NSTC 國家科學及技術委員會
National Science and Technology Council

超高齡社會之精準再生醫學啟航計畫

期中成果發表會

2024/7/26(五)10:30-12:30

技術發表手冊

推動辦公室 DOB 生物技術開發中心 Development Center for Biotechnology

NSTC 國家科學及技術委員會
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超高齡社會之精準再生醫學啟航計畫

期中成果發表會

計畫參與單位

- 中央研究院 ACADEMIA SINICA
- 國立成功大學 National Cheng Kung University
- 國立陽明交通大學 NATIONAL YANG MING CHIAO TUNG UNIVERSITY
- 國立臺灣大學 National Taiwan University
- 中國醫藥大學 China Medical University
- 長庚大學 CHANG GUNG UNIVERSITY
- 亞東紀念醫院 FAR EASTERN MEMORIAL HOSPITAL

NSTC 國家科學及技術委員會
National Science and Technology Council

超高齡社會之精準再生醫學啟航計畫 期中成果發表會

長官的話：

楊台鴻 處長
國科會生科處

感謝大家盛情參與「超高齡社會之精準再生醫學啟航計畫期中成果發表會」，這場發表會不僅為專案計畫團隊提供展現成果的舞台，同時更是一個匯聚生醫新創與投資再生醫療產業的最佳機會。

近年來，全球再生醫療技術突飛猛進，成為國際生醫產創發展新趨勢。今年六月再生醫療雙法(「再生醫療法」及「再生醫療製劑條例」)公告實施後，我國再生醫療正式邁入新紀元。國科會積極推動加強再生醫療基礎及臨床研究，透過「超高齡社會之精準再生醫學啟航計畫」之執行，聚焦新興細胞治療方式及技術平台之創新研發，期能加速國內細胞治療產品開發，提升細胞製劑品質與製程效率，促進我國再生醫療尖端研發及精準健康產業之發展，為臺灣醫療帶來更多的選擇，讓全民能共享精準健康之福址。

今日的發表會展示中央研究院、成功大學、陽明交通大學、台灣大學、中國醫藥大學、長庚大學以及亞東紀念醫院等七大計畫團隊二年多來的研究亮點，期望本次發表會可以發揮產學合作交流平台之功能，讓研發團隊與各領域傑出業界人士相互充分交流，期待能點燃雙方更進一步的合作火花。

計畫辦公室：

劉韋博 處長
DCB 生物技術開發中心
計畫辦公室

人口高齡化已經是個無法避免的全球趨勢，臺灣於 2025 年將正式邁入超高齡社會，人口老化所衍生的慢性或退化性疾病、癌症治療，加上仍有許多「未被滿足的醫療需求（unmet medical need）」，新興醫療科技例如細胞及基因治療，將有機會成為主要的治癒方案。

本計畫以臨床應用與產業導向作為推動之核心策略，於細胞治療技術及產品開發過程，建構定期與法規單位溝通及諮詢機制，以利製程品質管控與臨床試驗推動，符合未來產品開發時程；此外，早期鏈結細胞治療產業供應鏈，透過產學研醫合作互動，開發細胞治療產業之關鍵技術，提高整體產業價值。

生物技術開發中心 (DCB) 長期扮演國內生技醫藥產業價值鏈中「扶育加值」角色，可以說是國內「生技產業最佳夥伴」，透過技術評估、專利佈局、市場分析、商業媒合、新創育成之商業發展量能，串聯創新研發、轉譯加值到產業商化，協助學研機構創新技術順利產業銜接，並透過計畫辦公室的推動，完善落實國內細胞治療產品之技術發展及產業供應鏈。

計畫主持人：

中央研究院

謝清河
特聘研究員

國立成功大學

沈延盛
院長 / 特聘教授

國立陽明交通大學

邱士華
特聘教授

國立臺灣大學

鄭乃禎
教授

中國醫藥大學

鄭隆賓
講座教授

長庚大學

游正博
特聘講座教授

亞東紀念醫院

張至宏
副院長 / 教授

NSTC 國家科學及技術委員會
National Science and Technology Council

活動議程

2024/7/26 (五)10:30-12:30

Time	Topic	Speaker
10:00-10:30	報到 Register	
開場 Opening		
10:30-10:35	長官致詞 Opening Remark	國科會長官 National Science and Technology Council
10:35-10:40	計畫介紹 Project Introduction	計畫辦公室 Project Office
10:40-10:45	大合照 Group Photo	來賓與講者 Guests and Speakers
【Subject 1】誘導型多潛能幹細胞 Induced Pluripotent Stem Cells		
10:45-11:00	HLA 超級捐贈者 iPS 幹細胞於精準再生醫學之應用 Precise Tissue Regeneration Using HLA Super Donor iPS Cells	吳登強 教授 Deng-Chyang Wu, Professor Kaohsiung Medical University
11:00-11:15	以低免疫原性人類誘導多潛能幹細胞建立通用型細胞治療 Establishment of Universal Cell Therapy Using Hypoimmunogenic Human Induced Pluripotent Stem Cells	劉嚴文 教授 Yen-Wen Liu, Professor National Cheng Kung University
11:15-11:30	半導體技術推動之高效臨床級 iPSC 視網膜色素上皮細胞製造 Semiconductor Technology-driven Efficient Clinical-grade iPSC-derived Retinal Pigment Epithelium Cell Production	邱士華 特聘教授 Shih-Hwa Chiou, Distinguished Professor National Yang Ming Chiao Tung University
【Subject 2】異體幹細胞或異體免疫細胞 Allogeneic Stem Cells or Allogeneic Immune Cells		
11:30-11:45	開發細胞生產及品質測試平台 以應用於皮膚與角膜內皮再生醫學 Development of Cell Generation and Quality Assessment Platform for Skin and Corneal Endothelium Regenerative Medicine Application	鄭乃禎 教授 Nai-Chen Cheng, Professor National Taiwan University
【Subject 3】基因修飾細胞 Genetically Modified Cells		
11:45-12:00	以奈米技術轉殖的雙基因修飾間質幹細胞 - 創新癌症治療 Innovative Cancer Treatment with Nanotechnology-transduced Dual-gene Modified Mesenchymal Stem Cells	鄭隆賓 講座教授 Long-Bin Jeng, Chair Professor China Medical University
12:00-12:15	異體自然殺手細胞療法之創新研發 Development of Novel Allogeneic Natural Killer Cell Therapies	游正博 特聘講座教授 John Yu, Distinguished Chair Professor Chang Gung University
【Subject 4】外泌體 Exosomes		
12:15-12:30	開發膝關節脂肪墊幹細胞輔以間葉幹細胞外泌體之綜合療法 Development of Infrapatellar Fat Pad Stem Cell and Mesenchymal Stem Cell-derived Exosome-based Combination Therapy of Osteoarthritis	張至宏 副院長 Chih-Hung Chang, Vice President Far Eastern Memorial Hospital

* 主辦單位保留議程調整、變更之權利。

地點： 台北南港展覽館 1 館 4 樓 國科會論壇區 N923
(台北市南港區經貿二路 1 號)

超高齡社會之精準再生醫學啟航計畫 期中成果發表會

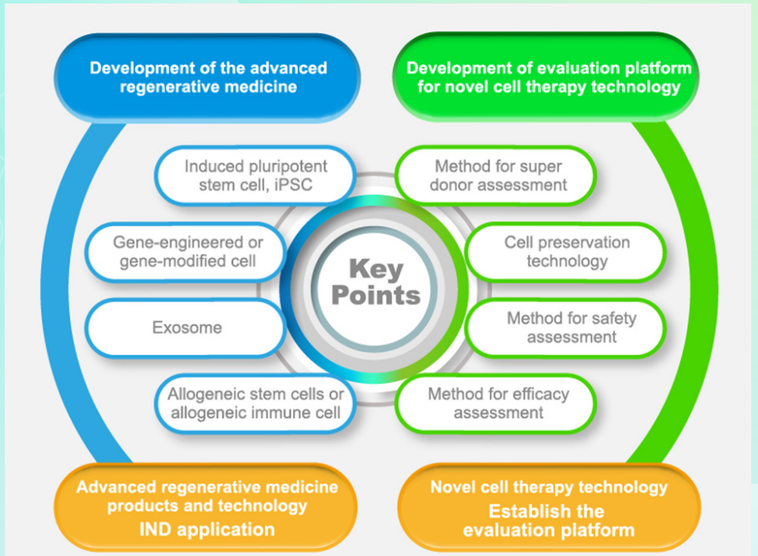
超高齡社會之精準再生醫學啟航計畫：

台灣即將於 2025 年正式邁入超高齡化社會，人口結構的急遽變化使得高齡族群老化與失能病患照護所產生的「未被滿足的醫療需求」顯著增加。就全球發展趨勢來看，以「細胞治療為核心的再生醫學」將會是未來解決老化、失能以及未被滿足醫療需求最具有發展潛力的方案。本計畫因應政府於 2020 年所提出之「台灣 2030 科技願景」，以解決「未被滿足的醫療需求」為訴求規劃未來的醫療樣態，推動細胞治療走向「精準化、產業化」。

有鑑於細胞治療的高度異質性與複雜度，為建立精準化治療及安全性與有效性的評估平台，本計畫規劃兩大推動重點，方向如下：

In 2025, Taiwan will officially become a super-aged society. The sharp changes in the demographic structure have significantly increased the unmet medical needs for the care of the aging population. From the perspective of global development trends, cell therapy-based regenerative medicine holds the greatest potential for addressing aging, disability, and unmet medical needs in the future. In response to the "Taiwan 2030 Science and Technology Vision" proposed by the government in 2020, this program aims to promote research into new therapeutic methods and strategies to fulfill these unmet medical needs, as well as to advance the progress of cell therapy towards precision and industrialization.

Given the high heterogeneity and complexity of cell therapy, this plan outlines two major focal points to establish platforms for precision treatment and the evaluation of safety and effectiveness as follows:



本計畫將以此雙主軸策略將基礎再生醫學研究連接至臨床轉譯醫學，同時致力改善細胞治療產品之品質，以提升國人之醫療效能與治療精準性，期將完善細胞產業供應鏈，促使再生醫療產業化之發展，達成促進全民健康福祉。

By adopting the two strategies mentioned above, this program will facilitate the translation of regenerative medicine into clinical practice while enhancing the efficacy and precision of treatments by improving the quality of cell therapy products. The expected outcomes of this program will further complete the cell supply chain, fostering the industrialization of regenerative medicine and benefiting public health.

推動辦公室 DCB 生物技術開發中心 Development Center for Biotechnology

HLA 超級捐贈者 iPS 幹細胞於精準再生醫學之應用

研發單位 »

中央研究院 生物醫學科學研究所

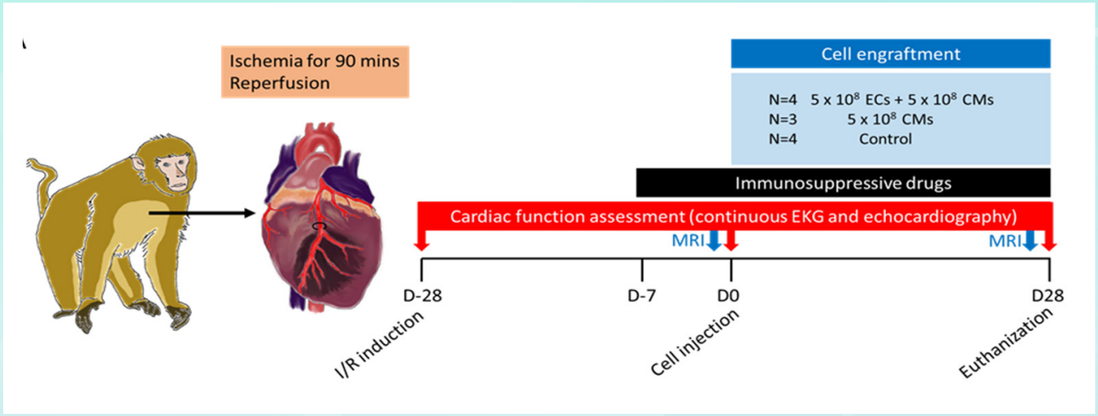
計畫主持人 »

謝清河 特聘研究員

技術簡介 »

人類誘導型多潛能幹細胞 (Induced Pluripotent Stem Cell, iPSC) 對於再生醫學的發展扮演極重要的角色。目前雖可建立病人之 iPSC 並分化成特定細胞用於自體 (Autologous) 移植並使組織再生，但其時效性與高成本仍是急需克服的兩大難題；使用異體 (Allogenic) 細胞雖可省去產製時間，但會產生免疫排斥的問題。因此，建立台灣 HLA 代表性基因型之超級捐贈者 iPSC 及細胞庫便成為推動異體細胞移植的首要目標之一。

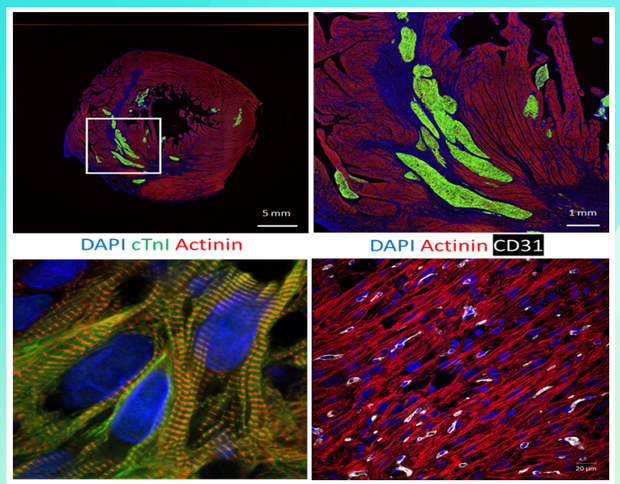
本計畫進行健康受試者招募，找出超級捐贈者後，將其周邊血液細胞於「人體細胞組織優良操作規範 (GTP)」實驗室重編程為臨床等級之 iPSC、建立台灣 iPSC 細胞庫，再進一步將其分化成內皮細胞與心肌細胞後，以動物疾病模式測試其療效，最終申請人體試驗倫理委員會 (IRB) 與新藥臨床試驗 (IND)，進入人體細胞治療臨床試驗。



【圖1】非人類靈長類心肌梗塞模式之實驗設計。

技術優勢 »

謝清河教授為「人類疾病誘導型多潛能幹細胞 (iPSC) 服務聯盟」之總主持人、國內再生醫學領域翹楚，以此全台第一且唯一之核心設施九年來所累積的成熟技術與豐富經驗作為此計畫之基石，不僅可產出穩定且高品質的細胞、成功建立台灣 iPSC 細胞庫；憑藉本團隊與國際知名專家學者多年來之合作默契，更能整合國際合作之豐沛資源與量能，以動物實驗為基礎，進一步推動人體細胞治療臨床試驗，達成精準化醫療之應用。本計畫相關細胞治療之靈長類研究已發表於心血管領域頂尖期刊 -Circulation (IF: 39.918)。



【圖2】非人類靈長類心肌梗塞模式之相關實驗數據。

應用領域 / 適應症 »

本計畫擬透過招募，找出超級捐贈者，於 GTP 細胞處理中心完成臨床等級 iPSC 建立後，利用其可代表台灣人族群的特性，更能達成精準醫療的目的，並將在未來申請臨床試驗，推向商品化，以造福多數病人，推動 iPS 細胞治療。除此之外，亦可將其 iPSC 細胞株進一步分化為內皮及心肌、肝臟、胰島、神經、血液等細胞，在各領域具有極大之潛在應用價值。

技術發展期程 »

專利狀況 »

尚無

聯絡方式 »

聯絡人 阮淑倩 專案研究人員
Email ruanpapapa@gmail.com
電話 +886-2-2652-3002

Precise Tissue Regeneration Using HLA Superdonor iPS Cells

Institution »

Institute of Biomedical Sciences, Academia Sinica

Principal Investigator »

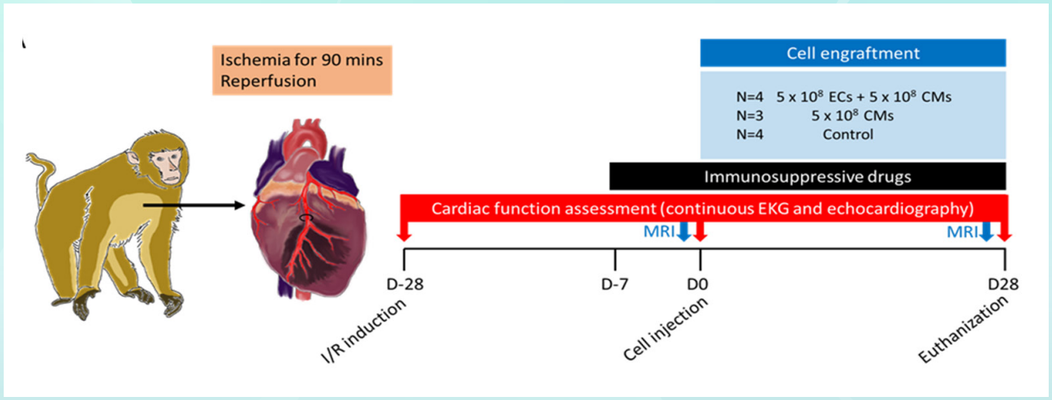
Patrick Ching-Ho Hsieh, Distinguished Research Fellow

Introduction »

Human induced pluripotent stem cells (iPSCs) play a crucial role in the development of regenerative medicine. Currently, iPSCs can be derived from patients and differentiated into specific cells for autologous transplantation, facilitating tissue regeneration. However, challenges such as time efficiency and high costs remain significant hurdles. While using allogeneic cells could save production time, it raises concerns about immune rejection.

Therefore, establishing a repository of iPSCs from Taiwan's super donors with representative HLA genotypes has become a primary goal to promote allogeneic cell transplantation.

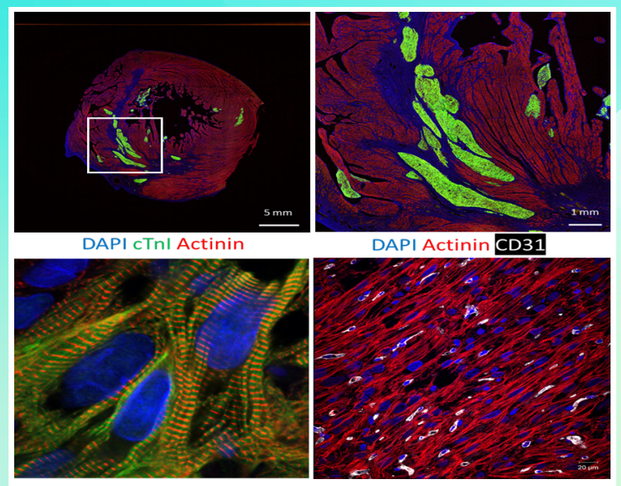
This project involves recruiting healthy volunteers to identify super donors. Peripheral blood cells from these donors will be reprogrammed into clinically compliant iPSCs at the Good Tissue Practice (GTP) laboratory. A Taiwan iPSC cell bank will be established, and these iPSCs will be differentiated into endothelial and cardiac cells. Their therapeutic efficacy will be tested in animal disease models, and applied for the Institutional Review Board (IRB) and Investigational New Drug (IND) for clinical trials of human cell therapy.



[Figure 1.] Experimental Design of Non-human Primate Myocardial Infarction Model.

Competitive Edge »

Professor Dr. Ching-Ho Hsieh is the principal investigator of the " Human Disease iPS Cells Service Consortium " and a leading figure in the field of regenerative medicine in Taiwan. Utilizing the mature technology and extensive experience accumulated over the past nine years from this first and only core facility in Taiwan as the foundation for this project, the team can produce stable and high-quality cells and successfully establish the Taiwan iPSC cell bank. With the team's long-standing collaboration with internationally renowned experts and scholars, the team can also integrate abundant international resources and capacities. Based on animal experiments, the team aims to further advance clinical trials of human cell therapy to achieve the application of precision medicine. The related primate research in cell therapy under this project has been published in the top cardiovascular journal, Circulation (IF: 39.918).

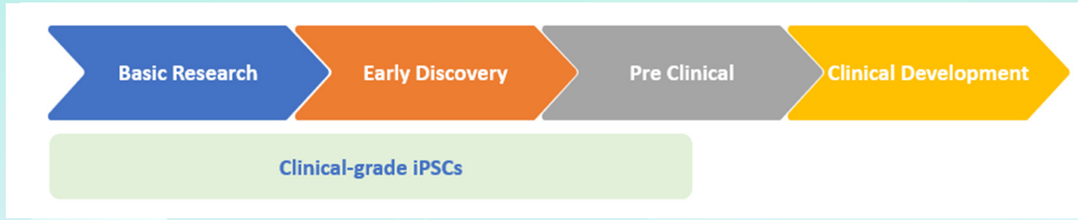


[Figure 2.] Related Experimental Data of Non-human Primate Myocardial Infarction Model.

Application/Indication »

This project aims to recruit super donors to establish clinical-grade iPSCs at the GTP Cell Processing Center. These iPSCs will represent the genetic diversity of the Taiwanese population, facilitating precision medicine. Future plans include applying for clinical trials to commercialize iPSC therapies, benefiting numerous patients and advancing iPSC therapy. Additionally, these iPSC lines can be differentiated into various cell types such as endothelial, cardiac, hepatic, pancreatic islet, neural, and blood cells, offering significant potential applications across multiple fields.

Development Status »



Patent Status »

No

Contact »

Name Shu-Chian Ruan, Project Research Fellow
Email ruanpapapa@gmail.com
Tel +886-2-2652-3002

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National Science and Technology Council

低免疫原性人類誘導多潛能幹細胞治療平台

研發單位 »

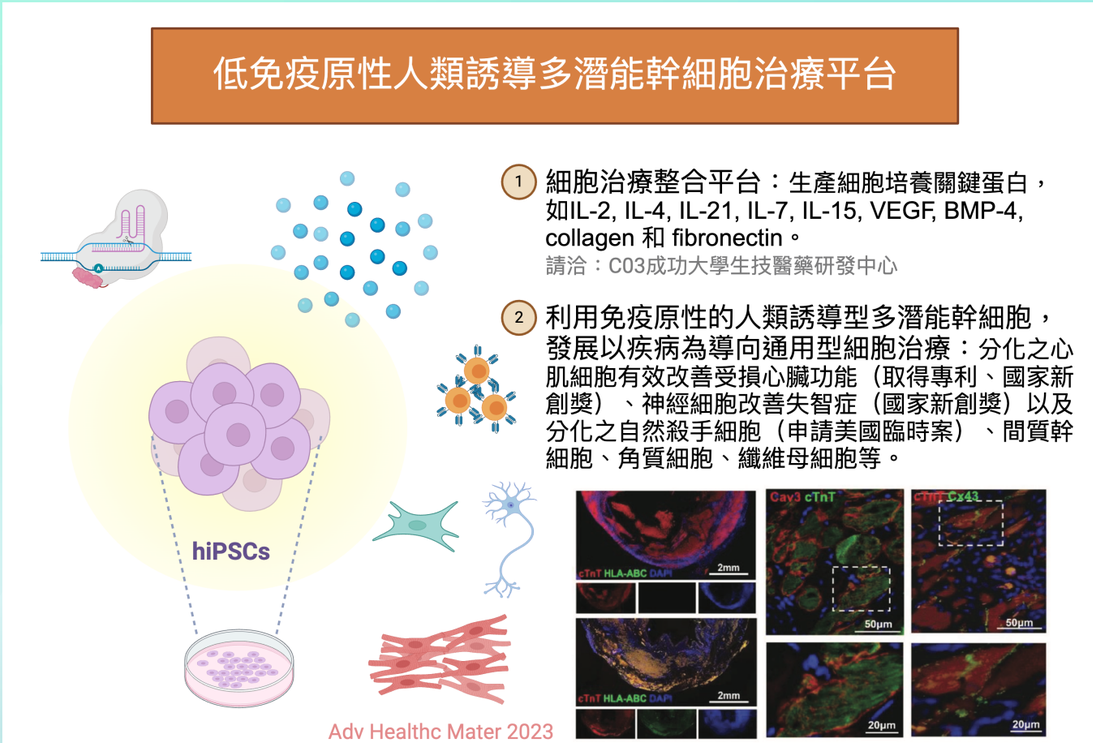
國立成功大學醫學院

計畫主持人 »

沈延盛 院長 / 特聘教授

技術簡介 »

本技術利用基因編輯、產製細胞培養關鍵蛋白等新穎方法，建立低免疫原性的人類誘導型多潛能幹細胞 (human induced pluripotent stem cells, hiPSCs)，降低異體間免疫排斥作為「通用細胞」來源，用於治療各種退化性及罕見遺傳疾病。目前該技術所分化低免疫原性心肌細胞，可有效改善受損的心臟功能，這項成果目前已通過專利並受到國家新創獎的肯定。另外，本技術分化之神經細胞、自然殺手細胞、間質幹細胞等陸續進入臨床前動物試驗，並持續開發臨床級細胞製品，推向臨床試驗階段。期待在展會上尋找合作夥伴，共同推動這一創新技術的臨床應用，提供病患治療的新希望。



超高齡社會之精準再生醫學啟航計畫 期中成果發表會

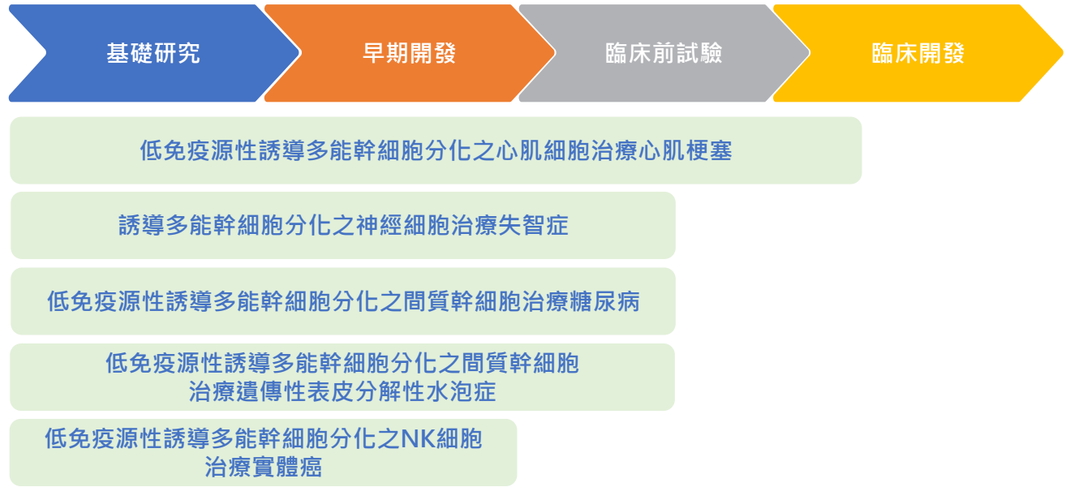
技術優勢 »

該技術突破傳統細胞療法的限制，能夠降低異體間免疫排斥，並具有大量生產、成本低廉且易於標準化，有望大幅降低治療成本，提高療效。

應用領域 / 適應症 »

1. 心肌梗塞：利用低免疫源性 hiPSCs 分化心肌細胞，移植後可取代壞死的心肌組織修復心臟收縮功能。
2. 失智症：hiPSCs 分化神經細胞有效改善額顳葉退化之失智症。
3. 糖尿病治療：利用低免疫源性 hiPSCs 分化間質細胞或是胰臟前驅細胞，可降低血糖，促使組織再生。
4. 遺傳性表皮分解性水泡症：利用低免疫源性 hiPSCs 分化成間質細胞、角質細胞或是纖維母細胞，促進患者皮膚再生。
5. 癌症治療：利用低免疫源性 hiPSCs 分化自然殺手細胞，並可進一步裝載 Chimeric Antigen Receptor，達到標靶治療的效果。

技術發展期程 »



專利狀況 »

中華民國專利發明第 I785479 號
(TW110103261/TWI785479B/TW202228738A)
發明名稱：羊水源性心肌細胞之醫藥配置品及其餘治療心肌梗塞之用途
專利權人：國立成功大學
發 明 人：劉嚴文
專利權期間：自 2022 年 12 月 1 日至 2041 年 1 月 27 日止

聯絡方式 »

聯絡人 李博士
Email ryichenli@gmail.com
電話 +886-6-2353535
#4207 or #1325

Hypoimmunogenic Human Induced Pluripotent Stem Cell Therapy Platform

Institution »

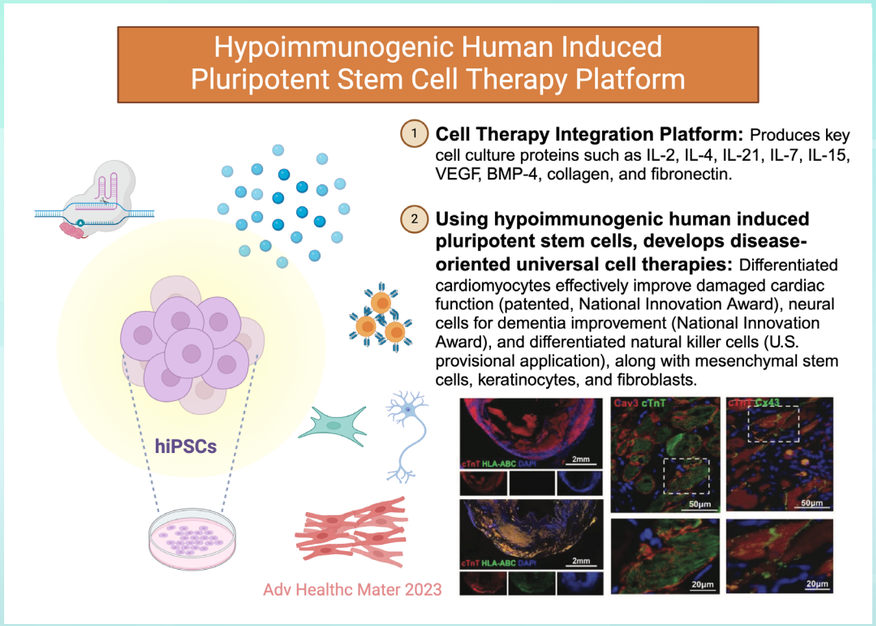
College of Medicine, National Cheng Kung University

Principal Investigator »

Yan-Shen Sha, Dean, M.D., Ph.D.

Introduction »

This technology utilizes innovative methods such as gene editing and the production of key proteins for cell culture to develop hypoimmunogenic human induced pluripotent stem cells (hiPSCs), reducing xenogeneic immune rejection and serving as a universal cell source for treating various degenerative and rare genetic diseases. Currently, the technology's derived hypoimmunogenic cardiomyocytes can effectively improve damaged cardiac function. This achievement has been patented and recognized by the National Innovation Award. Additionally, this technology has advanced nerve cells, natural killer cells, and mesenchymal stem cells into preclinical animal trials and continues to develop clinical-grade cell products for clinical trials. We look forward to finding partners at the exhibition to jointly promote the clinical application of this innovative technology, offering new hope for patient treatment.



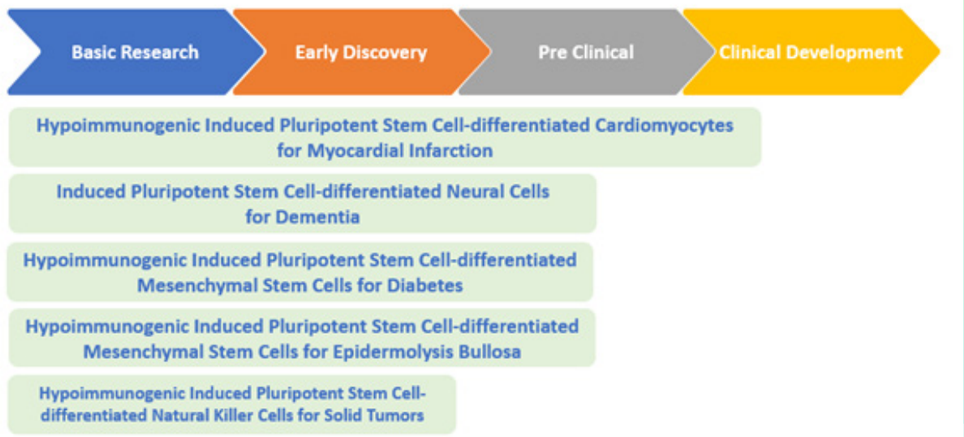
Competitive Edge »

This technology transcends traditional cell therapy limitations by reducing xenogeneic immune rejection and features mass production, low cost, and ease of standardization. It promises significant cost reductions in treatment and enhanced efficacy.

Application/Indication »

1. **Myocardial Infarction:** Utilizing hypoimmunogenic hiPSCs differentiated into cardiomyocytes to replace necrotic cardiac tissue and restore cardiac function.
2. **Dementia:** hiPSCs differentiated into nerve cells effectively improved dementia associated with temporal lobe degeneration.
3. **Diabetes Treatment:** Using l hypoimmunogenic hiPSCs differentiated into mesenchymal stem cells or pancreatic precursor cells to ameliorate hyperglycemia and promote tissue regeneration.
4. **Epidermolysis Bullosa:** hypoimmunogenic hiPSCs differentiated into mesenchymal cells, keratinocytes, or fibroblasts to enhance skin regeneration in patients.
5. **Cancer Treatment:** Hypoimmunogenic hiPSCs differentiated into natural killer cells, potentially enhanced with chimeric antigen receptors for targeted therapy.

Development Status »



Patent Status »

Taiwan Patent/ Patent NumberI785479
(TW110103261/TWI785479B/TW202228738A)
Title: Pharmaceutical preparations of amniotic fluid-derived cardiomyocytes and uses thereof on treating myocardial infraction.
Applicant: National Cheng Kung University
Inventor: LIU, YEN WEN (TW)
Issued Date: 2022/12/01~2041/01/27

Contact »

Name Li, Ph.D.
Email ryichenli@gmail.com
Tel +886-6-2353535 #4207 or #1325

誘導多能幹細胞 iPSC 生醫檢測晶片與精準再生臨床治療試驗平台

研發單位 »

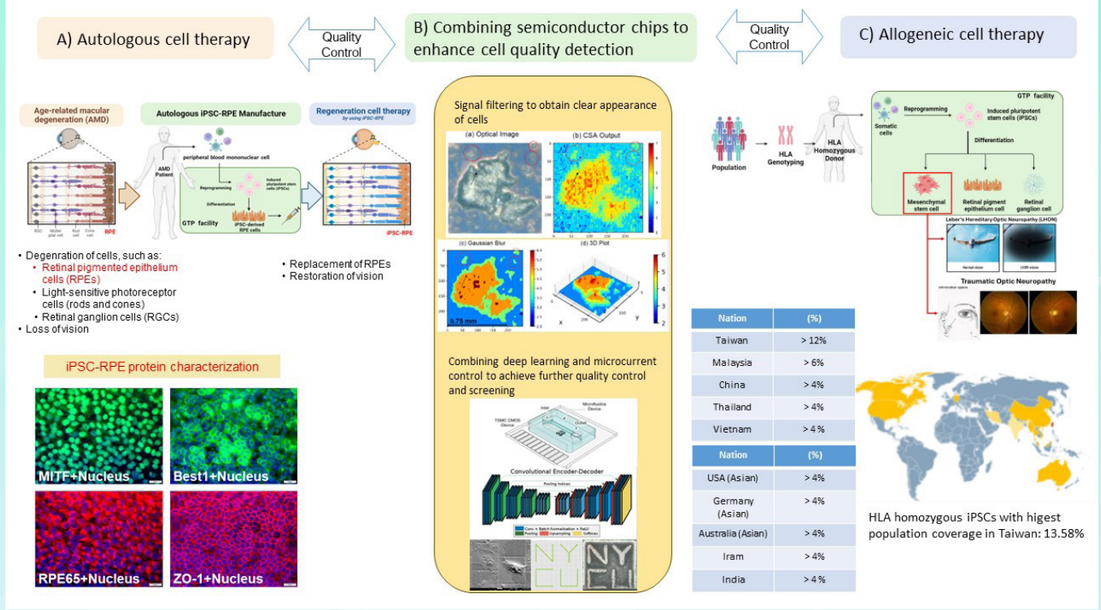
國立陽明交通大學藥理學研究所

計畫主持人 »

邱士華 特聘教授

技術簡介 »

製備臨床 GTP 等級的 iPSC：以低侵入性的抽血方式取得周邊血細胞，制定標準化的操作流程並依據臺北榮總 GTP 核心實驗室的入庫需求，生產 GTP 等級 iPSC。並進一步誘導為 GTP 等級工作細胞 iPSC-RPE 及 iPSC-MSC 等等。透過 GLP 安全性驗證實驗，驗證經過此標準操作流程的產品細胞具有可靠的臨床安全性。並透過基因篩選策略，選出具有 HLA 純合子 iPSC 細胞庫，進而擴大臨床應用範圍。



Nation	(%)
Taiwan	> 12%
Malaysia	> 6%
China	> 4%
Thailand	> 4%
Vietnam	> 4%
Nation	(%)
USA (Asian)	> 4%
Germany (Asian)	> 4%
Australia (Asian)	> 4%
Iram	> 4%
India	> 4%

A) 採用老年黃斑部病變病人周邊血再編程為 iPSC，進而分化為自體 iPSC-RPE，藉補充自體 RPE 以恢復視覺功能。

B) 利用半導體晶片平台建構 iPSC 品質管控流程，自動化、高精度與高通量的檢測與篩選，可促使細胞製程更先進更快速。

C) 純合子 HLA 貢獻者，其分型有極高族群覆蓋度 (台灣：13.58%) 而具廣泛異體治療潛力。分化為 iPSC-MSCs，有望治療其他視神經病變疾病如 LHON。

建立先進的細胞培養與晶片系統平台：採用半導體生醫晶片技術，建立先進的細胞培養與晶片系統平台，並透過提高感測靈敏度、開發可程式化 DEP 晶片、優化校正演算法和影像處理，成功達到了建構 iPSC 檢測平台的目標，並具有高通量與高精度的特性。這將有助於細胞品質分析模型的驗證，提升幹細胞檢測的可複製性、可靠度和檢測量能，為再生醫學領域的研究和應用提供了關鍵的技術支持。

技術優勢 »

iPSC-MSC 之重新編程及分化，除利用邱士華教授團隊先前取得的新穎 iPSC 誘導因子外，更利用邱士華教授及其團隊新開發的多功能生物支架系統，此系統能夠相容現有常見之 iPSC 建立方式，並不影響細胞性質並取得高細胞轉染效率，大幅減少 iPSC 在產品化的技術與實作障礙，並提高批次間穩定性，更有利於 iPSC-MSC 品質管控。

篩選出的純合子 iPSC，中國大陸、香港、南韓，以及越南、泰國、北美洲華人區域都有高比例相同 HLA 分型。這使得這一純合子不僅能滿足台灣本土需求，同時具有亞洲人適用性，提供全球再生醫學同種異體使用市場的獨特與競爭性優勢。

本團隊致力於建立了一個優越的細胞培養與晶片系統平台，一方面能讓本團隊設計優良的晶片得以發揮優勢，另一方面能夠與現有的生物技術接軌。使用非均勻電場操縱和分離細胞的技術一介電泳 (DEP)，複雜且可編程電場模式的 CMOS 技術，提供了用於生成可編程電場模式的集成控制電路。此外，側向負 DEP 力將細胞從晶片表面排斥，減少細胞附著風險，並消除對頂板的需求。晶片與傳統培養皿兼容，可整合到現有細胞培養過程中。在台灣，半導體製造實力的支持下，生物技術和半導體融合的前景非常光明，有望為全球生物製程產業帶來技術上的領先優勢。

應用領域 / 適應症 »

iPSC 分化出的 iPSC-RPE 可應用於老年性黃斑部病變的自體移植上。目前於臨床前試驗的結果，實驗小鼠於移植之後，無產生排斥或是致瘤等不良反應。此外，也有文獻指出利用 MSC 具有治療雷伯氏遺傳性視神經萎縮症 (LHON) 的潛力，而利用 iPSC 分化出的 iPSC-MSC 具有 **1. 解決不同來源 MSC 批次間差異 2. 解決 MSC 擴增與老化問題 3. 降低異體移植排斥風險**，之廣泛應用性。

建立出的細胞培養與晶片系統平台可應用於細胞工程的品質管控，建立自動化、高精度的細胞分離技術，減少人力自源的使用，於再生醫學的應用市場具有特別的優勢。

技術發展期程 »

專利狀況 »

美國專利 (證號 : US-2021102174-A1)
中華民國專利 (證號 : I799733)
美國專利申請案第 17/003,799 號
美國發明專利第 11,866,734 號

聯絡方式 »

聯絡人 楊逸萍 博士
Email molly0103@gmail.com
電話 +886-2-2871-2121 #24184

Induced pluripotent stem cell (iPSC) biomedical detection chip and precision regenerative clinical treatment trial platform

Institution »

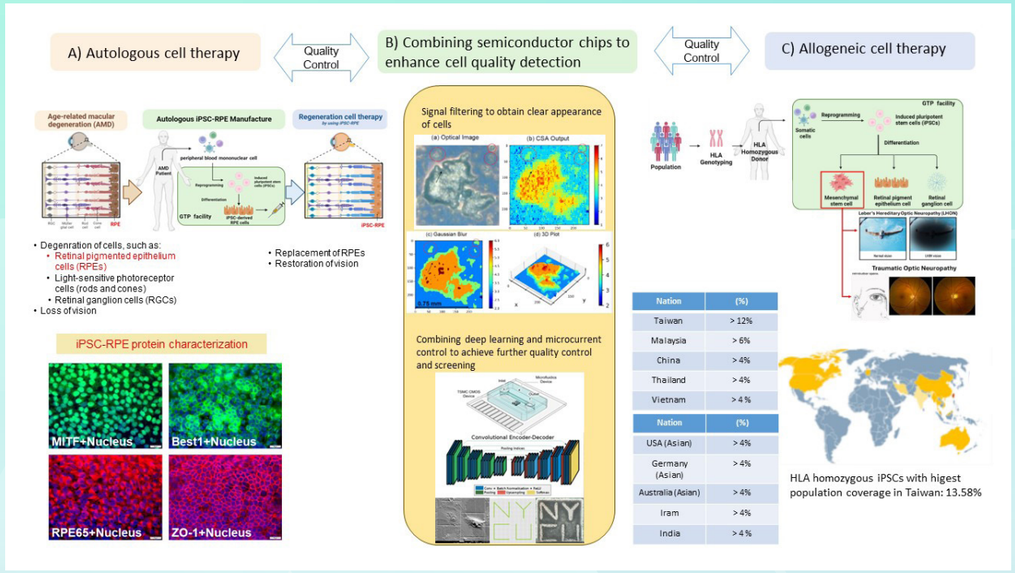
Institute of Pharmacology, College of Medicine, National Yang Ming Chiao Tung University

Principal Investigator »

Shih-Hwa Chiou, Distinguished Professor, M.D., Ph.D.

Introduction »

Preparation of clinical GTP-grade iPSCs: Peripheral blood cells are obtained through a low-invasive blood drawing method, standardized operating procedures are developed, and GTP-grade iPSCs are produced according to the warehousing requirements of Taipei veterans general hospital GTP core laboratory. And further induced differentiation into GTP-level working cells iPSC-RPE and iPSC-MSC, etc. Through GLP safety verification experiments, it is verified that the product cells that have gone through this standard operating procedure have reliable clinical safety. Through genetic screening strategies, HLA homozygous iPSC cell banks are selected to expand the scope of clinical application.



A) Peripheral blood mononuclear cells of patients with age-related macular degeneration would be reprogramed into iPSC, and then differentiate into autologous iPSC-RPE for treatment.
B) Using the semiconductor chip platform to do iPSC QC. Its automated, high-precision and high-throughput detection and screening can make the cell manufacturing process more advanced and faster.
C) Homozygous-HLA donors, whose genotype has high ethnic coverage (Taiwan: 13.58%) and has extensive allogeneic therapeutic potential. Differentiation into iPSC-MSCs is expected to treat other optic neuropathy diseases such as LHON and TON.

Establish an advanced cell culture and chip system platform: Using semiconductor biomedical chip technology to establish an advanced cell culture and chip system platform, and by improving sensitivity, developing programmable DEP chips, optimizing correction algorithms and image processing, we successfully achieved the goal of building an iPSC detection platform. And has the characteristics of high throughput and high precision. This will help verify the cell quality analysis model, improve the reproducibility, reliability and capacity of stem cell detection, and provide key technical support for research and application in the field of regenerative medicine.

Competitive Edge »

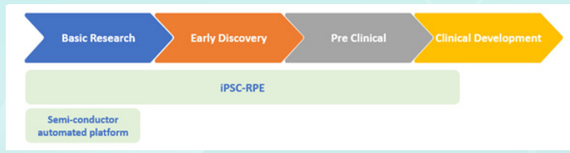
The reprogramming and differentiation of iPSC-MSCs utilize novel induction factors and a multifunctional biological scaffold system developed by Professor Chiou Shih-Hwa's team. This system is compatible with common iPSC establishment methods, achieving high cell transfection efficiency without affecting cell properties, thus reducing commercialization obstacles and improving batch stability for iPSC-MSC quality control. The HLA typing of homozygous iPSCs matches a high proportion of Asians, including in Malaysia, China, Hong Kong, South Korea, Vietnam, Thailand, and Chinese regions in North America, providing a competitive advantage in the global regenerative medicine market. The team aims to establish a superior cell culture and chip system integrating biotechnology with dielectrophoresis (DEP) and CMOS technology, enhancing cell manipulation and separation. Supported by Taiwan's semiconductor manufacturing, this integration promises to bring technological leadership to the global bioprocess industry.

Application/Indication »

iPSC-RPE differentiated from iPSCs can be used for autologous transplantation of age-related macular degeneration. Current preclinical test results show that experimental mice did not experience adverse reactions such as rejection or tumorigenesis after transplantation. In addition, some literature has pointed out that the use of MSC has the potential to treat Leber's hereditary optic atrophy (LHON), and homozygous-HLA iPSC-MSC differentiated from iPSC has the following functions: 1. Solve the differences between MSC batches from different sources; 2. Solve the problem of MSC expansion and aging problem 3. Reduce the risk of allogeneic transplant rejection and its wide applicability.

The established cell culture and chip system platform can be used for quality control of cell engineering, establishing automated and high-precision cell separation technology, reducing the use of manpower, and has special advantages in the application market of regenerative medicine.

Development Status »



Patent Status »

US patent: No. US-2021102174-A1
R.O.C patent: No. I799733
US invention patent 11,866,734

Contact »

Name Yi-Ping Yang, Ph.D.
Email molly0103@gmail.com
Tel +886-2-2871-2121 #24184

開發細胞生產及品質測試平台以應用於皮膚與角膜內皮再生醫學

研發單位 »

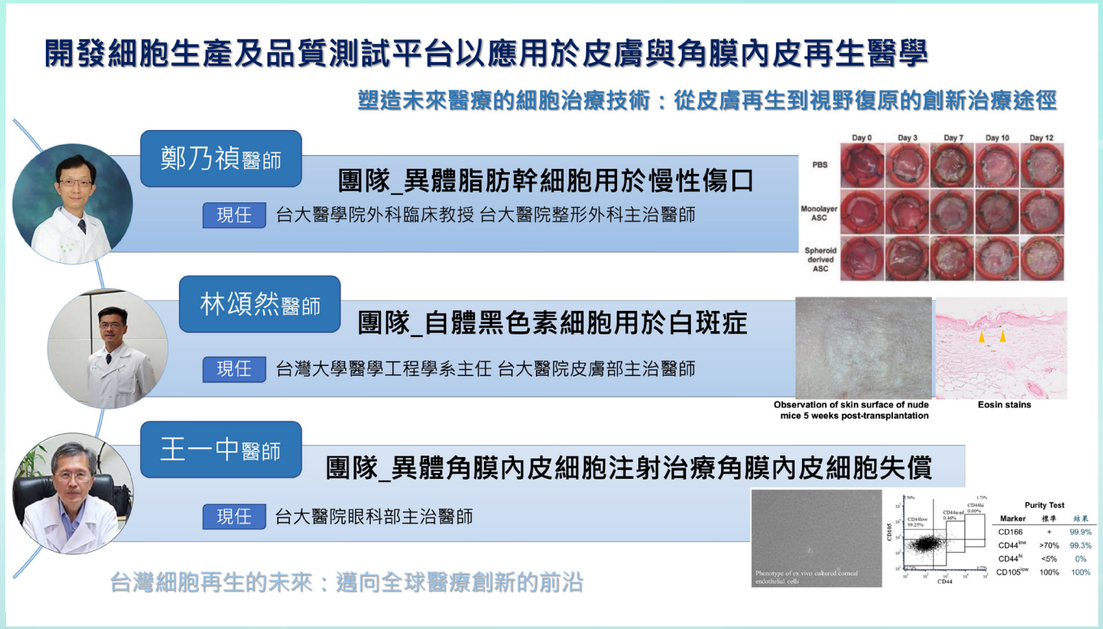
國立臺灣大學醫學院外科

計畫主持人 »

鄭乃禎 教授

技術簡介 »

在當代醫學領域，細胞治療技術的創新對於提升患者生活質量扮演著關鍵角色。我們的研究團隊專注於開發細胞生產及品質測試平台，旨在應用於皮膚與角膜內皮再生醫學。透過三大核心技術一皮膚傷口癒合、白斑症治療以及水泡性角膜病變的治療，旨在透過這些方法提升治療成效，從而改善患者的日常生活。首先，團隊開發了一種異體脂肪幹細胞貼片，這種貼片能夠促進細胞再生，特別是對於慢性傷口患者具有顯著的治療效果。其次，採用自體黑色素細胞移植技術，對於白斑症患者，這項技術能夠有效補充失去的黑色素細胞，幫助患者的皮膚恢復正常色素。最後，針對角膜內皮細胞失償，研發異體角膜內皮細胞注射療法，這種療法有望縮短病患等候移植的時間。這些創新方法有望解決迫切的臨床問題，為患者帶來希望。



技術優勢 »

本技術的競爭優勢在於其創新性和多功能性。首先，異體脂肪幹細胞貼片的開發，為患者提供了一種有效的慢性傷口治療方案，這是傳統治療所無法達成之再生醫療。其次，自體黑色素細胞移植技術的應用，能夠針對白斑症患者恢復皮膚色素，這不僅提高了治療的成功率，也改善了患者的自信和社交生活。最後，異體角膜內皮細胞注射療法為角膜內皮細胞失償帶來了新的希望，這種療法有潛力降低手術風險並提高治療效果。這些技術的結合，不僅提升了治療效果，也為患者提供了更全面的治療選擇，展現了我們在細胞治療與再生醫學領域的領先地位。

應用領域 / 適應症 »

本技術的應用領域主要集中在皮膚疾病與眼科疾病的細胞再生治療。對於皮膚方面，這項技術適用於慢性傷口患者的治療，以及白斑症的黑色素細胞恢復。異體脂肪幹細胞貼片的開發，特別針對難以癒合的傷口提供了一種新的治療選擇，而自體黑色素細胞移植則為白斑症患者帶來了色素恢復的可能。在眼科領域，角膜內皮細胞失償的治療則是這一技術的另一大應用領域。異體角膜內皮細胞注射療法不僅有望提供一種有效的治療選擇，還可能降低手術後的排斥反應，並提高角膜捐贈的效率。這些應用領域的開拓，不僅展現了細胞治療技術的創新，也為患者提供了更多的治療選擇，從而提高了生活品質與治療成效。

技術發展期程 »

專利狀況 »

三項技術已規劃將申請專利。專利申請涵蓋了異體脂肪幹細胞貼片、自體黑色素細胞移植技術，以及異體角膜內皮細胞注射療法等多項創新治療方法。這些智慧財產權反映了我們技術的獨特性和潛在的商業價值，期待未來能成功授權，以嘉惠病患。

聯絡方式 »

聯絡人 范邁儀 博士
Email maiyifan@ntuh.gov.tw
電話 +886-2-2312-3456 #262963

Development of Cell Generation and Quality Assessment Platform for Skin and Corneal Endothelium Regenerative Medicine Application

Institution »

Department of Surgery of NTUH

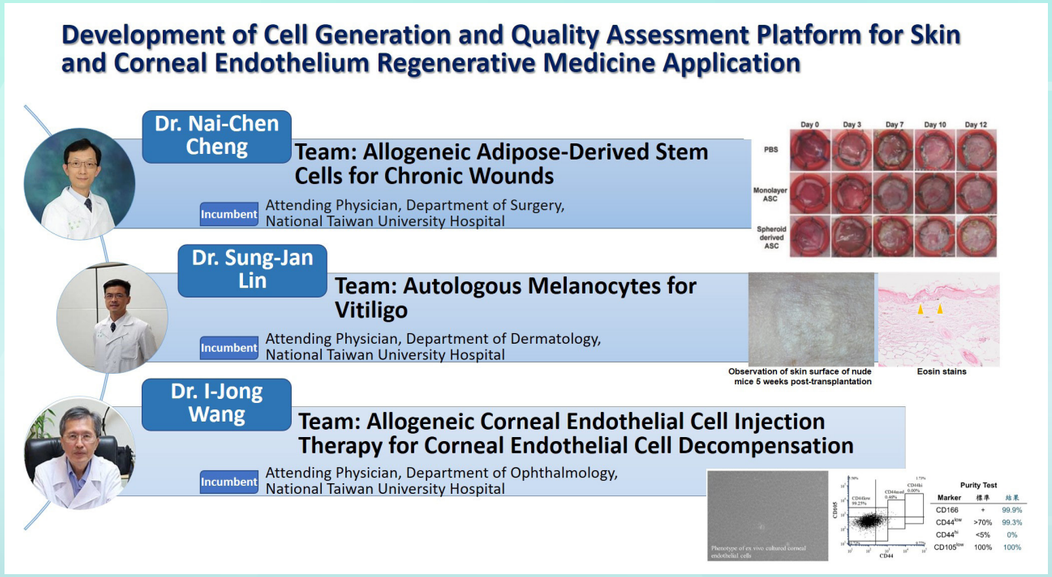
Principal Investigator »

Nai-Chen Cheng, Professor, M.D., Ph.D.

Introduction »

In contemporary medical fields, innovations in cell therapy technology play a crucial role in enhancing patients' quality of life. Our research team focuses on developing cell production and quality testing platforms aimed at applications in skin and corneal endothelial regenerative medicine. Through three core technologies—skin wound healing, vitiligo treatment, and corneal endothelial cell dysfunction treatment—we aim to improve treatment outcomes and enhance patients' daily lives.

Firstly, the team has developed an allogeneic adipose-derived stem cell patch that promotes cell regeneration, particularly effective for chronic wounds in various patients. Secondly, we employ autologous melanocyte transplantation technology, which effectively replenishes lost melanocytes for vitiligo patients, helping restore normal skin pigmentation. Lastly, for corneal endothelial cell dysfunction, we have developed an allogeneic corneal endothelial cell injection therapy, which promises a breakthrough treatment for this challenging ophthalmic condition. These innovative methods aim to address urgent clinical issues and bring hope to patients.



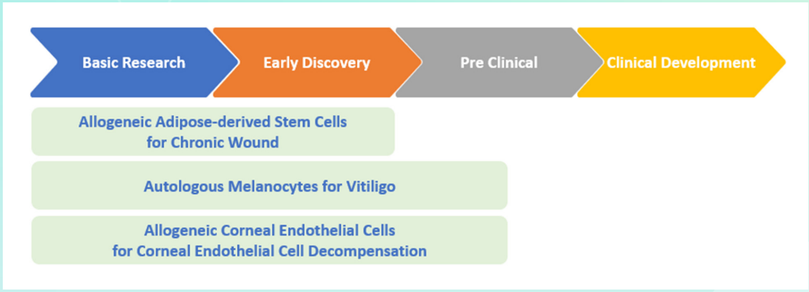
Competitive Edge »

The competitive advantage of this technology lies in its innovation and versatility. Firstly, the development of allogeneic adipose-derivedstem cell patches offers an effective treatment for chronic wound patients, resulting in tissue regeneration which is unprecedented in traditional therapies. Secondly, the application of autologous melanocyte transplantation restores skin pigmentation for vitiligo patients, enhancing treatment success and improving patients' confidence and social life. Lastly, allogeneic corneal endothelial cell injection therapy brings new hope for corneal endothelial cell dysfunction, potentially reducing surgical risks and improving outcomes. These combined technologies not only enhance treatment efficacy but also provide comprehensive options, showcasing our leading position in regenerative medicine.

Application/Indication »

The primary applications of this technology are in the cellular regenerative treatments for skin and ophthalmic diseases. For skin, it is used in promoting healing for chronic wound patients and melanocyte restoration in vitiligo. The development of allogeneic adipose-derived stem cell patches offers a new treatment option for hard-to-heal wounds, while autologous melanocyte transplantation provides a possibility for pigment recovery in vitiligo patients. In ophthalmology, the treatment of corneal endothelial cell dysfunction is another significant application. Allogeneic corneal endothelial cell injection therapy not only promises an effective treatment option but may also reduce postoperative rejection and increase the efficiency of corneal donations. These advancements not only showcase the innovation in cell therapy techniques but also offer patients more treatment choices, thereby improving their quality of life and treatment outcomes.

Development Status »



Patent Status »

Three technologies are planned for patent application and are currently in the drafting stage. The patent applications cover innovative treatment methods, including allogeneic adipose-derived stem cell patches, autologous melanocyte transplantation, and allogeneic corneal endothelial cell injection therapy. These applications reflect the uniqueness and potential commercial value of our technologies, and we look forward to successful commercialization to benefit the patients in the future.

Contact »

Name Mai-Yi Fan, Ph.D.
Email maiyifan@ntuh.gov.tw
Tel +886-2-2312-3456 #262963

以奈米技術轉殖的雙基因修飾間質幹細胞——創新癌症治療

研發單位 »

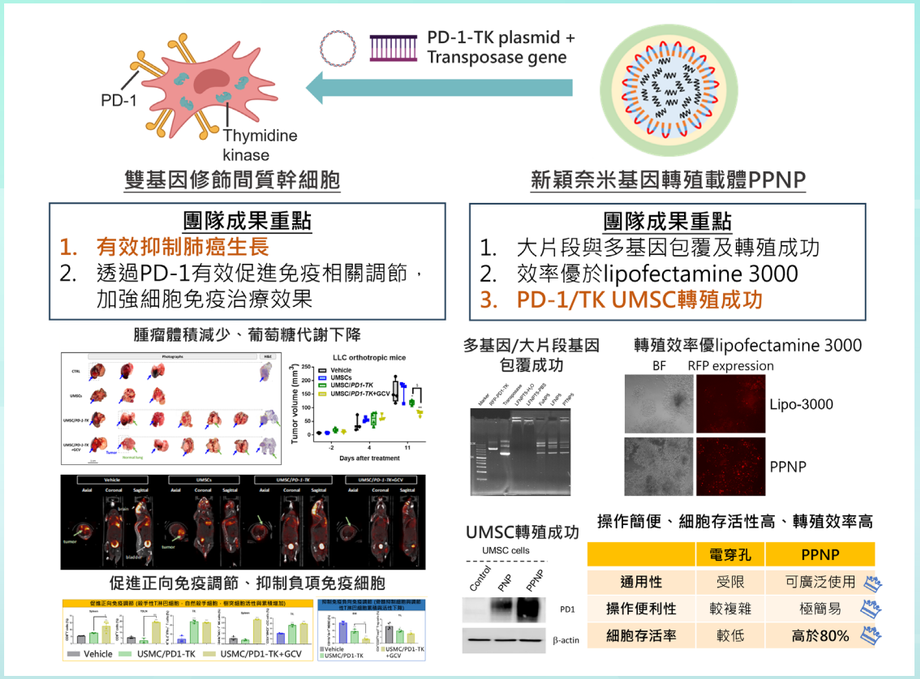
中國醫藥大學

計畫主持人 »

鄭隆賓 講座教授

技術簡介 »

團隊結合「幹細胞技術」、「基因編輯」及「奈米基因載體」等技術，致力開發新型免疫治療策略，打造奈米基因轉殖平台（PPNP）。並透過 PPNP 攜帶功能基因，打造雙基因修飾間質幹細胞（UMSC/PD-1-TK）。UMSC/PD-1-TK 能活化免疫系統、創造旁觀者效應，在動物癌症模型上帶來顯著療效，亦是一項異體細胞治療技術，可作為立即使用型細胞治療，解決臨床應用的困境。PPNP 為一新型非病毒載體，可大幅改善電穿孔和脂質轉殖的安全性問題，高效率地傳遞大片段（即 bp >10k）及多重基因至目標細胞，相比市售最新商用劑型，PPNP 產率更高，更證實可應用於多種細胞，克服了現行非病毒載體在幹細胞與 T 細胞中傳遞效率低落的問題，成為一高通用性平台。現階段，電轉與奈米平台細胞產品在非小細胞肺癌模型中均達到顯著療效，並進入工業化製造評估，以利後續生產臨床試驗規格細胞治療藥品。這項產品技術和平台為癌症患者提供了全新的免疫療法策略，成為台灣克服實體腫瘤與免疫治療挑戰的重要技術里程碑。



技術優勢 »

PPNP 由高生物相容性、高轉染效果之聚胺基酸與具標靶功能之蛋白所組成，擁有高彈性網狀內核，可裝載不同大小核酸 (1~12k base pair)，可同時傳遞轉殖多條核酸。團隊已成功透過首創的連續性製程合成出經工程化材料篩選的最佳配方 PPNP。此平台與傳統脂質類載體相比除具備高專利性外，也具備高應用擴充性，其內核亦可攜帶各式顯影劑，使此平台可實行細胞監控、進行生物分布測試、及篩選候選產品，加速產品開發進程。此系統，將有潛力達到轉染、顯影、追蹤為一體的新式奈米轉殖技術。

應用領域 / 適應症 »

未來透過雙基因修飾間質幹細胞載體的平台研發，及大數據分析，尋找合適標的基因，設計個人化醫療基因載體，實現精準治療，為癌症病患帶來嶄新的希望。PPNP 的應用領域則可包含體外細胞轉殖，並可能推展應用至體內 mRNA 與 RNAi，成為疫苗或核酸抑制劑，具備重大發展潛力。

技術發展期程 »

目前團隊全力推進 PPNP 轉殖 UMSC/PD-1-TK 系統，預計於本年度進行法規諮詢，並以先前的經驗引導，整合平台開發與生產技術，進行橋接性試驗，以利後續 IND 送件及臨床試驗的開展。

計畫執行項目		112年 (2023)	113年 (2024)	114年 (2025)	115年 (2026)
UMSC/PD-1-TK	動物試驗模型確效	■			
	法規單位諮詢會議		■		
PPNP開發	實驗室製程確立	■			
	放大生產評估		■		
	評估GMP 生產		■		
	GMP compliance生產		■		
樞紐橋接性試驗	表徵一致性			■	
	生物活性一致性			■	
法規單位與臨床試驗	IND送件			■	
	臨床試驗				■

專利狀況 »

PPNP 為全球首創之製造技術，具高度創新性的配方組成，目前已申請專利臨時案，後續也將進行多國專利保護。

聯絡方式 »

聯絡人 江智聖 博士
Email brian.chiang@mail.cmu.edu.tw
電話 +886-4-2205-3366 #1753

NSTC 國家科學及技術委員會
National Science and Technology Council

Innovative Cancer Treatment with Nanotechnology-Transduced Dual-Gene Modified Mesenchymal Stem Cells

Institution »

China Medical University

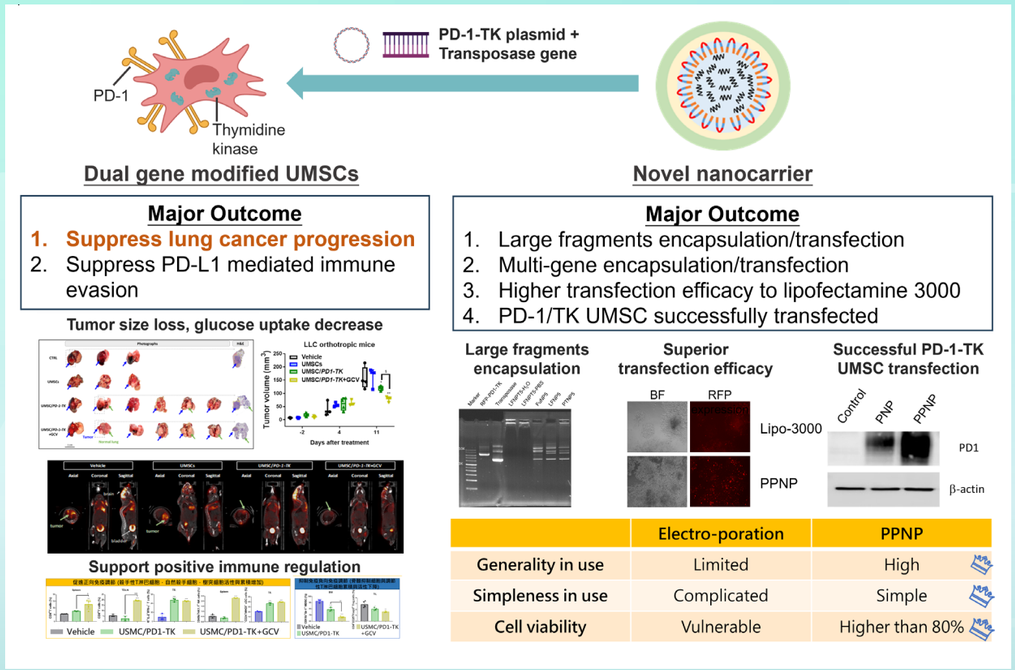
Principal Investigator »

Long-Bin Jeng, Chair Professor, M.D.

Introduction »

Our team has integrated stem cell technology, gene editing, and nanotechnology to develop innovative immunotherapy strategies. This includes dual-gene modified mesenchymal stem cells (UMSC/PD-1-TK) and a nanoparticle-based gene transfection platform (PPNP). We successfully transfected UMSC/PD-1-TK using both electroporation and PPNP, demonstrating significant efficacy in non-small cell lung cancer animal models. We have initiated the evaluation phase for industrial manufacturing, facilitating the production of cell therapy products to meet clinical trial specifications.

PPNP, a polyaminoacid-based nanoparticle, enhances the safety and efficiency of gene transfection compared to electroporation and lipid-based methods, effectively delivering large gene fragments (> 10 kb) and dual genes. Compared to the latest commercial Lipofectamine 3000, PPNP not only has higher efficiency and yield but also ensures effective and safe delivery in various cell types, overcoming the low delivery efficiency in stem cells and T cells seen with Lipofectamine 3000. This versatile platform offers new immunotherapy strategies for cancer patients and marks an important technological milestone in Taiwan's fight against solid tumors and immunotherapy challenges.



	Electro-poration	PPNP
Generality in use	Limited	High
Simpleness in use	Complicated	Simple
Cell viability	Vulnerable	Higher than 80%

Competitive Edge »

Our team has synthesized and optimized PPNP using a pioneering continuous process strategy. Composed of biocompatible polyamino acids and functional human-derived proteins, PPNP offers high patentability and scalability compared to traditional lipid-based vectors. It can encapsulate multiple genes, fluorescent substances, and various imaging agents, enabling cell monitoring, biodistribution testing, and candidate product screening in preclinical trials, thus accelerating product development. The system features a flexible mesh-like core capable of loading nucleic acids ranging from 1-12k base pairs.

Application/Indication »

Considering the clinical application of the nanoplatform technology, we focus on developing PPNP and implementing it through the clinical translation of UMSC/PD-1-TK. Our next step is to leverage big data analysis from China Medical University Hospital to identify potential targets and biomarkers for personalized medicine design. The PPNP platform's application scope includes ex vivo uses such as cell transfection for cell therapy and in vivo mRNA and RNAi delivery for gene therapy and vaccination. This integration holds the potential to achieve precise therapeutic goals and bring new hope to cancer patients.

Development Status »

The FDA responded positively to the Pre-IND meeting on electro-transfected mesenchymal stem cell technology, permitting the waiver of toxicology studies under specific conditions. The team plans to apply for a Pre-IND meeting for PPNP-transfected UMSCs this year. Leveraging previous experiences and integrating platform development, production technologies, and bridging studies, we aim to expedite the IND submission for clinical trials.

Items/Tasks		2023	2024	2025	2026
UMSC/ PD-1-TK	Validation on animal model				
	PIND meeting				
PPNP	SOP validation				
	Scale up				
	GMP evaluation				
	GMP compliance production				
Bridging studies	QC tests consistency				
	Bioequivalence				
Regulatory	IND submission				
	Clinical trials				

Patent Status »

Comprehensive intellectual property protection is crucial due to its significant potential. Collaboration with a patent attorney has verified the uniqueness and innovation of PPNP through a global patent search report. Following the filing of provisional patents, the team looks forward to applying for PCT patents to facilitate the technology's commercialization.

Contact »

Name Chih-Sheng Chiang
Email brian.chiang@mail.cmu.edu.tw
Tel +886-4-2205-3366 #1753

自然殺手細胞新穎癌症標靶療法

研發單位 »

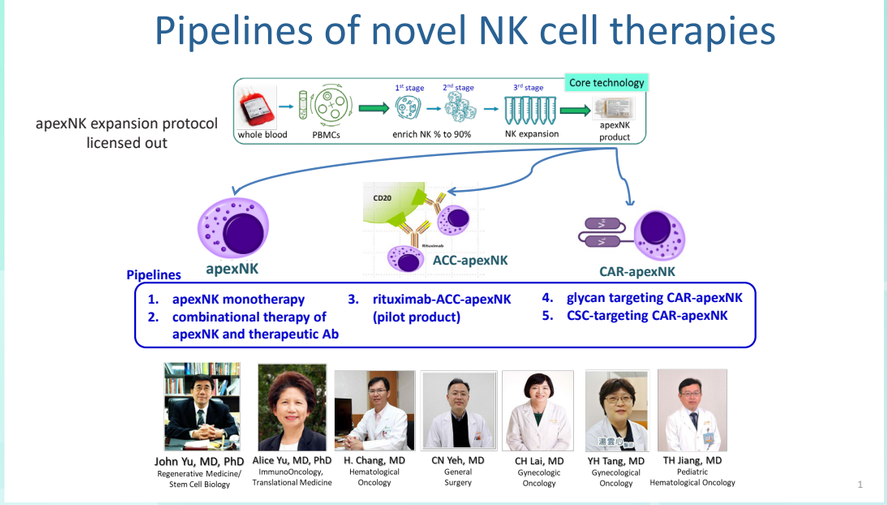
長庚大學

計畫主持人 »

游正博 特聘講座教授

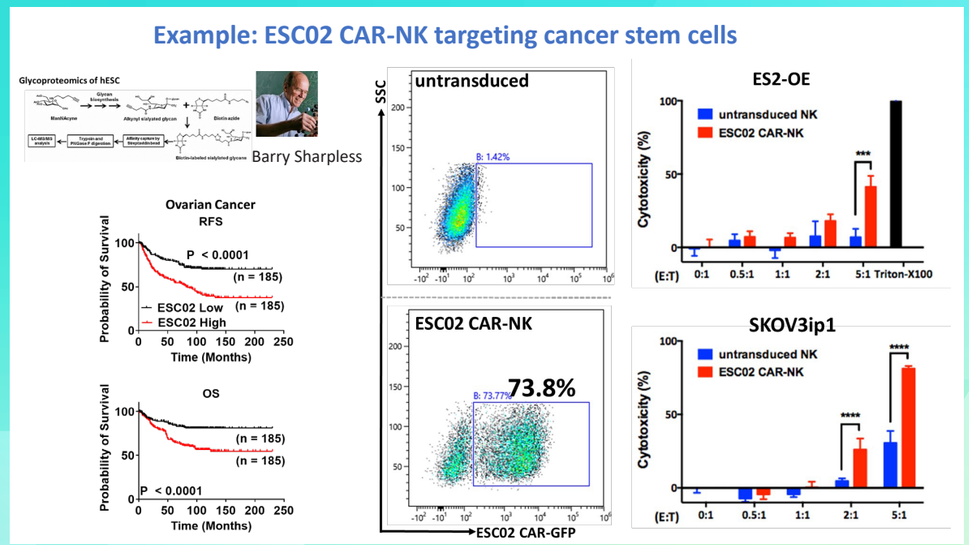
技術簡介 »

我們開發獨特三階段 apexNK ™擴增方法，可從週邊血液產生大量具有高純度、高活力和細胞毒性的 NK 細胞，無需分選或飼養細胞，此技術遠遠超過國際競爭對手。目前使用非病毒化學綴合 ACC ™技術，針對血液 NK 細胞進行改良，成功地開發以 CD20 為標靶的細胞療法。達成 Rituximab 與 NK 細胞表面高度綴合，且動物實驗顯示，比未綴合 NK 有更強的抗 CD20+ 淋巴瘤功效。這項技術可與其他廣泛的癌症標靶抗體合用，如同針對各種癌症的 ADC 技術平台。其次，為了解決膽管癌和卵巢癌未滿足的臨床需求並對抗癌症幹細胞，我們以高病毒轉導效率之技術，建立兩種抗 Globo H 和抗 ESC02 的 CAR-NK。證明了它們的特異性細胞毒殺作用。我們也建立新一代「現成的」低免疫 iPSC 作為細胞治療的來源。建立基因体檢測大結構變異的分析策略，將有助於確保 CRISPR-Cas9 編輯的細胞基因体完整性。我們已建立不含 HLA I/II 的 iPSC，並衍生 NK 細胞將用於異體 NK 癌症治療。



技術優勢 »

獨特三階段 apexNK ™擴增技術，可產生大量高純度且具毒殺能力的自然殺手 (NK) 細胞，可利用非病毒化學綴合 ACC ™技術或病毒轉殖技術生產 ACC-NK 或 CAR-NK。並研發出高病毒轉導效率之技術，建立兩種具有抗 Globo H 和抗 ESCO2 的 CAR-NK，可用於治療肝內膽管癌、膽囊癌與卵巢癌。以基因體檢測技術查驗 CRISPR-Cas9 基因修飾後細胞內 genome integrity 的情況，並以此技術挑選出「現成的低免疫」，不表現 MHC I/II 的 iPSC。



應用領域 / 適應症 »

癌症治療 / 再生醫學細胞療法。

我們使用非病毒改良式 A CC ™技術進行 Rituximab 與血液 NK 高度綴合已經成功達成。並將啟動首創 Rituximab 綴合的 NK 治療 CD20+ 淋巴瘤第 I 期臨床試驗 (pilot product)。這項技術可與其他的標靶抗體 (例如 Herceptin) 合用，治療其他各種癌症。其次為了解決膽管癌和卵巢癌未滿足的臨床需求並對抗癌症幹細胞，我們建立具有抗 Globo H 和抗 ESC02 的兩種 CAR-NKs。將尋求技術轉移以啟動第 I 期臨床試驗。我們也建立新一代低免疫 iPSC 作為細胞治療的來源，並建立基因体檢測的分析策略，確保 CRISPR-Cas9 編輯 iPSC 的基因体完整性。將從 iPSC 衍生 NK 用於癌症治療。

技術發展期程 »

專利狀況 »

" The ex vivo natural killer cell compositions, manufacturing method and use thereof" (Application # 63/519,254)。Other patent applications to be submitted。

聯絡方式 »

聯絡人 游正博 特聘講座教授
Email johnyu@gate.sinica.edu.tw
電話 +886-3328-1200 #7803

Novel allogeneic targeted NK cell therapy

Institution »

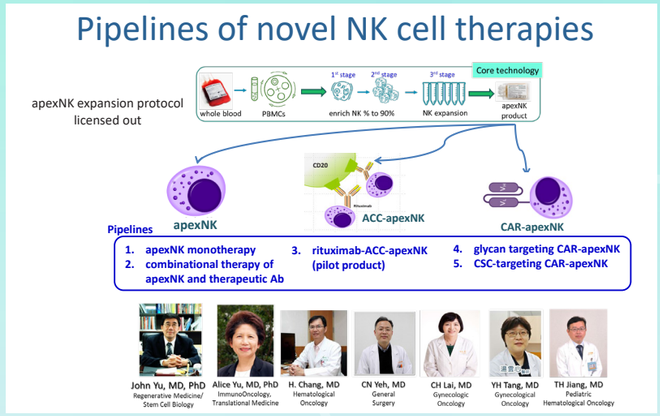
Chang Gung University

Principal Investigator »

John Yu, Distinguished Chair Professor, M.D., Ph.D.

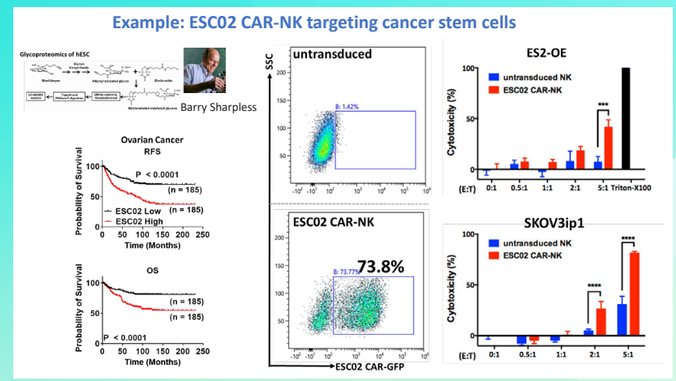
Introduction »

We have developed a unique three-stage "apexNK" expansion protocol capable of generating large quantities of NK cells with high purity, activity, and cytotoxicity from peripheral blood, without the need for cell sorting or feeder co-culturing. This technology far surpasses international competitors. Now we improved a non-viral chemical conjugation ACC™ technology specifically tailored to utilize primary NK cells, successfully developing allogeneic therapy targeting CD20. High levels of conjugation between Rituximab and primary NK cells have been achieved, and animal experiments demonstrate superior anti-CD20+ lymphoma efficacy compared to non-conjugated NK cells. This approach can be combined with a wide range of cancer-targeting antibodies, akin to ADC technology platforms for various cancers. Additionally, to address unmet clinical needs for bile duct and ovarian cancers and combat cancer stem cells, we have established two CAR-NKs with high viral transduction efficiency targeting Globo H and ESC02, demonstrating their specific cytotoxic effects in vitro. We have also developed a next-generation "off-the-shelf" low-immunogenic iPSC as a cell therapy source. Our genetic screening strategy for detecting off-target large structural variations will help ensure the genetic integrity of CRISPR-Cas9 edited cells. We have established iPSCs lacking HLA I/II expression and generated iPSC-derived NK cells potentially suitable for cancer therapy.



Competitive Edge »

We have developed unique three-stage apexNK™ expansion technology which generates large quantities of highly pure, potent, and cytotoxic natural killer (NK) cells from peripheral blood, without sorting or feeder cells, far exceeding international competitors. Now we improved a non-viral chemical conjugation ACC™ technology specifically tailored to utilize NK cells from blood, successfully developing allogeneic therapy targeting CD20. High levels of conjugation between Rituximab and primary NK cells have been achieved. Akin to ADC technology platforms, this pilot product for anti-CD20+ lymphoma can be combined with a wide range of cancer-targeting antibodies (such as Herceptin) to treat various cancers. In addition, we have developed highly efficient viral transduction techniques and established CAR-NKs targeting Globo H and ESC02, which address unmet clinical needs for intrahepatic cholangiocarcinoma, gallbladder cancer, and ovarian cancer. Additionally, we have established the off-the-shelf B2M-/-CIITA -/- iPSCs for allogeneic cell therapy. We employ comprehensive genetic analysis for detecting atypical off-target large structural variants to ensure the genome integrity of CRISPR-Cas9-edited iPSCs.

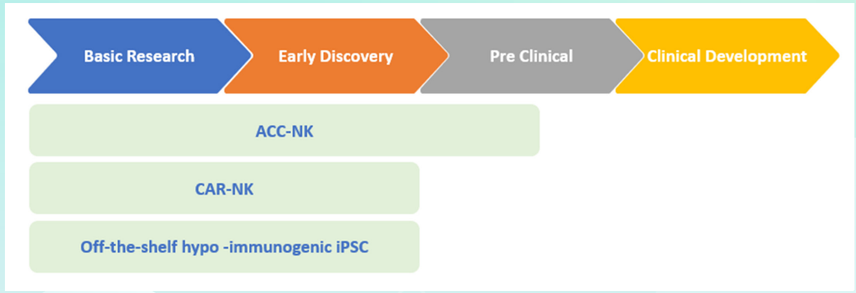


Application/Indication »

Anticancer therapy/regenerative medicine cell therapy.

We have successfully achieved chemical conjugation between Rituximab and blood NK using modified non-viral ACC™ technology. We will initiate the first-in-human pilot study of Rituximab-conjugated NK cell therapy for CD20+ lymphoma. This technology can be combined with other targeted antibodies (such as Herceptin) to treat various cancers. Secondly, to address unmet clinical needs in cholangiocarcinoma and ovarian cancer and combat cancer stem cells, we have developed two CAR-NK cells targeting Globo H and ESC02. We will seek technology transfer to initiate Phase I clinical trials. We have also established a new generation of low-immunogenic iPSCs as a source for cell therapy and developed a comprehensive genetic analysis strategy to ensure the genomic integrity of CRISPR-Cas9 edited iPSCs. These iPSC-derived NK cells will be used for anticancer therapy.

Development Status »



Patent Status »

" The ex vivo natural killer cell compositions, manufacturing method and use thereof" (Application # 63/519,254). Other patent applications to be submitted.

Contact »

Name John Yu, Distinguished Chair Professor
Email johnyu@gate.sinica.edu.tw
Tel +886-3328-1200 #7803

NSTC 國家科學及技術委員會
National Science and Technology Council

胞外體藥物之修飾與編輯技術應用於骨關節炎治療

研發單位 »

醫療財團法人徐元智先生醫藥基金會亞東紀念醫院
國立陽明交通大學

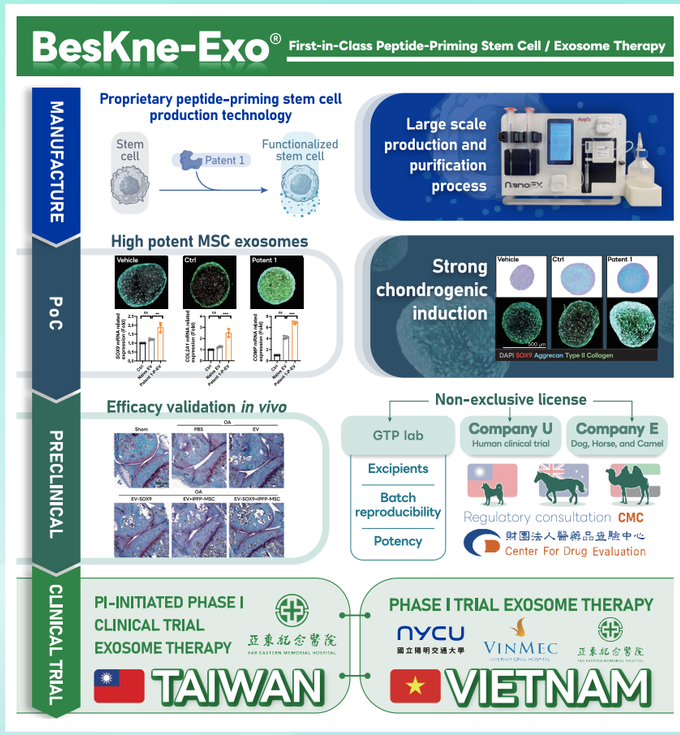
計畫主持人 »

張至宏 副院長 / 教授

技術簡介 »

隨著超高齡社會的來臨，老年化相關疾病將對醫療系統造成巨大負擔。為應對這一挑戰，本團隊開發了新穎的胞外體製劑，用於治療骨關節炎。目前骨關節炎治療方式都在於症狀緩解，缺乏有效的治療方式，因此我們開發了一系列技術，克服未被滿足的需求。

- AI 大數據生物標記探索模型：透過大規模單細胞定序探索新穎生物標記，用於分析高效價幹細胞和探索重要軟骨再生與分化因子。
- 細胞與胞外體修飾技術：透過特有奈米電穿孔方式，改造細胞並產生大量胞外體。
- 胞外體製劑製造與純化：與美國新創 Aopia Biosciences 合作開發新穎奈米顆粒純化高純度的胞外體製劑。
- 核酸藥物載入：利用奈米電穿孔技術修飾，將核酸藥物有效且大量載入胞外體中。
- 胜肽重組技術：透過高通量定序尋找關鍵調控因子，並透過重組胜肽來增強胞外體的治療特性。



技術優勢 »

- 高效生物標記探索：此平台快速探索關鍵調控基因表現，並找尋高效價幹細胞，作為異體細胞庫建立之依據。
- 高效抗發炎與再生效果：胜肽活化胞外體製劑在實驗中顯示出顯著的抗發炎和軟骨再生效果。
- 高核酸載入效率：採用細胞電穿孔技術，實現精確的核酸藥物載入，核酸胞外體製劑富含大量軟骨分化調控基因，並增強高達 30 倍的軟骨分化能力效果。
- 高純度胞外體藥物：透過新穎非對稱性奈米孔膜純化奈米顆粒，相較於傳統方式，將大幅降低游離蛋白殘留率以及管道堵塞所造成之剪切力問題。

透過以上技術，本團隊將推動兩項新穎生物製劑的臨床試驗。我們研發的兩樣製劑，胜肽活化胞外體製劑以及核酸胞外體製劑將進入臨床試驗階段。

應用領域 / 適應症 »

骨關節炎在超高齡社會中造成社會醫療負擔，全球有將近五億多患者。本團隊以新穎胞外體工程化修飾技術平台以及與美國新創公司 Aopia Biosciences 合作的奈米顆粒純化平台，我們將胞外體製劑應用於再生醫學與骨關節炎的治療。

技術發展期程 »

基礎研究 → 早期開發 → 臨床前試驗 → 臨床開發

EXOSTAND®膝克穩 (富含SOX9 mRNA胞外體)

BesKne-Exo®顧寧膝 (新型胜肽活化胞外體)

專利狀況 »

1. GENE THERAPY FOR TREATING OSTEOARTHRITIS USING SOX9 (5992-0454PUS1)
2. NEW APPROACH FOR CARTILAGE REGENERATION (5992-0462PUS1)
3. METHOD AND PHARMACEUTICAL COMPOSITION FOR CARTILAGE REGENERATION (5992-0485PUS1)

聯絡方式 »

聯絡人 廖秀蓉 博士
Email liaohsiujung@gmail.com
電話 +886-2-8966-7000 #4566

Modification and editing technologies of extracellular vesicle (EV) drugs applied to osteoarthritis treatment.

Institution »

Far Eastern Memorial Hospital/National Yang Ming Chiao Tung University

Principal Investigator »

Chih-Hung Chang, Vice President/Professor, M.D., Ph.D.

Introduction »

With the advent of a super-aged society, aging-related diseases pose a significant burden on healthcare systems. To address this challenge, our team has developed innovative extracellular vesicle (EV) formulations for treating osteoarthritis. Current treatments for osteoarthritis focus primarily on symptom relief and lack effective therapeutic options. We have developed a series of technologies to meet these unmet needs:

AI Big Data Biomarker Exploration Model: Utilizing large-scale single-cell sequencing to explore novel biomarkers, this model analyzes cells from super-donors and identifies key factors in cartilage regeneration and differentiation.

Cell and EV Modification Technology: We modify cells to produce a large quantity of EVs using unique nanoelectroporation methods.

EV Formulation and Purification: In collaboration with U.S.-based startup Aopia Biosciences, we have developed novel nanoparticle purification methods to produce high-purity EV formulations.

Nucleic Acid Drug Loading: Through nanoelectroporation techniques, we efficiently and abundantly load nucleic acid drugs into EVs.

Peptide Recombination Technology: We enhance the therapeutic properties of EVs by identifying key regulatory factors through high-throughput sequencing and recombining peptides.

These advancements aim to provide effective treatments for osteoarthritis and address the unmet medical needs in this area.

Competitive Edge »

Efficient Biomarker Exploration: This platform rapidly identifies key regulatory gene expressions and seeks super donors, serving as a basis for establishing an allogeneic cell bank.

High Anti-inflammatory and Regenerative Effects: Peptide-activated extracellular vesicle formulations have shown significant anti-inflammatory and cartilage regenerative effects in experiments.

High Nucleic Acid Loading Efficiency: Utilizing cellular nanoporation technology, we achieve precise nucleic acid drug loading. The nucleic acid EV formulations are rich in genes regulating cartilage differentiation and enhance cartilage differentiation capacity by up to 30 times.

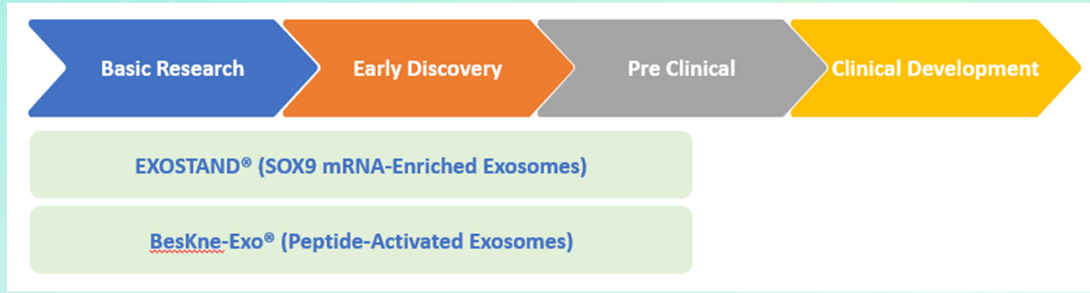
High-Purity EV Drugs: Through innovative asymmetric nanopore membrane purification of nanoparticles, we significantly reduce free protein residues and shear force issues caused by channel blockage compared to traditional methods.

Clinical Trial Promotion: Our team will use the above technologies to advance two novel biological formulations to clinical trials. Our developed peptide-activated EV formulation and nucleic acid EV formulation will enter the clinical trial stage.

Application/Indication »

Osteoarthritis imposes a significant burden on healthcare systems in super-aged societies, affecting nearly 500 million patients worldwide. Our team utilizes an innovative extracellular vesicle (EV) engineering modification technology platform and collaborates with the U.S. startup Aopia Biosciences on a nanoparticle purification platform. We apply EV formulations in regenerative medicine and the treatment of osteoarthritis.

Development Status »



Patent Status »

1. GENE THERAPY FOR TREATING OSTEOARTHRITIS USING SOX9 (5992-0454PUS1)
2. NEW APPROACH FOR CARTILAGE REGENERATION (5992-0462PUS1)
3. METHOD AND PHARMACEUTICAL COMPOSITION FOR CARTILAGE REGENERATION (5992-0485PUS1)

Contact »

Name Hsiu-Jung Liao, Ph.D.
Email liaohsiujung@gmail.com
Tel +886-2-8966-7000 #4566

【附錄】各單位計畫負責人

中央研究院

計畫主持人：
謝清河　特聘研究員

共同主持人：
吳登強　教授 / 高雄醫學大學
郭耀仁　教授 / 高雄醫學大學
傅尹志　教授 / 高雄醫學大學
余明隆　教授 / 國立中山大學
陳俊安　研究員 / 中央研究院

Principal Investigator:
Patrick Ching-Ho Hsieh, Distinguished Research Fellow

Co-Investigators:
Deng-Chyang Wu, Professor
Yur-Ren Kuo, Professor
Yin-Chih Fu, Professor
Ming-Lung Yu, Professor
Jun-An Chen, Research Fellow

國立成功大學

計畫主持人：
沈延盛　院長 / 特聘教授

共同主持人：
顏家瑞　教授 / 國立成功大學
蔡坤哲　教授 / 國立成功大學
黃珍語　助理教授 / 國立成功大學
喬納森　助理研究員 / 國立成功大學
莊偉哲　教授 / 國立成功大學
劉嚴文　教授 / 國立成功大學
許釗凱　副教授 / 國立成功大學
張光裕　醫師 / 國家衛生研究院

Principal Investigator:
Yan-Shen Shan, Dean

Co-Investigators:
Chia-Jui Yen, Professor
Kuen-Jer Tsai, Professor
Chen-Yu Huang, Assistant Professor
Jonathan Hobley, Assistant Research Fellow
Woei-Jer Chuang, Professor
Yen-Wen Liu, Professor
Chao-Kai Hsu, Associate Professor
Kwang-Yu Chang, Doctor

國立陽明交通大學

計畫主持人：
邱士華　特聘教授

共同主持人：
李鎮宜　教授 / 國立陽明交通大學
洪凱風　副教授 / 國立陽明交通大學
霍德義　教授 / 國立陽明交通大學
傅毓秀　教授 / 國立陽明交通大學
陳世真　醫師 / 臺北榮民總醫院
楊逸萍　助理研究員 / 臺北榮民總醫院
梁恭豪　副研究員 / 臺北榮民總醫院

Principal Investigator:
Shih-Hwa Chiou, Distinguished Professor

Co-Investigators:
Chen-Yi Lee, Professor
Kai-Feng Hung, Associate Professor
Teh-Ia Huo, Professor
Yu-Show Fu, Professor
Shih-Jen Chen, Doctor
Yi-Ping Yang, Assistant Research Fellow
Kung-Hao Liang, Associate Research Fellow

國立臺灣大學

計畫主持人：
鄭乃禎　教授

共同主持人：
林頌然　教授 / 國立臺灣大學
王一中　教授 / 國立臺灣大學
范邁儀　助理研究員 / 國立臺灣大學附設醫院

Principal Investigator:
Nai-Chen Cheng, Professor

Co-Investigators:
Sung-Jan Lin, Professor
I-Jong Wang, Professor
Mai-Yi Fan, Assistant Research Fellow

中國醫藥大學

計畫主持人：
鄭隆賓　講座教授

共同主持人：
洪明奇　教授 / 中國醫藥大學
徐偉成　教授 / 中國醫藥大學
李光申　教授 / 國立陽明交通大學
許斐婷　副教授 / 中國醫藥大學
江智聖　助理教授 / 中國醫藥大學
王啟鴻　醫師 / 中國醫藥大學

Principal Investigator:
Long-Bin Jeng, Chair Professor

Co-Investigators:
Mien-Chie Hung, President
Woei-Cheang Shyu, Professor
Fei-Ting Hsu, Associate Professor
Chih-Sheng Chiang, Assistant Professor
Chi-Hung Wang, Doctor
Oscar Kuang-Sheng Lee, Professor

長庚大學

計畫主持人：
游正博　特聘講座教授

共同主持人：
葉俊男　醫師 / 長庚醫療財團法人
張　鴻　醫師 / 長庚醫療財團法人
湯雲心　醫師 / 長庚醫療財團法人
賴瓊慧　醫師 / 長庚醫療財團法人
江東和　教授 / 長庚醫療財團法人
洪榮堂　助理研究員 / 長庚醫療財團法人
陳鈴津　教授 / 長庚醫療財團法人

Principal Investigator:
John Yu, Distinguished Chair Professor

Co-Investigators:
Chun-Nan Yeh, Doctor
Hung Chang, Doctor
Yun-Hsin Tang, Doctor
Chyong-Huey Lai, Doctor
Tung-Her Jaing, Professor
Jung-Tung Hung, Assistant Research Fellow
Alice L. Yu, Professor

亞東紀念醫院

計畫主持人：
張至宏　副院長/教授

共同主持人：
黃奇英　教授 / 國立陽明交通大學
李　利　教授 / 國立陽明交通大學

Principal Investigator:
Chih-Hung Chang, Vice President

Co-Investigators:
Chi-Ying Huang, Professor
L. James Lee, Professor