School of Applied Science **Biennial Report 2017**

Temasek POLYTECHNIC | School of Applied Science

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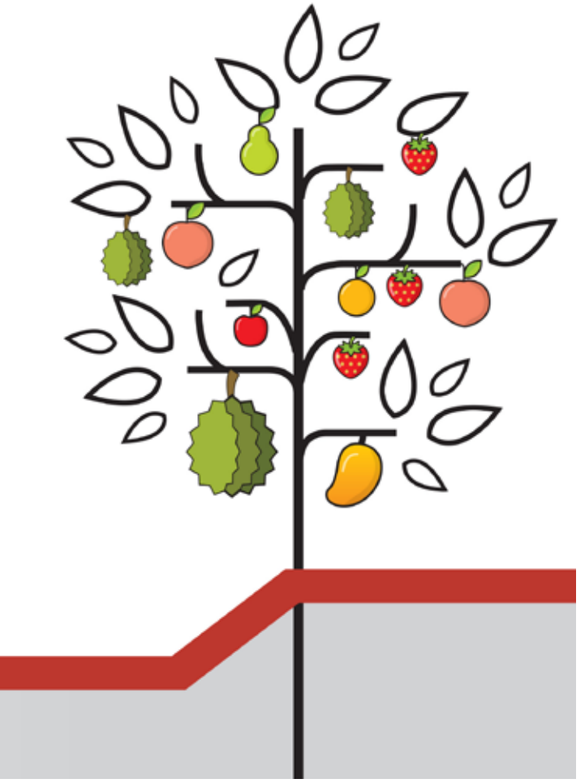
School of Applied Science

Biennial Report 2017

Making Your Business Better



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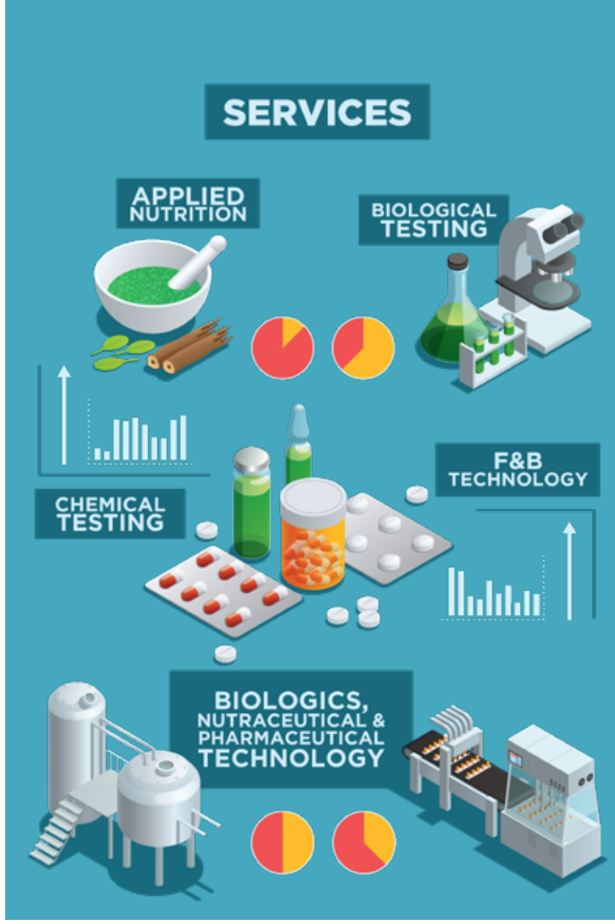


PARTNER US.

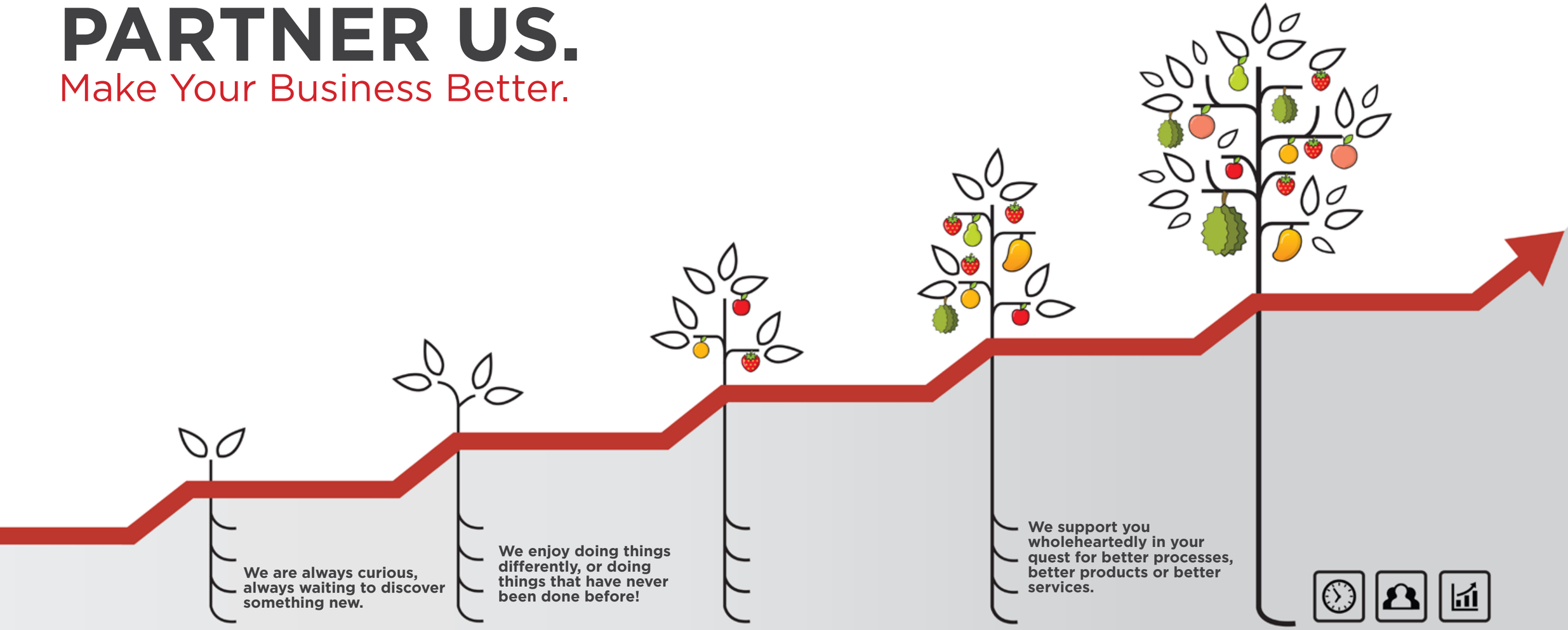
Make Your Business Better.

Vision

To be a leading centre for training, education and applied research in the chemical and life sciences.

Mission

To continuously seek innovative ways to train and educate school leavers and the workforce, and to carve niche applied research areas that will benefit students, industry and the community.



MESSAGE FROM PRINCIPAL & CEO

Mr Peter Lam

Over the years, the polytechnics are increasingly becoming a rich nexus of research partnerships with the industry. Here at the School of Applied Science (ASC), we have partners from the private, public and people sectors, working closely with us to create new intellectual properties (IPs), enhance productivity or develop capabilities.

As the push for an innovation-driven economy gains greater momentum, ASC is set to play an expanded role in training and developing talent and skilled manpower for Singapore and to help the industry to be more competitive.

A close partnership between Temasek Polytechnic (TP) and the industry can reap many benefits for both parties. For TP, we can better identify trends for manpower training purposes and ensure that our staff remain relevant and up-to-date with industry developments. For the industry, it can have access to lecturers with industry expertise and knowledge, well-trained students to support industry activities and well-equipped testing laboratories and facilities, such as the Centre of Innovation for Complementary Health Products and the Centre for Aquaculture and Veterinary Science. Through such close working relationships, we can gain unique perspectives and new understandings, which in turn lead to exciting new opportunities.

Indeed, we see many such opportunities being created through the collaboration between ASC and the industry. Scientists and researchers at the School have been integrating and pooling together their technical competencies to develop innovative solutions for our partners. Today, ASC has a strong track record in providing technical solutions to industry partners across multiple industries, such as in aquaculture, traditional Chinese medicine, functional foods, and the biologics, nutraceutical and pharmaceutical industries. In the past 2 years, ASC provided consultancy and services to 83 companies and organisations.

ASC has made significant developments in research, particularly in the areas of agri-food technology, applied diagnostics and sustainable resources. For example, through our collaboration with DSO National Laboratories and the Environmental Health Institute of the National Environment Agency, ASC has developed a novel method to detect biological contaminants in food within two hours instead of two days, without the need for expensive laboratory equipment. This rapid diagnosis method is a potential game-changer in the field of public health. To date, ASC has developed IPs that benefitted several companies and organisations through licensing arrangements or spin-offs.

Another important mode of collaboration with the industry is through Continuing Education and Training (CET). ASC works closely with industry partners to support the training needs of their staff, and equip the staff with the latest skills to be even more effective at the workplace. The School is also leveraging the expertise of our partners to jointly design and deliver CET programmes to meet industry's needs. One such partner is the American Society for Clinical Pathology. Plans are under way to offer various customised courses conducted by the School and our partners.

Collaboration is crucial to success. Today's world requires it. When we work together, both TP and our partners can leverage resources, creativity and experience. Together, we and our partners are able to innovate much more quickly, and arrive at a solution in less time. For this reason, we welcome every opportunity to strengthen our existing relationships, and to develop new ones locally and worldwide.

To our existing partners, thank you for the opportunity to work with you and create value for your organisation. We hope to continue and expand our partnership with you. To potential partners, please feel free to contact us to see how we can collaborate, and support you in your organisation's growth.

INTERVIEW WITH CHAIRMAN

School Advisory Committee

Mr Andrew Tjioe

PRESIDENT / CEO
TUNG LOK RESTAURANTS (2000) LTD

Powering Through Uncertain Times With Industry

How is the school impacted by the quest to reinvent Singapore's economy?

The call by the government for workers to actively upgrade their skills, and employers to redesign jobs and develop talent, has been a headline-grabber as Singapore seeks once again to transform its economy in the face of global uncertainties. The unprecedented confluence of technological, political and economic trends today gives the call a heightened sense of urgency.

An educational institute such as ASC must have a 'business unusual' approach, because business as usual will no longer serve us. Our responsibility today is to take the issue of employability seriously, and this calls for a massive mind shift in the curricula and its delivery, as well as the staff delivering it. Skills such as complex problem solving, critical thinking and creativity continue to be valued by employers. However, when we talk of employment vis-à-vis employability, it is the technical skills profile of graduates that must be the yardstick.

Today, our top priority, in order to contribute to the transformation and reinvention of Singapore's economy, is to ensure the employability of our graduates. Employability must be preceded by the learning of the right skills, followed by an individual's continuing journey of deepening those skills over his lifetime.

In partnering ASC, TungLok is able to provide the students with real-life experiences in a commercial kitchen and the restaurant, and this enables them to put into practice the theories taught in school. This is our way of grooming talents for the future.

> **"ASC has a powerful capacity to create value and to make your business better."**

Are our graduates ready for the heightened uncertainty ahead?

No one can be fully ready for an uncertain future, but it is important that the school is confident, and the learning attitude students have cultivated in their three years here will ensure that they continue to learn how to learn.

The ASC diploma courses which the school offers are comprehensive programmes which equip students with a strong theoretical foundation, and also hands-on experiences which prepare them well for the working world. The school's approach of building a good foundation from the very beginning, moving on to strengthening the understanding of key concepts, and finally to practical application of their learning, gives the students a good head start in their career.

How would you rate the school's results over the past few years?

For Singapore to stay competitive, the government has emphasised the need to be more productive, innovative and adaptable, and constantly develop new and better ways of doing things. We will look at ASC's results in this context.

In fulfilling its mission, ASC has shown a tremendous commitment to fostering innovation, and to doing things differently to benefit its stakeholders. With its relatively small staff strength, the school bagged almost $2.9 million in external research grants in 2017 alone. In terms of projects and consultancy, the total value in 2017 was more than $600,000.

These figures speak for themselves. They are a good indication of the kind of research work happening in the school across thirteen domain areas. From aquaculture health and disease management, to bringing healthier convenience food products to the masses, or developing a quick and novel method to certify antioxidant products, ASC's scientists are translating research into concrete innovation that benefit enterprises. More importantly, this dramatically changes the trajectory of student learning as I have explained earlier, deepening their professional competencies right from the start even before they begin employment. A good example is Siti Anisah, a graduate of the Diploma in Applied Food Science and Nutrition. Siti's deep learning and training at ASC gave her an advantage – she went on to take up the SkillsFuture Earn and Learn Programme (Advanced Diploma in Applied Food Science). Her results were very impressive and the company decided to sponsor her for further studies in Food Technology at Singapore Institute of Technology. There are many more success stories like Siti, and they are all a testament to the school's good performance.

In conclusion, let me congratulate the School's management, staff and students for their hard work and achievements over the past two years. ASC has a powerful capacity to create even more value and to make businesses better!

INTERVIEW WITH DIRECTOR

Dr Lee Chee Wee

DIRECTOR / SCHOOL OF APPLIED SCIENCE

In Industry, For Industry: **Deepening Engagement for a Sustainable Future**

The School of Applied Science (ASC) is entering its eighteenth year. Has its vision and mission changed since 2000?

A lot has changed in the last 18 years. New technologies which are shaping the economy of the future are transforming the world of work, and demand new knowledge and skills in the years ahead. Artificial intelligence, cell therapy, gene editing, blockchain technology and new advances in data science are disrupting life as we know it, and at the same time opening up new possibilities in various aspects of life.

However, ASC's vision to be a leading centre for training, education and applied research in the chemical and life sciences has not changed. In fact, today more than ever, it is an important road map that sets a defined direction for our growth, and guides our transformation. Likewise, our mission statement encapsulates our purpose as an institute of higher learning (IHL), with the end goal of benefiting students, industry and the community.

The Singapore economy has gone through massive transformations over the decades, and whilst our purpose remains unchanged, we must be nimble in the face of new challenges. Today, business models are being disrupted by technological advances. Jobs and value chains are being redesigned or made obsolete.

We must seize these new opportunities, and to do that, we need to build our capabilities.

So how does ASC create and offer value to its students as well as to industry today?

The answer is deep engagement with industry.

The Minister for Education Mr Ong Ye Kung has said that we must have a 'meritocracy of deep skills', where Singaporeans are encouraged to 'uncover their passions and aptitudes in a diverse range of skills, and master them through lifelong learning'. This, in fact, has been ASC's focus over the past two years - deepening skills, building capabilities, extending networks - and this is how we simultaneously create value for both students and industry.

Our strategy is to be in industry, for industry, because working closely with our partners is the best way to access talent outside the school. Harnessing external expertise enables us to access the best. We cannot rely on organic growth, which may not be able to meet industry's demands or worse, may be irrelevant to industry's needs. Hence, with this strategy, we are open to collaboration with organisations and companies, both local as well as overseas. Today, I am proud to say that we have more than 200 partners supporting the training and education of our next generation.

Industry engagement, which enables continuous learning, is the only sustainable way forward. By bringing industry into the school, we ensure our students are properly trained and equipped through their early exposure to industry. Upon graduation, they go back to industry. This approach to training has a tremendous impact in that it is not piecemeal by project, but constitutes a lifelong journey for all parties involved. For the student, the opportunity to work with a 'master' from industry is priceless. For the 'master' (industry), the value we offer is in the form of the well-trained 'disciple' (our graduates). Finally, for our staff, increased value and calibre are the key benefits.

> **"By leveraging and learning from industry, we are able to feel its pulse and keep the curriculum alive and responsive... Educators must be good learners!"**

Industry offers insights and a real world environment. By leveraging and learning from industry, we are able to feel its pulse, provide a meaningful education, and keep the curriculum alive and responsive. It is the best learning journey for students, the school and our partners.

Specifically, how does the school engage industry? Please give some examples.

With more than 200 partners, our engagement and collaboration span a broad range of industries, particularly those that are aligned with our three growth areas: Agri-Food Technology, Applied Diagnostics and Sustainable Materials.

Let me share just one example. In the area of aquaculture, I am pleased to report that we have made significant inroads in the industry. We are excited by the promise and challenges of aquaculture, and we want to make a difference. Our scientists are looking for innovative ways to address the main issues faced by the industry - maximising growth rate and minimising production costs. To focus our effort, we set up the Centre for Aquaculture and Veterinary Science (CAVS) in 2016, with the aim of providing solutions in aquaculture nutrition, health and disease management, breeding and seedstock, and aquaculture culture systems.

We have signed Memoranda of Understanding with the industry's leaders. For example, Blue Aqua International Pte Ltd has set up a joint research and training centre both at TP and their local farm. The Blue Aqua-Temasek Polytechnic Research Centre at the shrimp breeding farm will create opportunities for our students to have hands-on training in shrimp breeding, broodstock development and hatchery as well as farm operation and management. We are also collaborating with Oceanus Group Ltd on aquaculture technology and R&D.

In November 2017, CAVS was appointed as the Technology Resource Centre for the Asia Pacific Economic Cooperation (APEC) Policy Partnership on Food Security for the sustainable development of agricultural and fishery sectors. The appointment opens up opportunities for staff from different technical domains to work together in innovative R&D and contract services in the area of agrotechnology beyond Singapore.

What are your aspirations for the school?

Never stop learning - this is the culture we must embrace if we want students to be good learners.

I'd like to see ASC forming even closer ties with more and more friends from all around the world, learning together, doing things differently, and always waiting to discover something new.

Our core business is education, and educators must be good learners!

School of Applied Science Advisory Committee

CHAIRMAN
Mr Andrew Tjioe
President / CEO
Tung Lok Restaurants (2000) Ltd

DEPUTY CHAIRMAN
Dr Lee Chee Wee
Director
School of Applied Science

MEMBERS
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Group Manager
Nestle R&D Centre (Pte) Ltd

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Director
Allied Health

Dr Annie Ling Mei Chuan
Director
Adult Health Division
Health Promotion Board

Ms Chang Kwei Fern
Director
Accreditation
SPRING Singapore

Dr Cheng Wen Haur
Deputy Chief Executive Officer &
Chief Life Sciences Officer
Wildlife Reserves Singapore

Assoc Prof Elizabeth Ng Siew Kuan
*(1961 -2018)**
Deputy Chairman
Centre for Law & Business
National University of Singapore

Mr Eric Ng
Chief Executive
Apollo Aquaculture Group

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Economic Development Board

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Ms Low Min Yong
Assistant Group Director
Applied Sciences Group
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*A*STAR*

Mr Mock Siew Fai
General Manager (Plant)
Mitsui Phenols (S) Pte Ltd

Dr Rufaihah Binte Abdul Jalil
Research Assistant Professor
Department of Surgery
Yong Loo Lin School of Medicine
National University of Singapore

Mr Teng Chong Seng
Director
EHS
Pfizer Asia Pacific Pte Ltd

Dr Wong Hon Mun
Group Director
AGRI Establishment Regulation Group
Agri-Food and Veterinary Authority

School Advisory Committee

Standing (left to right)

Mr Teng Chong Seng, Mr Lucas Ng, Mr Lu Jin Ping, Ms Lee Choon-Siew, Mr Mock Siew Fai

Seated (left to right)

Assoc Prof Elizabeth Ng Siew Kuan (1961-2018)*, Mr Andrew Tjioe (Chairman), Dr Lee Chee Wee, Ms Goh Han Yan

Not in photo:

Dr Allan Lim, Ms Ang Hui Gek, Dr Annie Ling, Ms Chang Kwei Fern, Dr Cheng Wen Haur,
Mr Eric Ng, Ms Low Min Yong, Dr Manjeet Singh, Dr Rufaihah Binte Abdul Jalil, Dr Wong Hon Mun

**We would like to record our deepest appreciation for Elizabeth's commitment and service to the School. She was a valued member who truly cared about the development of the School. Elizabeth will always be deeply admired for her enduring commitment to education.*

Andrew Tjioe, Chairman / School Advisory Committee

THESE ARE OUR MOMENTS

Mr Peter Lam (left) and Mr Andrew Tjioe with students from the Diploma in Baking & Culinary Science at the ASConference 2017.

Dr Amy Khor, Senior Minister of State (Ministry of Health and Ministry of the Environment and Water Resources) at the launch of the Centre of Innovation for Complementary Health Products in June 2016.

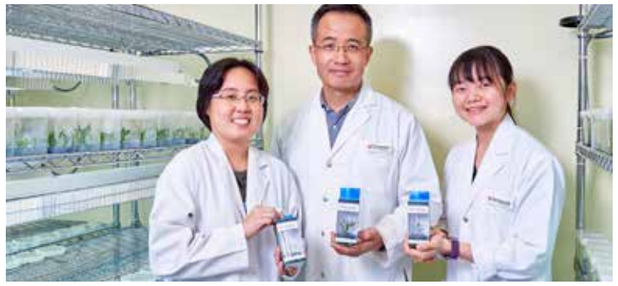
These are our moments



















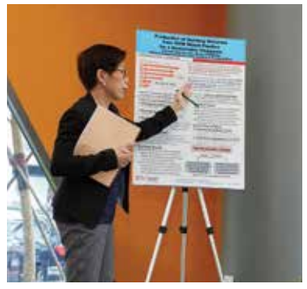



Memorandum of Understanding
Signing Ceremony
Foodfare
Temasek
POLYTECHNIC


CROWN OF
HEALTHY GOODNESS


AquaSG'16
Today's schedule
17 OCTOBER 2016


LYTECHNIC




APPLIED SCIENCE


No.1
Selling
Bread Brand
Enriched
WHITE BREAD

A FRUITFUL 2 YEARS

ASC IN NUMBERS

Driven by our vision to make a positive and sustainable impact, we continued to provide our expertise to match industry's needs, leveraging on funding sources and industry partners. With our support, many SMEs were able to adopt technology to enhance or develop new products, processes, applications, operations or best practices.

A fruitful journey

ASC in numbers

More than

200

Friends & Partners

External Research Grants
(Project Value)

2016

$2,022,000

2017

$2,972,000

Total Project Value
(Projects & Consultancy)

2017

$615,195

Centres of Excellence/ Innovation

5

Centre of Innovation for Complementary Health Products (COI-CHP)

Centre for Applied Nutrition Services (CANS)

Centre for Traditional Medicine (CTM)

Centre for Aquaculture & Veterinary Science (CAVS)

Centre for Molecular Diagnostic (CMD)

Learning Enterprises

6

TP Animal Clinic

Village Café

Bistro Lab (central kitchen)

CU2+ (staff lounge)

Agilent Partner Lab @TP

APEC (PPFS) Centre for Sustainable Development in Agriculture & Fishery Sector

Off-Site Facilities

5

KoolWerkz Ice Cream Factory

TP-Oceanus Innovation Centre @Xiamen

TP-Lubitrade Ubin Aquaculture Research Station

TP-Blue Aqua Research & Breeding Centre

TP-Apollo Live Feed Research & Production Station

Domains 13

Conferences Organised 7

171
Full-time staff

1,752
Full-time students

Powering Education Through Innovation and Research

ASC'S journey of Growth

Supported by Core Capability: **ANALYTICAL SCIENCE**

To achieve optimal growth amidst challenging economic conditions, rising competition, and disruption from technological advances, ASC has been rapidly developing capability in three growth areas that are aligned with Temasek Polytechnic's technology clusters. The growth areas are: **Agri-Food Technology, Sustainable Materials** and **Applied Diagnostics.**

ASC's technical domains, learning enterprises, and centres of excellence / innovation all work synergistically, contributing to growth in the three areas, whilst providing solutions to meet industry's needs.

AGRI-FOOD TECHNOLOGY

Technology plays a key role in the operation of the agri-food sector, but the pace of innovation in this sector lags far behind other industries. Changing consumer demands, a growing population, and limited natural resources, especially land and water, are just some of the issues that make the need for innovation more urgent than ever.

As food travels from the farmer to the consumer, the operations and processes involved are extremely complex. Whether it is in aquaculture, food processing, research and development, or any of the numerous other processes, the opportunity to disrupt the industry are therefore abundant. Here at ASC, our teams of researchers have the right expertise to disrupt the agri-food industry, using technology to make the industry more sustainable, nimble, and able to respond more swiftly to changing market demands.

AGRI-FOOD TECHNOLOGY

- Agrotechnology
- Applied Nutrition & GI Research
- F&B Technology
- Water Technology
- Centres of Excellence / Innovation (CANS, CAVS, CTM, COI)
- Learning Enterprises

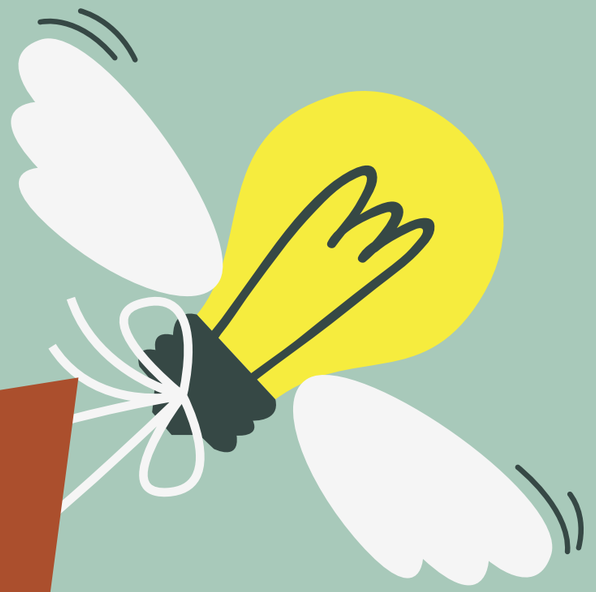
SUSTAINABLE MATERIALS

We align our roadmap in accordance with the RIE 2020 Urban Solutions, Sustainability and Advanced Manufacturing (Advanced Materials) technology sectors The three main thrusts of research and development are renewable resources as functional materials, solid waste recycling for strategic building materials, and food waste reduction and recycling.

In ASC, we focus on green materials development to promote recycling of solid wastes generated in Singapore. We have developed mix formulations that allow the recycling of wood waste, incineration ash and plastics into building materials for walls, park benches and even souvenirs. Our researchers are also working on the use of recycled plastics in hot mix asphalt, and plans are in the pipeline to set up an accredited laboratory to conduct material testing for green materials.

Another area of focus is smart materials that are able to 'think' and function upon activation or under stipulated conditions. The development of smart functional building materials will be critical to address Singapore's resource constraints (natural resources, space and manpower).

SUSTAINABLE MATERIALS
- Materials Technology



APPLIED DIAGNOSTICS

- Biologics, Nutraceutical & Pharmaceutical Technology
- Point-of-Care Technology
- Centre of Excellence (CMD)

APPLIED DIAGNOSTICS

Our research scientists focus on the development of point-of-care testing platforms and in vitro diagnostics for application in aquaculture, medical technology, food and environment-related industries. Currently, they are developing biosensors for non-invasive diagnosis of infectious diseases and pathogens. This is of significance in aquaculture and the food industry, for disease surveillance as well as ensuring food safety and food security.

We also have the capability to help companies to develop new formulations and health products. We offer a suite of services from product development to safety, efficacy and stability testing, and provide support and training in Quality Assurance matters especially in current Good Manufacturing Practices (cGMP).

Domains Provide Customised Solutions

We continue to innovate in many areas, and the entire education eco-system within the school is kept vibrant, relevant and up-to-date, ever ready to respond to the evolving needs of industry. The school's implementation of the 'domain' framework is testimony of our commitment to innovation. Under the framework, there are 13 domains in the School of Applied Science, each helmed by a Domain Lead.

Each domain offers specific competencies and capabilities uniquely suited to meet the needs of industry. At the same time, our domain capabilities are also synergistically inter-linked to form a one-stop applied science centre, where customers can benefit from customised solutions.

The domain framework enables us to match our expertise to a need, as well as leverage on funding sources and industry partners, hence taking the project through to commercialisation, from concept to product.

With a history that spans 17 years, ASC has gained the respect and recognition of industry.

We remain committed to making your business better.

TECHNOLOGY DOMAINS

1. Agrotechnology
2. Applied Nutrition & GI Research
3. Biological Testing
4. Biologics, Nutraceutical & Pharmaceutical Technology
5. Chemical Testing
6. F & B Technology
7. In silico Testing
8. Materials Technology
9. Point-of-Care Technology
10. Water Technology

SUPPORTING DOMAINS

11. Business Development
12. Corporate Development
13. Education R & D

What's Hatching at ASC?

We DESIGN,
DEVELOP,
DEVISE,
CONCOCT,
FORMULATE,
HATCH
PLAN,
PRODUCE,
INVENT,
CREATE

ideas, products, processes,
procedures and services that

MAKE YOUR BUSINESS BETTER.

OUR PROJECTS
INNOVATIVE SOLUTIONS FOR ENTERPRISE

AGRI-FOOD TECHNOLOGY

Advancing Aquaculture with Technology

Alternative Feeds With Replacement of Fish Meal Using Insects, Animal or Plant Based Wastes

Feed formulations followed by feed making for feeding trials are performed when developing feeds with fish meal substitutes or feed additives. Feed characteristics can also be worked out in addition to the efficacy study in supporting growth performance.

Aquaponics

Growing vegetables using recycled spent fish water containing nutrients from faecal waste and uneaten feed via the recirculating aquaculture system (RAS) has many benefits. Water coming from the fish tank is filtered through physical and biological processes, and toxic ammonia is converted to nitrate by bacterial nitrification. The filtered, nutrient-rich water is then circulated to the hydroponic growing units for the plants to utilise.

Autogenous Bacterial Vaccines for Marine Aquaculture

A heat-killed autogenous vaccine was produced from Vibrio alginolyticus that was isolated from diseased fish. Different routes of delivering the vaccine modulated the selected immune responses of tilapia and protected them following bacterial challenge.

Biofloc Technology for Intensive Indoor Cultivation of Freshwater Tilapia

Biofloc technology (BFT) is based on a more efficient use of nutrient input with minimal or zero water exchange. Higher organic load and bacterial population in the BFT system provide an alternative food source for the fish, while lower feed conversion ratio (FCR) in the BFT system leads to decreased feed cost during culture.

Culinary Herbal Extract as Feed Additive Supplement in Aquaculture

Herbal therapy using natural culinary plants is gaining popularity as a means of disease prevention. Garlic, ginger and onions were each tested for their effects on immune response and overall growth performance. Feeds incorporated with garlic increased Specific Growth Rate and lower Feed Conversion Rate as well as upregulation of lysozyme during feeding trials.

Development of a Fish Counting and Morphometric Monitoring Device

Currently, there is no commercially available device that helps farmers to count as well as record the shape and size of the fish other than monitoring abnormalities on the body surface. Using image analysis and algorithms, the device would enable farmers to keep track of the fish stock, species differentiation or identification and morphometric changes, thus monitoring fish health. This would greatly enhance farm biosecurity in ornamental fish farms.

Development of an Innovative Soilless Medium for Improving the Taste of Chinese Leafy Vegetables

There is limited arable land space available for local agrotechnology farming. With this in mind, a multi-disciplinary team at ASC is developing a novel soilless medium that could support plant growth of Chinese leafy vegetables under intensive farming conditions.

Development of an Intelligible Solution for Sustainable Fish Feed Supply

In an unprecedented development which can greatly improve the profitability of aquaculture, our researchers are working to convert algae biomass from the treatment of wastewater into algae-based fish feeds. This process allows for the symbiotic coupling of waste water treatment to the production of fish feeds, and enables aquaculture systems to be self-sustaining with substantial savings in the cost of fish feed.

Fine Bubble (FB) Technology for Intensive Agrotechnology

Fine bubble water was generated using a fine bubble generator. The technology could support high stocking densities and survival of tilapia in a closed containment system.

> With Singapore's positive business climate, natural biosecurity and strategic location, it is important to train and educate our youths on the importance of the aquaculture industry and the skills to contribute. It has been a pleasure working with ASC in bridging academia and practical work. Our most recent collaboration, the Blue Aqua-Temasek Polytechnic Research Centre in Neo Tiew aims to bring about the required hands-on experience and industry skills training. We look forward to more collaborative work with ASC's dedicated team.
>
> **Dr Farshad Shishehchian**
> President & CEO
> Blue Aqua International Group

LAMP Assay for Pathogen Diagnosis

The loop-mediated isothermal amplification (LAMP) assay is a molecular diagnostic technique that can detect the presence of pathogens through direct visualisation of the precipitate or change in colour. The LAMP assay can be completed in two hours including sample preparation. It is highly sensitive, cost-effective and has potential for on-site diagnostics.

Live Feed Enrichment for Hatcheries

Enriching live feeds with low cost and natural ingredients to increase their fatty acid profile (e.g., omega 3 fatty acids, omega 6 fatty acids) is the goal of this project.

Mud Crab Hatchery and Larviculture

Mud crab hatcheries are gaining importance due to depleting sources of wild caught mud crabs. Gravid females were sourced from local suppliers and brought back to the Centre for Aquaculture and Veterinary Science (CAVS) where they were quarantined, acclimatised and induced to spawn. There were four episodes of spawning success, and the crab zoea managed to reach Z5 stage.

Nutritive Phytofilters for Sustainable Farming

A nature-inspired innovation that is set to boost the profitability of sustainable aquaculture. The phytofilter is an attractive waste-to-resource converter to generate high value feed supplements from the water treatment process. It functions via the growth of microalgae which assimilates the nitrogenous toxins in the fish water during photosynthesis.

Oral vaccine against Iridovirus

Development of microalgae-based oral vaccine against iridovirus was demonstrated in experimental fish groups. The vaccinated fish showed significant immune response and improved survival when challenged with a lethal dose of the iridovirus. An oral vaccine has significant operational benefits such as mass administration, and elimination of risk of injury due to handling during the vaccination process.

Organic Fertiliser Supplement for Vegetables

Our researchers are exploring the efficacy of seaweed liquid extracts as an organic fertiliser supplement for leafy vegetables (spinach) using hydroponics and soil-based cultivation.

Phototrophic Biofilm Reactor (PBR)-based RAS for Sustainable Fish Farming

In this project, an innovative PBR has been developed and used as a water treatment unit in a recirculating aquaculture system (RAS) for raising freshwater tilapia fingerlings. This proves that a PBR-based RAS can be used for low cost, and sustainable fish farming.

Rapid On-site Detection of Iridovirus by Optical Immunoassay

This innovative assay comprises a customised sample extraction tool kit to concentrate the virus from fish tissue samples and iridovirus antibody from blood, and a disposable test device capable of detecting both iridovirus and iridovirus antibody in a single test in less than two hours.

Smart Integrated System for Sustainable Aquaculture

The project involves water quality monitoring where parameters that are out of the acceptable range would trigger a water pump to perform some water exchange in the production pond. The algorithm set up will collate the data on water quality, feed used and number of fish per production pond.

Study of Recirculating Aquaculture System (RAS): Different Biofiltration Technologies for Nitrification and Denitrification

This newly-designed biofiltration technology can achieve nitrification and denitrification simultaneously. The system can improve the performance of freshwater and saltwater RAS and the efficiencies of different biofiltration technologies.

Tilapia Hatchery and Larviculture

Tilapia is a good yet cheap source of dietary protein for the majority of people. A bottleneck in the culture of this fish is the availability of constant and disease-free seedstock. Our RAS system ensures that the seedstock is biosecure and free from pathogens before they are stocked to the aquaculture facility.

> ONI Global has leveraged on the School of Applied Science's knowledge and expertise in chemical analysis to better understand and improve our products. Through several collaborations, much value has been added to our products, and we are happy to continue the strong partnership between ONI Global and the School of Applied Science.
>
> **Cynthia Poa**
> Group CEO
> ONI Global Pte. Ltd.

Ensuring Product Safety, Efficacy & Authenticity

Alcohol Testing and Porcine DNA Testing in Food Products

As companies are increasingly trying to cater to new markets, alcohol testing and porcine DNA testing are key elements in ensuring that both fresh and processed food products have not been contaminated with either constituent at any point during the manufacturing process. Both these testing services are currently offered to the industry.

A Novel Method to Certify Antioxidant-Containing Food and Herbal Products

Using advanced Liquid Chromatography Time of Flight Mass Spectrometry (LC-QTOF), researchers at ASC have developed a new analytical platform to identify and evaluate antioxidant components present in matrices such as food and herbal products. This new analytical approach enables a more comprehensive profile of active antioxidant ingredients, and measures their relative antioxidant activity towards the quenching of free radicals. This technology is being implemented as a cheap and accurate antioxidant assay on a paper strip, which speeds up the antioxidant-certifying process and further decreasing the cost.

A Prototype of Colour Strip Aided by Smartphone Application to Quantitate Antioxidant Capacity of Food Products

A colour strip prototype that can be used to determine the antioxidant capacity of food products has been developed. This allows visible colour differences to be observed among food products containing different amounts of antioxidants. With the camera function on a smartphone, an application is also being developed to facilitate rapid antioxidant quantification.

Compilation of an HPTLC Atlas for Commonly Used TCM Herbs in Singapore

In collaboration with the Academy of Chinese Medicine, Singapore (ACMS), this project will compile a high performance thin-layer chromatography (HPTLC) atlas for commonly used herbs locally. Aiming at developing the method into the Singapore TCM Standards, this project will provide the industry a rapid and cost-effective alternative for the testing and certification of quality TCM products manufactured in Singapore.

Consultancy Service and Support for the Registration of Herbal Medicine and Health Supplement Products in Foreign Markets

ASC is consolidating its wide-ranging capabilities towards becoming a one-stop service centre offering consultancy service and support for the registration of products in overseas markets. By integrating these capabilities, ASC will be able to facilitate the registration process for SMEs' products, enabling market penetration in the fastest time possible.

Development of an Immunopotentiator from Bioactive Polysaccharides of Dendrobium

A complete and efficient methodology for isolating and purifying polysaccharides from Dendrobium herbs (Shi Hu) has been established. A patent has been filed for the method.

Development of Anti-Diabetic Functional Food with Kidney-Protective Effect

This diabetic-friendly functional food is formulated with TCM herbs so as to provide anti-diabetic and kidney-protective effects. It is a joint collaboration with Nanyang Technological University (NTU) and Academy of Chinese Medicine, Singapore (ACMS). This functional food will be part of Singapore's nationwide effort to prevent the development of diabetes and its complications through diet management. In particular, this functional food aims to prevent the onset of diabetic nephropathy, which is a major diabetic complication that causes kidney failure.

Development of a Shi Hu Herbal Preparation for the Prevention of Diabetes

A Shi Hu herbal preparation that is effective for the prevention of diabetes and convenient for consumption has been developed. Oral supplementation or medication with TCM can be an excellent way to regulate blood glucose.

Harmonised ASEAN Guidelines for Stability and Shelf-Life Testing of Traditional Medicines and Health Supplements

ASEAN countries have come together to develop a harmonised set of guidelines for the conduct of stability studies and shelf-life testing. ASC staff members have attended training on these guidelines and will be sharing this knowledge with key stakeholders in the local traditional medicine and health supplement industries. Between 2015 and 2017, ASC has also conducted projects involving stability testing of herbal products, and will continue to offer these services to companies while integrating the harmonised ASEAN guidelines into our protocols.

Facilitating the Development of Premium Singapore TCM Products

The Centre for Traditional Medicine is assisting a local company to calibrate its product quality with training provided to its employees on product analysis to build the company's technical competencies for innovation. With the setting of product specifications using chromatographic methods, the Centre is able to facilitate safety and efficacy studies of TCM products at local hospitals to develop premium Singapore TCM products of consistent quality with proven safety and efficacy.

> We collaborated with Temasek Polytechnic in various projects last year. All our projects, for example, Kesennuma shark & salmon seminar, project with Kanto-METI for localising Japanese food, and two Japanese cuisine lectures for Thai Airways' chef and students were successfully completed, and they received favourable comments. This is all thanks to Dr Lee, Ms Petrina and all staff from Temasek Polytechnic. Thank you very much for your kind and excellent support.
>
> We look forward to your continued cooperation and collaboration in the future. Again, thank you from the bottom of my heart.
>
> **Mr Masaki Fujishiro**
> Managing Director
> Ippin Pte Ltd

Fighting Disease With Food & Designing Healthier Food and Meal Options

Designing Children's Menu Items at TP's Childcare PLAY

As part of a consultancy project to develop a set of healthier cyclic menus for childcare centres, ASC worked with its Preschool Learning Academy (aka TP@PLAY) to test-bed twenty menu items. The test-bedding was an excellent opportunity to help the team understand the children's acceptance of healthier food items and also provided valuable insights on improving the menu planning for the client.

Development of a Functional Tea

Our researchers are fighting diabetes and other diseases with food. Infused with antioxidants, this functional tea boasts functional ingredients to beat the 2Ds - diabetes and dementia.

JOY, Premium Low Fat Ice Cream

A unique formulation with good mouthfeel, overall texture and stability, this ice cream is registered under Health Promotion Board's Healthier Choice Symbol (HCS) programme. JOY delivers 'happiness in every scoop', is halal certified and has less than 200 kcal per serving.

Partnering NTUC Foodfare Co-operative Ltd to Fight the War on Diabetes

NTUC Foodfare's food service and manufacturing business entered into a partnership with ASC to develop healthier food products and meal options. This partnership saw the creation and launch of a series of healthier choice, low Glycemic Index (GI) meals which are halal-certified, and six varieties of low GI ready-to-eat frozen pizza that is included in NTUC FairPrice's house brand range of products. The partnership is a game changer in the 'War on Diabetes' which aims to revolutionise awareness-building of how nutrition can reduce the risk of diet-related diseases.

APPLIED DIAGNOSTICS

Diagnostics on the Go

Colour Array Sensor for Detection of Volatile Organic Compounds for Novel Biological Indicator

On-site and equipment-free testing for chemicals, pesticides, heavy metals and volatile organic compounds. This innovative solution cuts down the waiting time for results from six hours to 30 minutes.

Customised Artificial Lighting for Indoor Farming

The technology uses photoactivation using LED lights, with specific wavelength combinations, to increase biomass, yield related parameters, enhance nutritional value, induce insect-pest and disease resistance. The technology is applicable in soil based systems and soilless culture systems such as hydroponics and aeroponics.

Development of Multiplex High Resolution Melting Assay for Shrimp Pathogens

Together with Agri-Food & Veterinary Authority of Singapore (AVA), our researchers have developed a novel detection kit that is able to detect multiple shrimp pathogens simultaneously in a simple, rapid and cost-effective manner. A patent under the Protocol Cooperation Treaty has been filed to protect the invention.

This novel detection kit has also been successfully licensed to a biotechnology business conglomerate that plans to deploy the kit to farms and laboratories in the region.

Development of Thermo Stabilised Taq DNA Polymerase

We are developing Lyophilised Taq DNA Polymerase which are stable at room temperature for one year.

Genome Editing and Screening for Fast Growing Mutants of Geobacillus Stearothermophilus for Commercial Biological Indicators

With a growing demand for medical devices and implantations in the medical industry, there is a need for rapid biological indicators. With the current commercially available biological indicators, there is a waiting time of three to six hours to confirm that the sterilisation process is valid.

High Resolution Melting Technology for Multiplex Diagnostic Assay Platform

This is another device that is simple, user friendly, and cost effective, with high sensitivity and rapid turnaround time.

Immobilisation of Protein on Cellulose Discs for Low Cost On-site Diagnostic Assays

Equipment-free testing anywhere, anytime, with a rapid turnaround time of five minutes. A visual read-out ensures ease of use for blood, serum, water or food samples.

Low Cost Rapid Diagnostic Devices

Our researchers are working on the following low cost rapid diagnostic devices: a multiplex detection system for early prediction of kidney damage, a diagnostic device for blood glucose, and another for gout.

Rapid Assay for Meat Identification and Halal Testing

This is a rapid, specific, sensitive, cost-effective, user-friendly HRM based porcine detection assay.

Smart Rapid Quantitative Assay Platform for Mobile Health

With this simple, user-friendly platform, the result is managed by a mobile phone application or PC software user interface. The information can then be communicated, enabling digital data management.

Healthcare Meets Self Care

Development and Testing of All-Natural Hair Growth Products

There is an increasing demand for all-natural hair care products that effectively promote hair growth. Our researchers are working on new formulations of stable all-natural hair care products, conducting quality & product stability evaluation, and efficacy and safety testing.

Development of Oral Dissolving Films

The oral dissolving film is a convenient form of drug delivery for the aged and people with swallowing difficulties. It is also convenient for consuming on the go, and can be administered without water or additional aids.

Discovery Lab Life Science Series

The Discovery Lab Life Science Series transforms classroom research into real life laboratories. The programme applies fundamental life science concepts to stimulate innovation through visual hands-on learning.

Formulation and Testing of All-Natural Teeth Whitening Products

The effects of existing teeth whitening products include inflammation, breakdown of collagen matrix, reduced enamel strength, and dental abrasion. This formulation, made of natural ingredients, aims to provide the whitening benefits without the undesirable side effects.

Haemostatic Cream with Anti-Bacterial & Wound-Healing Properties

Our 'in-house' formulation is an effective haemostat with a high concentration of chitosan. It is anti-bacterial and suitable for people on anti-coagulants, coagulopathy, and diabetics. This effective haemostatic cream can be easily applied to crevices and challenging bleeding sites.

Lipoprotein-Based Therapy for Cardiovascular Diseases

Reduced HDL is associated with increased cardiovascular risk and is being evaluated as a potential treatment for atherosclerosis, a leading cause of death globally. This project aims to develop novel formulations of reconstituted HDL which carry specific proteins that confer athero-protective properties.

Self-applicable Chitosan-Based Wound Dressing

This chitosan-based wound dressing features a chitosan-based active film with significant hemostatic efficacy. It is self-applicable for single-hand use, with an elastic bandage providing additional compression to stop bleeding.

Stem Cell Cultivation: Cell Technologies & Tissue Regeneration Capability

Our researchers are working with Quintech Life Sciences to utilise the developed workflows for tissue regeneration in home-grown technology (TisXell).

SUSTAINABLE MATERIALS

Making The Planet Cleaner

An Integrated Solution for Hazardous Industrial Wastewater Mixture (HIWM)

An integrated wastewater management technology for HIWM comprising Fenton oxidation, UASB and SBR. This integrated technology has various operating disturbances optimised, e.g. shock organic loading, fluctuating pH and high salt content.

Bioplastics (Polyhydroxyalkanoate) Production by Mixed Culture Technology Using Waste Stream as Feed Stock

This project has adopted mixed culture technology in the design and operation of a PHA-generating biological treatment process. The process uses non-aseptic cultivation, with waste as raw materials so as to achieve economical production.

From Sugarcane Bagasse to Biobutanol

Biomass conversion of sugarcane waste to biofuel serves as an alternative energy source. The method eliminates the carbon emission from conventional oil fuel energy generation, creating a new form of clean energy.

High Grease Absorbent Materials from Renewable Resources

Our researchers have successfully developed a novel, eco-friendly and cost effective grease removal material involving the development of a super hydrophobic oil absorbing material, and a microbial system that allows in-situ oil degradation.

Hydrothermal Liquefaction (HTL) of Organic Wastes

Compared to incineration and digestion, HTL is a simpler process which is environmentally friendly and with high energy efficiency. Converting food waste to biofuel via HTL eliminates the pre-processing of wet waste via drying.

Low Cost, Environmentally Friendly, Fire Resistant Thermal Insulation

An organic natural material has been developed as a replacement for thermal insulation materials. The use of such renewable resources contributes zero carbon footprint from the growing, production and by product, yet the final product has comparable properties to current state-of-the-art thermal insulation materials.

Production of Xylan and Xylooligosaccharide from Sugarcane Bagasse

Xylan and xylooligosaccharide (XOS) are both bioactive macromolecules widely used in food, feed, beverage, cosmetics, and healthcare products. This project explores a new approach to deal with bagasse waste and obtain high value XOS from xylan.

Self-Cleaning and Anti-Fouling Coating Materials

A permanent composite coating material using advanced nanotechnology with self-cleaning and anti-fouling effects has been developed. The coating can serve as a next generation smart material that does not require any manual cleaning and can be applied for land, marine and aerospace applications.

Self-Healing Building Materials

These are smart materials that are able to 'think' and function upon activation or under stipulated conditions. These smart self-healing materials will play a strategic role to address Singapore's resource constraints in maintenance and the development of future underground cities.

Solid Waste Recycling For Strategic Building Materials

The solid waste recycling of waste plastics aims to address Singapore's resource needs in the construction industry. Sand, which is the key component in any infrastructure, is our targeted replacement product using an integrated plastic conversion technology.

Superabsorbent Hydrogel to Prevent Stagnant Water Formation

In response to the prevalence of Dengue and Zika virus cases in Singapore, our researchers have developed a reusable superabsorbent hydrogel to prevent stagnant water formation in common mosquito breeding sites. The hydrogel can be applied to voids that are prone to water accumulation, will swell and imbibe water during wet conditions, and dehydrate during dry conditions.

> The School of Applied Science has offered us great assistance in the development of Low GI meals and innovative healthier children's meals. We sincerely appreciate the efficiency and professionalism the team has demonstrated on each project. We look forward to continuing this relationship with the school.
>
> **Mr Perry Ong**
> Chief Executive Officer
> NTUC Foodfare Co-operative Ltd

STUDENT & MAJOR PROJECTS

AGRI-FOOD TECHNOLOGY

1. An Epigenetic Approach Towards Resistant Seabass Bleeding
2. Application of Functional Food Ingredients and Development of Clean Label/ Healthier Food Products
3. Applied Carbohydrate Research
4. Applied Research on Tea Antioxidants' Effects on Food Product Quality

> We have been collaborating with Temasek Polytechnic's School of Applied Science on the development and commercialisation of low GI whole grain noodles. TP and Leong Guan worked closely on this healthier noodle in the areas of product development, process control and product quality assurance. Like many food companies in Singapore, we have limited resources for innovation. By partnering with TP, we are now able to tap into the knowledge and technology in developing low GI noodles, supported by their technical expertise. This helps to lower our capital investment and operational cost and enable us to focus our resources on our core business activities.
>
> **Mr Lim Hock Chai**
> Managing Director
> Leong Guan Food Manufacturer Pte Ltd
> Leong Guan Food Trading Pte Ltd

5. Assessment of the Effects of an Algae-Based RAS on Fish Growth
6. Authenticity Verification and Quality Control of Local Herbs
7. Breeding of Rainbow Trout in the Tropics
8. Characterisation and Study of the Effect of Fine Bubble Water Application on Aquaponics/ Hydroponics and Soil Culture Systems
9. Characterisation and Study of the Effect of Ultrafine Bubbles (UFB) Water Technology in Aquaponics Systems
10. Chemical Fingerprinting Methods for Herbal Preparations: A Product QC Tool
11. Community Nutrition
12. Comparative Study of Carotenoids in Algae Samples
13. Comparing the Efficacy of Un-Processed Farm-made Food Against its Pelletised Forms in Culture of Milkfish
14. Cultivation of Microalgae for Lipid Production
15. Determination of Glucan Content in TCM Herb Samples
16. Developing Integrated Aquaponics System
17. Developing Nutrition Resources
18. Development and Application of Anti-Fish (Asian Seabass/ Tilapia) Monoclonal Antibodies
19. Development of a Rapid, Cost Effective Herbal Identification and Authentication Method QC Capability with FT-IR
20. Development of Algae-Polymer Beads for Enhanced Water Treatment
21. Development of an Innovative Asian RTE Meal
22. Development of an Innovative Food Product
23. Development of Autogenous Bacterial Vaccines for Aquaculture
24. Development of Database of Available Carbohydrate Values on Selected Local Food
25. Development of Healthier Noodles
26. Development of Healthy Recipes for Weight Management and Diabetes
27. Development of Lab Scale PLC and LabVIEW Systems for Monitoring and Controlling Water Quality Parameters
28. Development of Low GI Filled Buns
29. Development of Low GI Swiss Rolls
30. Development of Natural/Plant-Based Immunostimulants for Ornamental Fish
31. Development of Nutrition Education Resources and Therapeutic Recipes
32. Development of Phytobiotics for Ornamental Fish
33. Development of Recipes for Culinary Competitions
34. Development of Recipes for Major Project, Workshops and F&B Related Learning Enterprises
35. Development of Web-Based Glycemic Index Education Material
36. Efficacy Studies of Kang Zhen's Health Supplement Healthy Heart Capsule
37. Efficacy Study on Resveratrol and Exercise on Weight Loss in Males
38. Enhancing of Plant Health Using LED Grow Lights
39. Fluidised Bed Bioreactor for Vertical Fish Farming in RAS
40. Focused Research and Applications of Starch Chemistry such as Assessment of Resistant Starch, Amylose Content and In-vitro GI on Selected Food Products

> We have the privilege of co-developing a low GI Multigrain Hot Drink with the ASC team. With the consumer insights, professional guidance and timely response of ASC staff, we have been able to fast track the launch of the product within a short time.
>
> **Dr Saw Lin Kiat**
> CEO
> Faesol Pte Ltd

41. Food Hygiene Monitoring and Control for ASC Learning Enterprises and TP Canteens
42. Formulated Pellets for Lobster Juveniles to Improve Survival Rate as Compared to Farm-made Foods
43. Generation and Application of Monoclonal Antibody Against Fish Iridovirus
44. Hygiene Control/Improvement/QA/QC Projects for ASC Learning Enterprises and TP Canteens
45. Intensive Farming of Mud Crab Scylla serrata
46. Investigation of Microalgae Growth in Bioreactors
47. Literature Search of Tea Antioxidants
48. Live Feed Enrichment on Guppy Growth and Development
49. Mass Culture of Algae and Zooplankton for Growth and Development of Fish Fry
50. Metabolome Analysis and DNA-free Genome Editing in Sweet Potato with Preassembled CRISPR-Cas9 Ribonucleoproteins
51. Monitoring the Performance of Phototrophic Biofilm Reactor Used in RAS

> We have been working with Glycemic Index Research Unit, School of Applied Science since 2013 on testing of our AceNuwara Red Basmati Rice and other products. All our projects we embarked on with ASC has made a difference to our business and has helped us to promote healthier choice products for all health conscious consumers.
>
> **Agnes Seah**
> Director
> Ace Trading Management Services

52. Nutrition Surveys/Assessment and Development of Nutrition Education Programme/Materials
53. On-the-Job Training (Off-Campus Training) on Equipment to Produce Frozen Dessert
54. Optimisation of the Heat Treatment Condition and Development of New PCR Primers to Diagnose Fish Iridovirus Infection
55. Optimisation of Canned Meat Soups
56. Optimisation of Heat Treatment and Development of New PCR Diagnosis Primers to Prevent Fish Iridovirus Disease
57. Porcine Detection Kit
58. Propagation, Characterisation and Applications of Monoclonal Antibody Against Fish Iridovirus
59. Prototype Development for Microalgae Cultivation
60. Purification of Seawater Using Nanofiltration System
61. Relative Antioxidant Activity of Compounds in Tea Leaves
62. Seaweed Liquid Extract as Fertiliser Supplement for Hydroponics and Soil Based Cultivation
63. Semi-quantitative Analysis of 10 Commonly Used Singapore Herbs
64. Simultaneous Determination of Multi-Class Antibiotic Residues in Shrimp Using Triple Quadrupole LC-MS
65. Sports Nutrition Research, Nutrition Studies
66. Strain Development for Lipid Production from Microalgae
67. Studies of Food Ingredients and Packaging Applications/ Shelf Life Test/ Quality Evaluation and Development of Clean Label and/ or Healthier/ Functional Food Products
68. Study on Growth Performance of Leafy Vegetables Using Receptacle Prototype
69. Targeted Genome Editing for Enhancing the Secondary Metabolites and Inducing Pest Resistance in Economically Important Crops/ Vegetables
70. Thermal Adaptation and Reproductive Ecology of the Japanese Abalone Haliotis Discus Hannal Under Thermal Stress
71. Toxic Heavy Metals Limits for Traditional Medicine (TM) Products
72. Use of Biofloc Technology (BFT) for Intensive Culture of Freshwater Ornamental Fish
73. Use of Waste Fruit Skin for Flocculation of Wastewater

APPLIED DIAGNOSTICS

74. Bioprospecting and Genome Editing of Geobacillus Stearothermophilus
75. Color Array Biosensor to Detect Alive Bacteria
76. Development of a Desalination Cell
77. Development of an Oral Thin Film
78. Development of Geriatric Drug Oral Dissolving Film (ODF)
79. Development of Non-Enzymatic Protein Stabilisation Workflow
80. Development of Quality Control for Insect Repellent
81. Development of Signal Amplification Reagent for Immuno/Molecular Assays
82. Development of Transdermal Delivery Dosage Forms of Diclofenac Epolamine
83. Effect of Anserine on Lactate Levels as Fatigue Biomarkers in Athletes
84. Evaluation of Anti-Microbial Activity of Organic Liquid Toothpaste
85. Formulation of Hair Products
86. Genetic Alteration to Induce Rapid Germination in Bacterial Spores

> The School of Applied Science at TP has collaborated with us on multiple projects. Over the years, they have provided reliable support in the area of chemical testing for product quality control. Most recently, they have also used chemical analysis to identify active ingredients in our incoming raw materials. We are pleased to have them as our partner and look forward to even closer collaborations in the future.
>
> **Ms Karol Tong**
> General Manager
> Tai Tong Ah Company Pte Ltd

87. Implementation of Good Laboratory Practice (GLP) System in the Development and Optimisation of Protocols for In-vitro Biocompatibility Assays
88. LC-MS Based Analysis of Drug Metabolites to Improve Liver-Immune Chip Prediction of Skin Sensitisation Potential
89. Mobile Application for Diabetes Management
90. Natural Products as Mosquito Larvicide
91. Optimising Features of a Mobile Application for Diabetes Management

STUDENT & MAJOR PROJECTS

92. Physiological Effects of Cyclic Hypobaric Exposure in Sports Performance
93. Protective Effect Alpinia Oxyphyliafructus on Lipid Peroxidation, Antioxidant Enzymes and Inflammatory Status in Diabetic Rat Pancreas
94. Stability Testing of Coated Tablets
95. The CLP Mouse Model Bridging the Gap Between Animal and Human Sepsis and Repositioning Known Drugs for Treatment of Sepsis
96. To Establish a Bioprocess to Manufacture Protein-Based Components Used in Biological Testing
97. To Establish Novel Recombinant Protein Expression Technologies in Microbial Systems for Biological Testing
98. Validation of Chronic Stress Model in Mice for Antidepressant Drug Screening

SUSTAINABLE MATERIALS

99. Bioplastic Generation by Mix Culture
100. Characterisation of Novel Oil-Degrading Microorganisms
101. Determination of Metals in Wastewater
102. Development of Effective Cleaning Method for Soiled Cooking Utensils Used for Grilling
103. Development of High Grease Absorbent Materials
104. Development of Highly Mouldable, Environmentally Friendly Incense Replacement Material
105. Development of Natural Fibres Embedded Thermal Insulation Composite Materials
106. Development of Xylan and Xylooligosaccharide from Sugarcane Bagasse
107. Environmentally-Friendly Way in Treating Copper Ions (Cu^{2+}) Waste from the Electronic Industry
108. Hydrothermal Synthesis of Surface Functionalised Nano TiO_2 as Functional Coating Materials
109. Incorporation of Natural Fibres in Polymer Composite for Thermal Insulation Application
110. Incorporation of Waste PP in Hot Mix Asphalt
111. Industry Wastewater Treatment
112. Investigation on Varying Waste PS Content in Polymer Modified Bitumen
113. Production of Park Facilities from Recycled Materials
114. Study of Non-Explosive Demolition Agent (NEDA) in Concrete
115. Study of Waste LPDE in Polymer Modified Bitumen
116. Surface Functionalisation of Natural Fibres for Grease Absorption Application
117. Synthesis of Ag-Coated TiO_2

Meet some of the People Behind the Projects

MS SUKHPREET KAUR

DEPUTY HEAD / CENTRE OF INNOVATION FOR COMPLEMENTARY HEATH PRODUCTS

Over the years, more people are turning to natural and complementary health products to manage their well-being and also for disease prevention. It is really important that these products are scientifically tested to be safe and effective and that's exactly what we do here at the Centre of Innovation. The centre was established in 2016 together with SPRING Singapore. It draws on our extensive expertise across several scientific domains to help small and medium-sized enterprises to advance their capabilities and to grow their businesses. We license technologies that are developed in-house by our R&D experts and we work closely with clients to create formulations that are innovative. We further help companies navigate regulatory hurdles of market expansion. In my role, I reach out to these companies and I connect them with the right technical experts, to offer customised solutions. This enhances the value of Singapore brands and facilitates their expansion into the regional and international markets.

DR SHI LEI

RESEARCHER / CHEMICAL TESTING

Polysaccharides from Dendrobium Herbs

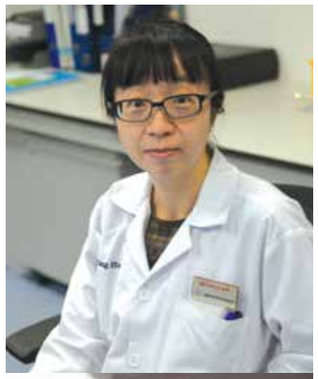
My research involves polysaccharides from natural sources which have been demonstrated to possess a variety of medical attributes and attracted much attention in the areas of glycochemistry and glycobiology. Due to the potential therapeutic effects and relatively low toxicity, polysaccharides from natural sources have a huge potential for pharmaceutical, food and cosmetic applications. We have established a methodology for extracting and purifying polysaccharides from Dendrobium herbs. Another breakthrough is the discovery of two bioactive polysaccharide candidates that may be used in health supplements and functional food products. The methodologies established also apply to polysaccharides from other tropical plants. The project may lead to innovation of other value-added functional food ingredients or products.

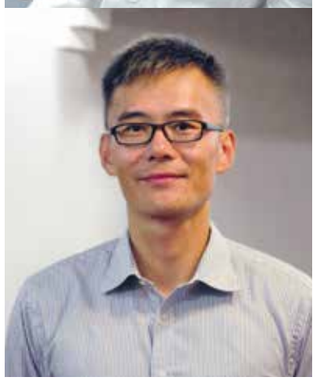
DR MIAO HUANG

RESEARCHER / MATERIALS TECHNOLOGY

Harnessing Versatile Microorganisms

I am working on microbial fermentation of organic waste materials for biosynthesis of valuable compounds. I choose to work on this area because there is a large amount of organic waste that is currently disposed of by incineration. I would like to transform the waste to resources by harnessing the versatile microorganisms. This area of work is aligned with Singapore's environmental drive to reduce, reuse and recycle. There is also commercial interest in further applications of these naturally derived compounds, and the potential market within the region is huge and untapped.





DR YANG HONG & DR XUE XUEJIA

RESEARCHERS / CHEMICAL TESTING

Identifying and Evaluating Antioxidant Components

Antioxidants have attracted increased interest from the general population in recent years, due to wide publicity on their potential health benefits. Retailers of food products containing these compounds have also capitalised on this increased interest, readily marketing their products as 'high in antioxidants' or 'rich in antioxidants' in order to draw increasingly health-conscious consumers to their products.

Using advanced Liquid Chromatography Time of Flight Mass Spectrometry (LC-QTOF), we have developed a new analytical platform to identify and evaluate antioxidant components present in matrices such as food and herbal products. The results from this study could potentially allow local enterprises to differentiate their products from competitors, as their products will be reliably certified as "super antioxidative". This work can be applied to traditional medicines, herbal remedies, and health supplements. It also presents an opportunity to give products in this space a competitive advantage.

DR MANDAR GODGE

RESEARCHER / POINT-OF-CARE TECHNOLOGY

Modifying Vegetables for Urban Farmers

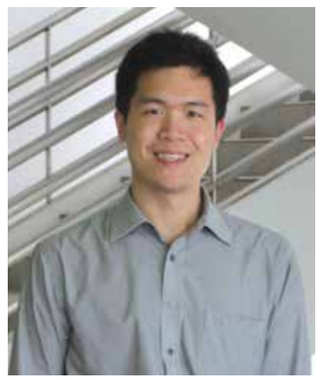
Our lab focuses on urban integrated farming systems and plant biotechnology. We are looking at modifying leafy vegetables and fruit vegetables to suit the urban farmers. By using non-chemical sustainable ways to induce insect pest disease resistance and increasing productivity, we are meeting the demand from the urban farming sector. We're using synthetic biology and CRISPR-Cas techniques to modulate the plants. We are also looking at modular functional plants in the form of leafy vegetables and fruit vegetables with high nutritional value.

DR CHENG JIALIANG

SECTION HEAD / MATERIALS TECHNOLOGY

Smart Functional Building Materials

I believe we can all do our part to ensure our planet's resources are well utilised and sustainable for our future generations. Hence, my research focuses on developing advanced functional materials from renewable resources. I am passionate about using environmentally friendly and sustainable materials to develop next generation functional coatings, thermal insulation and high grease absorbents. One of the projects I am working on involves smart materials that are able to 'think' and function upon activation or under stipulated conditions. The development of smart functional building materials will be strategic to address Singapore's resource constraints (natural resources, space and manpower). Such materials are crucial for strategic infrastructure where human repairs/maintenance should be kept at bare minimum eg, underground/underwater infrastructures, chemical plants and military ammunition storage etc. Our work here at the Materials Technology domain is closely aligned with the vision of the government's RIE 2020 Urban Solutions and Sustainability initiative.



DR MATTHEW KONG

SECTION HEAD / CHEMICAL TESTING

My interest lies in the application and development of new techniques for sampling and testing Complementary Health Products. I am currently leading a project that involves the use of Gas and Liquid Chromatography to evaluate the quality of raw materials used in an SME's flagship herbal product. The methods and results in these studies are part of a plan for the SME to incorporate more stringent Quality Control measures for their manufacturing processes, and is in line with a national shift towards higher standards of product development and manufacturing. The integration of business, manufacturing, and science allows SMEs to make objective evaluations regarding the consistency of products across different batches, which translates to consumers having increased confidence when using these products.

Centre of Innovation for
Complementary Health Products (COI CHP)

The Centre of Innovation for Complementary Health Products (COI CHP) is a one-stop centre of excellence for the advancement of the CHP industry, providing scientific evidence-based analysis to enhance quality, safety and efficacy.

Jointly established with SPRING Singapore in 2016, the COI's analytical capabilities go beyond routine testing and quality control or assurance. Assessing the authenticity and safety of novel and innovative products is a key part of our business. The COI has been accredited for more than 30 tests, such as alcohol and porcine DNA for halal testing.

SERVICES

Applied Nutrition

We specialise in human research studies to determine and validate the health promoting benefits of food and complementary health products. We also provide consultancy on regulatory requirements and guidance on the ethics approval process.

- Glycemic Index Testing & Research
- Sports Nutrition
- Clinical and Community Nutrition

Biological Testing

Through a range of services that encompass both in vitro and in vivo testing of biological materials and devices, we custom design testing approaches to validate the efficacy of your products.

- In vitro Testing
- In vivo Testing (Pre-Clinical)

Chemical Testing

We provide analytic testing solutions with the help of cutting-edge chemical instrumentation and expertise. We can help to authenticate and validate your complementary health products (CHP) through product testing to ascertain its quality, safety and efficacy.

- Chemical Profiling of CHP for QA/QC
- Authentication of active compounds
- Alcohol & porcine DNA detection
- Trace heavy metals analysis
- Antioxidant testing
- Metabolomics & Pharmacokinetics studies
- Stability studies of CHP for shelf life analysis
- Residual antibiotics & pesticides analysis
- Quantification of vitamins

F&B Technology

We create healthier and commercially viable prototypes for a range of functional food products and healthier recipes to meet the needs of key industries.

- Customer-driven high value food and recipe concept development
- Incorporation of herbal and/or functional ingredients
- Innovative product packaging applications for extended shelf-life

Biologics, Nutraceutical & Pharmaceutical Technology

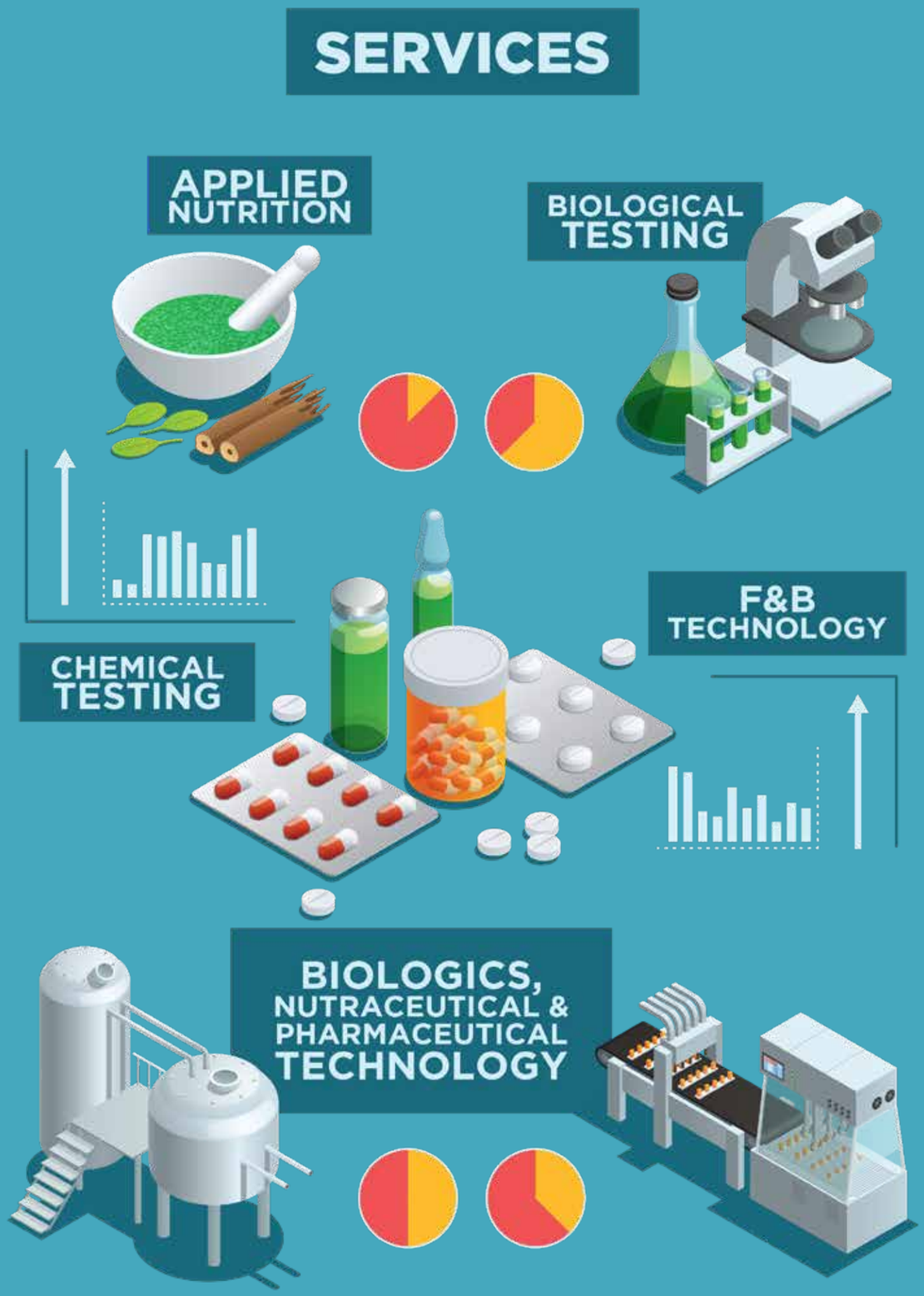
We provide tailored product innovation to enhance the performance and the shelf life of your product, through differentiating formulations and drug delivery modes. We offer guidance in Good Manufacturing Practice (GMP) and related matters, to assure quality and consistency of your products.

Formulation Research & Development

- Develop formulation and final dosage forms for various complementary health products
- Perform pilot scale manufacturing of dosage forms using a wide range of processing equipment such as wet and dry granulators, tablet presses and encapsulation machines

Quality Assurance

- Perform statistical process control analysis
- Provide internal QMS and GMP consultancy
- Provide process, cleaning and other validations
- Provide annual product review reports and GMP documentation



CENTRE FOR AQUACULTURE AND VETERINARY SCIENCE (CAVS)

CAVS has been appointed as the Technology Resource Centre of APEC PPFS (Asia-Pacific Economic Cooperation Policy Partnership on Food Security).

Translational Pre-clinical Research & Services for Biomedical and Healthcare Industries

- Non clinical safety testing using rodents
- In vivo and in vitro studies
- Pathological models for the study of disease mechanisms and treatment modalities
- Evaluation of the efficacy of drugs and vaccines using relevant specific pathogen-free laboratory animal species and animal models

Veterinary Diagnostics, Disease Prevention and Treatment

- Research and development in animal health and disease management
- Training workshops in areas such as rapid pathogen detection
- Services such as veterinary and aquatic diagnostics and kit development, pathogen testing and identification, necropsies and histopathology, vaccine development and efficacy trials

Education, Care and Support for the Veterinary and Pet Industry

- Veterinary services such as health screening, grooming, vaccination, microchipping, dental procedures
- Nutrition counselling
- Animal wellness planning
- Behavioural enrichment
- Hydrotherapy and physiotherapy
- Canine day care
- Training workshops on pet care and management and pet wellness

Research, Education and Services for Aquaculture Industry

- Genetics, breeding & propagation
- Aquaculture nutrition, feeds and feeding
- Live feed research and supply
- Urban intensive production
- Aquaponics and integrated aquaculture systems
- Aquaculture health management

A novel detection kit that is able to detect multiple shrimp pathogens simultaneously has been successfully licensed to a biotechnology business conglomerate that plans to deploy the kit to farms and laboratories in the region.

CENTRE FOR TRADITIONAL MEDICINE (CTM)

CTM aims to be the leading academic research centre to promote evidence-based Traditional Chinese Medicine (TCM) and help local TCM enterprises innovate.

Facilitating the development of Singapore TCM products of premium quality, with proven safety and efficacy

Development of functional foods incorporated with TCM

Capacity building for industry

- Assist enterprises to solicit funding for product innovation
- Organise training programmes to upgrade the skills of the industry & TCM community

CENTRE FOR MOLECULAR DIAGNOSTIC (CMD)

CMD's three-pronged focus enables innovation through education and partnership.

Surge Research and Education Programme

- Capability building for detection and diagnosis of known & unknown pathogens
- Preparation and planning for specific types of emergencies – natural disasters, sporadic and epidemic outbreaks, and zoonosis
- National preparedness – strategic stockpile of therapeutic supplies, epidemic information exchange, preparedness and response
- Capability building for monitoring and surveillance of disease agents of importance in aquatic, pet and wildlife animals
- On-site sample collection and processing protocols

Point-of-Care (POC) and Continuous Monitoring Diagnostics Platform Development

- POC detection systems for on-site diagnosis of pathogens and toxins
- Portable instrumental analysis systems for molecular typing
- Field capability to detect pathogens/toxins/biomarkers
- Development of IVD/POC kits customised for diagnostic applications
- Development of molecular diagnostic kits for customised pathogen test panel

Synthetic Biology with Bioinformatics Programme

- Whole genome analysis and bio-informatic services
- Modular functional plants, microbes using CRISPR cas system
- Development of database for plant pathogens, control measures, and diagnostic capabilities

CENTRE FOR APPLIED NUTRITION SERVICES (CANS)

CANS aims to provide a holistic support service to the food manufacturing, F&B, and healthcare industries through the application of nutrition to improve food and diet quality.

New Food Product Development & Technology Translation, such as:

- Ingredient applications
- Food product development
- Process optimisation

Creative Bakery & Culinary Applications

- Recipe creation
- Formulation of bakery & confectionary products

Applied Nutrition Research & Consultancy, such as:

- GI testing & research
- Sports nutrition
- Nutrition intervention studies

We have successfully licensed the low GI formulation of two products:

- wholegrain noodles - licensed to a local food manufacturer
- pizza - licensed to NTUC Foodfare

It starts with a dream.

Dream Catchers

Our people at ASC are constantly dreaming up a better future. They pursue their vision relentlessly, until it becomes a reality...

We profile some of them - and the dreams they're chasing - here.

DR MELIANA RIWANTO

DOMAIN LEAD / BIOLOGICS, NUTRACEUTICAL & PHARMACEUTICAL TECHNOLOGY

My team focuses on two research areas. The first is the development and formulation of products ranging from pharmaceuticals, cosmetics to personal care products. We are driven by formulations using organic natural ingredients. The second research area is biologics. These are pharmaceutical products synthesised from living organisms. Biologics have immense capabilities - they can be used to treat various diseases such as cancer and immunological conditions. Through these two research capabilities, we strive to provide high quality innovative products to companies through consultancy projects. It's been a very fulfilling experience to know that we can make a positive impact on our client's businesses.

MS KRISHNASAMY SUSILA

DOMAIN LEAD / CORPORATE DEVELOPMENT

The Corporate Development domain focuses on two competencies: corporate governance and service excellence which comprise seven skill sets. These skill sets provide my team with on-the-job (OJT) skills practice and mastery. With these OJT opportunities the team spearheads the school's administrative, financial, academic services and operations in addition to conference/event management. In line with ASC's three strategic arms, we are involved in education, service and research.

DR WUANG SHY CHYI

DOMAIN LEAD / WATER TECHNOLOGY

The Water Technology domain focuses on the treatment of waste waters, including aquaculture waste water and chemical waste water. We incorporate a combination of physical, chemical and biological methods in our waste water treatment and we also look into system design operation and optimisation. Besides sustainable water technology, my research focus is also in the area of microalgae work. Currently, my on-going projects include optimisation of an algae-based recirculating aquaculture system and the development of a novel waste to resource conversion system supporting urban food sustainability.

DR EDMUND TIAN FENG

DOMAIN LEAD / CHEMICAL TESTING

The Chemical Testing domain is currently consolidating our wide-ranging capabilities towards becoming a one-stop service centre offering consultancy service and support for the registration of herbal medicine and health supplement products in foreign markets. As registering herbal products in foreign markets involves navigating many technical and regulatory hurdles, this approach will require the collaboration of experts and consultants from different specialty domains at ASC. These experts can come together to contribute and ensure that local SMEs can register their products quicker and more efficiently, by eliminating the need for them to approach multiple institutions for inputs on different aspects of the product registration process. The impact of such consultancy services is particularly significant for the herbal medicine and health supplement sector, where many technical and regulatory requirements for product registration are vague and may differ significantly across countries.

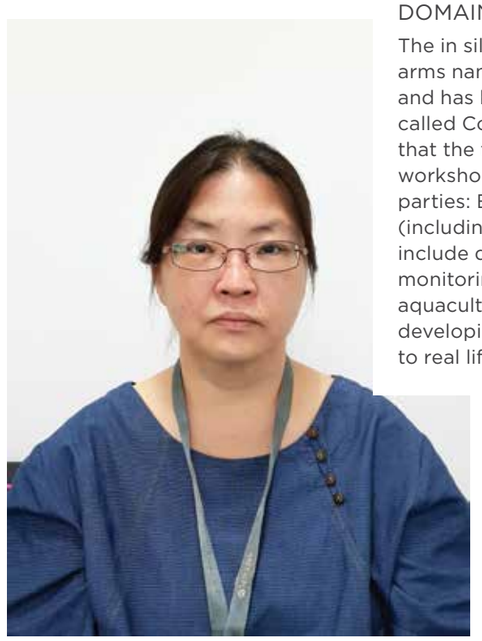
By developing, and more importantly, integrating these capabilities, ASC will be able to help SMEs facilitate the registration process for their products, thereby ensuring that their products can penetrate foreign markets in the fastest time possible.

DR WONG SOOK FUN

DOMAIN LEAD / MATERIALS TECHNOLOGY

My research interests include sustainable development of advanced composite materials and structural components, integration of materials design with structural performance, as well as utilisation of waste materials (e.g. recycled plastics, wood and horticultural wastes) and industrial by-products (e.g. incineration ash and sludge).

In the area of sustainable urban waste management, our team is currently developing an integrated system to convert municipal solid waste (MSW) mixed plastics into new building products as standardised forms (e.g. fibres and aggregates), to be incorporated into building and infrastructural components. In the area of advanced manufacturing, we are working on a project to formulate 3D printable composite materials and to establish laboratory-scale 3D printing technology, capable of producing construction materials with properties and performance comparable to conventional casting methods.



MS CHEW SWEE CHENG

DOMAIN LEAD / IN SILICO TESTING

The in silico testing domain started with three technical arms namely, Bioinformatics, Biostatistics and Biomodelling and has been updated to include an additional branch called Computational Methods due to the research work that the team engages in. The team has been conducting workshops in the following areas for our staff and external parties: Biostatistics (including R and SPSS), Bioinformatics (including Python, sequence analysis). Some of our projects include development of fish counting and morphometric monitoring device, and smart and sustainable land based aquaculture farming system. Our main work now includes developing mathematical algorithms for specialised solutions to real life problems.

DR MABEL WANG RONG

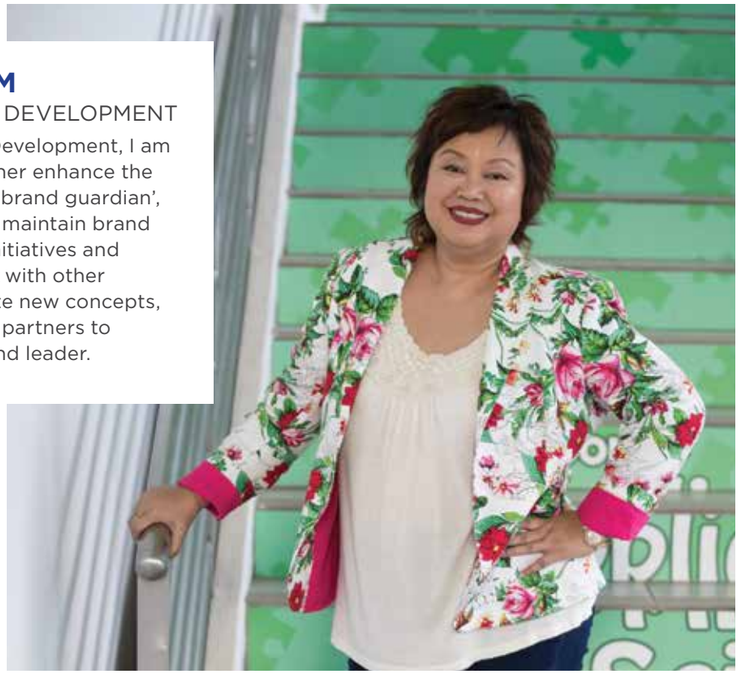
DOMAIN LEAD / F&B TECHNOLOGY

Our R&D work in developing low GI noodles started several years ago. In November 2017, a low GI wholegrain noodle was successfully developed jointly by Temasek polytechnic and Leong Guan Food Manufacturer Pte Ltd. The healthier version of the noodle was carefully formulated to a high standard in terms of taste and mouthfeel, yet maintaining its high nutritional and low GI value. This noodle contains more than 15% wholegrains, which meets the criteria of the Healthier Choice Symbol (HCS). This low GI wholegrain noodle will provide nutritional benefits to consumers who are health conscious, as well as those in search of functional foods to combat diet-related diseases. We hope to apply this technology to a wider variety of food products in future.

MS HAMIDA ZAM ZAM

DOMAIN LEAD / BUSINESS DEVELOPMENT

As Domain Lead for Business Development, I am always looking for ways to further enhance the branding of the school. As the 'brand guardian', it is my team's responsibility to maintain brand integrity across all marketing initiatives and communications. We also work with other domains to develop and execute new concepts, business models, channels and partners to position ASC as an innovator and leader.



MR LOH GIN HIN

DOMAIN LEAD / EDUCATION R&D

The Education R&D domain focuses on two research areas. We conduct joint action research to inform pedagogy for adolescent learners and andragogy for adult learners. As a team, we use education technology to enhance student learning. We cherish collaborations with internal and external partners to impact the education and training of students and the workforce. Partner us, we can make education and training better!

DR CHRISTOPHER CAIPANG

DOMAIN LEAD / AGROTECHNOLOGY

My team consists of dedicated members who possess expertise in aquaculture, plant technology and veterinary sciences. We aim to establish a close working relationship with our industry partners in capability building, applied research and the development of innovative solutions. Currently, we are developing new technologies and fine-tuning technological platforms that address issues of food security and sustainable food production. These include aquaponics, Biofloc technology, feed development, pathogen detection, and hatch and larvae breeding operations. We are also conducting studies and formulating guidelines related to the wellness and welfare of both farm and companion animals.

DR KADAMB PATEL

DOMAIN LEAD / POINT-OF-CARE TECHNOLOGY / BIOLOGICAL TESTING TECHNOLOGY

My team and I are developing a low-cost diagnostic platform that is very easy to use, user-friendly and can provide results within 15-20 minutes. We have developed prototypes for kidney panel marker, liver panel enzymes and gout. The beauty of this particular platform is that it is adaptable - we can use the platform for any kind of testing in any industry, e.g. the food industry, biochemistry, or to detect plant pathogens. Besides this, we are also working on a molecular based assay - we have developed a diagnostic assay for shrimp pathogens, which has recently been commercialised.

DR KALPANA BHASKARAN

DOMAIN LEAD / APPLIED NUTRITION & GI RESEARCH

The Glycemic Index (GI) Research Unit is the first accredited GI research facility in the region as well as in the world, and we have tested thousands of foods for their GI value. We are the first laboratory to test the GI values of Asian foods in collaboration with HPB. We have also created the first database on GI. In addition to GI testing, we also conduct glycemic response studies, extended glycemic response, insulinemic index, insulinemic response studies as well as flash glucose monitoring, continuous glucose monitoring and nutrition intervention studies. We are also well equipped to conduct research in geriatric nutrition and community nutrition.

Centre Heads

MS PETRINA LIM
HEAD / CENTRE FOR APPLIED NUTRITION SERVICES (CANS)

The Centre for Applied Nutrition Services aims to provide a holistic support service in areas of applied nutrition to the various food and health-related industries. Housing an integrative team with expertise in nutrition, food and culinary sciences, the Centre builds upon the school's capability in applied research, training and services in areas of food and applied nutrition. Tasked with the role to identify, strategise and plan new and industry-relevant growth areas in food and applied nutrition, I oversee the portfolio in developing food and nutrition-related research, consultancy projects, and strategic partnerships.

My role is to promote industry relevance for staff through engagement in strategic industry projects, and students through training at the food and F&B-related learning enterprises; and ultimately to develop and satisfy the overall business objectives through collaborative industry partnerships.

DR ONG SENG POON
HEAD / CENTRE FOR TRADITIONAL MEDICINE (CTM)

The Centre for Traditional Medicine aims to be the leading academic research centre to promote research in evidence-based Traditional Chinese Medicine and facilitate the development of Singapore TCM products of premium quality, with proven safety and efficacy. The work scope of CTM can be broadly divided into 2 main areas, namely evidence-based TCM, and capacity building for the industry and TCM community.

I believe the modernisation of TCM with the adoption of evidence-based approach is vital for the traditional practice to gain acceptance by Western medical practitioners and become an important component of the healthcare system. At the national level, it is hoped that TCM can be a cost-effective treatment option to help tackle key healthcare issues in our ageing population amidst rising healthcare costs. The CTM will align its focus with the national healthcare agenda and do its part to contribute to the nation's economic growth.

DR PADMANABHAN SARAVANAN
HEAD / CENTRE OF INNOVATION FOR COMPLEMENTARY HEALTH PRODUCTS (COI CHP)

The complementary health products (CHP) industry is rapidly growing in many regions around the world, including North America, Europe and Asia Pacific. This growing interest in CHP is attributable to an increasing demand among consumers for natural alternatives for the purpose of health maintenance, disease prevention and treatment. The sector is particularly vibrant in the Asia Pacific region, leading all the other regions around the world across the three main categories – traditional medicines, health supplements and functional foods.

The COI CHP is a one-stop resource centre to facilitate innovative approaches fostering objective evidence-based information for CHP development, validation and training. Integrating a research-intensive, industry-centered environment, the Centre offers innovative and creative solutions for technical challenges faced by SMEs. We invite you to leverage on our scientific capability to increase your business competitiveness in a sustainable and innovative manner.

DR SHABBIR M MOOCHHALA
HEAD / CENTRE FOR MOLECULAR DIAGNOSTIC (CMD)

The Centre for Molecular Diagnostic is a 'maker space' serving the Surge Research and Education (SuRE) Programme, Biological Testing & Point-of-Care Technology Domains. We focus on creating point-of-care (POC) diagnostic devices and setting testing standards. The Centre is currently growing capabilities in bioinformatics, synthetic biology, real-time PCR, NGS, MALDI-ToF-MS, OIA wafer, paper-based low-cost diagnostics platform, BioDot, etc.

A key contributor to ASC's Research, Innovation and Enterprise activities, the Centre also supports the SkillsFuture initiative by strengthening pre-employment training for industry, as well as continuing education training (eg in the areas of biological testing and biosensor workshops). Our projects with various industry partners include the OIA Food Toxin Test Kit (DSO/MINDEF/NEA), Continuous Flow Microfluidics (DSO, EHI, NEA, SIMTech), Multiplex Diagnostic Kit for Malaria (MOE-TIF), Kidney Panel Markers, and Shrimp Pathogens, Meat Speciation & Gout (MOE-TIF). We also collaborate with Thermo Fisher Scientific in the area of biological testing capability, and with Steris Corporation (USA) on novel biological indicators.

DR DIANA CHAN PEK SIAN
HEAD / CENTRE FOR AQUACULTURE & VETERINARY SCIENCE (CAVS)

The Centre for Aquaculture and Veterinary Science is a one-stop solution provider for training, service and research to meet the needs of the aquaculture, pet, biomedical and veterinary sectors. The facilities housed within CAVS include TP Animal Clinic, Animal Wellness Facility, Veterinary Diagnostic Facility including in vitro laboratories, and the Specific Pathogen-Free Laboratory Animal Facility.

I oversee and spearhead research and services activities undertaken by the Centre. Other than veterinary diagnosis and diagnostic development, one of the Centre's areas of expertise is in aquaculture. With increasing interest in land-based farming, our multidisciplinary research team also looks into developing cost-effective and eco-friendly ways of sustainable aquaculture especially in land-scarce Singapore.

Our Friends & Partners

Over the years, we have made many good friends and partners not just in Singapore, but internationally as well. We support each other in our ventures. Together, we make our business better.

OUR FRIENDS & PARTNERS

1. 3 M
2. 3D Matters
3. A*STAR
4. Aalst Chocolate Pte Ltd
5. AASTAR Pte Ltd
6. Abbott Manufacturing Singapore Pte Ltd
7. Academy of Chinese Medicine
8. Ace Biomed Pte Ltd
9. Ace Trading and Management Services Pte Ltd
10. Active Analytics
11. Agency for Integrated Care
12. Agilent Technologies Singapore (Sales) Pte Ltd
13. Agri-Food & Veterinary Authority of Singapore (AVA)
14. Agrimax Pte Ltd
15. Apollo Aquaculture Group Pte Ltd
16. Aqua FAME Pte Ltd
17. AquaRes Technology Pte Ltd
18. Astuce Envirotec Pte Ltd
19. Auric Pacific Marketing Pte Ltd
20. Bakels Singapore Pte Ltd
21. BD Biosciences
22. Bio3D Technologies Pte Ltd
23. Bio.etc Pte Ltd
24. BioGreen
25. Bioinformatics Institutes
26. BlueAqua International Pte Ltd
27. Business Compass Consultancy
28. Centre for Environment, Fisheries and Aquaculture Science, UK
29. Changi General Hospital
30. Chew's Group Limited
31. Chye Choon Food Pte Ltd
32. CLP EnviSystem Pte Ltd
33. Coca Cola Singapore
34. Compass Food
35. Dana Products Inc
36. Danone Asia Pacific Holdings Pte Ltd
37. Danone Nutricia Research (PTSH Holdings Singapore Pte Ltd)
38. Dav Electronics Pte Ltd
39. Dawyn Impex Pte Ltd
40. DHI Water & Environment (S) Pte Ltd
41. Diabetic Society of Singapore
42. DSO National Laboratories
43. Dynaglass Reinforced Plastic Pte Ltd
44. Dynalynk Pharma Pte Ltd
45. Economic Development Board
46. Ecosoftt Pte Ltd
47. Eco-Wiz Group Pte Ltd
48. Eng Seng Construction
49. Enterprise Singapore
50. Environmental Health Institute
51. Esco Aster Pte Ltd
52. Eu Yan Sang International Ltd
53. Faesol Pte Ltd
54. Fairmont Hotels and Resort
55. Fishery Research Institute of Shizuoka Prefecture
56. FrieslandCampina Amea Pte Ltd
57. G5 International Holdings Pte Ltd
58. Gaia Science Pte Ltd
59. Gardenia Foods (S) Pte Ltd
60. GeneSing Technologies Pte Ltd
61. GlaxoSmithKline
62. Green Faculty Pte Ltd
63. Greenology Pte Ltd
64. Griffith University
65. Guardian Health and Beauty
66. H.W. Traditional Medicine
67. Harbin Medical University
68. Health Promotion Board
69. Health Science Authority
70. Health Supplements Industry Association (Singapore)
71. Herbal Life Asia Pacific Services Ltd
72. Herbalife International
73. Herbalink Pte Ltd
74. Herb & Fashion Pte Ltd
75. HSD Holding Smart Device S.R.L.
76. Huay Feng Hang Pte Ltd
77. IDEC Corporation
78. IE Singapore
79. IM Gateway Pte Ltd
80. Innoheart Pte Ltd
81. Institute of Bioengineering and Nanotechnology
82. Institute of Infocomm Research
83. Institute of Molecular and Cell Biology
84. Institution of Aquaculture Singapore
85. International Enterprise Singapore
86. INVE Aquaculture
87. InvitroCue Pte Ltd
88. IPI Singapore
89. Ippin Pte Ltd
90. Islamic Religious Council of Singapore
91. James Cook University Pte Ltd
92. Japan External Trade Organisation (JETRO)
93. Jiangnan University
94. Johnson & Johnson
95. Jurong Health Services Pte Ltd
96. Kang Zhen Pte Ltd
97. Kei-Y Corporation Pte Ltd
98. Kiat Lee Landscape and Building Pte Ltd
99. Kim Sin Medicine Manufactory Pte Ltd
100. KK Women's and Children's Hospital Pte Ltd
101. Kovax Ltd
102. Le Choix Pte Ltd
103. Leading Bioenergy (S) Pte Ltd
104. Ledrink (Singapore) Pte Ltd
105. Leong Guan Food Manufacture
106. Life Technologies Holdings Pte Ltd (ThermoFisher)
107. Ligi Import
108. Lonza Biologics Tuas Pte Ltd
109. Lubritrade Ocean (Ubin) Pte Ltd
110. Lynk Biotechnologies Pte Ltd
111. Malaysian Feedmills Pte Ltd
112. Mandrake Medical Pte Ltd
113. Marine Life Park
114. McGraw-Hill Education (Asia)
115. Merck, Sharp and Dohme Animal Health Innovation Pte Ltd
116. MesoPhase Technologies Inc (Taiwan)
117. Ministry of Economy, Trade & Industry (METI) (Japan)
118. Modular Farms Incorporated
119. Montreux Patisserie Pte Ltd
120. Mount Pleasant Animal Medical Centre Pte Ltd
121. Nanchang University
122. Nanjing University of Chinese Medicine
123. Nanyang Technological University
124. National Environment Agency
125. National Heritage Board
126. National Parks Board
127. National Research Foundation
128. National University of Singapore
129. Nestec Ltd (Switzerland)
130. Nestlé Professional Singapore
131. Nestlé R&D Centre (Pte) Ltd
132. New Eastern (1971) Pte Ltd
133. North East Community Development Council
134. NSL Oilchem Waste Management Pte Ltd
135. NTUC Foodfare Co-Operative Ltd
136. NTUC Health Co-Operative Ltd
137. NU International Singapore Pte Ltd
138. Ocean Health Pte Ltd
139. Oceanus Group Limited
140. Oceanus Tech Pte Ltd
141. OneNine57 Pte Ltd
142. ONI Global Pte Ltd
143. Panasonic R&D Centre Singapore
144. Philips Electronics (S) Pte Ltd
145. Photocatalysis Industry Association of Japan
146. Pioneer Environmental Technology Pte Ltd
147. PolyBen Pte Ltd
148. Prima Pte Ltd
149. PT Sahabat Lingkungan Hidup (Indonesia)
150. QuantumTx Pte Ltd
151. Quintech Life Science Pte Ltd
152. Raffles Hospital Pte Ltd
153. Realstuff Aquaculture and Food Pte Ltd
154. Reckitt Benckiser (S) Pte Ltd
155. Reckitt Benckiser LLC (USA)
156. Revongen Corporation Sdn Bhd
157. Resorts World at Sentosa Pte Ltd
158. RIKEN Centre for Integrative Medical Sciences
159. Roche Diagnostics Asia Pacific Pte Ltd
160. Ross University School of Veterinary Medicine
161. SAGA Foodstuffs Manufacturing Pte Ltd
162. Saint George's University Limited, Grenada, West Indies
163. Science Arts Co Pte Ltd
164. Scuta Farms
165. SEA Business Centre Pte Ltd
166. Seerpharma Singapore Pte Ltd
167. Select Group Limited
168. Sembcorp EOSM Pte Ltd
169. Shizenature Pte Ltd
170. Shizuoka Prefectural Government of Japan
171. Shokuken Prefectural Government of Japan
172. Singapore Accreditation Council
173. Singapore Chinese Physicians' Association
174. Singapore College of Traditional Chinese Medicine
175. Singapore District Cooling Pte Ltd
176. Singapore General Hospital Pte Ltd
177. Singapore Health Services Pte Ltd
178. Singapore Heart Foundation
179. Singapore Institute of Engineering Technologists
180. Singapore Mabs Pte Ltd
181. Singapore Nutrition and Dietetics Association
182. Singapore Peking Oxford Research Enterprise (SPORE), National University of Singapore
183. Singapore Police Force
184. Singapore Salads Pte Ltd
185. Singapore Sports Institute
186. Singapore Veterinary Association
187. Singapore Workforce Development Agency
188. Somnetics Global Pte Ltd
189. South Island Aquarium Pte Ltd
190. Southern Taiwan University of Science and Technology
191. Soyjoy
192. Speedy Assay Sdn Bhd
193. ST Kinetics Integrated Engineering Pte Ltd
194. STERIS Corporation
195. StratifiCare Pte Ltd
196. Sultan Qaboos University (SQU)
197. Sunward Pharmaceutical Pte Ltd
198. Tai Tong Ah Co Pte Ltd
199. Tan Seng Kee Foods Pte Ltd
200. Techkon Properties Pte Ltd
201. Temasek Foundation
202. Temasek Life Sciences Laboratory
203. The Kettle Gourmet
204. The Mitolo Group
205. The National Centre for Genetic Engineering and Biotechnology, National Science and Technology Development Agency (BIOTEC)
206. Thermo Fisher Singapore Pte Ltd
207. Tong Jum Chew
208. Transalgae Israel Ltd, Israel
209. Trichokare Pte Ltd
210. Tung Lok Millenium
211. UglyGood Pte Ltd
212. Ultra Low Asia Hygiene Technology Pte Ltd
213. Unicurd Food Company Pte Ltd
214. United BMEC Pte Ltd
215. University of Applied Sciences, Utrecht
216. Upgrown Farming Asia Pte Ltd
217. USA Poultry and Egg Export Council
218. Watsons Singapore
219. WEMMS Enterprise
220. WDA
221. Wenken Group
222. WhiteRock Medical Company Pte Ltd
223. Wildlife Reserves Singapore
224. Willowvale Asia Pte Ltd
225. YaizuSuisankagaku Industry Co Ltd (YSK)
226. Yakult (Singapore) Pte Ltd
227. Yi Shi Yuan Pte Ltd
228. Yikowei Pte Ltd
229. Yun Onn Company Pte Ltd

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Journal Publications

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2. Beaumont C, Sackville A & Chew SC (2004). Identifying Good Practices in the Use of PBL to Teach Computing, ITALICS 3 (1), LTSN-ICS.

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4. Caipang CMA, Choo HX, Bai Z, HuiLin H, Lay-Yag CM & Lim J (2015). Small-scale Production of Biofloc Using Various Carbon Sources for the Freshwater Culture of Tilapia. Oreochromis sp. ABAH Bioflux, 7 (1), 103-111.

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6. Caipang CMA, Fagutao FF, Fatira E, Lazado CC & Pavlidis M (2015). Cortisol Levels and Expression of Selected Stress- and Apoptosis-related Genes in the Embryos of Atlantic Cod, Gadus Morhua Following Short-term Exposure to Air. International Aquatic Research, 7 (1), 75-84.

7. Chan GF (2014). Teaching and Learning Strategies Used in Metabolic Biochemistry to Stimulate Learning among Polytechnic Students. Scottish Journal of Arts, Social Sciences and Scientific Studies, 20(1), 55- 69.

8. Cheng JL, Mi JY, Miao H, Sharifah Fatanah BSA, Wong SF & Tay BK (2017). Synthesis of Ammonium and Sulfate Ion-Functionalised Titanium Dioxide for Photocatalytic Applications. Applied Nanoscience, 7 (3), pp.117-124.

9. Chew LL (2014). A Curriculum Redesign for Enhanced Student Engagement and Meaningful Learning. The International Journal of Pedagogy and Curriculum, 22(12), 1-13.

10. Choo HX & Caipang CMA (2015). Biofloc Technology (BFT) and Its Application Towards Improved Production in Freshwater Tilapia Culture. AACL Bioflux 8, 362-366.

11. Hoseinifar SH, Zoheiri F & Caipang CMA (2016). Dietary Sodium Propionate Improved Performance, Mucosal and Humoral Immune Responses in Caspian White Fish (Rutilus frisii kutum) Fry. Fish & Shellfish Immunology, 55, 523-528.

12. Hoseinifar SH, Sun Y-Z & Caipang CMA (2017). Short-Chain Fatty Acids as Feed Supplements for Sustainable Aquaculture: An Updated View. Aquaculture Research, 48, 1380-1391.

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Just Desserts

A selection of our finest pastries from Bistro Lab, our latest Learning Enterprise where new food concepts and menus are explored and tested by staff and students.

Construction of Bistro Lab was completed at the end of 2017.

Reaching Higher
Upgrown Farming Company

Lionel Wong Kok Wei (left) and & Terence Tan
Entrepreneurs & Diploma in Biotechnology Graduates

Terence and Lionel both graduated from the Diploma in Biotechnology in 2007. In 2014 they bravely ventured out on their own to start their own company, Upgrown Farming Company. Upgrown is an urban farming company that specialises in indoor, greenhouse and controlled environment agriculture. They aim to equip farmers of any level of experience and scale, with the tools and knowledge to grow healthy, sustainable food for local communities and to run a commercially-viable operation.

"We empower modern farms, through science and technology, to feed the world's growing populations in urban cities throughout the world. Controlled environment agriculture allows foods to be grown safer, cleaner, sustainably and of better quality. Growing closer to where the population is in urbanised cities means reducing the carbon footprint needed to bring food from the farm to the plate," says Terence.

Lionel remarks, "The Diploma in Biotechnology at TP gave us the firm foundation, knowledge and skills in biology, problem based learning and communication. These skills encouraged us to think out of the box and get out of our comfort zone to venture out and explore new horizons beyond the classroom and our shores."

Other ASC graduates who have set up their own businesses include:

Fan Mingwei
Director & Co-Founder, Bio3D Technologies
Group CEO, Emcero Pte Ltd

Mingwei, a Biotechnology graduate, has been an entrepreneur for 17 years including nine years in bioentrepreneurship. He was honoured as one of the fifty SG50 Entrepreneurs in 2015.

Samuel Gan
Founder
APD SKEG Pte Ltd

Dr Gan is also a Biotechnology graduate. His company provides services in consultancy, scientific apps, and holds educational workshops based on their in-house student-developed research and educational kits, as well as IOT devices.

Arielle Low Hwee Min
Business Owner
The Flourist

Arielle is a Baking & Culinary Science graduate. The Flourist is a cafe serving ice cream, waffles, pastries, and coffee, all of which are made by Arielle and her team. She has created over twenty flavours of ice cream, such as Miso Butterscotch, Jasmine and Lemongrass and Sea Salt Hokkaido Milk.