Ultrafast Multi-material 3D Nano-fabrication Platform Based on Two-photon Projection Technology
基於雙光子投影技術的超快多材料 3D 納米製造平台專案

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Advanced manufacturing is driven by engineering innovations that drastically lower production costs and enable the fabrication of structures and devices previously impossible. Currently, the $180 billion precision manufacturing market is stifled by a "speed-precision tradeoff" where nanoscale resolution is too slow and costly for mass production. To address this, Professor Chen Shih-chi and his team at The Chinese University of Hong Kong (CUHK) have developed the **Femtosecond Projection NanoPrinter (FP NanoPrinter)**, a breakthrough that significantly advances the envelope of micro-additive manufacturing.

By exploiting spatiotemporal focusing and digital holography, the project utilises ground-breaking methods to parallelise the 3D printing process, setting new world records for printing rates (400 mm^3/hour) and resolution (20–100 nm) – resulting in a 95% reduction in manufacturing costs. Unlike conventional platforms limited to single-material plastics, this process enables the high-speed 3D integration of over 20 material classes – including metals, semiconductors, and ceramics.

These capabilities allow for the mass production of functional nanostructures, such as optical metamaterials and flexible electronics, which are critical for the future of electric transportation, healthcare, and telecommunications.

The solution is being commercialised by **Astra Optics Limited**, a venture-backed CUHK spin-off, now supported by the Raise+ award, focused on high-precision components ranging from AR/VR optics and photonic interconnects for AI data centres to next-generation 3D photonic computing chips.

先進製造的驅動力在於工程創新，它能大幅降低生產成本，並使製造以前無法實現的結構和設備成為可能。目前，價值1800億美元的精密製造市場正受到「速度-精度權衡」的限制，納米級分辨率的製造速度太慢且成本太高，無法實現大規模生產。為了解決這個問題，香港中文大學陳世祈教授及其團隊開發了飛秒投影納米打印機（FP NanoPrinter），這項突破性技術顯著拓展了微增材製造的邊界。

本項目巧妙運用空間與時間聚焦效應，結合數位全息技術，成功研發出一套突破性的並行化3D打印方法，創下了列印速度（高達400立方毫米/小時）、解析度（介於20至100納米間）的全新紀錄，將製造成本降低 95%。與僅限於單一材料塑膠的傳統平台不同，該方案能夠高速 3D 打印超過 20 種材料——包括金屬、半導體和陶瓷。

這些創新技術首次為大規模生產功能性微米與納米結構提供了可能，如機械與光學超材料、微光學元件、以及柔性電子產品等。這些產品在電動汽車、醫療保健、計算及通訊等多個領域均展現出巨大的應用潛力。

本項目的 3D 納米製造技術由香港中文大學孵化的初創公司——超奈科技商業化，並且獲得「產學研 1+計劃」的支持。該公司已完成風險投資，專注於高精度微納光學元件及其模具的製造，產品範圍廣泛，包括虛擬實境設備的光波導元件、AI數據中心的光子互連及下一代3D光子計算晶片。

AI-Powered Robot for Retrograde Intrarenal Surgery
用於逆行性腎內手術的人工智能機器人

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Retrograde intrarenal surgery (RIRS) is now one of the most widely used minimally invasive treatments for urinary stones. However, the procedure remains technically demanding. Surgeons must manually manipulate long and flexible endoscopes within the complex renal collecting system, resulting in long learning curves and variable clinical outcomes.

This project develops the world's first **AI-powered robotic system for RIRS with Level-3 supervised autonomy**. By integrating flexible robotics, fiber-optic sensing, and advanced AI perception, the system enables real-time understanding of the surgical environment and robot-tissue interactions. It can automate tasks such as intrarenal navigation and laser positioning while the surgeon maintains supervisory control.

The platform aims to improve surgical precision, safety, and efficiency while reducing training barriers. Through clinical validation and regulatory approval, the project will advance the commercialisation of next-generation robotic solutions for urinary stone treatment and strengthen the development of intelligent medical technologies.

逆行性腎內手術（RIRS）已成為治療尿路結石的重要微創手術方式，但其操作技術要求高。醫生需手動操控柔性內窺鏡在複雜的腎盂系統中導航，導致學習曲線長並缺乏一致性。

本項目將開發全球首個具備 **Level-3「監督式自主」能力的人工智能 RIRS 手術機械人系統**。該系統融合柔性機械人操控、光纖感測與人工智能感知技術，可即時理解手術環境及機械人與組織的互動，並能自主完成腎內導航與雷射定位等操作，同時由醫生保持監督控制。

該平台有望提升手術精準度、安全性與效率，並降低手術培訓門檻。透過臨床驗證與監管審批，項目將推動新一代腎結石治療機械人技術的發展，並促進智慧醫療技術的進一步應用。

Nucleic Acid-based Nanomedicine for Targeting Treatment of EBV-associated Cancers EBV 相關癌症標靶治療的核酸納米藥物

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ACE NanoMed is dedicated to developing therapies for Epstein-Barr virus (EBV)-related malignancies, with a focus on nasopharyngeal carcinoma (NPC), which is prevalent in southern China, Hong Kong, and Southeast Asia. Currently, clinical treatment primarily relies on radiotherapy and chemotherapy, which, while killing tumour cells, cause substantial damage to healthy tissues. Furthermore, there are currently no approved targeted therapies for NPC worldwide.

Our solution comprises two distinct and innovative drug platforms. Our core product is the "aptamer-drug conjugate" (ApDC) – a precision drug that acts as a "targeted killer" in cancer treatment. This platform uses specially designed DNA aptamers as navigation devices, specifically recognising and binding to unique biomarkers on NPC tumor cells. This aptamer can be conjugated with chemotherapeutic drugs such as 5-fluorouracil or gemcitabine, achieving precise drug delivery to cancer cells. This targeted strategy requires only one-tenth the dose of traditional chemotherapeutics to produce potent anti-tumour effects and therefore significantly reducing the toxic side effects of conventional chemotherapy.

Our second investigational asset is an "EBV lytic inducer" based on mRNA technology, with a largely different mechanism of action. Given that nearly 100% of NPC tumours carry latent EBV, this therapy delivers instructions encoding a specific protein to tumour cells via synthetic mRNA encapsulated in nanoparticles. This synthetic protein acts as a "master switch", forcibly activating the latent EBV into its lytic cycle, ultimately leading to tumor cell death.

The project's innovative advantages include: pioneering ApDC and mRNA therapies for NPC; core sequences protected by international patents; and a lean asset business model. Our strategic partnership with the prestigious China Pharmaceutical will also enable direct access to the Chinese market and can be expanded to other EBV-related cancers.

Based on the top-tier research capabilities of The Chinese University of Hong Kong, we not only bring new hope to patients but also strive ourselves to promoting the development of Hong Kong's life science and technology innovation ecosystem.

頂尖納米醫療有限公司致力於研發 EB 病毒相關惡性腫瘤的療法，重點攻克在中國南方、香港及東南亞地區高發的鼻咽癌。目前臨床療法主要依賴放射治療和化學治療，在殺傷腫瘤的同時會對健康組織造成嚴重損傷，且全球範圍內尚無獲批的鼻咽癌標靶藥物。我們的解決方案包含兩個獨特且創新的藥物平台。核心產品是「適配體-藥物偶聯物」，一種在癌症治療中發揮「靶向殺手」作用的精準藥物。該平台採用特殊設計的 DNA 適配體作為導航裝置，能夠特異性識別並結合鼻咽癌腫瘤細胞的獨特生物標記。該適配體可與 5-氟尿嘧啶或吉西他濱等化療藥物偶聯，實現藥物對癌細胞的精準遞送。這種標靶策略僅需傳統化療藥物十分之一的劑量即可產生強效的抗腫瘤效果，顯著降低傳統化療的副作用。

我們的第二款在研資產是基於 mRNA 技術的「裂解誘導劑」，其作用機制截然不同。鑑於近100%的鼻咽癌腫瘤攜帶潛伏態 EB 病毒，該療法透過納米顆粒包裹的合成 mRNA，將編碼特殊蛋白的指令遞送至腫瘤細胞。這種合成蛋白如同「主控開關」，可強制激活潛伏的EB病毒進入裂解周期，最終導致腫瘤細胞死亡。

項目創新優勢包括：首創針對鼻咽癌的 ApDC 與 mRNA 療法、擁有國際專利保護的核心序列、採用輕資產商業模式；並與知名的中國醫藥集團的策略合作提供了直達中國市場的渠道，且可拓展至其他 EBV 相關癌症。憑藉香港中文大學的頂尖科研實力，我們不僅為患者帶來新希望，更致力於推動香港生命科技創新生態建設。