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ASPECTS OF PROTEIN SYNTHESIS ADAPTATION

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The fidelity of natural protein synthesis is maintained by specific aminoacylation of a transfer RNA (tRNA) with an amino acid, and the ribosomal decoding of each tRNA in response to a cognate codon on a messenger RNA (mRNA). The pattern of molecular structural, biochemical and genetic investigations has shown complex and the tangled net of specific interactions of aminoacyl-tRNA synthetase with tRNA.There is guarantee of an accuracy, right choice of cognate tRNA and throwing aside non-cognate one. With the age of animals, the mistakes are appeared in the process of aminoacylation because of the alterations of aminoacyl-tRNA synthetases. Eukaryotic and prokaryotic Tyrosine tRNAs belong to different classes of tRNA. It's known that eukaryotic and prokaryotic $tRNA^{Leu}$ and $tRNA^{Ser}$ belong to the 2nd class of tRNA with a long variable loop. Prokaryotic $tRNA^{Tyr}$ (for example, $tRNA^{Tyr}$ from Escherichia coli) has also long variable loop (the 2^{nd} class of tRNA) but eukaryotic $tRNA^{Tyr}$ has a short variable loop (the first class of tRNA). A length of variable loop of tRNA was very changed during evolution that has possibly influence on cognition by tyrosyl-tRNA synthetase causing above-mentioned alterations reflection of which can be observed during aminoacylation.

The aim of this work was to determine an accuracy of quality control on the level of aminoacylation of eukaryotic and prokaryotic tyrosine tRNA by tyrosyl-tRNA synthetase from hepatic tissue of young and old rats. For the purpose of isolation of the high-purified preparations of $tRNA^{Tyr}$ and tyrosyl-tRNA synthetase from liver (according to experimental procedures of our previous articles), rats of different ages were used. 16 rats were divided in 2 groups: in the first group, animals were at 3–4 weeks of age and in the second one - at 24 months. There are main components of aminoacylation reaction: tyrosine (H*(*^{3})-Tyr), $tRNA^{Tyr}$ ($tRNA^{Tyr}$ from rat liver and E. coli) and eukaryotic tyrosyl-tRNA synthetase. Aminoacylation reactions of eukaryotic $tRNA^{Tyr}$ (from liver tissues of young and old rats) and prokaryotic tyrosine tRNAs (from E. coli) by tyrosyl-tRNA synthetase from the liver of rats of different ages made it possible to assess the accuracy of quality control at this level. Aminoacylation $tRNA^{Tyr}$ by eukaryotic tyrosyl-tRNA synthetase from E. coli is not carried out because of a bacterial TyrRS cannot recognize eukaryotic $tRNA^{Tyr}$ (while eukaryotic enzyme recognizes tyrosine tRNA from E. coli). According to our research of interaction sites of $tRNA^{Tyr}$ bovine liver with homologous aminoacyl-tRNA synthetase by chemical modification (by alkylation nitrosoethylurea), tyrosyl-tRNA synthetase effectively protects against alkylation of phosphoric acid remains in D-loop (in the 21st position), anticodon branch (in 31 position) and at the junction of anticodon and variable branches (in 44th position), as well as at 59- and 64-positions of TΨS-branch. However, anticodon $tRNA^{Tyr}$ area is not protected by homologous tyrosyl-tRNA synthetase (molecular weight form of 2x39000 Da) from alkylation nitrosoethylurea but $tRNA^{Tyr}$ anticodon site is protected by homologous ARS-ase if its molecular weight 2x59000 Da, as in $tRNA^{Tyr}$ from E. coli, in which the interaction of the enzyme involved anticodon and variable branches.

The levels of tyrosylation of $tRNA^{Tyr}$ in the hepatic cells of young and old rats are different (they are lowered with age), and obviously depend on alterations in structure of tRNA and tyrosyl-tRNA synthetase that are probably caused by rise of cell oxidative processes. Differences in aminoacylation of eukaryotic and prokaryotic $tRNA^{Tyr}$ (they are belong to classes I and II tRNA) by tyrosyl-tRNA synthetases are indicative of higher quality control at the first stage of translation in young animals. Effectiveness of control mechanisms of protein synthesis processes is decreased with animal age; it's specifically mirrored in precision of quality control of aminoacylation of eukaryotic and prokaryotic $tRNA^{Tyr}$ by tyrosyl-tRNA synthetase.