**Rolling circle replication**

It describes a process of unidirectional nucleic acid replication that can rapidly synthesize multiple copies of circular molecules of  [plasmids](https://en.wikipedia.org/wiki/Plasmid).

Rolling circle [DNA replication](https://en.wikipedia.org/wiki/DNA_replication) is initiated by an initiator protein encoded by the plasmid or bacteriophage DNA, which nicks one strand of the double-stranded, circular DNA molecule at a site called the double-strand origin, or DSO. The initiator protein remains bound to the 5' phosphate end of the nicked strand, and the free 3' hydroxyl end is released to serve as a [primer](https://en.wikipedia.org/wiki/Primer_(molecular_biology)) for DNA synthesis by [DNA polymerase III](https://en.wikipedia.org/wiki/DNA_polymerase_III). Using the unnicked strand as a template, replication proceeds around the circular DNA molecule, displacing the nicked strand as single-stranded DNA. Displacement of the nicked strand is carried out by a host-encoded helicase called PcrA (the abbreviation standing for plasmid copy reduced) in the presence of the plasmid replication initiation protein.

Continued DNA synthesis can produce multiple single-stranded linear copies of the original DNA in a continuous head-to-tail series called a [concatemer](https://en.wikipedia.org/wiki/Concatemer). These linear copies can be converted to double-stranded circular molecules through the following process:

First, the initiator protein makes another nick in the DNA to terminate synthesis of the first (leading) strand. [RNA polymerase](https://en.wikipedia.org/wiki/RNA_polymerase) and DNA polymerase III then replicate the single-stranded origin (SSO) DNA to make another double-stranded circle. [DNA polymerase I](https://en.wikipedia.org/wiki/DNA_polymerase_I) removes the primer, replacing it with DNA, and [DNA ligase](https://en.wikipedia.org/wiki/DNA_ligase) joins the ends to make another molecule of double-stranded circular DNA.

As a summary, a typical DNA rolling circle replication has five steps:

1. Circular dsDNA will be "nicked".
2. The [3' end](https://en.wikipedia.org/wiki/3%27_end) is elongated using "unnicked" DNA as leading strand (template); [5' end](https://en.wikipedia.org/wiki/5%27_end) is displaced.
3. Displaced DNA is a lagging strand and is made double stranded via a series of [Okazaki fragments](https://en.wikipedia.org/wiki/Okazaki_fragment).
4. Replication of both "unnicked" and displaced ssDNA.
5. Displaced DNA circularizes.

