博士生學以致用
一滴淚水冀讓糖尿病患者無須每日拮針

PhD in Tech Start-ups – Get out of the laboratory, bridging science and social innovation

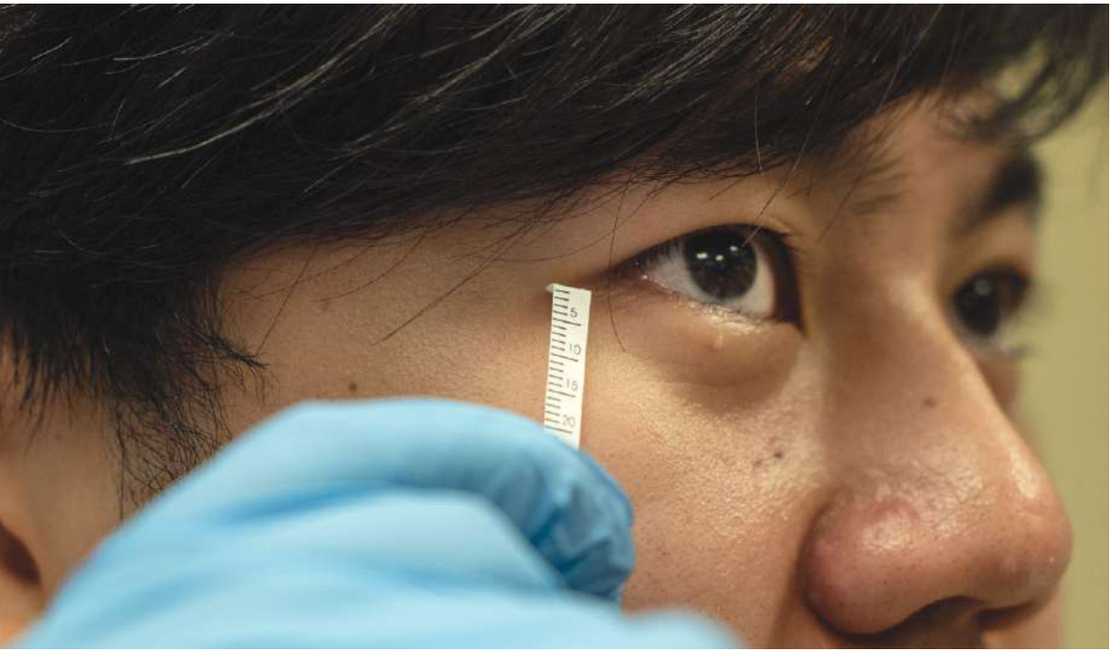
Non-invasive Tear Biomarker of T2DM - Andes Sze

撰文 羅坎

一滴眼淚除了有水份、鹽份，還包含了數百種蛋白質，當中蛋白質的濃度可望能作重要指標用於預測或監控糖尿病及糖尿病視網膜病變。要用文字形容這樣的科學發現，實在簡單不過；但要從研究轉移至臨床應用或社會創新項目，過程困難重重。就讓我們看看創辦人施英漢（Andes）於Good Seed提出應用淚液針對二型糖尿病的非侵入式早期篩查測試方法，了解如何透過Good Seed把科學知識轉化為社會影響力。

Human tear film composites of hundreds to thousands of proteins, in addition to water, salt and lipids. The concentration of certain proteins may have important biological characteristics for the prognosis, monitoring or diagnosis of diseases, such as diabetes mellitus and diabetic retinopathy. The story is full of challenges in the knowledge transfer process from research to clinical trial and commercially available applications.
A group of scientists hope to identify novel biomarkers in molecular assay that will surpass academic literature, contribute to advanced, personalized medicine, and benefiting every stakeholder in the community.

PhD in Tech Start-ups – Getting Science and Social Innovation out of the Laboratory



這天，我來到位於香港理工大學眼科視光學院的實驗室訪問Andes，今年27歲的他正在該學院攻讀哲學博士學位。實驗室內燈光泛黃，放滿儀器及實驗用品，顯得走道有點狹窄，對訪客來說或許略嫌焗促，但對於在這裡沒日沒夜地做研究的Andes來說卻十分自在，他在Good Seed獲資助的項目－糖尿病的非侵入式早期篩查測試方法（Non-Invasive Tear Biomarkers of T2DM），正是在這裡孕育而成。

港平均十分一人患糖尿病 篩查工作更顯重要

顧名思義，糖尿病的非侵入式早期篩查測試目的正是研發一種非侵入式的方法去篩查二型糖尿病，當中透過視光師檢查眼睛及抽取淚液，再送到實驗室利用儀器分析固中的蛋白質作為生物標記物作篩查結果。淚液與眼睛的研究，自然與Andes的眼科學術研究背景有關，但為何牽扯到糖尿病？ Andes說，根據醫管局統計數字，香港每十個人便有一人患有糖尿病；此外，根據美國疾病控制及預防中心統計，有八成多人已有糖尿病前期（prediabetes）徵兆的人並不察覺身體有此變化。因此，預防與篩查糖尿病的工作顯得非常重要及有意義。

「很多人都知道現有篩查糖尿病的方式有『篤手指』和醫生抽血再送住實驗室化驗，這些方式都是很侵入式的」，Andes說。以淚液篩查糖尿病有什麼好處？當然就是比現有方法的入侵性低得多，也非常容易取得。「取眼淚不需要特殊技術例如抽血，不需要用針，其實可以有很大益處。你可以看到現在坊間有很多協助病患者控制糖尿病的產品，包括接觸式或將晶片植入人體讀取生物信息，就可以監察病情進展，其目的都是減低

Mr. Sze Ying Hon Andes, 27 years old, is a PhD candidate in the School of Optometry, The Hong Kong Polytechnic University (PolyU). He proposed a non-invasive tear film biomarkers screening for type 2 Diabetes Mellitus (T2DM), Taking his scientific expertise to the social impacts, and greatly supported by Good Seed, which cultivates and empowers youth to be compassionate leaders who are positively influencing their communities. I met Andes in the laboratory of PolyU. The laboratory was densely packed with equipment and supplies. Visitors might find the room rather stuffy, however, this is the comfort zone for Andes. After all, this is where he has spent countless days and nights in research. Through a project funded by Good Seed, he embarked on the great entrepreneurial adventure and explored non-invasive biomarker in tear film for T2DM screening.

One-tenth of Hong Kong's population is affected by type 2 diabetes mellitus

"Many people are aware of existing diabetes screening methods. For example, measuring fingertip blood glucose level and fasting blood glucose levels." He said. These methods are relatively invasive due to potential infection and blood-carried pathogens. The tear film has significant advantage in that it is non-invasive in nature and easy access to samples. The tear film fluid can be collected with Schirmer's strip or microcapillary tube, replacing the blood tubes and needles in conventional methods. There are products available to help patients monitor diabetes, including contacting or implanting chips that detect blood glucose level that offer continuous monitoring of diabetes. Diabetes patients also suffer from poor wound healing, and daily 'finger pricks' are an inevitable painful experience.

According to statistics from the Hospital Authority, one in ten people in Hong Kong suffer from diabetes. United States Centers for Disease Control and Prevention show that more than 80% of people with pre-diabetes symptoms are not aware of it. Therefore, prevention and screening of diabetes are essential and meaningful. Their goal is to use a new generation of label-free quantitative analysis (SWATH-MS) would allow multiplexed, high-throughput screening of protein profile in tear film fluid with mass spectrometry.

每次『篤手指』帶來的痛苦：糖尿病患者傷口癒合比一般人慢，每日『篤手指』的過程，其實很痛苦。」看似微小的改變，卻可能在分分秒秒間減少千萬人生理和心理的痛苦，這樣的社會影響力正是Andes所憧憬。以他所知，應用新一代非標記定量質譜儀(SWATH-MS)分析淚液中蛋白質譜圖篩查糖尿病是較新的概念。

博士生創業　指導教授支持不可或缺

創新的概念往往令Andes著迷，期望為社會創新出一分力。他在英國先後完成化學學士及碩士課程，數年前回港發展後於科學園的初創公司當過一兩年打工仔。他發現，「在創新科技這一範疇發展，沒有博士課程的學術基礎是很不足夠的。我又想運用專長開發新技術及應用。所以我想創業。而在科學這一範疇創業，缺乏大學的支援是相當困難的。」輾轉間他獲香港理工大學眼科視光學院取錄。十分慶幸，指導他的導師，眼科視光學院副教授林全博士 (Dr. Thomas Lam) 與他志趣相投，成為他開展Good Seed的計劃時一股不可或缺的助力。

唸博士就像一對一的師徒制，學生與指導教授是否志趣相同十分重要。就如Andes，他的論文是研究近視，只是在學業以外還涉足糖尿病而已，如果身為老闆兼師父的Thomas不認同其做法，此項目不會誕生於Good Seed。令Andes感動的是，Thomas不止口頭上支持他，還身體力行，在Good Seed的決賽演講中與他一同站在評判面前，適時回答評判的提問。除此之外，Thomas還動用其人際網絡，介紹志同道合眼科視光師加入團隊，為Andes帶來莫大幫助。「他們除了在研究方面幫助了我很多，我會說是亦師亦友，大家有共同目標。」在參與Good Seed的過程中，Andes深深感受到導師、學系教職員、以至整間大學對學生創業的鼓勵與支持，而這對初創而言尤其重要。

港學術制度非以創新科技為重心

這亦令他進一步反思，為何創新科技在香港不成氣候？他分析，「為何只有美國做到？因為美國有一個很大的推動力。在美國，如果我是博士生，我進一間大學做的所有研究，成果是屬於發明者。在香港和很多歐洲國家，成果是屬於學校的，也不屬於教授，所以動力不會大。而且對教授而言，他們的績效指標不是做生意、初創及產品，而是學術論文，因此很多都寧可做一個出名的研究人員，專注於學術研究……美國的環境確實特殊，你看矽谷旁邊是什麼？史丹福大學為矽谷提供了無形的配套。」

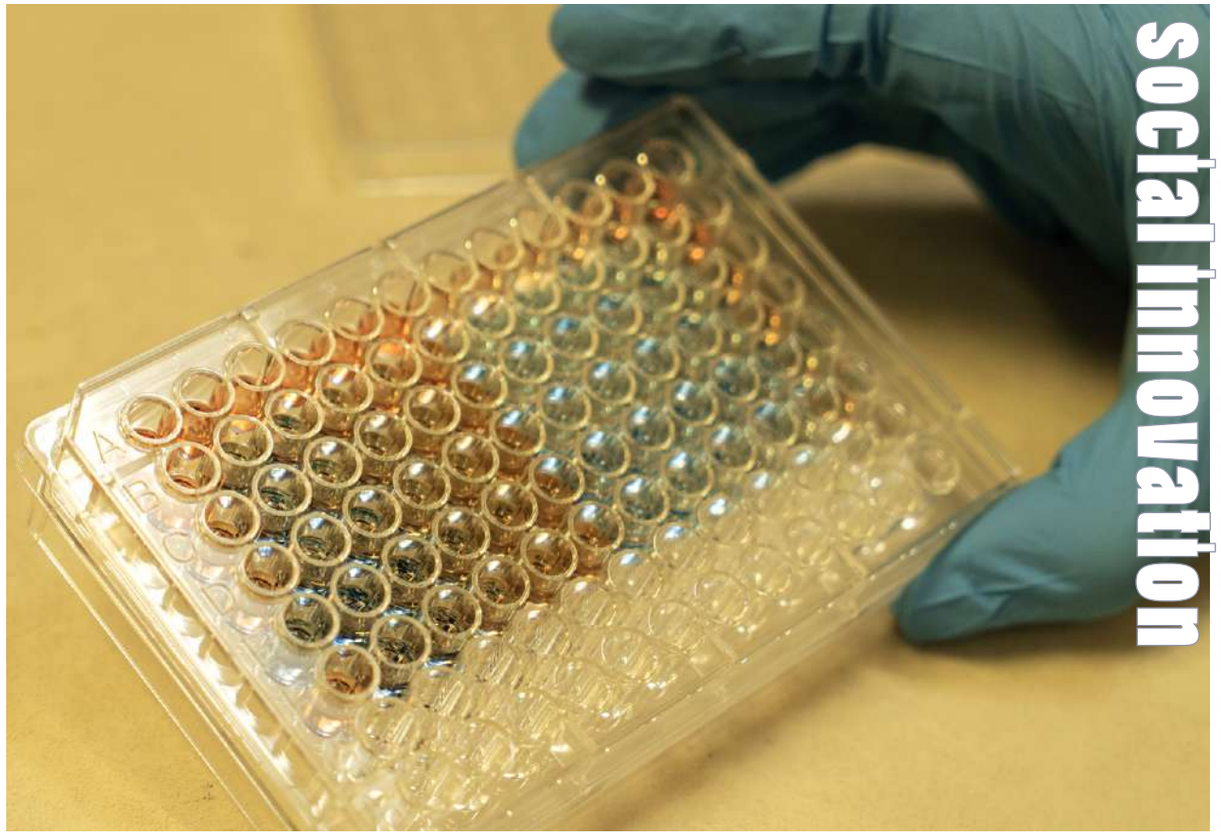
看似微小的改變，卻可能在分分秒秒間減少千萬人生理和心理的痛苦，這樣的社會影響力正是Andes所憧憬。

Team Up. Supportive advisors are essential for successful start-ups

Inspiration is our daily life; such concept should not be limited in the laboratory. Andes has completed the bachelor and master's degree in chemistry in the UK. Soon after graduation, he worked as a research scientist in a start-up company in The Hong Kong Science Technology Park (HKSTP). A PhD degree is inevitably important to a highly competitive, and innovation driven industry. The doctoral program provides training in critical thinking, rationale and practice to address novel question systematically that are largely unknown. Private companies often have strict budgets for research and development. Importantly, the lack of resources and opportunity to nurture entrepreneur. He is honored to receive support from Good Seed and his academic supervisor, Dr. Thomas Lam, associate professor of the School of Optometry, who share his interests and friendship to discuss, share expert experience, and other soft skills required for successful start-ups. Finally, team up with other expertise and collaboration to come up with novel ideas and deliver the project.

Doctoral programmes engage one-on-one mentorship as an education strategy; shared interest between the student and the supervisor is essential. Take Andes for example, his thesis is on myopia. His project on diabetes will not be born in Good Seed if his supervisor, and boss indeed, did not agree with his visions. What touched Andes most was not his professor's mental support, but how he endeavoured to help Andes. Thomas stood shoulder to shoulder with Andes to answer questions from the judges during the Good Seed's short-listing speech. He also made use of his network and helpfully brought an optometrist into the team. "They are not just helpful colleagues in research; they are both my mentors and friends. We share the same vision." Throughout his experience with Good Seed, Andes was deeply impressed by the support and encouragement he received from his supervisor, the university staff and the university. This is essential for an innovation project.

在計劃的進度方面，Good Seed團隊已為37名受訪者提供以淚液篩查糖尿病、糖尿病診斷及視光檢查，樣本將安排至實驗室運用液相層析質譜儀進行分析。惟礙於肺炎疫情，研究計劃不得不滯後。雖然Andes對此感到無奈，但保持社交距離十分重要，同時也了解他把目光放在更遙遠的將來。疫情總會過去，機會還是會留給有所準備的人。



More PhDs are leaving academia to entrepreneurship

United States is a hub for entrepreneurs and many successful start-ups. Hong Kong is catching up with the trend and promoting innovation and technology culture. Most universities, including Hong Kong, are limited to the development of academia, partly because of the performance indicators and measures on defining a successful PhD candidate. These academic achievements count on the quality of research reflected in academic journals. Professors and students are devoted to academic research rather than entrepreneurship, that is innovation or technology to benefit all human beings in any aspect. In addition, the intellectual property of works is one of the motivations for entrepreneurs. Universities in Hong Kong fully own any intellectual property rights generated by professors and students. In comparison to the United States, Stanford University has provided invisible, yet inevitable policies and entrepreneurial support for student and have contributed to the success of the nearby Silicon Valley.

The team has provided services to 37 beneficiaries with optometric assessments, diagnosis of T2DM and tear film biomarker screening of T2DM. Tear samples were collected and analyzed in laboratory for protein analysis using the state-of-the-art mass spectrometry. Due to the current Covid-19 situation and the importance of social distancing, however, the schedule has been postponed. A sense of frustration is evident in Andes's tone, but his steadfast attitude and faith in the future seeped out of his words. The pandemic will eventually pass, and opportunities will come to those who are prepared.