The NUS Yong Loo Lin School of Medicine has come far in 120 years. In the first of a two-part series that ends tomorrow, The Straits Times takes a look at some of its achievements and where it is headed.

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NUS Medicine turning into a research powerhouse

Its research findings are cited more frequently than others in the medical field

Salma Khalik

Research is a very important facet of working at the NUS Yong Loo Lin School of Medicine, and almost every member of its faculty is involved in scientific or clinical studies.

The school secures more than $100 million in research grants each year to fund impactful research and breakthroughs that shape the future of healthcare, with the money coming from a variety of sources, including the university, the Government, industry partners and private foundations.

In 2024, NUS Medicine researchers published 3,865 papers, which were cited 21,829 times, and this intense focus on research has borne fruit, both in discovering better ways to treat patients and raising the school's standing in the world, said Professor Roger Foo, vice-dean of research.

There are at least 220 labs in NUS Medicine, each of them helmed by a group leader or principal investigator, distributed among 10 translational research programmes and 15 faculty research centres. All these programmes and centres are led by prominent and world leaders in their research area.

There is also dedicated research administrative staff who support the school's research mission, through often complex approval processes, sometimes involving collaborations with multiple institutions all at one time. "Without this contingent of professional research administrators, none of us would be able to do the research smoothly," said Prof Foo.

An example of better patient care is the development in 2019 of the world's first molecular blood test for early gastric cancer detection. The team was led by Professor Jimmy So, a senior gastrointestinal surgeon at National University Hospital (NUH) and the National University Cancer Institute; Associate Professor Too Heng-Phon from the department of biochemistry at NUS Medicine; and Professor Yeoh Khay Guan, a former dean and currently a senior consultant at the division of gastroenterology and hepatology at NUH and chief executive at the National University Health System (NUHS).

Gastric, or stomach, cancer is the fifth-most common cancer globally, with Asians being the most prone to it. In Singapore, it is the fourth-most common cause of cancer death in men, and fifth-most in women.

The researchers' discovery led to spin-off company Mirxes, which was listed on the Stock Exchange of Hong Kong in May. It closed its first day of trade as a new biotech unicorn, with a market capitalisation of HK$8.29 billion (S$1.34 billion).

The school also uses artificial intelligence to search available data to see where patient care can be improved.

NUS Medicine gained permission in early 2025 to duplicate the National University Health System's (NUHS) Electronic Medical Records. In the CardioSight-Horus platform, records are anonymised so patient identities are not revealed, and researchers from various departments have been able to mine the data to see where the gaps are in patient care.

Within three months, the school had found 2,000 patients in the NUHS cluster with high cholesterol levels who were not being treated for it.

Given the medical ramifications of uncontrolled cholesterol levels, the researchers received the green light to identify and alert the patients. Hotlines were set up so that these patients could seek advice.

There will be follow-ups in the coming months to see if these patients have brought their cholesterol levels to within acceptable limits. If they have, it would prove that by acting on available data, "we can move the needle" in directly improving patient care, said Prof Foo.

With regard to international recognition, Prof Foo said research findings from the school are now frequently cited. He added: "As demonstrated by robust, quantifiable growth in research performance, NUS Medicine's Field-Weighted Citation Impact has climbed from 1.04 in 2000, to 2.59 in 2024."

>$100m

Amount in research grants which NUS Medicine secures each year.

3,865

Number of papers NUS Medicine researchers published in 2024.

21,829

Number of times these papers were cited in 2024.

A citation impact of 1 reflects the global average. An impact of 2 means the article or research is cited twice as often as similar publications in the field. The school's 2.59 impact puts it near the pinnacle. In 2024, the impact factor among top medical schools was 3.07 at Oxford, 2.81 at Stanford, 2.38 at Johns Hopkins, and 2.4 at Harvard.

A major turning point came in 2005 with the National Medical Research Council's Clinician Scientist Award, which offered funding to secure protected research time, thus giving clinicians an incentive to embark on studies.

At about the same time, Singapore launched initiatives to train clinician-scientists on how to carry out high-level research, while also bringing in some of the best foreign talent to augment the local pool.

Prof Foo said getting research funding is competitive but overall, the most meaningful and innovative research projects do get funded. "The money is there. But the bar for getting a research project awarded has been going up over the years."

The school decides on the projects to support based on several factors.

One factor is the researcher's achievements. Prof Foo said: "Track record is very important. Like when you see a person has a great idea now, and you can see that he's had a previous great idea that he took to great places, then you kind of think that, wow, this person has the capability to do the same again."

But the school is also conscious that everyone has to start somewhere, so "we don't want to have so high a bar where people without a track record cannot even get on the escalator".

For those starting on research, the school looks at commitment and "a certain level of sacrifice and readiness to go through the grind". Someone who is willing to pursue a PhD, for instance, would be missing out on three or four years of getting a higher salary as a clinician.

Another factor is research that is important to the country. "We pay attention to what's happening at the country level, what the Health Ministry wants to see, what are the important trends going forward, such as an ageing population."

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Some significant research efforts from NUS Medicine

A. PROF JASON LEE

Heat resilience

Project HeatSafe was set up in 2021 to investigate the impact of rising temperatures on the health and productivity of people in South-east Asia. The combination of high heat and humidity in the region holds back the body's ability to cool down through sweat evaporation, leading to heat exhaustion and heat stroke.

Thermal physiologist Jason Lee's project demonstrated that thermal distress has detrimental impacts and consequences – affecting decision-making, productivity, fertility and pregnancy outcomes.

Anchored at the Heat Resilience & Performance Centre, the Global Heat Health Information Network South-east Asia Hub was established in January 2025 to advance partnership, collaboration and advocacy in the region to protect and prepare for the impacts of heat on human health and well-being.

PROF CHONG YAP SENG

Growing Up in Singapore Towards healthy Outcomes (Gusto)

This comprehensive longitudinal study started in 2009 by Professor Chong Yap Seng, an obstetrician and gynaecologist who is the dean of NUS Medicine, is ongoing. It aims to understand how conditions in pregnancy and early childhood influence the health of women and children.

Findings from Gusto have led to changes to policy and practice – such as the routine testing now of all pregnant women for gestational diabetes after the study discovered that half of them, especially those who were not overweight, went undiagnosed. Investigators have published 420 articles on various findings over the years since 2012.

PROF ROGER FOO

Project Reset

This project led by Professor Roger Foo aims to find the best way to prevent heart disease, which causes one in five deaths here. One in three people with underlying heart disease does not know it, and hence does not get early treatment, which could lead to better outcomes.

The project, launched in 2023, is still recruiting participants, who will have their heart, liver and metabolism assessed. Of the 10,000 people whom researchers plan to recruit, 3,000 will have follow-ups over five years to pilot new treatments, including lifestyle changes.

Project Reset is one of the initiatives that will be piloted at Health District @ Queenstown, launched in 2023, where the study team will work closely with policymakers, urban planners and community leaders to support the community's physical, social and mental well-being, and reduce environmental factors that contribute to heart disease.

PROF NICK WATTS

Sustainable medicine

The practice of healthcare leaves a huge climate footprint. NUS Medicine set up the Centre for Sustainable Medicine in 2023 aiming to accelerate the transition to net-zero emissions healthcare in Singapore and around the world.

The centre is the first-of-its-kind institution in Asia and the largest in the world. Its head, Professor Nick Watts, a medical doctor who led the UK National Health Service's response to climate change, is pioneering clinically relevant and solutions-focused research that supports high-quality and low-carbon care.

The healthcare system produces as much as 8 per cent of the world's greenhouse gas emissions – more than shipping and aviation combined.

The centre has embedded the need for sustainability in medical school and offers the first-in-the-world master's degree in sustainable medicine.

PROF DARIO CAMPANA

CAR-T cell therapy

Using a technology developed in Professor Dario Campana's laboratory under the department of paediatrics at NUS Medicine, a team comprising Dr Esther Chan, Dr Bernice Oh and Professor Allen Yeoh at the National University Health System successfully treated both children and adults suffering from T-cell acute lymphoblastic leukaemia who have exhausted all other forms of treatment.

Of the 17 patients treated between 2019 and 2023, 16 had complete remission within a month – with no cancer cells detected, even through ultra-sensitive tests. Eleven of these patients were foreigners who had sought the treatment at National University Hospital.

The first patient, who was treated when he was 10 years old, has not needed chemotherapy or a bone marrow transplant for five years.

PROF ZHANG CUILIN

Women's health

Global health research generally focuses on men and non-Asians. The Global Centre for Asian Women's Health (GloW) hopes to address knowledge and practice gaps in women's health especially among Asians, emphasising cardio-metabolic and reproductive health, ageing and longevity, cancer screening and prevention, and mental health and wellness.

GloW also aims to shift the paradigm of women's health from conventional sick care to preventive care.

In March 2025, the school and Harvard University jointly launched the NUS Medicine-Harvard T.H. Chan Women's Health Initiative to promote women's health and improve global health outcomes for Asian women.

The initiative is led by Professor Zhang Cuilin, a clinical epidemiologist who is director of GloW.

PHOTOS: NUS, A*STAR, CHONG JUN LIANG, ADOBE STOCK STRAITS TIMES GRAPHICS

Seeking ways for Singaporeans to age more healthily

Eternal youth might be a pipe dream, but having healthier bodies as one ages is a reality that the Healthy Longevity Translational Research Programme hopes to make possible for people.

Its mission is to add healthy years of life by delaying ageing, as well as having people stay free of disease for as long as possible, so they are able to lead physically adept and socially active lives.

It is an ambitious project involving about 45 NUS Yong Loo Lin School of Medicine faculty members. They are leading or participating in many associated projects that look at different aspects of ageing, with the aim of slowing its progression.

The programme, headed by Distinguished Professor Brian Kennedy, who was trained in biochemistry, mathematics and biology, was launched in 2022. Prof Kennedy said they hope to accomplish this goal "through developing biomarkers to measure ageing, testing interventions to slow ageing, and creating implementation strategies to extend healthy life expectancy in Singapore".

The programme has developed an algorithm to calculate people's biological clock, which could be different from their years of life and indicates their mortality risk. Prof Kennedy said Singaporean Chinese, in general, have a biological age that is three to four years younger than their chronological age.

But while Singaporeans today have a life expectancy of 83.5 years, they will spend an average of 10 years in relatively poor health.

Prof Kennedy said: "Ageing impacts every aspect of how you function. It's the biggest risk factor for everything that goes wrong. So if we understand that, we can understand why people are getting sick and what to do about it better."

The team pursues a two-pronged approach. One is the effect of lifestyle, which means understanding the role of exercise, mental health, sleep and nutrition in ageing. The other focuses on the small molecules that impact ageing.

Prof Kennedy said: "We test supplements and repurpose drugs that we would target for people while they're still healthy to keep them healthy, rather than waiting until they get a diagnosis of some disease (before) trying to treat them at that stage."

Keeping its population healthy and active as it matures is what will make Singapore economically strong and give its citizens the best quality of life, he added.

But while there are many products on the market that claim to keep people healthier for longer, there is also a lack of unbiased science around these products for people to know what truly is useful.

"We're trying to provide that credibility," said Prof Kennedy. Many of the supplements his team tests are commercially available. "These are not drugs that need 10 years to be developed. There are things that consumers can already purchase."

One supplement the team has studied that he is confident of pushing is alpha ketoglutarate (AKG), a compound made by the body that is involved in hundreds of different cell reactions. As people age, their levels of AKG drop.

He said AKG acts as a kind of lubricant that allows enzymes to do what they need to do at the right time. "But when the levels drop, the cell has trouble compensating for changes in its environment. We're trying to restore that, as in a way, that slows ageing and promotes health," he explained.

The team is also looking at the possibility of repurposing several drugs that have shown anti-ageing effects. Studies are still being done on these prescription-only drugs.

Prof Kennedy added that there is no one magic bullet, but many different things which, together, can slow the ageing process. "Small, sustainable changes make differences. Maybe it only gives you two to five years of extra health, but that's still a big effect."

One study involved deep phenotyping – determining and predicting the similarities and differences in how people age biologically and how the impact of the environment affects a person's health – of 400 people across ethnicities here. It measured the participants' biological age, physical function, body composition of fat, muscle and bone, and their grip strength. They were also given cognitive tests.

"We're trying to understand how Singaporeans are ageing, and what's unique in the Singapore population that may need to be addressed," Prof Kennedy said. The study has been completed and is awaiting publication.

Asians lose more bone density with age, compared with Caucasians. Prof Kennedy said that in the West, obesity and diabetes are driving age-related complications. Among Asians, the bigger issue is loss of muscle strength and frailty.

Salma Khalik

Professor Brian Kennedy heads NUS Medicine's Healthy Longevity Translational Research Programme, whose mission is to add healthy years of life by delaying ageing, and having people stay free of disease for as long as possible, so they are able to lead physically adept and socially active lives. PHOTO: NUS

Seniors exercising in Toa Payoh in February. Among the student-led community projects at the NUS Yong Loo Lin School of Medicine is Tri-Generational Homecare, or TriGen, which provides medical and psychosocial care to patients aged 65 and above with multiple chronic conditions who have been recently discharged from hospital. The assistance is transitional and most patients are eventually connected with community organisations. ST FILE PHOTO

Community projects a key part of student life at medical school

It is a purely voluntary exercise, with no marks given for participation, but almost all medical students have helped in one or more community projects during their time at the NUS Yong Loo Lin School of Medicine.

There is a long history of voluntary work among the school's students, with some projects running continuously for more than 20 years, said Associate Professor Marion Aw, vice-dean of the Office of Students.

"All student projects are self-initiated, empowering students to take ownership and leadership of their initiatives. NUS Medicine provides guidance through faculty advisers for each project and training from the Office for Students," she said.

Each year, the school provides financial and administrative support for some 20 to 30 student-led projects. Those that run for years are passed on to younger students.

Associate Professor Chen Zhi Xiong from the department of physiology, who is a faculty adviser for several student projects, said: "We strongly encourage all our students to be involved in some kind of volunteering.

"We take it very seriously, and we actually have, over the past four or five years, strengthened the framework of equipping, evaluating and also advising how some of these projects should move in terms of sustainability, in terms of creating real impact."

One of the projects he advises was started in 2014. It provides medical and psychosocial care to patients aged 65 and above with multiple chronic conditions who have been recently discharged from hospital.

Called Tri-Generational Homecare, or TriGen, to reflect three different stages in life – seniors, young adults at university (including nursing, pharmacy, dentistry and allied healthcare) and polytechnics, and students from secondary schools – it is currently led by third-year medical student Ryan Krishnan, who has been part of the project since 2021, when he was studying at a polytechnic.

TriGen is currently led by third-year medical student Ryan Krishnan, who has been part of the project since 2021, when he was studying at a polytechnic. His team recruits volunteers in August, and starts training them the following month in basic healthcare monitoring, communications skills, and how to nudge seniors to make healthy choices. PHOTO: NUS

Currently, there are some 180 students involved in the project, with 30 of them from NUS Medicine.

Mr Krishnan's team recruits volunteers in August, and starts training them the following month in basic healthcare monitoring, such as measuring blood pressure and blood glucose levels, communications skills, and how to nudge seniors to make healthy choices.

The teams have 25 seniors whom they visit once a fortnight; how long the visits continue depends on how long each senior needs them. Though the help is meant to be transitional, and most people are eventually connected with community organisations, those who need longer-term care may be passed on to the following year's team of volunteers.

Said Mr Krishnan: "When we visit them, we want to help with their continuity of care from hospital back to their homes. That's the medical thing. But the other bit is also how we can help them achieve their sort of ideal healthy life at home."

Most of the seniors under their care live alone, with many estranged from their families, or having outlived them. TriGen's vision, Mr Krishnan said, "is that every elderly person in Singapore can experience the love and care of a family, through these visits".

The student volunteers are not left to muddle along on their own. They meet and report to the patient's healthcare providers, such as doctors, nurses, dieticians and physiotherapists, and are advised on how best to continue the care.

The teams may also link seniors to community resources that can help them in the longer term, such as nearby active ageing centres, where they can mingle with others living in the same neighbourhood and take part in stimulating activities.

Said Mr Krishnan: "It's not just what happens when we are there for an hour or so each time. It's also what happens when we are not there. What we really try to do is to change the health behaviour to have lasting impact for when we are not actually at the senior's home."

Mr Krishnan, who has been with the project for five years, said he had joined with the intention of making life better for someone else. Over time, he realised that he himself has gained a lot from it.

He said: "You gain lessons, and you get wisdom from the seniors. As a medical student, something we learn a lot about is the physical medical care of people. Something that I really learnt from these visits is the social aspect.

"My patients are people, not just conditions. They are humans with emotions, and there are a lot of other things that may be a bigger priority for them than their health. Addressing those priorities may actually improve their health."

Salma Khalik

NUS team taps digital medicine to make treatments more precise

Drugs not only work differently on different people, but they could also have different effects on the same person at different times of their lives.

Professor Dean Ho heads biomedical engineering at the National University of Singapore and is director of the Institute for Digital Medicine at the Yong Loo Lin School of Medicine. He and his team are developing ways to take the guesswork out of medication, and to optimise drug doses and combinations for each person.

For instance, said Prof Ho, it is common for doctors to give cancer patients a two-drug combination as the standard dose. Though adequate, the treatment would be even more effective if there was a way to "modulate the dose a little bit to study the interplay of the two within the patient".

In a clinical trial that he is conducting on his algorithm, called Optim.AI, a small piece of a tumour is used to find the best dose for a particular patient. It is tested against up to a dozen drugs, providing about 900 different combinations to find which works best.

His team then recommends the dose to the doctor, who will decide what to give the patient.

Sometimes, the optimum dose for a patient might be lower than the standard dose, and it could change as treatment progresses. In Singapore, a lower dose could result in significant savings for the patient, who also benefits from the lower toxicity.

Prof Ho, who moved to Singapore from the United States in 2018, is known for his work in the use of artificial intelligence in precision and personalised medicine, among other things. In 2023, he was invited by the US Food and Drug Administration to speak on defining and optimising drug dosages using AI.

His work at NUS and the University of California, Los Angeles, where he started on it, has led to a spin-off company called KYAN Technologies.

In March 2025, KYAN and Mayo Clinic Laboratories (MCL), a subsidiary of Mayo Clinic and a global leader in diagnostics, especially those related to cancers, formed a collaboration to test Optim.AI.

MCL's president and chief executive, Dr William Morice, said: "This collaboration with KYAN Technologies provides another avenue for physicians to have access to the most robust and reliable diagnostic options available, empowering them to make informed decisions for better health outcomes and deliver customised treatment plans for their patients."

Professor Dean Ho and his National University of Singapore team are developing ways to take the guesswork out of medication, and to optimise drug doses and combinations for each individual. PHOTO: NUS

Digital medicine is important not only for cancer.

Said Prof Ho: "Digital medicine is our ability to leverage tools that we have, whether it's through wearables or through making better sense of our biomarkers and how they change over time, so we are able to better manage care, to better dose medicines, exercise, and even train our brains."

He is a strong proponent of wearable technology, which tracks people's exercise, sleep, stress levels and other patterns. He said people are more likely to make changes if they are aware of what is happening in their own bodies.

His trials have also included cognitive training carried out on about 300 to 400 people: "We developed this multitasking game, and we've helped healthy people sharpen their brain performance even more."

Another area Prof Ho plans to pursue is diabetes prevention, to give people tools "to pre-emptively and behaviourally change, to strengthen insulin sensitivity, not lose it over time".

The American is an ardent supporter of Singapore, and he said he is never leaving because "if you want to move your treatments from bench to bedside, from idea to implementation, Singapore is the place to be in".

"It's not the technology alone. You need leadership at a university that really supports what you do. You need accessible stakeholders, policymakers, regulators, reimbursement people, implementation scientists. Singapore, in my opinion, is the only place in the world where you can have that access at a timescale that lets you help people quickly and safely."

Salma Khalik