



Techxfer Tonewsletter Tonewsletter







48[™]
INTERNATIONAL
EXHIBITION
OF INVENTIONS
Geneva

26 - 30 APRIL 2023



The 48th International Exhibition of Inventions Geneva Received nearly a thousand of inventions from around the world.

The International Exhibition of Inventions Geneva is an annual event dedicated to invention. It is a unique opportunity for industrial and commercial companies, universities, inventors and researchers, associations, private and state organisms and institutions to present their inventions, the results of their research and their new products. This year, nearly 1000 innovations from Asia, the Middle East and Europe were showcased at the exhibition.

The University's participation in this year's competition was coordinated by the Technology Transfer Office of HKU.





HKU'S AWARD-WINNING INVENTIONS IN 2023

INVENTION & INNOVATION CAI AWARD (China Delegation) & PRIZE OF THE DELEGATION OF MALAYSIA & GOLD MEDAL

*	Artificial Intelligence MGF Network for Anomalies Detection	3
	GOLD MEDAL WITH CONGRATULATIONS OF THE JURY	
•	Programmable Cell Niche Engineering Platform	4
	GOLD MEDALS	
*	Respiratory Organoids	5
•	Bismuth-based Cocktail Therapy for Coronavirus	5
•	PERFECT Wearables for Digital Health	6
	Method of Developing a Peptide-based Vaccine Conjugated with 1V209	
•	DipμChip – Capillary Microfluidic Platform for ———————————————————————————————————	7
	SILVER MEDALS	
*	Smart Address Plates for Pedestrian Indoor Navigation and Location-based Services and Management	8
	A Novel Stem Cell-based Platform for Antiviral Discovery, Vaccine and Healthy Natural Products	
*	Ultra-thin Flexible Robotic Instruments for Endoluminal Surgery	9
	Automatic Alignment of Microparticles	9
•	Interferon-integrated Coronavirus Vaccine: a next-generation universal live vaccine protects against pan beta-coronavirus infection	10
•	NanoComplex ————————————————————————————————————	10
	BRONZE MEDALS	
*	Remote e-Inspection System for the Manufacturing and Delivery of Offsite Modular Construction	11
*	On-site Fertilizer Production for Perpetual Farming	11
*	Smart Elderly Walker	12
*	Aptasensor for Sepsis Diagnostic	12



Artificial Intelligence MGF Network for Anomalies Detection



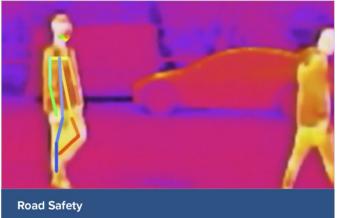
The invention was developed by the research team of Dr Wilton Fok from the Department of Electrical and Electronic Engineering, The University of Hong Kong.

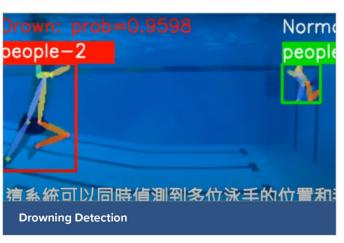
By leveraging AI technology, this invention can detect human skeletons in a video and quickly analyse their posture and movements to identify abnormal behaviours and situations more precisely and effectively. It can also capture the context information in a long video and focus on specific portions to detect multiple anomaly scenarios in real time, such as abuse, drowning, terrorist attacks, traffic accidents, fighting and criminal behaviour. The invention can be applied in children's centres, swimming pools, public transport and exhibition centres for public safety and security.

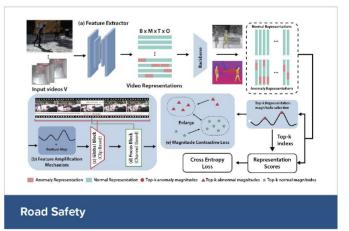


Prof Sun Dong, JP, Secretary for Innovation, Technology and Industry (third from left), shared the joy with Dr Wilton Fok (forth from left) and his research team on stage for their awarded invention.









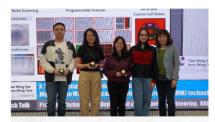
GOLD MEDALS WITH CONGRATULATIONS OF THE JURY

Programmable Cell Niche Engineering Platform

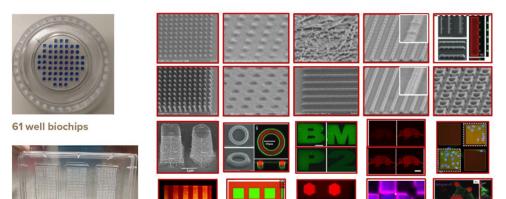


The platform was developed by Professor Barbara Chan and her team from the Department of Mechanical Engineering, Biomedical Engineering Programme, The University of Hong Kong.

When growing cells for drug research, scientists typically use unnatural flat and rigid surfaces that are very different from native tissues of human bodies, leading to non-representative cell responses. This is one of the reasons why many drugs that successfully pass the laboratory tests do not work well in clinical trials. To address this issue, Professor Barbara Chan and her team from the Department of Mechanical Engineering, Biomedical Engineering Programme, The University of Hong Kong has developed this platform to provide a programmable niche solution to mimic biological conditions for cells, aiming to ensure proper cellular functions and highly predictable clinical results. With the ability to identify the ideal niche for different cell types, the multifactorial biochips of the platform can help build up a comprehensive library of individual niche factors, enabling scientists to develop optimal culture environments for specialised applications.



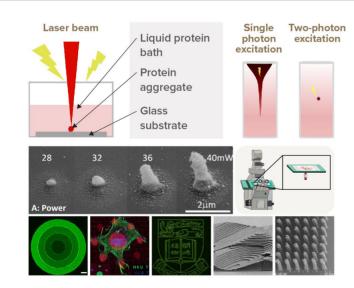
(right to left)
Professor Barbara Chan with project team
members Mina Razaghzadeh, Dr. Abigail
Chen, Dr. Xinna Wang, and Dr. Nan Huang



288 well biochips Programmable Features



All-in-one cell niches



Applications

Regenerative Medicine and Drug Screening

- Biochips and culture inserts with native tissue-like substrates
- Accurate and predictive results for drug discovery and personalized drug screening
- Platform for designing novel products for regenerative medicine and tissue engineering
- ◆ Human cell-derived mini organ-like culture
- ◆ Pathophysiological disease modeling

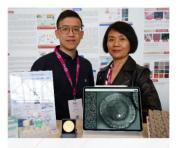
GOLD MEDALS

Respiratory Organoids



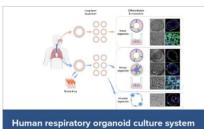
The project was originated by Dr Jie Zhou, Dr Man Chun Chiu, Dr Cun Li and Professor Kwok Yung Yuen from the Department of Microbiology, The University of Hong Kong.

Cell lines and animal models have been the major tools for biomedical research, but lack physiological relevance to human biology and pathology. A research team from HKU has developed the first-ever respiratory organoid culture system, enabling efficient reconstruction and reproducible expansion of the entire human respiratory epithelium in culture plates. In this system, all the differentiated respiratory organoids, such as nasal, airway and alveolar organoids, represent universal tools with high biological relevance for different biomedical and pharmaceutical applications, ranging from disease modeling, therapeutics development and toxicological evaluation to personalized medicine. Through mimicking the multicellular composition of native respiratory epithelium and phenocopying the functionality, this project aims at developing respiratory organoids as robust models with superior performance to the current in vitro models.



(left to right) Dr Raymond Chiu and Dr Jie Zhou

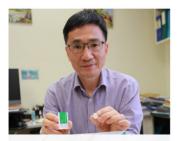








Bismuth-based Cocktail Therapy for Coronavirus



Prof SUN Hongzhe



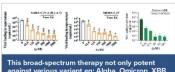
Derek Chan from Prof SUN's research team

The invention was developed by Professor Sun Hongzhe, Professor Yuen Kwok-yung, Dr Yuan Shuofeng, Dr Wang RunMing, Dr Li Hongyan, Dr Jasper Chan Fuk-Woo, Dr Cheng Tianfan, Mrs Wang SuYu, and Mr Chan Chun Lung of The University of Hong Kong.

Facing the increasing transmissibility of the SARS-CoV-2 variants, together with emerging drug resistance and decreasing vaccine-induced protection, a research team from HKU committed to devising a safer and more effective therapeutic option to combat COVID-19. Under this project, it was found that the orally-administrated bismuth drug colloidal bismuth subcitrate with N-acetyl cysteine is a broad-spectrum anti-coronavirus cocktail therapy against a diverse range of SARS-CoV-2 variants and coronaviruses. Two US Food and Drug Administration (FDA) approved over-the-counter drugs are combined in a ratio of 1 molar equivalent of colloidal bismuth subcitrate to 3 molar equivalents of a mucoactive drug N-acetyl cysteine, to create a safe and highly potent orally-administered therapy which is 10 times more selective in killing the virus, compared with the first FDA approved drug. This therapy is currently undergoing its phase II/III clinical trial in Hong Kong, with a phase III trial underway in China.







GOLD MEDALS

PERFECT Wearables for Digital Health



The invention was developed by the WISE Research Group from The University of Hong Kong and SESIC LIMITED.

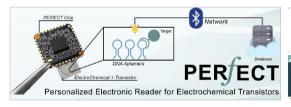
Developed by the WISE Research Group led by Dr. Shiming Zhang from The University of Hong Kong, "HKU PERFECT" is a first-of-its-kind wearable platform enabled by decentralised medical technologies for remote and personalised healthcare, with exclusive features such as being highly sensitive, energy efficient, lightweight and ultracompact. Unlike existing wearable devices that can simply measure vital signals such as heart rate, breathing rate or blood pressure, PERFECT is able to detect molecular indicators in body fluids, providing more relevant data for screening and monitoring chronic/fatal diseases, and has received positive endorsements from over 100 leading scientists worldwide on social media. This device can help cope with problems associated with an aging population, quarantine or a shortage of medical instrumentation.

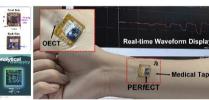




Dr Zhang Shiming

Dr Zhang's project team









Method of Developing a Peptide-based Vaccine Conjugated with 1V209



Prof HUANG Jiandong

The invention was developed by Professor Jiandong Huang and Dr Yefan Hu from

the School of Biomedical Sciences, The University of Hong Kong.

In the past, synthetic peptide vaccines needed to be used together with vaccine adjuvants to stimulate T cells against specific antigens to treat cancer – but simply mixing antigens and adjuvants cannot reliably induce targeted immune responses. This invention embodies the development of a safer and greener method to conjugate 1V209, a toll-like receptor (TLR) 7 agonist, to antigens in order to generate peptide-drug conjugates, forming a self-adjuvating vaccine to deliver antigens and adjuvants simultaneously. This can induce a stronger T cell response to provide more stable and successful tumour growth suppression.

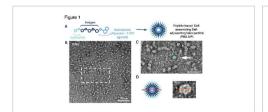


Figure 1. The physical characteristics of peptide-based self-adjuvanting vaccine. A. Design of peptide-TLR7 agonist conjugates. B. Transmission electron microscopy (TEM) image at 52,000 X magnification. C. Zoomed in area of TEM image. D. The comparison of the modeling structure and imaged structure of 1V209-conjugated peptide.

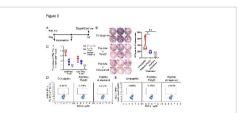


Figure 2. Immunogenicity test of peptide-based self-adjuvanting vaccine. A Administration process in mouse model for immunogenicity test, as well as dose of different groups. B. IFN-y EUSpot results of 1V209-conjugated peptide vaccine (conjugates) comparing with Imiquimod or poly(I:C)-adjuvanting original peptide. Here, students' t test is used. *P <0.05, **P <0.01. C. The percentage of IFN-y+ T cells in CD8+ or CD4+ T cells measured by flow cytometry. D. CD8+ IFN-y+ T cell flow cytometry result. E. CD4+ IFN-y+ T cell flow cytometry result.

GOLD MEDALS

DipµChip – Capillary Microfluidic Platform for Point-of-care Diagnostics



The platform was developed by Prof. Anderson Shum, Dr Sammer UI Hassan and Mr. Nicky Lee from the Department of Mechanical Engineering, Advanced Biomedical Instrumentation Centre, and MicroDiagnostics Ltd, Hong Kong.

Designed and fabricated by leveraging advanced molecular biology and microfluidic technologies, DipµChip is an automated capillary microfluidic-based point-of-care (POC) microsystem for rapid and portable detection of various high-impact and mortality diseases. This microsystem utilises capillary pressure and surface-activating treatments that enable laboratory-level analytics to be conducted in an accessible manner, paving the way for a diverse range of clinical and academic applications involving multiple conjugations and washings. This invention can be used in clinics, hospitals, homes and assisted living healthcare facilities, enabling caretakers to provide timely clinical care to patients in need and save lives.





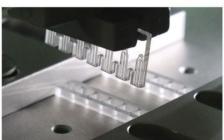


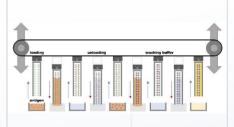
Dr. Sammer UI Hassan



Mr. Nicky Lee









SILVER MEDALS

Smart Address Plates for Pedestrian Indoor Navigation and Location-based Services and Management



The Smart Address Plates and Location Confirmation System were developed by Professor Anthony Yeh, Dr Zhong Teng and Dr Run Shi from the Department of Urban Planning and Design, The University of Hong Kong.

Inaccuracy of outdoor GPS and indoor positioning has been a longstanding problem for pedestrian navigation and position identification using the conventional Location Positioning System (LPS) with trilateration. The Location Confirmation System (LCS) has been developed as an innovative cost-effective alternative, using Smart Address Plates (SAP) to accurately locate and guide users to their destinations. Transmitting stored geographic coordinates with its 3D Smart Address (SA) codes, this SAP system can help users find the exact location of shops/ offices/ restaurants/ car parking spaces inside a multi-storey building even without Wi-Fi or telephone signals. Apart from providing location-based services and supporting management for precise target marketing, its highly scalable Smart Address Plate Management System (SAP-MS) can connect shops/rooms on a floor to a building and even to a district and to the whole city.



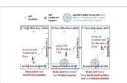
(left to right)
Dr Run Shi and Prof Anthony Yeh



Location Confirmation System (LCS) - A New Paradigm for Pedestrian Indoor Navigation



Transmission of Geographical Location by Smart Address Plate (SAP) that Can Work in Basement Without WiFi or Telephone Signals



Display of Confirmed and Last Confirmed SAP Location



Example – HKUSAP Campus Indoor and Outdoor Navigation System



Many Indoor Navigation and Location Based Services (LBS) Applications



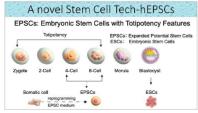
A Novel Stem Cell-based Platform for Antiviral Discovery, Vaccine and Healthy Natural Products

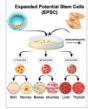


(left to right)
Prof Fang Liu, Prof Pengtao Liu,
Dr Degong Ruan

The platform was developed by Professor Pengtao Liu from the Li Ka Shing Faculty of Medicine, and Dr Degong Ruan and Professor Fang Liu from the Centre for Translational Stem Cell Biology, The University of Hong Kong.

Led by Professor Pengtao Liu of the Li Ka Shing Faculty of Medicine, and Dr Degong Ruan and Professor Fang Liu of the Centre for Translational Stem Cell Biology, a research team from The University of Hong Kong has developed a new type of human cell model for anti-virus drug development with enhanced sensitivity and efficiency to address the urgent needs of the vaccine industry. The project's human Expanded Potential Stem Cells (hEPSCs) help generate trophoblast stem cells (TSCs) and syncytiotrophoblasts (STBs) which exhibit high levels of SARS-CoV-2 host factors and an elevated susceptibility to the viral infection, with the infected eSTBs 1,000 times more sensitive to antiviral drugs. Hence, this TSC-STB platform is a more ideal human cell source for viral production and performing antiviral discovery, including SARS-CoV-2, MERS, their variants, and the FDA approved anti-virus drugs and natural products.









SILVER MEDALS

Ultra-thin Flexible Robotic Instruments for Endoluminal Surgery



The system was developed by the research team of Dr Ka-Wai Kwok from the Department of Mechanical Engineering, The University of Hong Kong.

Endoluminal surgery is an effective approach for treating early-stage cancers in the gastrointestinal and urinary tract. Also known as incisionless surgery, it does not require any external incisions, with access to cancers made exclusively through natural openings in the body. However, current practice is hindered by cumbersome and unintuitive instruments that create an extremely steep learning curve for clinicians. In view of this, a research team led by Dr Ka-Wai Kwok from the Department of Mechanical Engineering, The University of Hong Kong, has developed a robotic system to flatten the learning curve while enhancing clinician's surgical capabilities. The system features highly miniaturised and flexible instruments, which are as small as Ø2.5 mm with 5 degrees of freedom each. These instruments are controlled in a highly intuitive and simplified manner, and seamlessly integrate with standard rigid and flexible endoscopes without disrupting existing clinical workflows. The team has founded a startup company, Agilis Robotics Limited, to bring their technology to market and advance it towards true clinical implementation.



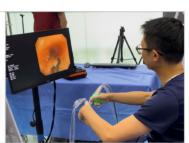
Dr. Ka-Wai KWOK



Mr. Justin HO









Automatic Alignment of Microparticles

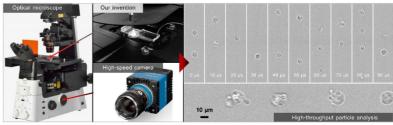


(right to left)
Prof Kevin Tsia and Dr Kelvin Lee

The invention was developed by Professor Kevin Tsia and Dr Kelvin Lee from the Department of Electrical and Electronic Engineering, The University of Hong Kong.

A research team from HKU has invented a credit card-sized device which can align up to one million microparticles per minute in liquids, with precision down to 0.001 mm at a cost of less than USD10. This groundbreaking invention uses a revolutionary microchannel with specifically arranged roadblocks to guide disordered particles into an ultrafast-flowing chain, overcoming the limitations of current methods with exceptional performance at a low cost. This game-changing innovation is ideal for applications that involve microparticle analysis and processing, especially blood cell screening and water filtration.





SILVER MEDALS

Interferon-integrated Coronavirus Vaccine: a next-generation universal live vaccine protects against pan beta-coronavirus infection



The technology was developed by Dr Kin-Hang Kok and the team from the Department of Microbiology of The University of Hong Kong and the Centre for Virology, Vaccinology and Therapeutics.

After the COVID-19 pandemic, there is a pressing need to develop next-generation coronavirus vaccines to combat both existing and future beta-coronavirus infections. By combining innovative designs and cutting-edge genetic engineering technologies, the research team has created the ideal nasal vaccine to protect us. The IBIS vaccine features: 1) universal protection against a broad range of beta-coronaviruses, 2) enhanced mucosal T cell immunity, and 3) robust innate anti-viral mechanisms for safety. Preclinical studies in two animal models have demonstrated unparalleled efficacies of IBIS as a nasal vaccine. The team also overcame technical difficulties and streamlined a vaccine production pipeline that can greatly benefit mass production.



(left to right)
Dr KH Kok and team member
Dr Jack Yuen





NanoComplex

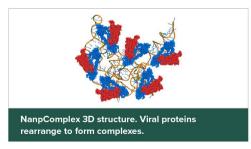


(left to right)
Dr KH Kok and team member
Dr Joy Lam

The technology was developed by a research team led by Dr Kin-Hang Kok from the Department of Microbiology of The University of Hong Kong and the Centre for Virology, Vaccinology and Therapeutics.

NanoComplex is a next-generation vaccine technology designed for nasal use and carries the potential to target all kinds of viruses. Viruses have proteins as antigens and nucleic acids as genomes, both are critical components to alert our immune system and generate strong protection. The NanoComplex technology takes full advantage of these components, combines viral proteins and nucleic acids with innovative methods, and creates a nano-sized complex that can be used as a nasal vaccine. Since all viruses have the same components, the NanoComplex can switch its internals for different viruses, and therefore can potentially defend against all known viruses.





BRONZE MEDALS

Remote e-Inspection System for the Manufacturing and Delivery of Offsite Modular Construction

The system was developed by Prof Wilson Lu, Director of the iLab of the Faculty of Architecture, together with Professor Anthony Yeh, Chair Professor of the Department of Urban Planning and Design, and Mr KL Tam, Former Director of the Estates Office of The University of Hong Kong.

Modular Construction (MC) is now commonly used to help solve housing problems, but it's difficult to monitor the quality of production and the progress of transportation from remote sites. This e-Inspection System has been developed to reduce the resources and paperwork required for supervising offsite modular construction with secured tamper-proof data. The Modular Construction Supply Chain Quality Assurance system comprises four components: (i) an i-Core IoT device attached to each MC module to monitor the position, humidity, temperature and collision data; (ii) an e-InStar app to upload the checking result of each production step in a remote factory to the blockchain; (iii) an e-TranStar app to monitor the location and condition of the MC module during the transportation process; and (iv) a blockchain-based backend. A pilot application has been deployed in an HKU project in Hong Kong, with two 17-storey buildings using 952 Modular Integrated Construction (MiC) modules.



(left to right) Prof Anthony Yeh, Prof Wilson Lu and Mike Wu



e-Inspection System







e-Inspection in the offsite factory

On-site Fertilizer Production for Perpetual Farming

Assurance

Dr Edmund Tse



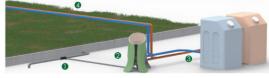
(left to right) Team member: Wanying Wang and Jackson Yip

The device was innovated by Dr Edmund Tse, Wanying Wang from the Department of Chemistry, The University of Hong Kong, and commercialised with the help of Yip Jackson Ho So.

With the ultimate goal of improving the urban municipal discharge situation and local marine environment, the EC Flow device developed under this project provides an energy-neutral system to detect and remove a diverse range of toxic residual nitrates and nitrites (NOx) in soil and then upcycle NOx to feed fertilizer back into urban farming sites. Driven by renewable energy, the device is fully integrated with solar panels and battery storage systems for waste remediation, pollution mitigation and resource recovery to achieve nitrogen neutrality. This solution can help lower toxin levels in municipal waste and alleviate ecological strains on urban sewage systems, and can be applied to different scales and types of plantation areas, such as farms, lawns, roof gardens and balconies.



pumped into the system



Operation

NOx are converted into

1. Set up an adaptor on the efflux pipe, and NH₄+ by electrocatalysis is delivered to an EC Flow system through a central pump.

2. Electrocatalytically reform the wastewater from plant beds into fertilizer.

3. Fertilizer-rich water stored in tanks can be used for future irrigation cy

4. Reintroduce fertilizer-rich water to the plant beds using our complementary mobile app.

BRONZE MEDALS

Smart Elderly Walker

The device was developed by the research team of Professor Chuan Wu, Dr Hao Luo, Dr Zhao Chongyu and Dr Wen Rongwei from the Department of Computer Science of The University of Hong Kong; and Professor Wang Zheng from the Department of Mechanical and Energy Engineering of The Southern University of Science and Technology in Shenzhen. Dr. Hao Luo is also from the Department of Social Work and Social Administration, The University of Hong Kong.

Aiming to help the elderly stay healthy, active and independent while living an easier and safer life, the Smart Elderly Walker has been developed with a home-friendly design paired with advanced Artificial Intelligence technologies. This smart and handy device features a stable mechanical structure with smooth omnidirectional mobility, dual-mode actuation and control for simultaneous walking/standing support and fall prevention/recovery, plus soft robotic handles and privacy-friendly sensors for event detection and control and fall detection. Its specialised sound-source localisation can help locate the elderly user in a fast and effective way to ensure a higher level of protection whilst offering outstanding walking assistance.





(left to right) Dr Zhao Chongyu and Dr Wen Rongwei



The Sound Source Localization (SSL) technology can quickly and accurately pinpoint the precise location of sound coming from any direction. That means with its auto navigation feature, the walker can find you more quickly. Enjoy the convenience!



Our Smart Elderly Walker is designed to provide enhanced safety protection and superior walking assistance for older adults, making their daily life easier and more secure.



Combining a thermal imaging camera with unparalleled user privacy, 2D LIDAR tracking for exact positioning, a deep learning model to anticipate user intention and a soft robotic handle for emergency detection - the Walker enables hands-free and effortless walking.

Aptasensor for Sepsis Diagnostic



Dr William Whitehouse



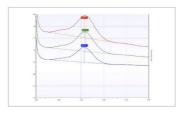
Prof Julian Tanner



Dr Louisa Lo

The invention was developed by Dr. Louisa Hoi-Ying Lo, Dr. William Whitehouse, supervised by Professor Julian Tanner, from the Advanced Biomedical Instrumentation Centre.

To ensure optimal survival for sepsis patients, a timely diagnosis with swift treatment is essential. However, this remains a major challenge. Aiming to advance sepsis diagnosis, an aptasensor leverages a novel DNA-based biosensor that integrates aptamers into a point-of-care (POC) platform, revolutionising POC sepsis detection with a prompt and highly sensitive solution. By specifically binding to unique structures on their surface, aptamers can effectively recognise biomarkers and be readily integrated into different platforms, including electrochemical platforms (quantitative device) and/or colorimetric assays (rapid test). Compared to antibody-based tools, aptamers deliver a number of advantages in terms of stability, production cost, reproducibility and flexibility.









We are delighted to have been able to assist the award-winners in participating in the International Exhibition of Inventions of Geneva 2023.

Would you like to participate in next year's exhibition? We are ready to help!

Contact us and let us know what you are working on, and we will help you to take the next steps.

You can contact us by email (info@tto.hku.hk) or telephone (3917 3111).



HKUTTO



HKU Technology Transfer Office





HKU Technology Transfer Office