How ion adsorption affects biological membranes' functions

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In a new study published in *EPJ E*, Izabela Dobrzy?ska from the University of Bia?ystok, Poland, develops a mathematical model describing the electrical properties of biological membranes when ions such as calcium, barium and strontium adsorb onto them at different pH levels. These factors need to be taken into account when studying the diverse phenomena that occur at the lipid membrane in living cells, such as ion transport mechanisms.

Ions with two positive electrical charges, such as calcium ions, play a key role in biological cell membranes. The adsorption of ions in solution onto the membrane surface is so significant that it affects the structural and functional properties of the biological cells. Specifically, ions interact with surface molecules such as a double layer of lipids, or liposomes, formed from phosphatidylcholines (PC). In a new study published in EPJ E, Izabela Dobrzy?ska from the University of Bia?ystok, Poland, develops a mathematical model describing the electrical properties of biological membranes when ions such as calcium, barium and strontium adsorb onto them at different pH levels. Her works helps shed light on how ion adsorption reduces the effective surface concentration of add-on molecules with a specific function that can take part in biochemical reactions. These factors need to be taken into account when studying the diverse phenomena that occur at the lipid membrane in living cells, such as ion transport mechanisms.

The equilibrium at the membrane surface can be changed by the ion adsorption levels, leading to variations in the membrane surface charge

density. Using a method called microelectrophoresis, the author experimentally determines the surface charge density as a function of pH. She then develops a mathematical model of the surface charge density to identify the equilibrium, and finds that her model agrees with experimental data.

Dobrzy?ska finds that calcium ions have a greater ability to adsorb onto the lipid bilayer of the biological membrane than barium ions. In addition, she observes that ions containing hydroxide endings are adsorbed onto the membrane more readily than positively charged metal ions, like strontium. Ions' adsorption onto the surface of the liposomes may affect their movement through the cell membrane, and with it, the delivery of the substances they carry.

More information: Izabela Dobrzyńska. Association equilibria of divalent ions on the surface of liposomes formed from phosphatidylcholine, *The European Physical Journal E* (2019). DOI: 10.1140/epje/i2019-11762-6

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