Contribution ID: **644** Type: **Poster**

# 3P50 - CELL GEOMETRY-INVARIANT CALCULATION OF PLASMA MEMBRANE POTENTIAL DUE TO ELECTRIC PULSES USING VARIATIONAL CALCULUS

*Wednesday 26 June 2019 13:30 (1h 30m)*

The plasma membrane potential of non-spherical cells has been solved for the spheroidal case analytically [1,2] and approximated in other cases[3] These solutions become cumbersome for more complex shapes, such as spheroidal cells with protrusions or rod-like cells. In particular, many microorganisms are rod shaped and a direct method for determining membrane potential for these cells is valuable for quantifying electroporation for sterilization. In this presentation, we investigate a geometry-invariant calculation of the plasma membrane potential using variational calculus and the minimum energy principle. Comparisons to theories for ellipsoid and cylindrical geometries will be presented. The implications of these solutions for electroporation theory will be discussed.

1. Q. Hu and R. P. Joshi, "Transmembrane voltage analyses in spheroidal cells in response to an intense ultrashort electrical pulse,"Phys. Rev. E, vol. 79, 2009, Art. no. 011901.
2. J. Gisma and D. Wachner, "On the analytical description of transmembrane voltage induced on spheroidal cells with zero membrane conductance,"Eur. Biophys. J., vol. 30, pp. 463-466, 2001.
3. G. Pucihar, T. Kotnik, B. Valic and D. Miklavic, "Numerical determination of transmembrane voltage induced on irregularly shaped cells,"Ann. of Biomed. Eng., vol. 34, pp. 642-652, 2006.

---

Work supported by a Purdue Doctoral Fellowship.

**Authors:** DARR, Adam (Purdue University West Lafayette); GARNER, Allen (Purdue University)

**Presenter:** DARR, Adam (Purdue University West Lafayette)

**Session Classification:** Poster - Industrial/Commercial/Medical Applications and Plasma and Pulse Power Diagnostics

**Track Classification:** 6.5 Medical and Biological Applications