

---

Product Manual

# StemTAG™ Alkaline Phosphatase Staining Kit (Red)

Catalog Number

CBA-300

100 assays

**FOR RESEARCH USE ONLY**  
Not for use in diagnostic procedures

---



**CELL BIOLABS, INC.**  
*Creating Solutions for Life Science Research*

## **Introduction**

Embryonic stem (ES) cells are continuous proliferating stem cell lines of embryonic origin first isolated from the inner cell mass (ICM). Two distinguishing features of ES cells are their ability to be maintained indefinitely in an undifferentiated state and their potential to develop into any cell within the body. Based on previous methods developed for mouse ES cells, human ES cell lines were first established by Dr. James Thomson and colleagues. Like mouse ES cells, human ES cells express high levels of membrane alkaline phosphatase (AP) and Oct-4, a transcriptional factor critical to ICM and germline formation. However, unlike mouse ES cells, hES cells do not express stage-specific embryonic antigen (SSEA-1). In addition, prolonged propagation of hES cells is typically achieved by coculture with primary mouse embryonic fibroblasts (MEFs) serving as feeder cells. Human ES cell lines are not able to maintain their undifferentiated state in the absence of supporting feeder layer cells, even when exogenous cytokines such as leukemia inhibitory factor (LIF) and gelatin-coated plates are used.

<b>Marker Name</b>	<b>Mouse ES Cells</b>	<b>Mouse EG Cells</b>	<b>Human ES Cells</b>	<b>Human EG Cells</b>	<b>Human EC Cells</b>
AP	√	√	√	√	√
SSEA-1	√	√	–	√	–
SSEA-4	–	–	√	√	√
TRA-1-60	–	–	√	√	√
TRA-1-81	–	–	√	√	√
Oct-4	√	√	√	unknown	√
ES Cell = Embryonic stem cell EG Cell = Embryonic germ cell EC Cell = Embryonic carcinoma cell					

**Table 1. Comparison of Mouse and Human Pluripotent Stem Cells.**

Although stem cells from different origins require different growth conditions for self-renewal and display different cell surface markers (see Table 1), AP is the most widely used stem cell marker. The StemTAG™ Alkaline Phosphatase Staining Kit provides an efficient system for monitoring ES cell undifferentiation/ differentiation through AP activity by immunocytochemistry staining.

## **Related Products**

1. CBA-301: StemTAG™ Alkaline Phosphatase Activity Assay Kit (Colorimetric)
2. CBA-306: StemTAG™ Alkaline Phosphatase Staining Kit (Purple)
3. CBA-312: MEF Feeder Cells (Puromycin-resistant)
4. CBA-316: SNL Feeder Cells
5. CBA-320: CytoSelect™ 96-Well Hematopoietic Colony Forming Cell Assay

## **Kit Components (shipped at room temperature)**

1. Fixing Solution (Part No. 30001): One bottle – 50 mL
2. StemTAG™ AP Staining Solution A (Part No. 30002): One amber bottle – 20 mL
3. StemTAG™ AP Staining Solution B (Part No. 30003): One amber bottle – 20 mL

## **Materials Not Supplied**

1. Human or Mouse Embryonic Stem Cells and Culture Medium
2. 1X PBS
3. 1X PBST (1X PBS containing 0.05% Tween-20)

## **Storage**

Store all components at 4°C.

## **Preparation of Reagents**

- StemTAG™ AP Staining Solution: Prepare FRESH 1X StemTAG™ AP Staining Solution by mixing equal volume of StemTAG™ AP Staining Solution A and StemTAG™ AP Staining Solution B. The volume of StemTAG™ AP Staining Solution needed is based on the number of samples. The chart below is suggested for samples in a 24-well plate, and may be modified accordingly to suit other culture plate sizes.

<b>Reagents</b>	<b>Half plate (12 samples)</b>	<b>1 plate (24 samples)</b>	<b>4 plates (96 samples)</b>
Staining Solution A	2.4 mL	4.8 mL	9.6 mL
Staining Solution B	2.4 mL	4.8 mL	9.6 mL
<b>Total</b>	<b>4.8 mL</b>	<b>9.6 mL</b>	<b>19.2 mL</b>

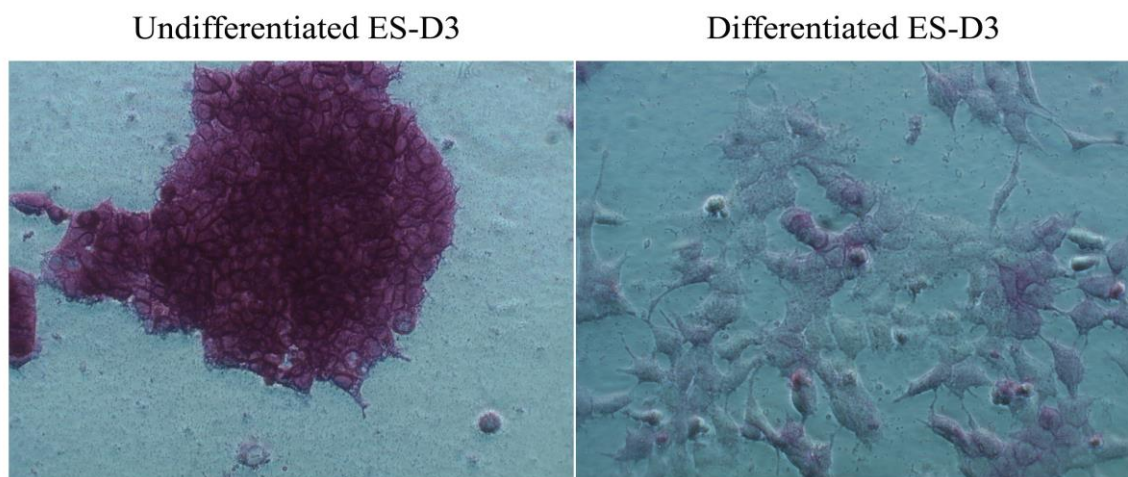
**Table 2. Preparation of StemTAG™ AP Staining Solution**

## **Assay Protocol (24-Well Plate)**

1. Culture mouse ES cells in medium containing LIF; alternatively, culture human ES cells on a MEF feeder layer.
2. Gently aspirate the medium from the ES cells and wash the cells with 1 mL of 1X PBST. Aspirate the wash solution.
3. Add Fixing Solution to the cells, 0.4 mL per well for a 24-well plate. Incubate at room temperature for 2 minutes.
4. Remove the fixing solution and wash the fixed cells twice with 1 mL of 1X PBST.
5. Aspirate the final wash, and add 0.4 mL per well of freshly prepared StemTAG™ AP Staining Solution (see Preparation of Reagents section).
6. Incubate the cells at room temperature for 15-30 minutes, protected from light.
7. Remove the AP Staining Solution, and then wash the stained cells twice with 1 mL of 1X PBS. Store cells in 1X PBS at 4°C. For long-term storage, overlay the cells with 1X PBS containing 20% Glycerol. Store at 4°C.
8. Count the red stained cell colonies (undifferentiated ES cells) vs. colorless colonies (differentiated ES cells) using a light microscope.

## **Example of Results**

The following figures demonstrate typical results with the StemTAG™ Alkaline Phosphatase Staining Kit. One should use the data below for reference only. This data should not be used to interpret actual results.



**Figure 1: AP staining of ES Cells.** Murine embryonic stem cells (ES-D3) are maintained in an undifferentiated stage on gelatin-coated dishes in the presence of LIF, as indicated by the high AP activity. To induce differentiation, LIF was withdrawn over a period of several days; various differentiation events were observed (cells became flattened and enlarged with reduced proliferation). At the end of day 5, AP staining of undifferentiated cells was performed as described in the Assay Protocol.

## **References**

1. Wobus AM, Holzhausen H, Jäkel P et al. (1984). *Exp Cell Res* **152**:212–219.
2. Thomson JA, Itskovitz-Eldor J, Shapiro SS et al. (1998). *Science* **282**:1145–1147.
3. Smith AG, Nichols J, Robertson M et al. (1992). *Dev Biol* **151**:339–351.
4. Reubinoff BE, Pera MF, Fong CY et al. (2000). *Nat Biotechnol* **18**:399–404.

## **Recent Product Citations**

1. Kim, E.J. et al. (2023). Lidocaine inhibits osteogenic differentiation of human dental pulp stem cells in vitro. *J Int Med Res.* **51**(2):3000605231152100. doi: 10.1177/03000605231152100.
2. Lee, S.H. et al. (2023). Lidocaine intensifies the anti-osteogenic effect on inflammation-induced human dental pulp stem cells via mitogen-activated protein kinase inhibition. *J Dent Sci.* doi: 10.1016/j.jds.2022.11.020.
3. Fang, S. et al. (2022). Pro-angiogenic and pro-osteogenic effects of human umbilical cord mesenchymal stem cell-derived exosomal miR-21-5p in osteonecrosis of the femoral head. *Cell Death Discov.* **8**(1):226. doi: 10.1038/s41420-022-00971-0.
4. Choi, E.J. et al. (2022). Propofol attenuates odontogenic/osteogenic differentiation of human dental pulp stem cells in vitro. *J Dent Sci.* doi: 10.1016/j.jds.2022.04.006.
5. Lee, R. et al. (2021). Effect of Epidermal Growth Factor on the Colony-formation Ability of Porcine Spermatogonial Germ Cells. *Biotechnol Bioproc E.* doi: 10.1007/s12257-020-0372-3.
6. Liao, W. et al. (2019). BMSCs-derived Exosomes Carrying MicroRNA-122-5p Promote Progression of Osteoblasts in Osteonecrosis of the Femoral Head. *Clin Sci (Lond).* pii: CS20181064. doi: 10.1042/CS20181064.

7. Clarke, D. et al. (2018). Genetically Corrected iPSC-Derived Neural Stem Cell Grafts Deliver Enzyme Replacement to Affect CNS Disease in Sanfilippo B Mice. *Mol Ther Methods Clin Dev.* **10**:113-127. doi: 10.1016/j.omtm.2018.06.005.
8. Ghosh, N. & Banerjee, E.R. (2017). A Review on Various Tissue Engineering Techniques to Induce Differentiation of Pluripotent Stem Cells. *Medical Glory.* **1**(2):130-149.
9. Vitali, M., S. et al. (2017). Use of the spectrophotometric color method for the determination of the age of skin lesions on the pig carcass and its relationship with gene expression and histological and histochemical parameters. *J. Anim. Sci.* **95**:3873-3884. doi:10.2527/jas.2017.1813
10. Lee, K. H. et al. (2016). In vitro ectopic behavior of porcine spermatogonial germ cells and testicular somatic cells. *Cell Reprogram.* doi:10.1089/cell.2015.0070.
11. Lee, K. H. et al. (2015). Subculture of germ cell-derived colonies with GATA4-positive feeder cells from neonatal pig testes. *Stem Cells Int.* 6029271.
12. Jacinto, F. V. et al. (2015). The nucleoporin Nup153 regulates embryonic stem cell pluripotency through gene silencing. *Genes Dev.* **29**:1224-1238.
13. Langlois, T. et al. (2014). TET2 deficiency inhibits mesoderm and hematopoietic differentiation in human embryonic stem cells. *Stem Cells.* **32**:2084-2097.
14. Lee, K. H. et al. (2014). Identification and in vitro derivation of spermatogonia in beagle testis. *PLoS One.* **9**:e109963.
15. Manukyan, M. & Singh, P. B. (2014). Epigenome rejuvenation: HP1 $\beta$  mobility as a measure of pluripotent and senescent chromatin ground states. *Sci Rep.* **4**:4789.
16. Lee, J. et al. (2010). Ultraviolet A regulates adipogenic differentiation of human adipose tissue-derived mesenchymal stem cells via up-regulation of Kruppel-like factor 2. *J. Biol. Chem.* 285:32647-32656.
17. Izadyar, F. et al. (2008). Generation of multipotent cell lines from a distinct population of male germ line stem cells. *Reproduction* **135**:771-784.
18. Dharmacon Application Note: DharmaFect transfection reagents for siRNA transfection into embryonic stem cells (2006). Publication # 00078-06-E-01-U.

## **Warranty**

These products are warranted to perform as described in their labeling and in Cell Biolabs literature when used in accordance with their instructions. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THIS EXPRESSED WARRANTY AND CELL BIOLABS DISCLAIMS ANY IMPLIED WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR PARTICULAR PURPOSE. CELL BIOLABS' sole obligation and purchaser's exclusive remedy for breach of this warranty shall be, at the option of CELL BIOLABS, to repair or replace the products. In no event shall CELL BIOLABS be liable for any proximate, incidental or consequential damages in connection with the products.

## **Contact Information**

Cell Biolabs, Inc.  
 5628 Copley Drive  
 San Diego, CA 92111  
 Worldwide: +1 858-271-6500  
 USA Toll-Free: 1-888-CBL-0505  
 E-mail: [tech@cellbiolabs.com](mailto:tech@cellbiolabs.com)  
[www.cellbiolabs.com](http://www.cellbiolabs.com)

©2010-2023: Cell Biolabs, Inc. - All rights reserved. No part of these works may be reproduced in any form without permissions in writing.