human induced pluripotent stem cells derived airway epithelium

Commonly used acronym: *iPSC*

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Organisation

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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Translational - Applied Research
Type of method	In vitro - Ex vivo

DESCRIPTION

Method keywords

Human induced Pluripotent Stem Cell

differentiation
airways
lung epithelial cells

Scientific area keywords

Induced pluripotent stem cells
human airways
3D organoid models
Chronic obstructive pulmonary disease
asthma
epithelial cells
co-culture

Method description

We devised a simple and reliable method for reprogramming peripheral blood mononuclear cells into hiPSC and then to differentiate them into air-liquid interface bronchial epithelium (iALI) within 45 days. Of note, this method does not involve any cell sorting step. We reprogrammed blood cells from one healthy control and three patients with very severe COPD. The mean cell purity at definitive endoderm and ventral anterior foregut endoderm was >80%, assessed by CXCR4 and NKX2.1 expression respectively. vAFE cells from all four hiPSC differen-tiated into bronchial epithelium in air-liquid interface (ALI) conditions, with large zones covered by beating ciliated, basal, goblets, club cells and neuroendocrine cells, as found *in vivo*.

Lab equipment

Flow cytometry,
Biosafety cabinet,
Microscopy phase contrast,
Fluorescence PCR,
Matrix (geltrex, matrigel),
Transwell insert for culture,
Transepithelial/transendothelial electrical resistance.

Method status

History of use

Internally validated

Published in peer reviewed journal

PROS, CONS & FUTURE POTENTIAL

Advantages

Robust, efficient and reproducible protocol

Human normal lung development modeling and diseases modeling

Stem cells: renewable and sustainable source of airway epithelial cells

High-Yield Human Induced Pluripotent Stem Cell-Derived airway epihelial cells

Personalized medicine

High input pharmacological screening

Genome editing CRISPR Cas9 technology

Challenges

Cost,

Mandatory to check regulary genetic stability of stem cells during culture maintenance,

Derivation of clinical grade iPSC culture and derived therapeutic cells.

Modifications

Optimization of differentiation protocol,

Co-culture with other cell type such as immune cells

Future & Other applications

Disease modeling cell therapy

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

References

Differentiation protocol frome the team PMID: 35954266 iPSC cell lines derived PMID: 34624616 , PMID: 33099111, PMID: 30296669 Kotton DN protocol lab: PMID: 35781291, PMID: 35499347 Gotoh Lab: PMID: 34798066

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