ion occupying pore

ion permeability

inward drive

total ring charge of

 selectivity filter

ion entering pore

charge of ion entering pore

charge of ion occupying pore

charge attractivity

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
| **qi** | **qr** | **rq** | **qi** | **qr** | **A** | **B** | **AB** |
|  |  |  |  |  |  |  |  |
| Na+ |  | -4 | 1 | 0 | 1 | 1 | YES |
| Na+ | Na+ | -4 | 1 | 1 | 1 | 1 | YES |
| Na+ | Ca2+ | -4 | 1 | 2 | 1 | 1 | YES |
| Ca2+ |  | -4 | 2 | 0 | 1 | 1 | YES |
| Ca2+ | Na+ | -4 | 2 | 1 | 1 | 1 | YES |
| Ca2+ | Ca2+ | -4 | 2 | 2 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Na+ |  | -3 | 1 | 0 | 1 | 1 | YES |
| Na+ | Na+ | -3 | 1 | 1 | 1 | 1 | YES |
| Na+ | Ca2+ | -3 | 1 | 2 | 1 | 0 | NO |
| Ca2+ |  | -3 | 2 | 0 | 1 | 1 | YES |
| Ca2+ | Na+ | -3 | 2 | 1 | 1 | 1 | YES |
| Ca2+ | Ca2+ | -3 | 2 | 2 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Na+ |  | -2 | 1 | 0 | 1 | 1 | YES |
| Na+ | Na+ | -2 | 1 | 1 | 1 | 1 | YES |
| Na+ | Ca2+ | -2 | 1 | 2 | 1 | 0 | NO |
| Ca2+ |  | -2 | 2 | 0 | 0 | 1 | NO |
| Ca2+ | Na+ | -2 | 2 | 1 | 0 | 1 | NO |
| Ca2+ | Ca2+ | -2 | 2 | 2 | 0 | 0 | NO |
|  |  |  |  |  |  |  |  |
| Na+ |  | -1 | 1 | 0 | 0 | 1 | NO |
| Na+ | Na+ | -1 | 1 | 1 | 0 | 0 | NO |
| Na+ | Ca2+ | -1 | 1 | 2 | 0 | 0 | NO |
| Ca2+ |  | -1 | 2 | 0 | 1 | 1 | YES |
| Ca2+ | Na+ | -1 | 2 | 1 | 1 | 1 | YES |
| Ca2+ | Ca2+ | -1 | 2 | 2 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Na+ |  | 0 | 1 | 0 | 1 | 1 | YES |
| Na+ | Na+ | 0 | 1 | 1 | 1 | 1 | YES |
| Na+ | Ca2+ | 0 | 1 | 2 | 1 | 1 | YES |
| Ca2+ |  | 0 | 2 | 0 | 1 | 1 | YES |
| Ca2+ | Na+ | 0 | 2 | 1 | 1 | 1 | YES |
| Ca2+ | Ca2+ | 0 | 2 | 2 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Na+ |  | -5 | 1 | 0 | 1 | 1 | YES |
| Na+ | Na+ | -5 | 1 | 1 | 1 | 1 | YES |
| Na+ | Ca2+ | -5 | 1 | 2 | 1 | 1 | YES |
| Ca2+ |  | -5 | 2 | 0 | 1 | 1 | YES |
| Ca2+ | Na+ | -5 | 2 | 1 | 1 | 1 | YES |
| Ca2+ | Ca2+ | -5 | 2 | 2 | 1 | 1 | YES |

**Supplementary Figure 1**. Predictions of the charge permeability equation (1) for the selectivity and permeability of Na+ and Ca2+ in AMPA and NMDA receptor channels under various ionic configurations as a function of total ring charge **rq**.

charge attractivity

charge of ion occupying pore

charge of ion entering pore

ion entering pore

total ring charge of

 selectivity filter

inward drive

ion permeability

ion occupying pore

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **qi** | **qr**  | **rq** | **qi** | **qr**  | **A** | **B** | **AB** |
|  |  |  |  |  |  |  |  |
| Cl- |  | -4 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -4 | -1 | 1 | 1 | 1 | YES |
| Cl- | Ca2+ | -4 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | -4 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -3 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -3 | -1 | 1 | 1 | 0 | NO |
| Cl- | Ca2+ | -3 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | -3 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -2 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -2 | -1 | 1 | 1 | 0 | NO |
| Cl- | Ca2+ | -2 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | -2 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -1 | -1 | 0 | 1 | 0 | NO |
| Cl- | Na+ | -1 | -1 | 1 | 1 | 0 | NO |
| Cl- | Ca2+ | -1 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | -1 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | 0 | -1 | 0 | 1 | 0 | NO |
| Cl- | Na+ | 0 | -1 | 1 | 1 | 0 | NO |
| Cl- | Ca2+ | 0 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | 0 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -5 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -5 | -1 | 1 | 1 | 1 | YES |
| Cl- | Ca2+ | -5 | -1 | 2 | 1 | 0 | NO |
| Cl- | Cl- | -5 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -6 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -6 | -1 | 1 | 1 | 1 | YES |
| Cl- | Ca2+ | -6 | -1 | 2 | 1 | 1 | YES |
| Cl- | Cl- | -6 | -1 | -1 | 1 | 1 | YES |
|  |  |  |  |  |  |  |  |
| Cl- |  | -7 | -1 | 0 | 1 | 1 | YES |
| Cl- | Na+ | -7 | -1 | 1 | 1 | 1 | YES |
| Cl- | Ca2+ | -7 | -1 | 2 | 1 | 1 | YES |
| Cl- | Cl- | -7 | -1 | -1 | 1 | 1 | YES |

**Supplementary Figure 2**. Predictions of the charge permeability equation (1) for the selectivity and permeability of Cl- in AMPA and NMDA receptor channels under various ionic configurations as a function of total ring charge **rq**.