SPECIAL EDITION

NCIS CELEBRATES A DECADE OF EXCELLENCE IN CANCER CARE

2008 – 2018

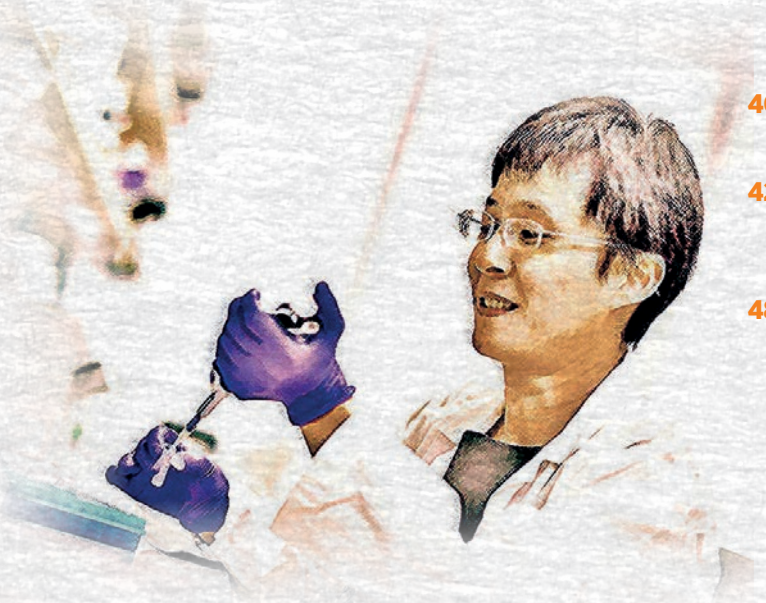
10

Every Person Matters

National University Cancer Institute, Singapore
A member of the NUHS

NCIS 10 Excellence in Cancer Care
Our Commitment for Life

Contents



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NCIS 10 Excellence in Cancer Care Our Commitment for Life

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A DECADE OF CANCER CARE EXCELLENCE

2008

2008
Following the Ministry of Health's announcement, TCI was renamed the National University Cancer Institute, Singapore (NCIS), playing a key role as a national specialist centre for cancer.

1988: Establishment of the Oncology Centre

2007
TCI's research team conducted a successful "First-in-Human" Phase I Clinical Trial for an experimental drug for advanced stage cancers.

2005
TCI & NUH performed Asia's first bone marrow and kidney transplant.

1988
The Oncology Centre, Singapore's first ambulatory care facility for cancer patients, was set up at the National University Hospital's (NUH) dentistry wing.

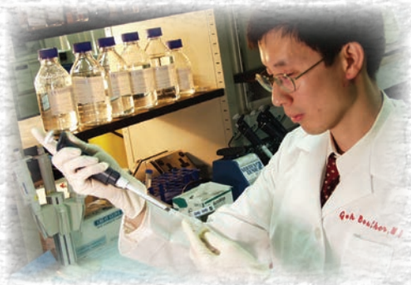
2000
The Oncology Centre was renamed The Cancer Institute (TCI).

1999
The Radiation Therapy Centre (RTC) officially opened at NUH.

1999: Official opening of The Radiation Therapy Centre

1988

2011: Adjunct Prof Goh Boon Cher, lead Investigator for the SB939 cancer drug



2011
The first outpatient autologous stem cell transplant was performed at NCIS.

NCIS and the Cancer Science Institute of Singapore (CSI) partnered local biotechnology firm S*BIO to further develop Singapore's first cancer drug SB939.

2009
NCIS formalised a 15-year contract with Tan Tock Seng Hospital's Radiation Therapy Centre.

2010
NCIS was officially launched by then Senior Minister Goh Chok Tong and Minister for Health Khaw Boon Wan.

Expansion of the NCIS Cancer Centre and private ward facilities.

NCIS formalised the Haematology-Oncology Research Group (HORG) as part of the Cancer Therapeutics Research Group (CTRG).

NCIS' RTC adopted the 3D High-Dose-Rate (HDR) Brachytherapy, a first in Southeast Asia.

2010: The official opening of NCIS was officiated by then Senior Minister Goh Chok Tong

2012
NCIS' Stem Cell Transplant Programme was the first in Asia to receive international FACT Accreditation (a gold standard for medical institutions offering stem cell transplant).

NCIS and Fudan University Shanghai Cancer Centre signed a Memorandum of Understanding (MoU) to promote joint research and development activities.

2013
NCIS signed a MoU with Jurong Health Services (JurongHealth), forming the Western Cancer Action Network (WCAN) to develop a cancer care plan for people living in western Singapore.

2012: NCIS and Fudan University Shanghai Cancer Centre signed a MoU to promote joint research and development

NCIS together with the National University of Singapore's (NUS) Yong Loo Lin School of Medicine received $25 million from the Yong Loo Lin Trust to develop new models of cancer care through research and education.

NCIS' RTC was the first in Southeast Asia to offer Accelerated Partial Breast Irradiation, providing positive outcomes and high local control rates in selected early-stage breast cancer patients.

2014: NCIS signed a 10-year agreement with JurongHealth to provide cancer services at NTFGH

NCIS signed a 10-year agreement with JurongHealth to provide haematology and oncology services at the future Ng Teng Fong General Hospital.

2014
NCIS' new premises for outpatient services on Levels 8-10 of the new NUH Medical Centre officially opened.

The first NCIS Annual Research Meeting (NCAM) was launched to allow clinicians, investigators and researchers to present and discuss the latest discoveries in cancer science.

2015
NCIS piloted cancer treatment at home with the Bortezomib@Home programme.

NCIS commenced outpatient consultations and inpatient care for breast, colorectal and lung cancer patients at NTFGH.

2015: Pilot of the Bortezomib@Home programme that delivers cancer treatment to patients in the comfort of their homes

2018

2017: Launch of the "NCIS on the GO" mobile service

2018
NCIS celebrated its 10th anniversary on 23 January, marking a decade of excellence in, and our enduring commitment to cancer care.

2017
The "NCIS on the GO" mobile service was launched, bringing simple clinical procedures and chemotherapy treatment to community locations and homes.

Blood-drawing services at 10 selected polyclinics were rolled out in collaboration with the National Healthcare Group (NHG) Diagnostics.

2016
A new cancer treatment harnessing the body's Natural Killer (NK) cells was tested at NCIS – a world first. The treatment demonstrated great promise in treating women suffering from aggressive breast cancer.

2012: NCIS' Stem Cell Transplant Programme was the first in Asia to receive FACT Accreditation

Director's Note

WHAT IS OUR DNA?

The National University Cancer Institute, Singapore (NCIS) has evolved over the years. Now in our 10th year, we are a full-fledged, comprehensive cancer centre, as well as the only one-stop cancer centre in Singapore to treat both adult and paediatric cancers under one roof. Today, NCIS represents something of meaningful significance to our staff, our patients and the community we serve.

We are always striving to improve cancer outcomes, through a strong focus on screening and prevention to reduce cancer incidence and increase cure rate, as well as by continuing to expand treatment resources for cancers through clinical trials. Our patients have access to the newest treatments from these trials, even as we push the boundaries of cancer therapeutics by testing new combinations.

Innovation, therefore, is at our core. Besides innovating in clinical trials and research, we also develop innovative models of care that benefit our patients and the healthcare system. We are the first to perform outpatient stem cell transplants and also the first to deliver home-based cancer therapy.

These initiatives reduce healthcare cost and optimise healthcare resource utility. Our philosophy of pushing treatment from inpatient to outpatient and from outpatient to the home or community is at the heart of our design for a decentralised cancer network – one that utilises all the assets within the National University Health System (NUHS) cluster.

To ensure we can build a centre of excellence that can deliver patient-centric treatments, we have established tumour groups that are multidisciplinary in nature and academically robust. Their task is to deliver end-to-end care to their patients and achieve outcomes comparable with the best in the region and the world.

We believe in a holistic approach to treating our patients, which explains our strong focus on the psychosocial aspects of the cancer treatment journey. We have established a psychosocial oncology programme and a health resource centre to cater to these needs. We also have support groups for patients with different cancers, and are developing a mobile application that can be customised by patients, based on their diagnosis and treatment plan. The application will help integrate clinical care with patient education and support, and also allow caregivers to be linked to the patient's progress.

Through these efforts, we hope to empower patients and caregivers, as we believe that we are our patients' partners in their cancer journey, and we are working together for a common cause. Last but not least, at NCIS, we believe every member of our team is critical – we value everyone's contributions and we need Team NCIS to shine.

Professor Chng Wee Joo
Director
National University Cancer Institute, Singapore (NCIS)

NCIS TURNS 10!

This year marks a special year for the National University Cancer Institute, Singapore (NCIS) as it celebrates its 10th anniversary!

As a tribute to this auspicious milestone, this special edition of *SPARK* highlights our past, present and future. The section on Pioneers of NCIS takes us back to when it all started and showcases the great efforts of our leaders who laid the foundation when NCIS was formally designated as a national specialist centre for cancer in Singapore in 2008. We then see the growth and successes of NCIS through the years in the Department & Tumour Group Milestones section.

I would like to thank the various Departments within NCIS - Surgical Oncology, Haematology-Oncology, Radiation Oncology, Paediatric Haematology-Oncology, Oncology Nursing, Oncology Pharmacy, our 10 tumour groups and our research partner, the Cancer Science Institute of Singapore at NUS, for their contributions in this issue and sharing with us their history, achievements and forecast as we strive to fulfil our mission of "Conquering Cancer: Excellence in Cancer Care – Our Commitment for Life." Also, a big thank you to our NCIS corporate communications team for your tireless efforts in the past year in producing this special edition of *SPARK*.

As the landscape for cancer care becomes more complex and expensive, it is exciting to see innovative strategies and efforts within NCIS and its various partners in continuing to provide good quality and cost effective cancer care (see sections on Moving Forward). We also hear from our cancer survivors and patients who have benefitted from the generosities of our philanthropists via the Cancer Fund (see sections - 10 Years On and A Gift of Life).

It has been, and will be, a busy and exciting year for all of us, including our community and institutional partners and most importantly, our patients. So do check out *www.ncis.com.sg* for information on our year-long events and activities, including our NCIS charity gala dinner in November 2018. Last but not least, Happy 10th Birthday, NCIS!

With best wishes

Chee Cheng Ean

Dr Chee Cheng Ean
Consultant, Chief Medical Editor
National University Cancer Institute, Singapore (NCIS)

Our pioneers

OUR TRAILBLAZERS AND TORCHBEARERS

What began as a spark of an idea ignited by the passion of doctors has become today's NCIS, a leading light in cancer care. Much credit goes to NCIS' pioneers; from day one, they have fuelled the NCIS mission with their drive and dedication. Here are 10 who have pushed the boundaries of patient care and clinical science. By Low Jat Leng

THE MAN WHO started it all was NCIS' founding director, **PROFESSOR JOHN EU-LI WONG**. A medical oncologist-haematologist, he graduated from NUS and completed his residency and fellowship at the New York Hospital-Cornell Medical Center and Memorial Sloan-Kettering Cancer Center in the United States. While in the US, he noted that genetic factors affected how patients responded to cancer treatments. Over the course of a distinguished career, he made it his mission to develop treatments for cancers that afflict mainly Asians. In 1997, he co-founded the Cancer Therapeutics Research Group, a consortium of academic researchers from around Asia Pacific, which carries out clinical trials for cancers common in this part of the world. In 2000, he helped set up The Cancer Institute (TCI) under the National Healthcare Group and served as its director.

He also played a key role in bringing NUH and the NUS schools of medicine, dentistry and public health into the fold of the National University Health System (NUHS) in 2008. This has enabled the integration of clinical care, research and education in Singapore, paving the way for medical innovations that will provide solutions to the country's health issues. With the formation of NUHS, TCI became NCIS. In 2013, Prof Wong oversaw the opening of NCIS' Yong Siew Yoon Wing, which would develop new models of cancer care through research and education. He also helped establish the Western Cancer Action Network with NCIS' medical oncologists based at the Ng Teng Fong General Hospital. He says, "I am proud that every Singaporean and resident of Singapore, regardless of socio-economic status, can obtain world-class treatment at NCIS. I am equally proud of the quality of staff that we have in every discipline of cancer care." Prof Wong is now NUHS' chief executive.

THE SECOND PERSON to join NCIS was **PROFESSOR ADRIAN LEONG**, a colorectal surgeon who was then NCIS' deputy director and head of Surgical Oncology. His interest is in colorectal cancer treatment. Under his watch, NCIS' organisation, strategy and operations took shape. In particular, he was in charge of developing the NCIS facility in the Medical Centre. He says, "Once upon a time, NCIS was just a meeting room of a few people discussing what NCIS could be. The challenge was in taking what was essentially a concept and making it a reality. It is great knowing that all the efforts have resulted in something thriving." Prof Leong is currently the director of his own firm, AFL Consulting, as well as adjunct professor of surgery at the NUS Yong Loo Lin School of Medicine.

INITIALLY TRAINED AT NUS, **ASSISTANT PROFESSOR LIU TE CHIH** obtained specialist qualifications in internal medicine and haematology from the Royal Colleges of Medicine and Pathologists in the United Kingdom. Appointed head of Clinical Haematology at NUH in 2001, he advocated for haematology trainees to receive rigorous training in both clinical and laboratory disciplines. He was also instrumental in introducing flow cytometry as an investigative tool for haematologic diseases. NCIS, as an early adopter, has become the leading authority on flow cytometry in the region. Assistant Prof Liu is now senior consultant haematologist at the Department of Haematology-Oncology, NCIS. "The best part of my NCIS experience is that everyone here works together as a team. We feel like family rather than colleagues," he says. "It's a great working environment where everyone helps out and nobody grumbles about doing that extra bit of work."

IN THE 1980S, cancer incidence was on the rise while cancer care in Singapore was relatively underdeveloped despite great potential for specialised fields of clinical oncology. **DR LEE KHAI MUN** saw where he could make a difference – radiation oncology. He joined NUH as senior consultant in 2003 and was appointed head of Radiation Oncology for The Cancer Institute at Tan Tock Seng Hospital (2005) and at The Cancer Institute at NUH (2007). In 2010, he was appointed associate director (clinical) at NCIS. At NCIS and its related hospitals, he introduced various advanced radiation therapies, such as intensity modulated radiation therapy, image-guided radiation therapy and 3D high-dose-rate brachytherapy, thus making a wider range of treatments and quality care accessible to patients. And this, Dr Lee says, is his main contribution to NCIS.

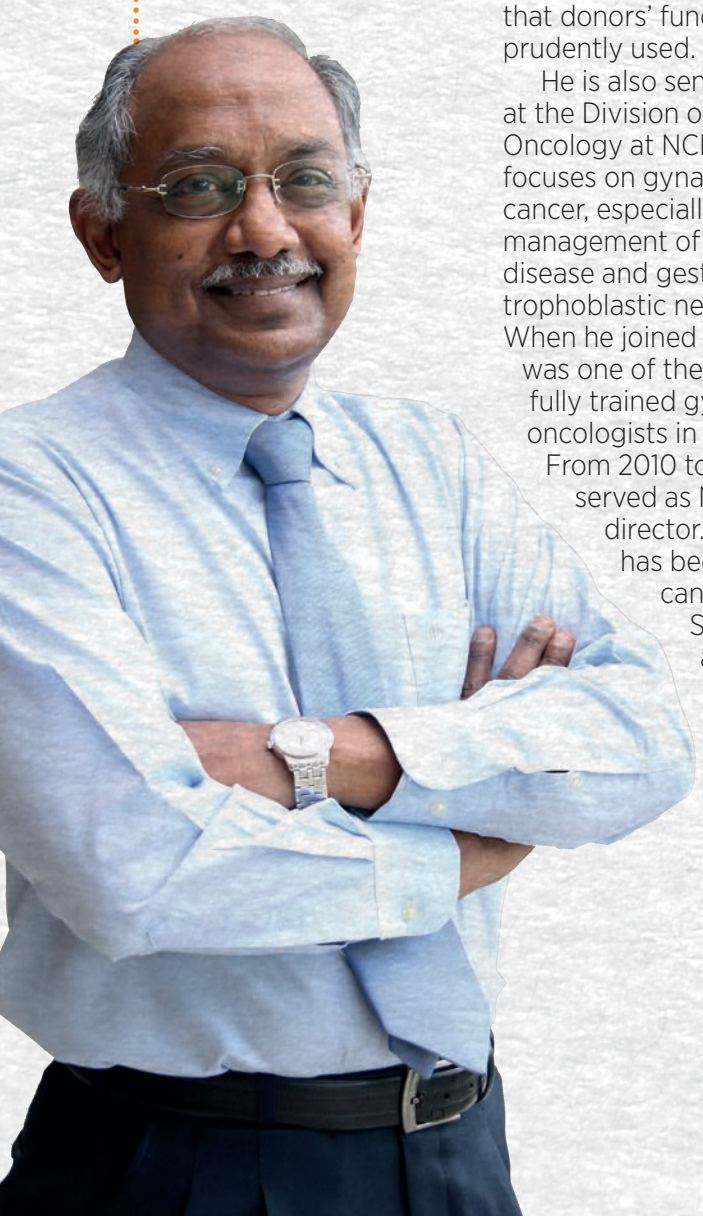
AS A COMPREHENSIVE cancer centre, NCIS treats and cares for patients of all ages. **ASSOCIATE PROFESSOR QUAH THUAN CHONG** headed the Division of Paediatric Haematology and Oncology from 1982 until recently. He received his medical training at the then University of Singapore and specialist paediatric training at NUS. He trained under Professor Wong Hock Boon, and in Australia and Jerusalem under Professor Shimon Slavin.

In 1984, he performed the first bone marrow transplant in Singapore under Professor Slavin's guidance. A/Prof Quah also introduced the first homegrown protocol for acute lymphoblastic leukaemia (ALL) known as the NUH I/II protocol. NCIS was the first to use high-dose methotrexate instead of cranial radiation in ALL. "We are blessed to have wonderful colleagues who share their expertise and experience," he says. "We manage patients across all age groups, so when we see children with cancers that are more commonly seen in adults, we can always seek advice from our colleagues with adult patients."

"WE ARE BLESSED TO HAVE WONDERFUL COLLEAGUES WHO SHARE THEIR EXPERTISE AND EXPERIENCE."

Our pioneers

"NCIS HAS BECOME A PREMIER CANCER INSTITUTE IN SINGAPORE. IT IS GREAT TO BE RECOGNISED AS ONE OF ITS PIONEERS."



FINANCIAL PRESSURES CAN often put cancer patients in a vulnerable position. To ensure that no one got left behind because of financial constraints was **ASSOCIATE PROFESSOR ILANCHERAN ARUNACHALAM**, who was chairman of NCIS' Cancer Endowment Fund from 2008 to 2018. Every year, the fund supports more than 100 patients in need, so that they can undergo treatment with peace of mind. At the same time, A/Prof Ilancheran, as the fund's custodian, ensured that donors' funds were prudently used.

He is also senior consultant at the Division of Gynaecologic Oncology at NCIS. His practice focuses on gynaecological cancer, especially the surgical management of advanced disease and gestational trophoblastic neoplasms. When he joined NCIS, he was one of the only two fully trained gynaecologic oncologists in Singapore. From 2010 to 2016, he served as NCIS' deputy director. He says, "NCIS has become a premier cancer institute in Singapore with an excellent reputation. It is great to be recognised as one of its pioneers."

MORE THAN 40 years on, **DR EMILY ANG** is as passionate about caring for patients as on her first day as a nurse at age 16. She started out in critical care, before moving on to specialise in oncology nursing. As NCIS' Head of Oncology Nursing from 2008 to 2015, Dr Ang nurtured a team of nurses and led the restructuring of the oncology wards. She also developed the oncology nursing service at the Tan Tock Seng Hospital and Ng Teng Fong General Hospital. She started distress counselling for patients and initiated end-of-life training for nurses. She was also involved in developing the Psychosocial Oncology Programme, which gives patients and their caregivers all-round support.

Among her many awards are the President's Award for Nurses in 2002 and the World Health Organisation Fellowship for Oncology Nursing in 1983. "Throughout my journey, I have built relationships with patients that go beyond work. Even now, my former patients come visit me at NUS where I currently teach," she says. Dr Ang is now head of the Alice Lee Centre for Nursing Studies at the NUS Yong Loo Lin School of Medicine.

FOR ZARINAH HAIROM, being a nurse means having the chance to help people. In 1996, she was assigned to the NUH Outpatient Oncology Unit after stints in oncology, cardiology, endocrinology and surgery. Zarinah (pictured below, in blue) remembers the early years of NCIS when nurses were few; those were busy days and nights when they cared for both adult and paediatric patients while finding time to fulfil other duties.

One of her most memorable projects was collaborating with physicians, pharmacists and IT personnel in 2010 to build the electronic Chemotherapy & Immunotherapy Medication Record (CIMR), which has led to safer and more efficient chemotherapy administration. Zarinah received the MOH Merit Award for Nurses in 2004 and the National Day Efficiency Medal in 2007. She is now assistant director of Nursing, NCIS Outpatient, Ambulatory Services Nursing Quality and VVIP Services.

"I AM PROUD TO BE A PART OF THE NCIS FAMILY. NCIS IS STILL THE BEST IN THE REGION, AND ITS NURSES ARE AMONG THE BEST."

WAITING TIME IS an important yardstick of service quality at any hospital. And the man who has made waiting at NUH Pharmacy a breeze is **WU TUCK SENG**. In 2014, he implemented the outpatient pharmacy automation system (OPAS). The system uses technology and robotics to automate prescription filling, improve drug-picking accuracy and patient safety, and cut waiting time significantly. Referring to pharmacy as his "calling", Mr Wu was head of the NUH Cancer Centre Pharmacy in 1996 before taking over as head of NUH Pharmacy in 2001. In 2009, he was instrumental in implementing the inpatient electronic closed-loop medication management system – a first in Asia Pacific – which has greatly enhanced patient safety by revolutionising how drugs are ordered and administered electronically. He also leads the pharmacy in ensuring that cytotoxic drugs are appropriately and safely prepared. He passes on his knowledge to pharmacists and pharmacy technicians, and promotes medication safety through work standardisation via industry standard operating procedures. As a pioneer of NCIS, he is glad to have helped lay a solid foundation to enable those who come after to provide even better care for NCIS patients.

A KEY FOCUS of NCIS is translating research discoveries from the laboratory into better treatments. **ADJUNCT PROFESSOR GOH BOON CHER,** one of the centre's most accomplished clinician scientists, has helped put NCIS on the global drug development and cancer clinical pharmacology map. After his advanced medical oncology training at NUS in 1995, he completed a National Medical Research Council Fellowship in clinical pharmacology and experimental therapeutics at the University of Chicago in 1997. He then joined the clinical trials team at NCIS to develop Phase I and II clinical trials in haematology oncology. Under his research directorship, NCIS has led the identification of differences in cancer-drug pharmacology between East Asians and Caucasians, and in developing cancer drugs for Asians. His work has contributed to pharmaceutical research being based in Singapore. Adjunct Prof Goh received the Senior Clinician Scientist Award at the National Medical Research Council (NMRC) in 2010 for his excellence in translational and clinical research. Through the years, he has also nurtured and mentored clinical scientists at NCIS. Adjunct Prof Goh is now deputy director for Research at NCIS.

Department milestones

HAEMATOLOGY-ONCOLOGY

1983
• Performed first-in-Singapore stem cell transplant.

1988
• First allogenic stem cell transplant carried out.

1997
• Formation of the Cancer Therapeutics Research Group (CTRG) to carry out early phase studies on cancer drugs.

2004
• Performed Asia's first dual NM stem cell and related kidney transplant.

2005
• The first first-in-human clinical trial began.

2006
• Performed first unrelated stem cell transplant with donor from the Bone Marrow Donation Programme.

2007
• Performed first single unit umbilical cord blood transplant in March, followed by first double unit umbilical cord blood transplant in August.

2008
• Carried out first unrelated stem cell transplant with donor from the National Marrow Donor Programme.

2010
• Formation of the Haematology-Oncology Research Group (HORG) to carry out translational research in cancer therapeutics.

The Department of Haematology-Oncology (2017)

• NCIS was awarded its first Centre Grant.

2011
• Performed first outpatient autologous stem cell transplant.

• Conducted first adult haplo-identical stem cell transplant.

2014
• The Developmental Therapeutics Unit (DTU) was formed, comprising a multidisciplinary team of clinicians, nurses, allied health professionals and scientists, who work together to ensure the highest standards of safety in conducting early phase trials.

2016
• The Palliative Medicine Research and Training Fund was set up under the National University of Singapore (NUS) Yong Loo Lin School of Medicine.

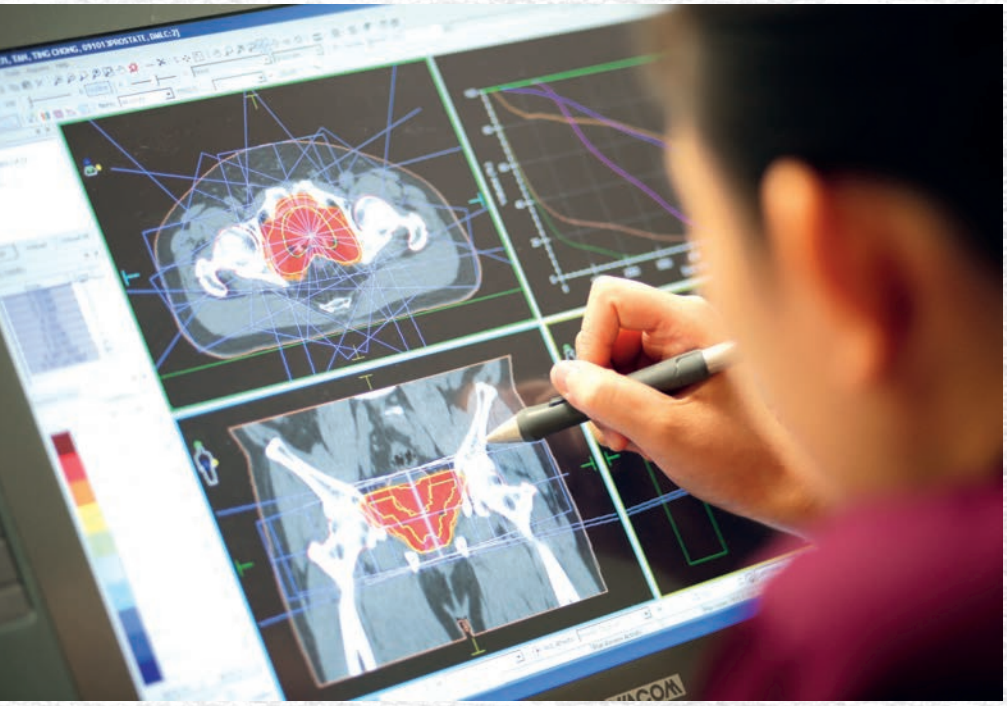
• The Division of Palliative Care was set up.

2017
• Launched home and community chemotherapy treatments.

• Conducted the first NCIS-AbbVie Haematology Preceptorship to train junior doctors in haematology.

2018
• Piloted telemedicine clinic offering tele- and video consultation.

RADIATION ONCOLOGY



2002
• First patient to be treated using Total Body Irradiation (TBI), a specialised radiation therapy often used in conjunction with high-dose chemotherapy to treat leukaemias or other forms of blood cancers.

2005
• Introduction of Intensity Modulated Radiation Therapy (IMRT) routinely used to treat nasopharyngeal cancers and other complex tumours, resulting in improved accuracy and lower toxicity for our patients.

2007
• NUH offers multicatheter Accelerated Partial Breast Irradiation (APBI), which enables breast cancer patients to undergo radiation therapy over a shorter duration, with reduced side effects.

2009
• Introduction of Image-Guided Radiation Therapy (IGRT), an important quality assurance tool that checks the accuracy of treatment with cone beam CT images.

2011
• First patient treated with Stereotactic Ablative Body Radiation (SABR), a technique capable of delivering one to five high precision radiation treatments to a small target at high doses, which can increase tumour control rates with fewer side effects than conventional radiation therapy.

• Introduction of First Volumetric Modulated Arc Therapy (VMAT), used mainly for tumours in the rectum, prostate, oesophagus and brain, where a single radiation beam moves around the patient in an uninterrupted complete or partial arc, significantly reducing beam-on time.

2015
• Conducted first regional IMRT/IGRT teaching course. A total of 28 delegates were trained to improve their use of IMRT/IGRT in their respective countries.

Attendees at the first regional IMRT/IGRT teaching course

Department milestones

ONCOLOGY NURSING

Dr Emily Ang (seated, centre), former Deputy Director of Oncology Nursing, with nurse clinicians

2000
• The Division of Oncology Nursing was formed.

2002
• Formation of the Haematopoietic Progenitor Cell Transplant (HPCT) nursing team.

2003
• Launch of the Majlis Ugama Islam Singapura Cancer Awareness (MUIS CA) Project to boost cancer screening among the Malay community through educational intervention.

2006
• Establishment of oncology Ward 8A at NUH Kent Ridge Wing.

• NCIS welcomed its first advanced practice nurse (APN) in Haematology-Oncology.

2008
• Oncology Nursing sees its first PhD nurse.

2009
• The first batch of six nurses graduated from the in-house American Nurses Credentialing Centre (ANCC) accredited oncology nursing course.

2010
• Launch of first evidence-based clinical fellowship programme to enhance the training and education of our nurses.

• Expansion of Ward 8A by eight more beds.

2013
• Expansion of Ward 56 at the NUH Main Building from 20 to 44 beds.

• Launched the End-of-Life Nursing Education Consortium (ELNEC) Training Programme to train nurses in the area of palliative care.

2014
• Set up of oncology Ward 8C at NUH Kent Ridge Wing.

• The first APN-led Ultrasound Peripherally Inserted Central Venous Catheter service was introduced in NCIS.

• Birth of the NCIS home care team to help transit cancer patients' care from hospital to home or community.

2016
• Launch of the APN-led Urgent Care Cancer Clinic.

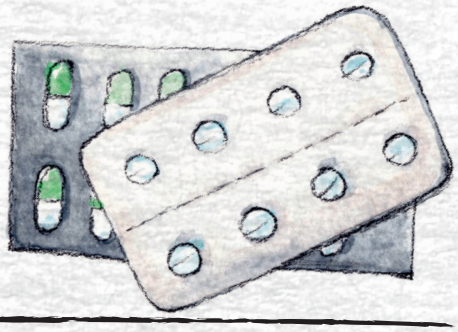
2017
• Launch of apheresis nursing services at NCIS, providing stem-cell harvesting as well as other cell collection and exchange procedures for blood cancer patients.

• Birth of the palliative care nursing team.

2018
• NCIS opens the Acute Care Cancer Unit, a walk-in clinic for cancer patients presenting non-emergency symptoms related to disease or treatment.

The Division of Oncology Nursing in 2016 (not in picture: Dr Ang Neo Kim Emily, Sister Joanna Mah Kong Yeng, Sister Kok Yin Lai Amanda, Sister Haryani Binte Mustadi, Sister Chua Chue Teng and Sister Bao Dan)

ONCOLOGY PHARMACY



2008

• Formalised Aseptic Dispensing and Safe Handling of Chemotherapy Training Programme to provide structured training to staff at NCIS, local private and restructured hospitals in chemotherapy drug compounding.

2010

• Set up of Haematology/Oncology Pharmacy & Therapeutics Subcommittee, which supports the NUH Pharmacy & Therapeutics Committee. It reviews new drugs to be included into NUH formulary and provides oversight in the appropriate use of anti-cancer drugs in NCIS.

2013

• Relocation and expansion of Oncology Pharmacy, with the new facility tripled in size, and the team doubled in strength.

• Formation of Oncology Pharmacy Medication Safety Subcommittee to improve patient safety.

2015

• Implementation of Phase One Cytotoxic Immunosuppressive Medication Record (CIMR) System to improve medication safety by removing handwritten chemotherapy orders and incorporating system checks on calculations of drug doses and patients' parameters.

2016

• Implementation of Phase Two CIMR, which further improved medication safety in chemotherapy drug processing and work efficiency.

Tumour group milestones

BLOOD CANCERS

TRANSFORMING INTO A COMPREHENSIVE CANCER CENTRE

When the NUH Oncology Centre commenced operations in 1988, cancer treatment was delivered by the different departments across a spectrum of disciplines. As cancer care became increasingly more complex, NCIS was established as the second national specialist centre for cancer in Singapore, and the focus of care shifted towards a more holistic approach. This transformed NCIS into a one-stop comprehensive cancer centre.

As NCIS grew, the Multidisciplinary Tumour Groups were formed to tackle the various cancers holistically. These tumour groups meet weekly, bringing together the expertise of multiple clinical departments, facilitating robust discussions on complex tumour cases, and allowing for more efficient treatment processes.

2007
• Started offering treatment to young patients with acute lymphoblastic leukaemia in outpatient setting, thus minimising costs and hospital-acquired infections.

2012
• Appointed the regional testing centre for major multiple myeloma drug trial.

• First centre in Asia to receive international FACT accreditation for its Stem Cell Transplant Programme.

• Started offering treatment to acute promyelocytic leukaemia patients in outpatient setting.

2015
• Launched home-based treatment for multiple myeloma patients.

2016
• Conducted first-in-human combination oral therapy clinical trial for the treatment of acute myeloid leukaemia, aimed at improving treatment efficacy and reducing toxicity.

• Started offering treatment to lymphoma patients in outpatient setting, resulting in cost- and bed-savings.

2017
• Performed the first selective T-cell depleted haploidentical stem cell transplant in adults.

BREAST CANCER

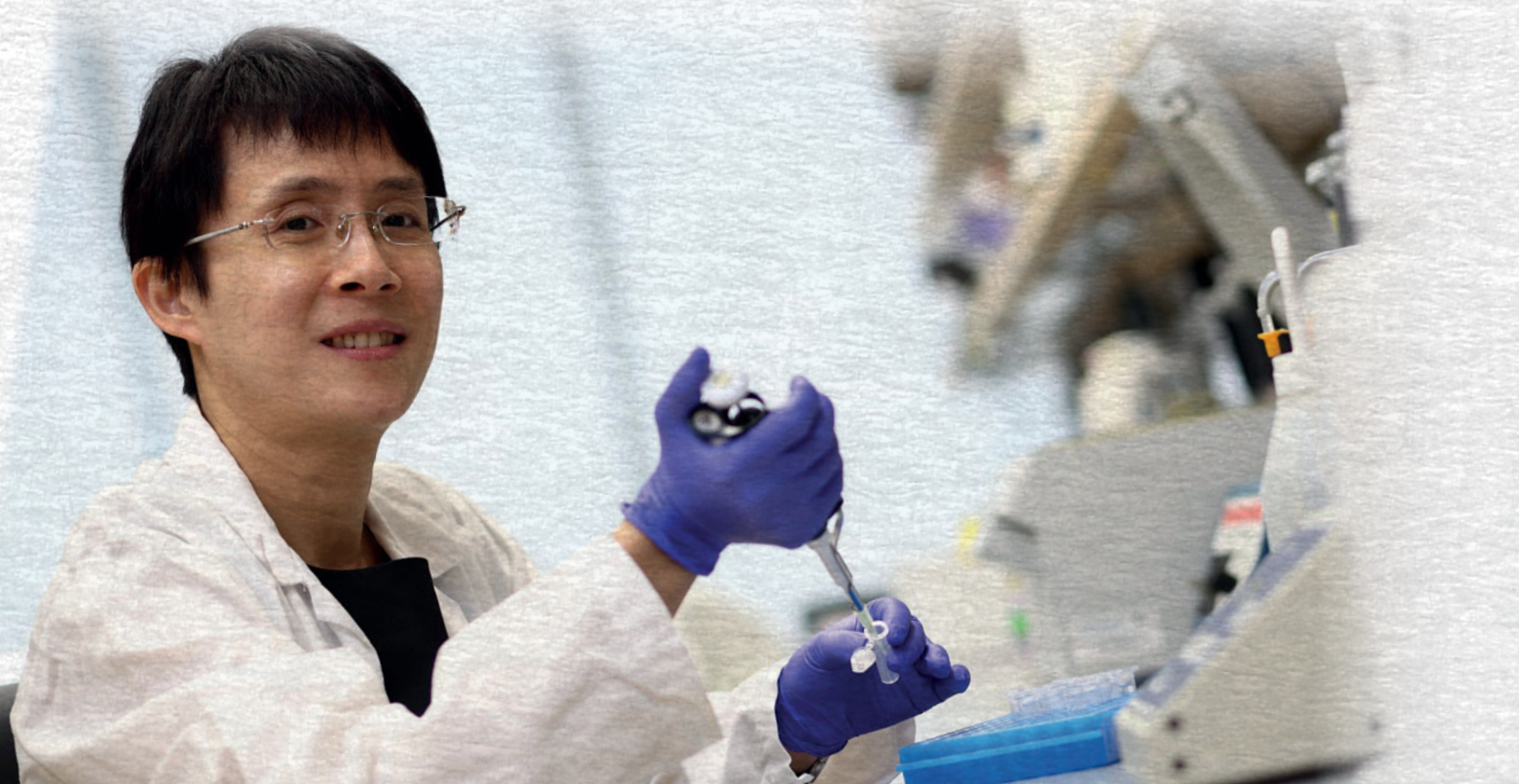
2010
• Local study led by Dr Lee Soo Chin found that taking the drug Sunitinib before chemotherapy shrinks tumours more.

2015
• NCIS chaired the nationwide Breast Cancer Awareness Month through a series of public education events and activities in collaboration with the Breast Cancer Foundation, Singapore Cancer Society and the National Cancer Centre, Singapore.

2016
• Oncologists at NCIS and NUS Yong Loo Lin School of Medicine discovered two novel drug combinations – typically used to treat conditions like ovarian cancer and a rare type of lymphoma – that could potentially treat triple-negative breast cancer.

2017
• A breast cancer and exercise study revealed that regular exercise leads to higher survival rates in breast cancer patients.

2018
• NCIS partners with primary doctors and polyclinics to launch follow-up cancer care for breast and colorectal cancer patients. Eligible patients can now have their cancer follow-ups done with their primary doctor.



Tumour group milestones

COLORECTAL CANCER

2009
• No scar, Single-Incision Lap Colorectal Surgery (SILACS) offered to patients.

2013
• NCIS conducted a major study on colorectal cancer screening, which showed that seven out of 10 Singaporeans were not up to date with colorectal screening.

2014
• NCIS worked with corporates and schools to raise awareness of colorectal cancer.

2016
• A study by NCIS identified an old cancer drug that can inhibit growth of colorectal cancer cells.

2017
• NCIS colorectal team was awarded more than $2 million in grant money from the National Medical Research Council to study the impact of colorectal cancer on patients, as well as the barriers to screening amongst family members of colorectal cancer patients.

2018
• NCIS partners primary doctors and polyclinics to launch follow-up cancer care for breast and colorectal cancer patients. Eligible patients can now have their cancer follow-ups done with their primary doctor.

GYNAECOLOGIC CANCERS

2007

• Establishment of the Division of Gynaecologic Oncology, which serves as a one-stop multidisciplinary centre for the management, prevention and holistic care of women with gynaecologic cancers.

2014

• First in Singapore to implement an evidence-based workflow for the HPV Primary Screening Programme, and to offer the HPV Primary Screening as an alternative to cytology screening.

2017

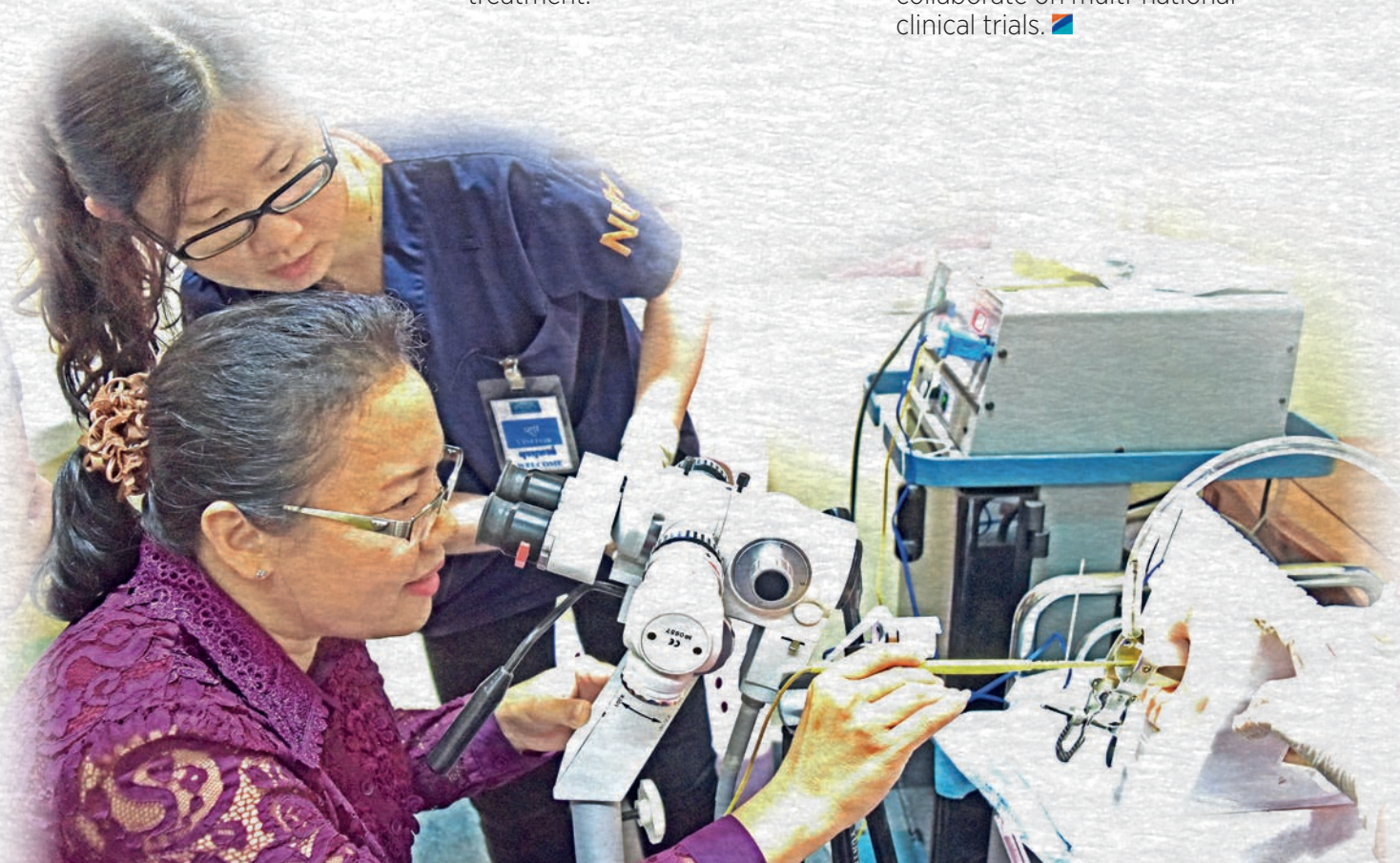
• Hysterectomy for endometrial cancer offered as a day procedure, allowing patients to be discharged on the same day after surgery.

The Gynaecologic Cancer Group Singapore

.

• First in region to offer outpatient-based interstitial and intracavitary image-guided brachytherapy, which has enabled patients to undergo more advanced treatment with lower toxicity, something not achievable with conventional treatment.

• The Gynaecologic Cancer Group Singapore (GCGS) was officially registered as a society set up for the study and advancement of gynaecological cancer care in Singapore and the region. This allows NCIS to leverage GCGS as a platform to collaborate on multi-national clinical trials.



Tumour group milestones

HEAD & NECK CANCERS

2015

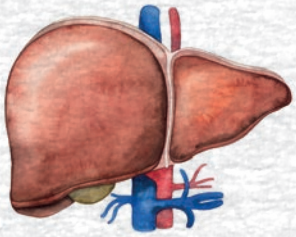
• First clinical trial in Singapore conducted using Natural Killer (NK) cells in treating refractory head & neck cancer.

2016

• Clinicians at NCIS/NUH used narrow band imaging to identify possible oncological changes in the nasopharynx, as well as evaluate the utility of raman spectroscopy and its role in detecting early nasopharyngeal cancer.

• NCIS won two Oral Presentation awards at the 9th International Conference on Head and Neck Cancer held in Seattle, USA. In addition, Dr Lim Chwee Ming (pictured right) clinched the Best Prevention & Early Detection Paper award, while Dr Donovan Eu won the Best of Clinical Title award.

LIVER, PANCREATIC, BILIARY CANCERS



2012
• Establishment of a NUH core Hepatocellular Carcinoma (HCC) research group working on "Integrative HCC Research towards Precision Therapy".

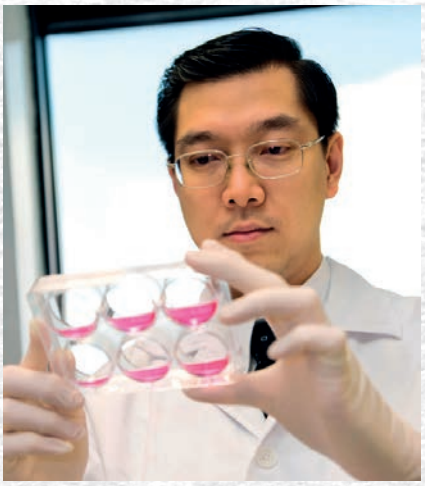
2015
• Development of minimally invasive surgery for HCC and other hepatobiliary cancers.

• Expansion of the hepatobiliary multidisciplinary tumour board to include cases from Ng Teng Fong General Hospital (NTFGH).

• NUH/NCIS began to accept referrals of HCC cases for transplantation from NTFGH.

2016
• Establishment of a dedicated HCC (liver cancer) clinic.

2017
• The 8th Asia Pacific Primary Liver Cancer Expert Meeting was held in Singapore with several NCIS clinicians serving on the organising committee or as faculty members.



Members of the Hepatobiliary Tumour Group

Tumour group milestones

LUNG CANCER

2003
• Started offering molecular-targeted therapy and immunotherapy in lung cancer treatment.

2009
• Introduction of Uniportal Thoracscopic Surgery (UVATS), resulting in faster post-operative recovery and shorter inpatient stay.

• Launch of first Image-Guided Radiation Therapy (IGRT) to ensure accurate delivery of radiation dose to the tumour while avoiding healthy organs.

2010
• Introduction of Endobrochial Ultrasound (EBUS), which has improved diagnostic yield and staging in the field of thoracic oncology.

2017
• Establishment of the multidisciplinary lung nodule clinic, which offers a complete one-stop solution for the management of lung nodules to facilitate diagnosis and treatment.

MUSCULOSKELETAL/ SARCOMA CANCERS

2013
• Established the Singapore Sarcoma Consortium as a platform to collaborate with other healthcare institutions to enhance patient care, specialist education and research.

2016
• Launched Singapore's first Sarcoma Support Group and public forum on musculoskeletal cancer.

2017
• Conducted first-in-Singapore clinical trial for sarcoma using Natural Killer (NK) cells.

The Sarcoma Support Group at their first public forum

PAEDIATRIC CANCERS

2012

• Opening of the Viva-CCF (Children's Cancer Foundation) hub at NUH Medical Centre.

• A 2003 Malaysia-Singapore (Ma-Spore) acute lymphoblastic leukemia (ALL) study led by NCIS/NUHKids clinicians achieved a cure rate of 80 per cent.

2013

• NCIS/NUHKids researchers identified microRNA genes that can predict the chances of survival of leukaemia in children.

2016

• NUS Yong Loo Lin School of Medicine and international collaborators confirmed the high frequency of a variant gene that causes Asian children to be very sensitive to mercaptopurine, a common type of chemotherapy drug.

2018

• NCIS doctors successfully doubled the chances of cure for young adults with leukaemia by using the Ma-Spore ALL protocol.

Tumour group milestones

PROSTATE/UROLOGIC CANCERS

2014

• Introduction of the Robotic Partial Nephrectomy for minimally-invasive therapy of small renal masses, thereby reducing post-operative pain and duration of stay.

2015

• Launched the Prostate Cancer Specialist Nursing Programme in collaboration with partners to provide training for nurses to deliver specialty nursing care to prostate cancer patients.

• Launched the Robotic-Assisted MRI-Guided Prostate Biopsy Programme, a targeted approach to biopsy prostate lesions, which effectively eliminates the risk of potentially life-threatening post-biopsy sepsis while obtaining clearer insight on the most effective treatment plan.

2017

• Established Enhanced Recovery After Surgery (ERAS) Programme targeted at radical prostatectomy patients, thus improving overall patient experience and minimising costs and duration of stay.

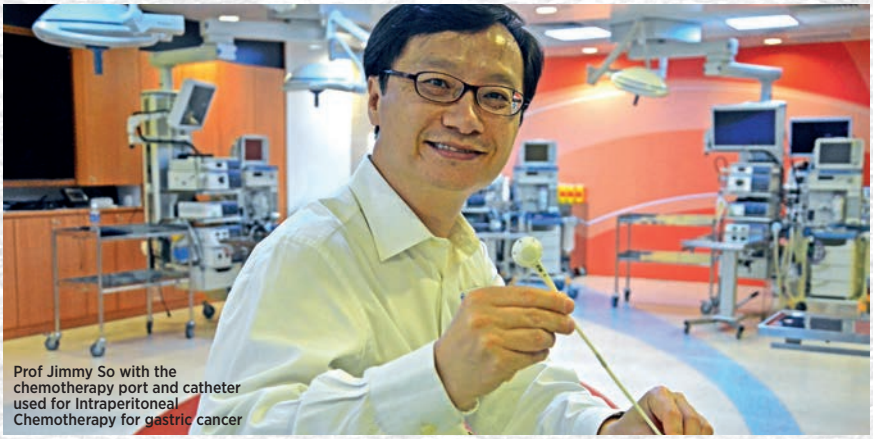
UPPER GASTROINTESTINAL CANCER

1992
• Performed world's first laparoscopic gastrectomy.

2007
• Collaborated with the Singapore Gastric Cancer Consortium (SGCC) in re-defining management of gastric cancer through early detection, improved treatment strategies, and the study of the biology of gastric cancer alongside global centres of excellence.

2013
• Performed first minimally-invasive oesophagectomy, which has been significantly effective in improving treatment outcomes.

2015
• Performed first robotic gastric cancer surgery.



Prof Jimmy So with the chemotherapy port and catheter used for Intraperitoneal Chemotherapy for gastric cancer

2016
• Performed first-in-Asia Pressurised Intra-Peritoneal Aerosol Chemotherapy (PIPAC), which improves intra-peritoneal drug distribution and tissue penetration.

2017
• Developed outpatient treatment regime incorporating intra-peritoneal chemotherapy to boost treatment outcomes.

• Conducted first Asia-Pacific Symposium and hands-on PIPAC course attended by overseas delegates.

After its inception in 2007, the SGCC held its 1st Annual Scientific Meeting in July 2008

Moving forward

TECHNOLOGY FOR BETTER HEALTH

NCIS has adopted a range of tech-driven solutions to raise treatment and service delivery for patients. By Janice Lin

Advances in technology have touched many sectors, and it is no different for healthcare. At NCIS, different digital solutions are used to enhance the delivery of health services and boost treatment outcomes.

To help patients in their recovery journey, NCIS has rolled out initiatives to reduce the stress of travelling to and fro for consultations.

One example is our telehealth service, which we first offered in 2008. This programme is led by our oncology nurses, who call in on patients undergoing chemotherapy treatments to check on their recovery.

For those whose conditions are stable, tele-consultations, held every three to four months to review patient medications and laboratory results, have helped minimise the number of necessary clinic consultations to just once a year.

Patients can thus make fewer trips to the hospital, where the waiting time to see a doctor could take as long as an hour. In particular, it serves the elderly and patients with limited mobility well, since they are assessed in the comfort of their own homes. And for our nurses, the convenience brought on by a simple phone call enables them to monitor patients more regularly than they would with in-person appointments.

To further enhance our telecare programme, we rolled out a video-conferencing platform for tele-consultation in October 2017. This was made possible by our partnership with the Integrated Health Information Systems (IHiS), which provided the platform as part of the nationwide Smart Health Video Consultation Initiative. Our nurses can now visually check

NCIS offers brachytherapy, where radioactive sources are placed in or close to the tumour, for breast and prostate cancer patients

on wounds or symptoms from chemotherapy treatment, which is useful in cases where patients are unable to verbally describe their conditions. To access this platform, the patient must have a smartphone or desktop computer.

An app for better health

In assisting patients on their treatment journey, NCIS recently piloted a mobile application that can be customised to a patient's care plan. Besides offering information on a patient's diagnosis, treatment and medication, the app uses artificial intelligence to trend out a patient's logs and activities, which are then analysed to highlight potential issues that may require medical attention or advice.

It also has a social networking function that connects the patient with his family, friends and healthcare team, which we hope would spread the message on the importance of getting screened for cancer. To make health education more accessible to our patients, the app will also offer the latest education materials, lifestyle and diet advice.

"The data collected through our app will help us better understand patients' needs and develop better care models," said NCIS' director, Professor Chng Wee Joo. The app will begin a three-month beta trial later this year, and will soon be available to all our patients.

A smartphone is needed to access the tele-consultation video-conferencing platform

Robots to the rescue

Technology is also leveraged to improve surgical procedures and treatments.

The da Vinci Surgical System is a robot that assists in complex surgeries by using a minimally invasive approach. During the operation, the surgeon controls a set of four mechanical arms from behind a nearby console, which converts his hand motions into more precise movements. Feedback on the da Vinci has been positive. "Our patients are surprised that there is minimal pain after major surgeries, and that they can get out of bed and walk to the other end of the hospital the following day," said Dr Lincoln Tan, Consultant, Division of Surgical Oncology (Urology), NCIS.

NCIS first began offering this surgical option in 2007. Today, about 95 per cent of prostate surgeries and two-thirds of partial nephrectomies at the centre are done using the da Vinci, and slightly more than 90 per cent of endometrial cancer surgeries. Another soon-to-be-rolled out robot is a newly invented Master and Slave Transluminal Endoscopic Robot, or MASTER, which also offers a minimally invasive surgical option to stomach, colon and oesophageal cancer patients. Like the da Vinci, MASTER promises less pain, faster recovery and fewer surgical complications, and could potentially lower surgery cost.

Targeted treatment

Radiation therapy is another approach to treat cancer, using high-energy waves like X-rays delivered locally to affected tissues, killing off the cancer without damaging too many healthy cells. NCIS has been offering brachytherapy, a form of radiation therapy, where radioactive sources are placed in or close to the tumour site, for breast and prostate cancer patients since August 2008 and July 2009, respectively. Advanced imaging and precise radiation dose calculation and delivery systems ensure accurate radiation therapy treatment every time for every patient.

These developments show that innovations in technology and cutting-edge research continue to advance our search for cancer cures, and more importantly, improve delivery of care to our patients.

The da Vinci Surgical System is a robot that uses a minimally invasive yet precise approach for complex surgeries

Moving forward

BEYOND THE HOSPITAL

Bringing services and treatments to homes and the community. By Janice Lin

Cancer is a traumatic diagnosis for both the patient and their loved ones. Patients have to not only grapple with the demands of cancer treatment, which is often challenging and intensive, but also cope with the emotional and psychological stress.

One way of helping our patients in both the treatment and post-treatment stages is to bring cancer care closer to their homes. NCIS has a range of initiatives to achieve this, and our goal is to make cancer care more patient-centred.

Bringing care to the community

A key programme is NCIS On the Go, which brings basic nursing procedures closer to residents' neighbourhoods. By going to one of three locations — Jurong Medical Centre, Keat Hong Family Medicine Clinic and Woodlands Zone 9 Recreation Centre — patients can avoid long queues at the hospital. Since its roll-out in February 2017, NCIS On the Go has served more than 370 unique patients, and has not only helped reduce their waiting times at the hospital, but also allowed for fewer hospital visits. About 53 treatments are provided under this programme, including blood-taking, injections, simple wound-dressing and some chemotherapy treatments. Care is provided by the NCIS team of trained oncology nurses, and charges are the same as those for treatments done at the hospital.

"At NCIS, we show that traditionally complex cancer treatment can potentially be cost-effectively and safely delivered in the community and home." **PROF CHNG**

Home-based treatments

Beyond offering services in residential areas, NCIS has taken the extra step to provide care in the comfort of our patients' homes. Launched in 2014, the Home Care Programme ensures continuity of cancer care after patients are discharged from the hospital. The programme provides a range of services including blood tests and caregiver education, and is available to all our cancer patients.

On the whole, the Home Care Programme has helped an average 350 patients each year since its inception. By reducing the number of hospital visits our patients must make for their cancer treatment, it has helped improve their recovery journey and allowed for fewer disruptions in caregivers' lives. Home visits also enable nurses to observe patients in their native environment, so potential health issues can be brought to attention.

Partnerships with other hospitals

While much effort has been made to shift the care of our patients to the convenience of their homes or the community as much as possible, the reality is that some conditions still require specialist help at the hospital. Ideally, patients should not

have to travel far for these visits. To this end, we have partnered with Ng Teng Fong General Hospital (NTFGH), which is located in the JurongHealth Campus, to set up the JurongHealth – NCIS Cancer Services Centre. Since its launch in 2015, this specialist outpatient clinic, which is jointly managed by NCIS and NTFGH, has assisted us in the provision of cancer services, treating patients with breast, colorectal and lung cancers. Our collaboration has made cancer treatment more accessible for an estimated 840 patients living in the western parts of Singapore.

In addition, the NUH Acute Medical Unit (AMU), the Extended Comprehensive Care Programme (ECCP) and the NCIS team have collaborated in setting up Wards 2 and 3 at Alexandra Hospital. These subsidised wards play a role in our efforts to expand existing inpatient facilities at the National University Hospital (NUH). NCIS patients assessed as clinically stable but requiring a prolonged hospital stay for medical reasons are transferred over, where they continue to receive supportive and rehabilitative care from NUH's healthcare professionals.

Tailoring care for the elderly

A cancer diagnosis is arguably more devastating for the elderly, who often also have to cope with pre-existing health conditions and increased financial constraints, on top of physiological ageing. With this in mind, NCIS piloted two studies that began in March 2017 to evaluate the benefits of setting up a geriatric oncology clinic to provide tailored care to elderly cancer patients. The studies have recruited about 120 patients as of January 2018 and have shown promising preliminary results.

The NCIS Geriatric Oncology Clinic, which opened in March 2018, caters to the specific needs of elderly cancer patients. The one-stop clinic aids patients aged 65 years and above in managing their cancer treatment, comorbidities and functional limitations, and offers support to caregivers. In addition, our multi-disciplinary team of doctors, nurses, therapists, pharmacists and social workers help guide patients through the treatment journey, and provide a bridge between active cancer treatment and palliative management.

Seamless transition

Effective care involves making the transition from hospital to home/community seamless, and keeping treatments convenient yet affordable to our patients. Towards this goal, we have plans to increase the number of chemotherapy treatments in the community and home setting, initiate a pilot where patients undergoing complex chemotherapy for leukaemia and lymphoma receive most of their post-chemotherapy care at home rather than at the hospital.

In fact, even stem cell transplants at home are now possible. "Our first case was done in February 2018, where the patient did not have to return to the hospital after stem cell infusion," said Prof Chng Wee Joo, Director of NCIS. "He had no infection and did not need a transfusion. Our nurses visited him at home on certain days. Overall, cost was reduced, patient feedback was positive, and the patient himself is a strong advocate for home transplants."

"At NCIS, we show that traditionally complex cancer treatment can potentially be cost-effectively and safely delivered in the community and home," added Prof Chng.

Top: The Home Care Programme ensures cancer care continues after patients are discharged

Bottom: The chemotherapy bay at NTFGH makes treatment accessible to patients living in west Singapore

Follow-up cancer care with your primary doctor

Launching in late 2018, a new initiative will afford eligible cancer patients even greater convenience. Patients who have completed active treatment can now look forward to having their yearly cancer follow-up done with a primary doctor. Stay tuned for updates!

Moving forward

BRINGING CANCER CARE CLOSER TO HOME

Educating the community on cancer care management and delivering integrated, quality cancer care services to western Singapore, underpin the partnership between NCIS and NTFGH

For many cancer patients, repeated trips to the cancer centre can be tiring, painful and uncomfortable, particularly for those who live further away. Ng Teng Fong General Hospital (NTFGH) was officially opened in Jurong East in September 2015 to better serve the population in the western part of Singapore.

Seizing the opportunity for closer proximity to patients, the Western Cancer Action Network (WCAN) was formed on 16 October 2012 so that NTFGH and NCIS could collaborate and implement an integrated cancer care plan for cancer patients in the West. WCAN's four key thrusts are:

1) prevention and screening
2) diagnosis and treatment
3) survivorship
4) palliative and hospice

In Phase One, NCIS helped NTFGH to design, develop and implement Oncology Services to integrate cancer services across the care continuum in the Western cluster.

Working together for better cancer care

Fast forward to today, our collaboration has been a major success, providing economies of scale and high treatment frequency. We have seen an increase in workload for Medical and Radiation Oncology and a rise in chemotherapy cases from 179 in 2015 to 1,800 in 2017.

We are now embarking on Phase Two, where we will integrate community level services and promote cancer screening services. A leading effort is the screening of colorectal cancer – the most common form of cancer in Singapore, with over 9,800 new cases diagnosed between 2011–2015.

Together, we have held eight colorectal cancer screenings and 16 mammogram screenings with the South West Community Development Council (SWCDC) as well as five community health screenings in West Singapore.

As part of the national screening programme, the Health Promotion Board (HPB) and non-profit organisations in Singapore have handed out Faecal Immunochemical Test (FIT) kits to polyclinics, GPs, retail pharmacies

In July 2014, NCIS and JurongHealth signed a partnership to implement an integrated cancer care plan for patients living in the West

and community centres to be distributed to eligible individuals above the age of 50. The FIT is a quick and easy test that can detect colorectal cancer early through the presence of small amounts of blood in the stool. Efforts are now underway to consolidate these programmes within the NUHS cluster to optimise workflow and, more importantly, address any gaps in the programme.

Similar programmes are also being run by the Health Promotion Board (HPB) and non-profit organisations in Singapore. NCIS and NTFGH are also actively looking at definitive treatment, survivorship and palliative care across the end-to-end cancer care continuum.

Additionally, NCIS has collaborated with NTFGH, the National University Hospital and National University Polyclinics to form a Cancer Prevention & Screening Taskforce, which brings together various stakeholders such as HPB to address the lack of colorectal screening among Singaporeans, especially those living in west Singapore.

Educating our community

Patient and community education and awareness is another area that our collaboration is invested in. We believe that a combined outreach to the community would send a more consistent and coordinated message on the importance of prevention, screening and early detection. Thus, on 4 November 2017, we held our first public forum in both English and Mandarin at NTFGH, where specialists from NTFGH and NCIS spoke on the top three cancers, common misconceptions, tips on how to lead a healthy lifestyle, and the importance of diet in preventing the disease. A total of 533 people attended both sessions.

Our staff from both institutions have also teamed up with local cancer organisations like the Singapore Cancer Society (SCS) to further reach out to the community and educate them on cancer care and management.

In October 2016, NCIS, SCS and SWCDC held a Breast Cancer Public Forum; in 2017, a Pink Ribbon Launch Party was held in Jurong East in support of breast cancer awareness and prevention.

Moving healthcare forward

Providing integrated, seamless and quality cancer care is the ultimate goal of our collaboration. Moving forward, we will tap on the primary care network (GPs and polyclinics) as the main channel to identify at-risk populations and boost public sign-ups for screening. We will look into establishing workplace screening initiatives and integrating them with community screening facilities. In addition, we will carry on working with our partners such as the HPB, SCS and Regional Health Systems on public engagement and education programmes to improve screening take-up rate.

Finally, we will continue to further develop the areas of rehabilitation and palliative care to enhance patients' quality of life.

Dr Tan Ker Kan
Consultant, Division of Surgical Oncology (Colorectal Surgery), National University Cancer Institute, Singapore (NCIS)

Adj Asst Prof Heng Chin Tiong
Director & Senior Consultant (Urology), Ng Teng Fong General Hospital (NTFGH)

Dr Tan Chuan Chien
Consultant, General Surgery, Ng Teng Fong General Hospital (NTFGH)

Moving forward

BEATING CANCER WITH OUR IMMUNITY

Recent advances in immunotherapy treatments have been promising and provide hope for cancer therapy

In August 2015, former United States president Jimmy Carter revealed that his melanoma had spread to his brain and liver. However, just four months later, his doctors found that his tumours were gone. By undergoing a form of immunotherapy treatment that uses the drug pembrolizumab, they were able to kill off his cancer cells. President Carter's form of cancer would have been untreatable years ago, but immunotherapy successes like his have brought fresh hope to patients and the medical community.

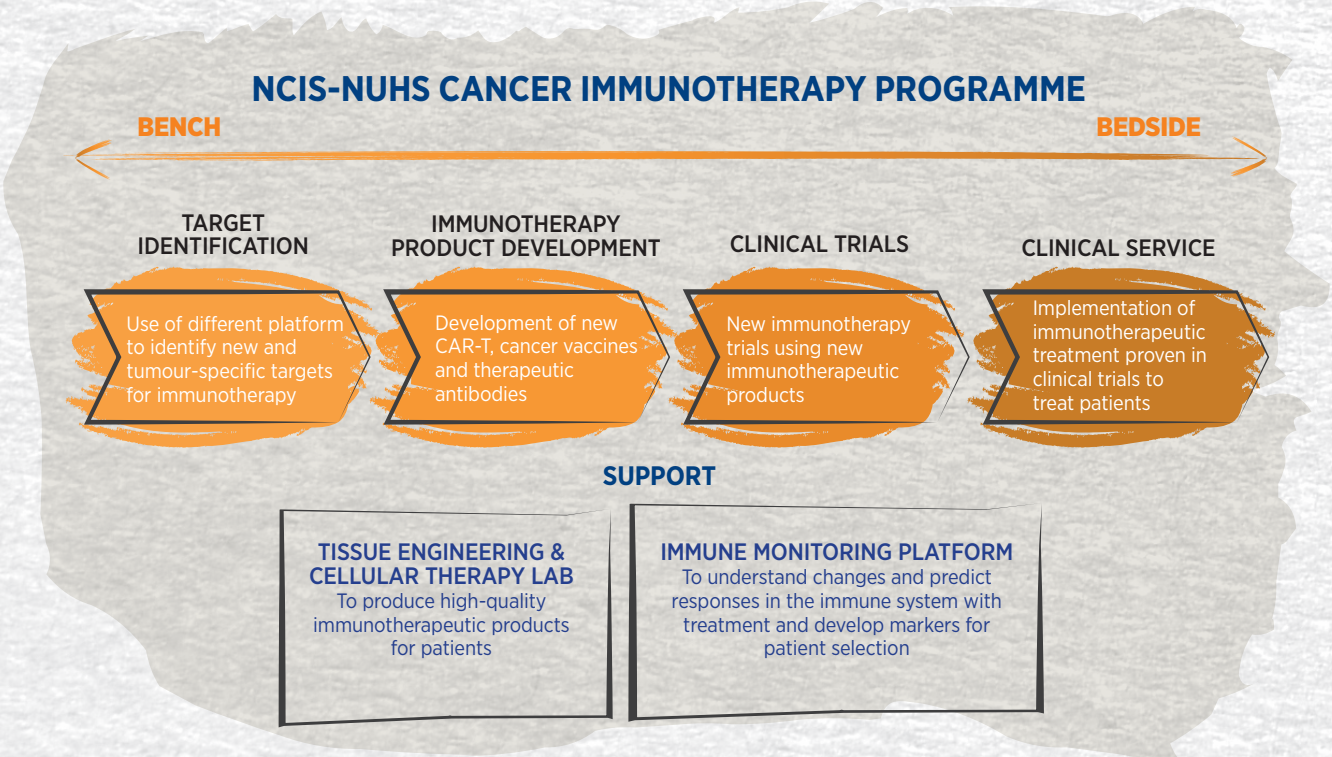
Immunotherapy, which harnesses the immune system to fight cancer, is not a new concept. Rather, it's been pursued with varying degrees of success for decades. Its prolonged progress partly stems from an inadequate understanding of the critical components of the immune system in anti-cancer immunity, as well as the defects that occur in cancer and how they may be treated by other anti-cancer agents.

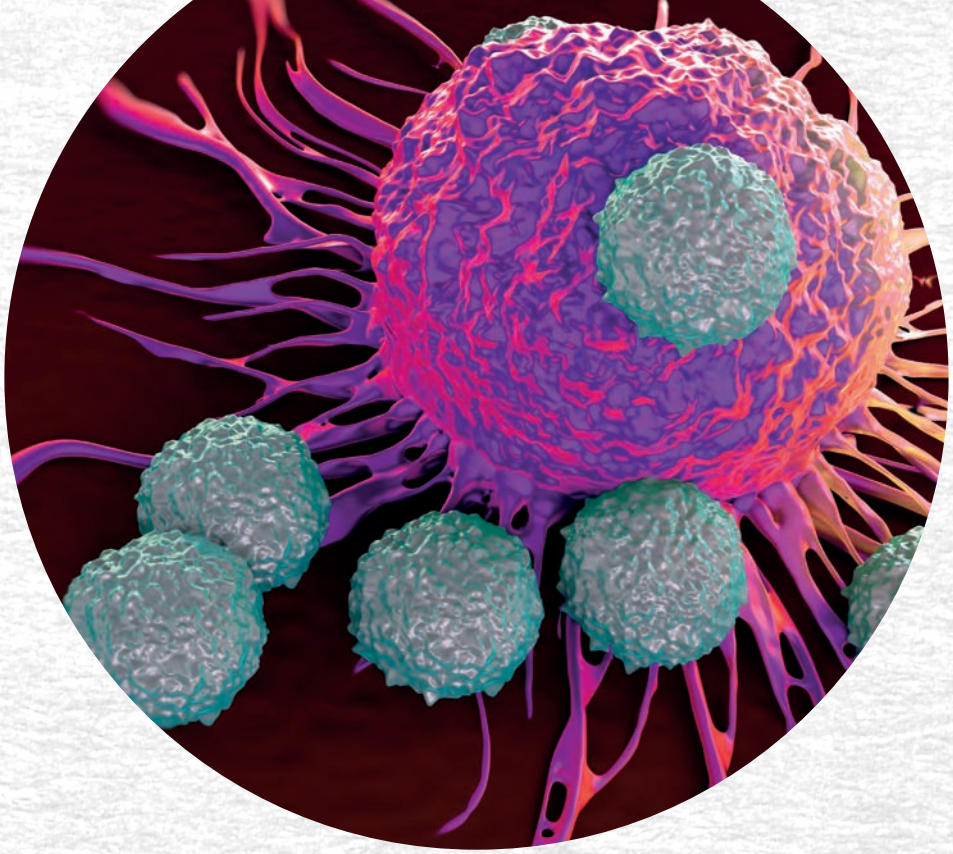
Treatment types

The most well-known immunotherapy method involves the use of therapeutic antibodies that target specific proteins on tumour cells. These are either naked antibodies that activate different immune cells to kill the cancerous ones, or antibodies tagged to a drug that will kill the tumour when the antibodies attach to its cells (called antibody-drug conjugates).

The antibodies can also be tagged with radioactive compounds, which will deliver radiation to kill the tumour cells upon binding with them. Using therapeutic antibodies is the best established form of anti-cancer treatment, and a number of therapies via this method have been approved across the world. So far, it remains the mainstay of treatment for lymphoma and breast cancer, among others.

A second type of immunotherapy is the form of treatment received by President Carter and involves the use of drugs to regulate the immune system. This class of treatment harnesses antibodies to block transmission of signals between





cancer cells and immune ones by binding to their targets.

The third category is passive immunity brought on by the infusion of immune cells from the patient, usually after stimulation or activation outside the patient. In addition, the cells may be modified to express a specific receptor against cancer targets. The immune cells can be natural killer cells or T cells. One exciting example of this type of treatment is Chimeric Antigen Receptor (CAR) T-cell therapy, which was recently approved for the treatment of Acute Lymphoblastic Leukaemia (ALL).

The last broad category is tumour vaccine, where tumour-specific, immunogenic proteins are used to vaccinate the patient and stimulate an immune response against the tumour. Due to advances in tumour-sequencing technology, there is now a way to identify the entire spectrum of tumour-specific antigens in cancer cells for more effective vaccinations. These neoantigens – new proteins formed as a result of genetic mutations in the tumour, and therefore specific to cancer cells but not normal cells — are a good source of immunogens for triggering an anti-tumour immune response in patients through vaccination.

Pushing frontiers in immunotherapy

In recent years, there has been an explosion of immunotherapeutic treatments that have produced unprecedented results. In myeloma, anti-CD38 (protein expressed highly on myeloma cells) antibodies such as daratumumab have produced excellent responses, while immunotherapy that targets B-cell maturation antigens (BCMA) – another protein expressed highly in myeloma cells – by using antibodies, antibody-drug conjugates or CAR-T treatments has shown exciting promise.

The PD1 inhibitor has also produced a remarkable response in a number of cancers, including lymphoma, melanoma and lung cancers. And CD19-targeted CAR-T therapy has been approved by the US FDA for relapsed ALL, as it has been shown to induce long-term remission, even in patients with relapse and refractory disease.

While these findings have fuelled tremendous excitement in this field, there are still many issues that need to be resolved. What are the best tumour antigens and targets? How do we make immunotherapy treatments cheaper and more accessible? How do we improve existing treatments for more positive results? What are the best immunotherapeutic approaches?

In view of this, the NCIS-NUHS Cancer Immunotherapy Programme (see diagram below left) was established this year with three key aims. Firstly, to approve and deliver effective immunotherapy therapies to our patients. Secondly, to research and identify better approaches and ways to predict patient responses to immunotherapy. Finally, we want to be a one-stop centre for immunotherapy researchers and companies by integrating basic science capabilities in immunology, as well as clinical, cell-processing and manipulation capabilities.

Central to this programme is the establishment of a facility known as the Tissue Engineering and Cellular Therapy laboratory, which can produce therapeutic cellular therapy products for cancer immunotherapy. Through this initiative, we plan to start offering CAR-T therapy to ALL and lymphoma patients in the later part of 2018.

We also hope to develop our own immunotherapy products for patient use by 2020. Currently, we have several ongoing clinical trials, some of which are already showing promising results. These developments demonstrate that NCIS is committed to, and remains at the forefront of, discovering new frontiers in cancer therapy.

Professor Chng Wee Joo
Director, National University Cancer Institute, Singapore (NCIS)

Senior Consultant, Division of Haematology, Department of Haematology-Oncology (NCIS)

Moving forward

MAKING BREAKTHROUGHS

Through intensive research and clinical efforts, doctors are bringing patients one step closer to a cure for cancer

During World War II, naval personnel who were exposed to mustard gas during military action were found to have toxic changes in their bone marrow cells, which developed into cancer blood cells. During that same period, the US Army also studied a number of chemicals related to mustard gas to develop more effective agents for war, while developing protective measures against the hazardous side effects caused by exposure to it.

As a result of those studies, a compound called nitrogen mustard was found to work against a cancer of the lymph nodes called lymphoma. This agent formed the basis for the development of a series of similar but more effective agents that killed rapidly growing cancer cells by damaging their DNA.

During a chance discovery and experimental screening of cytotoxicity using generic cell line models, scientists also uncovered cytotoxic chemotherapy, which formed the backbone of drug treatment for cancer. However, while chemotherapy targets dividing cells, it also has many side effects on normal tissues.

But since the use of nitrogen mustard derivatives to treat lymphoma, cancer treatment has evolved into a highly expansive discipline. Just 20 years ago for example, treatment for breast and colorectal cancer was largely guided by histology and stage; today, we routinely analyse the molecular characteristics of the tumour to select treatment, and predict outcome.

Advancements in technology have also led to better cancer survival rates through surgery. As a result of well conducted, practice-changing clinical trials, we now know when and how to apply a combination of treatment modalities, and when we should deploy surgery, precision radiotherapy and pharmacotherapy.

The next evolution in drug development

Even as we work towards developing more targeted and discriminate treatment, drug development remains a time-consuming and resource-intensive process. It involves highly trained research teams specialising in oncology, and these teams are led by oncologists who are scientists possessing deep understanding of cancer biology, clinical pharmacology, and clinical trial methods. There is also the painstaking trial and discovery process and lab testing before it reaches human evaluation. Only one in 20 drugs that arrive at human testing will eventually be approved for clinical use.

But there has been some breakthrough. Over the past decade, pharmaceutical companies and the relevant authorities have been speeding up the process of drug evaluation and regulatory approval. Backed by the development of more effective drugs against cancer, we have made great strides in cancer treatment.

"It is important that patients allow their tumour samples to be stored for future research, and permit access to their health information, so that we can continue to understand how cancers develop drug resistance."

We foresee that the next drug advancement would come from understanding how cancers evolve and rewire their molecular circuitry to become resistant to current

drugs, and how we can exploit these findings to develop specific targeted small molecules and antibodies to inhibit and stem cancer growth by promoting pathways.

Such research efforts have been boosted by the availability of cancer tissue banks collected from patients. Through the samples collected, we are able to apply molecular technology to dissect these molecular pathways. Researchers can now screen large chemical banks to match suitable drugs or engineer specific antibodies against these targets. They are also able to apply this information and develop special tests (also known as 'companion diagnostics') on a patient's cancer to identify if he or she has the appropriate molecular profile for the most effective drugs.

Still, in spite of the advancement in laboratory science, in order to reach the patient, it is necessary to engage highly specialised teams of physician scientists to evaluate these drugs in patients to determine important aspects like common side effects, appropriate doses and ways to administer the drugs, and their effectiveness in patients.

OUR FIGHT AGAINST CANCER

Over the past 17 years, the National University Cancer Institute, Singapore (NCIS) and the Haematology-Oncology Research Group (HORG) have been working together to develop more effective treatments for cancer patients. Adjunct Professor Goh Boon Cher shares more.

Tell us about the collaboration between NCIS and HORG on cancer treatment.
We have been conducting clinical trials of important drugs that have since been approved for routine management. In addition, our clinicians, some of whom are laboratory-trained, collaborate with laboratory scientists to design our own clinical trials based on ideas from new information we discover. We have special focus on cancers more common in this part of the world, such as Nasopharyngeal Cancer (NPC), Gastric Cancer and Hepatocellular Carcinoma (HCC).

What are some key findings gathered during your clinical research?
We recognised earlier that Asian patients may not metabolise drugs in a similar way to their western counterparts. We may need to adjust doses for efficacy and avoid toxicity, and have conducted studies to better understand this. This has helped us project our ideas into clinical trials with the industry through collaboration with the NCI-CTEP.

Which industry partners do you work with?
We collaborate with many renowned cancer centres, including the United States National Cancer Institute, as well as numerous drug companies to bring much needed new treatments to patients.

Can you share some new developments?
Over the years, many patients have benefitted from opting to receive novel drugs on clinical trial, as standard treatments are not available to them. Our Phase One clinical trial team is presently conducting a worldwide clinical trial comprising engineered immune cells, like Natural Killer cells for breast cancer, head and neck cancer, leukaemia and sarcoma, and a special form of dendritic cells for NPC. This is important as immunotherapy has emerged recently as the next frontier for cancer treatment, and will significantly advance patient care.

How can we bring more effective and targeted treatment to cancer patients?
It is important that patients allow their tumour samples to be stored for future research, and permit access to their health information within proper regulation. With combined effort, we can continue to understand how cancers develop drug resistance and spread – and devise strategies to overcome the challenges.

Adjunct Professor Goh Boon Cher
Group Chief Physician, Leadership and Organisation Development Office, National University Health System (NUHS)

Deputy Director (Research), Senior Consultant, Department of Haematology-Oncology, National University Cancer Institute, Singapore (NCIS)

Moving Forward

FORGING A ROBUST COMMUNITY

NCIS extends its expertise and friendship to healthcare practitioners from Asia, even as it continues to train new generations of oncologists. By Low Jat Leng

Participants attended case presentations and PIPAC training in a hands-on session

NCIS plays a key role in fostering a robust cancer healthcare community in Singapore and beyond. It partners hospitals in Asia as well as medical and pharmaceutical companies to develop healthcare professionals from the region. In sharing knowledge and extending its friendship, NCIS has also established itself as a centre of excellence for cancer care and education. We showcase recent training highlights.

Intensity Modulated Radiotherapy (IMRT) and Image Guided Radiotherapy (IGRT) Course

In November 2017, NCIS organised the fifth IMRT/IGRT course for regional radiation therapy practitioners, in partnership with Elekta, a leading provider of machines and technologies for radiation therapy. The course saw faculty members from NCIS' Department of Radiation Oncology provide educational training for users from ASEAN and India.

The inaugural course was held in August 2015, and had four participants. The third course in February 2017 came with an additional IGRT component. Since its launch up till November 2017, the IMRT/IGRT course has welcomed 28 radiation and clinical oncologists, physicists and radiation therapists from Vietnam, India, Indonesia and the Philippines.

A small team of NCIS radiation oncology faculty members also visited hospitals from the region

Attendees at the fifth IMRT/IGRT course for regional radiation therapy practitioners

Training the next generation of oncologists

Another key mission of NCIS is the education, training and mentoring of each generation – past, present and future – of healthcare professionals in oncology. Our haematologists and oncologists all undergo training through our gynaecologic oncology, haematology, medical oncology, paediatric haematology-oncology, radiation oncology, and surgical oncology sub-specialty programmes and fellowships.

participants came from, including Vietnam's Hue Hospital in November 2016 and K Hospital in April 2018. The team followed up on participants' learning progress, and taught wherever required.

A total of nine delegates – three from India, four from Thailand and two from the Philippines – attended the sixth course from 8 to 12 May 2018.

PIPAC Symposium

In 2016, NCIS/NUH became the first in Asia Pacific to perform Pressurised Intra-Peritoneal Aerosol Chemotherapy (PIPAC), a novel treatment for peritoneal carcinomatosis and metastases from stomach, colon and ovarian cancers. The chemotherapy drug is delivered as an aerosol directly into the peritoneal cavity using a micro-pump, where it is distributed evenly and penetrates the cancer cells deeply, with reduced side effects.

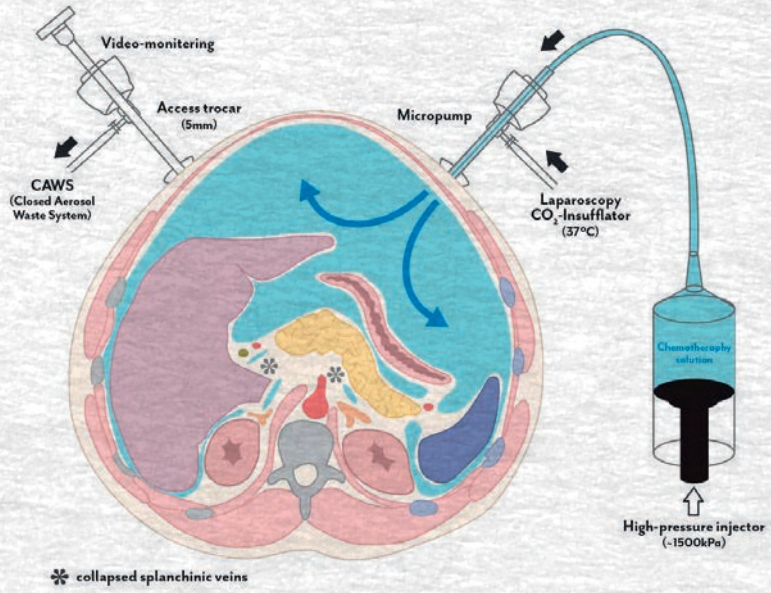
From 9 to 10 November 2017, NCIS held the first Asia-Pacific PIPAC Symposium and Hands-on Course at NUH. Six international academics, including Prof Marc Reymond, a PIPAC pioneer from Tubingen, Germany, headlined the workshop. The other 24 participants came from the USA, Europe and Asia Pacific, among others.

Participants shared the latest in peritoneal carcinomatosis management, attended case presentations and received PIPAC training in a hands-on session. The symposium culminated in two live PIPAC surgeries performed by Prof Jimmy So and Dr Kim Guowei. The symposium's success consolidated NCIS' position as the regional leader in peritoneal carcinomatosis management and PIPAC.

Multiple Myeloma Daycare Preceptor Programme

The Multiple Myeloma Daycare Preceptor Programme workshop – a collaboration with Xi-an Janssen Pharmaceutical – was held from 9 to 10 October 2017 at NUHS. NCIS hosted 18 doctors and nurses from China's top haematology centres, who gained insights from NCIS' nursing, operations, pharmacy and allied health teams on the treatment and care of multiple myeloma patients, the preparation of chemotherapy drugs and patient wellness programmes. Delegates also observed the operations at NCIS' clinics and wards, and together with their NCIS counterparts, participated in a panel discussion with lively exchange of ideas.

Diagram of PIPAC procedure



NCIS hosted 18 doctors and nurses from China's top haematology centres

Moving forward

VALUE-DRIVEN CARE FOR ALL

The cost of healthcare is growing at an alarming rate, affecting access to and quality of care. The solution, however, may well lie in value-driven care, according to Dr Keith Lim

Firstly, could you explain the concept of value-driven care?
It means providing the best clinical outcome per total cost of care in an environment with healthcare professionals committed to delivering high-quality patient experiences.

Why is there a need for value-driven care in Singapore?
We need an effective healthcare system to respond to the challenges of an ageing population, growing disease burden and rising healthcare costs.

Tell us about the NUHS Value-Driven Outcome (VDO) programme.
We started in early 2016 with two pilot projects – total knee replacement and community-acquired pneumonia.

We analysed and benchmarked quality and cost indicators – such as appropriateness of care, facility utilisation, and manpower costs – for these conditions. Data visualisation tools were used to track and analyse the outcomes of each quality indicator; cost drivers; percentage of patients who rated their experience with a perfect score; and what it costs NUHS to deliver this level of care.

Using these insights, our NUHS VDO team developed a way to allocate care costs and quality measures to each patient encounter. This was shared with healthcare professionals to enable them to identify cost-effective clinical practices, reduce unnecessary procedures and variations, and improve outcomes.

Teams were also able to initiate improvement plans such as to (a) reduce the use of drainage tubes during surgery; (b) boost DVT prophylaxis compliance; (c) adopt cost-effective standard implants; and (d) standardise investigations and discharge with a defined criteria.

How has the VDO programme progressed since the pilot projects?
Five more VDO projects were carried out in 2016, followed by nine others in 2017. Most of these have shown improvements in patient care quality and costs, which led to the implementation of six VDO projects at Ng Teng Fong General Hospital in 2017.

How has NCIS contributed to NUHS' VDO efforts?
In 2016, NCIS staff came together to define the indicators to measure good quality care for colorectal surgery patients, such as hospital readmission rates, and worked out the cost of care at the patient level. The team is now looking into improving patient outcomes, such as reducing the length of hospital stay.

NCIS has also completed two VDO projects – breast cancer and end-of-life care. For breast cancer, the team tracked patients' entire journey from diagnosis to end of treatment, to determine the quality of care they received and at what cost. The team also studied the quality of life that end-of-life patients experienced, the benefits of certain interventions and what they cost.

In 2018, NCIS will be involved in more VDO projects for conditions like haematological cancers and bone marrow transplants. By widening VDO coverage, NCIS aims to improve its overall quality of care and better understand the drivers of healthcare spending, in order to achieve the best value for its patients.

Dr Keith Lim
Group Chief Value Officer, National University Health System (NUHS)

Assistant Director (Clinical Education – Global Health) and Senior Consultant, Department of Radiation Oncology, National University Cancer Institute, Singapore (NCIS)

EVENTS & PROGRAMMES (JUL – DEC 2018)

July

- **NCIS Oncology Grand Rounds**
  For Healthcare Professionals
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **Lymphoma Support Group Activities**
  For Lymphoma Support Group Members
- **NPC oneHeart Support Group Walk @ Botanic Gardens**
  For all NCIS Support Group Members
- **GP CME Talk @ Ng Teng Fong General Hospital**
  For GPs / Family Physicians

August

- **NCIS 5th Annual Research Meeting (NCAM): Medical Informatics - From Big Data to Precision Oncology**
  For NUHS & NCIS investigators and researchers specialising in cancer
- **5th Centre of Excellence in Haematological Malignancies: Refining evidence-based medicine & patient-centered care**
  For Healthcare Professionals
- **Look Good Feel Better Programme**
  For NCIS Patients
- **NCIS Oncology Grand Rounds**
  For Healthcare Professionals
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **NPC oneHeart Support Group Organic Farm Visit - Frog Farm & Bollywood Veggies**
  For all NCIS Support Group Members
- **Gastric Cancer Public Forum**
  Open to the Public

September

- **Winning Against Cancer Public Symposium**
  Open to the Public
- **2nd World Lymphoma Awareness Day - Living with Lymphoma**
  For Lymphoma Patients, Survivors, Caregivers and the Public
- **NCIS Oncology Grand Rounds**
  For Healthcare Professionals
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **Sarcoma Support Group Activities**
  For Sarcoma Support Group Members
- **Adolescent and Young Adult Oncology (AYAO) Support Group Activities**
  For Adolescent and Young Adult Oncology Patients from all hospitals
- **Gynaecologic Oncology Patients TEAL Support Group Activities**
  For TEAL Support Group Members
- **NPC oneHeart Support Group Walk @ Botanic Gardens**
  For all NCIS Support Group Members

October

- **Breast Cancer Public Forum**
  Open to the Public
- **Public Health Service 2018**
  Open to the Public
- **Look Good Feel Better Programme**
  For NCIS Patients
- **NCIS Oncology Grand Rounds**
  For Healthcare Professionals
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **Sarcoma Support Group Activities**
  For Sarcoma Support Group Members
- **Adolescent and Young Adult Oncology (AYAO) Support Group Activities**
  For Adolescent and Young Adult Oncology Patients from all hospitals
- **NPC oneHeart Support Group Walk @ Botanic Gardens**
  For all NCIS Support Group Members

November

- ★**NCIS10 Fundraising Gala Dinner**
  Book a table or purchase a seat for a good cause! Proceeds go to the NCIS Cancer Fund. Visit www.ncis.com.sg for more information or email julie_tay@nuhs.edu.sg.
- **NCIS Oncology Grand Rounds**
  For Healthcare Professionals
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **Sarcoma Support Group Activities**
  For Sarcoma Support Group Members
- **Adolescent and Young Adult Oncology (AYAO) Support Group Activities**
  For Adolescent and Young Adult Oncology Patients from all hospitals

December

- **NCIS Celebrates Life – Combined Support Group Year-end Party**
  For NCIS Support Group Members
- **Relax Your Mind Yoga Class**
  For NCIS Patients & Caregivers
- **Chemotherapy Orientation Patient Education (COPE) Programme**
  For NCIS Patients
- **Sarcoma Support Group Activities**
  For Sarcoma Support Group Members
- **Adolescent and Young Adult Oncology (AYAO) Support Group Activities**
  For Adolescent and Young Adult Oncology Patients from all hospitals

LOOK OUT for our NCIS10 roving exhibition in west Singapore throughout the year!

For the exhibition schedule and latest updates on NCIS events & activities, visit www.ncis.com.sg!

CSI Showcase

BRIDGING THE GAP BETWEEN RESEARCH AND PATIENT CARE

Clinician scientists at CSI Singapore have made potentially life-saving inroads into research on cancers endemic to Asian populations

The Cancer Science Institute of Singapore (CSI Singapore) was established in October 2008 and is one of five Research Centres of Excellence funded by the Ministry of Education and the National Research Foundation. It is an anchor for research expertise in three areas: the Cancer Stem Cells and Biology Programme, the Experimental Therapeutics Programme, and the RNA Biology Centre. These are main platforms that facilitate CSI Singapore's focus on key cancers in gastric, liver and lung, as well as leukaemia, which are endemic to Asian populations.

CSI Singapore is home to prominent experts in the cancer research field, including six faculty members who have received the Singapore Translational Research (STaR) Investigator Award, one of the country's top scientific honours. Our younger faculty members have been recognised for their outstanding research work, with two conferred the President's Assistant Professorship at the National University of Singapore (NUS) in 2014 and 2015, and the Young Scientist Award at the President's Science and Technology Awards (PSTA) in 2014 and 2016.

CSI Singapore organises several local and international symposia annually, including the Frontiers in Cancer Science (FCS) conference, which is co-organised with other local institutes. The three-day event brings together cancer researchers, clinicians and industry partners with complementary knowledge and expertise from across the globe for the exchange of ideas and information.

Developing more effective cancer-fighting drugs

Globally, there is an increased need for clinician scientists, or doctors in research, to form a bridge between laboratory research and patient care in the clinic. Their work builds opportunities for crosstalk between science and medicine.

Within the laboratories at CSI Singapore, a number of research projects have been set up by clinician scientists to focus on developing new cancer treatments and improving existing ones. Their presence allows for greater interaction with regular scientists, which can open avenues for powerfully relevant research that may directly benefit patients.

One interesting area of research involves providing a greater understanding of how chemotherapy drugs work, and discovering how they can be improved to bring about better patient care and treatment outcomes. Our laboratories study how modifications to drugs and/or their environment can improve their effectiveness.

Exciting research work, led by Adjunct Professor Goh Boon Cher, CSI Singapore's Deputy Director and Deputy Director (research) at NCIS, has shown that chemotherapy drugs can be made more effective when used in combination with other medicines. For example, combinations of the chemotherapy drug Belinostat

ONE INTERESTING AREA OF RESEARCH INVOLVES PROVIDING A GREATER UNDERSTANDING OF HOW CHEMOTHERAPY DRUGS WORK, AND DISCOVERING HOW THEY CAN BE IMPROVED TO BRING ABOUT BETTER PATIENT CARE AND TREATMENT OUTCOMES.

were tested with Irinotecan or Seliciclib. These drugs block essential cellular pathways in tumour cells, such as cell division and gene expression, ultimately leading to tumour cell death. The results have shown promise for the treatment of specific cancer types, such as colon cancer or lung squamous cell carcinoma.

Junior investigators at CSI Singapore have also made inroads into research that could be translated into clinical trials. Dr Edward Kai-Hua Chow, Principal Investigator at the institute, is working with NCIS' Haematological Malignancy Group to find out whether an Artificial Intelligence (AI)-based drug combination platform would be able to identify the best drug combination from a set of drugs for individual patients. The Haematological Malignancy Group comprises fellow CSI Singapore Principal Investigators, Prof Chng Wee Joo, Dr Anand Jeyasekharan and Dr Sanjay de Mel, who are oncologists with the Department of Haematology-Oncology at NCIS.

This precision-style therapy enables clinicians to test different combinations of drugs on tumour tissue, and through analysis, find out which combinations are better able to target and kill tumour cells, or work together synergistically. Understanding more about the AI-based drug combination platform will enable us to develop specialised treatment options tailored to individual patients.

CSI Singapore continues to engage in life-saving research work against cancer. These exciting developments are clear indications that close collaboration between institutes can bring about fruitful outcomes against cancers, particularly those endemic to Asian populations.

Professor Daniel Tenen
Director, Cancer Science Institute of Singapore (CSI)

Distinguished Professor in Medicine, National University of Singapore (NUS)

FLYING HIGH

A look at our winning moments

Prof John Eu-Li Wong was presented the SASS Foundation Award granted by the SASS Foundation in conjunction with the MD Anderson Cancer Center and The Medal Group.

Adjunct Prof Goh Boon Cher was awarded the NMRC's Senior Clinician Scientist Award.

NCIS received a three-year endorsement as an Evidence-Based Healthcare Institution by the Joanna Briggs Institute (JBI).

Prof Chng Wee Joo and **A/Prof Allen Yeoh** were awarded the NMRC's Clinician Scientist Award.

2008

2010

2007

Prof Chng Wee Joo received the Celgene Future Leaders in Haematology Award.

Dr Yong Wei Peng won the Clinician Scientist Award from the National Medical Research Council (NMRC).

Dr Emily Ang, TCI's Deputy Director of Oncology Nursing, bagged the Healthcare Humanity Award.

2009

A/Prof Lee Soo Chin clinched the NMRC's Senior Clinician Scientist Award.

Prof John Eu-Li Wong won the NMRC's National Outstanding Clinician Award.

2011

Prof Chng Wee Joo was honoured with the Young Researcher Award at the NUS University Awards.

Senior Nurse Clinician Belinda Tan was presented with the National Day Award.

A/Prof Allen Yeoh was honoured with the NMRC's National Outstanding Clinician Scientist Award.

Prof John Eu-Li Wong was conferred the President's Science and Technology Medal at the President's Science and Technology Awards (PSTA).

Nurse Clinician Sharmila D/o Kasinathan received the Efficiency Medal at the National Day Awards.

Senior Staff Nurse Myint Myint Than was presented the Healthcare Humanity Award by The Courage Fund.

NCIS received the international FACT accreditation for our stem cell transplant programme – the first in Asia to be accredited.

2012

2014

Dr Lee Yee Mei received the Innovation Champion Award (Silver) at the Public Service for the 21st Century Excellence through Continuous Enterprise and Learning (PS21 ExCEL) Convention.

Dr Gurpal Singh was awarded the NMRC's Clinician Scientist – Individual Research Grant.

Advanced Practice Nurse Jedidah Lieow bagged the Ministry of Health's (MOH) Nurses' Merit Award.

Prof Chng Wee Joo was presented the NMRC's National Outstanding Clinician Scientist Award.

Adjunct Prof Goh Boon Cher and **A/Prof Lee Soo Chin** were honoured with the NMRC's Clinician Scientist Award – Senior Investigator.

2016

2013

The **NCIS** Department of Radiation Oncology was reaccredited by the Royal Australian and New Zealand College of Radiologists.

2015

Nurse Clinician Dora Lang Siew Ping was conferred the Efficiency Medal at the National Day Awards.

Prof Jimmy So was awarded the NMRC Clinician Scientist - Individual Research Grant.

2017

Dr Choo Bok Ai clinched the Singapore Patient Advocate Award at the Singapore Patient Action Awards organised by Tan Tock Seng Hospital.

Nurse Educator Wendy Wee won the MOH Nurses' Merit Award.

Dr Raghav Sundar and **Dr Joline Lim** were awarded the Merit Award at the American Society of Clinical Oncology (ASCO) Meeting.

Dr Lee Yee Mei received the President's Award for Nursing.

Prof Chng Wee Joo won the NMRC's Singapore Translational Research Investigator Award.

Dr Tan Ker Kan bagged the NMRC Health Services Research Grant.

a gift of life

GIVING HELP & HOPE

How the NCIS Cancer Fund supports our patie nts and the life-saving work of our medical team. By Janice Lin

In 2015, Madam Tan May Ling, 56, was suddenly diagnosed with stage 3C ovarian cancer. As she sought treatment, doctors at NCIS suggested she enrol in a clinical trial that tests a new way of delivering chemotherapy to the body.

"My doctor explained that the trial used a more targeted treatment direct to the cancer source, so it made sense to opt for it," she revealed.

Her treatment began in April 2015, and it involved the injection of chemotherapy drug carboplatin through the abdominal cavity, otherwise known as intraperitoneal (IP) chemotherapy. The drug is typically delivered through the veins. Previous studies had indicated that this form of chemotherapy improved the condition of patients with newly diagnosed stage 3 ovarian cancer.

In September — just five months later — Mdm Tan's cancer was found to have gone into remission. She has since remained cancer-free, and her doctors attest that she is "doing very well".

Funding treatments and research

Mdm Tan is one of 25 patients who found hope in their cancer journey by undergoing the IP chemotherapy clinical trial, supported by the NCIS Cancer Fund. Launched in 2002, the Cancer Fund's main aims are to assist patients in

Mdm Tan (top) is one of 25 patients who found hope in their cancer journey by undergoing a clinical trial financed by the NCIS Cancer Fund.

financial need, fund research in common cancers, assist in the development of services that will enhance cancer care in Singapore, and help keep our staff abreast of advances in cancer treatment.

Between April 2014 and December 2017, an estimated $1.6 million in financial assistance has been given to 337 patients. Our IP chemotherapy trial, which targets both ovarian and gastric cancers, has helped more than 60 patients since 2013, and NCIS is the seventh highest recruiting site for the study out of 57 international sites.

Training staff

The NCIS Cancer Fund also goes towards educating and training our staff. The Medical Education Fund, a part of the Cancer Fund, has benefitted 67 NCIS staff between April 2014 and December 2017.

One example is senior staff nurse Mr Andrew Ong from Oncology Nursing, who is pursuing a master's degree in counselling at the Singapore University of Social Sciences (SUSS).

The knowledge he has gained from his studies, which are fully funded by NCIS, has helped him extend better care to his patients. Mr Ong revealed an incident where an elderly patient broke down in tears on finding out he was diagnosed with cancer. The reason for his distress: the patient did not know how to break the news to his children.

To help him manage his fears, Mr Ong used a role-play method he learnt in cognitive behavioural therapy courses, where he pretended to be the patient's child and helped him rehearse sharing his diagnosis to his children.

"By the end of the hour, my patient felt confident enough to relay the news to his children and left for home feeling calm and in control," said the 37-year-old.

He added, "I've seen how our cancer patients benefit from having someone to share their concerns or emotions with. I plan to learn more about oncology nursing so as to provide holistic care to my patients."

Mr Andrew Ong is one of 67 NCIS staff who benefitted from the Medical Education Fund

Besides degree courses, staff are also given opportunities to attend short training sessions via the NCIS Cancer Fund Sponsorships, which cover conferences, seminars, workshops and courses on cancer treatments.

The future of the Fund

At NCIS, the life-saving work we do can often be costly, especially with experimental treatments and therapies that extend over longer periods. But a lack of funds should not prevent us from continuing our work, or for patients to stop receiving the treatment they require.

This year, as we mark our 10th anniversary, we aim to raise upwards of $1 million for the Cancer Fund through our NCIS10 celebrations. These included the NCIS Ribbon Challenge 2018, a public event organised in March with fundraising activities, as well as an upcoming fundraising gala dinner happening on 8 November this year.

"Cancer treatment is getting more effective, but also more expensive," said NCIS Centre Director, Professor Chng Wee Joo. "We want all patients, rich or poor, to get access to effective treatment."

The Fund will also be used to build and expand our signature research programmes in immunotherapy, early-phase clinical trials, personalised cancer treatments, and early detection and prevention.

Finally, we will continue to fund education for nurses and allied health professionals. "Cancer care is also rapidly evolving for these groups, but their training is not well funded, even though they play a critical role in patient care," said Prof Chng.

10 years on

EMBRACING LIFE

A cancer diagnosis marks a turning point in the lives of those diagnosed with it. These five cancer survivors are testament that there is hope and renewal after cancer

"IF YOU CAN HELP SOMEONE, REACH OUT – SEEING A SMILE ON THEIR FACE IS AWESOME."

Dave Cheow, 54
Logistics & Document Control Manager

In 2002, when Dave was diagnosed with stage 2 nasopharyngeal cancer – a rare type of head and neck cancer – it broke his spirit and made him ask, "Why me?" However, after 33 sessions of radiation therapy under a clinical trial, and with the support of the NPC Support Group, Dave managed to pull through – in 2009, he went into remission. Today, the father of twins sees life in a new light, cherishes his relationships more, and appreciates the positive in everything. Since 2012, Dave has also been leading the NPC Support Group, actively reaching out to survivors and their families by sharing his cancer journey and reassuring them that cancer is not a death sentence.

Wong Lee Pheng, 60
Start-up Owner

Lee Pheng was diagnosed with early stage endometrial cancer in September 2010. Given the treatment options, she went with robotic surgery because of its short downtime. She didn't require follow-up treatment, and after one year of regular check-ups, was cleared of cancer. Her experience has taught her to slow down and be less demanding on herself. She keeps busy by doing things she enjoys – her latest venture is with her husband, Christian, who has been her pillar of strength. They design and sell food waste recycling machines and systems. Although the business is still in its infancy, Lee Pheng is hopeful about playing a part in keeping the planet healthy for future generations.

"CANCER OR NO CANCER, WE ONLY LIVE ONCE."

Julie Seah, 69
Retiree / Homemaker

Julie was diagnosed with stage 2 breast cancer in 2002. As she had no family history of the disease, the diagnosis stunned her. But the then office administrator chose to remain upbeat throughout her treatment, which comprised surgery, five cycles of chemotherapy and 32 rounds of radiation therapy. During that period, Julie took comfort in the support of her family, especially her now late husband, Henry, who was her primary caregiver. He encouraged her to join a support group, which subsequently sparked her interest in volunteering. Today, as a grandmother of three, Julie finds immense joy caring for her family. She is also an active volunteer with the Breast Cancer Foundation and other cancer centres.

"BE A CANCER WARRIOR, HOLD ON AND 加油 (*JIA YOU*, PRESS ON)."

"THE DOCTORS AND NURSES ARE OUR WEAPONS AGAINST CANCER, – TRUST THEM."

Dinesh Kumar S/O Thangavelu, 42
Technical Officer

In 2008, a visit to the emergency room to seek treatment for his severe headaches and blurry right eye vision took an expected turn when tests revealed that Dinesh had acute lymphocytic leukaemia. The diagnosis hit him hard. However, as he thought about how his wife and two young children would carry on without him, Dinesh made the decision not to let cancer get the better of him for the sake of his family. In the same year, he underwent chemotherapy and a stem cell transplant, and though the treatment journey was challenging, he got through it with his family supporting him every step of the way. Dinesh has been cancer-free for 10 years now and is back to his normal life. Grateful for the second chance, his brush with the disease taught him a lesson that he carries with him daily. "Things happen for a good reason," he says. "Always remain strong and positive."

Helen Wong, 64
Retiree /Homemaker

In 2007, at the age of 53, Helen was diagnosed with stage 3 multiple myeloma. Multiple myeloma causes cancer cells to accumulate in the bone marrow where they crowd out healthy blood cells. This disease may also harm other tissues and organs, such as the kidneys. Overcome by shock and disbelief at her diagnosis, Helen worried over finances. Then she had to face the challenge of seven chemotherapy cycles followed by an autologous stem cell transplant in 2008. But the former real estate agent persevered and even continued to work remotely from home and the hospital, thanks to support from family, friends and the medical team. Finally in 2015, Helen was given the all-clear. Her encounter with cancer has been life-changing, inspiring her to help other cancer patients and survivors. She regularly visits cancer patients in hospitals or hospices, accompanying them for treatment and spending time with them. She is also a volunteer cooking instructor at the Singapore Cancer Society. Her advice to overcoming the odds? "Love yourself, and don't forget to allocate 'me time'. Motivate yourself – exercise, talk to people, eat your favourite food, and travel while you can."

"DO THINGS THAT MAKE YOU HAPPY, AND BE WITH PEOPLE WHO MAKE YOU HAPPY."

10 years on

GROWING WITH NCIS

With careers spanning a decade or more, 10 medical and healthcare staff talk about what keeps them committed to cancer care at the Institute

Dr Koh Wee Yao,
Radiation Oncologist
YEARS IN NCIS: 13

Dr Koh spent most of his housemanship in NUH after graduating from NUS, and it was in the oncology wards where he encountered the pain that cancer brings – the physical, emotional and financial strain. Treating patients of all ages with terminal cancer had a profound impact on him and stirred his interest in reading and understanding how it can be treated. He subsequently rotated through other hospitals, working in various speciality areas, but eventually returned to NCIS as a trainee in radiation oncology. Now, Dr Koh leads the radiation oncology team in neuro-oncology, attending tumour board meetings and determining appropriate treatment plans and doses. He spends the rest of his time doing research, running a nationally funded prospective trial in neuro-oncology imaging, as well as teaching undergraduates and post-graduates about radiation oncology. "The most satisfying thing about my job is being able to help those who initially decline treatment out of fear or because of financial constraints," he says.

Dr Lim Yi Wan,
Medical Oncologist
YEARS IN NCIS: 14

During her earlier years, Dr Lim's first experience with cancer was when a relative was diagnosed with the disease. The experience eventually led her to pursue a career in oncology where she hoped to treat and guide patients along their cancer journey. Dr Lim began her medical career as a registrar back in 2004, taking notes and learning from senior doctors. As the department expanded and patient load grew, she took on more responsibilities. Now, besides treating patients, she is also the department's safety officer, working with colleagues in other departments to ensure safety for our staff and patients. She says, "What is gratifying to me is seeing an improvement in a patient's quality of life when treatment works."

"WORKING AT NCIS IS A REWARDING JOURNEY THAT CHANGES YOUR APPRECIATION FOR LIFE."

Marini Binte Othman,
Senior Staff Nurse
YEARS IN NCIS: 12+

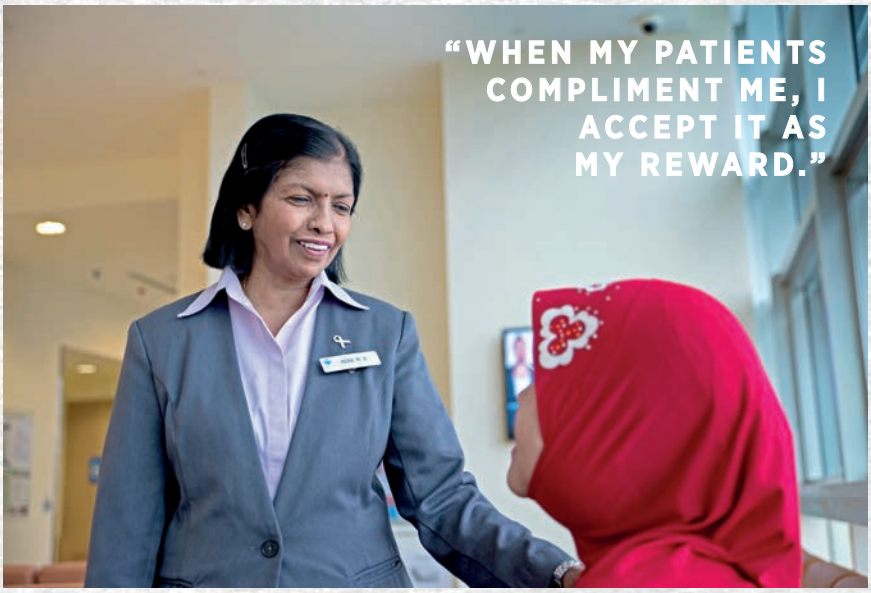
Marini started out as an inpatient nurse at a local hospital, but it was in 1997, when she started caring for patients who had had their cancerous tumours removed, that she started to develop a passion for oncology nursing. Three years later, Marini obtained an advanced diploma in oncology nursing from Nanyang Polytechnic to further her career. Her role today involves a lot of patient interaction and cross-departmental collaboration. Although it can get intense, Marini tries to stay focused, and makes it a point to balance the physical and emotional needs of her patients and their caregivers. "It's rewarding to work in the outpatient oncology setting as I feel I am doing something meaningful for someone. Plus, we work as a team, with physicians and nurses collaborating and management supporting our personal and professional growth." Looking ahead, Marini hopes to participate in and learn about more ground-breaking treatments.

Indra D/O Maruda Ramalingam,
Clinic Coordinator
YEARS IN NCIS: 21

Indra's experience as her father's primary caregiver after he was diagnosed with cancer in 1985 was what compelled her to work in a hospital to learn more about the disease. She first joined what was then The Cancer Institute @ NUH as a patient service associate. Since then, she has seen many changes, both in her responsibilities and the various clinics she has worked in. From managing a staff of three in a small clinic, Indra, who now works part-time, currently manages 20 frontline staff across an extensive clinic floor. The transition from paper to digital was especially exciting for her as it allowed her to develop her skills. Besides managing the clinic, Indra also mentors and leads junior staff. "I enjoy working at NCIS, especially interacting with young patients," she says. "Seeing the children recover gives me a lot of hope, and it has helped me develop patience and passion for my work. I enjoy serving my patients and ensuring their experience in the clinic goes smoothly."

Wong Yuet Peng,
Senior Principal Pharmacist
YEARS IN NCIS: 16+

It was fate that led Yuet Peng to work with cancer patients. Before joining NCIS, she was a ward pharmacist at another hospital, until one day, she met her current department head at a colleague's wedding. She was offered a job at NCIS that would see her move to a specialised area; Yuet Peng took that leap of faith, joined the oncology pharmacy division and has not looked back since. She now trains and manages a team of 33 staff comprising 20 pharmacists and 13 pharmacy technicians, oversees operations in the division and does resource planning. "What keeps me going is the close working relationship among teams across departments, and the opportunity to improve the health of patients."



"I AM HAPPY KNOWING THAT I AM ABLE TO MAKE A DIFFERENCE, REGARDLESS OF HOW BIG OR SMALL MY ACTION IS."

Eileen Tan,
Principal Enrolled Nurse
YEARS IN NCIS: 29

Entering nursing almost 30 years ago, Eileen eventually chose to specialise in oncology nursing in 1989 as she wanted the challenge of caring for cancer patients. As she gained experience and grew on the job, her perspective of nursing changed. "Nursing is not just a clinical role. There are emotions and bonds forged with patients," she says. Instead of setting professional boundaries, Eileen chooses to build trust and develop friendships with her patients, by lending a listening ear and interacting with them daily. Her passion for her work and close ties with everyone around her explain her long career with NCIS. "Being an oncology nurse is fulfilling, especially when patients return to pay us a visit after their discharge," she says. In all that she does, Eileen is inspired by a quote from musician Carlos Santana: "No act of kindness, no matter how small, is ever wasted, and there is no greater reward than working from your heart."

Fu Jinfeng,
Operations & Administration Manager
YEARS IN NCIS: 10

Jinfeng first joined The Cancer Institute @ NUH back in 2001 as a radiation therapist. After several years with the Radiation Therapy Centre, he decided to try something different and switched to the commercial sector instead. Eight years went by and along the way, Jinfeng found himself missing the personal connection with patients and the ability to help them. In 2012, he returned to NCIS and was put in charge of the day-to-day running of the Radiation Therapy Centre, where his past experience in treating patients gave him an advantage. Today, he manages NCIS' Cancer Centre. While operations work is different from his previous scope as a radiation therapist, Jinfeng finds it just as meaningful. "Previously, I used to focus very much on the clinical or technical part," he says. "Now, I look into matters like finance and logistics and for patients, these are important factors in determining their treatment options. My various experiences at NCIS have given me a better understanding of a patient's treatment journey."

"MY HOPE IS TO CONTINUE ENGAGING THE COMMUNITY IN HEALTH ADVOCACY."

A/Prof John Tam,
Senior Consultant
Division of Surgical Oncology (Thoracic Surgery)
YEARS IN NCIS: 11+

A/Prof Tam started out as a consultant specialising in thoracic surgery, but later decided to work with cancer patients at NCIS as well, as he understands the kind of holistic care and support they need. "NCIS has a team of multidisciplinary healthcare professionals who work well together to provide highly coordinated and personalised care for our cancer patients," he adds. Today, A/Prof Tam's clinic sessions have more than doubled from one per week, and he now performs between two to four surgeries weekly, while training the next generation of doctors and surgeons. Beyond clinical work, he is also involved in improving our systems and processes to advance patient care, and is active in public outreach to raise awareness so as to help prevent cancer. Despite his hectic schedule, A/Prof Tam finds his job exciting and fulfilling. "Helping patients treat their cancer successfully, facilitating a smooth journey in their overall care, and seeing them return to their normal lives with their loved ones – that's the greatest job satisfaction for me."

Yvonne Loh,
Senior Principal Radiation Therapist
YEARS IN NCIS: 16

Yvonne always knew that radiation therapy was the field she would build a career in. As a senior principal radiation therapist, she is in charge of clinic-related services in addition to her daily responsibilities of administering radiation treatment to patients. She is also heavily involved in grooming the next generation of radiation therapists – teaching students as an adjunct lecturer at the Singapore Institute of Technology, and providing in-house imaging training for radiation therapists. Yvonne credits the nurturing work environment at NCIS for keeping her motivated over the years. "It's a team-centric workplace that allows everyone to flourish!"

"I APPRECIATE BEING PART OF AN ORGANISATION THAT HAS 'HEART'."

Terina Tan,
Principal Medical Social Worker
YEARS IN NCIS: 10

Several cancer deaths in the family gave Terina first-hand experience of the pain and suffering that come with the disease. A firm believer in quality of life, she decided to develop her career in social work around cancer patients. In 2004, Terina joined NUH. At the time, her focus was mainly on helping patients with their financial issues. Her work today at NCIS is more expansive – she provides palliative support, helps with crisis cases, supports training and teaching for internal and external engagements and oversees the oncology team of medical social workers. While the team is larger, the number of patients have also increased significantly, with more younger patients coming in with complex psycho-social issues. Nonetheless, Terina welcomes the challenges. "There is increasing awareness of supporting patients psycho-emotionally, not just medically," she says. "I appreciate being part of an organisation that sees patients first as people. As much as we have an impact on the lives of patients and families, they also have an impact on us."

TUMOUR GROUP SPECIALISTS

BLOOD CANCERS AND BLOOD DISORDERS

Bone Marrow and Stem Cell Transplant Programme

Haematology-Oncology
A/Prof Koh Liang Piu (Lead)
Dr Michelle Poon
Dr Tan Lip Kun

Diagnostic Imaging
Dr Loi Hoi Yin

Radiation Oncology
Asst Prof Bala Vellayappan

Coagulation

Haematology-Oncology
Dr Chee Yen Lin
Asst Prof Liu Te Chih
Dr Lee Shir Ying
Dr Yap Eng Soo

General Haematology

Haematology-Oncology
Asst Prof Liu Te Chih (Lead)
Dr Joanne Lee
Dr Lee Shir Ying
Dr Ng Chin Hin
Dr Tung Moon Ley

Leukaemia, Myelodysplastic and Myeloproliferative Neoplasms (MDS /MPN)

Haematology-Oncology
Dr Ng Chin Hin (Lead)
A/Prof Koh Liang Piu
Adj Asst Prof Melissa Ooi
Dr Esther Chan
Dr Lui Pak Ling
Dr Tan Lip Kun
Dr Tung Moon Ley

Diagnostic Imaging
Dr Loi Hoi Yin

Pathology
A/Prof Ng Siok Bian
A/Prof Tan Soo Yong

Radiation Oncology
Asst Prof Bala Vellayappan

Lymphoma

Haematology-Oncology
Dr Michelle Poon (Lead)
Dr Esther Chan
Dr Chee Yen Lin
Dr Anand D Jeyasekharan
Dr Sanjay De Mel
Dr Joanne Lee
Dr Tan Lip Kun
Dr Wang Shi

Diagnostic Imaging
Asst Prof Arvind Kumar Sinha
Dr Loi Hoi Yin

Pathology
A/Prof Ng Siok Bian
A/Prof Tan Soo Yong
Dr Wang Shi

Radiation Oncology
Asst Prof Bala Vellayappan
Asst Prof Wong Lea Choung

Multiple Myeloma

Haematology-Oncology
Prof Chng Wee Joo (Lead)
Dr Sanjay De Mel
Dr Melissa Ooi

Diagnostic Imaging
Asst Prof Arvind Kumar Sinha
Dr Loi Hoi Yin

Pathology
A/Prof Ng Siok Bian
A/Prof Tan Soo Yong

Radiation Oncology
Dr Wong Lea Choung
Asst Prof Bala Vellayappan

BREAST CANCER

Surgical Oncology
Dr Chan Ching Wan (Lead)
A/Prof Mikael Hartman
A/Prof Philip Iau
Dr Shaik Ahmad Bin Syed Buhari
Dr Tang Siau-Wei

Diagnostic Imaging
A/Prof Quek Swee Tian
Dr Eide Sterling Ellis
Dr Pooja Jagmohan
Dr Jeevesh Kapur
Dr Premilla Pillay
Dr Felicity Pool

Haematology-Oncology
Prof John Eu-Li Wong
A/Prof Lee Soo Chin
Dr Joline Lim
Dr Lim Siew Eng
Dr Lim Yi Wan
Dr Samuel Ow
Dr Andrea Wong

Pathology
A/Prof Thomas Choudary Putti

Plastic, Reconstructive & Aesthetic Surgery
Dr Jane Lim
Dr Ong Wei Chen
Dr Yap Yan Lin

Radiation Oncology
Asst Prof Choo Bok Ai
Asst Prof Koh Wee Yao
Asst Prof Vicky Koh
Asst Prof Johann Tang

COLORECTAL CANCER

Surgical Oncology
Dr Cheong Wai Kit (Lead)
Asst Prof Chong Choon Seng
Asst Prof Tan Ker Kan
Dr Ridzuan Farouk
Dr Sharon Koh
Dr Lee Kuok Chung
Asst Prof Bettina Lieske
Dr Frances Lim

Diagnostic Imaging
Dr Bertrand Ang
Dr Thian Yee Liang
Dr Lynette Teo

Gastroenterology & Hepatology
Prof Lawrence Ho
Dr Bhavesh Kishor Doshi
Dr Calvin Koh
Dr Mark Muthiah

Haematology-Oncology
Dr Chee Cheng Ean
Dr Angela Pang
Dr Ho Jingshan
Dr Raghav Sundar
Dr Tan Hon Lyn
Dr Yong Wei Peng

Pathology
Prof Teh Ming
Dr Brendan Pang

Radiation Oncology
Asst Prof Francis Ho
Asst Prof Leong Cheng Nang
Asst Prof Jeremy Tey
Asst Prof Bala Vellayappan

GYNAECOLOGIC CANCER

Gynaecologic Oncology
A/Prof Jeffrey Low (Lead)
A/Prof Arunachalam Ilancheran
Dr Ida Ismail-Pratt
Dr Joseph Ng
Dr Pearl Tong

Diagnostic Imaging
Prof Joseph Lee
Dr Bertrand Ang
Dr Thian Yee Liang

Haematology-Oncology
Dr Lim Siew Eng
Dr Lim Yi Wan
Dr David Tan

Pathology
A/Prof Raju Gangaraju Changal
Dr Diana Lim

Radiation Oncology
Asst Prof Vicky Koh
Asst Prof Johann Tang

HEAD & NECK CANCER

Surgical Oncology
A/Prof Thomas Loh (Lead)
Dr Donovan Eu
Dr Goh Xueying
Dr Lim Chwee Ming
Dr Jane Lim

Diagnostic Imaging
Prof Vincent Chong
Dr Tan Ai Peng
Dr Jocelyn Wong

Haematology-Oncology
Adjunct Prof Goh Boon Cher
Dr Chong Wan Qin
Dr Tan Chee Seng

Pathology
A/Prof Fredrik Bengt Petersson

Radiation Oncology
Asst Prof Francis Ho
Asst Prof Vicky Koh
Asst Prof Ivan Tham
Asst Prof Wong Lea Choung
Dr Timothy Cheo

THYROID CANCER

Surgical Oncology
A/Prof Thomas Loh (Lead)
Dr Donovan Eu
Dr Lim Chwee Ming
Dr Ngiam Kee Yuan
Dr Rajeev Parameswaran
Dr Tan Wee Boon

Diagnostic Imaging
Asst Prof Arvind Kumar Sinha

Endocrinology
E/Prof Lim Pin
Asst Prof Samantha Yang
Dr Chionh Siok Bee
Dr Kao Shih Ling
Dr Eric Khoo
Dr Soh Lip Min

Haematology-Oncology
Adjunct Prof Goh Boon Cher

Pathology
A/Prof Nga Min En
A/Prof Fredrik Bengt Petersson

LIVER, PANCREATIC AND BILIARY (HPB) CANCER

Surgical Oncology
Dr Iyer Shridhar Ganpathi (Lead)
Prof Krishnakumar Madhavan
Dr Glenn Bonney
Dr Alfred Kow

Diagnostic Imaging
Dr Stanley Loh
Dr Kamarjit Singh Mangat
Dr Neo Wee Thong
Dr Prapul Rajendran
Dr Pavel Singh
Dr Bernard Wee
Dr Yeong Kuan Yuen

Gastroenterology & Hepatology
Prof Lawrence Ho
Prof Lim Seng Gee
A/Prof Dan Yock Young
Dr Bhavesh Kishor Doshi
Dr Michelle Angela Gowans
Dr Leo Hartono Juanda
Dr Calvin Koh
Dr Lee Guan Huei
Dr Lee Keat Hong
Dr Lee Yin Mei

Dr Kieron Lim
Dr Loo Wai Mun
Dr Low How Cheng
Dr Mark Muthiah
Dr Tan Poh Seng

Haematology-Oncology
Dr Chee Cheng Ean
Dr Ho Jingshan
Dr Raghav Sundar
Dr Tan Hon Lyn
Dr Yong Wei Peng

Pathology
Prof Aileen Wee
Dr Pang Yin Huei
Dr Benjamin Wong

Radiation Oncology
Asst Prof Francis Ho
Asst Prof Leong Cheng Nang
Asst Prof Jeremy Tey
Asst Prof Bala Vellayappan

LUNG / THORACIC CANCER

Haematology-Oncology
Dr Ross Soo (Lead)
Adjunct Prof Goh Boon Cher
Dr Huang Yiqing
Dr Tan Chee Seng

Surgical Oncology
A/Prof John Tam
Dr Harish Muthiah

Diagnostic Imaging
Asst Prof Arvind Kumar Sinha
Asst Prof Anil Gopinathan
Dr Loi Hoi Yin
Dr Stanley Loh
Dr Lynette Teo
Dr Bernard Wee

Pathology
Dr Seet Ju Ee

Radiation Oncology
Asst Prof Koh Wee Yao
Asst Prof Leong Cheng Nang
Asst Prof Ivan Tham

Respiratory & Critical Care Medicine
Prof Lim Tow Keang
A/Prof Lee Pyng
Dr Adrian Kee
Dr Khoo Kay Leong
Dr See Kay Choong

PROSTATE / UROLOGY CANCER

Surgical Oncology
Prof Kesavan Esuvaranthan (Lead)
A/Prof Edmund Chiong
A/Prof Tiong Ho Yee
Dr David Terrence Consigliere
Dr Lincoln Tan
Dr Wu Qing Hui

Diagnostic Imaging
Dr Bertrand Ang
Dr Wynne Chua
Dr Stanley Loh
Dr Edwin Siew

Haematology-Oncology
Prof John Eu-Li Wong
Dr Alvin Wong

Pathology
Prof Teh Ming
Dr Thomas Paulaj Thamboo

Radiation Oncology
Asst Prof Keith Lim
Asst Prof Jeremy Tey

UPPER GASTROINTESTINAL CANCER

Surgical Oncology
Prof Jimmy So (Lead)
E/Prof Ti Thiow Kong
Dr Kim Guo Wei
Dr Asim Shabbir

Haematology-Oncology
Dr Chee Cheng Ean
Dr Ho Jingshan
Dr Angela Pang
Dr Raghav Sundar
Dr Tan Hon Lyn
Dr Yong Wei Peng

Diagnostic Imaging
Dr Sheldon Ng
Dr Prapul Rajendran
Dr Pavel Singh
Dr Bernard Wee
Dr Yang Cunli
Dr Yeong Kuan Yuen

Gastroenterology & Hepatology
Prof Lawrence Ho
A/Prof Yeoh Khay Guan
Dr Bhavesh Kishor Koshi
Dr Calvin Koh
Dr Jonathan Lee
Dr Lim Li Lin
Dr Low How Cheng
Dr Mark Muthiah

Haematology-Oncology
Dr Chee Cheng Ean
Dr Angela Pang
Dr Ho Jingshan
Dr Raghav Sundar
Dr Tan Hon Lyn
Dr Yong Wei Peng

Pathology
Prof Teh Ming
A/Prof Nga Min En
Dr Jeffrey Lum
Dr Benjamin Wong

Radiation Oncology
Asst Prof Francis Ho
Asst Prof Leong Cheng Nang
Asst Prof Jeremy Tey
Asst Prof Bala Vellayappan

PAEDIATRIC HAEMATOLOGICAL MALIGNANCIES

Paediatric Haematology-Oncology
A/Prof Allen Yeoh (Lead)
Prof Dario Campana
A/Prof Quah Thuan Chong
A/Prof Tan Poh Lin
Dr Elaine Coustan-Smith
Dr Krista Francisco
Dr Miriam Kimpo
Dr Koh Pei Lin
Dr Mariflor Villegas
Dr Frances Yeap

Diagnostic Imaging
Dr Jeevesh Kapur

Pathology
A/Prof Tan Soo Yong

Radiation Oncology
Asst Prof Vicky Koh
Asst Prof Johann Tang

BRAIN CANCER

Neurosurgery
A/Prof Yeo Tseng Tsai (Lead)
A/Prof Chou Ning
Dr Sein Lwin
Dr Vincent Nga
Dr Teo Kejia

Diagnostic Imaging
Asst Prof Eric Ting
Dr Choong Chih Ching
Dr Tan Ai Peng
Dr Jocelyn Wong

Haematology-Oncology
Dr Chong Wan Qin
Dr Andrea Wong

Pathology
Dr Tan Char Loo

Radiation Oncology
Asst Prof Koh Wee Yao
Asst Prof Bala Vellayappan
Dr David Chia

MUSCULOSKELETAL CANCER / SARCOMA

Hand & Reconstructive Microsurgery
Dr Mark Puhaindran (Lead)
E/Prof Robert Pho

Orthopaedic Surgery
Dr Gurpal Singh

Diagnostic Imaging
A/Prof Quek Swee Tian
Asst Prof Arvind Kumar Sinha
Dr Sachin Agrawal
Dr Louise Gartner
Dr James Hallinan
Dr David Sia
Dr Salil Singbal

Haematology-Oncology
Dr Angela Pang

Paediatric Haematology-Oncology
A/Prof Quah Thuan Chong

Pathology
Dr Victor Lee

Radiation Oncology
Asst Prof Wong Lea Choung
Asst Prof Choo Bok Ai
Dr Timothy Cheo
Dr Ooi Kiat Huat

SUPPORTIVE & PALLIATIVE CARE

Palliative Care
Dr Noreen Chan (Lead)
Dr Yong Woon Chai

Psychological Medicine
A/Prof Rathi Mahendran

Radiation Oncology
Asst Prof Wong Lea Choung

CANCER RISK ASSESSMENT AND GENETICS CLINIC

Haematology-Oncology
A/Prof Lee Soo Chin (Lead)
Dr Samuel Ow

DEVELOPMENTAL THERAPEUTICS UNIT (DTU)

Haematology-Oncology
Adjunct Prof Goh Boon Cher (Lead)
Prof Chng Wee Joo
A/Prof Lee Soo Chin
Dr Chee Cheng Ean
Dr Joline Lim
Dr Ross Soo
Dr Raghav Sundar
Dr David Tan
Dr Andrea Wong
Dr Yong Wei Peng

A SPECIAL EDITION OF SPARK BY NCIS