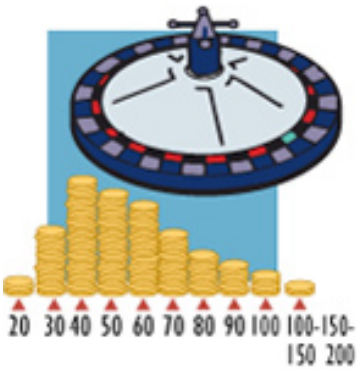
DNA, genes and genomes - Detailed

Genomes: not just genes

Making molecules

Genes were once defined as lengths of DNA that carried the instructions to make a protein. Researchers now know that the instructions in some genes can produce many proteins, and that other genes are transcribed into RNA, but don't ever produce a protein.

No-one is sure exactly how many genes there are in the human genome, but the latest estimate suggests between 20,000-25,000 - barely a third more than a fruit fly! During the Human Genome Project, researchers placed bets on the number of human genes. Their estimates ranged from 27,462 to 200,000 . . .



Although genes make up about a third of our genome, only about 2% of the DNA sequence is transcribed and translated into protein. At the moment, only about 400 non-protein-coding genes have been found, but the number may be far higher - perhaps thousands.

Regulating protein production

Although we carry complete copies of our genome in most of our cells, only certain genes are switched on at any one time. Control sequences in the DNA contain the instructions to switch genes on and off and to produce varying amounts of different proteins at different times.

In humans and other complex organisms, the coding sequences of the genes are separated into small chunks by lengths of noncoding DNA. The coding sequences are called exons, and the noncoding areas between them are called introns. Once the DNA is transcribed into RNA, these noncoding sequences are usually cut or 'spliced out'

DNA, genes and genomes - Detailed

Genomes: not just genes

However, the presence of these noncoding gene sequences is thought to give the cell the ability to generate many proteins from one gene. This way, the protein could be derived from all the exons, use only some of them, or perhaps even use some of the usually noncoding sequences to make different proteins. This is known as 'alternative splicing'.

Junk?

More than half of the DNA in our genome is made up of repeated sequences. The result is as if a printer had made a mistake and scattered lots of copies of one page of a book throughout the story. Some of these repeated areas appear to stabilize the chromosomes; others may have a role in spacing out the coding sequences so that they can be activated independently.

Recent studies have suggested that the amount of noncoding DNA increases according to the complexity of the organism. The 'junk' might conceivably have a role in enabling our genomes to change and evolve. We don't know all the answers yet, but stay tuned for the next update . .