THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

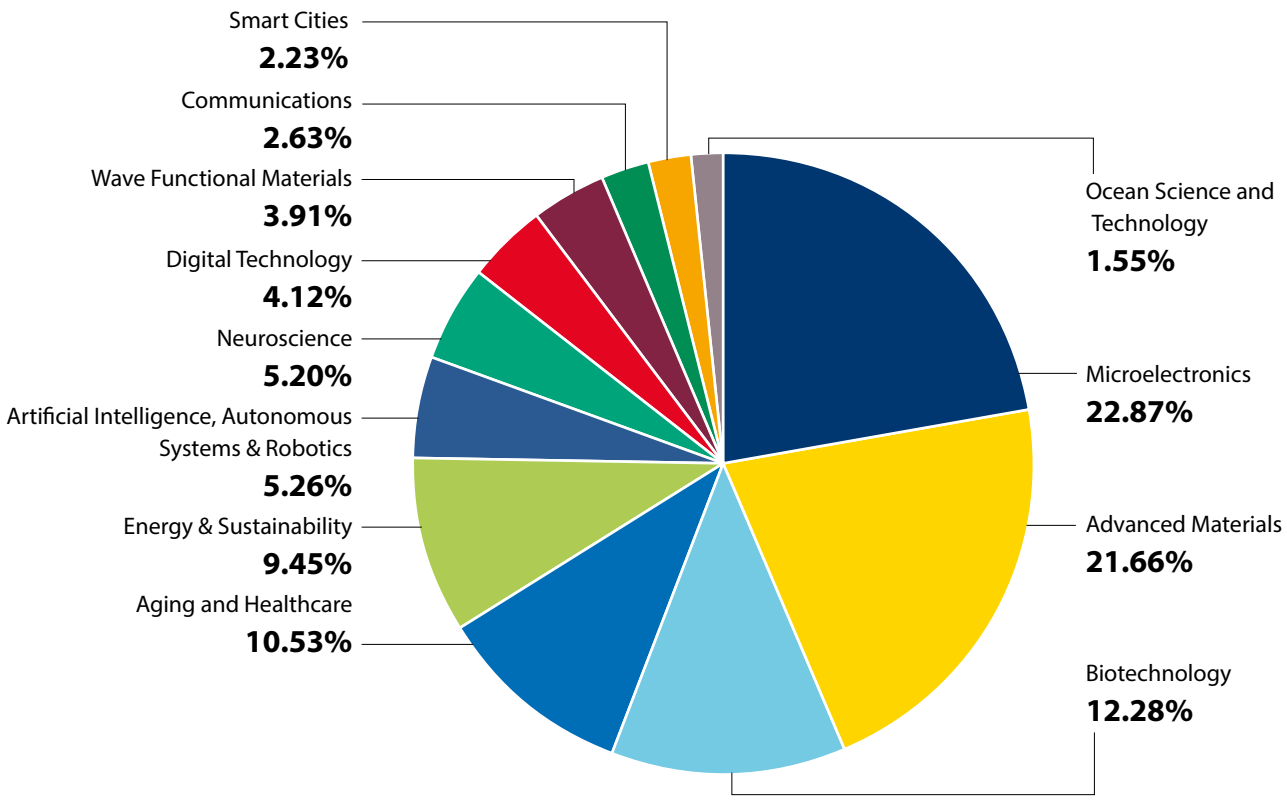
OKT OFFICE OF KNOWLEDGE TRANSFER

HKUST DeepTech Playbook 2023

About The Hong Kong University of Science and Technology

The Hong Kong University of Science and Technology (HKUST) (*https://hkust.edu.hk/*) is a world-class research intensive university that focuses on science, technology and business as well as humanities and social science. Over 80% of our research work were rated "Internationally excellent" or "world leading" in the Research Assessment Exercise 2020 of Hong Kong's University Grants Committee. We were ranked 3rd in Times Higher Education's Young University Rankings 2022, and our graduates were ranked 30th worldwide and among the best from universities from Asia in Global Employability University Ranking and Survey 2022. HKUST was ranked first in four engineering and materials science subjects according to the QS world university rankings by subject 2021. As of early 2023, HKUST members have founded 1,645 active start-ups, including 9 Unicorns and 11 exits (IPO or M&A), generating economic impact worth over HK$400billion.

Current Active Patent Portfolio by Technology Area



- **No. 1 patent influence metric in China and 33rd in global by Nature Index (2022)**
- **Patent utilization: 28%**

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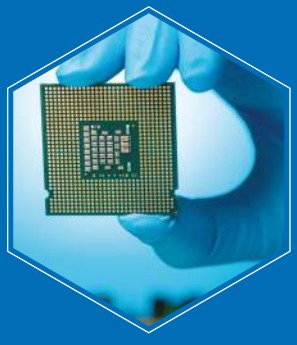


Electronics, AI and Smart Systems (EAS)

EAS 01 AIoT and Sensing Technologies for Smart City Applications: Seamless Pervasive Positioning, Real-Time Asset Tracking, and Edge AI-Based Computer Vision

Principal Investigator | **Prof. Gary CHAN**

From indoor to outdoor, for versatile localization or asset tracking applications, the proprietary edge AI algorithms and computer vision technologies with real-life adoptions can provide accurate, real-time, and low-cost deployment methods for building a smarter city.

Key Technology Edges:

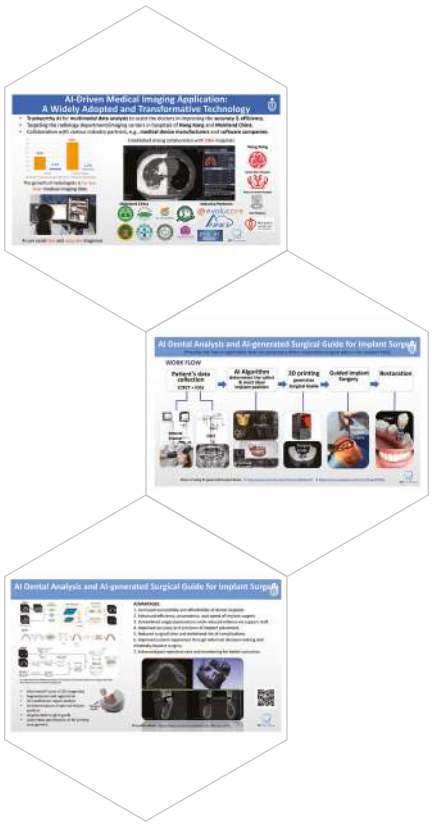
- A pervasive positioning standard with the government supporting seamless roaming between indoor and outdoor space.
- Lightweight machine learning algorithms to support accurate real-time IoT localization, asset tracking and people sensing.
- Edge AI approach to support novel cost-effective computer vision applications (smart carpark, activity recognition, object counting, medical AI, etc.)

Potential Applications

- Indoor Localization and Personalized Recommendation
- People Sensing, Asset Tracking, Crowd Counting and People Flow (in Mall, Stations or for Public Safety)
- Smart Carpark with Ultra Wide-Angle Cameras Supporting Massive License Plate Recognition, Vacancy and Mis-Parking Detection, Car Tracking, Parallel Parking, Car Type and Brand Recognition, etc.

Industries

- Information Technology, Communications and Software Services



EAS 02 AI-Generated Surgical Guide for Implant Surgery and Dental Analysis

Principal Investigator | **Prof. Hao CHEN**

AI assistive technologies that improves the accuracy and timeliness of dental implant design and guide planning processes, significantly reduces the preparation time from days to minutes.

Key Technology Edges:

- Contour-aware multi-modality registration for CBCT and 3D intra-oral scan.
- Generative teeth crown inpainting.
- Human-in-the-loop implant position design.

Potential Applications

- AI Dental Analysis System
- AI-Generated Teeth Crown Inpainting
- AI-Generated Surgical Guide for Implant Surgery

Industries

- Biomedical, Healthcare and Food

EAS 03 VideoCrafter: A Unified Toolkit for Personalized Text-to-Video Generation and Editing

Principal Investigator | **Prof. Qifeng CHEN**

The generative AI technologies empower automated video generation based on plain text descriptions. It enables instant content creation based on personalized interests and reduces over 90% of time and cost for video editing.

Key Technology Edges:

- Generic Text-to-video Generation - a leading open-source text-to-video foundation model in the market and research fields.
- VideoLoRA: Personalized Text-to-Video Generation with LoRA. Text-to-video generation with given styles.
- VideoControl: Video Generation with More Condition Controls. Text-to-video generation with more user controls.

Potential Applications

Text-to-Video Generation | Animation Generation | Digital Avatars

Industries

Information Technology, Communications and Software Services

EAS 04 Building Safer and Smarter: A Digital Platform for Construction Safety and Efficiency

Principal Investigator | **Prof. Jack CHENG**

At construction workplaces, the smart digital platform combines automated BIM generation and AI-based data processing capabilities, which improves the efficiency of infrastructure building and inspection, as well as site safety.

Key Technology Edges:

- Automated BIM generation using UAV and 3D laser scanning tech.
- Scanning of targeted environments for construction safety and efficiency.
- Post-processing of scanned data to generate BIM models for infrastructure building, inspection, and maintenance.

Potential Applications

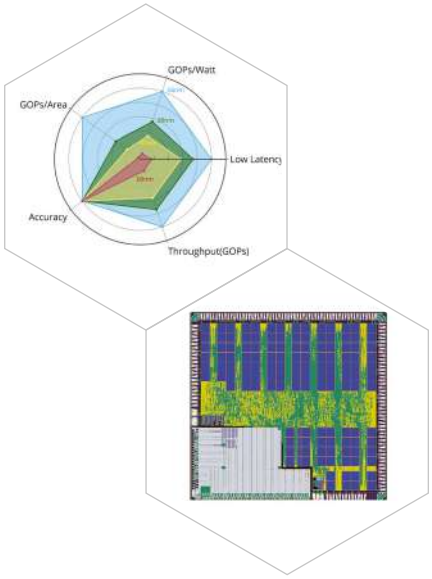
Construction | Site Safety | AI | Computer Vision

Industries

Construction and Property

EAS 05 Application Specific AI Accelerators for Edge Computing

Principal Investigator I **Prof. Tim CHENG**



To develop low power application specific AI accelerators for various edge applications using algorithm-compiler-hardware codesign and emerging IC technologies.

Key Technology Edges:

- High performance AI accelerator architecture through NN compression, compilation and hardware co-design for specific application.
- Fast customization for specific application using NAS-DSE toolchain and fine-tuned core module library.
- New technology of transformer acceleration, NVM storage and computing, and 3D IC for various application requirements.

Potential Applications

- Health Care: Providing A Dedicated AI Accelerator SoC or Chiplet Solution with Bio-Signals and Visual Input for Remote Monitoring and Analysis
- Intelligent Security Camera: Providing a Dedicated AI Accelerator SoC or Chiplet Solution for Detection of Suspicious Activities, Person Behavior, Etc.
- Automotive: Providing a Dedicated AI Accelerator SoC or Chiplet Solution for Detection and Comprehensive Anaysis of the Driving Environment

Industries

- Electronics and Semiconductors

EAS 06 An Integrated Low-Powered Nano-Gas Sensor for Air Quality Monitoring and Odor Detection

Principal Investigator I **Prof. Zhiyong FAN**

The technology offers a monolithic low-power metal oxide sensor array with extra low detection limits and remarkable gas classification performance, allowing ultra-low concentration (part-per-trillion level) of Volatile organic compounds (VOCs) and inorganic gases measurement and AI/ML driven data calibration and classification of multiple gases and odors.

Key Technology Edges:

- Ultra-low concentration (part-per-trillion level) of Volatile organix compounds (VOCs) and inorganic gases measurement.
- High selectivity and AI/ML driven data calibration and classification of multiple gases and odors.
- Low-power consumption semniconductor devices.

Potential Applications

- Environmental Safety, Air Quality
- Food Quality and Safety
- Healthcare

Industries

- Electronics and Semiconductors

EAS 07 Reliable and Scalable Quantum Computers Based on Neutral Atoms

Principal Investigator I **Prof. Gyuboong JO**

The recent lab developed advanced technologies offer reliable and scalable quantum computers using nature-born perfect qubits based on Rydberg atoms and sophisticated atom-by-atom assembly technique, allowing the companies and researchers to solve difficult problems far beyond the reach of current classical computers.

Key Technology Edges:

- Local company - IBM, Google, and others do not provide service to China because of geopolitical competition.
- Scalable system - tweezer trapped neutral atoms make well-connected (i.e. controlled long-range interaction) and scalable qubits due to flexible nature of optical tweezers.
- Better technology - neutral atoms feature longer coherence times, operates at the room temperature unlike superconducting qubits. Tweezer-trapped-atoms offer highly connectivity and scalable qubits.

Potential Applications

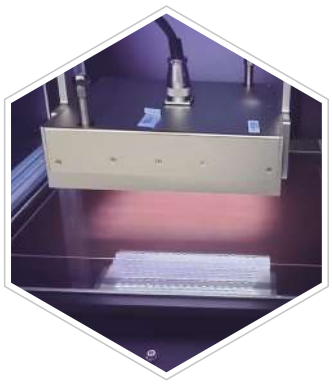
Quantum computing has the potential to revolutionize many fields, including:

- **Cryptography: Quantum Computers Can Quickly Factor Large Numbers**
- **Simulation: Quantum Computers Can Simulate the Behavior of Quantum Systems, Accelerating the Discovery of New Drugs and Materials**
- **Optimization: Quantum Computers Can Solve Optimization Problems Much Faster Than Classical Computers, Allowing for More Efficient Solutions to Problems in Scheduling, Logistics, and Financial Modeling**

Industries

- **Information Technology, Communications and Software Services**

EAS 08 Photo-Aligned Multi-Domain Vertical Alignment LCD for Cost Effective Mass Production with Existing Equipment



Principal Investigator I **Prof. Hoi Sing KWOK**

The technology offers a method of using azo dye for photo-realignment using blue light with viscosity modifiers optimizing the coating solution, allowing the manufacturer to achieve an efficient and cost effective way of LCD mass production using existing equipment.

Key Technology Edges:

- Patented advance material for photo-alignment to break foreign country material monopoly.
- Patented LED light exposure system much cheaper than conventional photo-alignment exposure system.
- Easy to implement multi-domain manufacturing process suitable for all existing LCD production lines.

Potential Applications

- **To Produce Unique All Viewing Angle, High Contrast LCD That Can Replace All Existing Black and White Passive LCDs in the Market**
- **To Enter the Active TFT LCD (TV or Monitor) Market with Strong Competitiveness**

Industries

- **Manufacturing and Engineering**

EAS 09 An Integrative System for Food 3D Printing and Multi-Level Cooking for Making Personalized Meals with Ease

Principal Investigator I **Prof. Mitch LI**

The technology offers a multi-heating combination method that enables simultaneous printing and cooking of 3D printed food precisely and efficiently via joule heating, infrared radiation, and laser cooking, allowing the user to solve the lower energy efficiency and less control on the cooking parameters of the conventional cooking methods.

Key Technology Edges:

- The first integrative system to simultaneously print and cook food in ultrafast time.
- Multi-level cooking methods to create limitless selective cooking by programming cooking parameters and patterns.
- Health data-driven food fabrication platform with an integrated software to monitor, print and cook customised meals.

Potential Applications

- 3D Food Printing
- Personalised Nutrition
- Personalised Traditional Chinese Medicine
- Smart Manufacturing
- Healthcare Monitoring

Industries

- Biomedical, Healthcare and Food

EAS 10 An Integrative Footwear Wear Telemonitoring System for Elderly Via Evidence-based Physiological Information

Principal Investigator I **Prof. Mitch LI**

The technology offers a novel integrative footwear system to telemonitor evidence-based physiological information for the elderly, comprising hardware and software smart internet-of-things solution, allowing user to have a holistic care for aging people, including continuously monitoring potential chronic diseases, predicting potential falls, and preventing loss using embedded GPS.

Key Technology Edges:

- Non-Invasive Monitoring: Uses comfortable, non-invasive sensors for monitoring physiological signals and sweat biomarkers.
- Predictive Fall Detection: Utilizes gait monitoring to predict falls, providing early warning to caregivers.
- Scalable and Affordable Fabrication: Low-cost fabrication technique maintains ergonomics and wearer's comfort for widespread adoption.

Potential Applications

- Tele-Monitoring
- Gerontechnology
- Health-Aging
- Biosensors

Industries

- Biomedical, Healthcare and Food

EAS 11 Revolutionizing Construction with a Suite of Robotics, Automation and Intelligent Solutions

Principal Investigator I **Prof. Haobo LIANG**

By leveraging robotics, AI, and cutting-edge technologies, the project offers comprehensive and ready-to-use technological solutions that address needs during the construction design, planning, building, control, and on-site assembly phases.

Key Technology Edges:

- Handheld color 3D scanner with advanced SLAM and robotics capabilities.
- Construction tools such as Rebar Tying Machine for efficient and automated construction processes.

Potential Applications

Construction | Productivity | Safety | Robotics

Industries

Construction and Property

EAS 12 Ezpie: The Ultimate Platform to Unlock Value from Data

Principal Investigator I **Prof. Mengqian LU**

Ezpie is an innovative one-stop technology platform that harnesses the power of artificial intelligence (AI) to transform the market for data analysis. Our platform offers a unique marketplace that optimally matches data and industry experts, catering to the needs of both clients and professionals. Our clients can leverage our platform to find solutions to their data-related challenges, while professionals can utilize their skills and expertise to deliver high-quality projects. With ezpie, we provide a secure and collaborative workspace that empowers users with maximum data security. Our cutting-edge technology also includes AI-powered data visualization tools that transform data into a visually appealing format, facilitating easy comprehension and actionable insights.

Key Technology Edges:

- Proprietary dynamic pricing and personalized recommendation system that can optimally match data with experts to maximize mutual value proposition at an online marketplace.
- Build-in web3.0 online workstation that allows experts to securely work on data-related projects with maximum data security allowing for versatile collaborations.
- Generative AI-empowered tools that assist task posting, management and data visualization, making ezpie a marketplace where data, technology, and art meet.

Potential Applications

Web3.0 | Data Analytics | Knowledge Discovery | Marketplace

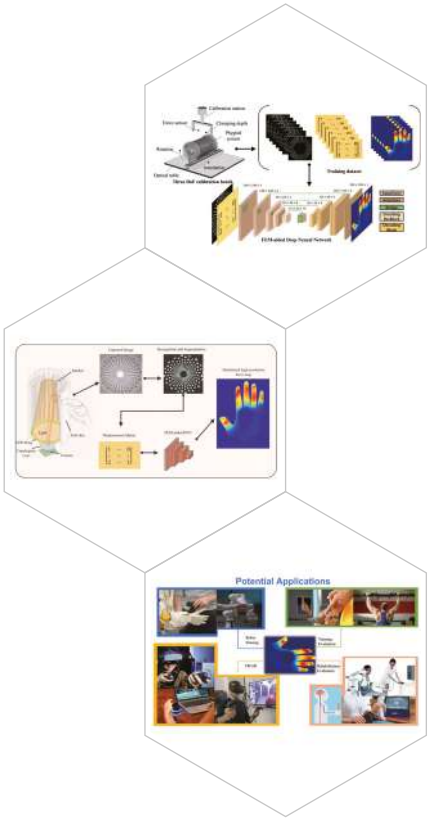
Industries

Information Technology, Communications and Software Services

EAS 13 Phygital Skin: Bridging Human-Robot-Environment Interaction

Principal Investigator | **Prof. Yajing SHEN**

For various biomedical and virtual reality applications, the AI-based artificial skin enables robust and reliable sensing with an accurate force mapping algorithm which greatly improves human-robot-environment interaction experiences.



Key Technology Edges:

- Nature-inspired artificial skin for effective human-robot-environment interaction.
- Optical trapping enabled robust and reliable force mapping.
- Physical model and AI-enabled algorithm enabled dynamic measurement with high resolution.

Potential Applications

- Metaverse and Virtual Reality
- Biomedical Evaluation and Sports Training
- Intelligent Robotics

Industries

- Information Technology, Communications and Software Services

EAS 14 Quantum Rod LEDs for Display and Lighting with High Quantum Yield and Tunable Wavelength of Emission

Principal Investigator | **Prof. Abhishek SRIVASTAVA**

The technology offers a method for fabricating core shell/alloy quantum rods that can have tunable emission in the visible region of the spectrum, particularly around green emission, allowing the maker to produce polarized emission, achieve high quantum yield and tunable wavelength of emission better than quantum dots.

Key Technology Edges:

- Using innovative quantum rod nanomaterial we can create any desired light spectrum solving the main problems of LED illumination.
- Better thermal stability of QRs enables development of low-blue lighting LEDs with high color performance and efficacy.
- Applying of quantum material in on-chip configuration enables a new generation of QLED display with up to 40% less price and better performance.

Potential Applications

- Displays (LCD Backlighting, Micro-LED, QR-CF, Mini-LED)
- Lighting (High CRI Low-Blue LEDs, Highly Efficient LEDs, Monochromatic LEDs)
- Illumination for Special Needs (Medical Application, Exhibition Space Etc)

Industries

- Electronics and Semiconductors

EAS 15 SpaceGPT: Visual ChatGPT Empowered Remote Sensing Satellite Data Service Platform

Principal Investigator I **Prof. Hui SU**

Aerospace big data technology, which can generate up to 100TB of data per day, enables the efficient and cost-effective extraction of usable information from massive remote sensing satellite data. SpaceGPT offers a cloud-native platform that features proprietary data updated daily, machine learning analytics, and a ChatGPT interface for natural language text queries. This guarantees customized insights on deforestation, agriculture, climate change, biodiversity, and many other remote sensing applications around the globe.

Key Technology Edges:

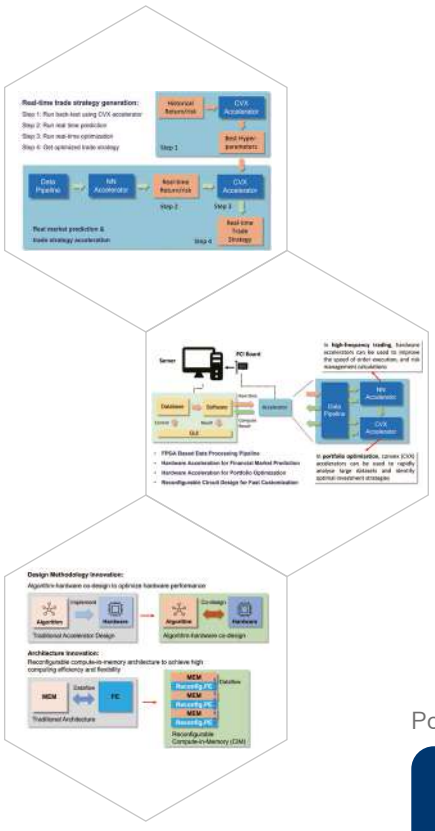
- ChatGPT-enabled natural language command interface.
- AIGC-empowered spatiotemporal data fusion.
- Segment Everything Everywhere All At Once Model (SEEM) for remote sensing data analysis.

Potential Applications

- Disaster Response (Landslides, Typhoons, Earthquakes, Floods, Fires, Volcanoes)
- Environmental Monitoring (Forestry, Agriculture, Air Pollution, Ocean Color)
- Sustainable Smart City Development (Urban Planning, Traffic, Business Activities)

Industries

- Information Technology, Communications and Software Services



EAS 16 Hardware Accelerator for Financial Computing

Principal Investigator I **Prof. Chi-Ying TSUI**

Our goal is to create a hardware accelerator system for financial computing applications using FPGA and ASIC, implementing software-hardware co-design and reconfigurable circuit technology.

Key Technology Edges:

- Customized high power efficiency and low latency AI core optimized for finance market prediction using co-design technology.
- A hardware solver for fast portfolio optimization and trading strategy suggestion.
- Reconfigurable compute in memory circuit technology for flexible algorithm adoption.

Potential Applications

- Investment Portfolio Optimization Hardware Accelerator
- Real-Time Market Prediction with AI Hardware
- Flexible High-Performance AI Chip for Market Prediction

Industries

- Electronics and Semiconductors

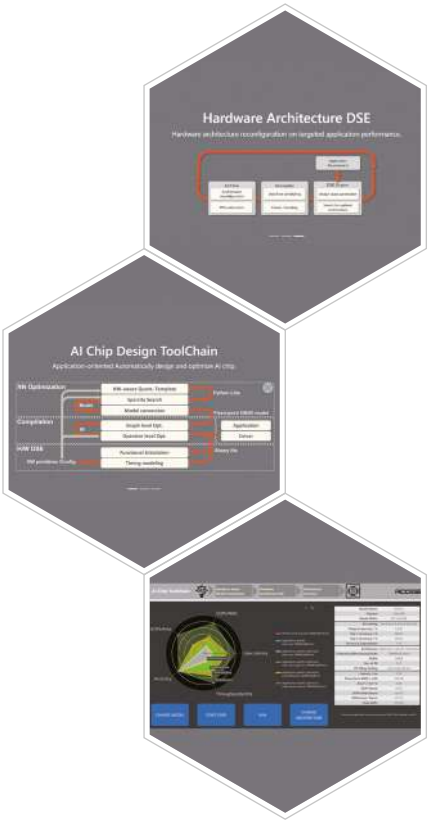
EAS 17 Electronic Design Automation (EDA) for Deep Learning Accelerator Design

Principal Investigator I **Prof. Fengbin TU**

Design automation and optimization for high-energy-efficiency, high-performance special computing chip.

Key Technology Edges:

- Compiler-driving NAS-DSE.
- Different granularity of simulation and modeling.
- Hardware acceleration for EDA.



Potential Applications

- Deep Learning Accelerator Design
- Deep Learning Accelerated Application
- Deep Learning Solution

Industries

- Information Technology, Communications and Software Services

EAS 18 Smart Climate Adaptive Solar Façade System

Principal Investigator I **Prof. Changying XIANG**

It provides an essential and practical solution to reduce carbon emissions for buildings by generate clean electricity onsite. It can provide better interior climate and reduce the energy consumption of buildings, while transfer buildings into smart infrastructure of the Zero-carbon cities.

Key Technology Edges:

The smart climate adaptive solar façade system will integrate tailored colourful solar panels into building envelopes (especially facades), which can provide high-efficient energy production, aesthetic pleasing architectural appearance (suits for both new design or renovation), while enable the facades to be climate-responsive with smart solar shading systems.

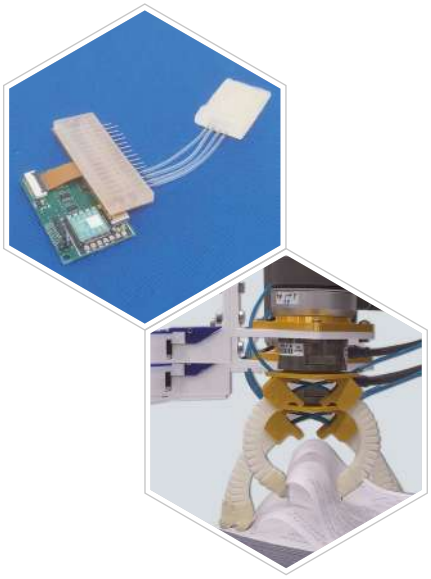
- High energy generation efficiency and with various colour choice for architectural design.
- Smart, the solar façade elements can be responsive to the exterior weather condition and interior user demands.
- Integrated with self-cleaning coatings and anti-reflection coatings, the solar façade can minimize cleaning demands and maintenance (avoid overheating issues).

Potential Applications

- Zero-Carbon
- Smart City
- Smart Building

Industries

- Energy, Environmental and Utilities



EAS 19 High Performance and Cost-Effective Sensing System for Detecting and Predicting Human-Robot Interaction

Principal Investigator | **Prof. Hongyu YU**

The technology can detect and predict human-robot interaction through integrating vision, RF, and haptic sensing functions to achieve safe and effective cooperation with humanoid robots with low cost and high performance.

Key Technology Edges:

- A full body, flexible haptic sensor skin for humanoid robots with low cost and high performance.
- Fusion of vision, RF, and haptic sensors for full-scale effective human-robot interaction and cooperation.
- Embedded AI to understand the gathered information from the sensing system for future social interaction between humans and robots.

Potential Applications

- Flexible Multi-Robot Cooperation
- Co-Living and Cooperation of Human and Service Robots
- Metaverse and Gaming

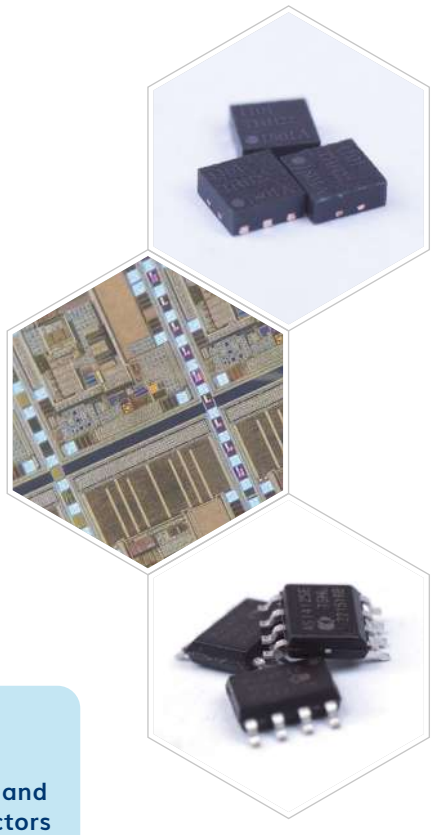
Industries

- Manufacturing and Engineering

EAS 20 High-Performance Specialized Digital Sensor Chip for IoE Era

Principal Investigator | **Prof. George YUAN**

Atom semiconductor offers specialized high-performance mixed-signal sensors including integrated digital sensor chips and high-performance analog-to-digital conversion (ADC) chips, allowing customers to use in consumer, industrial, medical, automotive, and communication electronic products fields with much better performance.



Key Technology Edges:

- Low Noise: 10nV | High Precision: 1μV | Low Power: 1μA IC Chips.
- High-level integration: Sensor | Peripheral Circuits | Software & MCU.
- State-of-the-art direct R&D-to-production IC pipeline.

Potential Applications

- Telecommunication Infrastructure (Servers, Data Canters 5G Base Stations)
- Next-Gen Wearable Devices and Smart Home Appliances Medical and Robotics Optical Sensing (X-Ray Detection, Servomotor Encoder)

Industries

- Electronics and Semiconductors

EAS 21 Autonomous Marine Robots with Advanced Navigation for Environment Monitoring

Principal Investigator I **Prof. Fumin ZHANG**

Autonomous maritime robotic system with advanced navigation and environment monitoring capabilities, providing accurate and efficient data collection for hurricane monitoring, scientific ocean data collection, and environmental surveying, enabling a range of applications for weather forecasting, oceanographic research, and environmental monitoring.

Key Technology Edges:

- Incorporate data-driven environmental modeling to navigate marine robots against strong ocean current.
- Implement AI planning techniques to generate optimal sampling and sensing trajectories.
- Tested and verified in ocean observation missions for more than 10 years.

Potential Applications

- Autonomous Maritime Robot
- Hurricane Monitoring and Prediction
- Scientific Ocean Data Collection
- Environmental Survey

Industries

- Information Technology, Communications and Software Services

MES01	SANI® Process - A Paradigm-Shift Sewage Treatment Technology with a 70% Reduction of Sludge (Prof. Guanghao CHEN)	P.14
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Material, Energy and Sustainability (MES)

MES 01 SANI® Process - A Paradigm-Shift Sewage Treatment Technology with a 70% Reduction of Sludge

Principal Investigator I **Prof. Guanghao CHEN**

SANI® process was developed for the removal of organics and nitrogen with sludge minimization in the treatment of saline sewage generated from seawater used for toilet flushing or salt water intrusion.

Key Technology Edges:

- Reduces 60%-70% of biological sludge production.
- Saves 30%-40% of space.
- Saves 20%-30% of energy consumption and CO2 emission.

Potential Applications

- Saline Wastewater Treatment
- High Sulfate-Laden Municipal or Industrial Wastewater
- Low C/N Ratio Wastewater

Industries

- Energy, Environmental and Utilities

MES 02 Smart Polymer Processing Plant (S-P³) - Open Collaborative Intelligent Platform

Principal Investigator I **Prof. Furong GAO**

The next-generation intelligent injection molding with real-time material and quality monitoring using breakthrough sensors, award-winning control algorithms for superior precision, and a dedicated big-data system for intelligent collaboration.

Key Technology Edges:

- Breakthrough and world first sensor for capturing material and quality changes on line.
- Award winning control algorithms for superior precision for injection molding.
- Dedicated big-data open system for collaborative intelligent molding.

Potential Applications

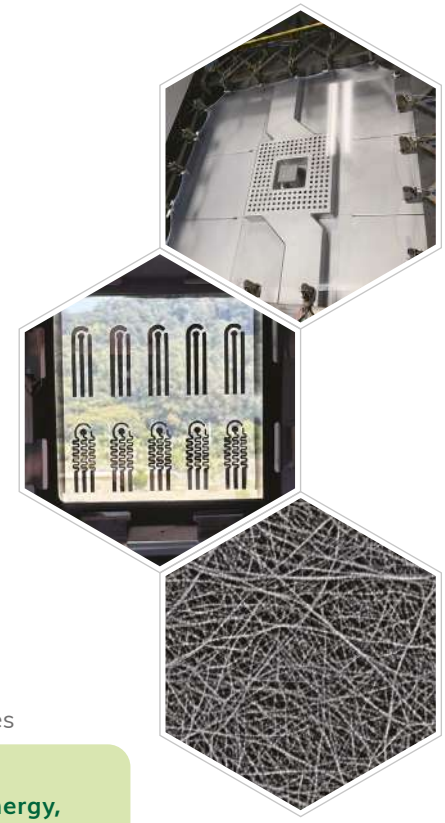
- A Smart Sensor for a Huge Injection Mold Market (14 Million Molds Annually for Chinese Mainland Alone)
- A Smart Control System for Millions Production Lines
- A World First Real Intelligent System Platform for Thousand Polymer Processing Plants with Collaborative Development Applications

Industries

- Manufacturing and Engineering

MES 03 Strength in Thinness: Ultra-Strong Polymer Nanofilm for Cutting-Edge Applications

Principal Investigator I **Prof. Ping GAO**



Ultrathin polymer nanofilm, 25 times stronger than steel with the same mass, transparent, gas-permeable and adjustable porous, ideal for advanced energy separators, wearables, biomedical applications and desalination.

Key Technology Edges:

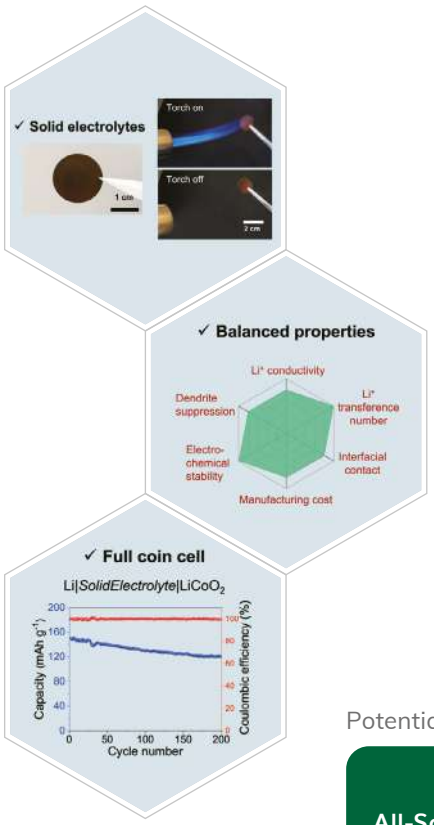
- Ultrathin: 20 nanometers or less than one thousandth the thickness of a hair strand.
- High strength: 25 times stronger than steel with the same mass.
- Formulation improvement to reduce cost.

Potential Applications

- Advanced Battery Separator
- Fuel Cell Proton Exchange Membrane
- Liquid/Gas Filtration
- Wound Dressing Patch

Industries

- Energy, Environmental and Utilities



MES 04 Revolutionizing Energy Storage: Tube transport-Inspired All-Solid-State Electrolytes for Li-based Batteries

Principal Investigator I **Prof. Yoonseob KIM**

Composite all-solid-state electrolytes enables rapid and reliable selective transport of Li+ ions, making it possible to produce smaller and lighter Li-based rechargeable batteries.

Key Technology Edges:

- Our electrolytes' Li+ conductivity and transference number outperform liquid electrolytes and sulfides.
- These all-solid-state electrolytes are fire-proof and economical in large-scale production.
- Prototype coin cell, paired with Li metal anode and LCO cathode, shows a capacity of 150 mAh g-1.

Potential Applications

- All-Solid-State Electrolytes
- Li-Metal Batteries
- High-Energy-Density Energy Storage Devices

Industries

- Energy, Environmental and Utilities

MES 05 On-Site Microplastic Detection for Rapid and Accurate Waste Effluent Analysis

Principal Investigator I **Prof. Frank LAM, Prof. Cindy LAM**

An innovative and ground-breaking portable device to conduct microplastics and microfiber detections efficiently and effectively for real-time effluent quality monitoring.

Key Technology Edges:

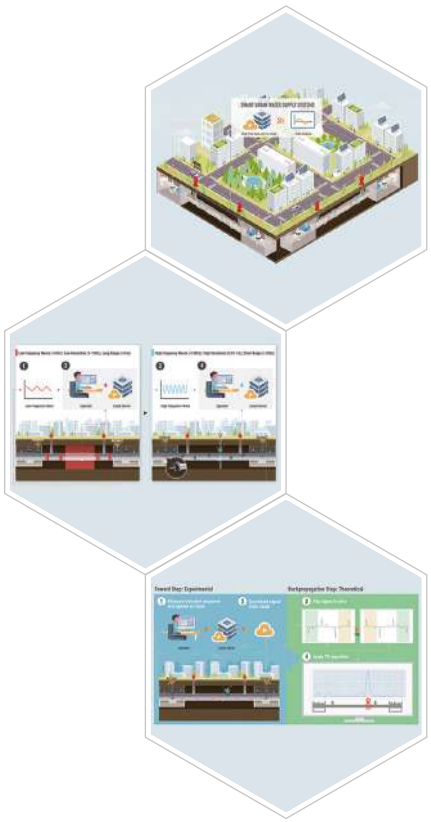
- The first portable device for microfiber/microplastic detection.
- Offers a prompt response to reflect process effluents' quality, enabling the engineers to provide an instant solution for process modification.
- Builds a solid foundation for efficient and effective microfiber detection technology in the field of related industries.

Potential Applications

- Water Quality Assessment on Industrial Wastewater Qualification
- Microplastics Detection for Process Modification, as well as Modifying the Life Cycle Analysis and Potential ESG Analysis
- Analytical equipment for Education Sectors

Industries

- Manufacturing and Engineering



MES 06 Time-Reversal Diagnostic for the Health Monitoring of Pressurized Pipelines

Principal Investigator I **Prof. Moez LOUATI**

The time-reversal diagnostic technology enables a quick and non-disruptive way to identify diverse and multiple defects in pipelines including drainage and potable water mains.

Key Technology Edges:

- The technology uses fast-traveling waves for rapid diagnostic testing, around 1000 times faster than roving sensors.
- The TR methodology is non-disruptive and non-intrusive, eliminating service interruption, isolation of mains, and contamination risks.
- The technology offers controllable localization resolution and allows for the development of automated and autonomous processes.

Potential Applications

- Water Supply Systems
- Sewage Rising Mains
- Gas & Oil Pipelines

Industries

- Energy, Environmental and Utilities

MES 07 Cementless Lightweight Materials from CO2-Sequestering Waste Mixtures for Sustainable Construction

Principal Investigator I **Prof. Charles NG**

Construction and household wastes, including plastic waste and food waste, are upcycled to produce sustainable construction materials.

Key Technology Edges:

- Minimize the use of carbon-intensive cement and natural aggregates that are typically required for production of construction materials.
- Sequestrate carbon dioxide (CO2) in mixture of wastes to form cementless construction materials.
- Enable production of lighter construction materials with different dimensions to improve construction flexibility.

Potential Applications

Produce Sustainable and Durable Materials for Construction and Earthen Structures (E.g., Partition Walls, Pavements, etc.)

Provide a Novel Solution to Facilitate Waste Reduction and Recycling in the Society to Achieve Sustainable Development and Carbon Neutrality

Integrated with Coating Science to provide Cooling in surroundings and Reduce Energy Consumption for Temperature Control

Industries

Construction and Property

MES 08 Low Emission Filter Bags with Denitrification Function

Principal Investigator I **Prof. Minhua SHAO**

Filter Bags with both dust filtering and denitrification functions.

Key Technology Edges:

- Combine both dust filtering and denitrification functions in one bag.
- Novel low temperature denitrification catalysts.
- Cost and space savings.

Potential Applications

Cement Production

Waste Incineration Power Plants

Industries

Energy, Environmental and Utilities

MES 09 Acoustic Metamaterials: Next-Generation Noise Control and Audio Solution

Principal Investigator | **Prof. Ping SHENG**

Coupling applied physics with intelligent design, the acoustic metamaterials finely construct tiny artificial structures to achieve optimal noise absorption performance.

Key Technology Edges:

- Low frequency noise absorption capabilities covering broadband frequency as well.
- Customization of absorption spectrum.
- High-efficiency noise absorption while maintaining High ventilation.

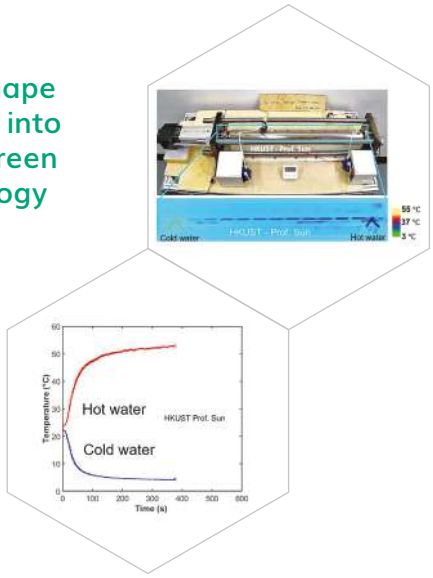
Potential Applications

- HVAC Silencer, Acoustic Panel for Building Noise Reduction
- Noise Control Parts for Home or Daily Appliances, E.g. Mobile Phones, Computers, Refrigerator, Etc., Aerospace, Automotive or Boat
- Audio Functional Parts for Hi-Fi and Speech Recognition

Industries

- Manufacturing and Engineering

MES 10 Green-House-Gas-Free Elastocaloric Cooling/ Heating Technology - Materials and Devices



Principal Investigator | **Prof. Qingping SUN**

By harvesting the unique phase transformation latent heat of shape memory alloys, the elastocaloric effect is utilized and developed into cooling/heating modules like fridges and air conditioners. This green technology revolutionizes the conventional refrigeration technology that has used harmful refrigerants for decades.

Key Technology Edges:

Compared with the conventional vapor-compression cooling, our elastocaloric cooling technology has the following advantages.

- Completely avoid the usage of greenhouse gas refrigerants. Use solid shape memory alloys instead.
- Save electricity consumption and the related carbon emission by at least 10%.
- The cooling core material (shape memory alloy) is a typical smart material and is 100% recyclable.

Potential Applications

- Fridges
- Air Conditioners
- Homes, Office Rooms, Shopping Malls, Industries. Anywhere in Need of Cooling

Industries

- Energy, Environmental and Utilities

MES 11 A Novel Highly Efficient Photocatalysis and Anti-Reflection Self-Cleaning Nano-Coating for Sustainable Photovoltaic Panel

Principal Investigator I **Prof. Jinglei YANG**

A nanocoating, concurrently possessing more functions including super-hydrophilic, anti-static, anti-reflection, weather resistant features, significantly enhances the power generating efficiency of PV panels.

Key Technology Edges:

- The product is a super-hydrophilic nanocoating with excellent antistatic, anti-reflection, weather resistance, and water scouring resistance properties.
- Our low-cost product can improve the power generation efficiency of PV panels by about 20% and save about 50% on cleaning labor costs.
- This product can also be extended to specific fields (such as building envelope systems/automobile glass windows) by integrating self-cleaning, anti-fogging, and de-frosting and reducing maintenance manufacturing and decarbonization costs.

Potential Applications

Bathroom Mirror | Curtain Wall Window | Automobile Windscreen

Industries

Energy, Environmental and Utilities

MES 12 Material Innovations for a Sustainable World

Principal Investigator I **Prof. Jinglei YANG**

Quantifiable life cycle analysis with considerations of low energy consumption and low carbon emission has been adopted and developed to innovate green materials and composites that contribute to a sustainable world.

Key Technology Edges:

- Fundamental innovation of materials via controllable interfacial science and engineering.
- AI+Robotics empowered high throughput discovery of new materials.
- Durable and long-lasting performance, low cost, customizable.

Potential Applications

Energy Saving Coatings / Materials | Sustainable Industrial Adhesives | Core-shell Materials Technologies

Industries

Energy, Environmental and Utilities

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BMH03	Phenotypic-Screening Based Drug Discovery Platform (Prof. Tom CHEUNG)	P.22
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Bio-Medical and Healthcare (BMH)

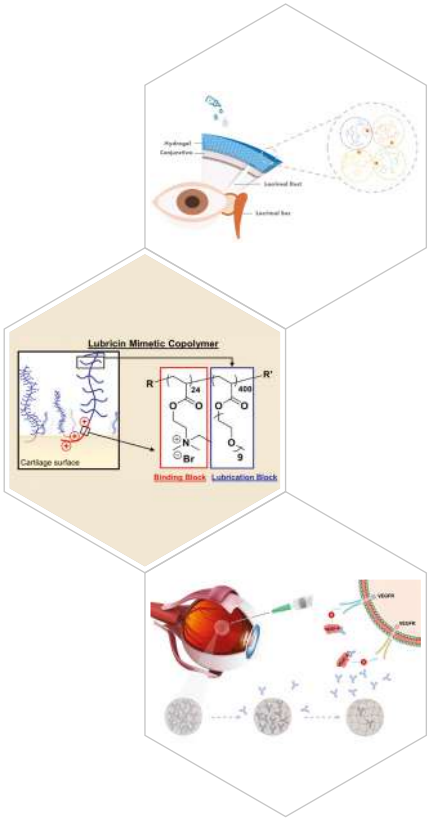
BMH 01 Advanced Polymer-Based Therapeutics for Chronic Diseases

Principal Investigator I **Prof. Ying CHAU**

Pleryon Therapeutics: Polymer-based therapeutics for new drug development and drug delivery.

Key Technology Edges:

- Pleryon is a platform company dedicated to improving the standard of living across the global community by advanced polymer and drug delivery technologies.



Potential Applications

- Drug Delivery

Industries

- Bio-Medical, Healthcare and Food

BMH 02 AimGel: Enhancing Cell Therapy Production and Cutting Costs

Principal Investigator I **Prof. Ying CHAU**

An artificial cell-based system for ex vivo live cell growth and manipulation in cell therapy.

Key Technology Edges:

- Improve T-cell growth 2X faster and 4X more cells than existing materials.
- Customizable with diverse signals to fit user needs, expanding the potential of cell therapeutics.
- Compatible with existing cell production workflow, lowering the switching cost.

Potential Applications

- Cell Therapy (Aimgel Helps to Simplify and Refine Cell Manufacturing into Therapeutics)
- Immunotherapy (Aimgel First Product, Aimtconv, Serves to Accelerate T-Cell Production for Adoptive Immune Cell Therapy for Treatments Against Cancer and Infections)
- Versatile Cell Research Tool (Aimgel Platform Technology Enable R&D of Novel Signal Combinations to Facilitate in Vitro Cell Manipulations)

Industries

- Bio-Medical, Healthcare and Food

BMH 03 Phenotypic-Screening Based Drug Discovery Platform

Principal Investigator I **Prof. Tom CHEUNG**

Deep learning model accurately predicts cell states to identification of drug candidates within 2 days.

Key Technology Edges:

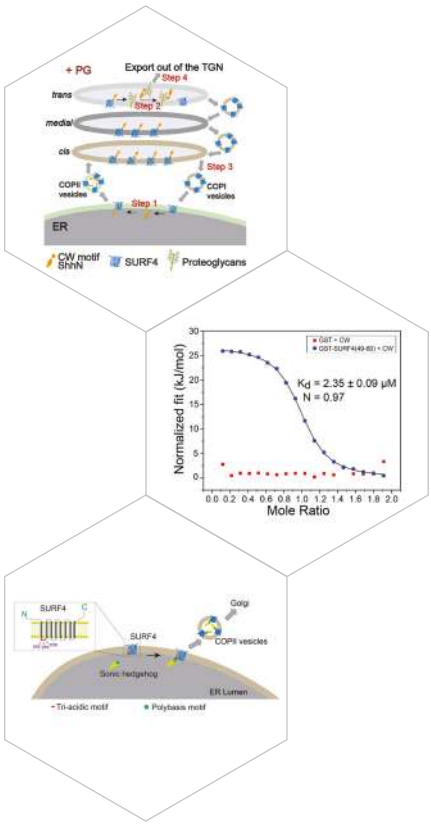
- High-throughput and cell-type specific phenotypic screening platform.
- Unbiased image-based disease phenotype modelling system using selected perturbagens.
- Accurate drug candidate ranking system for relevant hits.

Potential Applications

Drug Screening

Industries

Bio-Medical, Healthcare and Food



BMH 04 Secretion-Management Targeted Skin Cancer Treatment

Principal Investigator I **Prof. Yu Song GUO**

Controlling the secretion of Shh as a new therapeutic target for drug discovery in Melanoma Treatment.

Key Technology Edges:

- Identified a novel target for blocking hedgehog signaling for cancer treatment.
- Hedgehog signaling is one of the most important drug target for cancer treatment.
- A robust platform to screen drugs to block secretion of sonic hedgehog.

Potential Applications

Cancer Treatment

Melanoma

Drug Discovery

Industries

Bio-Medical, Healthcare and Food

BMH 05 Non-Tolerance Type-$1^{1/2}$ ALK Inhibitor for Cancer Treatment

Principal Investigator I **Prof. Yong HUANG**

Restructuring the drug molecule with AI target structuring and drug screening.

Key Technology Edges:

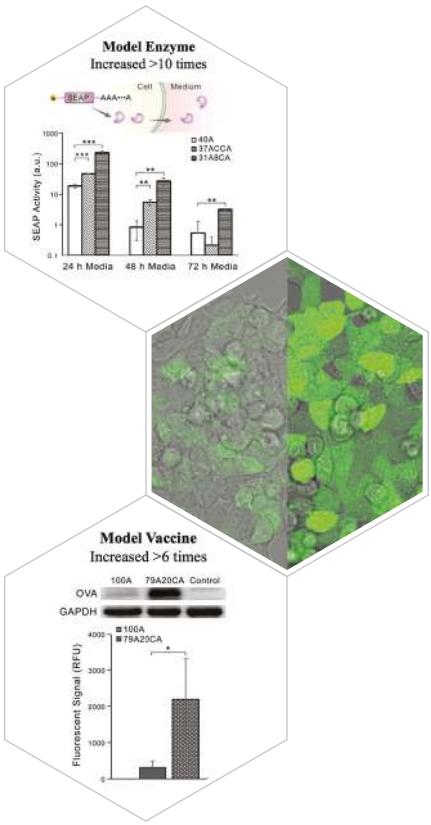
- A bridged inhibitor to combat drug resistance.
- Identification of the key linker joining two warheads.
- Exceptional efficacy in xenograft mouse models.

Potential Applications

Cancer Therapy | Drug Structure | Drug Discovery

Industries

Bio-Medical, Healthcare and Food



BMH 06 Triple the mRNA Vaccine Efficacy Via Tailored Tail Sequence

Principal Investigator I **Prof. Becki Yi KUANG**

Optimized tail sequences enalbe mRNA therapeutics and vaccines to have stronger and long-lasting efficacy.

Key Technology Edges:

- Do not increase synthesis cost.
- Do no need to change synthesis protocol.
- Can be combined with existing mRNA enhancement technologies.

Potential Applications

Enhanced mRNA Vaccines | Enhanced mRNA Therapeutics | Cell Therapy

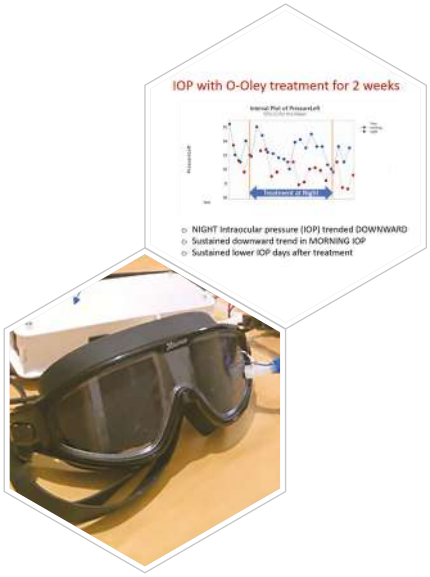
Industries

Bio-Medical, Healthcare and Food

BMH 07 Alleviate Glaucoma Symptoms with an Wearable Device

Principal Investigator I **Prof. David LAM**

An eye-mask providing immediate ocular tension relief to help alleviate glaucoma symptoms, offer protection for those over 50 and restore comfort for weary eyes.



Key Technology Edges:

- O-Oley clinical and O-Oley home therapy reduce intraocular tension and glaucoma risk.
- First preventive treatments to decrease intraocular tension and reduce glaucoma danger in the clinic and at home.
- Specific therapy with a mask that reduces the risk of overdosing and the side effects of medications.

Potential Applications

- Clinical O-Oley: Clinical Intraocular Pressure Reduction in Glaucoma Patients to Reduce Dependence On Medication and Side Effects
- 50+ O-Oley: Management of Intraocular Tension in 50+ Public to Prevent Glaucoma
- Anti-Aging O-Oley: Relief of Ocular Tension in Tense Weary Eyes and Slows Tissue Stiffening from Aging

Industries

- Bio-Medical, Healthcare and Food

BMH 08 Trauma Free Thrombectomy Device for Neurovascular and Peripheral Vascular Blood Clot Removal

Principal Investigator I **Prof. David LAM**

Utilizing radio frequency (RF) treatment during blood clot removal procedures can prevent fragmentation and vessel trauma.

Key Technology Edges:

- Reduced Trauma to Blood Vessel During Surgery.
- Strong Binding with the Thrombus without Fragmentation.
- Can Replace the Current Thrombectomy Catheter.

Potential Applications

- Medical Device
- Stroke
- Diabetic Treatment

Industries

- Bio-Medical, Healthcare and Food

BMH 09 Population-Wide Disease Prediction: A Data-Driven Blood Test Health Assessment

Principal Investigator I **Prof. David LAM**

SpectrumCheck - Utilizes routine blood test items for a fast and accessible screening for stroke, heart disease and cancer.

Key Technology Edges:

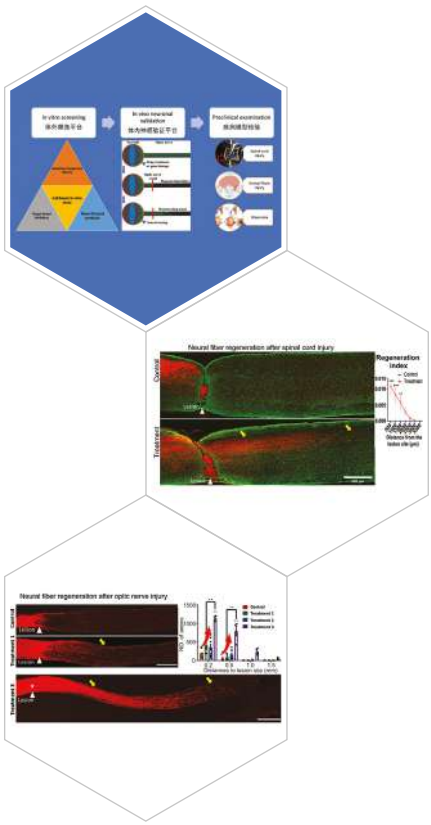
- Implemented in multiple local public hospitals.
- Based on 20 years of Hong Kong Chinese cohort data from Hospital Authorities.
- Successfully predicts risk levels for stroke, heart disease, liver health, and Colon/Gaslic Cancer.

Potential Applications

Disease Prediction | Big Data | Public Health

Industries

Bio-Medical, Healthcare and Food



BMH 10 A Breakthrough on Drug Development for Central Neuron Regeneration

Principal Investigator I **Prof. Kai LIU**

Targeting to a noval and safe target for CNS regeneraion with available drug structure.

Key Technology Edges:

- Promising Chemical Structure on cGAS-STING Pathway Stimulates Neural fibre regeneration.
- Multi-cell type and disease models feasibility promising broad application.
- New targets that help regenerate CNS safely and effectively.

Potential Applications

Neuron Disease | Regeneration | Drug Discovery

Industries

Bio-Medical, Healthcare and Food

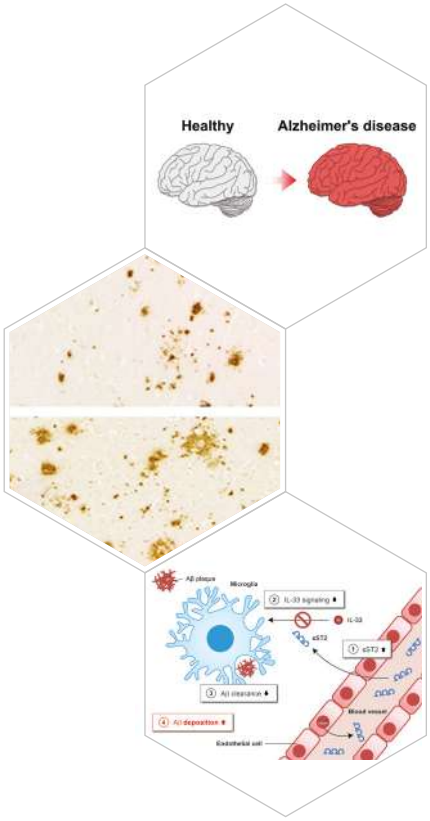
BMH 11 sST2 - Novel Therapeutic Target for Alzheimer's Disease

Principal Investigator I **Prof. Nancy IP**

sST2, a decoy receptor of interleukin-33–ST2 signaling, is a new disease-causing factor and novel therapeutic target for Alzheimer's disease.

Key Technology Edges:

- Novel therapeutic target: increased sST2 level is associated with more severe pathological changes in female individuals with Alzheimer's disease.
- Solid human data support: Mendelian randomization analysis revealed that decreased sST2 levels lower AD risk and endophenotypes in ApoE4 females.
- Accumulated research and extensive data: activation of interleukin-33–ST2 signaling ameliorates Alzheimer's disease-like pathology and cognitive decline.



Potential Applications

- Therapeutics for Alzheimer's Disease
- Modulation of Brain Immunity
- Personalized Medicine

Industries

- Bio-Medical, Healthcare and Food

BMH 12 Prediction and Prevention of Alzheimer's Disease Years Ahead

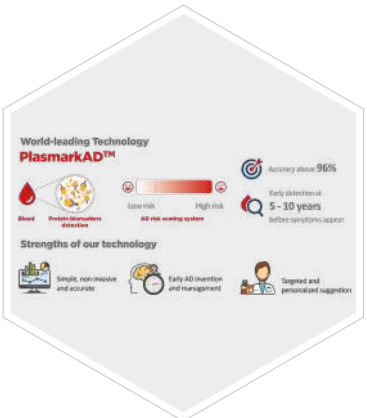
Principal Investigator I **Prof. Nancy IP**

A biomarker-based detection system can identify Alzheimer's disease early in aging populations.

Key Technology Edges:

Cognitact is translating cutting-edge proteomic research into risk prediction, diagnostic, and monitoring tools for Alzheimer's disease (AD). By utilizing world-leading proteomics and machine learning algorithms, we can diagnose AD 5-10 years before symptoms manifest by detecting changes in blood biomarker levels. Additionally, we offer long-term biomarker monitoring to aid in disease management and provide personalized therapeutic recommendations.

- Detect Alzheimer's disease 5 to 10 years before symptoms manifest.
- Up to 96% accurate detection of Alzheimer's disease.
- Facilitate monitoring of disease progression.
- Cost-effective, faster, and less invasive.



Potential Applications

- AD
- Diagnosis
- Disease Prediction

Industries

- Bio-Medical, Healthcare and Food

BMH 13 Herbal Formulation for Treating Neuronal Degeneration

Principal Investigator I **Prof. Nancy IP**

InfiTech: Composition for Treating Neurodegenerative Disease or Neuropathological Condition, AD PD and Stroke.

Key Technology Edges:

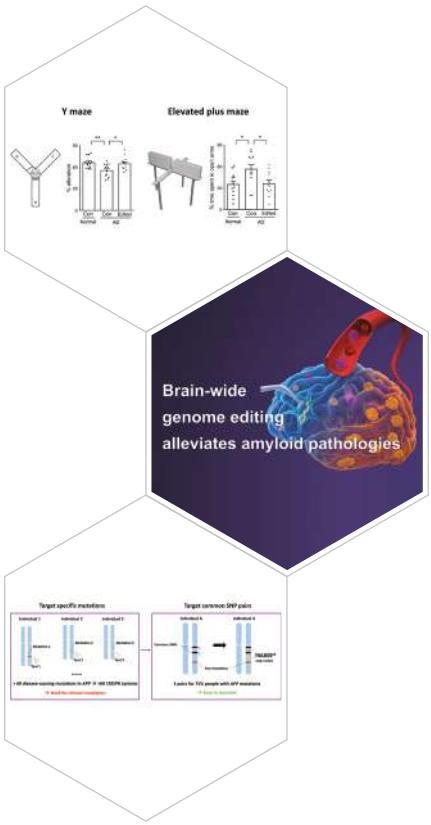
- Natural herbs with clinical use in forgetfulness.
- Screened by molecular neuroscience platforms.
- Active ingredients promote synaptic functions.
- Well-defined dosages that are safe for routine use.

Potential Applications

Herbal Medicine | AD

Industries

Bio-Medical, Healthcare and Food



BMH 14 Genome Editing for Alzheimer's Disease Treatment

Principal Investigator I **Prof. Nancy IP**

Genome editing-based approaches to delete Alzheimer's risk genes and permanently rescue disease pathologies.

Key Technology Edges:

- Targeted deletion of Alzheimer's risk genes to rescue disease pathologies.
- First in the world to achieve non-invasive brain-wide genome editing approach.
- Universal genome editing approach for disease mutations based on genome-wide association studies.

Potential Applications

Therapeutics for Alzheimer's Disease | Gene Therapy | Personalized Medicine

Industries

Bio-Medical, Healthcare and Food

BMH 15 Aggregation - Induced Emission - a Breakthrough in the Field of Biomedical Fluorescence

Principal Investigator I **Prof. Ben Zhong TANG**

AUSIET Biotechnology Co Ltd : A Breakthrough of the Luminous limitations "ACQ" and opening up a new technology of chemiluminescence in biomedicine.

Key Technology Edges:

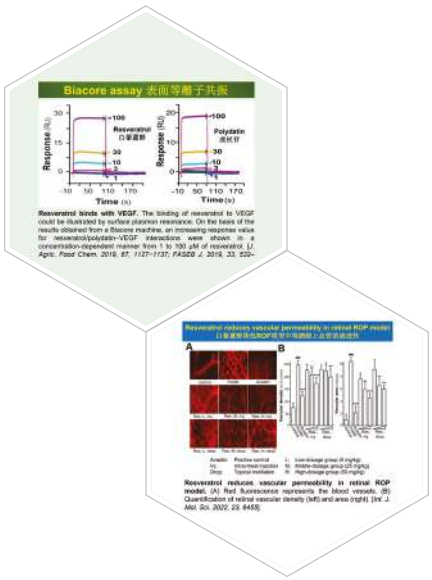
- Breaking through the classic thesis that "aggregation-caused quenching" and creating a material system with independent intellectual property rights.

Potential Applications

- In Vitro Diagnostics
- Cell Tracking
- Bacterial Labeling

Industries

- Bio-Medical, Healthcare and Food



BMH 16 Development of Anti-Angiogenic Eyedrop for Eye Disease

Principal Investigator I **Prof. Karl TSIM**

Therapeutic potential of resveratrol, polydatin and/or its analogues for eyedrop against age-related macular degeneration (AMD) by angiogenic inhibition.

Key Technology Edges:

- Solid foundation and clinical applications of VEGF-targeted drugs from traditional Chinese medicines (TCMs) [7 publications and 1 Chinese patent].
- Phytochemicals targeting VEGF with easy administration with low-cost manufacturing, long-term administration and easy topical instillation.
- New therapeutic and non-invasiveness strategy over standard treatment options such as argon laser photocoagulation and photodynamic therapy.

Potential Applications

- Anti-Angiogenic Therapy for Abnormal or Pathologic Angiogenesis in Age-Related Macular Degeneration (Amd), Retinopathy of Prematurity (Rop) and Diabetic Retinopathy
- Anti-Angiogenic Therapy for Angiogenesis of Various Cancers E.g., Colorectal Cancer
- Prevention of Oxygen Radical Damage in Rheumatoid Arthritis (Ra), Atherosclerosis, Pulmonary Emphysema, Cancer, Inflammatory Bowel Disease And Periodontal Disease

Industries

- Bio-Medical, Healthcare and Food

BMH 17 SGC: A Scar Healing Solution Targeting Serious Wounds

Principal Investigator I **Prof. Karl TSIM**

Groundbreaking initiative invents the pioneer clinically-proven biologic SGC, swiftly and naturally remedying chronic non-healing wounds and autoimmune diseases.

Key Technology Edges:

- Boost cell regeneration by 300% safely and naturally without additives or toxicity through personalized and customized optimization bio-techniques.
- SGC biologic contains “live” proteins with 2-year “LONG” shelf-life without preservatives. High scalability. Lower cost and price than other biologics.
- BT+IT: Create “Woundwise” detector , Tracking System, “Health-in-One-Click" App with patients+doctors+hospitals+insurance+bank integration for efficient detection, prescription and prevention of disease.

Potential Applications

Cosmetics | Wound-Healing | Skin | Drug Discovery

Industries

Bio-Medical, Healthcare and Food

BMH 18 A Non-Invasive Method to Identify Drug Target for Treatment of Cerebral Cavernous Malformation

Principal Investigator I **Prof. Jiguang WANG**

Big Data-Driven.
Precision Medicine for Cancer and Genetic Disorders.

Key Technology Edges:

- Computing key genetic mutations for precision diagnosis in Chinese population.
- AI-based integration of multi-modality data for prognosis prediction.
- AI-based drug repurposing for personalized medicine.

Potential Applications

AI | Cancer Therapy | Rare Disease

Industries

Bio-Medical, Healthcare and Food

BMH 19 CHAMP Microscope: Instant Staining Results During Cancer Surgery

Principal Investigator I **Prof. Terence WONG**

CHAMP microscope revolutionizes cancer surgery with fast and accurate on-the-spot histological imaging with extensive machine learning.

Key Technology Edges:

- Label-free, slide-free imaging for quick on-the-spot histological information during cancer surgeries.
- High-fidelity histological images in 3 minutes with over 90% similarity to the clinical gold standard.
- Non-organ-specific imaging before, during, and after cancer surgeries for fast and accurate histopathological studies.

Potential Applications

Oncology | Digital Pathology | Telemedicine

Industries

Bio-Medical, Healthcare and Food

BMH 20 Massively Parallel High-Throughput Multi-Omic Single-Cell Sequencing for Target Discovery

Principal Investigator I **Prof. Angela WU**

OneDrop: A high-throughput solution for single-cell sequencing with redesigned reaction and chip.

Key Technology Edges:

- Novel droplet single cell sequencing platform distinct from existing products on the market.
- High-throughput sequential droplet reactions, up to 18,000 reactions per run.
- Multi-omic single-cell sequencing solutions for DNA/RNA simultaneous profiling.

Potential Applications

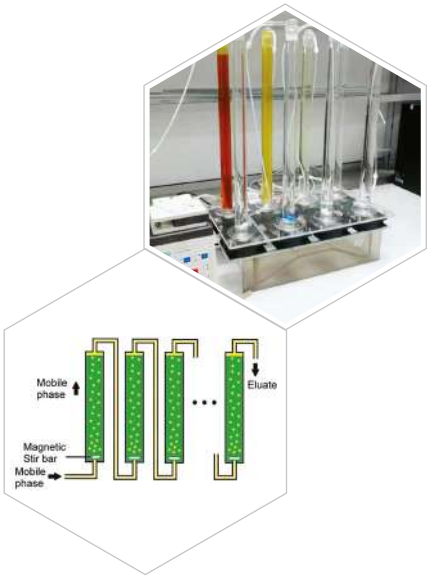
Tumor Biology | Infectious Disease | Discovery of Novel Cell/ Molecular Targets | Environmental and Microbial Applications

Industries

Bio-Medical, Healthcare and Food

BMH 21 DMCC: An Environmental Friendly API Purification System

Principal Investigator I **Prof. Hong XUE**



A highly scalable dispersed mobile-phase countercurrent chromatography platform for purification of commercially valuable chemicals.

Key Technology Edges:

- A breakthrough platform technology with patent protections, for effective purification of commercially valuable chemicals.
- Unprecedented scalability for purification of chemical materials at industrial scales unachievable with any existing technologies.
- Both user and environmentally friendly, with no solid waste and no irreversible material loss, commonly occurred using competitive technologies.

Potential Applications

- Demonstrated Effective Isolation of Active Pharmaceutical Ingredients From Chinese Herbal Medicine Extracts
- Broad Applications in Purification of Organic Chemical Synthesized Materials
- Potential Applications in Petroleum Chemical and Nuclear Industries, with No Radioactive Solid Waste Generated and Hence Environmentally Friendly

Industries

- Bio-Medical, Healthcare and Food

BMH 22 Portable Device for Quick DNA Testing Using CRISPR/Microfluidic Technology

Principal Investigator I **Prof. Shuhuai YAO**

Molecular tests with sensitivity as PCR using next-generation nucleic acid detection system.

Key Technology Edges:

- Simpler self-testing enabled by microfluidic passive-driven chip.
- Faster determination of CRISPR to compete with PCR.
- Lower cost of miniaturized fluorescence system to test at home.

Potential Applications

- Flexible High-Performance AI Chip for Market Prediction

Industries

- Bio-Medical, Healthcare and Food

BMH 23 Painless Microneedles for Transdermal Drug Delivery

Principal Investigator I **Prof. King Lun YEUNG**

A new generation of painless drug delivery system suitable for advanced pharmaceuticals, biomolecules, and stem cells.

Key Technology Edges:

- Uses extremely hard and sharp crystalline zeolites as microneedle materials that are extremely safe.
- Easy and inexpensive to fabricate, use, and dispose.
- Application flexibility and compatibility.

Potential Applications

Advanced Painless Administration of Drugs, Hormones, Vaccine, and Cell Therapeutics

Allows Design of Wearable Devices for Long-Term, Controlled Administration

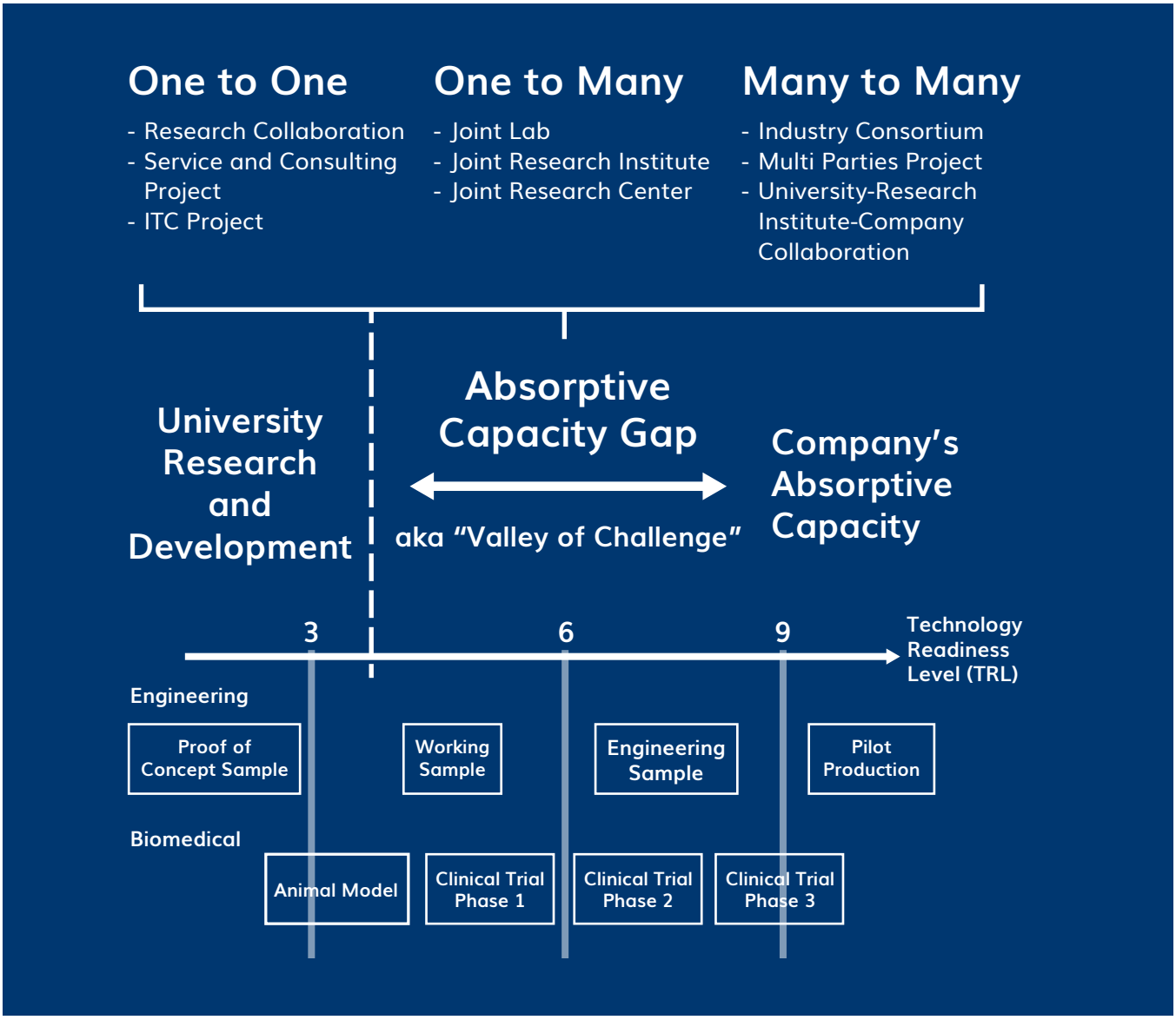
Potential for Smart and Intelligent Components for Monitoring Health and Well Being

Industries

Bio-Medical, Healthcare and Food

Strong Industry Engagement

- 648 industry collaborators
- 153 Active License Agreements
- No. 1 in industry income index in HK (THE ranking 2023)



HKUST Office of Knowledge Transfer
okt.hkust.edu.hk

HKUST Available Technologies
kt.hkust.edu.hk/featured-technologies

HKUST Entrepreneurship Fund
e-fund.hkust.edu.hk

HKUST Technology Start-up Support Scheme for Universities ("TSSSU")
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HKUST Entrepreneurship Center
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