SCIENTIFIC MALAYSIAN

ISSUE 9 /NOVEMBER 2014

THE DISTANT UNIVERSE

In one of the largest scientific endeavours to date, the Square Kilometre Array will peer into the distant universe when the first stars, and lights, were born

SciMy Magazine

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ARTICLES

The Northeast Monsoon, formed by wind that travels across the South China Sea, starts from November until March annually in Malaysia. The Monsoon brings frequent rainfall to Peninsular Malaysia and western Borneo, contributing to the average annual rainfall of 3,000 mm. Picture: A woman in the midst of rainfall in Bukit Bintang district, Kuala Lumpur. Source: Chot Touch© chottouch@gmail.com

LIFE AS A SCIENTIST

Cover Illustration

Humanity's endeavour to investigate and explore the universe by Mohd. Arshad Yusoff
Scientific Malaysian Magazine Issue 9 (November 2014) ©

FOREWORD

EDITOR'S FOREWORD

One of the major missions of Scientific Malaysian (SciMy) is to promote research collaboration and knowledge sharing within the scientific community and with the industry. Although the Malaysian scientific community is small, the SciMy team could not help feeling impressed and humbled by the breadth and depth of Malaysian science throughout 9 issues of SciMy Magazine. If you would like to share your scientific knowledge and views with our readers, please drop us an email at magazine@scientificmalaysian.com

In this issue, we have articles that interest scientists from almost every discipline. As a cover story, **Dr. Koay Jun Yi** highlights the advent of the Square Kilometre Array (SKA) and its role in revolutionising future radio-astronomical research (pg. 22). **Sharrada Subramaniam** and **Abraham Mathew Saji** discuss about the biology of allergies (pg. 9) and chronic hepatitis (pg. 17), respectively.

Health-conscious readers should pay attention to the article by **Chang Sui Kiat** – he shares his opinion on the redundancy of consuming antioxidant supplements (pg. 12). On pg. 15, **Assoc. Prof. Ibrahima Faye** describes how pattern recognition and objective measurement are the fundamental concepts for engineering biomedical devices. Environmental scientists, **Lee Khai Ern**, **Goh Choo Ta** and **Prof. Dato' Dr. Mazlin Mokhtar**, elaborate on the importance of Responsible Care initiative developed by the chemical industry (pg. 26).

We are honoured to feature interviews with two respectable scientists in this issue: **Prof. Dato' Dr. Lam Sai Kit**, who was awarded the Merdeka Award in 2013 for his longstanding work in virology (pg. 30), and **Prof. Dato' Dr. Jafri Malin Abdullah**, who spearheads the development of clinical neuroscience in Malaysia (pg. 33). Finally, **Juliana Ariffin** offers some tips for aspiring young scientists *i.e.*, PhD students on how to survive (and even enjoy!) their arduous PhD journeys (pg. 36).

We sincerely thank your support throughout all 9 issues. Please stay tuned for Issue 10 of SciMy Magazine – we believe 10 is a perfect reason to celebrate, right?

Cheers!

Dr. Valerie Soo
Editor-in-Chief
valwc.soo@scientificmalaysian.com

CONTACT DETAILS
Email: magazine@scientificmalaysian.com
Website: http://www.scientificmalaysian.com
Facebook: http://facebook.com/ScientificMalaysian
Twitter: @ScientificMsian

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NEWS HIGHLIGHTS

AUGUST 2014

Universiti Malaya marine biologist awarded prestigious Pew Fellowship 2014 to study dugong ecology
Reported by Tang Mei San

Dr. Louisa Shobini Ponnampalam, Ph.D., a research fellow at the Institute of Ocean and Earth Sciences, University of Malaya, has received the prestigious Pew Fellowship to study the impact of rapid, large-scale development in the coastal areas of Peninsula Malaysia on dugong ecology. She is the first Malaysian to be awarded this competitive international grant for marine conservation, a testament to her capabilities and contributions as a scientist and marine conservationist.

Local marine conservation research is challenged by limited funding – local funding bodies are more likely to award biotechnology and medical research, while international conservation-based grants are highly competitive and short-termed. A research project conducted by Dr. Louisa and her team in 2010 had identified an unprotected area around the Johor east coast islands to be an area of congregation for dugongs, but her research effort could not be continued due to a lack of funding.

This project will now be revived with the Pew Fellowship. Under this fellowship, Dr. Louisa will be awarded a total USD150,000 over a duration of 3 years. Her research project will use a combination of visual and acoustic methods, as well as sea grass mapping and contaminant analyses to better understand the distribution and ecology of the dugongs. This multi-pronged approach in studying dugong ecology will enable her research team to make comprehensive and evidence-based recommendations for the protection of the critical sea grass habitats.

In addition to that, Dr. Louisa plays multiple roles in the conservation effort of dugong ecology in Malaysia. As an academician, she leads three different research projects : one on dolphin ecology and conservation in Langkawi, one on dolphin ecology and conservation in Matang (Perak) and the other on dugong ecology and conservation in the Johor east coast islands. She also splits her time between ecological data collection, data analysis, report and manuscript writing, as well as mentoring a doctoral student. Apart from her academic commitments, Dr. Louisa is also the co-founder of MareCet Research Organization, a non-governmental organization (NGO), where her scientific research findings are adapted for dissemination among the general public, in order to increase public awareness on marine conservation efforts.

REFERENCES

[1] Dr. Louisa's talk at the TEDxYouth@KL on November 6, 2013 – "Whales, Dolphins and What the Sea is Saying" http://goo.gl/m55lt2
[2] Dr. Louisa's interview by the BFM radio station on April 4, 2014 – "Keeping Dugong Alive" http://goo.gl/oT5Emx
[3] Pew Fellows Program in Marine Conservation – The Pew Charitable Trusts Website http://goo.gl/NBqtGs
[4] MareCet Research Organization – Official Website http://marecet.org/

CONFERENCES

Upcoming conferences and symposia in Malaysia

NOVEMBER 2014

The Kuala Lumpur Convention Centre located adjacent to the PETRONAS Twin Towers opened in 2003 and has since been Malaysia's focal convention centre. It consists of two auditoria for 3,500, a conference hall for 1,800, a grand ballroom for 2,000 diners, 12,310 sqm of exhibition halls, and 20 other meeting rooms. It hosted its biggest event in 2006, the 18th FIGO World Congress of Gynecology and Obstetrics, with 8,294 delegates. Photo credit: Convex Malaysia Sdn Bhd; The Centre, http://www.klccconventioncentre.com/

Pharma + Bio Manufacturing 2014 Introducing Biotechnology Asia 2014
19th – 21st November 2014, Kuala Lumpur Convention Centre
More info: http://biotechasiaconvention.com/

Regional Conference on Science, Technology and Social Sciences (RCSTSS 2014)
23rd – 25th November 2014, Copthorne Hotel, Cameron Highlands, Pahang
More info: http://www2.pahang.uitm.edu.my/rcstss2014/

2nd IEEE International Symposium on Telecommunication Technologies (ISTT2014)
24th – 26th November 2014, Langkawi, Kedah
More info: http://istt2014.comvt.info/v0p1/

28th Regional Conference on Solid State Science and Technology (RCSSST 2014)
25th – 27th November 2014, Copthorne Hotel, Cameron Highlands, Pahang
More info: http://www2.pahang.uitm.edu.my/rcssst2014/

International Conference on Utilization and Management of Non-wood Forest Products (NWFP) for Sustainable Livelihoods
26th – 28th November 2014, Royal Mulu Resort, Miri, Sarawak
More info: http://www.eventm.net/icnwfp2014

15th Asia Pacific Congress on Clinical Microbiology & Infection (APCCMI)
26th – 29th November 2014, Sunway Pyramid Convention Centre, Kuala Lumpur
More info: http://www.apccmi2014.org

DECEMBER 2014

The historical Malacca City, with records dating back to the 14th century and now sits numerous historical monuments, is a UNESCO World Heritage Site since 2008. The Christ Church, Malacca is one of the oldest Protestant churches in Malaysia. By using bricks shipped from the then Dutch Republic, the church's construction began in 1741 by the Dutch Empire to commemorate the Empire's 100 years of capturing Malacca from the Portuguese in 1641. Its porch and vestry were constructed in the mid of 19th century after the takeover of Malacca by the British Empire in 1824. Photo credit: Christopher Chan/flickr

2nd International Symposium on Insects (ISoI 2014)
1st – 3rd December 2014, Bayview Hotel, Melaka
More info: http://entoma.net/Event%202014.html

International Health Conference IIUM (IHCI) 2014
3rd – 4th December 2014, Kuantan, Pahang
More info: http://www.iium.edu.my/ihci/

3rd International Conference on Computer Engineering and Mathematical Sciences
4th – 5th December 2014, Aseania Resort & Spa, Langkawi
More info: http://www.iccems.com/cms/page.php?id=11

2014 IEEE Conference on Biomedical Engineering and Sciences (IECBES 2014)
8th – 10th December 2014, Meritz Hotel, Miri, Sarawak
More info: http://www.myembs.org/conferences.php?p=21

2014 3rd International Conference on Life Science and Engineering (ICLSE 2014)
13th – 14th December 2014, Hotel Royal, Kuala Lumpur
More info: http://www.iclse.org/

The International Association for the Study of Traditional Environments (IASTE)
14th – 17th December 2014, The PARKROYAL Hotel, Kuala Lumpur
More info: http://iaste.berkeley.edu/conferences/105.html

International Conference of Global Network for Innovative Technology (IGNITE-2014)
15th – 16th December 2014, TUT-USM Technology Collaboration Centre, Penang
More info: http://www.cedec.usm.my/ignite/

Energy and Sustainability 2014
16th – 18th December 2014, Putrajaya
More info: http://www.wessex.ac.uk/energy2014

3rd International Conference on Advances in Engineering & Technology (ICAET)
26th – 27th December 2014, Dynasty Hotel, Kuala Lumpur
More info: http://goo.gl/nCdBt2

SCIENCE@MALAYSIA

CONFERENCE FOR NATIONAL SCIENTIFIC ENGAGEMENT

22 NOV 2014 | UNIVERSITY OF OXFORD, UK



OVERVIEW

Science@Malaysia is a scientific conference co-organised by the Oxford University Malaysia Club and Scientific Malaysian. The conference consists of a series of panel discussions to be held at the Examination Schools, University of Oxford, United Kingdom.

AIMS/OBJECTIVES

- To highlight the efforts by the Malaysian government in advancing science and technology in the nation
- To highlight career opportunities in the field of science and technology in Malaysia (in academia, industry or governmental agencies)
- To provide a platform for Malaysian scientific communities abroad to provide their input towards nation building and other ways for them to contribute to the nation from abroad
- To promote research collaborations and knowledge-sharing among the scientific communities in Malaysia and abroad
- To inspire and provide guidance to early stage researchers

TARGET PARTICIPANTS

- Malaysian scientists abroad, particularly in the UK and Europe
- Malaysian undergraduate and postgraduate students in the UK and Europe
- Non-Malaysians interested in working in the field of science and technology in Malaysia

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For more information (including how to participate via live streaming), please visit our conference website at http://conference2014.scientificmalaysian.com.

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EXAMINATION SCHOOL, UNIVERSITY OF OXFORD

KEYNOTE SPEAKERS

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Scientific Advisor to the
Prime Minister of Malaysia

Professor Robin Grimes,
UK Foreign & Commonwealth Office
(FCO) Chief Scientific Advisor

CONFIRMED SPEAKERS

President of the Academy of Sciences Malaysia

Director of International Council for Science

President and CEO of Malaysia Industry-Government Group for High Technology

General Manager of TalentCorp (Malaysian Diaspora Outreach)

Dean of the Faculty of Science, University of Nottingham Malaysia

Head of the Department of Materials, University of Oxford

Research Coordinator of Universiti Malaya High Impact Research

Maître de conférences (Physics) at Université Paris-Sud, France

CEO of Malaysian Technology Development Corporation

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Have ideas on how developed and developing countries can work together to improve science and technology?

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Allergies and What We Need to Know About Them

by Sharrada Subramaniam

How often do you suffer from an annoying runny nose, sneezing, watery eyes, or hives on your skin? The common cold shares many similar symptoms; however, what goes unnoticed very often is the underlying allergy. An allergy is a disorder of the immune system whereby the body overreacts to the allergen (substance causing the allergy).

An allergen could be an airborne particle (*e.g.*, house dust mites or pollen), a food allergen (commonly peanuts, milk or seafood), and other proteins such as natural rubber latex, animal dander, toxins from insect stings or drugs (*e.g.*, penicillin or aspirin).

An allergic response can range anywhere from being mild and hardly noticeable, to dangerous and life threatening. Common allergic symptoms include sneezing, watery eyes and itching, while severe allergic responses can lead to breathing difficulties (asthma) due to narrowing of the airways or excess mucus production. The most severe, often life threatening, form of an allergy is anaphylaxis, which leads to a systemic response affecting major body systems.

Worldwide statistics from the American Academy of Allergy, Asthma, and Immunology (AAAAI) show that up to 40% of the world population is sensitised to foreign antigens, while 10-30% of the population amounting to hundreds of millions of people are affected by allergic rhinitis [1,2]. Three hundred million others suffer from asthma [1]. For the last 50 years, the prevalence of allergies has shown an increasing trend [1].

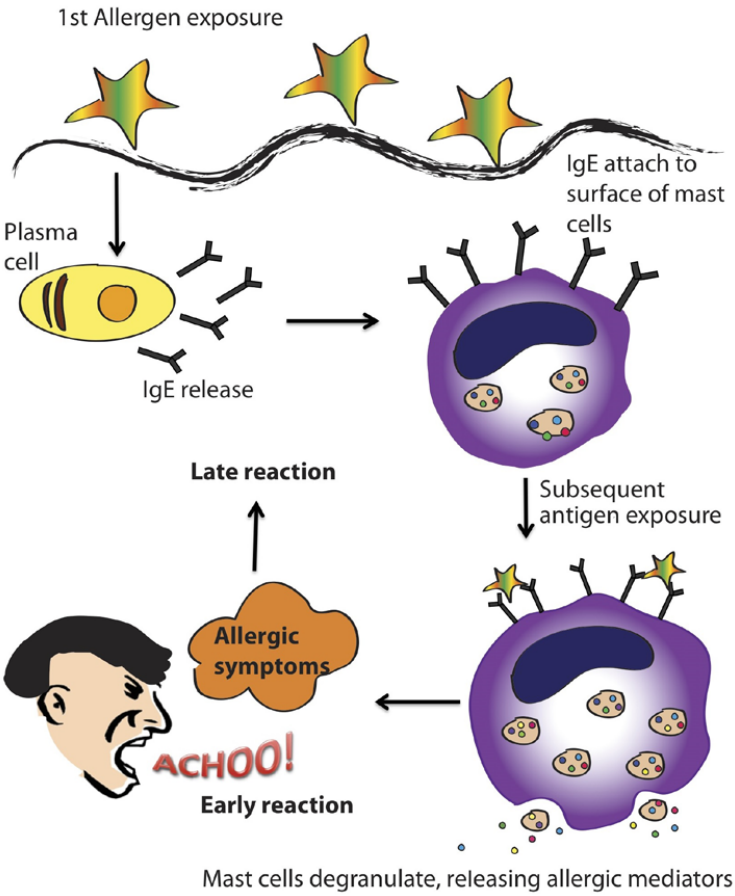


Figure 1: Allergen exposure causes secretion of IgE. This leads to the release of allergic mediators (e.g., histamine), causing allergic symptoms that can occur within seconds to minutes or hours. Constant exposure to the allergen could lead to chronic allergic reaction. Illustration by Sharrada Subramaniam.

Risk factors and causes

In Malaysia, we are frequently exposed to dust mites, pollen, and spores. While many of us are immune to these harmless allergens, they trigger an allergic reaction in others. It is not fully understood why some people respond to the allergens, but not others, although genetics and environmental factors may play a role.

The genetic predisposition to have an allergic disease is 70% if an identical twin has it, and 40% for non-identical twins [3]. Early contact with airborne allergens could cause atopic disease later in life [4].

Atopy is a condition whereby individuals are more likely to develop an allergic response to allergens. Atopic individuals have a higher level of serum immunoglobulin E (IgE) antibody compared to healthy people. Genetic studies have identified candidate genes and gene cluster patterns that might explain these differences.

Some allergies are present from a young age while others can develop over time. Overexposure to an allergen for a prolonged period of time can lead to a process of sensitisation to the allergen. Children who grow up being near to cats and dogs whose dander is a common cause of allergies are at a higher risk of

developing an atopic allergy [5]. Hence, environmental factors play a pivotal role in allergic diseases.

More than two decades ago, an epidemiological study proposed the "Hygiene Hypothesis" which suggested that the occurrence of hay fever in a family with children was inversely proportional to the household size [6]. Children who were exposed to dirtier living conditions when they were young were less likely to develop certain allergies when they were older. Instead, children who contracted fewer childhood infections may have an inefficient maturation of the immune system and may be more susceptible to allergies [7]. Different versions of this hypothesis were formulated years later, pointing to the link between the lack of early exposure to parasites and other microorganisms and the likelihood of allergic diseases.

The main player in the allergic response - IgE

First described in the 1960s by Kimishige Ishizika and colleagues [8], IgE belongs to a class of antibodies (proteins that are made when the body encounters a foreign antigen) together with other isotypes such as IgG, IgA, IgM and IgD. IgE, which is coincidentally the least abundant isotype in healthy humans, is the main player in the manifestation of an allergic response.

Why then do humans produce IgE antibody? There have been some suggestions that IgE have been evolutionarily produced for immunity against worm or parasitic infections in mammals, which used to be a severe problem in developing countries. Nonetheless, we still retain the ability to deal with a parasitic infection, and mount a defense reaction to eliminate the parasite. This beneficial role of IgE comes with a disadvantage: when IgE is released under non-threatening circumstances, the immune system recognises it as foreign, and thus, triggering allergic symptoms (Figure 1).

An acute allergic response is an immediate response to the allergen which can bring about a localised (*e.g.*, rhinorrhea, or eczema) or systemic reaction (*e.g.*, anaphylaxis). This early stage response stems from activated mast cells that release their contents leading to the various symptoms. The late phase allergic response, which happens hours later is due to the recruitment of specialist cells to the site of encounter with the antigen.

Diagnosis, treatment and prevention

Nowadays, a simple skin or blood test can often reveal the allergenic status of a person to common allergens or to confirm suspected allergens. A tiny amount of the antigen is placed on the skin or below it, and any signs of inflammation are observed. IgE levels can also be measured from blood samples.

The best way forward in allergy prevention is avoiding the antigen. Firstly, one needs to identify the allergen, which may prove more challenging if it is not a common allergy. Change of lifestyle can help avoid common allergic attacks. This may include using "allergen impermeable" covers on bedding, keeping humidity low and avoiding close proximity with cats or dogs in the early years [10].

It is also very important to be prepared for the symptoms that may appear and have the necessary precautions taken. For those with a risk of an anaphylactic shock, having handy a dose of adrenaline may save a life. It is equally important for asthmatic patients to have their inhalers with them at all times too.

While a number of treatment options are available, nearly all of them target the symptoms rather than the prevention of the allergy. Anti-histamines, anti-inflammatory drugs, bronchodilators as well as decongestants are among more commonly used prescriptions to relieve common allergic symptoms such as rhinitis, hives, and asthma attacks due to bronchial constriction.

"up to 40% of the world population is sensitised to foreign antigens, while 10-30% of the population amounting to hundreds of millions of people are affected by allergic rhinitis"

While scientists understand a lot about the production of IgE, as well as the cellular and molecular pathways involved, a complete understanding of this complicated "allergic response" is still lacking. New generation drugs are targeted to inhibit the production of IgE, rather than just alleviating the symptoms. Research in the field is faced with many limitations due to the scarcity of IgE, the rarest immunoglobulin isotype. Nonetheless, this is a hot topic in immunology today, as drugs which are able to inhibit IgE production could bring relief to millions of people worldwide.

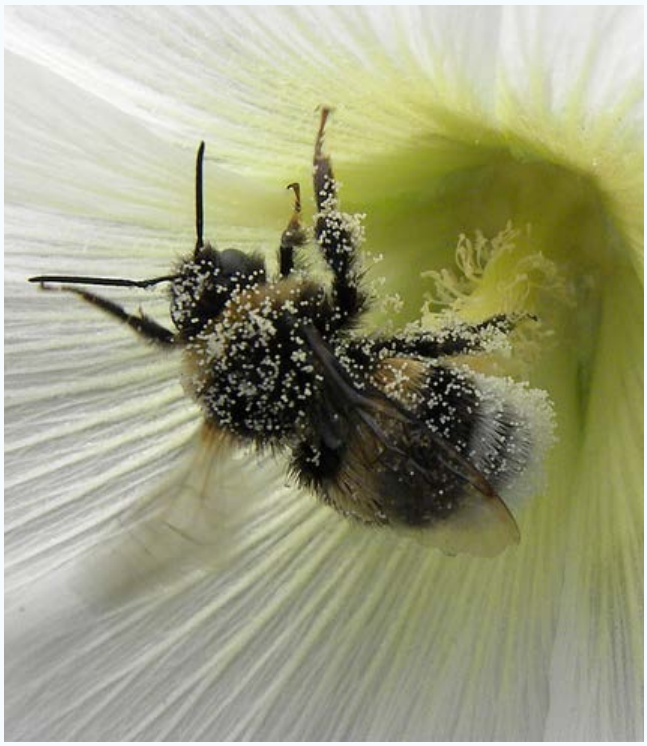
REFERENCES

[1] Pawankar et al. (2012) *World Health Organization*
[2] http://goo.gl/4wtFA
[3] Galli (2000) *Curr Biol*. 10:R93-R95
[4] Soothill et al. (1976) *Clin Allergy*. 6:305-319
[5] Warner et al. (1990) *Pediatr Allergy Immunol*. 1:79-86
[6] Strachan (1989) *BMJ*, 299:1259-1260
[7] Holt et al. (1999) *Nature*. 402:B12–B17
[8] Ishizaka et al. (1966) *J Immunol*, 97:75-85
[9] Janeway et al. (2001) *Immunobiology*, Garland Science.
[10] http://goo.gl/5DMSwD

ABOUT THE AUTHOR

SHARRADA SUBRAMANIAM is a final year A*STAR scholar at Singapore Immunology Network/NTU pursuing a PhD on the regulation of allergic diseases. Her work focuses on identifying and characterising the key players in an allergic response using murine models. She obtained her BSc (Hons) Biomedical Sciences at the University of Manchester, United Kingdom in 2010. Prior to that, she studied at Wesley Methodist School and Tunku Abdul Rahman college in Kuala Lumpur. Find out more about Sharrada at http://www.scientificmalaysian.com/members/sharrada/

ABOUT ALLERGY, DID YOU KNOW THAT...



Pictures of the common types of allergens (from left, clockwise): Pollen that could be spread by bees (nicolas_gent/flickr); House dust mites not visible to the naked eyes (GS Martin/flickr); Seafood (M Jones/flickr); Variety of nuts (S Blackmore/sciencefocus.com)

- **1 in 5** Malaysian children could develop allergies.
- **If both parents** have an allergic condition, their child may have a **50-80% risk** of having an allergic condition.
- **Allergic rhinitis** is the **most common** of all childhood allergies, causing runny nose, nasal blockage and sneezing.
- **Anaphylaxis or anaphylatic shock** is the most severe form of allergy affecting **0.05-2%** of world's population, with rapid onset and may cause death.
- **There are no known cures** for many types of allergies.
- **Malaysian Allergy Day 2014** was held in Kuala Lumpur on 14th June 2014.

Source: MedlinePlus (NIH); Malaysian Society of Allergy and Immunology (MSAI)

Q. Do you have any of the following symptoms for at least one hour on most days?

	Symptom	YES	NO
I.	Watery runny nose	☐	☐
II.	Sneezing, especially violent & repetitively	☐	☐
III.	Nasal obstruction / Nose block	☐	☐
IV.	Nasal itching / Nose itching	☐	☐
V.	Conjunctivitis (red, itchy eyes)	☐	☐

If you have answered YES to one or more, you probably have AR. Talk to your healthcare professional.

AR: allergic rhinitis; Adapted from "Allergy Self-Test", MSAI, www.allergymsai.org

Why Consumption of Dietary Antioxidant Supplements May Not Work?

by Chang Sui Kiat

There have been accumulating evidences that suggest the consumption of large doses of dietary antioxidant supplements does not have significant medicinal effect and could be harmful in some cases. This is because the effect of free radicals in the development of various chronic diseases is still unclear. Furthermore, the natural antioxidant capacity and the immune system of the human body could counteract the actions of dietary antioxidants. The dosage of antioxidant in dietary supplements may also be inappropriate. The consumption of food naturally rich in antioxidants, such as fruits, vegetables and grains should be promoted instead of the consumption of dietary supplements.

Antioxidant supplementation, either in tablets or in food per se, is based on the notion that reactive oxygen species (ROS) and other free radicals contribute to many human diseases by causing oxidative damage, and that decreasing oxidative damage will help to prevent those diseases [1]. Therefore, the notion that 'antioxidant is good - the more antioxidants we take, the better our health will be' is common among the general public. The supplements and nutraceutical industries use these concepts to market their products, often portraying them as safe, health-providing molecules to be eaten as mega-dose supplements. Hence, antioxidant-enriched food, drinks (typically rich in sugars and colouring agents), cosmetics and supplements are being advertised extensively.

"Over-consumption of antioxidants may down-regulate important endogenous antioxidants and depress parts of the immune system"

Scientists are now baffled by latest research findings advising against routine consumption of antioxidant or dietary supplements. Numerous clinical trials showed no beneficial effect of multivitamin or multi-mineral supplements, folic acid and vitamin B supplements on all-cause mortality, cancer, cardiovascular diseases and cognitive impairment [2-5]. Moreover, it was found that β-carotene, vitamin E and vitamin A supplements may be associated with higher all-cause mortality [6]. This happens because β-carotene, vitamin E and vitamin A may exert pro-oxidant activities in human body, especially when consumed in large doses [7]. Furthermore, most supplements do not prevent non-communicable diseases (NCDs) or death [8]. This statement is especially true for healthy general population with no obvious evidence of nutrient deficiencies [7, 9, 10]. Therefore, consumption of antioxidant supplements appears to be redundant.

The general public has the perception that free radicals or ROS are bad due to their association with ageing, cancer and neurodegenerative diseases e.g., dementia and Alzheimer's disease. Three factors have been proposed to explain on the lack of beneficial effects of antioxidants in humans.

(i) Moderate levels of ROS are essential for health

A common misconception from the general public is that free radicals or ROS are bad, whereas antioxidants must be good. Indeed, ROS are bad as they contribute to ageing, cancer and neurodegenerative diseases such as dementia and Alzheimer's disease [7, 9, 10]. There are several reasons why these antioxidants fail to show benefits in humans.

Firstly, ROS may not be the main causes in some NCDs. We have a well-balanced pool of ROS and antioxidants that allows some ROS to perform their useful physiological functions while minimising oxidative damage (Figure 1). This can be exemplified by the role of ROS in killing pathogens as part of the human innate immune system [10, 11]. In addition, it has been reported that stem cells need some ROS to function properly, but excessive amount of ROS can impair their function [12].

The overall antioxidant defense in our body depends heavily on endogenously-synthesised antioxidant enzymes such as reduced glutathione (GSH), catalase and superoxide dismutase (SOD) instead of diet-derived antioxidants (Figure 1) [10, 11]. Therefore, it will be more effective if the antioxidant defense system is stimulated with some weak or mild pro-oxidants or ROS, which will in turn stimulate the level of our own antioxidants, such as GSH to fight infections [1,

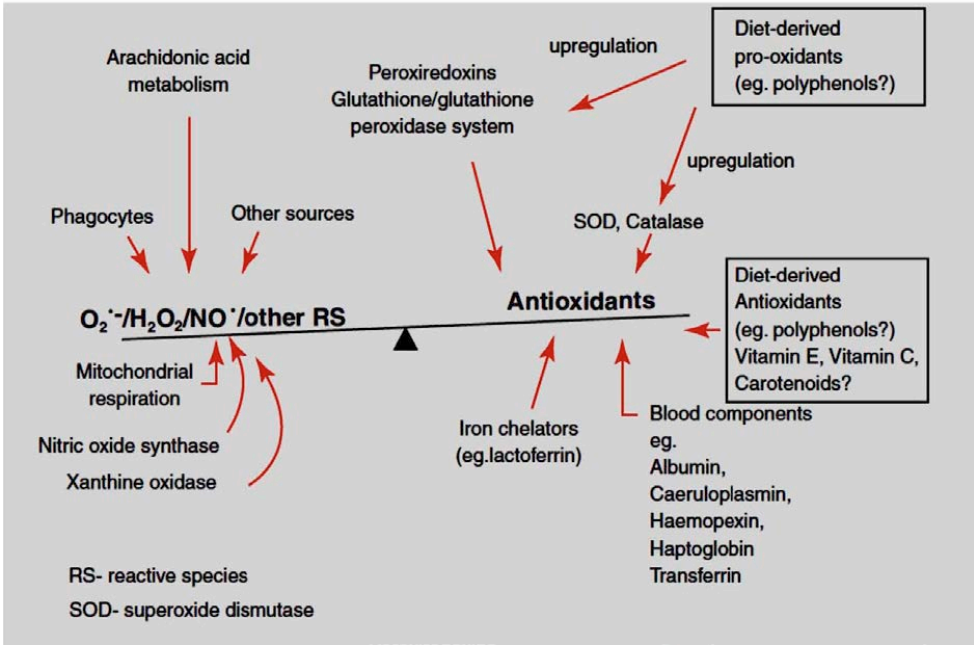


Figure 1: Balance of antioxidants and reactive species (RS) in vivo. Adapted from [12] with permission from Elsevier.

7, 9]. In relation to that, ROS is the culprit for the development of cancer although ROS also exhibits anti-cancer effects [13]. In the same vein, exercise is well known to be beneficial for humans because it is a mild pro-oxidant challenge that stimulates beneficial adaptation in skeletal muscles [14].

Therefore, basal levels of pro-oxidants could be better for our health than huge amounts of antioxidants. Over-consumption of antioxidants may down-regulate important endogenous antioxidants and depress parts of the immune system or the normal cellular protective responses to oxidative stress.

(ii) Physiological sensitivity to dietary antioxidant
It is possible that only patients with high levels of oxidative damage or those whose diet and lifestyle are in poor conditions will respond to antioxidant supplementation [11]. It is also important to note that those antioxidants are more efficient in decreasing oxidative damage in animal models like mice or rabbits than in human patients [1, 9-11]. It seems that human antioxidant defense system resists modulation by dietary antioxidants, while the laboratory rats and rabbits appear more sensitive to administered dietary antioxidants.

(iii) Doses of dietary antioxidant matter
Thirdly, the doses of administered dietary antioxidant may be incorrect. The dosages of nutrients in the form of supplements often exceeded the recommended daily allowances (RDA) [15]. There is evidence that lower doses and/or mixtures of antioxidants demonstrated more benefits than higher doses of single agents [10]. For example, consumption of foods rich in vitamin C was shown to decrease oxidative damage physiologically whereas the intake of vitamin C alone did not [16].

Antioxidants from organic sources
Consumption of fruits, vegetables and grains help maintain good health and delay disease occurrence. The intake of 3-5 servings of fruits and vegetables daily would protect against NCDs like heart disease, cancer and diabetes. This happens because fruits and vegetables are chemically complex, where the health benefits could arise from the additive effects of many compounds or mixtures of components present, including vitamins, minerals, fibre, phenolic compounds and flavonoids [15, 16, 18]. This mechanism is called synergistic actions where nothing happens in isolation in complex biological systems [7].

Isolating individual nutrients making them into quantity for human consumption to imitate the nutritional benefits from whole foods might not be a good idea after all. This is because the isolated nutrient may either lose its bioactivity or may not behave the same way as the same compound in whole food [18]. More importantly, plant foods like fruits and vegetables are low in 'calories', the term of which the people is most concerned about. So, why not take more fruits and vegetables for our good health?

An understanding of why dietary antioxidant supplements do not completely benefit human health remains a target of research in the scientific field. In conclusion, **consumption of natural foods containing antioxidants, such as fruits, vegetables and grains, coupled with regular exercise are suffice to maintain good health and prevent the onset of NCDs.**

Note: Find out more about various types of dietary supplements on http://fnic.nal.usda.gov/dietary-supplements, the website of Food and Nutrition Information Center, USDA.

REFERENCES

[1] Halliwell (2012) *Nutr Rev* 70:257-265
[2] Briancon et al. (2011) *Intl J Epidemiology* 40:1605-1616
[3] Fortmann et al. (2013) *Ann Intern Med* 159:824-834
[4] Kesse-Guyot et al. (2011) *Am J Clin Nutr* 94:892-899
[5] Lamas et al. (2013) *Ann Intern Med* 159:797-804
[6] Bjelakovic et al. (2013) *J Am Med Assoc* 310:1178-1179
[7] Halliwell (2009) *Free Radical Bio Med* 46:531-542
[8] Gahche et al. (2011) *Natl Center for Health Statistics*
[9] Halliwell (2012) *Brit J Clin Pharmaco* 75:637-644
[10] Halliwell (2011) *Trends Pharmacol Sci* 32:125-130
[11] Gutteridge et al. (2010) *Biochem Bioph Res Co* 393:561-564
[12] Juntilla et al. (2010) *Blood* 115:4030-4038
[13] Halliwell (2007) *Biochem J* 401:1-11
[14] Jackson (2011) *Antioxid Redox Signal* 15:2477-2486
[15] USDA & HHS (2010) *Dietary Guidelines for Americans*
[16] Halliwell et al. (2005) *Am J Clin Nutr* 81:268S-276S
[17] John et al. (2002) *Lancet* 359:1969-1974
[18] Liu (2003) *Am J Clin Nutr* 78:517S-520S

ABOUT THE AUTHOR

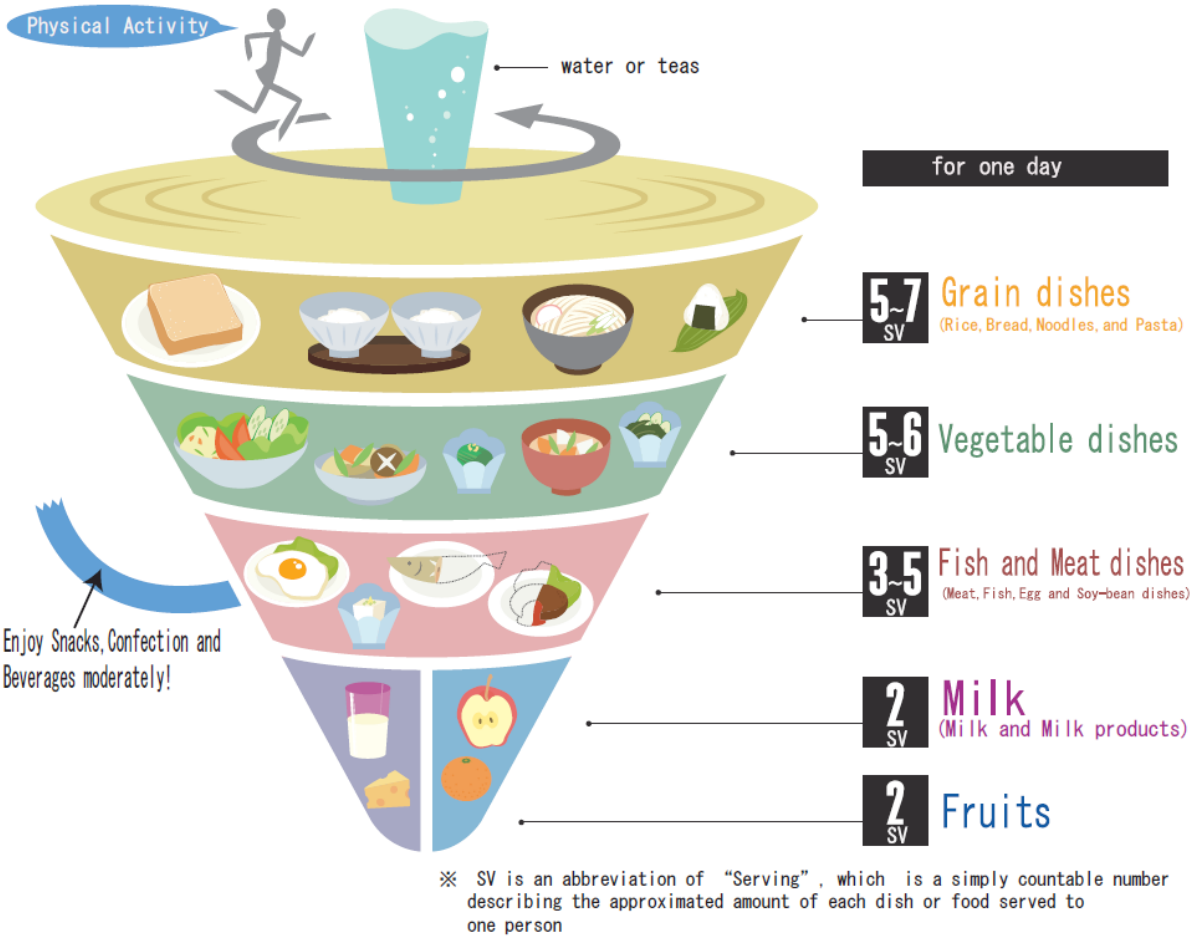
CHANG SUI KIAT (SHAWN) is a PhD candidate (Nutritional Sciences) who have submitted his PhD thesis under the sponsorship of *Biasiswa Yang Di-Pertuan Agong*. His research interests include bioactive food components and nutritive qualities of food that advance and impact the understanding of human health. As a graduate nutritionist and a life member of Nutrition Society of Malaysia (NSM), he is involved in the health promotion and screening programs, such as Nutrition Month of Malaysia and World Digestive Health Day organised by NSM and Ministry of Health annually. Find out more about Sui Kiat at http://www.scientificmalaysian.com/members/suikiatchang/

FACTS & FIGURES

In 2014, Japanese was listed at the top of the overall life expectancy (84.6 years old) worldwide according to World Health Organization. Earlier this year, Office for National Statistics (UK) reported that Japanese diet rich in vegetables, green tea and raw fish as some of the keys to longevity.

Photo: Ashalboldsky.com

The *Japanese Food Guide Spinning Top* was introduced in 2005 by the Japanese Ministry of Health, Labor, and Welfare and the Ministry of Agriculture, Forestry, and Fishery to promote healthy diet as follows (*Source: www.mhlw.go.jp*):



Patterns and Measurements in Biomedical Engineering

by Associate Professor Dr. Ibrahima Faye

Pattern recognition and objective measurement techniques in biomedical engineering are used to solve practical problems in medicine. The following examples (fruit classification and measurement) explain the concepts of pattern recognition and objective measurement techniques.

Biomedical engineering is a multidisciplinary field with special focus in improving human health. Biomedical engineers construct diagnostic tools and devices used by medical practitioners. For this reason, biomedical engineering incorporates approaches from different research fields (*e.g.*, engineering, mathematics, physics, computer sciences) to come up with practical solutions with minimal constraints from high cost as well as ethical and pain complications.

Pattern recognition and objective measurements are two expressions that can be used to illustrate how biomedical engineering could be applied in medicine. Differentiating between normal and abnormal situations is a fundamental step in medicine. For instance, various pattern recognition techniques are used to detect cancer in breast, lung, skin, etc.

In the same vein, an objective measurement that statistically explains pattern differences helps medical doctors to assess severity of disease and decide appropriate treatments. An effective objective measurement could solve the problem of assessment difference from different doctors (inter-variability), and from a doctor at different times (intra-variability).

FEATURES FOR CLASSIFICATION OF PATTERNS

Fruit Pattern

Consider a bag containing apples and oranges, and one fruit is to be removed from the bag. For each fruit selected from the bag, without seeing it, we need to determine whether it is an orange or an apple based on a given criteria or feature. From the shape and the skin texture, we are able to classify the fruit as apple or orange. Thus, we would say the shape and the skin texture are good features, *i.e.*, features that can be used to differentiate between apples and oranges in the bag. If the weights of oranges and apples are in the same range, however, then we may not be able to classify the fruits correctly. In this case, we would say that the weight is not an optimal feature to distinguish between oranges and apples.

As fruit weight may not be a good identifying feature, we can further use a transformed feature of the fruits as part of the identification process. If each selected fruit is pressed (*i.e.*, 'transformed') into juice, the taste of the juice and the texture of the pulp allow us to differentiate between oranges and apples. Pattern recognition is an important technique in detection

One of the active areas for biomedical research is the development of 'brain-computer interface' (BCI), a communication pathway between the brain and a computer. Brain waves registered by electrode helmet are analysed by a computer (Photo: Ars Electronica/flickr). It is possible to operate a computer or write texts by just thinking about them through BCI technology.

of breast cancer. The standard diagnostic method is analysis of mammogram images obtained from X-rays. For each patient, two images are obtained for each breast. Radiologists will examine the images to detect any sign of abnormality. The work can be tedious especially in screening programs where a large number of images have to be examined. Computerised system is needed to assist radiologists to identify suspicious mammograms or areas of mammograms where radiologists could focus on.

The main objective of a computer-aided system is to identify abnormality, and finding good features (characteristics) will be the key for this task. Good features are those that are able to differentiate normal from abnormal images using mathematical and statistical features (*e.g.*, mean, standard deviation).

As mentioned previously, the fruits could be differentiated after a transformation. For mammogram images, such transformations are translated into mathematical functions such as Fourier and Wavelet transformations, which allow us to visualise the functions in different dimensions. An image is a mathematical function whereby each point in the image (pixel) corresponds to a grey-level value representing the intensity. Such transformations are useful in feature differentiation.

Fruit colours

Consider a scenario where we have to estimate the percentage of yellow parts in red apples. For such a visual-based estimation, different people may give different percentages for the same apple; inter-variability (different percentages given by different people) and intra-variability (different percentages given by the same person) are inevitable owing to the subjectivity of the task.

Thus, an objective optical measurement could be used to scan a fruit and assign a specific colour to each pixel based on a specified rule that is common to all examined fruits. Such an objective measurement of colour percentage not only solves the problem of variability, but also reduces assessment time especially if there is a large number of fruits to be examined.

Estimating the healing of an ulcer wound is a challenging task. For chronic ulcers, the healing process can be very long and medical doctors need to assess the effects of prescribed medicines. Because of the pain, a non-invasive method is preferred. An assessment based on doctors' observation is usually subjected to inter- and intra-variability.

After the wound is treated with a medication for a period of time, the rate of healing needs to be determined based on the volume of wound that has recovered. Volume estimation can be challenging, as it depends on the shape of the organ where the wound is situated. An objective measure obtained using a 3D camera can thus be used, and algorithms can be developed to estimate the recovered volume, and hence, the overall healing.

"Computerised system is needed to assist radiologists to identify suspicious mammograms or areas of mammograms where radiologists could focus on"

Similarly, estimation of acne severity is subjective when it is based on visual observation. The assessment for acne includes counting of the number of pimples, their sizes and also the colour. For an objective assessment, a segmentation of the face image is needed. The face is subdivided in regions, which consist of pimple, and non-pimple regions. The first stage of evaluation involves the counting of the number of pimples as well as the estimation of the sizes.

The second stage consists of classification of the pimples depending on their colours. Each pixel in a pimple region can be represented by its content in terms of the three primary colours: Red Blue Green (RGB). A pimple region will then be assigned to a class based on its colour distribution of RGB.

As for conclusion, pattern recognition is used to differentiate between normal and abnormal cases in biomedical applications. For objective measurement technique, there should be very minor differences in the measurements of an object by different operators or the same operator at different times. Finally, finding practical and viable solutions in medicine is a challenging task; an optimal combination of different expertise is the key for developing the right tools.

ABOUT THE AUTHOR

DR. IBRAHIMA FAYE is an Associate Professor at Universiti Teknologi PETRONAS, Tronoh, Malaysia. He is based at the Department of Fundamental and Applied Sciences and the Centre for Intelligent Signal and Imaging Research (CISIR). His BSc, MSc and PhD degrees in Mathematics are from University of Toulouse, France, while his MS degree in Engineering of Medical and Biotechnological data is from Ecole Centrale Paris, France. His research interests include Engineering Mathematics, Signal and Image Processing, Pattern Recognition, and Dynamical Systems. Find out more about Ibrahima at http://www.scientificmalaysian.com/members/ibrahimafaye/

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Photo: *www.lumaxart.com/Flickr*

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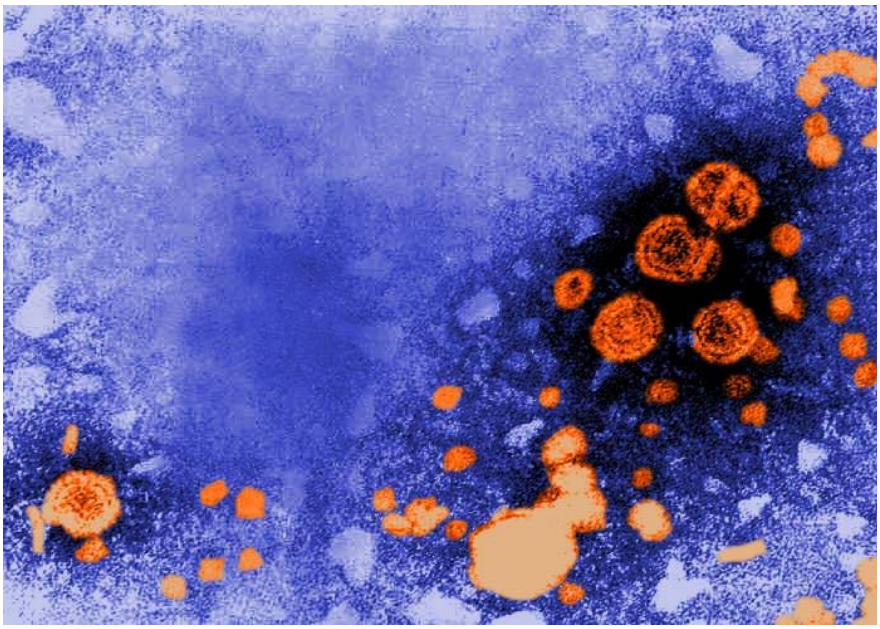
Introduction to Chronic Hepatitis

by Abraham Mathew Saji

Hepatitis, or commonly known as inflammation of the liver, is a silent killer that shows up late in its lifecycle. It can be caused by viruses, lifestyle, medication and/or inherited metabolic disorders. When infected for a prolonged duration, it is referred to as chronic hepatitis which can lead to liver cirrhosis, followed by liver cancer. Depending on the severity, hepatitis manifests itself with varying symptoms, which can provide valuable leads into an appropriate diagnosis and treatment regimen. Like all other ailments, there are means and methods to prevent hepatitis.



Hepatitis B virions digitally-colorised transmission electron micrograph (TEM). The large round virions are known as 'Dane particles'. Photo and description: Microbe World & Dr. E Palmer/flickr

What Is Hepatitis?

Hepatitis is an inflammation of the liver. In chronic hepatitis, liver inflammation continues for at least six months. This condition may be mild and result in relatively little damage, or may be more serious, causing resulting in destruction of many liver cells. Some severe cases lead to cirrhosis[1] and eventually liver failure.

Viruses are the most common cause of hepatitis (according to the "World Health Organization, Hepatitis" report dated 25 November 2013). Viruses that cause hepatitis include:

- *Hepatitis B and C:* These viruses cause two-thirds of all cases of chronic hepatitis. Both these viruses usually begin with mild symptoms. Over time, perhaps a decade or more, both may lead to serious complication of cirrhosis due to ongoing destruction of liver cells and resultant scarring, eventually leading to liver cancer.

- *Hepatitis D:* Infects only patients already infected with hepatitis B, and it generally results in a flare of active hepatitis.

These viruses are primarily passed from one person to another through sexual contact, blood or other body fluids during blood transfusions or using shared needles. Treatment for some types of viral chronic hepatitis can eliminate active infection. However, the virus can remain dormant in cells, causing a recurrence of liver inflammation when the infection gets active. The common diagnosed causes of non-infectious chronic hepatitis include:

- *Alcohol:* Considered to be the main cause of non-infectious chronic hepatitis. Also, even moderate intake of alcohol can worsen pre-existing chronic hepatitis (especially hepatitis C), with an increased risk of advancing to cirrhosis.

- *Non-alcoholic steatohepatitis (NASH):* NASH has become a relatively common cause of persistent liver inflammation. "Steato" means fat and the hallmark of NASH is fat accumulation in the liver and active on-going liver damage. Most people do not display symptoms. Asymptomatic patients are usually discovered when a routine blood test is performed and the level of liver enzymes are found to be elevated.

- *Autoimmune hepatitis:* In this form of chronic hepatitis, the immune system mistakenly destroys the body's own liver cells. What triggers autoimmune chronic hepatitis is unknown. If left untreated, it can lead to cirrhosis. It may occur in autoimmune diseases such as Sjögren's syndrome[2] and autoimmune hemolytic anaemia.

[1]Cirrhosis is a chronic liver disease marked by cellular degeneration, inflammation, and thickening of fibrous tissue. The latter leads to scarring of the liver; [2]Sjögren's syndrome is a chronic autoimmune condition characterized by degeneration of the salivary and lachrymal glands, which results in dryness of the mouth and eyes.

Some medications can also lead to chronic hepatitis. These medications include:

- Isoniazid for tuberculosis.
- Methyldopa for hypertension.
- Phenytoin for seizure disorders.
- Nitrofurantoin for urinary tract infections.

However, chronic hepatitis caused by medications is relatively uncommon. Periodic blood tests are warranted when patients are placed on drugs known to cause hepatitis. Discontinuing the medication usually reverses early liver inflammation.

Several rare inherited metabolic disorders also can lead to chronic hepatitis. They include:

- Wilson's disease, a condition in which the body has difficulty in metabolizing copper.
- Haemochromatosis, a condition of excessive iron deposits in the liver and other parts of the body.

Symptoms

At first, chronic hepatitis often does not display any symptoms. People with symptoms most commonly complain of fatigue. Fatigue worsens throughout the day and may even be debilitating. Other common symptoms include:

- Mild upper abdominal discomfort
- Loss of appetite
- Nausea
- Body aches

If chronic hepatitis becomes more severe, people may experience additional symptoms, including:

- Jaundice (yellowing of the skin and eyes)
- Abdominal swelling
- Weight loss
- Muscle weakness
- Dark urine
- Easy bruisability and spontaneous bleeding

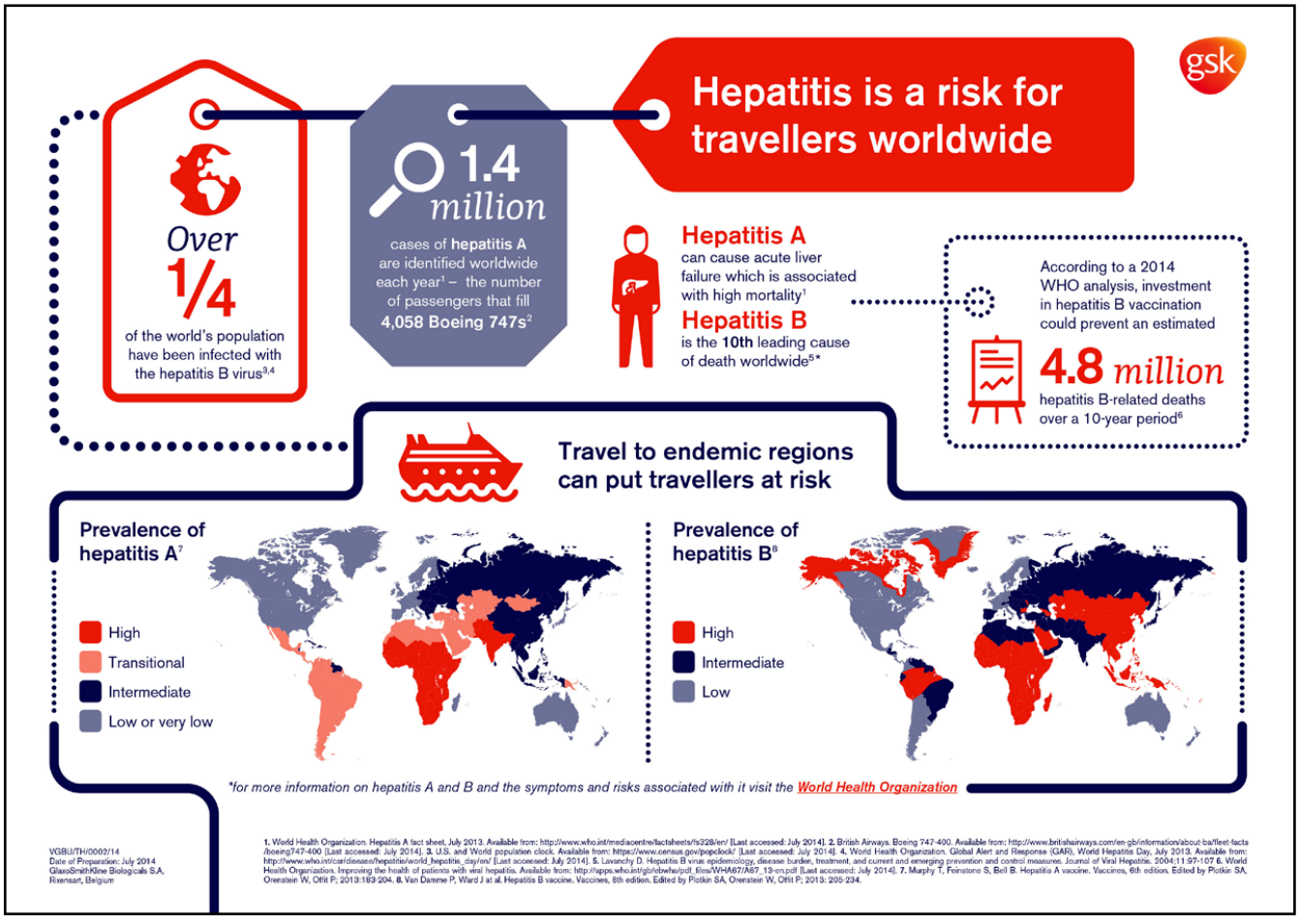
Diagnosis

Because chronic hepatitis often does not have any early symptoms, the disorder is frequently discovered during a routine blood test. If chronic hepatitis is suspected, the patient is usually examined for jaundice, tenderness in the abdomen (especially the right upper corner where the liver is located) and signs of fluid that fills the abdomen during liver failure.

Blood tests are done to measure the levels of:

- Liver enzymes, which are released when liver cells become inflamed or damaged
- Bile duct enzymes
- Bilirubin, a pigment produced by the breakdown of red blood cells. High level of bilirubin can cause jaundice.
- Protein and clotting factors to assess how the liver is functioning

If these tests show signs of liver inflammation or liver failure, further tests for hepatitis B and C as well as antibodies that signal autoimmune hepatitis are



Infographics: GSK/flickr

> "The best way to protect against chronic hepatitis is to protect against the viruses"

recommended. The suspected roles of medications taken concomitantly are also considered to determine the case, as long-term administration of some medication have adverse effects on the liver. If the cause is still unknown, further blood tests are performed to check for uncommon causes. An ultrasound or computed tomography (CT) test may be done to assess the size of the liver to assess the magnitude of liver damage. A small liver that appears shrunk and scarred is suspected to be cirrhosis.

In this case, a liver biopsy may be recommended. A small piece of tissue removed from the liver will be examined to determine:

- the cause of chronic hepatitis.
- the severity of inflammation.
- the amount of scarring.
- the extent and type of liver damage.

Information from biopsy examination can help to determine the best treatment and to assess the risk of developing cirrhosis and liver failure. A liver biopsy can also help to check for other disorders, such as alcoholic liver injury or fatty liver.

Prevention

The best way to protect against chronic hepatitis is to protect against the viruses. Vaccinations for hepatitis B are recommended for health care practitioners and people who travel to certain countries. Infants are now routinely vaccinated against hepatitis B.

Needles should never be shared. Avoid getting a tattoo or any body piercing done. If needed, ensure choice of an establishment where all equipment is sterilised adequately.

Non-alcoholic steatohepatitis (NASH) is commonly seen in people who are overweight, especially if they accumulate excessive fat around the midsection. Women with a waist circumference of ≥35 inches and men with a waist circumference of ≥40 inches are at high risk of developing this type of chronic hepatitis. Maintaining a healthy weight and regular exercise are keys to preventing NASH.

Regular blood tests are warranted when taking medications with potential to damage the liver to avoid development of chronic hepatitis.

Treatment

The treatment goals for chronic hepatitis are to prevent the disease from getting worse and to prevent cirrhosis and liver failure. In mild cases of chronic hepatitis from hepatitis B or C, treatment may not be necessary, and the condition may not get worse. With active infection, or if a liver biopsy shows early signs of damage, treatment is more likely to be recommended to eliminate active infection.

Viral hepatitis is treated with antiviral medications. Drugs used to treat hepatitis C include alpha interferon, ribavirin, boceprevir and telaprevir. For hepatitis B, the drugs used include lamivudine, adefovir, tenofovir and entecavir. Clinical trials are under way to determine the best treatment regimen to improve response and lower the chances of relapse of the disease.

Common side effects with antiviral medication include:

- Fatigue
- Muscle aches
- Headaches
- Nausea and vomiting
- Fevers
- Weight loss
- Irritability and depression

Treatment of alcoholic hepatitis is complete abstinence from alcohol.

People with NASH usually need to lose weight and exercise more. In addition, many people with NASH have elevated blood sugars and frequently progress to type 2 diabetes. Adopting a healthy low sugar diet and maintaining a good control of blood sugar can help to decrease the fatty accumulation and inflammation in the liver.

Corticosteroids and other medications, such as azathioprine, that suppress the immune system are the main treatment of autoimmune chronic hepatitis. These drugs usually decrease symptoms, reduce liver inflammation and prolong survival.

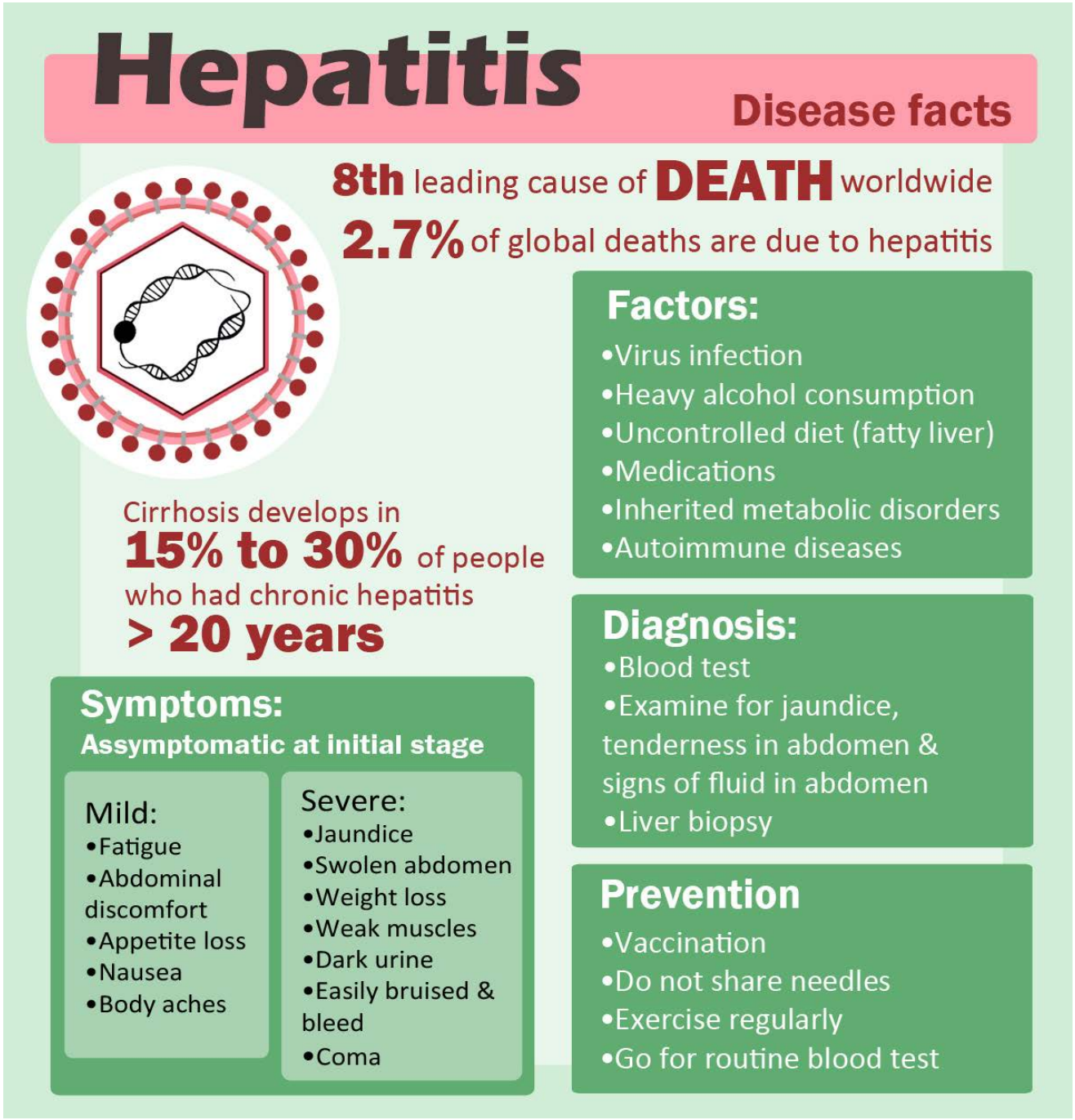
Treatment for the less common forms of chronic hepatitis focuses on the disease that is causing the condition. For example, medication-related chronic hepatitis requires stopping or changing the drug. If cirrhosis or liver failure develops, a liver transplant may be needed.

Supportive care is important in coping with chronic hepatitis. A well-balanced diet and good physical fitness can help battle fatigue and improve overall health.

Summary
The hepatitis causing viruses can progress slowly and silently within the liver to cause varying types and extents of liver damage. In its most severe stages, it can lead to cirrhosis, liver failure and death unless a liver transplant is done. Other factors that affect the prognosis include age, other medical illnesses, subtype of virus and alcohol use. The diagnosis would be aided by pathological and radiological tests, which can assist the medical practitioner to prescribe the appropriate dosage regimen of medications along with lifestyle changes.

ABOUT THE AUTHOR

ABRAHAM MATHEW SAJI is a pharmacist who engages extensively in research and development of modern medicine and its implications on the human body. He hold a Masters Degree in Pharmacy with 20 years of industrial experience in the field of Pharmaceutical Research and Development. He is actively involved in the formulation and development of various pharmaceutical dosage forms with a local pharmaceutical manufacturing company. He holds memberships with reputable international professional bodies. He is an ardent reader with a passion for writing. He works closely with medical and paramedical practitioners to get a better insight into certain areas before publishing articles on the subject of interest. Find out more about Abraham by visiting his Scientific Malaysian profile at http://www.scientificmalaysian.com/members/abraham/



Infographics by Kong Yink Heay

New Eyes on the Universe: The Square Kilometre Array

by Dr. Koay Jun Yi

The Square Kilometre Array (SKA) has been touted as the most ambitious scientific endeavour in human history. It will be a radio telescope made up of more than 3,000 individual antennas and dishes, spanning two continents. In a single day, the telescope could produce more data than the total daily Internet traffic worldwide. Its high sensitivity will allow us to peer into the distant Universe to observe the cosmic dawn – when the first stars, black holes and galaxies have just begun to form.

Of Lenses and Dishes

One instrument has completely revolutionised our understanding of the Universe and our place in it - the telescope. When Galileo, recorded as the first person to use a telescope to observe the heavens, first saw that Jupiter had its own moons, it was further evidence to him that not every heavenly body revolved around the Earth.

Since then, advances in science and technology have increased the capability of telescopes by enabling the construction of increasingly larger lenses or mirrors. Larger apertures lead to higher resolution (*i.e.*, ability to see finer detail) and better sensitivity (*i.e.*, ability to collect more light and thus see fainter objects). Telescopes sent to space circumvent the blurring effects of the Earth's atmosphere; the Hubble Space Telescope can observe infant galaxies close to 13 billion light years away.

Technological advances have also enabled us to see light that is invisible to the human eye. Infrared telescopes allow astronomers to peer through thick dust obscuring many galaxies as well as the centre of our own Milky Way Galaxy. X-ray and Gamma-ray telescopes collect light from the most energetic phenomena in the Universe, from black holes feeding on hot gas to the explosions of dying stars. Radio telescopes probe the leftover radiation from the Big Bang, and huge jets of particles launching out from regions surrounding supermassive black holes.

Figure 1: Artist's impression of the three different components that make up the SKA. The dishes (top) will observe at frequencies from 1-20 GHz, while the dense (middle) and sparse aperture arrays (bottom) will probe lower frequencies of 100s of MHz. Photo: Swinburne Astronomy Productions and SKA Organization.

Instead of mirrors and lenses, radio telescopes use dishes and antennas to detect these invisible signals from space. Radio astronomy has grown considerably since the 1940s, when it was largely ignored by mainstream astronomers and considered a domain for radar engineers who had too much time on their hands and didn't know what to do with all their antennas after the Second World War!

In fact, radio astronomy was founded by an engineer named Karl Jansky at Bell Labs (US). Jansky was tasked to investigate an unknown source of static noise detected by long-distance telecommunication antennas, which he found to originate from the centre of the Milky Way.

The advent of radio interferometry, the technique of combining signals from many separate antennas to simulate giant telescopes the size of entire continents, allowed radio telescopes to produce the sharpest ever images in all astronomy, probing objects with 10 times finer detail than the Hubble Space Telescope. To date, radio astronomy has been directly responsible for no less than four Nobel prizes in physics.

The Square Kilometre Array

A new golden age of radio astronomy beckons, with the planned construction of the largest telescope and scientific facility in the world – the Square Kilometre Array (SKA). The SKA is a scientific enterprise on the scale of the Large Hadron Collider, if not more ambitious. It is a truly global initiative, helmed by a consortium of 11 member countries, involving more than 100 institutions across 20 countries.

With a collecting area equivalent to one square kilometre, it will be the most sensitive radio telescope, capable of observing objects 50 times fainter than current instruments. To achieve such a high sensitivity, thousands of dishes and antennas will be deployed, spread across more than 3000 km. Now in the final stages of design, the plan is to begin construction in 2018 for early scientific observations in 2020.

Two core sites, where most of the antennas will be located, have been selected to host the SKA. One is the Murchison region in Western Australia, the other is the Karoo desert in South Africa. Some antenna stations will be placed in other sites in Australia and New Zealand, as well as in eight other African countries. An important criterion for the selection of these core sites was their radio quietness.

To probe faint signals from the distant Universe, radio telescopes have to be isolated as much as possible from man-made radio signals *e.g.*, TV/radio transmissions or mobile phone networks. A mobile phone, placed on the moon, could be one of the brightest objects in the sky at radio frequencies!

Cutting-Edge Science

There are five key questions scientists are looking for answers to with the SKA, which will significantly influence its design:

The Dark Ages and the Epoch of Reionisation: After the hot Big Bang, rapid expansion cooled the Universe sufficiently so that neutral hydrogen atoms could form out of protons and electrons. Since visible light is absorbed by neutral gas, and thus cannot travel far, the Universe was generally opaque during these 'Dark Ages'. When and how did the first stars, black holes and galaxies form to light up and re-ionise the Universe, turning it transparent again?

"It is critical to train up the next generation of astrophysicists who could fully utilise the SKA's capabilities, and there is no stopping Malaysians from being among them"

Galaxy Evolution, Cosmology and Dark Energy: What is this dark energy that causes the Universe to expand at an ever-increasing rate? How did galaxies form and evolve to how we observe them today?

Cosmic Magnetism: What roles do magnetic fields play in the formation and evolution of structures in the Universe? How did these large-scale magnetic fields form in the first place? The SKA will study imprints left by these magnetic fields on the radio waves that travel through them.

Extreme Tests of Einstein's Theories: Predicted by Einstein's theory of general relativity, gravitational waves are ripples in space-time, but have yet to be detected directly. The SKA will monitor an interstellar network of pulsars – the rapidly spinning cores of dead stars detected as regular radio pulses – which will function as very accurate clocks to detect these gravitational waves.

The Cradle of Life: The SKA will search for possible radio emissions generated by other extraterrestrial civilisations. It will also search for complex molecules that form the building blocks of life and determine how common they are in the Universe.

An Engineering and Technological Feat

Building the SKA and making it work will in itself be a feat of human ingenuity. The SKA is expected to generate an exabyte (10^{18}) of data in a single day, which is more than the total amount of data transmitted daily through the Internet worldwide today – no computers yet exist that are powerful enough to handle and process these vast amounts of data! The project will thus be a test-bed for supercomputing and large-scale data handling.

There are also plans for it to be a 'green telescope'; engineers are exploring alternate sources of energy to power the instrument. The new Pawsey Centre for SKA Computing in Perth, Australia, is already using geothermal solutions to cool its supercomputers. In the mean time, new antenna technologies and image processing techniques are being developed, to increase survey speeds, and improve the reliability of data.

It is hoped that the SKA will drive innovation leading to technological spin-offs that will eventually impact society in other ways. For example, many people may be unaware that all Wi-Fi devices we use today are dependent on a technique developed in the 1970's by radio astronomers who were trying to detect exploding black holes in space!

Opportunities for Malaysia and Malaysians?

Radio astronomy is still a fledgling field in Malaysia, though there are plans by the Radio Cosmology group in Universiti Malaya to construct a radio telescope that can be used in tandem with telescopes in Australia and East Asia. Perhaps, there could be a future SKA station in Malaysia? Do we dare to dream?

The key question, however, is whether Malaysian tax-payers are keen to fork out money for fundamental sciences like astrophysics and cosmology. In the meantime, opportunities are already opening up for passionate postgraduate students to be involved not just in the science but also in the engineering and computing aspects of the SKA.

Aspiring astrophysicists and engineers from Malaysia do not have to travel far, as one of the core sites of the SKA is situated in Western Australia, not more than 5.5 hour's flight from Kuala Lumpur. It is critical to train up the next generation of astrophysicists who could fully utilise the SKA's capabilities, and there is no stopping Malaysians from being among them.

Figure 2: Maintaining radio-quietness is essential if the SKA and other radio telescopes are to observe faint radio signals from space without interference from man-made signals. Photo: Western Australia Department of Commerce.

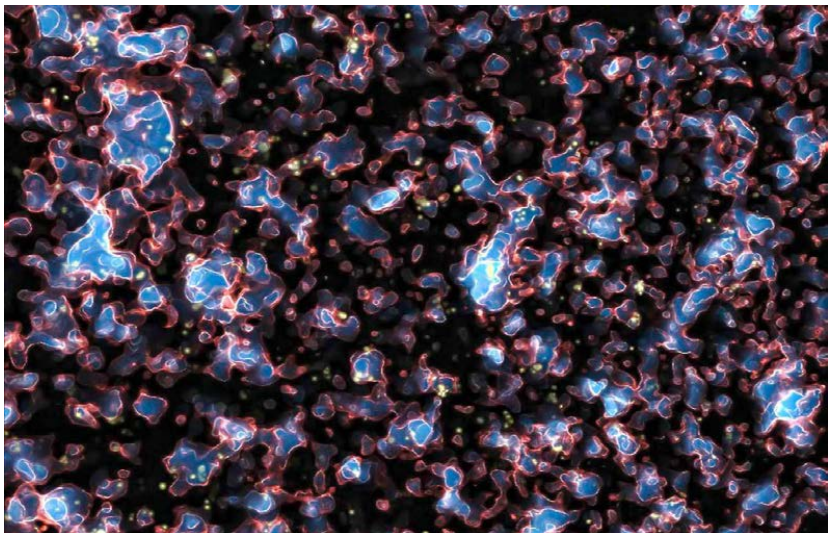


Figure 3: Simulations of the 'Epoch of Reionisation', when the first stars and galaxies formed to light up the Universe and create pockets of ionised gas that is transparent to visible light, in between neutral gas that absorbs light. Today, the Universe is almost 100% ionised. Image credits: Marcelo Alvarez, Tom Abel and Ralf Kaehler

For non-specialists, there are also ways to participate through citizen science projects. One example is theSkyNet, which allows volunteers to share a tiny fraction of the processing power of their laptops and personal computers to crunch radio astronomy data from existing telescopes (and SKA precursors in the near future).

The Story Continues…

The story of the telescope is one in which science and technology are closely intertwined. Advances in technology open up new avenues for exploring the Universe. If history is any indicator, it is inevitable that the SKA will make many unexpected discoveries that will further transform what we know about the Universe. We live in exciting times indeed!

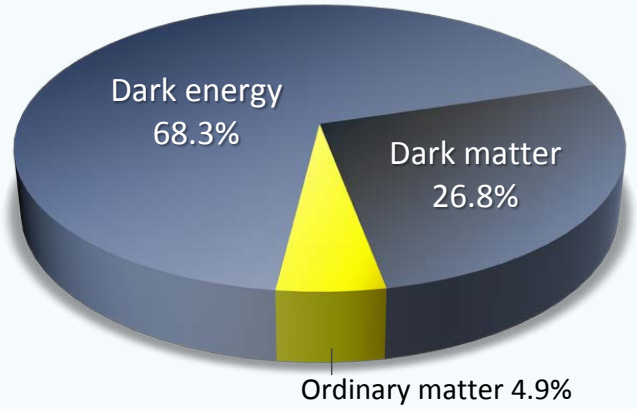
For more information on the SKA: https://www.skatelescope.org; http://www.ska.ac.za; http://www.ska.gov.au
Find out more about theSkyNet and to participate: https://www.theskynet.org

ABOUT THE AUTHOR

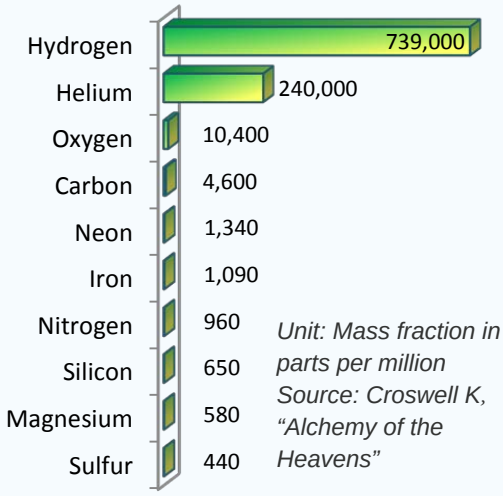
DR. KOAY JUN YI is an astrophysicist at the Dark Cosmology Centre, Niels Bohr Institute, University of Copenhagen. He obtained his PhD at the International Centre for Radio Astronomy Research (ICRAR), Curtin University in Perth, Australia, and a BEng (Hons) Electronics (majoring in telecommunications) from Multimedia University, Malaysia. His research involves studying the structure and growth of supermassive black holes in distant galaxies, and how they affect galaxy evolution by using mainly radio telescopes. He is also interested in exploring the next generation of radio telescopes such as the SKA. Find out more about Dr. Koay by visiting his Scientific Malaysian profile at http://www.scientificmalaysian.com/members/kevinkoay/

COMPONENTS OF THE UNIVERSE AND THE MILKY WAY GALAXY

Over 95% of the components of the Universe could not be seen or detected with any of our existing technology yet: the dark energy (hypothesised to permeate all of space and responsible for expansion of the Universe) and dark matter (hypothesised to account for gravitational effects).



Top 10 most abundant common element of the Milky Way Galaxy



Unit: Mass fraction in parts per million
Source: Croswell K, "Alchemy of the Heavens"

Embracing Responsible Care in Malaysian Chemical Industries

by Dr. Lee Khai Ern, Dr. Goh Choo Ta, Prof. Dato' Dr. Mazlin Mokhtar

Increasing chemicals manufacturing and usage need effective chemicals management. Responsible Care program is a voluntary initiative to drive continuous improvement in environmental, health and safety performances. It encourages companies to listen and respond to public concerns,to promote responsible management practices of chemicals along the product chain and to build confidence and trust in the chemical industries.

Illustration by Kong Yink Heay

Malaysia has transformed itself from an agriculture-based economy into an emerging industrial manufacturing entity since 1970s. The manufacturing industries have a substantial contribution to the Gross Domestic Product (GDP) in Malaysia especially when the Malaysian government initiated the Economic Transformation Programme (ETP) in 2010, attempting to realise its aspiration to become a high-income country by the year 2020. The manufacturing sector stands as one of the important National Key Economic Areas (NKEAs) proposed by the Economic Transformation Programme (ETP), not only as a source of economic growth, but also a manifestation to be a high income country.

Along with rapid growth in manufacturing sectors, Malaysia is also undertaking sustainable management practices to prevent detrimental effects of rapid industrialisation on the environment and human health. Improper management of chemical products can cause adverse impacts to the environment, human health and safety.

Back in 1984, an estimated 5,800 people were killed due to a major leak of deadly chemical methyl isocyanate in Bhopal, India. After Bhopal's incident, the chemical industries have gone through extensive reviews. William G. Simeral, former board chairman put up his remark in an annual meeting of the Chemical Manufacturers Association (CMA) that **"while the industry saw itself as a producer of high-tech jobs and exports, the public saw only leaking drums and hazardous waste sites- and that image meant trouble for the industry"** [1].

With the occurrence of more life-threatening chemical pollution, chemical industries realised that their industrial practices have a direct influence on the well-being of the society. Effective chemicals management emphasises a preventive approach from its formulation through its final disposal [2]. What has resulted is a tough set of self-imposed environmental standards that embraces responsible initiatives which makes an important contribution to opening up the chemical industries to public scrutiny, dialogue and accountability.

Shortly after Bhopal disaster, a detailed program called "Responsible Care" which promotes responsible initiatives has been initiated by Canadian Industry Association of Canada in 1985. Responsible Care is the global chemical industry's environmental, health and safety (EHS) initiative to drive continuous improvement in performance, technologies, processes

Code of management practices	Purpose
Distribution code	To reduce the potential for harm posed by the distribution of chemicals to the general public, employees and the environment.
Community awareness and emergency response code	To work with nearby communities to understand their concerns and to plan and practice for emergencies.
Pollution prevention code	To achieve ongoing reductions in the amount of all pollutants released into the environment
Process safety code	To prevent fires, explosions and accidental chemical releases.
Employee health and safety code	To protect and promote the health and safety of people working at or visiting company sites.
Product stewardship code	To make health, safety and environmental protection a priority in all stages of a product's life, from design to disposal.

Table 1: Codes of management practices of Responsible Care program in Malaysia.

"Malaysian chemical industries must possess practical, effective and responsible governance to attract more foreign investments"

and products over the life cycles to safeguard environment and human. This program is a voluntary initiative adopted by various chemical companies to promote good chemicals management as well as to continuously improve EHS performance in terms of their operations and products in a manner responsible to the concerns of the public.

In Malaysia, Responsible Care program was launched by Chemical Industries Council of Malaysia (CICM) in 1994. CICM is the steward of Responsible Care program and has developed 6 Codes of Management Practices which cover the EHS measures for the entire life-cycle of chemicals from initial research and development to ultimate disposal. These codes do not dictate how a company should operate but instead they are performance indicators that encourage commitment, innovation and continuous improvement. The codes of management practices are shown in Table 1.

However, to date, only 122 companies have pledged their commitment to Responsible Care program. Less than 10% of the signatory companies are Small Medium Enterprises (SMEs). The signatory companies are mainly Multi National Corporations (MNCs), bigger local companies which have better technology and more resources in implementing this program. The participation of the SMEs in Responsible Care program remains low.

The Malaysian chemical industries must possess practical, effective and responsible governance to attract more foreign investments. The chemical industries not only must fulfill its mission – to generate profit to satisfy the needs of the shareholders, but it must respond to the sustainable development challenge of profitability, social-economic, and EHS responsibilities. Apart from profitability and ensuring high quality products to meet growing customer's demands, the Responsible Care also encourages signatory company to meet their corporate social responsibility through its community awareness and outreach programmes [3, 4].

Responsible Care is not merely forward-looking management concept promoted by chemical companies, but it is now an internationally recognised set of standards by United Nations and many national governments. In essence, Responsible Care has become one of the best initiatives to be embraced by industrial operations, particularly in the chemical industries, to ensure meeting the objectives of SAICM: **"to achieve by 2020, the use and production of chemicals in ways that lead to the minimisation of significant adverse effects on human health and the environment"**. Also, the former United Nation Secretary General Kofi Annan praised Responsible Care program as "inspiring models of voluntary self-regulation for other associations to follow."

REFERENCES

[1] www.jonentine.com
[2] Kubota et al. (2011) *J Clean Prod*, 19:1134-1140.
[3] Given (2007) *Health Policy*, 81: 85-92.
[4] Lee et al. (2014) *J Clean Prod*, DOI: 10.1016/j.jclepro.2014.08.010

ABOUT THE AUTHORS

DR. LEE KHAI ERN & **DR. GOH CHOO TA** are Senior Lecturer and Research Fellow at the Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia. **PROF. DATO' DR. MAZLIN MOKHTAR** is the Deputy Vice Chancellor (Research & Innovation Affairs) of Universiti Kebangsaan Malaysia cum Principal Research Fellow at LESTARI. Find out more about Dr. Lee by visiting his Scientific Malaysian profile at http://www.scientificmalaysian.com/members/khaiernlee/

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Contact
Your local Enterprise Europe Network advisor / CCI Rhône-Alpes: een.ec.europa.eu or
Diana OUERDANI ouerdani@rhone-alpes.cci.fr /+33 (0)4 72 11 43 24;
Anna ESTELLER esteller-fibla@rhone-alpes.cci.fr /+33 (0)4 72 11 33 42
Etienne FAYOLLE fayolle@rhone-alpes.cci.fr /+33 (0)4 72 11 43 07

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SciMy Interview: Professor Dato' Dr. Lam Sai Kit

interviewed by Dr. Valerie Soo and Dr. Lee Hooi Ling

Emeritus Prof. Dato' Dr. Lam Sai Kit is a renowned medical virologist whose outstanding research in infectious diseases has earned him many prestigious awards, including the Prince Mahidol Award for Public Health from Thailand, a Knighthood of the National Order of Merit by France and the prestigious Merdeka Award 2013 from Malaysia. Prof. Lam was a central figure in the discovery of Nipah virus in late 1990s, and was instrumental in developing in-house rapid diagnostic techniques to detect dengue virus. His work has resulted in more than 200 articles including those published in top peer-reviewed journals such as *Nature*, *Science*, *Lancet* and *New England Journal of Medicine*. After obtaining his PhD from the Australian National University, Prof. Lam joined Universiti Malaya (UM) in 1966 as a lecturer, and has remained in the same university ever since. At present, Prof. Lam serves as a Consultant for UM High Impact Research.

Q1. How did you get involved in the virology field?
My decision to work on virology is the turning point of my career. Prior to my PhD research, I was studying microbiology that focused mostly on bacteria. My sister is a bacteriologist, and she was trying to convince me to work on bacteriology. However, during that time, very little was known about viruses. I decided to do something different than everyone else, and work on something that is more difficult than the norm, so I took up virology.

Q2. You have worked in the World Health Organisation (WHO) as a scientist for two years, and remain very active in WHO. What was your role during your 2-year stint at WHO?
I was recruited by WHO owing to my work on Rapid Viral Diagnosis. Back in those days (1970s to 1980s), the way to diagnose viral infection was to isolate viruses from patients or to detect antibodies in response to viral infections in patients' blood sera. Results from both of these methods were slow. Furthermore, many developing countries did not offer diagnostic service for viral infection because viral isolation using tissue-culturing techniques was very expensive.

My work on Rapid Viral Diagnosis was independent of viral isolation; instead the technique relies on the interaction between antigen-antibody to yield detectable fluorescence, and this technique gave diagnosis results on the same day. For instance, many children had lower respiratory infections. All we did was to take a swab from the back of the nose and we immuno-stained the specimen against up to eight different viral or bacterial agents, and the presence of

Receiving the UM Excellence Award in Recognition of Winning the Merdeka Award 2013 from UM Pro-Chancellor, HRH Raja Dr. Nazrin Shah, Regent of Perak

Motivating young researchers to conduct high impact research

viral or bacterial antigens would yield fluorescence. Since this technique detects viral or bacterial antigens instead of the patient's antibodies, we did not have to spend weeks to grow up the virus or wait for the antibody to appear in the blood serum. Normally, by the time we could detect the antibody titer, the patient would have died or recovered from the infection.

Q3. What do you wish someone could have told you before you embarked on a career in virology?
I think the training background is very important. Instead of seeing the patients and assessing the symptoms directly, I had to depend on someone who had a medical training or a pathologist for clinical diagnosis. Having said that, I have no regret in working on medical virology.

Despite that I never had a medical degree, I have had great colleagues and we worked as a team very well. For example, during the Nipah virus outbreak in 1998, I worked very closely with epidemiologists, clinicians, and neurologists.

"The lack of awareness is not something we can change overnight, but we have to keep trying to educate the public"

Q4. What is the most memorable moment for you in your nearly 50 years of career?
The most memorable moment for me was when I was told by the CDC[1] during the Nipah virus outbreak that we were handling a P4 agent. P4 agent is the most pathogenic agent in the world.

It was a very stressful and challenging situation in 1998. We faced huge pressure from the public and media because the information we produced had impact on everyone in the country. In the initial stage, we did not know what was causing viral infections in swine farmers and how the disease spread, so we could not simply do things blindly (*e.g.*, killing mosquitoes, assuming that it was another case of Japanese encephalitis that just hit the country in 1997). Working closely with the Ministry of Health, we tried to perform diagnostic tests as quickly as possible to exclude all known possible agents; however, all results were tested negative. After consulting with CDC, we finally identified a new virus (Nipah, that is) that was causing the viral infection.

There was a lot of unwanted attention and people were passing unnecessary comments. Due to the death of many people, the public wanted "snap" answers. In a way, I understand their concern but the public did not understand that diagnosis results could not appear in a single day, especially in this case where the agent was unknown. We tried to stay focused on working in the lab, but there were also reporters snooping around

[1]*CDC, Centers for Disease Control and Prevention: http://www.cdc.gov*

"too much bureaucracy that takes up unnecessary time is hampering our effort in developing fundamental research"

trying to get answers. Along with the Ministry, we had to provide a lot of explanation to the media and public. We provided data to the Ministry, and let the Ministry disseminate the information. Both parties worked very well as a team.

Q5. Do you think Malaysian scientists are doing enough to create public awareness about their work or their field of science in general?
I think the public can be further educated in science. As a consultant for UM HIR, I made short write-ups of our research projects to be sent to the press with the hopes of capturing the public's attention. In fact, UM HIR aims to produce a lot more write-ups to get the public interested in our research. We hope that by showcasing the work we are doing, the public and private bodies will realise the impact our research and start contributing to our research funds. The lack of awareness is not something we can change overnight, but we have to keep trying to educate the public.

Q6. Speaking of UM HIR, there have been a lot of collaboration going on between scientists funded by UM HIR and those from overseas. How were these collaborations initiated?
UM HIR is all about fundamental research, and we realised that we have something unique to offer in every collaboration. For example, Prof. Barry Marshall (a Nobel Prize recipient in 2005) is interested in the phylogenies and origins of the gastric bacterium, *Helicobacter pylori*. We established the collaboration with his research group by offering the opportunity to examine the *H. pylori* strains in our country that were isolated from patients of various ethnic groups. Some patients showed mild symptoms from *H. pylori* infection (*e.g.*, developing gastric ulcer), and some eventually progressed to gastric cancer.

Despite living under the same environment, what made these strains genetically different from one another? Are differences due to food, cultural, genes or a combination of all these factors? And of course, this collaboration would not have happened without the help of our country's top gastroenterologists in providing these clinical samples.

Q7. In your opinion, what are the challenges of doing fundamental research in Malaysia?
First of all, research projects often take years to mature. The main challenge we face is producing high-impact results within a short time. We want to be innovative, but too much bureaucracy that takes up unnecessary time is hampering our effort in developing fundamental research. For example, purchasing one piece of equipment may require going through multiple layers of approval.

Our country also puts heavy emphasis on targeted research that gears towards developing product. While this strategy works well for industries, it defeats the purpose of a university where fundamental research should take place. Therefore, the establishment of UM HIR is a great initiative for boosting fundamental research in Malaysia. We hope the government will continue to support HIR, as we believe this is one way to attract our talents back home and to retain our local talents.

Q8. Finally, what would be your advice to potential Malaysian students who would like to pursue microbiology?
I would advise students to pick and choose their specialisation. Start looking at job opportunities, whether in universities, healthcare systems, or in industries. For those who are interested to work on fundamental research, I would encourage them to start obtaining funding early in their career; otherwise, the path to doing basic research can be very frustrating. Gather information on the work they would like to focus on in a way that their work will have maximum impact to the society.

Family photograph after receiving the Merdeka Award in 2013

SciMy Interview:

Professor Dato' Dr. Jafri Malin Abdullah

interviewed by Dr. Wong Kah Keng and Dr. Lee Hooi Ling

Prof. Dato' Dr. Jafri Malin Abdullah is no stranger in the Neuroscience arena in Malaysia. He was born in Kuantan, Pahang and is currently based in Universiti Sains Malaysia (USM) Health Campus, School of Medical Sciences as a Professor of Neurosciences. He is known as one of the pioneers in introducing and enhancing clinical and experimental neurosciences in Malaysia. He is the founding director for Center for Neuroscience Services and Research (P3Neuro) and the Founding Head of Department of Neurosciences, School Of Medical Sciences in USM. Throughout his career, he has published more than 178 publications and won several local and international awards. In this interview, Prof. Jafri shares his experiences and opinions as a clinical neuroscientist.

Q1. What motivated and inspired you to be a neuroscientist?

When USM sent me to University of Ghent, Belgium, in 1989 to pursue neurosurgery, I had no intention to be a neuroscientist but I was later influenced to be one by my neurosurgeon supervisors, Prof. Dr. Luc Calliauw (MD, PhD). In Europe, especially in university hospitals, it is a norm for every specialist physician to have MD, a specialist and PhD degrees. If we do not obtain our PhD qualification within 5 years of our specialist degree, we would not be accepted to have a pensionable post and "removed' out of that university. Prof. Calliauw once said to me, "You must be a neuroscientist", and I replied "I just want to be a neurosurgeon". His response to my reply was: "No, a neurosurgeon is merely a *robot*. Without science, you'll not be able to understand the disease thoroughly and there will be no progress in the treatment of diseases."

Another aspect that drove me to be a neuroscientist is that science is mandatory in the postings to every clinical department during the postgraduate training in neurosurgery. We had to perform fundamental scientific experiments which must ultimately result in publications. This component brought me closer to science, laboratory, experiments involving animal models and also innovation.

Q2. Upon return to Malaysia, did you focus on neurosurgery, neurosciences or both?

Upon my return to Malaysia in end of 1995, I decided to pursue neurosciences after I completed establishing the neurosurgery and some neurological components at the School of Medical Sciences as well as at the Hospital Universiti Sains Malaysia (HUSM), Kubang Kerian. Once neurosurgery and neurology aspects were established, I then returned to developing neurosciences in 2001. Today, after practising for 25 years, I would say my commitment is roughly 90% neurosciences and 10% neurosurgery.

Q3. What is the main highlight of your research findings?

It would be the development of anti-epileptic drugs – the drugs that we currently use to treat epilepsy were discovered 20 to 30 years ago, thus there is a need for novel anti-epileptic drugs with higher efficacy and less toxicity. To discover novel drugs, we screened chemical compounds isolated

Prof. Jafri and colleagues at the magnetoencephalography (MEG) facility

from different varieties of plants for anti-epileptic effects. Both *in vivo* and *in vitro* experiments were conducted on the identified compounds and we have found that certain isolated compounds could reduce seizure in rodent models. We hope to bring these compounds into human clinical trials one day, whereby the brain activities of epileptic patients in response to the compounds will be measured.

Q4. What are the strengths that Malaysia can offer in the field of neurosciences?

My colleagues in the West usually approach us for collaborations due to Malaysia's rich biodiversity. Our neuroscientists should conduct further research on our biodiversity for the identification of novel drugs to treat neurological conditions such as dementia and strokes. One strategy that Malaysian researchers could employ is to collaborate with overseas researchers via a win-win collaboration by providing the compounds isolated from plants or other natural products in Malaysia to facilitate the identification of novel drugs.

Q5. What are the challenges that local neuroscientists face and how should these challenges be overcome?

I have to be honest in addressing this question. A major problem is the "racial segregation", which is apparent even at the level of the three societies that represent neurosciences in Malaysia, whereby there are separate Chinese majority based, Indian majority based and Malay majority based societies. It is encouraging to have several different societies addressing neurosciences in Malaysia; however, the existence of different societies could result in duplication or overlap in their work, skewed efforts towards a particular subsection of neurosciences and the lack of emphasis to address the nation's neurological problems as a whole. If we could be united and remove this "invisible barrier" which I know a lot of my neuroscientist colleagues may deny it exists, I really believe that we can produce the quality of research on par with other countries at the international level.

Secondly, there are no local grants specially dedicated to the fields of fundamental neurosciences. If you look at most of the major grant applications, there is little or no room for the neurosciences field as we know exist in developed countries. Last year, President Obama of the United States launched the Brain Research Through Advancing Innovative Neurotechnologies (BRAIN) initiative to propel neurosciences research in the US and European Union's Human Brain Project. This assive initiative has finally motivated different levels of Malaysian scientific bodies to meet and plan funding opportunities for neuroscientists.

However, neuroscience researchers will still have to wait two to three years for its implementation before they can apply for such grants. This is frustrating especially for young and energetic neuroscientists returning to Malaysia from their overseas studies or training. This needs to be addressed before we lose even more talents.

"Access to journals should be free-of-charge so that any researchers, especially those from the poorest of countries, are able to access them"

Q6. As the Founding Director for the Center for Neuroscience Services and Research (P3Neuro), can you tell us more about the center?

In brief, the center provides advanced neurological, neurosurgical and psychiatric treatment to patients as well as functioning as a storage bank for patient samples such as tissue, blood and DNA samples. The library of patient samples and relevant electrophysiology data generated by functional Magnetic Resonance Imaging (fMRI), magnetoencephalography (MEG) and electroencephalography (EEG) techniques can be used for research on the treatment and understanding of the disease.

We have signed a memorandum with Universiti Teknologi Petronas to utilise their advanced computing technologies for the efficient storage of patients' electrophysiology data, which usually occupy huge amount of digital spaces, as well as scientific collaborations with the Cuban Neuroscience Center, International Neuroinformatics Coordinating Facility (INCF) and the Society for Brain Mapping and Therapeutics, USA (SBMT) to promote

large scale brain mapping. These are of course done with human ethics committee approval and the patients' names are kept anonymous.

Q7. Can you tell us about your role as an editor of open access journals?
My job scope is to choose suitable peer reviewers for the neurosciences articles sent to me by the respective authors and to see through that the articles being reviewed to their final publication or rejection. It is a lot of work, and all of us on the editorial board do not get paid a single cent – we are doing it from the kindness of our hearts because access to journals should be free-of-charge so that any researchers, especially those from the poorest of countries, are able to access them without any financial boundaries.

Q8. Finally, what are the most stressing issues that both the Malaysian government and neuroscientists need to address in order to improve the local research arena?
The government should establish the core facilities at different parts of Malaysia. The new facilities should not just be based in Kuala Lumpur with much less emphasis on other regions in Malaysia. Secondly, scientists need to be mobile – if they are working in Kuala Lumpur, they should be capable of working or collaborating with researchers in Kota Bharu or other places in Malaysia. The passion to find scientific answers should not be limited by geographical locations.

Thirdly, bigger science funding is absolutely crucial – our funding for scientific research compared to the country's gross domestic product (GDP) is hugely imbalanced. Take a look at developed countries, their funding for science is a significant proportion of their countries' GDP.

Fortunately, the government is working on the Akta Sains Negara (National Science Act) and we hope that it will be tabled in the Parliament soon and when implemented, there will be more emphasis and more job opportunities for scientists. This would encourage the young generations to take up fundamental and applied sciences as their basic degree and work up till they receive their PhDs knowing that there will always job securities, promotions and rewards at the end of the road.

There are very few neuroscientists in Malaysia; according to 2011 UNESCO Institute of Statistics data [1], we had five scientists per 1,000 workforce whereas in Singapore, there were 13 scientists for the same number of workforce. Ideally, our universities should focus on developing more neurosciences programme to fuel the growth of this field. In addition, our children in Malaysia, less than 30% of them are interested in science [2]; that is science as a whole, and we are not talking about neurosciences yet!

> "Bigger science funding is absolutely crucial - our funding for scientific research compared to the country's GDP is hugely imbalanced"

Neuroscientists, and scientists in general, need to be more outspoken and reach out to the press or the public to encourage emphasis on science in our country. Science generates innovations and economic growths in every developed country; I don't see why we can't do the same.

Find out more about P3Neuro and Dept. of Neurosciences, USM at:
http://www.p3neuro.usm.my/index.php/en/
http://www.medic.usm.my/neurosciences/

REFERENCES

[1] http://data.uis.unesco.org/index.aspx?queryid=61
[2] Jayarajah K et al. A Review of Science, Technology, Engineering and Mathematics (STEM) Education Research from 1999-2013: A Malaysian Perspective. EJMSTE. 2014;10:155-63.

Caricature entitled 'Neurogardener'; made by a friend of Prof. Jafri on watering a plant as an analogy to nurturing the neurosciences field in Malaysia.

Survival Tips for PhD Students

by Juliana Ariffin

Everyone starts graduate school for different reasons. Some may have always had a passion for science, others are determined to push the boundaries of human knowledge and discover their inner Einstein. You may even be a bit of an idealist and desire to improve human destiny even if you have to sacrifice yourself, ala Marie Curie. Or maybe you are a go-getter and you think a PhD is your stepping stone to a better future. For many, it will be combination of all the above.

However, the journey through a PhD is hardly ever a straight and narrow road. And amongst the twists and turns and backtracking you will be forced to take, you can easily lose sight of your goals and reasons for starting out on the journey. So it helps to be prepared and well aware of how best to make the most of your PhD. With that in mind, here are ten survival tips to help you on your way.

Survival Tip #1

Choose a supervisor you can get along with

One thing to be careful about is to choose a suitable supervisor for you. You should not choose a lab simply because you like the lab members in it, because they will leave at one point or another! Even supervisors may leave or even pass away, but those are unique situations, and more often than not, your supervisor will be a constant presence throughout your PhD.

So before you commit to a lab, attend seminars by the supervisor you are aiming to work with, and talk to their current and former students. You'll want someone whose supervising style is suitable for you. Do they provide enough structure and attention, or are they hardly ever available? Are you comfortable with discussing your concerns with them?

A good match will be one where both of you can communicate effectively, and where you get enough encouragement, feedback and direction, but still feel free to voice your opinions and have some say in the direction of your project. If you have already started your PhD and discover that you cannot get along with your supervisor, change labs within the first year of your project or seek out a co-supervisor you can get along with and depend on instead.

Survival Tip #2

Choose a project you are excited about, but make sure you have options!

Show initiative and think about what captivates you, then read up on the available literature before deciding on your project. Bear in mind though that projects do change depending on how the research turns out, or even what your supervisor feels is in the lab's best interest to work on. You will face challenges for any project you pick, but it is always better to pick one that is not too isolated from the general research direction of the lab (for obtaining guidance and experimental protocols), but not shared amongst a few people (ownership issues can give rise to conflicts!).

If your research project turns into a graveyard of failed experiments and dead-ends, it helps to have a side project to fall back on. However be wary of taking on too many side projects, and always ensure that you and your supervisor agree on which project takes priority.

In addition, when collaborating, take steps to ensure your supervisor is aware of the work you have done so that you may receive appropriate acknowledgement or authorship for the work you do (though determining authorship is usually beyond the authority of a PhD student).

Survival Tip #3
Treat your PhD like a lifestyle, not a 9-5 job

If you're fortunate, you'll have a project that lets you clock in 8-10 hour days, and not work on the weekends. If you're not… well it is normal to keep a stash of caffeine, chocolate, instant noodles and a pillow at your desk for those all-nighters. It is important that you do work longer hours because the more time you spend in the lab, the more experience you have and the more likely you are to make a breakthrough.

You don't have to live in the lab, but do make sure you are getting work done even if you have to stay late. When not doing experimental work, do read research papers and attend talks. Make sure you stay updated on the current research and available techniques in your field, it will save you a lot of time in the long run.

It is said that you need about 10,000 hours of practice to become an expert at something, which is approximately the time it takes to complete a PhD. So do not begrudge the time spent working on your PhD, 3-5 years is not that long considering you will have the knowledge you gain for the rest of your life.

Survival Tip #4
Get used to failure

Even the most interesting project gets dull very quickly if you are faced with constant failure. However all projects worth working on will involve a fair amount of failed experiments, and seasoned scientists get used to and even learn to embrace failure.

Okay, maybe not quite embrace failure, rather to accept it. **Science is about exploring where no one has ever explored before, and that means the price of discovering something novel is a hefty amount of failure.** A good scientist learns from failure, and does not get disheartened by it.

Survival Tip #5
Intra-lab relationships

Now, working all those late hours and embracing failure will likely result in you relying a lot on the people you work with for professional and emotional support. Many scientists will find lifelong friends or significant others through their work and it can lead to many happy endings. But things often can go awry, leading to some awkward years ahead in the same lab. So where possible, it is always best to be as professional as possible.

Be friendly and learn to collaborate – show an interest in other people's research and be conscientious about communal lab equipment and reagents. Attend lab

"do not begrudge the time spent working on your PhD, 3-5 years is not that long considering you will have the knowledge you gain for the rest of your life"

retreats or lunches. However when conflict arises, remember that your labmates are colleagues first and friends later, so it is always best to not take things personally, take care not to gossip and seek to resolve issues before they get out of hand.

Survival Tip #6
Networking

Do make the effort to establish relationships with other PhD students and researchers from other labs and institutes. Socialise - show up for department seminars and talk to people. It is always good to know what is going on in other labs as each lab is run in a different style with different areas of expertise.

Talking to people will also make it easier for you to learn more outside your field, and about funding processes, grant proposals and current issues. Do not get so caught up in being a scientist that you find it hard to talk to someone who is not in your own field of research or even someone who is not in science.

Survival Tip #7
Get a mentor

The importance of a mentor can never be stressed enough. He or she may not be your supervisor, or even within your lab. However, they should be someone who is in a higher position than you in your field, and who is willing to give you honest, trustworthy advice.

They will share their experiences, warn you of the pitfalls to avoid and the opportunities to look out for and grasp. They will also be your reference and your go-to-guide for career questions and choices.

It is not easy to find a good mentor, but the benefits far overweigh the challenge. The best way to find one is to keep talking to people and consider their suitability. Once you have found someone you think is suitable, you could ask if they would like to be your mentor, or keep it casual and drop a line to say you consider them

"Many PhD students concentrate on lab work until they forget to lift their noses from the grindstone to search out opportunities"

as a mentor. Acknowledgement is one thing however, and a true mentor will be someone you can rely on, who will freely and willingly give you advice.

Survival Tip #8
Plan ahead and keep yourself motivated

Many PhD students concentrate on lab work until they forget to lift their noses from the grindstone to search out opportunities. This is very unfortunate as there are very many opportunities to be had for PhD students!

So keep your eyes open for travel grants, scholarships, conferences, workshops, training opportunities *etc*. Do not ignore them, thinking you will utilise them in your third or final year when you have a complete story to tell, or will be able to job search as you travel to overseas conferences in your final year. The best laid plans of mice and men often go astray, and you should be looking out for conferences from the start, and job-searching a year in advance of graduation.

Part of the joy of a career in science is also getting to travel to international locations and learning about exciting new advances in research. This will give you new perspective on your own project and keep you motivated.

Survival Tip #9
Build your portfolio and look into alternative careers

No matter how wonderful your project is at the moment, the reality of science is that it is a tough field to be in. Work contracts are short, the hours are long and the competition is fierce. So it is always best to make sure your skills are updated and that you are aware of the alternative careers available to you.

Take the time to tutor or supervise students, join community outreach programmes and public speaking or demonstrations at schools. Also, take advantage of career guidance talks and communicate with people in science related jobs outside research, or with those who have left science altogether. Do not be afraid to approach someone for an informational interview* or an internship.

Most importantly, do not underestimate the skills you have gained from pursuing a PhD, which include project management, time management and problem solving skills. Do not be a wallflower or too humble, instead be confident and learn to market yourself and your abilities.

Survival Tip #10
Take care of yourself and have fun

It is easy to get caught up in the race to publish or get disillusioned by the seemingly never-ending onslaught of failure. There will be times when you curse the day you decided to pursue a PhD and question the worth of a project that hardly anyone (not even your own mother) is going to fully understand or be interested in.

When those days come, remember that it is a privilege to explore the frontiers of science. View it as challenging and exciting work and be confident that you can handle it. Do not fall prey to imposter syndrome†. Make sure you find time to get out of the lab and pursue your hobbies. Exercise to relieve your frustration. Eat healthily and sleep regularly or you will burn out, and always remember a PhD is a marathon and not a sprint.

There will always be ups and downs in science but try to find the humour and the silver lining in each situation and you will survive and even enjoy each moment… most often in retrospect.

**Informational Interviews:* http://www.idealist.org/info/GradEducation/Resources/Preparing/Interviews

†*Imposter syndrome:* http://geekfeminism.wikia.com/wiki/Impostor_syndrome

Resources for more tips (or time-wasting):
- The Thesis Whisperer: http://thesiswhisperer.com/
- PhD Comics: http://phdcomics.com/comics.php
- Barking Up the Wrong Tree: http://www.bakadesuyo.com/

ABOUT THE AUTHOR

JULIANA ARIFFIN is a final year PhD student studying human immune responses at The Institute for Molecular Biosciences, University of Queensland, Brisbane, Australia. Prior to beginning her PhD, she worked for a year as a research assistant following her Honours degree. Find out more about Juliana Ariffin by visiting her Scientific Malaysian profile: http://www.scientificmalaysian.com/members/julianna/

10 Survival Tips for PhD Students

#1: Choose your favourite supervisor
Choose a supervisor you get along with, whose personality & supervising style is suitable for you.

#2: Choose projects you are excited about
Pick one that is not too isolated from the research direction of the lab, but not shared amongst a few people.

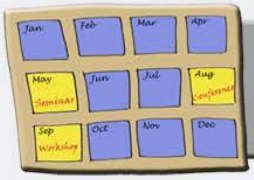
#3: PhD is a lifestyle, not a job
Get your work done even if you have to stay late. Read research papers and attend talks.

#4: Get used to failure
Good scientists learn from failures & do not get disheartened by it.

#5: Have good intra-lab relationships
Be friendly & professional. Show interest in other people's research. Be conscientious about communal lab equipment & reagents.

#6: Network with other labs and institutes
Socialise - show up for department seminars and talk to people.

#7: Get a mentor
Find someone in higher position than you in your field who is willing to give you trustworthy advice.



#8: Plan ahead & keep yourself motivated
Keep your eyes open for travel grants, scholarships, conferences, workshops, training opportunities, etc.

#9: Build your portfolio
Make sure your skills are updated. Be aware of the alternative careers available to you.

#10: Take care of yourself and have fun
Find time to get out of the lab and pursue your hobbies. Exercise to relieve your frustration.Eat healthily & sleep regularly.

Infobox by Kong Yink Heay

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