Dynamic Culture, DS

動態培養系統應用於體內微環境之生物醫學研究

I. 肺與氣管呼吸系統

1. 動態拉伸肺內皮/上皮細胞研究參與**呼吸器引發肺損傷** ventilator-induced lung injury (VILI)的細胞蛋白和訊息路徑:
    - Connexin 43 [1]; P120 (γ-catenin) [2]; Paxillin [3]; NAMPT [4]; HMGBI [5]; GADD45a [6]
    - 相關藥物機制研究: Prostacyclin [7]; Resveratrol [8]; Hypercapnia [9]; Isoflurane [10]; Imatinib [11]
2. 動態拉伸肺血管平滑肌細胞模擬 pulmonary vascular remodeling associated with persistent pulmonary hypertension of the newborn (**新生兒肺高血壓** PPHN) [12]
3. 動態拉伸肺 airway smooth muscle (ASM) cells 促進**氣喘**和慢性阻塞性肺病的 ATP 釋放 [13, 14]

熱門研究趨勢

用動態培養系統探討
細胞生理/病理微環境

ATM
Advanced Biosciences System

II. 心臟血管循環系統

4. 模擬胚胎發育時血流的沖激促進胚胎**心臟發育** [15]
5. 模擬二尖瓣受力造成**發炎鈣化** [16]
6. 模擬心律不同步可能促進 **EMT** 造成**心臟纖維化** [17]
7. 研究心臟受到壓力時
    - **心肌肥大**的機制 [18]
    - 活化 TNF-α 造成**心肌細胞凋亡** [19]
8. 活化 bFGF 和 VEGF，促進**血管新生** [20]
9. 促進血管內皮細胞有序排列，活化 atheroprotective signaling [21]，防止**動脈粥狀硬化**
    - 醣化膠原蛋白抑制內皮細胞 mechanosensing ability，可解釋**糖尿病**病人的**週邊血管病變** [22]
10. 模擬高血壓促進血管內皮細胞**氧化壓力** (JNK↑, Nox↑, ROS↑, NO↓) [23]
    - 茄紅素可降低此氧化壓力 [24]，因此具**血管保護效果**
11. 過度 DS 活化血管平滑肌細胞 [25]，造成**血管狹窄**，**支架再狹窄** [26]
12. 模擬血壓影響血管內皮細胞上**凝血酶調節素** (Thrombomodulin, TM) 之表現與活性 [27]

III. 骨骼與肌肉系統及結締組織

13. 過度 DS 抑制**蝕骨細胞**的凋亡 [28]
14. 過度 DS 促進**造骨細胞**的凋亡，釋放 MCP-3 吸引蝕骨細胞 [29]
15. 輕微 DS 處理骨髓細胞→ 活化 ERK 以及 **osteogenesis** 相關基因表現 [29]
16. 骨骼肌細胞以 DS 處理 → 釋放可抑制蝕骨細胞的 IL-6 [30]
17. Ossification of the posterior longitudinal ligament (OPLL)**韌帶骨化**之機制研究
    - DS 處理韌帶細胞增加 osteogenesis 指標蛋白[31, 32]
    - 可能是由於病變韌帶細胞波形蛋白 vimentin 表現低落 [33]
    - 與 BMP 的特定 SNP 有關 [34]
18. 慢性過度使用**肌腱病變** Chronic overuse tendinopathy 取病人肌腱細胞施予 DS 會促進血管新生相關基因表現 [35]
19. **先天性肌失養症** Congenital muscular dystrophy 對帶有 laminin A/C 突變的肌原母細胞施予 DS → 發現 Defective mechanosensing 可能是 muscular dystrophy 的肌原母細胞無法分化出具功能的骨骼肌的原因 [36]
20. 對**關節軟骨**細胞施予 DS
    - 模擬機械性損耗 [37]
    - 模擬良性生理刺激 [38, 39]

IV. 腎臟與泌尿系統

21. DS 促進膀胱平滑肌生長，促進**腎纖維化** [40]

22. 對人類近曲小管上皮細胞 HK-2 施予 DS，活化促進**腎纖維化**之訊息路徑 [41]

23. 對腎絲球的足細胞施予 DS 作為一種環境壓迫，會使足細胞釋出 0.1-1μm 大小的微顆粒。同樣的微顆粒也可在糖尿病的動物模式發現，意味尿液中的微顆粒可能可以做為蛋白尿發生前的**腎病變的早期指標** [42]

V. 幹細胞分化

24. 誘導高階幹細胞向特定細胞種類分化，在單獨或伴隨其他因子的情況下，週期性細胞拉伸可:

- 誘導中胚層幹細胞 (mesenchymal stem cell, MSC) 分化成**血管內皮細胞** [43]
- 誘導胚胎幹細胞 [44]，脂肪組織幹細胞 (adipose-derived stem cell)及骨髓幹細胞 [45] 分化成**心肌細胞**
- 誘導**脂肪組織幹細胞**參與肌肉分化 [46]
- 誘導下頷骨髓中的中胚層幹細胞及先趨細胞往**成骨路徑**發展 [47]

其他可能研究應用:

- 促進癌症細胞的 EMT?
- 測試帶有神經退化疾病的神經細胞的機械力耐受度?

靜置培養	1855年至今，你我熟悉的靜態培養技術			
動態培養	跨領域的創新整合，可擴充於任一款靜態培養箱內，讓細胞培養動靜皆宜			
	病理面、物理性力學生物學刺激	加速研究疾病 加速疾病細胞模式建立	加速探討機制 加速致病機制的探討	發展對應藥物 加速開發新藥或老藥應用
	生理面、物理性力學生物學刺激	作為細胞教育基地 1.誘導細胞表現 2.誘導細胞分化	作為細胞訓練基地 1.強化特定功能指標 2.賦予生理面機械強度	強化細胞的內外 1.表現特定功能 2.提前適應在體內微環境的機械強度與角色
	3D 動態物理性力學生物學刺激	結合細胞與醫材 1.整合3D列印 2.整合醫材支架 3.細胞與醫材都加入機械強度參數培養	仿真培養 培養不再只有2D、3D靜態，是朝向3D動態發展，更仿真做選擇	加速個體化醫療的衍生 植入前的最佳化、更適生理的培養選擇 1.整合幹細胞科學研究 2.傷口、韌帶修復研究 3.心、肺、骨等修復研究

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