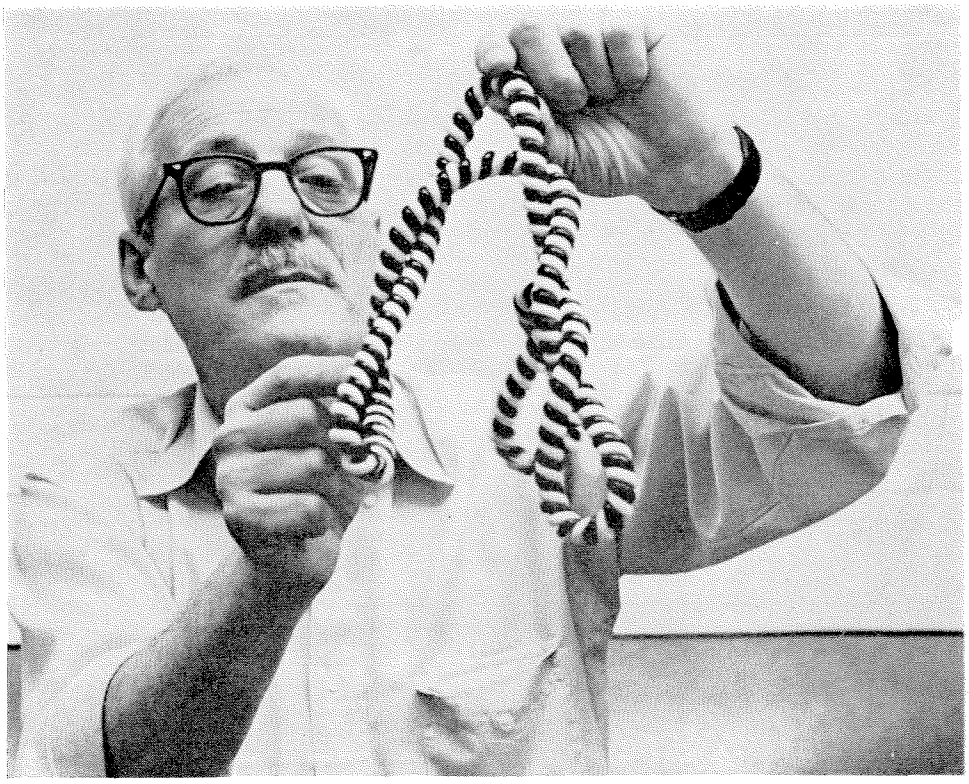

Jerome Vinograd, Caltech associate in chemistry and biology, with a model of a double-stranded helix arranged to form a twisted circular structure like that found in the DNA from polyoma virus.

DNA — Structure and Superstructure

Jerome Vinograd, research associate in chemistry and biology, and his collaborators at Caltech, have succeeded in isolating the most highly organized DNA molecule that has yet been found. This is the DNA of the polyoma virus which causes cancer in some rodents.

Like other DNA molecules, the DNA of the polyoma virus consists of long, double strands of atoms, the strands being intertwined in a helix. In addition, Caltech research workers had found that each of the two strands is joined at the ends, forming a circle of two, continuous strands wrapped around each other in 500 right-handed turns.

Now the Caltech group has discovered that the circle forms an additional superstructure by twisting to the left upon itself five or more times. Thus, five or more smaller loops are formed by the twistings of the larger circle.

The detailed picture of this complex DNA molecule — a circle only one fifty-thousandth of an inch in diameter — was accomplished in enzymatic and chemical studies, with ultracentrifuge techniques developed by Dr. Vinograd, and with electron microphotographs.

This is the first evidence of a higher organization of an isolated DNA molecule. As with protein molecules, it may now be said that DNA has a tertiary structure. There are indications, from the work of others, that the DNAs of three other viruses may have a similar structure. These viruses are SV-40 and the human and rabbit papillomas.

To replicate, a virus must invade a living cell and must use the cell's building materials. But viral DNA cannot replicate in the super-twisted form in which polyoma DNA is found. It must somehow open up, and in doing so loses the twisted structure. After the twisted viral DNA invades a cell, at least one break in either of the two DNA strands must occur for the two strands to separate and form two daughter molecules.

It is not known what causes the strand break in nature. Presumably an enzyme is responsible. In the laboratory, Dr. Vinograd and his associates have unlocked the super-twisted configuration with an enzyme named pancreatic DNAase.

Associated with Dr. Vinograd in the research are Dr. Jacob Lebowitz, research fellow in chemistry; Roger J. Radloff, graduate student in biology; Robert Watson, research assistant in chemistry; and Philip Laipis, undergraduate student in chemistry. The work is supported by the U.S. Public Health Service.