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The DNA theory of inheritance in the scope of protein inheritance

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Statement of the Problem: It has long been accepted that any hereditary factor in any organism is represented by DNA sequences. This idea became fundamental in molecular genetics and was implicitly transformed into the DNA theory of inheritance. All basic genetic terms (genotype, gene, allele, mutation, recombination, etc.) were considered as specific DNA sequences or their alterations. However, multiple examples of stable epigenetic inheritance lacking any distinctions in DNA sequences were recently discovered, and the most exciting among them is protein inheritance. Amyloid hereditary prions in fungi were considered as "protein-only" hereditary factors, which features were determined entirely by protein conformation. As a result, the principal question arises whether the DNA theory of inheritance is wrong or not.

Methodology & Theoretical Orientation: Considering different variants of the same hereditary prion as prion alleles, we examined the molecular nature of such variety.

Findings: To perpetuate stably in cell generations a certain prion allele requires two entities: a specific state of the prion protein, and the corresponding DNA sequence to provide reproduction of the prion particles. We name these entities as the DNA determinant and the epigenetic determinant, respectively. Thus, a certain prion allele is a bimodular hereditary system depending on both the DNA determinant and the epigenetic determinant. Alteration of any of these two determinants may result in the establishment of a novel prion allele. Moreover, similar regularities are characteristic to all other cases of epigenetic inheritance, irrespective to the underlying mechanisms.

Conclusion & Significance: The hereditary role of DNA is fundamental for any known mechanisms of inheritance, including epigenetic. However, it becomes an element of a more complicated concept: in addition to "DNA-only" hereditary factors, various bimodular hereditary factors also exist.

Biography

Oleg N Tikhodeyev is the author of the original approach for resolving multiple ambiguities and contradictions in current genetic concepts. He has shown that the key source of such ambiguities and contradictions is the erroneous belief that the same genetic term (for example, mutation) is able to comprise both specific phenomenology and the underlying mechanisms (Tikhodeyev, 2015). This belief became widely accepted after 1952 when the hereditary role of DNA had been demonstrated. In modern genetic concepts, the terms describing molecular mechanisms should be clearly distinguished from those describing phenomenology because there is no strict correlation between phenomenology and molecular mechanisms (Tikhodeyev, 2016).

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