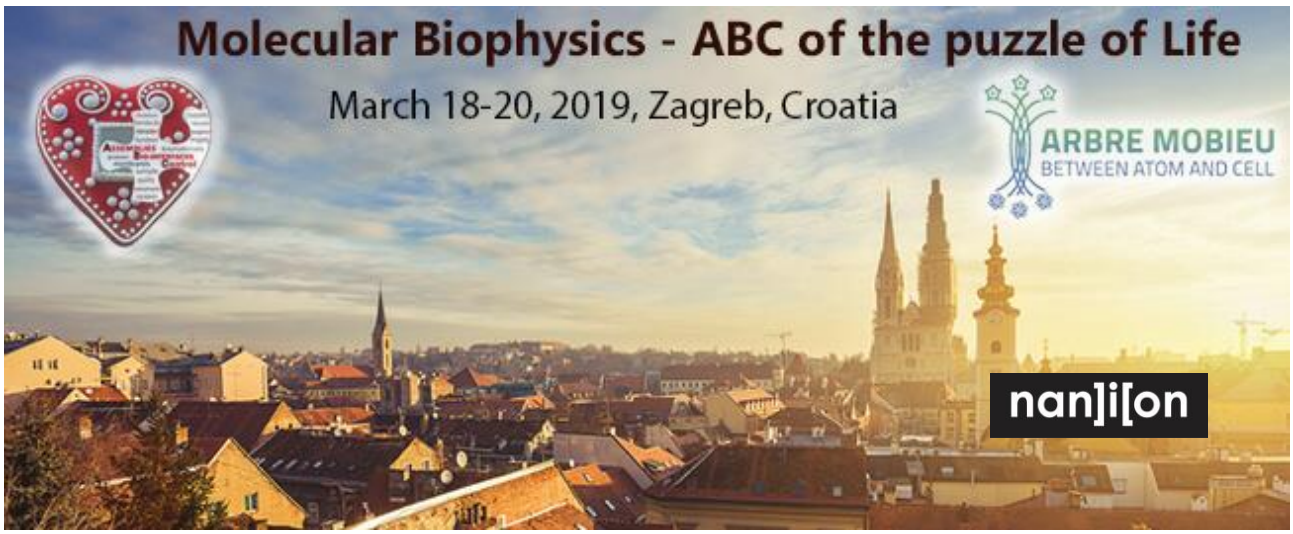

Comprehensive biophysical assays: From single channel electrophysiology to overall cell behavior

Elena Dragicevic[1], Conrad Weichbrodt[1], Ilka Rinke-Weiss[1], Nadine Becker[1], Krisztina Juhasz[1], Ekaterina Zaitseva[2], Gerhard Baaken[2], Alison Obergrussberger[1], Matthias Beckler[1], Michael George[1], Sonja Stoelze-Feix[1], Andrea Brüggemann[1], Niels Fertig[1]

[1]Nanion Technologies GmbH, Ganghoferstr. 70a, 80339 Munich, Germany
[2]Ionera Technologies GmbH, Hermann-Herder-Str. 7, 79104 Freiburg, Germany

Integral membrane proteins, predominantly ion channels and transporters, have been the focus of basic biophysical research, as well as drug discovery and safety projects for decades. Electrophysiological experiments on fully functional artificial lipid bilayers enable the investigation of basically any membrane-affecting agent. In combination with automated patch clamp and impedance/electrical field potential (EFP)-like recordings of relevant targets expressed in heterologous systems, as well as of human iPSC-derived cardiomyocytes and neurons, we demonstrate broad biophysical application assays, connecting single channel electrophysiology with overall single cell and cell population behavior.

Here, we present the temperature dependent activation or deactivation of different Transient Receptor Potential (TRP) channels by means of planar patch clamping on our medium and high throughput screening (HTS) platforms Patchliner and SyncroPatch 384PE, as well as with highest resolution on a single channel level on our recently introduced Orbit mini setup. Additionally, the effect of drugs on action potentials as recorded in iPSC-cardiomyocytes is important for assessing the interaction of the cardiac ion channel ensemble. We present our advances in development of iPSC-cardiomyocytes "ready-to-use" assays for automated patch clamp. We also show, short and long-term impedance/EFP-like recordings of diverse cell-types, such as drug safety experiments on iPS cardiomyocytes and cancer tox-assays. In summary, medium and high throughput screening (HTS) assays such as automated electrophysiological patch clamp and impedance-based assays allow for the determination of drug effects on a whole cell level whereas artificial bilayers provide a robust environment for the assessment of single ion channel molecules.