

# NHGRI *fact sheet*

## Polymerase Chain Reaction (PCR)

### *What is PCR?*

Sometimes called “molecular photocopying,” the polymerase chain reaction (PCR) is a fast and inexpensive technique used to amplify, or copy, small segments of DNA. Because significant amounts of a sample of DNA are necessary for molecular and genetic analyses, studies of isolated pieces of DNA would be impossible without PCR amplification.

Often heralded as one of the most important scientific advances of the decade, PCR so revolutionized the way molecular biologists approach the study of DNA that its creator was awarded the Nobel Prize for Chemistry in 1993.

### *How does PCR work?*

To amplify a segment of DNA using PCR, the sample is first heated so the DNA denatures, or separates into two pieces of single-stranded DNA. Next, an enzyme called *Taq* polymerase synthesizes, or makes, two new strands of DNA, using the original strands as templates; this process results in the duplication of the DNA, with each of the new molecules containing one old and one new strand of DNA. The cycle of denaturing and synthesizing new DNA is repeated as many as 30 or 40 times, leading to more than 1 billion exact copies of the original segment of DNA.

The entire cycling process of PCR is automated and can be completed in just a few hours. It is directed by a machine called a thermocycler, which is programmed to alter the temperature of the reaction every few minutes to allow DNA denaturing and synthesis.

### *Why is PCR useful?*

Once amplified, PCR products can be used in many different laboratory procedures; for example, most mapping techniques in the Human Genome Project rely on PCR.

PCR is also valuable in a number of newly emerging laboratory and clinical techniques, including DNA fingerprinting, detection of bacteria or viruses (particularly AIDS), and diagnosis of genetic disorders.