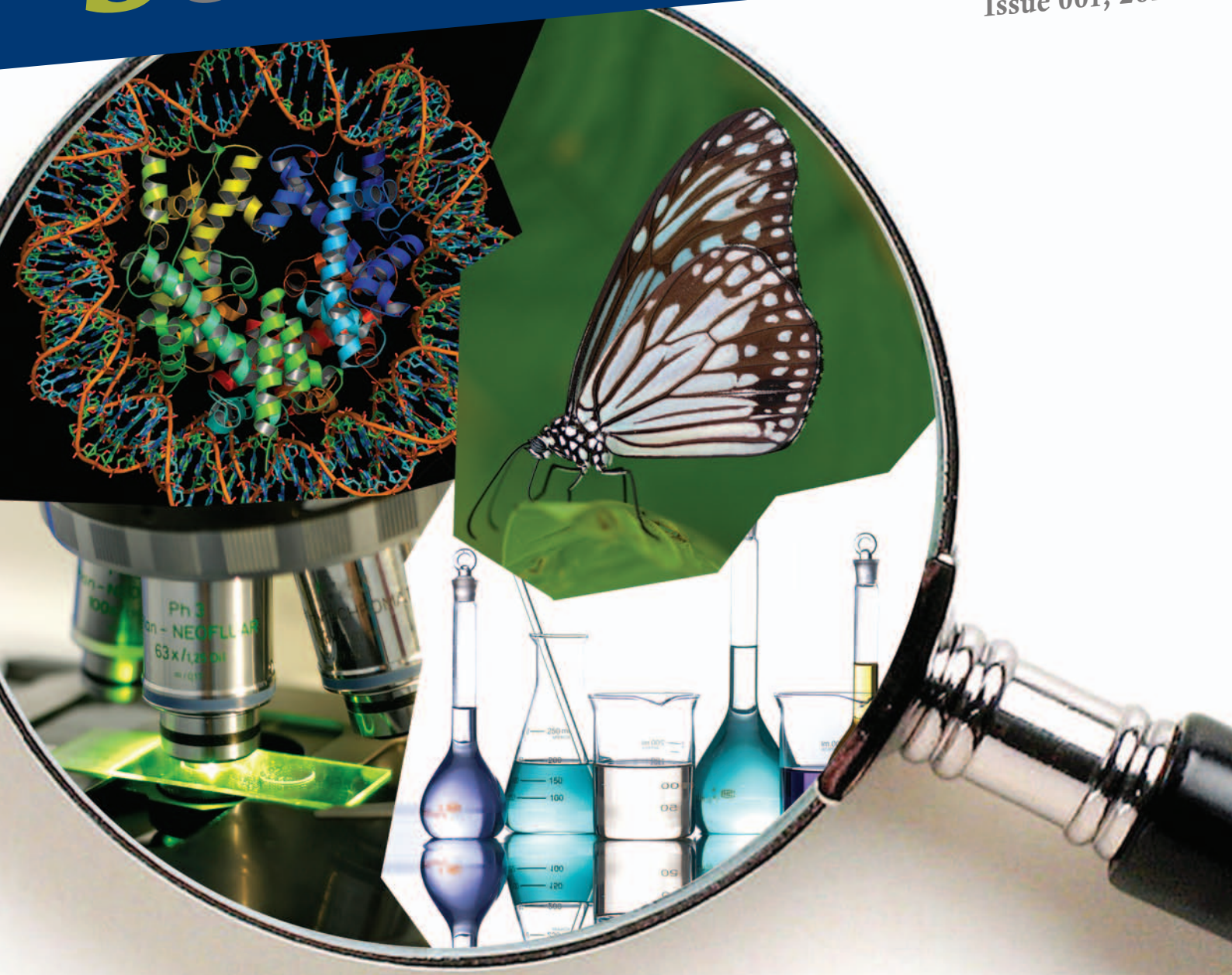
SCIENCE FOCUS 科言

Issue 001, 2014



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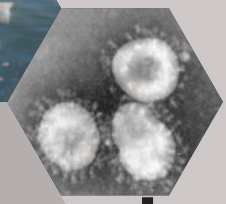
香港科技大學
THE HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY



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Message from the Editor-in-Chief 主編話語

Dear Readers,

Welcome to the inaugural issue of *Science Focus*!

Innovations in science and technology will be a key factor for Hong Kong and China's economic success in the future. A fundamental requirement to be a competitive leader in science and technology is the continuous supply of talented scientists. While universities are training our scientists, instilling the spirits and practice of scientific research could commence at earlier stages of education.

Science Focus is a new initiative conceived by the School of Science at HKUST, offered free-of-charge and designed for secondary school students. The magazine aims to stimulate and nurture students' interest in science and scientific research, by providing a credible resource on the advancements of science in various disciplines. Our vision is to inspire students to become enthusiastically engaged in science activities through reading a selection of interesting scientific articles. Readers can learn about present-day science discoveries and be enlightened by interesting facts and trivia that are associated with our daily lives.

The *Science Focus* editorial team welcomes your invaluable feedback and suggestions.

Prof. Yung Hou Wong
Editor-in-Chief

親愛的讀者：

你好！歡迎你閱讀「科言」的創刊號。

創新科技是影響香港及中國未來經濟增長的重要因素，要提升這方面的競爭力，必先要儲備優秀科研人才。大學固然是培育研究人員的基地，但在大學之前的教育中，可以著力啓蒙學生的科學探究精神和理性實踐。

「科言」是香港科技大學理學院首份專為中學生而設的免費雜誌，旨在觸發及培養學生的科技學習興趣，提供不同科學範疇的最新資訊。我們為學生精選了一些富有趣味性的科研報導，介紹科學新發現，以及各種趣味生活小常識，從而鼓勵讀者積極參與科學活動。

「科言」編委會歡迎你提出寶貴的意見和建議。

主編 王殷厚教授
敬上

Email: sciencefocus@ust.hk **http://sciencefocus.ust.hk**

What's Happening in Hong Kong?
香港科技活動

By Flora Ng 吳紫瑜

How much do you know about science activities happening around you? There are many opportunities around you. Every year, there are two exhibitions targeted at secondary school students, both of which are free to join.

Joint School Science Exhibition

The JSSE is organized by secondary school students once a year, reaching its 47th year in 2014. Apart from exhibitions, there are also projects from overseas. Each year, the theme is different and the topic of 2013 was "Nature Inspiration, Science Exploration". Various inventions made by students were reported by local newspapers. The organization also holds other activities, such as workshops and walkathons. The exhibitions are usually held at the end of August in the Hong Kong Central Library, Exhibition Gallery. Check out their website: http://www.jsse.org.hk/

Hong Kong Student Science Project Competition

The Hong Kong Student Science Project Competition is organized by The Hong Kong Federation of Youth Groups and the Education Bureau and the Hong Kong Science Museum. It is supported by the Innovation and Technology Commission and Hong Kong Science and Technology Parks Corporation. This competition is open to the public. The judging criteria are detailed and cover many areas, which include creativity, presentation skills, and last but not least, team work. The winning team will receive an opportunity to go overseas to join more competitions. Every year, outstanding inventions come from the junior and secondary students divisions! If you are interested and capable, why not take a chance? http://hksspc.hkfyg.org.hk/

Public Talks from Science Museum

The Stanley Ho Space Theatre has always been playing different movies for the public. From now on till 28th February, it will be playing "Titans of the Ice Age", to show you the prolonged ice age happened twenty thousand years ago! Don't miss out!

不知道各位中學生對自己身邊發生和科學有關的活動知道多少？其實參與各大小展覽的機會就在大家的身邊。每年香港都有兩個和中學生有關的科學展覽，供大家自由參與。

聯校科學展覽

其一想必大家也有所耳聞，乃為每年一度，由中學生自行組成內閣籌備的聯校科學展覽 (Joint School Science Exhibition, JSSE)。至二零一四年已舉行至第四十七屆。參展單位除了本地中學生之外，還有從外國而來的參展單位。為香港中學生提供了極其寶貴，與外國參展單位交流的機會。每年的展覽均有不同主題。以一三年為例，有份參展的同學圍繞著主題：「靈感始於自然　創意科學無邊」挖空心思，發明了不同的科技產品，各報章亦曾有所報導。除了展覽外，主辦內閣亦有小學生工作坊、步行籌款之類的活動，盡力把科學推廣到每一個角落。其內閣通常於每年八月下旬假香港中央圖書館地下展覽廳舉行有關展覽。想知道多一些? 可以查看以下網站：http://www.jsse.org.hk/

香港學生科學比賽

其二則為由香港青年協會、教育局及香港科學館合辦的香港學生科學比賽。與上述展覽不同，此比賽除了中學生參與外亦設有公開組。其評選準則十分詳細並包括多個範疇，從創意到設計、表達，甚至隊伍合作性均會被列入總分，極具挑戰性。各組別的優勝隊伍將會獲得書券，冠軍更可獲資助參加海外交流活動、參與海外比賽等，實為非常難得的機會。各歷屆得獎作品中更可看到，即便是初中組的參賽隊伍也可以做出十分出色的報告以及發明，有能力又有興趣的各同學為什麼不參加比賽一試身手呢？http://hksspc.hkfyg.org.hk/

科學館

太空館巨型天幕放映的電影，一直都吸引不少公眾人士慕名前往。由即日起至二月二十八日，太空館將會放映《冰河巨獸》，將二萬年前的冰河時期帶到大家眼前，讓大家有機會一窺當時野外的情況。有興趣的同學萬勿錯過！

Atomic Weight Changed for 19 Elements

個元素的原子量改變

By Sunjung Lim 林宣廷

neutron 中子

proton 質子

carbon-12 碳-12 99%
carbon-13 碳-13 1%

= (12 x 0.99)+(13 x 0.01)
= 11.88 + 0.13

Atomic Weight 原子量 = 12.01

Calculation of Atomic Weight 原子量計算方式

Wow Cadmium, you have gotten chubbier these days!

According to the International Union of Pure and Applied Chemistry (IUPAC), the federation responsible for overseeing international standards for atomic weights since 1919, nineteen elements on the periodic table are getting their atomic weight adjusted. IUPAC has approved new weights for these elements due to better measurements and calculations of certain isotopes [1]. Scientists have been publishing tables with atomic weights that were determined as far back as 1899 [2].

How do we calculate the atomic weight? To use carbon as an example, a carbon atom has six protons in its nucleus. For the atoms to be neutral (no net charge), the number of electrons must equal the number of protons. Thus, a carbon atom has six electrons orbiting around its nucleus. However, each carbon atom also has neutrons in its nucleus, and different types of carbon atoms exist that have different numbers of neutrons. These different versions of element's atoms that have the same number of protons but different numbers of neutrons are called isotopes. In the case of carbon, the most abundant stable isotopes can be found as carbon-12 and carbon-13. Chemists calculate the

References

[1] Gannon, M. (2013, September 24). Atomic weight changed for 19 elements. Retrieved from http://www.livescience.com/39912-atomic-weight-changed-for-19-elements.html

[2] Yirka, B. (2013, September 26). IUPAC votes to change standard atomic weights of 19 elements. Retrieved from http://phys.org/news/2013-09-iupac-votes-standard-atomic-weights.html

Element 元素	Old Atomic Weight 舊有原子質量	Revised Atomic Weight 更新原子質量
Molybdenum 鉬	95.96 (2)	95.95(1)
Cadmium 鎘	112.411(8)	112.414(4)
Selenium 硒	78.96 (3)	78.971 (8)
Thorium 釷	232.038 06 (2)	232.037 7(4)
Beryllium 鈹	9.012 182 (3)	9.012 183 1(5)
Fluorine 氟	18.998 403 2 (5)	18.998 403 163 (6)
Aluminum 鋁	26.981 538 6 (8)	26.981 538 5(7)
Phosphorus 磷	30.973 762 (2)	30.973 761 998 (5)
Scandium 鈧	44.955 912 (6)	44.955 908 (5)
Manganese 錳	54.938 045 (5)	54.938 044 (3)
Cobalt 鈷	58.933 195 (5)	58.933 194 (4)
Arsenic 砷	74.921 60 (2)	74.921 595 (6)
Yttrium 釔	88.905 85 (2)	88.905 84(2)
Niobium 鈮	92.906 38 (2)	92.906 37(2)
Cesium 銫	132.905 451 9 (2)	132.905 451 96(6)
Praseodymium 鐠	140.907 65 (2)	140.907 66(2)
Holmium 鈥	164.930 32 (2)	164.930 33(2)
Thulium 銩	168.934 21 (2)	168.934 22(2)
Gold 金	196.966 569 (4)	196.966 569 (5)

Weight change of 19 elements　19個元素的原子量改變

average atomic mass of an element that you see on the periodic table from the masses of its isotopes, giving more common isotopes more weight than less common isotopes. The diagram further explains how the atomic weight is calculated.

The standard atomic weights of four elements—molybdenum, cadmium, selenium, and thorium have been changed based on recent determinations of terrestrial isotopic abundances. The modification in weight change for the non-metal selenium is particularly remarkable as it has not been revised since 1934. For the remaining elements, the new weights were determined through more precise measurements and only minor changes have been made. The weight of gold, for example, has been updated from 196.966 569 (4) amu (atomic mass unit) to 196.966 569 (5) amu. The number in parentheses represents the uncertainty in the last digit of the atomic weight.

Though these changes may seem subtle and you may wonder why the chemists have gone through so much hassle, but in fact, new weights could tremendously impact scientific research and many other fields that rely on chemistry. Besides, this change could potentially affect you as well since the gold bar you own might be worth less now due to the slight increase in gold's atomic mass!

The changes will be published in a new "Table of Standard Atomic Weights 2013" in Pure and Applied Chemistry in 2014 as seen above [2].

唏鎘！你近來好像胖了一點吧！

自1919年開始，國際純化學與應用化學聯合協會（IUPAC）負責監察原子量的國際標準。根據資料提供，十九個元素的原子量在元素周期表中已經有所調整 [1]。上一次公布國際元素周期表是於1899年國際原子量成員第一次召集的時候，某些同位素經過更加準確的計算，科學家現在已經推出新的原子量 [2]。

原子量是怎樣計算的？試舉碳為例子，於原子核中碳有6粒質子。因為原子整體上是中性的，電子的數量必定等於質子的數量，所以碳原子有6粒電子圍著原子核的軌道運行。但是每一粒碳原子的原子核也有中子，而不同的碳原子可以有不同中子數量。這些質子數量相同但中子數量不同的原子，我們稱之為同位素。例如最主要的穩定碳原子是碳-12和碳-13。化學家是根據各種同位素的重量及其所佔的比例來計算每一元素的平均原子量的。左邊圖更詳細解釋原子量的計算方法。

根據近年來對於各種元素的同位素在地球上的多寡改變，四個元素 - 鉬、鎘、硒和釷 - 的標準原子量已經被改寫。在四個元素當中，硒的重量改變是最為明顯，因為硒的重量自1934年從未曾有任何修改。透過更加準確的計算，其他的元素只有輕微的改變。例如金的重量只是由196.966 569 (4) amu（原子質量單位）改至 196.966 659 (5) amu（括號中的數字代表原子量最後一個位是未能準確測定的）。

你或許不明白為何化學學家要因為這些微小的改變而爭論，但事實上，這些微小的改變對科研及其他以化學為基礎的領域會構成極大的影響。另一方面，這個改動或許會影響你，因為金的原子重量有輕微的增長，你現在所擁有的金條可能沒有那麼值錢了！

這些改變將會公佈於純化學與應用化學的期刊的「標準原子量表2013」中，如上 [2]。

Red Planet: A Hidden Sponge

Mars, named after the Roman God of War is, approximately, 56 million km away from Earth, making it our second closest neighbor (Venus, being the closest). The Red Planet is covered with iron-rich soil and resembles Earth in various ways. For instance, it is enwrapped by a thin atmosphere, and has polar ice caps, volcanoes, and seasonal cycles. These resemblances draw a deeper curiosity to reveal the secrets and potential of life on this mysterious planet.

In November 2011, NASA-developed robotic rover Curiosity was launched into space from Cape Canaveral, USA to explore 'Gale', a crater on Mars. It shouldered a mission to investigate Martian climate and geology, as well as environmental conditions favorable for life. Since landing in August 2012, Curiosity has sent pictures and data of Mars back to Earth, where leading scientists have analyzed and revealed exciting evidence of the presence of water in Martian soil.

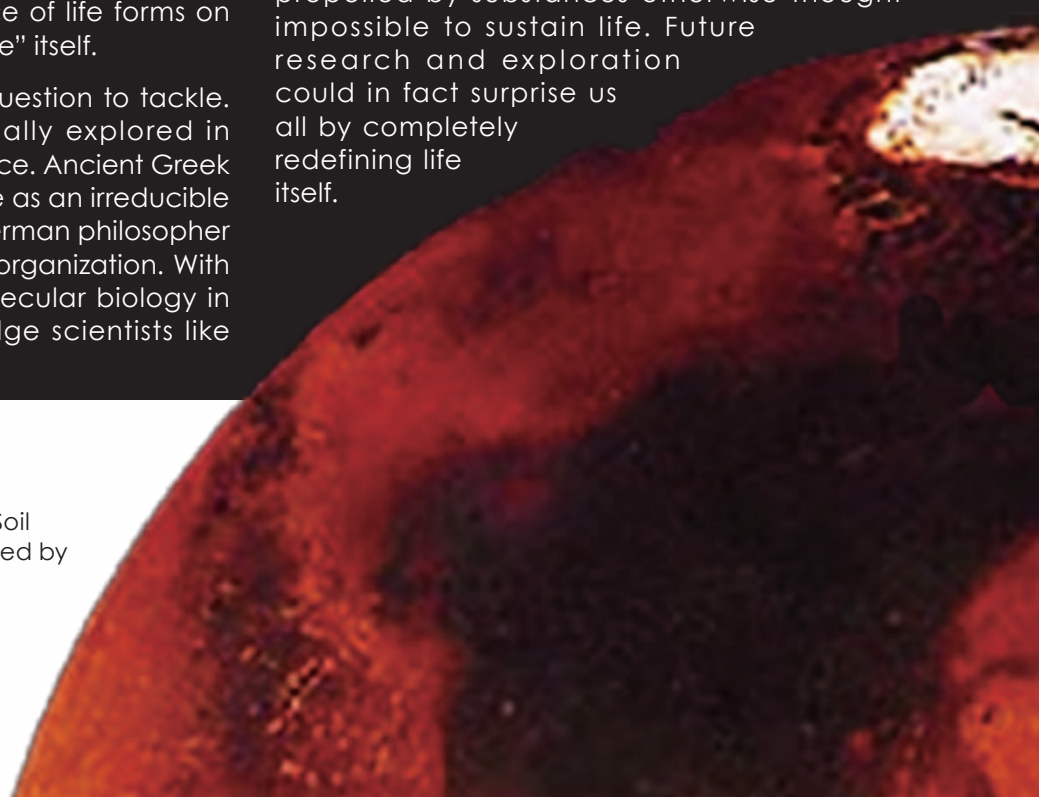
Laurie Leshin, Dean of Science from Rensselaer Polytechnic Institute at New York and her team discovered solid carbonated minerals in Martian soil that imply a presence of water [1]. Another researcher E.M. Stopler also suggested the presence of water in Martian soil by finding Jake Matijevic (or Jake M), a type of rock named after the engineer contributing to the Curiosity project. Stopler and his team found striking resemblances between Jake M and mugearite, a type of rock found on rifts and islands on Earth that forms from magma, crystallized with 1-2% water [2]. This similarity implies that Jake M is likely to form only where water is present.

Yet the pursuit of the presence of life forms on Mars brings up the definition of "life" itself.

This is not a straightforward question to tackle. The definition of life is continually explored in philosophy as much as it is in science. Ancient Greek philosopher Aristotle perceived life as an irreducible fact of the natural world. 1800s German philosopher Immanuel Kant viewed life as an organization. With the rise of biochemistry and molecular biology in the twentieth century, Cambridge scientists like Sir Frederick Gowland Hopkins viewed life from a cellular level as a collection of physical and biochemical processes. Simply put, a single cell is a unit of life.

A normal cell is anywhere between 60% to 75% water. Water is essential for biochemical functions, including being the final electron recipient of glucose metabolism that provides ATP or energy for living organisms to function. It is ideal in its ability of remain liquid over a wide range temperatures and its property in having a high specific heat capacity means that higher energy input (or heat) is required to change a given amount of water. The variation of the surrounding temperature would therefore have less of an impact on the change in temperature of water, making it a favorable environment for marine life as well as stabilized temperatures for cellular activity. The role of water in sustaining life as we know it on Earth is vitally important.

The discovery of the potential presence of water on Mars is exciting news as this suggests the potential for the Red Planet to harbor life forms similar to that of Earth. However, if Mars were a book, our current knowledge of this mysterious planet would barely fill up the first page. Scientists are currently investigating the presence of life on Mars based on the understanding of life from Earth. Yet some scientists like Norman Wingate Pirie hold the opinion that life is too complicated to confine to a list of processes. For now, the discovery of water on Mars holds exciting implications, but perhaps, 'life' on Mars has nothing to do with what we are familiar with on Earth, and is instead propelled by substances otherwise thought impossible to sustain life. Future research and exploration could in fact surprise us all by completely redefining life itself.



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[1] Leshin, Laurie (2013) Crater, Mars Soil Diversity and Hydration as Observed by ChemCam at Gale, Science

[2] Stopler, E. M. et al. (2013) The Petrochemistry of Jake_M: A Martian Mugearite, Science

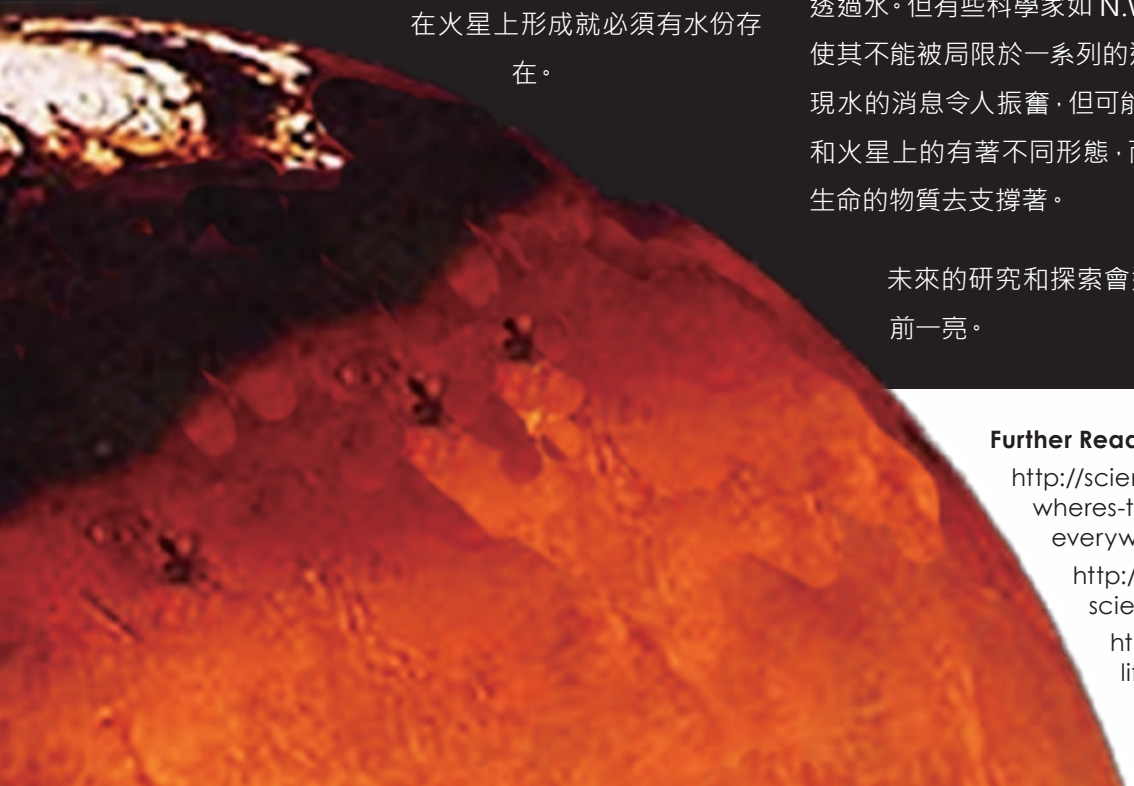
紅色星球：隱藏著的海綿

By Yang Yang 楊揚

以羅馬神話中的戰神命名的火星和地球的平均距離為五千六百萬公里，是和地球第二近的行星（和地球最接近的行星是金星）。這個含有豐富鐵質的火紅星球在不同層面上都和地球十分相似。它和地球一樣，被一層薄薄的大氣層所覆蓋；亦和地球一樣擁有位處兩極的冰層、火山和季節週期。地球和火星的相似度之高引起了不少好奇的人去解開它的疑團，以及生命在這星球上的可能。

在二零一一年十一月，美國在卡納維爾角發射了由美國國家航空暨太空總署（NASA）所發明的「好奇號」前往火星探索一個名為「蓋爾」的火山口。好奇號肩負著研究火星氣候和地質的使命，同時亦要尋找適合維持生命的舒適環境。自二零一二年八月成功登陸後，它一直傳送有關火星的數據和圖片。經過科學家的分析後，得出了火星上有水份存在的興奮結果。

紐約的倫斯勒理工學院科學院院長洛里·萊辛（Laurie Leshin）和她的團隊在火星土壤數據中發現了固體碳酸礦物質，意味著火星上有水存在 [1]。 另一位研究人員 E.M. 史朵普亦提議了透過在火星土壤中尋找「傑克·馬蒂耶維奇」（或作傑克M），一種以有份參與好奇號項目的工程師命名的礦石。史朵普和他的團隊發現傑克·馬蒂耶維奇和一種在地球上的島嶼、地殼裂痕找到的火成岩——Mugearite很相似，兩者均需百分之一至二的水份以形成結晶 [2]。這種特性代表著傑克·馬蒂耶維奇可以在火星上形成就必須有水份存在。



在尋找火星上的生命時亦會帶出另一個問題：「生命」的定義為何？

這不是一個容易解決的問題。生命的定義在哲學和科學層面上均在不斷演變。古希臘哲學家亞里士多德認為生命是自然世界中不可少的事實。十九世紀德國哲學家康德視生命為一種組織。隨著生物化學和分子生物學在二十世紀的崛起，劍橋大學科學家如弗雷德里克高蘭·霍普金斯爵士等則從細胞層面把生命理解為物理過程和生化過程的集合。簡單而言，單一細胞是一個生命的單位。

在微米尺度上，一個正常細胞的百分之六十至七十五的成份為水；而人體則約有百分之六十為水。水對生化反應而言非常重要，其中包括擔任為身體提供三磷酸腺苷或能量的葡萄糖代謝反應中最終電子受體。水在較高溫度範圍內維持液態的能力十分理想，其較高的比熱容亦代表它需要較多的熱去升溫。因此，周邊溫度的變化對水的影響不大，使它成為海洋生態的一個理想環境，同時亦為細胞活動提供了穩定的溫度。水必然而不可避免地維持著地球上的生命。

火星上有可能找到水，揭示這火紅色的星球，有可能和地球一樣有生命存在。然而，若將火星比喻成一本書，我們現時對這惑星的了解只能勉強填滿第一頁.....科學家們正根據他們對地球上生命的了解去研究火星上的生命，那就是透過水。但有些科學家如 N.W. 皮里則認為生命過於複雜，使其不能被局限於一系列的過程中。現時，可能在火星上發現水的消息令人振奮，但可能，我們在地球熟悉的「生命」和火星上的有著不同形態，而且是利用我們認為不能維持生命的物質去支撐著。

未來的研究和探索會透過重新定義生命而使我們眼前一亮。

Further Reading:

http://science.time.com/2013/09/26/wheres-the-water-on-mars-everywhere/

http://www.bbc.co.uk/news/science-environment-24287207

http://plato.stanford.edu/entries/life/


PHILIPS
HYUNDAI
OLYMPUS
SAMSUNG
HITACHI
CHINA MOBILE

The Plastic Ocean
塑膠海洋

By Yang Yang 楊揚

From afar, the beautiful blue oceans of our planet stand mesmerizing, dazzling and clear. Now, look closer. What if the oceans we see are not blue, but grey and turbid, and filled with plastics?

Such is the case with the Pacific Ocean. The truth becomes apparent on closer inspection of what is perhaps more befitting as the Plastic Ocean. At a first glance, one might notice large pieces of plastic, floating crudely atop ocean waves, not unlike the ones seen on beach shores, readily recognized as bottles, foams, or bags. Upon closer inspection, plastic in the midst of the waters are generally much smaller in size.

According to the samples first brought back by researcher Moore in 2001, the ocean is like a homogenous yellowish "plastic soup" with a significant amount of plastic concentrated in the waters [1]. Bigger plastic pieces like foam boards drift from the shores to the inner oceans through currents. Collisions break larger lumps into smaller scraps. Prolonged exposure to UV radiation and solar heat induce reactions with free radicals termed photo-degradation, and the scraps soaked in waters degrade into yet smaller fragments known as microplastics. In other words, a soft drink bottle from the ocean lines could be ground up into minute fragments by the time it reaches the center of the ocean.

Regardless of whether they are macro- or microplastics, both endanger marine life. The most common problems are entanglement and ingestion. News of turtles and dolphins caught in nylon fishing nets are not uncommon. Marine life suffocates in plastic bags. Turtles choke from ingesting bottles and foam mistaken as jellyfish. Sea birds die of nutrient deprivation from the illusion of being full after ingestion of bottle caps.

Microplastics concern marine biologists as much as plastics concern environmentalists. With these tiny plastic pieces having diameters smaller than 5 mm, scientists are concerned about the hazardous effects of ingestion. Ingestion of these tiny plastic pieces most likely occurs due to their resemblance to zooplanktons. According to a 2010 research by Boerger's team in the North Pacific Central Gyre, approximately 35% of the fish examined had ingested plastics, averaging 2.1 pieces per fish [2]. Another research team led by Browne found that these plastic pieces linger in the guts of the animals as plastic is not biodegradable [3]. Furthermore, Teuten and coworkers have found that marine plastics absorb toxic substances like polychlorinated biphenyls (PCBs), which are used in coolant fluids and the banned insecticide dichlorodiphenyltrichloroethane (DDT) [4]. The long duration of microplastics residing within marine animals poses potential concern to the ecosystem.

1. Daily use of plastic product and taking marine animal as food soure.
日常使用塑料產品和食用海洋生物

塑料海洋 Plastic oceans

4. Marine life suffocates in plastic bags, or ingests plastic.
塑料引至海洋生物窒息或誤食塑料

2. Improper Disposal of plastic into ocean.
不當棄置塑料產品到海洋

3. UV radiation and collision turn plastic in to tiny pieces
紫外光和浪擊將大片塑料變成微型塑料

Flowchart of the Plastic ocean　塑料海洋流程圖

Plastic is so ubiquitous and convenient these days that most users utilize them without considering the long-term effects. The concern about plastic runs deeper than its accumulation as seen by the naked eye. The stark reality reveals that the adverse effects of macro- and microplastics ripple through the waters to all levels of the marine ecosystem.

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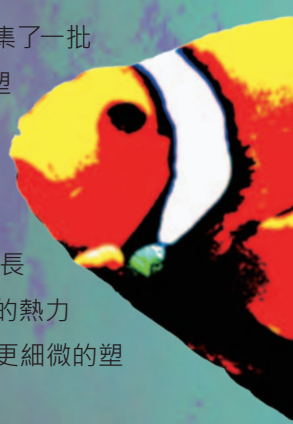
喜歡這期的文章？

下期你將會讀到關於奧茨冰人的最後一餐，以及爲什麼我們的身體無法合成維生素C！

從遠處眺望，蔚藍的海是多麼的迷人、是多麼的閃爍、是多麼的清澈。但仔細再看看，或許我們會發現海洋不再藍、不再閃爍、不再清徹，卻變成了灰色、汙濁的水，並且到處都有塑膠碎片在浮著.....

我們的太平洋便是如此。一般而言，太平洋是我們心目中那蔚藍的太平洋。可是仔細觀察下，太平洋確實是一個名符其實的塑膠海洋。我們對塑膠海洋的第一個印象通常是一個滿佈塑膠樽和膠袋的海灘，但事實上，在海洋中塑膠的體積卻是十分微小的，數目更是不可勝數的。

科學家Moore於2001年從海洋中採集了一批海水樣本。 這些樣本中含有大量細小的塑膠碎片，海水因而呈現乳黃色，就像一碗“塑膠湯水”[1]。當較大塊的塑膠隨著洋流從海岸線往內海流動時，它們會不斷互相撞擊，繼而變成一塊塊細小的塑膠片。長期浸泡在海水中的塑膠片被紫外線和太陽的熱力引發出的自由基所產生的光降解作用變成更細微的塑

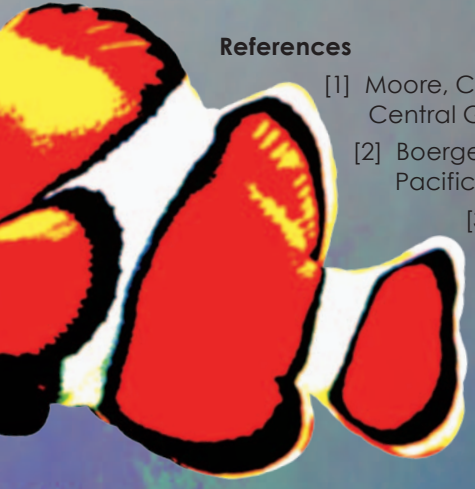


膠屑，科學家將此稱為微型塑膠（microplastics）。換句話說，一個完整的塑膠汽水瓶隨著海水的沖擊，到了海洋的中心時已化成無數的微型塑膠。

不論是大塊的還是微型塑膠，都會威脅到海洋生物的生命。最常見的例如海龜和海豚被尼龍漁網纏住、各種海洋動物被膠袋引致窒息、海龜誤把塑膠瓶和塑膠泡沫當成海蜇吃進肚子裏、還有海鳥吞下太多瓶蓋而自覺吃飽，因而缺乏營養致死等等。

如環保人士對塑膠廢物一樣，海洋生物學家十分擔心微型塑膠帶來的災害。微型塑膠直徑小於5毫米，大小猶如浮游動物一般，很多海洋生物誤會食微型塑膠。根據Boerger和他的團隊於2010年在太平洋中部環流的調查中發現：約百分之三十五的魚類曾吞食塑膠片，每條魚平均吞食2.1片[2]。另一組由Browne帶領的科學團隊發現，這些被吞下的塑膠片會一直留在動物的腸道內，因為塑膠是不能被生物降解的[3]。Teuten的團隊更發現海洋塑膠會積聚用作冷卻劑的聚多氯聯苯（PCBs）和違禁殺蟲藥滴滴涕（DDT：二氯二苯基三氯乙烷）等有毒物質[4]。微型塑膠因長時間殘留在動物體內與胃液接觸，便有機會被這些有毒物質釋放出來。

塑膠已成為人類日常生活中不可或缺的一部分，大多數人在使用時都不會考慮它們對環境和海洋的影響。科學家的發現證明塑膠對環境的危害遠遠比我們想像中的還要驚人。不爭的事實告訴人類無論是完整的塑膠片或微型塑料也好，它們對海洋生態中每一種生物都產生負面的影響。



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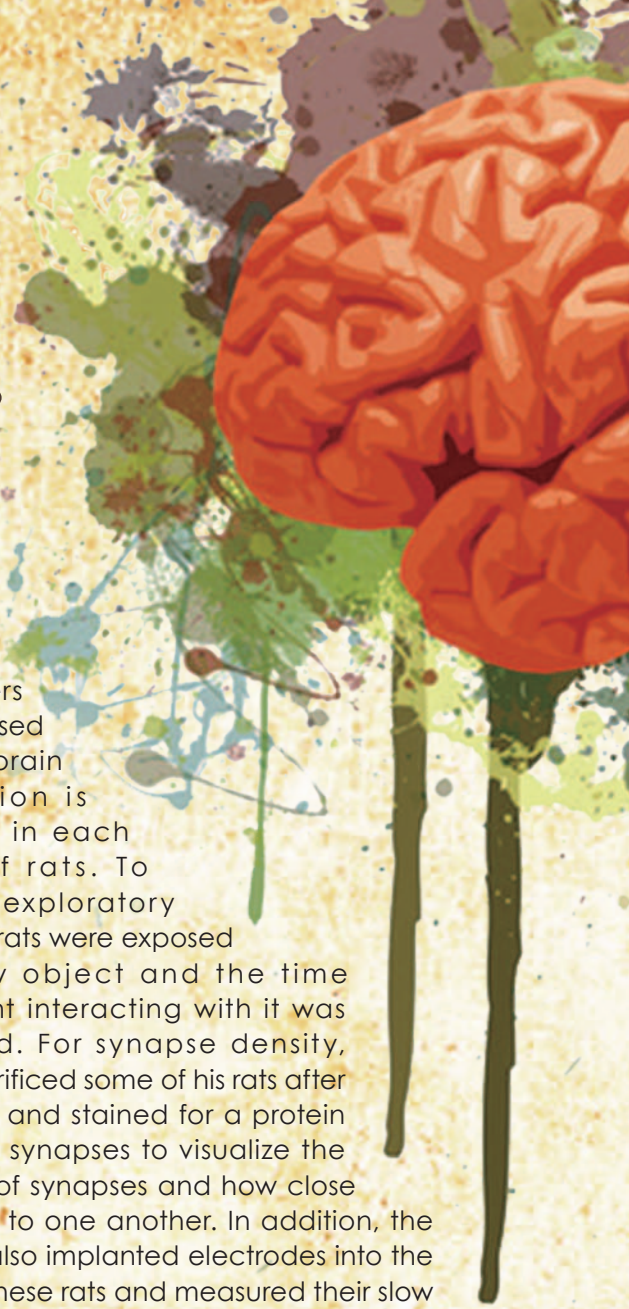
Coffee?! No Thanks.



Many hong kong students stay up late to finish assignments or to cram that extra bit of studying before tests. As a result, we tend to crave for coffee in the morning in order to negate the effects of staying up late at night. While we all know that coffee contains an addictive ingredient, caffeine, much less is known about how this chemical stimulant affects developing teenage brains. A group of scientists supported by the swiss national science foundation decided to investigate this question.

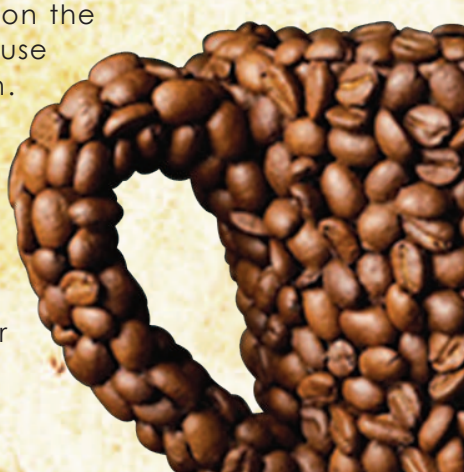
As human testing is often considered unethical, scientists typically use what they call "model systems" – other organisms that model our body's responses. In this study, Dr. Reto Huber and his team worked on 28 male rats. In both rats and humans, the number of neurological connections increases in childhood, peaks at puberty, and decreases as our brains prune out the unwanted connections between nerve cells known as synapses, or the areas where two neurons connect. Synaptic pruning is a critical part of brain maturation as it increases the brain's efficiency by reducing the amount of 'cluttering synapses' [1].

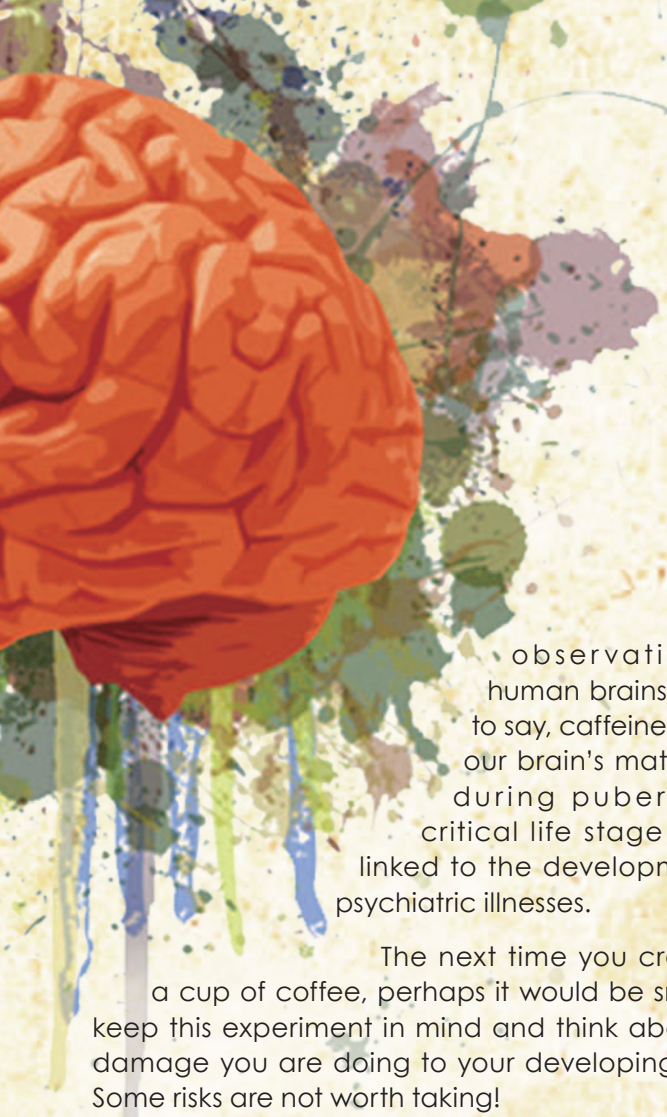
In order to measure brain maturation, scientists assessed three indicators: exploratory behavior, synapse density, and slow wave activity in the brain during sleep. Exploratory behavior towards a new object increases as a rat matures, which elucidates the curiosity of the rats towards new things. Synapse density decreases due to synaptic pruning in normal neurological development. The decrease in synapse density implies that the activated neuron has fewer places where it can pass on its message. Neural signaling, measured by the brain's slow wave activity during sleep, also decreases as a result.

For five days after the start of puberty, Huber's rats received a fixed dosage of caffeine in their drinking water that is equivalent to about three or four cups of coffee a day for humans. Control rats received normal drinking water with no caffeine. The researchers then assessed whether brain maturation is affected in each group of rats. To quantify exploratory behavior, rats were exposed to a new object and the time they spent interacting with it was measured. For synapse density, Huber sacrificed some of his rats after treatment and stained for a protein present in synapses to visualize the locations of synapses and how close they were to one another. In addition, the scientists also implanted electrodes into the brains of these rats and measured their slow wave activities during sleep.

The findings were significant: all three indicators suggested that the caffeine-treated rats have less matured brains than the control rats. As the caffeine-treated rats aged, both their synapse density and brains' slow wave activity did not decrease as much as that of the rats in the control group. The caffeine-treated rats also showed weaker explorative behavior.

You may wonder, "what does an experiment on rats have to do with us?" This study alone is not a comprehensive revelation of the actual effects caffeine has on the human brain that cause delayed maturation. Since the patterns in the development of neurological connections in rats and human are very similar, Huber's results most likely reflect similar





咖啡？不用了，謝謝。

By Raphaella So 蘇韋霖

observations in human brains; that is to say, caffeine affects our brain's maturation during puberty – a critical life stage that is linked to the development of psychiatric illnesses.

The next time you crave for a cup of coffee, perhaps it would be smart to keep this experiment in mind and think about the damage you are doing to your developing brain. Some risks are not worth taking!

很多香港學生時常要熬夜做功課和溫習。因此，我們經常會在早上喝一兩杯咖啡來提提神。雖然大家都知道咖啡含有令我們上癮的咖啡因，可是我們卻不太清楚這刺激物到底對年青人正在發育的腦部有什麼具體的影響。為了解開這個疑團， 一班由瑞士國家科學基金會資助的科學家便做了一項研究。

因為在人體身上做試驗不人道，所以科學家通常會用另一種生物來模擬人體的反應。在這個研究裏，Huber教授和他的團隊們用了二十八隻雄性大鼠來做試驗。不管是大鼠還是人類，腦細胞的突觸 (細胞與細胞之間的連接點) 數量會從幼兒期開始增加，直到青春期達到高峰。之後，腦部會消除不需要的突觸，使數量陸續下降。突觸數量下降是腦部成長的重要指標，因為可以把腦裡面雜亂多餘的突觸去掉，提高效率[1]。

團隊對三個腦部成長的指標作出評估：探索行為、腦細胞的突觸密度和睡眠慢波活動。當大鼠日漸成熟時，牠對新事物的探索行為會增加，表示對新事物日感興趣。突觸密度因精簡化而亦隨之下降，意味著一個被激活的腦細胞少了可以傳達訊號的地方。此外，訊號傳導點的減少也會減低慢波睡眠的活動。

在大鼠青春期開始後的五天，牠們從飲用水中攝取咖啡因，大概相等於人體一天喝三、四杯咖啡的份量， 再將測試結果和沒有攝取咖啡因的老鼠比較。為了量度老鼠的探索行為，科學家給了牠們一個新物體讓他們自由探索，然後紀錄牠們探索的時間長度。在突觸密度方面，Huber教授對其中幾隻大鼠進行解剖，然後把一種突觸特有的蛋白質染色，以觀察在腦部突觸的位置和密度。除此之外，科學家還在大鼠的腦部植入了電極，以便量度牠們的睡眠慢波。

研究結果十分顯著：三種測試都顯示咖啡因令大鼠的腦部發展比正常老鼠慢。隨著年齡的增長，攝取咖啡因的大鼠的突觸密度和睡眠慢波活動沒有下降得比較慢，而探索行為亦比較弱。

或許你會問：「到底一個在大鼠身上做的實驗跟我們有什麼關聯？」。雖然單靠這次研究是不能全面剖析咖啡因到底是怎樣影響和拖慢腦部的發展，可是，因為人類跟老鼠腦部的發展模式很相似，所以我們有理由相信，Huber教授的研究結果能反映出在人腦會有相似的結果的。總括而言，咖啡因是會影響青春期 - 一個與精神病發展有關的關鍵時期 - 的腦部發展。

下次你要喝咖啡的時候，或許要重新考慮一下， 你正在傷害自己發展中的腦部。不值得冒險吧！

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Dissecting Shampoo

What does shampoo do for our hair?

By Oi Ying Wong

Most of us use shampoo daily to clean our hair. When unwashed for a few days, our hair becomes cased in a layer of grease, appearing dull, unkempt and generally unpleasant. Further prolonging of going *au naturel* often means itchy scalps and eventually, matted hair. Once shampoo is applied, our hair can return to its former shining glory. What happens chemically, when we wash our hair with shampoo and what exactly is in shampoo?

The human scalp contains sebaceous glands that secrete a greasy, waxy substance called sebum, made primarily of triglyceride oils and wax. When sebum coats the cuticle or outer keratin layer of the hair strand, it can protect hair and hair follicles. However, when there is an excess amount of sebum on your hair, the hair strands tend to stick together, creating a greasy and stringy look. Using water to clean the sebum is essentially ineffective. Sebum creates a hydrophobic barrier on the surface of the hair, akin to a pseudo-waterproof layer. Hydrophobic molecules are electrically neutral and non-polar and water is a polar molecule. This means that sebum molecules tend to cluster together when submerged in water and therefore, insoluble, making it very difficult to remove sebum with water alone.

This is where shampoo comes in. Shampoo contains a blend of surfactants that can act as detergents, foaming agents or emulsifiers. The surfactants in shampoo are organic compounds that contain both hydrophobic groups and hydrophilic groups. The hydrophobic groups, containing a fatty chain, are insoluble in water and soluble in oil. In contrast, the hydrophilic groups, containing the polar head, are soluble to water and insoluble in oil. The hydrophobic groups attach to the sebum coating of the hair and other greasy substances, whilst the polar heads attach to water molecules. When the hair is rinsed, the detergent is washed away by the water, along with sebum and other undesirables.

Aside from surfactants, modern shampoos also include other ingredients such as sodium chloride, which serves the roles of adjusting viscosity as well as acting as a preservative. The surfactants in shampoos organize themselves in structures called micelles. Many shampoos contain anionic surfactants, where there exists an overall charge density. Positive sodium ions from sodium chloride help to lower the charge density of the surface of the micelles, allowing a closer packed structure, hence, a thicker solution. This is, of course, a simplification of the process, as the tolerance to salt varies in different shampoo solutions.

Shampoo does indeed keep our hair clean. However, the chemicals in shampoo are specifically designed to strip away the natural oils in our hair. Over-washing hair can induce the sebaceous glands to secrete more sebum and overcompensate for the stripped oils. Experts recommend a spectrum of differing opinions on the optimal frequency of shampooing hair, but the general consensus seems to indicate that shampooing once every other day is enough to keep hair clean, while not harming the essential oils that keep our hair strong and healthy.

Further Reading:

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分析洗頭水

洗頭水究竟對我們的頭髮幹了什麼？

黃靄盈

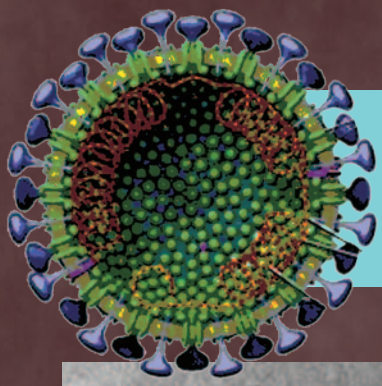
相信很多人每天都會用洗頭水清潔頭髮。頭髮一旦幾天不經過清洗，就會出現一層油脂、顯得乾燥和不整潔，繼而會引起頭皮癢和頭髮纏結。但當我們用洗頭水清潔頭髮後，頭髮就會立即回復原本的光澤。究竟洗頭水有什麼化學成份能夠達致這個效果？

頭皮含有皮脂腺，它會分泌一種油脂和蠟質的物質，而這種物質叫皮脂(sebum)。皮脂主要由三酸甘油(triglyceride oils)和蠟形成，當皮脂包住髮根的表皮和外角質層，它能夠保護我們的頭髮和髮囊。可是，當皮脂過量，髮根會黏在一起，形成油性和污穢的感覺。你也許曾經嘗試過用清水洗頭，可是你發現是徒勞無功的，頭髮依舊纏結。原因是，皮脂在頭髮的表面形成一個疏水性的屏障，就似一個防水的層面。疏水性的分子是中性和非極性的，而水是極性的分子。因此，當皮脂浸在水中，皮脂分子會集在一起而不溶於水，這令水難以完全清走皮脂。

洗頭水是多種表面活性劑的混合製成的。表面活性劑可以當成洗滌劑、起泡劑和乳化劑。它是包含疏水性組(hydrophobic groups)和親水性組(hydrophilic groups)的有機化合物。疏水性組合包含不溶水和溶於油的脂肪酸(fatty chain)。相反地，親水性組包含溶水和不溶油的極性頭部(polar head)。疏水性組會附上頭髮上的皮脂層和油脂物，而極性頭部會附上水分子。當我們洗頭時，皮脂和污物就會連同洗滌劑一起被水沖走，這能令頭髮回復潔淨。

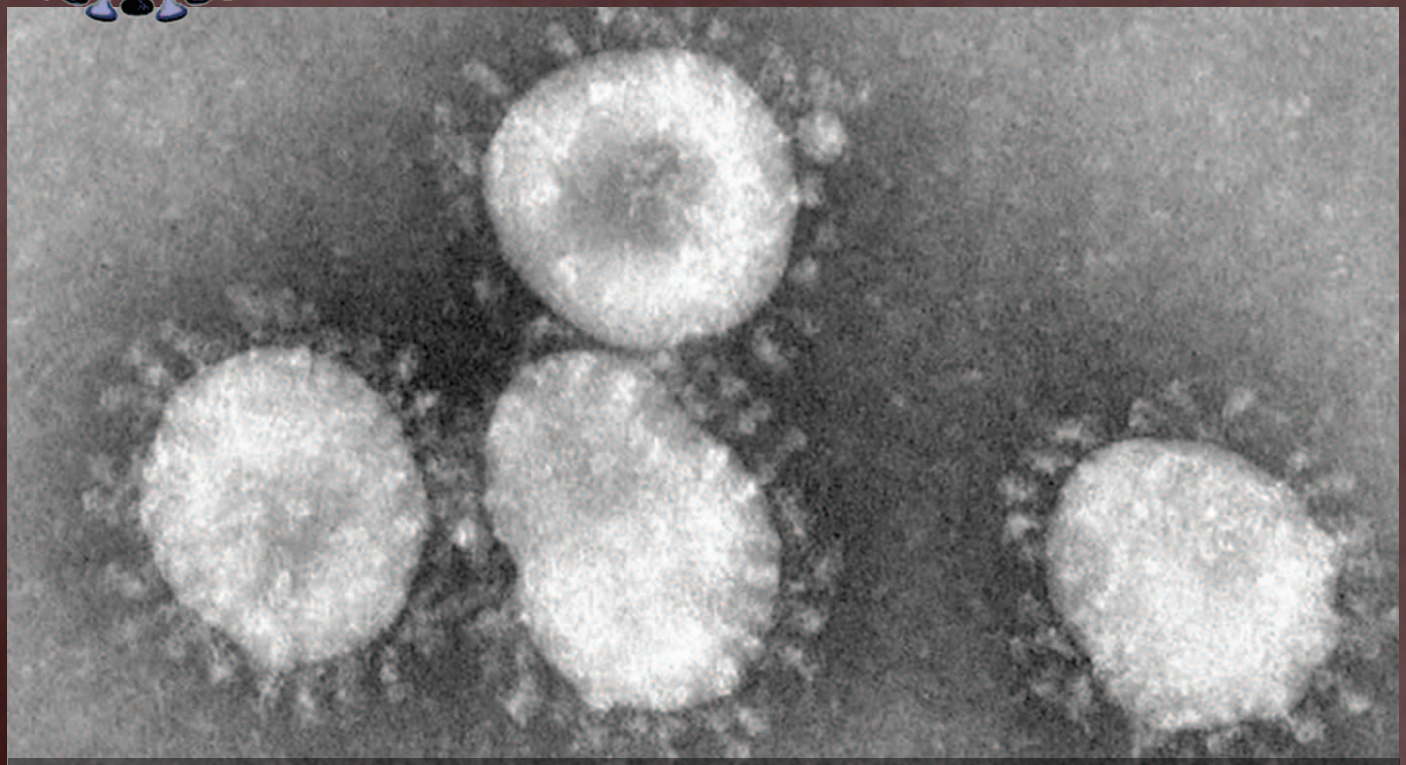
除了上述的表面活性劑，現時的洗頭水還包含其他成分，如氯化鈉(sodium chloride)能夠調節洗頭水的黏性和有防腐劑的作用。表面活性劑自行組織為一種名為膠束(micelles)的架構。很多洗頭水都包含陰離子的表面活性劑，當電荷密度增加，膠束會相斥，溶液會愈來愈稀。氯化鈉中的正鈉離子能夠幫助降低膠束表面的電荷密度，從而達至一個更緊密的裝填架構，令溶液更濃縮。當然，溶液的濃縮程度會根據不同洗頭水的特質而變化。

洗頭水固然能夠把我們的頭髮變得柔順、潔淨。可是，洗頭水中的化學物是專門用來除走我們頭髮中的天然油脂。過量洗頭會誘發皮脂腺分泌更多皮脂和油份，矯枉過正。專家們雖然對洗頭的次數作了很多不同的意見，但他們最終的共識就是隔天洗頭已經足夠保持頭髮潔淨、健康而不受損害了。



Stay Away From Bats!
遠離蝙蝠

By Sunjung Lim 林宣廷



Micrograph of coronavirus, with a halo-like appearance. Photo courtesy of Frederick A. Murphy
顯微鏡照片中的冠狀病毒呈光環形狀。照片由Frederick A. Murphy提供

In November 2002, a lethal strain of virus arose in southern China. In less than a year, the terrifying pandemic disease, known as Severe Acute Respiratory Syndrome (SARS), had spread over thirty-three countries, affecting more than 8,000 people and killing more than 700 worldwide. Hong Kong was no exception and the lively city was covered by a shroud of nightmare from March to June 2003. All activities in schools and higher institutions were suspended during the course of the pandemic and reports on the number of newly infected and deceased cases increased daily on the news.

It has been a decade since, and scientists have discovered that the host animal of the SARS virus is a civet, a nocturnal cat-like mammal belonging to the taxonomical family Viverridae. Recently, however, researchers have isolated a closely related virus from bats in China that can infect human cells. According to one of the lead researchers Peter Daszak, this discovery is significant because it demonstrates that there are bats carrying the virus that can directly infect people and may potentially cause another SARS-like epidemic in China in the future [1].

Although scientists have suspected bats as a source of coronaviruses, the virus responsible for SARS, they were unable to prove how the infection passed from these nocturnal animals to humans for many years. Thus, in order to learn more about the SARS virus, Chinese researchers obtained genetic samples from horseshoe bats in Kunming. Together with researchers from Australia, Singapore and the United States, the team identified at least seven different strains of a SARS-like coronavirus [2]. Two of the strains closely resembled the SARS strain, especially for the genes encoding the important spike proteins. Furthermore, direct bat-to-human transmission is feasible since the SARS virus is able to bind directly to protein receptors (angiotensin converting enzyme II or ACE2) on human cells. It suggests that SARS viruses do not need to be transferred to another host before infecting humans.

This finding brings forth some serious issues for public health control, especially due to the outbreak of a SARS-like virus in the Middle East in September 2012. The new virus, dubbed Middle East respiratory syndrome coronavirus (MERS-CoV), causes severe pneumonia and kidney failure and has infected 64 and killed 38 people in the Middle East and Europe so far. As the virus is likely highly contagious and might initiate infections between humans, health workers and infectious disease experts who have been examining MERS wish to quarantine infected patients as soon as identified, before things get out of control. The contagiousness of the virus signifies its potential to trigger another disastrous epidemic [3]. Scientists have yet to wipe out the virus completely, but have managed to halt new infections. As Chinese horseshoe bats are a common species in Hong Kong, we should be cautious with bats since it is very likely that the viruses are common among bats in Asia.

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在零二年十一月，一種致命性病毒在中國南部出現。在不到一年的時間內，這種被稱為「嚴重急性呼吸系統綜合症」（又稱非典型肺炎或非典）的疫症已經迅速蔓延到三十三個國家，並感染超過八千人，死亡人數高達七百多人。香港亦不能幸免，在零三年三至六月短短的三個月內，疫症的惡夢一下子籠罩這個本是朝氣勃勃的城市。因為確診病人數目和死亡數字不斷上升，所有學校、大專院校亦因而停課，社會及經濟活動大受影響。

十年過去，科學家認定非典是透過果子狸這種在夜間出沒，有點像貓的靈貓科哺乳類動物作宿主，並傳播到世界各地。然而最近研究人員又在名為中華菊頭蝠的一種蝙蝠身上發現一種和非典病毒相近，具有感染人類的能力的新病毒。負責這項研究的 Peter Daszak 指出，這種在蝙蝠身上的這種病毒是可以直接感染人類，令中國有機會再次爆發像非典般的另一場疫症[1]。

非典病毒是一種冠狀病毒，縱使科學家多年來一直懷疑蝙蝠是這種病毒的載體，他們一直都不能確切地證明冠狀病毒是如何從動物傳播至人類。為了對非典病毒作更深一步的研究，中國的研究人員從昆明的菊頭蝠身上抽取了基因樣本，並聯同來自澳洲、新加坡和美國等的研究人員一起發現了最少七種和非典病毒相似的冠狀病毒，其中兩種所含刺突蛋白的基因排序和非典病毒十分相似[2]。再者，由於非典病毒是可以直接黏附在一種名為二型血管緊張素轉化酶的人類細胞受體上，這證明非典病毒是不需要經由第二宿主，而可以直接從蝙蝠身上感染人類。

去年九月，在中東地區爆發和非典相當相似的病症。這種被稱為中東呼吸系統綜合症冠狀病毒（MERS-CoV）的新型病毒可引發嚴重肺炎和腎衰竭病徵，已有64人在沙特阿拉伯和其鄰近地區及歐洲等地確診，及造成38人死亡。基於其傳染力之高，及有可能發生人傳人的情況，衛生工作者和傳染病學家希望能在疫情一發不可收拾之前成功隔離MERS的病人，該病毒有着的高傳染性標誌著可能觸發另一場災難性的傳染病[3]。科學家尚未能完全消滅這種病毒，但要及時遏止新症發生。因為中華菊頭蝠是香港常見的一種蝙蝠，在亞洲區內的蝙蝠很可能都帶有這些致命的病毒，所以我們對蝙蝠必須保持警覺。

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SZECHUAN PEPPER EXPLAINED

解構四川麻辣火鍋

By Oi Ying Wong 黃靄盈

For spicy food enthusiasts, Szechuan pepper hotpot is one of the best winter treats. Strong Szechuan pepper can cause your tongue to feel tingly and partially paralyze your mouth and lips, resulting in a feeling of numbness. For people who are particularly sensitive to the spice, this feeling sometimes spreads all over the mouth cavity.

Have you ever wondered why you experience a tingly feeling after eating Szechuan pepper?

Spicy berry is the main culprit involved in generating the paralyzing sensation. The Northern Chinese is known for using spicy berries as seasoning. While spicy berries are not actually "spicy," in the traditional sense, they do carry a taste that resembles spiciness. According to New Beijing News, a group of European scientists recently discovered that spicy berries contain a component called sanshoamide, which can stimulate certain nerves in our body. This generates a frequency of neural signals, which is what our brains interpret as the tingling sensation.

What is the frequency of neural signals generated by sanshoamide?

The scientists did a simple experiment. They ground sanshoamide and mixed it with ethanol. They then placed the mixture onto the lower lip of a volunteer. At the same time, a finger of the volunteer was placed on a vibrator for mechanical vibration. When the volunteer senses a tingle, he or she would convey to the scientists whether the frequency of the tingling sensation from their lips were higher or lower than that of the defined frequencies of finger vibration. It took scientists forty trials before they could equilibrate the two frequencies. They eventually determined that spicy berries produce a frequency of approximately 50Hz. This frequency matches a class of nerve fibers, RA1, which has an optimal sensitivity of around 50Hz to 100Hz. From this information, the scientists concluded that spicy berries stimulate RA1 fibers. The finding serves as a plausible scientific explanation of why we feel tingly when we eat Szechuan pepper.

Think about it: the electricity we use at home typically has a frequency of 50Hz. It is not an exaggeration to say that when we eat Szechuan pepper hotpot, we are experiencing a mild electric shock!

在天寒地凍的天氣下，對於一個嗜辣的人來說，相約一眾好友圍坐一起享用四川麻辣火鍋絕對是最佳選擇。四川麻辣鍋的辛辣能夠令食者有舌頭及嘴唇感到麻痺以及刺痛，這種感覺慢慢地攻入腦中，熱騰騰的感覺攻陷全身，感覺快要頭頂冒煙了.....

在享受麻辣火鍋之際，大家有沒有想過為什麼嘴唇及舌頭會感到麻痺及刺痛？

麻辣火鍋產生麻辣的主要成份是花椒。北方人喜歡用花椒作為調料，它本身並不辣，但卻能帶出獨特麻辣口味，是中國的特色產物。一個英國科研團隊最近發現，花椒含有一種名為「花椒麻素」的成份，能夠激發我們身體某些神經，這些神經會產生特定的振動頻率，繼而將信息送往大腦導致某種感覺，而該感覺就是我們吃麻辣火鍋後感到的嘴唇舌頭麻痺及刺痛。

但究竟花椒激發的神經振動頻率是多少？

科學家對此做了一個簡單的實驗。他們把花椒麻素磨成粉末加入酒精塗在自願者的下唇，同時於自願者食指上綁著一個振動器，當刺痛出現時，自願者需要判斷花椒刺痛感引起的頻率比振動器高還是低，重覆四十次實驗，直至兩者頻率相似。科學家由此推斷出花椒麻素產生的振動頻率為50Hz。被稱為RA1神經的振動頻率剛好在50Hz-100Hz時最敏感，因而確定花椒能激發RA1神經而誘發50Hz的振動，這種振動頻率就是大家吃麻辣火鍋時感到的麻刺感。

試想想，香港一般家居用電的頻率亦是50Hz，如果說吃過四川麻辣火鍋後感到像輕微觸電一樣的麻痺、刺痛之感，也沒有誇張之嫌吧！生活中到處也是科學，簡單的實驗也能得出偉大的結果，嘗試多留意身邊的事物，你也會得益良多。

Further Reading:

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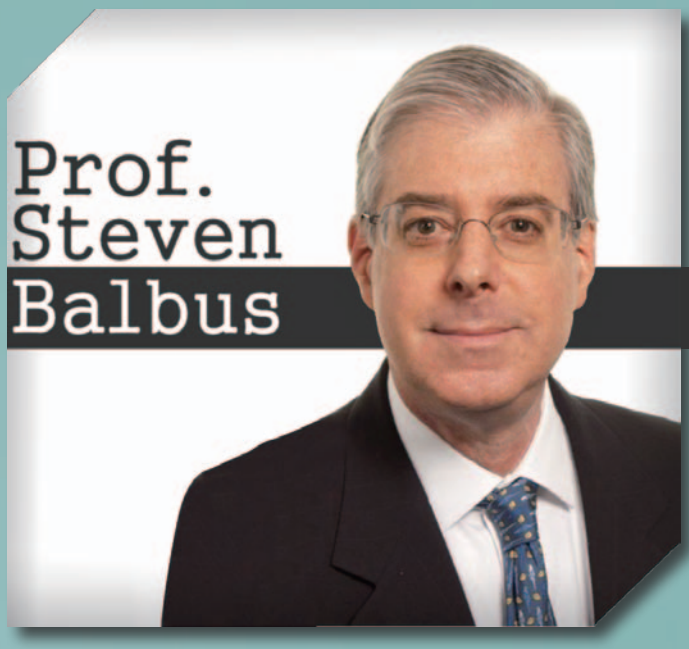
The Astronomical Journey of Research

拜爾巴斯教授 - 研究天文學之路



By Kwan Shu Tse 謝鈞澍

Passion, curiosity and perseverance are only a few of the key qualities possessed by Prof. Steven Balbus, 2013 Shaw Laureate of Astronomy and Savilian Professor of Astronomy at the University of Oxford. Prof. Balbus jointly won the 2013 Shaw Prize with Prof. John F Hawley for their outstanding research on astrophysical accretion disks providing a viable mechanism named magneto-rotational instability (MRI), which leads to accretion disk turbulence. The Shaw Prize, established in 2002 by the late media mogul, Sir Run Run Shaw, honors individuals who have made outstanding contributions in academic and scientific research. We were fortunate enough to obtain an e-mail interview with him in late October 2013, shortly after being awarded the Shaw Prize. His sincerity and enthusiasm overflowed through his words in an e-mail reply to our questions.

Prof. Balbus' exposure to astrophysics began early. As a young child, his supportive, physician father regularly took him to museums and star-gazing excursions. In high school, he derived inspiration from his geometry teacher, Bruce Hartman, who demonstrated creativity within mathematical thought. Prof. Balbus' own fascination and curiosity with reading physics texts of famous physicist, Richard Feyman, further fueled his thirst for knowledge and honed his skills in devising simple physical models. These factors helped transform his interest in "outer space" as a child to a fascination with black holes and neutron stars as a teenager. He went on to obtain double degrees in Physics and Mathematics from the Massachusetts Institute of Technology (MIT) in 1975 and finished his PhD in Theoretical Astrophysics from the University of California, Berkeley in 1981. In 2012, he was named Savilian Professor of Astronomy at Oxford and his current research deals with the Sun's internal rotation.

As a student myself, I often wonder if the field of research is long and arduous. When posed with this concern, Prof. Balbus readily admits that research can be frustrating at times. He doesn't, however, feel that his research is ever 'unfruitful'. Difficulties are inevitable during research, yet he regards these challenges as motivation that drives him to strive for results. He believes that one will find more joy in research if one truly enjoys their field of interest. "Even if the results are not what one hopes for, it is so much fun to see how it all works out... Even failures are surprising in an interesting way".

When it comes to the accompanying math, students are often discouraged if they were initially interested in astronomy. Fortunately, the wide discipline of astronomy means that not all aspects are interlocked with heavy and difficult mathematics. That being said, while interest is important to becoming a successful researcher and scientist, Prof. Balbus stresses that "there is a limit to where undisciplined enthusiasm alone can take you"; wise words to heed, and undoubtedly applicable to more than being successful in scientific research alone.

Perhaps the most important qualities one should possess, besides interest and discipline, are curiosity and perseverance. Curiosity fuels the need to obtain knowledge and answers, while perseverance allows one to plough through the difficult times when the answers might take years to derive. Prof. Balbus believes that "You have to love the subject and allow it to dominate most of your waking hours... you do it because you can't help it and can't imagine doing anything else". Finally, after having mastered the fundamentals of the subject, one has to open up one's mind and start thinking outside of the box for new and innovative ideas. Do you have what it takes?

熱情、好奇和毅力成就了2013年邵逸夫天文學獎得主、英國牛津大學Savilian天文學講座教授 - 史蒂芬·拜爾巴斯教授的天文學之路。史蒂芬·拜爾巴斯教授和約翰·霍利教授共同分享邵逸夫天文學獎以表彰他們對天體物理學裏吸積盤的研究，並提出磁性旋轉不穩定性來解釋吸積盤出現的湍流。「邵逸夫獎」由已故的邵逸夫先生成立於2002年，得獎者在學術或科學研究上應有傑出貢獻或突破性的成果。 我們非常榮幸可以在10月下旬，在他剛獲獎後邀請他透過電郵接受訪問。從回覆的電郵，可以從字裡行間看出他的真誠和對天文學的熱情。

從小開始，拜爾巴斯教授就開始接觸天體物理學。當他還是小孩的時候，他的父親就帶他去觀星和參觀博物館。而在他讀高中的時候，他的幾何學老師，布魯斯·哈特曼，用了創新的方式去解釋數學理論，並啟發了他。當拜爾巴斯教授閱讀著名物理學家理察•費曼的物理課本後感到趣味盎然，進一步燃點他對知識的渴求，也磨練了他對建立和利用直覺推想物理模型的技巧。這些因素令他漸漸由一個單純對外太空感到興趣的小孩，蛻變成一個對黑洞和中子星等產生興趣的青少年。因此，他前往美國麻省理工學院修讀，於1975年取得數學及物理學學士雙學位，並於1981年在加州大學柏克萊分校完成理論天體物理學博士課程。2012年，他在英國牛津大學出任並冠以Savilian天文學講座教授。拜爾巴斯教授最近正研究太陽的內部旋轉。因為進度良好，我們期望在不久的將來會聽到他的研究成果。

身為一個學生，我經常覺得做研究想必是既漫長又艱鉅。當我提到這個擔憂時，拜爾巴斯教授承認總會有挫敗的時候，可是，他從不覺得他的工作枯燥乏味。做研究，困難是無可避免的，但困難正好給予動力，驅使他去尋求答案。他認為只要真正喜愛和享受那份工作，自然會發現當中的趣味。「即使結果不是如你所願，只要能了解當中的奧妙……你也會發現原來失敗也可以這麼有趣。」

Founder of the Shaw Brothers Studio and Hong Kong Television Broadcasts Limited (TVB), **Sir Run Run Shaw** was an entertainment mogul who produced over 1000 movies and nurtured many TV and movie stars as well as directors. He was a generous philanthropist, who donated $6.5 billion to various charities, schools and hospitals throughout his life.

影視大亨**邵逸夫爵士**創立邵氏兄弟電影公司及電視廣播有限公司(TVB)，製作逾千部電影，培育無數演藝界人才。邵爵士生前熱心公益事業，歷年捐贈金額65億港元，惠及不同的慈善項目、學校和醫院。

當提到天文學需要大量數學時，有些學生即使原本喜愛天文學，也因為發現數學十分深奧而為之卻步。幸好，在天文學的眾多學科中，不是所有範疇都需要艱深的數學理論。話雖如此，要成為一個成功的研究人員，興趣也是非常重要的。拜爾巴斯教授強調「只是有無節制的熱情不能帶你走多遠」。這句話非常明智，不單純適用於科研的成功，也值得細細思索。

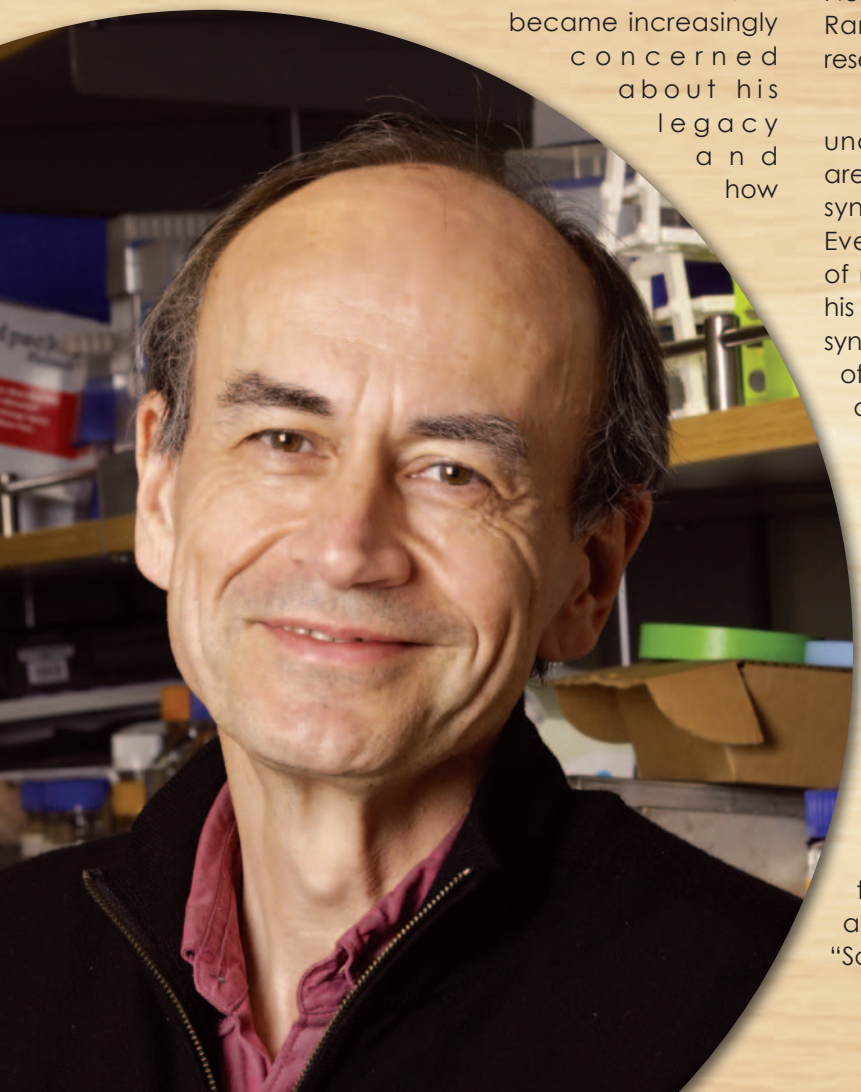
除了興趣和專業外，好奇心和毅力也是成功的必要元素。好奇心增強對知識和答案的渴求，而當遇到一些需要多年時間才能解決的難題，毅力就能幫助衝破難關。拜爾巴斯教授相信「你必定要愛上它，而且能讓它佔據你大部份的時間……這是因為你不能自拔地愛上它，亦無法接受投放時間入其他領域」。最後，當學習了並有能力駕馭這個領域的基本條件，這便是時候開放思想跳出框框，才能以創新的思維推陳出新。你，又有沒有這些元素呢？

Photograph courtesy of **The Shaw Prize Foundation**

The Nobel Prize – Featuring Professor Thomas C. Südhof

Named after Alfred Nobel, the Nobel Prize is the annual international award to praise and acknowledge individuals with outstanding contributions in cultural and scientific research. Founded in 1901, the Nobel Prize has since been regarded as the most prestigious award for the six prize categories of Peace, Physics, Chemistry, Physiology or Medicine, Literature and the Sveriges Riksbank Prize in Economic Sciences.

Alfred Nobel was a Swedish chemist, engineer, inventor and entrepreneur in the 19th century. Among his 355 patents, he was most famously known for the invention of dynamite. The active ingredient in dynamite, nitroglycerin is extremely dangerous to work with as the highly unstable, colorless liquid can be detonated by the slightest triggers of friction or movement. Nobel discovered that by adding kieselghur, a type of a naturally occurring sedimentary rock, nitroglycerin became much easier to handle. Along with his invention of dynamite and his other patents, he set up various companies and laboratories turning himself into a very wealthy man. Toward the end of his life, he became increasingly concerned about his legacy and how he would be remembered. As a result, he specified in his will that his amassed wealth would set up a trust to create a series of prizes for those who confer the "greatest benefit on mankind" in peace, physics, chemistry, physiology or medicine, and literature.



The Nobel Prize truly awards recognition and honor to its Laureates. Prof. Thomas C. Südhof is a testament to this. Prof. Südhof is currently the Avram Goldstein Professor in the School of Medicine as well as a Professor of Molecular & Cellular Physiology, Psychiatry, and Neurology in Stanford University. He completed his doctoral study in the Max Planck Institute for Biophysical Chemistry in 1982, and began his postdoctoral fellowship in the University of Texas Health Science Center (now the UT Southwestern Medical Center) in 1983, under the supervision of two Nobel Laureates, Joseph Leonard Goldstein and Michael Stuart Brown, who were awarded the Nobel Prize in Physiology in 1985. Initially, he faced opposition to his ideas but through his continuous hard work and perseverance, he was able to prove his worth. He was awarded the Nobel Prize in 2013 along with James Rothman and Randy Schekman in medicine or physiology for their research in cell organization and transport system.

Prof. Südhof's Nobel winning work helps us to better understand how nerve cells communicate. Nerves are interconnected by numerous junctions known as synapses that pass information via neurotransmitters. Every action, emotion or behavior requires the firing of millions of synapses simultaneously. Südhof began his work on synapses in 1980s, with the realization that synaptic transmission is the fundamental building block of virtually all brain activity, determining the functions and processes that happen in the brain. He was ultimately successful in identifying the proteins involved in this precise mechanism, revealing their role in neurotransmission, which was previously not well understood.

For Südhof, the greatest inspiration in research was from an unusual channel – his classical music teachers, in particular, his bassoon teacher, where he learned that creativity is intimately intertwined with hard work and scrupulous attention to detail. To him, motivation comes naturally in a field he finds "intrinsically interesting" and useful to mankind. His advice for students who are interested in science and research as a career is to possess curiosity, energy as well as the satisfaction and yearning to learn without becoming exhausted. "Science really is for idealists".

諾貝爾獎 – 托馬斯•聚德霍夫教授

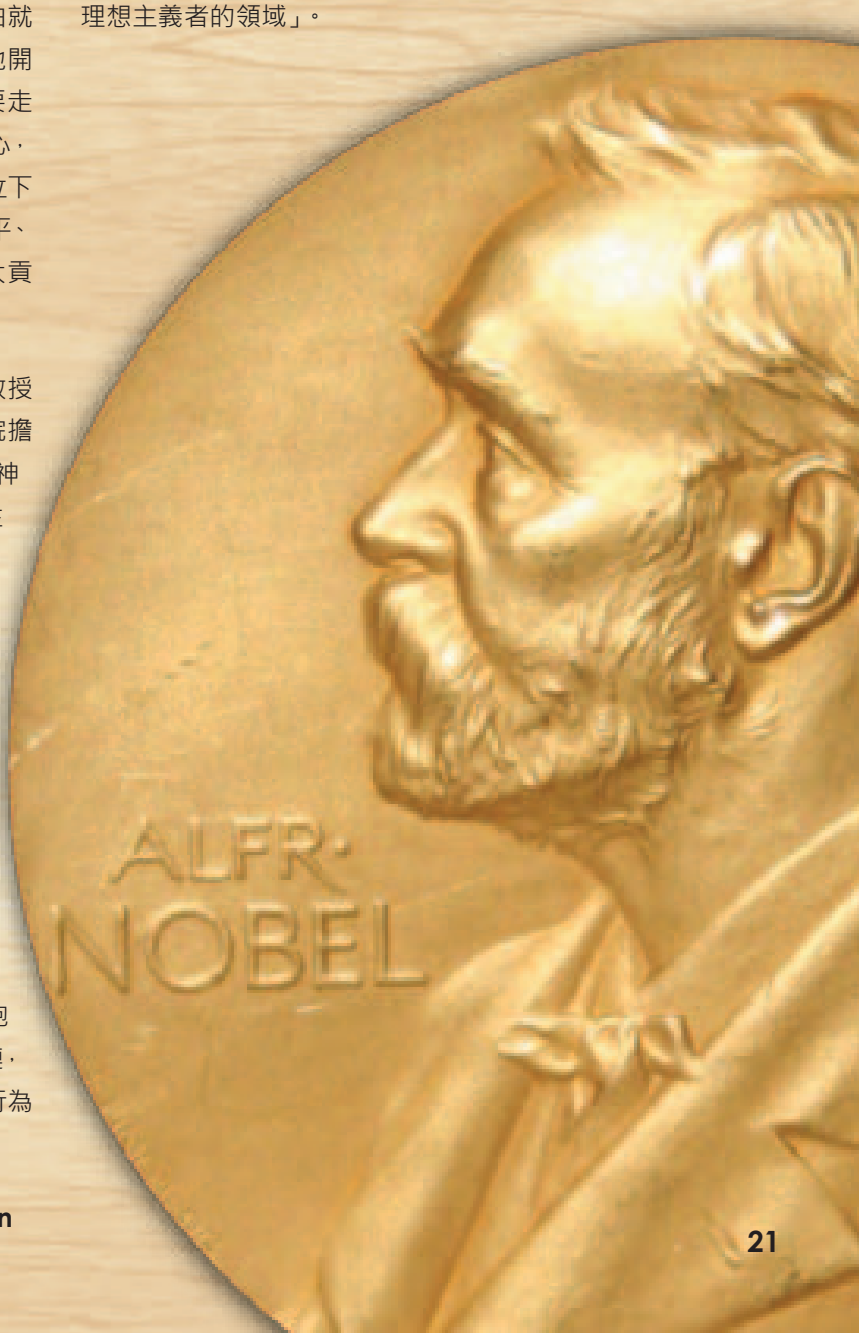
以阿爾弗雷德•諾貝爾命名的諾貝爾獎是一年一度的國際性獎項，目的在於表彰那些在文化和科學研究有卓越貢獻的人士。自1901年成立以來，諾貝爾獎已經被譽為全球最具權威性的獎項。諾貝爾獎涵蓋和平、物理學、化學、生理醫學、文學和經濟學等六大領域，其中經濟學獎名為瑞典銀行經濟學獎。

阿爾弗雷德•諾貝爾是十九世紀的一個瑞典化學家、工程師、發明家和企業家。在他所擁有的355項專利中，令他聞名於世的是發明了炸藥。炸藥的活性成份是硝酸甘油，由於它是一種非常不穩定和無色的液體，即使是輕微的摩擦和移動都有機會觸發爆炸，所以處理硝酸甘油是非常危險的。諾貝爾發現只要加入矽藻土 (一種天然的沉積岩) ，硝酸甘油就會較穩定和方便處理。在發明炸藥和其他專利的同時，他開設了多間公司和實驗室，令他賺得大量財富。隨著他快要走到生命的盡頭時，他開始為如何處置這筆巨大遺產而擔心，同時思索如何能令世人記得他對世界的貢獻。因此，他立下了遺囑，把遺產用來成立基金會，每年以之獎勵那些在和平、物理學、化學、生理醫學和文學各領域上對「人類有重大貢獻」的人士。

諾貝爾獎給予得獎人肯定和榮譽，托馬斯•聚德霍夫教授得獎便是一個見證。聚德霍夫教授現於史丹福大學醫學院擔任Avram Goldstein教授暨分子細胞生理學，精神科及神經科教授。他於1982年在德國哥廷根的馬克斯•普朗克生物物理化學研究所完成其博士課程，隨後於1983年加入德克薩斯大學健康科學中心 (現為得克薩斯大學西南醫學中心) 開始博士後研究。他的研究導師亦是兩位諾貝爾獎得獎者：約瑟夫•里歐納德•戈爾茨坦和麥可•斯圖亞特•布朗，他們於1985年榮獲諾貝爾生理醫學獎。起初，有很多人反對聚德霍夫教授提出的觀點，但經過他努力不懈的研究，最終證明自己是正確的。他與詹姆斯•羅思曼和蘭迪•謝克曼兩位教授於2013年共同獲得諾貝爾生理醫學獎，以表揚他們對細胞組織和運輸系統的研究。

聚德霍夫教授獲獎的研究有助我們更加了解神經細胞的溝通機制。各神經之間以成千上萬稱為突觸的接點相連，藉著神經傳遞素來傳遞信息。我們每一個動作，情感或行為都靠著上百萬次的突觸發射來傳遞。聚德霍夫教授在八零年代開始在突觸上的研究。他意識到了突觸發射是所有大腦活動的基本組件，以決定所有大腦的功能和作用。他最終成功地識別出這精確的機制所涉及的各組蛋白質，揭示它們從未為人所知在神經訊息傳遞的角色。

聚德霍夫教授在研究上的靈感原來是來自一條不尋常的渠道 – 古典音樂，尤其是他的巴松管導師。他透過學習音樂領會到創意是與努力和對細節的關注緊密連繫在一起的。對他而言，作研究的動力是來自從心而發對某個領域的興趣，與及對人類要有幫助。聚德霍夫教授對有志於科研工作的學生建議：要具有好奇心，活力和一顆嚮往滿足感的心。「科學是理想主義者的領域」。



Photograph courtesy of © ® **The Nobel Foundation**

Test Yourself! 測一測

- How old is the oldest text that mentions electricity?
  文獻中最早提及電力的是在
  a) 1200 A.D. 公元 1200 年
  b) 50 A.D. 公元 50 年
  c) 2740 B.C. 公元前 2740 年
  d) 1600 A.D. 公元 1600 年

- How old is the Milky Way?
  銀河系有多久的歷史？
  a) 12.5 Billion years old 一百二十五億年
  b) 13.2 Billion years old 一百三十二億年
  c) 7 Billion years old 七十億年
  d) 400000 years old 四十萬年

- Who gave the first evidence of the Big-Bang theory?
  哪位科學家最先提出「大爆炸」的理論？
  a) Edwin Hubble 愛德文•哈勃
  b) Albert Einstein 阿爾拔•愛因斯坦
  c) S. Chandrasekhar 蘇布拉馬尼揚•錢德拉塞卡
  d) Stephen Hawking 史蒂芬•威廉•霍金

- True or False: Humans share the same number of neck vertebrae as giraffes.
  是非題：人類和長頸鹿的脊椎骨數目相同嗎？

- Which of the following food can be an ingredient for dynamite?
  以下哪一種食物可用作炸藥的成份？
  a) Peanut 花生
  b) Apple 蘋果
  c) Chocolate 朱古力
  d) Rice 米

- Which of the following can be recycled almost forever?
  以下哪一種東西可以無止境地被回收？
  a) Paper 紙
  b) Aluminum 鋁
  c) Copper 銅
  d) Vinyl 乙烯基

For detailed answers and explanations, or have suggestions and feedback please visit our website at
若你想知道更多，或有建議，請參觀我們的網站

http://sciencefocus.ust.hk

Answers 答案：c, b, a, T, a, b

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