Rhodopsin Structure is Not an Ideal Template for Modeling G-protein Coupled Receptors: Results from Measuring Variability in Multiple Sequence Alignments

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Conservation relations have been traditionally employed as a basis for constructing 3-dimensional comparative models of proteins. In G-protein coupled receptors (GPCRs), this approach is less obvious due to the lack of experimental structures, except for the single structure of rhodopsin. However, GPCRs are the largest group of drug targets and models for their 3D structures are valuable for drug design.

We have recently developed a novel approach for observing sequence identities in GPCRs, that is based on cumulative conservation in each position and along stretches of residues, starting from either the exoplasmic or endoplasmic helix terminals. The overall average identity of 40 representative GPCRs, 26.3%, is found to be composed of very different values for the endoplasmic (34.5%) and for the exoplasmic parts (17.7%). In five of the 7TM helices (I, II, V, VI, VII), the exoplasmic parts of length 9-17 residues have low cumulative conservation values. We thus expect to find less structural conservation between these helical parts and the corresponding ones of rhodopsin. This should affect any attempt to construct GPCR models based on rhodopsin coordinates. Our recommendation is thus to use the endoplasmic parts of the helical region of rhodopsin as template, and to reconstruct the rest of the structure by different methods, such as de-novo prediction.