Lymphoid Tissues with Switchable Protein Gradients

Methods for immunity response research can be invasive and carry risks

Lymphoid tissues are crucial components of the immune system, where immune cells interact and respond to pathogens and other foreign substances. Currently, most research being done on insufficient immunity response is done using blood draws, which provides limited information on the maturation of B cells and an incomplete picture of an immune response. Ultrasound guided fine needle aspiration (FNA) does allow for some sampling of the lymph node tissue, however, these procedures are invasive, carry the risk of bleeding and infection, may require imaging to complete, and are not considered routine. At this point, it is not fully understood how a reduced immune response affects clinical outcomes in immunocompromised patients, such as those with lymphoma. Therefore, ex vivo models that provide a comprehensive overview of realistic immune system activity are vital to overcome barriers to optimal immune response.

Hydro-gel based system mimics the 3D environment of lymphatic tissue

Researchers at the Georgia Institute of Technology are developing a hydrogel-based human immune system that mimics the 3D microenvironment of human lymphatic tissue. This provides a solution to the limitations and risks that are inherent in invasive sampling methods used currently. Additionally, the potential range of use is extensive, as this invention is not only usable for studying healthy and lymphoma-derived B cells but can be readily applied to patient demographics (age, gender, BMI), non-malignant B cell diseases such as Systemic Lupus Erythematosus (SLE), hypogammaglobulinemia, and more.

The invention focuses on developing hydrogel-based human immune system organoids that replicate the lymphoid tissue environment, enabling the differentiation of naïve B cells into plasma and memory B cells in response to viral infections and vaccinations. Utilizing blood-derived immune cells within a synthetic lymphoid tissue microenvironment, this technology facilitates the study of human immune responses ex vivo, overcoming the limitations of current methods that rely on invasive procedures or lack the complexity of lymphoid tissues.

Summary Bullets

- **Technology Overview:** Georgia Tech's hydrogel-based immune organoids mimic lymphoid tissue, enabling ex vivo differentiation of B cells and studying immune responses to infections and vaccinations.
- **Advantages:** This non-invasive method supports long-term B and T cell survival, mimics antibody production processes, and offers insights into diseases like lymphoma.
- **Commercial Applications:** Useful for drug discovery, clinical research on immune disorders, personalized medicine, and academic studies in immunology.

Solution Advantages

- Facilitates the study of immune responses to infections and vaccinations in a controlled environment.
- Overcomes the limitations of invasive lymph node sampling and provides a non-invasive alternative for immune system modeling.
- Supports long-term survival and differentiation of primary human B cells, T cells, and their response to pathogens and vaccines.
- Enables the production of high-affinity human antibodies in vitro by mimicking the germinal center reactions.
- Offers insights into the mechanisms of immune dysregulation in diseases like lymphoma and potential therapeutic strategies.

Potential Commercial Applications

- Drug discovery and development, specifically for vaccines and immunotherapies.
- Clinical research to understand immune dysregulation in diseases and develop new treatments.
- Personalized medicine, by modeling individual immune responses to predict vaccine and drug efficacy.
- Academic research in immunology, virology, and biomedical engineering.

Inventors

- Dr. Ankur Singh
  Associate Professor - George W. Woodruff School of Mechanical Engineering and Wallace H. Coulter Department of Biomedical Engineering
- Zhe Zhong
  Graduate Research Assistant - Georgia Tech George W. Woodruff School of Mechanical Engineering
- Manuel Perez
  Graduate Research Assistant - Georgia Tech

IP Status

Patent application has been filed. :

Publications

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Images

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