CAREERS in Chemistry

Forensic Chemist

A forensic chemist applies scientific methodology to physical evidence. Forensic chemists focus on analyzing evidence that has been collected at a crime scene. They then report any conclusions that they can draw from the analysis. Understanding evidence requires knowledge of biology, materials science, and genetics in addition to chemistry. Because forensic chemists are often asked to testify in court, they need to be comfortable speaking in public and able to give clear and concise explanations to those who do not have a background in science.

RNA and Protein Synthesis

RNA is made from DNA in a process that is similar to how DNA replicates itself. At a gene, a portion of DNA unwinds and RNA is assembled using the same complementary base pairs as DNA except that uracil replaces the thymine. When a signal to stop is received, the RNA is released. As in DNA replication, the RNA sequence that forms has the complementary base pairs of the DNA gene. The DNA sequence below would form the complementary RNA sequence shown.

DNA strand: C C C C A C C C T A C G G T G
RNA strand: G G G G U G G G A U G C C A C

A sequence of three bases in mRNA codes for a specific amino acid. Thus, the sequence CAG codes for glutamic acid, and GUC codes for valine. There are 64 (4^3) unique combinations of three-base sequences made from four bases. Because only 20 amino acids require codes, some of the amino acids have more than one code. For example, leucine is coded by six three-base sequences: UUA, UUG, CUU, CUC, CUA, and CUG. The genetic code is universal, meaning that the same three-base sequence always codes for the same amino acid regardless of whether the organism is a bacterium or a human. The "stop" signal in the gene is also a three-base code: UAG, UAA, or UGA.

Technology and Genetic Engineering

The discovery of DNA's function in life has provided new options for the production of food, medical diagnosis and treatments, and increased understanding of genetic disorders. Scientists in the field of genetic engineering study how manipulation of an organism's genetic material can modify the proteins that are produced and the changes that result in the organism. Although the selective breeding of plants and animals has been practiced for hundreds of years, today genetic engineering refers to recombinant DNA technology that is used for cloning and the creation of new forms of life. Because the technique is so powerful, it is controversial and must be used responsibly.

DNA Fingerprinting

One of the most visible uses of molecular technology is DNA fingerprinting. DNA is unique to an individual except for identical twins. This technology is used in criminal investigations and victim identification. Often there are only very small samples available, such as a single drop of blood or one strand of hair. The technique of the *polymerase chain reaction* (PCR) may be used to copy a DNA sample to supply sufficient DNA for identification. The processes of electrophoresis and autoradiography may be used to compare DNA from a sample with the DNA of a known individual to confirm identification, as **Figure 25** shows. DNA technology can also be used to test paternity or to trace heredity.

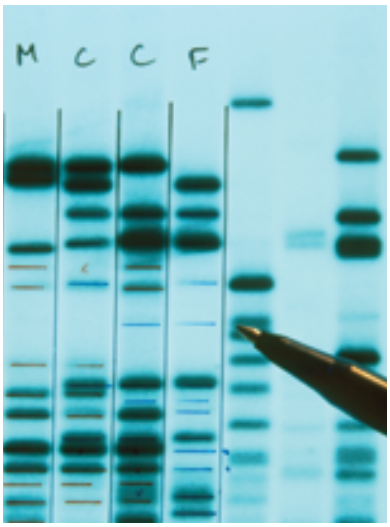

FIGURE 25 A DNA autoradiograph shows the pattern of DNA fragments of an organism after they have been separated from each other by electrophoresis.