### Supplementary file 1. Sdk and other horseshoe IgSF protein characteristics

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Protein** | **Chain** | **Ig14:Ig23 (°)** | **Ig1:Ig2 (°)** | **Ig2:Ig3 (°)** | **Ig3:Ig4 (°)** | **Ig1:Ig4 (°)** | **Ig4:Ig5 (°)** |
| Sdk1Ig1–4 crystal form 1 | A \* | 30.0 | 40.6 | 23.2 | 27.8 | 27.8 |  |
| Sdk1Ig1–4 crystal form 2 | A \* | 37.1 | 43.5 | 23.1 | 33.1 | 35.6 |  |
| Sdk1Ig1–5 | A \* | 31.7 | 42.8 | 23.4 | 28.3 | 30.4 | 54.3 |
| B | 35.5 | 42.7 | 23.2 | 33.9 | 31.5 | 54.0 |
| Sdk2Ig1–4 crystal form 1 | A | 31.2 | 40.5 | 14.3 | 30.8 | 29.5 |  |
| B \* | 30.9 | 42.3 | 18.2 | 30.8 | 27.4 |  |
| Sdk2Ig1–4 crystal form 2 | A \* | 26.2 | 42.5 | 18.8 | 26.7 | 27.4 |  |
| B | 26.0 | 41.5 | 17.4 | 35.7 | 27.9 |  |
| Sdk2Ig1–2/ Sdk1Ig3–4 | A | 31.7 | 37.4 | 19.3 | 20.4 | 27.4 |  |
| B \* | 22.1 | 41.5 | 22.7 | 26.7 | 26.9 |  |
| Sdk2Ig1–4 H18R/N22S | A | 24.7 | 45.3 | 23.3 | 19.5 | 32.7 |  |
| B | 19.3 | 44.2 | 24.9 | 17.8 | 29.2 |  |
| C \* | 24.6 | 41.9 | 19.1 | 18.5 | 30.7 |  |
| D | 21.4 | 43.6 | 15.9 | 18.7 | 31.1 |  |
| *Average* |  | *28.0 ± 5.4* | *42.2 ± 1.9* | *20.5 ± 3.3* | *26.3 ± 6.3* | *29.7 ± 2.5* | *54.2 ± 0.2* |

### Supplementary file 1A. Sidekick interdomain angles

Ig14:Ig23 is the angle between the Ig1:Ig4 and Ig2:Ig3 planes in the horseshoe. Ig1:Ig2 is the angle between the Ig1 and Ig2 axes, defined by mass weighting. \*Indicates chain shown in Figure 2A or Figure 4–figure supplement 3A.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protein** | **Ig14:Ig23**  **(°)** | **Ig1:Ig2**  **(°)** | **Ig2:Ig3**  **(°)** | **Ig3:Ig4**  **(°)** | **Ig1:Ig4**  **(°)** | **RMSD to Sdk1** |
| Sdk1 | 34 | 42 | 23 | 31 | 31 | N/A |
| Sdk2 | 29 | 42 | 17 | 31 | 28 | 1.0 Å |
| DscamPDB: 3DMK | 10 | 69 | 43 | 30 | 30 | 5.8 Å |
| CNTN2PDB: 2OM5 | 8 | 43 | 21 | 13 | 29 | 3.4 Å |
| CNTN4PDB: 3JXA | 15 | 51 | 30 | 14 | 33 | 2.8 Å |
| DCCPDB: 3LAF | 36 | 82 | 40 | 6 | 44 | 5.5 Å |
| NeurofascinPDB: 3P3Y | 14 | 50 | 23 | 7 | 35 | 4.8 Å |
| HemolinPDB: 1BIH | 20 | 55 | 27 | 7 | 31 | 6.2 Å |
| *Average* | *21 ± 11* | *54 ± 14* | *28 ± 9* | *17 ± 11* | *33 ± 5* |  |

### Supplementary file 1B. Structural comparison of IgSF protein horseshoe structures

Average horseshoe protein interdomain angles over all chains in all crystal structures are given. Ig14:Ig23 is the average angle between the Ig14 and Ig23 planes. The right hand column gives the root mean square deviation over aligned C atoms (RMSD) between the Ig1–4 structures of the various IgSF proteins and Sdk1. The Ig1:Ig4 angle is most rigid among horseshoes, highlighting the importance of Ig1:Ig4 interface in horseshoe conformations.