



An Ethical and Affordable Alternative to Fetal Bovine Serum



Introduction

Cell Culture research has increased significantly in recent years due to technological advancements and a growing awareness of its significant potential to advance drug discovery, tissue engineering, and regenerative medicine. The success of cell culture research is highly dependent on the ability to scale optimal growth media.

Plenty overcomes the challenges of using current growth media products and is able to meet the current and future demands of research, testing, and industry in a reliable, cost-effective manner.

Fetal Bovine Serum (FBS) is the most popular growth serum used today. However, FBS has downsides, including high costs, limited and unpredictable supply, and ethical concerns about the FBS harvesting process.

Due to these drawbacks, researchers have actively sought alternatives in cell culture research. Synthetic serum substitutes, defined media, and serum-free media have been developed as potential alternatives. However, they still have limitations that need to be addressed before they can completely replace FBS in all types of cell culture experiments.

That is why we have set out to develop Plenty, a cell culture supplement that is affordable, effective, and slaughter-free.

Current Industry Challenges

In the context of cell culture research, growth media refers to the nutrient-rich solution in which cells or microorganisms are grown for use in research. This growth media solution provides the necessary nutrients for cells to grow and produce the desired product.

Bovine serums are a rich source of nutrients and growth factors that support cell growth and division. FBS in cell culture research has several significant drawbacks.



Fetal Bovine Serum and Drawbacks

Many standard growth media that are commercially available require the use of FBS. This product has been used for many years in research and biotechnology applications as a source of nutrients and growth factors to support cell growth and proliferation. It is considered the gold standard in growth media due to its effectiveness and reliability. Despite its widespread use, FBS has its drawbacks.



Expensive

The current price of FBS is on average \$1,000/Liter, and has increased by over 300% in the last few years



Ethically Questionable

FBS is harvested from bovine fetuses taken from their mothers during slaughter. The blood is extracted by puncturing the heart of the bovine fetus without any form of anesthesia



Limited Supply

The annual supply is capped at approximately 300,000L and can vary greatly depending on environmental and industry factors




Batch to Batch Variability

Due to geographical and seasonal variations, the serum can vary significantly which can lead to variable cell growth from batch to batch

FBS Alternatives Still Fall Short

Several alternatives to FBS have been explored, including plant-based, chemically defined, and human-based supplements. However, these alternatives are either still in the early stages of development or are not nearly as effective as FBS.

	 Plenty	FBS	Chemically Defined	Recombinant Proteins	hPL
Low cost	✓	✗	✗	✗	✗
Effective	✓	✓	✗	✗	✓
Consistent	✓	✗	✓	✓	✗
Free of Transmissible Diseases	✓	✓	✓	✓	✗



Plenty™



Low cost



Slaughter-free



Abundant



Consistent

The Plenty Approach

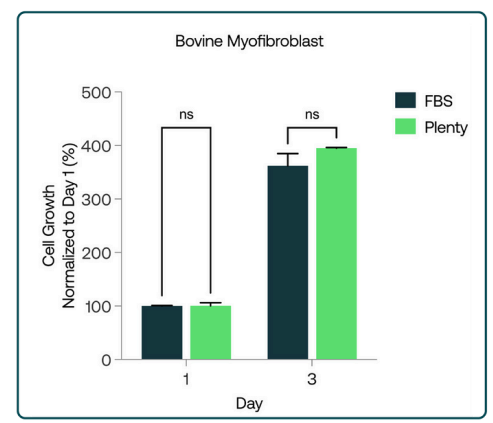
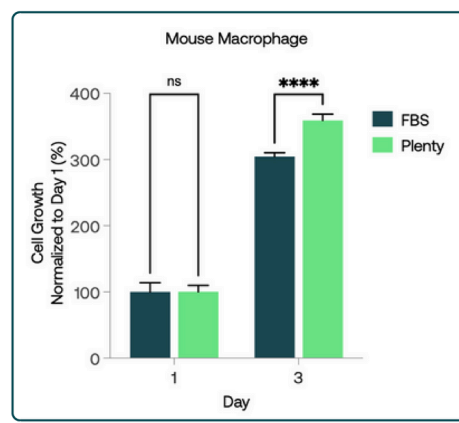
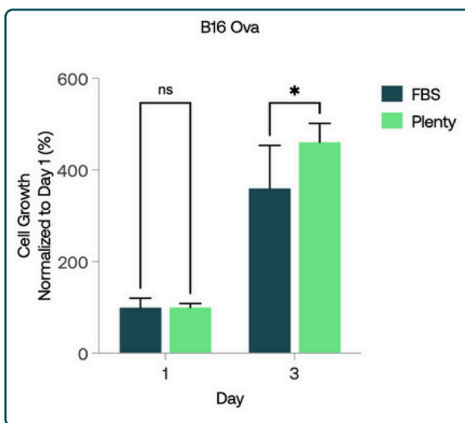
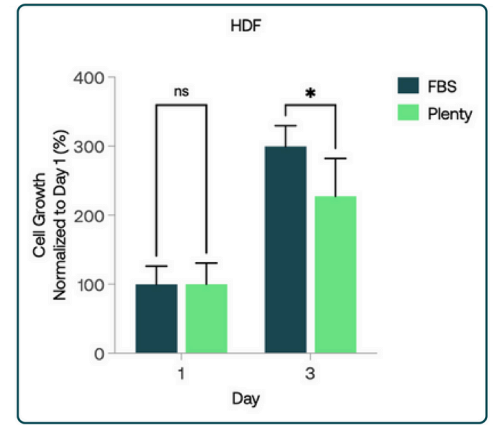
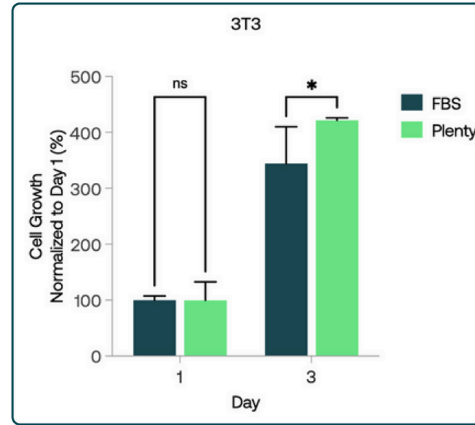
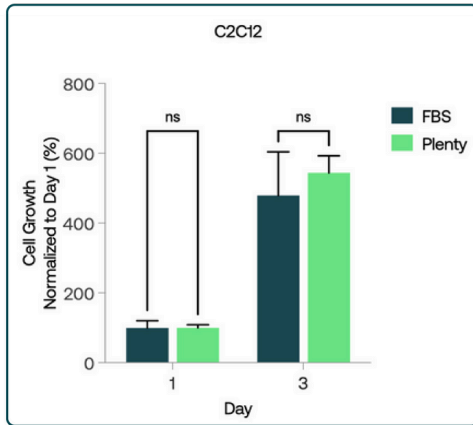
Plenty is a nutrient-rich cell culture supplement filled with growth factors and proteins, which are essential for regenerative medicine, cell culture, and vaccine production of different types of cells, such as mesenchymal stem cells (MSCs).

It was developed by a group of scientists who were passionate about finding an environmentally friendly and slaughter-free approach to produce an FBS alternative. Our proprietary process involves using a gentle and minimally invasive method to collect plasma samples from our herd of cows rescued from dairy farms and slaughterhouses. We then process the plasma to enhance its efficacy and create Plenty.

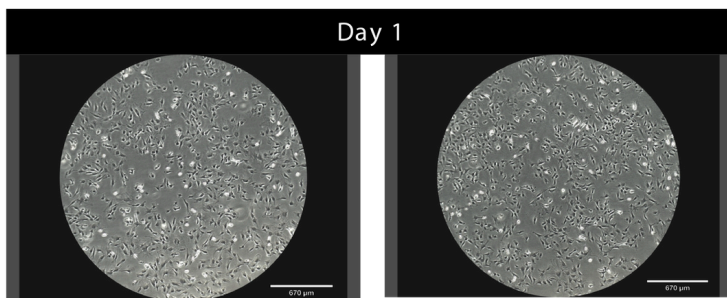
Ethics Driven, Results Proven

Below, we present a detailed examination of cell growth data, comparing the performance of Plenty with FBS across various cell lines. As an innovative and sustainable cell culture supplement, Plenty's potential to revolutionize industries relying on FBS services is explored. These industries include cell culture, antibody production, antigen production, and diagnostics quality assurance. The evidence-based results clearly demonstrate that Plenty is comparable and, in some cases, surpasses FBS in supporting cell growth, presenting a promising alternative with multifaceted benefits for a diverse array of applications.

10% Plenty vs. 10% FBS

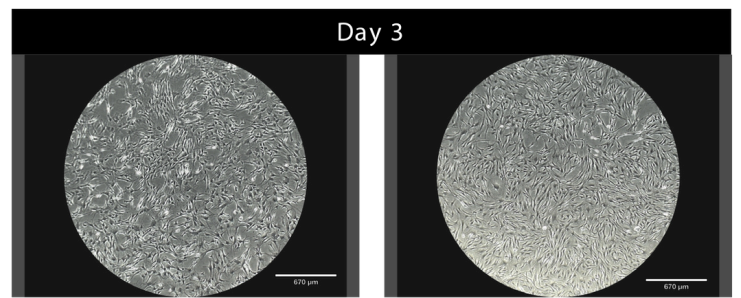


Bovine Myofibroblast vs. FBS



FBS

Plenty



FBS

Plenty

Independently Tested

Plenty has undergone extensive independent testing by esteemed research universities worldwide. The following table summarizes various cell lines and applications that these independent experts from institutions have investigated.

Table: List of cell lines, research foci, possible applications, and centers performing the tests.

Cell Line	Hierarchy	Research Focus	Applications	Center
HeLa	Epithelial	Cancer biology, cell cycle regulation	Drug discovery, cancer research	Northwestern
10T1/2	Fibroblasts	General cell culture, drug testing	Drug discovery, cell-based assays	UIC
50B11	Fibroblasts	General cell culture, drug testing	Drug discovery, cell-based assays	Syracuse U
Astrocytes	Neural	Glial cell function, central nervous system support	Neuroscience research, neurodegenerative disease studies	Syracuse U
HepG2	Hepatocyte	Hepatocyte function, liver metabolism, drug metabolism	Drug discovery, hepatotoxicity studies	Clemson U, Georgia Tech, UIC
SK-MEL-28	Other	Melanoma biology, cancer signaling pathways	Drug discovery, cancer research	Stanford
Microglia	Hematopoietic	Neuroinflammation, central nervous system immune response	Neuroscience research, neurodegenerative disease studies	Northwestern
Human Myoblast	Myoblast	Regenerative medicine	Biotechnology, regenerative medicine	Uniklinikum Erlangen
HUVEC	Endothelial	Cardiovascular studies, angiogenesis research, vascular biology	Drug discovery, vascular disease research	Clemson U, Georgia Tech, Northeastern
3T3	Fibroblasts	General cell culture, drug testing	Drug discovery, cell-based assays	U of Connecticut, Stanford
HEK-293T	Other	Biotechnology, protein expression	Biotechnology, pharmaceutical production	Boston U, Virginia Tech, SRI International
B16-F10	Epithelial	Cancer, cancer drug testing, vaccine development	Drug discovery, cancer research	John Hopkins
MDA-MB231	Epithelial	Cancer, cancer drug testing	Drug discovery, cancer research	Clemson U, Stanford
C3H10	Embryonic Fibroblast	Stem cell research	Biotechnology	Syracuse U
Human Dermal Fibroblasts	Epithelial	Tissue engineering, drug discovery	Biotechnology	UNMC

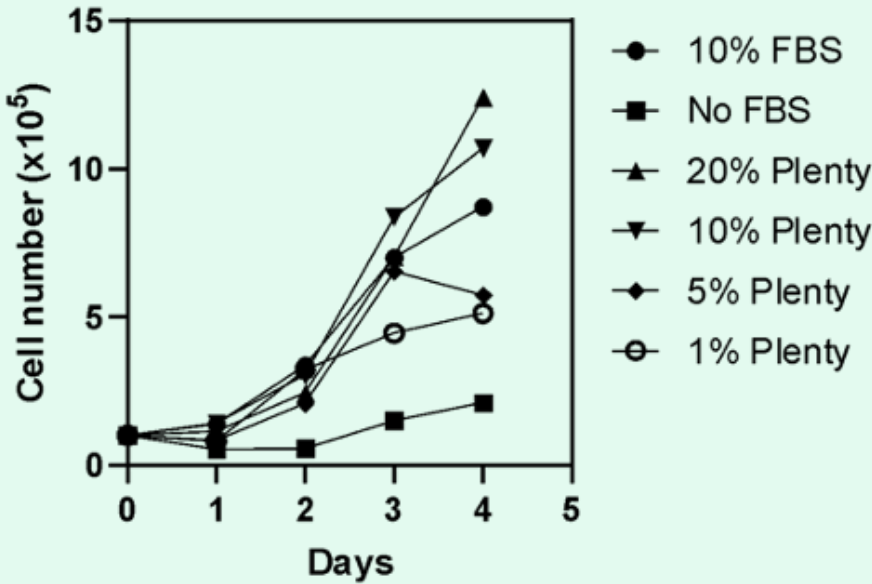
This validation comes from a wide range of experts with various specializations, highlighting Plenty's robust performance and reliability as a cell culture supplement. The institutions involved in this rigorous evaluation include, but are not limited to, Boston University, Clemson University, Stanford University, Emory University, Johns Hopkins University, Northeastern University, SRI International, Syracuse University, Texas A&M University, UCLA, Universitätsklinikum Erlangen, University at Buffalo SUNY, University of Colorado Boulder, University of Connecticut, University of Delaware, University of Illinois Chicago, University of Wisconsin-Madison, University of Nebraska Medical Center, and Virginia Tech. Such thorough investigation by these institutions underscores Plenty's potential to be a game-changer in industries traditionally relying on FBS.



Highlight 1: Human embryonic kidney cells' dose response to Plenty

293T/17 [HEK 293T/17] is a cell line exhibiting epithelial morphology that was isolated from human embryo kidney tissue.

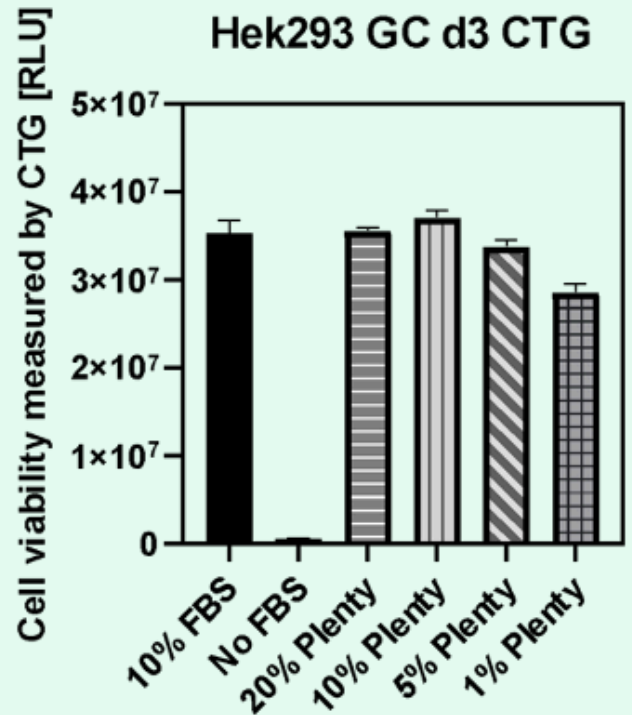
HEK293 GC_Counts



HEK293T/17 cell growth in RPMI media supplemented with Plenty at different concentrations (1%, 5%, 10%, and 20%) and compared to the ATCC recommended growth condition of 10% FBS supplemented medium. The cell viability was determined on day 3 using Cell Titer Glo® reagent following the manufacturer's instructions.

Researchers at SRI International demonstrated comparable growth of human embryonic kidney cells with Plenty to FBS, showcasing high viability even at low concentrations.

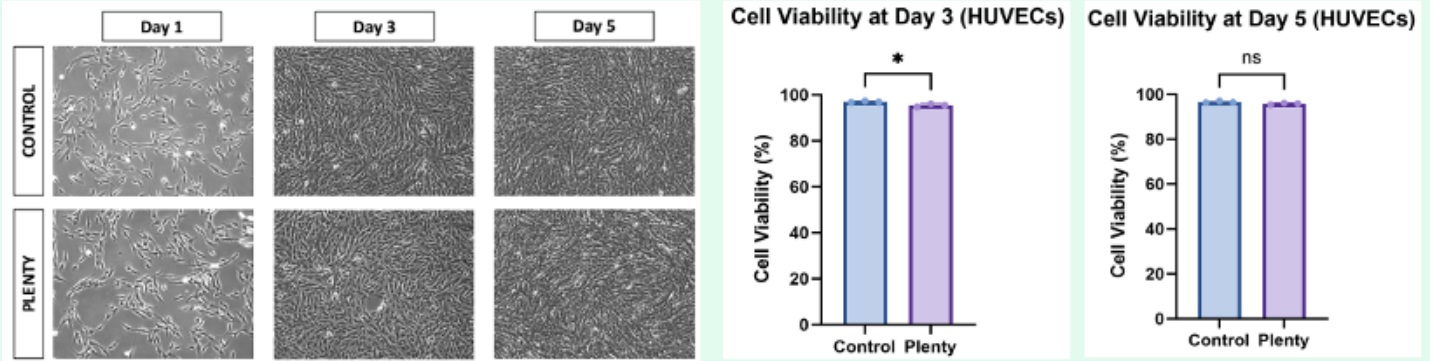
HEK293T/17 cell growth in RPMI media supplemented with Plenty at different concentrations (1%, 5%, 10%, and 20%) and compared to the ATCC recommended growth condition of 10% FBS supplemented medium. Cell growth under FBS and Plenty supplemented medium was compared to serum-free culture conditions. The cells were counted daily after trypsinization.



Highlight 2: 2D vs 3D culture of human vascular endothelial cells in Plenty

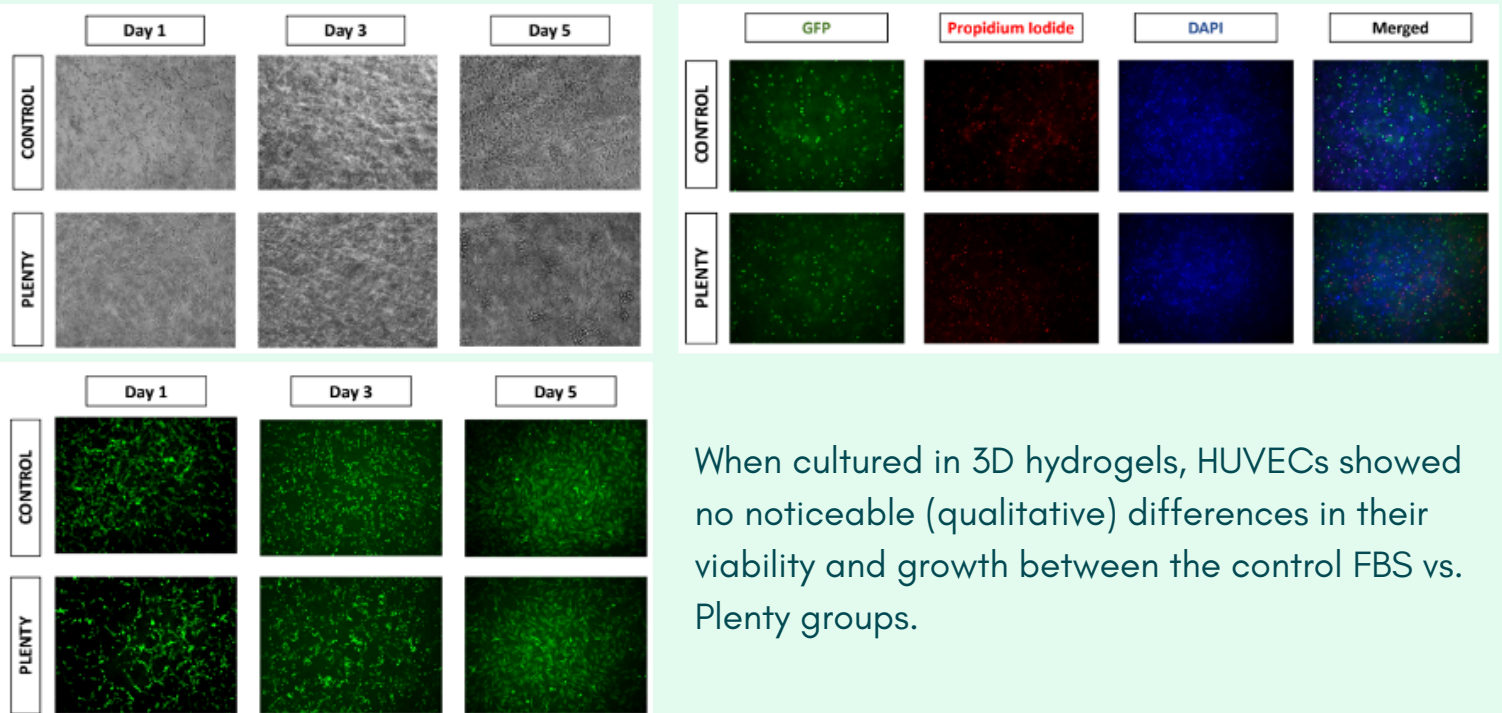
HUVECs are a type of endothelial cell that lines blood vessels and are derived from the umbilical vein. They are important for 2D and 3D cell culture models because they closely mimic *in vivo* conditions, allowing for the study of endothelial functions, vascular biology, angiogenesis, and the development of vascular diseases.

2D Culture



No significant differences were observed in the time needed to reach confluency in 2D culture for HUVECs when cultured with regular FBS vs. Plenty.

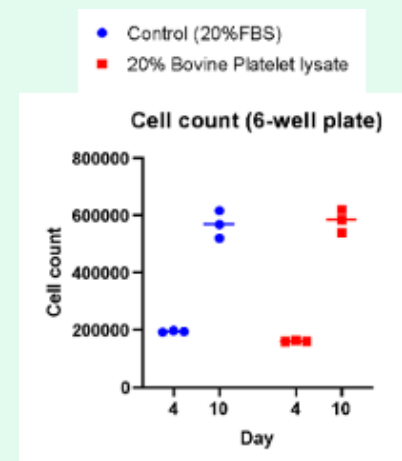
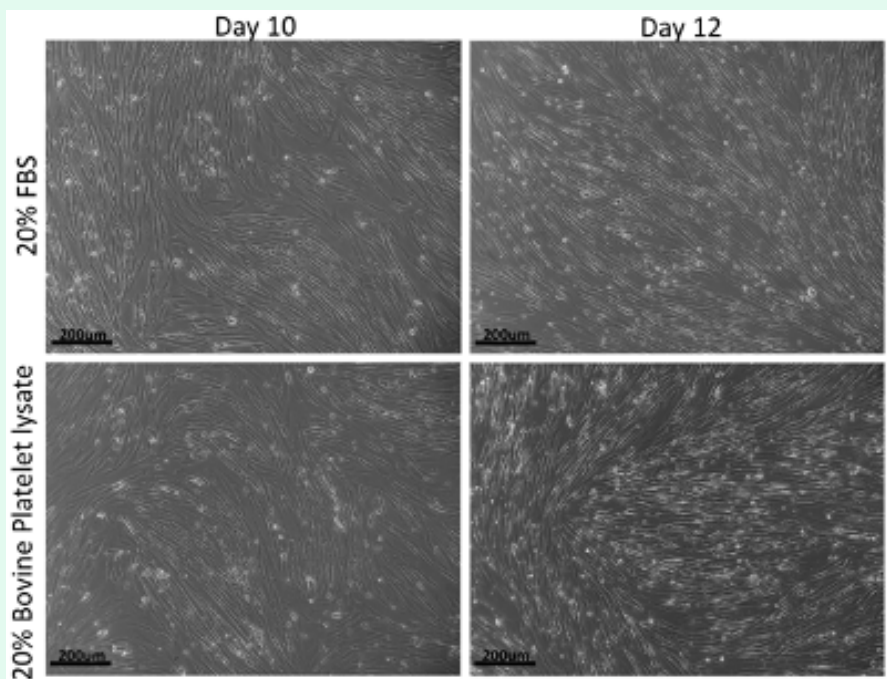
3D Culture



Plenty emerges as a promising alternative to traditional FBS, demonstrating its efficacy in supporting HUVEC viability and growth in both 2D and 3D cultures, paving the way for more sustainable and consistent *in vitro* vascular research.

Highlight 3: Myoblasts growth in Skeletal muscle Growth media (SKGM: containing bFGF and EGF) supplemented with Plenty

This study shows that Plenty can replace FBS in complex media formulations like Skeletal Muscle Growth Media (SKGM) enriched with bFGF and EGF. These growth factors stimulate cell proliferation, differentiation, and survival, essential for myoblast growth and skeletal muscle research.



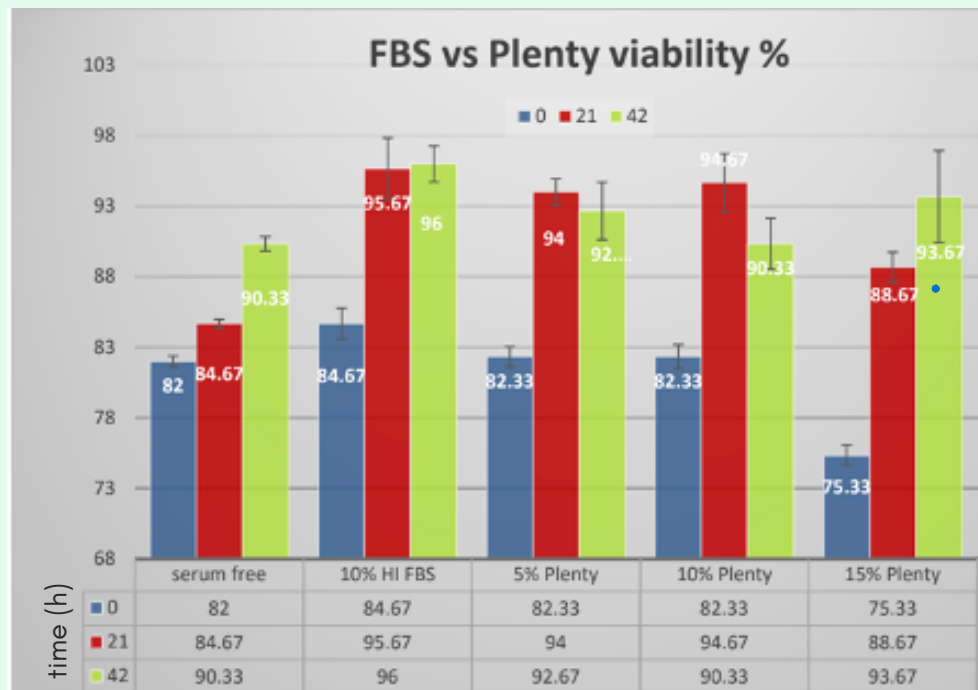
This experiment was performed on 14YO passage 5 myoblasts in Skeletal muscle Growth media (SKGM: containing bFGF and EGF) with 20%FBS vs the FBS substitute (Plenty). Cells are counted on day 4 and day 10 without passage in between.

Plenty, when tested in media enriched with growth factors, displayed comparable effectiveness to FBS, underscoring its compatibility and potential as a reliable option for muscle cell culture applications.



Highlight 4: A dose-response study of Plenty on Jurkat (T cell line) cell growth in suspension cultures

The Jurkat cell line, derived from human T lymphocytes, is a pivotal tool in biotechnology, especially in studying T cell leukemia, immune response mechanisms, and signal transduction. Its origin from an acute T cell leukemia patient makes it particularly valuable for research into cancer biology, enabling scientists to explore the intricacies of T cell function, apoptosis, and the molecular pathways involved in cell proliferation and death. This cell line's easy cultivation and manipulation facilitate high-throughput screening for drug discovery, making it an essential model for developing new therapies targeting cancer and immune system disorders.



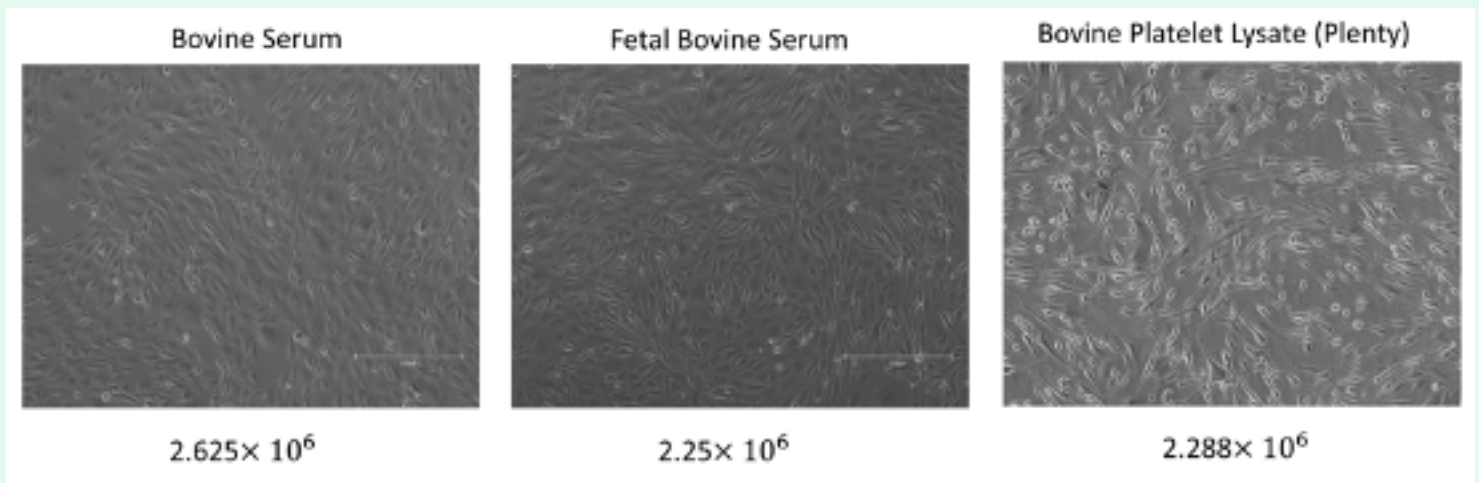
Dose-response studies conducted on the Jurkat cell line with varying concentrations of Plenty serum (5%, 10%, and 15%) have demonstrated growth rates comparable to those achieved with the standard 10% FBS.

This consistency across different Plenty serum concentrations highlights its effectiveness as a substitute for FBS in Jurkat cell cultures. The ability of Plenty to support similar cellular proliferation at multiple dosage levels not only underscores its reliability and efficiency but also suggests its potential as a versatile and sustainable alternative to FBS in various biotechnological applications and research settings involving T lymphocyte studies.

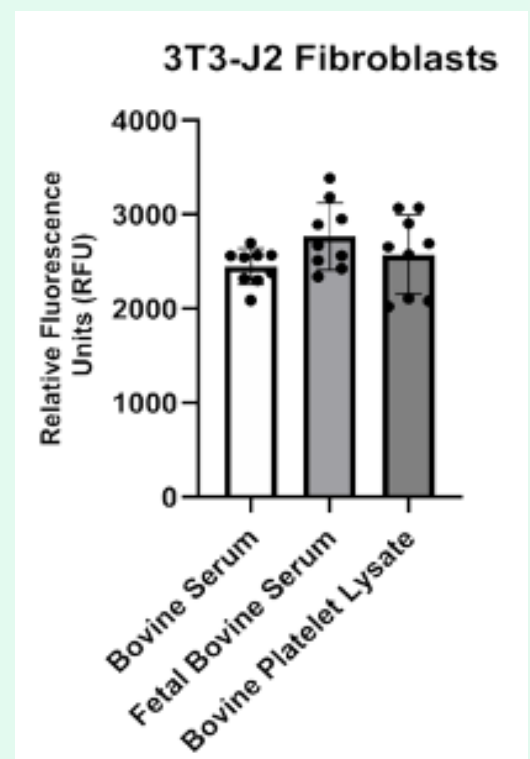
Plenty serum effectively supports T cell growth, offering a promising and sustainable alternative to traditional FBS in immunological research and applications.

Highlight 5: Fibroblast growth with Plenty

3T3-J2 fibroblasts, a subline of the original 3T3 cell line developed in the 1960s, are instrumental in the field of cell biology and regenerative medicine. These cells are derived from mouse embryonic fibroblasts and have been extensively used as a feeder layer in the culture of human keratinocytes, supporting their growth and proliferation. The 3T3-J2 fibroblasts play a critical role in studies related to wound healing, tissue engineering, and the skin's physiological processes. Their ability to maintain keratinocytes in an undifferentiated state makes them invaluable for research into skin biology, the mechanisms of skin diseases, and the development of novel dermatological therapies.



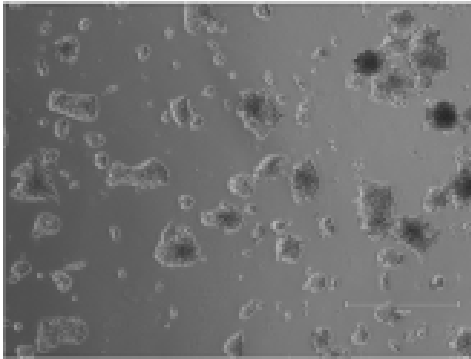
Plenty demonstrates comparable efficacy to FBS in the culture and proliferation of 3T3-J2 cells



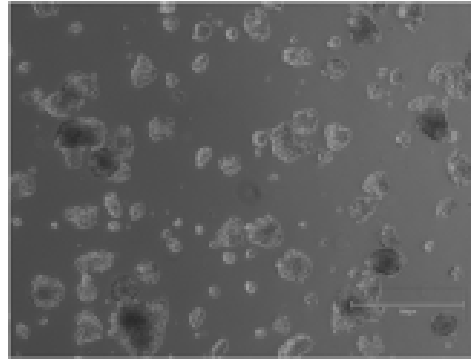
Highlight 6: HepG2 cells: mimicking liver physiology

The HepG2 cell line, derived from human liver carcinoma, is a widely used model for studying liver functions, including drug metabolism, liver diseases, and toxicology. A key feature of HepG2 cells is their ability to produce albumin, a major protein synthesized by the liver.

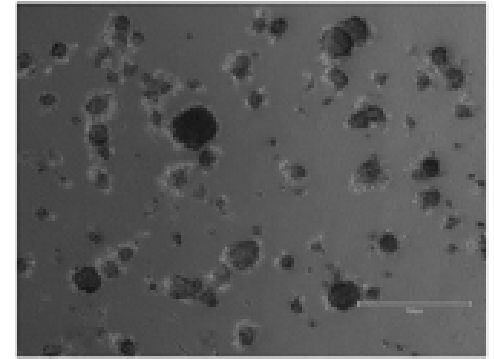
Day 5



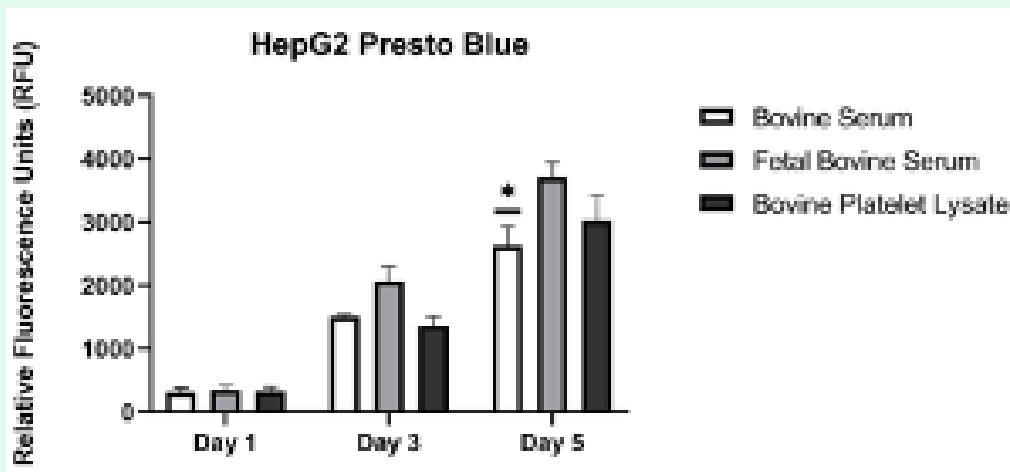
Bovine Serum



Fetal Bovine Serum



Bovine Platelet Lysate



Plenty yields growth rates in HepG2 cells comparable to those achieved with FBS and bovine serum.

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