Gene 'on-off' switch gives us our individuality

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When the human genome was sequenced in 2001, scientists raced to discover the genes responsible for making us unique. A German-US team has now revealed that rather than the genes themselves, it's the way the genes are regulated (turned on or off, for example) that makes us different from one another. Findings from the study are published in the journal Science.

The discovery, made by collaborators from the European Molecular Biology Laboratory (EMBL) in Germany and Yale and Stanford universities in the US, signals a new way of looking at ourselves that could lead to better ways of combating human disease.

Their study focused on non-coding regions of the human genome which, unlike genes, do not carry the instructions for producing proteins. These stretches of DNA that lie between genes can perform the role of hosts to transcription factors (TFs). TFs attach themselves to the DNA sequences to switch genes on and off.

'Our results indicate that many differences in individuals and species occur at the level of TF binding and provide insight into the genetic events responsible for these differences,' the authors write.

The team found that up to 25% of all human genes are regulated differently in each person, and that many of the differences in how TFs act are a result of changes in the DNA sequences to which they are attached. These changes can be as small as a difference in a single genetic code letter or as large as a change in a major section of

DNA.

The scientists also believe that some differences may be due to interaction between TFs. 'We developed a new approach which enabled us to identify cases where a protein's ability to turn a gene on or off can be affected by interactions with another protein anchored to a nearby area of the genome,' said EMBL's Dr Jan Korbel. 'With it, we can begin to understand where such interactions happen, without having to study every single regulatory protein out there.'

According to the scientists, even if people have identical copies of a gene, the way their cells regulate that gene can be different. With regard to gene regulation, they also found that there appears to be almost as much difference between humans as there is between humans and chimpanzees. This small variation could provide significant clues to human evolution.

Dr Michael Snyder from Stanford University explained that the findings have the potential to change the way we approach research into the human body and human disease. 'As well as looking for disease genes, we could start looking at how genes are regulated, and how individual variations in gene regulation could affect patients' reactions, ' he said.

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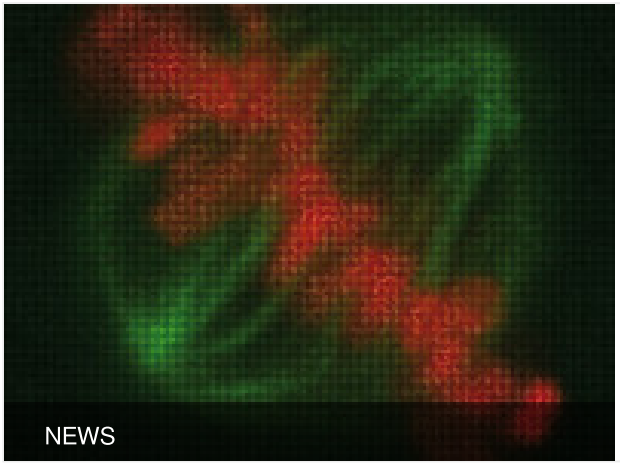

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Last update: 22 March 2010