Baker InvivO2 and PhO2x Box in orthopaedics, metabolism and body composition studies

Krista Rantanen, PhD
Director of Scientific Applications, The Baker Company

Physoxia refers to the physiological levels of oxygen present in the tissues of living organisms, which is crucial for maintaining cellular metabolism. Unlike atmospheric conditions, where oxygen levels are around 21%, physoxia involves much lower concentrations, typically around 1-5% in human tissues. This state is essential for the proper functioning of cells and has significant implications for medical research and therapeutic applications. For instance, culturing human adipose-derived stem cells under physoxia rather than atmospheric oxygen levels has been shown to enhance their proliferation, migration, and angiogenesis capabilities while reducing senescence and apoptosis. Moreover, physoxia is vital for the survival of cells under pathological conditions such as cancer, where hypoxia can severely disrupt tissue oxygenation.

Understanding the role of physoxia in cellular metabolism is therefore critical for developing effective treatments for various diseases and for improving the outcomes of cell transplantation therapies. The study of physoxia-responsive proteins also reveals that this condition influences cell growth, differentiation, and survival, which are key factors in tissue engineering and regenerative medicine.

Baker's InvivO2, InvivO2 300, and the PhO2x Box are advanced tools that can significantly enhance orthopaedic, metabolism, and body composition research. The InvivO2 series provides a controlled environment for cell culture, allowing researchers to simulate physiological conditions such as hypoxia, which is crucial for understanding cellular responses in bone healing and development. The invivO2 300, with its compact design and precise environmental control, is particularly beneficial for metabolic research, enabling the study of cellular metabolism under specific oxygen concentrations. The PhO2x Box extends these capabilities further, offering an economical and user-friendly platform for in vitro cell culture experiments, which can be pivotal in studying the effects of different oxygen levels on fat cell development and muscle metabolism. Together, these systems offer a comprehensive suite of options for researchers looking to replicate in vivo conditions and obtain physiologically relevant data in their studies.

The concept of using low oxygen levels, or physoxia, in orthopaedic research is gaining interest due to its potential benefits in understanding and improving healing processes. Physoxia can simulate the conditions of postoperative environments and has been shown to influence various cellular functions critical for bone and tissue regeneration. For instance, it can enhance chondrogenesis, the process by which cartilage is formed, and osteogenesis, the development of bone. This is particularly relevant in orthopaedics, where the healing of bones and joints is a primary concern.

Moreover, controlled hypoxia can help in studying the responses of bone cells to stress and the mechanisms of fracture healing. It's important to note that while low oxygen levels can be beneficial in a controlled research setting, they must be carefully monitored to avoid adverse effects such as tissue hypoxia, which can impede healing. Therefore, the application of physoxia in orthopaedic research represents a delicate balance between providing enough stress to stimulate cellular responses and ensuring tissue viability. Recent studies suggest that a conservative approach to oxygen therapy, titrating administration to achieve slightly lower oxygen levels, could be safely implemented and decrease susceptibility to hyperoxemia.

Baker's InvivO2 workstations are advanced tools designed to provide precise environmental control for cell culture, which is crucial in various research fields including orthopaedics, metabolism, and body composition. These workstations allow researchers to regulate and maintain critical parameters such as oxygen, carbon dioxide, temperature, and humidity, mimicking the physiological conditions of the subject matter under study. This capability is particularly beneficial in orthopaedic research, where the cellular mechanisms of bone healing and regeneration can be observed under controlled hypoxic conditions that resemble the natural environment of bone tissue.

Similarly, in metabolism and body composition studies, the ability to create specific physiological conditions enables scientists to better understand cellular metabolism and the effects of different environmental factors on body composition. The InvivO2 workstations, with their precise control and monitoring capabilities, are invaluable in pushing the boundaries of knowledge in these complex fields.

PhO2x Box is a cutting-edge solution designed to enhance research in fields such as orthopaedics, metabolism, and body composition. This system offers precise control over oxygen and carbon dioxide levels, providing an optimal environment for cell culture experiments that mimic physiological conditions.

The PhO2x Box includes a touchscreen control for easy adjustments and a data log feature that records up to 12 months of data history, ensuring researchers can track and replicate conditions as needed. Its versatility makes it suitable for a range of applications, from studying bone healing in orthopaedic research to understanding metabolic processes and changes in body composition. The system's design allows for integration into existing lab setups, making it a valuable tool for advancing research and potentially leading to breakthroughs in medical science.

If you have any questions on which method best meets your research needs, feel free to contact us to discuss further We have many resources available, from scientist webinars to journal citations, to help point you in the right direction.

To see the systems that Baker offers, please visit our website (www.scintica.com) or feel free to reach out to us via email at info@scintica.com or by phone at 519-914-5495 and we would be glad to assist you.