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張明瑞教授

Professor Thomas Ming Swi Chang

## 夢想創奇 改變世界 人類福祉一先驅

人類歷史上許多偉大發明，都是始於一個夢想、奇想、甚至幻想。在史上眾多偉大發明家之中，有一位“異想天開”的華裔，創造了叫人匪夷所思的全球第一個人造細胞——人稱“人工細胞之父”的張明瑞教授，早在1956年於麥吉爾大學就讀時，便奠下這劃時代的醫學科學里程碑，也成為華人的光榮與驕傲。58年後的今天，82歲的張教授依然繼往開來，為人類福祉努力研究和創新，並與全人類分享他的發明，難怪他曾說：“我是屬於全世界的”。

張明瑞教授在人工細胞方面的開創性工作，帶來許多有關人類健康及其他應用層面的創新企業與產品，包括納米醫學、納米生物技術、基因治療、酶療法、細胞/幹細胞治療、癌症治療、再生醫學、血液代用品、及肝臟支持系統上的應用，甚至對農業、水產文化、發酵工業、食品工業、生物技術、納米機器技術等眾多領域亦產生影響。

為了讓更多研究得以推展，開發裨益病人和公眾的“人工細胞”治療法，他無私地公開所有研究細節，讓全球各地的機構均可基於他的發明進行研究和開發，絲毫沒有為金錢的收益而保留任何研究秘密。

張教授已記不清接過多少次獎章了。作為“生物科學元老”，他身上的頭銜和榮譽不勝枚舉——歷任加拿大麥吉爾大學生理學、醫學和生物醫學工程教授、加拿大皇家醫學院院士，加拿大皇家學會院士。歷任國際人工細胞大會榮譽主席、國際人工血液大會榮譽主席、加拿大蒙特利爾中華醫院榮譽醫生；又曾榮獲加拿大勳章，及兩次獲諾貝爾獎提名。

對張教授來說，這些都算不了什麼，令他感到高興的是，這些榮譽和獎項說明了自己半世紀前以來的努力沒有白費，證明了自己年輕時在麥吉爾大學宿舍裏“鼓搗”出來的東西，如今已經使成千上萬的病人受益。

數年前，他更被麥吉爾大學和世界各地選為這大學190歷史上“最傑出的麥吉爾學者”，實在當之無愧。

### 男兒自強 漂洋過海創奇跡

1933年生於汕頭一個重教重商、誠善富足之家，張明瑞的家人對他的成長有深遠影響。他的祖父曾經漂洋過海到西方學習，回國後做抽紗生意，並成功創業。

“我的祖父告訴我，中國人要自強，要用實際行動告訴外國人我們能做什麼。”

張明瑞的外祖父則是一位醫生，平日在汕頭市區行醫，每到周末，他就騎著自行車到近郊的村子裏，為貧困患者免費治療，年少的張明瑞心中最大的願望，是像外祖父一樣懸壺濟世。為了學好英語準備赴笈海外，他13歲便隻身往香港入讀拔萃中學；22歲遠渡重洋，滿懷夢想和激情，晉身加國的頂尖醫科大學麥吉爾攻讀。

1956年，這位年僅23歲的潮汕青年一天忽發奇想：既然人體器官可以製造（當時醫學上已經有了人工腎），那麼作為器官最小單位的細胞也應該可以製造；若是有了人造細胞，那在醫學上的前景該是多巨大！人們就再也不用為血源緊張，亦不用擔心輸血過程中意外感染病毒等問題。

張明瑞把想法告訴教授和朋友，他們都認為這是“非常

荒唐的念頭”。但他沒有放棄，他說：“我從小就願意嘗試新的東西，而且父母曾經教導我：一旦做什麼事情，就要努力到底。”

張明瑞買了一些化學試劑，用香水瓶、塑膠袋等日常用品作為器具，在自己的睡房搞起了試驗。他把自己關在宿舍裏，廢寢忘食地進行實驗，他的室友們不得不忍受這位中國同學製造出來的種種嗆人異味。

經過千百次的實驗，世界上第一個人造血紅細胞終於在年僅23歲的張明瑞手上誕生！

在當時而言，他的研究報告過於“驚世駭俗”，只能當作他的本科論文，而校方為保險起見，未敢對外聲張。

他耐心等待，於1957年本科畢業，1961年獲醫學博士頭銜，到1964年成為生理學博士時，他的人工細胞理論才最終在國際最高科學刊物 -- 《Science》上亮相，震驚了世界。

### 無私公開成果 延展於世

張明瑞教授的技術讓幾家“嗅覺靈敏”的大公司察覺到巨大的商機，於是找他洽談買斷他的技術或跟他合夥賺錢。他卻一一拒絕了，為的是能更快地使更多的病人獲救。

他說：“我的人生目標是要幫助病人，不是追求名利。我把研究成果的所有細節都公諸於眾，讓全世界的人共同使用，這是好事。”

多年來，他總會把新發現第一時間在傳播最廣的科學雜誌上，全盤進行公佈，這份無私的濟世胸懷，亦贏得了世人的高

度敬仰。

1980年代，愛滋病的傳播和血液污染引起張教授的深切關注，他把研究重點聚焦於人工血液。他指出：“大規模的疾病傳播和血液污染，或大規模的天災人禍，如地震和戰爭，都需要大量的人工血施行緊急救助。”

張教授表示，第一代人工血液在俄羅斯和南非，已經被批准用於日常使用。他的實驗室目前正在研究第二代人工血液。他又鼓勵其他人進行這方面的研究，並親自協調每兩年在世界各地舉行的一系列人工血液國際研討會。

多年來身在異鄉，張教授依然心繫祖國，與中國科學界亦保持密切聯繫。

1978年，他曾應中科院之邀回國當了兩個月的訪問教授，並先後在北京、上海、廣東等市的大學和科學院訪問和演講，回到加拿大以後，繼續與許多中國科學家和學者保持著聯繫。這些年來，他經常返回中國內地，在一些醫學和科學會議上演講。讓張教授感到欣慰的是，他的研究成果讓中國的患者受益。

### “人工” 以外見真情

張教授的人生態度，就如他作為科學家的價值取向一樣，求新、求真、堅持不懈。

他回想人生和科研路上所經歷的，並非止於達成夢想的滿足和成功感，也同時學會如何在面對困難和挑戰時，保持信念和原動力：“如果你做的事是為了幫助別人，那你就容易泄氣。”

他亦慶幸一生中遇上幾個對他影響至深的重要人物，首先是與他結婚已50多年的妻子；她不僅從來沒有埋怨丈夫把發明公諸於眾而不是用來賺錢，也從不抱怨他們並不富裕的生活。太太的支持，是他終身最感動的幸運。當年曾唸護士科的她，如今即使在80高齡，也仍然在蒙特利爾的醫院當義工，幫助那裏的病人。

此外，他也十分感激在研究人工細胞還未成功以前，有許多曾經給他支持和鼓勵的“良師益友”，包括發明人工腎的荷蘭醫學家Willem Kolff，當年如何獨排眾議，在地球的另一角對他的研究予以肯定；還有麥吉爾大學的年青教授Arnold Burgen和F.C. Macintosh，特別在實驗室騰出一個角落讓他專心做他的實驗，默默支持他。

“這世上還是有很多好人，而且好人都是抱持一顆開放的心靈。”張教授語重心長地說。

時至今日，張教授可說是仍然在追尋夢想，並且為了夢想，付出心血，就好像他曾把自己比作一粒“血紅色的細胞”，要發揮它全部的張力，繁衍無盡的鮮血，讓世間所有需要的人取之不竭。

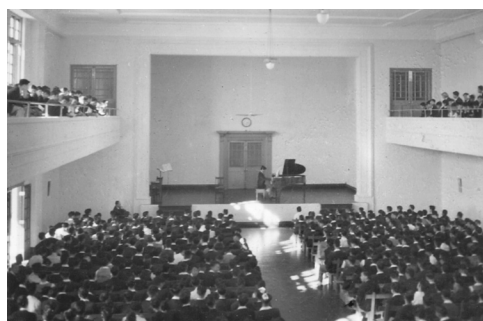
此間他笑言自己沒想過退休，也保持健康活躍的生活，早上還跟太太一起打網球。如廝生命力豈不正如他求新、求真的精神一樣，突破常規的界限？

“人工”這個名詞往往令人想到“人造的、虛假的、以至造作”，然而一生都與“人工”打交道的張明瑞教授，卻在一言一行上表現出，他是一個何等真實的人！





在中國汕頭唸小學  
Completing primary school in home town  
Shantou, China



在香港拔萃中學每天早會擔任司琴（1951）  
Being pianist for daily morning assembly at  
Diocesan Boys' School, Hong Kong



拔萃中學畢業  
Completed high school at Diocesan Boys' School,  
Hong Kong



與祖父(前)、爸爸和兒子 (Harvey) ,  
戴眼鏡的是他 (1966)  
With grandfather (front), father and  
son (Harvey), himself in glasses.



從麥吉爾大學醫學院畢業（1961）  
Graduated in Medicine (M.D., C.M.) from McGill University





與太太Lancy（1975）  
With wife Lancy



兒女：（左起）Harvey, Christine, Sandra,  
Victor（1970）  
Children (from left): Harvey, Christine, Sandra  
and Victor



在麥吉爾大學實驗室（1960s）  
Doing research in laboratory at McGill University



獲麥吉爾大學頒授  
名譽教授（2007）  
2007 Convocation at  
McGill: Emeritus Professor



兒孫滿堂（2012）  
With children, their spouses and grandchildren

## Professor Thomas Ming Swi Chang

*Many great inventions in human history began with a vision, a dream, or even a fantasy. A Chinese Canadian, among the many great innovators in history, could well have created the biggest fantasy of all: the first artificial cell in the world. He is Professor Thomas Chang, the “father of artificial cells”. It was back in 1956, while studying for his undergraduate degree, that he laid this epoch-making milestone in medical science, becoming the pride and glory of the Chinese community. Today, 58 years later, 82-year-old Professor Chang is still continuing his research and innovation work to better the future for the human race, and to share his inventions with all humankind. No wonder he says: “I belong to the whole world.”*

Professor Chang’s pioneering work in artificial cells has brought forth many innovative approaches in human health and other applications, including nano-medicine, nano-biotechnology, gene therapy, enzyme therapy, stem cell therapy, cancer treatment, regeneration medicine, blood substitutes, and applications in liver support systems. There is even impact in many areas of agriculture, aquatic culture, fermentation industry, food industry, biotechnological and nanotechnological equipment.

In order to allow more research to take his “artificial cell” invention forward for the benefit of patients and the public, Professor Chang has selflessly published the details of his studies, so that organizations around the world can conduct research and development without restrictions based on his work. He does not retain any research secret in order to profit by it.

Professor Chang has lost count of how many times he has been awarded. As a “bioscience pioneer”, the titles and honors bestowed on him are too numerous to mention. He was Professor (now Emeritus Professor) at the Departments of Physiology, Medicine and Biomedical

Engineering in the Faculty of Medicine at McGill University. He is the ongoing Director of Artificial Cells and Organs Research Centre at McGill since 1979, and serves as Honorary President, Artificial Cells, Blood Substitutes and Biotechnology (an international network) as well as International Society of Nanomedical Sciences. He is also Honorary Professor at a number of universities and institutes in China. He was awarded Officer of the Order of Canada, and was twice nominated for Nobel Prize.

Professor Chang is pleased that these honors and awards demonstrate that his efforts were not wasted half a century ago. They validated the work that he did in his dormitory room at McGill University has benefited thousands of patients today. But beyond this, it does not matter too much to him.

In 2011 he was voted the Greatest McGillian out of 700 nominees in McGill's 190 years history, a well-deserved recognition.

Thomas Chang was born in Shantou in 1933 into a well-off family, which valued education and business acumen highly. His family exerted a tremendous impact on his development. His grandfather studied overseas in the western world, and after returning home, built a successful textile manufacturing business.

“My grandfather told me that Chinese people must be self-reliant; we must tell foreigners what we can do through our actions.”

Thomas' maternal grandfather was a doctor, and practiced in the City of Shantou. During each weekend, he would ride a bicycle to the villages on city outskirts to give free treatment to impoverished patients. The young Thomas' greatest desire was to be a doctor like his grandfather, to provide help to those in need. The 13-year-old went on his own to study at Diocesan Boys' School in Hong Kong, so that he could learn sufficient English to go abroad. As a 20-year-old full of dreams and passion, Thomas went overseas to study at the top Canadian medical

school of that time, McGill University.

In 1956, Thomas, only 23 years old at the time, had a capricious idea one day: since human organs can be produced (artificial kidney was already in use at that time), then the smallest unit of human organ, a cell, could be built in theory. If we had artificial cells, then the prospects in medicine would be immense! People no longer have to worry about an adequate blood supply, or accidental infections in the blood transfusion process.

Thomas tried his idea on professors and friends, but many thought the idea was “absurd”. But Thomas did not give up, he said: “I grew up willing to try new things, and my parents had taught me: whatever you do, you must strive to reach your goal.”

Thomas bought chemicals, and experimented using perfume bottles, plastics and other items as his test equipment in his dormitory room. He shut himself up, and conducted experiments day after day, often foregoing meals and sleep. His roommates had to endure all sorts of pungent odors made by this Chinese student.

After hundreds of experiments, the world’s first artificial blood cell was finally born in the hand of the 23-year-old Thomas!

At the time, his research report was considered to be too ‘unconventional and shocking’, and could only be used as his undergraduate honours Physiology thesis in 1957. The department, as a safety measure, felt that it was too premature to make known his findings.

Thomas waited patiently and continued with his research. He graduated from university in 1957, and got his medical degree in 1961. But only after he obtained his PhD degree on artificial cells in Physiology in 1964 that he was allowed to submit his artificial cell study for publication. Surprisingly, it was accepted for publication with

him as the sole author in the most prestigious international scientific journal - "Science", shocking the world.

A number of large conglomerates perceived the tremendous business opportunities this artificial cell technology presented. They offered to buy out his invention or partner with him to make huge profits, asking him to sign exclusive and restrictive agreements. He understood why they needed this; after all, his father and grandfather were in the manufacturing business. However, he also knew that this area was potentially too large and diversified for a single company or for him to develop. Recognizing that artificial cells could impact the lives and well being of our fellow human beings, he opted to encourage and help all researchers and developers in a nonexclusive and nonrestrictive manner. This has resulted in explosive developments around the world in many related areas. A recent Google search on "artificial cells" showed many centers around the world working in this area.

He says: "My goal in life is to help patients, not the pursuit of fame and fortune. I make all my research details public, so that people around the world can use the results together, which is a good thing."

Throughout the years, he always publishes his new discoveries in the most widely read scientific journals at the earliest opportunity. This selfless act to share his work has won the highest admiration and respect from around the world.

In the 1980s, Professor Chang was deeply concerned about the spread of AIDS and the contamination of blood sources. He focused his priorities on the research of artificial blood. He says: "The global spread of infectious diseases and blood supply contamination, or large-scale natural disasters, such as earthquakes and war, require a tremendous amount of artificial blood in emergency relief."

Thomas says the first generation of artificial blood developed by others based on his basic research has been approved for routine use in Russia

and South Africa, where artificial blood is urgently needed because of the spread of AIDs and the contamination of conventional blood supply. His laboratory is currently studying the second-generation of artificial blood for more wide spread use for other situations.

He encourages others to carry out research in this area. One of the ways is to hold international conferences on artificial blood every two years around the world.

Over the years, Professor Chang has maintained close contact with the Chinese scientific community in China, his motherland, where his heart is.

In 1978, the Chinese Academy of Sciences invited him to return as a visiting professor for two months. He visited and gave lectures in universities and scientific institutions in Beijing, Shanghai, Guangdong and other cities. After he returned to Canada, he has kept in touch and collaborated in research with Chinese scientists and professors. Since then, he has often returned to China as speaker at medical and scientific conferences. Professor Chang was pleased that his research has also benefited patients in China.

Professor Chang's attitude towards life, just as his values as a scientist, focuses on perseverance in seeking innovation and the truth.

He recalls in his life and work, not only had he experienced a sense of satisfaction, a feeling of triumph, from realizing his dream, but at the same time he had learned how to face difficulties and challenges, how to keep his faith and his motivation: "If what you do is to help others, then you will not be easily discouraged."

He is also thankful that he had encountered in his life several important figures who had profoundly impacted him. The first person is his wife, Lancy Yeok Lan, who married him 57 years ago. She has never complained about her husband making public his inventions and not

profiting from them. She also never complains that they do not enjoy a luxury lifestyle. He is moved by his wife's unwavering support, and feels that it is his fortune to have her by his side. She was once a nurse, and even now at over 80 years old, she is still volunteering in the Montreal Chinese Hospital.

In addition, he is also very grateful to many people who had given him support and encouragement before the success of artificial cell research became apparent. A few examples include the inventor of artificial kidney, a U.S. Dutch physician Willem Kolff, who among many opposing voices supported his idea and research. There were at McGill University Professor F.C. MacIntosh, and Sir Arnold Burger, who was a young professor then. They gave him encouragements and made room for him in a corner of the teaching laboratory so that he could concentrate on doing his experiments.

"There are many other good people in this world, and good people have an open mind," says Professor Chang in earnest.

Today, Professor Chang is still in pursuit of a dream, and he dedicates himself to this dream. He likens himself to a red blood cell that wants to utilize its fullest potential for the endless proliferation of blood, so that the world will have an inexhaustible blood supply.

Here he smiles and says he has never thought of retirement. He maintains a healthy active lifestyle that includes martial art, weight training and tennis. In the morning before the interview, he played tennis with his wife. Such vitality is beyond conventional boundaries, just like his spirit seeking innovation, seeking truth.

"Artificial," the term is often reminiscent of "man-made, synthetic, or fake," but Professor Chang, whose entire life focuses on "artificial", is truly a genuine human being in both word and deed!