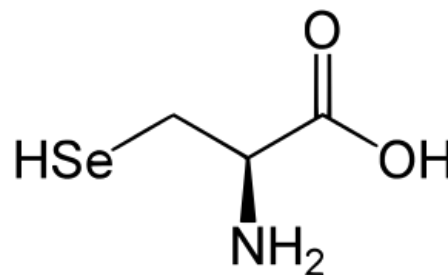


Selenocysteine

In late 70's or early 80's, newly discovered selenocysteine(Sec) was added to the list of the usual twenty coded amino acids and later discovered pyrrolysine(Pyl) became the twenty-second amino acid. Selenocysteine and pyrrolysine amino acids are rather unusually encoded by codons that commonly serve as signals to end translation(see genetic code). Selenocysteine and pyrrolysine are encoded by UGA and UAG codons respectively.

Selenium is important trace element and its deficiency causes serious illness(such as cardiomyopathy), although at higher concentrations it is highly toxic to organism. Selenium in selenocysteine is essential part of active site of some necessary enzymes. These selenoproteins, e.g. thioredoxin reductases, take part in redox reactions. They are present in some bacteria and archaea as well as in some eukaryotes. Plants and yeasts cannot incorporate selenocysteine in their proteins.



Selenocysteine - chemical structure

In order to include this unique amino acid into the protein chain, meaning of UGA codon needs to be redefined. This violates the rule of unambiguity of genetic code. If that was the case, UGA codon would have two functions(stop codon and Sec codon) which would engage randomly, and that would pose high risk factor for the cell. In reality, there are safety mechanisms that ensure proper engagement of each meaning of the UGA codon. One of them is specialized translation apparatus for this particular process. Another one is that mRNA must contain special sequence called SECIS - selenocysteine incorporation signal, either right behind UGA codon or in its untranslated region at its 3'-end (3' UTR). SECIS in these regions creates unique secondary structure of mRNA which is recognized by one of the members of the specialized translation apparatus and only then is selenocysteine allowed to be incorporated in the protein chain. If mRNA lacks SECIS sequence, UGA codon will always encode termination signal.

Links

Related articles

- Genetic Code

Sources

- JONÁK, J. RNA v proteosyntéze. Genetický kód a příprava aminoacyl-tRNA. *Živa* [online]. 2007, roč. 2007, vol. 5/2007, s. 195-198, dostupné také z <<http://ziva.avcr.cz/files/ziva/pdf/rna-v-proteosynteze-geneticky-kod-a-priprava-amino.pdf>>. ISSN 0044-4812.