**SI 3**

Modeling of the Gouy-Chapman-Stern (GChS) potentials and ion distribution in nearest proximity and on neuronal membrane surface.

The values of membrane surface potential for intracellular and extracellular sides of the membrane were calculated by solving the set of equations:

Where:

- Charge density of the outer and inner side of membrane (-0.0161, -0.0060 C/m);

- Potentials at inner and outer side of membrane;

  - Transmembrane voltage drop measured at points of bulk solutions;

- Potential drop at outer and inner surfaces of membrane due to Stern layers;

- Membrane permittivity (3);

- Membrane bilayer thickness (5 nm);

- Bulk solution permittivity ();

- Outer and inner concentrations of bulk solutions;

– Valence of i-th type of ion in the solution;

R – Universal gas constant (8.3144598 J/(mol‧K));

– The thickness of Stern layer on outer and inner side of the membrane;

– Stern layer permittivity on outer and inner side of the membrane;

- The size of the hydrated lipid heads on outer and inner layer;

– The size of the hydrated i-th ion in the solution;

– The bare ion size;

– The ion hydrating factor for i-th ion;

– The average hydrating number for i-th ion;

– The average binding energy of water molecules for i-th ion;

- The normality of the solution;

– Concentration dependent permittivity altering factor;

– The function of potential distribution from membrane surface into bulk solution;

– Debye length;

*T* – Temperature in Celsius scale ( ֩C).

Some additional values or specific parameters used in the model are provided in Table @ 2.

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| **Table @.** | **Parameters of ions size alterations with temperature**  (for non-concentrated solutions) | | | |
| *Ion* | *, Å* | *, Å* | *Ai, a.u.* | *, 10-20 J* |
| Na+ | 0.91 | 0.76 | 0.0397 | -2.23 |
| K+ | 1.43 | 0.69 | 0.0114 | -2.53 |
| Cl- | 1.95 | 0.62 | 0.0049 | -2.82 |
| Ca2+ | 0.85 | 1.61 | 2.37 | -0.6 |