Why *in vitro* testing?

E-cigarette liquids contain several components, which are generally approved as food additives. However, the approval for oral use is not necessarily relevant for their inhalational use.

Flavors especially can bear unknown risks, if inhaled. A prominent example of such a flavor is butane-2,3-dione. It is harmless if it is used as butterscotch flavor in confectionery and consumed orally. But after inhalation, it can cause bronchiolitis obliterans, a serious disease also known as the ‚popcorn lung'.

In order to learn more about the effects after inhalational use, a test system is required which resembles the exposure situation in the human body as closely as possible.

The direct exposure of living human bronchial epithelial cells with e-cigarette vapor can reveal toxic components in e-cigarette liquids and therefore protect the consumer as well as the liquid manufacturer.

In vitro tests using human bronchial epithelial cells represent the situation in the human lung more closely, than studies in rodents do. In addition, *in vitro* tests are less time-consuming and costly than the respective animal studies.

Further information

Rach J, Budde J, Möhle N, Aufderheide M. Direct exposure at the air-liquid interface: evaluation of an in vitro approach for simulating inhalation of airborne substances.
J Appl Toxicol. 2014;34(5):506-15

Steinritz D, Möhle N, Pohl C, et al. Use of the Cultex® Radial Flow System as an in vitro exposure method to assess acute pulmonary toxicity of fine dusts and nanoparticles with special focus on the intra- and inter-laboratory reproducibility.
Chem Biol Interact. 2013;206(3):479-90

Wijte D, Alblas MJ, Noort D, Langenberg JP, Van helden HP. Toxic effects following phosgene exposure of human epithelial lung cells in vitro using a CULTEX® system.
Toxicol In Vitro. 2011;25(8):2080-7

Cultex Laboratories GmbH
Feodor-Lynen-Str. 21
30625 Hannover
Germany

Phone + 49 (0)511 56 35 86-0
Fax + 49 (0)511 56 35 86-69
E-Mail info@cultex-laboratories.com
www.cultex-laboratories.com

Cultex® Laboratories

The *in vitro* inhalation toxicology experts

E-cigarette liquid testing

Test methods *tailor-made* for your needs

Who we are

Cultex Laboratories GmbH was founded in July 2007 by Prof. Dr. med. Drs. h.c. Ulrich Mohr and Prof. Dr. rer. nat. Michaela Aufderheide, to further advance their *in vitro* activities in the field of inhalation toxicology.

Our main activities comprise the sale of the CULTEX® technology, which has been continuously developed and advanced since 1999. Our product spectrum includes the CULTEX® LTC, a cultivation unit for long-term cultivation of cell cultures grown at the air-liquid interface. For the direct exposure of these air-liquid-interface cultivated cells, we developed the CULTEX® RFS. With this device, it is possible to analyze the toxicological potential of consumer products, pharmaceuticals and more.

Besides the development of the CULTEX® technology, Cultex has long-standing expert knowledge in the toxicological analysis of airborne components. We use cell lines, primary bronchial epithelial cells and immortalized cell lines under conventional conditions (microtiter plates) and under direct exposure conditions at the air-liquid interface in our CULTEX® RFS module to simulate the *in vivo* situation.

Cultex Laboratories GmbH is headquartered in the Medical Park Hannover/Northern Germany.

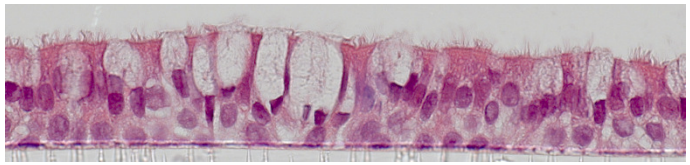
The CULTEX® RFS compact

Our solutions for you

Cell Cultures

Immortalized normal human bronchial epithelial cells have the properties of primary normal human bronchial epithelial cells with a constant and reproducible quality.

- **Undifferentiated cells** resemble the regenerating epithelium
- **Differentiated cells** reflect the situation of the intact epithelium



Endpoints

Undifferentiated cells:

- **Cell viability**
- **Oxidative Stress** in the cells

Differentiated cells:

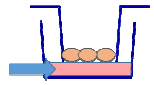
- **Histopathology** to study changes in the cell populations
- **Transepithelial resistance** (TEER) gives information about the integrity of the cell layer

The **Test Results** give information about the viability/ vitality of the cells, possible cell damage and damage of specific cell populations.

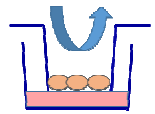
Four approaches customized for your special needs

E-liquid extract testing in 96-well format
Cells are cultivated in microtiter plates in the presence of e-liquid extracts. These tests give first insights into the toxicity of compounds.

E-liquid extract testing from the basolateral side using air-lifted cultures
Cells are cultivated air-lifted, resembling the in vivo situation. Nutrients as well as the test compounds are supplied from the lower side through a semipermeable membrane to allow differentiation of NHBE cells.



E-liquid aerosol testing on air-lifted cultures
The cells are cultivated air-lifted and are exposed directly to the e-cigarette vapor. The direct exposure resembles the in vivo situation most closely.



Ames Assay
E-liquid extracts are tested with regard to possible DNA mutations in bacteria