



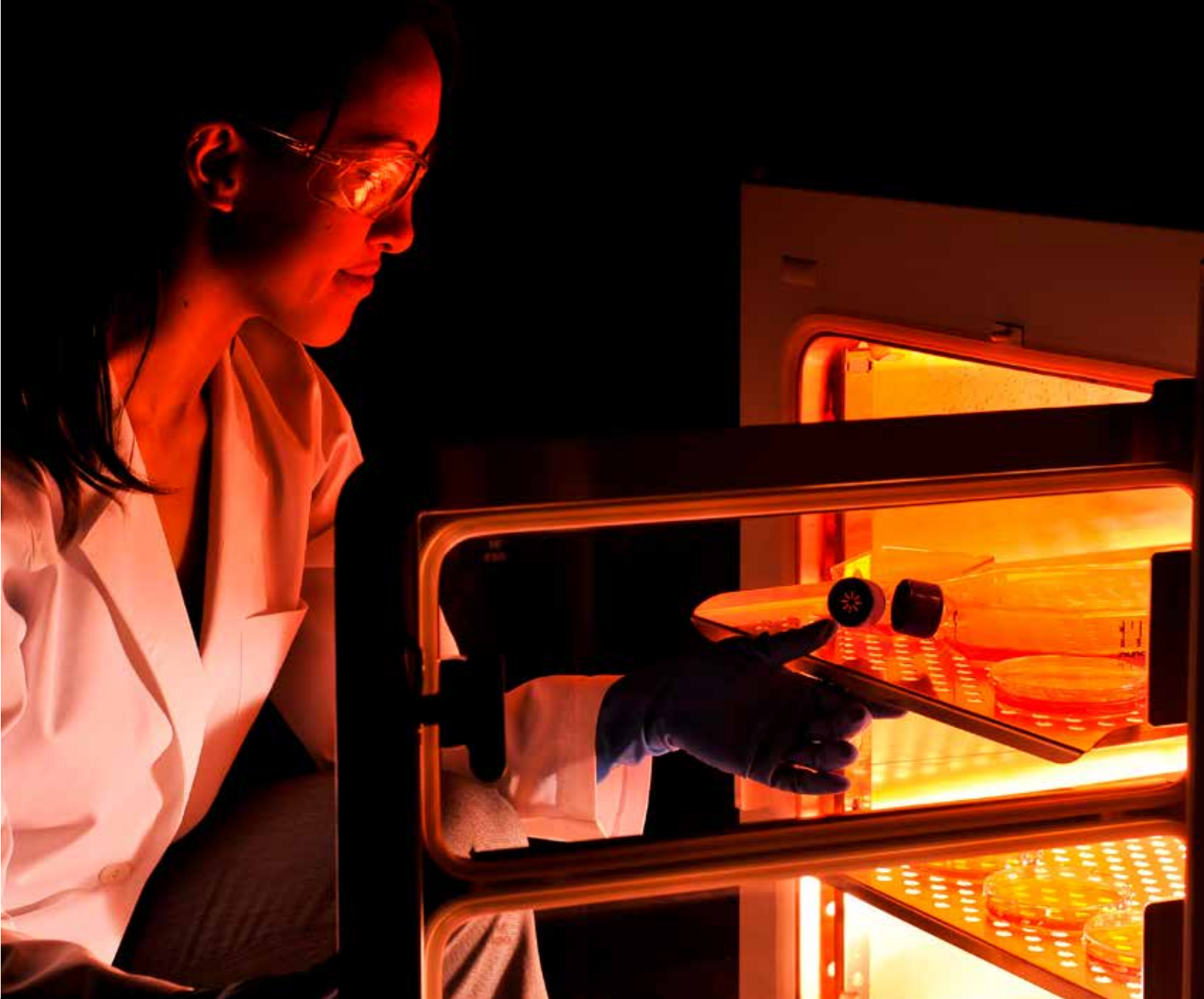
**Thermo Scientific CO₂ Incubators
with Variable Oxygen Control**



5 reasons

to enhance your cell culture using a
Thermo Scientific CO₂ incubator with
variable oxygen control

Thermo
SCIENTIFIC



“ We use the Heracell tri-gas incubator because the integrity of the cells is better, they develop better, and they are healthier. ”

— Neurobiology researcher, clinical research institute

Discovery thrives in a culture of confidence

Thermo Scientific Variable Oxygen Control CO₂ incubators are uniquely designed to optimize growth of mammalian cells in an environment that closely mimics *in vivo* conditions.

For many decades, animal cells have been cultured in air supplemented with carbon dioxide. But new technologies and applications for cell therapies require conditions that better mimic those *in vivo*.

Inside the body, oxygen concentrations range from 1-14%, rather than the 20-21% found in the atmosphere. Cells cultured in low oxygen (hypoxia) grow faster, live longer, and show lower stress. Our variable oxygen control (or “tri-gas”) incubators will generate hypoxic conditions to help your cells grow faster and healthier.

Maximize your productivity by surrounding your important cells in an environment you can trust.



1

Increased biological relevance

The air we breathe is 21% oxygen but that is different inside our bodies. Oxygen levels in tissues can be as low as 1-2%. Culturing your cells at lower oxygen concentration will better simulate physiological conditions, resulting in cell behaviors that are more predictive of an *in vivo* environment.

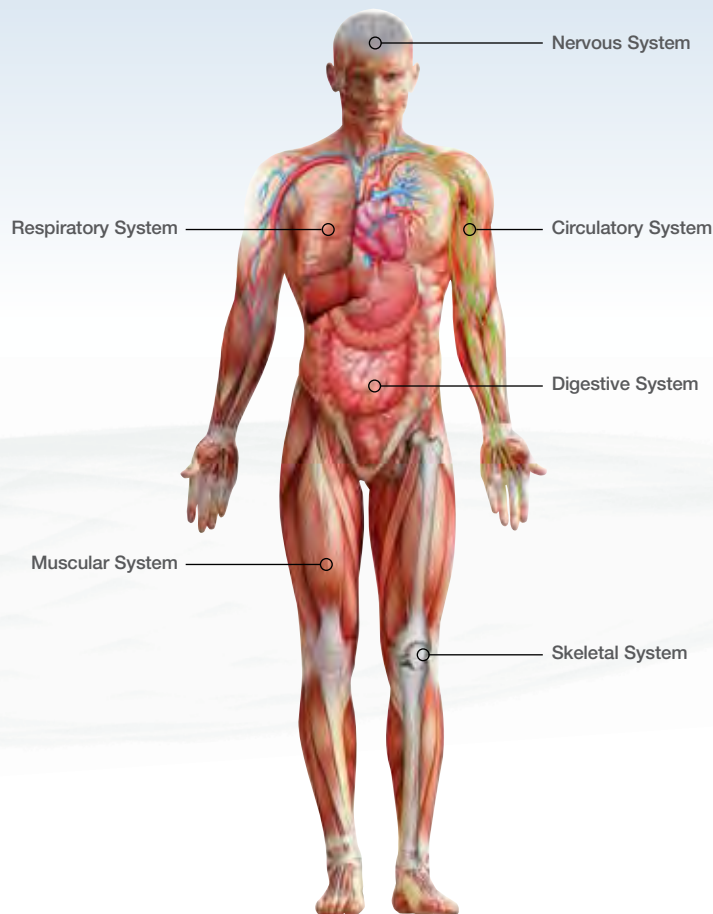
Oxygen Levels in Human Tissues	
Lungs	14%
Arteries	12%
Liver, heart, kidneys	4-12%
Eyes	1-5%
Brain	0.5-7%
Bone marrow	0-4%

APPLICATIONS:

Cell biology

Basic and applied research and production

Pharmaceutical testing



2

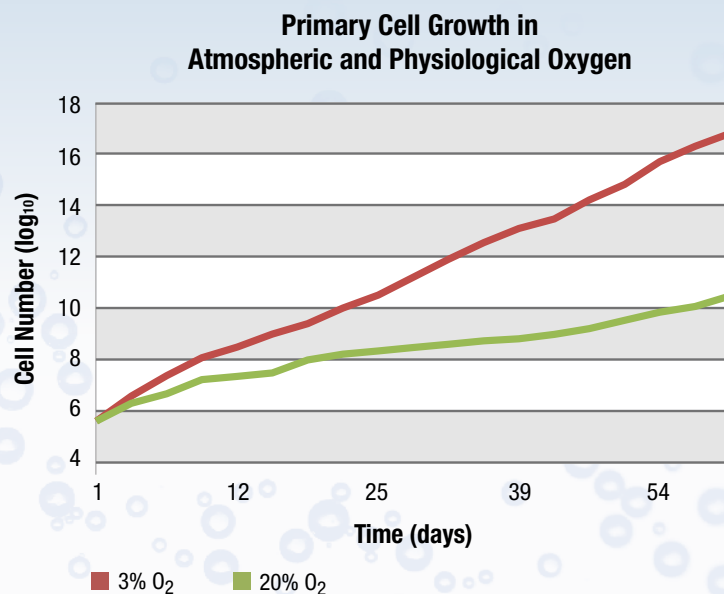
Greater cell number and longer life

Research shows that experiments using primary cells better mimic how cells will react *in vivo*. Many primary cell types grow faster and live longer when cultured under hypoxic conditions.

APPLICATIONS:

Vaccine and biopharma production

Basic and applied research



Newly isolated mouse embryonic fibroblast (MEF) cells avoid senescence and grow faster at physiological (3%) oxygen compared to atmospheric (20%) oxygen.

Adapted from Parrinello et al. *Nature Cell Biology* 2003.

3

Reduced differentiation and stress responses

Oxygen concentration is an important determiner of cell fate and modulates expression of stress markers. Human stem cells grown at 20% oxygen show an increase in oxidative stress and DNA damage. Shifting the cells to a lower oxygen concentration that mimics physiological levels increases lifespan while limiting oxidative damage, genetic instability, and telomere shortening.

Estrada et al. *Cell Death Diff* 2012.

APPLICATIONS:

Developmental biology
Neurology
Stem cell research
Regenerative medicine
Physiology

“Our lab mandates this [5% oxygen in the Heracell tri-gas incubator] in order to mimic conditions in the body, so that cells are as close to those conditions as possible and nothing is different. All of the signals for proper epigenetics are there.”

– Stem cell researcher at biomedical research institute



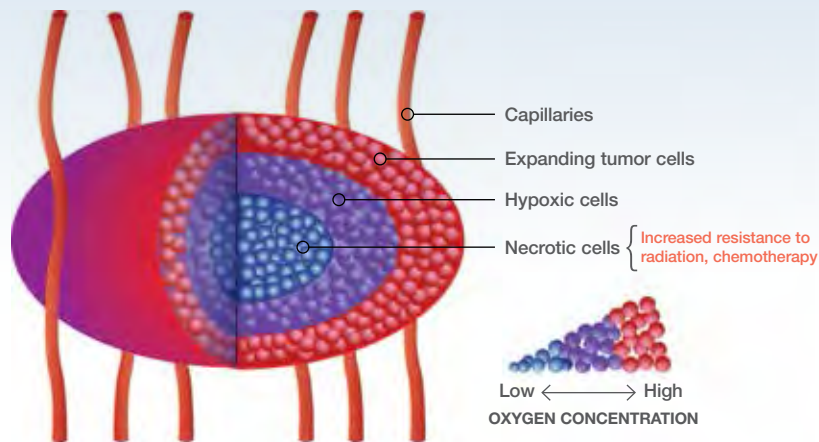
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Better simulation of tumor microenvironments

In a solid tumor there is a decreasing oxygen gradient from the outer edge of the tumor, where cells contact oxygenated capillary blood, toward the center. In the tumor's center, very low oxygen results in necrotic (dying) cells. This area of necrosis is associated with increased resistance to chemotherapy and radiation, and with continued tumor progression.

APPLICATIONS:

Cancer research
Drug discovery
Cancer treatment



The center of a solid tumor has very little oxygen and contains necrotic cells that are resistant to radiation and chemotherapy. These cells are also associated with continued tumor progression.

Adapted from Brahimi-Horn et al. J Mol Med, 2007.

5

Variable oxygen control provides optimal growth

We introduced the tri-gas incubator in 1979, only two years after Packer and Fuehr (*Nature*, 1977) proved that cells cultured in low oxygen had longer lifespans. Our decades of engineering innovative variable oxygen control technology provide you with:

- Exceptional interactive control and precise control technology
- Proven contamination prevention solutions providing 24/7 sample protection (in-chamber HEPA filtration, automated high temperature decontamination)
- Choice of oxygen control ranges 1-21% or 5-90% for application flexibility
- Water jacket or direct heat temperature management
- Advanced oxygen sensor technology for reliable and accurate control
- Innovative segmented inner doors to minimize disturbance of culturing conditions with reduced operating costs

APPLICATIONS:

All areas of cell biology
Basic and applied research and production

The segmented inner doors are standard on every Thermo Scientific Heracell tri-gas incubator, allowing access to individual areas and further reducing potential for incubator contamination. The zirconium oxide sensor provides fast recovery to desired hypoxic conditions.

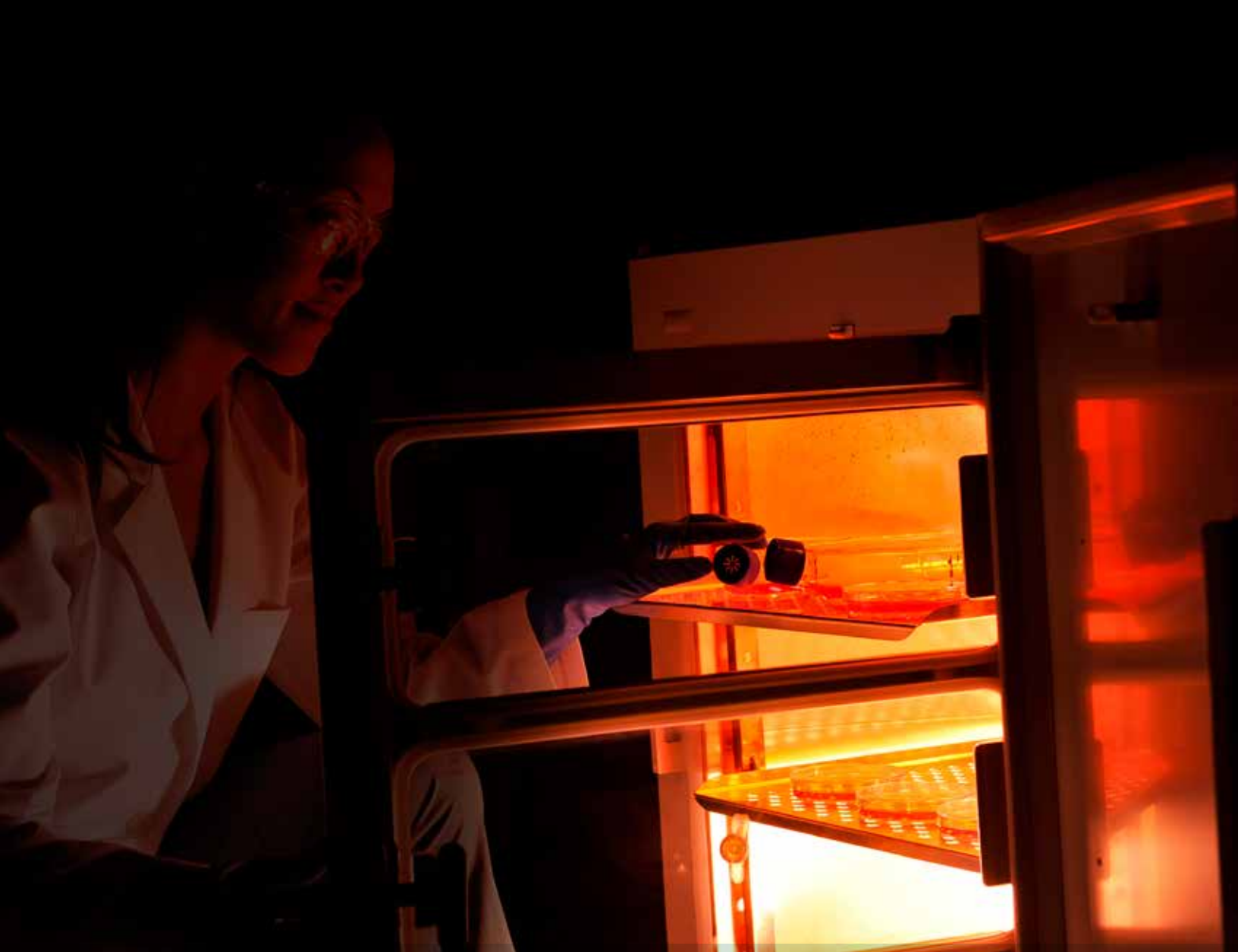


In-chamber HEPA filtration in the Thermo Scientific Forma Water Jacket incubator with variable oxygen control filters the entire chamber air volume every 60 seconds, providing outstanding air quality to protect cultures from airborne contamination.



“The Heracell 150i incubator quickly adjusts the oxygen concentration from normal (about 20%) to hypoxia conditions (3%). Furthermore, the design of three separated inner doors allows us to quickly put in or take out our samples without changing the oxygen concentration much. Since HIF protein is short-lived, the time efficiency is really important.”

– Faculty member researching Hypoxia-Inducible Factor-1



www.thermoscientific.com/co2incubators

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