

Table S1. Transmembrane helix length in ChR2 bioinformatic models.

|         | <i>Model 1</i> | <i>Model 2</i> | <i>Model 3</i> | <i>Model 4</i> |
|---------|----------------|----------------|----------------|----------------|
| Helix 1 | 53-75          | 53-75          | 53-74          | 57-74          |
| Helix 2 | 82-104         | 82-102         | 81-104         | 81-102         |
| Helix 3 | 110-140        | 118-140        | 118-139        | 118-139        |
| Helix 4 | 149-168        | 149-168        | 148-168        | 148-168        |
| Helix 5 | 172-202        | 172-202        | 172-202        | 172-206        |
| Helix 6 | 208-232        | 208-232        | 209-232        | 208-232        |
| Helix 7 | 242-272        | 242-272        | 242-272        | 242-262        |

Table S2. Residue correspondence among ChR2 models and halorhodopsin (HR, 3a7k), archaerhodopsin (AR, 2ei4) and bacteriorhodopsin (BR, 2zzl).

|                                       | <i>ChR2</i> | <i>HR</i> | <i>AR</i> | <i>BR</i> |
|---------------------------------------|-------------|-----------|-----------|-----------|
| Covalently bound to retinal           | K257        | K256      | K221      | K216      |
|                                       | W124        | W127      | W91       | W86       |
| Aromatic residues surrounding retinal | F178        | Y180      | W143      | W138      |
|                                       | Y184        | F187      | F150      | M145      |
|                                       | W223        | W222      | W187      | W182      |
|                                       | F226        | Y225      | Y190      | Y185      |
|                                       | F230        | W229      | W194      | W189      |