Protein folding/unfolding phenomenon is originated by synchronization/desynchronization of oscillatory phases of the van der Waals dispersion interaction. A hypothesis.

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Cooperativity in protein folding is generated by an immense set of small interactions, operating in consort, so if one or a small group of those interactions is perturbed the whole network is affected.

Nowadays the precise object underpinning this cooperativity remains unidentified.

In this work: A general mechanism is hypothesized proposed in which two opposed operative actions - synchronization/desynchronization- acts to modulate the state -folded/unfolded- of the same object, a protein.

This mechanism operate by changes in van der Waals interaction regime.
In proteins the main stabilization comes from hydrophobic aromatic alkyl interactivos ILE, VAL & LEU.

At the same time → Dihydrogen Bond in alkyls act as “Sticky Fingers”.

By an alternanting charge $C^+H\cdots H^+C^-$ / $C^+H\cdots H^-C$ mechanisms that gives rise to the London dispersion interactions (Danovich 2013)

Suggestive evidence:
Van der Waals dispersion is not constant!

The Casimir effect in microstructured geometries

The exchange between $D^{-6}$ and $D^{-7}$ regimes of the van der Waals dispersion interaction makes microelectromechanical systems Sticky (dephasing due relativistic signal retardation in the $D^{-7}$ regime).

Distance dependence of the van der Waals dispersion interaction regime

Superlubricity Using Repulsive van der Waals Forces

Repulsive version of the van de Waals interaction!
The Hypothesis

1.1) When the oscillation of the induced dipoles is synchronized an enhanced interacting $D^{-6}$ regime is triggered and the protein structure start to fold.

2.1) If a strong enough perturbation is introduced in the cooperative synchronized network a weakened $D^{-7}$ or even a repulsive regime starts to dominate in the molecular protein structure.

1.2) The propagation of this regime throughout the molecular structure complete the folding process.

2.2) This weakened or repulsive regime is associated to the desynchronization of the oscillating network and triggers a phase transition that finally unfolds the protein.

Cooperativity is originated by synchronization/desynchronization of the oscillatory phases of van der Waals interaction.
Theoretical models indicate that the van der Waals dispersion interaction has its origin at the UV range. Experimental results show that UV light denatures proteins.

A general mechanism is proposed in which two opposed operative actions - synchronization/desynchronization - acts to modulate the state -folded/unfolded- of the same object, a protein.
Further information


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