Inspiration from our Guru

Science is not just a scholarly enterprise, embedded as it were, in an ancient university where people just compile compendia. In other words, reading is not enough. You have to think as well... But sometimes thinking isn't enough either, because in the end it's doing what counts and so doing is what our business is about.

Out of bounds?  
No Way!

It’s great that wireless communication is increasingly used everywhere. After all, we are moving towards a world where we’re connected wherever we go. The A*STAR scholarship has enabled me to connect with my true passions.

Chandrasekhar Vijay Ramaseshan
National Science Scholarship (BS)
Electrical and Computer Engineering
Carnegie Mellon University
Hwa Chong Junior College

Chairman’s Honours List 2003-2005
AMSTAR Roll Of Honour 2005
Proceeding to National Science Scholarship (PhD) at Stanford University
SHE CHOSE TO WORK ON STEM CELLS
...and got more than she bargained for

CLEO CHOONG came home in October 2005 from the United Kingdom with a PhD in Tissue Engineering. She had been working on 3D-scaffold-based technology in bone replacement. “I could choose to go to any research institute lab as long as the principal investigator needed a postdoc,” says Dr Choong. “I chose this job with the Singapore Stem Cell Consortium (SSCC) as I had been working on stem cells for the last four years.”

The SSCC had just been formed. Its mission is to develop and coordinate stem cell research in Singapore. The first lab to be set up by the consortium, the Laboratory of Stem Cell Biology, did not exist physically when Dr Choong joined.

So she got a totally unexpected task: plan, equip and establish the lab in Biopolis by April 2006. Which she did after a brief training stint at Professor Roger Pedersen’s lab in Cambridge. Prof Pedersen is Chairman of the SSCC. With an initial team of just two research officers, she worked round the clock to kickstart the lab’s research and to acquire equipment.

Here is how she described her unique experience to the A*STAR newsletter Borneo: “This is so different from my PhD life when everything I worked on was for myself, now I am held accountable to many more groups of people, who are expecting this lab to begin experiments and produce results. This is definitely not the typical postdoc position... because it is challenging me in ways I never before imagined.”
In the Laboratory of Stem Cell Biology, patches of pink

Reading is not enough but essential.

Heels click on the parquet flooring
As the warm hue of sunrise stream through clear panels
Glass, wood, the still air trembling with the passion of research
Gazes inadvertently fixed upon
The beaming faces on the wall watching the world
Move pass them each and every morning
The Wall of Fame
Where internationally renowned figures
Watch the scientific breakthrough in the world of stem cell research
Occur in this very lab.

Cheryl is so inspired by Cleo that she says it in verse.
He Aims for That Perfect Polish

When he was a child, Gary Ng enjoyed taking things apart and then putting them back together. At university, he studied Mechanical Engineering. For relaxation, he enjoys knocking things down; he is a 10-pin bowler. When he was pursuing his PhD, his aim was to bowl the professors over with his thesis. It was on "Measurement and modeling of fluid pressure in chemical mechanical polishing". When he faced the Thesis Committee to defend his research findings, some of his laboratory-mates sat in but asked no questions even though they could. Why? "Didn’t want to sabo you," he was told.

That was in early 2005. Now he is home with his PhD and deeply immersed in his research work at SIMTech. How does it feel to have the title ‘Doctor’ preceding your name? “I was happy, of course, when my professors congratulated me after my oral defence,” Dr Gary Ng said. “But half the SIMTech people have PhDs!”

When you hear the initials CMP mentioned in the labs and lounges of SIMTech, you will know that they are talking about chemical mechanical polishing. It is a micromachining method in the processing of semiconductor wafers. Wafers are 0.5mm thick discs used in the mass production of integrated-circuit chips. The wafers have to be ultra flat and smooth. To get them that polished, you have to remove even the smallest bumps.

When you hear Dr Ng mention Brenda, Dylan and Denise, he is not referring to secret projects with code-names. He is talking about his wife, a homemaker, and their baby boy and girl.
COOL GADGETS COME FROM HIP PROCESSES

YOU love your latest mobilephone. How did it evolve from earlier models that you weren’t quite happy with? Or you recall reading about Dr Gary Ng in the previous A*STAR Yearbook. Remember the mention of totally painless injections that could result from R&D on microfluidic applications? R&D into manufacturing processes is the essential step that facilitates the turning of a concept and design into a finished product that users can love or need.

Microfluidics is Dr Ng’s other specialisation. That is the flow of liquids in microchannels. Such conduits are needed for biosips used for laboratory or field testing of samples such as blood. Dr Ng and team are working to develop new manufacturing processes that can be used to make lowercost chips. He still has an ongoing CMP project at SIMtech. But he is spending most of his research time on development of microfabrication processes for polymer chips.

"Currently, most of the chips used in labs and elsewhere are made of silicon or glass," Dr Ng says. "Our goal is to enable significant cost reductions for manufacturers by showing them how to make chips with polymer. The chips can also be used for cooling or heating of small devices, or in micro-pneumatics. That is the use of compressed air to drive activators, parts that make things move."

Developing a manufacturing process encompasses many steps. It takes time. "In a year or two, hopefully sooner; we will come up with a portfolio of processes that we can sell to a company," says Dr Ng. "That is technology transfer. The company we sell it to comes out with a cool new product. From its unique features, we will know immediately that it was made using our process. That means we have engineered a process that’s hip. It is really satisfying seeing people using the stuff that you developed!"

From our Science Reporter for the Day, Nicole Quah, a Raffles Junior College 1st year student and a recipient of the inaugural A*STAR JC Science Awards:

"Research is for those who truly have the passion for it." Through talking to Dr Gary Ng, one senses how his own passion and enthusiasm pervade everything he says. It is striking how he admits that as a scientist his hours tend to be long, and yet he continues to go about his work with gusto and excitement. His eagerness to encourage younger persons was also evident in his willingness to answer all my questions about his area of research and pet subjects. He is such a fun, approachable and multi-talented researcher!
Mission Impossible?
No, it’s MISSION in PROGRESS!

SINGAPORE, world famous for some notable achievements, was never thought of as a hub of scientific research and development.

Until very recently, that is.

In just five years, Singapore is becoming known as a hub of R&D in Asia. That places Singapore in the top league of Science and Technology.

It is not yet the best. But it has some of the best scientists in the world, some laboratories with cutting-edge equipment, the envy of even researchers in the world’s leading R&D countries.

And it has hundreds of young Singaporeans pursuing PhDs in the hard sciences at home and abroad. They are chasing their dreams, achieving real accomplishments, pushing scientific frontiers for the betterment of humankind and, of course, also Singapore.

Leading this mission is A*STAR, aka the Agency for Science, Technology and Research. A*STAR is an agency of the Ministry of Trade and Industry.

Five years ago, A*STAR was told that it had an impossible mission. Now it is able to report that it has accomplished its first 5-Year Mission!

Wow at Heart

I have great passion for my work in Cardiovascular Diseases. It’s an area that is challenging and one I wholeheartedly believe in. A*STAR has given me tremendous opportunities, not to mention a truly hearty education.

Farhana Bte Mohammed Anuar
A*STAR Graduate Scholarship (PhD) Pharmacology National University of Singapore Raffles Junior College

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HOW 3 Cs ADD UP TO A* 

A* IS, OF COURSE, THE TOP SCORE. HERE ARE THE TOP SCORING OUTCOMES FROM DOING WHAT COUNTS OVER 5 YEARS!

IT was project work of the exciting, challenging, never boring kind.

Mission: Build a solid foundation for Science and Technology R&D in Singapore.

To achieve that, A*STAR figured out that it needed three Cs. Not the kind of C that signifies just a credit score, but Cs that stand for CAPITAL.

The capital we mean is the resource that generates desired outcomes, including more resources.

The desired outcomes we want are economic growth. Science and Technology products that make life better for people around the world, make life better for people around the world, make life better for people around the world.

So we built up Human Capital:

817 research scientists and engineers nurtured in A*STAR's research institutes who now work in private companies. That is our way of helping to develop Singapore as a Knowledge-Based Economy.

489 Singaporeans and Singaporeans-to-be undergoing education and in-the-lab training at home and abroad for PhDs in the Biomedical, Physical and Engineering sciences. That is big-time talent training. No other Singapore organisation offers so many scholarships all the way to the PhD.

And we created Intellectual Capital:

4,971 scientific papers published in internationally respected journals. That is how prolific our researchers are in the laboratory.

760 primary patent applications to protect our intellectual property. That is how inventive our researchers are.

And we also have Industrial Capital:

807 collaborative projects with industrial partners.

103 licensing deals in which private-sector companies are given permission to use inventions and innovative processes. That is in exchange for payment of fees to the people who created the intellectual property.

120 new technologies are used in those 103 licensing deals.

Over and above all that, Singapore now has Biopolis, Biomedical Icon with a capital I:

Biopolis is the Biomedical Hub of Asia. It is a vibrant community of R&D scientists and engineers working for both the public and private sectors.
A*STAR has taken four big steps forward to bridge the gap between biomedical research and clinical applications. That gap is not unique to Singapore. It is a divide that research scientists and medical doctors are working hard to narrow even in the most advanced scientific nations. What is unique about these initiatives is that eminent scientists are commuting between their homes in the West and A*STAR facilities in Singapore. These frequent flyers are very busy in their respective jobs back home. But they make the long journeys regularly, because they see worthwhile purpose in our pursuits.
Enter the Bioimaging Consortium ...looking inside our bodies, like looking into space

In October 2004, the Singapore Bioimaging Consortium (SBIC) made its debut. An eminent scientific leader had come here from the United Kingdom to help set it up. He is Professor Sir George Radda, SBIC’s Chairman. “Everybody has experienced X-rays,” he says. “Now there are many other ways of looking inside a living being. The latest group of technologies for this is referred to as bioimaging. This provides pictures of living cells inside living organisms, often at the level of specific chemicals. One of the things that we are working on in Singapore is the study of individual molecular processes. It’s very powerful!”

Sir George is an eminent scientist who has had a varied career. He is now Head of the newly set up Department of Physiology, Anatomy and Genetics at the University of Oxford. Before that, he was Chief Executive of the UK Medical Research Council. “I came here 10 times in 2005, each visit lasting about a week,” he says. “By the end of 2006, i will have been here eight times.”

Singapore had various bioimaging capabilities before SBIC’s formation. But the organisations were working independently of each other. Hence the need for a consortium.

Says Sir George: “Your strengths are in image-analysis, image storage, image processing and optical imaging. In Magnetic Resonance Imaging (MRI) for research, Singapore is weak, so we decided that we had to start from scratch. But we can catch up fast. You have some very good people, a lot of enthusiasm, and you are training students. We are also bringing in leaders who are running things and also training locals for leadership roles.”

SBIC has a Laboratory of Molecular Imaging and a Laboratory of Metabolic Medicine. The Molecular Imaging lab has an MRI machine but for research, the first one here. The Metabolic Medicine lab focuses on research into diabetes, brain disorders and image-analysis.

“With bioimaging, you can see particular molecules,” Sir George says. “But the image is blurred, because you’re looking at something that is very, very small. It’s like looking at the stars. You have this huge number of stars, and some of them are very sharp and some are very blurred. Astronomers have to extract information about particular stars from the blurred images. The same technology is being used in bioimaging analysis to interpret small signs in a large background.”

The Singapore Stem Cell Consortium arrives ...tackling some of the most urgent and exciting challenges

Stem cell researchers got their own grouping in October 2005 with the arrival of the Singapore Stem Cell Consortium (SSCC). The Consortium will help push the development of basic stem cell research towards therapeutic applications. It will do so by funding key resources such as dedicated stem cell research laboratories, a Stem Cell Bank and a Cell Therapy Processing Facility. It will also fund collaborative projects by basic research and clinical research groups.

SSCC has set up a Laboratory of Stem Cell Biology that focuses on characterising stem cells. The lab will work with the Stem Cell Bank to create a central pool of well characterised stem cells for use by the Singapore research community. It is located in Helios at Biopolis, where the two SBIC labs are. That facilitates the needed cross-discipline collaboration, including leveraging on SBIC’s expertise.

SSCC’s Chairman is Professor Roger Pedersen, also a frequent flyer to Singapore. He is Professor of Regenerative Medicine in the Department of Surgery, and Director, Centre for Stem Cell Biology and Medicine, University of Cambridge, UK. “Stem cell research is becoming increasingly important for Singapore,” he says. “SSCC will support and promote research that addresses some of the most urgent and exciting challenges in stem cell biology, including research into embryonic stem cells, somatic stem cells and cancer stem cells.”

Stem cell research holds out the potential to cure some of humankind’s more dreaded diseases. Stem cell therapy also has the potential to repair crippling injuries such as spinal damage. So it is a frontier of biomedical research that preoccupies many leading labs and brilliant researchers. And it is a highly competitive exploration area.
Chemical Synthesis Laboratory operates @ Biopolis
...bridging the chemical and biological sciences

Professor K C Nicolaou is world renowned for his work in synthesising complex organic molecules. He flies regularly to Singapore from California, USA, to lead research at A*STAR’s Chemical Synthesis Laboratory @ Biopolis (CSL). He took up the Singapore appointment in January 2005. He is Chairman of the Department of Chemistry, The Scripps Research Institute, and Distinguished Professor of Chemistry at the University of California, San Diego. “My role in A*STAR is that of a Chemical Synthesis Programme Director,” says Prof Nicolaou, “but I also think of myself as an educator and motivator of young students who are interested in science, especially the chemical and biological sciences.”

CSL’s primary objectives are the development of young scientists in the chemical sciences, and the discovery and invention of new synthetic technologies and strategies for the construction of complex molecules, natural or designed. Prof Nicolaou came for all that because, as he put it, “A*STAR’s Chairman Philip Yeo convinced me of Singapore’s serious intentions to move into science and technology, especially biotechnology and medicine.”

And he adds: “It is absolutely a delight working with A*STAR, primarily because of the freedom of thought and long-term funding that allows science to flourish and eventually benefits society through applications in all walks of life. It is a privilege to be able to share the joys of this exciting venture with all Singaporeans at a time when chemistry and biology are making such great strides in the discovery and creation of so much new knowledge.”

Singapore Immunology Network on guard
...improving human health with vaccines

Flying in regularly from France is yet another eminent scientific leader, Professor Philippe Kourilsky. Not only is he helping out as Chairman of the Singapore Immunology Network (SigN), he will also supervise a new laboratory.

SigN was set up in January 2006. Says A*STAR Chairman Philip Yeo of Prof Kourilsky: “Philippe’s scientific leadership will be invaluable in shaping our Immunology Network’s research programmes and infrastructure, and establishing immunology as a core capability in biomedical science research in Singapore.” The Network will encourage collaboration among the various immunology groups.

Prof Kourilsky holds the Chair of Molecular Immunology at the College de France. He is also a noted expert in tumour immunity, and was formerly Director-General of the Institut Pasteur. He says: “The time is right to expand immunology research in Singapore. Immunology has a huge potential to improve human health through preventive and therapeutic vaccines, therapeutic antibodies, and many other products in fields as diverse and important as infectious disease, allergy, cancer and autoimmune disease.”

BusinessWeek
A leading American business newsmagazine

Look East, Look West, Looking at Singapore

BusinessWeek, the American magazine, had a report on 19 December 2005 headlined: “Renewing Britain’s Legacy of Innovation.” Journalist Rachel Tiplady reported that a Review of Creativity in Business in the United Kingdom came to this conclusion: the country that launched the Industrial Revolution may be falling behind the times. The study proposes some fixes, among them pointers to the East, including Singapore:

“In 2007, Singapore will open its … Fusionopolis creative center, which promises to dominate the headlines as well as the city’s skyline. Billed as a ‘city within a city’, the government-funded edifice will bring together business and technology entrepreneurs in a creative, open-minded setting.”
The new life of Singapore...

So says the headline over a report by Ben van Raaij in the 24 September 2005 edition of this newspaper in the Netherlands. The introduction to the report, translated from Dutch, says: “A good plan, money and smartly bought Western talent to make Singapore a centre for the ‘life sciences’.

Portrait of a scientific Valhalla in the tropics.” Also spelt Valhalla, the word has morphed from its Viking origins to also mean a very cool place to be.

My quantum leap

Getting to where I am now has been a tremendous experience. For research activities in Mathematics and Programming are truly stimulating. And to have this opportunity from A*STAR makes me leap for joy.
He breaks boundaries and he seeks breakthroughs

No, they are not twins but the objectives are twinned

TAKE another look at the lookalikes. They are not identical twins. They are one and the same person: Associate Professor Lam Kong Peng. Without the white lab coat, he is Acting Executive Director of A*STAR’s Biomedical Research Council. With the lab coat on, he is Principal Investigator — meaning the chief scientist — of a laboratory in one of BMRC’s new research centres.

The research leader and his team are working on ways to strengthen the body's defences against invasion by disease-causing bacteria and viruses. Technically speaking, the team is into molecular and cellular immunology. In chitchat, the researchers want to help develop a medical "cruise missile" that will target and kill specific pathogens without harming healthy cells. That will be a big breakthrough!

As leader of BMRC, Assoc Prof Lam’s current priority is the breaking of boundaries. These are the traditional borders that separate scientists of different disciplines. Even researchers working in the same domain but in separate teams may not be communicating or collaborating with each other. That usually means duplicated efforts and wasted resources. It is a global problem.

In Singapore, A*STAR is succeeding in breaking boundaries in the search for scientific breakthroughs. "After all, everything in Science is connected," says Assoc Prof Lam, "whether it is biomedical or physical science, or whether it is basic or applied research."

Making breakthroughs and breaking boundaries are inseparable twins!
More top scientists, more joint efforts

At Biopolis, you can watch a heart pumping in real time. “Our new labs, like the one that does bioimaging, are multidisciplinary facilities,” says Assoc Prof Lam Kong Peng. “They use products and processes created by biomedical and physical sciences. Our bioimaging lab has a high-resolution scanner which you can use to see a heart pumping. That will enable us to better understand molecular functions. And it’s non-invasive. No surgery is needed for the MRI scan.”

Breaking boundaries beyond A*STAR. “We collaborate with outside organisations, too. In Singapore, for example, we have the Singapore Consortium of Cohort Studies. It is a joint effort by our research institutes, the Genome Institute of Singapore, together with the National University Hospital and the Singapore General Hospital. The studies will deepen our understanding of how the environment affects our genes. We can then develop more effective medicines and treatment procedures. The studies have been described as ‘a gift to future generations.’”

Going outside Singapore, too. “We continue to go beyond our national borders to collaborate with top scientific organisations. For example, we have arrangements with RIKEN, one of Japan’s most respected science and technology institutes, and with Hungary, where many scientists are also medical doctors, and Australia which has really good basic sciences. And we receive many visitors who are distinguished scientists and scientific leaders.”

More than 30 top international scientific leaders working for or advising A*STAR. And more are coming in what has been described as “a second wave of top-notch scientists from overseas.” Says Assoc Prof Lam: “Now it is easier for us to attract top scientists. A*STAR has established a lot of credibility within five years. The completion of Biopolis phase 1, with its seven buildings and a truly vibrant community of scientists, and action plans for phase 2 highlight our commitment to biomedical research.”

BMRC’s 2006 focus is on translational and clinical sciences. “There will be a Singapore Institute for Clinical Sciences adjacent to NUH. It will be our 6th research institute, specially developed to cater for clinical research. It will be Bench to Bedside — turning research results into healthcare products and processes — at close proximity.”

SCHOLAR’s VOICE

Ms Crystal Yeo Jing Jing is a National Science Scholarship (MBBS-PhD) scholar now at the University of Cambridge (UK). She is on the A*STAR Roll of Honour. She says: “My aspiration is to bridge the medicine and science divide as a clinician-scientist. Bringing the bench to the bedside, and vice versa, the relevant clinical experience can be quickly brought into the labs to hasten the development of new and better drugs, which can be used in the clinic for the patients... This is a meaningful purpose to which I am happy to dedicate lifelong learning.”
He designs for the future with the magnificent seven
Getting great MEaT out of R&D

SERC’s Magnificent Seven
- Data Storage Institute (DSI)
- Institute for Infocomm Research (I²R)
- Institute of Chemical and Engineering Sciences (ICES)
- Institute of High Performance Computing (IHPC)
- Institute of Materials Research and Engineering (IMRE)
- Institute of Microelectronics (IME)
- Singapore Institute of Manufacturing Technology (SIMTech)

Coming soon to a site near Biopolis, another A*STAR scienceplex! The new Science and Engineering complex is called Fusionopolis. Professor Chong Tow Chong looks out of his 9th floor conference room in Biopolis, points and says: “What you see now are only the cores of two towers. There will be six levels of basement. Underground will be shops and food outlets as well as carparks. Aboveground, levels 1 to 3 will also be for retail and F&B. Labs and offices will occupy the rest of the 23 floors.”

June 2007, like a preview; October 2007, the grand opening. “We plan to start outfitting our space from June’07,” says Professor Chong with anticipation. “The tower blocks will house two of our research institutes [RIs], I²R and IHPC, as well as relevant groups from DSI and SIMTech. Our RIs will be there together with private companies and labs in the IT, infocomm and media sectors. That’s why we say that Fusionopolis is where Science meets Business and the Arts!

“We have scheduled 29 October 2007 for the official opening. Then, in 2009, Fusionopolis Phase 2 will be ready for IMRE and IME as well as the rest of DSI and SIMTech. Of course, there will be private-sector companies, too. Our value proposition is that they will get not just space but also researchers and shared facilities that would otherwise cost them lots of money and effort to recruit and assemble. And we will be having state-of-the-art equipment as well as a huge clean room they can all share.

“ICES will remain on Jurong Island. That is where their kind of action is. But whatever their locations, our RIs will be working much more closely together. That is because integrative, multidisciplinary scientific research is the best way to go. One example is in the field of medical devices. Chairman Philip Yeo has coined a phrase for it: focus on MEaT: Medical Engineering and Technology.”

Having made waves, we’re riding new waves. “One of our priorities has been and still is developing public-private collaboration in R&D,” says Prof Chong. “We’ve made some waves with SMEs. They are asking for more collaboration. Even with big companies, our unique advantage is that we can integrate capabilities much faster than most.” Now Singapore is transforming into an intelligent nation with a strong emphasis on pervasive digital technologies. That will revolutionise lifestyles via broadband, wireless and other technologies. Movies and computer graphics are a big part of our lifestyle. SERC’s Magnificent Seven are riding in to help with the design and R&D that will make possible the kind of future we desire.

SCHOLAR’s VOICE

Ms Adelene Sim is a National Science Scholar now on a year’s attachment at the Institute of Materials Research and Engineering. She has a Physics degree from the University of Cambridge, UK. She says: “I... went on my first retreat. (Now, ‘retreat’ in a corporate context takes on a different meaning altogether) ... At the SERC retreat, we got to contemplate how to rebrand SERC ... Not very sciency in the sense of hardcore research, but still very pertinent to the society and science within our culture and education... Before I end off, I’d like to put in a plug for my blog www.femalefizicist.blogspot.com. A sampling of her humour (20/06/08 blog): a head-and-neck photograph of a kangaroo is captioned, “Popping by today with a photo — not of me, but almost there!”
He Nurtures Young Talent And Watches It Flower

GREENERY connects with Professor Lam Khin Yong. He likes nature and relates to the nurturing that gardens big and small deserve. He brings this affinity with nature and nurture to his job as Executive Director of the A*STAR Graduate Academy (A*GA).

“Our talented scholars represent the future generation of aspiring scientists who dare to race with the world’s best towards the very limits of modern science.”

A*STAR Chairman Philip Yeo

Nurturing those aspiring scientists has been A*GA’s mission since 2002. Up to 2005, 17 National Science Scholars returned home and started work in A*STAR laboratories. In 2006, 21 scholars will return from training overseas with PhDs in the hard sciences. By 2008, 30 young PhDs will return each year.

“Our National Science Scholars are doing extremely well,” says Prof Lam. “With eight years of funding provided by A*STAR for their BS and PhD degrees, scholars complete four-year bachelor degree courses in three years, with some even finishing their courses in just two and a half years. Nearly half or 48% of our scholars achieve a GPA of 3.95 or more in US universities.” [GPA is the American system’s Grade Point Average whose perfect score is 4.0.]

Now isn’t that a flowering of talent?

A*STAR Graduate Academy (A*GA)
Executive Director
Professor Lam Khin Yong
More about the flowering of talent: "Every year, we publish the Chairman’s Honours List," says Prof Lam Khin Yong. "We publicise it in the national press. It recognises the most outstanding undergraduate scholars, those with a perfect GPA score of 4.0 in each semester. Then there is the A*STAR Roll of Honour that has pride of place in Matrix, one of the Biopolis buildings. A scholar goes on the Roll of Honour for winning a place on the Chairman’s Honours List for three years consecutively."

More talent goes with the flow: "The National Science Scholarship (B8) is so successful that in 2006 we have about 40 graduates back for year-long attachments at our laboratories," says Prof Lam. "The attachments are very important. The year allows the scholars to establish links with the Executive Directors of the various labs and the chief scientists, the Principal Investigators. Scientists work in teams, so the experience is invaluable for these graduates before they proceed to PhD studies. There is another plus. The year’s attachments will add to their CVs, making them more attractive to graduate schools."

And the talent search goes on inside and outside Singapore: "We need to work hard to ensure that this good flow of talent continues," says Prof Lam. "We have the Youth Science outreach programme. It packages fun and sends out a serious message to students in upper primary, secondary and junior college levels. The message: Science offers an exciting and rewarding career. We also have the Young Researchers Attachment Programme that brings in young people from different countries to study in Singapore at upper secondary and pre-university."

Top of the Pops: "The A*GA pages in the A*STAR website are very popular," says Prof Lam. "They get the most hits. My own favourite is the page with the Voices of our scholars. I get to "hear" about not just their studies, but also their other passions.

"Online we have the Star Connection E-newsletter. So the A*GA family is not a serious and discipline-focused. Take, for example, an article in the E-newsletter by MBBS-PhD scholar Rachel Chong in the UK. She entitles it: 'Say it again, Sam'. The heading caught my eye. And I had a treat, reading about her visit to London. She described that as full of surprises. Check it out."
No Strings attached

In the world of wireless communications, devices are not attached to anything, and boundaries no longer matter. For my part, I am using mathematics to create faster wireless speeds for the future. Thanks to A*STAR, I get to work with top scientists, in one of the best facilities in the world.
UBER Science is super-quality science. The German word über is synonymous with Latin for super, Greek for hyper and English for over as in "overkill". Asked for a soundbite that expresses his most important concern as A*STAR's second-in-command, Mr Boon Swan Foo says with vigour: "We must have Über Science!" Why? Because he sees that as the only way for A*STAR to help propel Singapore along as a Knowledge-Based Economy. The fuel for that is Human and Intellectual Capital.

A*STAR Managing Director and Exploit Technologies Executive Chairman
Mr Boon Swan Foo

THE BEST SCIENTISTS NEVER RETIRE

"AS a scientist," says Mr Boon, "you don't have to retire if you can continue to discover new knowledge. And you can have a fulfilling life without having to be an entrepreneur running a business. A*STAR's Exploit is here to enhance the value to society of your scientific discoveries. So we can take care of that side while you focus on deepening scientific skills."
Have ideas, will travel – that’s Foresight

"In the Biomedical Sciences," says Mr Boon Swan Foo, "A*STAR Chairman Philip Yeo is a one-man think tank. He can think fast and far ahead, and he sets the direction.

"In the Physical Sciences, we have organised the acquisition of good foresight. We get together in big committees to draw up pictures of the future. The process is called Foresight. It's trends---spotting and it's exciting. Foresight is about making sense of the future. It seeks to ask the right questions. Asking the right questions prepares us, so that no matter how the trends may evolve, we are ready to seize opportunities. So we have linked up with organisations such as the Institute for the Future, trend-spotting and foresight specialists based in Palo Alto, USA."

"This holistic approach was adopted for the SST2010 planning effort. The key thrust was the involvement of the local research community and beneficiaries of the Plan."

"Some 450 researchers from our RIs, our Universities and our Companies participated in the process, and no fewer than 17 committees were formed. Government agencies and sister agencies under MTI, and international advisers were involved in the complete exercise."

"The process included a review of our past research efforts, an extensive foresight study and also adoption of a Pictures of the Future methodology as well as a STEEP evaluation, together with a comprehensive industry, market and human resource study. This consultative and collaborative approach exemplifies the sort of no-boundary behaviour necessary for the next phase of our R&D."

"We also make observation trips to organisations in Singapore and overseas. We got to discover how our technologies and applications compare with the best already available out there. And we update our research priorities."

Mr Seow Yi Qi is a National Science Scholar who has completed undergraduate studies and is on one-year attachment at the Institute of Molecular and Cell Biology. He says: "I want to be involved in bringing findings in the lab to market, so that real people can benefit from our research. The A*STAR scholarship has empowered me with the tools … It allows me to pursue a PhD – to gain the credibility I need to contribute to the wonderful world of biomedical researchers, and to provide me with opportunities to interact with top researchers in various biomedical disciplines from all around the world."
"Now is a great time to be a scientist in Singapore!"

Mr Philip Yeo

That is a bold statement. It is open to challenge. But try questioning A*STAR's Chairman about his credentials and those of the agency.

To start with, the University of Toronto was where Colombo Plan Scholar Philip Yeo obtained his industrial engineering degree in 1970. In 2004, the university's magazine said of him: "In just three decades, Singapore has vaulted from impoverished third-world country to gleaming city-state, with a per-capita GDP approaching that of the top industrialised nations. As chair of two key economic agencies, Philip Yeo has helped shape his country's future."

The two key agencies are the Economic Development Board, where he was between 1986 and 2006, and the Agency for Science, Technology and Research from 2001 to the present.

Why I read...

When he became A*STAR's Chairman, Mr Yeo realised that he had to quickly acquire much deeper and up-to-date knowledge about Science and Technology.

So he started reading. He did it at a frenetic pace. He sought out relevant books, magazines and scientific journals. He would buy two copies of each book. He would speed-read a copy, marking key passages with highlighting or notes on the margin. Then he would read those passages again, but not so quickly the second time.

"The unmarked copies of the books are for my library," he tells visitors.

In the early months of his chairmanship, he supplemented his reading with one-to-one tutorials conducted by selected research scientists on his staff. Now he still has tutorials but of the informal kind. They are in the form of discussions with prominent scientists he meets in Singapore and abroad.

"We all must read," he says emphatically, "whether we are A*STAR scientists or other staff, or A*STAR scholars, or people outside the Science and Technology sector. That's the only way to keep up with new knowledge and to stimulate our own thinking."

"But reading alone is not enough. We have to think, too!"
Why we must think creatively...

Back in the 1980s, the Singapore economy's manufacturing sector employed thousands of people to make consumer electronics. Then we faced a big problem. Other countries were beginning to make such products at much lower cost. We would lose those factories and many jobs.

"So we had to think hard," recalls Mr Philip Yeo. "We decided to shift focus to industrial electronics, making components instead of assembling finished products. Making the electronic parts required more capital and more skills. We upgraded our factories and our workers' abilities."

Today Singapore is the leader in the production of high-capacity disk drives, making more than one-third of all capacities of disk drives for the world market.

"It took us some years to get there," Mr Yeo says. "Meanwhile, we continued thinking hard. We further diversified the manufacturing sector by building up the semiconductor industry. Then, in the late 1990s, the cyclical electronics sector began to slow down. Another problem!

"But we had anticipated that. In the second half of the 1990s, we added the petrochemical industry to broaden our industrial base."

Why we just do it and get it right...

By then, Mr Yeo and his team had noted that a biotechnology industry was emerging in the United States. It was time for more reading about that, talking with more people in the know — and thinking creatively about how Singapore could get into the action.

Action stations sounded on 28th June 2000!

"That was the day the successful completion of the 15-year international Human Genome Project was announced," says Mr Yeo. "I quickly got together three of our top doctors: Professor Tan Chorh Chuan, then Dean of Medicine of the National University of Singapore, and two oncologist colleagues, Professor John Wong and Associate Professor Kong Hwe Loong.

We brainstormed: 'Hey, how can we use the Human Genome when it is unveiled? How can we get into the sciences and turn knowledge into drugs and medicine?'"

One thing led to another, as the old saying goes. Now Singapore has leading-edge Biomedical Sciences that are vibrant and growing in Biopolis, an internationally recognised scientific icon.

Next year another scientific icon will rise in the form of Fusionopolis, slated to be an equally vibrant and growing hub for Science and Engineering.

"So reading leads to thinking. Yet reading and thinking are not enough. We have to take action, too! And get it right."

As the timeless Johnny Nash song puts it: 'I can see clearly now, the rain is gone, I can see all obstacles in my way... Obstacles have been cleared, like the doubts five years ago!"
Biopolis, built during the 15th Five Years, will have to put up a "Full House" sign soon. It is now almost fully occupied by A*STAR’s biomedical research institutes and also private-sector R&D outfits. By the end of 2008, Biopolis Phase 2 will be ready to enhance interactions between public and private-sector researchers.

Then, during the Next Five Years, another scientific icon with a capital I will rise near Biopolis.

From 2007, Fusionopolis will be home to A*STAR’s Science and Engineering research institutes as well as private-sector R&D and media organisations.

Media, too, because connected, interactive and wireless communication, information and entertainment are becoming a bigger and bigger part of people’s daily life. And inventions and innovations in those areas come from R&D in Science and Engineering.

So Fusionopolis will be where Science meets Business and the Arts!

And here are our other targets in Goal 2010:

A*STAR, recognised as a key provider of Human and Intellectual Capital for Singapore’s Knowledge-Based Economy.

A*STAR will have 2,000 research scientists and engineers. Half will be Singaporean talent, the other half will be international talent. That 50/50 mix will be a potent combination, unique in the world!

500 young Singaporean PhDs will be at work in A*STAR research institutes. Never before has Singapore had such a talent force!

May the Force be always with us in Singapore!

---

Human Capital, or what I call ‘Two-Legged Assets’, is the key resource for a Knowledge-Based Economy. The foundation of good scientific research and innovation is Talented People. The creative power of the human spirit and the inventiveness of the human mind are the propelling fuel for scientific advancement and technological progress.

---

A*STAR Chairman
Philip Yeo
Reeling in top researchers

“Singapore ... has been poaching top researchers from all over the world and providing jobs in which they lead research programmes and enjoy almost unlimited financial support. The latest example is Judy Swain, a heart researcher at the University of California, hired to run the newly-created Singapore Institute for Clinical Sciences from September (2006).”

— Kathrin Hille reported in the 27 April 2006 Financial Times.

Tiny Specks, Huge Prospects

Nano is about being tiny. Yet enormous possibilities exist in Nanotechnology, from electronics to biology. I want to contribute immensely to this industry. With the endless support and opportunities from A*STAR, I’m learning to dream big.

Shireen Goh
National Science Scholarship (BS)
Applied & Engineering Physics
Cornell University
Hwa Chong Junior College

Chairmen’s Honours List 2003-2005
A*STAR Roll Of Honour 2005
Proceeding to National Science Scholarship (PhD) at Massachusetts Institute of Technology
You hate maths? It’s OK. Dr Yeo Sze Ling understands even though she is a mathematician. She can also appreciate why people with no affinity for maths can enjoy the American TV series *Numb3rs*. According to TV.com, *Numb3rs* dramatises “the confluence of police work and mathematics in solving crime.” The show features FBI Special Agent Don Eppes and his math genius brother Charlie in Los Angeles. Dr Yeo works with the confluence of maths and people’s seemingly never-ending desire to hide messages in secret codes.

Codes and code-breaking have been the domain of geeks hidden deep inside military headquarters and spy networks. Secret messages used to be hidden in mooncakes, too, according to Chinese mythology. If you manage to break a code, you may uncover your enemies’ plans to harm you — or even your best friend’s juiciest secret. Hidden messages are also the stuff of childhood fantasies and children’s games.

In today’s digitally connected world, security codes have moved out from war-planning and game-playing to everyday living. Their applications have very important implications for human transactions such as e-banking and e-commerce. And the codes of today are almost entirely math based.

“The RSA Algorithm is one of the most widely used cryptography systems,” says Dr Yeo. “Written in 1976, it is named after its inventors Rivest, Shamir and Adleman. It relies on difficulty in factorising large numbers. Users of the RSA Algorithm require two pieces of information represented by numbers, one public and one private. Intuitively, the public information can be thought of as a public key, while the private information is the secret key to unlock the messages.”
Math can hide secrets

The heading above is printed in a two-dimensional representation of Braille. The dots should be raised, but regretfully we cannot do that here because of technical constraints. Braille is a system of six raised dots with 63 possible combinations, according to the definition from the Singapore Association of the Visually Handicapped. It is read by touch. We would like to give our readers a minor challenge: read the Braille-style heading by sight, using the alphabet key at the bottom of the facing page as a guide. If you need to check your decoding, the headline is translated below the guide, printed upside down.

In case you have not guessed, Dr Yeo Sze Ling is visually impaired. Glaucoma hit her when she was a child and robbed her of normal sight. But nothing was able to rob her of her vision.

She says: “I was among the few who have liked maths. But I took up Pure Maths only at university. It involves a lot of thinking. You need to read just a little. That, for me, is an advantage. But you can think a great deal. We are trained in maths to think rigorously and logically. That is a great help in problem-solving. You can tackle all kinds of problems, not just the mathematical ones, because you have been trained to think things through.”

Now that she has a PhD in maths, she is doing research work in cryptography, aka cryptology. That is the analysis of codes and coding systems. She does that in the wider context of systems security. Does she have secrets that she wouldn’t want revealed? “Of course,” she says, “who doesn’t?”

It is no secret that Dr Yeo goes for the occasional jog at Bishan and listens to classical and sentimental music. She is preparing to go overseas for her postdoc. Her PhD thesis was on “Global Function Fields With Many Rational Places”. That, she says, is about abstract curves and the number of points that make up the curves. Cheers, right? Not like Number 3s!

From our Science Reporter for the Day, Nicole Quah, a Raffles Junior College 1st year student and a recipient of the inaugural A*STAR JC Science Awards:

Mathematics research seems
A true pursuit of her life’s dreams
The love of problems since her youth
Has led her to her job as “eleuth”
Eschewing fortune in finance
She chose instead to help advance
Research in codes and abstract fields
Each for its math over what it yields
Every moment day and night
Her mind is blazing, set alight
Not fazed by what has to be read,
Connecting, imagining all in her head
Though one cannot think in groups, says she
So a lonely pursuit it can be
Idealistic though it seems
Dared she follow what she dared dream
Conquering challenges hurled her way
An inspiration she will stay,
(As here’s to her and RSA!)

Hey, readers! Take a crack at this very easy code:
The capital letters in the lines above can be unscrambled to form a sentence.
The answer is given below, upside down, but don’t look at it yet!

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Answer: After a successful trial...
Dr Arnesha Dey
Research Fellow
Tumour Suppressor Laboratory
Institute of Molecular and Cell Biology (IMCB)

PhD in Biochemistry (2004) from Howard Hughes Medical Institute, University of Maryland, USA.
A*STAR National Science Scholarship (Oversea PhD), BSc in Biotechnology, National University of Singapore; earlier education in India.

SHE WORKS ON A GOOD-GUY PROTEIN THAT IS THE MOST FREQUENTLY ALTERED PROTEIN IN HUMAN CANCERS

WHAT makes a good guy go bad? What turns a guardian angel into a rogue that stops protecting people? Biomedical laboratories around the world are working furiously to find out and to develop a remedy. "It is highly competitive and very challenging research," says Dr Arnesha Dey.

The p53 protein has been an area of intense research since it is the most frequently altered protein in human cancers. How do we re-activate the p53 protein when it shuts down and stops suppressing tumours? She is very well placed for this research in the postdoc phase of her development as a scientist. When she was due to come to Singapore for deployment after getting her PhD, the A*STAR scholar emailed Sir David Lane for a place in his laboratory. She got it!

Sir David discovered the tumour suppressor protein p53 way back in 1979. As a result, we know that it acts as a guardian against cells mutating, not dying when they should and becoming cancerous. But p53 molecules can stop functioning, allowing cancer cells to run wild.

Sir David was persuaded to come to Singapore from the United Kingdom to lead the Tumour Suppressor Lab in IMCB. Additionally, he was appointed Executive Director of the institute in 2004. "It was perfect timing for me," says Dr Dey, who obtained her PhD in the same year. "Overseas, I was working with viruses and HIV-based therapies. Back in Singapore, I am working in a different and very exciting area — and learning from one of the world's top cancer researchers."
Doing it her own way...

...the research, the outreach, the song and the dance

Dr. Anwesha Dey, her fellow postdocs and their scientific leader are seeking a deeper understanding of how p53 behaves. What affects its responses, how can it be activated and controlled? What shuts it down? Sir David’s team is hoping to discover or develop molecules that will activate p53 and to better understand the molecular basis of the action of such drugs.

This could lead to effective treatment for some cancers.

What an exciting prospect! It keeps researchers like Dr. Dey all charged up. “I have to admit that I work long hours and weekends, too. But that is my own choice and since the research is very motivating, it does not feel like work. Of course, there are down days when the experiments are not working no matter what you do. But you just keep trouble-shooting. And eventually it comes out right.”

So does she have time for relaxation? “Of course, I have, even though it sometimes means I get less sleep,” says Dr. Dey. “I like music, singing, dancing and reading all kinds of books. I sing in three Indian languages and also in English. I learn the South Indian classical violin. I have stereo-speakers on my bench in the lab. And I really enjoy all the fun activities organised by A*STAR.” She also makes time to help A*STAR’s outreach programmes to interest students in biomedical sciences. And she mentors Indian students studying in Singapore under A*STAR’s Young Researchers Attachment Programme.

Says Dr. Dey: “I hope to make the best of this opportunity so that A*STAR can be proud of its scholars, and to make a contribution to my field of research in my own way.”

From our Science Reporter for the Day, Cheryl Sim, an Anglo-Chinese School (Independent) 1st year International Baccalaureate student:

THE thing that struck me was The Centrifuge Room, where centrifuges of different types were placed. It was like a scene out of Minority Report, because before you could start operating the centrifuges, you had to scan a card, so that your personal data was logged in. Plus, there were two security cameras at opposite ends of the room. It all seemed so fancy and hi-tech!
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Sir George Padwa
Professor and Head,
Department of Physiology, Anatomy and Genetics, University of Oxford, UK
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Dr Paul Berg
Professor of Biochemistry, Stanford University, USA
A scientific hub with connections across the globe

When caravans, ships, trains, buses and aeroplanes started to speed up travel at different points of history, hubs were created: Central stations for land transport, transhipment ports for sea trade, intercontinental airports for planes.

Similarly, A*STAR had to create a hub for talent to meet and make progress for Singapore’s pursuit of Science and Technology. Many of the world’s most eminent names in scientific research and scientific leadership were persuaded to travel long distances to come and help.

Together with some Singaporeans, they have turned A*STAR into Talent Central.

You have met the leaders in pages 62 to 66. You will meet more leaders in pages 68 and 69.

And there is so much more talent, the experienced as well as developing stars, in A*STAR’s research institutes and at headquarters units.

At that, talent centralised here, but with connections everywhere.
Achievements
achievement > noun 1 a thing done successfully, typically by effort, courage, or skill

Waypoints
waypoint > noun 1 the computer-checked coordinates of each stage of a flight or sea journey

MISSION IN PROGRESS is like a journey that has not ended. A voyager who has not reached destination but who is on course is making progress. In navigating a long voyage, we regularly check our positions to ensure that we are both on course and on schedule. Our charts show our waypoints, the markers of progress towards and beyond significant stages of the journey.

A*STAR’s waypoints in its Mission In Progress are these:

Worldwide Credibility: Five years ago, who would have thought that Singapore had any potential in knowledge-intensive, highly competitive Science and Technology research? Today Singapore has Recognition around the world as a serious, fast-rising participant in world-class R&D.

Capital to the Power of 3: Human Capital in the living forms of research scientists and engineers in public-sector and private-sector laboratories, and young people training for PhDs in the hard sciences. Plus Intellectual Capital embedded in scientific papers and patent applications. Plus again Industrial Capital embodied in collaborative projects with industry partners and also licensing arrangements.

Those are considerable Achievements in just five years from 2001!

The company we keep...

WE are in good company in Singapore in more ways than one. The one way that we want to put on record here is the coming and settling in of big name global companies. They bring investments and expertise, they provide jobs and training, they open up overseas markets and add to Singapore’s global connections. Going into A*STAR’s Next Five Years from 2006, we present two of the latest investments by two of Singapore’s oldest friends.

JAWS? No, they call it the Cardiovascular X-Ray, inside a spaceship? No, we are inside Philips Medical Systems’ Learning Centre for advanced medical diagnostics equipment training. It is located in Singapore and is the largest dedicated facility of its kind in the Asia Pacific region. Philips Medical Systems is a division of Royal Philips Electronics.

DIGGING in for something special in 2010. That is when GSK’s first vaccine manufacturing plant in Singapore is scheduled to start operating. GSK is, of course, GlaxoSmithKline, one of the world’s leading vaccine manufacturers. The new plant is GSK’s biggest vaccine investment in Asia and will be the first such facility in Singapore.
Budding Young Researchers:
The Singapore Science and Engineering Fair received 256 project submissions from 486 secondary school and junior college students. It includes the National Science Talent Search. Four of the 52 participating students won awards. (29 April 2005)

2005-06
ACHIEVEMENTS!

Our R&D Intensity on the World Stage:
At 2.25% of GDP in 2004, Singapore’s R&D spending gave it an R&D intensity that was close to the average of the OECD economies. The OECD average was 2.26% in 2002. Small advanced economies like Sweden and Finland had high R&D intensity: 4.27% in 2001 and 3.46 in 2002 respectively. Moderate high are South Korea’s 2.64% in 2003, Belgium’s 2.42% in 2004, Denmark’s 2.52% in 2002, Switzerland’s 2.57% in 2000, and Taiwan’s 2.30% in 2002. (National Survey on R&D 2004 report released on 13 October 2005)

Singapore’s Highest Scientific Honours:
Five outstanding researchers and three young scientists were winners of the annual National Science and Technology Awards. (20 September 2005)

550 A*STAR Scholars and a Roll of Honour:
Education Minister Tharman Shanmugaratnam presented A*STAR scholarships to 114 talented young people on 22 July 2005. Total number: over 550. Mr. Shanmugaratnam also unveiled the A*STAR Roll of Honour.

Partnering Japan’s RIKEN:
Japan’s foremost network of public sector research institutes, RIKEN, signed a Memorandum of Understanding with A*STAR. They intend to collaborate, especially in the biomedical sciences and biotechnology. (16 September 2005)
GET-Up Gets Tech
Upgrades for 110
Local Companies:
A*STAR Science and Engineering Research Council’s GET-Up scheme has benefited over 110 local companies. [1 September 2005]

Four New Translational Research Initiatives:
The 10th meeting of the Singapore Biomedical Sciences International Advisory Council endorsed these proposals to bring basic science closer to clinical applications: (1) Singapore Stem Cell Consortium, (2) Singapore Immunology Network, (3) Singapore Consortium of Cohort Studies, and (4) A*STAR Data Privacy Framework. [31 October 2005]

Doing It Jointly, Your PhD Here and Abroad:
At first it was PhD and postdoctoral training for A*STAR Graduate Scholars at National University of Singapore, Nanyang Technological University or Imperial College London. Now A*STAR has partnerships for scholars to do half their PhD training at a top-notch overseas university and the other half at an A*STAR research institute. The PhD will be awarded by the overseas university. The partners are University of Illinois at Urbana-Champaign, USA, Sweden’s Karolinska Institutet, Scotland’s University of Dundee, and the United States’ Carnegie Mellon University [16 March 2008].

Important Discovery about Hepatitis B Virus:
It could lead to an entirely new approach to treating patients with the virus. That is the impact of a discovery at A*STAR’s Genome Institute of Singapore. [Public Library of Science Medicine, 26 July 2005]

Strategic Research Areas for Aerospace Industry:
Boeing the American aerospace giant and A*STAR signed a Master Research Collaboration Agreement to investigate and develop technology research projects. [21 October 2005]

Drug-loaded Gels that Hit Targets:
A*STAR’s Institute of Biomaterials and Nanotechnology has invented an injectable and biodegradable “hydrogel” that can deliver drugs at targeted sites, or act as a scaffold for tissue repair. [7 December 2005]
Why Mitsui Chemicals Renamed Its Symposium:
In April 2006, Mitsui Chemicals held a two-day conference in Singapore that focused on advances in materials and chemicals. That was the first time it brought its symposium to an Asian country outside Japan. It renamed the meeting Singapore International Symposium (SIS2006) in recognition of the host country's contribution and support. (13 January 2008)

Biomedical Sciences Industry's Growth Momentum:
The industry's manufacturing output grew to S$18 billion in 2005, a 9.8% increase over 2004. Pharmaceuticals' share was 66%. Medical technology grew 10.6% to reach S$2.1 billion. Employment increased by 8.6% to 10,200 jobs. MedTech provided 62% of those jobs. (27 January 2008)

Connecting with Finland in R&D Partnership: VTT is the Finnish contract research organisation. It signed a Memorandum of Understanding with two of A*STAR's research institutes on 20 January 2006: Institute for Infocomm Research and Singapore Institute of Manufacturing Technology

Chinese Hamster Cells and a Consortium:
A*STAR's Bioprocessing Technology Institute and the University of Minnesota in the US have jointly organised a Consortium for further development of genomic research tools for Chinese Hamster Ovary cell lines. (3 March 2006)

CSI and Six More Clinician Scientists: Six more medical doctors have received the Clinician Scientist Investigator (CSI) Award. Sponsors are A*STAR's Biomedical Research Council and the Health Ministry's National Medical Research Council. (23 January 2008)

For Creative Interaction between Business and Research:
A*STAR's Singapore Institute of Manufacturing Technology launched its SIMTech Membership on 19 January 2006. It is for multinational corporations and local enterprises. Purpose: to facilitate exchange of ideas and assistance in tackling problems.

Now Hear It from the President of India:
Dr A P J Abdul Kalam at the Indo-US Nanotechnology Conclave on 22 February 2006 in New Delhi:

During my recent visit to Singapore, I visited the facility built up in Biopolis... Biopolis has a scheme of searching talent globally and providing them all the facilities to acquire qualification of their choice.... This idea has emanated because they want quality manpower across the world to enhance their R&D potential leading to commercialisation initiatives. I am sure there is an important message for all of us for nurturing young talent for all scientific research... We have 540 million youth in the country.
Acknowledgements

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A*STAR’s FAST RESPONSE SCIENCE!
SARS in 2003: A*STAR’s GIS was one of the first labs to sequence the virus’ genome. It was the first to discover that the virus was mutating. It developed a detection kit together with Roche Diagnostics.

A*STAR’s IMCB developed a detection kit together with Genelab Diagnostics.

Ongoing BIRD FLU CRISIS: GIS came up quickly with proprietary nucleic acid diagnostic primers for the H5N1 avian flu virus. This enabled Veredus Laboratories to develop one of the first commercially available kits.