Nicolaidis, Argyris; Psomopoulos, Fotis
DNA coding and Gödel numbering. (English) Zbl 07491733
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Summary: We consider a DNA strand as a mathematical statement. Inspired by the work of Kurt Gödel, we attach to each DNA strand a Gödel’s number, a product of prime numbers raised to appropriate powers. To each DNA chain corresponds a single Gödel’s number $G$, and inversely given a Gödel’s number $G$, we can specify the DNA chain it stands for. Next, considering a single DNA strand composed of $N$ bases, we study the statistical distribution of $g$, the logarithm of $G$. Our assumption is that the choice of the $m$ th term is random and with equal probability for the four possible outcomes. The ‘experiment’, to some extent, is similar to throwing $N$ times a four-faces die. Through the moment generating function we obtain the discrete and then the continuum distribution of $g$. There is an excellent agreement between our formalism and simulated data. At the end we compare our formalism to actual data, to specify the presence of non-random fluctuations.

MSC:
82-XX Statistical mechanics, structure of matter

Keywords:
Gödel numbering; nucleotide sequences; information theory; language theory; language representation of biological sequences

Full Text: DOI

References:


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