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Mathematics of the Voting System of LegCo

by Dr Cheung Wai Shun and Dr Ng Tuen Wai, Department of Mathematics

Although not obvious, mathematics actually permeates through many areas of our modern society, affecting us fundamentally on an everyday basis. Even the voting system, an important feature of our democracy, can be analyzed with the help of game theory in mathematics. For example, we can use mathematics to study the complexity of the voting mechanism of the Legislative Council of Hong Kong (LegCo).

In game theory, the different voting systems can be classified by its dimension. We shall not state the precise definition of the dimension of a voting system (c.f. [1]) as it is actually easier to grasp the idea by considering some examples. The usual unicameral system in which the bills will be passed by a simple majority vote of the members is a one dimensional voting system. Bicameral legislatures which require a concurrent majority to pass legislation are two dimensional voting systems. For example, the United States Federal System which consists of 435 members of the House of Representatives, 100 members of the Senate, the vice president, and the president is a bicameral system with 537 members. Moreover, the vice president plays the role of tie breaker in the Senate, and the president has the veto power that can be overridden by a two-third vote of both the House and the Senate. Thus, for a bill to pass it must be supported by either:

i) 218 or more representatives and 51 or more senators (with or without the vice president) and the president;
ii) 218 or more representatives and 50 senators and the vice president and the president; or
iii) 290 or more representatives and 67 or more senators (with or without either the vice president or the president).

So given any coalition (subset) of the 537 members, we can determine if it is a winning coalition or a losing coalition and this property is very important for one to compute the dimension of the voting system. Note that a necessary condition for a bill to pass is the concurrent majorities of two separate parliaments, so the dimension of the voting system would be at least two. On the other hand, the concurrent majorities of two separate parliaments do not guarantee that a bill will be approved as the president has the veto power. However, it was proven in [1] that the dimension of this voting system is still two.

Now let's consider the voting system of our LegCo which consists of two groups of legislators: one group comprising 30 members selected in the functional constituencies and the other group comprising the remaining 30 members elected by universal suffrage in the geographical constituencies.

Since the handover of Hong Kong in 1997, in order to strengthen the executive dominance over the legislature, the Basic Law requires the passage of motions, bill or amendments to government bills introduced by legislators to pass by the concurrent majorities of two groups. On the other hand, motions, amendments to motions, bills and amendments to bill raised

From The Editor

Dear readers,

We have a few very interesting things to report in this issue of *science@HKU*. First of all, Dr K M Lau, who studied his BSc in Mathematics/Physics in HKU, is going to tell us a very touching story. He recently solved the final problem in his undergraduate summer project given by his teacher some 21 years ago. This kind of undergraduate research experience has long existed in HKU, but was not formally recognised in the transcript until several years ago.

Also, Dr W S Cheung and Dr T W Ng of the Department of Mathematics, will tell us some rigorous mathematical results concerning the share of power in the current LegCo. It demonstrates the power of mathematics in analyzing certain social and political issues.

Yours sincerely,
Dr H F Chau
Chief Editor

Contents

by the Hong Kong Government only need a simple majority vote of the members present to pass. Therefore, our LegCo is sometimes unicameral and sometimes bicameral, depending on whether the bill is proposed by the Hong Kong Government. This unique feature of LegCo makes the computation of the dimension of it a non-trivial task. For example, given a coalition of 30 members from the geographical constituencies and 2 members from the functional constituencies, there is no way to tell if it is a winning coalition or a losing coalition (unless you know if the bill is proposed by the Hong Kong Government). To overcome this difficulty, we introduce a virtual representative of the Hong Kong Government, which will vote for a bill if it is proposed by the government but against a bill otherwise.

To be more precise, the 30 members from geographical constituencies are numbered 1,...,30, the 30 members from functional constituencies are numbered 31,…,60 and the virtual member (the government) is numbered 61. Then, a coalition or subset S of the set {1,2,…,60,61} is a winning coalition if and only if

(a) 61 in S and $|S \cap \{1,\ldots,60\}| \geq 31$, or

(b) 61 is outside S, $|S \cap \{1,\ldots,30\}| \geq 16$ and $|S \cap \{31,\ldots,60\}| \geq 16$.

where $V \cap W$ is the intersection of the two coalitions V and W and $|W|$ is the number of members in the coalition W.

With this mathematical model of LegCo, it is now possible to compute the dimension of LegCo. It turns out that the dimension of it is three (see [2] for the details). It should be noted that the other known real voting system of dimension 3 is the European Union Council under the Nice rules since 2005 (see [3]).

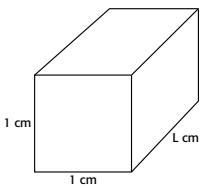
The pace of constitutional reform in Hong Kong is a central issue during the consultation period for the "Public Consultation on the Methods for Selecting the Chief Executive and for Forming the Legislative Council in 2012". The above mathematical model of LegCo allows one to quantify the pace of constitutional reform of LegCo from the point of view of its complexity. In fact, abolishing the difference between a bill proposed by the government and a LegCo member, while keeping the functional constituencies and the split-voting mechanism will make LegCo a bicameral system and its dimension will be reduced from three to two. If one further abolishes the split-voting mechanism, the dimension will then be reduced from two to one (even when one keeps the functional constituencies). This shows that it is the role of the government and the presence of the split-voting mechanism that determine the dimension of LegCo, not the existence of functional constituencies. Finally, we would also like to point out that if one only broadens the electorate base of the functional constituencies and implement the so-called "one person two votes" (i.e., each voter has one vote in the direct geographical election and has one vote in one of the functional constituencies), the dimension of LegCo will still be three and therefore, there is no change in the complexity of the voting system of LegCo.

1. Alan D Taylor, Mathematics and Politics. Springer-Verlag New York, Inc., 1995.
2. Wai-Shun Cheung and Tuen-Wai Ng, A Three-Dimensional Voting System in Hong Kong, preprint.
3. J Freixas, The dimension for the European Union Council under the Nice rules, European Journal of Operational Research, Volume 156, Issue 2 (2004),415-419.

Brainteaser

Question

Dice games have been involved in gambling for centuries. Rolling dice is often a popular activity in learning basic statistics and probability. Here, we consider the probability of getting a 6 in rolling a generalized die of size 1cm x 1cm x Lcm, where the two faces of 1 cm x 1 cm on the die are marked 6 and other faces are marked otherwise. When L = 1, it is a standard die where the probability of rolling a 6 is 1/3. One argument is that the probability of a particular face rests on the surface should be in proportion to the area of that face and since the total area of the six faces is 2 + 4L cm^2, the probability of the die resting on any 1cm x L cm face is 4L/(2+4L) and hence the probability of getting a 6 equals to 1- 4L/(2+4L) =1/(1+2L), which also gives the answer for a standard die. What do you think of this solution? Give reasons to support your argument.



Prize: $50 book coupon
Deadline: June 11, 2010

Please email your answer together with your name and school (for students), to scinews@hku.hk. FIVE winners will be drawn randomly from the contestants who give the correct answer.

Question of Last Issue's Quiz:

I am boy and I am girl.
I live in waters close to your home but I also travel the world, and have even been to Hollywood.
My home is an animal that looks like a plant.
Some people like to look at me; others like to eat me.
Please write a poem about me.

Answer: Clown Fish. Winning Poems of last issue:

Sobbin' Fish

It's tiny
It's cute
It's orange-dressed
It's white-striped
It's the clown in the aquarium
It's on stage every day for uncountable audience

It's pointed at
It's laughed at
It's lookin' at the glass window
It's starin' its reflected shadow

It's trapped
It's here for sale
It's scared
It's cryin' for help

It dreams, it wishes, desperately
It'll again surf in the sea
It'll again be feelin' free
It'll get rid of this gloomy destiny!

by Lau Ho Fan, Peter, CCC Mong Man Wai College

Little Clown Fish

Little clown fish, little clown fish
Swimming in the big sea that taste and smell so salty
Seeing all different kinds of coral reefs
Listening to the sounds of rushing waves
The color of your skin is red, yellow, orange and black
Camouflaging you from sharks and predators
The skin of you feels so smooth and soft
So smooth and soft it is just like silk
Your favorite host is sea anemone
Providing food for you to eat
In return, you will provide nutrients for it
Every day for you is fun and exciting
Exploring every place of the big blue sea
How I wish I could swim with you!

by Tania Chan, Kiangsu Chekiang Primary School (International Section)

Premier Zhou Enlai's "Daughter", If He Had One

by Tony W K Fung, Chair Professor and
Fan Xia, Student Research Assistant
Department of Statistics and Actuarial Science

Some years ago, a woman called Yibei wrote a book and claimed that she was the illegitimate daughter of the late Premier Zhou Enlai (周恩來總理). The book was then promoted by some media in China and Hong Kong, causing quite a storm and an uncompromising dispute: is it true or just a lie? Although the later investigation conducted by Xinhua News Agency had clearly identified the parentage of Yibei and thus shown that the whole story was purely a fictitious slander, there are doubtful people insisting the need of more persuasive evidence. So, how can we know the truth when all parties involved have passed away?

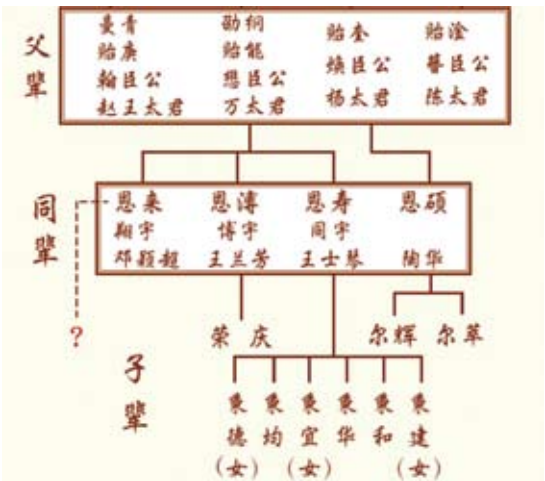
Way back in the early years of last century, few people knew about DNA, as it was not until 1953 that the most unique and important substance in heredity was discovered by James Watson and Francis Crick. It took three more decades for DNA technique to be first applied in to parentage testing. Nowadays, the application abounds in many cases. A very similar and famous case to the 'Premier Zhou's daughter' is the mystery of Anastasia, the youngest daughter of the last Tsar. There was a woman called Anna, who claimed to be the missing noble. However, the DNA testing in 1990 showed that she was not an immediate member of the Russian Royal Family. Another significant application of DNA testing is to identify victims and trace their relatives in serious natural disasters, like tsunami in Indonesia on December 26, 2004 and the May 12 Earthquake in Wenchuan, Sichuan in 2008.

A most common form of DNA profile, abbreviated STR, is a way of showing the unique pattern of inheritance. Parentage testing, which is to estimate the rarity of a match of DNA profiles of the child and alleged parent, involves the use of statistics. We use a standard trio (Mother-Child-Alleged Father) to illustrate the basic principle of the approach. Suppose that at a particular locus (a location on a chromosome) the DNA profile (or genotype) of the mother (M) is A_1A_2, the child (C) is A_1A_3, and the alleged father (AF) is A_3A_4. In STR analysis, we are interested in examining whether the alleged father is the true father, or a random man is the true father of the child. Under the Mendelian Inheritance Law, if the alleged father is the child's true father, he would transmit one of his two alleles, ie. A_3 and A_4, (and A_3 to the child in this case). Similarly, the mother would transmit her A_1 allele, thus constituting the child's A_1A_3 genotype. Statistically, we need to calculate the likelihood ratio, which is to compare the probability of observing the trio DNA profiles under the null hypothesis H_0 that the alleged father is the true father of the child to the associated probability under the alternative hypothesis H_1 that a random man is the true father. Mathematically, this likelihood ratio, which is also called the paternity index, is expressed as:

$$PI = \frac{P(C = A_1A_3, M = A_1A_2, AF = A_3A_4 \mid H_0)}{P(C = A_1A_3, M = A_1A_2, AF = A_3A_4 \mid H_1)}$$

where H_0 - *Alleged father is the true father of the child;*
H_1 - *A random man is the true father of the child,*

are the two competing hypotheses. In practice, we often need to consider DNA profiles for ten or more loci at different chromosomes. And the overall paternity index can then be obtained by taking the product of all individual indices. If the overall index is very large, say 1,000 or above, it provides very strong evidence to the null hypothesis H_0 that the alleged father is the true father of the child.



On the other hand, we may also be curious about other problems: how can we identify both parents at the same time; how can we deal with cases with missing parental information; how can we identity the kinship, like sibling relationship…? We can settle these problems by using the same likelihood ratio approach. Nevertheless, the most curious problem is that the reality may not be as simple and perfect as the formulae and lab results, so the scientific research always need innovation to narrow the gap.

DNA profiling does not limit its power to parentage testing. It in fact has an even wider use in crime investigation and other interesting applications. For instance, how can we test that all human beings are derived from the same ancestors in Africa? How can we use the very old bones or hairs in archaeology to identify some famous historic figures? Considering the deterioration of nuclear DNA over time, the Mitochondrial DNA, which is more ubiquitous and easy to detect, is commonly used for such testing.

Going back to the Premier Zhou's case, with genetic identification, we can present 'persuasive' proof and nail the lie to the counter. Although our Premier Zhou had chosen his final rest beneath the ocean wave, and the mother in the story is also not available, we can still settle down the dispute by using kinship determination. Considering Premier Zhou had four nephews and three nieces, who are the offspring of his blood brothers and are still alive, DNA profiling can still handle the dispute.

Just at the time we write this, the tomb of Premier Cao Cao (漢丞相曹操) was recently found. A young man in Jiangxi province claimed to be the descent of Cao Cao. Is he, like his 'ancestor', another 'hero' or …?

Introducing Professor Rudolf Wu

Chair Professor and Director of the School of Biological Sciences

by Dr D L Thomson, School of Biological Sciences

Professor Rudolf S S Wu and I share a number of things in common: we both joined the School of Biological Sciences in 2009, we both work across disciplines to study biology and the environment, and we both enjoy good single-malt whisky. Our roles are very different though, indeed Wu is my new boss, and he is taking up the mantle of directing the School with a long and distinguished track record behind him.

Wu has an international profile, with a PhD from the University of British Columbia, and further scientific appointments in Canada and Australia. His roots are however here in Hong Kong, indeed it was from HKU that Wu graduated with his MPhil and BSc Special Honours degrees and it was here that he became inspired to follow a career in science. The majority of his 180 publications and his extensive research funding (including an Area of Excellence award, a State Key Laboratory, and almost 40 million HKD of consultancy) have been generated in our local scientific institutions. Through this and through his experience on key committees such as RGC Council, he has built up an intimate knowledge of the Hong Kong academic system, and is well placed to lead the School of Biological Sciences through times of change.

Despite a good position as Chair Professor at the City University of Hong Kong, where he founded the Department of Biology and Chemistry and achieved top rankings in repeated Research Assessment Exercises, he was attracted to the opportunities here at HKU. "HKU is ranked among the world's top universities: it has good people, good infrastructure, and a good reputation; there are special opportunities here, so we can achieve things which are not possible elsewhere", says Wu.

As a new member of staff myself, I rather share his views, and in my case I was drawn especially by the university's strength in Ecology and Biodiversity. Not only could I see good individual scientists, I could see that they were working well as a team, making the most of their common interests and complementary expertise to help and support each other and deliver high profile results in both teaching and research. Wu is aiming to build on these sorts of strengths as he integrates the various parts of the school and leads it through changing times.

The School of Biological Sciences has been created through a process of fusion, bringing together the Department of Botany, the Department of Zoology, and the Department of Ecology and Biodiversity. Wu aims to integrate these components, promoting their strengths and focusing on their potential to attain international standing in Marine and Freshwater Biology, in Endocrinology and Cell Biology, and in Food for Health.

Wu has taken up this challenge at a time of substantial change in the Hong Kong higher education system. He is well in tune with the winds of change and thinks strategically, fostering competitiveness and building collaborative inter-disciplinary teams. "Competing successfully for individual-based research grants will continue to be important but we need to seize the new opportunities presented by large collaborative and theme-based grants for high-performing teams who can tackle the big issues."

Likewise in teaching, Wu recognizes the large-scale reforms involved in the 4-year curriculum, and aims to be one step ahead. "Students will have time to assess the quality of the teaching before choosing their majors. We need to ensure our teaching remains competitive and serves the needs of the students."

Wu has ambitious plans for the next five years. In adapting to the changing world, he is aiming to take us to new heights, achieving excellence across the board. If he gets time off, he may well stay fit with some swimming, relax with some yoga, and indulge the senses by traveling to exotic lands, enjoying international cuisine, and listening to a wide range of music. He has been a member of the HKU Senior Common Room since way back in the old days, and from time to time, he may revisit these old haunts to share a beer or two with his staff and colleagues.

We all welcome Professor Rudolf Wu and we look forward to working together in the years ahead.

Professor Rudolf Wu and members of School of Biological Sciences

A Closure of School Project 21 Years Belated

by Dr K M Lau, 1989 BSc (Mathematics/Physics) Graduate

Every HKU alumnus has a unique memory of his/her academic career at the Alma Mater. The good old memory may comprise regular hiking to the Peak with fellow classmates, Saturday afternoon football matches, attending a concert of Vienna Philharmonic at City Hall knowing that our Physics, Mathematics/Physics group took most of the discounted tickets, working with our professors on a summer research project. My own memory includes all of the above, plus a puzzle arising in my summer project which remained unsolved until recently.

1 The Story

It was the Boxing Day evening in 2009 . I was cleaning up my bookshelf and came across a copy of this paper (http://adsabs.harvard.edu/abs/1989ComPh...3...47C). The article was a write-up of a small summer project, led by Professor D J Newman and Dr Betty Ng, with Li Chi Leung, Mok Ho Ming and Chan Fuk-Lok, my fellow classmates. The result might not be significant by any standard, but the spirit of collaboration and the good memory transcend the passage of time.

I started re-reading that paper. Part of the last paragraph captured my thought. "..... we have not been able to prove that $Tr(\epsilon^2)$ is always reduced in T-fits, although this is apparently the case ....." I recalled I did spend some effort in the summer of 1988 trying to prove exactly that, to no avail obviously. So I sat down with some scratch paper and a strong will to un-knot a puzzle lingering for some 21 years. A couple of hours later, I worked out a proof! At that defining moment, I felt I unboxed a Christmas gift that brought me a closure and a sense of inner peace.

2 The Puzzle

2.1 A Phenomenological Model

Not too many observations in life can be logically deduced starting from first principles. In many occasions, a lot can still be learnt about a physical system and useful predictions made without a complete knowledge of the underlying Physics or Mathematics. In a phenomenological approach, we would obtain experimental results of a physical system, and use those results to "train" a simple model describing the system. Of course the simple model is constructed in such a way to incorporate our insights and limited understandings of the system so that we are not stuck with the impossible task of training a completely general model. The intricate details which we have not yet fully understood may be manifested as model parameters which we adjust so as to minimize the difference between the real experimental results and the same quantities as derived from the model. Once this training is done, the model may be employed to make predictions concerning the physical system.

The experimental result we were given was a set of N observed energy levels E_i in decreasing order. We wanted to "train" a parametrized Hamiltonian H,

$$H(\alpha_1, \alpha_2, ..., \alpha_M) = \sum_{k=1}^{M} \alpha_k H_k \qquad (1)$$

such that the eigenvalues $\{h_i\}$ of H were as close to $\{E_i\}$ as possible by adjusting the real parameters $\{\alpha_i\}$. More precisely, we would like to minimize the error measure

$$\sum_{i=1}^{N} (E_i - h_i)^2 = Tr\,[(E - U^T H U)^2] \qquad (2)$$

where E is given by

$$E = \begin{pmatrix} E_1 & 0 & \dots & 0 \\ 0 & E_2 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & E_N \end{pmatrix} \qquad (3)$$

and U is the orthogonal matrix diagonalizing H in decreasing eigenvalues h_i.

2.2 Training Procedure

Now a closed form solution of $\{\alpha_k\}$ seemed out of reach since the orthogonal matrix U in (2) depends on α_k in some intricate way. Instead we tackled the objective by an iterative algorithm of repeating the sequence of "diagonalization" step followed by a minimization step; starting with a set of α_k guesstimates.

2.2.1 Diagonalization Step

We computed U which diagonalizes H assuming all α_k are held fixed.

2.2.2 Minimization Step

With U fixed, we then adjusted $\{\alpha_k\}$ to minimize (2).

2.2.3 Iteration

We repeated the 2 steps above until the error measure was less than a predetermined goal.

2.3 A Pleasant Observation

By carrying out the training sequence, we observed that the parameters $\{\alpha_k\}$ would always converge to make (2) attain a local minimum. Our observation was so consistent that we were compelled to pursue a mathematical proof of the convengence. However summer was always short and there were always enough useless things to do, even before the advent of the Internet and its accompanying time wasting addictions such as facebook, mafia wars and farmsville, that we were unable to construct such a proof before the new school year started.

3 A Serendipity

Fast forward 21 years, in the comfort of my home compounded with the typical family chaos, the mood of the Christmas holiday still filling up the atmosphere, the proof was finally constructed, unplanned and unintended. Interested readers may read the proof by visiting: www.hku.hk/science/news/kmlau

4 Epilogue

Nowadays Physics may not be an active part of my daily work life. There seems to be not much opportunity in my present days to fit a parametrized Hamiltonian to measured energy levels. However what we have learnt at our Alma Mater 21 years ago, may find renewed relevance in this ever changing world. As an example, many websites nowadays can appear to be quite intelligent, able to recommend consumable items matching your individual interest, or to intelligently aggregate and classify world news based on subject matters and importance. Now an exact theory on individual's taste or his preference of movies, for instance, is quite an intractable endeavor. However a Bayesian model with its parameters trained using movie ratings from the entire user base may provide a good recommender leading to many additional sales for an e-commerce web site.

Inter-university Ecology Fieldcourse Facilitated International Exchange

by Professor G A Williams, School of Biological Sciences

What do you get if you mix a group of Hong Kong, Xiamen, and Johannesburg University staff and students? The 2009 Ecology Fieldcourse is the answer… as this year saw the first exchange between these three universities held at Pak Tam Chung Fieldcamp, Sai Kung organized by the Division of Ecology & Biodiversity, School of Biological Sciences, HKU.

This is a residential fieldcourse aimed to introduce students to the diversity of species in Hong Kong and their inter-relationships with their environment and each other. Each day has a separate set of learning objectives and is held in a different habitat to expose the students to the rich biodiversity of Hong Kong wildlife.

Students hiked over hillsides to mark and measure tree heights to investigate forest regeneration; waded up streams to collect and identify benthic insects; braved waves to measure the distribution and abundance patterns of rocky shores gastropods; dug up tons of mud and sand to quantify the distribution of infauna along a sandy shore and finally visited the fish markets of Sai Kung to 'sample' the seafood – finding out where it had come from and whether it was caught in a sustainable manner.

Despite coming from diverse backgrounds, students shared many of the same concerns over environmental degradation and loss of biodiversity. By working and discussing together, students were able to share a common belief to try to make a difference, both in their own countries, but also by working together to combat global environmental problems.

Hear from the participants

Andrea Naylor from Johannesburg University

"The Fieldcourse has shown me that problems in our environment are not only limited to our own countries but can be experienced similarly elsewhere. This trip has truly inspired me to continue further with my research, shown me that I am not limited by what I study further and that there are many opportunities and experiences out there that are waiting for me to grab and mould to my future as a scientist"

Terence Ng from HKU

"The mixing of local, Xiamen and Johannesburg students created a very interactive atmosphere for learning. This was my second year being a demonstrator but the experience this year was quite different for me. Like many local undergraduates, I learnt much more than I have expected by talking to students and staff from other regions of the world. We shared our knowledge, cultures and the ways of thinking. Such experience could never come from the text books. The camp was great fun for me. I enjoyed it so much!"

Leon Li from Xiamen University

"What impressed me most was the way we tried to find out answers, and the new approach to study the relationship between human beings and our environment. I find that the answer is not knowledge written in the book which we should follow or remember, but is the process we try to find out the essentials behind the phenomenon. We should observe it, think about it and reach a conclusion by ourselves. As the key point mentioned by Professor Williams 'You can make a difference! Yes, everybody has the capability to make a difference only if we could keep it in mind and do it like that."

Science Faculty Platinum Jubilee Celebrations

70th Anniversary Dinner

The spectacular 70th Anniversary Dinner, held on November 15, 2009 at Convention Hall, Hong Kong Convention and Exhibition Centre, marked the climax of year-long of Faculty Platinum Jubilee celebrations.

On this happy occasion, the Faculty was pleased to honour its outstanding alumni in various sectors and salute their remarkable achievements in their professions and contributions to society. A total of 43 Distinguished Alumni were honored, and no less than 900 guests, alumni, students and staff members witnessed and shared the joy of the awardees.

Order Now!

70th Anniversary Commemorative Volume

The recent publication of *Faculty of Science 70th Anniversary Commemorative Volume* marks the end of a year-long celebration of Platinum Jubilee Anniversary in 2009. While looking forward to the years ahead, the publication also reflects our glamorous history and keeps our memories alive.

Stainless Steel Watch Special Edition for 70th Anniversary

- Stainless steel case and band
- Water resistance
- Dial inscribed with Faculty of Science 70th Anniversary logo
- Japan quartz movement
- Limited edition with logo and a unique serial number at the back
- Two colours, black and silver, are available

For details, please visit www.hku.hk/science/70th

Achievements of Students

- **Dr Xiang Li**, PhD graduate of Department of Chemistry, was awarded *The Best PhD Thesis* in the Faculties of Dentistry, Engineering, Medicine and Science of Li Ka Shing Prizes at HKU Graduate School Award Presentation Ceremony 2007-08. Under the guidance of Professor Dan Yang, Dr Li's thesis entitled "*Using Alpha-aminoxy Acids as Building Blocks to Construct Anion Receptors and Synthetic Chloride Channels*" has presented groundbreaking discoveries in the development of artificial chloride channels based on α-aminoxy peptides.

- **Ms Amy Q Zhang**, MPhil student of School of Biological Sciences, was awarded *The Best MPhil Thesis* in the Faculties of Dentistry, Engineering, Medicine and Science of Li Ka Shing Prizes at HKU Graduate School Award Presentation Ceremony 2007-08. Ms Zhang's thesis entitled "*Ecotoxicities and Ecological Risks of Irgarol 1051 and Its Related 5-Triazine Compounds in Tropical Marine Ecosystems*" examines the implications of the common use of Irgarol 1051 as an antifouling booster biocide in marine environments worldwide. Her research is supervised by Dr K M Y Leung.

- The HKU-HKBU joint team shared the Gold medal with many other prestigious universities such as Harvard, Standford, Cambridge and Imperial College at iGEM 2009 (International Genetically Modified Machine Competition), a premiere international undergraduate synthetic biology competition where students are challenged to build their unique biological systems that operate in living cells. The competition was held in late October, 2009 in Massachusetts, United States.

  The HKU team consisted of 10 undergraduate and postgraduate students from various departments including Chemistry, Bioinformatics, Biochemistry, Mathematics and Physics. In addressing the issues of the lack of stable energy sources, the bottleneck in the development in nanotechnology, the team had designed the bacteria driven motor, generating propulsion energy and converting biological energy into mechanical work. The participating students benefit greatly from the exposure and interaction with many junior scientists all over the world.

Lectures

- November 4, 2009: Science-in-action Talk and Campus Visit – "Marine Management and Conservation in the Pacific and Southeast Asia" by Professor Y Sadovy, School of Biological Sciences

- November 6, 2009: 70th Anniversary Lecture – "Charles Darwin and the evolution of oceanic islands: the other theory" by Professor Brian Morton, Emeritus Professor, School of Biological Sciences

- March 15, 2010: Public Lecture Series – "New antibiotics that target outer membrane lipids of Gram-negative bacteria" by Professor Christian R H Raetz, George Barth Geller Professor for Research in Molecular Biology, Biochemistry, Duke University and member of National Academy of Sciences

- April 27, 2010: Public Lecture Series – "CERN and Its Particle Physics Programme" by Professor Emmanuel Tsesmelis, CERN Directorate Office

For details: please visit www.hku.hk/science

Science Scopes All Croucher Senior Research Fellowships in HKU

Three outstanding scholars, **Professor K Y Chan** and **Professor H Z Sun** (Department of Chemistry), and **Professor S Q Shen** (Department of Physics), all from the Faculty of Science, were awarded the prestigious Senior Research Fellowship by the Croucher Foundation in recognition of their excellent scientific achievements and contributions to the international scientific community. They were among the four recipients of the Senior Research Fellowship Award this year.

Professor K Y Chan's research focuses on multi-scale structured materials for electrochemical technologies such as fuel cells, batteries, super-capacitors, and ozone generation. These technologies are important for clean energy and environment. The bottleneck in energy conversion can be widened with fundamental understanding and optimization of various transport limited processes in the materials.

Professor H Z Sun investigates into metallodrugs and metalloproteins, inorganic structural biology and metallomics. He is a recipient of the 'Outstanding Young Scholar Award' (2005, NSFC).

Professor S Q Shen, an expert in the field of condensed matter physics, is distinguished for his research works on spintronics of semiconductors, quantum magnetism and orbital physics in transition metal oxides, and novel quantum states of condensed matters. He has proposed theory of topological Anderson insulator, spin transverse force, resonant spin Hall effect, and theory of phase separation and antiferromagnetism. He proved existence of antiferromagnetic and off-diagonal long-range order in itinerant electron systems.

Honours and Awards of Other Teachers

Professor L S Chan, Department of Earth Sciences, received the inaugural ***University Distinguished Teaching Award (UDTA) 2009*** for his exceptional accomplishments in teaching, engagement with students and their learning, curriculum design, renewal and innovation, and was honoured at the annual Award Presentation Ceremony for Excellence in Teaching and Research on January 28, 2010. The UDTA is introduced in 2009 to recognize a teaching staff who has made outstanding contributions to the leadership and scholarship of Teaching and Learning at both Faculty and University level. For details, please visit: *http://tl.hku.hk/teaching-excellence-award-scheme-2009*. Professor Chan was the recipient of Univeristy Teaching Fellowship in 2004.

Professor T W K Fung, Department of Statistics and Actuarial Science, has been conferred the *Fellow of Institute of Mathematical Statistics*. His research project has also been elected for the conferment of a ***Second Class Award of the Higher Education Institute Scientific Research Outstanding Achievement Award 2009*** under the category of Natural Science.

Professor T W K Fung and **Dr Y Q Hu**, Department of Statistics and Actuarial Science, were awarded the ***Research Output Prize***, for their remarkable efforts on the research paper "*Statistical DNA Forensics: Theory, Methods and Computation published by England: John Wiley & Sons, Ltd. (2008), 262 page*, which set out to provide a practical guide to the analysis of DNA evidence.

Professor F C C Leung, School of Biological Sciences, was awarded the ***Fellowship of American Association for the Advancement of Science (AAAS) 2009***, in recognizing the his commitment and distinguished contributions to the field of comparative molecular endocrinology, avian genomic and viruses, particularly for the molecular epidemiology and phylogenetic origin of SARS CoV.

Professor W K Li, Department of Statistics and Actuarial Science, was selected to receive the ***Outstanding Service Award*** by the International Chinese Statistical Association this year. The award is in recognition of Professor Li's dedicated effort, unselfish support and outstanding service for the Association.

Dr W Y Lui, School of Biological Sciences, was granted the ***Outstanding Young Researcher Award 2009***, for her accomplishments and involvement in the research of cell adhesion andmale reproductive biology. Results obtained from her studies not only provide new insights for the development of non-hormonal male contraceptives, but also improve our understanding of unexplained male infertility.

Dr S B Pointing, School of Biological Sciences, received the ***Award for Service Contribution 2008-2009*** in recognition of his devotion in serving the University, including his involvement at the highest level in curriculum development both for the new 4-year BSc Science curriculum and the Common Core Curriculum.

Professor J Wang, Department of Physics, received the ***Outstanding Researcher Award 2009***, for his contribution to quantum transport theory and modeling in nanostructures. On the theoretical side, he has successfully developed necessary formalisms to predict AC and nonlinear DC transport properties using the scattering matrix theory, the response theory, and the non-equilibrium Green's function theory.

Professor A O L Wong, School of Biological Sciences, received the award for *Teaching Excellence 2008-2009* in recognition of his outstanding teaching performance and innovative teaching methods, including his organization of "One-Day Symposium for Selected Topics of Animal Physiology", which was the first of its kind among the biology departments using a symposium format for undergraduate teaching.

Dr G Yin, Department of Statistics and Actuarial Science, has received the ***James E Grizzle Distinguished Alumni Award*** from the Department of Biostatistics, University of North Carolina at Chapel Hill in 2009.

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