8.14: Post-translational regulation

Proteins may be modified after their synthesis, folding, and assembly - this process is known as post-translational modification. A number of post-translational modifications have been found to occur within cells. In general where a protein can be modified that modification can be reversed. The exception, of course, is when the modification involves protein degradation or proteolytic processing. There are many different types of post-translational modification, and we will consider them only generically. In general they involve the formation of a covalent bond linking a specific chemical group to specific amino acid side chains on the protein - these groups can range from a phosphate groups (phosphorylation), an acetate group (acetylation), the attachment of lipid/hydrophobic groups (lipid modification), or carbohydrates (glycosylation). Such post-translational modifications are generally reversible, one enzyme adds the modifying group and another can remove it. For example, proteins are phosphorylated by enzymes known as protein kinases, while protein phosphotases remove such phosphate groups. Post-translational modifications act in much the same way as do allosteric effectors, they modify the structure and, in turn, the activity of the polypeptide to which they are attached. They can also modify a protein's interactions with other proteins, the protein's localization within the cell, or its stability.

Questions to answer & to ponder

• A protein binds an allosteric regulator - what happens to the protein?

• How is the post-translational modification of a protein like allosteric regulation? how is it different?

• Why are enzymes required for post-translational modification?

• Why is a negative allosteric regulator not considered a "competitive" inhibitor?
• Why do post-translational modifications (and their reversals) require energy?

• How does a signal sequence influence translation?

• How would a cell recover from the effects of an irreversible, non-competitive inhibitor?

• Why might a specific protein have a short half-life?

• What would happen if you somehow put a signaling sequence at the beginning of a normally cytoplasmic polypeptide?

• Draw out the factors and their interactions that control the half-life, activity, and location of a particular protein within a biological system.

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