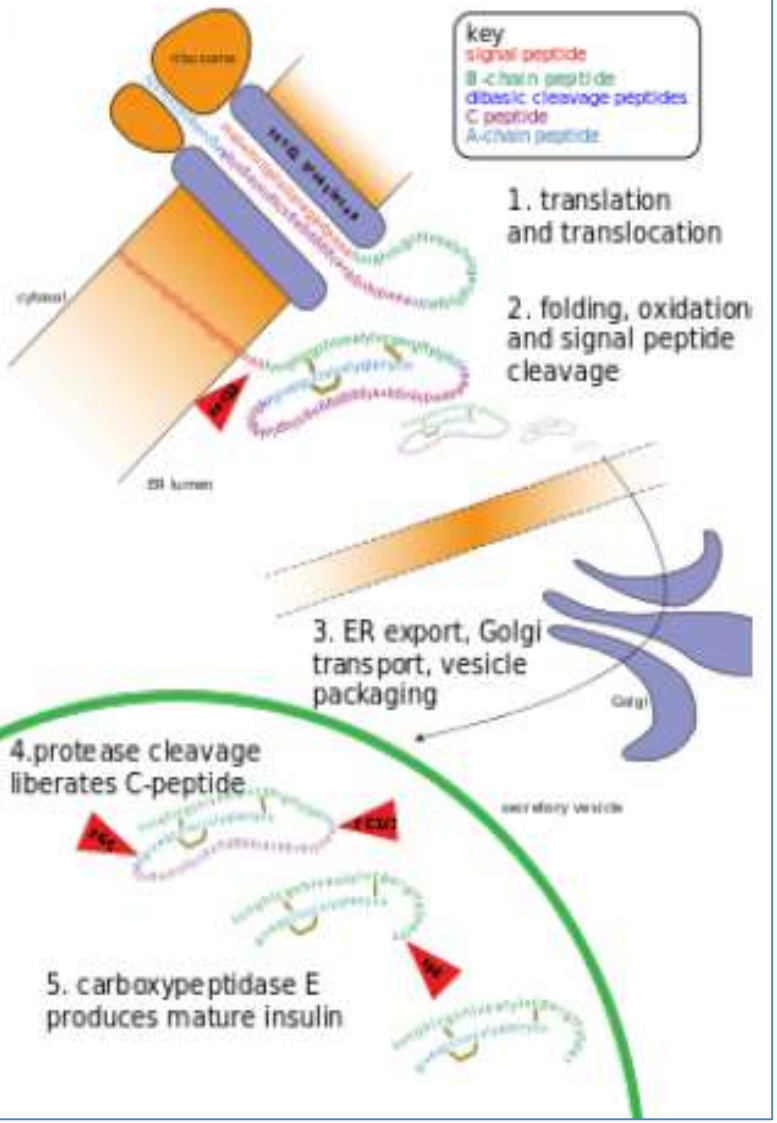
POST TRANSLATIONAL MODIFICATIONS

Dr. R. Prasad
Department of Zoology,
Eastern Karbi Anglong College,
Sarihajan

Post-translational modifications

Many proteins undergo chemical modifications at certain amino acid residues following translation. These modifications are essential for normal functioning of the protein and are carried out by one or more enzyme catalyzed reactions.

The chemical modifications that take place at certain amino acid residues after the protein is synthesized by translation are known as post-translational modifications.



Post-translational modifications

Gene encoding region (ORF)

↓transcription

mRNA

↓translation

Protein (nascent protein, precursor protein)

↓protein processing, post-translational modification

Mature protein

↓folding

Biological active protein

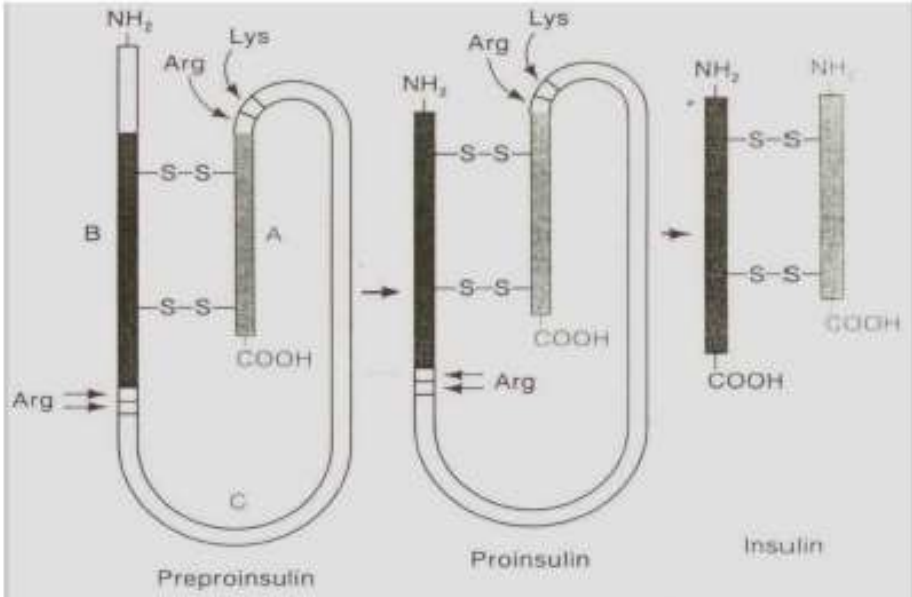
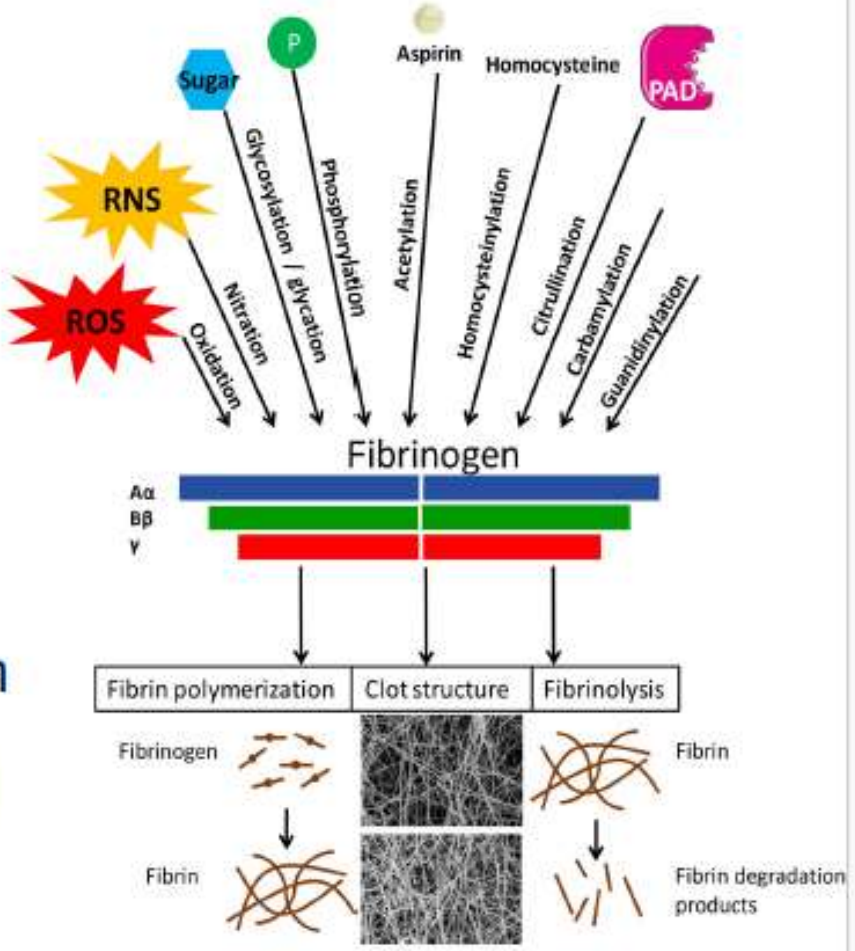


Figure 20-22
Conversion *in vivo* of preproinsulin to proinsulin and then to insulin.

Effects of Post-translational Modification

1. Stability of protein.
2. Biochemical activity (activity regulation)
3. Protein targeting (protein localization)
4. Protein signaling (protein-protein interaction, cascade amplification)



Main types of PTM

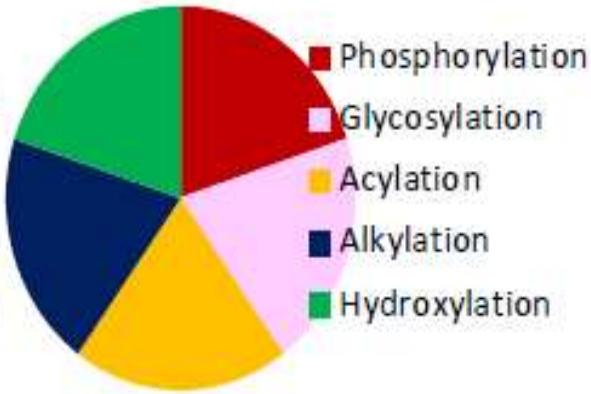
a) Phosphorylation: The process by which a phosphate group is attached to certain amino acid side chains in the protein, most commonly serine, threonine and tyrosine.

b) Glycosylation: The attachment of sugar moieties to nitrogen or oxygen atoms present in the side chains of amino acids like aspargine, serine or threonine.

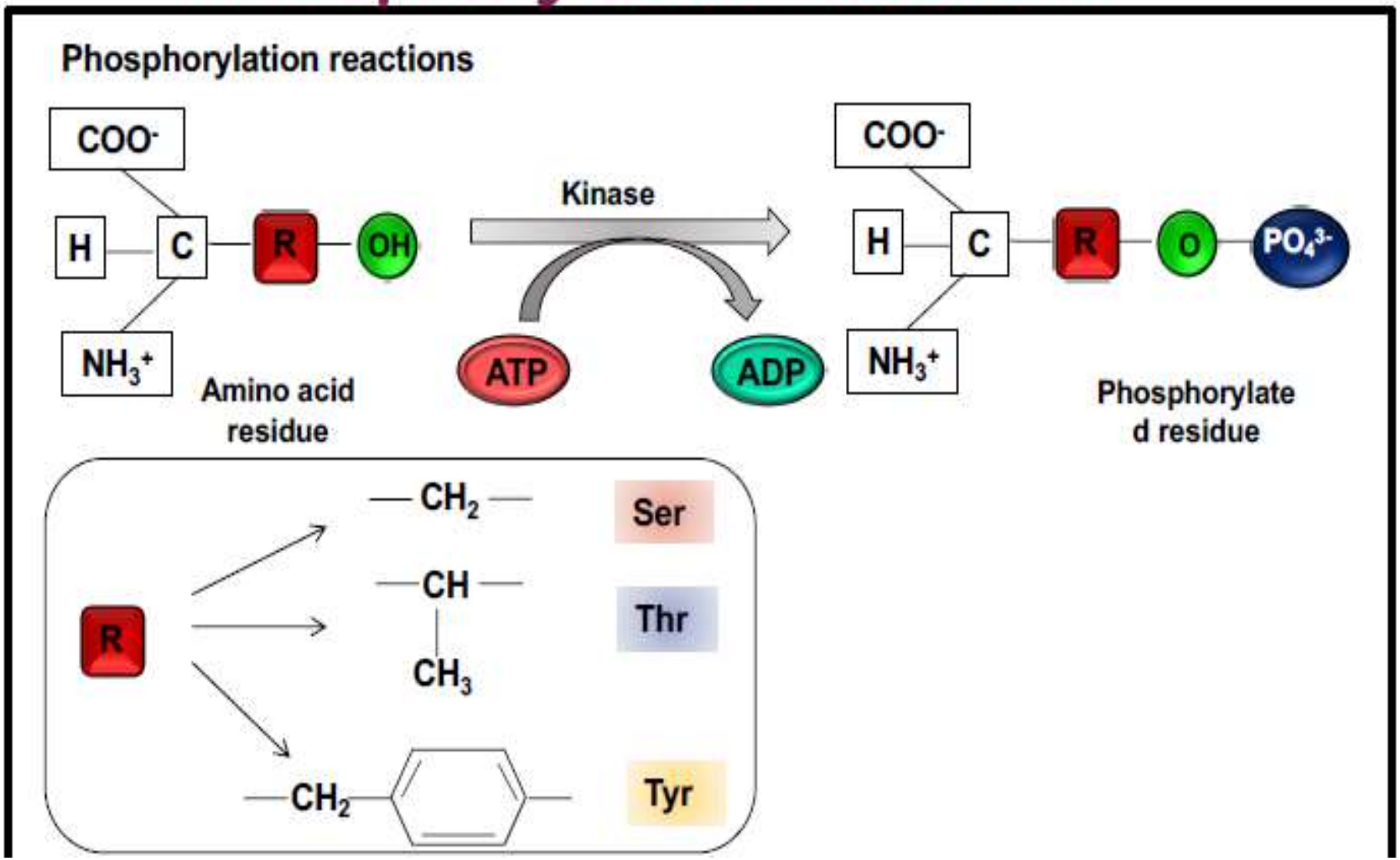
c) Acylation: The process by which an acyl group is linked to the side chain of amino acids like aspargine, glutamine or lysine.

d) Alkylation: Addition of alkyl groups, most commonly a methyl group to amino acids such as lysine or arginine. Other longer chain alkyl groups may also be attached in some cases.

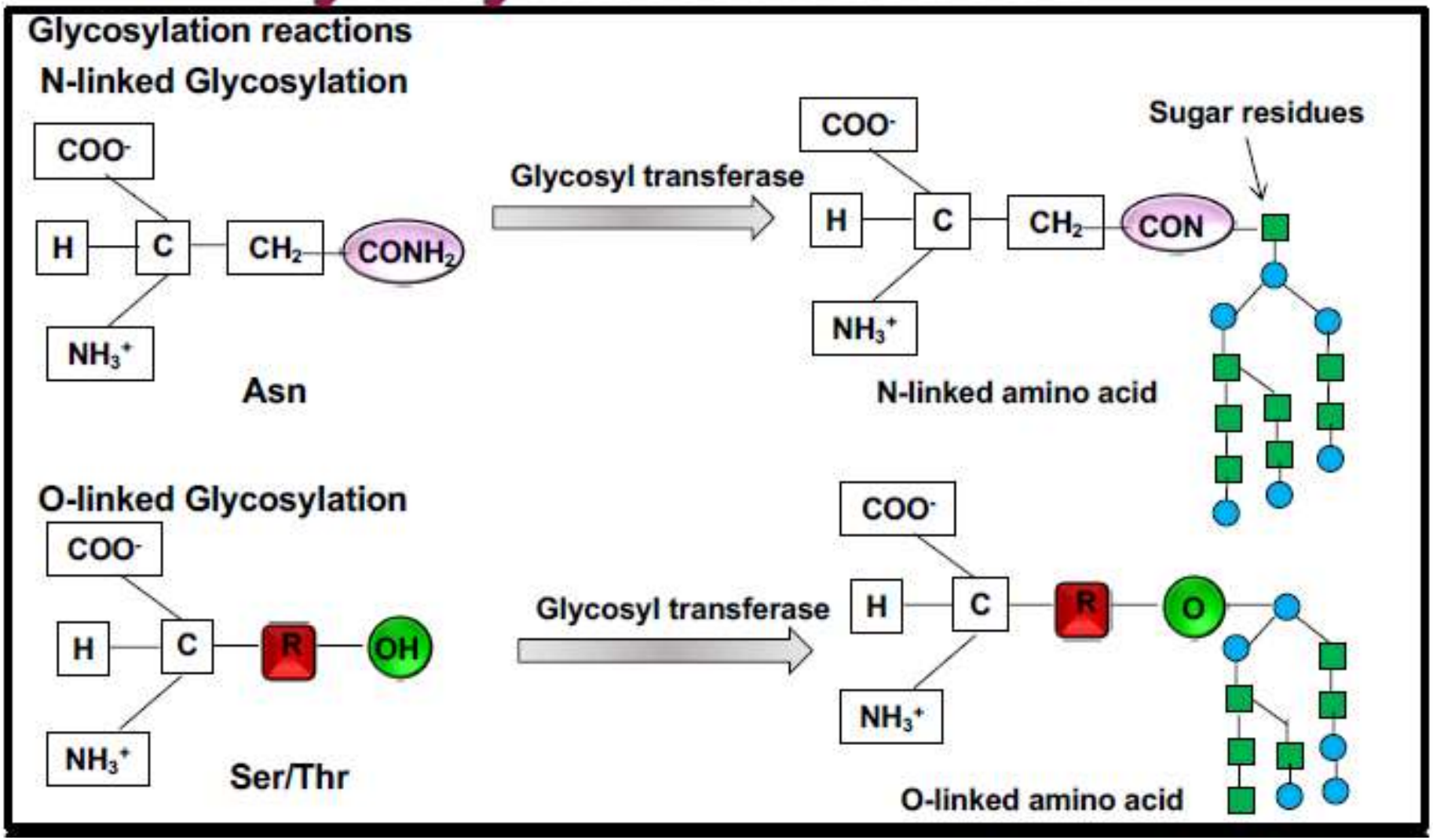
e) Hydroxylation: This PTM is most often found on proline and lysine residues which make up the collagen tissue. It enables crosslinking and therefore strengthening of the muscle fibres.

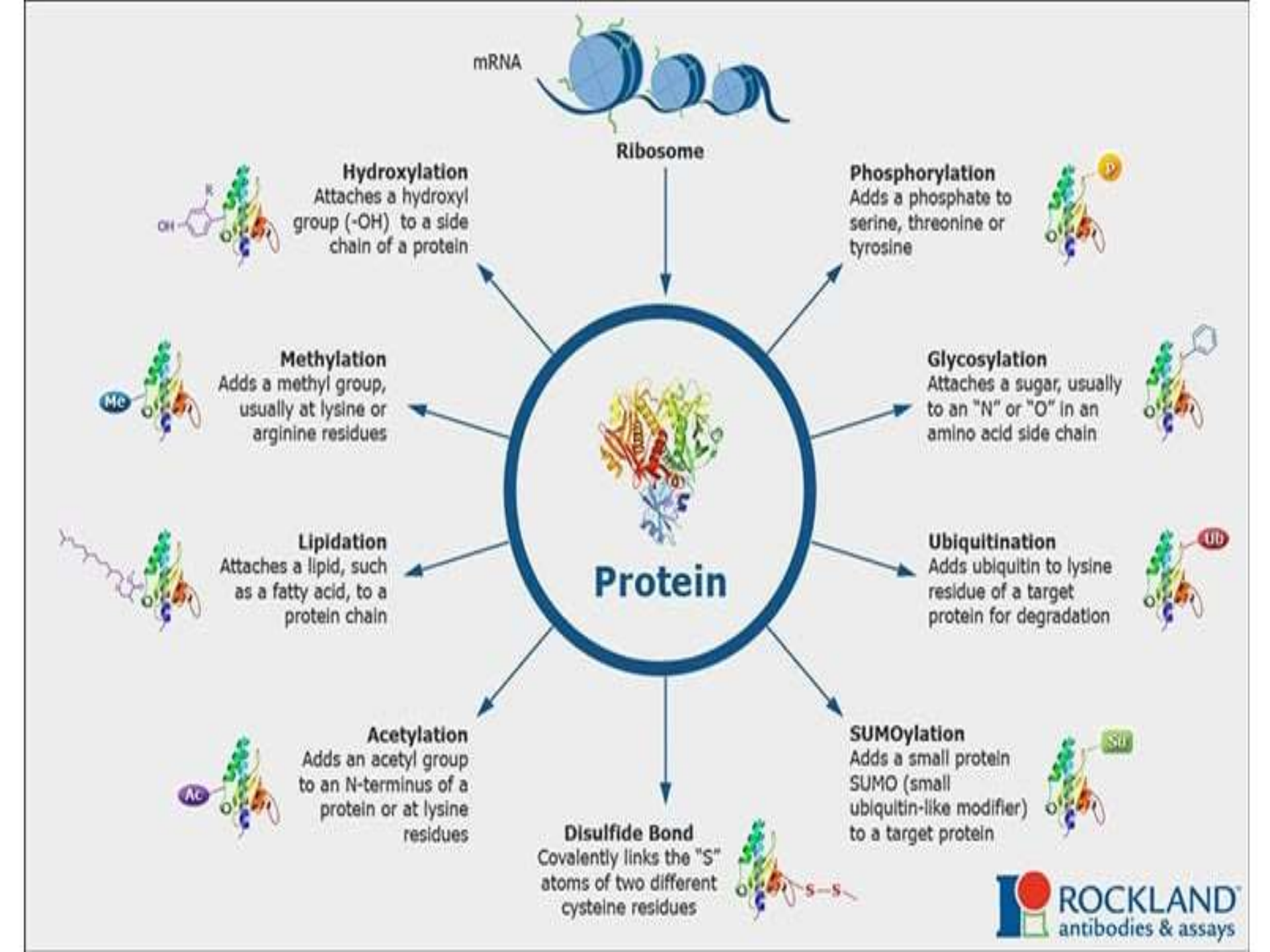


Phosphorylation reactions



Glycosylation reactions




mRNA
Ribosome
Protein
Hydroxylation
Attaches a hydroxyl group (-OH) to a side chain of a protein
Phosphorylation
Adds a phosphate to serine, threonine or tyrosine
Methylation
Adds a methyl group, usually at lysine or arginine residues
Glycosylation
Attaches a sugar, usually to an "N" or "O" in an amino acid side chain
Lipidation
Attaches a lipid, such as a fatty acid, to a protein chain
Ubiquitination
Adds ubiquitin to lysine residue of a target protein for degradation
Acetylation
Adds an acetyl group to an N-terminus of a protein or at lysine residues
SUMOylation
Adds a small protein SUMO (small ubiquitin-like modifier) to a target protein
Disulfide Bond
Covalently links the "S" atoms of two different cysteine residues
ROCKLAND
antibodies & assays