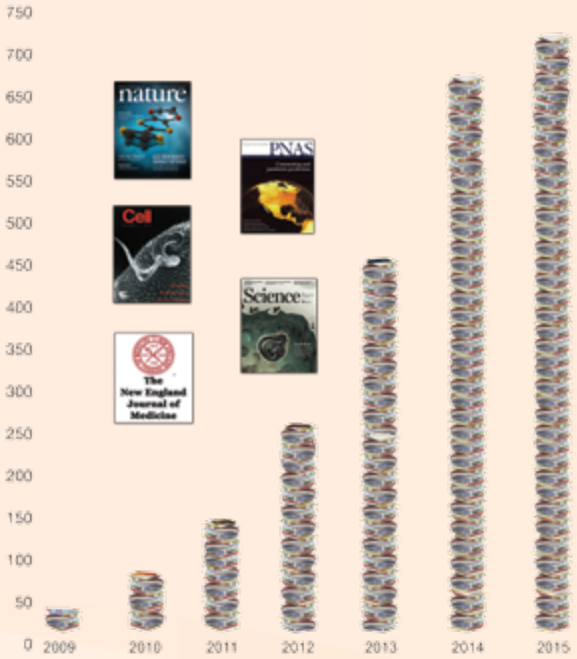
XF DATA IN PUBLICATIONS

There are over 2,000 references utilizing Seahorse XF technology published in leading journals such as Nature and Cell. Scientists are embracing Seahorse XF technology to identify metabolic phenotypes and reprogramming to target metabolic pathways for therapeutic purposes.



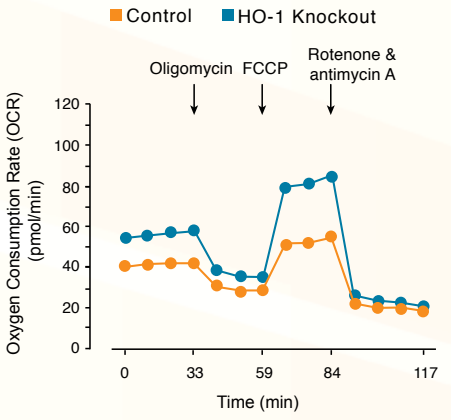
Glycolysis
ECAR (Extracellular Acidification Rate)

Mitochondrial Respiration
OCR (Oxygen Consumption Rate)



METABOLISM AND INFLAMMATION

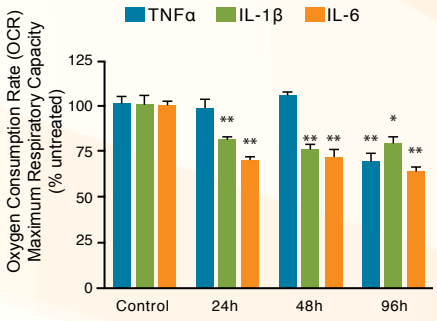
Chronic inflammation and other immunological effects are linked to metabolic disorders. Researchers are using Seahorse XF technology to further their research into the connection between metabolic disorders and chronic inflammation.



Murine macrophages

Jais KA *et al.*, (2014) Cell.

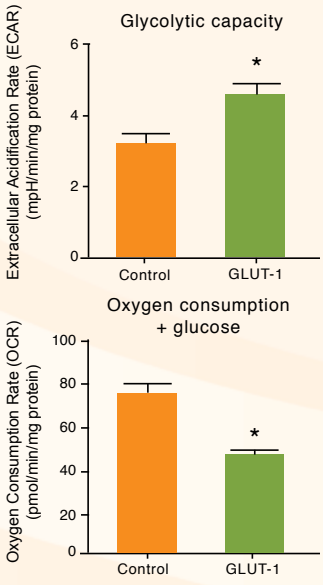
Seahorae XF Cell Mito Stress Test identifies heme oxygenase-1 (HO-1) gene requirement for metabolic programming of naïve macrophages.



3T3-L1 adipocytes

Hahn WS *et al.*, (2014)
Am J Physiol Endrocrinol Metab.

Seahorse XF technology demonstrates the reduction of respiratory capacity in the presence of proinflammatory cytokines.



Murine macrophages

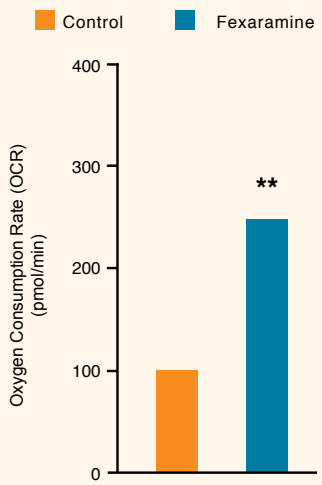
Freemerman AJ *et al.*, (2014) J Biol Chem.

Seahorse XF Glycolysis Stress Test reveals that glucose transporter 1 (GLUT1) overexpression increases macrophage glycolytic capacity while reducing mitochondrial respiration.

MEASURING THE KEY PARAMETERS OF CELL METABOLISM

TRANSLATIONAL DIABETES AND THERAPEUTICS

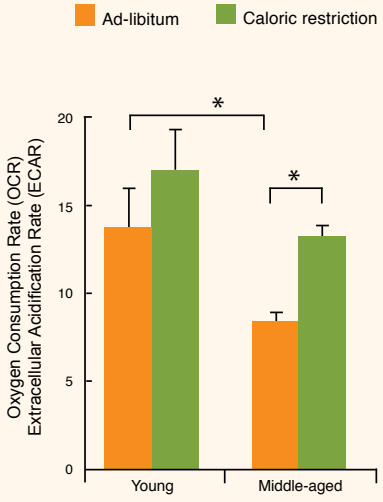
Research into promising therapeutics may provide much needed cures for obesity, diabetes, and other metabolic disorders. Seahorse XF technology provides researchers the tools necessary for comprehensive investigations into disease progression and therapeutic candidates.



Murine stromal vascular fraction cells

Fang S *et al.*, (2015) Nat Med.

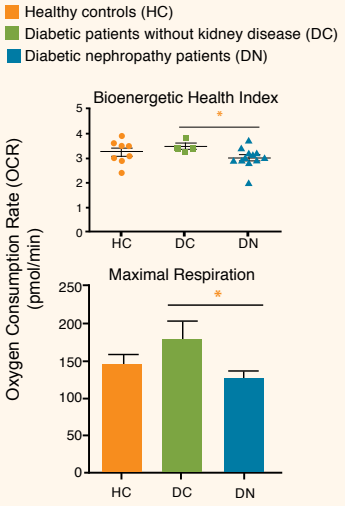
Seahorse XF technology reveals treatment with Fexaramine, a farnesoid X receptor agonist, increased mitochondrial respiration.



Rat muscle fibers

Chen CN *et al.*, (2015)
Am J Physiol Endocrinol Metab.

Seahorse XF technology reveals that caloric restriction improves metabolism in muscle from middle-aged rats.



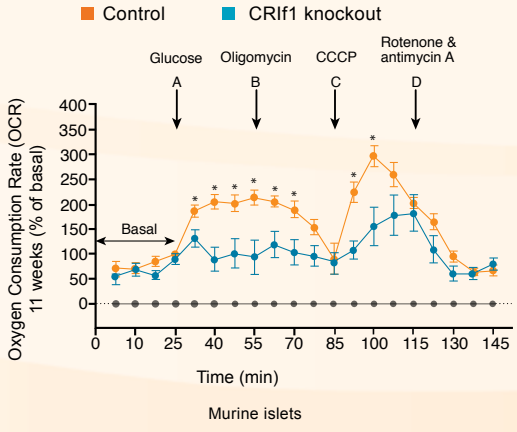
Human PBMCs

Czajka A *et al.*, (2015) EbioMedicine.

Seahorse XF Cell Mito Stress Test reveals a decreased maximal respiration in patients with diabetic nephropathy and correlates with patient Bioenergetic Health Index (BHI).

METABOLISM AND ISLETS

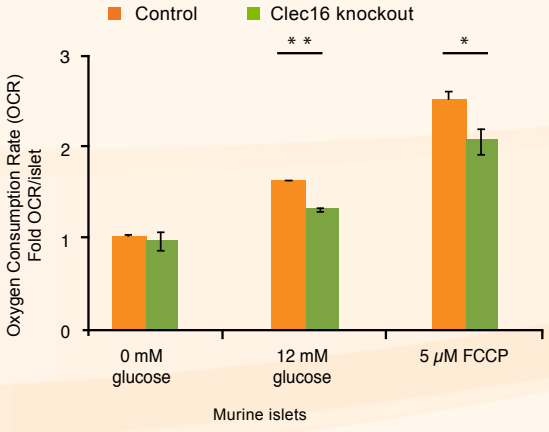
Using a cell line model to mimic the *in vivo* environment is crucial to any experiment. Researchers are using Seahorse XF technology with various cell lines and types to best represent the *in vivo* conditions associated with metabolic syndromes.



Murine islets

Kim YK *et al.*, (2015) Diabetologia.

Seahorse XF technology reveals a mitochondrial inner membrane protein (CRIf1) requirement for OXPHOS function in isolated islets.



Murine islets

Soleimanpour SA, *et al.*, (2014) Cell.

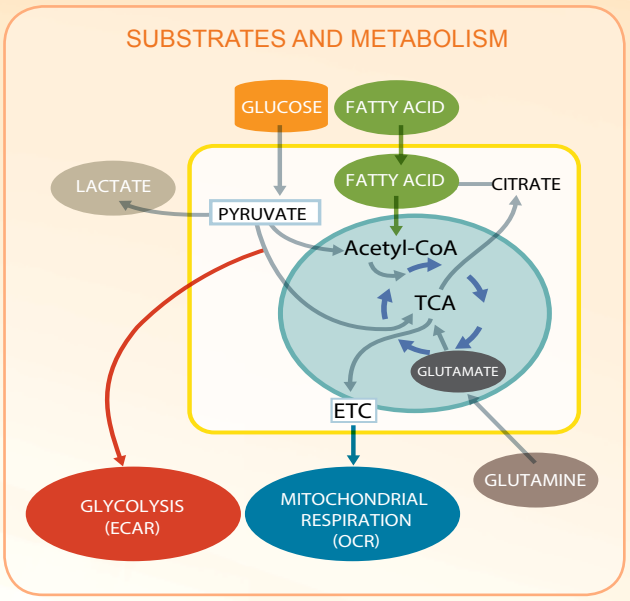
Seahorse XF technology identifies a diabetes susceptibility gene requirement, Clec16a, for normal glucose-utilization in islets.

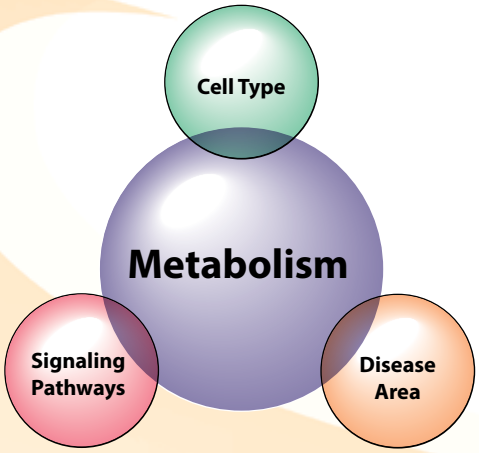
FUNCTIONAL XF METABOLIC ASSAYS

THE METABOLIC SYNDROME AND METABOLISM LINK

Metabolic syndromes are currently at pandemic levels and are a significant health risk to the general population. As one of the world's leading causes of death and disability worldwide, these syndromes include insulin resistance, obesity, non-alcoholic fatty liver disease, cardiovascular disease, and inflammation. The connection between metabolism and metabolic syndromes is evident, regardless of whether the research focuses on a specific cell type or tissue origin, disease area, or signaling pathway.

Mitochondrial dysfunction has emerged as a common thread amongst metabolic syndromes. Research into metabolic profiles and changes provides insight into browning, substrate and nutrient utilization, and inflammation. These metabolic paradigms are leading to opportunities for translational and t herapeutic candidates. Seahorse XF technology provides the capability to examine the mechanisms that link functional metabolism with the abnormalities that result in clinical disease.



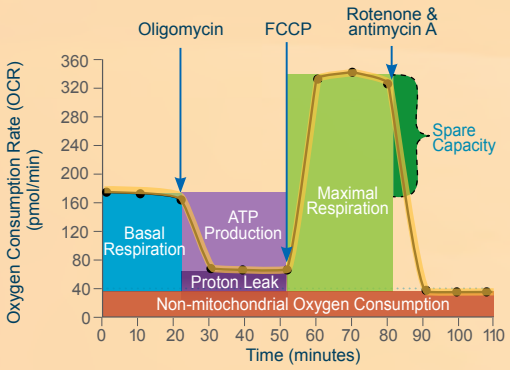


GOLD STANDARD METABOLIC ASSAYS

MEASURING THE KEY PARAMETERS OF CELL METABOLISM

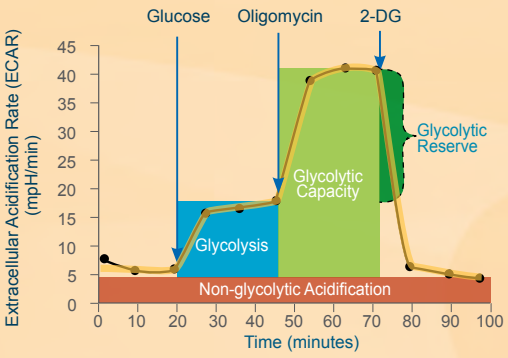
Seahorse XF Cell Mito Stress Test Profile

Mitochondrial Respiration



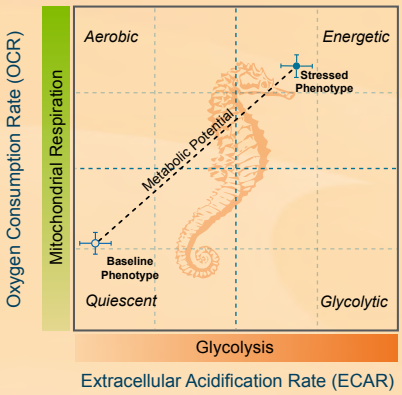
Seahorse XF Glycolysis Stress Test Profile

Glycolytic Function



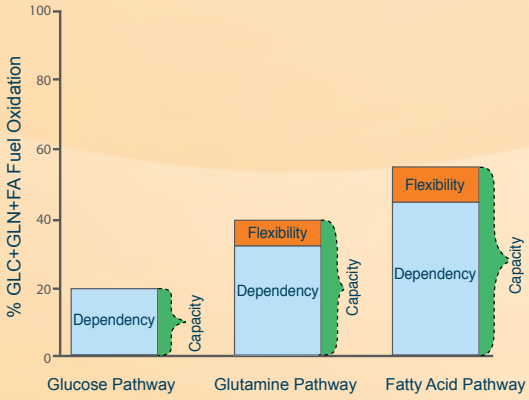
Seahorse XF Cell Energy Phenotype Test

Metabolic Phenotype & Potential



Seahorse XF Mito Fuel Flex Test Profile

Mitochondrial Function



Seahorse *Bioscience*

A part of **Agilent Technologies**

Corporate Headquarters

Seahorse Bioscience Inc.
16 Esquire Road
North Billerica, MA 01862 US
Phone: +1.978.671.1600
www.seahorsebio.com

European Headquarters

Seahorse Bioscience Europe
Fruebjergvej 3
2100 Copenhagen DK
Phone: +45 31 36 98 78

Asia-Pacific Headquarters

Seahorse Bioscience Asia
199 Guo Shou Jing Rd, Suite 207
Pudong, Shanghai 201203 CN
Phone: 0086 21 33901768

Rev 3