DEPARTMENT OF BIOTECHNOLOGY

Forces stabalizing DNA structure

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DNA Stability.....?

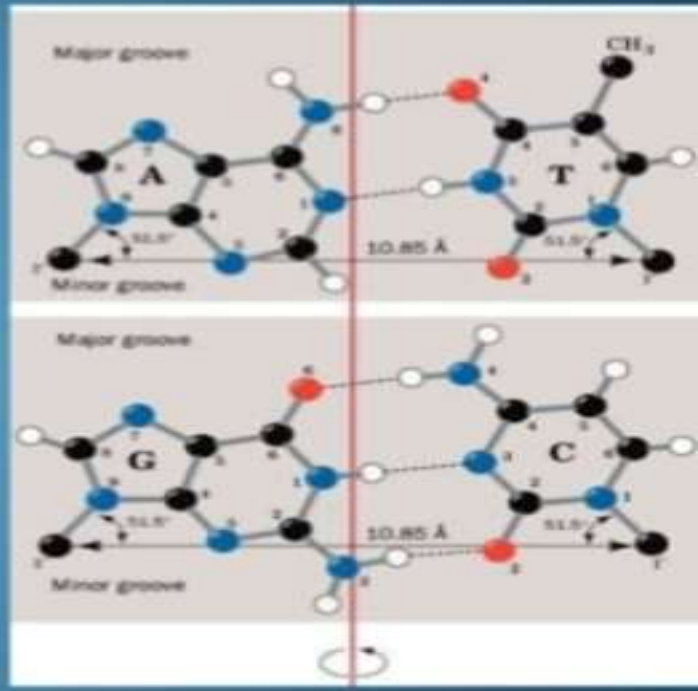
DNA double stranded helical structure is stabilize by

- Hydrogen bonding
- Base stacking interaction
- Hydrophobic force
- Ionic interaction

DNA Stability.....?

Hydrogen bonding-

- hydrogen bond b/w base pairs- G with C, and A with T.
- It is important to note that three hydrogen bonds can form between G and C, but only two bonds can be found in A and T pairs.
- This is why it is more difficult to separate DNA strands that contain more G-C pairs than A-T pairs. On the other hand, A-T pairs seem to destabilize the double helical structures. This conclusion was made possible by a known fact that in each species the G content is equal to that of C content and the T content is equal to that of A content.
- Although weak energy-wise, is able to stabilize the helix because of the large number present in DNA molecule



DNA Stability.....?

Base stacking interaction-

- also known as Van der Waals interactions between bases are weak, but the large amounts of these interactions help to stabilize the overall structure of the helix.
  - Double helix is stabilized by **hydrophobic effects** by burying the bases in the interior of the helix increases its stability; having the hydrophobic bases clustered in the interior of the helix keeps it away from the surrounding water, whereas the more polar surfaces, hence hydrophilic heads are exposed and interaction with the exterior water
  - Stacked base pairs also attract to one another through **Van der Waals forces** the energy associated with a single van der Waals interaction has small significant to the overall DNA structure however, the net effect summed over the numerous atom pairs, results in substantial stability.
  - Stacking also favors the conformations of rigid five-membered rings of the sugars of backbone.
  - **Evidence of Stacking interactions:** Compounds that interfere with Hydrogen bonds (urea, formamide) don't separate strands by themselves, still requires heat.

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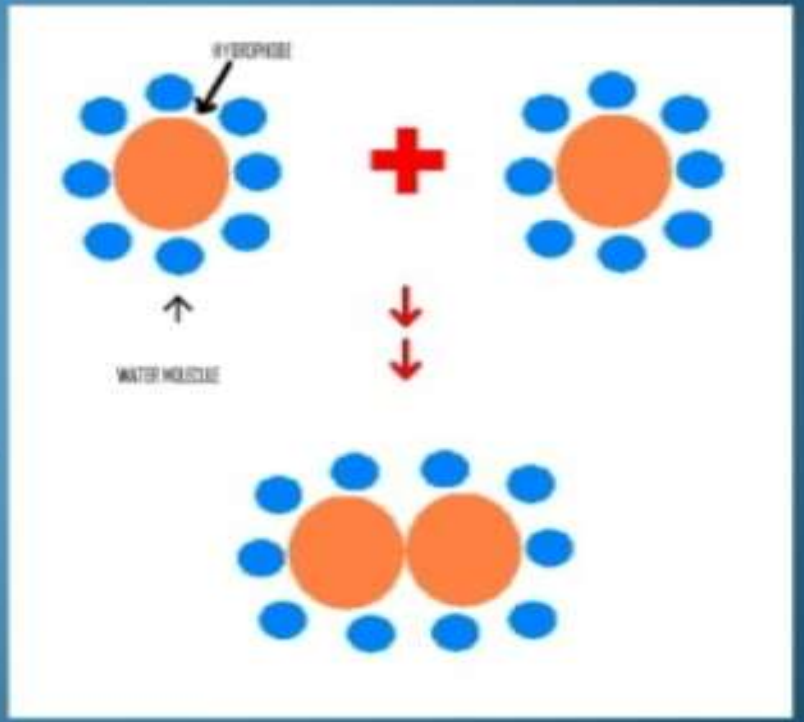
Ionic interaction-

- Ion-ion repulsion of the negatively charged phosphate make DNA duplex unstable.
- However the presence of Mg^{2+} and cationic proteins with abundant Arginine and Lysine residues that stabilizes the double helix.
- Double-stranded helix structure thus, promoted by having phosphates on outside, interact with H_2O and counter ions (K^+, Mg^{2+}, etc.).

DNA Stability.....?

Hydrophobic force-

- The hydrophobic interactions between the planar base pairs stabilize the bases on the inside of the helix, so these provide stability to the structure but do not contribute to the specificity.
- Hydrophobic Interactions are important for the folding, stability and biological activity.



Thank you