Algorithm to define the coordinate frames of the ZLBT and C domains of ZLBT-C

Terry Oas[*,1,2,], Aulane Mpouli[2], Edward Cheng[2], and Bruce Donald[*,1,2,3]

[1]Department of Biochemistry, Duke University
[2]Department of Chemistry, Duke University
[3]Department of Computer Science, Duke University
[*]Contacts: oas@duke.edu, brd@cs.duke.edu

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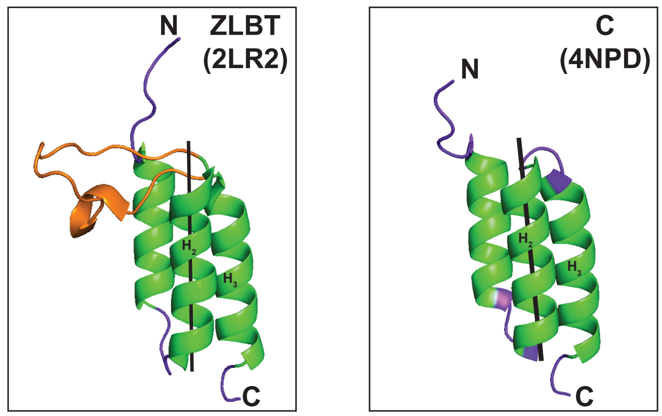
1. Define the residues corresponding to the cores of Helix 2 and Helix 3 in each domain as listed below:

Domain	Helix 2 Start	Helix 2 End	Helix 3 Start	Helix 3 End
ZLBT	36	50	70	85
C	112	125	129	143



2. Perform the following for each domain.
3. Let H_i denote helix i ($i = 2, 3$).
4. Make a list the coordinates of the N, C_α and C' backbone atoms of the Helices 2 & 3 ($H_2 \cup H_3$ list.)
5. Zero-mean the coordinates in $H_2 \cup H_3$.
6. We will use Singular Value Decomposition (SVD) to compute the optimal (least-squares) fit of orthonormal vectors (representing a coordinate frame) to the helical core. The SVD algorithm decomposes a list of n coordinates as an $n \times 3$ matrix ($\mathbf{M}$) into $\mathbf{U}\Sigma\mathbf{V}^\mathbf{T}$, where $\mathbf{U}$ is a $n \times$N orthogonal matrix, Σ is an $n \times 3$ diagonal matrix, and V is a 3×3 orthogonal matrix whose columns represent orthogonal axes based on the helical core coordinates. The first column of $\mathbf{V}^\mathbf{T}$ is the unit vector parallel to the major axis of the best-fit ellipsoid (in the least-squares sense) to the helical core. The third column is the unit vector parallel to the smallest ellipsoid minor axis.
7. Perform SVD on the centered $H_2 \cup H_3$ list and take the third column of $\mathbf{V}^\mathbf{T}$ as the 3×1 unit vector, $\overrightarrow{V_{23}}$. This vector is perpendicular to the central axes of Helices 2 & 3, points towards and bisects the two helices.
8. Make a list the coordinates of the N, C_α and C' backbone atoms of the Helix 2 (H_2 list.)
9. Zero-mean the coordinates in H_2.
10. Perform SVD on the centered H_2 list and take the first column of $\mathbf{V}^\mathbf{T}$ as the unit vector, $\overrightarrow{V_2}$. This vector is parallel to the central axis of Helix 2 and points towards the N-terminus.
11. The axes of the helical-core-based coordinate frame are defined as shown below:

Axis	Definition
x'	$-\overrightarrow{V_2} \times \overrightarrow{V_{23}} \times \overrightarrow{V_2}$
y'	$\overrightarrow{V_2} \times \overrightarrow{V_{23}}$
z'	$-\overrightarrow{V_2}$