

Artificial extracellular matrices for in situ monitoring of cardiomyocyte activity

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Organisation

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SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Translational - Applied Research
Type of method	Other

DESCRIPTION

Method keywords

Quantum dot
collagen
Two-photon fluorescence
Cardiomyocyte
Electrogenic cells

Scientific area keywords

Optical monitoring
Optical readout
Multiphoton imaging
Extracellular matrices

Method description

Quantum Dots (QDs) have been hypothesized as potential probes for the optical monitoring of electrogenic cell activity given their high optical absorption cross-sections compared to organic fluorophores, high brightness and low photobleaching. Despite the theoretical predictions, less than a handful of papers reported QD-based imaging of cell activity responses due to critical membrane localization requirements for membrane voltage sensing. Moreover, to the best of our knowledge, two-photon imaging of cellular activity dependent QD photoluminescence was never demonstrated. The high spatial and

temporal resolutions and higher penetration depths, inherent to nonlinear light-tissue interactions are particularly interesting for biological imaging. Therefore, we functionalized fibrous collagen matrices with semiconductor quantum dots and thereby created artificial extracellular matrices that can optically report cardiomyocyte contractile activity based on QD two-photon fluorescence. We have applied these optically-addressable nanofiber matrices to monitor activities of primary cardiomyocytes and, for validation, we compared the optical responses with simultaneously recorded patch-clamp data. Given the long-term stability of QD fluorescence, near infrared excitation and high spatio-temporal resolution achievable through multiphoton imaging, this approach can be used for continuous monitoring of cellular functions in cardiac tissue constructs.

Lab equipment

Two-photon microscope

Method status

Published in peer reviewed journal

REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

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