

Multi-Niche Human Bone Marrow-On-A-Chip for Plasma Cell Survival and Differentiation

Complexities of the immune system prevent discovery

Bone marrow is a complex and heterogeneous tissue composed of many different cell types, and it plays a crucial role in the immune system as the site where B cells develop into plasma. Despite decades of immunological discoveries, the process of this development remains largely elusive. Plasma cells rely on specific signals from their microenvironment for survival and function, which are challenging to reproduce in vitro, and traditional culture conditions often fail to sustain plasma cell viability and functionality over extended periods, leading to cell death or loss of phenotype. Due to the difficulties in recreating these models, we currently have a limited understanding of the plasma cell differentiation and maturation processes.

Researchers at the Georgia Institute of Technology are developing a microfluidic chip to mimic the environment of human bone marrow that includes the specialized niches present in vivo. This will allow a more comprehensive study of plasma maturation, allowing for the development of targeted therapies for plasma cell-related disorders and exploration of plasma cell biology, antibody production, and immunotherapy development.

New technology mimics bone marrow environment allowing for comprehensive studies

The invention is a novel microfluidic chip that simulates the human bone marrow environment, incorporating endosteal, central marrow, and perivascular niches. It uses a combination of human mesenchymal stromal cells, osteoblasts, human umbilical vein endothelial cells, and normal human lung fibroblasts within a micro-vascularized hydrogel, assembled on a bottomless 96-well plate. This device facilitates the maturation of plasma cells through a sophisticated mimicry of the bone marrow's microenvironment, supporting long-term culture and study of plasma cell behavior and development.

Summary Bullets

- This novel microfluidic chip simulates the human bone marrow environment, incorporating multiple niches and supporting long-term plasma cell culture and study.
- The prototype enables comprehensive study of plasma cell maturation, aiding the development of targeted therapies for plasma cell-related disorders.

- It overcomes limitations in traditional plasma cell culture, facilitating vaccine development, antibody production research, and immune response modulation.

Solution Advantages

- Enables long-term culture and maturation of plasma cells in vitro.
- Incorporates multiple bone marrow niches for a more accurate simulation of the human bone marrow environment.
- Supports preclinical vaccine studies and the development of plasma cell-based therapies.
- Facilitates the study of antibody secreting cells and their role in the immune response.
- Overcomes previous limitations in plasma cell culture and research.

Potential Commercial Applications

- Preclinical vaccine development and testing.
- Manufacture and testing of plasma cell-based cell therapies.
- Biomedical research into humoral immunity and antibody production.
- Drug discovery and development related to immune response modulation.

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IP Status

<p>A patent application as filed</p>:

Publications

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Images

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