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The effect of electrostatic energy in determining the stable configuration and handedness of small-ring-DNA in the absence and presence of protein.[1] SEYED AHMAD SABOK-SAYR, WILMA OLSON, Rutgers University — We studied the electrostatic energy stored in a small-ring-DNA while its configuration changes over the in-plane normal mode. Our result shows that the normalized energy of the configuration increases as the number of base pairs increases but the normalized energy starts saturating above 500 base pairs. It may suggest where a circular DNA with enough base pairs may form a supercoil. We also studied the energy related to the interaction between the circular DNA and a protein as the DNA forms a supercoil with one complete turn around the protein. We found a synergy between the configuration of DNA and the position of the protein. Our studies show that the DNA forms a more stable configuration when the protein is outside the ring. We determined that the handedness of the protein will not change as it rotates from inside to outside of the small-ring-DNA and forms a $SO(3)$ group, while the handedness of DNA will change from right handed to left handed or vice versa as the protein transforms from the inside to the outside of the DNA and therefore this transformation in DNA forms a $O(3)$ group.

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