Genetically Encoded Voltage Indicators in Circulation Research.

Membrane potentials display the cellular status of non-excitable cells and mediate communication between excitable cells via action potentials. The use of genetically encoded biosensors employing fluorescent proteins allows a non-invasive biocompatible way to read out the membrane potential in cardiac myocytes and other cells of the circulation system. Although the approaches to design such biosensors date back to the time when the first fluorescent-protein based Förster Resonance Energy Transfer (FRET) sensors were constructed, it took 15 years before reliable sensors became readily available. Here, we review different developments of genetically encoded membrane potential sensors. Furthermore, it is shown how such sensors can be used in pharmacological screening applications as well as in circulation related basic biomedical research. Potentials and limitations will be discussed and perspectives of possible future developments will be provided.