The Crafoord Prize in Biosciences 2015

The Royal Swedish Academy of Sciences has decided to award the 2015 Crafoord Prize in Biosciences to

Richard Lewontin
Harvard University, Cambridge, MA, USA

Tomoko Ohta
National Institute of Genetics, Mishima, Japan

"for their pioneering analyses and fundamental contributions to the understanding of genetic polymorphism".

Nowadays, it may seem obvious that our genetic makeup is as unique as our fingerprints, but this was a startling contradiction to the prevailing theories when it was discovered in the 1960s. This new understanding, and the new theories it gave rise to, have provided science with a more accurate picture of genetic variation and natural selection. Crucial contributions to this body of knowledge were generated by this year's Crafoord Laureates, Richard Lewontin and Tomoko Ohta.

Anyone who has watched forensic experts in television series, hunting for traces of DNA, knows that each individual has his or her own unique set of genes. If our DNA wasn't as unique as our fingerprints, genetic traces could never be used to link a murderer to a crime.

However, until the 1960s, the view of genetic variation was entirely different: biologists believed that most individuals in a population were fairly similar, genetically speaking. This must, they assumed, be the result of natural selection, where every genetic variant that was less beneficial was eliminated.

This was why **Richard Lewontin's** discovery of the actual situation, made when he was working at the University of Chicago in the 1960s, was so revolutionary. Lewontin used a method that separated proteins based on their molecular characteristics, obtaining very surprising results: the genetic variation between individuals in a population was many times greater than expected.

The results were published in *Genetics* in 1966 and aroused a great deal of attention. The first analysis used fruit flies, but the pattern was repeated in every species that the researchers examined: they all demonstrated a significant and unexpected genetic variation, appearing to contradict the principles of natural selection.

A theory of neutral mutations was put forward, in which gene variants that neither improve nor worsen an individual's fitness are created. This theory seemed to explain the significant variation discovered by the researchers. However, geneticist **Tomoko Ohta** from the National Institute of Genetics in Japan, believed that such a simple division into three types of mutations – good, neutral and harmful – did not reflect reality's true complexity. In actual fact, almost all mutations in genes that affect the encoded proteins are somewhat harmful, but the effect of this is so small that these gene variants can remain in the population. They can thus be considered nearly neutral. Ohta also showed that the size of a population is decisive for the effectiveness of natural selection: the smaller the population, the greater the effect of chance, and natural selection will function more poorly. Ohta presented this theory in the scientific journal *Nature* in 1973.

After these early and revolutionary publications, both Lewontin and Ohta have continued to study genetic variation and have, over a number of decades, made sizable contributions to the continuing development of knowledge in the field.

Richard Lewontin and Tomoko Ohta are awarded the Crafoord Prize for basic research of great general significance. However, it is also possible to provide real-life examples of the applied knowledge of genetic variation:

• In ecology and conservation, it has led to a better understanding of population structure and genetic vulnerability among threatened populations. Another result has been new methods for estimating the size of natural populations using the DNA analysis of animal spoor, such as scat.

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• In systematic biology, knowledge of genetic variation has resulted in new opportunities for understanding relationships between and within species.

• Thanks to knowledge of genetic variation, it is now possible to determine close relationships between individuals using DNA analysis. This has had a great impact on evolutionary ecology, such as its use in paternity analyses. It has been shown that in many species the females mate with more than one male, so that the offspring in one litter are often half-siblings.

• Additionally, knowledge of genetic variation has naturally been very important in the field of medicine. It lays the foundation for the extensive research being conducted into genetic risk factors for various diseases, but also for the increased focus on individually-adapted treatments on the basis on the patient's genetics.

Richard Lewontin, US citizen. Born 1929 in New York, USA. Ph.D. 1954 from Columbia University, NY, USA. Emeritus Professor at Harvard University, MA, USA.

www.mcz.harvard.edu/Departments/PopGenetics/lewontin_r.html

Tomoko Ohta, Japanese citizen. Born 1933 in Miyoshi, Japan. Ph.D. 1967 from North Carolina State University, NC, USA. Emeritus Professor at the National Institute of Genetics, Mishima, Japan.

www.nig.ac.jp/english/section/ijin/ijin-1.html

See the video about the Crafoord Prize 2015 at

http://kva.screen9.tv/#_Yu4mg6WJ4nMl7qVhmAqlg

Prize amount: SEK 6 million, to be shared equally between the Laureates.

The award ceremony is to be held at the Royal Swedish Academy of Sciences (RSAS) on 6 May 2015, in the presence of Their Majesties the King and Queen of Sweden.

Crafoord Days, 5–7 May 2015 in Stockholm and Lund, Sweden
Prize symposium, Tuesday 5 May, RSAS, Stockholm
Award ceremony, Wednesday 6 May, Beijer Hall, RSAS
Prize lecture, Thursday 7 May, Lund University, Lund
Registration at http://kva.se/events

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