Claims

1. A method for a cell-based drug screening assay to evaluate the effectiveness of a drug substance being tested on cells or formed tissue, the method comprising the steps of:

- seeding of cells and culturing a cell population in a culturing environment,
- assaying the cells for profiling the cells for their physiological change and behaviour over time in view of at least one characteristic selected form the group consisting of the cell types, physiological characteristics of the cells, physiological characteristics of formed-tissue, the mode of action of a drug substance being tested and the culturing environment, thereby creating a cell profile,
- determining at least an early first monitoring point in time and a later second monitoring point in time depending on said cell profile, and the first and second monitoring points in time being determined such that either:
  during said first monitoring point in time in the cell population said at least one selected characteristic is fully or more developed than at the second monitoring point in time, and during said second monitoring point in time in the cell population said at least one selected characteristic is not or less developed than at the first monitoring point in time, or
  during said first monitoring point in time in the cell population said at least one selected characteristic is not or less developed than at the second monitoring point in time and during said second monitoring point in time in the cell population said at least one selected characteristic is fully or more developed than at the first monitoring point in time,

- applying the drug substance being tested to the cultured cells at least at one treatment point in time,
- monitoring of the effect of said drug substance on cells or formed tissues at least at both said first and second monitoring points in time.
- either rejecting or selecting a drug substance being tested based on the determined effect on the cells or formed tissue at said first and second monitoring points in time.

2. The method of claim 1, wherein said first and second monitoring points in time are selected from the group consisting of

- a time point relevant for an early-stage of a specific cell, preferably between four and seven days after culturing the cells in the environment, and
- a time point for a late-stage, preferably fourteen to seventeen days after culturing the cells in the environment, and
- a point in time for a late-stage preferably defined by the absence or presence of a specific physiological characteristic e.g. hypoxia or change in cell growth kinetics,
  and
- a time point relevant for measuring drug efficacy after a drug-free recovery phase.

3. The method of claim 1 and 2, wherein monitoring of cell proliferation continues one to seven or more days after termination of the drug application.

4. The method of claims 1 to 3, wherein cells are cultured in an environment, which comprises a structural compound,

preferentially comprising a multi-branched polyethylene glycol with vinyl sulfone end groups; and a linker compound, preferentially a peptide comprising at least two cysteines or, generally thiol groups; and wherein the structural compound and the linker compound are polymerizable to a three-dimensional matrix.

5. The method of claim 4, wherein said three-dimensional environment promotes three-dimensional growth of the encapsulated cells, preferentially spheroid growth.

6. The method of claim 4 and 5, wherein said three-dimensional environment is cast in a recipient such as a gel casting device or a standard cell-culture device, preferably a 384-well plate.

7. The method of claim 1 to 6, wherein said cells is selected of the group of any type of cell, cell line, differentiated cell, and cancer cell such as colon, pancreatic and ovarian cancer cell.

8. The method of claim 1 to 6, wherein said cells are cells of which the growth is promoted by the drug treatment.

9. The method of claim 1 to 8, wherein said drug substances are selected of the group of

(i) any chemical, natural or synthetic substance and any substance of known drug screens; or

(ii) any combination of substances according to i);

(iii) any substance(s) according to i) or ii), either in solution or combined with any carrier, nanoparticle or delivery device.

10. The method of claim 1 to 9, wherein monitoring of cell characteristics is assayed by
metabolic activity
and/or flow cytometry,
and/or DNA content,
and/or protein quantification,
and/or cell counting,
and/or image-based analysis,
and/or levels of hypoxic and angiogenic markers,
and/or Ribonucleic acid (RNA) levels,
and/or protein expression levels,
and/or mass spectrometry,
and/or immunohistochemistry.

11. The method of claim 1 to 10, wherein the maximally tolerated dose of a drug substance is determined for a given type of cell.

12. The method of claim 1 to 11, wherein the lowest effective dose of a drug substance is determined for a given type of cell.

13. The use of the method of claim 1 to 12 for evaluating
(i) reprogramming of differentiated cells with respect to an applied substance and
(ii) differentiation of stem cells with respect to an applied substance.

14. A method for a cell-based drug screening assay to evaluate an effectiveness of a drug substance being tested on cancer cells, the method comprising the steps of:
- seeding of cancer cells and culturing a cell population in a culturing environment,
- assaying the cancer cells for profiling the cancer cells for their physiological change and behaviour over time in view of at

least one of cell types, physiological characteristics of the cells, physiological characteristics of formed-tissue, a mode of action of the drug substance being tested and a culturing environment, thereby creating a cell profile,

- determining at least an early first monitoring point in time and a later second monitoring point in time depending on said profile,

wherein in said early first monitoring point in time and in said later second monitoring point in time the cancer cells show a different degree in at least one of spheroid size, cell proliferation and hypoxia,

-applying the drug substance being tested to the cultured cancer cells at least at one treatment point in time,

- following application of the drug substance being tested to the cultured cancer cells, determining an effect of said drug substance being tested on the cancer cells at least at both said first and second monitoring points in time,

- rejecting or selecting a drug substance being tested based on the determined effect on the cells at said first and second monitoring points in time.