

The Dr A.H. Heineken Prize for Medicine 2004

The work of Professor Elizabeth H. Blackburn presented by Professor Peter van der Vliet, Chair of the Jury of the Dr A.H. Heineken Prize for Medicine

Prize citation: for 'identifying the structure of chromosome ends (telomeres) and discovering the enzyme telomerase'.

Your Royal Highness,
Your Excellencies,
Members of the Board of the Heineken Foundation
and the Alfred Heineken Fondsen Foundation, in particular their Chair, Ms De Carvalho,
Distinguished laureates,
Ladies and gentlemen,

Professor Blackburn,

To build and maintain an organism like the human body, cells must divide. Before cells can divide, the genetic material – that is the DNA present in our chromosomes – must replicate so that the daughter cells have the same genetic make-up. The problem with this crucial process is that the replication mechanism shortens the ends of the chromosome every time it replicates. Dr. Elisabeth Blackburn has solved this problem by proposing that the ends of the chromosomes, the telomeres, have a unique structure that replicates by means of a special mechanism, a discovery that has important implications for medicine. For her pioneering work in identifying the structure of telomeres and for discovering the enzyme telomerase, the jury has proposed to award Dr. Blackburn the 2004 Dr A.H. Heineken Prize for Medicine.

Dr. Elisabeth Blackburn's name is almost synonymous with telomeres and telomerase. Much of what we know about the form and function of telomeres began with her discovery that the ends of linear chromosomes protect DNA from degradation. She found that these ends are specialized structures that distinguish natural chromosome ends from artificial ones, caused for instance by DNA breaks. She subsequently discovered that telomeres consist of a short, simple DNA sequence repeated over and over again. She then went on to show that telomeres were not replicated like the rest of the chromosomal DNA, but were elongated by an RNA-dependent DNA polymerase, called telomerase. This enzyme uses an RNA template to add repeats to the telomeres, thereby elongating them, a surprising departure from the models of that time.

Over the past two decades, the study of telomeres has become a central component of biology, with major new findings coming from the Blackburn lab. Most interestingly, Dr. Blackburn's group showed that telomerase is vital to normal cell growth and therefore governs the life span of cells. These studies are important to our understanding of cancer. Whereas normal cells lose their telomeres because they lack telomerase, cancer cells contain a large quantity of telomerase which enables them to elongate their chromosome ends and continue cell division, a hallmark of cancer. Telomerase has therefore become a prime target for novel therapeutic cancer intervention. Many drugs are now being developed to kill cancer cells by inhibiting telomerase, thereby preventing elongation of their telomeres.

Dr. Blackburn has received over forty awards and served on many editorial boards and committees. One of these is the President's Council on Bioethics, a committee advising President Bush on ethical issues related to advances in biomedical science. Why do I mention this particular one? Because in March this year, Dr. Blackburn heard that the White House had, unexpectedly, not renewed her membership of this committee. This was because she had publicly criticized the Bush administration's views on stem-cell research. This event caused quite an uproar among scientists in the US, as it was the latest example of the administration's penchant for filling advisory panels only with members who supported its own viewpoints, a dangerous development. Controversial issues need open scientific

debate in which all viewpoints are considered, even unwelcome ones. For science, above-board information, a broad spectrum of views and a critical attitude are essential. Policy decisions should be based on unbiased scientific data and arguments. When a friendly person and prominent scientist such as our prize-winner has to stand up in public to defend these principles, something is deeply wrong.

But we should not give the impression that such things occur only in the United States, and that the Netherlands is immune to manipulation for political ends. It can happen here as well. We are glad that our Minister of Education, Culture and Science is aware of these risks and has asked the Academy to advise her on the matter of independent scientific advice on policy issues. The viewpoints and attitude expressed by our prize-winner will set a good example of how to act when scientific integrity is threatened.

In summary, the work carried out by Dr. Blackburn has not only led to the discovery of new phenomena in biology, but it also has vast medical implications. Dr. Elizabeth Blackburn therefore has the uniqueness that makes her a truly outstanding winner of the 2004 Dr A.H. Heineken Prize for Medicine.