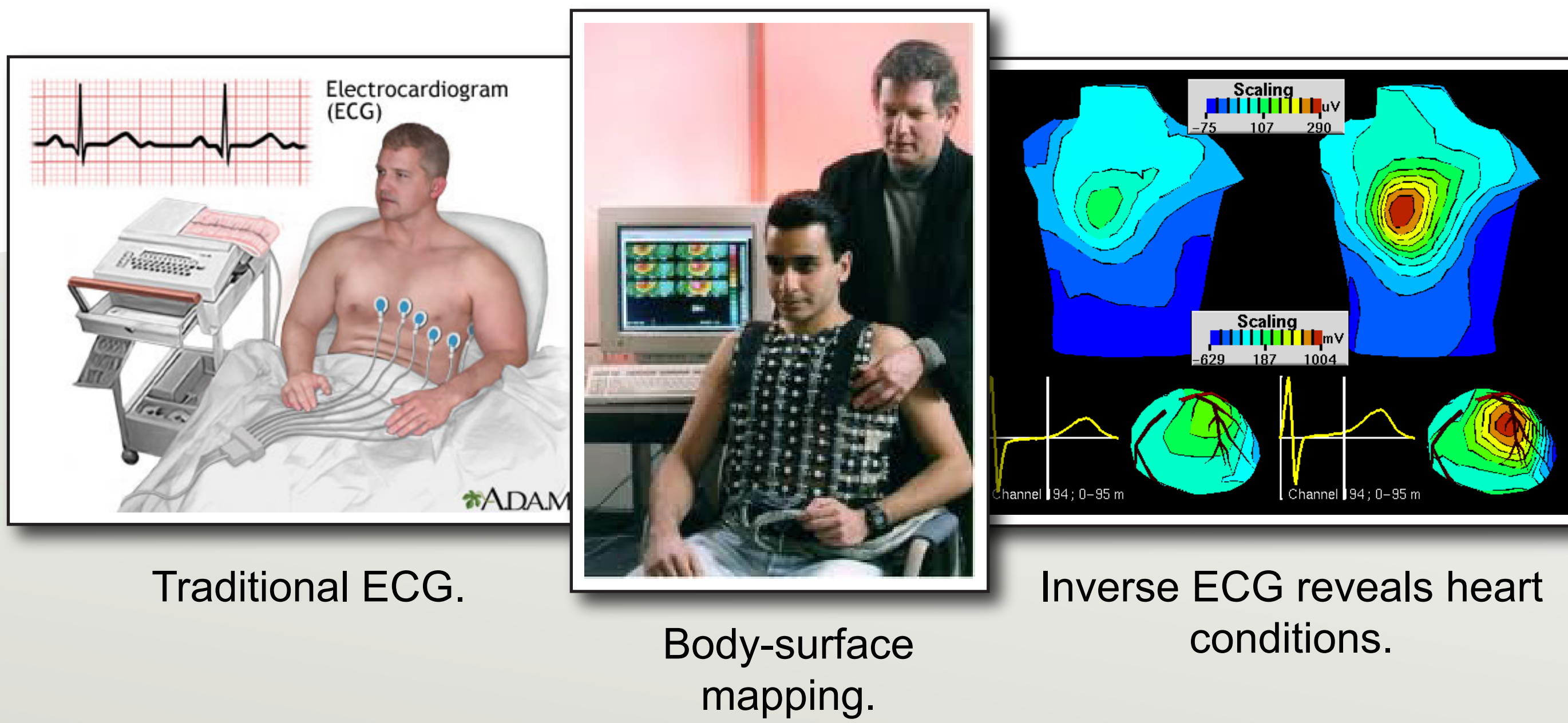


Noninvasive Diagnosis and Localization of Heart Ischemia from Body-Surface Electrocardiography

ECG in the Era of Personalized Healthcare

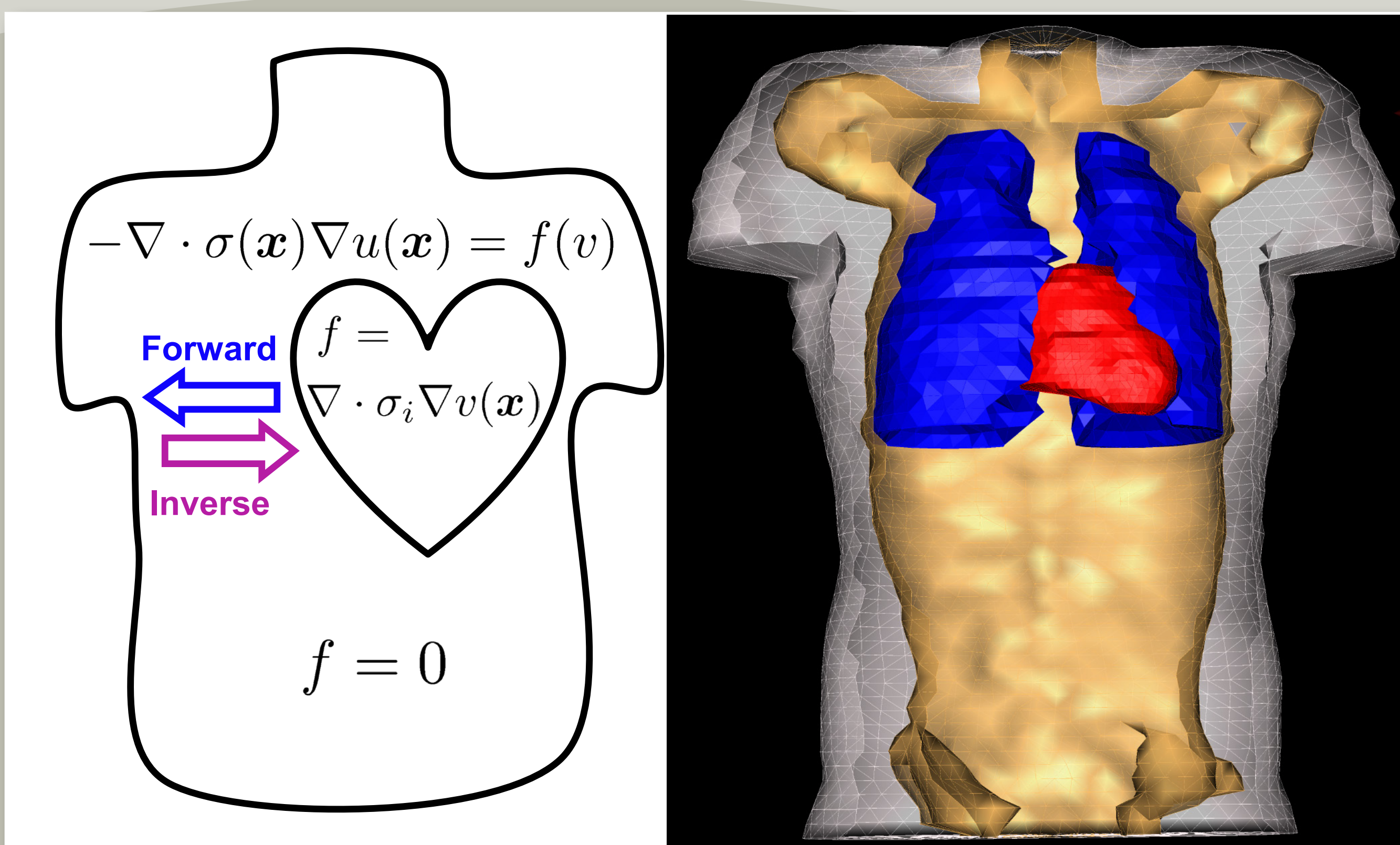
With unprecedented computing power and medical imaging technology nowadays, electrocardiography (ECG) is becoming a patient-specific technique for clinical practice.



Clinical Motivation

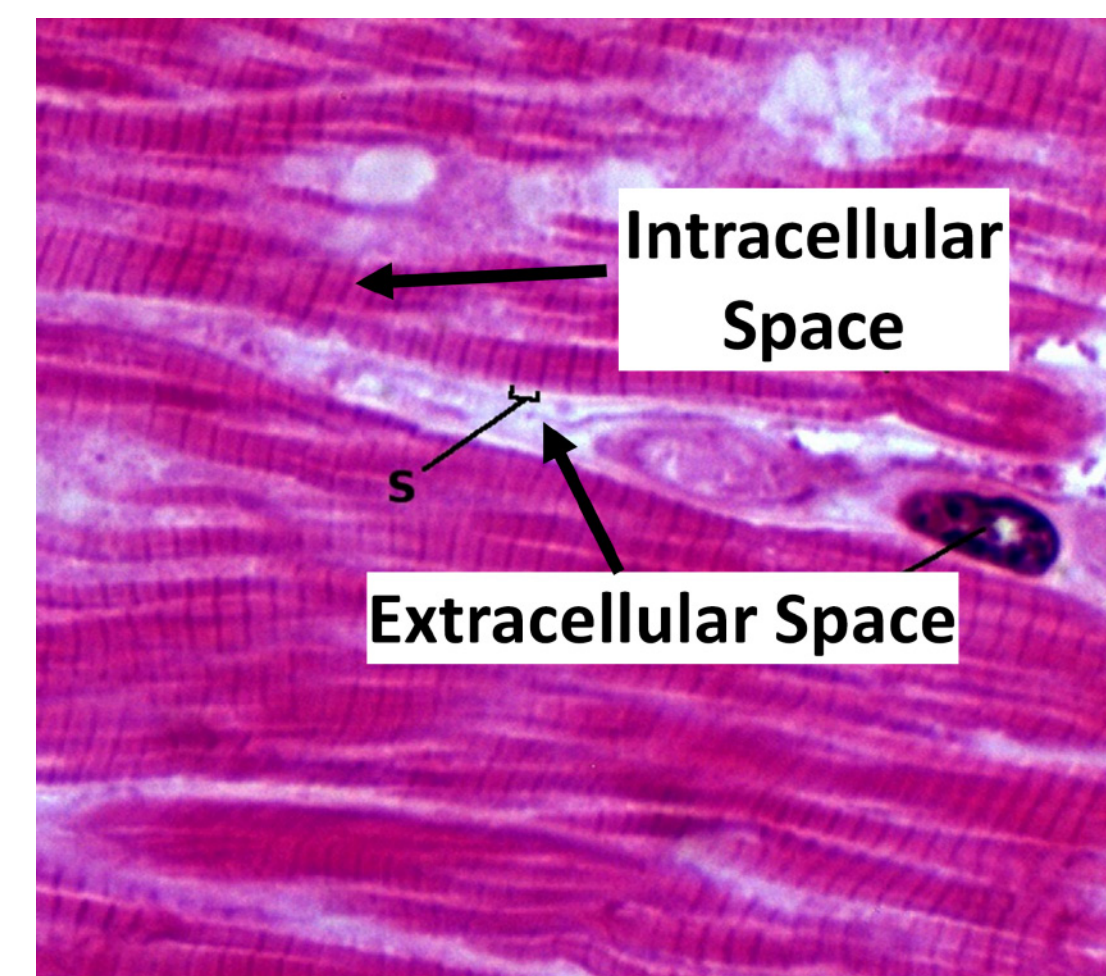
Myocardial ischemia occurs when heart is damaged due to insufficient blood supply. Our goal is to noninvasively localize myocardial ischemic regions based on body-surface ECG recordings.

Patient-Specific Simulation

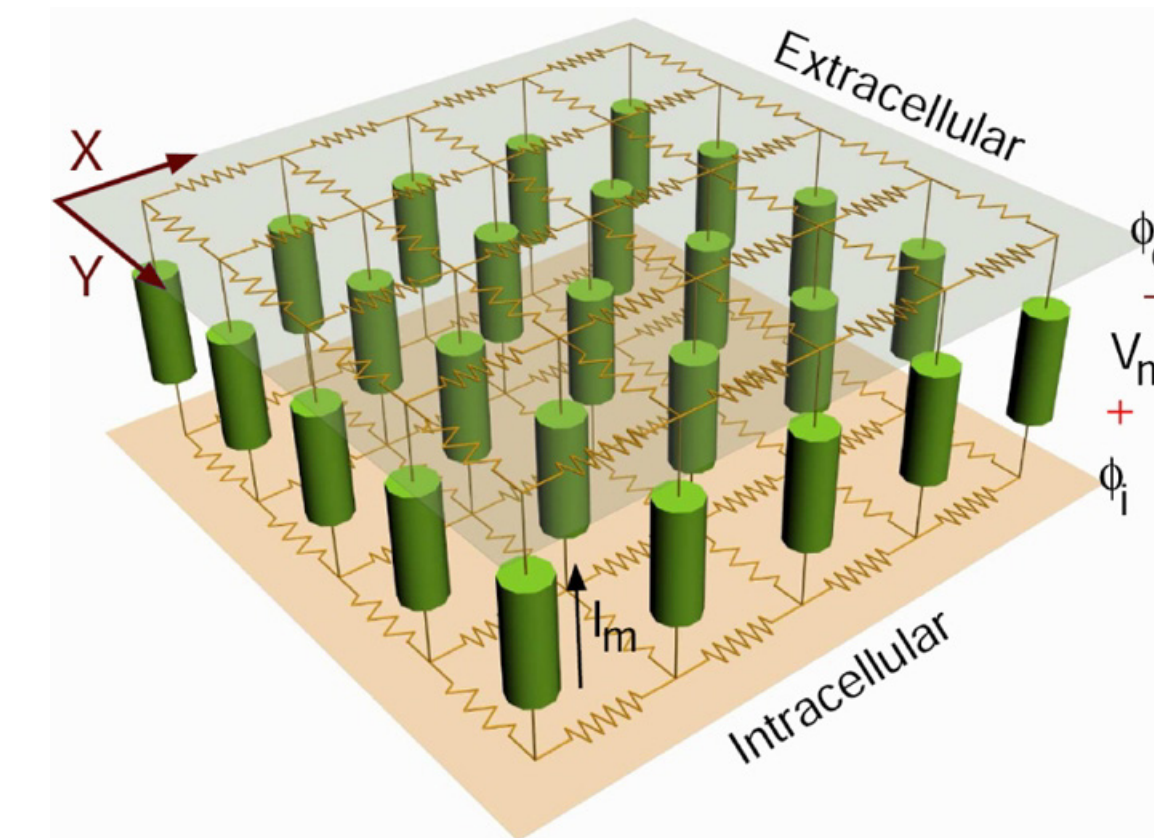


The Utah-Torso model has 1 million tetrahedral elements.

Bioelectric Models

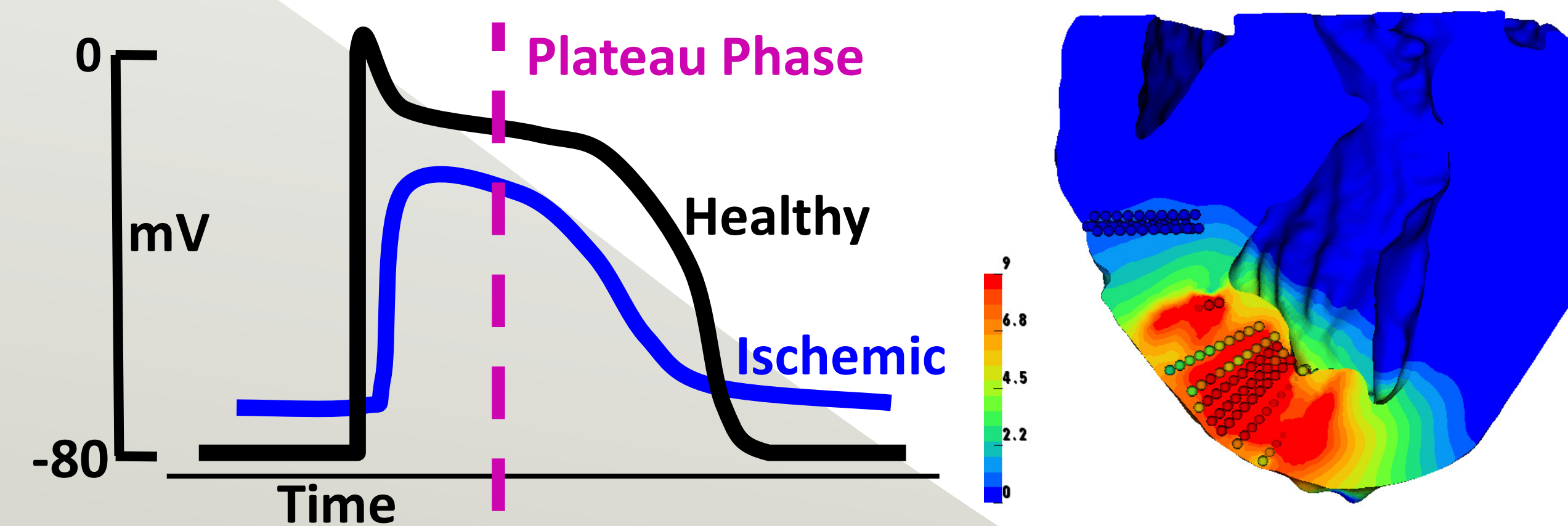


Microscopic image of heart tissue.

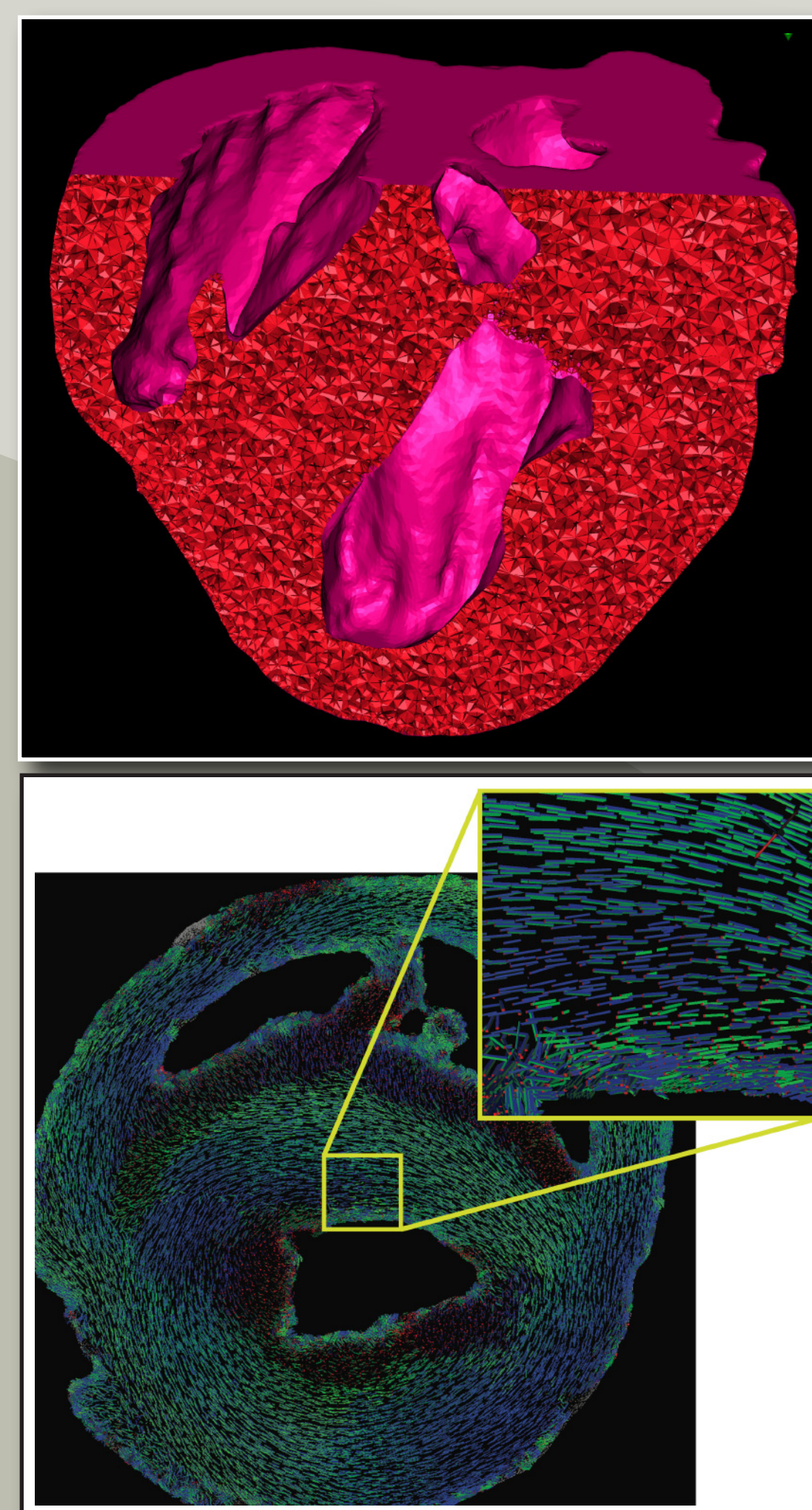
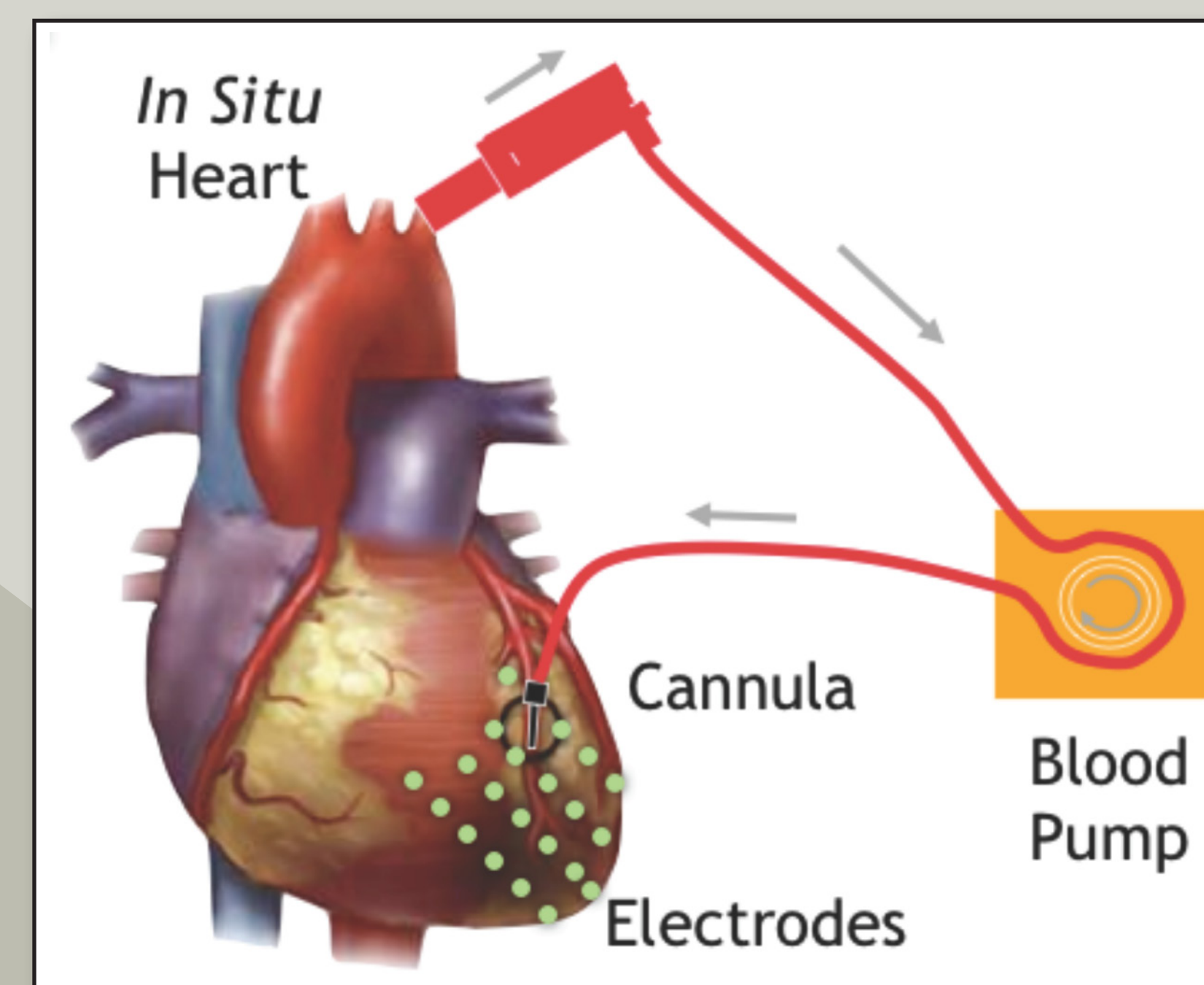


Computer model of heart tissue. The transmembrane potential is the source.

Ischemic tissues are characterized by reduced amplitude of the transmembrane potential.



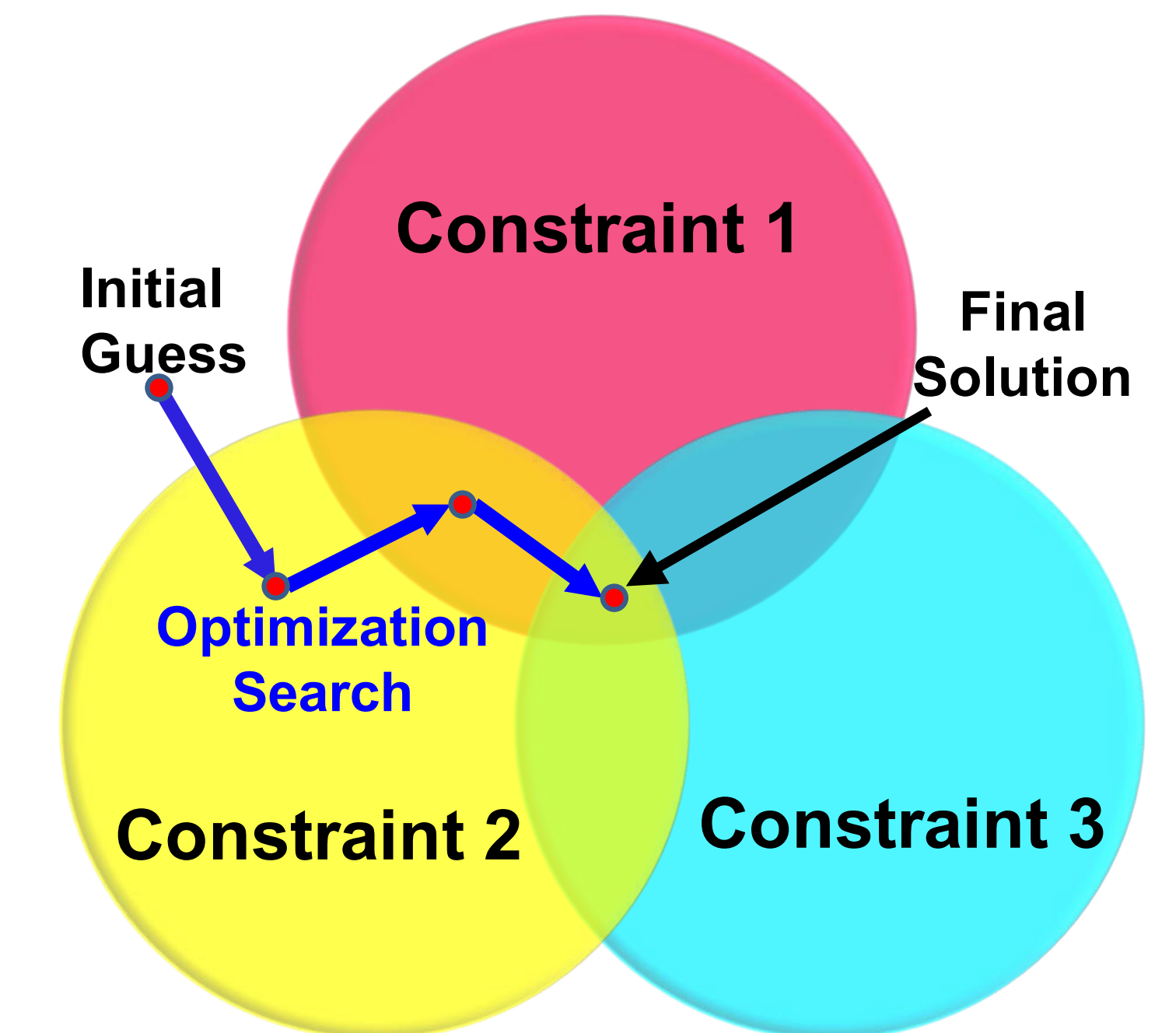
Clinical Experiments and Validation



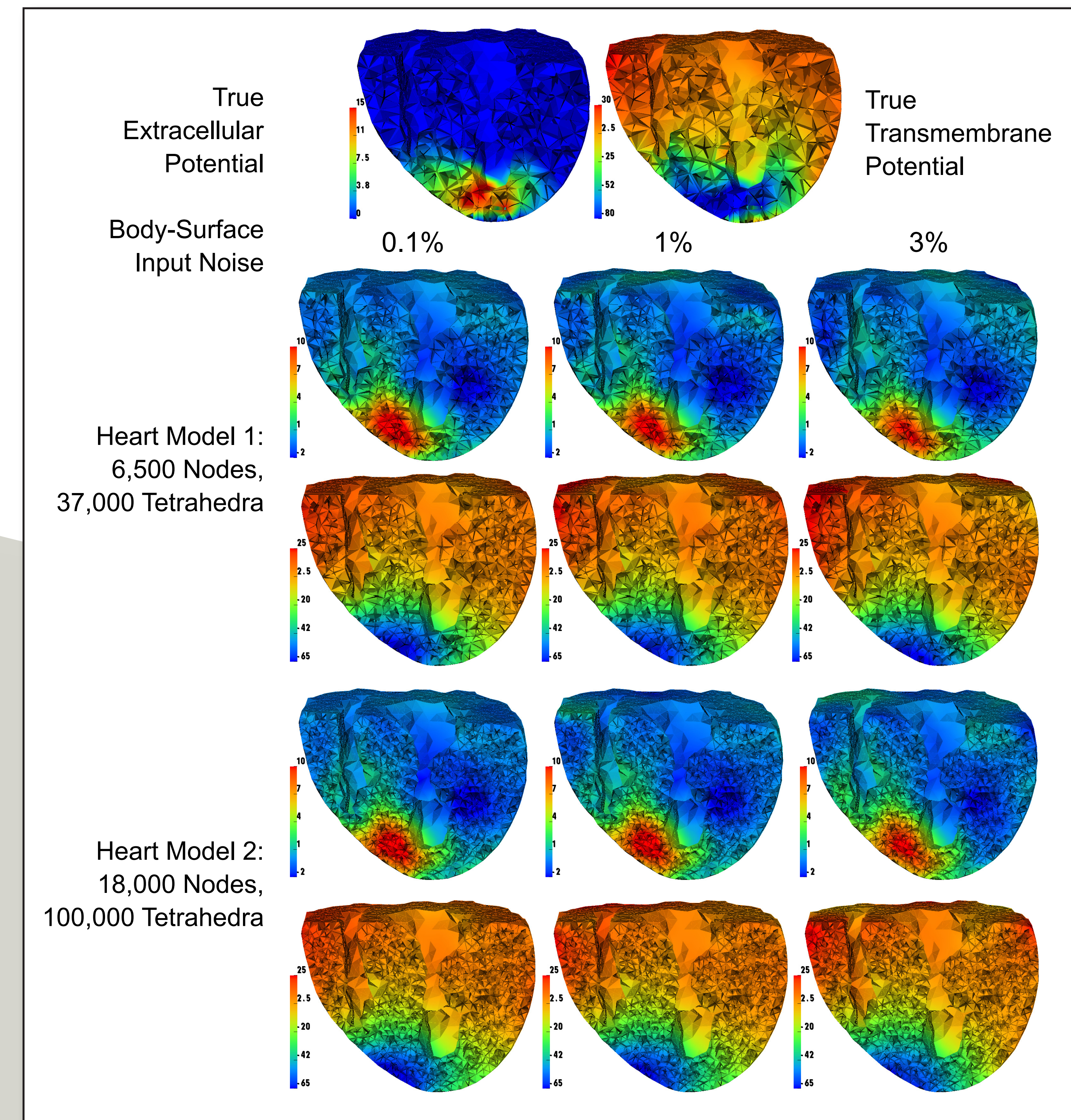
MRI-derived heart geometry and fiber structures.

Heart Potential Reconstruction

This is the core of our research. We apply an advanced mathematical technique named “constrained optimization”, which enables us to simultaneously impose multiple physically-based constraints, thereby achieving good reconstruction.



Results



Reconstructed heart potentials during ischemia.

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