

Faculty News

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Mathematical models used to identify mutations

One of the recipients of this year's prestigious Göran Gustafsson prize, awarded by the Royal Swedish Academy of Sciences, is Ola Hössjer, Professor of Mathematical Statistics at Stockholm University. Professor Hössjer has developed statistical methods for identifying genetic mutations that increase the risk of developing a hereditary disease.

The Göran Gustafsson prize is Sweden's most prestigious national prize for scientific research. The prize amounts to SEK 23 million and is shared between five prize-winners. "The prize means a great deal to me. I am very pleased that my work has been recognised, and I am glad to have this opportunity to present my work to a wider audience. This is also good news for the Department and for mathematical statistics as a subject area," says Ola Hössjer.

Hössjer has been doing research in the field of mathematical statistics for almost 22 years, first in Uppsala, then in Lund and now in Stockholm. He is interested in applications for mathematical statistics and has recently worked on applications in the field of human genetics.

The process of identifying genes using statistical methods began in the 1930s. Since then, a number of molecular advances have made it possible to describe DNA and genetic variations. During the 1980s, genetic mutations were identified that give rise to monogenic diseases, such as cystic fibrosis and Huntington's disease. This generated great optimism among researchers and research funders, and the research in this area really began to take off.

Polygenic diseases, such as diabetes, some forms of cancer and cardiovascular diseases, are more complex because they are influenced by a larger number of genes. A mutation in



Ola Hössjer is the fifteenth researcher at Stockholm University to receive the Göran Gustafsson prize.

a single gene only marginally increases the risk of developing these diseases. Polygenic diseases are also made more complex by the fact that they can be influenced by other factors, such as a person's environment and population group.

The projects to sequence the human genome (HUGO project) and to describe variations in the genome between individuals (HapMap project) also promoted the development of statistical methods for identifying genes. It was possible to see where and how the genome differed between healthy and sick people.

One individual's DNA has around three billion base pairs or nucleotides, of which only about 0.1 to 0.5 percent determine the differences between individuals. Consequently, a large amount of data is needed to identify the mutated genes responsible for complex diseases. By scanning the genome, it is possible to find common variations between different individuals. It is also possible to determine indirectly how we inherit genetic material from our ancestors by means of mutations and recombinations.

One of Hössjer's contributions to the statistical identification of genes has been

to combine random models for mutations, inheritance and recombinations in order to discover whether or not differences between the DNA of sick and healthy people indicate that the sick individuals have inherited their DNA from a common ancestor. He has also created a model that specifies how much data is needed to guarantee good results, depending on the disease's complexity.

In future, models may be developed that require more complex calculations and allow more data to be compared. Among other things, more information could be obtained by comparing strings of DNA and investigating the positions adjacent to mutations. It is hoped that these models will allow more information to be gathered without requiring highly compute-intensive algorithms or extensive prior knowledge about the disease.

Hössjer is optimistic about the five years ahead. The prize money will go to the research group, and will partly be used to work on some of his own ideas. Hössjer currently has two doctoral students and collaborates closely with the Karolinska Institutet. He plans to appoint another doctoral student. "We'll start by celebrating with coffee and cakes at the Department," says Hössjer. "Now I'll have more time to spend on my research, and might be able to appoint a postdoctoral researcher."

Text: Ylva Carlheim-Gyllensköld

Photo: Anders Björkström

Find out more about Ola Hössjer's research at www2.math.su.se/~ola/.

The Dean's corner



The start of the year has been unusually busy. We have a new Faculty Board, which means that new committees have to be established and new members be initiated in the work of the Faculty Board. Luckily, there are also a few old hands left to ensure continuity. During the away meeting with the new Faculty Board, I had the feeling that we have three very exciting and fruitful years ahead of us. I am certain that we can successfully meet the challenges ahead.

We have also submitted applications for grants in strategic research areas. We are the main applicant for four of these grants and a joint applicant in another five. We are very grateful to the people responsible for the applications, who have put in a great deal of hard work. The research councils will submit their priorities to the government in mid-June, so this will be an exciting time.

The final accounts for 2008 have been completed. The Faculty has an overall deficit of SEK 25 million in the direct government funding. This is made up of SEK -46 million in the undergraduate programme and SEK +21 million in the research funding. However, the departments' budgets vary widely. Some of them have large reserves of capital, while others show a deficit. Neither of these situations is good. The accounts show that more focus should be given to financial planning.

The spring sun is shining, the summer is almost here and we are moving towards brighter times. I hope you all have a chance to enjoy this wonderful season, including those of you are working on your research council applications.

Stefan Nordlund, Dean, stefan@dbb.su.se

News from the Faculty

Open day 2009

On 10 March, Stockholm University held its annual Open Day where upper secondary school students get the chance to meet existing and former university students, members of the teaching staff and study advisers. As well as visiting the different exhibitors, the upper secondary school students attended seminars and listened to panel discussions. As usual, the Faculty of Sciences was based in the Department of Geology and Geochemistry building, where all visitors were treated to "semlor". One new feature of this year's Open Day was a presentation of our master's programmes in science. This was many of the upper secondary school students' first encounter with the University and their first opportunity to find out about what is involved in studying science at university level. The survey carried out, showed that most of the visitors were satisfied with the day and the information they received.

New members of the Faculty Office

Bibi Pehrson has retired, and will spend her time with her grandchildren and playing golf. Marie Welander has also retired, but will continue to work part-time at the Faculty Office until the end of April. Felicia Markus is now working as Director of Studies at the Social Sciences Faculty Office. We would like to thank Felicia, Bibi and Marie for their excellent work and wish them the best of luck for the future. Bibi's successor is Katarina Gustafsson. Anders Jigin will replace Marie Welander as the Faculty's financial controller. Katarina and Anders began working for us in March. We would like to extend a warm welcome to these new members of staff. We are currently seeking a replacement for Felicia. Monika Stolarska has taken over responsibility for the formal matters concerned with PhD dissertations.

Handbook for PhD students

The Faculty's handbook for PhD students is available at www.science.su.se/doktorand. It contains useful information for PhD students, including regulations, guidelines and details of admissions, appointments, study programmes and defences of doctoral theses. English-speaking doctoral students should refer to the handbook produced by the Swedish National Agency for Higher Education, www.doktorandhandboken.nu/english.

Welcome day for PhD students

A welcome meeting for new PhD students will be held from 15.00 to 18.00 on 23 April in Magnélisalen. The new students will have the opportunity to meet the Faculty management team, members of the Faculty Office staff, the ombudsman for PhD students and the occupational healthcare service. At the end of the meeting, refreshments will be served and there will be the chance to socialise. Details of the programme can be found at www.science.su.se.



The Faculty presentation folder

An updated version of the Faculty presentation folder, together with a brief version of the report on our activities, is now available in Swedish and English. This is available for downloading from www.science.su.se. You can also order it from ylva.gyllenskold@science.su.se.



Conference material

The Faculty has produced note pads and folders with a brief description of the Faculty in English. These can be used at conferences and meetings and can be ordered from ylva.gyllenskold@science.su.se.