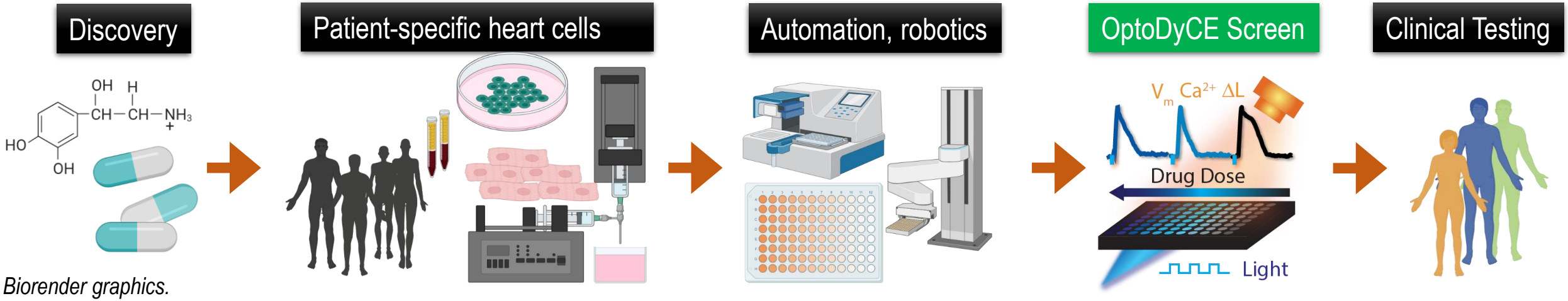
# SPARKBio

*high-throughput optical cardiotoxicity screening*

**Developed by The George Washington University**

# Technology Summary

- First scalable automated all-optical system for high-throughput cardiac toxicity screening (OptoDyCE).
- Optically measures electrophysiology of a variety of primary and stem-cell-derived cells and tissues.
- Compatible with proprietary “spark-cell” spheroids: easy to manipulate, store and deploy for immediate use.
- No genetic modification of the studied cells of interest needed; no viral delivery needed; fast deployment.




*Biorender graphics.*
*Klimas, A. et al. Nat. Commun. 7, 11542 (2016)*
*Klimas A et al. Prog Biophys Mol Biol, 154:62-70 (2020)*

**OptoDyCE is applicable to various experimental models for drug discovery and cardiotoxicity screening.**

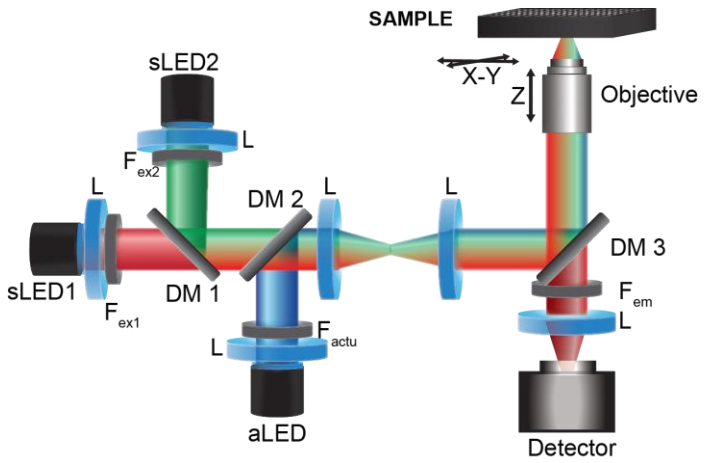
# Problems with Drug Development Pipeline

**Cardiotoxicity is one of the leading causes for discontinuation at different phases of drug development.**

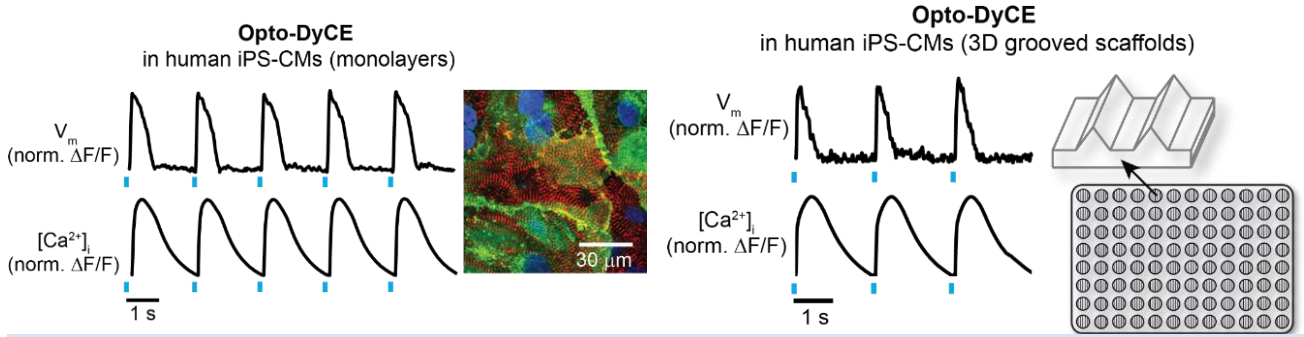
- Current methods of pre-clinical cardiotoxicity testing are slow, expensive, and lack the complexity of in vivo cardiomyocytes.
- There are no scalable and high-throughput compatible cellular cardiac electrophysiology assays in the market.
- Current automated systems can’t characterize tissue-level/multicellular effects.

# Our Solution

## A Device and Method Providing Multi-Parameter, High-Content Information

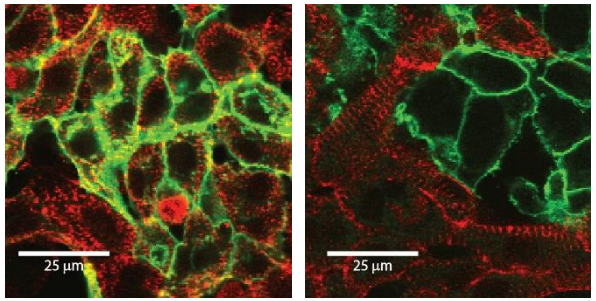



Light-based device provides simultaneous multi-parameter control and measurement of hiPSC-CMs.




Physiologically relevant, multi-parameter data can be obtained in different tissue configurations within 10 seconds per sample.

***Gene Delivery*** ***Modular Delivery***

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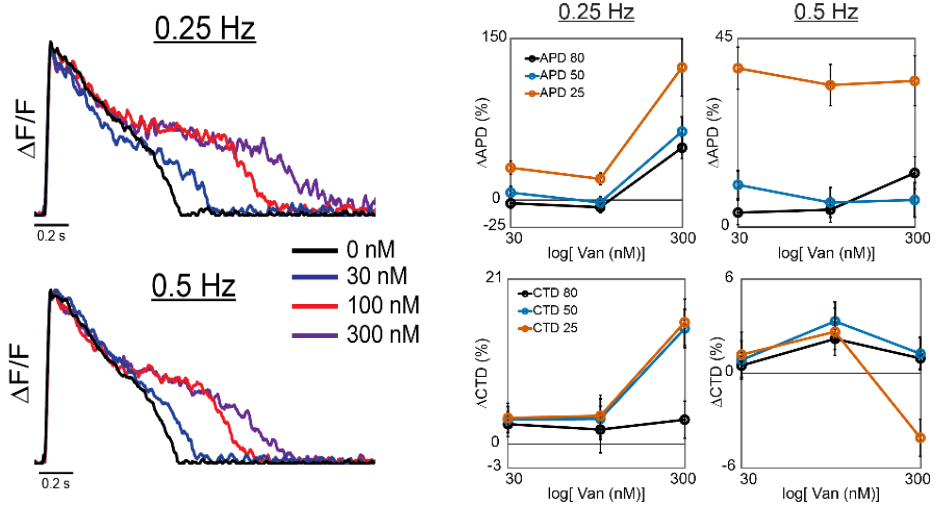
Light sensitivity (green) imparted on CMs (red) using gene delivery or "spark" cells.

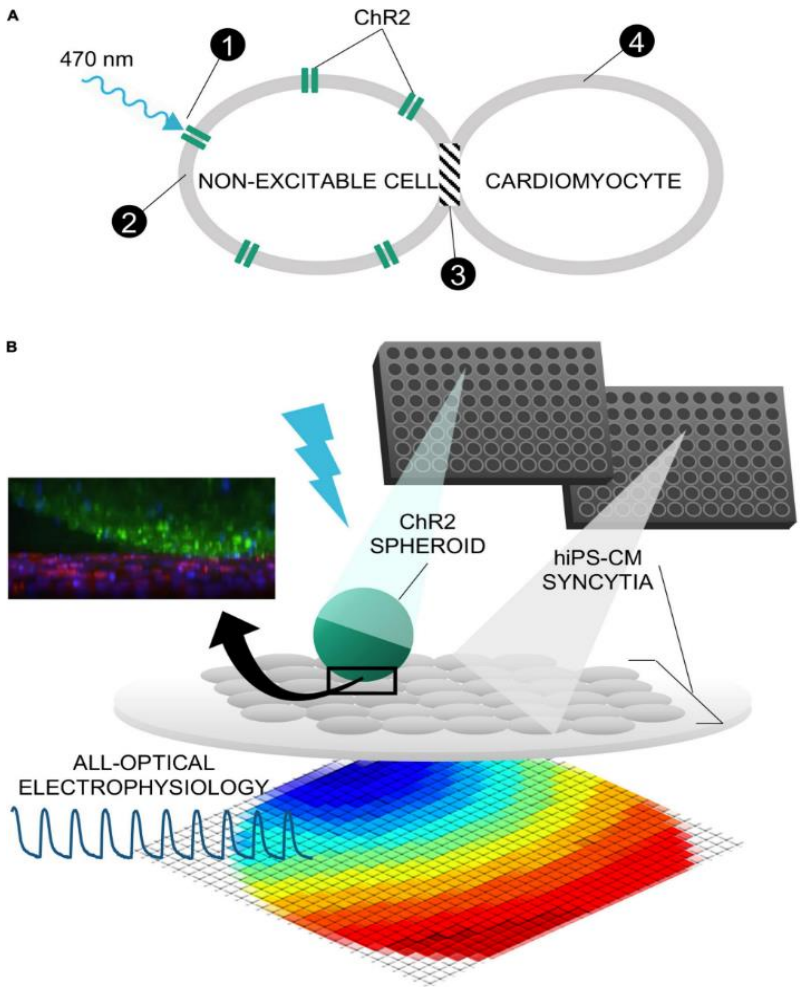



Pro-arrhythmic effects of a drug (Vanoxerine) recently removed from Phase III clinical trials were easily revealed using the OptoDyCE Platform.

System can dynamically interrogate 10,000 samples per day (20 years of patch clamp man-hours) and provide a more complete profile of potential cardiotoxic effects compared to traditional methods.

# Our Solution

## OptoDyCE-compatible “Spark-Cell” Spheroids for Optical Pacing of Cardiac Tissue




*Chua C et al. Front Bioeng Biotechnol ;9:658594 (2022).*

- “Spark-cell” spheroids are scalable and cost-effective for contactless optical stimulation of cardiac cell constructs for high throughput drug screening.
- Confer optical responsiveness of cardiac tissue earlier than direct viral or liposomal genetic modification of the cardiomyocytes.
- Offer multimodal responsiveness – optical, magnetic, ultrasound – for navigation and actuation.

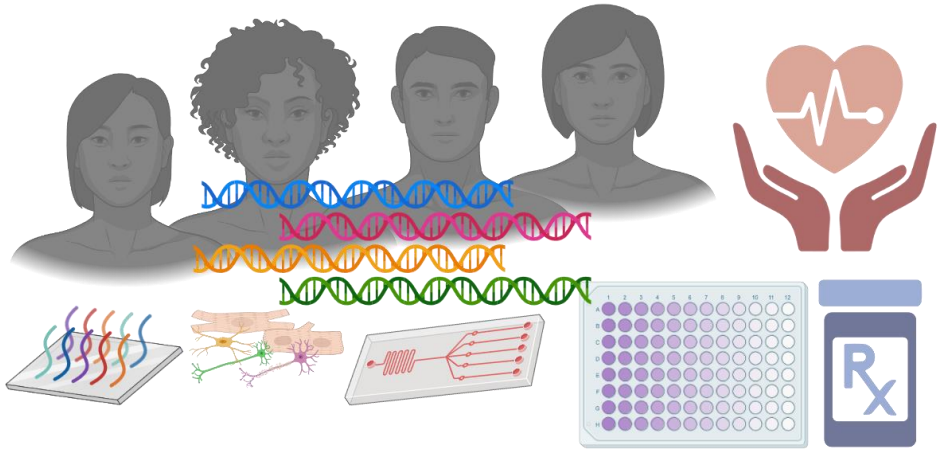

*Chua C et al. Front Bioeng Biotechnol ;9:658594 (2022).*

**“Spark-cell” spheroids can be manufactured in a high-throughput (HT) format, and can be positioned onto hiPSC-cardiomyocytes, also grown in HT format**

**“Spark-Cell” spheroids can be frozen, transported, and quickly deployed on-site to confer optical pacing of cardiac cells**

# Target Customers

- Industry
  - High-throughput screening developers (Nanion, Axion Biosystems, Q-State Biosciences)
  - Pre-clinical CROs doing cardio toxicity screening (Eurofins, Cardiomex, Cyprotex, etc.)
  - Pharma companies (Bayer, Novartis, Bristol-Myers Squibb, Johnson & Johnson etc.)
  - Biotech, gene therapy developers
  - AI, machine learning companies for personalized medicine (In Silico Medicine)
- Research Institutions
  - Academic labs
  - University core facilities



# What makes SPARKBio unique?

- Allows precise optogenetic stimulation without genetic modification of cells
- Allows all-optical electrophysiology-simultaneous voltage, calcium optical measurements
- Safer for cells due to low intensity and long wavelength light used
- Spheroids respond to electrical, optical, magnetic, and ultrasound signals
- Compatible with standard high-throughput plate format (96- or 384-well plates)

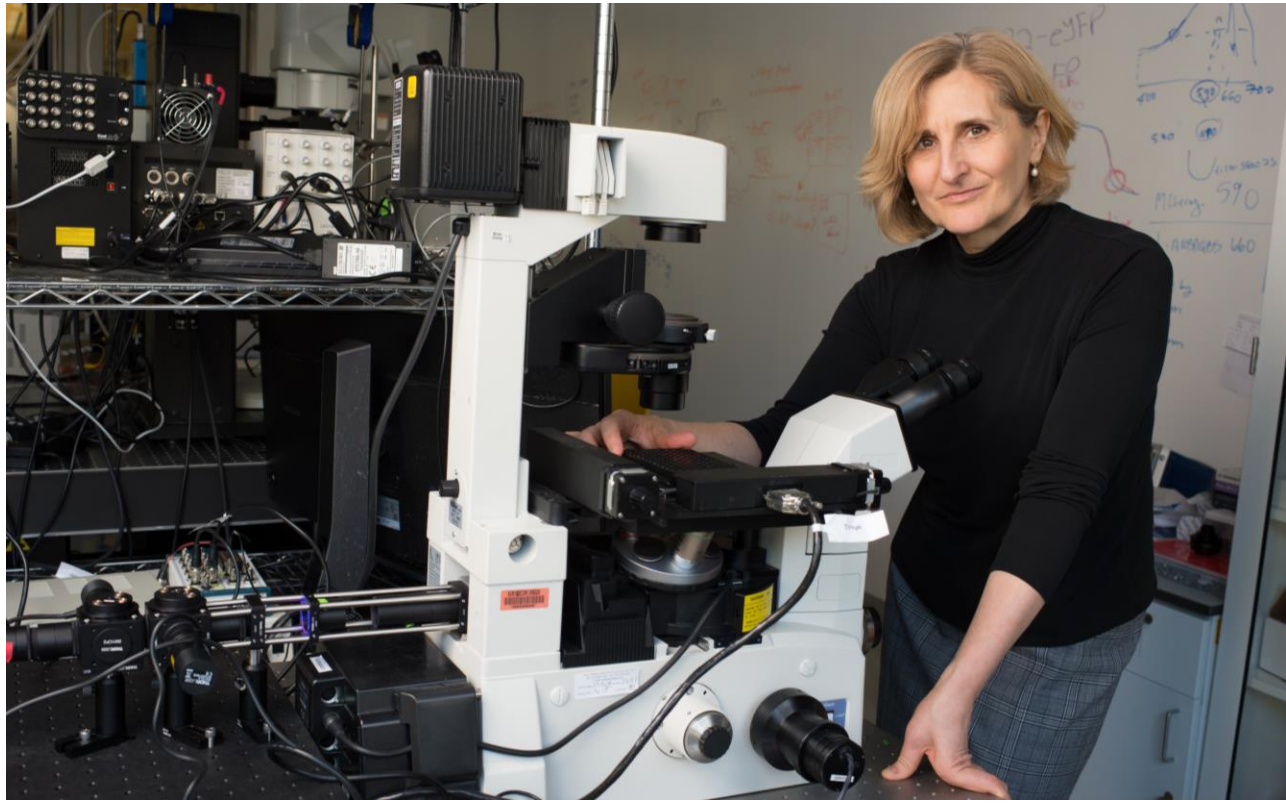
# Competitive advantages

| | | Patch Clamp | MEAs | Vala Sciences | Q-State | OptoDyCE |
|---|---|---|---|---|---|---|
| General | Low Cost | | | | | ✓ |
| | High Throughput | | ✓ | ✓ | ✓ | ✓ |
| | High Sensitivity | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Modular | | | | | ✓ |
| | Multi-cell recording | | ✓ | ✓ | ✓ | ✓ |
| | Contactless Actuation | | | | ✓ | ✓ |
| | Contactless Recording | | | ✓ | ✓ | ✓ |
| Assay | Voltage | ✓ | | | ✓ | ✓ |
| | Calcium | | | ✓ | ✓ | ✓ |
| | Contraction | | | | | ✓ |
| Sample Type | Monolayer | | ✓ | ✓ | ✓ | ✓ |
| | 3D Structure | | | | | ✓ |
| | Single Cells | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Human Cells | ✓ | ✓ | ✓ | ✓ | ✓ |
| Study Type | Cardiotoxicity | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Chronic Study | | ✓ | ✓ | ✓ | ✓ |
| | EC-Coupling | | | | | ✓ |
| | Mechanistic Screen | | | | | ✓ |
| | Lead Screening | | ✓ | ✓ | ✓ | ✓ |

# Innovator

## Emilia Entcheva, PhD

- Director of the Cardiac Optogenetics and Optical Imaging lab at the George Washington University
- PhD in Biomedical Engineering
- Pioneer of cardiac optogenetics and optical methods
- Extensive knowledge of cardiac electrophysiology – experiments and computer modeling



# What does SPARKBio need?

- What we are looking for?
  - Serial entrepreneur with potential for CEO role
  - CSO/CTO
  - Investment / Financing

- Is there a market for SPARKBio's technology?
  - Yes. Cardiotoxicity alone accounts for >30% of drugs withdrawn. To avoid late-stage drug attrition, pharmaceutical industries needs high-throughput platforms to screen drug-induced cardiac toxicity in vitro.

- What is the current development state of SPARKBio's technology?
  - Patents filed
  - Have fully-functional prototype