Macrophage Enabled 3D Enrichment of Cancer Stem Cells

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Technology description

Background:

A major contributing factor to mortality in cancer patients is relapse (after surgery or therapy) and developing resistance to therapy. For example, breast cancer recurrence affects 30% of the patients and leads to $10-22K increase in cost over 10 years. Cancer recurrence is related to the existence of a very small population of cancer stem cells (CSCs) in the tumor tissue. The bulk of a typical tumor shrinks to <1% of its initial volume after cancer therapy and the tumor tissue becomes enriched with CSCs that are highly resistant to future therapies. The CSCs that survive after therapy grow into a heterogeneous population of colonies with a range of invasiveness. Consistent with that notion, 15% of breast cancer patients are diagnosed with the most aggressive triple negative breast cancer (TNBC) with the highest sub-population of CSCs with a survival rate of 77% after 5 years, compared to 93% for other subtypes. Newly discovered drugs in the pharmaceutical industry are screened against the entire population of patient's cancer cells or the entire population of cells in a cancer cell line. Since CSCs constitute only a small fraction of the entire cancer cell population, conventional 2D and 3D drug screening approaches do not measure CSCs' response to drugs. Thus, these drug pass toxicity tests and move to the next stage of animal and human testing. We now know that many drugs that are used in cancer therapy, like Paclitaxel or Doxorubicin, are not effective against the most aggressive CSC sub-population of cancer cells. As a result, tumor relapses after therapy with much higher aggressiveness leading to more frequent patient casualty. There is therefore a need for a system for screening against the most invasive cells.

Invention Description:

The product is a three-dimensional gel culture system encapsulating cancer cells of interest and programmable macrophages. This system enriches the most aggressive cancer cell type in the population of cancer cells. The gel culture system can be applied as a thin film on tissue culture plates for cancer drug screening against the most invasive cell colony in the population of cancer cells.

Application area

This 3D cell culture system can be used to test cancer drugs against the most aggressive and malignant cells in the population of cancer cells. This gel culture system can be used with all cancer cells including breast, lung, colon, gastric, liver, thyroid, bladder, oral, ovarian, and nasal, to name a few.

Advantages

1) Matrix- and macrophage-enabled enrichment of the CSC sub-population of cancer cells provide a more reliable and accurate model for preclinical drug toxicity testing over competing products in the market.
2) A reliable 3D macrophage-enabled drug testing has the potential to significantly decrease preclinical screening expenses for pharmaceutical companies and reduces the chance of late-stage failure of the drug candidate in clinical trials.

Institution

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