DNA synthesis

DNA synthesis is the natural or artificial creation of deoxyribonucleic acid (DNA) molecules. The term DNA synthesis can refer to DNA replication - DNA biosynthesis (in vivo DNA amplification), polymerase chain reaction - enzymatic DNA synthesis (in vitro DNA amplification) or gene synthesis - physically creating artificial gene sequences.

In nature, DNA molecules are created by all living cells through the process of DNA replication, with replication initiator proteins splitting the cell's DNA and copying each split strand, with the copied strands then joining together with their template strand into a new DNA molecule. Various means exist to artificially stimulate the replication of naturally occurring DNA, or to create artificial gene sequences.

A polymerase chain reaction is a form of enzymatic DNA synthesis in the laboratory, using cycles of repeated heating and cooling of the reaction for DNA melting and enzymatic replication of the DNA.

Artificial gene synthesis is the process of synthesizing a gene in vitro without the need for initial template DNA samples. In 2010 J. Craig Venter and his team were the first to use entirely synthesized DNA to create a self-replicating microbe, dubbed Mycoplasma laboratorium.

Twist Bioscience developed a silicon-based manufacturing process to industrialize the production of synthetic DNA. By synthesizing DNA on silicon instead of on traditional plastic plates, cost-effective, high-quality synthesis of genes, gene fragments, oligo pools and variant libraries (groups of gene sequences) for antibody and protein engineering, as well as consumable products for next-generation sequencing is enabled.

Oligonucleotide synthesis is the chemical synthesis of sequences of nucleic acids. The process has been automated since the late 1970s and can be used to form desired genetic sequences as well as for other uses in medicine and molecular biology.

New nucleobase pairs can also be synthesized, A-T (adenine - thymine) and G-C (guanine - cytosine). A third base pair would expand the number of amino acids that can be encoded by DNA from the existing 20 amino acids to a possible 172.