# A Primer on Primary Cells and Culture

**A Guest Blog by Daniel Schroen, PhD, Vice President at Cell Applications, Inc. (Now Vice President at Nucleus Biologics)**

**Primary Cells: What are they and why use them**

Cell-based experiments play a key role in life science, biomedical and pharmaceutical research breakthroughs. The experiments and assays depend on a superior cell culture system and careful selection of cell types. Isolated directly from tissue, primary cells resemble normal physiology and lack modifications associated with immortalized, genetically-altered cell lines. They are first carefully removed and released from tissue, and then established as a growing, healthy cell population in a controlled culture environment. Properly isolated primary cells should be low passage and robust, with high viability, transfection efficiency and doublings. After isolation, the cells can then be expanded, frozen, documented and tested. Researchers can select from many unique human and animal cell types, available in various sizes and packaging configurations, including freshly isolated, cultured, proliferating or cryopreserved cells. Frozen vials, microwell plates, flasks or easy-to-use total kits provide further options. Tissues and cells can also be isolated in matched sets from the same donor.

**What are some advantages of primary cells compared to cell lines?**

Immortalized cell lines definitely have an important place in life science research. However, for particular applications and research protocols, they can be associated with false-positives and false-negatives, sub-optimal pairing with media, misleading cell growth, and erroneous data due to genetic alterations inherent to cell lines. Compared to primary cells, immortalized cell lines have important phenotypic differences and can lose physiological properties from modification and passage. Labs that use immortalized lines exclusively sometime take risks, if studies are not confirmed in primary cells and in vivo.

**Isolating primary cells in the lab vs. purchasing primary cells**

Many begin their research careers in the lab preparing cells, using a variety of available techniques and materials. For the typical lab, successful isolation of primary cells from tissues requires substantial time, money, equipment, culture ware, media, reagents, human resources and training, Even then, protocols and results vary and cells are subject to contamination. Also, mass-produced, general-use culture media are not optimized for the unique requirements of individual primary cell types. Protocols can differ substantially, depending on the person, laboratory, materials, reagents, cell culture plastic, even temperature, humidity, time of year and HVAC system! These variables too often result in data inconsistencies, unexpected costs, repeats and project delays. After contamination or unsuccessful attempts to do it themselves, research institutions can ultimately increase cost-effectiveness over time and save money by purchasing primary cells. They achieve this efficiency using meticulously-isolated, quality-controlled, tested, qualified, rigorously characterized cells & media. Non-standard approaches, on the other hand, impose risk for phenotypic inconsistency, contamination, poor growth, repeats, invalid results and erroneous data, all with substantial personnel costs. Improper technique and non-optimized media can also result in cell death and unwanted cell types in the isolate.

**Tips for optimizing primary cell culture**

Despite their numerous advantages, primary cells can be notoriously finicky and present challenges to culture unless proper care is taken. Available resources outline steps to achieve optimal results with primary cells. Prior to working with the cells, lab workers should review the cell-specific instructions provided with commercial products. Care should be taken to ensure the corresponding, optimized, cell-specific growth media, reagents and culture conditions have been selected help maintain optimal cell health, behavior and performance. Cell culture flasks and plates must be suitable for primary cell culture, surface-treated and in some cases coated with biomolecules that promote cell plating and adhesion.

[**Culture of Animal Cells**](https://www.amazon.com/Culture-Animal-Cells-Specialized-Applications/dp/1118873653/ref%3Dsr_1_1?s=books&ie=UTF8&qid=1489529956&sr=1-1&keywords=culture+of+animal+cells+a+manual+of+basic+technique+and+specialized)A Manual of Basic Technique and Specialized Applications

[**The Case for Primary Cells**](http://www.labmanager.com/insights/2016/02/the-case-for-primary-cells#.WMhr1W_yupq) Lab Manager Magazine

[**Primary Cell Culture**](https://youtu.be/jA9DKdx04Xg)Protocols & Guidance (Video)

[**Primary Cell FAQ**](https://www.cellapplications.com/support/primary-cell-faq)Tips to culture, store, thaw, grow, subculture

[**5 Cell Culture Rules**](https://www.cellapplications.com/sites/default/files/documents/misc/5%20Important%20Cell%20Culture%20Rules.pdf)Tips to optimize primary cell health & data

[**Why Primary Cells?**](https://www.cellapplications.com/why-primary-cells)A top choice for research & pharma

**Selecting a primary cell supplier**

Look for an established provider for primary human and animal cell types and optimized culture media. Primary cells should be maintained in multiple lots, with unique profiles of donor age, gender, ethnicity, disease status, and even medications taken. They should have deep experience handling many different primary cell types, with ample evidence they’ve mastered isolation, purification, subculture and growth. Importantly, look for documentation confirming high cell purity, quality control and characterization. PhD level staff, who have mastered the craft of purifying primary cells from different tissues, should be available to answer questions and provide guidance.

**Quality**

* Low passage, robust, cells, with high viability, transfection efficiency and doublings
* Media and reagents optimized for each cell type
* Extensive publications citing use of the products
* Media and cells made using standard operating procedures, quality control, and characterization
* Manufacturing, packaging, management systems, standards and guidelines approved to ISO and cGMP Selection
* Extensive array of human & animal cell types, in numerous ordering configurations
* Freshly isolated, cultured, proliferating or cryopreserved cells, convenient sizes & formats
* Frozen vials, microwell plates, flasks or total kits including both cells and media
* Multiple lots, unique profiles of donor age, gender, ethnicity
* Normal or diseased donors, matched sets from same donor

**Support**

* Expert isolation, purification, subculture and growth of primary cells, both standard and custom
* Deep hands-on experience, step-by-step, laboratory-tested instructions, strong technical support
* Direct sales, sound logistics and global distribution