

## 附件四、技術說明表



## 一種具有薄膜基材的肌細胞培養裝置

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簡歷：(可列出相關連結，例如系所、研究室網頁)

<https://www.iam.ntu.edu.tw/zh/component/content/article/166-member/professors/professor-info/1204-yu-hsiang-hsu?Itemid=819>

### 市場及需求：

目前在新藥開發中，所有的心臟藥物皆須探討其功效及心臟毒性，且除心臟藥物外的所有藥物在開發過程中皆須進行心臟毒性測試，因此能培養出具有與體內組織相近收縮特性的心肌或肌肉細胞體外模型格外重要，因此可以預期本技術在藥物開發的市場中將具有的競爭性，也有其一定的市場需求。

### 技術摘要(含成果)：

目前在心肌及肌肉細胞培養的方式多以塑膠盤的培養皿或多孔盤進行，但因塑膠的硬度高於心肌及肌肉細胞組織硬度約 4 到 5 個數量級，因此需培養較長時間才會達到較接近體內肌細胞的肌肉收縮行為，但所培養出的肌細胞的成熟度仍與實際組織有一差距。其中主要原因之一是因塑膠材料硬度太高，影響肌肉細胞的收縮能力及表現，且會影響基細胞的形態。因此目前的培養方法多以加入水膠的方式補償此一差異，但肌細胞容易因收縮施力而脫落。而在學界研究上，多是使用自行製作較低硬度的矽膠或矽橡膠為基材的裝置進行培養，但因在量產上有其限制，目前尚未有市售的產品。因此本技術提出一創新的肌細胞培養裝置，藉由塑膠基材的撓曲剛度設計，以塑膠薄膜及薄膜結構設計來補償塑膠材料與肌肉組織硬度上的差異，可有效降低基材硬度，提供可與體內肌肉細胞相近之機械特性，以促使所培養的心肌細胞或肌肉細胞達到成熟及具有與體內成熟細胞相近之收縮特性。此技術的優勢是整體細胞培養皿或多孔盤仍是使用全塑膠之材料，符合一般業界塑膠製程，具有可以量產之潛力。

### 優勢：

1. 此裝置可以提升肌細胞的成熟度及縮短培養時間。
2. 此裝置為全塑膠裝置，符合業界製程，在倉儲及運送上有低成本的優勢

### 競爭產品：

一般市售多孔盤裝置、客製化 3D 列印裝置

### 專利現況：

- (1) 本技術已申請美國專利臨時案 (美國專利臨時案: 63/179,536)。
- (2) 本研究團隊具有八年以上的心肌細胞培養裝置的設計、製作、及研究經驗

### 聯絡方式(請不用填)：

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## A myocyte culture device having a thin-film substrate

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### Experience:

<https://www.iam.ntu.edu.tw/zh/component/content/article/166-member/professors/professor-info/1204-yu-hsiang-hsu?Itemid=819>

### Market Needs:

In the process of drug development, all cardiac drugs need to study their drug functions and cardiac toxicity, and all other drugs also need to check their cardiac toxicity before release to market. Thus, it is very important to develop an *in vitro model* to reproduce the contraction behavior of a cardiac tissues. Thus, the competitiveness and market need of our technology in drug development and drug screening can be expected.

### Our Technology:

Currently, standard culture dish and multi-well plate are used to culture cardiomyocytes and myocytes. However, these dishes and plates are all made of plastic materials, and their stiffness are 4- to 5-order higher than the stiffness of cardiac or myocyte tissues. Thus, it could take longer time for cells to reproduce contractile characteristics, and they cannot be as mature as *in vivo* tissue. One of the major reasons is due to the high stiffness difference between cells and substrate, and it can affect the contraction behavior and morphology of cardiomyocytes and myocytes. Thus, hydrogels usually are used to provide an intermediate interface, but cells can detach due to contractions on mechanically mismatched substrates. In recent academic studies, method to solve this issue is using silicone or silicone rubber to create a softer substrate. However, due to the limitation of mass production of this type of materials, a commercial product based on silicones is still not available. In our technology, we use thin-film structure and microstructure to design a thin plastic film with an ultra-low flexural rigidity to compensate the stiffness difference between myocytes and plastic materials. This design can significantly reduce the resultant stiffness of the substrate, and it can promote cell maturations with higher contractility. The advantage of this technology is that it is constructed all by plastics, and it is compatible with industrial processes. Thus, it has a high strength to be commercialized.

### Strength:

1. This design can promote cardiomyocyte and myocyte maturation and shorten culturing time.
2. The culture dish or multi-well plate designed by this technology is all-plastics. It matches industrial process well, and it is compatible for storage and shipping.

### Competing Products:

Current commercial culture dishes and multi-well plates. 3-D printing.

### Intellectual Properties:

- (1) A USA provisional application has been filed. (63/179,536)
- (2) Our team has over 8-year experience on device design, fabrication, and experimental studies for cardiomyocytes

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