

How to Become a Cardiovascular Investigator

Careers in Electrophysiology
Research

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Careers in EP Research

Background

- Reduce incidence cardiac arrhythmias is desirable
 - Accurate identification of patients at risk
 - Effective treatments
- Achievement of goal requires
 - Elucidation of basic molecular/cellular mechanisms
 - Development of innovative methods to establish proof-of-concept in humans
 - Novel therapies
 - Focused clinical trials
 - Expertise in management of patients with arrhythmias

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Outline

- Division structure/philosophy
- Training program
- Maintenance program/challenges
- Research theme examples

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Division Structure/Philosophy

- Triple-threat division
 - Basic scientist
 - Clinical scientist
 - Clinical scholar
- Disease-oriented research
- Diverse research training programs
- Encouragement/protected time

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ACGME/ABIM Training Requirements

- Internal medicine (2-3 yrs)
- Cardiovascular medicine (3 yrs)
- Clinical cardiac electrophysiology (1-2 yrs)
- Mentored research training (1-3 yrs)

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Training Programs - Common Features

- Pre-fellowship research opportunities
 - Sarnoff/Hughes endowments
 - MSTP/PSTP
 - House staff research electives
- CV fellowship 01 year
 - Research discovery rotation (research essay)
- Career differentiation
 - Investigator pathway
 - Basic scientist
 - Clinical scientist
 - Master clinical pathway
 - Clinical scholar

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Basic Scientist Pathway

- 01-02 yrs: Clinical CV medicine
- 03 yr: Clinical cardiac EP
- 04-06 yrs: Mentored research training
 - Training grant 04 yr
 - Research trainee award 05 yr (AHA, NRSA)
 - Trainee/faculty transition award 06 yr (NIH/AHA)
 - Limited clinical cardiac EP

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Basic Scientist Research Training Program

- Core Curriculum
 - Human/animal welfare/scientific integrity/ethics
 - Laboratory safety/federal regulations
 - Grant/manuscript preparation
 - Gel to animal/basic laboratory to human
 - Biostatistics
- Mentored/collaborative research
 - Specific research tools/methods
- Trainee research seminars
- Scientific advisory committee

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Clinical Scientist Pathway

- 01-02 yrs: Clinical CV medicine
- 03-04 yrs: Mentored research training
 - Training grant 03 yr
 - Research trainee award 04 yr (AHA, NRSA)
- 05 yr: Clinical cardiac EP
- 06 yr: Faculty transition award (NIH/AHA)

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Clinical Scientist Research Training Program

- Core Curriculum
 - Human/animal welfare/scientific integrity/ethics
 - Laboratory safety/federal regulations
 - Grant/manuscript preparation
 - Evidence-based medicine/designing outcomes and clinical research
 - Biostatistics
- Mentor/collaborative research
 - Specific research tools/methods
- Trainee research seminars
- Scientific advisory committee

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Maintenance - Basic/Clinical Scientist

- Adequate protected time
- Adequate start-up package (3 yrs)
 - Incentive (retain 50% unused start-up monies) to acquire grant support
- Faculty advisory committee
 - Clear expectations of goals
 - Feedback 1-2 times each year
 - Formal written evaluation 04 yr
- Shared resource mentality
- Access to trainees

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Challenges – Basic/Clinical Scientist

- Protected time
 - Independent grant support
 - Center/SCCOR/PPG grants
- Integration into clinical service
 - Part-time FTE in a 24/7 clinical service
- Maintenance of clinical skills/volumes
 - Acceptance of loss of some skills

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Clinical Scholar Pathway

- 01-02 yrs: Clinical CV medicine
- 03 yr: Clinical research experience/clinical cardiac EP
- 04 yr: Clinical cardiac EP

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Clinical Scholar Research Training Program

- Core Curriculum
 - Human/animal welfare/scientific integrity/ethics
 - Laboratory safety/federal regulations
 - Industry grant/manuscript preparation
 - Evidence-based medicine/designing outcomes and clinical research
 - Biostatistics
- Participation in clinical trial
- Trainee research seminars
- Trainee advisory committee

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Challenges – Clinical Scholar

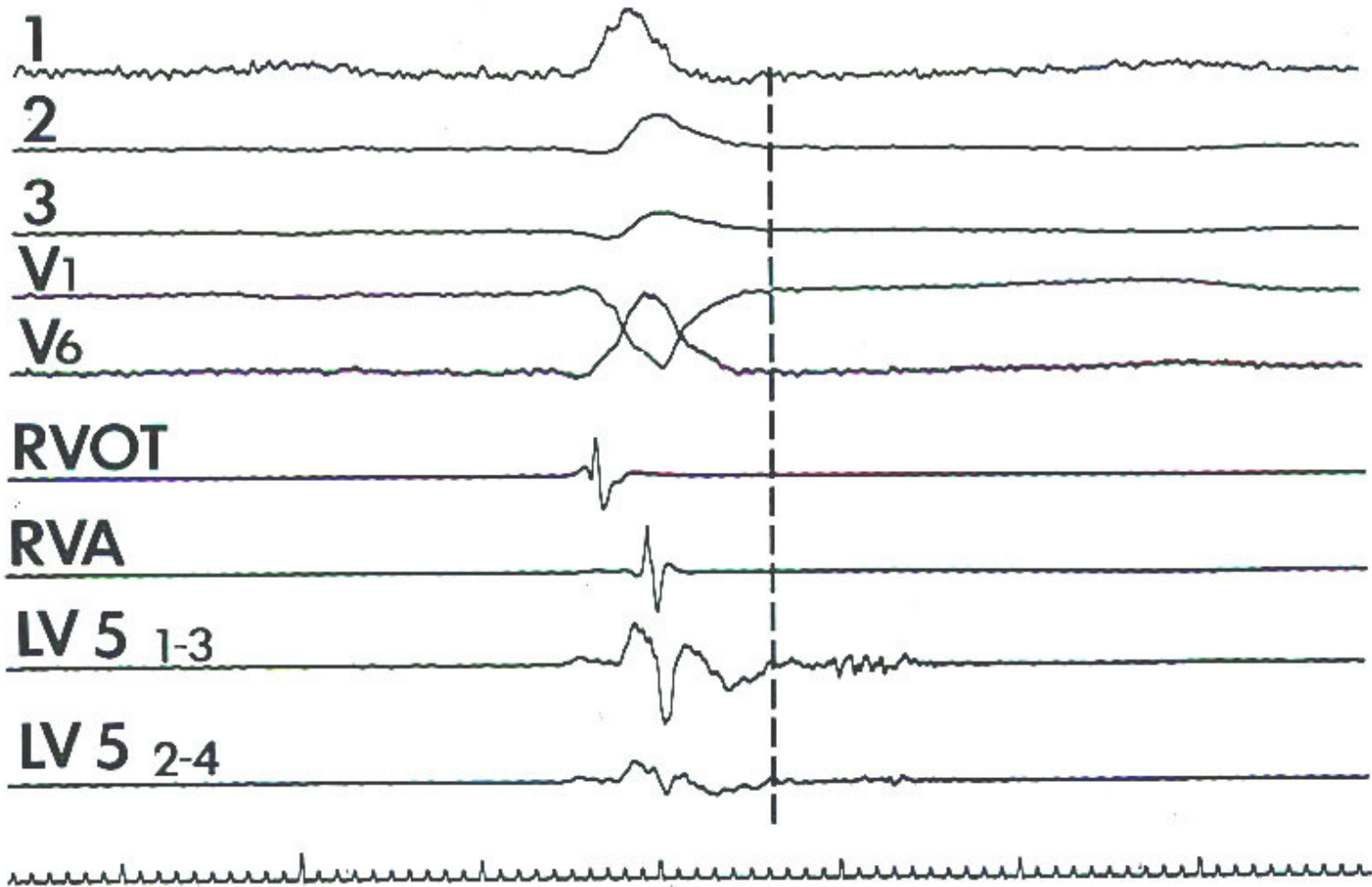
- Protected time
 - Acquisition of industry-sponsored project
 - Participation in clinical trials
 - Participation in Center/SCCOR grants
 - Scholarly publications
- Participation in a 24/7 clinical service
 - Loss of academic mission
- Maintenance of clinical skills/volumes
 - Developing/learning innovative procedures

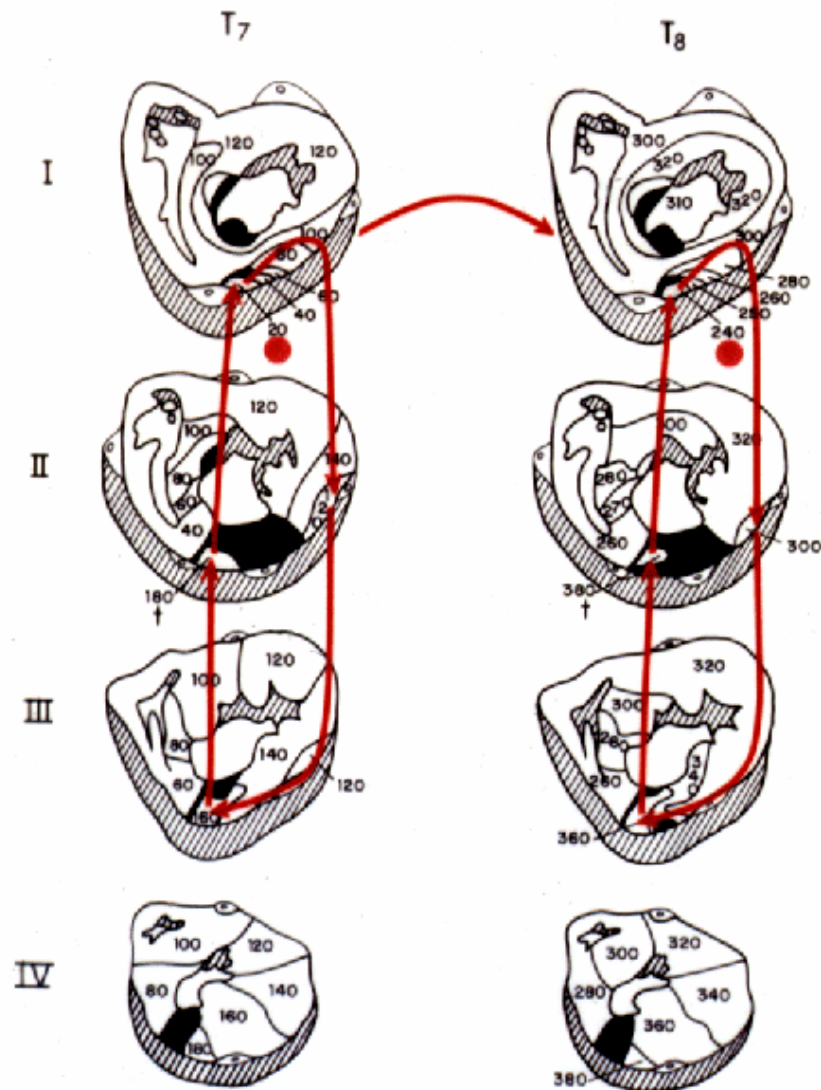
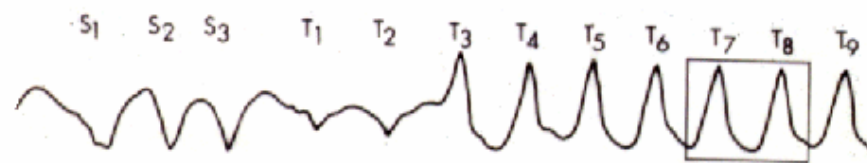
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Research Theme-Sudden Cardiac Death

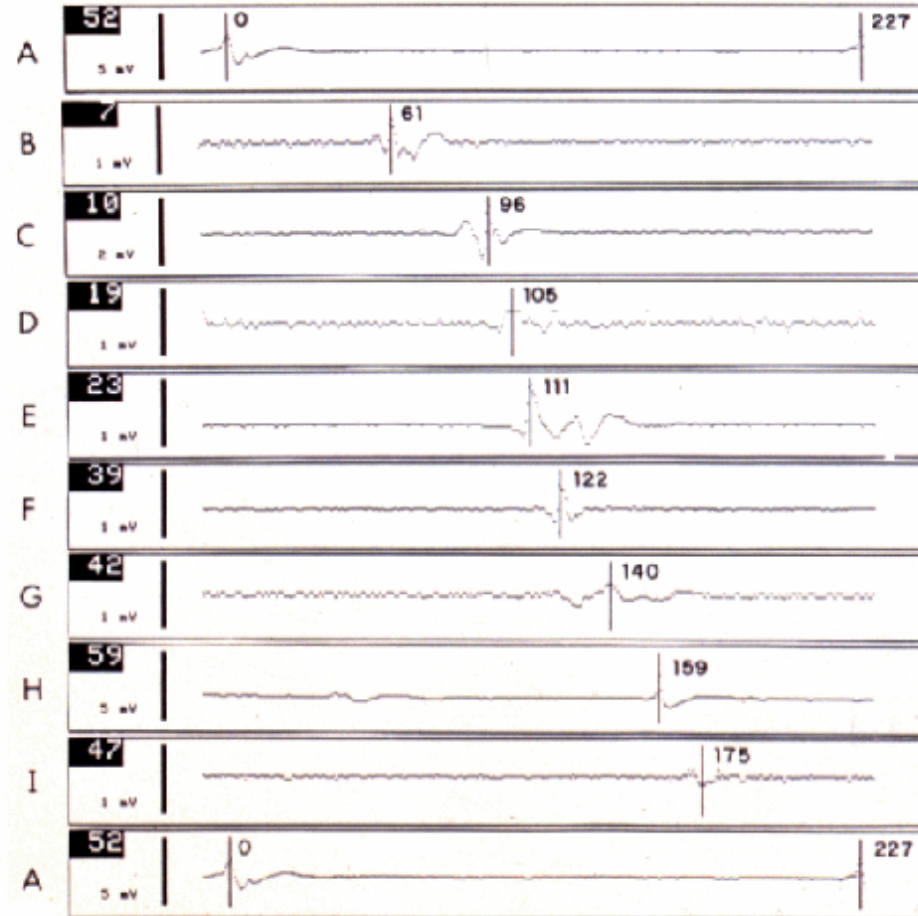
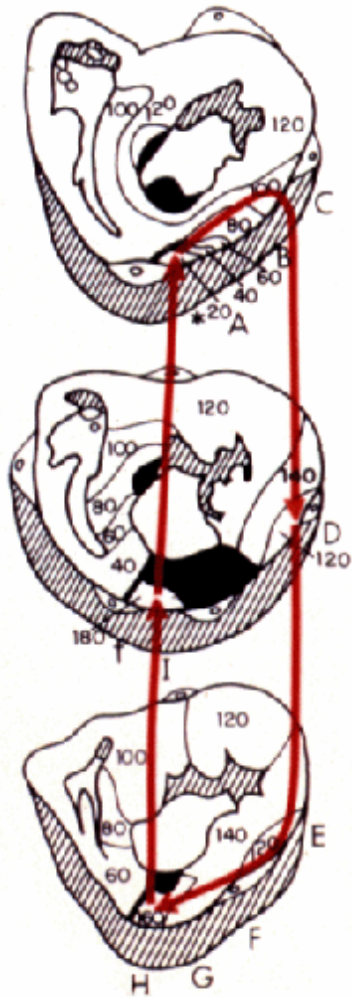
- Mechanisms of VT/VF
 - Ion channels
 - Gap junctions
 - Wave fragmentation
 - Border zone remodeling
- Develop pathophysiologically-based risk stratification method
- Establish proof-of-concept in select patient group
- Clinical trial

Electrophysiologic Basis for VT after MI



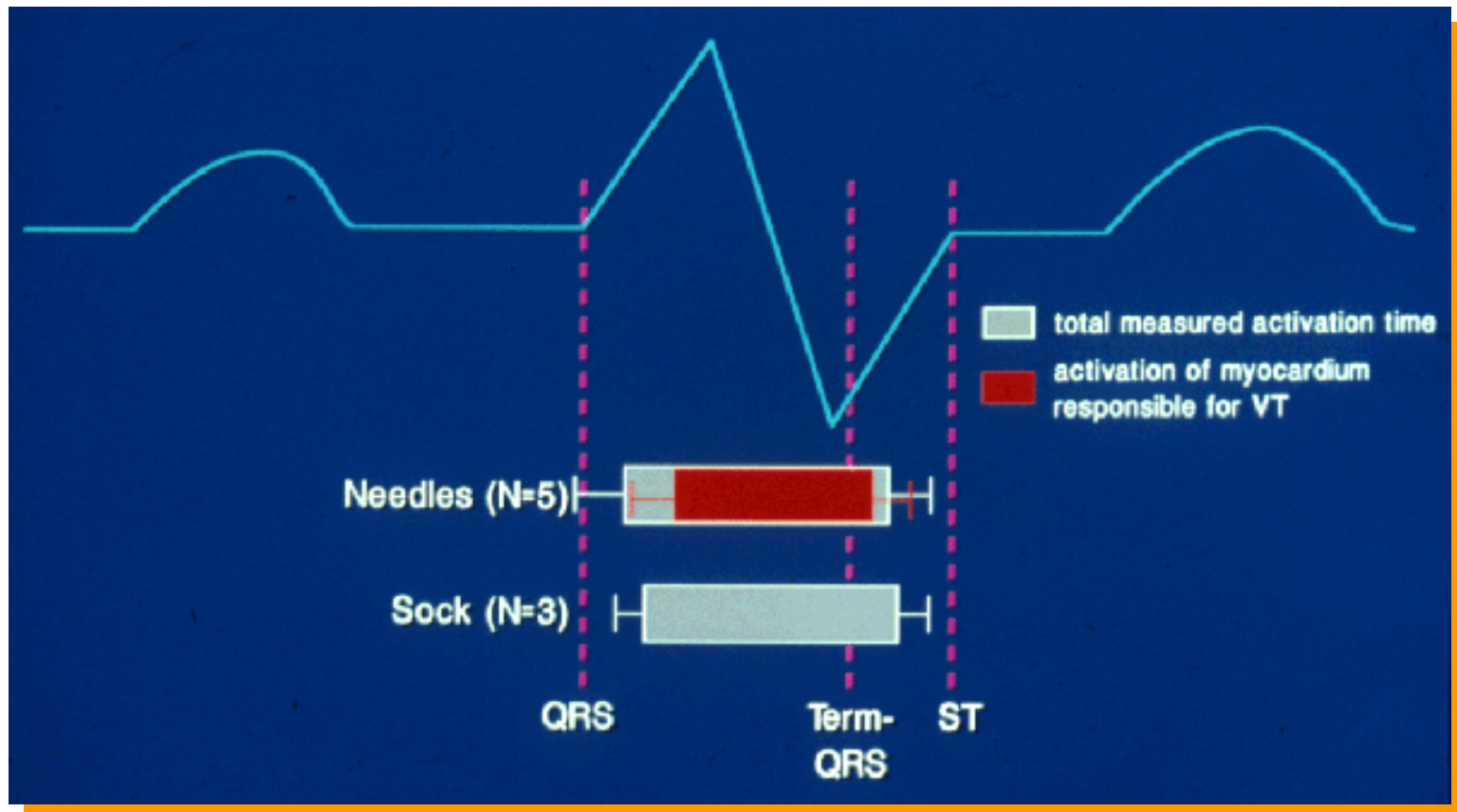


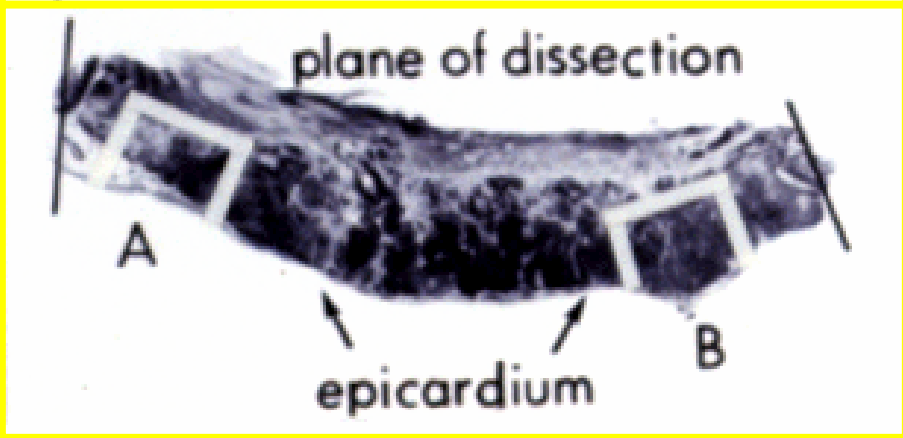
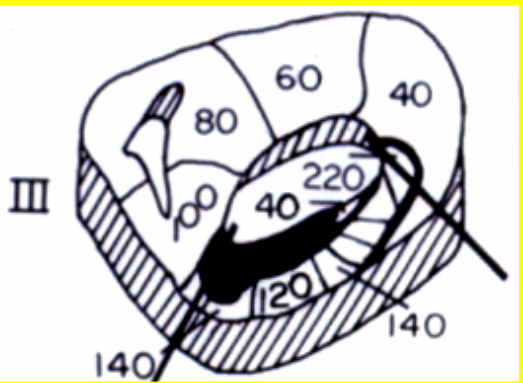
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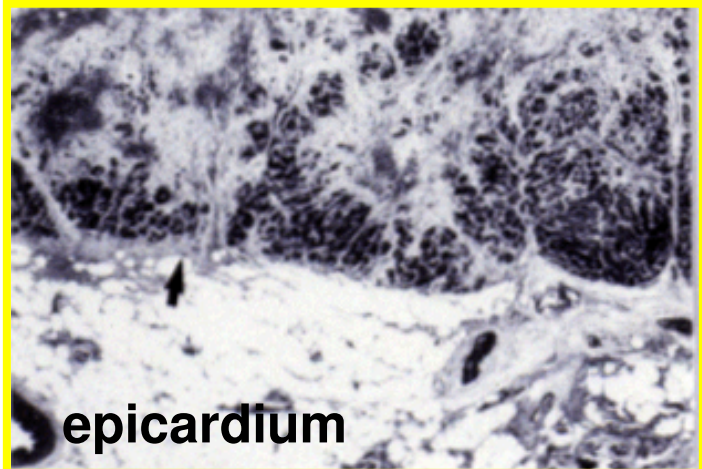
Activation During Sinus Rhythm

(Patients with Macroreentrant VT)

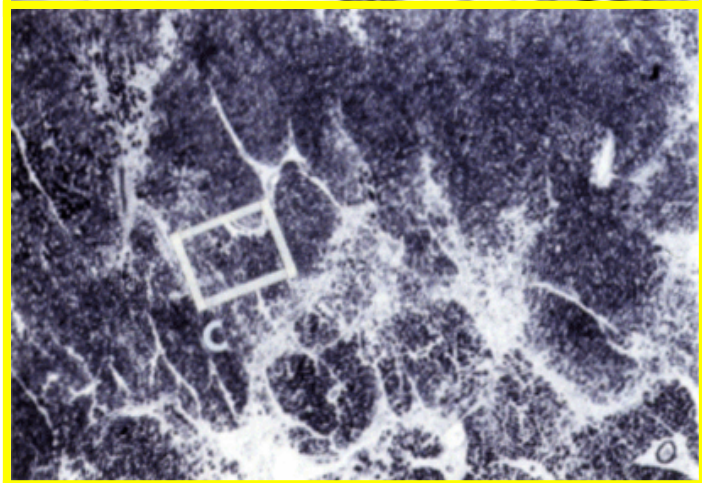




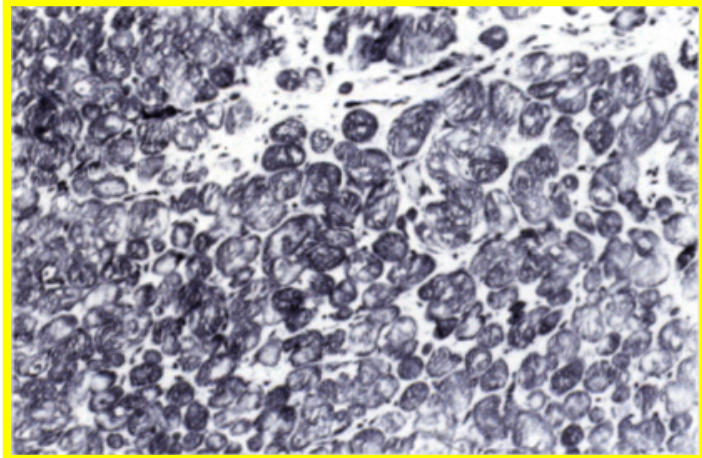
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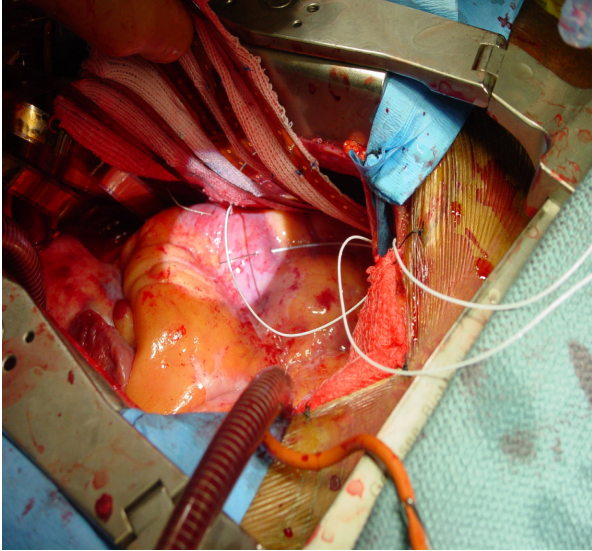
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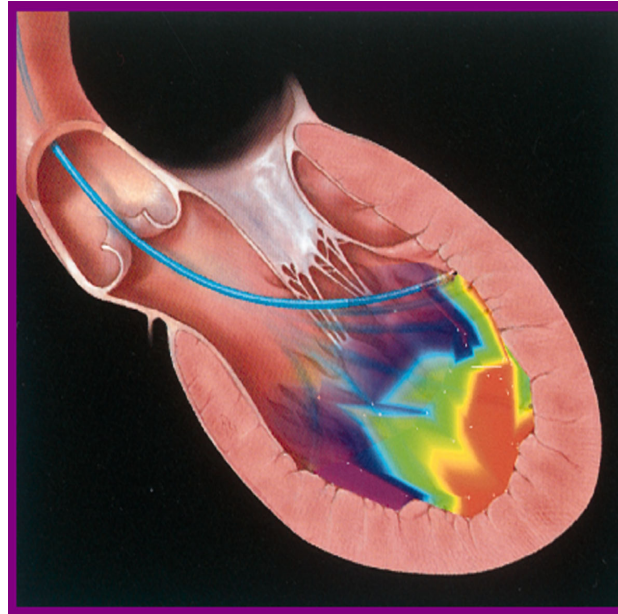
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Methods for Mapping and Imaging Arrhythmias



Intraoperative mapping

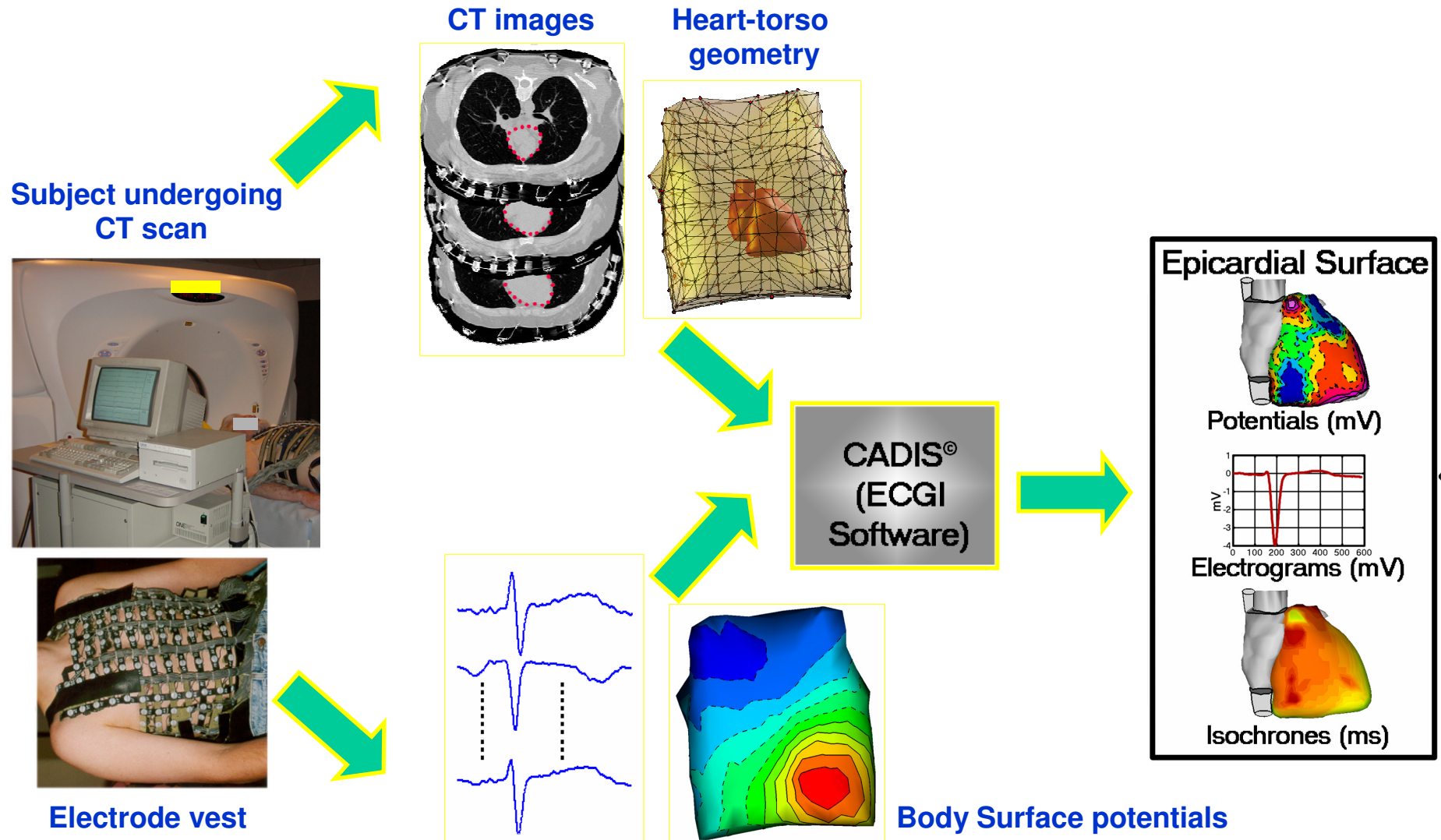


Catheter Mapping

Electrocardiographic
Imaging (ECGI)



ECGI Procedure



Careers in EP Research

Research Theme-Sudden Cardiac Death

- VT/VF in heart failure
 - Maladaptive switch FA/glucose energy utilization
 - Accumulation of long-chain FA proarrhythmic
 - Type-2 diabetes/ischemia augments FA accumulation
- Proof-of-concept in diabetic/heart failure patients
 - Positron emission tomography
 - MRI interrogation infarct border zones
- Development novel therapies
- Clinical trial