Dear readers,

Statistics is around us, affecting our lives in visible and not so visible ways. In this issue of Science@HKU, Dr P L H Yu will tell us the power and impact of statistics in our daily lives.

We encourage communications and feedbacks from readers. Here we publish a reader’s feedback on our recent article “Pepper spray, how does it work?” together with our response. Please write us an e-mail if you have any comments and suggestions about our Newsletter in general or any article published here in particular.

Yours sincerely,
Professor H F Chau
Chief Editor

Do you know that the analysis of big data helped Obama win swing voters and get re-elected last year? Do you know that an accurate estimate of the number of marchers does not just make use of the simple head counting technique but also a sample survey and a statistical estimation method? Do you know that statistics was used to protect astronauts on their preparation of journey to Mars?

Let’s take a look on how the data crunchers helped Obama win. At the beginning, the Obama campaign’s data crunchers collected data on millions of voters from pollsters, fundraisers, field workers, consumer databases, social media and private companies. Using the big data, they ran computer simulations every day to estimate Obama’s odds of winning each state. They also built statistical models to generate scores to all potential swing voters, on a range from 0 to 100. The two important scores measured an individual’s likelihood of supporting Mr Obama and of casting a ballot. Using the data on 2008 voters, Obama’s data

2013 INTERNATIONAL YEAR OF STATISTICS  RECOGNIZING THE CONTRIBUTIONS OF STATISTICS TO SOCIETY WORLDWIDE

From The Editor

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Contents

- Words from the Editor P.1
- Highlights – The Power and Impact of Statistics P.2
- Letter to the Editor P.3
- Brainteaser P.4
- Behind the News P.5
- Students’ Corner P.6
- Faculty News P.7
- Achievements P.8
- Research P.9
2013 is a very special year for statistical profession not only because the International Year of Statistics will be celebrated by thousands of organizations all over the world but also it is the 300th Anniversary of Jacob Bernoulli’s Ars Conjectandi and the 275th Anniversary of Laplace’s Théorie. The former one is a work of the greatest significance in the theory of probability and the latter one is a simple statistical formula used in a wide variety of areas that affect virtually every aspect of daily life.

Throughout 2013, participating organizations plan conferences, competitions, media outreach and other educational and promotional activities in their countries. For example, all six issues of Significance, the magazine distributed as part of our activity in an entertaining way, are free to be seen at the Significance ISO and America appreciation. Don’t miss this chance of reading such a high quality magazine free of charge. For a complete list of updated news and activities that will be organized by the participating organizations, visit the website www.statich2013.org.

Being one of the largest statistical departments in the Far East region, the Department of Statistics and Actuarial Science of The University of Hong Kong (Benedict, the Department) is going to take a leading role in organizing a series of activities to promote the importance of statistics to the general public. First of all, the Department takes part in organizing the 8th World Statistics Congress (WSC) of the International Statistical Institute (ISI) to be held in Hong Kong during 26-30 August 2013. Such biennial congress is regarded as an important event of the international statistical community and it is expected to attract more than 2,000 participants this time. This is the first time Hong Kong hosts such a large-scale statistical conference.

Established in 1895, the ISI is one of the oldest scientific societies operating in the modern world. It is our honor that the Department has 14 teaching staff being elected members of the ISI. This is really a remarkable record in Far East region.

The ISWMS in 2013 will be held under a special theme “Youth”. As such, there will be many theme-related sessions for young statisticians and also various activities including the Young Statisticians Satellite Meeting (YS 2013) to be organized by the Department. Taking place in the campus of The University of Hong Kong, the YSM 2013 will give an opportunity for young statisticians to present their work in an encouraging and heartwarming environment, and provide them with a forum where they can build scientific bonds with other participants in their respective fields.

The ISI and its Associations will partner with the Department to arrange some short courses before the WSC during 22-25 August 2013. All the Congress delegates are very welcome to participate in the courses. There are totally 15 short courses covering topics of statistics, including Analysis of complex sample survey data, Wavelet methods for environmental time series, Actuarial and statistical aspects of reinsurance, etc. With a view to promote the importance of the proper use of statistical concepts in various areas, I brought up an idea of establishing a new statistics competition with an aim at encouraging students to creatively express in words the daily application of statistical concepts or put statistical concepts into a story in a scientific and objective manner. With the full support from Hong Kong Statistical Society and Education Bureau, the first Statistics Creative-Writing Competition (SCC) for Secondary School Students was organized in 2009. Since then, the Department has been the sole sponsor of the prize of each edition of the Competition. The prize presentation ceremony of the current round is scheduled to be held on 28 August 2013 in the venue of the 35th WSC. The winning teams will present their work in the ceremony and have a chance to experience an international statistical meeting.

The International Year of Statistics in 2013 is not only for statistical professionals but also for every person in the world. Let us explore together how statistics shape our lives.

References


**The Gutter Oil Scare**

by Dr F T S L, School of Biological Sciences

In December 2012, the unfounded rumor that restaurants in Hong Kong were using the so-called “gutter oil” had led to societal chaos and a series of investigation was launched by the Centre for Food Safety (CFS). The culprit in this saga was a chemical called benzo[a]pyrene (BaP) with the formula C_{12}H_{10}O. It belongs to the chemical class of polycyclic aromatic hydrocarbons (PAHs). Benzo[a]pyrene and in particular BaP are health hazards because they intercalate into DNA and can cause cancer in humans. Hence, it is listed as a Group 1 carcinogen by the International Agency for Research on Cancer. As the story unfolded, it now appears that the BaP risk is relatively minimal. However, the public should not ignore other potential health risks related to cooking oil. The following questions and answers will provide readers a proper perspective on food safety, nutrition and health.

**Gutter oil**

It is definitely wrong to equate gutter oil with BaP. BaP needs not be present in gutter oil. There is no clear definition for gutter oil and not any established scientific method to test and identify ‘gutter oil’. A potential approach in identifying the source of oil is on the basis of their fatty acid profile. Because cooking oils are primarily plant-based and each has a typical profile, careful analysis may provide clues as to the origin. One would expect gutter oil to contain mixture of fatty acids from plant and animal sources.

In BaP the “gold standard” in assessing oil quality?

PAHs are ubiquitous in the environment and BaP can be found in old exhaust flues (especially from diesel engines) and in cigarette smoke and charred food. Normally, BaP level in cooking oil is very low. CFS only found 4 samples with BaP level exceeding the European Union’s limit of 2 micrograms. In fact, consumers who frequently eat stir fry and BBQ products would be at a higher risk than those consuming BaP in fried cooking oil. The metabolism of BaP’s carcinogenicity has overshadowed other indicators of oil quality. On a day-to-day basis, we should be more concerned with the pork content and fatty acid composition of household as well as restaurant cooking oil.

**Porcine Value**

Fats and oils consist of saturated and unsaturated fatty acids. Unsaturated fatty acids are susceptible to autoxidation (free radical reaction involving oxygen) leading to the formation of peroxides (ROOH). When this happens, the oil is notated indicating structural changes had occurred. The amount of peroxides can be easily determined by the amount of iodine absorbed upon reacting peroxides with iodine ion.

\[
2I_2 + H_2O \rightarrow ROOH + ROH + 2I^-
\]

The iodine liberated in then titrated with sodium thiosulphate.

\[
25I_2O_5 + I_2 \rightarrow 5O_2 + 2I^-
\]

Heating and re-heating speed up peroxidation and fats with a high degree of autoxidation are more susceptible to free radical attack. Oxidation products are formed; they can undergo secondary oxidation leading to a variety of degrading lipid structures known to exert negative health impacts in laboratory animals including hyperlipidaemia, thickening of arterial wall and reduce capillary elasticity. Thus, it is advisable not to consume re-use oil at home and decrease the consumption of food fried in “mystery-oil” when eating out.

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**Students’ Corner**

**Exchanging Knowledge on DNA technologies to Secondary Schools**

In the new ESE Biology curriculum, DNA technologies, including polymerase chain reaction (PCR) and genetic fingerprinting, are important elements of the Biotechnology module. Secondary school students studying this module are required to have hands-on experience on these techniques. Noting not every secondary school has the resources and equipment to plan or conduct such experiments, the School of Biological Sciences with the support of the Faculty, partnered with Caritas Chan Chun Sui Field Studies Centre to set up DNA technology workshops, with the use of simple equipment, reagents and plant materials near the Field Studies Centre.

While developing the PCR and fingerprinting protocols, two undergraduates were involved and worked as interns under the supervision of Dr A T Wong and Dr K W Y Yan last summer. The workshops the team ran for secondary school teachers and students could be potentially run in other secondary school laboratories of similar settings, fostering knowledge exchange on DNA technologies to local schools.

Let’s hear from our students on their experience of developing the project.

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**Charmaine Wong**

Year 3, BSc (major in Biotechnology)

This project had both theoretical and practical ideas. We planned our own experiments with great flexibility. The process involved lots of techniques which we have learnt in class. In addition to knowledge acquisition, repeated attempts at designing experiments inspired me a lot on learning methods, scientific analysis and idea delivery. I would say it was indeed a very unique learning experience.

The task we were given was challenging yet meaningful. Passion of scientists always begins with just a tiny spark. We hope that can arouse their interest and enhance our understanding of the subject by encouraging students to participate in some up-to-date experiments. As a student majoring in Biotechnology, PCR is undoubtedly a well-acquainted topic for me. However, this is the first time I used my team’s research tools to design the workshop, which was very different from just attending laboratory sessions. Guidance from supervisors and their team helped us a lot when we were stuck in the bottlenecks. Also, passionate teachers at Field Studies Centre gave us feedback and support, and their Biotechnology theme camp day camp allowed us to put forward the DNA extraction protocol for practice.

Finally, I feel cool to be a teacher’s helper, though only for a single laboratory session! I wish the programmes can benefit more undergraduates as well as secondary school students in the future.

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**Lao Ka Long Lao**

Year 3, BSc (major in Biotechnology, double minor in Biology and Biochemistry)

“Already, in the very beginning, I thought this internship could be done within a short period since the principle of polymerase chain reaction had already been taught for several terms in different courses. Nevertheless, reality was totally different from my expectation. It took me nearly three months, but everything is just so meaningful and worthwhile.

The most impressive moment in this internship is definitely when we were presenting our protocol to the teachers at Caritas Chan Chun Sui Field Studies Centre on behalf of HKU & the School. After two months of hard work, my “baby” finally came to the world. Although it might not be perfect and there were rooms for improvement, I was greatly satisfied for I had done my best already.

This internship allowed me to have a taste of research life. I had to read scientific journals and worked in the lab day and night. It is absolutely an unforgettable and memorable experience to me as I can work with two nice supervisors, their team and my fellow classmates on the project. Without the internship, I would not have the chance to know more about them and experience the research life. Thanks to you all!”
Science and Art Crossover Programme – Visualizing Science via Creative Lens & Interactive Art for Secondary School Students

Science and art, intertwined yet pales apart, were the twin driving forces of the creative development of any civilization. However, people often mistakenly consider their purity, which leads to the partitioning of curiosity, inquiry and knowledge into specialized compartments; to promote science literacy and enhance students' appreciation of science in an artistic sense. The Faculty organized a one-day programme on January 26, 2013, attracting 80 junior secondary school students to join in.

The programme consisted of a series of lectures and workshops, and responses from the participants were overwhelmingly positive. Here are some of them:

**Lectures**

**The participants felt that** "in the morning lectures, the lectures were very informative, and some made me believe helped my understanding."**

**Geology and Origami by Dr Patrick TW Ng, Department of Mathematics**

"It gives us a chance to try to solve these problems in a different way (that we normally use to solve them)."

**Workshops**

"Workshops were offered in the afternoon. Students found that the workshops were fun. I think it's a great opportunity for kids to learn more about art and science. It triggers me to further learn more on the topic."**

Create the Impossibility by LEGO - Leen Esther, So Del

Participants learned how to use LEGO to make the impossible; construction inspired by the Dutch painter MC Escher in building relativity, one participant said, "I like the idea that I can't touch this topic in school and I am quite curious about the relation of directions."

**Dr W K Lo from Department of Mathematics was luminary in their painting workshop.**

**Painting on Canvas**

"It's fun to be hands-on things and produce something you love."**

**Origami Arts**

Mathematical equations were visualized by strings. "It was fun to be hands-on things and produce something you love."**

**Explore the moment in a Laboratory**

Participants were guided to a laboratory. Some found that "I knew more about a laboratory in universities and have learned to use the laboratory in a different way."**

**Complimented the programme much and hoped there will be summer programmes available.**

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**By Dr B C K Ng, Director of Science and Art Crossover Programme**

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**Finally, after the workshop, some participants expressed their view on science and art. "I knew about the relationship between art and science, and I found that art is actually based on science and I am much more interested in science now."** They enjoyed the programme very much and hoped there will be summer programmes available.**

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**Public Lectures**

February 19, 2013. The Elements of Life and Mathematics by Professor William Goldman, Follow me! The Royal Society of Edinburgh (RSE) and the Royal Society of Arts (RSA) along with The RSA's Young Distinguished Visiting Professor, Dr. Constantine P. K Summary Article.

Iron is indispensable to the functioning of our body. A healthy human body consists of 4 grams of iron in total. More than 60% of the iron is associated with hemoglobin in red blood cells for oxygen transport, with the remaining distributed throughout our body for normal cellular metabolism. Have you ever wondered how our body transports iron from the site of uptake to the designated body tissues? This is achieved by the iron-carrier protein human transferrin.

Human transferrin binds iron tightly but reversibly, and delivers iron with high efficiency. For the specific recognition by human cells, it was predicted to undergo significant structural changes during the iron binding and release process. However, the structural evidence of this was absent over a long time. In our first structure determined, we successfully captured the ‘intermediate state’ of transferrin during the iron release process, which is in between the known ‘iron fully-loaded’ and ‘iron fully-released’ states. We can thus draw the conclusion that the release of iron from transferrin in normal cells is a continuous and dynamic process, resembling an opening clamp that is ‘loosening what has been gripped’.

Though transferrin is responsible for iron delivery, only 30% in total is iron-saturated. This leaves the remaining 70% the capability of binding and delivering other metals with chemical properties similar to iron, while some of them are essential for our life and some are not. Some scientists were also considering of exploiting such availability for metallodrug (a new class of drugs utilizing metals that are key to their pharmacological effects) delivery. Another achievement of our research is the structural snapshot of transferrin in the bismuth-binding form. This provides the first structural evidence of transferrin’s capability of being a ‘vehicle’ of metallodrug in human body, since bismuth-containing drugs have long been applied clinically to gastrointestinal infections and cancers.

We hope that our new findings can stimulate relevant researches on other metallodrugs in the near future. Hopefully, our work will make contribution to the design or improvement in current metallodrugs by enhancing their delivery efficiency in the human body.