Inverted Organoids for Breast Cancer and Other Invasion Studies (#8460)

Aids in drug discovery and screening

Researchers at Georgia Tech have developed a method for producing large and inverted organoids useful for studying the early phases of ductal carcinoma *in situ* (DCIS) breast cancer. Organoids are miniaturized and simplified 3D versions of organs produced *in vitro* that mimic micro-anatomy. They are useful for studying diseases and their treatments in laboratories.

In DCIS, breast cancer cells reside within the lumen of ducts on the side of the epithelium opposite the basement membrane. An organoid platform with an inverted orientation (also known as a basal-in phenotype) provides direct access to the epithelial surface opposite the basement membrane, significantly aiding in the study of DCIS cancer progression.

Georgia Tech researchers determined that having the epithelial cells self-assemble around and encapsulate a minimal gel scaffold plays a critical role in the inverted phenotype and provides easy lumen access. This cell-assisted scaffolding enables cells to self-organize into patterns with distinct cancer cell populations both inside and at the periphery of the epithelial organoid.

Benefits/Advantages

- **Innovative**: Serves as a convenient platform for studying the invasive abilities of breast cancer cells
- **Stable**: Enables formation of large inverted organoids where the basement membrane forms on the interior surface alongside a breast cell line epithelium
- **Flexible**: Allows for long-term studies of at least 25 days due to the robust maintenance of the inverted orientation

Potential Commercial Applications

- Drug discovery
- Drug screening
- Personalized medicine
- Xenograft alternatives

Background/Context for This Invention

In vitro cancer models are highly sought after as low-cost alternatives to investigate basic cell functions, such as proliferation and invasion, in addition to providing high-throughput platforms for drug-screening.

While a variety of platforms exist—ranging from Transwell migration assays to 3D microfluidic models—3D spheroid/organoid cultures are of particular interest for their ability to be grown in co-cultures for long durations if needed, used for high-throughput screens, and applied as patient surrogates for precision drug testing. Organoids that mimic physiological cell heterogeneity, basement membrane structures, and 3D cellular organization are particularly valuable.

While recent advances in breast cancer organoids derived from patients have been impressive, the small lumens of organoids and cell-filled spheroids make invasion studies difficult. This Georgia Tech innovation is envisioned to open new opportunities for convenient, standardized, and physiological cancer cell invasion studies.

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More Information

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Publications

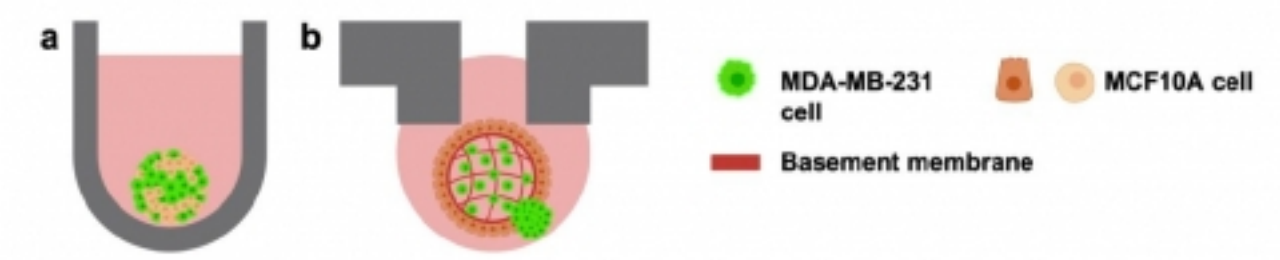
Cancer Cell Invasion of Mammary Organoids with Basal-In Phenotype, Advanced Healthcare Materials, June 25, 2020

A reproducible scaffold-free 3D organoid model to study neoplastic progression in breast cancer, Journal of Cell Communication and Signaling, December 4, 2018

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/inverted-organoids-breast-cancer-and-other-invasion-

studies

Images:



Comparison of inverted mammary organoids to existing co-culture models. Schematic of (a) multicellular spheroid model and (b) inverted organoid model.