Agency for Science, Technology and Research
SINGAPORE

POWERING **INNOVATION,** DELIVERING **IMPACT**

A*STAR ANNUAL REPORT
APRIL 2024 - MARCH 2025

Contents

About A*STAR

Our Mission

We advance science and develop innovative technology to further economic growth and improve lives.

The Agency for Science, Technology and Research (A*STAR) drives mission-oriented research that advances scientific discovery and technological innovation. We play a key role in nurturing and developing talent and leaders for our research institutes, the wider research community, and industry.

Our research creates economic growth and jobs for Singapore. As a Science and Technology Organisation, we bridge the gap between academia and industry in terms of research and development. In these endeavours, we seek to integrate the relevant capabilities of our research institutes and collaborate with the wider research community as well as other public sector agencies towards meaningful and impactful outcomes.

Together with the other public sector entities, we develop industry sectors by: integrating our capabilities to create impact with multinational corporations and globally competitive companies; partnering local enterprises for productivity and gearing them for growth; and nurturing R&D-driven start-ups by seeding for surprises and shaping for success.

Our research, in addition, also contributes to societal benefits such as improving outcomes in healthcare, urban living, and sustainability. These serve to enhance lives in Singapore and beyond.

Our Vision

A global leader in science, technology, and open innovation.

A*STAR is a catalyst, enabler, and convener of significant research initiatives among the research community in Singapore and beyond.

Through open innovation, we collaborate with our partners in both the public and private sectors, and bring science and technology to benefit the economy and society.

Message from the Chairman and CEO

Science is transforming our world, and at A*STAR, we believe that innovation is most powerful when excellent science is matched with and driven by purpose. In an era shaped by geopolitics, industrial strategy, and technologies like AI, we are working to both address the challenges and to leverage the opportunities presented. Our research seeks to fuel economic growth, advance health, drive sustainability, and strengthen Singapore's scientific capabilities. Beyond individual breakthroughs, we build an ecosystem of talent, platforms, and partnerships that connects discovery to delivery and turns long-term investment into real-world impact.

The growing momentum of our work was a key feature of this past year.

In semiconductors, A*STAR and our ecosystem partners integrated strengths in silicon photonics, MEMS, advanced packaging, and materials to launch the National Semiconductor Translation and Innovation Centre (NSTIC). This reinforces Singapore's role as an indispensable node in the global semiconductor value chain—advancing critical technologies, creating high-value jobs, and growing talent.

The same approach is supporting industry transformation. Coca-Cola's Singapore plant—now recognised by the World Economic Forum as a Global Lighthouse—implemented advanced automation with A*STAR's support, achieving world-class productivity. In aerospace, Rolls-Royce's advanced manufacturing facility in Seletar produces high-performance fan blades for widebody aircraft worldwide, supported by our joint lab with Rolls-Royce and SAESL. These partnerships strengthen Singapore's position as a hub for high-value aerospace engineering and MRO innovation.

We continue to push frontiers in human health. With Wellcome Leap, we launched Asia's first non-GMP mRNA BioFoundry to accelerate next-generation vaccines and therapeutics. This platform is part of a broader ecosystem where A*STAR-trained scientists are translating science into enterprise in partnership with biotechs and pharma companies like Engine Biosciences and Chugai Pharmabody Research, and progressing therapies from discovery into global trials.

A*STAR made significant contributions to national initiatives which have informed policy and shaped lives. Insights from the GUSTO cohort study underpin Singapore's national screentime guidelines for children, promoting healthier developmental outcomes. Genome mapping of 100,000 Singaporeans under the National Precision Medicine programme supports data-driven healthcare and a more predictive, preventive health system.

We are also investing in the future with a $500 million commitment to refresh A*STAR's biomedical research infrastructure, including cutting-edge labs and shared spaces that connect scientists, clinicians, entrepreneurs, and venture builders. In parallel, we are advancing national sustainability efforts through the Low-Carbon Technology Translational Testbed (LCT^3) and Centre for Energy and Emissions Modelling 2.0 (CE2M 2.0), which support national decarbonisation and planning for Singapore's 2050 net-zero goals.

A*STAR's impact is driven by its people. Since 2001, our scholarships have nurtured over 1,800 talents, many now leading innovation in research, translation, and enterprise. Our researchers are recognised globally, with honours including the Genome Valley Excellence Award and MIT Technology Review's Innovators Under 35 Asia Pacific (TR35).

This is how public R&D serves as a national catalyst—empowering people, enabling enterprise, and opening new frontiers for growth—and how A*STAR continues to be a strategic driver of innovation.

A very big thank you to our colleagues for embracing bold ideas, working across disciplines and institutions, and delivering impact that matters. We also extend our appreciation to Mr Frederick Chew, who stepped down as CEO in November 2024, for his leadership.

With science as our compass and people as our force, together with our partners, we are building a future defined by innovation for Singapore.

Professor Tan Chorh Chuan
Chairman

Mr Beh Kian Teik
Chief Executive Officer

FY2024 Key Achievements at a Glance

Industry Overview

1,154*
industry projects undertaken with companies

$251.6M
industry R&D spending

Contributing to Public Sector Transformation

307*
projects undertaken with public sector agencies and IHLs

Advancing Quality Science

1.94
A*STAR publications average Field-Weighted Citation Impact in RIE2025

27.7%
of our publications were amongst the top 10% of the world's most highly cited

Supporting Local Enterprises' Productivity and Growth

83%
projects with SMEs and start-ups

15%
projects with LLEs

52
research scientists and engineers seconded to industry

Strengthening Innovation and Enterprise

6
successful A*STAR spin-offs

$83.9M
of follow-on funding

72
licenses taken up by 66 companies (>68% licensing to SMEs and start-ups)

Attracting and Building Pipeline of STEM Talent

As of end FY2024, A*STAR has built a pipeline of

1,902
R&D talent through a suite of scholarships since 2001

92
A*STAR scholarships awarded in FY2024

*Excluded Service-Characterisation, Measurement and Technical Consultancy (C/M/TC) projects

POWERING SINGAPORE'S INNOVATION ECONOMY

A*STAR addresses key challenges facing Singapore with our multi-disciplinary R&D capabilities. Co-developed with industry, clinical and private sector partners, our solutions deliver economic impact and jobs for Singapore.

Future-proofing Singapore's Semiconductor Global Position

Singapore is an integral part of the global semiconductor supply chain, accounting for 10% of all chips production and 20% of global semiconductor equipment. Through sustained investment over three decades, A*STAR has developed deep capabilities in advanced packaging, silicon photonics, MEMS, flat optics, and sensors—critical technologies that power the future of computing, AI, mobility, and connectivity.

Looking ahead, our ambition is clear: Over the next five to 10 years, Singapore will be an indispensable node in the global semiconductor supply chain. This will strengthen our economic growth and resilience, and create quality jobs, while ensuring continued access to critical technologies that shape everyday life.

FY2024 Initiatives to Drive Semiconductor Innovation

Advanced packaging for AI and other applications

CoE in Advanced Packaging

Innovation in frontend semiconductor equipment component manufacturing development

APEX

Flat optics and advanced photonics, advanced packaging, GaN

NSTIC

Building Capabilities to Advance Singapore's Semiconductor Innovation

For over a decade, **A*STAR and Applied Materials** have partnered to advance semiconductor technology and ecosystem innovation in Singapore. Since 2011, this long-standing collaboration has delivered breakthrough technologies, built deep local capabilities, and brought **Singapore-developed innovations to global markets**.

6
products developed and launched since 2011

120+
R&D jobs created since 2011

The New Challenge
The rise of AI and ICAPS markets (IoT, communications, automotive, power, sensors) is driving new demands for chip performance, energy efficiency, and sustainable manufacturing. Meeting these demands requires advanced chip packaging, innovative equipment components, and stronger local capabilities to support global leaders.

The Response
A*STAR strengthened its partnership with Applied Materials through the following strategic initiatives:

- **Centre of Excellence (CoE) in Advanced Packaging**, a Joint Lab between Applied Materials and A*STAR, brings together firms from across the semiconductor industry in Singapore and focuses on the development of advanced semiconductor packaging technologies that promise more energy-efficient system performance. Ecosystem partners will gain access to next-generation process equipment in this facility to co-develop solutions and accelerate innovations.

- **Applied Materials - A*STAR Joint Lab for Applied Process Equipment Accelerator (APEX)** targets the development of frontend semiconductor equipment component and manufacturing. Research includes process efficiency, component functionality, and simulation tools to optimise design. APEX uplifts local SMEs to build their technical expertise to become Applied Materials Original Parts Manufacturers and be globally competitive.

The Impact
Together, the Joint Labs strengthen Singapore's semiconductor ecosystem by aligning deep science with industry needs. These collaborative initiatives enable local firms to innovate alongside a global leader, uplift SME capabilities, and advance Singapore's position in the global semiconductor value chain.

Infrastructure for a New Era

The Challenge

Singapore's semiconductor sector faces a critical gap: a shortage of cleanroom infrastructure and advanced manufacturing tools, which has become a bottleneck in scaling up translational research.

The Response

The National Semiconductor Translation and Innovation Centre (NSTIC), hosted by A*STAR, drives coordinated R&D to strengthen Singapore's semiconductor industry. It supports next-gen technologies such as flat optics, advanced photonics, advanced packaging, and Gallium Nitride (GaN), with facilities serving both MNCs and local enterprises. NSTIC also focuses on training local R&D talent, opening access to public sector IP, and strengthening ecosystem partnerships.

The Impact

NSTIC lowers the cost of innovation, enabling more companies to prototype and commercialise new technologies in Singapore. It accelerates product development and innovation, strengthens local capabilities, and positions Singapore to move up the global semiconductor value chain.

Engineering the Future of Aerospace

As Asia's leading hub for aerospace Maintenance, Repair and Overhaul (MRO), Singapore accounts for 10% of global output, playing a key role in advancing aviation resilience, connectivity, and innovation.

A*STAR is an integral part in this journey. Through partnerships with industry leaders like Rolls-Royce, SAESL, and SIA Engineering Company, A*STAR has co-developed next-generation MRO and manufacturing technologies while enabling local enterprises to scale up. These collaborations have translated R&D into real-world impact—enhancing production throughput, reducing downtime, and strengthening Singapore's aerospace ecosystem by moving local SMEs up the value chain for long-term resilience and competitiveness.

Forging the Future of Advanced Manufacturing

The Challenge
Rolls-Royce faced bottlenecks in their production operations and processes. To meet rising demand for air travel in the region and improve production efficiency, there was a need to accelerate the adoption of automated, precise and digitally enabled manufacturing techniques.

The Response
To address these challenges, A*STAR, Rolls-Royce and SAESL established the **Smart Manufacturing Joint Lab** to co-develop next-generation aerospace manufacturing and MRO capabilities. The collaboration focused on translating advanced R&D into deployable technologies—integrating automation, digital twins, robotics, and precision processes.

Key innovations developed and adopted at Rolls-Royce and SAESL facilities include:
- Automated boron nitride spray systems
- Automated masking systems for plasma weld and patching operations

The Impact
The joint lab's first phase concluded in 2025.

Anchoring of Rolls-Royce fan blade and hollow titanium wide chord fan blade **manufacturing in Singapore**

30-50%
improvement in process lead time, enabled by automation and precision engineering

A*STAR's contributions have also been pivotal in elevating SAESL's engine repair capabilities and strengthening Singapore's competitiveness as a trusted global node for aerospace manufacturing and MRO innovation. Building on this momentum, the second phase of the joint lab will focus on advanced remanufacturing techniques, enhanced assembly and disassembly processes and AI-enabled automation with predictive capabilities.

Watch the story

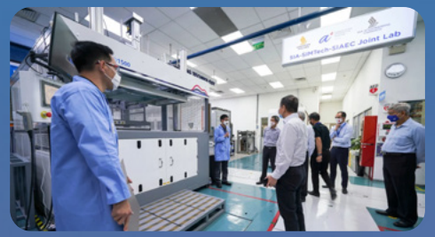
Strengthening Singapore's Global Aviation Leadership

The Challenge
In response to challenges common across the global aviation sector, **SIA** and **SIAEC** sought to transform their MRO processes to boost resilience, efficiency, and competitiveness.

- Prolonged repair lead times for cabin interior components, driven by an over-reliance on global supply chain posed risks in times of disruption.
- Unplanned aircraft maintenance as well as sub-optimal engine deployment and swap strategies, which led to grounded fleets, unnecessary downtime, underutilised resources, and cost inefficiencies.

The Response
To advance local capabilities in sustainable manufacturing and aircraft maintenance, A*STAR partnered with SIA and SIAEC to establish the SIA-SIAEC-A*STAR Joint Lab centred on two key innovation streams:

- **Localised refurbishment of cabin components,** specifically copper trim recoating. These new technologies have reduced lead times and established a resilient local supply chain for SIA and SIAEC.
- **AI-driven solutions for proactive fleet management,** including a predictive maintenance tool that detects recurring defects and potential failures early. This helped the airline prevent operational delays, and optimise engine and line maintenance.



The Impact
Phase 1 of the Joint Lab concluded in 2024, delivering significant operational and cost benefits. By leveraging advanced manufacturing and AI technologies, the collaboration established a resilient local supply chain and enabled SIA's digitalisation goals by optimising maintenance workflows and airline operations.

5,000+
repaired trims have been delivered, with **durability improved by 50%** and **replacement lead times reduced from six months to three weeks**

70,000+
cabin components produced locally, achieving a **30–50% average cost savings**

28
companies upskilled in high-value aerospace manufacturing

Boosting Advanced Manufacturing and Trade & Connectivity for Singapore

Harnessing AI and Advanced Computing to Enhance Port Safety and Efficiency

*Master Agreement Framework inked between A*STAR and seven industry partners, under the Maritime AI Research Programme.*
Source: Singapore Standards Council

In the high-stakes environment of busy ports, even near-misses matter. To enhance maritime safety and pave the way for smarter, more scalable port automation, A*STAR and PSA Marine co-developed AI-powered digital solutions to close operational and risk management gaps. In our studies, the tool **identified 90% more near-miss incidents** in our port waters than the manual reporting baseline, giving port operators the ability to monitor risks in real time and guide safer ship movements.

The team also tackled the scalability of Automated Guided Vehicle (AGV) systems. Drawing on A*STAR's high-performance computing expertise, the team developed a decentralised AGV fleet management system, laying the groundwork for PSA to **scale up operations to at least 1,000 AGVs**. This is crucial for Tuas Port, designed to be the world's largest fully automated container terminal, to handle 65 million TEUs annually. Together, these efforts reinforce a safe, resilient and future-forward maritime sector for Singapore.

Boosting Advanced Manufacturing and Trade & Connectivity for Singapore

Accelerating AI for a Future-Forward Manufacturing Sector

AI is transforming the shop floor—reducing downtime, improving quality, and boosting efficiency across Singapore's manufacturing sector. To accelerate this shift, the Sectoral AI Centre of Excellence for Manufacturing (AIMfg) launched by A*STAR and the Ministry of Trade and Industry aims to position Singapore as a global leader in AI-driven manufacturing. AIMfg will develop AI tools for predictive maintenance, quality assurance and automation—enhancing efficiency, reducing costs and extending machine lifespan. Industry leaders such as Coca-Cola and Philips are among **13 companies** collaborating with AIMfg to turn these tools into real-world applications that drive innovation on the ground.

Enabling Faster Certification of Maritime Parts for Scalable Additive Manufacturing (AM) Adoption

As maritime operations grow more complex, AM presents new opportunities for faster, more resilient part replacement. To support broader adoption of AM technologies in Singapore's maritime sector, a new model-based framework is proposed to accelerate the certification of 3D-printed parts for maritime use by reducing manual testing efforts. Co-developed by A*STAR, the American Bureau of Shipping, the Maritime and Port Authority of Singapore, and Mencast Marine, the certification process uses predictive models to assess defect risks in AM parts.

Strengthening Local and Regional Capabilities in Additive Manufacturing Through Strategic Partnerships

Additive manufacturing (AM) is unlocking new ways to design, produce, and scale across industries. Through strategic partnerships, NAMIC is advancing Singapore's AM sector, by spurring innovation and commercialisation to enable ecosystem growth across industries.

- Its Digital Design Innovation Centre entered a partnership with Jaringan Semangat Sdn Bhd to support oil and gas companies like PETRONAS, in building a digital inventory of 3D-printable parts for local fabrication, improving asset uptime and SME adoption.
- NAMIC co-developed the National Additive Manufacturing Jobs-Skills Accreditation Framework, aligning AM training to industry needs, in collaboration with SkillsFuture Singapore and the American Society of Mechanical Engineers.
- It established an Advanced Technology Centre of Excellence with Eng Teknologi International, supported by Prime Movers Equity, to build high value capabilities in automotive, semiconductors, and life sciences, and anchor regional operations in Singapore.

Building a Future-ready Robotics Ecosystem

Building a Future-ready Robotics Ecosystem

From healthcare robots to intelligent warehouses, robotics is unlocking smarter ways of working across sectors. Yet without the right support, many start-ups struggle to scale. To nurture early-stage start-ups and scale industry-wide adoption, NRP launched RoboNexus with public agencies and global investors to offer mentorship, international market access, and business development support. Since its pilot, **six companies have fast-tracked product development** and expanded industry partnerships. NRP's flagship event, RoboSG! 2025, more than doubled in scale with **over 100 robots to more than 1,500 visitors,** including international delegates. These efforts reflect Singapore's ambition to grow a globally competitive robotics ecosystem that delivers real-world impact.

"Often, while these start-ups have innovative robotics technologies, they are less familiar in terms of how to get funding, or in crafting a market strategy to sell the product. We will therefore pull together existing resources to support these companies in their growth journey."

Dr Tan See Leng, Minister for Manpower and then-Second Minister for Trade and Industry

Accelerating Growth of Local Companies

Reimagining Single-Use Waste for a Greener Future

Source: Crunch Cutlery

Tackling waste in food services calls for solutions that are sustainable and scalable. Blending sustainability with innovation, A*STAR and Crunch Cutlery developed a compact, automated solution to produce edible spoons. The solution enables on-demand manufacturing at retail outlets and central kitchens and is estimated to **reduce manual labour by 75% and cut production costs by half.** This decentralised model improves product freshness, lowers carbon emissions, and has helped Crunch Cutlery secure larger commercial contracts. The automated solution has helped provide edible cutlery to over a dozen locations in Singapore including F&B chains such as YOLE.

Powering Next-Gen Optics with Metalens Innovation to Strengthen Singapore's Advanced Manufacturing Edge

Ultra-thin metalenses are revolutionising smartphone and wearable device cameras, correcting image distortion and powering sharper cameras. A*STAR partnered with MetaOptics Technologies to co-develop metalens design, testing, and manufacturing capabilities. In under a year, the team went from concept to commercial-ready prototypes, launching a collimating metalens for pico projectors and colour cameras. These capabilities enabled MetaOptics to launch new products, secure initial sales and expand commercial opportunities with global clients. This collaboration signals how we are growing capabilities in next-generation optics manufacturing for Singapore and beyond.

Reinventing Cooling to Power Greener Data Centres

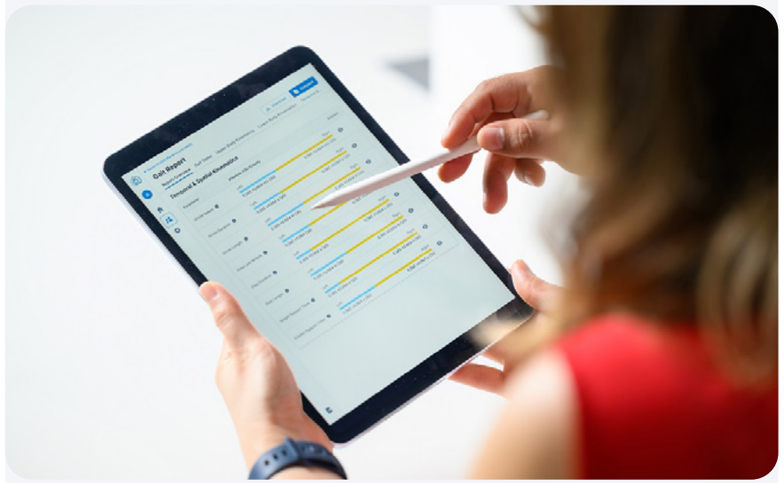
Data centres are major energy consumers in Singapore, where the tropical climate means cooling can account for up to 40% of total energy use. To tackle the high-energy demands of AI-powered data centres, KoolLogix and A*STAR launched a joint lab to develop an advanced heat removal solution for AI and GPU-powered data centres that **cuts energy consumption by up to 50%.** Supported by A*STAR's expertise in computational modelling, the Heat Removal Module 50 Series—a pump and compressor-free system boosts operational efficiency and supports greener data infrastructure. Deployed by OCBC Bank and the National Supercomputing Centre (NSCC), the solution demonstrates how local innovation contributes to more energy-efficient data centre solutions in a digital and AI-driven economy.

Targeted Relief for Hand Eczema Through Skincare Innovation

Hand eczema is a chronic condition that often resists conventional treatment and affects the quality of life for many. A*STAR partnered with Hyphens Pharma to co-develop Ceradan® Advanced Hand Balm—a science-backed solution that provides targeted relief and lasting protection. Designed to restore the skin barrier and maintain optimal pH balance with patented technology, the balm is especially beneficial for healthcare professionals prone to hand eczema. This demonstrates how public-private collaboration drives local enterprise growth through product development and technology transfer from bench scale-up to commercial-scale manufacturing in Singapore.

Accelerating Growth of Local Companies

Innovating Global Standards in Mobility Diagnostics for Improved Healthcare



Ageing populations worldwide are driving demand for earlier, more precise diagnosis of movement-related conditions like frailty, stroke-related impairment, and musculoskeletal disorders. To modernise the diagnosis of movement-related conditions, A*STAR spin-off Carecam launched 3DGait, an AI-powered digital assessment tool that delivers precise insights into human motion patterns and related disorders. This tool generates clinically validated digital biomarkers that enable faster and more accurate detection, leading to actionable clinical endpoints that guide targeted intervention. With initial use cases in frailty screening and stroke rehabilitation, 3Dgait has been piloted in local hospitals and polyclinics and is now listed as a Class II 510(k) Exempt Device by the U.S. FDA, gaining international traction and opening new commercial opportunities.

Transforming MedTech Ideas into Scalable Solutions for a Stronger Health Ecosystem

With the MedTech sector in Asia projected to grow to over US$225 billion by 2030, Singapore is strengthening its position as an innovation hub and empowering local manufacturers to co-drive R&D in emerging life science tools and medical devices. MedTech Catapult connects innovators with local manufacturers to fast-track medical technologies from concept to market — strengthening Singapore's MedTech ecosystem and driving healthcare innovation.

It is supporting the accelerated development and upcoming clinical validation of Castomise's 4D-printing remoudable cast, which is now being prepared for clinical studies in Singapore and South Korea. Working with Dornier MedTech, Singapore Biodesign, and clinical partners, it is also advancing an intelligent laser system for kidney stone treatment from research to functional prototype.

Accelerating Venture Creation to Strengthen Singapore's Global Edge in Deep Tech

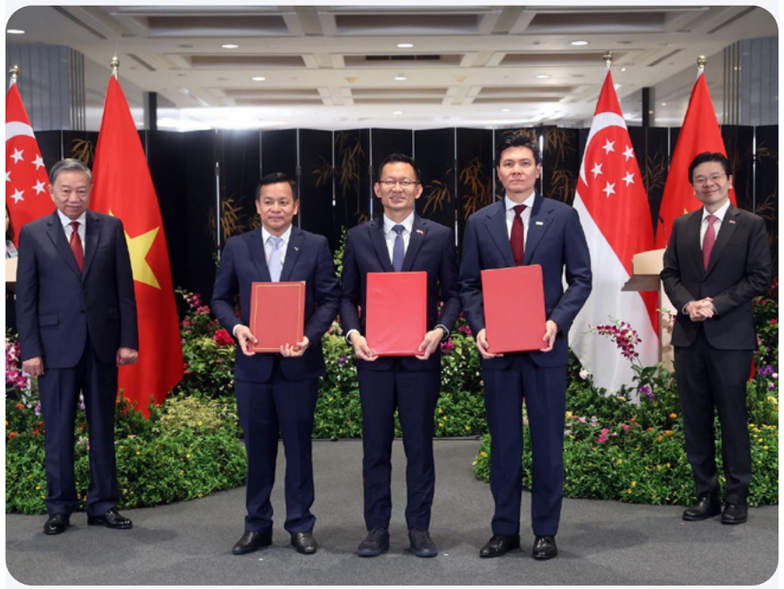
A*STAR has rolled out a venture programme to strengthen Singapore's position as a global launchpad for competitive deep tech ventures—translating public research into high-impact science and engineering enterprises through strategic partnerships with leading global venture builders. A*STAR's partnership with Xora Innovation accelerates the creation and spinout of start-ups built on strong IP foundations and market-ready technologies. Collaborations with Flagship Pioneering and MPM Biotech are advancing breakthrough innovations in health and sustainability, and anchoring biotech ventures in Singapore. Collectively, these efforts are building a vibrant pipeline of deep tech companies, attracting global capital and talent, and growing a world-class innovation ecosystem.

Fostering International Partnerships

Singapore-Japan Collaboration Delivers Faster Avian Flu Detection

With the persistent global concern of avian influenza and other zoonotic diseases, rapid detection is critical for effective containment. Steadfast is a portable rapid test that detects highly pathogenic avian influenza **in under three hours,** compared to conventional methods that take days. Co-developed by A*STAR, DxD Hub, and Japan's National Institute for Environmental Studies (NIES), the kit also distinguishes between high- and low-pathogenic strains, enabling faster, more targeted containment. Steadfast has been successfully deployed in Japan for zoonotic disease surveillance, supporting global efforts in pandemic preparedness and early intervention.

Advancing Industry 4.0 and Sustainability Across Vietnam-Singapore Industrial Parks



A*STAR signed an MoU with Becamex IDC and Sembcorp Development to strengthen R&D collaborations with Vietnam-Singapore Industrial Parks (VSIP) tenants, anchoring innovation in Singapore while expanding technology deployment into Vietnam. Partnering MNCs such as P&G, OLAM, and Schaeffler, these efforts support A*STAR's regionalisation strategy by enabling local enterprises to co-innovate, access early market opportunities in high-tech sectors, and integrate into global value chains—reinforcing Singapore's position as a hub for advanced manufacturing R&D solutions.

Singapore-France Collaboration Targets Southeast Asia's Top Infectious Disease Threats

Three of Southeast Asia's most pressing health threats—vector-borne diseases, respiratory infections, and antimicrobial resistance—are being tackled through a new research collaboration between A*STAR and France's Pasteur Institute. With Asia-Pacific identified as a hotspot for infectious diseases, the partnership aims to boost pandemic preparedness and advance technologies for early detection and treatment. By strengthening regional health resilience, it lays the groundwork for faster, more effective responses.

DRIVING NATIONAL PRIORITIES

A*STAR addresses key challenges facing Singapore with our multidisciplinary R&D capabilities. Our solutions, co-developed with public sector and industry partners, deliver tangible improvements for Singapore and Singaporeans.

Shaping Singapore's Policies for a Healthier Tomorrow

Singapore's healthcare expenditure is projected to reach S$30B by 2030, up from S$20.9B in 2025. To support long-term sustainability of its healthcare system and reduce the national burden of chronic disease, Singapore is placing greater emphasis on preventive health and earlier intervention.

Longitudinal cohort studies help identify early risks, improve disease prediction, and inform national policies. These insights are powered by a robust data platform linking research, clinical and health records. One clear example is Growing Up in Singapore Towards Healthy Outcomes (GUSTO), Singapore's largest and most comprehensive birth cohort study that is now shaping the nation's approach towards a healthier next generation.

GUSTO by the Numbers

1,000+ women and their children since 2009

15+ years of longitudinal data

450+ peer-reviewed publications

National Guidelines/Initiatives Informed by GUSTO

2018 MOH introduced universal screening for gestational diabetes

2021 The College of Paediatrics and Child Health introduced the Singapore Integrated 24-hour Activity Guidelines for Early Childhood (0 – 6 years)

2023 KKH introduced first clinical guidelines to address perinatal mental health

2023 MOH first published the Guidance on Screen Use for Children

2025 MOH launched Grow Well SG, which includes updated national screen use guidance

The Challenge

Children's development is shaped long before school age by genetics, environment, and culture. Most global research has been based on Western populations, offering limited insights into the unique factors that influence childhood development in Asian contexts. To drive better outcomes across generations, Singapore needed its own robust, longitudinal data.

The Response

GUSTO is a national research collaboration between the National University of Singapore (NUS), National University Health System (NUHS), KK Women's and Children's Hospital (KKH) and A*STAR. Since 2009, GUSTO has followed over 1,000 Singaporean families—producing rich data that is transforming how Singapore supports women and children's health and development. Building on its success in shaping national clinical guidelines for universal gestational diabetes screening during pregnancy to enable earlier detection and intervention, GUSTO continues to deliver evidence insights that address modern parenting challenges in the past year.

- **Sleep pattern**: Preschoolers with delayed sleep-wake cycles were more likely to experience sleep difficulties, which in turn correlated with increased socio-emotional difficulties when they enter primary school.
- **Screen time:** Children with more than 3 hours of daily screen exposure engaged in less physical activity. The more screen time the child has, the more their executive function is affected.

The Impact

Findings on screen time and child development from GUSTO, together with insights from other research, have informed Grow Well SG, a new national initiative led by the Ministry of Health (MOH) to promote healthier childhood development, starting with children up to 12 years old.

Updated national screen use guidance:

- No screentime under 18 months old
- <1 hour daily for 18 months to 6 years old
- <2 hours daily for 7 to 12 years old

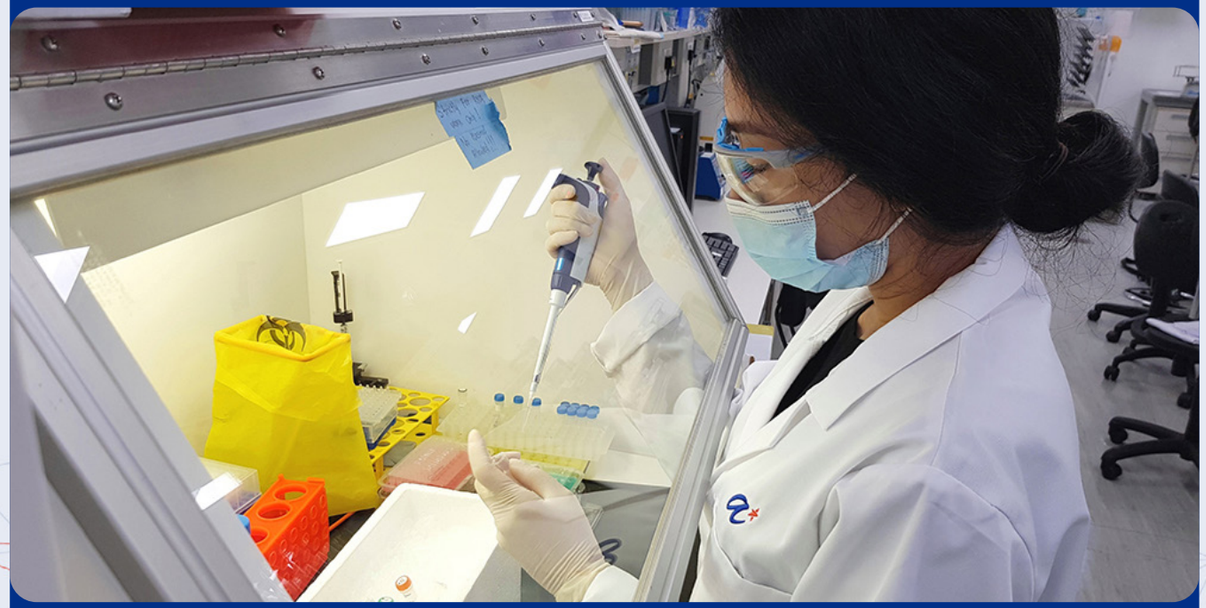
Grow Well SG signals a strategic shift towards preventive healthcare and exemplifies how science can deliver real-world impact—helping Singapore advance national priorities in child well-being and lifelong human potential.

Contributing to Better Health and Societal Outcomes

Advancing Precision Oncology in Singapore with Novel Therapies for Hard-to-Treat Cancers

With cancer as one of the leading causes of death worldwide, there is a growing push for more targeted, effective treatments. EDDC is advancing two promising cancer therapies that offer renewed hope for patients, reinforcing Singapore's role in shaping the future of precision oncology.

- ETC-159, co-developed with Duke-NUS, entered an investigator-led trial at the National University Cancer Institute for platinum-resistant ovarian cancer, following encouraging Phase 1B results.
- EBC-129, an antibody-drug conjugate for pancreatic cancer co-developed with SingHealth, completed patient cohort enrolment and has attracted clinical interest from leading global oncology organisations.



Scaling Local mRNA Innovation for Regional Resilience and Commercial Growth

Faster, more agile vaccine development is key to staying ahead of future health threats. To strengthen outbreak readiness, NATi, A*STAR and Wellcome Leap launched Asia's first non-GMP mRNA BioFoundry to accelerate the production of mRNA-based vaccines and therapeutics. The facility adopts advanced automation technologies developed through the Wellcome Leap R3 Programme to reduce production costs and turnaround time. This infrastructure supports preclinical research and enables the local development, testing, and production of RNA therapies—reinforcing Singapore's ability to respond to future health emergencies and strengthening our nation's biomedical hub ambition.

Contributing to Better Health and Societal Outcomes

Accelerating Therapies for Cancer Care to Strengthen Singapore's Biotech Edge

Source: EDDC

Cancer affects millions worldwide yet treatment options remain limited or ineffective for many. EDDC is collaborating with Engine Biosciences to develop precision oncology drugs, leveraging its AI-powered NetMAPPR platform to prioritise high-potential drug targets for cancers prevalent in Singapore and globally.

Developing Novel Gene Therapies for Eye Diseases and Cancer

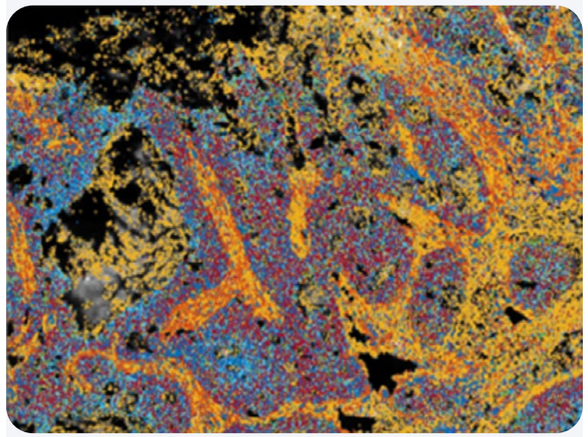
Source: Ring Therapeutics

Through more targeted gene therapies, research on novel treatments for eye diseases and cancer is underway. A*STAR's partnership with Ring Therapeutics and the Singapore Eye Research Institute will advance R&D efforts—spanning from characterising novel anelloviruses to testing therapeutic payloads, that will help accelerate the clinical translation of gene therapies for conditions that lack effective treatment option. The collaboration stems from a MoU with Flagship Pioneering to support next-generation therapeutic discovery, talent development, and venture building—reinforcing Singapore's role as a regional hub for advanced therapeutics.

Transforming Diagnostics with Integrated Precision Platforms to Address Global Health Needs

Early and accurate diagnosis is critical to improving health outcomes and managing disease burden globally. The Shimadzu–DxD Hub Diagnomics Centre (SDDC) was launched to develop rapid, accurate, and cost-effective diagnostics for infectious diseases, cancer, and metabolic disorders. Established by DxD Hub and Shimadzu Corporation, the facility supports earlier detection, precision treatment, and enhanced disease management on advanced molecular and mass spectrometry diagnostics platform. By combining strengths in productisation and analytical science, the centre reinforces Singapore's diagnostics ecosystem and drive global health impact.

Reimagining Target Discovery with Spatial Omics to Shape the Future of Precision Health



Source: Prabhakar Lab, A*STAR GIS

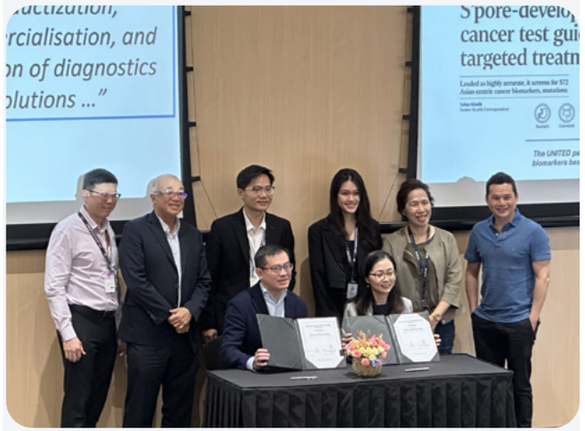
Understanding how diseases behave at the cellular level is key to unlocking new treatments. Meet TISHUMAP, an AI-powered platform that A*STAR is leading the development of, to map disease biomarkers and better understand cell-to-cell interactions. Tapping into the SingHealth Digital Pathology Archive, TISHUMAP integrates spatial omics, imaging, and clinical data to support high-resolution analysis of complex cancers and chronic diseases. This platform aims to accelerate drug discovery, improve diagnosis accuracy, and enable more precise and personalised treatment strategies across the region.

Contributing to Better Health and Societal Outcomes

Positioning Singapore as the Sensory Science Hub of Asia Through Precision Nutrition

Culture, taste, smell and texture shape food preferences and influence health outcomes, particularly among Asian populations. A*STAR has entered a five-year partnership with the US-based Monell Chemical Senses Center to study how sensory experiences, and cultural drivers influence food choices, with the aim of developing healthier, culturally tailored foods. By integrating sensory science with precision nutrition, the collaboration promotes healthier eating habits and supports sustainable food solutions across the region.

Re-engineering Cancer Treatment for Asian Populations



Source: DxD Hub

Cancers like lymphoma can behave very differently across populations—making Asian-centric research critical for precision care. A*STAR partners with multiple institutions through SYMPHONY 2.0, the next phase of a national research initiative focused on Asian-centric lymphoma and colorectal cancer. In its first phase, the collaboration published **over 100 studies** and developed prognostic tools and genomic models to drive precision treatment. These efforts are translating research into personalised, cost-effective diagnostics. Building on this foundation, DxD Hub and the National Cancer Centre Singapore are advancing cancer care by kickstarting Singapore's first tissue-based next-generation sequencing panel for lymphomas, set to launch at Singapore General Hospital.

PREDICTing Healthier Futures for Asian Families

Source: DxD Hub

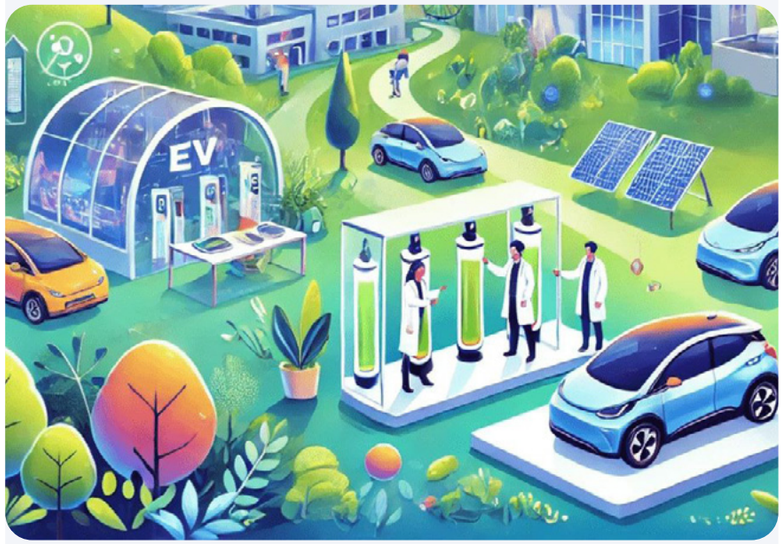
Many genetic conditions are inherited silently—only surfacing when it's too late to intervene. PREDICT, the world's first Asian-centric carrier screening panel, enables earlier detection of genetic risks and more informed reproductive planning for families. Co-developed by DxD Hub, KK Women's and Children's Hospital, and the SingHealth Duke-NUS Institute of Precision Medicine, PREDICT is powered by the PRECISE SG10K dataset and includes **20 Asian-prevalent genes often missed by commercial tests.** With support from Temasek Foundation, **free screening will be offered to 40,000 couples at KKH until 2027**—improving long-term health outcomes for future generations.

Reimagining Acne Care with mRNA-Powered Precision

Acne affects millions globally, yet treatment remains largely symptomatic and short-term. A*STAR, Sanofi, and the National Skin Centre are partnering to co-develop a novel mRNA-based acne vaccine that restores microbiome balance through the immune system. Facilitated by the BMSIPO, the collaboration aims to identify biomarkers associated with acne severity and disease progression. Phase 1 clinical trials are scheduled to begin in 2025 to evaluate the safety, efficacy, and immunogenicity of the vaccine in patients with mild acne, advancing efforts to develop more targeted acne treatments and accelerate dermatological innovation.

Shaping a Sustainable Future

Charging Ahead with Innovative EV Solutions for a Greener Future



As the world shifts to cleaner transport, next-generation batteries are key to making electric vehicles safer, more efficient, and more sustainable. Under the Singapore Battery Pack Programme, A*STAR and local Institutes of Higher Learning (IHLs) are advancing electric vehicle (EV) battery innovation, and have developed technologies to enhance immersion cooling and improve battery pack designs for better performance and safety. Other efforts include enabling real-time diagnostics and a streamlined disassembly process that **accelerates battery recycling by 50%**. These initiatives support national targets to de-register internal combustion vehicles by 2030 and phase them out by 2040, reinforcing Singapore's leadership in future mobility towards a greener future.

Scaling Sustainable Biomanufacturing for a Greener Global Economy

Sustainable biomanufacturing is a key pillar of the emerging bioeconomy—offering new ways to produce materials with lower emissions and greater circularity. A*STAR and MojiaBio are co-developing a Sustainable Biomanufacturing Technology Platform in Singapore to produce bio-based molecules from low-cost renewable resources such as methanol. Leveraging MojiaBio's proprietary bioconversion processes, the platform offers **up to 60% lower carbon emissions** at cost parity with petrochemical methods—advancing the Green Plan 2030 and strengthening Singapore's role in the global bioeconomy.

Pioneering Sustainable Aviation Fuel for Greener Flight Solutions

Decarbonising air travel is one of aviation's greatest challenges—and opportunities. To support global decarbonisation targets, A*STAR and Japan's IHI Corporation co-developed a catalytic process that converts carbon dioxide and hydrogen into Sustainable Aviation Fuel (SAF). The technology features one of the world's largest bench-scale SAF test rigs, capable of producing 5kg of liquid hydrocarbons daily. This accelerates SAF production, reduces emissions, and supports certification and potential for scale up to a commercial plant by 2030. The initiative reinforces Singapore's role in advancing sustainable aviation to meet international aviation's net-zero carbon target by 2050.

Shaping a Sustainable Future

Advancing Maritime Readiness for Alternative Fuels to Power Sustainable Ports

As alternative fuels like ammonia and methanol gain traction in green shipping, ensuring safe bunkering is critical to their adoption. Supporting Singapore's green shipping drive, A*STAR and public research partners are working on solutions to improve safety during bunkering operations. The Dispersion Analysis and Simulations for Handling (DASH) programme was launched to predict the dispersion behaviour of alternative future fuels such as ammonia and methanol in the event of accidental leakage during bunkering operations. A predictive tool that integrates dispersion analysis, consequence simulations, and real-time environmental data is used to create a dynamic safety and risk management system. DASH informs preventive action, emergency response, and mitigation for fuel leaks reinforcing Singapore's maritime innovation and sustainability leadership.

Innovating with AI to Advance Recycling Efficiency

Manual plastic sorting is slow, labour-intensive, and produces low-purity output. To tackle this, A*STAR and the Singapore University of Technology and Design co-developed an AI-powered plastic sorting system trained on visual and infrared images to accurately classify seven types of plastics. In collaboration with SembWaste, the system achieved **95% accuracy**—an 85% improvement from when the system only relied on images for training. Trials at SembWaste's facility will inform wider deployment—supporting Singapore's Zero Waste Masterplan and demonstrating the role of AI in driving sustainable innovation.

Powering Low-Carbon Innovation for a Net-Zero Future

Achieving net-zero emissions requires bold innovation, coordinated planning, and industry-wide transformation. To support Singapore's net-zero ambition, A*STAR has launched key platforms that help industry and policymakers advance low-carbon innovation and planning.

- **The Low-Carbon Technology Translational Testbed** helps companies test and scale innovations in areas such as carbon utilisation and hydrogen.
- **The Centre for Energy and Emissions Modelling 2.0** was co-launched with ecosystem partners, to evaluate cross-sector decarbonisation trade-offs across sectors, supporting coordinated and data-driven climate policies toward net-zero goals.

Cultivating Singapore's Quantum Ecosystem

Supercharging Quantum Breakthroughs in Genomics and Beyond

Quantum computing holds vast potential to transform fields from biology to logistics, but unlocking its power requires real-world use cases and scalable infrastructure. Singapore is stepping up its quantum ambitions on these fronts.

NQO, together with A*STAR, NUS, Duke-NUS, and Quantinuum signed a Master Research Collaboration Agreement to explore quantum computing applications in areas such as computational biology. Leveraging Quantinuum's 56-qubit H2 quantum computer, the first project on DNA classification aims to accelerate breakthroughs in genomics and personalised medicine—advancing Singapore's position as a quantum computing hub.

Source: Quantinuum

Source: National Quantum Computing Hub (NQCH)

Singapore is also scaling quantum innovation with two new initiatives in hybrid quantum-classical computing announced at the SupercomputingAsia 2025:

- The Hybrid Quantum-Classical Computing 1.0 initiative—a S$24.5 million effort by NQO to build integrated infrastructure, nurture talent, and co-develop applications with industry.
- A new MoU between the National Quantum Computing Hub (NQCH) and NVIDIA to advance use cases in areas such as DNA classification and optimisation.

These efforts leverage A*STAR's middleware expertise and NSCC's computing infrastructure to unlock scalable, high-impact quantum innovations.

CREATING IMPACT THROUGH EXCELLENT SCIENCE

A*STAR advances science that deepens understanding and delivers solutions—growing knowledge, capabilities, and innovations that power industries, address national needs, and contribute to a better world.

Biomedical Science

Mapping Asia's Immunity Blueprint to Advance Equitable Healthcare

Most cell maps are based on data from people of European descent, limiting the accuracy of diagnostics and treatment for Asian populations. The Asian Immune Diversity Atlas (AIDA) is the first large-scale single-cell map of over 1.2 million immune cells across seven Asian population groups. It offers critical insights into how ethnicity, age, and sex shape immune systems. This landmark resource enables more accurate diagnostics and population-specific therapies, advancing precision medicine for Asian populations. AIDA was developed by A*STAR scientists in collaboration with partners across five Asian countries.

Why This Matters

Reveals how immune systems vary across Asian ancestries, age and sex, down to cellular and molecular level.

Improves disease detection through more accurate, population-specific diagnostics for Asian communities.

Equips pharma and biotech with the data needed to develop tailored, more effective therapies for Asia.

Shyam Prabhakar, A*STAR GIS
Jay Shin, A*STAR GIS
Kian Hong Kock, A*STAR GIS
with collaborators from A*STAR SIgN

Cell

Smart Predictions: AI for Liver Cancer Recurrence

Liver cancer has one of the highest relapse rates post-surgeries. Yet, existing clinical tools often fail to predict relapses. A*STAR scientists, in collaboration with teams from China and Duke-NUS Medical School, developed TIMES, an AI-powered spatial immune profiling system trained on tumour samples. By mapping the distribution of five key biomarkers, including SPON2 on NK cells, TIMES predicts relapses with over 80% accuracy, outperforming existing staging methods. Ongoing efforts aim to develop a clinician-facing interface for automated readouts from stained images, and a fully automated model that requires no specialised staining or equipment.

Why This Matters

Reveals how immune cell spatial dynamics contribute to tumour relapse, demonstrating AI's potential in decoding complex tissue environments.

Supports doctors in tailoring post-surgical care by identifying high-risk patients.

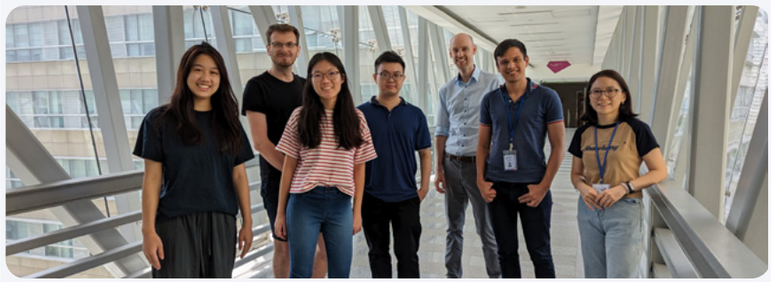
Improves clinical trial design and treatment matching. Ongoing efforts for a fully automated solution support broader adoption in clinical and research settings.

Denise Goh, A*STAR IMCB
Joe Yeong, A*STAR IMCB and SIgN

Nature

Sharpening RNA Sequencing for Better Disease Insights

The Singapore Nanopore Expression (SG-NEx) dataset sets a new benchmark for RNA sequencing technologies. Developed by A*STAR researchers and partners, it is the first comprehensive comparison of five sequencing methods, including long-read platforms like Nanopore and PacBio, across 14 human cell lines. SG-Nex's analysis showed that long-read sequencing offers more accurate insights into gene transcripts, including identifying major transcript isoforms, fusion genes, and RNA modifications.



Why This Matters

Provides researchers with a robust reference dataset for studying how changes in gene activity affect development, cancer, and other diseases.

Highlights the potential of long-read sequencing technology in the discovery of new biomarkers and a deeper understanding of disease mechanisms for precise diagnostics and targeted therapies.

Supports bioinformatics tool development and growth of the long-read sequencing market through validated benchmarks.

Ying Chen, A*STAR GIS
Jonathan Göke, A*STAR GIS

Nature Methods

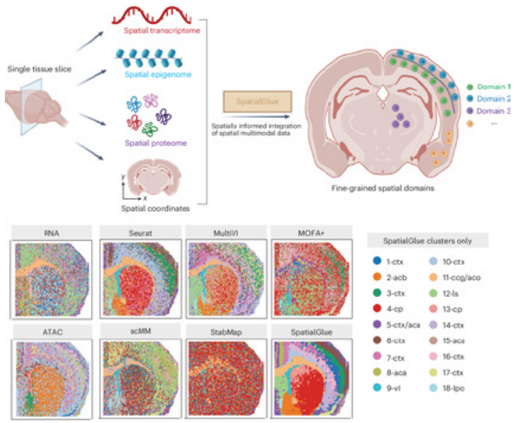
Biomedical Science

Seeing What Others Miss: Reconstructing Hidden Tissue Architecture with Deep Learning

SpatialGlue is a deep learning model that maps the organisation of cells in tissues by integrating spatial multi-omics data—an emerging approach that combines molecular insights with spatial context. This helps uncover hidden biological structures, such as layers of the brain cortex or rare immune cell subtypes in the spleen, that other tools often miss. By combining graph neural networks with a dual-attention mechanism, SpatialGlue can accurately reconstruct tissue architecture and reveal complex cellular interactions. It was developed by A*STAR researchers in collaboration with international partners.

Why This Matters

Enables biologists and scientists to uncover detailed spatial patterns in complex tissues, offering a fuller view of cell interactions and gene regulation.



Yahui Long, previously with A*STAR IMCB
Jinmiao Chen, A*STAR IMCB and BII
with collaborators from A*STAR BII and SIgN

Nature Methods

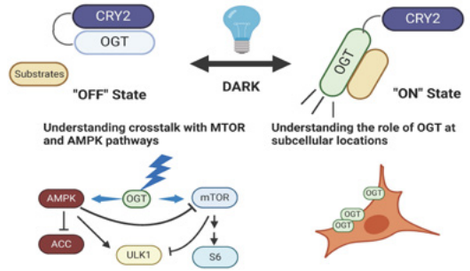
Shining a Light on Disease Pathways with Opto-OGT

Opto-OGT is a light-activated enzyme that gives researchers precise control over protein activity inside cells, offering new insights into how cells respond to nutrients. Activated by blue light, Opto-OGT mimics real-world nutrient signals by switching the sugar-based tag O-GlcNAc on or off in targeted parts of the cell. This reveals its role in critical functions such as insulin signalling, cell growth, and energy regulation. Opto-OGT is developed by scientists from A*STAR and Yale.

Why This Matters

Enables a precise way to study O-GlcNAcylation dynamics and its role in cellular behaviour and disease pathways.

Helps scientists understand how conditions such as cancer, diabetes and neurodegeneration develop, and identify new intervention points.

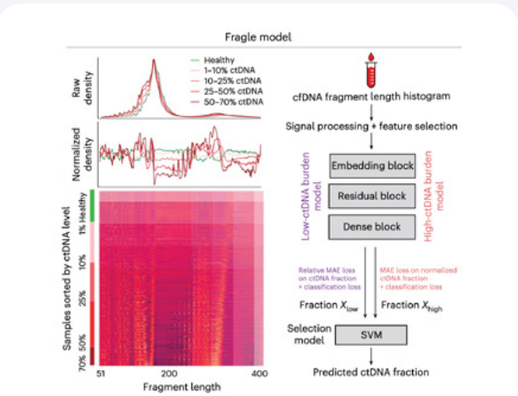


Qunxiang Ong, A*STAR IMCB
Weiping Han, A*STAR IMCB

Nature Chemical Biology

Fragle Unlocks Early Cancer Detection by Analysing Fragment Patterns in Blood

Fragle is a deep learning model that helps detect early signs of cancer by analysing the length patterns of DNA fragments in blood, without relying on known mutations. Trained on over 4,000 samples from 10 solid tumour types, it can detect circulating tumour DNA (ctDNA) at levels as low as 1% and works across both whole-genome and targeted sequencing data. Fragle was developed by A*STAR researchers and partners, achieving 50% to 90% sensitivity depending on tumour stage.



Why This Matters

Equips researchers with a powerful, mutation-independent tool to track ctDNA dynamics and tumour biology.

Enables early detection, personalised monitoring, and risk stratification in clinical settings, particularly for cancers lacking clear gene mutation signals, including post-surgery.

Helps biotech firms and clinical labs extract more value from existing sequencing data without extra tests or tumour samples.

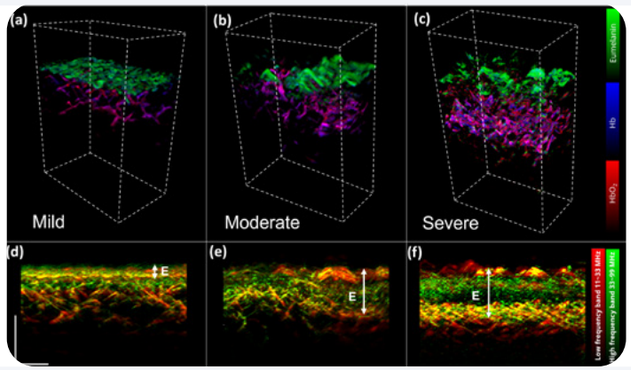
Guanhua Zhu, A*STAR GIS
Chowdhury Rahman, A*STAR GIS
Anders Skanderup, A*STAR GIS

Nature Biomedical Engineering

Biomedical Science

High-Resolution Photoacoustic Imaging Enables Objective Psoriasis Monitoring

Psoriasis is a chronic inflammatory skin condition marked by scaly patches that flare up unpredictably. Current clinical assessments often rely on semi-subjective visual scoring or invasive biopsies, which may miss early or subtle changes in disease activity. A*STAR researchers, in collaboration with the National Skin Centre Singapore, used a non-invasive label-free, photoacoustic imaging method that leverages the skin's natural melanin to assess both structural and functional characteristics of psoriatic skin. By quantifying digital biomarkers such as epidermal thickness, blood oxygen saturation, and total blood volume, the method offers objective evaluation of disease activity and treatment response.



Why This Matters

Provides new insights into how vascular structural and functional changes can be used to study inflammatory skin conditions. Valuable for dermatology and medical imaging research.

Supports the development of portable photoacoustic tools for dermatology, potentially reducing reliance on biopsies and improving long-term care for chronic skin conditions.

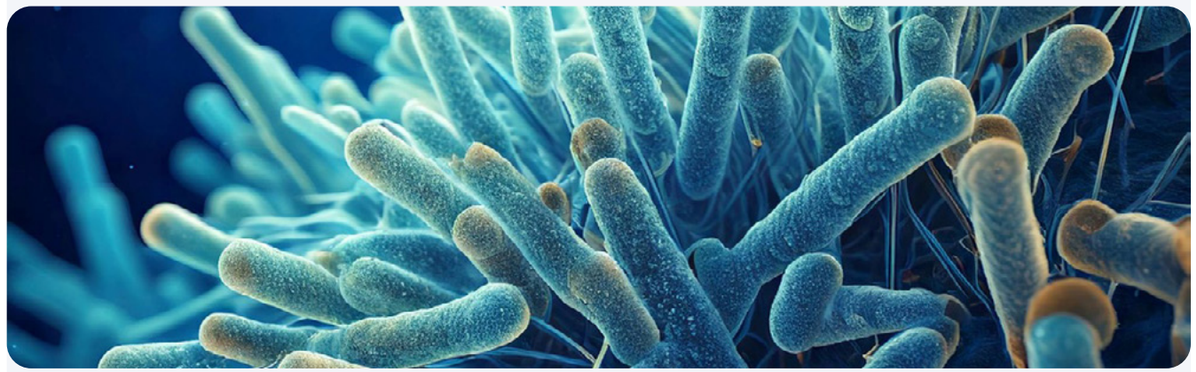
Enables non-invasive, real-time monitoring of psoriasis, improving patient comfort and helping clinicians better track progression and treatment response.

Xiuting Li, A*STAR SRL
Dinish US, A*STAR SRL
Malini Olivo, A*STAR SRL

Photoacoustics

Uncovering the Gut Microbiome's Role in Healthy Ageing

With over a third of Asia's population projected to be over 60 by 2050, supporting healthier ageing is a key public health priority in many countries. Ageing is a complex phenomenon associated with gradual declines in several physiological functions—including gut health, which plays a central role in immunity and metabolism. Researchers from A*STAR and NUS analysed gut microbiomes from over 200 older adults in Singapore using shotgun metagenomics to capture the full spectrum of microbial diversity. They discovered specific bacterial shifts that appear to compensate for the loss of key microbes responsible for producing vital compounds, revealing a sophisticated microbial interplay that may support gut health in later life.



Why This Matters

Establishes one of the largest high-resolution gut microbiome datasets in ageing Asian populations using advanced DNA sequencing.

Opens avenues for new dietary or probiotic interventions aimed at sustaining gut health in older adults.

Supports the development of microbiome-targeted strategies to promote healthy ageing and improve well-being. Lays groundwork for non-invasive gut bacteria tests to monitor frailty and ageing health.

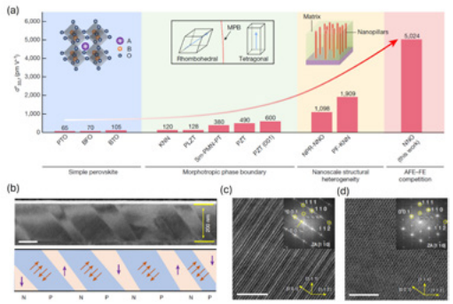
Aarthi Ravikrishnan, A*STAR GIS
Indrik Wijaya, A*STAR GIS
Niranjan Nagarajan, A*STAR GIS

Nature Communications

Physical Science and Engineering

New Piezoelectric Material Sets Stage for Faster, More Efficient Devices

A newly designed and fabricated sodium niobate ($NaNbO_3$) thin film achieves record-high piezoelectric performance by stabilising two competing phases—ferroelectric and antiferroelectric—at room temperature. This discovery allows the material to undergo dramatic structural changes when exposed to an electric field, producing a piezoelectric response of over 5,000 pm V^{-1}. The finding by A*STAR scientists and collaborators opens possibilities for next-generation microelectronics technologies.



Why This Matters

Provides materials scientists a new approach to enhance electromechanical performance.

Supports development of compact, energy-efficient medical imaging tools and health monitors.

Powers innovations in ultrafast wireless communication, smart sensors, and ultrasonic transducers.

Baichen Lin, A*STAR IMRE
Huajun Liu, A*STAR IMRE
with collaborators from A*STAR IHPC

Nature

Wearable Sensor Enables Real-Time, Painless Health Monitoring from Skin

A soft, stretchable sensor offers a non-invasive alternative for monitoring biomarkers, such as lactate and cholesterol, without the need for sweat or blood. It detects solid-state biomarkers directly from the skin surface using an ionic-electronic bilayer hydrogel, and has accurately tracked physiological changes with readings that closely match conventional blood tests. The device was developed by researchers from A*STAR, NUS and NTU.

Why This Matters

Provides researchers with a new approach to studying solid-state epidermal biomarkers, previously underexplored due to unsuitable sensing tools.

Offers a painless, non-invasive way to monitor biomarkers relevant to metabolic and cardiovasular health.

Drives the next generation of healthtech wearables by enabling personalised health tracking and remote care.

Ruth Arwani, previously with A*STAR IMRE
Le Yang, A*STAR IMRE
with collaborators from A*STAR IHPC and IMCB

Nature Materials

Closing the Loop on High-Performance Plastics

Traditional thermoset plastics used in cars, electronics, and construction are valued for their durability and heat resistance. However, they cannot be recycled, leading to waste and loss of high-value materials such as carbon fibres. A*STAR researchers and collaborators in China engineered a new class of thermosets called poly (α-cyanocinnamates) using the Knoevenagel reaction. These retain conventional strength and heat resistance but can be reshaped, recycled, and selectively degraded to recover both the material and embedded, enabling closed loop recycling.

Why This Matters

Enables the design of high-performance plastics that are recyclable, addressing long-standing trade-offs in thermoset design.

Reduces plastic waste and pollution through material reuse.

Can lower material costs and waste in sectors such as automotive, aerospace and electronics by enabling the recovery and reuse of high-value components.

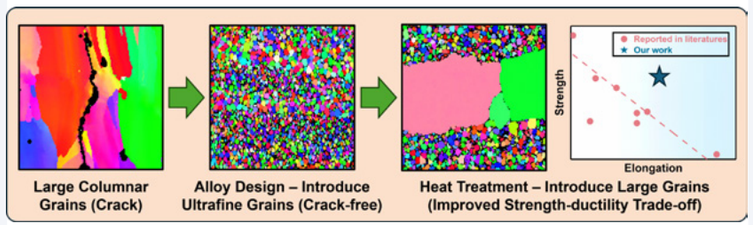
Sheng Wang, previously with A*STAR ISCE²
Zibiao Li, A*STAR ISCE² and IMRE

Journal of the American Chemical Society

Physical Science and Engineering

Stabilising 3D-Printed Aluminium for Aerospace and Semiconductor Applications

There are some 3D-printed metals that suffer from brittleness and cracking, limiting their use for critical applications in aerospace and semiconductors. Researchers from A*STAR and NTU enhanced Al6061 alloy with scandium and zirconium, applying precise laser adjustments and T6 heat treatment to suppress ductility loss. The result is a strong, ductile, and thermally conductive alloy suited for high-performance industrial use. The alloy's performance makes it ideal for high-demand sectors, with A*STAR and industry partners co-developing, validating and qualifying it for real-world use through the NAMIC-supported Additive Innovation Centre at A*STAR.



Why This Matters

Enables the use of printable lightweight aluminium alloys towards more sustainable, efficient production across sectors by reducing material waste and energy use.

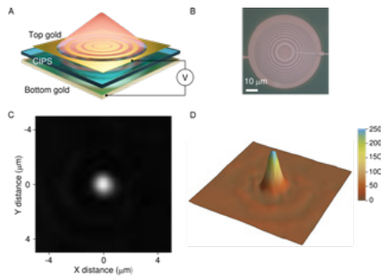
Powers innovations in ultrafast wireless communication, smart sensors, and ultrasonic transducers.

Zhiheng Hu, A*STAR SIMTech
Sharon Nai, A*STAR SIMTech
with collaborators from A*STAR IHPC

Advanced Materials

Electrically Tunable Flat Lens Powers the Future of Optical Devices

The first electrically tunable flat lens made from the 2D ferroelectric material $CuInP_2S_6$'s marks a significant advancement in dynamic, ultra-thin optics. By modulating $CuInP_2S_6$'s birefringence, A*STAR researchers achieved a tuning efficiency of 34% in a flat lens made of this material. With its strong electro-optic response and van der Waals layered structure, $CuInP_2S_6$'s enables precise light modulation at low voltages and seamless integration with a variety of substrates. This discovery demonstrates real-time, energy-efficient control of light in a compact and all-solid-state device, opening the door to reconfigurable and adaptive optical technologies in imaging, sensing, and communications.



Why This Matters

Opens new opportunities for nanophotonics, materials science, and optoelectronics by enabling reconfigurable, chip-integrated optical systems using emerging 2D materials.

Paves the way for smaller, smarter lenses in medical diagnostics, wearable optics, adaptive imaging systems in healthcare and consumer technologies.

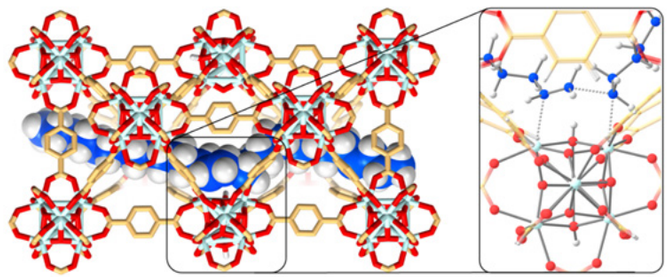
Supports compact, energy-efficient solutions for AR/VR, autonomous vehicles, cameras, and telecommunications.

Yuanda Liu, A*STAR IMRE
Yong-Wei Zhang, A*STAR IHPC
Jinghua Teng, A*STAR IMRE

Advanced Materials

New Family of Porous Catalysts Breaks Down Plastic Waste into Valuable Chemicals

Polyethene and polypropylene, the most common plastics, are chemically stable and hard to recycle. Researchers from A*STAR, in collaboration with Japan, demonstrated that UiO-66, a zirconium-based metal–organic framework (MOF), acts as an efficient catalyst to break down polyolefin plastic waste via pyrolysis. Its porous structure allows plastic to enter and react at zirconium sites, producing valuable liquid products. The catalyst is scalable for industrial use and has been shown to effectively break down real-world waste such as detergent bottles and packaging foams.



Why This Matters

Establishes MOFs as a new class of catalysts for breaking down unreactive plastics, opening doors to broader further applications of MOFs in recycling other plastics.

Enables closed-loop recycling of single-use plastics, reducing landfill and incineration, correspondingly reducing the associated greenhouse emissions.

Provides a selective, scalable solution for converting plastic waste into valuable chemical feedstocks.

Jerry Heng, A*STAR IMRE **Enyi Ye**, A*STAR IMRE
Tristan Tan, A*STAR IMRE **Jason Lim**, A*STAR IMRE
Xin Li, A*STAR IMRE
with collaborators from A*STAR ISCE²

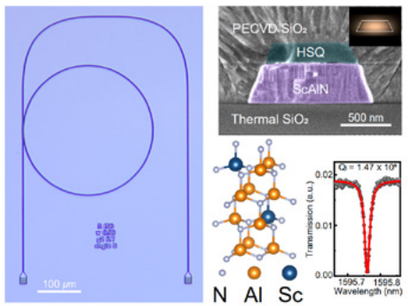
Angewandte Chemie - International Edition

Physical Science and Engineering

New Photonic Chip Material Powers Compact, High-Speed Optical Devices

Many emerging photonic integrated circuits (PICs) rely on materials not fully compatible with CMOS processes, limiting production scalability and integration with electronics. A*STAR and international partners developed a CMOS-compatible platform to build PICs using scandium-doped aluminum nitride (ScAlN).

It supports both active and passive components on a single chip, with low optical losses, compact size, and broad wavelength coverage from visible to near-infrared. This enables advanced functions such as frequency combs and quantum light sources, paving the way for future optical communication and computing.



Why This Matters

Demonstrates ScAlN's unique capability to combine electro-optic, piezoelectric, and nonlinear properties across a broad spectrum for versatile PICs.

Supports mass production of advanced photonic chips for telecom, data centres, AI, and quantum applications using existing semiconductor processes.

Enables compact biomedical sensors, wearable diagnostics, and lab-on-chip systems using light-based data.

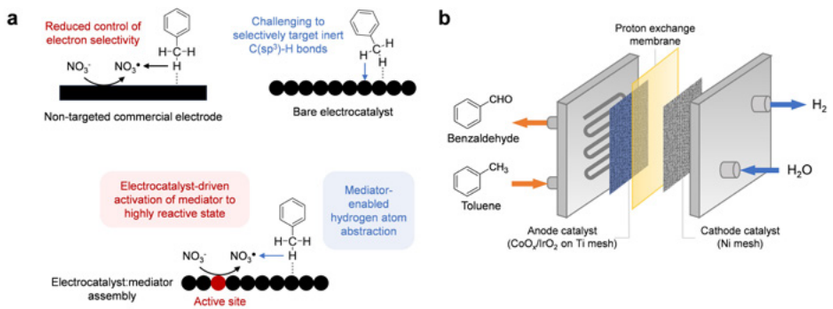
Sihao Wang, A*STAR IMRE and Q.InC
Veerendra Dhyani, A*STAR IMRE and Q.InC
Nanxi Li, A*STAR IME
Di Zhu, A*STAR IMRE and Q.InC

APL Photonics

Electrocatalyst Enables Green Conversion of Stable C–H Bonds

Converting stable carbon-hydrogen (C–H) bonds into high-value chemicals typically requires harsh, energy-intensive processes that are costly and environmentally taxing. This limits their sustainability and scalability. A*STAR and NTU scientists have developed a novel iridium oxide (IrO_2) electrocatalyst decorated with cobalt oxide clusters (CoO_x) that activates nitrate (NO_3^-) into a reactive radical for selective benzylic C–H oxidation.

The CoOx–IrO_2 interface enhances nitrate activation and hydrogen abstraction, enabling efficient conversion at room temperature. Demonstrated on toluene as the substrate, the system achieved over three times the efficiency of standard catalysts, remained stable for over 100 hours, and performed well in flow systems, offering potential for more sustainable chemical production.



Why This Matters

Demonstrates how catalyst–mediator interfaces can convert nitrate into reactive radicals for selective C–H bond activation under mild conditions.

Supports low-emission, electricity-driven oxidation processes for scalable, cost-efficient green manufacturing.

Enables sustainable production of fine chemicals and pharmaceuticals without toxic oxidants or high temperatures.

Ziyu Mi, A*STAR ISCE²
Yuke Li, A*STAR IHPC
Jia Zhang, A*STAR IHPC
Wan Ru Leow, A*STAR ISCE²
with collaborators from A*STAR IMRE

Nature Communications

NURTURING TOP TALENT

Talent is the lifeblood of a vibrant ecosystem. A*STAR cultivates research and entrepreneurial talent to advance discovery, translate innovation, and deliver impact—strengthening Singapore's research, innovation, and enterprise landscape.

National Awards

President's Science and Technology Medal

Prof Richard Parker, Singapore
Aerospace Programme, A*STAR

Recognised for his outstanding contributions in stimulating the establishment of corporate R&D capabilities in Singapore, leadership in bringing companies and research institutions together for the benefit of Singapore, and for promoting international collaboration in research and technology.

President's Technology Award

Prof Malini Olivo, A*STAR SRL
Dr Gurpreet Singh, Respiree Pte Ltd
Dr Renzhe Bi, A*STAR SRL
Assoc Prof Augustine Tee, SingHealth

Recognised for the innovative integration of biophotonics, machine learning and clinical data to create Respiree, a healthcare solution which has demonstrated the potential to transform cardio-respiratory disease management in real-world settings.

Young Scientist Award

Dr Jonathan Göke, A*STAR GIS

Recognised for pioneering computational methods for long read RNA sequencing data that have enabled the profiling of RNA transcription and modifications at unprecedented resolution and accuracy.

National Awards

Public Sector Transformation Awards

Dr Sebastian Maurer-Stroh, A*STAR BII

Exemplary Leader Award
Recognised for transforming BII into a dynamic data hub aligned with national digitalisation needs. His computation expertise has catalysed impactful applications in infectious diseases and allergy prediction, reshaping global scientific, public health and regulatory landscapes.

Dr Fan Yan, NMC

Exemplary SkillsFuture @ Public Service Award
Recognised for advancing metrology training. She led the development of WSQ-certified training modules for NMC, enhancing measurement quality, innovation, and competitiveness for Testing, Inspection, and Certification companies in Singapore.

IES/IEEE Joint Medal of Excellence

Prof Lean Weng Yeoh, A*STAR

Recognised for his significant impact on engineering advancements, particularly in reducing carbon footprint and sustainability in engineering.

IES Sustainability Awards

A*STAR ISCE²

Project: Realising Sustainable Aviation Fuel (SAF) production from CO_2 (in partnership with IHI Corporation)
Recognised for developing a revolutionary technology that converts CO_2 into SAF. The solution improves energy efficiency and reduces reactor footprint, supporting greener aviation with lower capital costs.

MTI Firefly Awards

A*STAR IHPC

Innovative Project/Policy Award (Gold)
Project: Modelling for Enhanced Maritime Environmental Safety Assessment (in partnership with Maritime Port Authority Singapore)

Recognised for leveraging computational fluid dynamics tools to assess accidental risks in Singapore's first methanol and ammonia bunkering trials – a significant accomplishment in Singapore's decarbonisation efforts and strengthening its position as a global bunkering hub.

A*STAR IHPC

Innovative Project/Policy Award (Silver)
Project: Dr Buddy: Personalised Home-Based Patient Care Through Innovative Virtual Ward Telemedicine Platform (in partnership with SingHealth)

Recognised for the significant development of Dr Buddy – a solution that reduces hospital admissions, enhances patient comfort, and optimises healthcare efficiency.

A*STAR I²R

Borderless Award (Bronze)
Project: Co-operative Unified Smart Traffic System (in partnership with LTA)

Recognised for pioneering the development of a locally owned, intelligent AI-based next gen traffic light control system to enhance sustainability and resilience in Singapore's land transport system.

IES Prestigious Engineering Achievement Award

A*STAR I²R

Project: Aircraft Predictive Maintenance (APM)

Recognised for developing an APM tool that leverages aircraft sensor data to predict potential failures in critical components and system – minimising flight delays and Aircraft on Ground incidents.

International Awards

Genome Valley Excellence Award

Prof Patrick Tan, Duke-NUS Medical School, SingHealth, PRECISE and A*STAR GIS

Recognised for his outstanding contributions to precision medicine, cancer genomics, and population health research. Prof Tan has played a transformative role in advancing biomedical research and personalised healthcare, particularly through his leadership at PRECISE.

IEEE Communications Society

Dr Sumei Sun, A*STAR I²R

Awarded the inaugural **Asia Pacific WICE Outstanding Achievement Award** for her contributions to wireless research, technology translation, and leadership in the wireless community.

Also conferred the **2024 Donald W. McLellan Meritorious Service Award** for her outstanding long-term service to the welfare of the IEEE Communications Society.

MIT Technology Review Innovators Under 35 (TR35) Asia Pacific

Dr Di Zhu, A*STAR IMRE and Q.InC

Recognised for advancing two technological platforms, superconducting nanowire detectors and lithium niobate photonics, that enable scalable photonic quantum processes.

Dr Wan Ru Leow, A*STAR ISCE²

Recognised for developing electrochemical methods to refine petrochemicals under ambient conditions using renewable electricity, minimising the carbon footprint of the chemical industry.

Emerging Investigator by J Mater Chem A

Dr Jason Lim, A*STAR IMRE

A cradle-to-cradle approach for successive upcycling of polyethylene to polymer electrolytes to organic acids.

Dr Shengnan Sun, A*STAR IMRE

Short-range disorder mediated stability of Zn in rock-salt MgO beyond configurational entropy.

Rising Stars in Optics 2024

Dr Tony Ha, A*STAR IMRE and NSTIC

For leading the research group Novel Light Source (NLS), focusing on metamaterials and their applications in light-emitting diodes and nanolasers for advanced displays (AR/VR).

International and National Fellowships

Association of American Physicians

Prof Patrick Tan, Duke-NUS Medical School, SingHealth, PRECISE and A*STAR GIS

Recognised for his research into deciphering the molecular mechanisms and genetics of gastric cancer, which paved the way for improved diagnostic and precision medicine strategies for the disease, which remains a leading cause of death worldwide.

Fellow of the Royal Society of Chemistry

Dr Zibiao Li, A*STAR ISCE^2 and IMRE

Awarded for significant contributions and leadership in the chemical sciences.

Fellow of the American Medical Informatics Association

Dr Pavitra Krishnaswamy, A*STAR I^{2}R

Recognised for her expertise in evidence-based informatics practice, enabling I^{2}R's cutting-edge AI advances towards the transformation of health and healthcare.

L'Oréal-UNESCO For Women in Science Singapore

Dr Grace Lim, A*STAR IMCB

Recognised for groundbreaking cancer research.

Fellow of the Singapore National Academy of Science

Prof Xian Jun Loh, A*STAR IMRE

Recognised for his contributions to the field of modelling polymers, spanning molecular insights to clinical applications.

Prof Malini Olivo, A*STAR SRL

Recognised for her pioneering contributions in biophotonics science and technology and extensive translation from bench to clinic to market.

Prof Loh and Prof Olivo were among eleven distinguished scientists awarded in 2024.

Elected Fellow of The Institute of Physics, Singapore

Dr Johnson Goh, A*STAR IMRE and Q.InC

Recognised for advancing the scientific domain of physics.

Asian Young Scientist Fellowship

Dr Wei Wu, A*STAR SIgN

Recognised for her research in affinity mass spectrometry and neoantigen-based immunotherapy.

Dr Wu was among 12 early-career researchers selected in fundamental science disciplines.

NCID Short Term Fellowship

Dr Fok Moon Lum, A*STAR ID Labs

Recognised infectious disease researchers who demonstrate active engagement in current research.

Major National and International Grants

NRF Competitive Research Programme (CRP) 31st Grant

Dr Hong Liu, A*STAR IMRE and NSTIC
Optotwistronics: Enabling Ultrahigh-efficiency Nanoscale Nonlinear Light Sources.

Dr Shi Yan Ng, A*STAR IMCB
Identifying novel microglia-based targets for neurodegeneration using immuno-competent organoids.

NRF Investigatorship (Class of 2024)

Dr Niranjan Nagarajan, A*STAR GIS and NUS
Understanding and remodeling microbial communities to prevent the spread of antimicrobial resistant pathogens.

Dr Qi-Jing Li, A*STAR IMCB and SIgN
Harnessing distant resident memory T cells to prevent breast cancer metastasis.

Dr Zhi Wei Seh, A*STAR IMRE
Universal Design Principles for Multivalent-Ion Batteries.

NRF Fellowship (Class of 2024)

Dr Kenneth Lay, A*STAR SRL
Going Skin-Deep: Targeting Stem Cells to Tackle Inflammatory Skin Diseases.

Dr Leslie Beh, A*STAR IMCB
Mechanistic studies and applications of RNA modifications using 'Designer' RNA.

Dr Timothy James Stuart, A*STAR GIS
Design of synthetic DNA regulatory elements for precision gene therapy.

Dr Wan Ru Leow, A*STAR ISCE^2 and NTU
Photoelectrocatalytic:mediator strategies towards emissions-free e-refining of chemicals.

Dr Yong Kiam Tan, A*STAR I^{2}R and NTU
Verifying the Verifiers: Trustworthy Proofs for Critical Computer Systems.

3rd Science of Learning (SoL) Grant Call

Dr Lining Sun, A*STAR IHPC and IHDP
Adult Learning for Career Change: Motivating Skills Transfer and Reskilling.

MTC Programmatic Fund

Prof David Rosen, A*STAR IHPC and SIMTech
4D Additive Manufacturing (4DAM) of Smart Structures.

Dr Le Yang, A*STAR IMRE
BLISS: Beyond Liquids with In-Situ Solid-state Surficial Sensorics.

Dr Xianshu Luo, A*STAR IME
High Linearity Silicon Germanium Photonic Modulator for 6G Analog Radio over Fiber.

National Medical Research Council (NMRC) Individual Research Grant and Young Individual Research Grant

A total of 29 A*STAR researchers were awarded the funds from NMRC to nurture basic, translational and clinical research that are relevant to human health and potential. Full list of awardees.

NRF Frontier CRP 2024

Dr Anjan Soumyanarayanan, A*STAR IMRE and NUS
Engineering Spin-Triplet Zero-Energy Quasiparticles in Ferromagnet-Superconductor Heterostructures.

Dr Chit Siong Lau, A*STAR Q.InC
Overcoming Boltzmann's Tyranny with Quantum Tunnelling Transistors for Sustainable Nanoelectronics.

Dr Tony Ha, A*STAR IMRE and NSTIC
Extreme Bose-Einstein Condensates for On-chip Ising Machines.

Manufacturing, Trade and Connectivity (MTC) Individual Research Grant and Young Individual Research Grant

8 A*STAR researchers were awarded for both grants which support novel and fresh R&D investigator-led ideas in the manufacturing, trade and connectivity domain sectors. Full list of awardees.

Other Awards and Recognition

Clarivate 2024 Highly Cited Researchers

Dr Gang Wu, A*STAR IHPC

Prof Florent Ginhoux, Institut Gustave Roussy and A*STAR SIgN

Dr Huazhu Fu, A*STAR IHPC

Dr Jinmiao Chen, A*STAR BII

Prof Lisa Ng, A*STAR ID Labs

Prof Laurent Renia, NTU and A*STAR ID Labs

Dr Shibo Xi, A*STAR ISCE^2

Dr Xiaoli Li, A*STAR I^{2}R

Prof Xian Jun Loh, A*STAR IMRE

Prof Yong Wei Zhang, A*STAR IHPC

Dr Zhi Wei Seh, A*STAR IMRE

Recognised as one of the world's most influential scientific minds globally, with highly cited research ranking in the top 1% globally by field and year on Web of Science™. Their contributions span diverse fields, reflecting a relentless pursuit of innovation and excellence.

NUS Outstanding Science Alumni Award 2024

Prof Huck Hui Ng, A*STAR

Recognised for his groundbreaking work on embryonic stem cell pluripotency and Parkinson's disease, as well as his internationally acclaimed contributions to gene regulatory networks and functional genomics. Prof Ng has played a key role in advancing Singapore's biomedical research ecosystem—developing A*STAR GIS into a leading genomics institute, shaping Biopolis, and mentoring the next generation of scientific talent.

Asia-Pacific Signal and Information Processing Association Distinguished Lecturer (2024-2025)

Dr Yan Wu, A*STAR I^{2}R

Recognised for his technical achievement, expertise and leadership, Dr Wu is one of the two in Singapore elected for this term.

World's Top 2% Scientists by Stanford University

Career Long Impact 2023
81 A*STAR staff were recognised on the list

Single Year Impact 2023
142 A*STAR staff were recognised on the list

Agency for Science, Technology and Research
SINGAPORE

Organisation Details

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Dr Wendy Soon, *Director, Joint Planning (Policy)*
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