Ribosomal proteins play multiple roles in DNA repair, cancer and cell cycle control through post-translational modifications

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Our lab has identified that eukaryotic ribosomal protein S3 (rpS3) is a multifunctional protein which plays a critical role through different post-translational modifications not only in protein synthesis but also in cancer related phenomena such as DNA repair, apoptosis and metastasis inhibition. This protein plays a role in DNA repair process with respect to a human disease called xeroderma pigmentosum. We also demonstrated that phosphorylation status of rpS3 is directly correlated with its DNA repair endonuclease activity mediated by PKCδ. In the oxidative stress condition, non-ribosomal rpS3 was phosphorylated in the cytoplasm and accumulated in the nucleus. Furthermore, PKCδ-dependent rpS3 phosphorylation induced the increased DNA endonuclease activity whereas the dephosphorylation of rpS3 mediated by phosphatase PP2A showed the decreased endonuclease activity. Recently, we also discovered that this protein is also involved in the repair of mitochondrial DNA damage through the translocation from the cytoplasm to the mitochondria upon excessive oxidative stress conditions. The function of rpS3 in the DNA repair processing is connected with cell viability, and the post-translational regulation mechanism determines the fate of rpS3 between a ribosomal component and a non-ribosomal soluble protein. Moreover, we will present novel data that rpS3 is involved in the crosstalk between cell survival and apoptosis via various kinds of post-translational modifications. The largest energy consumer in the cell is the ribosome biogenesis whose aberrancy elicits various human diseases which appear to be related with p53 induction, along with cell cycle arrest. In conclusion, various post-translational modification status of rpS3 in cells appears to determine the fate of multifunctional role of rpS3 protein not only in translation but also in DNA repair, apoptosis and cell cycle regulation.