DNA and the Cell

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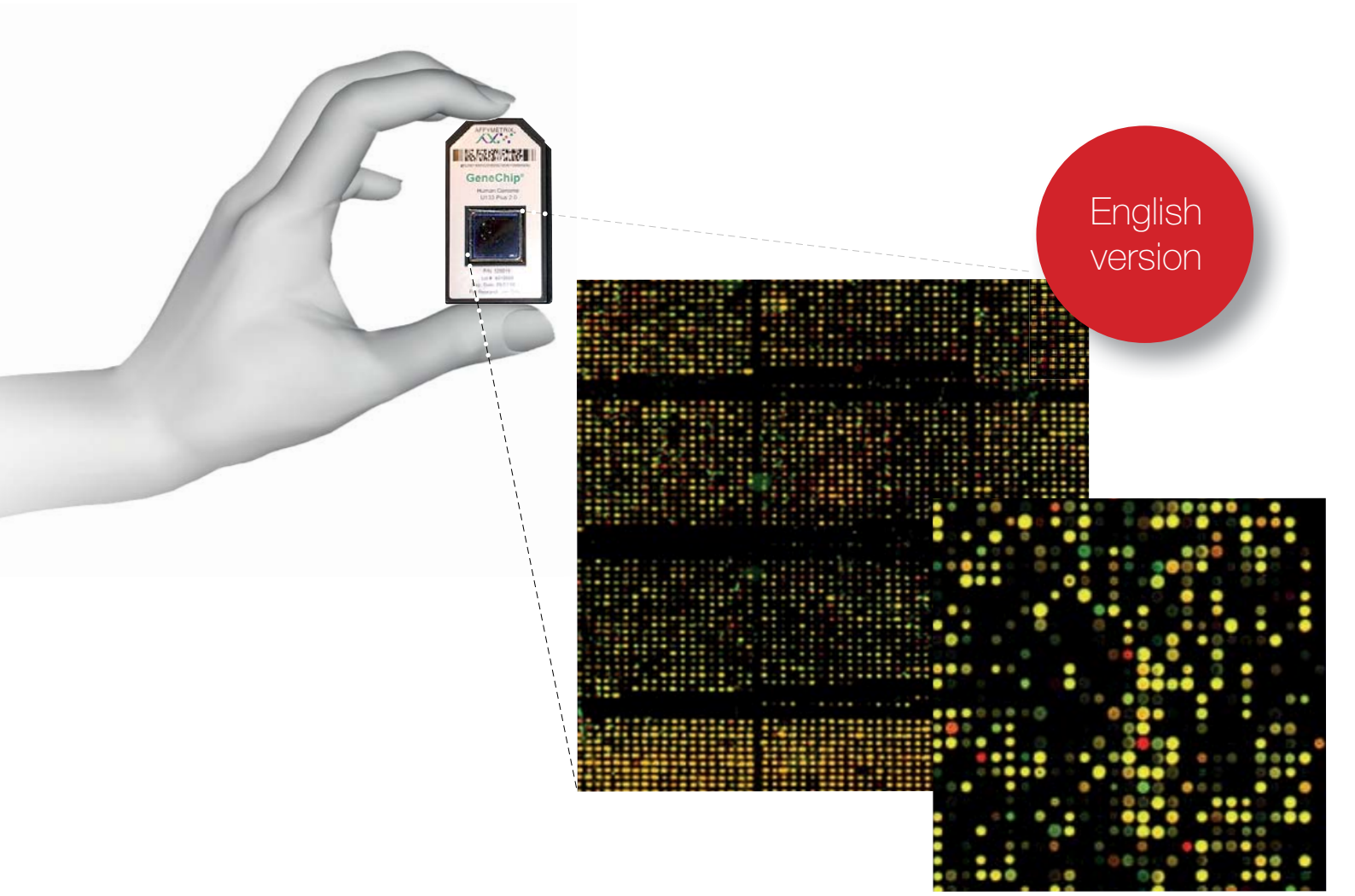
Version 2.3



English version

ELLS – European Learning Laboratory for the Life Sciences

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To understand the concept of DNA microarrays we have to go back to the fundamentals of molecular biology.

Double-stranded DNA can unzip to form two complementary strands, each of which acts as a template for the other when the molecule replicates (Figure 1).

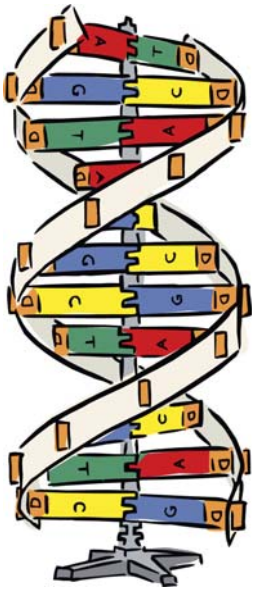

Fig. 1 DNA molecule

Inside the nucleus, DNA is packed with specific proteins to form chromosomes. The genetic code lies in the sequence of the nucleotide bases, adenine, cytosine, guanine and thymine (A, C, G and T), along the DNA molecule. In a gene, successive triplets of bases (codons) specify the order in which amino acids are joined to form a protein. When scientists say that they have mapped the genome of an organism, it means that they have managed to read the order of the nucleotides along the DNA molecule. Scientists already have a rough draft of virtually the entire human genome (3 billion nucleotides) and now know that 2.5 billion of them are not actually part of genes!

When a gene is expressed, the DNA is used as a template for the transcription of a complementary strand of the single-stranded nucleic acid, RNA. In most genes the coding regions (exons) are interrupted by non-coding regions (introns) which are cut out or “spliced” after transcription. The messenger RNA (mRNA) is then transported to the ribosomes in the cytoplasm, where the message is translated into proteins (Figure 2).

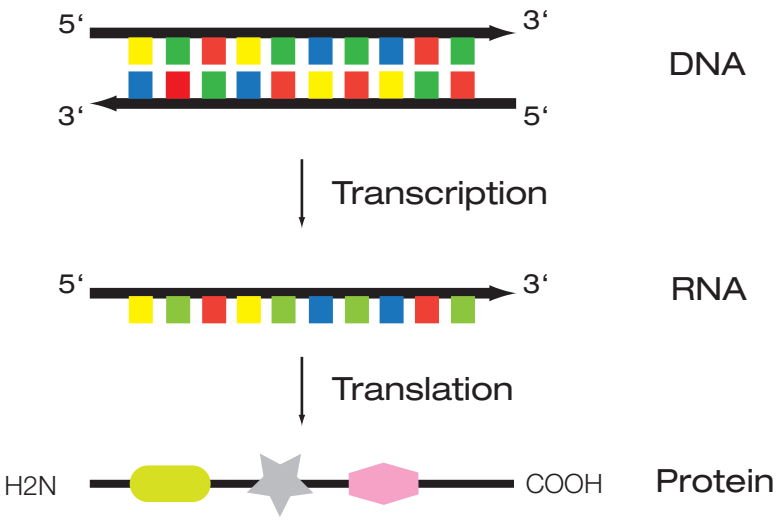

Fig. 2 The Pathway from DNA to protein

In the old days, scientists were usually interested in the expression of a handful of genes because technical hurdles and the cost prohibited them from studying the expression of many genes at the same time. The development of DNA microarrays has helped to overcome this obstacle. Since the middle of the 1990s, scientists have been able to monitor the expression of all the genes of a group of cells, or an entire organism. And, by assessing the expression of all the genes at a given time, scientists have gained a new understanding of how cells work and respond to different stimuli such as change of environment, lack of nutrients or even disease.

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