

# Reverse Transcriptase Encyclopedia Article

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# Reverse Transcriptase

Reverse transcriptase, also known as RNA-directed **DNA polymerase**, was independently discovered by **Howard Temin** and **David Baltimore** in 1970. Reverse transcriptase acts like a regular DNA polymerase in that it synthesizes DNA in the 5' to 3' direction from primed templates. The difference is that reverse transcriptase uses **RNA** as its template.

Reverse transcriptase was first discovered in retroviruses. Retroviruses are RNA containing viruses such as certain **tumor** viruses and human immunodeficiency **virus** (HIV, the causative agent of **AIDS**). In the infection cycle of **retrovirus**, the virus attaches to the host **cell** surface and releases its RNA **genome** and the prepackaged reverse transcriptase into the host cell. Reverse transcriptase then starts to retro-transcribe RNA into double stranded DNA. This event happens at the cytoplasm. The double stranded viral DNA genome is then translocated into the **nucleus**. The linear copy of the retroviral genome is inserted into the host chromosomal DNA with the help of other proteins to form a provirus. The provirus achieves the status of a cellular **gene** and is expressed through the agency of cellular RNA polymerase, and replicated by cellular **enzymes** in concert with chromosomal DNA. At the end of the virus life cycle, retroviral RNA and reverse transcriptase, together with other components, are packed into a viral particle and released out of the cell.

The discovery of reverse transcriptase was a surprise to the scientific world. The central dogma of molecular biology was that genetic information always flows from DNA to RNA to protein. Since 1970, reverse transcriptases have been found in insect and plant viruses. It is now believed that **reverse transcription** is not a singular odd exception, but rather a paradigm for a process that is shared by viral and nonviral genetic elements occurring widely in nature. The elements of **yeast** and the copia and Ulysses elements of *Drosophila* (fruit fly) all resemble retrovirus in that they all encode reverse transcriptases.

Reverse transcriptase has been a useful tool in genetic engineering because of its ability to transcribe mRNAs to complementary stands of DNA (**cDNA**). cDNAs can then be cloned, sequenced, or expressed for further studies. Murine and avian virus reverse transcriptases are the mostly used reverse transcriptases in genetic engineering. Research of reverse transcriptase also has clinical significance. Studies on inhibitors of reverse transcriptases are promising in the search for a cure to AIDS and other retrovirus related diseases.