Protein post-translational modification

Protein post-translational modification (PTM) refers to the chemical modifications that occur on proteins after they have been synthesized during translation. These modifications play a crucial role in regulating the structure, function, and localization of proteins within a cell. Numerous types of post-translational modifications exist, and they can influence protein activity, stability, and interactions with other molecules. Here are some common types of protein post-translational modifications:

Phosphorylation

Acetylation

Methylation

Glycosylation:

Process: Addition of sugar molecules (glycans) to specific amino acid residues. Function: Influences protein folding, stability, and interactions. Important in cell signaling and immune system function. Ubiquitination:

Process: Attachment of ubiquitin molecules to lysine residues on a protein. Function: Targets proteins for degradation by the proteasome, regulates protein stability, and influences cellular processes like cell cycle progression. Sumoylation:

Process: Attachment of small ubiquitin-like modifier (SUMO) proteins to lysine residues. Function: Involved in regulating protein localization, stability, and interactions. Can affect transcriptional regulation. Prenylation:

Proteolytic Cleavage:

Process: Removal of specific peptide segments from a protein. Function: Can activate or inactivate proteins, regulate protein maturation, and control cellular processes. These modifications provide a dynamic and precise way for cells to regulate protein function in response to internal and external signals. Dysregulation of post-translational modifications is implicated in various diseases, including cancer, neurodegenerative disorders, and metabolic diseases. Studying protein post-translational modifications is critical for understanding cellular processes and developing targeted therapies for diseases.

Protein posttranslational modification regulates synaptic protein stability, sorting and trafficking, and is involved in emotional disorders. Yet the molecular mechanisms regulating emotional disorders remain unelucidated. Shen et al. report unknown roles of protein palmitoylation/nitrosylation crosstalk in regulating anxiety-like behaviors in rats. According to the percentages of open arm duration in the

elevated plus maze test, the rats were divided into high-, intermediate- and low-anxiety groups. The palmitoylation and nitrosylation levels were detected by acyl-biotin exchange assay, and we found low palmitoylation and high nitrosylation levels in the basolateral amygdala (BLA) of high-anxiety rats. Furthermore, we observed that 2-bromopalmitate (2-BP), a palmitoylation inhibitor, induced anxiety-like behaviors, accompanied with decreased amplitude and frequency of mEPSCs and mIPSCs in the BLA. Additionally, we also found that inhibiting nNOS activity with 7-nitroindazole (7-NI) in the BLA caused anxiolytic effects and reduced the synaptic transmission. Interestingly, diazepam (DZP) rapidly elevated the protein palmitoylation level and attenuated the protein nitrosylation level in the BLA. Specifically, similar to DZP, the voluntary wheel running exerted DZP-like anxiolytic action, and induced high palmitoylation and low nitrosylation levels in the BLA. Lastly, blocking the protein palmitoylation with 2-BP induced an increase in protein nitrosylation level, and attenuating the nNOS activity by 7-NI elevated the protein palmitoylation level. Collectively, these results show a critical role of protein palmitoylation/nitrosylation crosstalk in orchestrating anxiety behavior in rats, and it may serve as a potential target for anxiolytic intervention [1)]

1)
Shen ZC, Liu JM, Zheng JY, Li MD, Tian D, Pan Y, Tao WC, Gao SQ, Xia ZX. Regulation of anxiety-like behaviors by S-palmitoylation and S-nitrosylation in basolateral amygdala. Biomed Pharmacother. 2023 Nov 8;169:115859. doi: 10.1016/j.biopha.2023.115859. Epub ahead of print. PMID: 37948993.

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