

SCIENTIFIC MALAYSIAN

ISSUE 8 / JUNE 2014



SIMPLE AND RAPID CANCER DIAGNOSTIC KIT

Could it really save more lives?

BIODIVERSITY OF MOUNT KINABALU

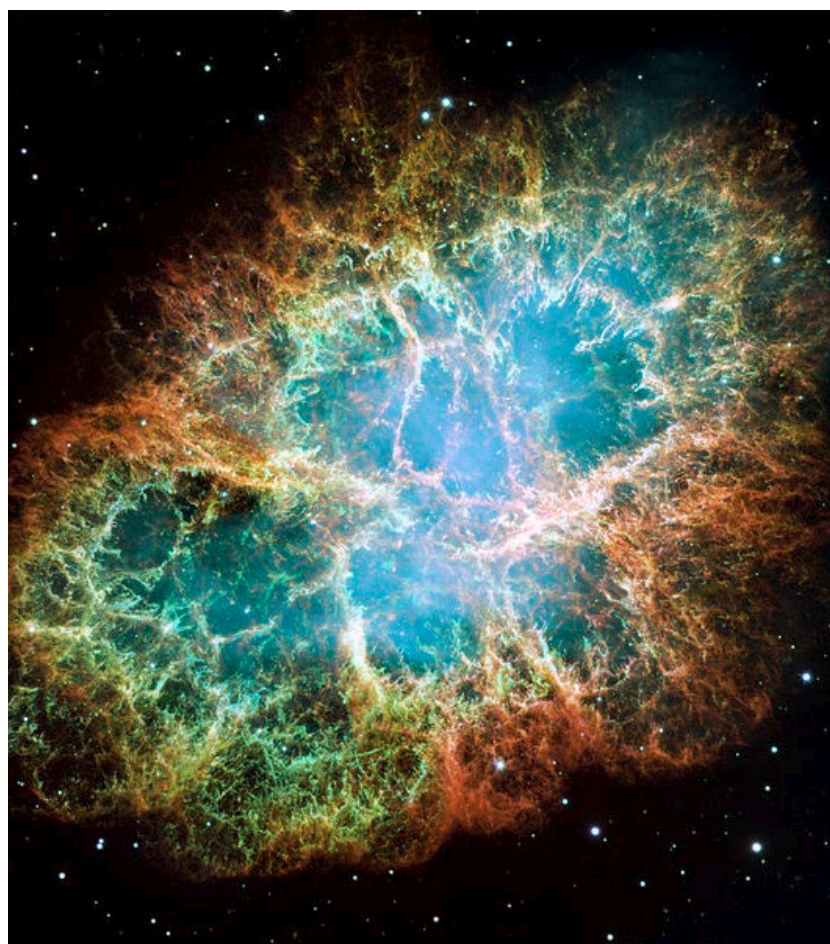
Malaysian-Dutch expedition
uncovers the mysteries
of its flora and fauna

MEET THE SCIENTIST

Interview with Dr. Lim
Boo Liat, Malaysia's
renowned zoologist

THE NIGHT WATCH

The experience and
intensity of working
the night shifts at CERN

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Physicists have recently created the first man-made minute supernova by using lasers [Meinecke *et al.* (Jun 2014) *Nature Physics*]. Picture (NASA & ESA): The Crab Nebula, a prominent supernova remnant that was also recorded by observers in China and Japan almost a thousand years ago in 1054.

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Abstract painting of a dividing cancer cell. Illustrated by Kong Yink Heay
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EDITOR'S FOREWORD

Howdy! The first half of 2014 has not been easy for us Malaysians – the disappearance of MH370 serves as a reminder that we should strive to give our best in life.

Our cover article on cancer detection (pg. 18) is one that is close to my heart. Due to delayed diagnosis, my aunt succumbed to cancer in the early 90s, and eventually passed away. Had the cancer been diagnosed earlier, could my aunt be saved? I believe this is a question almost everyone who has watched his/her closed ones battling against cancer had asked at some point.

Dr. Chang Yang Yew, the author of our cover article, argues that it is however not useful to establish generic cancer tests for everyone, and explains about the technical intricacies of cancer detection. In a similar vein, **Mohd. Firdaus** discusses about common challenges of stem cell therapy (pg. 11) that impede the advancement of medicine.

For the nature-loving readers, we are proud to present **Prof. Menno Schilthuis**'s highlights of his scientific expedition to Mt. Kinabalu in 2012 (pg. 8). Using various analogies, **Tan Li Li** and **Dr. Chooi Weng-Tink** introduce the major subdivisions within modern scientific psychology (pg. 14).

Next, **Gabriel Chong** from the SciMy team reported from the EmTech Singapore 2014 Conference where the world's best young innovators were recognised (pg. 22).

This issue's Project Collab features the use of microfluidic technologies in space exploration by **Dr. Jitkai Chin** from University of Nottingham, Malaysia, and his collaborator, **Tengku Farah Wahida** from National Space Agency (pg. 25).

On a lighter note, **Dr. Khoo Teng Jian** (pg. 33), **Mamduh Zabidi** (pg. 36) and **Lim Mei Chee** (pg. 39) share their research experience in "Life as a Scientist" section. Also, we strongly encourage our readers to check out Part I of an extensive and inspirational interview we conducted with **Dr. Lim Boo Liat**, one of the three Merdeka Award recipients in 2013 (pg. 29).

We wrap up this issue with **Yap Gaa Mun's** short story on gigantic ladybugs and futuristic dancing (pg. 41).

Happy reading!

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SCIENTIFIC MALAYSIAN MAGAZINE is published in a web format (<http://magazine.scientificmalaysian.com>) and in a downloadable digital magazine format (PDF). Our digital magazines are distributed to Malaysian societies around the world. The Scientific Malaysian Magazine will be published bi-annually and is FREE of charge.

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NEWS HIGHLIGHTS

Snippets of the latest/past news published on Scientific Malaysian website

FEBRUARY 2014

Breakthrough in malaria inoculation for vaccine development

A novel method which involves inoculating participants with aseptic cryopreserved *P. falciparum* sporozoites, manufactured by Sanaria who has fellow Malaysian, Dr. Betty Sim Kim Lee as its vice president, could hasten the progress of developing a malaria vaccine.



MARCH 2014



L'Oréal-UNESCO for Women in Science Fellowship 2014

Application for the L'Oréal-UNESCO For Women in Science National Fellowship was open until 30th May 2014 for Malaysian women researchers under the age of 40 years, who are PhD holders or pursuing research study in the field of Life Sciences. A financial assistance of RM30,000 each will be granted to 3 young female researchers.

Competition: The Great Lab Challenge

The Great Lab, organised by a group of undergraduate students passionate about science and supported by CREST Malaysia, is an innovation challenge open to all Malaysian students from pre-university level all the way through to postgraduate level.

The aim of the challenge is to cultivate an innovative spirit within Malaysian students as well as expose our students to the scene of industrial research and development back home in Malaysia, through a comprehensive competition involving aspects of proposal writing, ideas pitching as well as eventual product design and development. Deadline for submission of proposal was on the 4th April 2014.



APRIL 2014



Henry Louis Gehrig, the famous baseball player of New York Yankees, suffered from pure ALS, for which the disease was also named after. Photo: Robert Gusick/Flickr

Collaboration: University of Malaya (UM) and the National Institute of Health (NIH, US) are investigating amyotrophic lateral sclerosis (ALS) and/or frontotemporal dementia (ALSFTD)

UM and NIH in the United States are working together in characterising the *C9ORF72* gene in patients with ALS and/or ALSFTD. The objective of this project is to search for a possible explanation on why patients with ALSFTD have different degrees of disease severity. The PacBio II sequencing technology at UM will be used to the *C9ORF72* gene in patients with ALSFTD. Dr. Chan Kok Gan from UM will be contributing his expertise in sequencing, while Dr. Andrew Pliner from NIH will be performing the bioinformatics analyses. Findings from this study will contribute to developing a more accurate way to prognosticate ALSFTD patients and consequently, better management for this group of patients.

Recent PISA assessment highlights deteriorating education performance in Malaysia

The Programme for International Student Assessment (PISA) is a worldwide study by the Organisation for Economic Co-operation and Development (OECD). The PISA examines the scholastic performance of 15-year-old pupils in mathematics, science and reading. According to the 2012 PISA report published last year, Malaysia was ranked 52nd out of 65 countries. Malaysia obtained a reading score of only 398, a drop from the previous score of 414 in PISA 2009 report. In Mathematics, Malaysia did improve from the previous assessment with 412 points (compared to 404 in 2009), although this is still below the average score of 421 points. For scientific literacy, Malaysians scored 420 points, which is again below the average score of 501 points and a decline from the previous score of 422 in 2009.



Photo: Seth Saunders/Flickr

It is clear from the recent PISA report that Malaysia's performance was not only below the OECD average, but in areas such as science and reading, there was a deterioration in performance compared with the previous 2009 assessment.

Malaysia's disappointing performance on a global scale should be a wake-up call to address our declining standards in education. We have been significantly outperformed by our neighbours, most notably Singapore, which snagged second place in the recent PISA ranking. For the action plans to be successful, both governmental and non-governmental bodies must receive the support of students and parents. Setting high education standards is necessary if Malaysia is to achieve its goal of becoming a high-income nation. If all the key players execute their roles effectively, it is possible for Malaysia to be not only one of the top countries in international education rankings, but also a high-income country in the near future.

The full news articles are available on our website at www.scientificmalaysian.com. We welcome press releases and research news articles; please get in touch with us by email at news@scientificmalaysian.com

CONFERENCES

Upcoming conferences and symposia in Malaysia and Singapore

JUNE 2014

2nd International Conference on Science and Technology (ICST), Kuala Lumpur

Date: 17 June 2014

Venue: Hotel Dynasty, Kuala Lumpur

More info at <http://grdsweb.org/conferences/kaula-lampung/2nd-icst-kuala-lumpur>

JULY 2014

3rd International Renewable Energy and Environment Conference

Date: 4 - 6 July 2014

Venue: Coronade Hotel, Kuala Lumpur

More info at <http://sciconference.net/ireec/index.php>

International Bioprinting Congress

Date: 24 - 25 July 2014

Venue: Biopolis, Singapore

More info at <http://selectbiosciences.com/conferences/index.aspx?conf=IBC2014>

AUGUST 2014

6th Kuala Lumpur International Conference on Biomedical Engineering (BIOMED 2014)

Date: 27 - 29 August 2014

Venue: University of Malaya, Kuala Lumpur

More info at <http://biomed2014.um.edu.my/Biomed2014>



Photo: Frédéric BISSON / Flickr

Interested in joining the Scientific Malaysian Team?

By being part of us, you will have the opportunity to enhance your skills and improve your CV by working flexibly and contributing remotely from wherever you are.

We are now seeking for enthusiastic and passionate volunteers to join our team for the following positions:

a) Web Developers

- Role: Maintaining and adding new functionalities to our websites.
- Knowledge in *WordPress* is essential.

b) Scholarship Officers

- Role: Maintaining our scholarship directory, and liaising with scholarship funding bodies.

c) News Editors

- Role: Writing short news reports on scientific research and development news in Malaysia, to attend/report on scientific events/conferences.
- Good writing and reporting skills are essential.

d) Magazine Designers or Illustrators

- Role: Designing our magazine layout or producing original illustrations/photos for the magazine.
- Knowledge in *Adobe InDesign* or *Adobe Photoshop* is desirable.

e) Publicity Officers

- Role: Promote awareness of Scientific Malaysian especially via social media, distributing SciMy digital magazine, liaising with relevant organisations.

f) University Ambassadors

- Role: Promote awareness of Scientific Malaysian at university campuses and research institutes locally (Malaysia) or abroad. May involve organising events (such as talks or discussion forums).

If you would like to contribute to Scientific Malaysian in other ways not mentioned above, please do contact us - we are always looking forward to new ideas!

CONTACT US: team@scientificmalaysian.com



Photo: www.lumaxart.com/Flickr

Malaysian-Dutch expedition unveils the mysteries of Mount Kinabalu

A personal account by Prof. Menno Schilthuizen

In 2012, a large team of Malaysian and Dutch biodiversity experts collaborated in a joint expedition to the Crocker Range and Mount Kinabalu in Sabah. The expedition aimed to use DNA technology to resolve the question of whether the mountain is a “cradle” or a “last resting place” of unique species.

Mount Kinabalu, piercing the clouds in the far distance, beyond the cityscape of Kota Kinabalu in Sabah, was one of the first things I saw as the driver from Universiti Malaysia Sabah (UMS) picked me up from the airport and took me to my new home back in January 2000. As a tropical biologist with a long history of research in Malaysia, it was a dream come true. For more than a decade, I had studied Malaysian insects and land snails from my home universities in The Netherlands, spending sometimes a few weeks or months at a time in Malaysia to take samples that I would then process in my Dutch lab. But that roundabout, cumbersome way of doing research, was finally over when I landed a position as an Associate Professor in the Institute for Tropical Biology and Conservation of UMS, and could run my research projects literally in my backyard.



***Everettia layanglayang*, a newly discovered snail species from the summit of Mount Kinabalu. Photo: Menno Schilthuizen.**

For seven years I lived and worked there, built up a lab for conservation genetics and a mollusc collection, taught graduate and undergraduate courses in evolution, ecology, and conservation, and ran research projects funded by IRPA[†] and UMS. One of those projects focused on the land snails of Mount Kinabalu—sooner or later any Malaysian biologist will yield to her unique biodiversity. With my students Liew Thor-Seng and Tachaini Narainan, and in collaboration with Dr. Maklarin Lakim of the Research and Education division of Sabah Parks, who managed the state park and World Heritage Site, we surveyed the land snails of the Mountain, finding a grand total of 109 species, many of which were living only at the summit and were completely new to science [1,2].

Another Kinabalu project, which we collaborated with the Sabah Museum, Dr. Mustafa Abd. Rahman of Universiti Malaysia Sarawak (UNIMAS), and Louisiana State University, dealt with the White-Crowned Forktail, an emblematic forest bird, for which

we showed using DNA techniques that the Forktail living on mountaintops (not only on Kinabalu, but also many other tall mountains in Borneo) is a separate species, now known as the Borneo Forktail, *Enicurus borneensis* [3].

Still, paradoxically, it was only after I returned to The Netherlands and began working as a researcher at Naturalis Biodiversity Center in Leiden, that my Kinabalu projects blossomed. “Naturalis” is the new name for the Dutch National Museum of Natural History. Its collections consist of 37 million specimens, including many from Indonesia and other Southeast Asian countries. The Asian focus is also present among the over 100 biologists who work there: many have identified Asia, the global biodiversity hotspot, as their chief interest. Thus, the idea of organising a joint Malaysian-Dutch expedition was born. The team consists of Sabah Parks scientists Maklarin Lakim and Rimi Repin, Naturalis botanists Vincent Merckx and Constantijn Mennes, geneticists Kasper Hendriks

[†] The Intensification of Research in Priority Areas fund (IRPA) was provided by the Ministry of Science, Technology and Innovation (MOSTI) of Malaysia.



Two members of the Crocker Range / Kinabalu Expedition sampling *Begonia* plants. Photo: Joris van Alphen

and Lisa Becking, and myself. We set up the Crocker Range/Kinabalu Scientific Expedition that took place in September 2012 and in which some 20 Malaysian and 20 Dutch biodiversity experts participated [4].

The aim of the expedition was not simply to do an inventory of the fauna found in the Crocker Range/Kinabalu region. We had a specific research question, born from the old snail and bird projects I had done at UMS. Many of the species of plants and animals that live on this 4,095 m tall mountain are endemic: they live only there and nowhere else on Earth, and how had they evolved? Some, like the Kinabalu buttercup (*Ranunculus lowii*), had probably blown in from cooler parts of the world, as no other buttercup species live in Borneo's lowlands. But others, such as the gigantic *Nepenthes rajah* pitcher plant or the mountaintop Friendly Bush Warbler (*Locustella accentor*) have related species living in the foothills. The obvious scenario was that they had become geographically isolated and split off as new species as the mountain began rising a few million years ago. However, the opposite would also be possible: that the highland endemics are actually relics from a cooler period, surviving on the summit and having gone extinct elsewhere.

The aim of our expedition was to get a handle on these various evolutionary scenarios using DNA sequences of various organisms. Each expedition member would, from its own favourite group of organisms (birds, stalk-eyed flies, mushrooms, rhododendrons

etc.) collect specimens from one or more Kinabalu endemics and several closely related species from the lowlands. To do this, during the expedition, we worked at eight separate stations, from the foot of the mountain to the summit, and including the hills of the neighbouring Crocker Range Park.

Then, our genetics team sprang into action. Being handed more than 4,000 specimens by all expedition members, Kasper Hendriks and Lisa Becking took DNA samples from these specimens and preserved these in ethanol or silica gel, and then ferried all to the Naturalis DNA labs. Here, using a semi-robotic setup, we sequenced the DNA of several genes of all these

samples. These data were then analysed by Kasper Hendriks, who used them to build evolutionary trees that revealed which species were old and which were new. By comparing new and old species, and their respective habitats, we are able to conclude the origins of certain organisms, i.e., whether they have evolved from ancestors living in lowlands or in highlands.

As I write this, we are putting the finishing touches to our analyses, and drafting a joint research paper with all participants as co-authors to be submitted to a major journal. In addition, many of the scientists who participated in the expedition have discovered new species among the specimens they collected, and publications are beginning to appear on the first of these [5].

For the unravelling the scenarios our studies support, I refer the reader to our upcoming papers. But for me personally, the most important result is that so many top-notch biodiversity scientists

from both my native and my adoptive country have joined forces to pull off a unique example of binational biodiversity research in one of the world's most amazing places, Mount Kinabalu in Sabah, Malaysian Borneo.

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“Many of the species of plants and animals that live on this 4,095 m tall mountain are endemic: they live only there and nowhere else on Earth”

[4] The participants were from Sabah Parks, UMS, Forest Research Centre (Sabah Forestry Dept.), UKM, Naturalis Biodiversity Center, Natuurmuseum Friesland, Wageningen University, and the Royal Belgian Institute of Natural Sciences.
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PROF. MENNO SCHILTHUIZEN is an evolutionary biologist at Naturalis Biodiversity Center, Leiden, The Netherlands, and professor at Leiden University. He worked as an associate professor at Universiti Malaysia Sabah, where he still holds a research associateship. He is also a prolific author of popular science articles and books. His latest book, *Nature's Nether Regions*, will appear with Penguin USA in May 2014. Find out more about Prof. Schilthuizen by visiting: <https://science.naturalis.nl/en/people/scientists/menno-schilthuizen/> and <http://www.scientificmalaysian.com/members/menno/>

ABOUT MOUNT KINABALU, DID YOU KNOW THAT...



Photo: Darren Pearce/Flickr

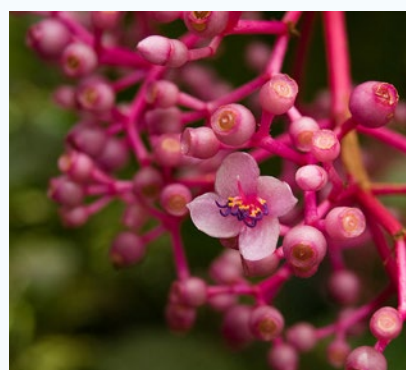
10 million years ago

Formation of the mountain began from solidified magma below Earth's surface

UNESCO World Heritage Site

The Kinabalu Park surrounding the mountain has been Heritage Site since year 2000

Unique biodiversity due to soils low in phosphates but high in iron and metals, toxic for other plants but ideal for Kinabalu's endemic plants



Moss/Flickr

5 thousand plant species

It is one of the richest plant regions in the world

>600

Species of ferns

>800

Species of orchids

13

Species of carnivorous pitcher plants

Orang Utan

One of the seven living species of great apes, including *Homo sapiens*



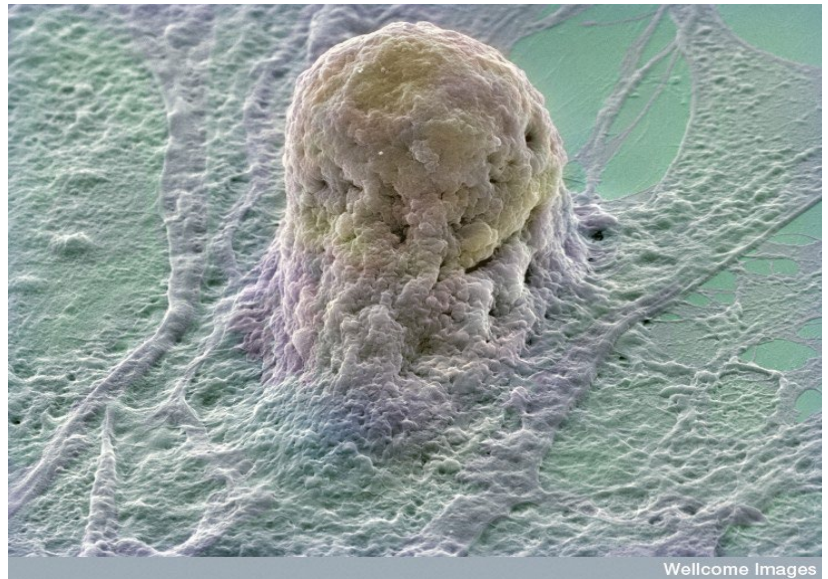
Justin Elson/Flickr

Stem cell therapy - challenges from bench to bedside

by Mohammad Firdaus Abdul Aziz

"The lack of clinical evidence to support stem cell therapy puts patients at risk of receiving at best ineffective, and at worst unsafe or even harmful treatments, raising calls for a campaign to raise awareness and educate patients about these dangers. This issue has recently become urgent." - Jawad et al. (2012)

Stem cell therapy is a treatment using stem cells that are induced to differentiate into a specific cell type, which is required to repair damaged or destroyed cells or tissues. Stem cell scientists have articulated that this therapy may be used to treat autoimmune diseases such as Parkinson's disease, multiple sclerosis, type 1 diabetes, rheumatoid arthritis, systemic sclerosis; organ and tissue repair such as heart diseases, macular degeneration, spinal cord injuries; and reproductive applications for germ cells generation. The great therapeutic potential of stem cell-based therapy has led to its recognition across the globe, as a modern medical intervention. Many patients with degenerative diseases believe that their incurable conditions can be treated using this new procedure.



Human embryonic stem cell (gold) growing on a layer of supporting cells (fibroblasts). Source: Annie Cavanagh, Wellcome Images.

However, it is important to comprehend that similar to other emerging technologies, the development of stem cells is a long and challenging process. Scientists all over the world are working hard to establish sound and scientifically proven basic research, before translating it into an effective medical procedure. Even the process of translation also involves an extensive process, which has to go through well-designed pre-clinical and clinical studies. The latter then requires different stages of strictly regulated trials to ensure patients' safety. In other words, despite the efforts to translate research from the bench to bedside, patients' safety remains the main concern among scientists. It is one of the core prerequisites that are required by ethics committees before any therapy can be accepted as effective and safe to be introduced in hospitals or clinics.

Ethical challenges of stem cell therapy

Despite its great potential, stem cells are surrounded by various ethical issues, ranging from the protracted debate over the use of human embryos for research, consent disclosure, privacy and confidentiality, to the concern over the protection for patients' safety. This is a challenge shared by stem cell scientists globally: advancing the field while safeguarding ethical

conducts. The prolonged debate over the surrounding ethical issues are not the only challenges faced by the scientists, as the field is also facing the risk of its credibility being tarnished by scammers who are more interested in making profit out of this promising field.

Unapproved and unproven stem cell treatments

Given the fact that stem cell-based therapy is extraordinarily promising and patients are desperate to see if it works, many clinics all over the world are taking advantage over this situation by offering stem cell treatments for a wide range of diseases and conditions [1,2]. Whilst many leading countries in this field such as the UK, Australia, United States, and Singapore spend a huge amount of money in research activities to develop scientifically proven and safe cell treatments to protect patients, scammers, on the other hand, are more interested in lining their pockets first and serving the patients' need or safety second by commercially exploiting them.

These providers claim that their treatments can cure a multitude of unrelated diseases by using a single cell type. The treatments are not backed by scientific evidence, are unproven to be safe and effective, and thus are unapproved by authorised regulatory bodies. In

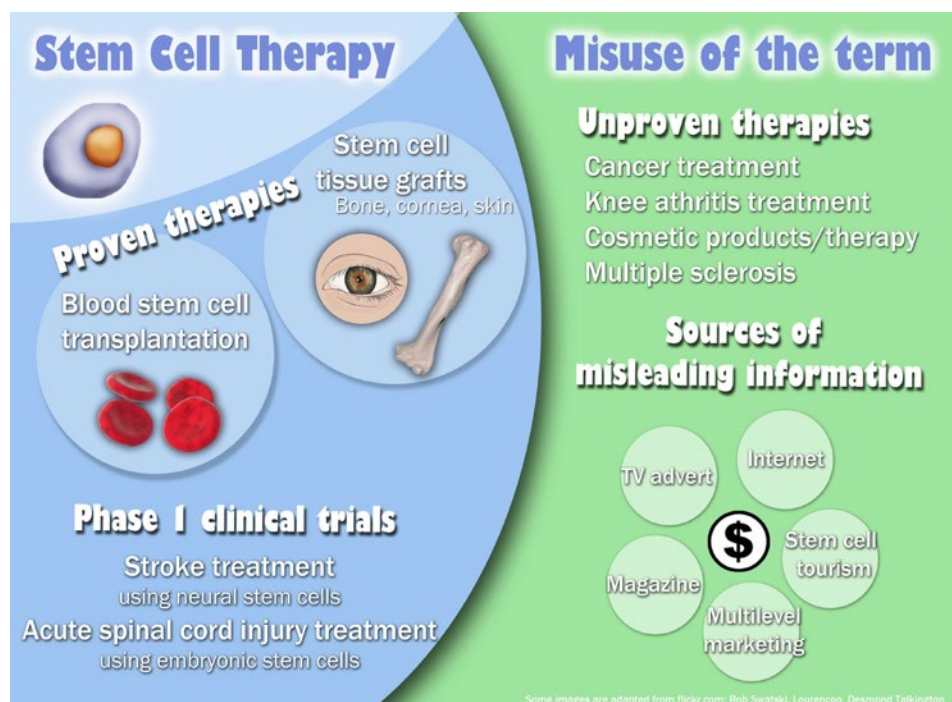


Illustration by Kong Yink Heay

cells in media such as portrayals in the movies, TV adverts, magazines and on the internet have led to misperceptions among the members of public. A very large number of people who are interested in stem cells technology often do not procure the right information from scientific reading materials but depend largely on the information from the internet, which often portrays stem cell myths and almost magical medical outcome from its usage via medical intervention. This has led to the increase of unrealistic expectations of stem cells among the general public. Hence, it has resulted in the exploitation that is now becoming a regular practice, and has proliferated quickly all over the world because there is

a demand from the misled and misinformed public.

addition, commercial entities are also opportunistically exploiting the situation to their own advantage by manipulating and misusing the term 'stem cells' as part of their products' branding. It has become a trend in many countries, including Malaysia, whereby 'stem cells' appears to be the magical ingredient in many health-related products encompassing supplementary pills and cosmetic products, *e.g.*, facial treatments.

Stem cell tourism, where patients travel to another country to get stem cell treatments, is another problematic phenomenon that imposes a great challenge for scientists and regulators to ensure ethical conducts, which is vital in order to safeguard patients' safety.

Lack of public awareness

Examples of existing dubious commercialisation of stem cells products in Malaysia are multi-level marketing companies that are rigorously promoting their so-called stem cells products to the public who mostly lack the knowledge about stem cells; and clinics that offer stem cells injection to treat various diseases, *i.e.*, knee arthritis, which have not been scientifically proven to be safe and effective.

It is always the case that general public are easily influenced by 'word of mouth' testimonials that are commonly exploited by scammers as their marketing strategy to build trust among their potential customers. It can be said as one of the most effective means of marketing, particularly when it involves spokespersons that are normally chosen among the high profile celebrities.

In addition, a plethora of exaggerated facts on stem

There are patients who contend through their testimonials that they view the unproven treatment as their last chance to find a cure and often argue that they feel much better after receiving the treatment and would repeat it again [3]. It is important to know that patients usually experience 'the placebo effect', which is a beneficial effect assumed by patients merely due to the patients' own belief that whichever treatment they received works. Also, testimonials do not justify and prove the efficacy of a medical treatment. Whilst some may be only experiencing placebo effect and no immediate harm occurs, others have been reported to fall casualty to this misinformation.

A German clinical center, XCell, offered stem cell based treatments involving injections of autologous bone marrow-defined cell to patients. The center was closed due to the death of its 18-month old Romanian patient after being injected with cells in the brain. However, since there is a demand, it is now moved to and operating in Lebanon and India using a new designation, Cell4health [4,5]. In Italy, a 72-year old man who suffered from Parkinson's disease has allegedly died following an autologous stem cell injection by an Italian physician in a clinic in the Republic of San Marino, which has prompted the government to regulate this area [6].

Approved and proven stem cell-based therapies

Since its inception in 1978 [7], only a few therapies that use stem cells are widely accepted and extensively practiced, *i.e.*, blood stem cell transplantation used to treat blood diseases, some degenerative diseases. Injuries involving bone, skin and corneas can now

be treated using tissue grafts generated from adult stem cells derived from these organs. In addition, while many potential treatments are now still being tested on animal models, a few have successfully been brought into clinical trials. ReNeuron, a British company, has announced its success in getting approval for conducting phase 1 clinical trial for stroke using neural stem cells. In USA, its Food and Drug Administration (FDA) has approved the first embryonic stem cell-based treatment for acute spinal cord injury to move into Phase 1 clinical trials [8, 9].

Even though stem cells science has a great therapeutic potential, its complexity has inevitably resulted in the slow pace of translation into regenerative medicine. Nevertheless, many world-renowned stem cell scientists and dedicated reputable research institutions are tirelessly continuing their research work and endeavour to develop safe and effective therapies so that they can be made available to the patients in the near future. It is worth noting that public trust is a vital factor that would influence government's decision in using federal funding to develop this area. If there is a backlash from the general public, it might affect funding, which is crucially needed for advancing this area [10].

Conclusion

As has been pointed out, stem cell treatment is indeed the way forward in medicine. However, more research is needed to develop an efficient treatment procedure. Scientists are aware that they need to bring safe and effective treatments to patients quickly but it is inevitable that the scientific process of improving the safety and efficacy of new treatments takes time. In the mean time, the general public must be aware of the fabricated treatments offered by unscrupulous private clinics and other commercial entities that are preying on potential patients through their false advertising. Public must be aware of the casualties that have been caused by unproven and fabricated stem cell treatments. It is important for the public to educate themselves with the right information and making sure that any stem cell treatment that they wish to undergo is proven and approved by relevant authorities.

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No mind reading!

A glimpse of modern psychology

by Tan Li Li and Dr. Chooi Weng-Tink

The modern field of psychology is a relatively new but rapidly developing science, generally aimed at understanding human behaviour and its underlying processes. Unfortunately, many myths and misconceptions have obscured the contributions and breakthroughs that psychologists have made. Almost every student of psychology will have been asked the question: ‘Can you read minds?’ (Answer: no).

In this piece, the common myths that still surround psychology today will be explored and refuted. To complete the picture, an overview of some of the major subdivisions within modern scientific psychology will also be presented. The hope is to show that psychology can and should be taken seriously as a science.

The myths

Psychology has some roots in the legacy of Freudian psychoanalysis. Sigmund Freud was interested in discovering new methods for treating mental disorders like phobias, anxiety, and obsessions. One of his main suggestions was that these disorders, or neuroses, occur as a result of the unconscious repression of problems such as feelings of resentment or guilt. Thus, he thought that neuroses could be cured by uncovering these repressed feelings. To achieve this, he developed various methods including dream analysis and free verbal expression of the patient’s thoughts. He also proposed extensive theories about psychosexual development and the human psyche.

Freud’s theories have come under heavy criticism [1] for its lack of scientific evidence. He relied heavily on individual case studies of his patients, which do not constitute good evidence because they cannot be generalised to the wider population. In addition, the treatment of his

patients were marred by his own preconceptions about how their experiences should be interpreted in order to fit his theories. Despite this, Freud’s ideas have persisted, possibly due to the sensational nature of his work. Psychology is still commonly thought to revolve around reading minds, treating neuroses, and analysing the significance of dreams, thoughts, and other behaviours, although it has long since moved on from this Freudian legacy.

“Modern psychology is just as reliant on rigorous experimentation and replication as any other well-established science”

AT A GLANCE

The modern field of psychology includes the following key research areas (and many more):

- **Cognitive psychology** – the study of mental processes collectively known as cognition, which covers perception, attention, memory, language, problem-solving, etc.
- **Social psychology** – the study of the effects that social environments have on human behaviour.
- **Developmental psychology** – the study of the changes that occur in humans as they age and grow, particularly in language acquisition, perception, motor skills, and reasoning.
- **Psychological disorders** – the study of a range of mental disorders including depression, schizophrenia, obsessive-compulsive disorder, anorexia nervosa, etc.

Having looked at what psychology is not, we can move on to explore some of the main areas of research that make up psychology today. This list is certainly not exhaustive, as the field continues to develop.

Cognitive psychology

This area focuses on the experimental study of mental processes collectively known as cognition, which covers many aspects including perception, attention, memory, language, and problem solving. Generally, researchers in this area take an information-processing approach to cognition.

They focus on finding out what kinds of inputs the brain collects and works with, and investigate how these inputs modulate behavioural responses and other processes.

For example, Yeshurun and Rashal (2010) demonstrate how attention can help to increase accuracy in identifying the orientation of a target stimulus that is presented only for a short flash in peripheral vision [2]. They manipulated the attention of their participants by presenting a cue dot before the flash of the target stimulus. When the cue dot was in the same location as the target, the participants were more accurate in identifying the target's orientation, compared to when the cue dot was in a different location than the target. This experiment is one of many that demonstrate that attention can influence our perceptual processes.

Social psychology

Social psychologists are interested in the effects that social environments have on human behaviour. This area has also relied on carefully manipulated experiments with highly controlled scenarios. Some have been carried out in the field, which refers to environments more natural than the laboratory such as the school, workplace or home, in order to better replicate real-life conditions. These experiments have looked at issues such as intergroup relations, conformity, stereotyping, prosocial behaviour, and cultural differences. Like all areas of psychology, social psychology is not independent. It has many links to cognitive and developmental psychology, as social environments have a large impact on how we think, feel, and grow.

Correll *et al.* (2002) demonstrates how stereotyping can be a rapid, automatic process [3]. Their participants were shown photographs of young men in various settings; half of the men were black and half were white, and additionally half of them were holding a gun while the other half were holding harmless objects. They had half a second to press a button to 'shoot' men who were armed, and to press 'don't shoot' if the man was unarmed. The results showed that the participants were more likely to 'shoot' an armed man more quickly when he was black than when he was white, and also more likely to 'don't shoot' an unarmed man more quickly when he was white than when he was black. This indicates the split-second use of a stereotype to guide decision-making, carried out at an automatic level. This would have important implications in law enforcement, where it is possible for police officers

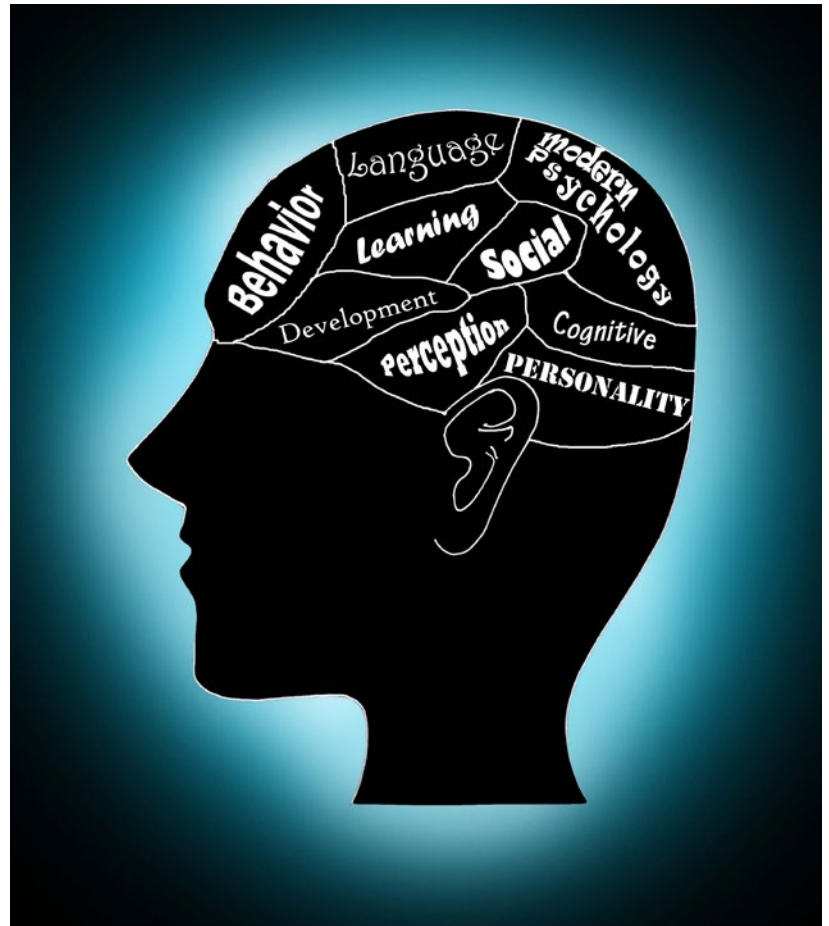


Illustration by Kong Yink Heay

to find themselves in the very situation that Correll and co-workers have recreated in the lab.

Developmental psychology

This area concentrates on the changes that occur in humans as they age and grow, particularly in language acquisition, perception, motor skills, and reasoning. A central question of developmental psychology is how genetic and environmental factors affect the development of a particular ability. These factors rarely work alone, and the interactions between them contribute to the diversity of skills and traits that we possess. There is also a focus on disorders that commonly have their onset in childhood, such as dyslexia and autism.

Developmental psychologists frequently study infants and children to understand the developmental path of certain abilities. For example, Swingley and Fernald (2002) found that at least by the age of 24 months, children no longer have to rely on visual cues to recognise familiar words [4]. They set up a visual display showing two pictures at once, and monitored the eye movements of seventy-two 24-month-old children. When the children heard a familiar word within a sentence that correctly labelled the picture on the display, they maintained their gaze; when they heard a familiar word that did not apply to the picture they were looking at, they quickly shifted their gaze to



Photo: Hartwig HKD / Flickr

the alternative picture, even if it did not match the word they heard. So just by listening to the words, the children could recognise them, without relying on additional visual evidence.

Psychological disorders

Lastly, this area seeks to understand a range of mental disorders including depression, schizophrenia, obsessive-compulsive disorder, anorexia nervosa, and so on. Current research mainly focuses on uncovering the genetic and environmental factors that contribute to these illnesses, how these factors interact to increase the risk of developing them, and how each disorder manifests at a behavioural and cognitive level. A clear understanding of these issues is important, as it guides the development of effective treatments and therapies.

To determine if a disorder has a genetic basis, studies usually compare its occurrence among identical and non-identical twins. Identical twins share all of their genes, while non-identical twins share only 50% of them. Thus, any greater incidence of the disorder among identical twins, as compared to non-identical twins, can be attributed to their genetic similarity. Using this method, studies have found that genetic factors account for 30-40% of the variance in adult depression, as reported in a review by Lau and Eley (2010). Further research into the genetics of depression has focused on a polymorphic DNA region called 5-HTTLPR on the *SLC6A4* gene - this gene affects the production of serotonin, a neurotransmitter found in the central nervous system. The presence of a particular variant of 5-HTTLPR has been consistently linked to higher levels of depressive symptoms. This has informed

the use of drug therapy, which typically help to improve mood by increasing serotonin levels.

Conclusion

These are just a few of the key research areas within psychology. Others, such as personality psychology, are equally important to paint a full picture of the field. However, it should be clear that there is a crucial difference between Freudian theories and the scientific approach to psychology. Psychoanalysis is concerned with the treatment of individuals on a case-by-case basis. On the other hand, experimental psychology involves building falsifiable hypotheses, gathering data through experiments, and carrying out statistical analyses to determine the significance of experimental results. Modern psychology is just as reliant on rigorous experimentation and replication as any other well-established science, and it is our hope that this has been adequately demonstrated. There is a lot of potential for psychology to grow in Malaysia, and students with a strong interest in biology and human behaviour should consider pursuing it.

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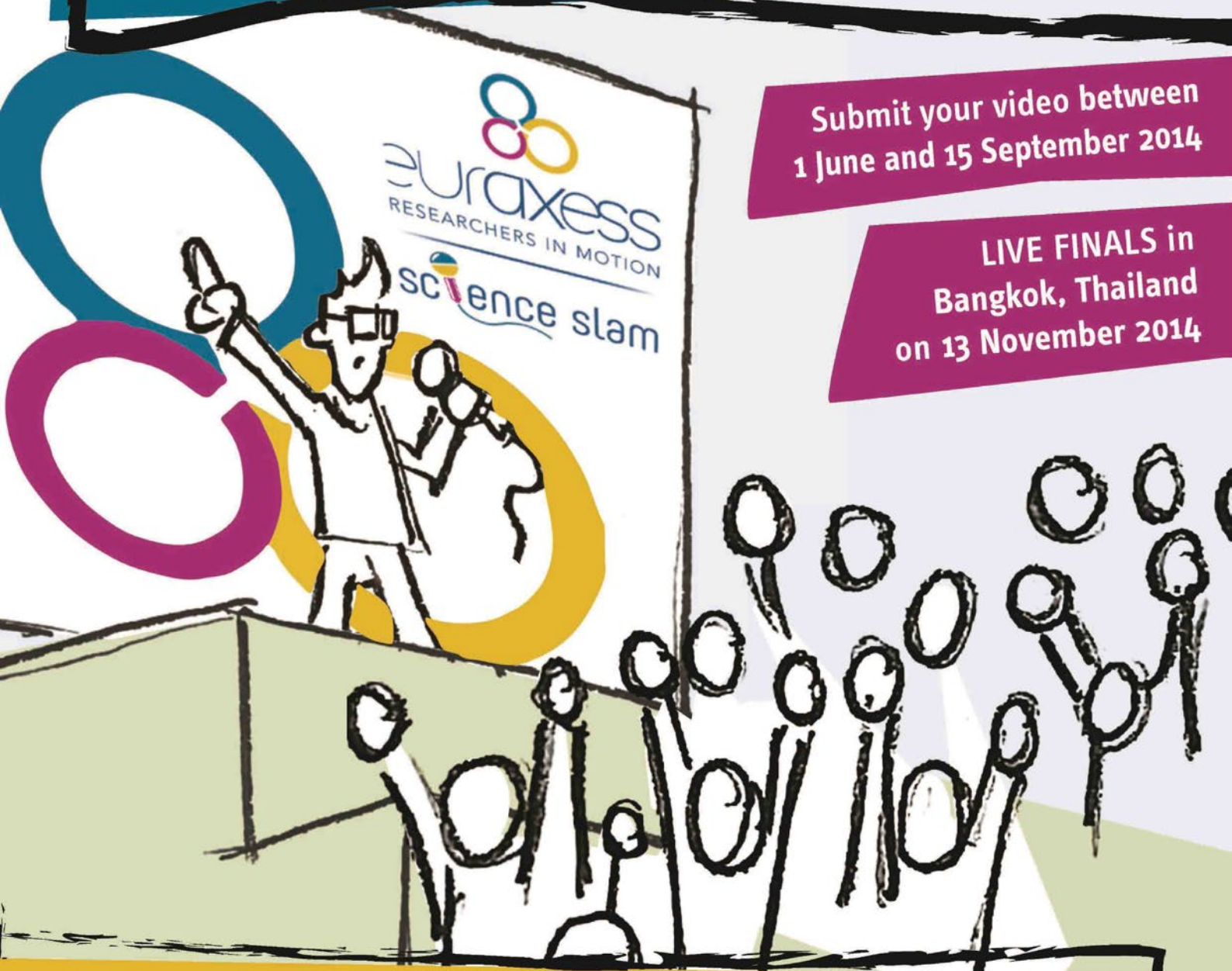
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by Dr. Chang Yang Yew

It is well known that the survival rate of cancer patients is much higher if the cancer is diagnosed at an early stage. As medical technology evolves, there are now an abundance of scans and blood tests available to help doctors detect cancers and other diseases. Putting these two facts together, a natural question is: *“Why don’t we scan and test everyone regularly so that we could pick up and cure more cancers?”*

To answer the question above, it helps to first establish some yardsticks of how we measure the usefulness of a medical test:

- A test needs to reliably display positive result when a disease

is present (in medical jargon it needs to be *sensitive*) - just imagine the futility of a “cancer test” which misses half of the cancer patients.

- A test should be reasonably *specific*, which means that amongst healthy people, it should not give a falsely positive result. False positive results contribute to anxiety and complications from subsequent invasive medical tests and procedures.
- Lastly, the most meaningful measure of a test’s usefulness is its effect on mortality. The important question is, “Does this test save lives?”

It is clear that ideal tests should be 100% sensitive (all cancer patients are detected) and 100% specific (all healthy individuals are negative for cancer). However, due to limitations of many tests, testing everyone indiscriminately is a futile exercise for most diseases.

One of the biggest cancer news which hit the mainstream media in recent time was about Jack Andraka, a 15-year-old boy from US who invented a test to detect pancreatic cancer in its early stages, promising a dramatically improved cure rate [1].

Pancreatic cancer is one of the most fatal cancers in the modern era. As the pancreas is seated deep inside

abdomen, patients do not usually suffer obvious symptoms in early stages, hence it is typically only diagnosed at an advanced stage, and about 75% of patients die within one year of diagnosis [2].

The simple, fast and cheap blood test Jack Andraka invented promises an unprecedented revolution in the detection of pancreatic cancer. This test costs 3 cents to produce, is nearly 100% accurate, and won him the grand prize in the prestigious Intel International Science and Engineering Fair. It employs nanotechnology to detect mesothelin, a type of protein which is present when one has pancreatic cancer. He hopes that this test will one day become available on supermarket shelves, and everyone could just pick it up and do this test during their free time, and no one will die from late stage pancreatic cancer any more.

It's a nice little idea, but unfortunately one that will never work.

First and foremost, congratulations are due for this bright young man for his dedication and progress in scientific research at such a young age. Having his name on a "cancer sensor inventor" as a 15-year-old boy is an amazing feat. Unfortunately that's where his achievement ends. This invention will not save lives; in fact if it were to be introduced unregulated in local supermarkets, it will do more harm than good to public health.

A common misconception regarding modern medicine is that diagnosing a disease is as easy as 'doing the appropriate blood test', like matching a fingerprint with a criminal. However, the majority of medical diagnoses are simply not made this way.

Let's look at the pregnancy test as an example. The standard urine or blood pregnancy tests today are extremely accurate, and it works by detecting the β HCG hormone which is secreted during pregnancy. So, if someone tests positive for β HCG, then she is pregnant, right? WRONG.

While the vast majority of positive β HCG is due to pregnancy, sometimes it could also be due to sinister causes called gestational trophoblastic diseases which are a type of tumour in the reproductive organs. However, in practice, if a lady has missed her period and is tested positive, she would be told "you are pregnant" unless something is amiss with the story.

** In early pregnancy of less than 1 week, β HCG may be negative. If clinical suspicion is high, a repeat test in 2-3 days time will give a definitive answer.*



Illustration by Charis Loke

This is due to:

- There are far more pregnant people than people with this tumour.
- The fact that she has missed her period makes pregnancy the more likely an explanation.

β HCG is useful because:

- In pregnancy β HCG level is always elevated*. (It is *sensitive*)
- When it is elevated, the vast majority of the cases are due to pregnancy, the rare exception being the gestational trophoblastic disease. (It is highly *specific*)
- Its usage enables good outcome (you know you are pregnant hence you commence antenatal care *etc.*)

While these three conditions, especially the last, may seem trivial, they are the criteria that any diagnostic test have to meet prior to being practical. If someone comes along and develop a new 5-cent pregnancy test, they will either have to meet these criteria, or be disregarded despite costing only 5 cents.

Another famous example is PSA (Prostate-Specific Antigen), a protein elevated in prostate cancer. PSA screening is in common use to screen for prostate

cancer (it's no longer recommended for everyone but that's a long story on its own). As prostate cancer is such a slow growing tumour, it's been found that even after using PSA and detecting some earlier cases, the mortality is almost the same whether or not we screen everyone with PSA [3].

Prostate cancer is so slow-growing that a lot of patients die *with* prostate cancer rather than *from* prostate cancer. On the other hand, screening gives rise to a lot of anxiety and risk over the need of doing further biopsy tests. Hence, PSA is only recommended for particular high risk groups, and/or after an informed discussion is conducted [4].

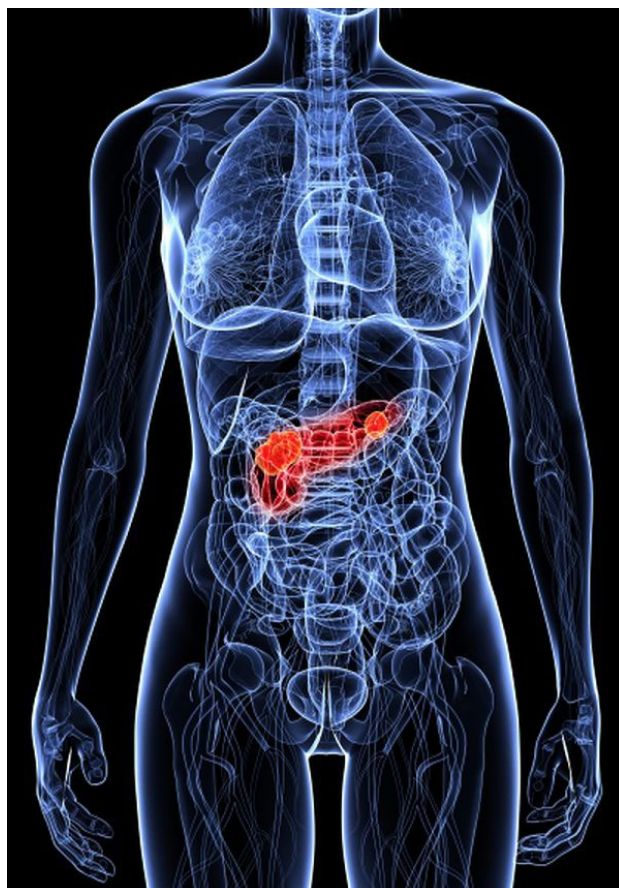
Now back to the story of mesothelin and pancreatic cancer.

Mesothelin is a protein which is present in cells lining the heart, chest cavity and abdominal cavity, and its level is increased in multiple cancers including pancreatic cancer, ovarian cancer and mesothelioma (cancer of chest cavity lining). This makes it a potential "cancer marker" for blood test. However, a major difference exists between mesothelin and established useful tests such as β HCG.

For β HCG, with the rare exception of the gestational trophoblastic disease, the range of β HCG level in non-pregnant and pregnant women are so distinctly different, making it both sensitive and specific. However, for mesothelin, the range of level is not similarly distinct. In a study looking at mesothelin levels in healthy people and pancreatic cancer patients, it is found that these two ranges overlap so much that it is impossible to differentiate the two groups with enough sensitivity and specificity [5].

Even though Jack claims this test to be 100% sensitive, it only means that it will detect a particular level of mesothelin 100% of the time. It is not known what the specificity is *i.e.*, how often a healthy patient is falsely tested positive. Given the overlap above, the logical conclusion is the specificity is low.

"A common misconception regarding modern medicine is that diagnosing a disease is as easy as 'doing the appropriate blood test', like matching a fingerprint with a criminal"



Pancreas is located deep inside the abdomen.

Photo: omnimedicalsearch.com

Let's put this in practical terms. If a person tests positive for mesothelin, he could either have pancreatic cancer, other pancreatic conditions, ovarian cancer, mesothelioma, or have nothing at all. Not that useful isn't it?

At this juncture, one might refute that even if some healthy people are mistakenly tested positive, they could always just do more tests and find out that they don't have disease - isn't that better than the alternative, having pancreatic cancer and not knowing it? The answer is a resounding NO.

As pancreatic cancer is such a rare disease, if everyone is tested with mesothelin, there will be fewer disease detection (true positives) than false positives. The thousands of people who have false positive results will now go through more tests (CT scans, biopsies etc.), and all these tests actually have inherent risks (CT increases the risk of cancer, biopsies are invasive procedures and may cause severe infection and bleeding).

At the end of the day, despite costing only 3 cents, such a test will end up harming more healthy people due to over-investigation, than saving the few lives from actual disease detections (refer to the rule 3 of the "usefulness yardstick" above).

To sum it up: This young man has a promising future but is no cancer saviour. ***He has not discovered something that millions of scientists in thousands of labs have overlooked in decades of research.*** Unfortunately there has been a huge media circus surrounding his invention, most of which have focused on perpetuating the “prodigy cancer saviour” feel-good story without commentary from established scientists to put things into context.

This may distort the public perception on cancer research, and could end up instilling distrust amongst public in proper scientists and researchers. In the comment section of the aforementioned news article [1], the top comment is about how such an invention (like the many dozens of “cancer cures” invented each month) will never see the light of the day because pharmaceutical companies need to keep making money from cancer treatment drugs rather than saving people’s life with cheap, easy and effective inventions like this. ***Such popular misconceptions insult the efforts of millions of scientists in labs worldwide, who toil away in their often frustrating and mundane efforts day in day out, without the benefit of being glorified in the media as a cancer saviour.***

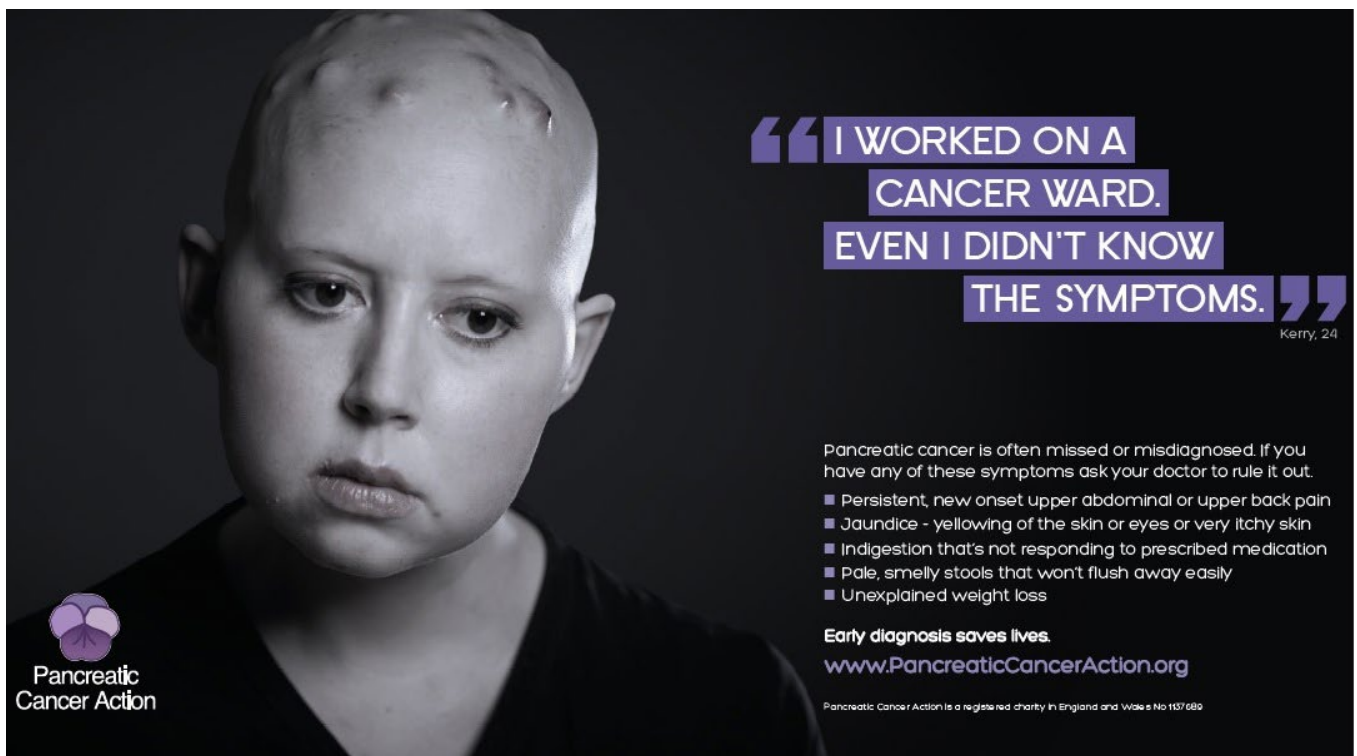
When something sounds too good to be true, it is often because it is. Medicine is hard, and that is why there is no easy solution such as “let’s test everyone for cancer everyday”.

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**“ I WORKED ON A
CANCER WARD.
EVEN I DIDN'T KNOW
THE SYMPTOMS. ”**


Kerry, 24

Pancreatic cancer is often missed or misdiagnosed. If you have any of these symptoms ask your doctor to rule it out.

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The Conference on the Emerging Technologies That Matter: EmTech Singapore 2014

by Yong Wei Chong Gabriel

Since 1999, the MIT Technology Review has celebrated the world's best young innovators through its annual Innovators Under 35 (TR35) awards. In 2007, the TR35 honorees were presented at the Tech Review's first conference on emerging technologies - simply known as "EmTech" - and the joint events have been held annually ever since.

This year, however, marked the first time the conference expanded beyond the Boston campus of Massachusetts Institute of Technology (MIT). The inaugural EmTech Singapore, a collaborative effort between the Singapore-MIT Alliance for Research and Technology (SMART) and MIT Enterprise Forum Singapore, was held between 20th-21st of January at Marina Bay Sands, Singapore.

The conference was split into a few sections on both days, covering diverse subjects such as big data, robotics and artificial intelligence, innovations in medicine, multidimensional printing, and the future of transportation, among others.

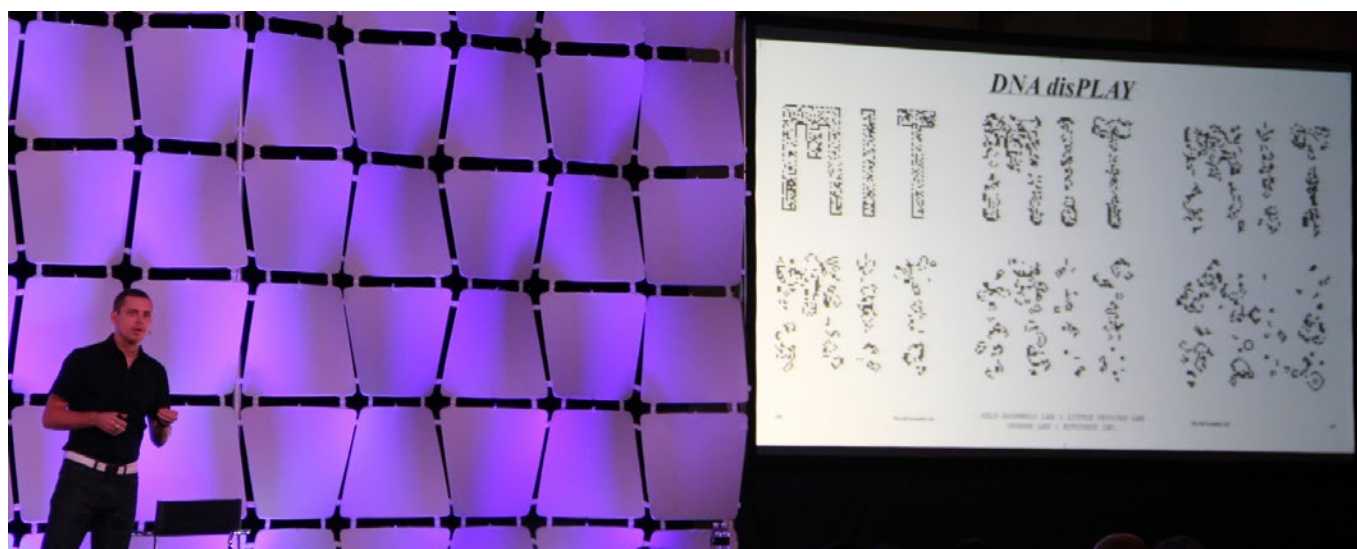
Speaking on virtual education, which has been surging on the prominence of Massive Open Courseware (MOOC) in recent years, Lashminarayanan Samadvedham [(Centre for Development of Teaching and Learning, National University of Singapore (NUS)] noted that existing platforms of virtual education must evolve to become more contextually rich and interactive in order to battle the multiple pathologies that currently plague both traditional and online learning.

Meanwhile, Jean Yong, a biochemist at Singapore University of Technology and Design (SUTD), explained the various applications of biomimicry that are currently utilised to enhance sustainable development in Singapore *e.g.*, the natural removal of arsenic in soil with ferns. He also proposed a "periodic table" plant filters - plants that are capable of removing toxins and other harmful elements from the urban environment effectively.

Timothy Lu, an Associate Professor of Biological Engineering and Electrical Engineering at MIT noted for his pioneering work in cellular computation, gave a presentation on how the analog dynamics in cells could be manipulated to perform simple tasks of computation and decision-making, along with genes that could be transformed into circuits, and strings of DNA converted as digital storage media.

Speaking on the theme of mobile entrepreneurship, Halle Tecco, CEO of healthcare startup Rock Health, who held hopes that the development of better healthcare apps would herald a new era of medicine that is preventive rather than reactive, patient-oriented rather than hospital-centric, and facilitated by teams of healthcare professionals rather than directed by individual physicians. Karen Stocks, Chief Strategy Officer of Twitter Australia, on the other hand, spoke of the role of social media apps as a form of "social soundtrack", providing an immediate picture of the emerging global trends.

While 3D printing may have been one of the



Skylar Tibbits of MIT's Self-Assembly on how 4D printing works.



Innovators Under 35 (TR35) nominees at the EmTech Singapore 2014 event.

buzzwords in the tech world in 2013, Skylar Tibbits, Director of the Self-Assembly Lab at MIT, presented on his research on the even more intriguing 4D printing. Incorporating the factor of time (the “fourth dimension” of 3D printing), Tibbit’s printed structures are capable of self-assembling into different configurations upon stimuli such as temperature and light exposure, as well as the reverse process.

Self-driving cars, another tech buzzword of recent times, was also the focus of a dedicated section, as Daniel Morton, a business analyst from SMART, described zero fatalities as the ultimate goal of autonomous vehicles despite public misconceptions.

On the topic of future cities, Ryan Chin of the City Science Initiative at MIT Media Lab commented that the major challenge of the modern city was mobility, with automobile-dependence being the prime factor for a host of social patterns, economic trends, and environmental problems. He envisioned the creation of microcities in the future (self-sufficient compartments of large cities) that would enable urban dwellers to “obtain 80% of what they need within 80% of their walking distance” [*sic*].

In line with EmTech MIT’s tradition of honoring the world’s best young innovators under 35, EmTech Singapore featured 10 regional finalists for the TR35 awards based in Southeast Asia and Australia. They will compete for the global TR35 finals due to be held in Fall 2014. Past global winners included technocrats such as Facebook’s Mark Zuckerberg as well as Google’s Sergey Brin and Larry Page. The EmTech Singapore regional finalists are as follows:

- Yuttanant Boonyongmaneerat, Assistant Professor, Metallurgy and Materials Science Research Institute, Chulalongkorn University (Thailand)
- Juliana Chan, Assistant Professor, School of Chemical and Biomedical Engineering, NTU (Singapore)
- Goh Ai Ching, Co-founder, Piktochart (Malaysia)
- Matthew Hill, Senior Research Scientist, Commonwealth Scientific and Industrial Research Organisation (CSIRO; Australia)
- Michael Hochberg, Visiting Professor, Dept. of Electrical and Computer Engineering, NUS (USA)
- Mudasser Iqbal, Co-founder of Visenti Pte. Ltd. (Singapore)
- Desmond Loke, Postdoctoral Fellow, MIT-SUTD (Singapore)
- Nripan Matthews, Assistant Professor, School of Materials Engineering, NTU (Singapore)
- Suranga Chandima Nanayakkara, Director & Principal Investigator of Augmented Senses Research Group, SUTD (Singapore)
- Yang Zhi, Assistant Professor, The Dept. of Electrical and Computer Engineering, NUS (Singapore)

Here, we speak to Goh Ai Ching, Malaysia's only regional TR35 finalist at EmTech Singapore.



Q&A with EmTech Singapore Innovators Under 35 (TR35) Malaysian finalist Goh Ai Ching (co-founder, Piktochart)

Q1. Can you tell us about yourself, and how did you get involved in the field of entrepreneurship in general?

Sure, I studied Experimental Psychology in Bristol, UK (neurobehavioural sciences). Then I left to do Marketing at Procter & Gamble (P&G). I was very intrigued by human psychology in purchase, acquisition, and visual behaviors. After that, I left P&G to start my own company. Initially, it was not backed by any academic interest but now, we are increasingly in touch with the research side of things because we want to ensure that the visuals are both memorable and easy to comprehend. I am also not trained by profession to start a business but it has all been a learning experience.

Q2. There are various visualisation tools available on the internet (e.g., Visual.ly, Easel.ly, and Infogr.am). What are Piktochart's competitive advantages over its peer companies?

Yes, there are indeed quite a few available on the internet. We are not focusing on data visualisation as research has found that just bar charts are low in memorability. We are looking at a combination of how to "design" for information in order to

enhance both memorability and comprehension. If you take a look at the output and the sort of designs that have come out from Piktochart versus its peers, they are remarkably different. We are also constantly challenging how much can be done in terms of making images search engine friendly (via Piktochart's infographics) so even on the technology side, there is a lot of innovation.

Q3. Besides Piktochart, are you involved in any other startups, or hold an interest in other areas of technopreneurship?

I am not involved in anything else at the moment. I mentor a few people from time to time and seek out great mentors for Piktochart. We are seeking to grow Piktochart beyond an infographic tool and want to see the Malaysian ecosystem flourish into one that is able to compete.

Q4. What advice do you have for budding entrepreneurs and innovators in Malaysia?

Be humble, always be learning, never sacrifice the quality or the bond of your team. Learn to embrace failures.



The audience at EmTech Singapore 2014.

Transforming future space exploration missions with microfluidic technologies

by Dr. Jitkai Chin (University of Nottingham Malaysia Campus, UNMC) & Tengku Farah Wahida Ku Chik (National Space Agency Malaysia, ANGKASA)

Introduction

Microfluidic technology has attracted attention of researchers from chemistry and biomedical sciences since its early development with the aim of limiting resource usage and waste reduction. By modifying the microfluidic devices and pulling in new technologies, the device could potentially transform future space exploration missions to be safer, more reliable and sustainable.

In manned missions, lab-on-chips could be used for health monitoring for astronauts, and may produce medicines in unfortunate cases. For outer space missions, chemical liquid propellant micropropulsion systems could drive satellites or mini-space probes. In the future, it may also be a significant part of space landers, revealing geological mystery on asteroids or comets unknown to us thus far.

Although manned missions may still be limited to International Space Station (ISS) and the moon for the next two decades, unmanned missions such as mining valuable resources may be common. Collecting and returning samples from an asteroid has been completed by Japan Aerospace Exploration Agency (JAXA) [1] while the ROSETTA mission is expected to land and

study Comet 67P/Churyumov-Gerasimenko by the end of this year [2]. New innovative technologies are continuously explored and pulled in to ensure success in space explorations. One of the key fundamental technologies useful in future space and planetary exploration is microfluidics, a key branch of miniaturisation technologies, which may be useful in a variety of systems of space vehicles or probes.

The concept of microfluidics was introduced about two decades ago with active research that only begun by late 1990s. It refers to creeping flow in microchannels ranges 50 – 500 microns in width and 20 – 75 microns in channel's depth. Absence of turbulence is a double-edge sword as the flow is predictable and easy to manipulate but it also essentially means external force is required to enhance mixing. Droplet microfluidics hence becomes an ideal alternative as it provides absolute spatial and temporal species control. In some cases, the interfaces can even act as a control mechanism for chemical reaction [3].

Microfluidics in Space Exploration

In recent years, successful biomedical testings and integrations with electronics parts have led to the development of Lab-on-chip. It means that lengthy

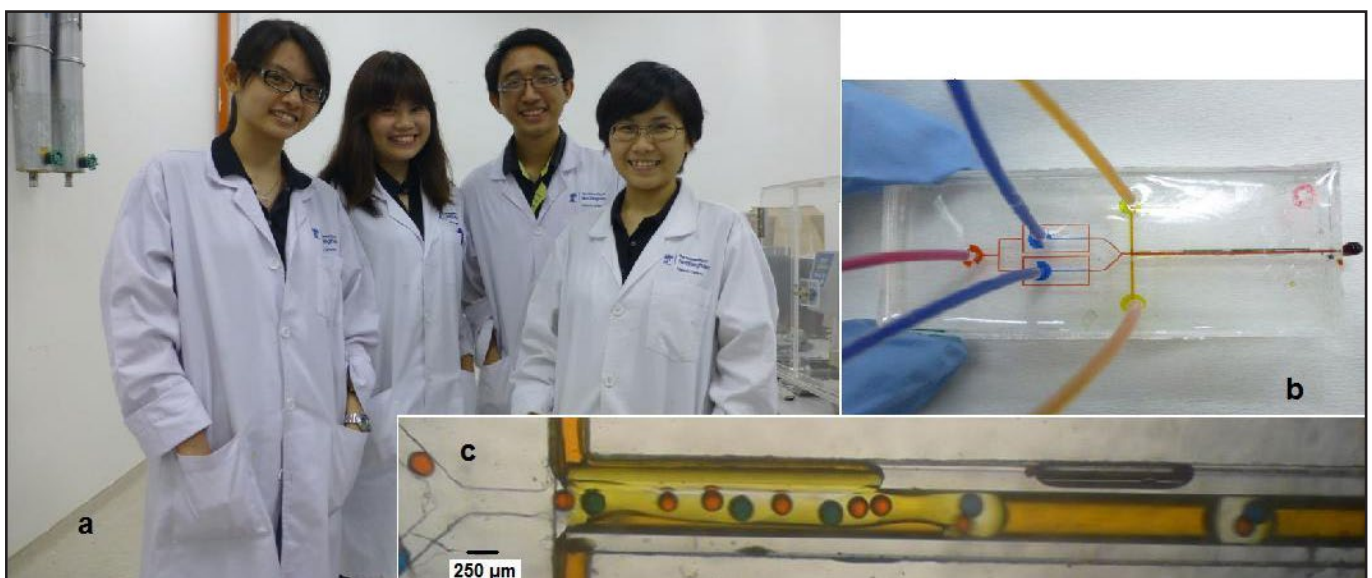


Figure 1: (a) Undergraduate research students who worked on double-emulsion in microfluidics. From left: Lim Chang Nong, Tan Xinyi, Jared Chong Sh'ng Yuan and Lee Pay Herng. (b) Microfluidic device for double-emulsion. Red input is the silicone oil while Blue and yellow streams are distilled water with dyes respectively. (c) Blue and red droplets of different sizes encapsulated in flow segments.

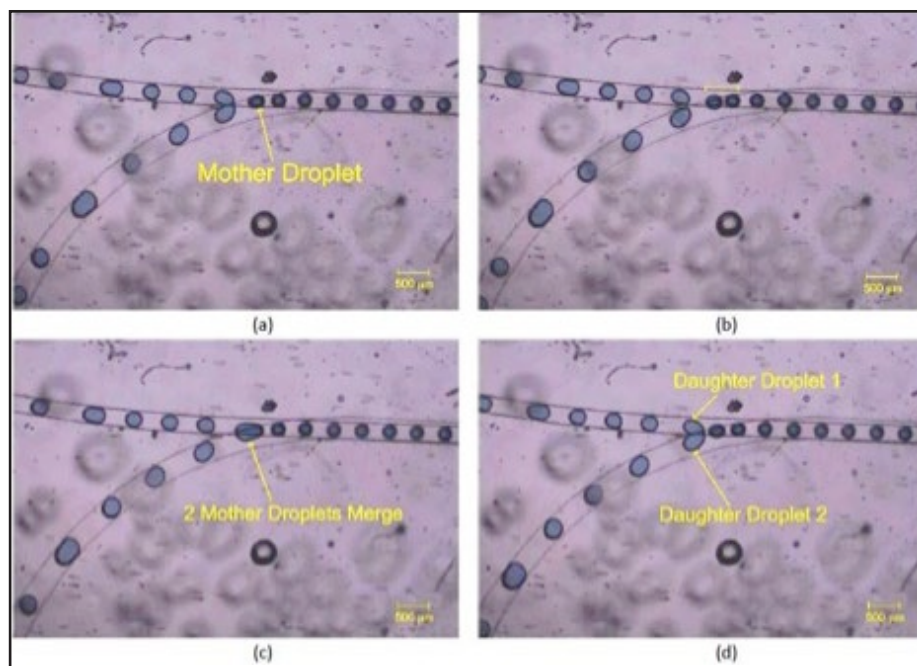


Figure 2: Sequence of pictures showing mother droplets merged at the Two-planar Y-junction before forced to split by the channel geometry. Droplets approaching the two-planar Y-junction at very low velocity (a & b). Two droplets merged at the Y-junction (c), and then forced to split (d).

and laborious process of sample preparation, manipulation, detection and analysis are not only successfully squeezed into a piece of microfluidic device within a hand palm, but also reduces standing time from hours to seconds.

These unique operational characteristics resulting in the Lab-on-chip becoming an ideal diagnostic device for astronauts, who are normally based in ISS for a duration of minimum 5 months with limited supplies from the ground. These devices are not only expected for health monitoring purpose but also, in the future, will be able to manufacture medicines for sick astronauts, through emulsion or nano-sized particles, which have been successfully demonstrated on ground.

As more unmanned landing missions on planets or asteroids are planned for the next decades, it is not surprising to see the potential of microfluidic technologies being further modified to suit in those automated machines to carry out in situ analysis. For example, microfluidic devices will be integrated into ExoMars rover seeking for biosignature of Martian life.

However, there are still tonnes of technical challenges ahead. For example, extracting biomarkers, organic compounds or morphology from fossils or organic-rich shales is the key step but solid handling of microfluidic devices still remains a significant challenge in which integration with other separation component seems unavoidable. Most asteroids or planet surfaces are notorious for violent and unpredictable weather.

Polymeric microfluidic devices are not only susceptible to huge temperature cycles that vary by hundred degrees on the planet surface but also other extreme

cases such as thundering, acid clouds and sand storms. Assuming that the devices are enclosed as a component in an analytical system that can survive cosmic rays, tiny particle such as sand or dust is a giant killer for any microfluidic device as it may completely block a single channel and causing the unit to completely malfunction, leading to major disaster or mission failure. In addition, whether the device can sustain years of space travel and survive bumpy landing process remains an enigma.

Our Research

Various microfluidic research works are being carried out in our laboratory using microfluidic devices fabricated with modified soft lithography method using polydimethylsiloxane (PDMS) and other composite materials. One of the focus areas is droplet microfluidics. In a previous study, we concluded that formation of immiscible liquid-liquid droplet at low Weber Number was dominated by hydrodynamic force.

On the other hand, shear force plays a significant role in droplet formation at high Weber Number due to increase in surface area as the disperse phase extruding into the main channel continuous phase. The findings lay down the foundation for droplet microfluidic research in our laboratory. For example, undergraduate research students successfully design and quantify double-emulsion in a microfluidic device, as shown in Figure 1.

Our recent work focuses on parallel splitting of liquid droplet via multi-layer-junction microchannel configuration. With proper channel geometry and microchannel configuration design (Figure 2), asymmetrical droplets can be consistently generated

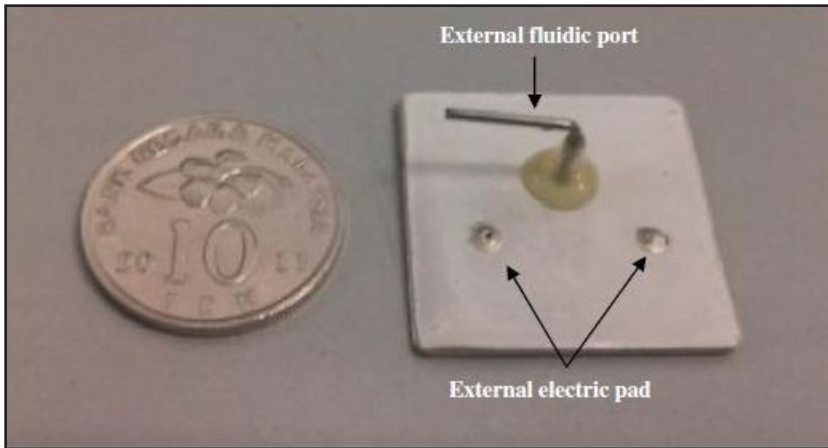


Figure 3: A zirconia-based ceramic micropropulsion system developed by our research group, compared with a Malaysia's 10-cent coin.

from each single nano-litre mother droplet. It enables parallel chemical detections carried out simultaneously on the same device. Furthermore, asymmetrical droplets enable custom detection to be carried out. For example, if a particular enzyme or nutrient detection requires only very tiny sample volume, small droplets can be utilised for this purpose; while larger droplets can be directed for other purposes of detection, hence ensuring high efficiency of sample utilisation.

By integrating the concept of microfluidic into a propulsion system for small satellites, our research group is developing a liquid chemical-based micropropulsion system, which is the 'heart' for next generation extremely small satellites such as micro-satellite, pico-satellite or Cubesat, poised to replace some satellites currently servicing Near Earth Orbits (NEOs) or altitude control for larger space-probes.

The basic design of the micropropulsion design consisted of a reservoir for temporary storage of the liquid propellant, a transport microchannel that connects the reservoir and a combustion chamber, where chemical reaction takes place (Figure 3). The post-combustion hot gas products are dispensed to ambient environment at high speed via a carefully designed nozzle, hence generating thrust in opposite direction. Similar effort also being carried out in NASA to develop Microfluidic Electrospray Propulsion (MEP) utilizing capillary force to feed indium propellant into reaction chamber.

There are a number of noticeable similarities between these systems with conventional microfluidics: extremely small flow-rate and the performance are highly dependent on the flow profiles throughout the systems.

However, polymer is not a good candidate as structural material for the micropropulsion system because of high chamber temperature that always beyond the melting points and degassing caused by cosmic rays. By using gel casting of homogeneously

dispersed zirconia suspension on PDMS soft mold, microthruster geometries were successfully replicated into a ceramic layer of 1.2 mm [4].

We are convinced that utility of microfluidics technology in future space exploration shall not be limited by the examples given. There are other potential applications such as capturing and returning cosmic dust to Earth, rapid diagnostic devices in first-aid-box, and culture medium for crops during space travel. We believe that microfluidics will transform space exploration in the near future.

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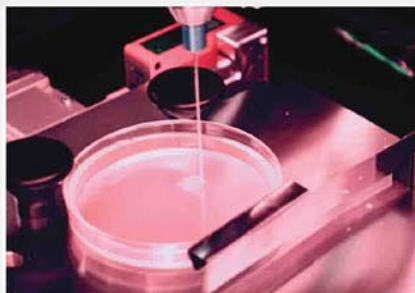
ABOUT THE AUTHORS

DR. JITKAI CHIN graduated with BEng from Department of Chemical and Process Engineering, University of Sheffield UK in 2001. He then obtained his PhD in Microfluidics from the same department. He joined Department of Chemical and Environmental Engineering, UNMC since 2007. He is an Associate Professor whose current research interest including droplet microfluidics, micropropulsion system and energetic materials. Find out more about Dr. Chin by visiting his Scientific Malaysian profile at <http://www.scientificmalaysian.com/members/jitkaichin/>

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SciMy Interview (Part I): Dr. Lim Boo Liat

interviewed by Dr. Lee Hooi Ling



Photo: Merdeka Award

Dr. Lim Boo Liat is renowned in the zoology arena in Malaysia. He is currently an Honorary Advisor on Zoology for the Department of Wildlife and National Park (DWNP). He obtained his Ph.D (Zoology) from Universiti Sains Malaysia in 1977.

Since 1953 to date, he has authored 302 scientific papers on small animals, reptile and amphibian ecology, rodent control and bio-medical studies (zoonotic diseases) associated with terrestrial vertebrates and helminth parasitology in many national and international journals. In fact, a number of animals were named after him with the latest addition in 2012, *Kalophrynus limbooliati*, a frog species from Johor, Malaysia [1].

In 2013, he was one of the Merdeka Award recipients for his contribution to the environment especially in the conservation of Malaysia biodiversity through scientific studies.

This is a two-part interview where Dr. Lim walked us through his journey of becoming an established zoologist in Malaysia. In the first part of this interview, we get to know Dr. Lim's humble beginning as a Lab Assistant at the Institute for Medical Research (IMR) post World War II (WWII) in 1947 to eventually being offered a Master of Science (MSc.) degree without having a formal Bachelor (BSc.) degree.

Q1. Can you share with us what it was like growing up in Malaysia before the World War II (WWII)?

Before WWII, the south of Klang where I grew up was a large kampung. Rubber and coconut were the main products. Cultivated farmlands, such as rice, vegetables, pineapples and fruit orchards were scattered all over, in urban and suburban areas. Basically Klang was an agricultural state with its forest still pristine.

After my Form 2, I decided to terminate my studies as my parents were struggling to support my two sisters, a brother and myself in schooling. As such, I stayed away from class for two weeks to help out in a small plot of farm. At the end of the second week on a Saturday morning, three teachers (Mathematics - Mr. S. Sabapathy, English- Mr. N. Francis, Art - Mr. Wong Ah Fatt) came to my house and told my parents that they expected me to be at school the following morning at 8 am.



Dr. Lim Boo Liat at the Scrub-Typhus Unit laboratory, Institute for Medical Research (IMR) in Kuala Lumpur 66 years ago (1948).

At the appointed time, I was in school and Mr. Francis took me to the Headmaster's office. Standing in front of the giant Irish man and quivering, I expected an addressing from him. Instead, I was shocked when he told me that those three teachers had paid for my school fees for the whole year, and the school would provide me all the textbooks including exercise books.

Just before I opened my shivering mouth, he ordered me back to class with a stack of new books the first time throughout my school years with everything new. Before that I had to salvage second hand books all the time.

Such was the time before WWII in Klang, where the environment centered on a caring society that integrated all the ethnic groups as a community. The teacher's devotion and commitment towards their students were such that once the child was handed to the school by the parents, the teacher took over the responsibility of parenting the child.

Q2. How did you get interested in zoology?

It started when I was in Klang High School, in Klang, Selangor. The school had a small plot of land where the gardener of the school kept a nursery of flowery plants and ferns, as well as rows of vegetables. Birds, insects, and occasionally, rats and snakes frequented the garden. I was fascinated by such varied fauna that I visited the gardener on a regular basis to observe the animal life in the garden.

Then, a friend and I started a small outlet on Carey Island to produce salt and soap from mid 1944 to the unconditional surrender of the Japanese Occupation in September 1945. Beside our own workers, we also employed a group of Orang Asli to help run the operation. I got along very well with them. They taught me the identification of rats, civets, wild cats, macaques and leaf-monkeys, snakes, frogs and tortoises.

In 1947, under the British Administration period, I joined the Institute for Medical Research (IMR) as a



*Taking a break under a tree at
Lakum Forest Reserve, Pahang.*

“Such was the time before WWII in Klang, where the environment centered on a caring society that integrated all the ethnic groups as a community”

temporary laboratory assistant in the Scrub Typhus Research Unit. I was assigned to the team of Prof. J. L. Harrison, a zoologist specialised in mammals. The unit was specialised in Scrub Typhus diseases, of which the paratenic hosts are vertebrates such as volant and non-volant mammals, birds, reptiles as well as amphibians. Because of my local knowledge on some of these vertebrate animals, he put me in charge of the animal collecting section. During this period, Prof. Harrison took me under his wing and taught me the taxonomy of mammals. My career progressed in leaps and bounds since then.

Q3. You were offered to pursue a MSc. at the University of Aberdeen despite not having a BSc. Can you tell us more about this opportunity?
My research experience, publications, and participation

in various international conferences played a major role in being offered an opportunity to pursue a MSc. despite the lack of a formal BSc. From 1955 through 1969, I managed to publish 80 scientific papers on vertebrate animals (volant and non-volant mammals, reptiles and amphibians, endo-ectoparasites of vertebrate animal species in relation to medical and public health importance). In 1965, I was asked to head the newly created Medical Ecology division.

In 1969, Professor Wynne-Edwards, Chairman of the Faculty of Science and Professor George Dunnet, Head of Zoology Department of the University of Aberdeen, as well as Professor Charles Elton, Head of the Animal Population Bureau, University of Oxford paved the way for me to apply to the University of Aberdeen to pursue a MSc. without



Field expedition with the Department of Wildlife and National Park (DWNP) in Krau Wildlife Reserve, Pahang.

a formal education. They also secured a Medical Research Council Fellowship to sponsor me for two years in Scotland. In 1972, I completed the MSc. programme. Two months after my return to the IMR in 1972, I was promoted as a zoologist and continued heading the Medical Ecology Division.

Q4. What are the career prospects of becoming zoologists in Malaysia?

In Malaysia, “zoologist” is misinterpreted by the public including even some academicians as a person dealing with the classification of animals. A zoologist has multidisciplinary ‘functions’ - not only as a taxonomist, but the zoologist must also deal with the behaviour, physiology and distribution of animals. He or she is also a good field person and understands the inter-relationship of the species diversity in the forest ecosystem and host-parasite in relation to diseases.

This takes years of hard work, not only in field study but also experimental observation in laboratory condition. With the advancement of biological technological knowledge, a zoologist with an exposure in molecular techniques such as DNA sequencing technology will have more job opportunities than a field zoologist.

The career prospect for a zoologist per se is rather limited in Malaysia. Other than universities, one can find opportunities in a few non-governmental organizations that are involved in conservation

of our natural heritage, DWNP and consulting firms dealing in environmental impact assessment.

To upgrade the status of zoologist on par with other disciplines, the Education Ministry can play an important role by instituting a policy whereby zoologists are required in all schools to teach natural history classes.

In the conservation of our natural heritage, nothing is more effective than to nurture such knowledge to children at very early ages in schools. If this is realized, it is anticipated that 20 years from now, one can expect that the conservation of our natural heritage in Malaysia will be very well-secured with the mass support of the younger generation. This in turn will encourage more students to study zoology with greater job opportunities.

“A zoologist has multidisciplinary ‘functions’ - not only as a taxonomist, but the zoologist must also deal with the behaviour, physiology and distribution of animals”

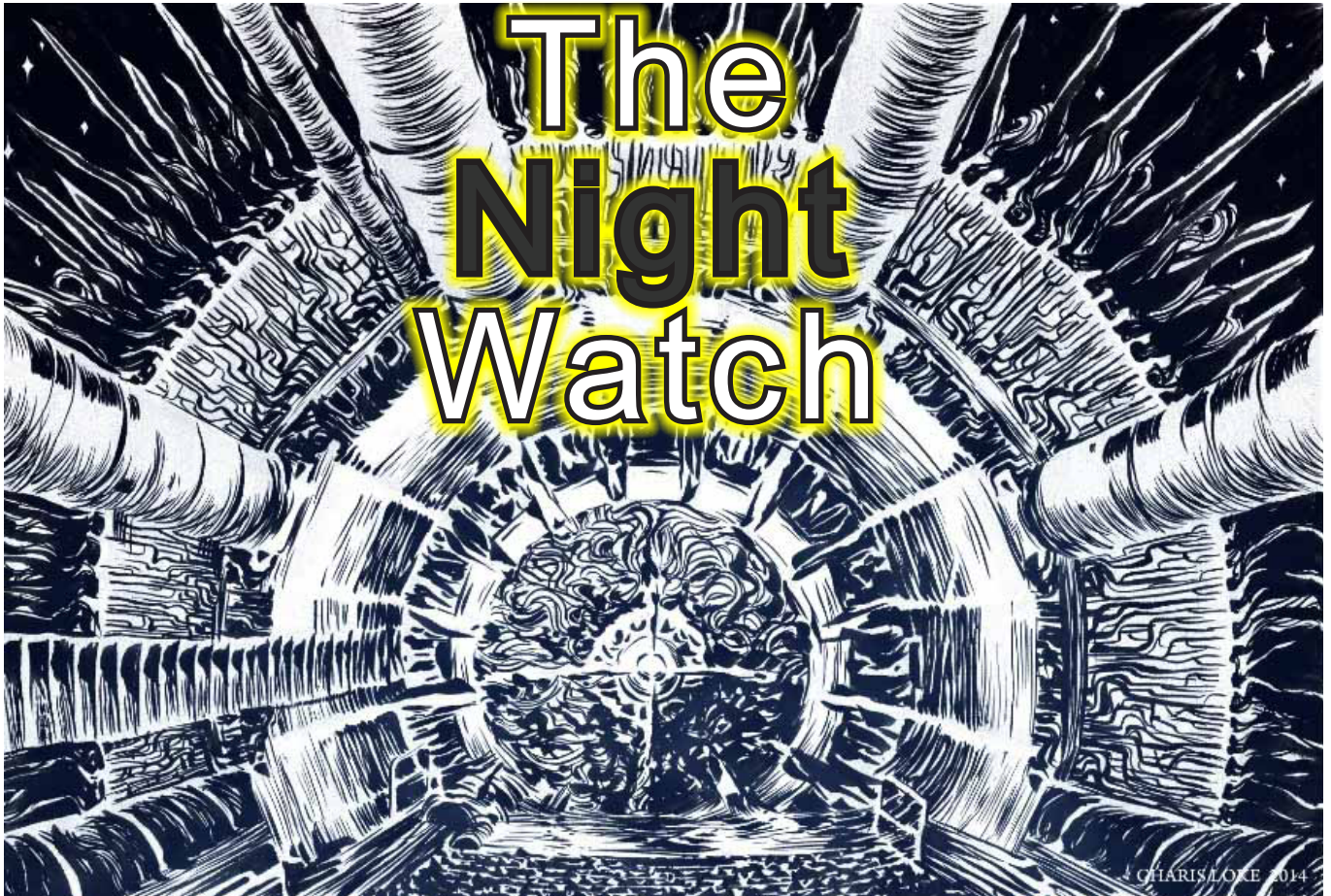
In the next issue, Dr. Lim will share his experiences in working for the World Health Organisation (WHO) in Indonesia and his life after retirement 27 years ago, in 1987.

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The Night Watch

Illustration by Charis Loke



Working the night shift at CERN

by Dr. Khoo Teng Jian

It is 3 a.m. on midwinter night, and I futilely wish for a nasi kandar and kopi tarik to keep me going. In their place, I have a couple of Swiss francs saved for vending machine coffee and chocolate, but the snacks have to wait for the 5 a.m. slump. The ATLAS Control Room (ACR) resembles a starship bridge at a lower level of alertness, with some individuals attempting to write analysis code, one of my neighbours watching a movie and another making conversation over Skype. We're also nervously eyeing the shift leader's banjo case, wondering when the instrument might come out to play. Welcome to the ACR late night special.

Being on call and taking night shifts is a standard part of a Medical Doctor's life, but it is also not unknown to the less practical sort of doctor. In our case, however, we haven't a stream of ailing patients to mend. Instead, our ministrations are reserved for the fragile titan that is the ATLAS detector. Our 7,000 tonne instrument is a

complex camera/microscope, blasted 40 million times a second by energetic radiation and doing its best to record the tracks of minute particles as they emerge from the interaction point. Given this harsh environment, ATLAS's vital signs are kept under the round-the-clock surveillance by half- and fully-baked PhD's.

“Checks on temperatures, coolant levels and other markers of detector health are made routinely, whether or not the LHC is delivering collisions”

Most shifters can be thought of as semi-skilled workers, knowing just enough to be aware of problems as they arrive. When there's something strange on the monitor, who're you gonna call? Specialist counterparts to the shifters are the on-call experts, who have more hands-on experience with the detector systems. They have the know-how to resolve common issues, and are able to diagnose and repair less typical problems. They are also responsible for calibrating and upgrading the control systems. Experts usually visit during the daylight hours to perform these tasks, and are a source of pleasant company as well as specialised

information about the detector. The ACR in the daytime can be like a hive, as various interested parties pass through to report or gather information about what needs doing and the odd tour party stares and strobes camera flashes. Night shifts are usually more quiet, being dedicated to data-taking.

During a data-taking run, which can last for more than 24 hours, shifters monitor the activity of detectors, flagging incidents where a particular component regularly reports errors and watching out for any problems with the flow of data. For example, an electronic component that develops a high level of noise can saturate the trigger system, causing useless events to be read out, wasting bandwidth and disk space. Such components need to be “masked” out and ignored. As the rate of collisions (*i.e.*, the instantaneous luminosity) changes over a run, the trigger

“menu” needs to be updated to maximise the efficiency of data-taking. Checks on temperatures, coolant levels and other markers of detector health are also made routinely, whether or not the LHC is delivering collisions.

With sensitive sensors situated centimeters from sizzling streams of accelerated protons, what could possibly go wrong? Quite a lot. Every LHC experimentalist’s worst nightmare is a stray beam slicing through the silicon of a particle tracker, carving through circuit components and simply making junk of expensive and irreplaceable detectors.

Fortunately, our counterpart accelerator physicists in the CERN Central Control Room (CCC) are similarly working around the clock to keep the protons confined in their orbits. Indeed, the most important call to action in the ACR is the “machine

people” announcing STABLE BEAMS, assuring us that the crossed proton streams will remain precisely placed in the detector’s hollow centre to deliver collisions.

From this moment, the detector is safe to switch on, and a flurry of activity ensues. Silicon strips and pixels are raised to high voltage and the trigger system kicks into gear, firing off signals to record data every time an especially interesting event is spotted. All the while, the human operators scan screens for signs of software or hardware malfunctions, transitioning from eagle-eyed to blurry-eyed over the course of an 8-hour shift. The buzz continues until eventually the fine focus of the beams degrades or a beam monitor spots an orbital deviation.

Then, the LHC dumps its cargo of protons, unceremoniously announced in the ACR by the sound of a toilet flush. A final set of checks



A jubilant ATLAS team when the LHC achieved its first 7TeV collision, the highest energy ever recorded for a particle collider. Photo: CERN.

is made to ensure that the beam loss has not caused any problems, and the detector is returned to standby, while the CCC refills the collider for the process to start anew.

Eventually, 7 a.m. rolls around, and we are relieved of our posts by fresher colleagues. Home is a 15-minute cycle away, past snowy fields and sleepy cows. As the sun rises and the world awakens, the night watch retires. Come 11 p.m. we'll return as the relief force, another day passing in the ceaseless collection of inverse femtobarns.

GLOSSARY

ATLAS: A Toroidal Large Hadron Collider (LHC) Apparatus, the biggest particle detector experiments of the LHC.

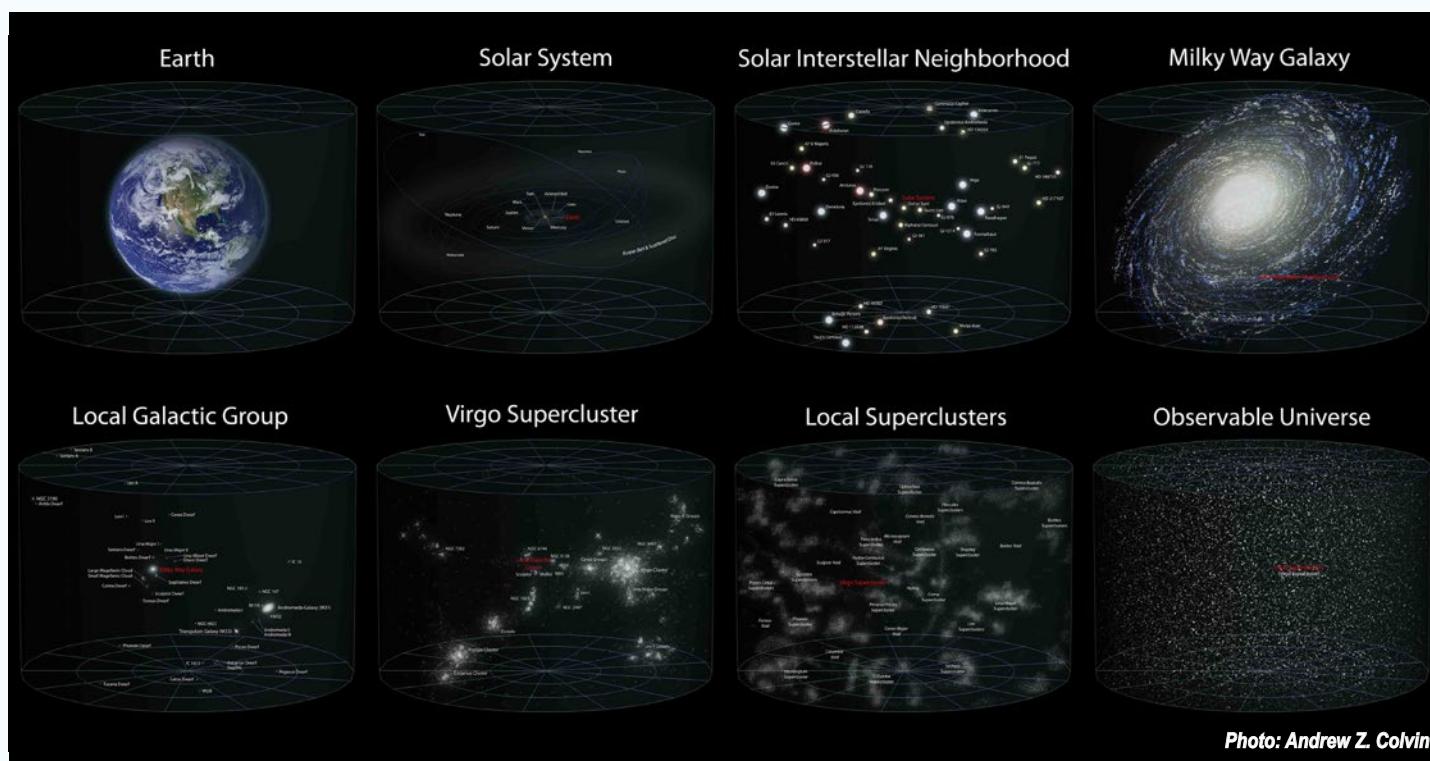
Inverse femtobarn: 1 / (the cross-section of a

uranium nucleus times 10^{-15}), it translates to “enough data to make 21,000 Higgs bosons at the LHC with 8 TeV proton collisions”.

ABOUT THE AUTHOR

DR. KHOO TENG JIAN is KL-born, Penang-bred, and an Old Free. A graduate of Williams College, Massachusetts, he completed his PhD in experimental particle physics at the University of Cambridge. His PhD thesis “The hunting of the squark” won an ATLAS Thesis Award in February 2014. As a member of the ATLAS collaboration, he searches for supersymmetric particles and investigates reconstruction techniques involving invisible objects. In 2013, he took up a Junior Research Fellowship at Jesus College, Cambridge. He can be contacted at tee.j.khoo@gmail.com. Find out more about Teng Jian at <http://www.scientificmalaysian.com/members/Khoo.Jian>

ABOUT OUR OBSERVABLE UNIVERSE, DID YOU KNOW THAT...



Higgs Boson, its discovery announced by CERN, is thought to play a role in causing an extremely rapid expansion of the universe 10^{-32} second after the Big Bang

13.798
billion years
Age of the universe

93 billion
light years
The diameter

200 billion
The number of galaxies

300 sextillion
(10^{21})
The number of stars

“The universe is like a safe to which there is a combination. But the combination is locked up in the safe.”
- Peter De Vries

PhD Studies in Vienna (Part II)

by Mamduh Zabidi

Currently I am pursuing my doctorate degree at the Institute of Molecular Pathology (IMP), Vienna, which is owned by the pharmaceutical giant Böhrlinger Ingelheim. IMP is a part of a larger campus consisting three other institutes: the Gregor Mendel Institute (GMI), Institute of Molecular Biotechnology (IMBA) and the Max F. Perutz Laboratories (MFPL). Collectively these institutes are often called the Vienna Biocenter (VBC).

Scientists at the VBC hail from different parts of the world, creating a highly diverse environment. In particular for doctorate students, out of around 200 applicants who apply on-line in each selection, about 40 of them are invited to the interview week in Vienna. In the first round of interview, applicants are first required to present a paper (given beforehand) in front of a panel of four faculty members, and then their research experience.

During this first round of interview, the applicants are thoroughly assessed in terms of their scientific knowledge and reasoning, as well as motivation. Oddly enough, I personally had the feeling that this style is somewhat similar to American Idol, minus the crowd and live telecast of course: you are in front of four judges to showcase your worth.

After passing the first round, the applicants are allowed to talk to the scientific groups. This step allows the applicant and the group members to get to know each other and to discuss potential projects. As hiring doctorate students involves an especially huge commitment from group leaders, this step is crucial to ensure the hiring of competent personnel with the right skills, motivation and enthusiasm, as well as the chemistry with the current group.

Possessing the right skills at the start of PhD might not be an absolute prerequisite provided that you make up for it in other areas. Despite having learnt only C/C++, with no formal bioinformatics background and limited research experiences, I was fortunate enough to secure a PhD studentship in Bioinformatics at the VBC.



Crowds throng to the Rathaus (the Town Hall) at the Christmas Market.

The contract for PhD students runs for an initial period of one year. During the first nine months, the students are expected to write PhD proposals (somewhat equivalent to international grant application format) with the help of their mentors. This stage helps the students in understanding the bigger picture of their projects, the steps and techniques involved, and the literature behind their work.

In addition, the students will be evaluated during the first PhD committee meeting. The meeting is to determine whether the projects are viable doctorate projects, whether the students are making satisfactory progress, and to identify any arising problems. On successful evaluation, their contracts will be extended for another two years. From then on, the students are required to hold similar meetings each year.



Ice-skating in front of the Rathaus (the Town Hall) is a popular winter attraction in Vienna.

Doctorate students at IMP are not required to attend any classes; hence they can fully concentrate their time and energy on their research. German classes, however, are offered free-of-charge for anyone interested. Perhaps unsurprisingly, attendance to journal clubs and lab meetings are mandatory. In addition, students are required to attend weekly students' seminar, where every student presents their work each year to the whole institute.

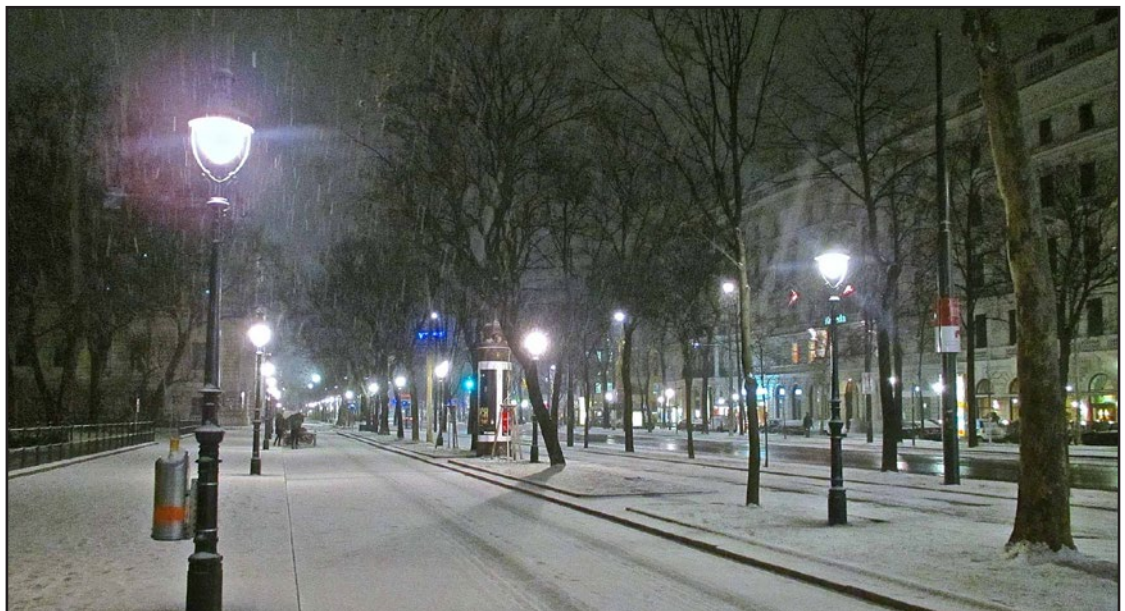
Students at IMP are allowed to pursue their PhD for up to four years, before which they are required to defend their projects. On graduation, they can only stay on for a maximum of one year as a postdoc. Despite an apparent uncanniness, this restriction has its own merit: By ensuring a constant turnover, a continuous stream of fresh ideas and people are

assured, thus preventing staleness and maintaining competitiveness.

It is not unusual for doctorate students here to graduate with 1-2 decent publications to their name. Typically, graduating doctorate students receive postdoc offers from high-profile labs from Europe or the United States (US).

This is a great place to pursue competitive science. The scientific research groups are supported by excellent support facility groups, for example in imaging, sequencing, bioinformatics, and mass spectrometry. Europeans, especially the Germans and Austrians, make up a huge percentage of scientists at IMP. However, in general the students originate from highly diverse background, representing more

Downtown Vienna being covered by snow flurries.



than 30 nationalities from different continents. Unfortunately the weather here could turn nasty, even though it rarely gets below -10°C , unlike in Midwestern and Northeastern parts of the US. During the winter, the sky frequently gets gloomy for days on end.

Most of the time, English is sufficient to get by in the city, but I personally recommend putting some effort in learning German. The public transportation is excellent and the city is far from overpopulated. The living cost here is also much cheaper compared to other major European cities.

The city is also fairly diverse, not just because of tourists who flock here all-year round, but also the city residents themselves who come from different parts of the world. Muslims, especially from Turkey and Arab countries, are a significant minority here; hence to find halal food is not a major problem.

In the next section, I will offer my own personal thoughts and ruminations on the aspects that we could improve on sciences in our own mother soil.

“By ensuring a constant turnover, a continuous stream of fresh ideas and people are assured, thus preventing staleness and maintaining competitiveness”

ABOUT THE AUTHOR

MAMDUH ZABIDI lived in the United States for his Bachelor's degree, during which he studied neurons in the slimy *Aplysia* slug. He worked for several years at CARIF, during which time he also finished his Masters at University of Malaya. Along the way he has hiked hills and mountains, waded through snow and mud, and chased after animals (only photogenic ones) for photos. When not coding in front of the computer, he

reads non-fiction books, watches German-dubbed version of Hollywood movies (even though barely understands them), and tortures Viennese people with his broken German. Find out more about Mamduh by visiting his Scientific Malaysian profile at <http://www.scientificmalaysian.com/members/mamduh>



Schönbrunn Palace, a top tourist destination in Vienna. It is a UNESCO World Cultural Heritage site since 1996. Photo: Thiranja Babarenda Gamage Photography

SUBMISSION OF 'LIFE AS A SCIENTIST' ARTICLE:

Do you have a studies/working experience article in scientific or related field that you would like to share? Contact or submit your article by emailing us at: magazine@scientificmalaysian.com

A Step Towards a Future in Cancer Research

An undergraduate internship experience by Lim Mei Chee

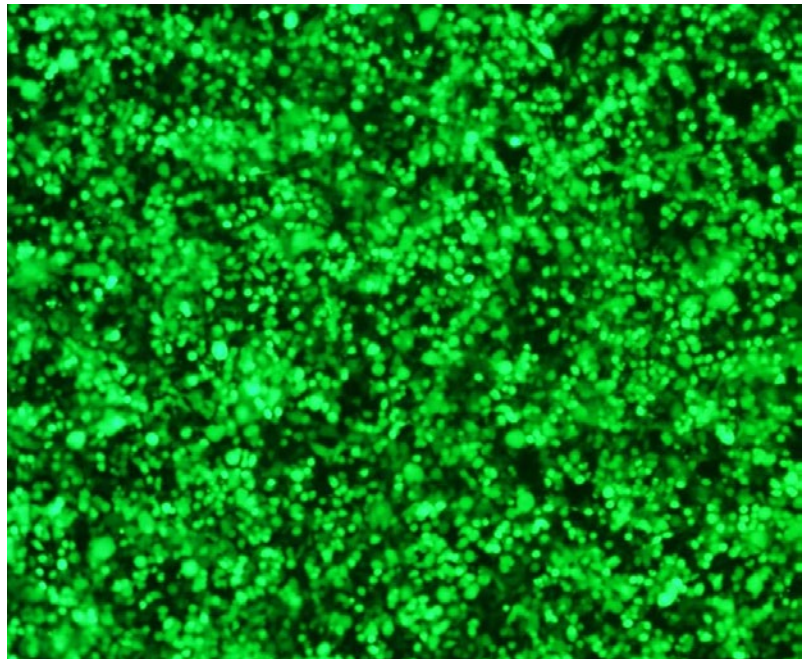
Having lost my grandfather and cousin to cancer, I have long vowed to myself that one day, I will help in the quest to find a cure or to improve the situation. As a Biomedical Sciences student, I was given the opportunity to learn more about how our body systems work.

It occurred to me that so many things in our body could go wrong and it is of utmost importance that our body carries on what it does best: homeostasis. And when homeostasis is not maintained, cancer can be one of the consequences. After talking to a few people who are involved in research work, I realise I will never truly understand how to combat cancer unless I involve myself practically.

In the summer of 2013, I spent approximately four weeks at the cancer research lab supervised by Dr. Wong Kah Keng at the School of Medical Sciences, Universiti Sains Malaysia (USM). The lab studies B cells and focuses mainly on non-Hodgkin's lymphoma.

As an intern, I was under the guidance of my supervisor's PhD student, Ms. Loo Suet Kee. In the first few days, I was watching her every step. She was carrying out western blots and staining cancer cells obtained from patients in the hospital, as well as culturing certain lines of cancer cells. Once I got used to the techniques, I was allowed to practise them myself.

"A fume chamber, freshly graduated pipettes, and sterilised apparatus and gloves made me understand how important it was to avoid all kinds of contamination..."

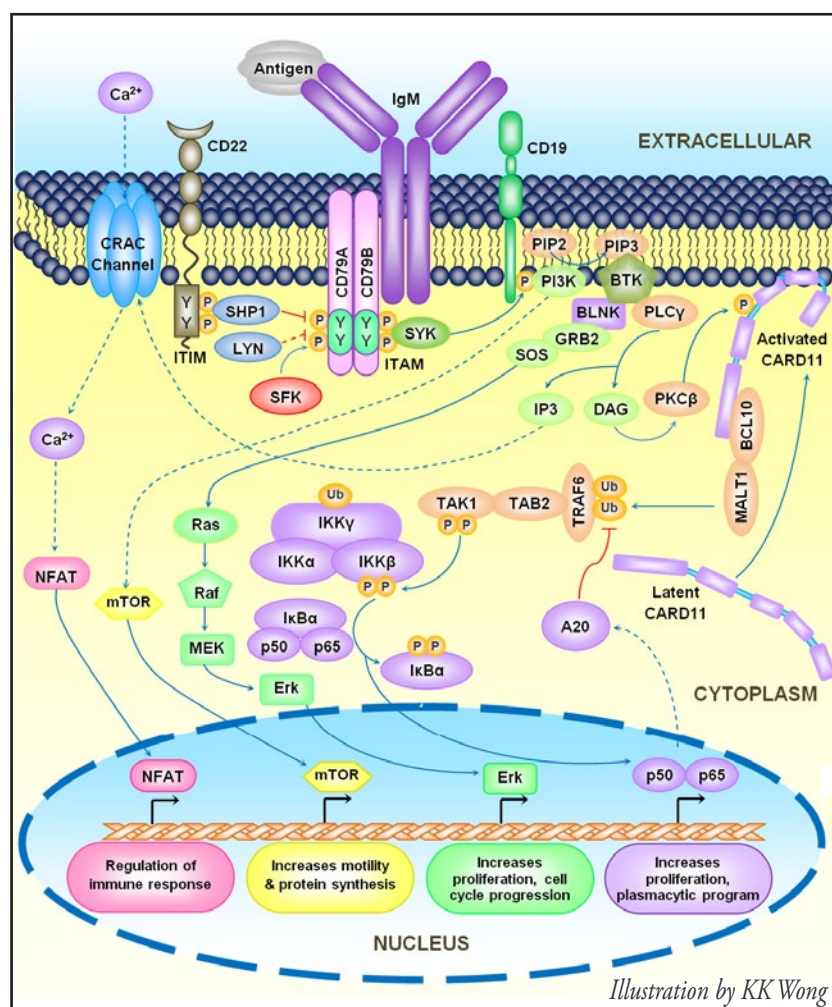


Adherent cells that were transfected with DNA plasmid encoding green fluorescent protein (GFP), achieving transfection efficiency of ~90-95% in one of the lab's experiments.

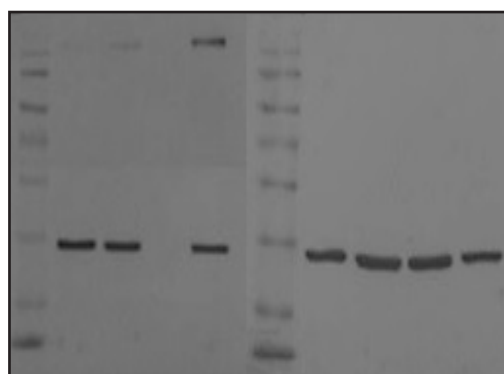
I was able to perform Western blots and cell culture techniques firsthand during my stay. What may have seemed minor to me before, became my point of focus when I carried out the techniques. A fume chamber, freshly graduated pipettes, and sterilised apparatus and gloves made me understand how important it was to avoid all kinds of contamination and how easy it was to make mistakes. It also told me how crucial it was to be meticulous in order to get accurate results, which may help save someone's life one day.

Aside from practical work, my supervisor taught me how to analyse scientific papers and the different types of graphs and bar charts that were too technical for me to understand before. He also taught me bioinformatics.

Now, I know how to get scientific information such as the sequence of DNA and amino acids for a particular gene or protein online. It amazes me how much information is available in a few clicks but it also makes me realise how little I know.



The complexity of molecular signaling within an activated B-cell upon encounter with its antigen. Four common pathways could be triggered i.e., the NFAT, mTOR, MAPK/ERK and NF-κB pathways.



Representative Western blot results in an experiment that I assisted.

Other than the techniques mentioned above, I have also learned how difficult it is to conduct scientific research from scratch. Not only does it take a lot of time and effort, it costs a lot as well. Perhaps the most important lesson I have brought back from my internship is to have patience and perseverance in the process of obtaining an accurate result.

For example, my supervisor and his postgraduate student conducted a viral transduction process in order to inhibit the transcription of a particular gene in cancer cells. I was given the honour of testing if the transduction process worked by running a western blot to detect the absence of the protein encoded by this gene.

After two days of western blotting, I was disappointed when the results showed that the transduction was not successful. However, when I talked to my supervisor about this, he did not seem surprised. Instead, he told me that this often happens. With a positive attitude and sparing no time, he looked through the protocol so he could improvise and repeat the whole procedure. It amazes me how someone can be so positive even after putting so much effort into something only to find out that it did not work. At that moment, I realised that the failure in carrying out experiments is a part of the journey. A reporter once asked Thomas

Edison, "How did it feel to fail 1,000 times?" and he answered, "I didn't fail 1,000 times. The light bulb was an invention with 1,000 steps". I did not truly understand what he meant then, but I understand now. Perseverance is part of the job.

I certainly understand that the main question is my own passion. I have always loved science and more specifically, the human body and all its complexities. I knew I wanted to become a researcher but did not know what it would entail. After having worked in a cancer research lab, I do; I can say that it only reaffirmed my dream of one day becoming involved in cancer research.

ABOUT THE AUTHOR

LIM MEI CHEE is a second year (going on third year) undergraduate student studying Biomedical Sciences at the University of Oxford, UK. This summer, she will be carrying out a cancer research project under the supervision of a research group in the Nuffield Division of Clinical Laboratory Sciences, Oxford. In her spare time, she enjoys watching documentaries as well as attending Zumba and swing dance classes. Find out more about Lim Mei Chee by visiting her Scientific Malaysian profile: <http://www.scientificmalaysian.com/members/meichee/>

Michael's Moonwalk

by Yap Gaa Mun

Imagine looking through your magnifying glass and you will find the *Coccinella saltare* a really amazing creature.

Analogous to a lady bug, it was the apple of the eye for any biologist. This bug was named *Coccinella* that registered the genus of the bug and *saltare* which meant dance in Latin as inspired by its proverbial swarm behaviour – when flying in aggregates, the colony wafted in figure-eight pattern as if they were dancing in the air.

Some insects were meant to be cute but not when it was about to collide with a planet full of living human beings!

For the human beings, *C. saltare* was a gigantic monster from outerspace the size of Godzilla, terrifying cities and towns once a year for hundreds of years since the year 2020. Like migrating birds, it flew from one galaxy to another, resting on earth for a week before flying off to another galaxy. For many years, biologists could not understand the reason this bug chose this region during its migration period.

But this did not stop one scientist from finding out the truth.

Michael Goh had been studying the *C. saltare* for 5 years already. He believed that the bug was genetically modified. After collecting sufficient data, he was sure that he had discovered the underlying reason for the migration of the bug to this region. All he needed to do was to test his hypothesis. The year 2500 was supposed to be his “eureka” year but the government suddenly withdrew all fundings for his research and instead invested in military to defend against *C. saltare*.



Photo: Gilles Gonthier / Flickr

Depressed, he confided to his friend, Kumar, “I was this close. This close! If only I had enough money to fund my research.”

“Buddy, if I were you, I would not be crying like this,” consoled Kumar. “Get Up! And dance!”

“Dance?”

“There will be an anti-gravity dance competition organised by a lottery company. The first on earth. The grand winner brings home 10 million dollars. That money should be more than enough to fund your research.”

Trying his best to be optimistic, Michael thought that it was a good opportunity since he was a dancer in his youth. He asked, “But how can I learn to dance?”

“No worries. I shall teach you the science of dancing.”

Michael agreed with a gulp.

So, every evening, he would practise dancing at Kumar’s dance studio. With 10 years of experience in anti-gravity moves coupled with yoga, Kumar was credible to be his dance instructor.

The anti-gravity dance move was actually a new dance move developed within the decade after humans discovered that by manipulating the gravitational waves using technology, could enable anything to float. So, choreographers took the opportunity to dance while afloat giving birth to the anti-gravity dance.

Although Michael had never tried this dance genre, he found that the anti-gravity dance easy as it did not require much strength since he did not need to move his limbs and head so much to fight low gravity. Whenever he was lazy to practise, Kumar would say to him, “Get Up! And dance!”

Finally, the day of the competition dawned on a sunny afternoon. Hundreds of participants went up to the digitally controlled stage to show their moves. Each dancer had a nickname and none revealed their real names. The audience that crowded the perimeter of the rectangular stage, watching them move 10 metres above the stage, performing from beginning till end.

When it was Michael’s turn, butterflies were in his stomach.



Illustration by Yink Heay

“Ladies and gentlemen! I now present to you... the “Saltare”!

He was finally on the stage. Kumar was at the backstage watching everything. The moment music started blasting from the speakers, Michael was lifted off the stage. He started performing to the sounds of the electronica music. Flashes of holographic laser beams criss-crossed the stage as the theatrical lights focused on Michael.

Suddenly, there was a blackout and Michael slowly descended to the stage like a fallen angel. The crowd silenced. The speaker muted. The judges were murmuring.

Stunned, Michael merely stood on the stage with 60 seconds left before time’s up.

“GET UP! AND DANCE!” shouted a voice.

Out of a spark of ingenuity, Michael started performing the moonwalk. He was not sure when the dance move started but it was passed down in his family for generations. He watched his grandfather did it like a folk dance when he was young. His footwork on the stage was so smooth, it was almost criminal.

The time was up.
His score was 99.99%.

Michael won the grand prize and the 10 million dollars was his! Kumar was overjoyed to see his student’s success.

With the huge sum, he continued his research and was finally able to test his hypothesis. He discovered that *C. saltare* was attracted to the high carbon dioxide levels of the ocean due to global warming of the earth.

Disclaimer: All names, including the species Coccinella saltare, are fictitious and that any resemblance to real person is purely coincidence.

ABOUT THE AUTHOR

YAP GAA MUN is a first year student studying physics at the University of Malaya. Her hobbies include writing fiction, photography and proposing scientific hypotheses. She hopes that one day, films will be directed based on her fictional stories. Currently, she dreams of a scientific career. Find out more about Gaa Mun by visiting her Scientific Malaysian profile: <http://www.scientificmalaysian.com/members/gaamun>



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