

**First published online August 4, 2005**

Stem Cells Vol. 23 No. 10 November 2005, pp. 1549 -1559

doi:10.1634/stemcells.2004-0357; [www.StemCells.com](http://www.StemCells.com)

© 2005 [AlphaMed Press](http://www.AlphaMedPress.com)

## Stem Cell Characteristics of Amniotic Epithelial Cells

Toshio Miki<sup>a</sup>, Thomas Lehmann<sup>a</sup>, Hongbo Cai<sup>a</sup>, Donna B. Stolz<sup>b,c</sup>, Stephen C. Strom<sup>a,c</sup>

<sup>a</sup> Departments of Pathology and

<sup>b</sup> Cell Biology & Physiology and

<sup>c</sup> McGowan Institute for Regenerative Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

**Key Words.** Placenta • Amniotic epithelial cell • Differentiation pluripotent

Correspondence: Stephen C. Strom, Ph.D., Department of Pathology and McGowan Institute for Regenerative Medicine, University of Pittsburgh, 200 Lothrop St., BST-s450, Pittsburgh, Pennsylvania 15261, USA. Telephone: 412-624-7715; Fax: 412-383-7969; e-mail: [strom@pitt.edu](mailto:strom@pitt.edu)

**Amniotic epithelial cells develop from the epiblast by 8 days after fertilization and before gastrulation, opening the possibility that they might maintain the plasticity of pregastrulation embryo cells. Here we show that amniotic epithelial cells isolated from human term placenta express surface markers normally present on embryonic stem and germ cells. In addition, amniotic epithelial cells express the pluripotent stem cell-specific transcription factors octamer-binding protein 4 (Oct-4) and nanog. Under certain culture conditions, amniotic epithelial cells form spheroid structures that retain stem cell characteristics. Amniotic epithelial cells do not require other cell-derived feeder layers to maintain Oct-4 expression, do not express telomerase, and are nontumorigenic upon transplantation. Based on immunohistochemical and genetic analysis, amniotic epithelial cells have the potential to differentiate to all three germ layers—endoderm (liver, pancreas), mesoderm (cardiomyocyte), and ectoderm (neural cells) in vitro. Amnion derived from term placenta after live birth may be a useful and noncontroversial source of stem cells for cell transplantation and regenerative medicine.**