CLAIMS

1. A system for determining the interaction between a test atmosphere and a simulated respiratory tract, said system comprising:

(a) a first pump comprising:

(i) a chamber configured for containing a first volume of gas comprising a test atmosphere;

(ii) a first port adapted for receiving and outputting gas and comprising a valve for regulating the flow of gas through the first port, said valve being moveable between open and closed positions, wherein in the open position said valve is openable towards a test atmosphere or surrounding air;

(iii) a second port adapted for outputting and receiving gas and comprising a valve for regulating the flow of gas through the second port, said valve being moveable between open and closed positions;

(iv) a piston plate in the chamber, said piston plate comprising one or more apertures for the uptake or inflow of gas into the chamber wherein one or more, or each, of the apertures include a valve that is movable between open and closed positions and is capable of regulating the uptake or inflow of gas; and

(v) a motor for controlling the operation of the first pump;

(b) a second pump comprising:

(i) a chamber configured for containing a second volume of gas, wherein the first and second volumes of gas are different;

(ii) a port adapted for receiving and outputting gas; and

(iii) a motor for controlling the operation of the second pump;

(c) a connecting structure operable to transmit the gas from the first pump into the second pump; and

(d) one or more openings in the first pump or the second pump or the walls of the connecting structure or a combination of two or more thereof, said openings being capable of receiving a module for containing a cell culture medium or for monitoring conditions in the chamber or for gas sampling or for gas characterisation.

2. The system according to claim 1, wherein the first pump and/or second pump is a piston pump comprising a piston plate and a base.

3. The system according to claim 1 or claim 2, wherein the system is contained in a housing, preferably, a temperature controlled housing.

4. The system according to any of the preceding claims, wherein the chamber of the first pump has a smaller volume than the chamber of the second pump.

5. The system according to any of the preceding claims, wherein the system further comprises a computer controller capable of synchronising the operation of the system.

6. The system according to any of the preceding claims, wherein the one or more openings contain the module.

7. The system according to claim 6, wherein the module is located on the base of the piston plate of the first and/or second pump.

8. A method for simulating the interaction between a test atmosphere and a simulated respiratory tract comprising the use of the system according to any of claims 1 to 7.

9. Use of the system according to any of claims 1 to 7 for simulating the interaction between a test atmosphere and a simulated respiratory tract.

10. A method for determining the effect of a test atmosphere on a culture of cells contained in a simulated respiratory tract comprising:

(a) providing the system according to claim 6 or claim 7, wherein the system contains a culture of cells in the module; and

(b) comparing the culture of cells before and/or after exposure to the test atmosphere, wherein a difference between the culture of cells before and/or after exposure of the cells to the test atmosphere is indicative that the test atmosphere effects the culture of cells.

11. A method for simulating the interaction between a test atmosphere and a simulated respiratory tract comprising:

(a) providing a test atmosphere to a chamber of a first pump;

(b) withdrawing the test atmosphere from the first pump into a connecting structure that joins the first pump to a second pump;

(c) flushing the first pump and at least of a portion of the connecting structure with surrounding air;

(d) holding the test atmosphere in the second pump and the connecting structure for a defined period of time;

(e) displacing the test atmosphere into the connecting structure and the first pump using the second pump; and

(f) performing one or more pumping cycles of the surrounding air in the second pump;

wherein the test atmosphere contacts a cell culture located in the first pump or the connecting structure or the second pump or a combination of two or more thereof.

12. The method according to claim 11, wherein the test atmosphere contacts a cell culture located in one or more modules located in the first pump or the connecting structure or the second pump or a combination of two or more thereof, and wherein said method comprises the further step of determining the affect of the test atmosphere on the cell culture, wherein a difference in the cell culture before and/or after exposure to the test atmosphere is indicative that the test atmosphere effects the cell culture.

13. An apparatus configured to or adapted to perform the method of claim 11 or claim 12.