Unimapper: an Online Interactive Analyzer/Visualizer of Optical Mapping Experimental Data

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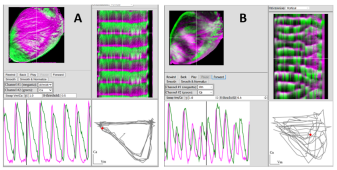
Aims: Optical mapping (OM) has been a useful tool in the discovery of many arrhythmic mechanisms; furthermore, advances in camera sensors over the past decade have made the setup of an OM system very affordable, with the price of OM cameras having dropped from $60K to under $3K. Given the widespread use of OM systems, it is desirable to have programs that can both analyze and display data interactively and independent of the operating system.

Method: JavaScript allows the creation of programs that run in a browser independent of the device used, making it an ideal language to develop software that interactively shares experimental data not only between collaborators but also with other research groups and the public.

Results: We developed a Unified Electrophysiology Mapping Framework (Unimapper) to facilitate the analysis, visualization and exchange of electrophysiology data. The program inputs experimental (and simulation) data, and process the data (e.g. filtering, de-drifting, smoothing, Hilbert's transform, etc). Then can display the data in time with variable speed, stop/rewind functions, it can also display voltage and/or calcium signals from dual optical recordings and can display the voltage and calcium signals in time for any chosen pixel and plot phase-space portraits of V-Ca. Line-scan figures along any direction of the tissue are also displayed simultaneously. Examples shown include V-Ca OM from pig, rabbit, guinea pig hearts and monolayers. Dynamics include SA-node pacing, electrode pacing, concordant-alternans, discordant-alternans, reentrant spiral waves and fibrillation.

Conclusions: We present an interactive program that analyzes and interactively displays OM experimental data in a web browser, independent of the device used. Data can be visualized in various modes and analyzed images, V(t)/Ca(t) signals, alternans and other measurements can be exported and saved. We expect that this software will facilitate creation of a repository of experimental data for modelers and other researchers.



Exmples: A)Rabbit pacing form apex with alternans in Ca
B) Rabbit Ventricular fibrillation