

# Paper Transcription & Translation: Proteins

PCNA (Proliferating Cell Nuclear Antigen) from corn



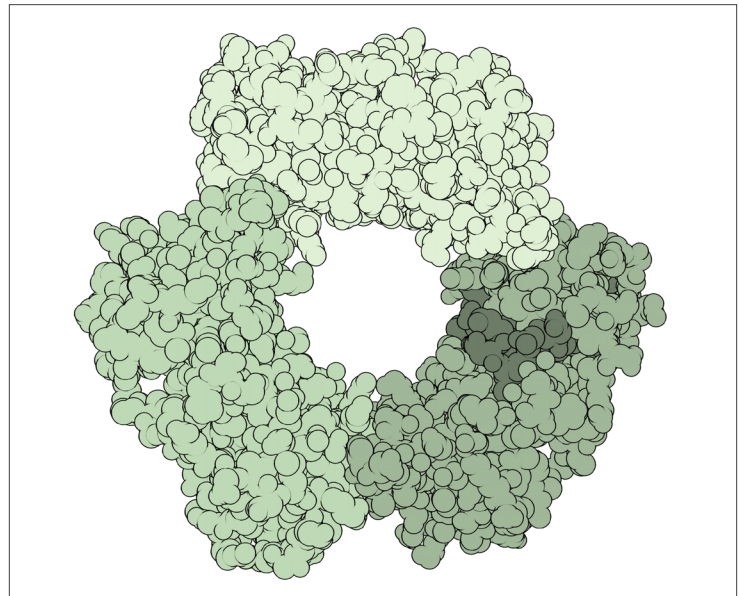
PCNA protein, partial amino acid sequence (20 out of 275 total)

## Function

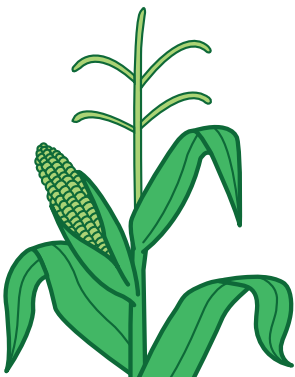
When three of these proteins come together, they form a ring that wraps around a single strand of DNA. The ring acts as a clamp for DNA polymerase—the molecular machine that copies DNA—so it can “lock” onto the DNA template strand during DNA replication.

## Structure

Three PCNA proteins from the plant *arabidopsis thaliana* are pictured to the right. DNA fits into the space in the center. The part of the protein that corresponds to the part you made is shown in the darkest shade. The overall shape of this group of proteins is nearly identical between vertebrates, plants, and archaea.



based on RCSB PDB reference 2zvw



## Organism

The gene you transcribed and translated came from corn. Corn (also called maize) is a plant that is farmed on a large scale around the world.

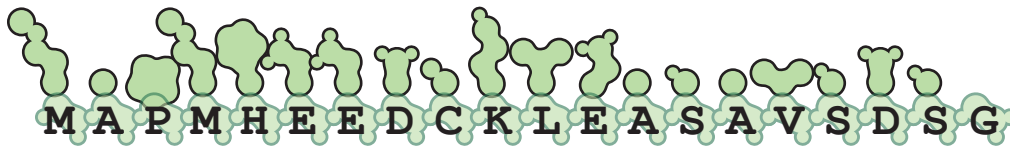
It was domesticated thousands of years ago from a wild plant called teosinte, which grows in Mexico.

Corn is used to make many edible and industrial products, including tortillas, corn syrup, animal feed, and ethanol.



# Paper Transcription & Translation: Proteins

DNA Polymerase 1 (PolA1) from mouse



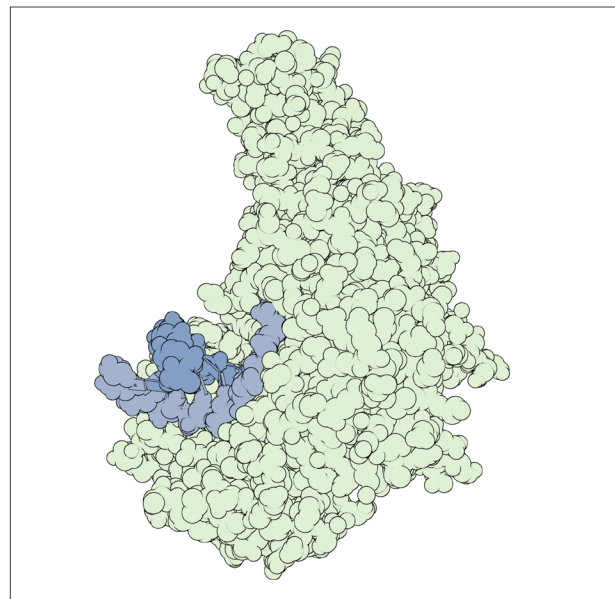
DNA polymerase 1 protein, partial amino acid sequence (20 out of 1,244 total)

## Function

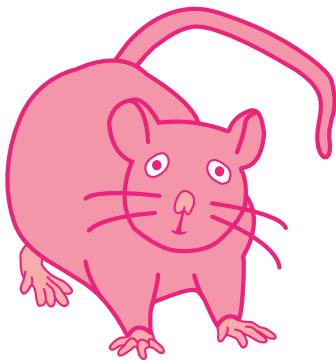
DNA Polymerase is a molecular machine that copies DNA. It moves along one strand of DNA, adding one building block (nucleotide) at a time to make a new, complementary DNA strand.

## Structure

Most of a DNA Polymerase protein is pictured to the right, attached to short piece of DNA (darker shade). The part that is shown is the “core” of the protein, about 900 amino acids out of 1,244 (the part that you made isn’t included).



*based on RCSB PDB reference 4q5v*

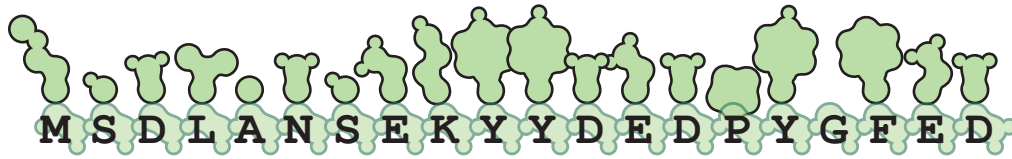


## Organism

The gene you transcribed and translated came from mouse. Mice are animals. More specifically, they are vertebrates and mammals—meaning they have an internal skeleton with a backbone, they have fur, and they make milk for their babies.

# Paper Transcription & Translation: Proteins

RNA Polymerase 2, subunit B, from yeast



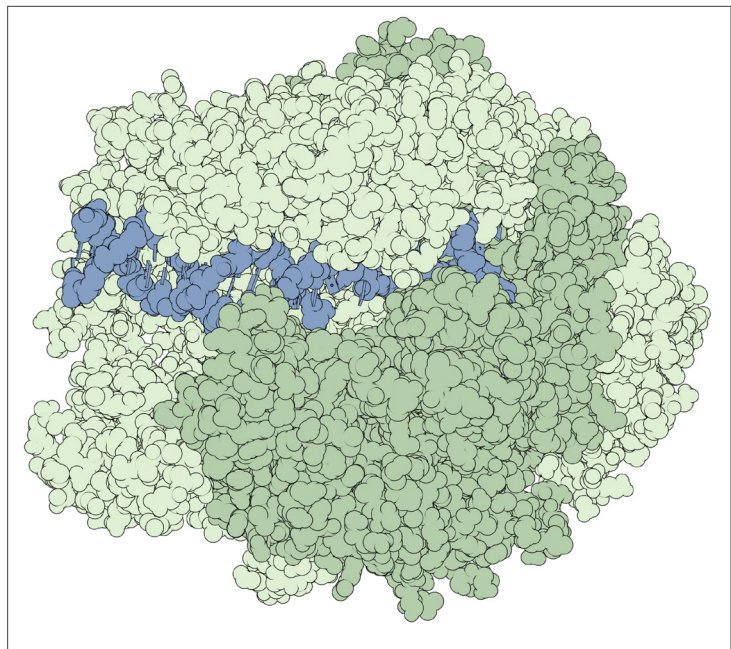
RNA polymerase 2, subunit B, partial amino acid sequence (30 out of 1,255 total)

## Function

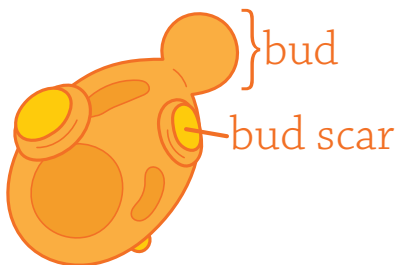
RNA Polymerase is a huge molecular machine made up of several proteins that work together (in yeast, there are 10). RNA Polymerase transcribes DNA: it moves along one strand and builds a complementary strand of RNA.

## Structure

An RNA Polymerase protein complex, 4,273 amino acids in all, is pictured to the right. It is attached to a short piece of DNA (squiggly line across the middle). You translated a very small piece of a protein known as subunit B, which is shown in a darker shade.



*based on RCSB PDB reference 2e2i*



## Organism

The gene you transcribed and translated came from yeast.

Yeast is a microscopic, single-celled fungus that is used for baking bread and brewing beer. When it reproduces, a new cell forms as a bud on the parent cell, eventually breaking away and leaving a scar on the parent.



# Paper Transcription & Translation: Proteins

Recombination Protein RadA from archaea



RadA protein, partial amino acid sequence (19 of 352 total)

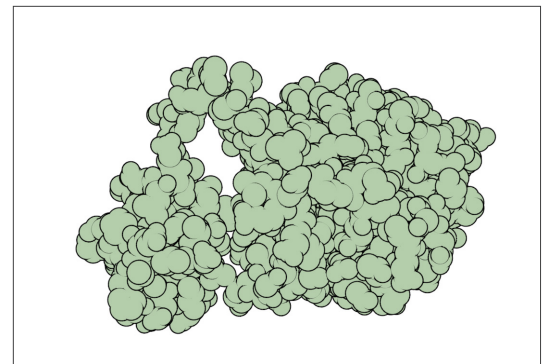
## Function

This protein has different names in different species, including RecA, RadA, and Rad51. In archaea, it is called RadA.

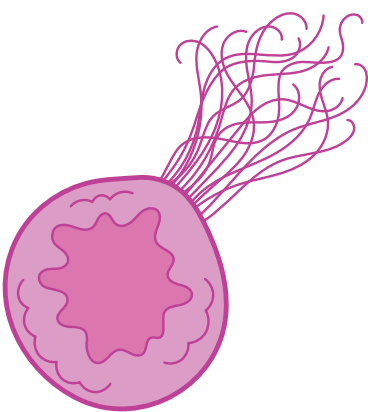
Whatever the name or the species, this protein has the same job: it helps cells repair damage to their DNA. RadA binds to single-stranded DNA and recruits other proteins needed to repair broken DNA strands.

## Structure

A RadA protein from the archaeal species *Methanococcus mariapaludis* is pictured to the right. Multiple copies of the protein fit together and wrap around DNA.



based on RCSB PDB reference 3etl



## Organism

The gene you transcribed and translated came from the archaeal species *Methanocaldococcus jannaschii*.

All archaea are microscopic, single-celled organisms. This species lives miles under the surface of the ocean, near hydrothermal vents.



# Paper Transcription & Translation: Proteins

Topoisomerase 1 from *E. coli* bacteria



Topoisomerase protein, partial amino acid sequence (19 out of 595 total)

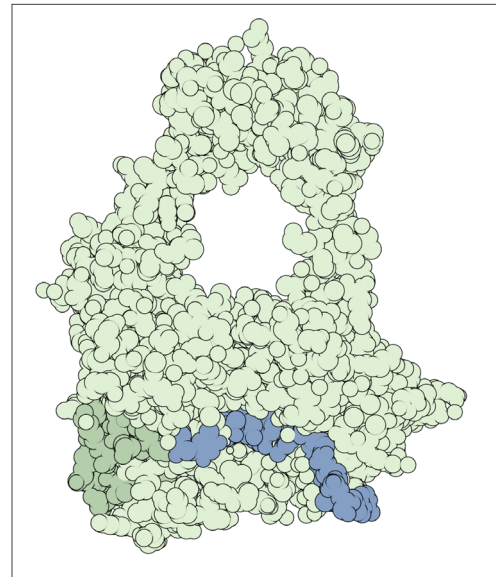
## Function

As DNA is copied to make more DNA (replication) or mRNA (transcription), it must unwind so that cellular machinery can access the sequences they need. And then it rewinds itself to stay compact.

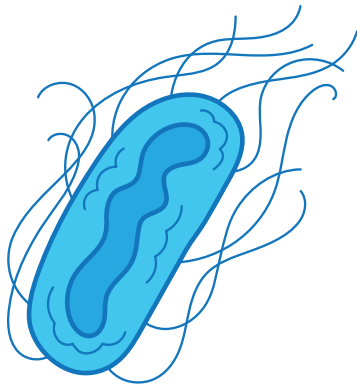
Unwinding and rewinding adds twists and tension to DNA, much like a pair of tangled headphone wires. Topoisomerase 1 cuts one strand of DNA, allows it to untwist and relax, then puts the strand back together.

## Structure

Topoisomerase 1 protein is pictured to the right, wrapped around a small piece of DNA (darker line toward the bottom right). The part of the protein that you made is in the lower lefthand corner, shaded darker.



based on RCSB PDB reference 3px7



## Organism

The gene you transcribed and translated came from the bacterial species *E. coli*.

Bacteria are microscopic, single-celled organisms. This species lives in the lower digestive tract of many warm-blooded animals, including humans. Most strains of *E. coli* are harmless and even beneficial, but a few can cause illness.