Arthur Kornberg Biography

Arthur Kornberg

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Biography

Arthur Kornberg was the first to synthesize deoxyribonucleic acid (DNA) outside the cell. He also isolated and purified one of the enzymes necessary for successful synthesis. His results showed that chromosome is composed of a continuous strand of DNA. For his success, he received half of the 1959 Nobel Prize in physiology or medicine.

Kornberg was born in Brooklyn, NY. He graduated from the City College of New York in 1937, and received his M.D. from the University of Rochester in 1941. After serving in the Coast Guard during World War II, he began his career in biochemical research. He headed the biochemistry department at Stanford University for many years.

After American biochemist Severo Ochoa synthesized ribonucleic acid (RNA) nucleotides in 1955, Kornberg began attempting to synthesize DNA. As a starting point, Kornberg isolated a pure form of the *E. coli* bacterial enzyme now known as DNA polymerase I, which plays a role in copying DNA within the cell. He then used as a synthesizing template a circular, single-stranded DNA from a bacteriophage (virus which parasitizes bacteria) called phX174, which was isolated by Robert Sinsheimer (1920-) at the California Institute of Technology. In nature, phX174 reproduces inside *E. coli*, forming a complementary second DNA circle that acts as a template for its new copy. Kornberg, Sinsheimer, and Mehran Goulian (1929-) (Stanford University) isolated this second DNA circle to use as their template. Then they added the enzyme and the four DNA nucleosides (base-sugar groups) with three-phosphate groups attached--ATP (adenosine triphosphate), GTP (guanosine triphosphate), CTP (cytidine triphosphate), and TTP (thymidine triphosphate). Finally, DNA nucleotides were formed. The scientists also showed that their synthetic DNA was biologically active. Since Sinsheimer's group had already found that even a single copying error would make the virus inactive, the activity proved that error-free DNA could be synthesized.

Later research by other scientists revealed details of the natural DNA-copying process. It is now known that DNA polymerase I's main task is examining copied DNA for errors, removing incorrect nucleotides, and repairing damaged ones. Both DNA polymerase I and polymerase III--the main synthesizing enzyme in many species--are needed for this replication.

Kornberg's current research focus at Stanford has changed from DNA replication to inorganic polyphosphate (poly P), a linear polymer with many functions, including phosphate and energy reservoirs, buffering against alkali, bacteria capsule formation, and regulation of growth and development especially under stress or deprivation.