Case Study 5

Simulation of Bioelectric Fields: Cardiac Defibrillation and Transcranial Stimulation

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Carma

Heart Disease is a Killer

Cardiovascular Disease and Other Major Causes of Death for All Males and Females United States: 2005

Males
- CVD+Congenital Cardiovascular Defects
- Cancer
- Accidents
- Chronic Lower Respiratory Disease
- Diabetes

Females
- CVD+Congenital Cardiovascular Defects
- Cancer
- Chronic Lower Respiratory Disease
- Alzheimer’s
- Accidents
Case Study 5

Simulation of Defibrillation in Children

Defibrillation in Action

PVC
VENTRICULAR TACHYCARDIA
FLUTTER
FIBRILLATION
DEFIBRILLATION
Implantable Cardiac Defibrillators (ICD)

68,000 adult cases annually in the US (2004)

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Ad Hoc Configurations in Children

Gasparini, JCE, 2005  Stephenson, JCE, 2006  CHB Case
Goal: Help Pediatric Cardiologists optimize and customize placement of ICD.
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Interactive ICD Placement

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Calculate Voltages
Report Results

Validation
Validation

Measurement Reconstruction

Simulation

The Future

Make Model

Place Device

Predict Outcomes

Modify Placement

Perform Implantation

Report Results
Transcranial Brain Stimulation

Don Tucker
Department of Psychology

[Images of brain scans and names of researchers]
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“Faradization”

Duchenne de Boulogne (1806-1875)

Transcranial Stimulation: Beginnings

Sylvanus P. Thompson, 1910
Transcranial Stimulation: Modern Era

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Anthony Barker, 1985

Stimulation Approaches

Magnetic

Electric

Time-varying current in coil

Time-varying magnetic field

Induced current in conductor

DC current applied via pair of electrodes; current induced in conductor

Hand-held coil

Camera device
tDCS Goals

Clinical Goal

Technical Goal

Patch Electrode Results

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Electrode Array Results

Case Study 5

Electrode Array Results

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tDCS Current Status

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Patch

Array
Optimization Goals (Future)

Simulation to optimize the system

The Tools

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