3D BIOPRINTED HUMAN TISSUE MODELS FOR PHARMACEUTICAL AND COSMETIC PRODUCT TESTING

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Introduction

Founded in 2016, CELLINK is the leading bioconvergence company in the world, providing technologies, products and services in bioprinting, multi-omics, cell line development and diagnostics. The company develops innovative technologies for 3D cell culture, high-throughput drug screening and printing human tissue and organ models for the medical, pharmaceutical, and cosmetic industries.
This work is essential for developing relevant *in vitro* models since 2D models in drug screening can lead to both false positive and false negatives, extending the time and resources needed for the drug to reach the patients [1]. There is also a great need for better *in vitro* skin models for cosmetic product testing to limit animal trials [2]. The aim is to fabricate many different types of functional tissues using 3D bioprinting as more reliable models for pharmaceutical and cosmetic product testing.

Materials and Methods

3D bioprinted constructs are fabricated layer by layer using BIO X bioprinter while living cells are embedded in biomaterials. CELLINK's bioinks are groundbreaking biomaterial solutions that enable researchers to culture human cells into functional tissue constructs. These bioinks provide an environment similar to native human tissue that cells can thrive in due to adhesion contacts, as well as the ability to be manipulated and remodeled, and direct differentiation and organization. After bioprinting, the constructs are cultured using standard culture conditions for 1-4 weeks for maturation.

Results and Discussion

A broad variety of tissue models can be printed using the BIO X bioprinter for pharmaceutical and cosmetic product testing such as cancer tumor models, heart, liver and skin.
Cells have the ability to remodel their environment and migrate forming spheroids within the bioprinted construct which can be used for cancer drug screening (FIG. 1).

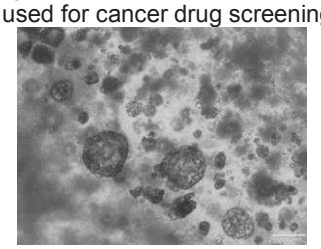

FIG. 1. Lung adenocarcinoma cells printed in GelMA bioink have migrated and formed spheroids after 16 days.

Human iPSC-derived cardiac aggregates were printed in CELLINK LAMININK 521 and after three weeks of culture, the bioprinted cardiac tissue model demonstrated intracellular mobilization of calcium (FIG. 2). These models can be utilized to investigate cardiomyocyte maturation, drug screening, identifying drug targets, and cardiac regeneration.

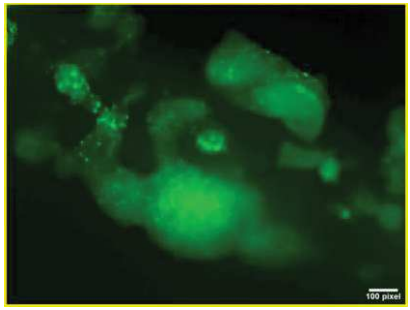

FIG. 2. Cardiac aggregates in CELLINK LAMININK 521 during a fluorescent calcium indicator assay.

Liver tissue models are being used for drug development and to study absorption, distribution, metabolism and excretion of drugs. For sensitive primary liver cells the bioink HEP X, which contain decellularized liver extracellular matrix, will give the cells the best prerequisites for functional tissues (FIG. 3).

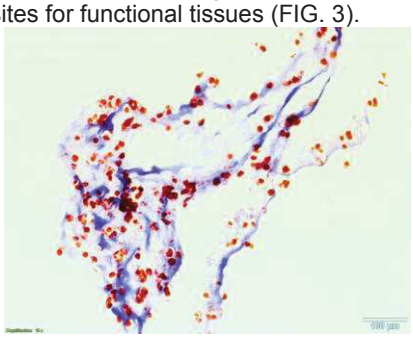

FIG. 3. Trichrome staining of constructs with primary hepatocytes in liver extracellular matrix bioink cultured for two weeks. (Cells-red; ECM-blue).

The different compartments of the skin can easily be layered with different cell types and bioinks using 3D bioprinting (FIG. 4). Skin tissue models can be used for drug and compound treatment to study the cellular response.

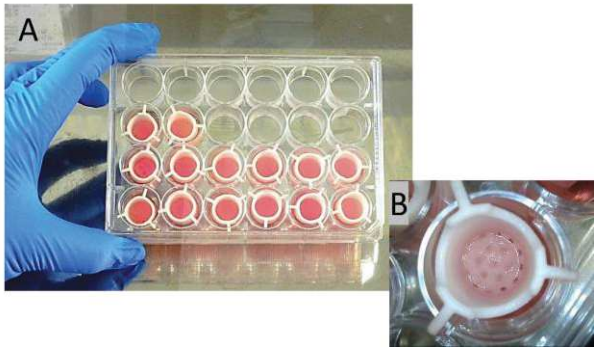

FIG. 4. Bioprinted skin constructs in transwell inserts in A) 24-well plate B) viewed from above.

Conclusions

Various types of 3D bioprinted human tissue models can be used as reliable models to improve the current pharmaceutical and cosmetic product testing.

References

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[2] Bondesson, I. Redwan, I.N, (2020). 3D Bioprinting Skin Tissue Models Using Primary Cells (Application Note No. BIOX-08272020V3). Retrieved from CELLINK website:https://www.cellink.com/global/wp-content/uploads/sites/7/2020/09/AppNote_3DBioprintedSkin_08272020V3_1.pdf