

# Mouse genome much more complex than expected

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More than 100 scientists from Australia, Asia, Europe and the US have been probing the genome of the mouse in a joint study lasting several years. Their results in some aspects have completely overturned geneticists' traditional assumptions. The findings are available in the prestigious journal *Science* on 2nd September. The general conclusion of the study is that the genome of mammals is much more complex than was hitherto supposed.

The genetic material of mammals, the DNA, can be compared to an enormous encyclopedia containing the complete blueprint of the animal in question. Yet this comparison is misleading: over the past few years it has been realised that on most pages of the encyclopedia there is no information at all: they contain a chaotic sequence of letters. Mixed in among these pages there are intelligible pages from time to time, the genes.

The DNA encyclopedia is stored in the nuclei of the cells. If the body is to produce a specific protein, the appropriate page of the encyclopedia is copied (rewritten or 'transcribed'). Only the copies can leave the cell nucleus. They consist of a DNA-like material known as mRNA. Each mRNA contains the blueprint for precisely one specific protein – this at least has been the traditional doctrine.

Three years ago the DNA of the mouse was completely sequenced. An international research team consisting of more than 100 scientists has been attempting since then to isolate and analyse the entire mRNA

transcripts in the mouse. Their most astonishing finding is that more than 60 per cent of all mRNAs are not protein blueprints at all. 'We don't know what the function of these RNAs is,' the Bonn neurobiologist Professor Andreas Zimmer admits. However, they seem to be extremely important: even in such different organisms as hens and mice these ostensibly so unimportant RNAs are very similar. If they really had no function they would have mutated during the course of evolution so quickly that there would nowadays be hardly any similarity between them.

The scientists came across an additional interesting phenomenon when they tried to find the 'original sources' of the mRNA copies in the DNA encyclopedia: information and nonsense are apparently not distributed randomly. Instead there are entire chapters with many different protein blueprints, which are separated by long passages devoid of meaning – Professor Zimmer talks of transcription 'forests' and 'deserts'.

Although the DNA encyclopedia only has a few tens of thousands of intelligible 'pages', the researchers counted more than 180,000 different mRNAs. 'The genetic information is arranged on the DNA in a very complex way,' Professor Zimmer concludes. For example, the 'copiers' in the cell nucleus combine the different 'paragraphs' in the DNA encyclopedia with each other in different ways. Thus there may be several different mRNA copies derived from the same page, which in turn serve as a blueprint for different proteins.

Only twice as many genes as a threadworm?

This observation might also explain the big question why mammals only have about twice as many genes as threadworms, which have a much simpler structure. 'Our study calls into question the classic view that one gene contains the information for exactly one protein,' Professor Zimmer explains. 'Mammals frequently use the selfsame place on the

DNA several times over, as a partial blueprint, so to speak, for different proteins. It is becoming more and more evident that mammal genes do not have any clearly defined limits.'

Source: University of Bonn

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