

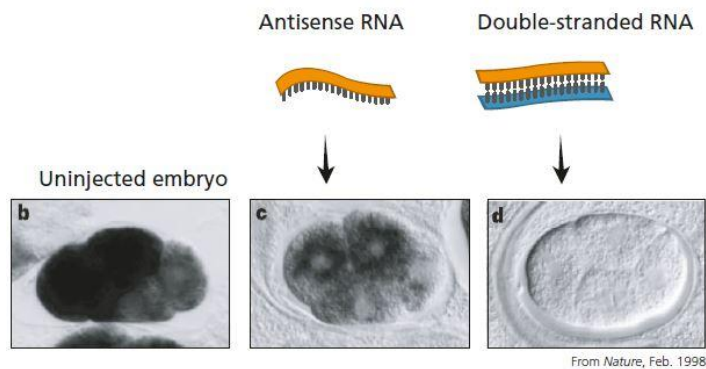
In 1972, Herbert Boyer and Stanley Cohen proved that, by inserting recombinant DNA (rDNA) into an organism and with the use of replicating plasmids, organisms and bacteria could express DNA not typically apparent in their species. This opened up the possibility of using similar methods to do the opposite—make an organism not express a gene typically apparent in their species.

In 1990, researchers began to notice that inserting single-stranded RNA (ssRNA) into an organism would stop that organism from expressing a particular trait. One example of this was a group that wanted to make bright red flowers: they ended up inserting ssRNA into the flower which lost all of its red coloring. This led the research duo of Andrew Fire and Craig Mello to investigate what happened when the ssRNA interacted with the messenger RNA (mRNA) that was supposed code for a protein to allow the flower to become red.

To answer the question of what happened to the mRNA after ssRNA was inserted, Fire and Mello used double-stranded RNA (ds RNA) and ssRNA. For this experiment, they inserted the RNA into their animal model *C. elegans* (a type of roundworm). Results showed that dsRNA would completely stop the expression of a gene in the roundworm, while ssRNA would partially stop the expression of a gene. The mechanism of this is due to the ds/ss RNA binding to the complementary mRNA and breaking it down—this technique would later become known as RNA interference (RNAi), which has become an effective method of gene silencing in the biotechnology industry, with hopes that it may allow researchers to silence harmful genes and prevent diseases like cancer, HIV, high cholesterol, and other harmful diseases. Fire and Mello were awarded the Nobel Prize in 2006 for their contributions to the discovery of RNAi.

Figure 1

RNAi experiment on C. elegans performed by Fire and Mello



Notes. This figure shows how expression of a gene was silenced in *C. elegans* using antisense RNA (ssRNA) and dsRNA. ssRNA shows partial silencing, while dsRNA shows complete gene silencing.

Citation:

The Nobel Prize in Physiology or Medicine 2006. NobelPrize.org. (n.d.).

<https://www.nobelprize.org/prizes/medicine/2006/popular-information/>