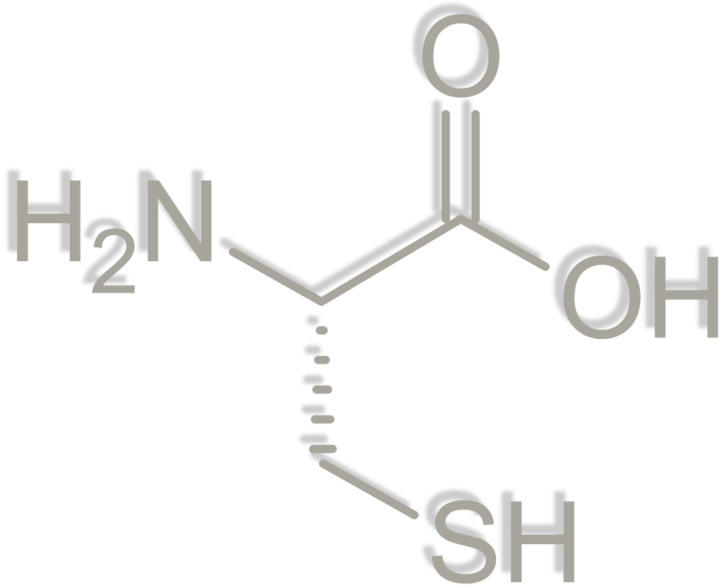
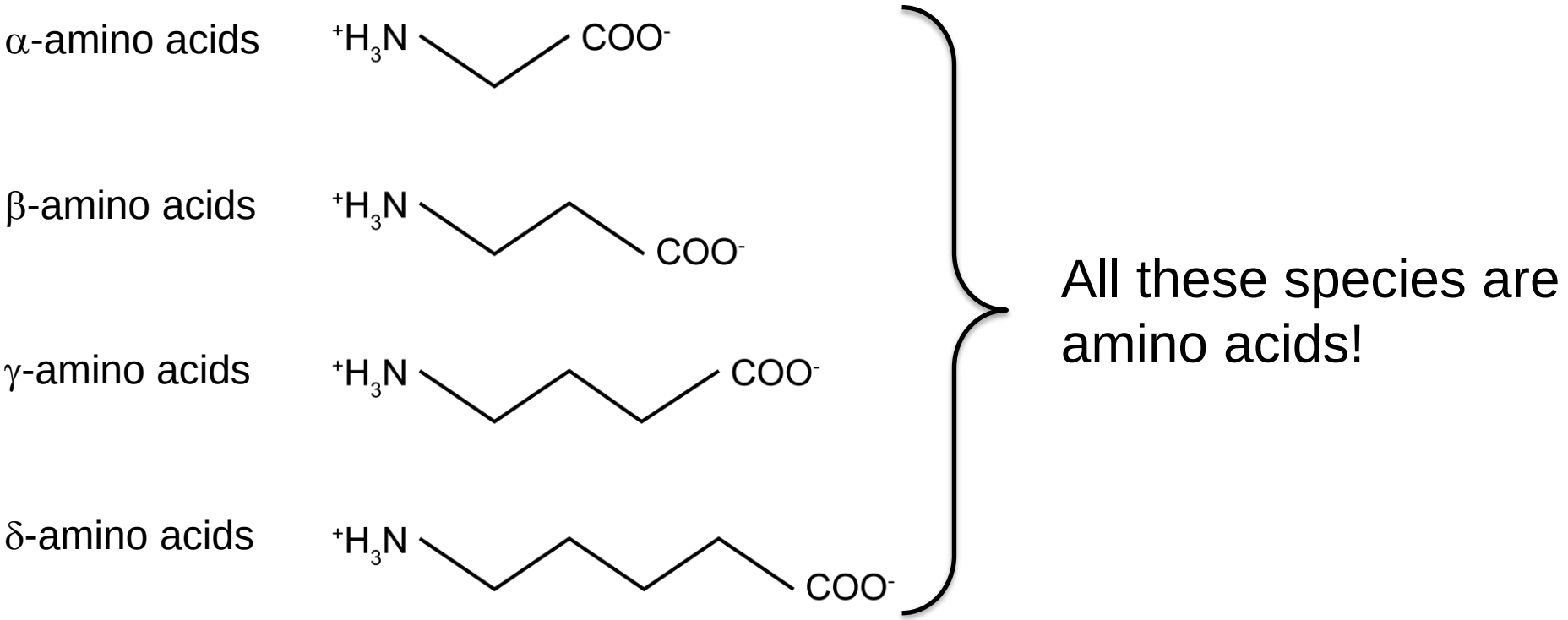
The art of Cysteine

the unique amino acid

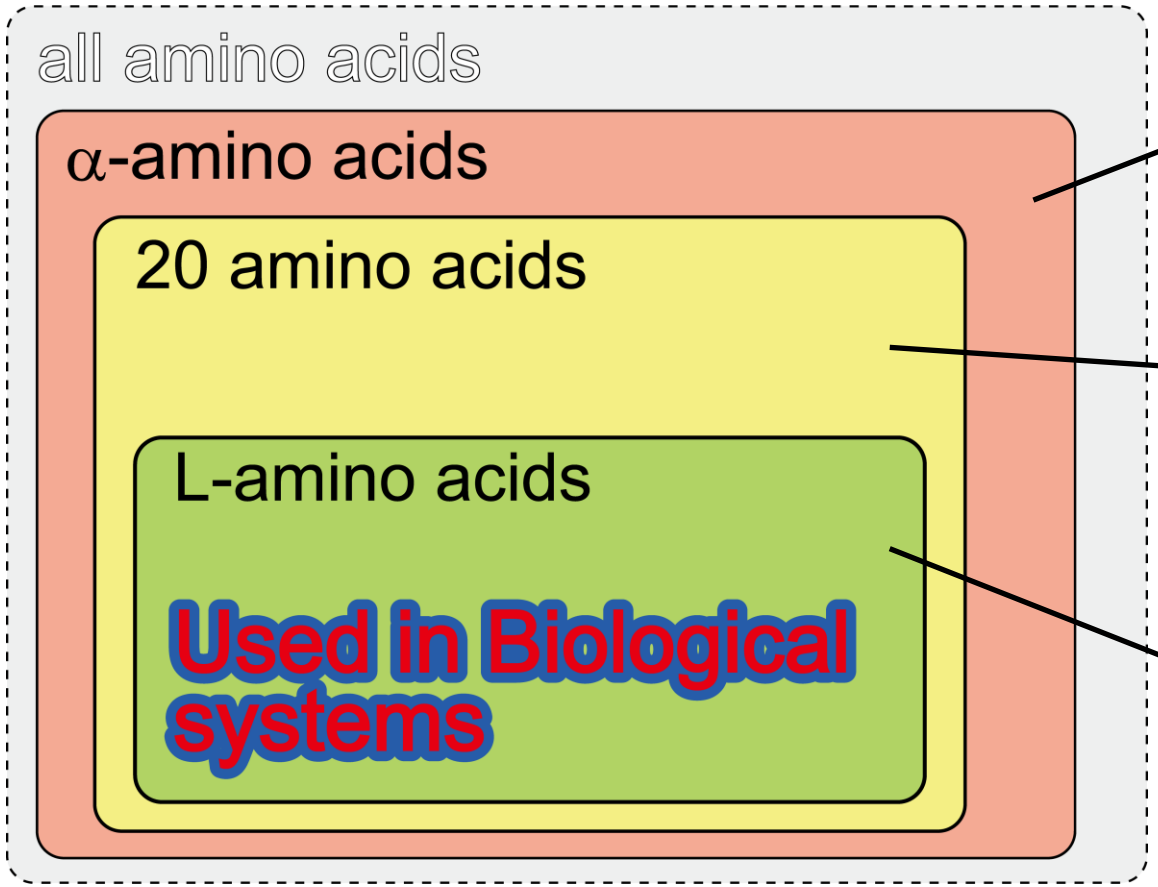


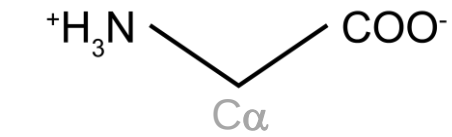
What's the amino acids ?

- **Amino acids** is the organic chemicals those contain amino- (-NH_3^+) and carboxylate (-COO^-) functional group…

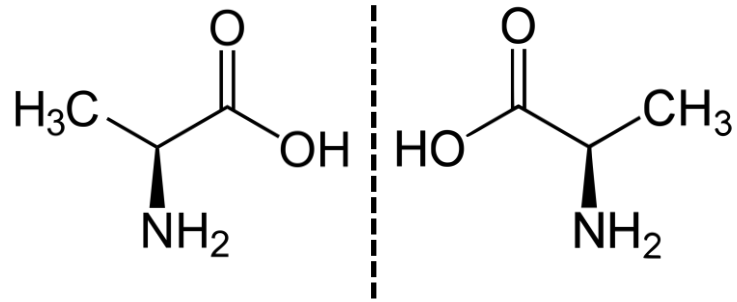


Biologically important amino acids



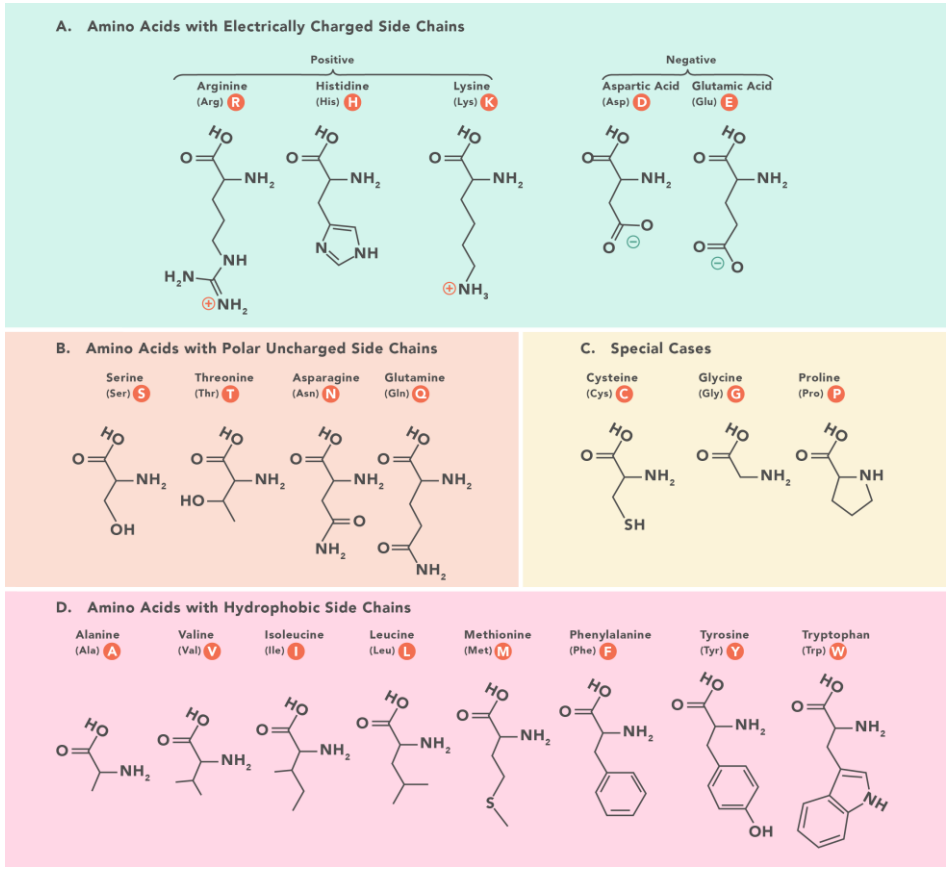


Next section



20 (or more) amino acids

- Basically, proteins in the biological systems are constructed by **20 amino acids**. However, several (quite a few) proteins are required other rare amino acids, selenocysteine and pyrrolysine.



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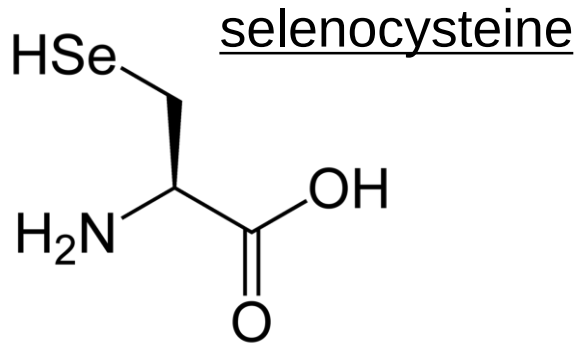
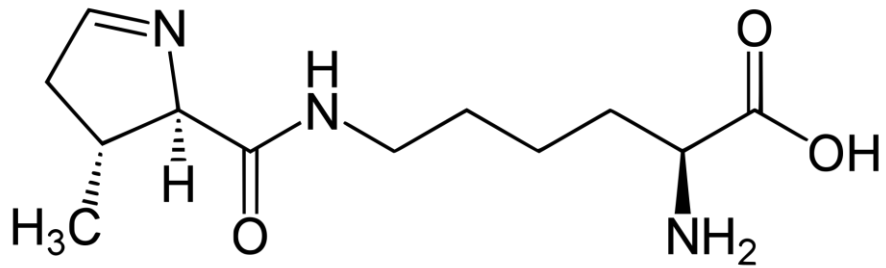


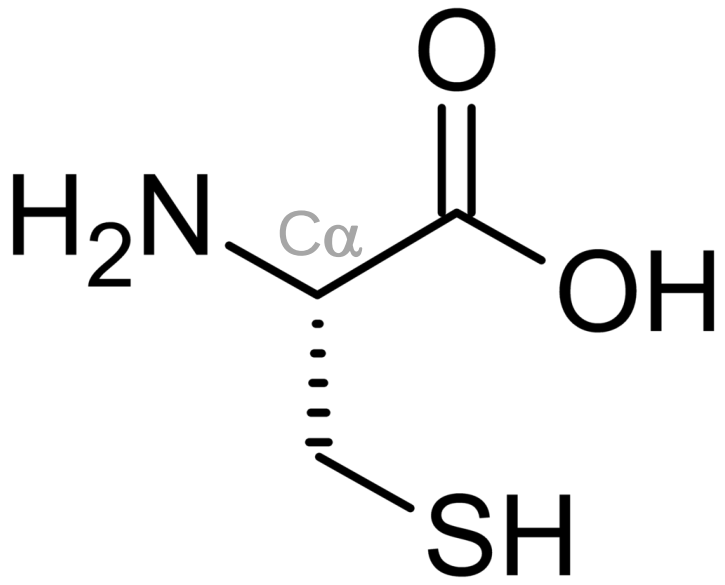
selenocysteine

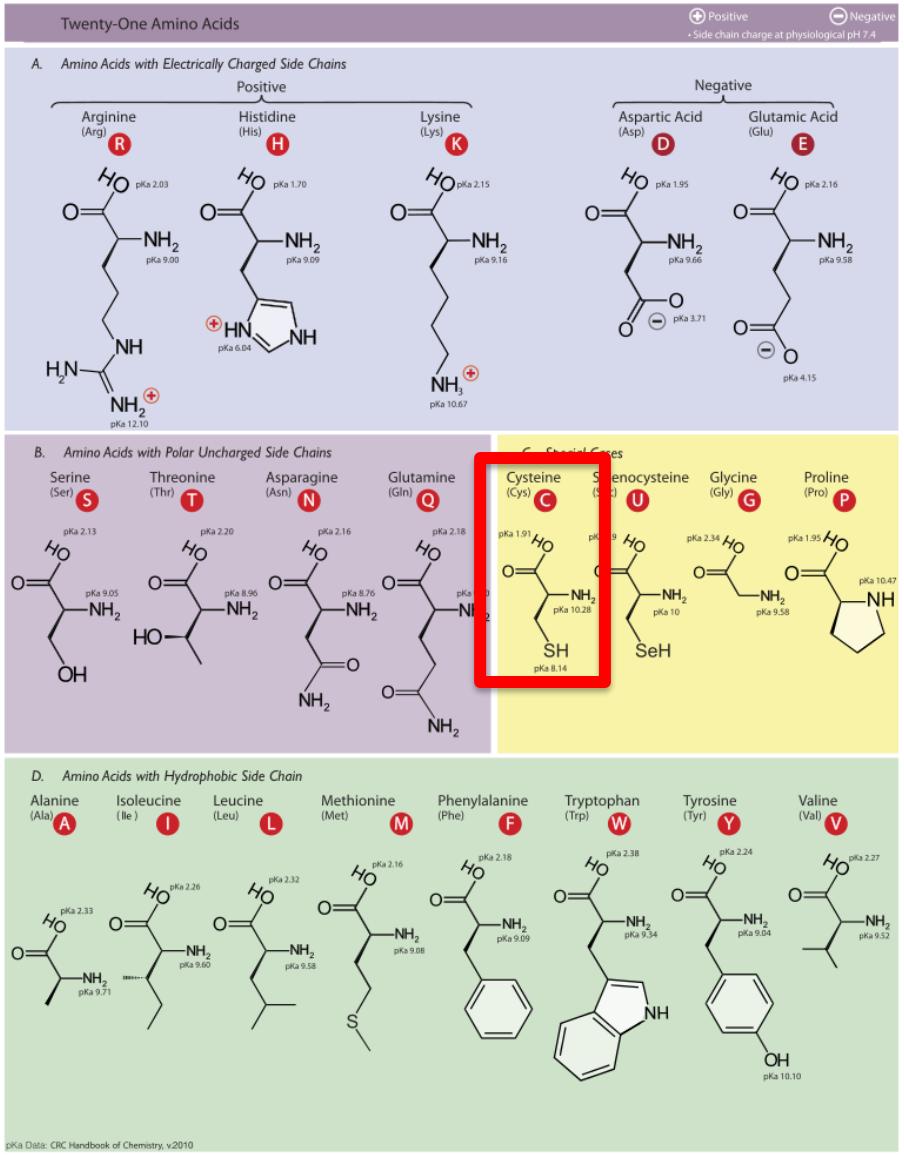


pyrrolysine

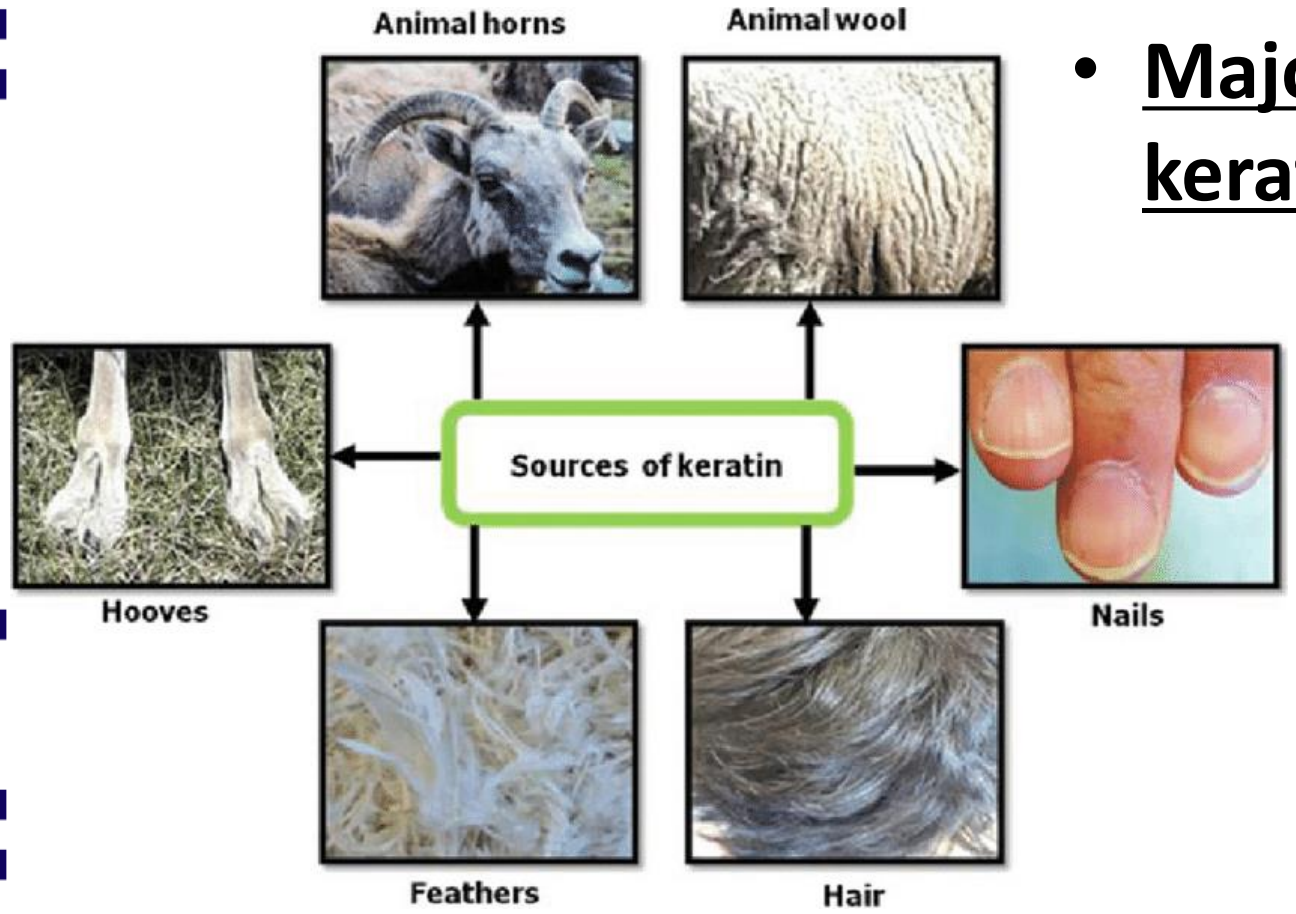
Cysteine (Cys) : one of the amino acids

- **Cysteine** is the one of the 20 (or more) amino acids used in the whole biological systems.

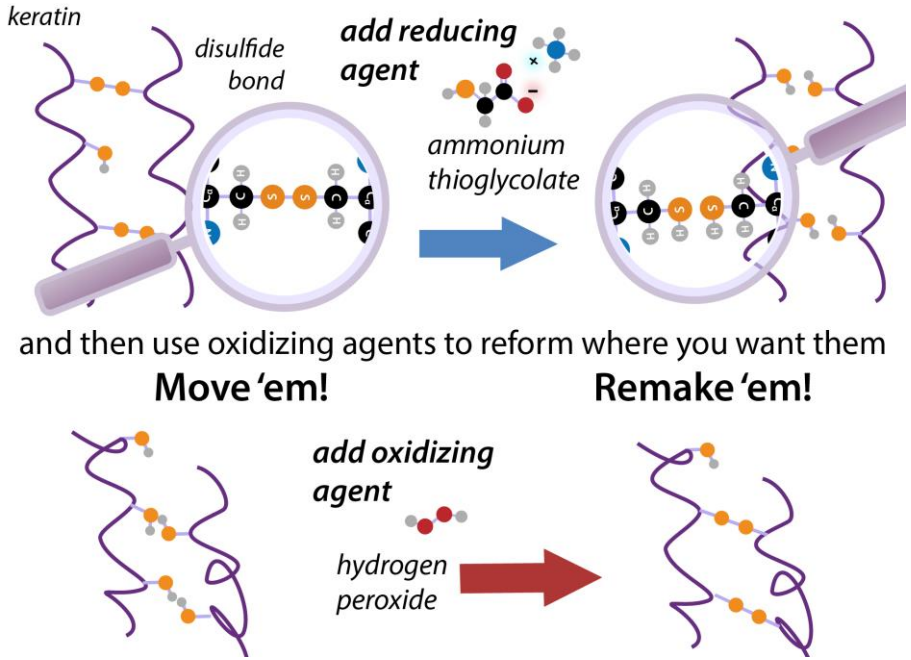




Where is the cysteines

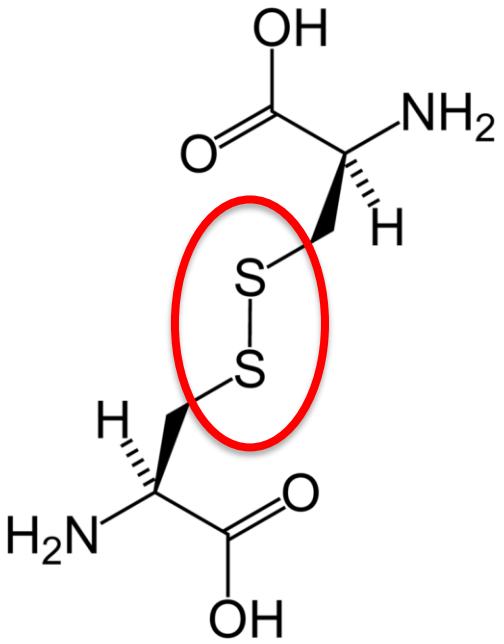


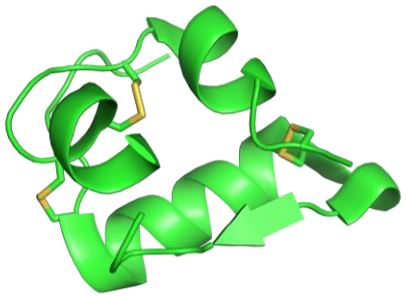
- **<u>Major cysteine rich protein is keratin</u>**



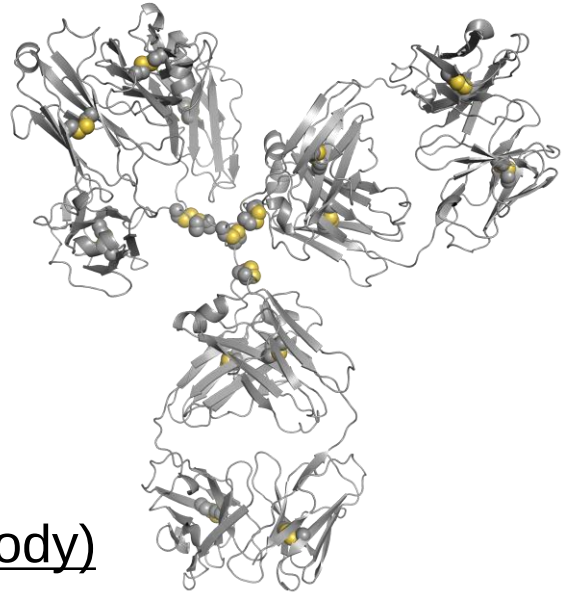
Special of Cys : Disulfide-bond

- **Disulfide-bond** is the covalent bonding between two cysteines, and is widely contained in the extracellular proteins (e.g. 30% of all human proteins).





Insulin



IgG (antibody)

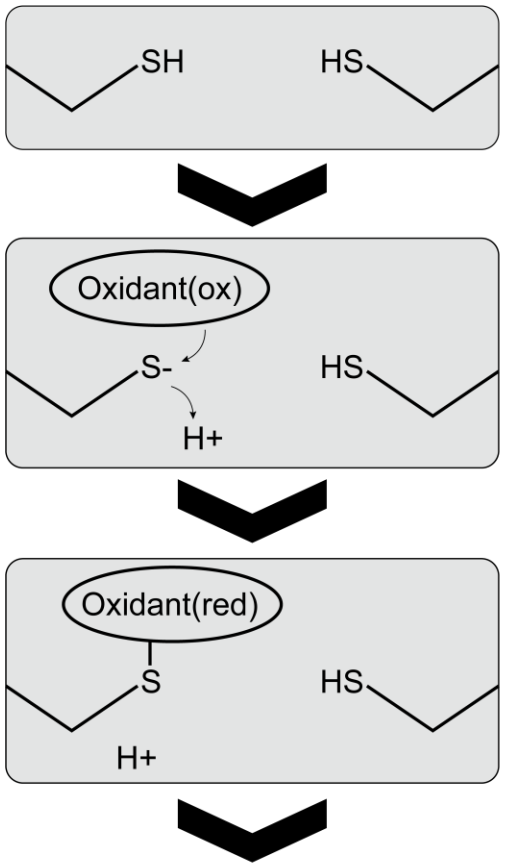
- Fix structure
- Increase stability
- Make hydrophobic area …

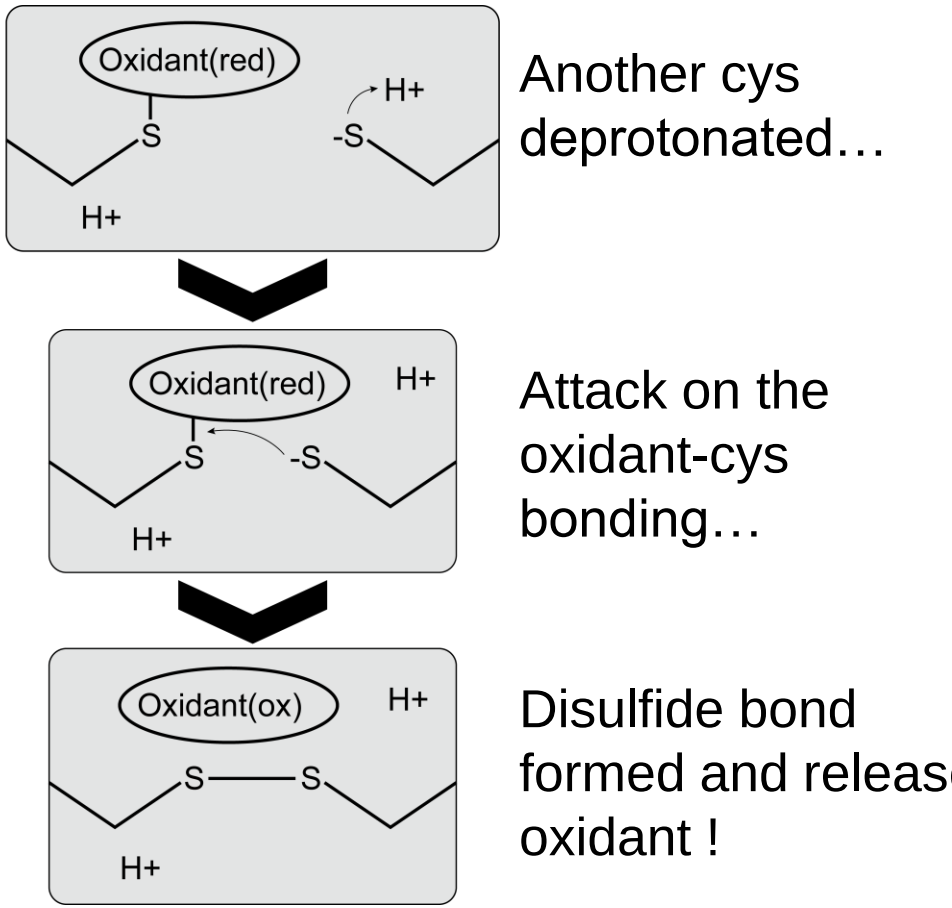
How to Disulfide-bond formation

Two cysteines…

One cys deprotonation and oxidant become close…

Cys and oxidant bond covalently…



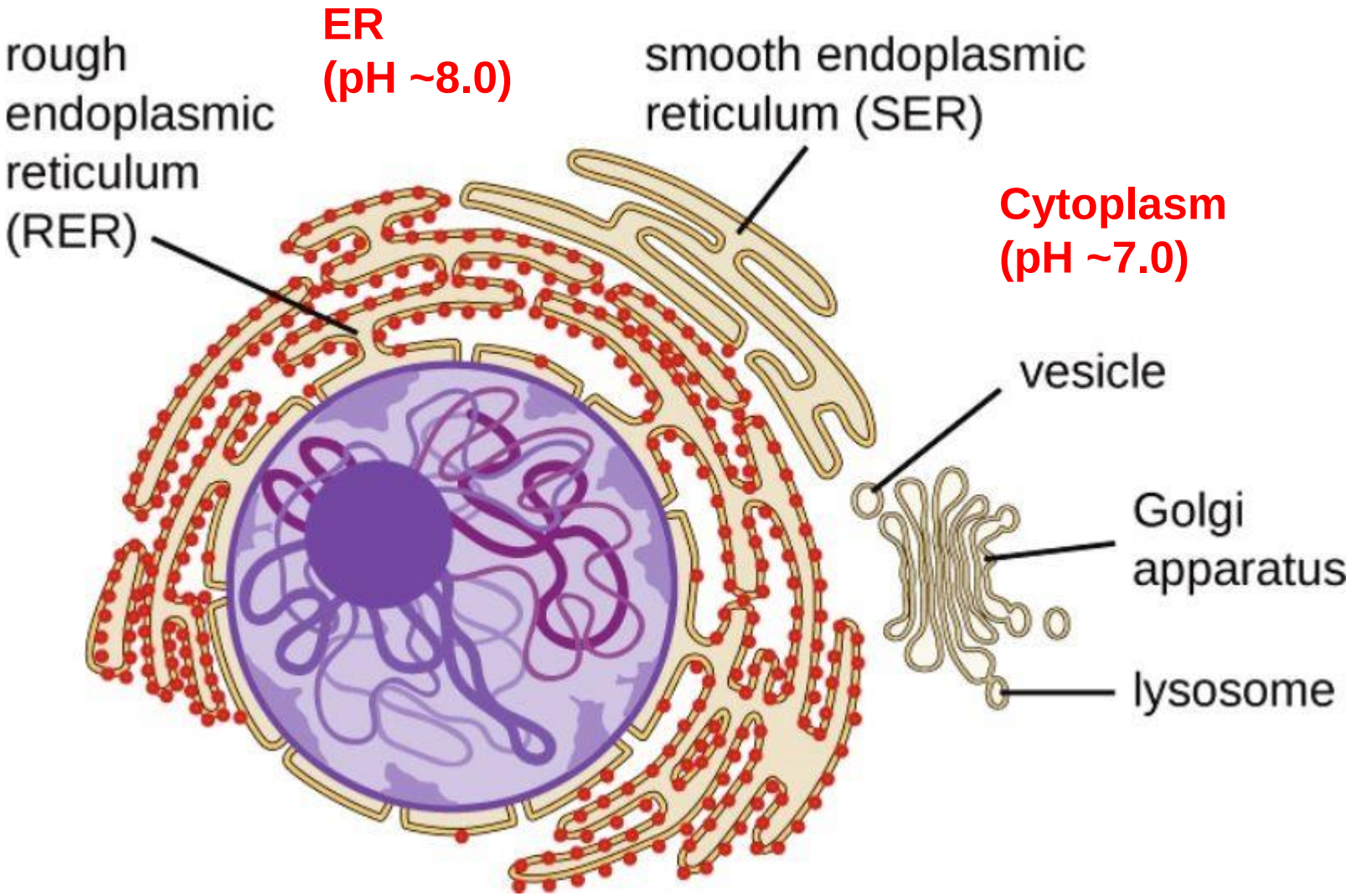


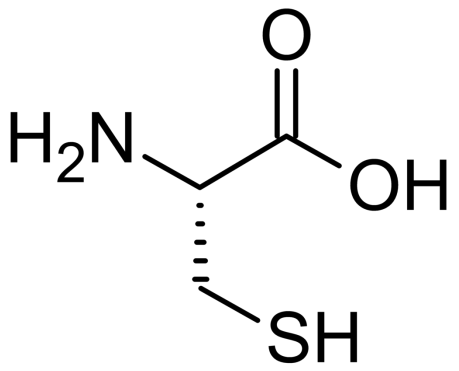
Another cys deprotonated…

Attack on the oxidant-cys bonding…

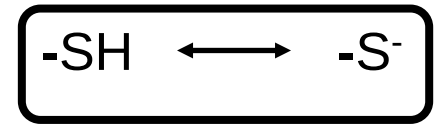
Disulfide bond formed and release oxidant !

Disulfide-bond formation in proteins

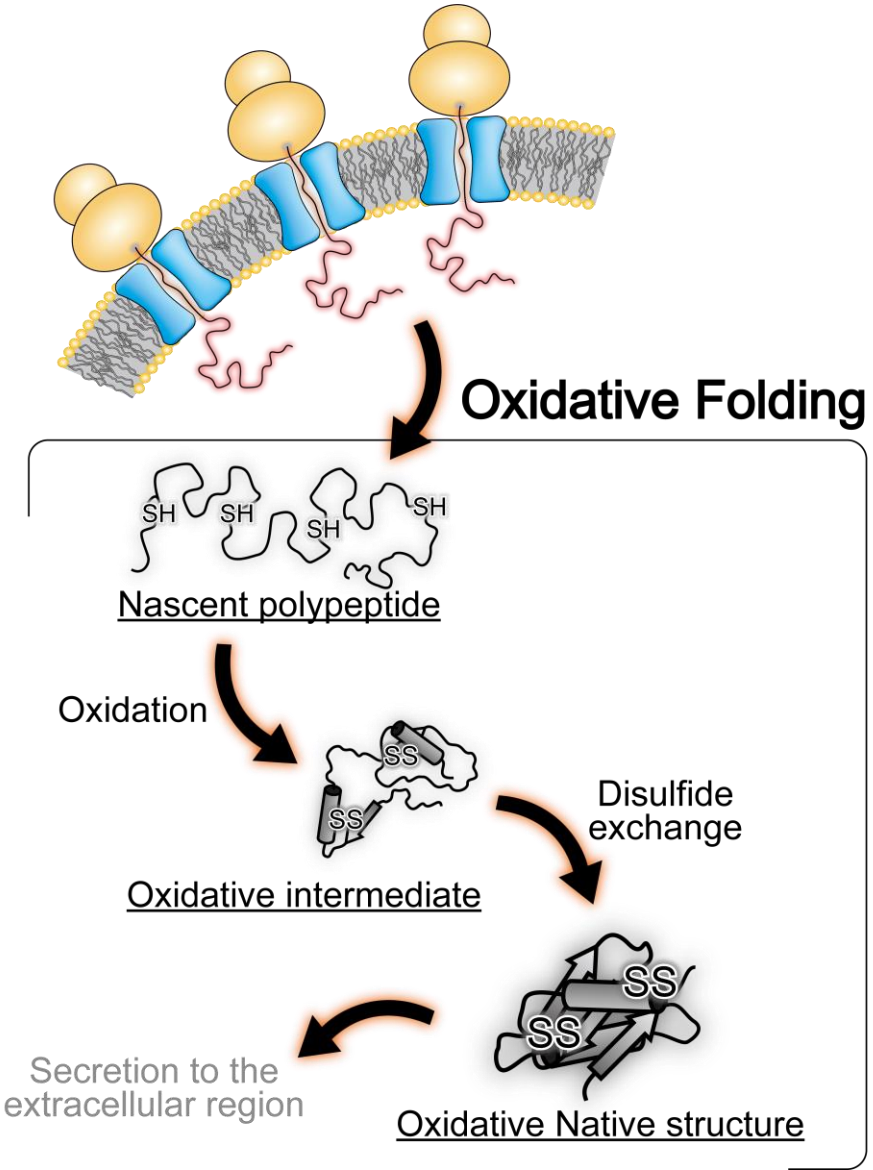




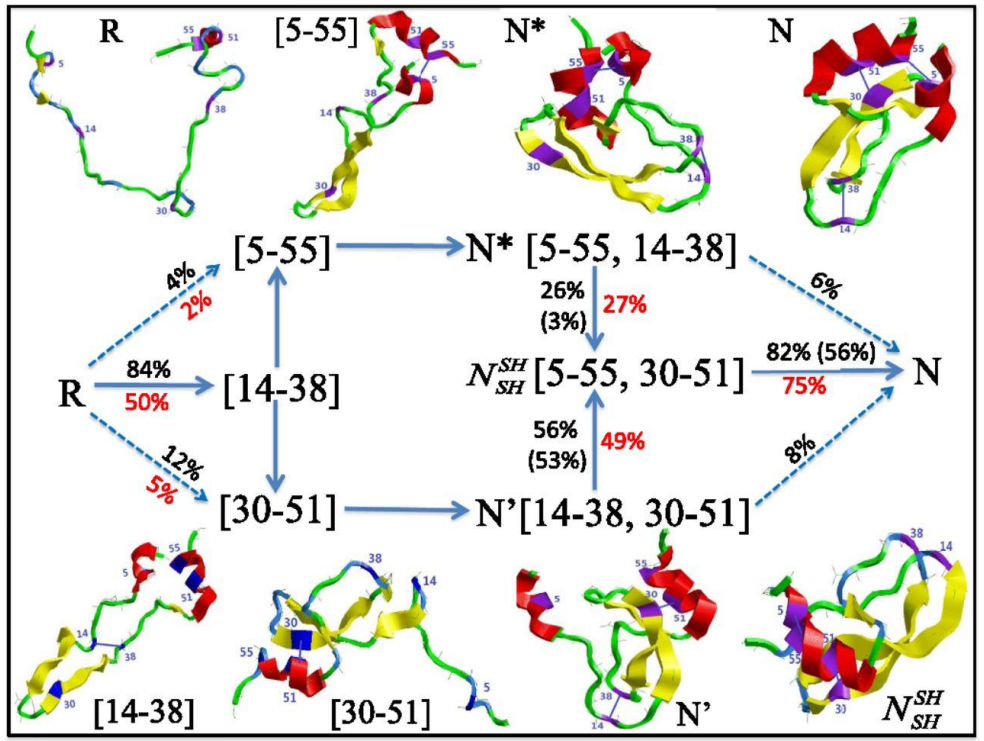
pKa ~ 8.14



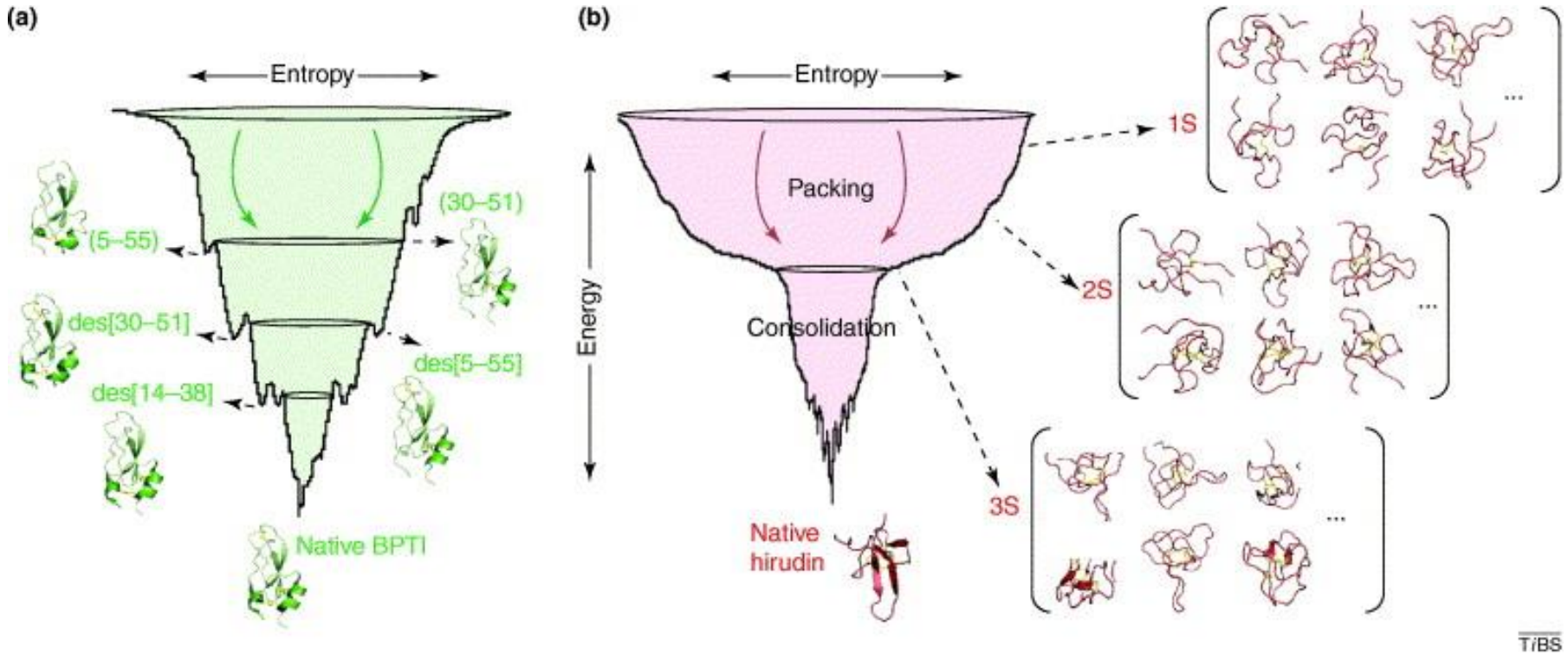
Disulfide-bond formation in proteins



- Inserted nascent protein was oxidated and fold into the native structure



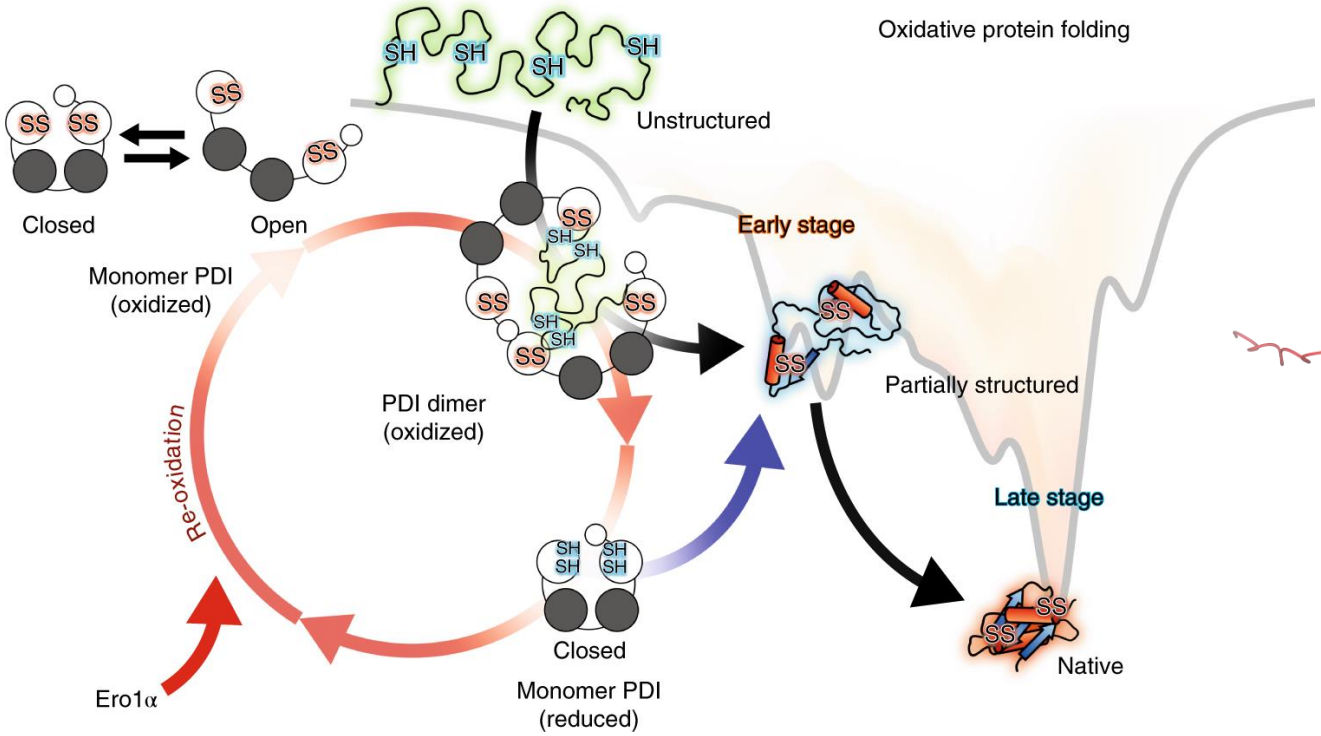
Difficulty of the native disulfide formation

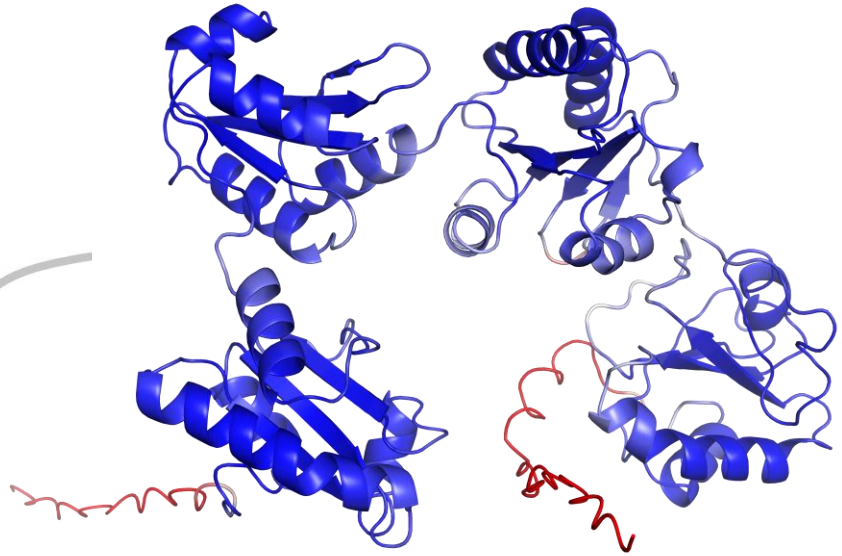


How the vast number of proteins in the ER form native structure with proper disulfide pairs?

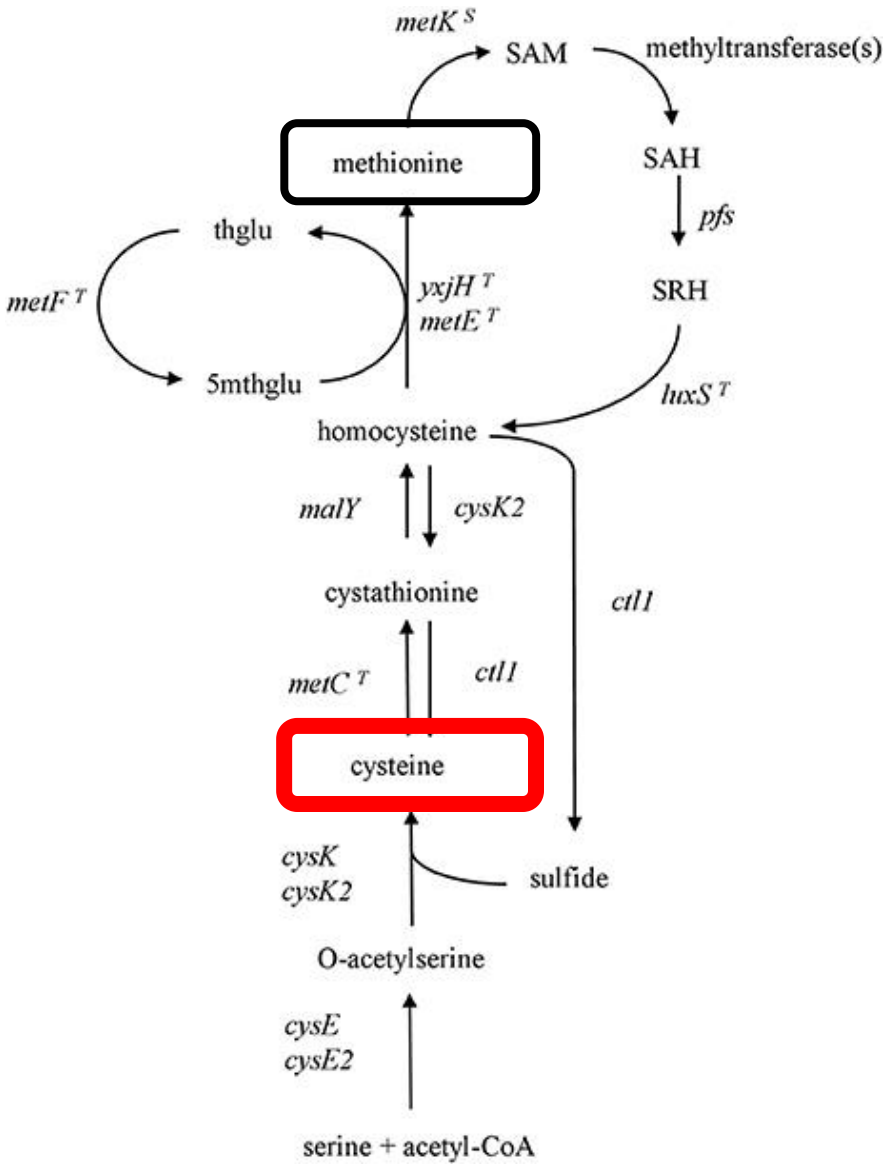
Enzyme for disulfide formation

Protein disulfide isomerase (PDI)





Synthesis of cysteine



- Cysteine can be synthesized from sulfide chems and methionine. So, it's not Essential amino acids… hahaha!

You need eat somethings containing rich sulfur compounds, e.g.ニンニク、玉ねぎ、ニラ!

For your health ！

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