CONCEPT: BETA TURNS

●_________ & loops: non-repetitive secondary structures causing the peptide backbone to _________ directions.

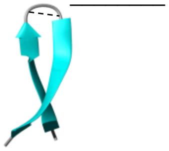
□ Usually found on the *surface* of proteins with ___________ residues & allow for a folded, compact shape.

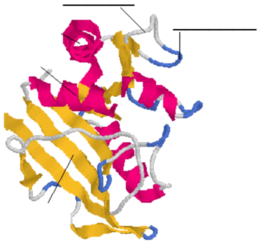
●*Loop*: _________ links of amino acids causing changes in backbone direction _________ fixed, internal hydrogen bonds.

●*β-Turns* (or *Reverse turns*): _______ loops (≤ 4 amino acid residues) causing _______ changes in backbone direction.

□ Stabilized by fixed, internal hydrogen bonds.

EXAMPLE: Identify all loops & β-turns in the figures below.





PRACTICE: Which of the following options contains a true statement about protein turns & loops?

a) Loops & turns can interact with other proteins & the environment.

b) Loops are short links causing abrupt changes in direction & extend only from β strands.

c) Loops and turns usually contain hydrophilic residues located on the interior of proteins.

d) Loops exposed to an aqueous environment are usually composed of hydrophobic amino acids.

Type I & II *β-Turns*

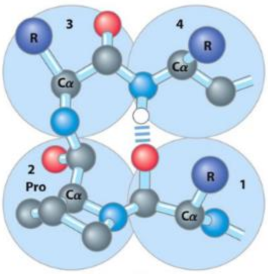
●Two common types of β-turns: 1) *Type __ β-turn* & 2) *Type ___ β-turn*.

●Both types produce abrupt ________ in direction, contain __ amino acid residues, & are stabilized by _________ bonding.

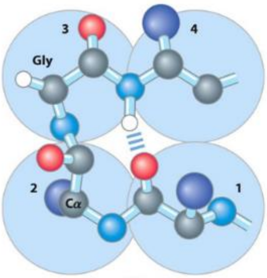
□ Type I β-turns: *more* common & usually contain a _________ amino acid residue at position #2 of the turn.

□ Type II β-turns: contain a __________ amino acid residue at position #3 of the turn.

EXAMPLE:



Type I β turn



Type II β turn

PRACTICE: In the peptide below, circle the *individual* amino acid residues indicating the most likely positions for β-turns:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Ile-Ala-His-Thr-Tyr-Gly-Pro-Phe-Glu-Ala-Ala-Met-Cys-Lys-Trp-Glu-Ala-Gln-Pro-Asp-Gly-Met-Glu-Cys-Ala-Phe-His-Arg

CONCEPT: BETA TURNS

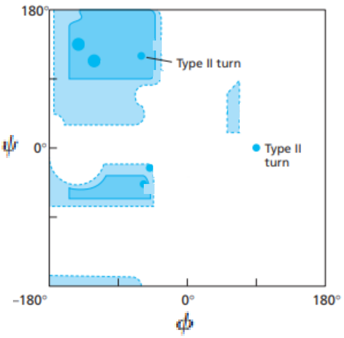
PRACTICE: Which of the following statements is true regarding β-turns?

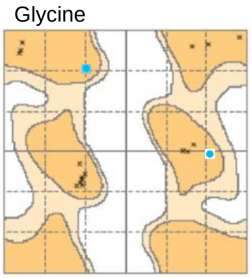
a) Only Type I β-turns are stabilized by hydrogen bonds, not Type II β-turns.
b) Type II β-turns have a Pro residue at position #2 of the turn.
c) Type I β-turns have a Gly residue at position #4 of the turn.
d) Type II β-turns have a Gly residue at position #3 of the turn.

Beta Turn Bond Angles

- Bond angles for loops & turns are found in __________ regions of a Ramachandran plot.
  - Type II β-turns: some φ and ψ angles lie ___________ expected permissible angles.
- ___________ can adopt a wide range of φ and ψ angles because of its small R-group that avoids steric hindrance.
  - Glycine is often a residue found in type ___ β-turns.

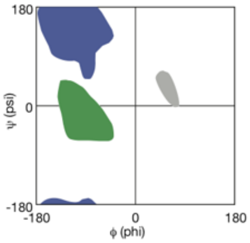
EXAMPLE:





PRACTICE: If the phi & psi angles of loop regions are plotted, where do they tend to fall on the Ramachandran plot below?

a) The area labeled in green.
b) The area labeled in blue.
c) The area labeled in grey.
d) All the above.



PRACTICE: Which of the following statements is correct?

a) Loops and turns are usually found tucked away on the interior of folded proteins.
b) An α-helix peptide backbone located in the interior of a protein will H-bond to R-groups of other residues.
c) In extended fibrous proteins that are elongated, we would expect to find numerous β-turns & loops.
d) Tightly compact spherical/globular proteins tend to have more β-turns than elongated fibrous proteins.
e) A membrane-embedded α-helix is likely rich in Asp residues.