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Opinion Article

Molecular Phylogenetics: Types and Applications

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DESCRIPTION

In order to understand more about the evolutionary links between animals, the branch of phylogeny known as molecular phylogenetics investigates genetic, hereditary molecular differences, especially in DNA sequences. DNA sequencing was developed several years before molecular phylogenetics. It was created as a result of Linnaeus's extensive use of the traditional method of grouping species according to their similarities and differences in the 18th century. A categorization is a hierarchical organization of items or living things in order. The criteria or characteristics employed in a classification's creation determine the kind of relationships that are disclosed. The relationships are known as phonetic if characters are quantified and statistically evaluated based on their total resemblance. If the characters are analyzed in a way that detects their evolutionary or genealogical development, the relationships are called phylogenetic.

Types

There are three types of phylogenetic classifications: monophyletic, polyphyletic, and paraphyletic.

Monophyletic: A group of species that is monophyletic comprises all of its progeny as well as the common ancestor they all share. A monophyletic group on a phylogenetic tree consists of a node and its entire offspring, represented by both nodes and terminal taxa.

Polyphyletic: The categorization is polyphyletic if the included creatures are descended from two or more different ancestors.

Paraphyletic: A classification is referred to as paraphyletic if it excludes some of the descendants of the most recent shared ancestor.

When possible, monophyletic groups should serve as the foundation for phylogenetic classifications. In order to build a phylogeny of organisms or taxa, we first need to determine how much a particular feature varies among different species. Characters must exhibit some variety to be valuable in systematics, such flowers having red, pink, or white petals. In this instance, the hue of the petal is the character, while the colours red, pink, and white are the character's states. We must establish character polarity, which distinguishes the ancestral, or plesiomorphic state, from the evolved, or apomorphic state, in order to employ petal colour in a phylogenetic study.

Applications

Molecular phylogenies are currently a crucial tool in fields including population genetics, genomics, and virology. They have a wide range of practical applications in the analysis of DNA sequences. A vast number of applications are now available as a result of the advancement of advanced approaches made possible by modern computers. In addition to assigning taxonomy to an organism, investigating reproductive biology in lower organisms, evaluating the process of cryptic speciation in a species, comprehending the history of life, and settling contentious historical issues are only a few of the uses of phylogenetics.

Identifying the origin of pathogens: A novel disease epidemic can be studied using phylogenetic methods and molecular sequencing tools. This entails learning which species the infection is related to and, as a result, the most probable source of transmission.

In DNA barcoding, the species of a particular organism is determined using tiny fragments of mitochondrial DNA or chloroplast DNA, which is another application of molecular phylogeny. A reliable way for figuring out how current species have developed is phylogenetics. By examining phylogenetic trees, scientists can explain the similarities and differences between species and discover more about how species have evolved.

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