A*STAR YEARBOOK 2009/2010
Sparkles, the motif of this year’s theme, represents the spirit of “partnerships for impact.” Each sparkle represents an individual— an individual talent, an individual company, an individual institution. Every one of these shines with a light representing their promise and potential, but individually they can only stand as lonely lights in a bleak landscape. However, when these individual sparkles are brought together, they form a beautiful pattern. This represents the bringing together of individual strengths and capabilities to create a dynamic and vibrant whole where the whole (the entire pattern) is certainly much greater than the sum of its parts (the individual sparkles).
Why We Exist

**MISSION**
Fostering world-class scientific research and talent for a vibrant knowledge-based Singapore.

**VISION**
A prosperous and vibrant Singapore built upon a knowledge-based economy.
The ESC was formed in May 2009 and was supported by eight sub-committees. One of them, Sub-Committee 4 on “Growing Knowledge Capital”, was focused on the research, innovation and enterprise system in Singapore. The ESC announced its findings in February 2010 and all the recommendations were accepted by the government.

The key thrust of the ESC’s findings was to make skills, innovation and productivity the basis for sustaining Singapore’s economic growth. This would then provide for growth across all sectors of society and bring greater prosperity to Singaporeans. As part of this thrust, Singapore needs to position itself as a vibrant and distinctive global city. Such a city, with an open and diverse culture, would be the best place to grow and reach out to a rising Asia, as well as a home that provides an outstanding quality of life.

To support this, Sub-committee 4 recommended ways to make innovation pervasive as well as strengthen the commercialisation of R&D here. The specific recommendations include raising Singapore’s Gross Expenditure on R&D (GERD) to 3.5% of GDP by 2015 through increased private sector R&D expenditures. At the same time, there will be a greater emphasis on innovation and commercialisation of various innovation platforms that will enable the private sector companies to better leverage on the world class R&D capabilities in the public sector. Our aspiration is for Singapore to become a key global R&D hub as well as Asia’s Innovation Capital.

More recently, in line with the ESC’s recommendations, the Research, Innovation and Enterprise Council (RIEC) announced that it would commit S$16.1 billion to support the drive to develop the research, innovation, and enterprise landscape in Singapore. PM Lee Hsien Loong declared Singapore’s long-term aim is to be among the most research-intensive, innovative and entrepreneurial economies in the world so as to create high-value jobs and prosperity for Singaporeans. Moreover, the country’s R&D expertise would be harnessed to solve complex challenges facing both Singapore and the world.

In the midst of the deepest global recession in decades, Singapore convened an Economic Strategies Committee (ESC) to fundamentally review our strategies and to chart new directions for the next 10 to 15 years. The focus was on sustainable, quality and inclusive growth.

A*STAR is bringing together partners of different sizes from many different sectors to integrate for impact – assisting the joining of forces to create powerful change.
we want to expand the boundaries of collaboration to provide more opportunities for more complex multi-party multi-dimensional collaborations.

A*STAR programme brings together industry giants such as Boeing, Rolls-Royce, Bombardier, Honeywell Aerospace, SIA Engineering Company, and ST Aerospace, and A*STAR's research institutes in a consortium to collaborate on projects that will shape the future of the aerospace industry. The consortium facilitates collaboration in the pre-competitive space across many different dimensions: it sees traditional industry rivals such as Boeing and Rolls-Royce working together; it sees private commercial giants collaborating with public research institutes; it also sees global multinationals partnering local SMEs to strengthen the links in the supply chain.

Another illustration is Roche's Translational Medicine Hub which was announced in early 2010. This is the first of Roche's TCR sites of this nature in the world and the company is prepared to invest 100 million Swiss francs or S$130 million over the next five years in two areas of research, namely, oncology and virology. Together with Roche, the Biomedical Sciences community created a platform that will enable the company to access the expertise of both basic scientists as well as clinician scientists/investigators in the hospitals, universities, and research institutes. This makes it much easier for Roche's scientists to conduct multi-disciplinary translational research in a seamless way that will greatly accelerate the drug discovery and development process. More recently, GSK also announced the setting up of their Academic Centre of Excellence (ACE) in Singapore which will also leverage the excellent public research infrastructure that we have put in place and organized to facilitate the rapid translation of research findings into novel healthcare solutions with both clinical and market impact.

The formation of the Aerospace Programme, the setting up of the Roche Translational Medicine Hub and the GSK ACE are examples of the opportunities that are coming this way in the next decade or two. We have responded to the opportunities and we are learning from the experience at the same time. Our focus remains to do this in a quality win-win partnership. As we go forward, we will have to make adjustments and raise our game as we are operating in a very competitive landscape.

The coming decade is a very promising and exciting one for Singapore and A*STAR. There are many opportunities out there and we are well positioned to seize them. However, we must always remember that we are in a good position because our greatest strength is our talent – talent across the whole research, innovation and enterprise system. We must always seek to attract the best talent, invest in their development and create pathways and opportunities for them to realize their full potential. As long as we sustain this flow of the most capable and committed talent into and in the country, Singapore will become a key global R&D hub and Asia's innovation capital.

With the recommendations of both the ESC and the directions of RIEC in mind, the mission of A*STAR is clear: A*STAR must continue to deliver world class impactful research in an increasingly diversified and competitive research landscape.

A*STAR is well poised to do this. With a critical mass of world class scientists spanning a spectrum of disciplines from the biomedical sciences to physical sciences and engineering, we are able to integrate our relevant capabilities synergistically to deliver a strong value proposition to our industry partners or to tackle significant national challenges. Indeed, our ability to integrate extends beyond A*STAR through our cooperative and collaborative links with the wider R&D community in the universities, the polytechnics and the hospitals as well as the other public sector agencies and our industry partners.

This ability to "integrate for impact" at the "Whole-of-Singapore" level; our very international and English speaking environment; the ease of doing business here with our strong IP protection laws; our high quality of life; and also our connectivity to the rest of the world are what set Singapore apart from R&D hubs in Asia. Our differentiating advantages are especially critical now that businesses in general, attracted by the size, rapid growth and increased affluence of the Asian markets, are responding more specifically to the needs of the Asian consumers and markets. Singapore and A*STAR should take advantage of the growing interest in Asia and the shift towards an open innovation model to develop significant partnerships with the MNCS and foreign companies which are seeking to grow their R&D activities in Asia.

One illustration of how A*STAR has done this successfully with the industry partners is the A*STAR Aerospace Programme. This groundbreaking programme brings together industry giants such as Boeing, Rolls-Royce, Bombardier, Honeywell Aerospace, SIA Engineering Company, and ST Aerospace, and A*STAR’s research institutes in a consortium to collaborate on projects that will shape the future of the aerospace industry. The consortium facilitates collaboration in the pre-competitive space across many different dimensions: it sees traditional industry rivals such as Boeing and Rolls-Royce working together; it sees private commercial giants collaborating with public research institutes; it also sees global multinationals partnering local SMEs to strengthen the links in the supply chain.

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A*STAR organized its 2nd Scientific Conference at the Biopolis. During the Conference, the inaugural award, “A*STAR Research” was launched. This publication presented high quality research from the A*STAR research institutes. Over 500 researchers from the research institutes participated in the Conference.

A COMMUNITY OF TALENT

A*STAR has attracted many talented individuals from around the world – it has scientific leaders, researchers, post-docs and PhD students from over 60 countries working in 21 research institutes, consortia and centres. As of Jun 2010, the total size of the A*STAR community was 4,085; comprising 223 at A*STAR HQ, and 3,862 post-docs and PhD students from over 60 countries around the world – it has scientific leaders, researchers, technical and non-technical staff, and industry development and commercialization staff.

This year, A*STAR announced its partnership with Stanford University Biodesign Programme and the EDB to establish a new training program called the Singapore-Stanford Biodesign Programme, which aims to train the next generation of Asian leaders to develop innovative medical devices to address Asia’s growing healthcare needs.

Dr Jonathan Loh, an A*STAR scholar, won the Young Scientist Award and Singapore Youth Award for his research into the genetic and epigenetic mechanisms regulating embryonic stem cells and the direct reprogramming of human somatic cells, and outstanding achievements in science and technology, respectively.

Members of the A*STAR community won many accolades in recognition of their excellent contributions to science and technology. A*STAR Research Staff Dr Ng Huck Hui from the Genome Institute of Singapore (GIS) was conferred the Medal of Commendation for Science and Technology at the Singapore Youth Awards 2010 for his accomplishments in science and technology. Dr Victor Tong from I²R won the National Youth Service Award for his grand-unifying research on “custom” design vaccines.

The Singapore Institute of Manufacturing Technology (SINTECH) was awarded the Best Talent Development Strategy Award and the Hudson Award for Champion of HR at the 2010 HRM Awards.

A*STAR’s reputation as an “Employer of Choice” was affirmed in the iQIyieP Employer of Choice Survey 2009 (University Edition) where entry-level graduates ranked A*STAR #4 as an Employer of Choice, in a field of over 150 companies in Public Service. A*STAR also won recognition for incorporating environmentally-friendly features into its offices by being awarded the BCA Green Mark for Office Interior Award Gold.

The quest for excellence never ends, A*STAR will continue to strive for the highest standards of performance by delivering impactful and relevant research, attracting the best talent, and focusing on efficient and optimal use of systems, processes and resources. This will enable us to remain on track to fulfill our mission to foster world-class scientific research and talent for a vibrant knowledge-based Singapore.
WHAT WE ARE DOING
Patients that suffer from ADHD and stroke can now get better by taking advantage of a technology that allows their minds to interface directly with machines. With the help of a ‘brain-computer interface’ (BCI), such patients can now undergo treatments that practically rewire their brains, reducing the effects of these debilitating conditions.

The BCI helps such patients by allowing their minds to have direct control over a machine. Patients who suffer from stroke can use the BCI to move a machine that, in turn, moves a cradle holding their immobile limb. By directing the movement of their arm in this manner, stroke patients can rebuild their damaged neural pathways and regain the use of their immobile limb. Patients who suffer from ADHD can use the BCI to play a computer game which rewards them for being able to pay attention for extended periods of time.

To find such innovative uses of the BCI, Dr Guan Cuntai’s team from I2R worked closely with local hospitals to discover the needs of stroke and ADHD patients. By studying the conditions that these patients suffered from and the kinds of rehabilitation these patients needed, Dr Guan’s team was able to adapt the BCI and use it to devise treatments for these patients. The treatments have already seen a great deal of success in preliminary trials, and Dr Guan’s continuing close collaboration with the hospitals enables him to improve and fine-tune his technology.

Dr Karen Chua Sui Geok, Senior Consultant at Tan Tock Seng Hospital Rehabilitation Centre, was responsible for conducting a clinical trial where Dr Guan’s technology was used to help stroke patients. She said “The results were quite promising with some patients recovering motor strength in their stroke affected arms comparable with manual robotic treatment. We’re looking forward to seeing the results of the new trial with a new version of Dr Guan’s machine.”

Said Dr Guan Cuntai, leader of the team, “It’s really gratifying to see something you’ve worked so hard on to turn into a device that can really change the lives of people. Of course, we couldn’t have succeeded without the help of our partners in the hospitals. They really gave us immense support to help find new and powerful ways to use the BCI.”
Though printed brain atlases have been available for almost half a century, this is the first time that a fully three dimensional (3-D), interactive model of the human brain has been made available. In performing such a feat of knowledge creation Dr Nowinski worked together with many partners, such as the University of Pennsylvania, the Singapore General Hospital, and the National University of Singapore. These valuable collaborators provided key knowledge and data to enable Dr Nowinski to come up with his revolutionary product.

To create the revolutionary brain atlas, Prof Nowinski and his team took countless pictures of the brain using sophisticated imaging technology. They then painstakingly reconstructed a 3-D model of the human brain from these 2-D pictures, adding in labels of the brain’s many structures along the way to create a tool that is invaluable to modern neuroscientific research and treatment.

One way medical professionals are finding Prof Nowinski’s brain atlas invaluable is the tremendous help it gives during surgery. Dr Yeo Tseng Tsai, a senior consultant neurosurgeon at the National University Hospital, said, “Before we go into surgery, this software will give us a better idea of the arrangement of blood vessels which is very complicated.” By helping neurosurgeons better understand the complex structure of the brain, the brain atlas helps to increase the success rate of brain surgeries.

Said Dr Nowinski, “For years surgeons and scientists have grappled with the difficulty of understanding the human brain in all its complexity. Our team helps scientists and medical professionals better understand this complex organ by creating the first of its kind 3D interactive brain atlas.”
Nature versus Nurture. To this day, the debate over how much of the diseases we suffer from and are likely to inherit is a product of our inherent genetic make-up or of the environment that we grew up in and live in. What’s more, a better understanding of just how much of our lives is determined by our genes (and what isn’t) may lead to a deeper knowledge of many common adult diseases such as cardiovascular disease and osteoporosis.

To settle the question, A*STAR’s Singapore Institute for Clinical Sciences (SICS) and the National University of Singapore (NUS) joined up with the EpiGen consortium, the leading worldwide force in developmental epigenetics. The founding members of the consortium were the MRC Epidemiology Resource Centre in Southampton, the University of Southampton’s Institute of Developmental Sciences, The Liggins Institute of the University of Auckland, and AgResearch Ltd (formerly the New Zealand Pastoral Agriculture Research Institute). In joining the consortium, SICS and NUS bring capabilities which help to address problems like obesity and diabetes.

Formed in 2006, the consortium works to understand the extent to which the environment has on human development and figure out just how much influence the environment has on children growing up, and how this influence can precipitate one to suffer certain types of diseases later in life. In fact, there is increasing evidence that factors in early development are major causes of obesity and type 2 diabetes, diseases which afflict many Singaporeans. By pooling its strengths with the abilities of the other consortium members, SICS hopes to discover new knowledge about these diseases that could lead to an impact on Singapore society.

Says Prof Sir Peter Gluckman, leader of the EpiGen consortium, “We’re delighted to have SICS and NUS on board with us. We are still light years away from solving the puzzle of genetics and the environment, and this partnership is going to go a long way to teasing out clues to that puzzle.”

Prof Judith Swain, Executive Director of SICS and Lien Ying Chow Professor of Medicine at the Yong Loo Lin School of Medicine in NUS, explains why SICS is so excited to be able to join the consortium. “This is a wonderful opportunity to bring to the consortium experts in human development and chronic disease who have particular expertise in the Asian phenotype. We are pleased to be joining the founding institutions as members of EpiGen.”

By understanding exactly how the environment influences disease, the consortium will help doctors and clinicians predict the risk of certain diseases and develop new drugs that may help retard or halt the progress of many of the health problems that Singaporeans now suffer from.
Innovation Capital is the ability to translate ideas to the marketplace. By building up our Innovation Capital, we will be able to realize societal and economic benefits from our R&D investment.
“Our technology programme is aimed at developing aircraft that are more comfortable, less expensive to own and operate, and more respectful of the environment,” says Dr Fassi Kafyeke, Director Strategic Technology, Bombardier. “Our participation in this Singapore SERC Aerospace Programme [also known as the Aerospace Consortium] is a further step in this direction.”

It is not hard to see why Bombardier chose to join the ranks of the Aerospace Consortium in April 2010. The consortium is arguably the world’s first platform where traditional industry rivals collaborate on pre-competitive research. This groundbreaking consortium brings together industry giants such as Boeing, Rolls-Royce, Honeywell Aerospace, SIA Engineering Company, and ST Aerospace to collaborate with A*STAR’s research institutes on projects that will shape the future of the aerospace industry. The local SMEs that are also part of the consortium fill up crucial links in the aerospace supply chain. By joining the consortium, Bombardier is taking advantage of an incredible opportunity to access the best expertise from both industry and academia.

Like Dr Kafyeke, Dr Colin Chan, Chief Executive Officer of Addvalue Technologies Ltd, a local SME participating in the consortium, is another enthusiast of the opportunities afforded by the consortium. “Through collaborating with other members and by tapping the rich R&D resources facilitated by A*STAR, we hope to proactively and directly contribute to the aerospace industry with innovative satellite communication solutions,” he said.

The Aerospace Consortium not only provides an exciting way for globally competitive companies to develop new capabilities in breakthrough areas of research, but also gives local companies a great opportunity to work with the leaders in the field. Local companies get the chance to demonstrate their value-add to global multinationals by filling up key component of the supply chain, thereby helping to anchor these commercial giants in Singapore.

In the future, the pioneering Aerospace Consortium is planning to explore avionics – an exciting area for the aerospace industry that has great potential for helping airplanes fly better, farther, faster, yet at the same time reducing the carbon footprint of planes through the electrification of aircraft systems. Eight projects have been selected for the next cycle of the consortium due to start next year, and work will begin in early 2011.
Imagine a device with the power of today’s desktops, yet smaller and lighter than an iPhone. Or a computer chip small enough to be embedded in your spectacles, yet powerful enough to compute an informative video overlay that tells you interesting information about what you are seeing. Today, thanks to the help of 3-Dimensional Through-Silicon Via technology, we may yet create chips even smaller, yet many times more powerful than today’s microprocessors.

“3D TSV is a critical technology that will enable the continued miniaturization, performance enhancement and energy efficiency of electronics devices such as smart phones, notebooks and e-readers,” said Mr. Damian Chan, Director of EDB. This new technology literally adds a new dimension to microprocessor technology, as it will take the possibilities of computer chip miniaturization from 2-dimensions to 3-dimensions.

Today, engineers and scientists are facing a crisis, as we are soon reaching the limits of current chip miniaturization. As a result, “3D TSV is a critical technology that will enable the continued miniaturization, performance enhancement and energy efficiency of electronics devices such as smart phones, notebooks and e-readers,” said Mr. Damian Chan, Director of EDB. This new technology literally adds a new dimension to microprocessor technology, as it will take the possibilities of computer chip miniaturization from 2-dimensions to 3-dimensions.

This platform for collaboration allows global MNCs, local enterprises, and A*STAR institutions to tap on each other's strengths to innovate in this new field. Professor Dim-Lee Kwong, Executive Director of IME, said, “The 3D TSV Consortium provides an ideal platform to integrate key companies across Singapore’s semiconductor supply chain to co-develop next generation technology.” By harnessing the capabilities of Singapore’s local enterprises and those of the global MNCs, the consortium creates win-win partnerships that will enhance the competitiveness of Singapore’s semiconductor industry.

The consortium is also an excellent way to align academic expertise with industry needs to create a more harmonised research ecosystem, one that leverages Singapore’s elite research capabilities in this rapidly growing field. Areas which the consortium will explore include finding ways for making MEMS devices more easily deployable, pushing the boundaries of MEMS innovation, as well as training expertise in MEMS-related technologies.

“We are excited to co-create a MEMS platform and MEMS supply chain with IME, A*STAR and EDB particularly in Singapore as a fertile breeding ground for new technologies,” said Dr. Raupach-Sumiya Joerg, President of NEC Schott to Singapore to work with our local research institutes and enterprises to create value in this rapidly growing field. Areas which the consortium will explore include finding ways for making MEMS devices more easily deployable, pushing the boundaries of MEMS innovation, as well as training expertise in MEMS-related technologies.

MEMS – Microelectromechanical systems: tiny mechanical devices powered by electricity that have the potential to revolutionise nearly every aspect of modern technology. From printers, to cars, to cell phones, to cameras, to displays, MEMS is an enabling technology allowing the development of smart products.

Much of today’s consumer technology would simply not work without the use of MEMS. These tiny devices are found in inkjet printers to deposit ink on paper, and in cars to facilitate proper airbag deployment. MEMS represents an extraordinary rich and fertile market with plenty of room for innovation.

To take advantage of this, A*STAR and EDB created the Singapore MEMS Consortium. Started in April 2010, the consortium brings together top names like Seiko and NEC Schott to create win-win partnerships with our local research institutes and enterprises to create value in this rapidly growing field. Areas which the consortium will explore include finding ways for making MEMS devices more easily deployable, pushing the boundaries of MEMS innovation, as well as training expertise in MEMS-related technologies.

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By slipping into a new skin, everyday objects like walls, glues, and tables can acquire completely new properties. Think about better non-slip floors, glues that do not leave sticky residues, and tables and chairs that are anti-bacterial.

Nanoimprint technology, or NIT for short, enables the creation of such innovation skins. With NIT, surfaces can be textured and designed at the nanometer level, enabling scientists to engineer to create synthetic surfaces that mimic the special properties of natural surfaces. For example, by copying the surface structure of a lotus leaf, scientists can imbue objects with new waterproofing properties.

The Industrial Consortium on Nanoimprint (ICON) launched in August 2010 saw A*STAR’s IMRE bringing together international companies from the US, Japan, and South Korea to a platform where research projects of common interests are carried out at a pre-competitive level but with specifications that are defined with direct inputs from the member companies. This research model helps companies adopt the technology into their products at an early stage and at a quicker pace.

Prof Low Teck Seng, A*STAR’s Deputy Managing Director (Research), and Executive Director, Science and Engineering Research Council said, “A*STAR is keenly aware of our vast technological capabilities and the need for transferring these technologies to industry, which ultimately benefits the public at large. Industry consortia are but one of the many avenues A*STAR uses to shorten the route, and timeframe, that our research takes to reach your homes.”

“We were sold on the benefits of nanoimprint technology from the start and having a platform like ICON that helps put that technology into practice was all the convincing we needed to join the consortium,” said Mr Tatsuo Shirahama, President of Innox Co Ltd, Japan, a founding member of ICON.

All these will be made possible with cloud computing - a technology which promises innovation in the way companies, businesses, and people relate and use computers and the Internet.

To explore this new area of research and usher in a new age in computing, A*STAR embarked on a research partnership with computing giant Hewlett Packard to set up HP Labs Singapore in February 2010. This new research facility in Fusionopolis aims to create a new platform where both local and global enterprises can create new knowledge and add value to the economy. The lab is the seventh research lab set up by HP worldwide.

Prof David Srovolitz, Executive Director, Institute of High Performance Computing, said “I'm really excited about the possibilities created by this partnership, through this collaboration, A*STAR and HP will be able to work together to create exciting potential in the new landscape of cloud computing and help to usher in a next revolution in computing technology.”

“HP Labs Singapore at Fusionopolis serves as a hub for open innovation in the region, bringing collaboration amongst HP’s customer and partner communities to bring a variety of advancements to market, the research being driven out of HP Labs Singapore is engaged on a range of ambitious research projects to re-examine data center and application design concepts to explore how future cloud computing needs will be met,” says Dr Chris Whitney, director of HP Labs Singapore.

Added Prof Srolovitz, “This collaboration shows how public agencies can work together with private enterprise to explore revolutionary technologies that promise to change the way we interact with computers and data. This sort of win-win partnership is exactly the kind of cross-boundary synergy that we need as we move into the next decade.”
Fujitsu is one of the many MNCs that have planted R&D facilities in Singapore to build on the country’s expertise in research and development. In coming to Singapore, Fujitsu brings their expertise in two important areas to the country, creating diversity in the research landscape and providing opportunities for local companies to tap on the company’s expertise.

The two key innovations being explored by Fujitsu and A*STAR are Petascale Computing and Aptamers. Petascale computing provides computing power a million times more than what is widely available today and will be crucial to solving problems like environmental sustainability, disease prevention, and disaster recovery. Aptamers are molecules that will enable more effective and cheaper diagnosis of diseases.

MNCs like Fujitsu are drawn to Singapore because Singapore not only has key capabilities in areas that are relevant to Fujitsu’s interests, but the country also has the ability to integrate its strengths and abilities to offer global companies a comprehensive array of expertise. For example, in the area of aptamer technology, Fujitsu Laboratories Singapore will co-operate with institutions such as the Experimental Therapeutics Centre, the National University of Singapore, the National University Hospital, and the Cancer Science Institute to explore ways in which aptamers can improve the diagnosis of diseases such as dengue and prostate cancer.

“Fujitsu’s collaboration with A*STAR represents our commitment to being part of an ecosystem that will enable Singapore to harness innovations in technology, with the aim of developing a world-class R&D hub for diagnostic aptamer research,” said Mr Lawrence Wee, Regional Chief Executive Officer, Fujitsu Asia Pte Ltd.

Fujitsu’s decision underscores Singapore’s attractiveness as an R&D and innovation hub. In setting up its R&D facilities in Singapore, the company joins a growing ecosystem of enterprises such as Roche, Novartis, and Abbott that have set up shop in Singapore, Asia’s Innovation Capital.
SMEs are the backbone of Singapore’s economy and are key creators of innovation. Companies such as Resin & Pigment, Winrigo, and Astoria have developed new in-house technologies that allow work to be done better, cheaper, and faster. Helping these companies become more competitive through equipping them with cutting-edge knowledge is part and parcel of realising A*STAR’s vision: a prosperous and vibrant Singapore built upon a knowledge based economy.

One key programme which A*STAR has initiated is GET-Up - Growing Enterprises through Technology Upgrade (GET-Up). Through this programme A*STAR helps to contribute to increasing the competitiveness of local companies by partnering them to provide scientific expertise to help them leverage on the latest advances in technology and R&D. Under this programme, A*STAR researchers can be seconded to SMEs to help improve production processes, develop new products and strategies and develop technology roadmaps.

“The researchers have contributed significantly to the development and localization of products for Resin & Pigment’s key customers. Their work towards capability and technology development are key contributors to the successful start up of Resin & Pigment’s new toll compounding business ... more importantly, their work has helped Resin & Pigment clinch a business contract with ExxonMobil to be its first contracted compounder in Asia, products of which will be applied in automobiles,”

- MR ALEX TAN, MANAGING DIRECTOR OF RESIN & PIGMENT.

He was able to share the same technical ‘language’, which gained their confidence in CEI. If not for GET-Up, it would be very difficult for us to find an optics expert to do this. Our achievements have distinguished us in the industry and moved us up the value-chain,” added Mr Tan Ka Huat, Managing Director of CEI Contract Manufacturing Limited.

The polytechnics will help our local companies in three main ways. First, researchers from the polytechnics’ Centres of Innovation (COIs) will be seconded to SMEs on a full-time basis to build up the SMEs’ research capabilities. Second, faculty from the COIs will provide consultation services to help SMEs develop their long-term plans to meet the needs of the market. And third, equipment and facilities at the COI will be made available for use by the SMEs. In the future, opportunities to extend GET-Up to other clusters of expertise in the polytechnics will also be explored.

COIs
In April 2010, Singapore Polytechnic, Nanyang Polytechnic, and Ngee Ann Polytechnic have joined GET-Up as strategic partners. They will contribute expertise from their Centres of Innovation to help SMEs make an impact in today’s exciting economy. These Centres of Innovation stand ready to help our local companies in areas ranging from Food Innovation, to Electronics, to Marine & Offshore Technology, and to Environment & Water Technology.

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Building innovation capital with industry

Exploit Technologies Pte Ltd (ETPL), the marketing and commercialization arm of A*STAR, helps researchers translate their lab discoveries into value propositions for the market. ETPL drives the whole process, from nurturing a pool of market-ready technologies for commercial applications, providing intellectual property (IP) portfolio management, to supporting budding technopreneurs from A*STAR’s research institutes who wish to spin-off.

“To traverse the challenges of bringing technology from lab to market requires a concerted effort and commitment from industry partners who work closely together from the early days of conceptualization to shape the business strategy, leverage available avenues to garner funds and accelerate development.”

- Philip Lim, Chief Executive Officer, Exploit Technologies Pte Ltd

Says Mr Philip Lim, Chief Executive Officer, Exploit Technologies Pte Ltd, “Exploit Technologies is happy to steer the way forward and catalyze the transition of good science to a commercially viable business. We look forward to working closely with our partners to bring A*STAR’s technologies to market through creating viable start-ups.”

To date, ETPL manages a portfolio of close to 1260 active patent families, has granted about 300 licenses for A*STAR technologies and created a portfolio of 34 spin-off companies. Estimated business revenue to be generated by licensees from sales of products and provision of services using or incorporating A*STAR’s technologies is projected to be over $550m. The total market value created through A*STAR startups amounts to about $250m.

One of ETPL’s recent successes is Tera-Barrier Films Pte Ltd (TBF).

One of ETPL’s recent successes is Tera-Barrier Films Pte Ltd (TBF), is a spin-off from A*STAR’s Institute of Materials Research and Engineering (IMRE), with a strong patent portfolio of 29 patents on transparent gas barrier technology, encapsulation and gas permeation measurement system. The technology know-how and expertise could provide a total barrier solution for flexible solar cell and flexible electronics device manufacturers.

From the initial stages, ETPL played an active role to shape the business plan, raise funds and eventually start the company. In August 2009, TBF secured an investment from Applied Ventures, LLC, the venture capital arm of US-based Applied Materials, Inc., which is a global leader in nanomanufacturing technology solutions. This strategic investment is a strong endorsement of A*STAR IMRE’s technology and of TBF’s long term development and marketing plans.

“The investment by Applied Ventures enables Tera-Barrier to move forward with commercialization plans into the flexible solar cells and printed electronics market. Tera-Barrier Films is in the process of securing product qualification and sample orders, and has strong subcontract partnerships in place for scalable production of high performance barrier films. We are excited to be able to bring to market a key enabling product that could help propel faster growth in our target markets.” says Dr. Mark Auch, Chief Executive Officer, Tera-Barrier Films Pte Ltd.

Applied Ventures, LLC, invested in TBF to further develop and manufacture a new proprietary, moisture resistant film, which is able to significantly extend the lifespan of devices such as organic solar cells and flexible displays.

The new film, based on technologies developed at IMRE and licensed from ETPL, is used to protect the moisture-sensitive organic materials of plastic devices from degradation, thereby meeting a critical need of the rapidly growing plastic electronics industry.

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The aim of the Boston-based Centre for Integration of Medicine and Innovative Technology (CIMIT) is to foster interdisciplinary collaboration among world class experts in medicine, science, and engineering, in concert with industry and government, and to rapidly improve patient care. The partnership between A*STAR and CIMIT aims to bring this spirit of collaboration and innovation to Singapore to create a vibrant Medical Technology ecosystem, one which encourages innovation in medical technology and provides the support needed to help startups turn promising prototypes into full-fledged commercial products.

Medical technology refers to devices that are used to diagnose, monitor, or treat human diseases. Innovation in such devices may lead to machines that one day can instantly tell you whether your itchy throat was just a simple case of sore throat or something more sinister, or lead to the development of artificial organs that could save the lives of millions of patients who need urgent organ transplants. Under the A*STAR-CIMIT collaboration, engineers, clinicians and/or BMS scientists in Singapore will be able to work with clinicians in Boston to come up with engineering solutions that can be turned into medical technology devices. By collaborating with CIMIT’s in-house team of experts who are experienced in facilitating the complex process of introducing technological innovations into healthcare, Singapore’s innovators will be able to leverage on their capabilities and experience to learn how to better bring their promising inventions all the way from the lab to the market. The building of such knowledge in Singapore will go a long way to helping more and more local inventors set up companies to bring their inventions to market.

Dr Tan Sze Wee, Programme Director for A*STAR MedTech Initiatives, said, “The CIMIT-A*STAR collaboration provides a wonderful platform for Singapore’s clinicians and scientists to learn techniques for innovation and invention. Equipped with these skills, our talent will be able to translate better the exciting ideas they have in their head into reality, producing innovations that fit our uniquely Singaporean context.”

The Scholarship Award Ceremony 2010 was an exciting and inspiring affair. Not only did 136 of Singapore’s future scientific leaders receive scholarship awards that enable them to study at prestigious overseas institutions, this year’s ceremony also marks a particularly important milestone in A*STAR’s scholarship journey: the 10-year scholarship drive has been successful in nurturing a pipeline of 1,000 scholars who will contribute in meaningful ways to the Singapore R&D scene.

Nurturing talent in such great numbers can only be done well for Singapore’s R&D scene. Prof Sir David Lane, A*STAR Chief Scientist, who has mentored nine scholars during their undergraduate and postgraduate studies as well as many others on their research attachments during his six-year stint here, is very excited about the quality of talent that will one day shape Singapore’s scientific future. “The A*STAR scholars whom I have had interactions with have displayed exceptional drive and eagerness to learn. With their caliber and the excellent opportunities available here, they are poised to make great contributions to science and to Singapore,” said Prof Lane, testifying to the quality of talent of the scholars.

A*STAR’s talent nurturing programmes help to create a more vibrant, exciting, and innovative research environment in Singapore, adding value to other companies in Singapore. Pradip Mukerji, Center Director, Asia-Pacific R&D, Abbott, says “…Abbott is privileged to include among its many talented scientists Dr Low Yen Ling who earned her PhD under an A*STAR scholarship. The effort that A*STAR puts forth in attracting talented students to science-based careers has provided an opportunity to use their strengths to serve the nation.”

A*STAR has a comprehensive range of schemes and programmes designed to nurture top talent and provide excellent opportunities for young and aspiring scientists to grow their interest and their passion for science. Talent plays a crucial and important role in Singapore’s future R&D-based knowledge-driven economy, and these scholarship programmes benefit both the nation as well as give bright talents an opportunity to use their strengths to serve the nation.

These scholarship programmes include:

- The National Science Scholarship (BS-PhD) provides opportunities for undergraduate and postgraduate studies at some of the world’s finest universities in Biological Sciences, Physical Sciences and Engineering disciplines.
- The National Science Scholarship (MBBS-PhD) represents A*STAR’s efforts in grooming students aspiring to be clinician-scientists into Singapore’s next generation of leaders in translational medicine.
- The A*STAR International Fellowship provides PhD graduates with two years of fully funded post-doctoral research for up to two years at a leading overseas laboratory of their choice.
- The AGA Post-doctoral Fellowship is a fully funded overseas post-doctoral fellowship awarded to current AGA scholars. This fellowship allows AGA scholars to conduct research at world class scientific research and PhD studies in National University of Singapore, Nanyang Technological University and A*STAR Research Institutes.
- The Singapore International Pre-Graduate Award (ARAP) is a collaboration between A*STAR and overseas universities to provide research opportunities at A*STAR Research Institutes and Consortia.
- The Singapore International Graduate Award (SINGA) provides an opportunity for international students to pursue world-class scientific research and PhD studies in National University of Singapore, Nanyang Technological University and A*STAR Research Institutes.
- The Singapore International Post-Graduate Award (SIGA) supports short-term research attachments for international students at A*STAR. It provides a unique opportunity for top overseas students to experience the vibrant scientific environment in A*STAR Research Institutes and Consortia.
- The A*STAR also introduced a new scholarship programme this year, the A*STAR Undergraduate Scholarship (AUS). The AUS supports bright local students with a keen interest in research for a Bachelor’s degree in science or engineering at local universities. Undergraduates have the flexibility to pursue their PhD studies locally or abroad on A*STAR or other university scholarships.
Voices of A*STAR Scholars

Liang Kaicheng is an NSS(BS-PhD) scholar who has just graduated from Duke University with a Bachelor's degree in Biomedical Engineering. Here, he talks about what interested him in the A*STAR scholarship, how the scholarship gave him opportunities that he would not have had otherwise, and what he is looking forward to after he completes his PhD studies.

“I applied for A*STAR because it offered the rare opportunity to be fully funded for an education that would prepare me for a career in scientific research. I was intrigued by a potential career which would exploit my strengths in quantitative sciences while never ceasing to challenge and surprise me. Research fits the bill perfectly, and, though I knew the road ahead would be long, I had no qualms in taking up the A*STAR scholarship.

Having completed my bachelors, I must say that I’m really thankful to A*STAR for providing me with the rare privilege to study overseas. I’ve been able to learn from some of the best professors and faculties in the world, but more importantly I’ve made friends with people from countless countries and cultures, and experienced life like I’ve never known it back home.

Though I’m glad to be back, I’m looking forward to returning overseas for my PhD studies. At this point I can’t really see where my advanced degree is taking me to, but I think I’d like to be involved in both research at A*STAR as well as teaching in one of our local universities. My PhD training has certainly helped improve my research career as well.”

Working in industry is only one of the many career choices that are open to A*STAR scholars. Dr Low Yen Ling is happy to be working as a Clinical Scientist in Abbott Asia-Pacific’s Nutrition Research & Development department. Here, she talks about how her PhD training benefited her immensely, and why she chose to work in industry.

“Getting the A*STAR scholarship to pursue a PhD has opened up a whole new world of possibilities for me, in both academic and industry sectors. The PhD training not only involved learning a specialized field of research but also taught me to think analytically, systematically, and critically. So the PhD training equipped me with skills that will serve me well for both a research career or an administrative career.

In my case, I chose to pursue a research career. My postdoctoral training at A*STAR has been very valuable in sharpening my research skills and helping me build my professional network with researchers in both the local and international community. Through A*STAR’s collaborations with industry, I also had the opportunity to gain exposure from the work in the private sector and learn about their research and needs. The research training I have received and my knowledge of the local and regional research environment and networks with the scientific community are all attributes that industry needs and values highly. I am really grateful for A*STAR’s training, as it has given me a headstart for my job in the private sector and my transition has been very smooth.”

Professor Ho Han Kiat received an Overseas Graduate Scholarship from A*STAR in 2000 (initially under EDB scholarship) to pursue doctoral studies in Medicinal Chemistry at the University of Washington. Han Kiat is currently an Assistant Professor at the National University of Singapore. Here, he talks about what motivates him in research, and why he chose academia.

“Research as a career is like no others. In other professions, the pursuit of knowledge is the mean to an end. But in research, the pursuit of knowledge is an end in itself. It is what the career is all about! I chose this path because I wanted a job that would allow me ask questions where answers may not be readily available, and in so doing, push the frontiers of knowledge. It is exciting to know that I’m working on problems that help in the fight against diseases that at present have no effective treatments. The research training I have received and my knowledge of the local and regional research environment and networks with the scientific community are all attributes that industry needs and values highly. I am really grateful for A*STAR’s training, as it has given me a headstart for my job in the private sector and my transition has been very smooth.”

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Liang Kaicheng

Low Yen Ling

Ho Han Kiat
The Singapore-Stanford Biodesign (SSB) programme is about nurturing the next generation of Asian medical technology innovators in Singapore and training leaders to fill key links in the innovation and enterprise value chain. An integrated collaboration between Stanford University, the Economic Development Board of Singapore and A*STAR, the programme is modelled after the established Biodesign programme at Stanford University and aims to offer multidisciplinary training to fill up key links in the innovation and enterprise value chain. An integrated collaboration between Stanford University, the Economic Development Board of Singapore and A*STAR, the program is modelled after the established Biodesign programme at Stanford University, the Economic Development Board of Singapore and A*STAR, the program is modelled after the established Biodesign programme at Stanford University.

The SSB programme will provide a fellowship for four fellows each year to undergo six months of training at Stanford University and six months of training at one of the local universities in Singapore. Promising talents will be trained to meet those needs by developing new medical device technologies and bringing concepts to the prototype or proof-of-concept stage. The fellows will come from different disciplines – namely engineering, medicine and business – which represent key segments in the technology transfer process and provide them with a broad education in key concepts needed in all links of the innovation value chain. In doing so, young Singaporeans will become equipped with the knowledge that will allow them to participate at any point along the innovation process.

Dr Anthony Tang, one of the 2011 Stanford-Singapore Biodesign Fellows said, “It is an amazing opportunity and privilege to be in the first ever group from Singapore to be sent to Stanford under the Singapore-Stanford Biodesign programme.”

What’s more, the SSB programme will also launch a graduate module on medical technology innovation in partnership with the National University of Singapore and Nanyang Technological University. The course seeks to expose students to the technology transferring process and give them a broad education in key concepts needed in all links of the innovation value chain. In doing so, young Singaporeans will become equipped with the knowledge that will allow them to participate at any point along the innovation process.

The first batch of 16 trainees received their Professional Certification on 29th Sept 2010. They produced their own graduation video to describe their exciting learning journey which is featured on the website www.TTN.sg.

The Traineeship in Technology Transfer Management (T3M) is Singapore’s programme to groom technology transfer professionals who will play a key role in helping to turn innovative ideas into real-world solutions. The programme’s core objective is to provide training in technology transfer management to meet the needs of both sides of the innovation and enterprise value chain. By pooling its resources together with Singapore’s Workforce Development Agency and the local polytechnics, A*STAR’s Technology Transfer Network has created a rigorous course consisting of projects, seminars and on-the-job training to expose trainees to broad areas in technology, business, policy and law. Graduates of the programme are fully qualified to become entrepreneurs, investors, patent agents, lawyers, industry analysts or consultants – key players in the innovation and enterprise value chain.

What the graduates find most valuable about the programme is the interaction these young, aspiring professionals get to have with like-minded peers, technologists and investors. This helps them build up a deep understanding of what the needs across different innovation and enterprise value chain areas are. As Ms Eunice Teo said, “The delightful portion in this program is the interaction and network opportunities I’ve gained between the scientists, industry players and the tech transfer family from the on-job training (OJT) component.” Ms Teo is currently working with A*STAR’s Exploit Technologies to shape the future of innovation in Singapore.

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The first batch of 16 trainees received their Professional Certification on 29th Sept 2010. They produced their own graduation video to describe their exciting learning journey which is featured on the website www.TTN.sg.
In an exclusive interview with The Straits Times, A*STAR Chairman, Dr Lim Chuan Poh, discussed A*STAR’s talent strategy and research direction for the year, highlighting how Biopolis and Fusionopolis were better positioned to “do something truly transformational in science and technology”.

Two teams of engineers from FR I won the Institution of Engineers, Singapore Prestige Engineering Achievement Award 2010 for their work titled “Advancing the Brain Computer Interface (BCI) technologies” and “Unleashing the Power of Knowledge: Singapore Science and Engineering Research Institutes: Sustainable Future Communications”, respectively.

Dr Du Shijian from FR I and his team member from NUS beat two teams of engineers from Fusionopolis to be in the ‘final four’ in the race for the inaugural A*STAR Research Academy’s ‘custom’ design vaccines.

Dr Victor Tong from FR I was presented with the President’s Science and Technology Medal. The medal was presented by President S R Nathan.

A*STAR signed a Memorandum of Understanding (MOU) with Nanoyeg Technology (NTU) and National University of Singapore (NUS) to jointly offer A*STAR with Nanyang Technological University (NTU) and National University of Singapore (NUS) or A*STAR Graduate Fellowships (AIF) or A*STAR Graduate Scholarships (Post-doctoral Fellowships) to pursue post-doctoral training at world-class laboratories overseas.

A*STAR signed a Memorandum of Understanding (MOU) with Waseda University in Japan to foster closer ties through scientific collaborations and student exchange at the opening of Waseda Bioscience Research Institute in Singapore (WABIOS) – Waseda University’s first independent overseas research operations.

At the President’s Science and Technology Awards 2010, Prof Miranda Yap, Executive Director of Singapore’s largest professional organisation in the areas of speech, language, and hearing, the Singapore Institute for Clinical Sciences (SICS), KK Women’s and Children’s Hospital and NUS jointly launched Growing Up in Singapore Towards healthy Outcomes (GUSTO), a major longitudinal study of pregnant mothers and their foetuses as well as infant children in Singapore. GUSTO aims to find ways to prevent the onset of diseases such as diabetes and obesity.

At the 14th Biomedical Sciences International Advisory Council (BISI ACC) meeting, A*STAR announced that $300m would be pumped into new programmes to give Singapore a stronger foothold in emerging technology industry a greater push. The new programmes included the collaboration between A*STAR and Centre for Integration of Medicine and Innovative Technology (CMIT) in Boston, USA, and A*STAR’s Biomedical Engineering Programme.

Researchers at FIMC developed a new microfluidic system to test for specific cardiac biomarkers in blood, which could cut sample preparation and analysis time from the typical 6 hours to just 45 minutes and thus save precious time for medical intervention.
FEBRUARY

A*STAR was ranked the seventh most prolific publisher in Asia-Pacific regions in terms of annual research publications, according to the Nature Asia-Pacific Publishing Index.

APRIL

A*STAR and Japan Science and Technology (JST) jointly announced R2m in research grants under the Strategic International Cooperative Programme (SICC) to develop advanced applications technologies for the information communication science & technologies.

A*STAR announced its Strategic Partnership Agreement with InForm (Integrating Scientific and Medical Informatics), a strategic partner of InForm Europe (Informatics for Integrating Biology and the Environment) based in Grenoble and President of the Group of Mayors of French Cities, Dr Michel Destot.

A*STAR hosted a joint visit by officials of the Food and Drug Administration of the United States to exchange views on regulatory issues in pharmaceuticals and biotechnology.

In conjunction with the Singapore Airshow, A*STAR announced the official opening of a new research facility in Singapore, the Experimental Therapeutics Centre (ETC) and Singapore Immunology Network (SIN), entered into strategic partnerships with Italy’s Siena Biotech S.p.A. to develop new diagnostic and bone disease therapies, respectively. This is the fifth major collaboration between A*STAR and Siena Biotech S.p.A. in Italy.

The Institute of Microelectronics (IME) announced the launch of the Micro-Electro-Mechanical-Systems (MEMS) Consortium to bring together 9 MNCs and local enterprises from the MEMS supply chain in public-private sector research collaboration to grow the MEMS industry in Singapore.

The Experimental Therapeutics Centre (ETC) and Singapore Immunology Network (SIN), entered into strategic partnerships with Italy’s Siena Biotech S.p.A. to develop new diagnostic and bone disease therapies, respectively. This is the fifth major collaboration between A*STAR and Siena Biotech S.p.A. in Italy.

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The Forum for Advanced Manufacturing Technology in Southeast Asia (FAMTSEA) was officially launched by Deputy Prime Minister Teo Chee Hean at the Singapore Airshow. The forum’s objective is to promote technology transfer and collaboration across the region.

A*STAR hosted visits by Mr Peter Jurascheck, Governor and President of the Science and Technology (S&T) Forum (STF) to discuss the STF's role in promoting technology transfer and collaboration across the region.

A*STAR hosted separate visits by Mr Koji Omi, President of the University of Tokyo, and Dr Meenakshi Nandan, Director of the Indian Institute of Science and Technology, to discuss ways to further strengthen collaboration between Singapore and Japan.

A*STAR hosted a visit by Mr Alex Vlavianos, First Deputy Minister of the National Economy, to discuss ways to further strengthen collaboration between Singapore and Greece.

A*STAR hosted a visit by Mr Ivan Suharno, Secretary General of the Norwegian Government, to discuss ways to further strengthen collaboration between Singapore and Norway.

A*STAR hosted a visit by Mr Eike Batista, Chairman of the瘦身王 Group, to discuss ways to further strengthen collaboration between Singapore and Brazil.

A*STAR hosted a visit by Mr Anandプラット, President of the General Council of Public Universities, to discuss ways to further strengthen collaboration between Singapore and India.

A*STAR hosted a visit by Mr Dato Khor Tze Chun, Pro-Chancellor of the University of Malaya, to discuss ways to further strengthen collaboration between Singapore and Malaysia.

A*STAR hosted a visit by Mr Sajeev Kumar, President of the Indian National Science Academy, to discuss ways to further strengthen collaboration between Singapore and India.

A*STAR hosted a visit by Mr Dato Haji Mustapha, President of the National Association of Malaysia, to discuss ways to further strengthen collaboration between Singapore and Malaysia.

A*STAR hosted a visit by Mr Dato Supriyono, President of Indonesia, to discuss ways to further strengthen collaboration between Singapore and Indonesia.
ENGINEERING AND NANOtechnology

BREAKTHROUGH DESIGN OF EFFICIENT MODULATION CODES FOR DATA STORAGE SYSTEMS
Researchers from the Data Storage Institute (DSI) developed a systematic methodology for constructing efficient modulation codes for data storage systems. The error correction capabilities of these codes could achieve efficiencies within a few tenths of a percent of the theoretical maximum, and could overcome all the drawbacks of existing art code design technologies. The new codes could also correct any type of error events in the system and thus increase the storage capacity of discs (e.g. Blu-ray disc) by 20%, as well as facilitate easy hardware implementation. A patent for this technology has been filed in several countries including the USA, Korea, Taiwan and Singapore.

NEW WAY TO BOND COPPER SURFACES ON SILICON
Researchers from the Singapore Institute of Manufacturing Technology (SIMTech) developed a new technology that promises to transmit data at the speed of light, is set to revolutionise the way we communicate. This innovation, which avoids the need for “under bump metallisation”, enabled bonding to be achieved in 30 seconds. The resulting bond strength also exceeded 50 MPa, a figure significantly higher than those obtained by conventional methods of bonding. A patent has been filed for this technology, which could potentially be applied to 3-D integrated circuits and systems, hybrid MEMS/NEMS, systems-in-package and large component bonding in many industries.

HIGHLIGHTS OF SCIENTIFIC BREAKTHROUGHS

IN A*STAR RESEARCH INSTITUTES, CONSORTIA & CENTRES

Below are some examples of discoveries and innovations made by teams of scientists from research entities under A*STAR’s Biomedical Research and Science and Engineering Research Councils.

IN A*STAR RESEARCH INSTITUTES, CONSORTIA & CENTRES

IN A*STAR RESEARCH INSTITUTES, CONSORTIA & CENTRES

MATERIALS AND CHEMISTRY

Nanoparticles provide a new direction for thermoelectric materials research, promising to deliver high performance and thereby enhance the efficiency of energy storage and cooling systems. A team of researchers from the Institute of High Performance Computing (IHPC) demonstrated that hexagonal palladium cobalt dioxide and palladium iron cobalt dioxide had unique properties that could be exploited for use in thermoelectric materials in energy storage and cooling systems. They showed that these materials could be used as a cost-effective and low temperature and without the need for vacuum, thus shortening the manufacturing process and significantly lowering cost. Researchers from the Singapore Institute of Manufacturing Technology (SIMTech) successfully realised high performance silicon photonics devices with standard manufacturing processes, which would enable fabrication of these state-of-the-art devices at very low cost. Silicon photonics, a technology that promises to transmit data at the speed of light, is set to revolutionise the way we communicate. This work was also published in top journals including Applied Physics Letters, IEEE electron Device Letters, Nature Nano Technology, and Nature Communications. This research was published in Nature Chemistry.

NEW PROCESS FOR PRODUCING AROMATIC HYDROCARBONS
A team of researchers from the Institute of Chemical and Engineering Sciences (ICP) and Mitsui Chemicals invented an effective method for producing aromatic hydrocarbons from methane and other lower hydrocarbons, using a novel transition-metal supported crystalline metallosilicate catalyst. The use of this catalyst, which gives a conversion rate and high yield of benzene for long periods, could lead to the development of cheaper and more environmentally friendly processes for making benzene, toluene and xylenes, three chemicals that are used in many petrochemicals, plastics and materials e.g. polyester fibers for clothing, polystyrene foams used to make packaging, and polycarbonate lenses used to make cameras. ICP has filed for patents on this technology.

UNDERSTANDING UNUSUAL METALLIC TRANSPORT IN OXIDES
Researchers from the Institute of High Performance Computing (IHPC) demonstrated that hexagonal palladium cobalt dioxide and palladium iron cobalt dioxide had unique properties that could be exploited for use in thermoelectric materials in energy storage and cooling systems. They showed that these materials could be used as a cost-effective and low temperature and without the need for vacuum, thus shortening the manufacturing process and significantly lowering cost. Researchers from the Singapore Institute of Manufacturing Technology (SIMTech) successfully realised high performance silicon photonics devices with standard manufacturing processes, which would enable fabrication of these state-of-the-art devices at very low cost. Silicon photonics, a technology that promises to transmit data at the speed of light, is set to revolutionise the way we communicate. This work was also published in top journals including Applied Physics Letters, IEEE electron Device Letters, Nature Nano Technology, and Nature Communications. This research was published in Nature Chemistry.
How we are doing

Research involved collaborations with over 15 hospitals and research institutions in the gene that led to conditions associated with ageing, such as signs of premature ageing. They also uncovered specific mutations in the gene on chromosome 17 of patients who, at a young age, displayed premature skin ageing. They located the defective gene, known as PYCR1, and their colleagues in Germany discovered that mutations in the gene are involved in regulating oestrogen-mediated gene expression in breast cancer cells. These findings, which were published in the top scientific journal Nature, could lead to the development of highly specific anti-hormone treatments in breast cancer.

RESULTS INTO GENE THAT HELPS MAINTAIN YOUTHFUL SKIN

A team of scientists from the Institute of Medical Biology (IMB) and researchers from the Singapore Institute of Neurotechnology (SPIN) discovered that a protein, WIP1, acting as a suppressor of cell death, might soon be less life threatening. In their landmark discovery, the team highlighted that WIP1 is a regulator of both immune and liver cells. As such, the discovery of gene that regulates cell death in triggering inflammation, and in keeping NF-kB levels within a safe range, an "ideal" WIP1 would minimize the extent of inflammatory response that could lead to septic shock and subsequent death of patients.

Scientists from the Institute of Molecular and Cell Biology (IMCB) discovered how the gene “Fas- Associated Inhibitory Molecule” (FAIM) protects brain-computer interface (BCI) robotic rehabilitation system, which could guide stroke patients towards recovery after long-term disability. This technology significantly improved the recovery of limb movement in patients under clinical trials. For their work by the I2R team was ranked among the Top Ten BCI Projects by Wadsworth Centre.

NOVEL AND EFFECTIVE IMMUNISATION METHOD AGAINST MALARIA PARASITE

Scientists from the Singapore Institute for Clinical Sciences (SICS) discovered that myostatin, a factor long known to control muscle development, also played a critical role in energy production in muscle by regulating carbohydrate and lipid metabolism. The strong influence myostatin had on muscle a factor long known to control muscle development, also played a critical role in energy production in muscle by regulating carbohydrate and lipid metabolism. The strong influence myostatin had on muscle growth was a regulator of both calcium-dependent insulin and glucagon secretion and that it could be a potential new target for diabetes treatment. They found that absence of the myostatin gene resulted in a 40-50% reduction of glucagon secretion and near complete loss of calcium-dependent glucagon secretion in mice. This research was published in top journals Proceedings of the National Academy of Sciences and Journal of Physiology. As myostatin—like NF-κB and WIP1—it also played a critical role in suppressing the activity of NF-κB, a signalling molecule known to be involved in triggering inflammation, and in keeping NF-κB levels within a safe range. This could allow the human immune system to direct its response to eliminate the parasite in the liver at an earlier stage of its life cycle. Their findings, which could contribute significantly to the development of an effective vaccine for this infectious disease, were published in the prestigious New England Journal of Medicine.
Niometrics develops high-performance network traffic analysis engine

Niometrics Pte Ltd, a spin-off from A*STAR’s Institute for Infocomm Research (I2R), is developing and producing a range of new security products and services built around CUB4 – a next-generation, highly accurate network traffic recognition engine. Niometrics designs with the constantly changing information security landscape in mind and its products use automated protocol learning and a flexible software design to stay ahead of the market as new protocols and risks emerge. Developed by I2R and licensed from Exploit Technologies Pte Ltd (ETPL), CUB4 can detect more than 4,000 protocols, services and applications. This is a four-fold improvement over existing products in the market. The new engine also allows corporate users to detect IT policy violations and perform fine-grained analysis for potential threats without enforcing unnecessarily strict blocking policies.

Knorex creates unique knowledge discovery platform

Knorex Pte Ltd, a spin-off from I2R, has created a service-oriented knowledge discovery platform to provide seamless access to meaningful information for enterprise users. Knorex’s technology, called Knorex Lumina™, aggregates, mines and integrates disparate silos of information by searching from public and proprietary data sources, as well as structural information assets such as compound libraries and project databases. It also automatically categorises search results into meaningful groups and customises them to users’ requirements. The portfolio of semantic technologies that constitute Knorex Lumina™ was developed by I2R and licensed from ETPL.

Rhapsody biologics creates versatile personalised peptide vaccine platform

Rhapsody Biologics (S) Pte Ltd has capitalised on discoveries made at A*STAR’s Singapore Immunology Network (SIgN) to create a unique and versatile Personalised Peptide Vaccine (PPV) platform. The company, a spin-off from SIgN, is developing the world’s largest validated database of vaccine peptide epitopes that can be applied to predict and optimise peptide vaccines for use at an individual and population level. This unique technology was developed by a team of SIgN researchers and licensed from ETPL. Rhapsody Biologics is currently in talks with two major pharmaceutical companies to develop vaccines based on their PPV platform.

Tera-BARRIER FILMS COMMERCIALISES MOISTURE RESISTANT FILMS FOR PLASTIC ELECTRONICS

Tera-Barrier Films Pte Ltd, a spin-off from A*STAR’s Institute of Materials Research and Engineering (IMRE), secured an investment from Applied Ventures, LLC1, to develop and manufacture a new proprietary, moisture resistant film that could significantly extend the life span of devices such as organic solar cells and flexible displays. The new film, based on technologies developed at IMRE and licensed from ETPL, is used to protect the moisture-sensitive organic materials of plastic devices from degradation, thereby meeting a critical need of the rapidly growing plastic electronics industry. The technology may also be used in the manufacture of flexible, lightweight and cheap electronics such as disposable or wrap-around displays, identification tags, low cost solar cells and chemical- and pressure-sensitive sensors.

1 Applied Ventures, LLC is the venture capital arm of Applied Materials, Inc.
A*STAR is forging partnerships across the globe with research institutes and industry. This contributes towards Singapore’s efforts to establish itself as a global research hub and Asia’s Innovation Capital – an international and dynamic hub for research, innovation, and enterprise.
Academic & Public Institutions

DSO National Laboratories
Duke NUS
Maritime and Port Authority of Singapore
Ministry of Education and Schools
Ministry of Health
Nanyang Polytechnic
Nanyang Technological University
Ngee Ann Polytechnic
Nanyang Technopreneurship Centre
Norvatis Institute for Tropical Disease
National University Hospital
National University of Singapore
Ngee Ann Polytechnic
Nanyang Polytechnic

Industry

Addvalue Technologies
Advago (Singapore) Pte Ltd
Advanced Technologies & Regenerative Medicine, LLC
Alignment Tool (Singapore) Pte Ltd
AMIDH Precision Technology Pte Ltd
ASM Technology (Singapore) Pte Ltd
Astral Consulting Pte Ltd

Aurig Technology Pte Ltd
Aercon Singapore Pte Ltd
Anearstruk Asia Pte Ltd
Aerena Pharma Manufacturing Pte Ltd
Aerentanyl Technologies Pte Ltd
BaSF South East Asia Pte Ltd
Becton Dickinson Biavnent
Biotexesis
BrightLake Systems Pte Ltd
Cadbury Enterprises Pte Ltd
Cardinal Health Singapore 225 Pte Ltd
Chartered Semiconductor Manufacturing Ltd
Chemicon Industries Pte Ltd
Ciba Specialty Chemicals Industries (Singapore) Pte Ltd
Component Technology Pte Ltd
Crosa Singapore
Cubic Micro Design
Curox Biosystems Pte Ltd
Delphi Automotive Systems Singapore Pte Ltd
Dell Optics Technology Pte Ltd
Dino Vye
D-SIMLAB Technologies Pte Ltd
Dyad Biotech Pte Ltd
Dyson Singapore Pte Ltd
EADS Innovation Works Singapore
EADS Singapore Pte Ltd
Ecopex Global Technology Pte Ltd
Elco Scientific Industries
EPOC Pte Ltd
ETLA Ltd
EVDO Media
Finnair Corporation
GLOBALFOUNDRIES Singapore Pte Ltd
GraduSolve Systems Pte Ltd
HealthSTATS International Pte Ltd
iXten Singapore Pte Ltd
ICognitive Pte Ltd
IDI Laser Services
Infinion Technologies Asia Pacific Pte Ltd
InnoBrace Orthodontics Pte Ltd
Intelligent Chip Connection Pte Ltd
Invata (S) Pte Ltd
Kim Hap Lee Co Pte Ltd
Knergy Ltd
LanTinhAin (Singapore) Ltd
Liang Huat Aluminium Industries Pte Ltd
Dio Yee
Nanomaterials Technology
Nanyang Optical & Chemical Industries Ltd
National University of Singapore
Ngee Ann Polytechnic
Nanyang Polytechnic
Norvatis Institute for Tropical Disease
National University Hospital
National University of Singapore
Ngee Ann Polytechnic
Nanyang Polytechnic

Monetary Authority of Singapore
Motorists
Nanomaterials Technology
Nanoseq Optical Co Pte Ltd
National Instruments Singapore Pte Ltd
Nephos Pte Ltd
Nitto Denko (Singapore) Pte Ltd
NSP Semiconductors Singapore Pte Ltd
Olympus
Pacific Forest Products Pte Ltd
PBA (Singapore) Pte Ltd
POM Media
Philips Electronics Singapore Pte Ltd, DAP
PiDa Innovation Centre Pte Ltd
Qnpch Nanosystems Pte Ltd
Quantum Precision Instruments Asia Pte Ltd
Rainfly Media
Ream Technologies Pte Ltd
Rheo Asia Pacific Pte Ltd
RISIS
RoF-Base Singapore
Rothi & Schwarz Systems and Communications Asia
Roya Royce Fuel Cell Systems Ltd
Roya Royce PLC
SATS Airport Services Pte Ltd
Sherving Pough Limited

Schlumberger Oilfield (Singapore) Pte Ltd
SG Molecular Diagnostics
SIA Engineering Company
SIMEMS Pte Ltd
Singapore Aerospace & Chemical & Solder Industries Pte Ltd
Singapore Manufacturing Federation
Singapore Technologies Kinetics
Solvex Innovative Technology Pte Ltd
Sony Electronics (Singapore) Pte Ltd
ST Electronics (Info-Cern Systems)
Stardom Tyres International Pte Ltd
STARS ChipMC Ltd
Sumitomo Bakelite Singapore Pte Ltd
Sunry Instruments Singapore
Seng Eng Systems on Silicon Manufacturing Company Pte Ltd
Tafco Pak Xiong Pte Ltd
Tru Marine Pte Ltd
United International Pte Ltd
United Microelectronics Corp
United Test and Assembly Center Ltd
Veitas Laboratories
Vestas Technology R&D Singapore
Wangi Industrial Co Ltd
Zemtek Technology
Zheng Guang Fa Pte Ltd
Human Capital

No. of PhD students trained and graduated:
- 96 in 2006
- 230 in 2007
- 362 in 2008
- 441 in 2009

No. of RI staff spun out to locally base industry as RIEs:
- 184 in 2006
- 439 in 2007
- 634 in 2008
- 799 in 2009

Intellectual Capital

No. of papers published:
- 3683 in 2006
- 6490 in 2007
- 9668 in 2008
- 12,869 in 2009

No. of primary patent applications filed:
- 213 in 2006
- 416 in 2007
- 655 in 2008
- 896 in 2009
WHO WE ARE
We thank Mr. Boon Swan Foo, former Executive Chairman, Exploit Technologies Pte Ltd.; Prof. Chong Tow Chong, former Executive Director, Science and Engineering Research Council; and Prof. Miranda Yap, former Executive Director, A*STAR Graduate Academy, for their service.

(Updated as of Sept 2010)
Leaders of Research Institutes and Consortia

Dr. Frank Eisenhaber
Director, Bioinformatics Institute

Prof. Jackie Ying
Executive Director, Singapore Institute for Clinical Sciences

Prof. Judith Swan
Executive Director, Singapore Institute for Clinical Sciences

Dr. Alan Colman
Executive Director, Singapore Stem Cell Consortium

Prof. Miranda Yap
Executive Director, Biomanufacturing Technology Institute

Prof. Birgitté Lane
Executive Director, Institute of Medical Biology

Prof. Sir George Radda
Chancellor, Singapore Biomanufacturing Consortium

Prof. Colin Blackmore
Chancellor, A*STAR Duke-NUS Graduate Medical School Neuroscience Research Partnership

Prof. Edison Liu
Executive Director, Genome Institute of Singapore

Prof. Neale Copeland
Executive Director, Institute of Molecular and Cell Biology

Prof. Philippe Kourilsky
Chairman, Singapore Immunology Network

Prof. Anny Hor
Executive Director, Institute of Materials Research and Engineering

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BIOMEDICAL SCIENCES
INTERNATIONAL ADVISORY COUNCIL

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The Salk Institute for Biological Studies, USA

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The Walter and Eliza Hall Institute of Medicine Research (Australia)

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Global Health Programme Bill & Melinda Gates Foundation (USA)

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Director, Eugene McDermott Center for Human Growth and Development
University of Texas Southwestern Medical Center (USA)

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Distinguished Scientific Samurai Lumenfeld Research Institute of Mount Sinai Hospital (Canada)

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Max Planck Society (Germany)

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Director General
Research and Development
Department of Health (UK)

DR PETER GRUSS
President
Max Planck Society (Germany)

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President
Max Planck Society (Germany)

SIR VICTOR HAMBURG
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Karolinska Institutet (Sweden)

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EMERITUS MEMBERS

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Robert A. Millikan Professor of Biology
California Institute of Technology (USA)

DR SAMUEL BARON
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Executive Director
Global HIV Vaccine Enterprise (USA)

DR ALAN BERNESTEIN
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President & Director
Fred Hutchinson Cancer Research Center (USA)

DR DAVID I. HIRSCH
Member, BMS IAC (2000-2003)
Executive Vice President for Research
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PROFESSOR WILLIAM A. WOODHEAD
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University of California, San Diego (USA)
National Science Scholars who have attained the highest honours every year in their undergraduate studies.
We recognise our scholars who have excelled academically this past year.

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Department</th>
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<tbody>
<tr>
<td>Chee Jeng Yee</td>
<td>Cornell University</td>
<td>(Physics)</td>
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<td>Chen Wei Yan Serene</td>
<td>Imperial College London</td>
<td>(Chemistry)</td>
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<td>Chew Wei Leong</td>
<td>Duke University</td>
<td>(Biology)</td>
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<td>Chen Niangjun</td>
<td>University of Cambridge</td>
<td>(Computer Science)</td>
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<td>Koh Jun Yong</td>
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<td>(Physics)</td>
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<td>Koh Guang Yong</td>
<td>University of Illinois at Urbana–Champaign</td>
<td>(Engineering Physics)</td>
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<td>Lee Yau Ti Ng Le Nnon</td>
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<td>University of Wisconsin - Madison</td>
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<td>Lee Wee Teck William</td>
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<td>Foo Min Hui Francine</td>
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<tr>
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**Chairman’s Honour List**

We recognise our scholars who have excelled academically this past year.
A WORD OF THANKS

This yearbook is the result of the efforts and contributions of many talented individuals. We would like to thank all our colleagues at A*STAR who have given their time, energy and insightful comments to make this book possible. We would also like to thank Ms Li Xin Hui, without whose creativity and amazing talent, we would not have the lovely motifs and design.

Finally, we would like to thank you for your time and attention in reading the A*STAR Yearbook 2009/2010. We hope that you now have more than a glimpse of our agency and are excited about our work.

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