

ASIA'S FIRST UNDER-ONE-ROOF NUTRITIONAL RESEARCH CENTRE SET UP IN SINGAPORE

Singapore to be hub in Asia for nutritional sciences with state-of-the-art Clinical Nutrition Research Centre

1. The Clinical Nutrition Research Centre (CNRC)– a \$20 million joint-venture by the Agency for Science, Technology and Research (A*STAR) and National University Health Systems (NUHS)– is the most comprehensive centre in Asia that will conduct nutritional studies to understand the causes of metabolic diseases such as diabetes and obesity, and develop products and formulate diets that can reduce the risks of these diseases. CNRC will also conduct studies in research areas such as nutrition in women, children and the elderly, and body weight control (Detailed in Annex A).
2. As the first centre in Asia to have under-one-roof capabilities to perform research across the food chain and at all levels from the cellular level to whole-body nutrition, the CNRC will play an integral role in developing Singapore as a major hub for food and nutrition research. Having developed a strong base of R&D capabilities, Singapore is already home to some of the world's largest nutrition companies who have set up R&D centres here (Detailed in Annex B) to access Asian markets by tapping on Singapore's access to various ethnicities. Since CNRC's inception in late 2012, several collaborative projects with various food & nutrition companies have already been clinched. Our industry partners include BENEIO Asia Pacific, Danone, DSM, Nestlé and Mead Johnson.
3. Mr Lim Chuan Poh, Chairman A*STAR said, "A*STAR, working closely with our partners from NUS and NUHS and the wider research community, has made Singapore an attractive and competitive location for food and nutrition research. Last week, we announced a new partnership with the largest food and nutrition company in the world, Nestlé. This new research collaboration will bring together capabilities and expertise from both sides in a complementary way to design better products for the consumers."
4. Besides having a network of industry contacts and collaborations, CNRC has a range of important academic collaborators, such as Yong Loo Lin School of Medicine, National University of Singapore (NUS), and Monell Chemical Senses Center – the

world's only independent, non-profit scientific institute dedicated to sensory science (particularly for taste and smell). Other notable academic collaborators include the EpiGen Consortium¹, which focuses on discovering mechanisms underlying the interaction between the environmental factors and genetic processes which influence health and the risk of disease across the life-course. In addition, the centre will leverage upon existing partnerships between A*STAR and NUHS, such as the Singapore Centre for Nutritional Sciences, Metabolic Diseases, and Human Development (SiNMeD) initiative. This enables interdisciplinary research in the basic sciences as well as clinical studies in human nutrition. This encompasses the formulation of food ingredients, to diet interactions that will ultimately affect health outcomes, food policies, and food manufacturing practices.

5. Associate Professor Chong Yap Seng, Founding Director of SiNMeD, said, “One of the approaches we are taking in SiNMeD is to see how we can modify factors like pre-pregnancy, pregnancy, and early life nutrition and lifestyle to promote health and prevent disease, especially non-communicable diseases like obesity and diabetes. The CNRC will bring new precision to our understanding of how food can be used for good.”

6. The prevalence of diabetes in the adult population in Singapore has increased from 9% in 1998 to 11.3% in 2010², while that for obesity has increased from 6% to 10.8%. These studies could thus impact health outcomes and aid policy-makers in the challenges they face in reversing obesity and other metabolic diseases. The cumulative cost of all non-infectious diseases, for which obesity is a leading risk factor, was estimated to be about US\$1.4 trillion in 2010³. It is important to reduce economic costs through promoting a change in eating habits, hence enhancing nutrition in food systems.

7. Research on the nutritional needs and preferences of Asians is currently lacking. CNRC aims to fill this gap by applying cutting-edge nutritional science to deliver new and innovative solutions catered to the Asian population, to enhance health and well-being. Due to prevalence of obesity and Type II diabetes in Singapore and the region, one of major areas CNRC will concentrate its research efforts on these themes, focusing on how appetite is controlled, and how diets can be optimized to maximize weight loss and weight maintenance. Some products currently in development include

¹ An international alliance of the world's leading epigenetics researchers from A*STAR's Singapore Institute for Clinical Sciences, National University of Singapore, University of Southampton, Medical Research Council- Lifecourse Epidemiology Unit, AgResearch Limited, Auckland UniServices Limited

² [National Health Survey 2010](#), Epidemiology & Disease Control Division, MOH

³ [The State of Food and Agriculture](#), Food and Agriculture Organization of the United Nations

foods that will enable diabetics to lower their blood glucose, and specialised foods for the elderly to enhance cognition and palatability.

8. Professor Jeyakumar Henry, Director of CNRC, said, “The CNRC is a one-stop research centre that applies state-of-the-art technology to address contemporary nutritional issues. I am confident that the research and technological expertise that we have here will provide deep and clear dietary solutions to nutritional problems amongst Asians.”

9. CNRC is helmed by Professor Jeyakumar Henry, along with A/P Melvin Leow Khee Shing, who is the Deputy Director of CNRC. A Steering Committee has also been put together to set the overall direction and strategy of CNRC (See Annex C). CNRC will also be a magnet for attracting the best young trainees and established nutritionists interested in nutritional science, and a platform for training up and developing a talented workforce in this field. There are plans to offer a postgraduate programme (PhD) in Nutritional Sciences, with CNRC being the core facility in this programme.

10. Said Professor Tan Chorh Chuan, Chairman, NUHS, “The CNRC brings together researchers across a broad spectrum of disciplines from the basic sciences in A*STAR and NUS, to clinical nutrition and medicine in NUHS. Together with the state-of-the-art infrastructure, this would enhance the translation of basic science discoveries into novel and useful clinical applications for the improvement of health, and the prevention of disease and medical complications. The key is to grow highly competitive clinical research in nutritional science and to build the nutrition and food industries in Singapore.”

11. The CNRC is fully-equipped with state-of-the-art facilities to conduct its nutritional studies. One of this is a whole-body calorimeter (detailed in Annex D), which measures energy intake and output of an individual. The Centre is the first in Asia to have two such whole-body calorimeters, where an individual can live and carry out all normal daily activities in the comfort of a room while their energy expenditure is being continually measured. Studying an individual’s detailed energy expenditure could provide better understanding of how food and physical activity affect one’s ability to maintain body weight. Changes in metabolic function could also be monitored to uncover relationships with metabolic illnesses such as diabetes and obesity, thus potentially allowing for the development of new treatments and drugs for these metabolic disorders.

12. Other facilities in the Centre include a laboratory for chemical analysis of food and a dedicated product development kitchen, booths for sensory analysis of food as

well as for computer-based cognitive testing of subjects, and laser body imaging for volume determination (See Annex D).

Enclosed:

Annex A- CNRC Priority Research Themes

Annex B- Top F&N Companies With R&D Base In Singapore

Annex C- Leadership at CNRC

Annex D- CNRC Facilities

For media queries and clarifications, please contact:

Ms Vithya Selvam

Senior Officer, Corporate Communications

Agency for Science, Technology and Research

Tel: (+65) 6826 6291

Email: vithya_selvam@a-star.edu.sg

Ms Dawn Sim

Assistant Director, Communications Office

National University Health System

Tel: (+65) 6772 3989

Email: dawn_sim@nuhs.edu.sg

About the Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is Singapore's lead public sector agency that fosters world-class scientific research and talent to drive economic growth and transform Singapore into a vibrant knowledge-based and innovation driven economy.

In line with its mission-oriented mandate, A*STAR spearheads research and development in fields that are essential to growing Singapore's manufacturing sector and catalysing new growth industries. A*STAR supports these economic clusters by providing intellectual, human and industrial capital to its partners in industry.

A*STAR oversees 18 biomedical sciences and physical sciences and engineering research entities, located in Biopolis and Fusionopolis, as well as their vicinity. These two R&D hubs house a bustling and diverse community of local and international

research scientists and engineers from A*STAR's research entities as well as a growing number of corporate laboratories.

Please visit www.a-star.edu.sg

About the Singapore Institute for Clinical Sciences (SICS)

Established in 2007, the Singapore Institute for Clinical Sciences (SICS) is a research institute within the Agency for Science, Technology and Research (A*STAR), and its mission is to develop clinical and translational research programmes in key disease areas.

SICS is distinguished by its focus on clinical sciences and the use of innovative approaches and technologies that enable the efficient and effective study of human health and diseases. The clinical scientists in SICS conduct the full spectrum of "bench to bedside" research activities in metabolic diseases (including diabetes, obesity and insulin resistance), pathways to normal growth and development (including cognitive and behavioural development), and nutritional sciences. The institute aims to attract, train and nurture clinician-scientists and to develop joint programmes with universities, academic medical centres, government hospitals and research institutes.

For more information on SICS, please visit: www.sics.a-star.edu.sg.

About the National University Health System (NUHS)

The National University Health System (NUHS) groups the National University Hospital (NUH), the NUS Yong Loo Lin School of Medicine, the NUS Faculty of Dentistry and the NUS Saw Swee Hock School of Public Health under a common governance structure to create synergies for the advancement of health by integrating clinical care, research and education.

The enhanced capabilities and capacity enable the NUHS to deliver better patient care, train future generations of doctors more effectively and bring innovative treatments to patients through groundbreaking research.

For more information about the NUHS, visit www.nuhs.edu.sg

ANNEX A: CNRC PRIORITY RESEARCH THEMES

1. Obesity and Type II Diabetes

Due to the significant public health relevance of obesity and Type II diabetes, the CNRC will concentrate its research efforts on these themes. This strategic priority seeks to build our expertise and innovation in order to deliver solutions and commercial opportunities to combat these two growing public health concerns. Our research will focus on understanding how food components and food ingredients influence glucose expenditure. We also aim to understand how the structure of food (carbohydrates, proteins and fats) influences metabolic outcomes. A key area of research will be to understand how blood glucose can be modulated to minimize spikes in blood glucose level, thus reducing the risk of diabetes.

2. Regulation of bodyweight

As the public is getting more conscious in dieting – through the suppression of appetite to lose weight, CNRC is seeking to identify the neural and cognitive mechanisms that may predict risk for the development of obesity. This research study identifies the factors that underlie individual differences in feeding behaviour and weight regulation, and establish the neural processes underlying individual differences in (a) sensitivity to foods, (b) self-control in food selection, and (c) sensitivity to the feeling of fullness.

3. The Senses (Taste, Smell, Sight) and Nutrition

CNRC will be working together with United States' Monell Chemical Senses Centre to carry out research on human nutritional sensory sciences. Our major aim is to understand the mechanisms and functions of taste and smell and how these senses relate to human health.

4. Women and children's nutrition

Although women represent approximately 50% of the global population, basic and applied research on their nutrient needs are scarce. Research on Asian women is even more limited. A major focus of our research on women will be to understand the significance of the menstrual cycle on energy regulation, appetite control, protein metabolism and nutrient losses. In pediatric nutrition, we are interested to study how early nutrition impacts health and the risk of metabolic disease later in life.

5. Nutrition in the elderly

The global population is experiencing a dramatic increase in the number of elderly. Singapore is no exception. Aging research within CNRC will concentrate on how to optimize nutrient needs in the elderly in order to maximize physiological function, and also investigate how food intake and appetite may be enhanced during the aging process.

ANNEX B: TOP F&N COMPANIES WITH R&D BASE IN SINGAPORE

Leading food and nutrition companies have made Singapore their base for Research and Development. These companies include:

- Abbott

Abbott opened its US\$20million investment, an Asia Pacific R&D Centre in Singapore on May 2010. It was Singapore's first nutrition R&D centre at that point of time.

This Singapore R&D centre is Abbott's largest nutrition R&D facility outside of the United States. It houses about 65 scientists and is involved in developing new food ingredients and food flavours to address critical nutritional challenges, dietary needs and the ever-changing taste preferences of Asia-Pacific consumers.

- Danone

Opened in 2011, the Nutricia Research Centre Singapore (then Danone Research Centre for Specialised Nutrition) is the first in Asia Pacific focusing on child and maternal health – especially on the impact of nutrition on: gut bacteria, immune system and overall growth, and development of babies and children.

- Kellogg

In 2013, the world's largest manufacturer of ready-to-eat breakfast cereals and second largest producer of savory snacks, cookies and crackers decided to make Singapore its regional headquarters and savoury snacks R&D centre for Asia Pacific. The R&D centre will focus on food, flavour and packaging developments, as well as nutrition and sensory science.

- Mead Johnson

Mead Johnson has invested US\$325m to develop a manufacturing plant and a Pediatric Nutrition Institute (PNI) in Singapore. Expected to open in 2014, the facility will study pediatric nutrition and expand its capacity to produce leading infant formulas in the heart of the growing Asian market.

- Mondelez International

Mondelez International houses its R&D Centre of Excellence for Indulgent Candy in Jurong. It is responsible for research of the company's top brands, including *Cadbury*. Established with the support of the Economic Development Board Singapore in 2006, this facility brought more than S\$5 million in cumulative investments to Singapore to date.

- Nestlé
Nestlé Singapore R&D centre is the global lead for the company's innovations in their F&N products – *Milo* and *Nescafe*. The centre specialises in fields such as mechanical engineering, analytical chemistry, microbiology and sensory science. One of its main objectives is to ensure that nutrition and health are integral considerations in new product development.
- Royal Friesland Campina
Friesland Campina launched their Development centre in Science Park on September 2013. The centre focuses on: (1) developing dairy-based beverages and infant and toddler nutrition that suit Asian consumers' palate, and (2) addressing consumers' specific nutritional requirements.

ANNEX C: LEADERSHIP AT CNRC

DIRECTORS



**PROFESSOR CHRISTIANI JEYA HENRY
DIRECTOR (CLINICAL NUTRITION RESEARCH CENTRE)**

Professor Christiani Jeya Henry initially trained as a Food scientist and subsequently obtained his MSc and PhD in Nutrition from the London School of Hygiene and Tropical Medicine. He was instrumental in the development & launch of UK's First dedicated Functional Food Centre. He was Head of Food Sciences and Nutrition at Oxford Brookes

University, and Director of the Functional Food Centre in Oxford. Professor Henry has served on several committees including UK committee on medical aspects of food & nutrition policy (COMA) panel on Novel Foods, Board member of the UK Food Standards Agency and currently a member of the general Advisory Committee on Science of the Food standard agency. He also served as a panel member of Department for International Development Health & population research committee, Member of the research panel of UK Crop post harvest Technology. He was Royal Society visiting professor at the Chinese university of Hong Kong & continues to remain a visiting professor at the same university.

He was also a member of the recent Joint FAO/WHO consultation on fats and fatty acids in human nutrition. He has also acted as a consultant to FAO, WHO & UNICEF. He regularly acts as a consultant to Global food Companies on aspects of food product development with special reference to Nutrition. His major research interests are in Energy regulation, Functional Foods, Obesity, Glycaemic index, energy and protein metabolism and nutrition in the elderly. He is Editor-in-Chief of the International Journal of Food Sciences and Nutrition. He has presented over 200 lectures around the world and in 2010 was awarded the British Nutrition Foundation prize for his outstanding contribution to Nutrition. He is Fellow of the UK Institute for Food Science & technology & is a registered Public Health nutritionist In June 2011 he was appointed as Director of Clinical Nutrition at Singapore Institute of clinical Science to spearhead the translation of Nutrition research into food applications. His works are highly recognized internationally – in 2012, the UK government and the European Union decided to use the “Henry equation” to predict basal metabolic rate. These equations will be used to estimate basal metabolic rate (BMR) and energy needs worldwide.

ANNEX C: LEADERSHIP AT CNRC

DIRECTORS



ASSOCIATE PROFESSOR MELVIN LEOW KHEE SHING DEPUTY DIRECTOR (CLINICAL NUTRITION RESEARCH CENTRE)

Melvin Leow is a senior consultant endocrinologist who is an elected fellow of the American College of Endocrinology, the American College of Physicians, the Royal College of Physicians of Edinburgh and the Academy of Medicine (Singapore). He is a clinical faculty member of the Yong Loo Lin School of Medicine at NUS where he is clinical associate professor and is also an adjunct associate professor at Duke-NUS Graduate Medical School. A/Prof. Leow is a member of the Department of Endocrinology at Tan Tock Seng Hospital since 1999. His field of interests includes the endocrine manifestations of systemic disorders, thyroidology, developmental origin and epigenetics of metabolic diseases, mathematical modeling of endocrine physiology, drug-induced/paraneoplastic endocrinopathy and endocrine neoplasms, in which he has published works in both local and international refereed journals. His achievements include the NHG Doctor Award, Researcher-Investigator-Scientist Enabler (RISE) Award, Investigator-Clinician Award, Best Teacher Award and the Dean's Award for Teaching Excellence.

His research activities entail clinical physiological studies which have the collective goal of understanding better the contribution of developmental factors to the emergent pattern of metabolic disease in the different ethnic populations in Singapore. His expertise lies in the understanding of the control over energy balance, neuroendocrine function and metabolism that is exerted through the critical centers of the brain and feedback loops involving the intricate network of the gastrointestinal tract, pancreas, adipose tissue, liver, muscles and thyroid.

ANNEX C: LEADERSHIP AT CNRC

STEERING COMMITTEE

A Steering Committee (SC), comprising three SICS appointees and one NUHS appointee was put together to set the overall direction and strategy of the CNRC. The CNRC SC includes the following members:

 <p>CHAIRMAN</p>	<p>Sir Professor Peter Gluckman Chief Scientific Officer Singapore Institute for Clinical Sciences</p>
 <p>MEMBER</p>	<p>Professor Ravi Kambadur Senior Principal Investigator, Singapore Institute for Clinical Sciences Professor, School of Biological Sciences College of Science, Nanyang Technological University</p>
 <p>MEMBER</p>	<p>Dr Tan Sze Wee Deputy Executive Director, Biomedical Research Council Agency for Science, Technology & Research</p>
 <p>MEMBER</p>	<p>A/Prof Tai E Shyong Head & Senior Consultant, Division of Endocrinology National University Hospital Associate Professor, Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore</p>

ANNEX D: CNRC FACILITIES

CNRC boasts a wide range of cutting-edge equipment and facilities for nutritional research. This includes the following:

No.	Facility	Description
1	Consultation room	<ul style="list-style-type: none"> To assess participants' suitability to the study through a set of inclusion and exclusion criteria
2	Anthropometry room	<ul style="list-style-type: none"> Assess physical measurements: weight, height, waist circumference, BMI, and skinfold thickness
3	Food analysis lab	<ul style="list-style-type: none"> Analysis of protein, carbohydrates, moisture and fat in food, drinks and biological samples
4	Suites with Indirect Calorimeter	<ul style="list-style-type: none"> For overnight studies To measure Resting Energy Expenditure Identifies metabolism, carbohydrate and fat use, allowing improved nutrition and evaluation of nutritional therapies
5	DEXA scan room	<ul style="list-style-type: none"> Non-invasive method to measure total body composition eg. percentage of body fat.
6	BodPod	<ul style="list-style-type: none"> Uses air Displacement Plethysmography technology, considered the "Practical Gold Standard" in body composition assessment We also have a paediatric BodPod for measurements in children
7	Roche Cobas machine	<ul style="list-style-type: none"> Measurement of metabolites, amino acids using immunology
8	IR Camera room	<ul style="list-style-type: none"> Taking heat-producing images and correlating this to the amount of brown adipose tissue, insulin sensitivity.
9	Glycaemic index testing room	<ul style="list-style-type: none"> To measure blood glucose response to carbohydrate-rich foods
10	Sensory booths	<ul style="list-style-type: none"> Investigation of how taste, odour, colour and texture play a part in food intake, satiety and appetite Lighting colours of booths: white, green, blue, red

ANNEX D: CNRC FACILITIES

11	Whole body calorimeter	<ul style="list-style-type: none">• Measures total energy expenditure (resting and non-resting//dynamic state), evaluates ability to burn different fuels.• Carbon Dioxide produced and Oxygen consumed by the volunteer to be very accurately measured; these quantities make it possible to determine a subject's energy expenditure. This is combined with additional measurements (urine and fecal samples – can be freeze-dried) to determine the type of macronutrients (e.g. fat, carbohydrates or protein) that are used to create that energy.• First in Asia to have a <i>dual</i> whole-body calorimeter
12	Food development kitchen	<ul style="list-style-type: none">• A fully-equipped kitchen (with stoves, table tops and utensils) –dedicated to the development of new food for subject testing and tasting

ANNEX D: CNRC'S WHOLE BODY CALORIMETER

Whole-body calorimetry is best known for assessing human energy balance, based on the oxygen consumption and carbon dioxide production from the subject in the study. It is a key instrument to understand how best to manage obesity and related disorders common in today's society.

Here at CNRC, we have dual units of Whole-Body Calorimeter, where two subjects' energy expenditure can be studied simultaneously under varying conditions and durations.

Each unit, providing a living space of 12 cubic metres for a single user, is furnished with wooden wall panels, bedding, television, computer, a portable toilet, and three windows. Subjects are able to stay for extended periods beyond 24 hours comfortably. Meals are catered for, and our research personnel specially prepare each meal with careful measurement of the food content. Automated climate regulation is installed and gas analyzers are attached to the unit to measure oxygen consumed and carbon dioxide produced.



Fig.1.1 Calorimeter's Exterior



Fig.1.2 Calorimeter's Interior

ANNEX D: CNRC'S WHOLE BODY CALORIMETER



Fig 2.1. Gas processing and analysis units linked to a data acquisition computer