

# International Seminar on Applied Geometry in Andalusia

Granada (Spain) September 4-8, 2006

---

ANGEL FERRÁNDEZ AND JOSÉ A. PASTOR, UNIVERSITY OF MURCIA

## *Geometry Applied to DNA*

---

We will survey the three main invariants involved in the doubly stranded DNA molecule. We will talk about linking  $L$ , twisting  $T$  and writhing  $W$  numbers and the fundamental result in the geometry of twisted, closed ribbon loops known as the Calugareanu theorem (also referred to as either White's formula or Calugareanu-White-Fuller theorem, which is expressed as  $L = T + W^2$ ).

## References

- [BF1] F. Brock Fuller: The writhing number of a space curve, Proc. Nat. Acad. Sci. 68 No. 4 (1971), 815–819.
- [BF2] F. Brock Fuller: Decomposition of the linking number of a closed ribbon: A problem from molecular biology, Proc. Nat. Acad. Sci. 75 No. 8 (1978), 3557–3561.
- [C] F. H. C. Crick: Linking numbers and nucleosomes, Proc. Nat. Acad. Sci. 73 No. 8 (1976), 2639–2643.
- [FHCP] A. Ferrández, M. A. Hernández-Cifre & J. A. Pastor: Algunos aspectos matemáticos de la doble estructura helicoidal del ADN, La Gaceta de la RSME 6.3 (2003), 557–570.
- [M] K. Murasugi: Knot Theory and its Applications. Birkhäuser, Boston 1996.
- [P1] W. F. Pohl: Some integral formulas for space curves and their generalization, Amer. J. Math. 90 (1968), 1321–1345.
- [P2] W. F. Pohl: The self-linking number of a closed space curve, J. Math. Mechanics 17 No. 10 (1968), 975–985.
- [P3] W. F. Pohl: DNA and Differential Geometry, Math. Intelligencer, 3 (1980), 20–27.
- [PR] W. F. Pohl & G. W. Roberts: Topological considerations in the theory of replication of DNA, J. Math. Biology 6 (1978), 383–402.
- [PPC] L. Postow, B. J. Peter & N. R. Cozzarelli: Knot what we thought before: the twisted story of replication, BioEssays 21 (1999), 805–808.
- [S1] D. W. Sumners: Untangling DNA, Math. Intelligencer 12 (1990), 71–80.

- [S2] D. W. Sumners: Lifting the curtain: Using topology to probe the hidden action of enzymes, Notices Amer. Math. Soc. 42 No. 5 (1995), 528–537.
- [WC] J. D. Watson & F. H. C. Crick: Molecular Structure of Nucleids Acids, Nature 171 (1953), 737–738.
- [W] J. H. White: Self-linking number and the Gauss integral in higher dimensions, Amer. J. Math. 91 (1969), 693–728.