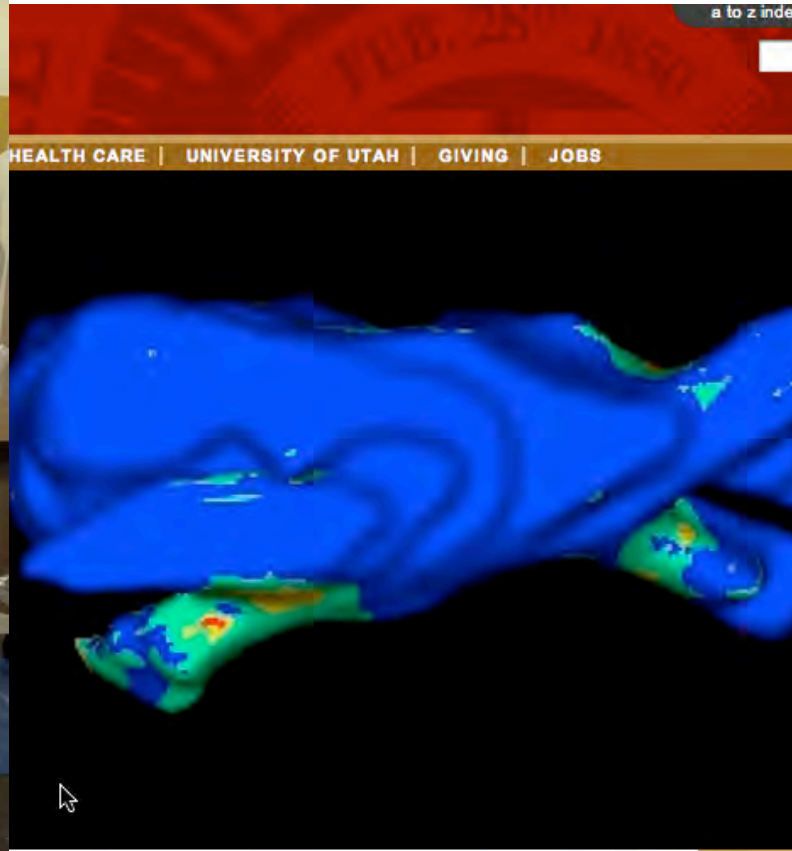# Imaging Based Analysis of Patients with Atrial Fibrillation

Rob MacLeod, University of Utah
CARMA Center, SCI Institute, CVRTI
Bioengineering Department

SCI INSTITUTE

CIBC

CARMA
COMPREHENSIVE ARRYTHMIA
RESEARCH & MANAGEMENT CENTER

What is Atrial Fibrillation?
= Afib = AF

Background I

John C Grammer MD FACC

Comprehensive **A**rrhythmia **R**esearch and **MA**nagement

Atrial Fibrillation Illustrated

ATRIAL FLUTTER WITH 3:1 CONDUCTION

Normal Contraction
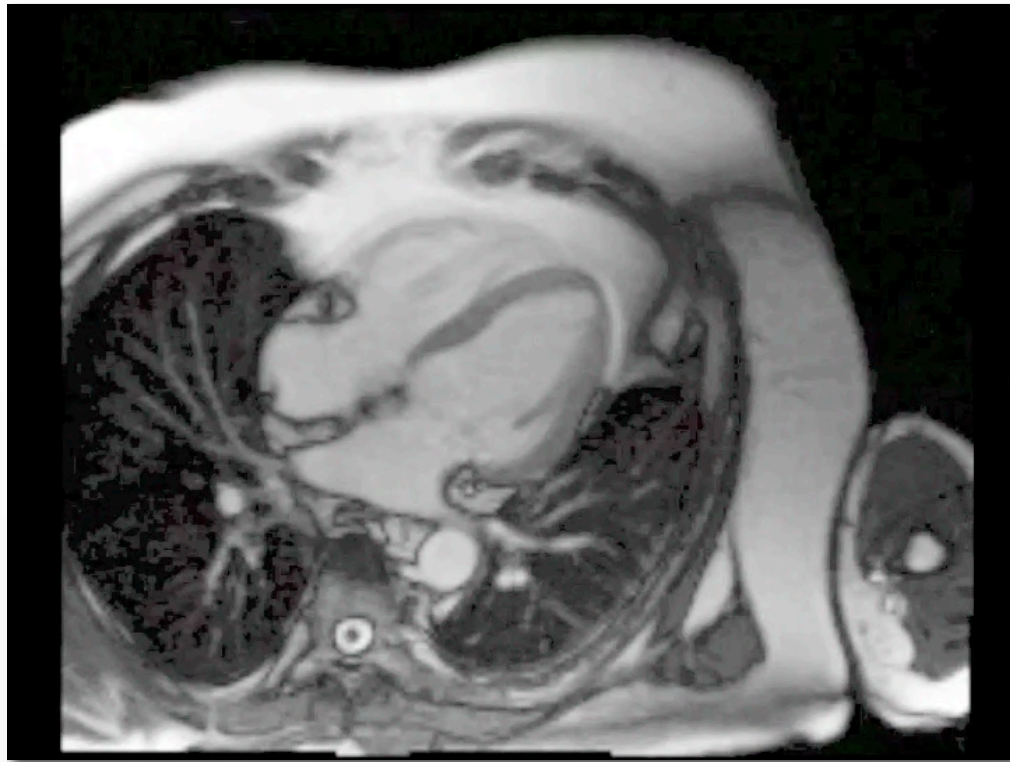
Atrial Fibrillation

AF Prevalence

Miyasaka et al. *Circulation.* 2006;114:119-125.
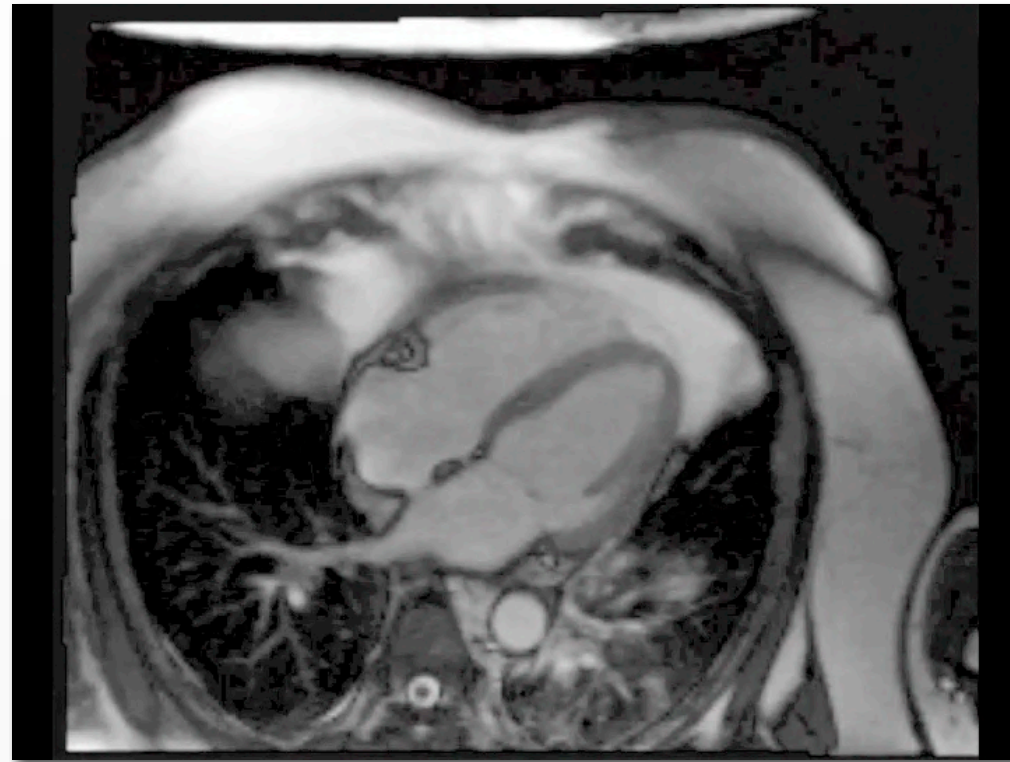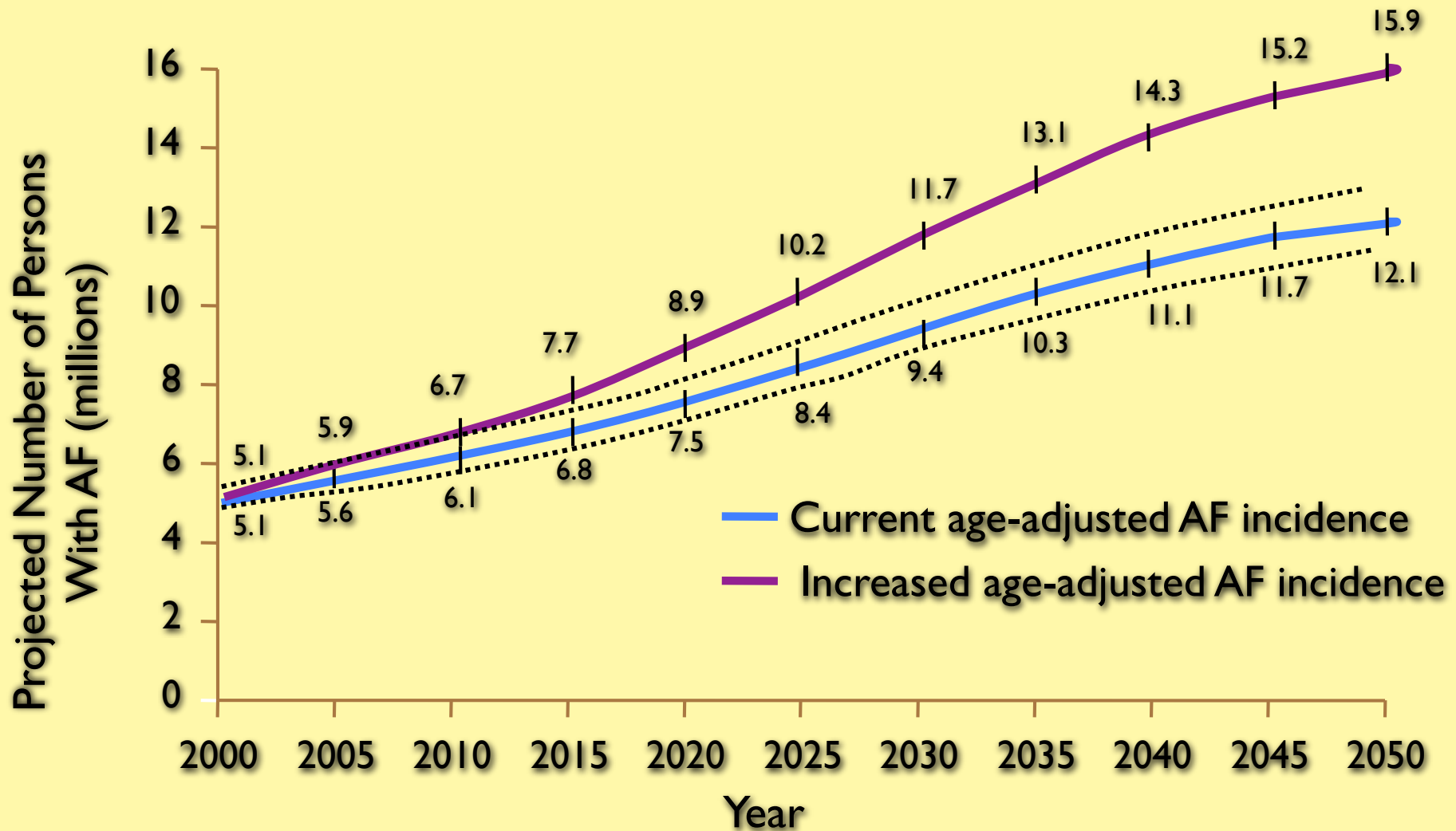
20% of Strokes
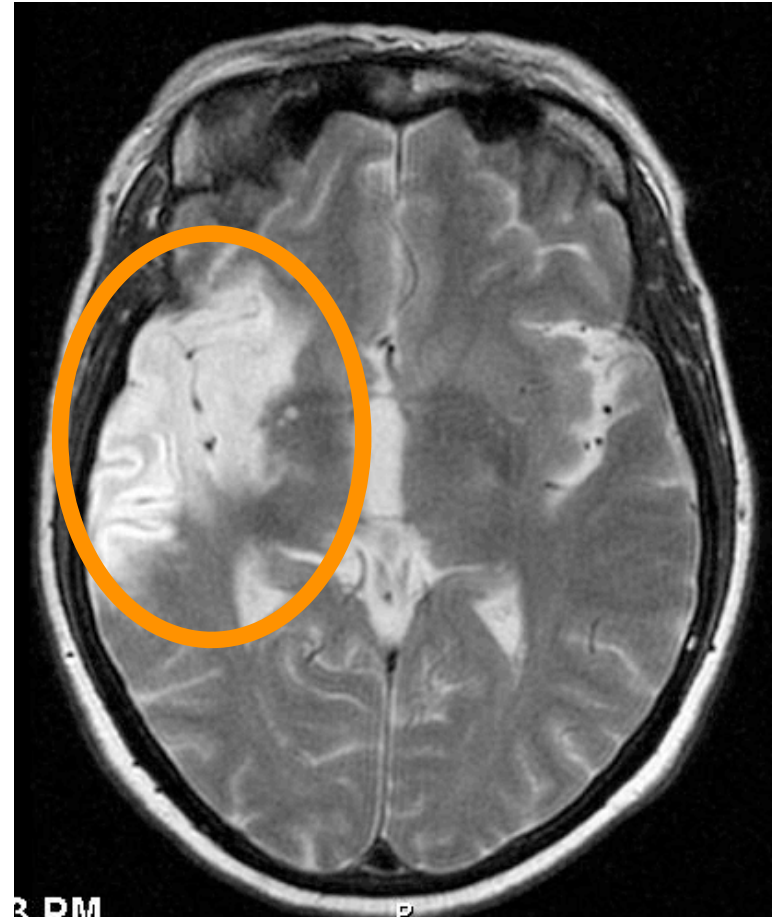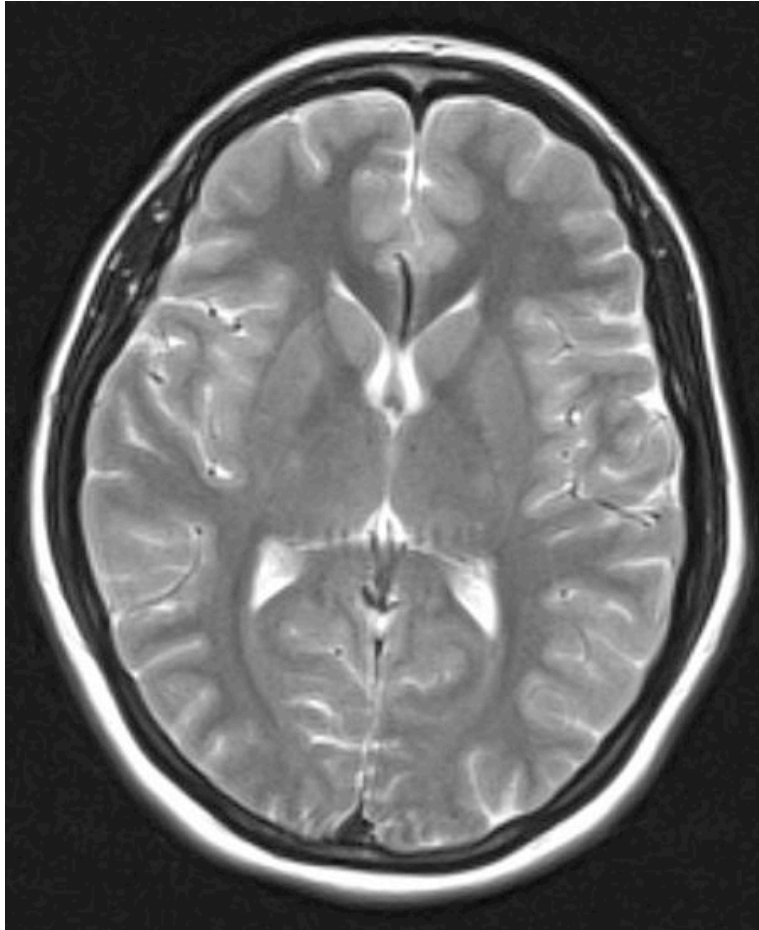
$20 billion/year

The CARMA Mantra

"AF is a heart tissue disease"

| Normal | Early stage | Mid stage | Late stage |
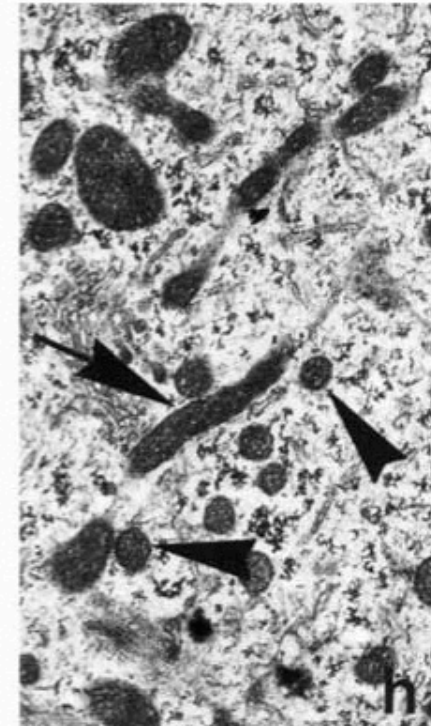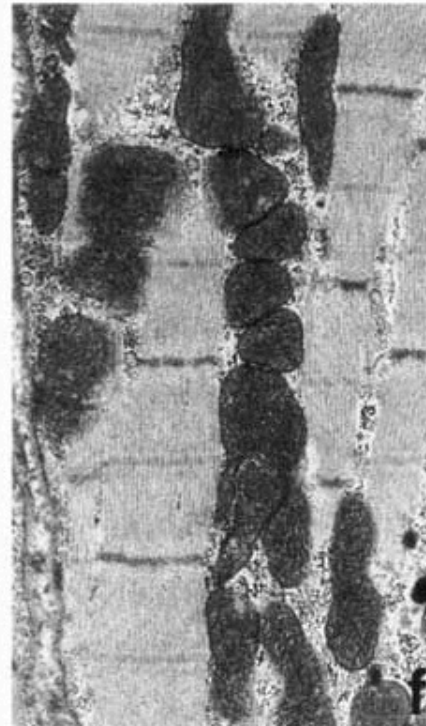
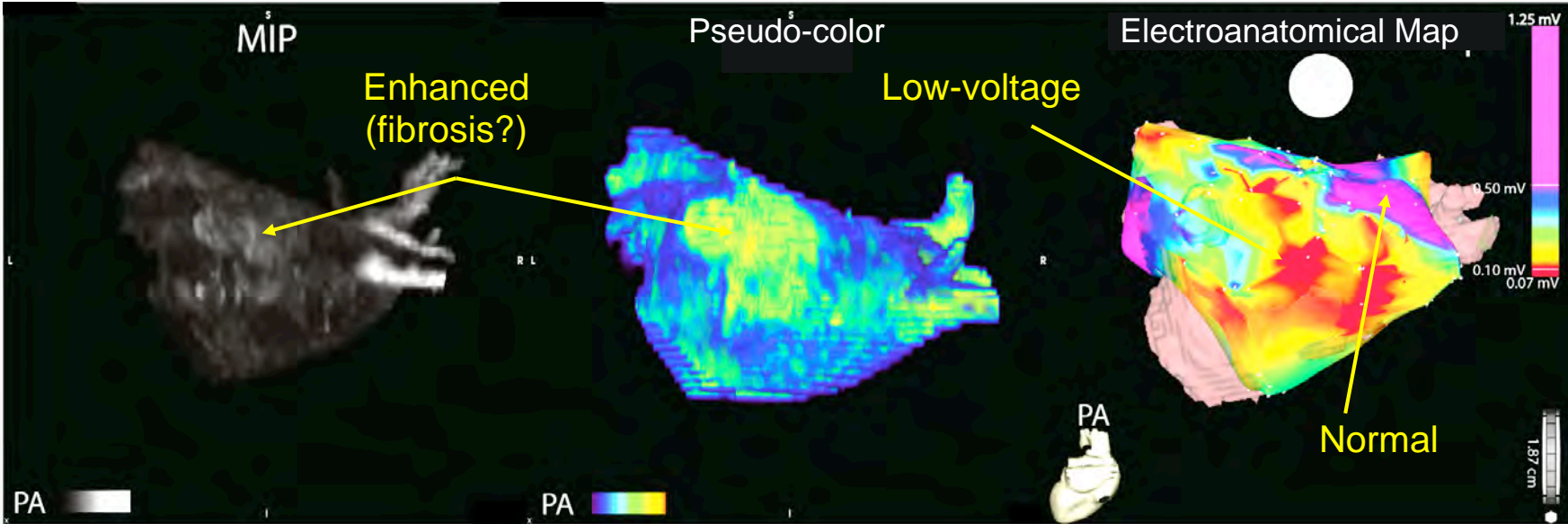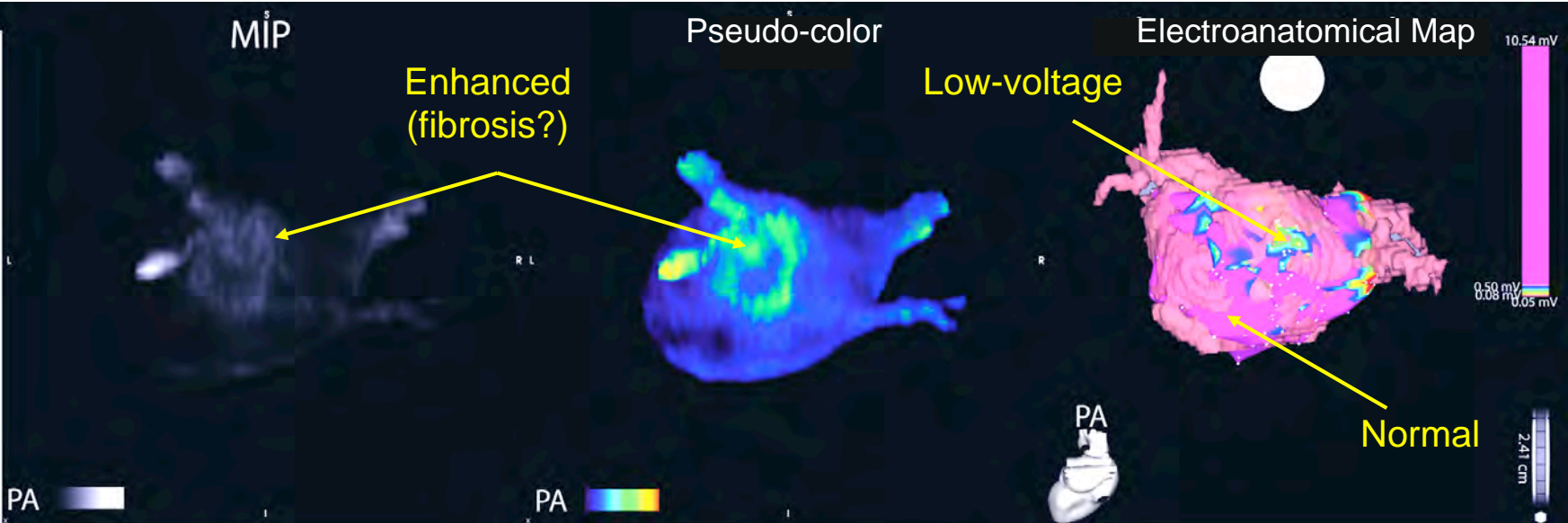Ausma J, ... Allessie M ...J mol Cell Cardiol. 2001: 2083.

Structure Matters

Late Gadolinium Enhancement
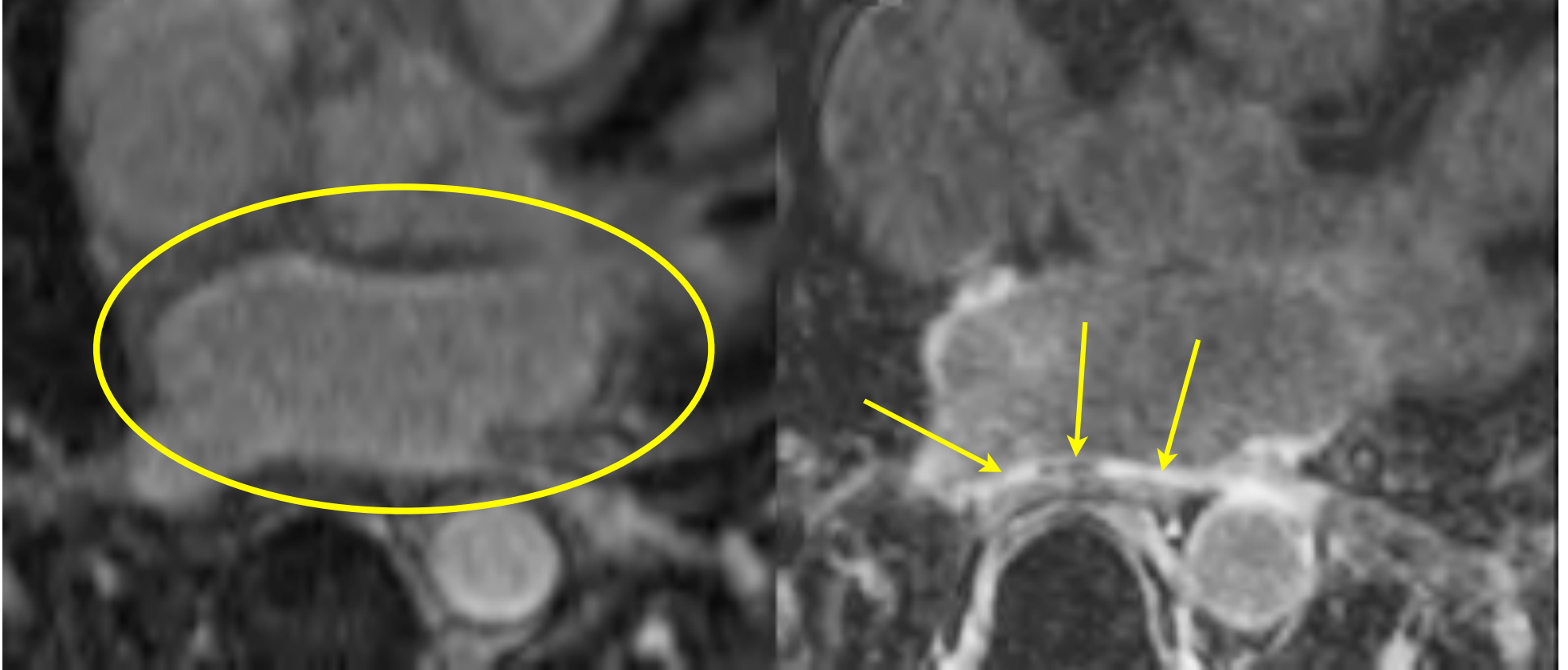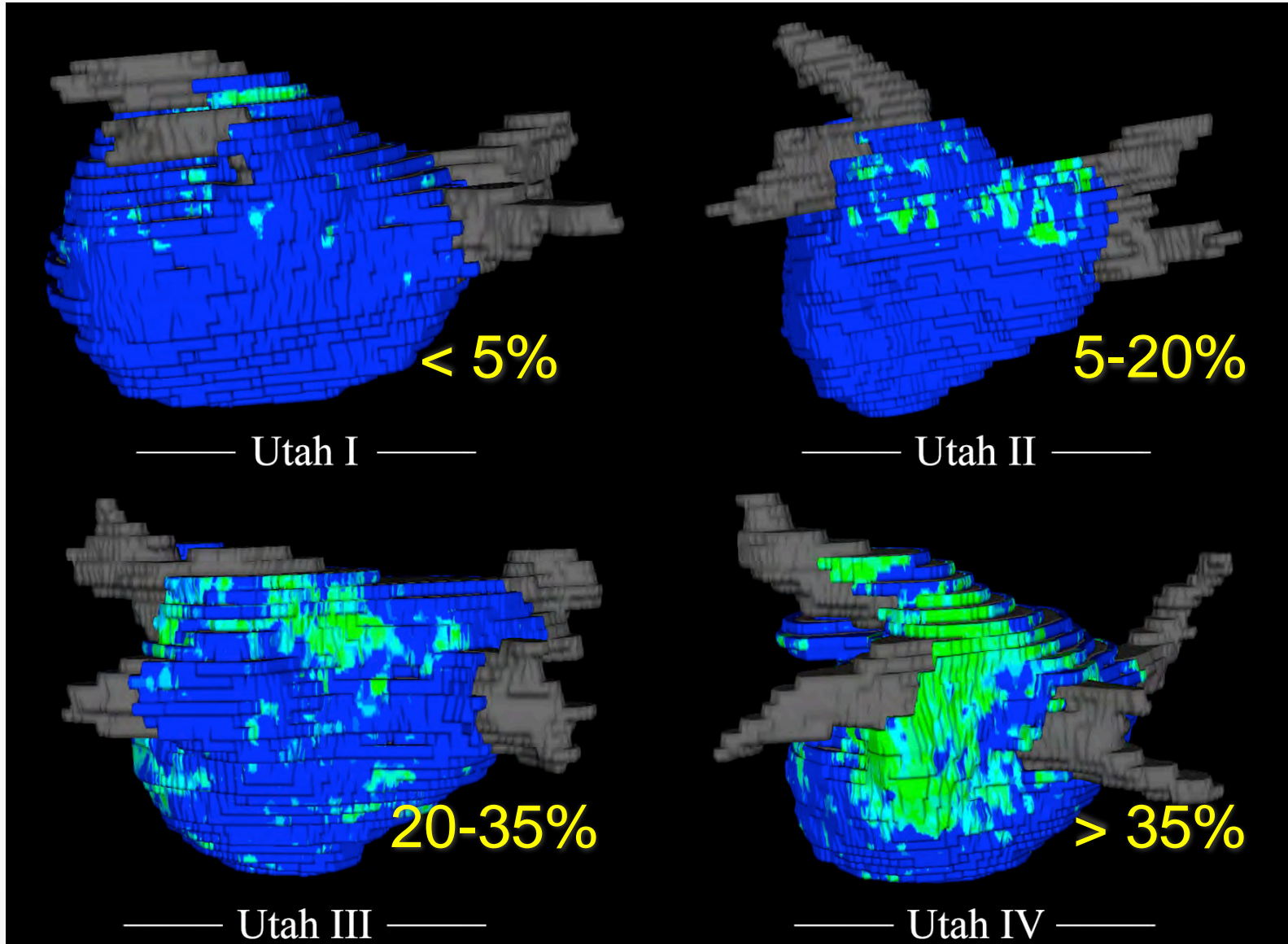

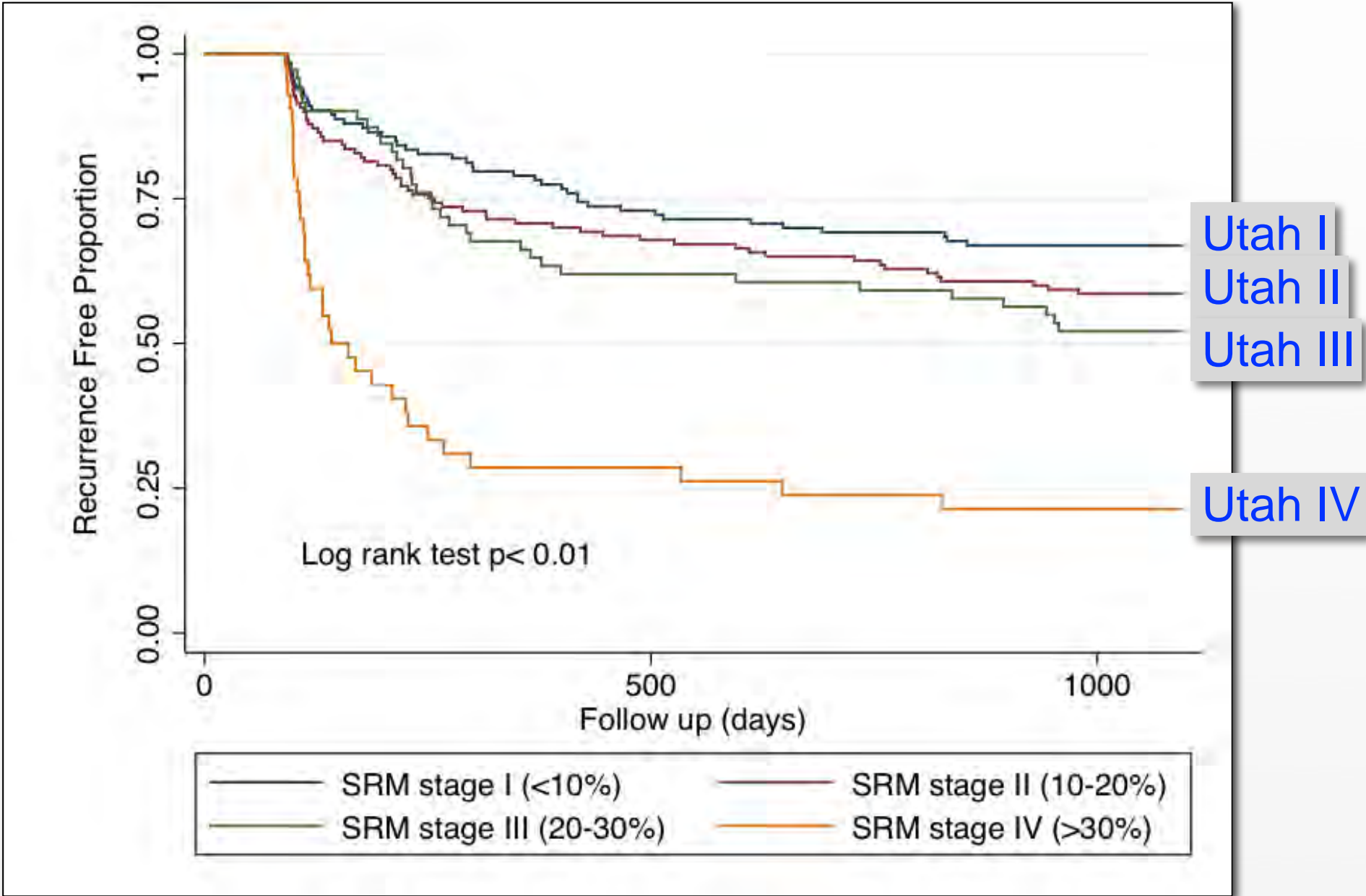Pre-treatment   3 month Post

CARMA Started Here

Utah Scoring Scheme: 2011

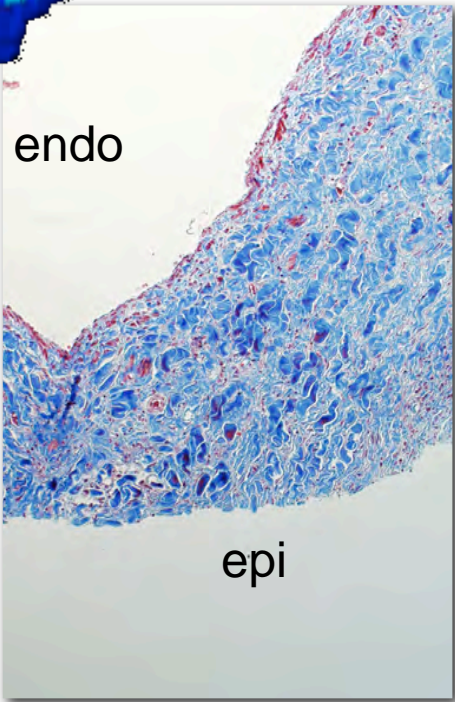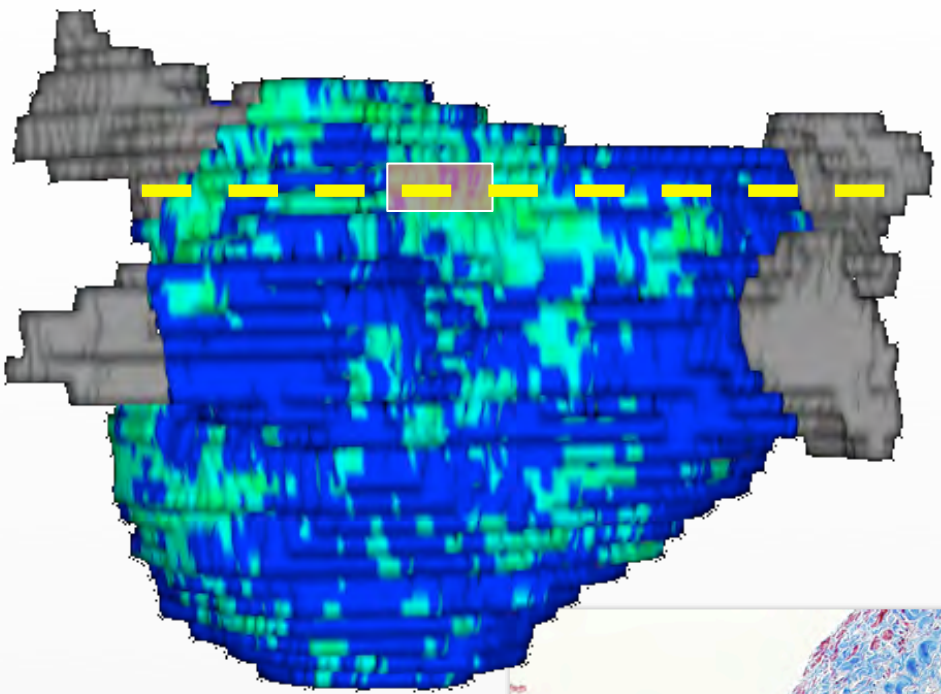# Utah Score Predicts Outcome

MRI & Fibrosis: Blue is Normal
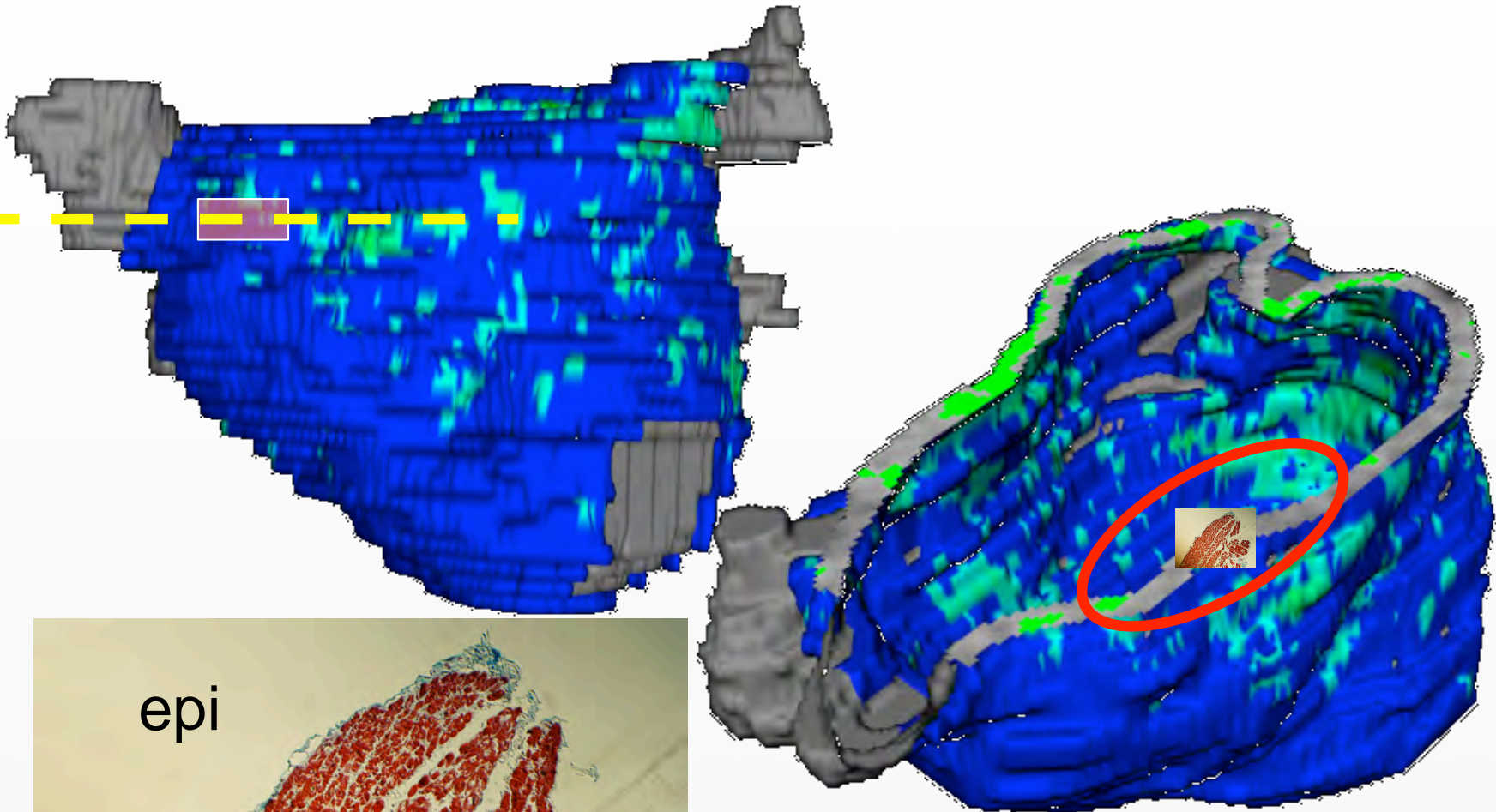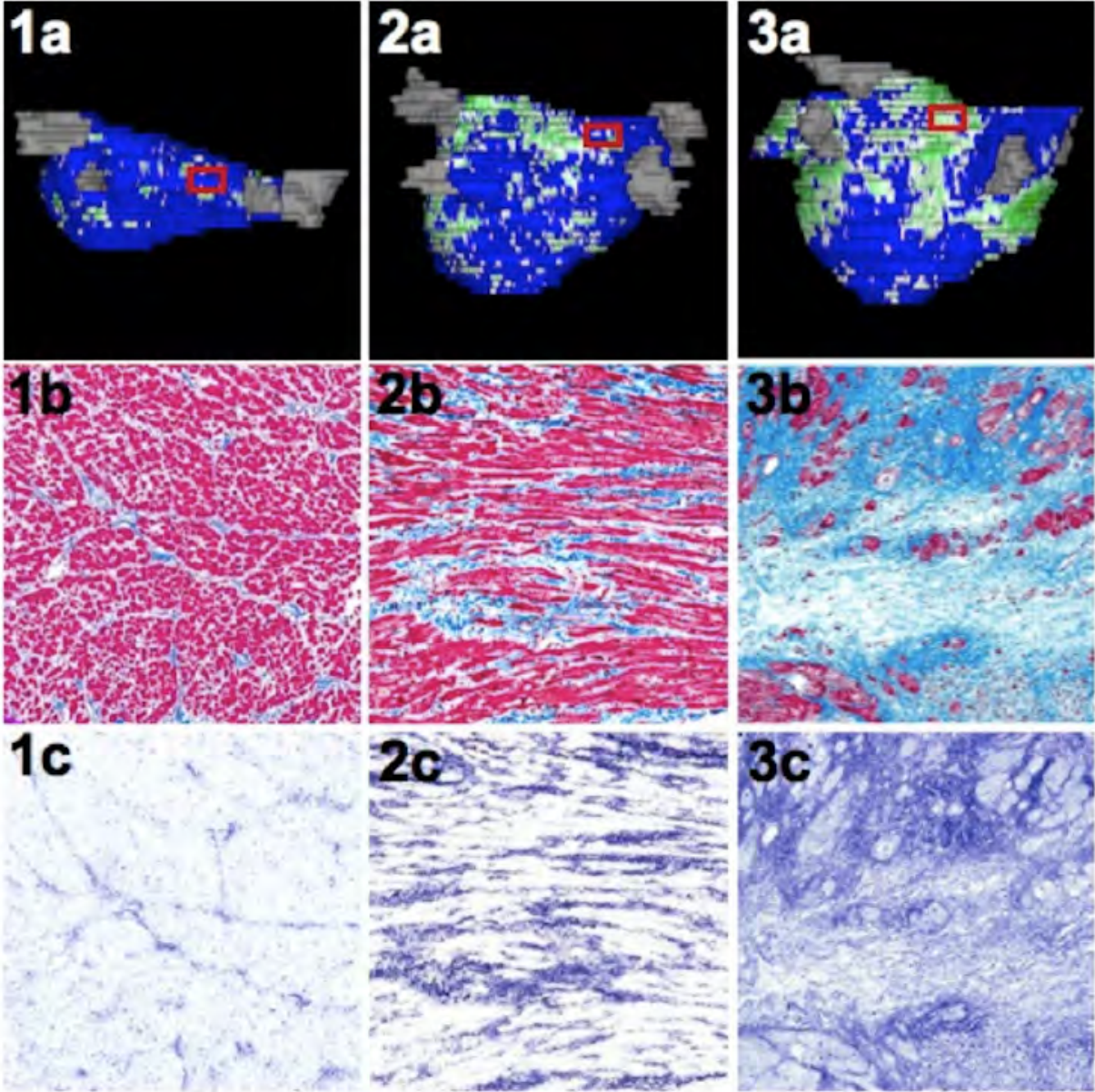

Chris McGann

Amit Patel

epi
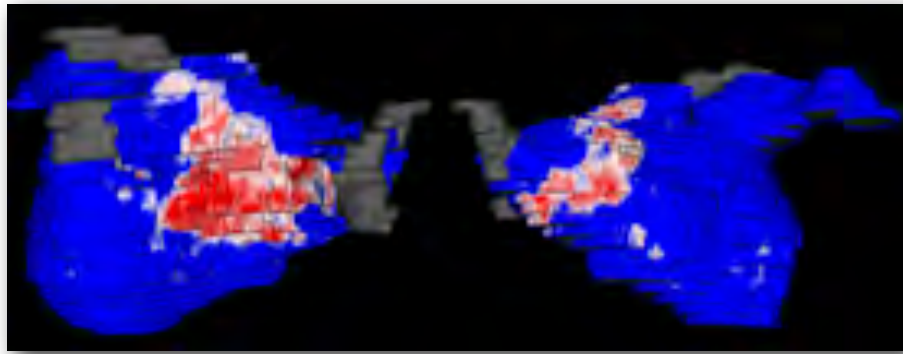
endo
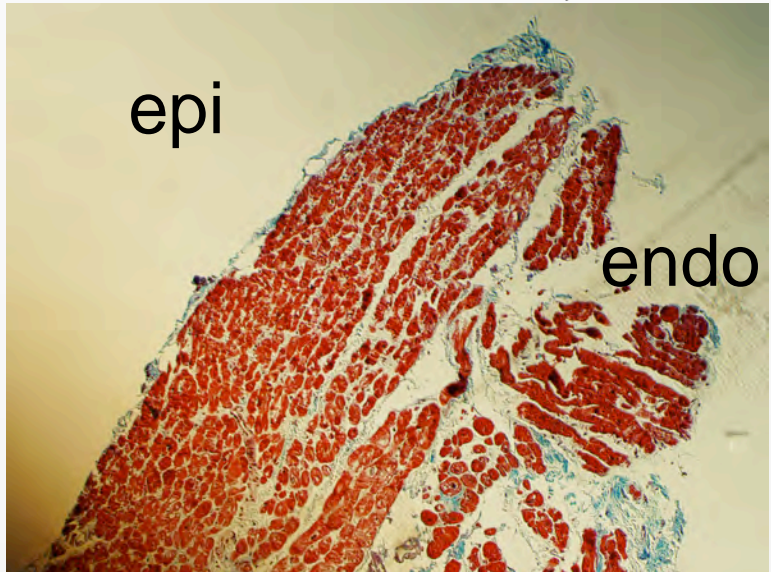
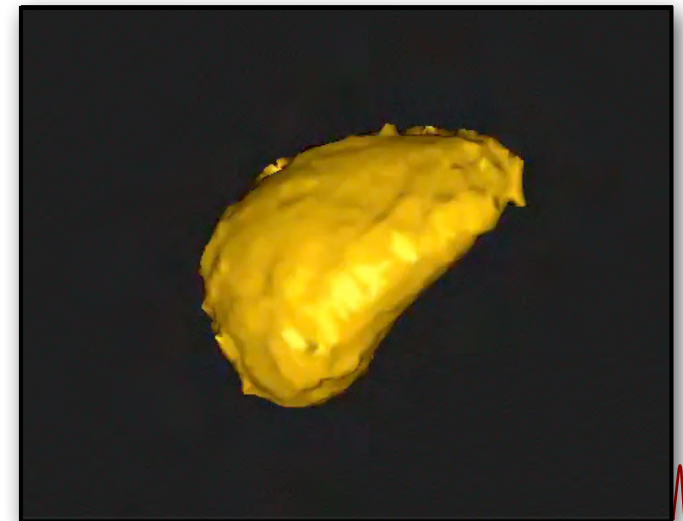# MRI & Fibrosis: Green is Fibrosis
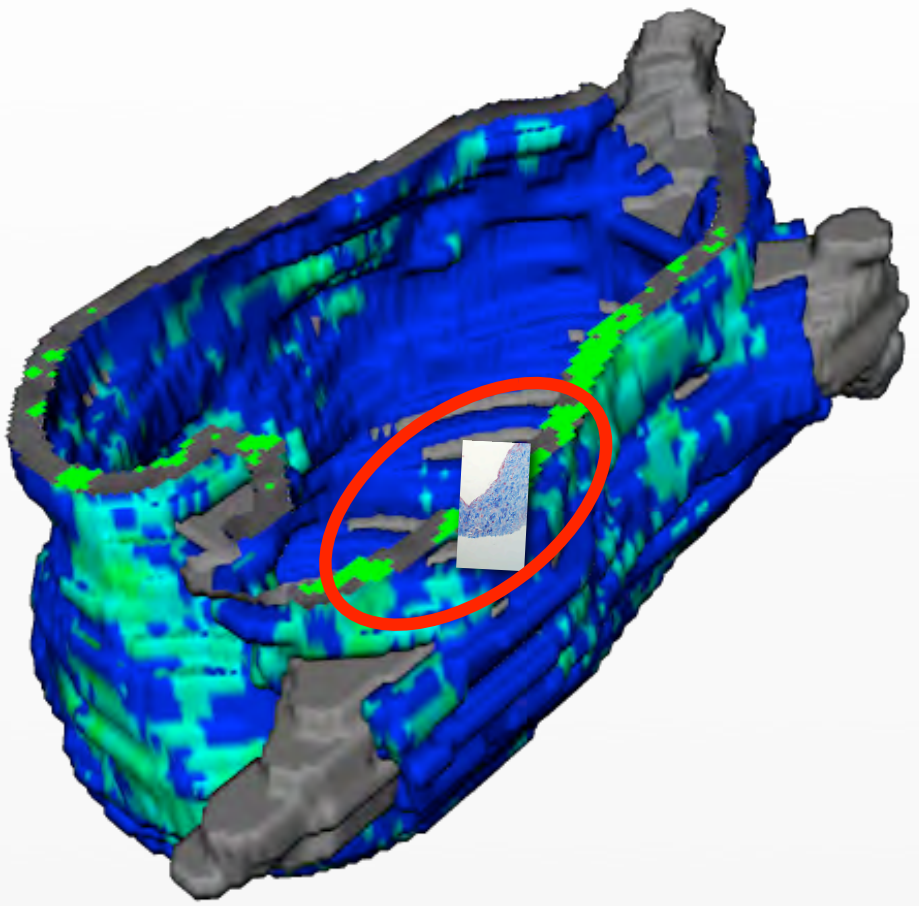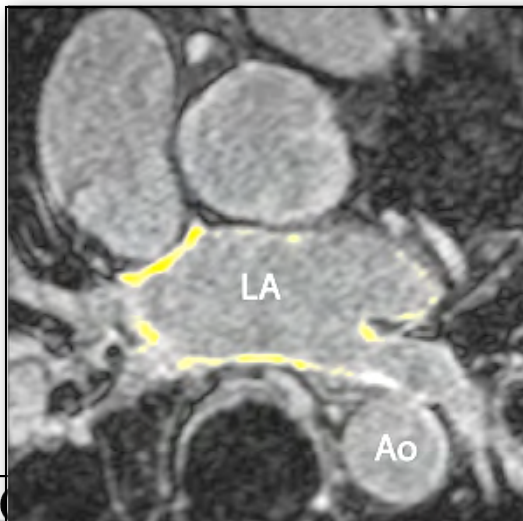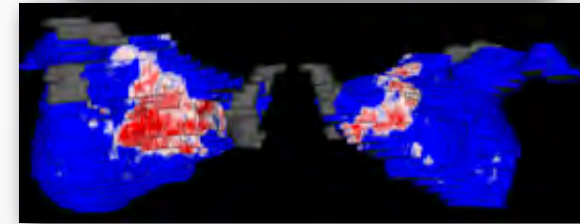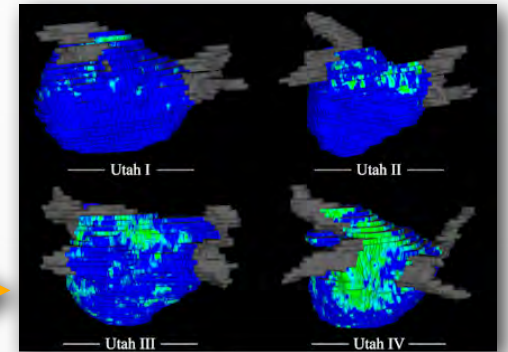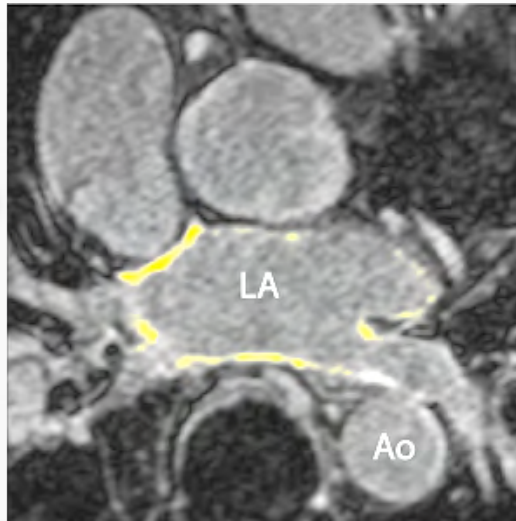
Histology Summary

Control | AF-mix | AF-fibrosis
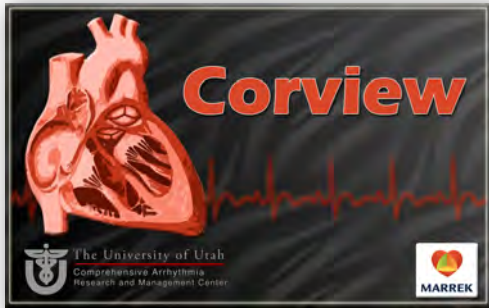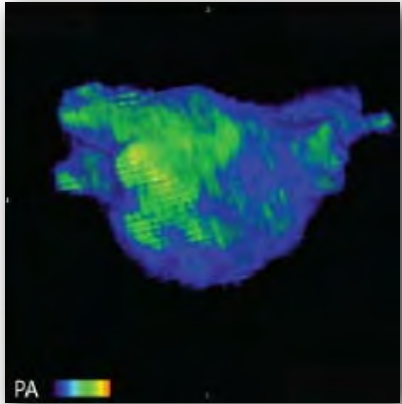
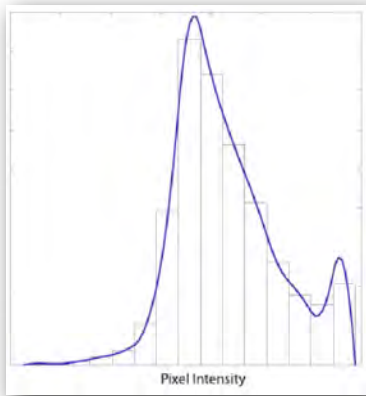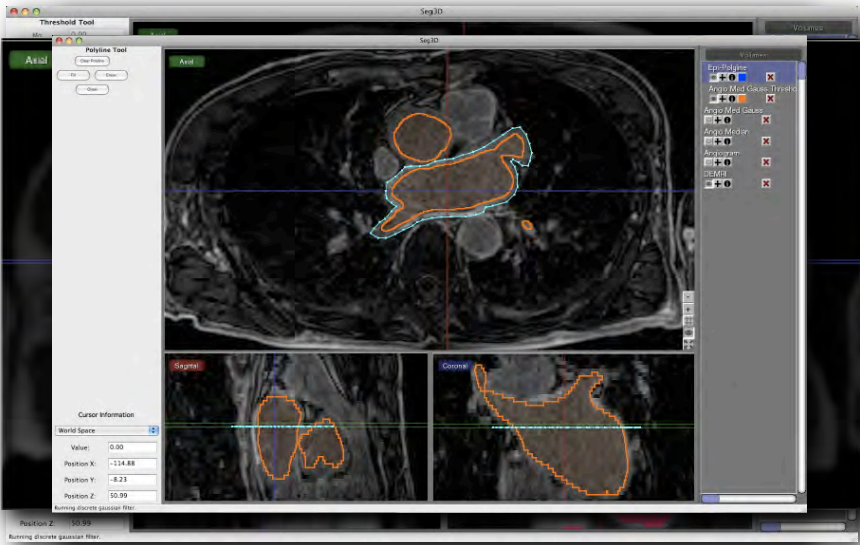# Fibrosis Analysis
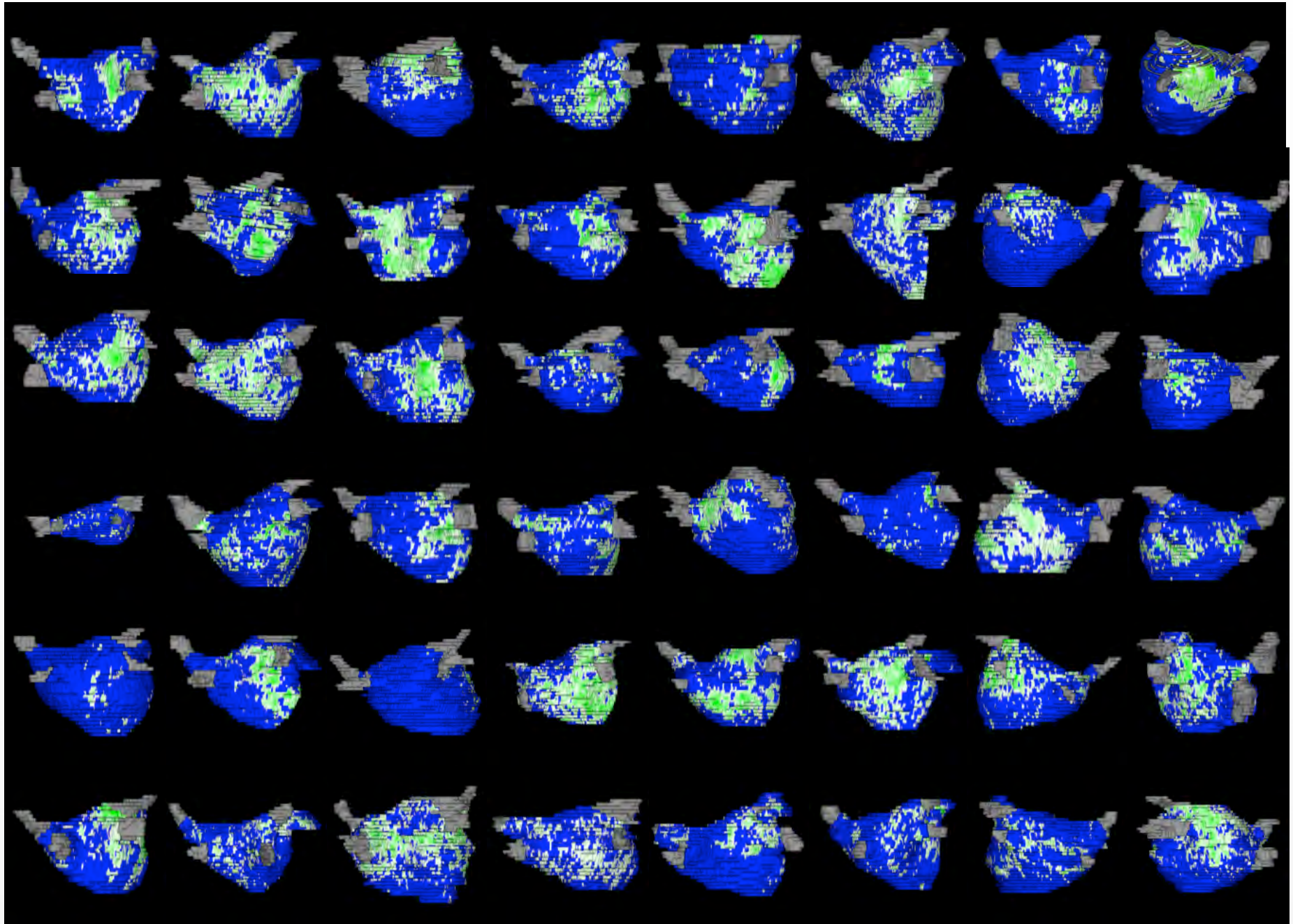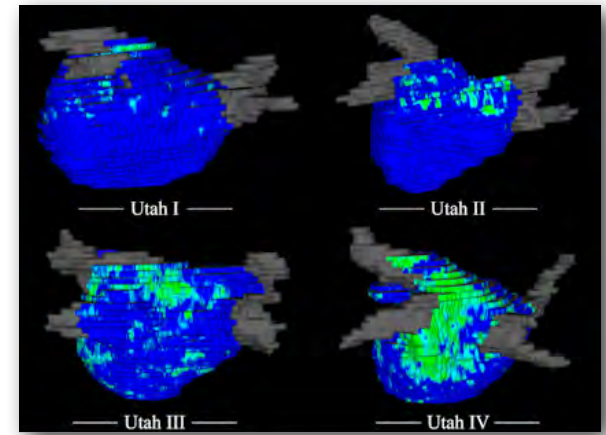
What Role Does Image Segmentation Play?
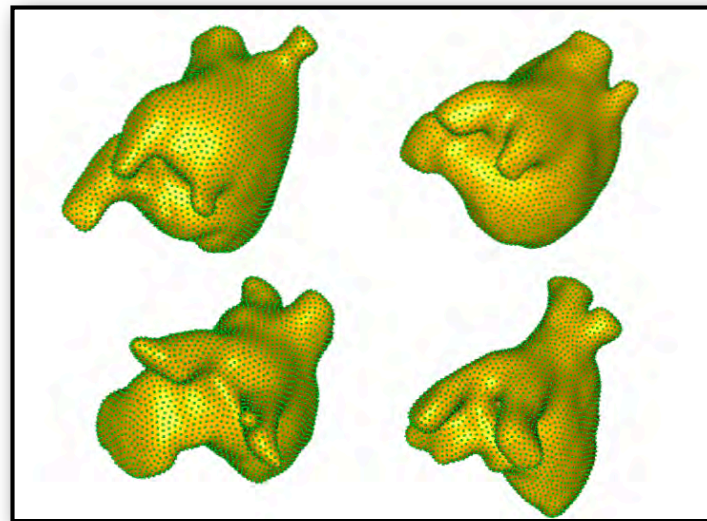
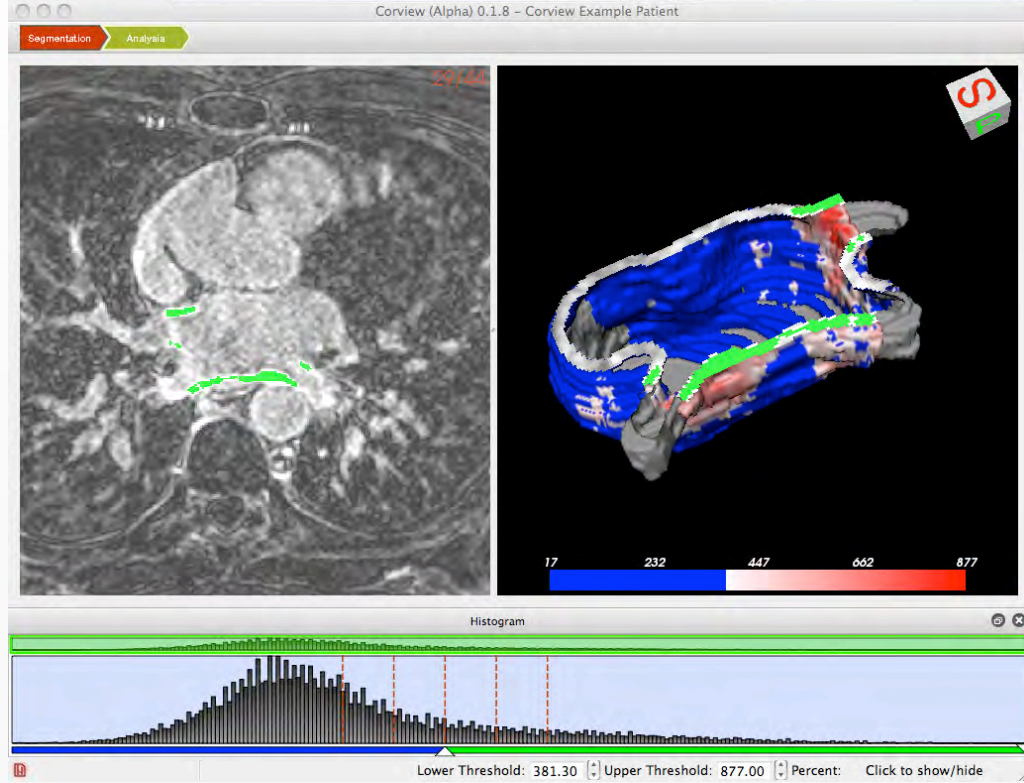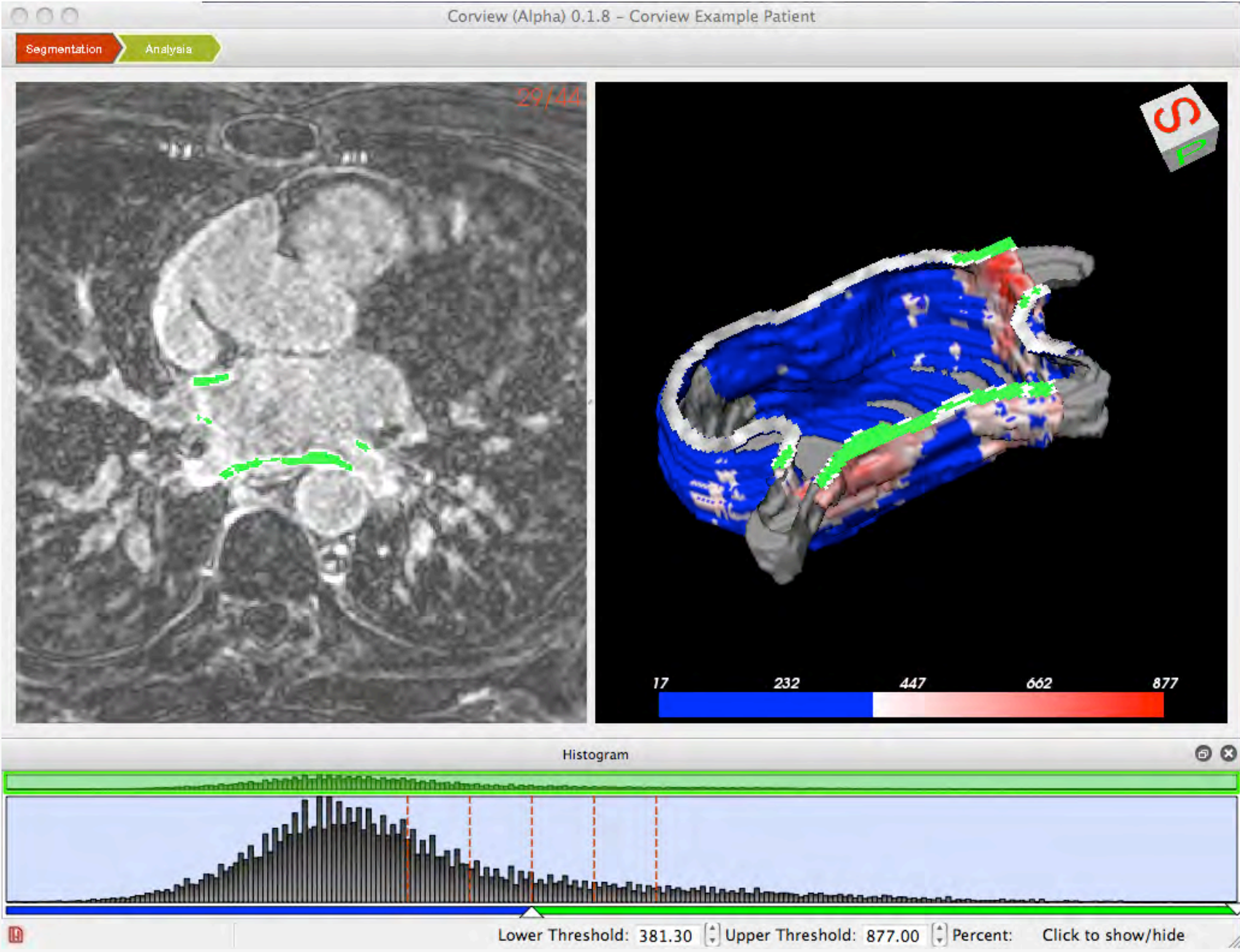# The CARMA AF Workflow
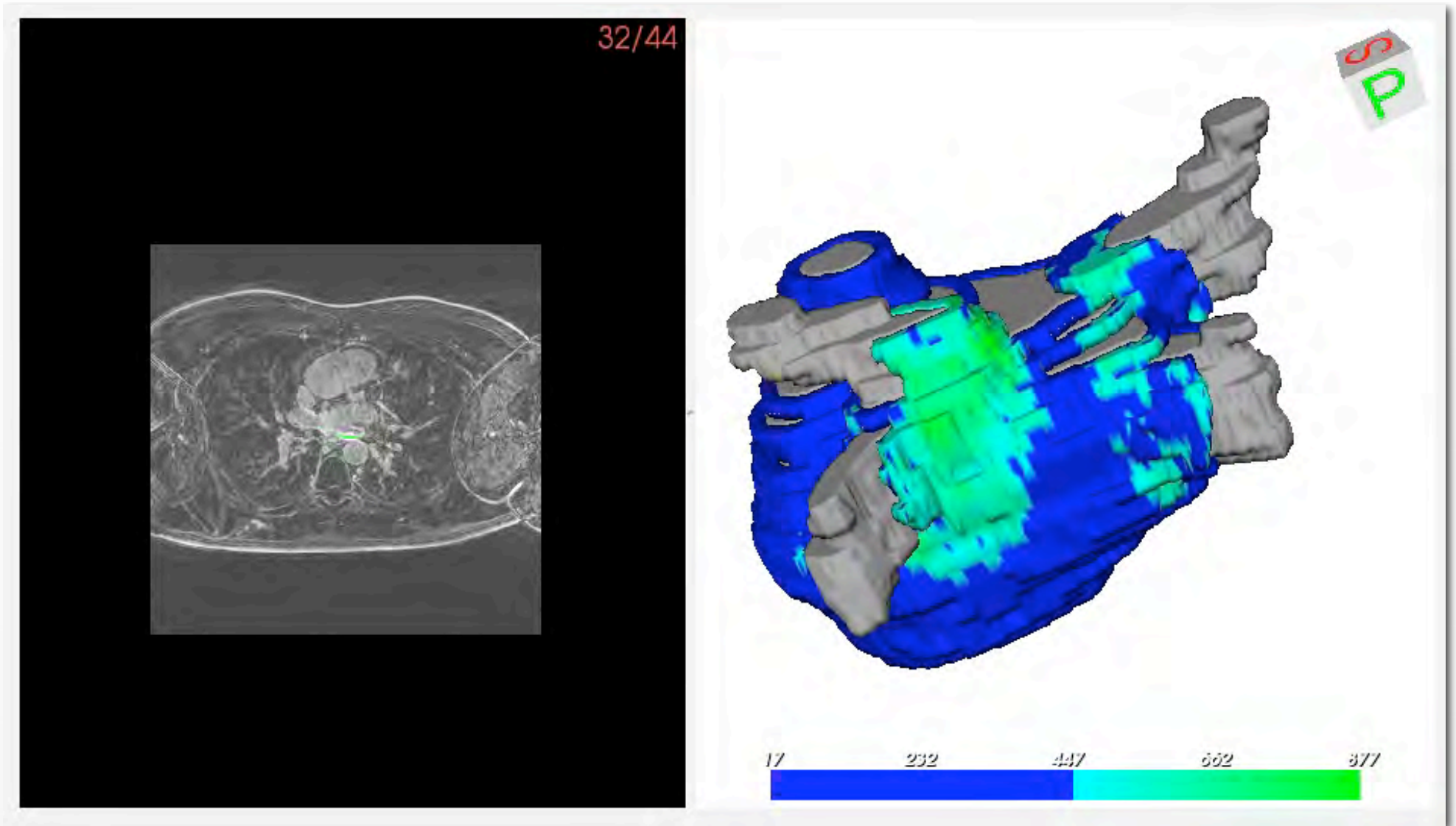
Automated Segmentation

Workflow Past

The New Workflow

Corview in Action

Corview in Action

Role of Shape Analysis in AF

Shape Analysis
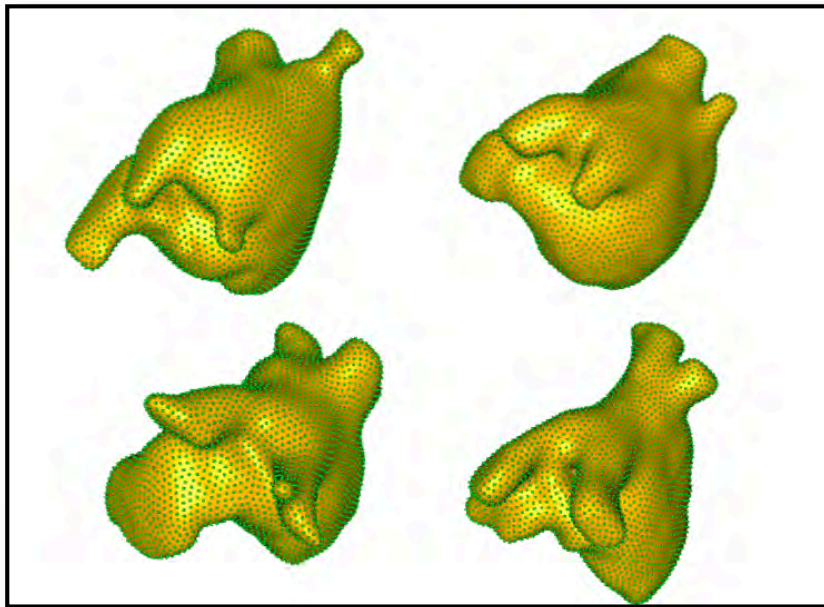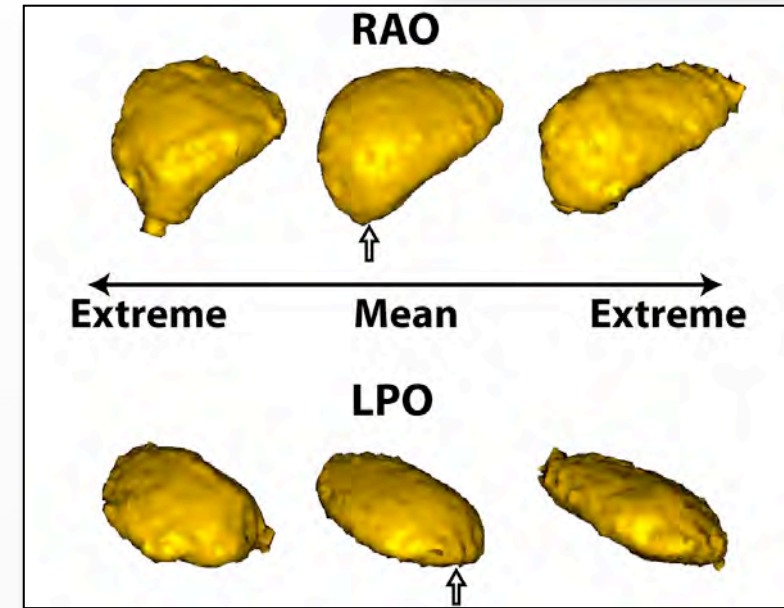
Greg Gardner

Josh Cates

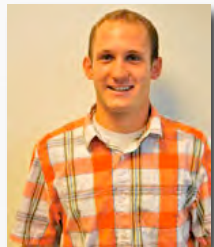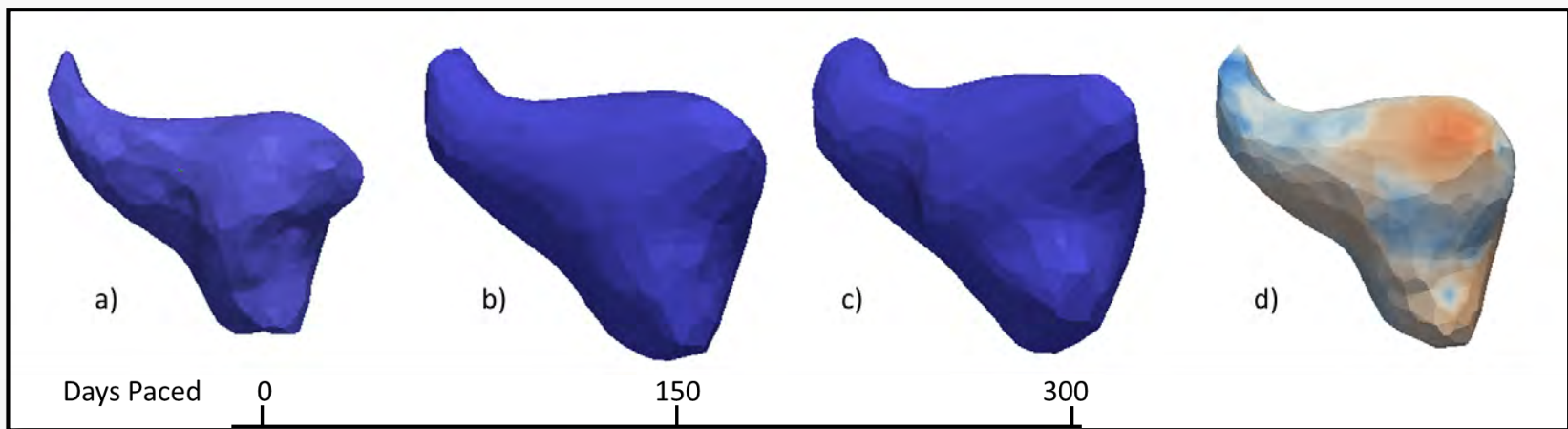Jason Jenson

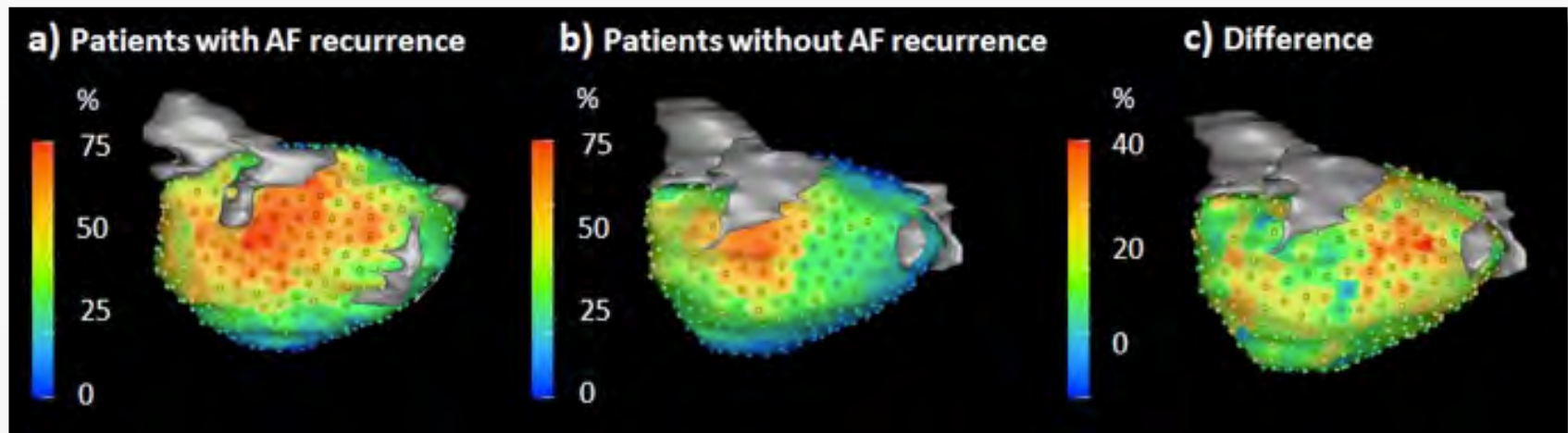LA Shape

LAA Shape
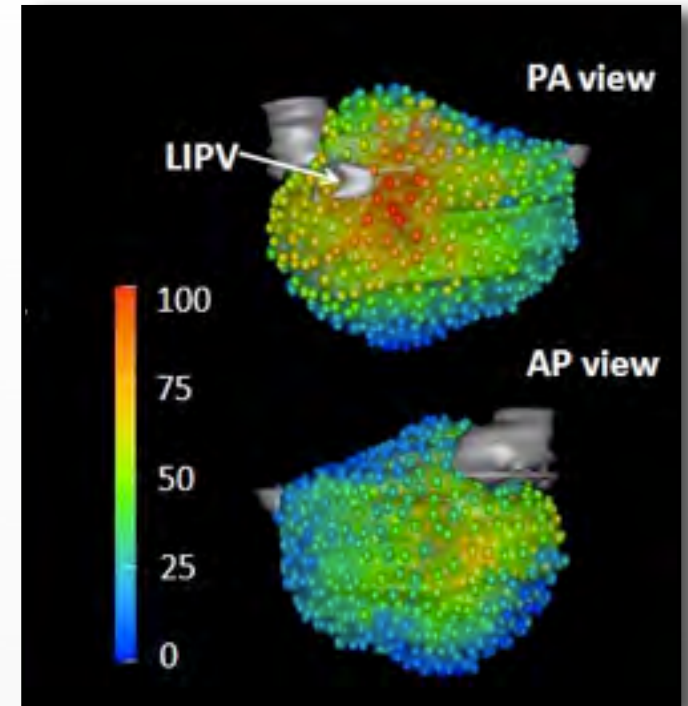

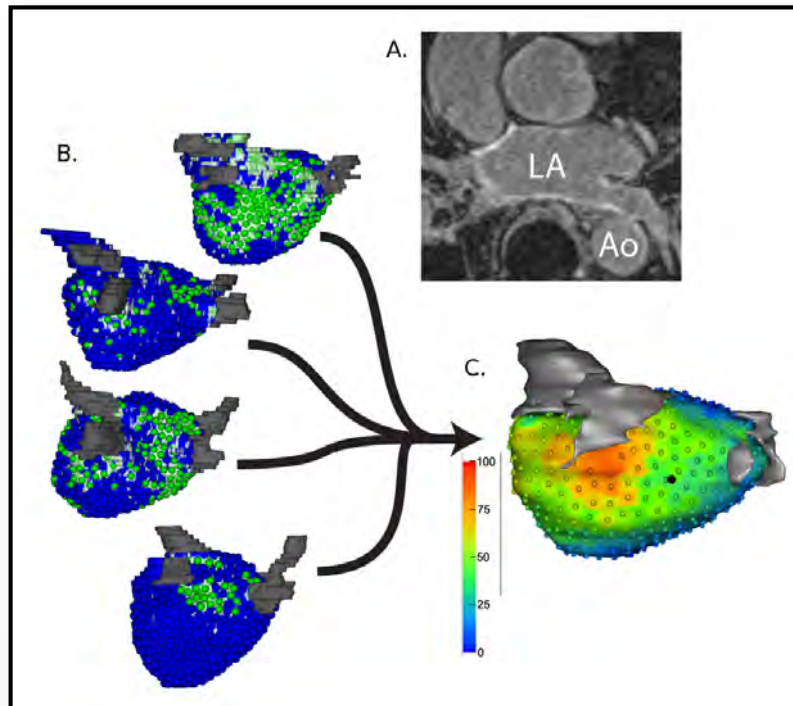LA Shape Change over Time

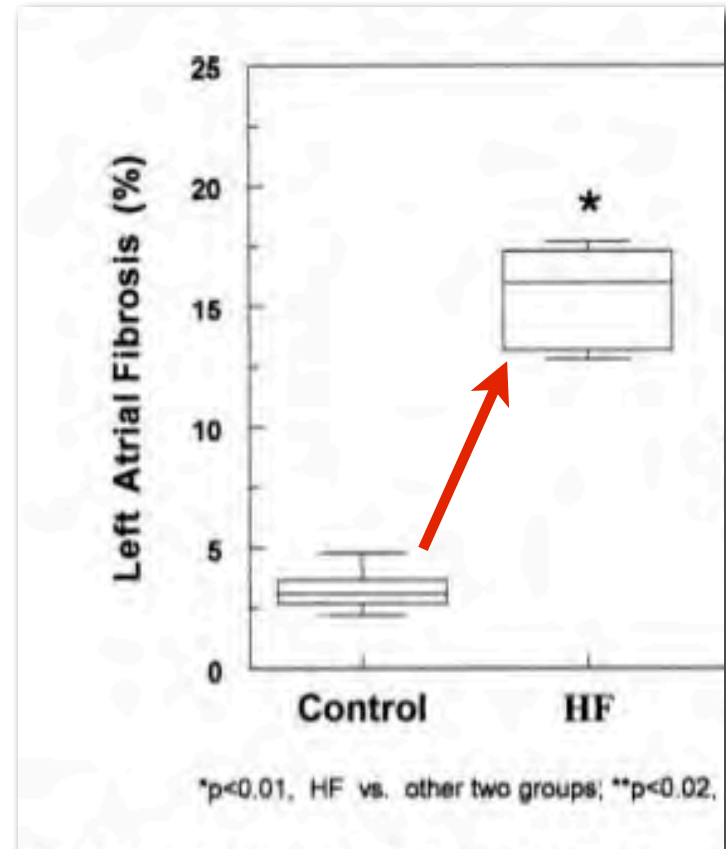# Registration

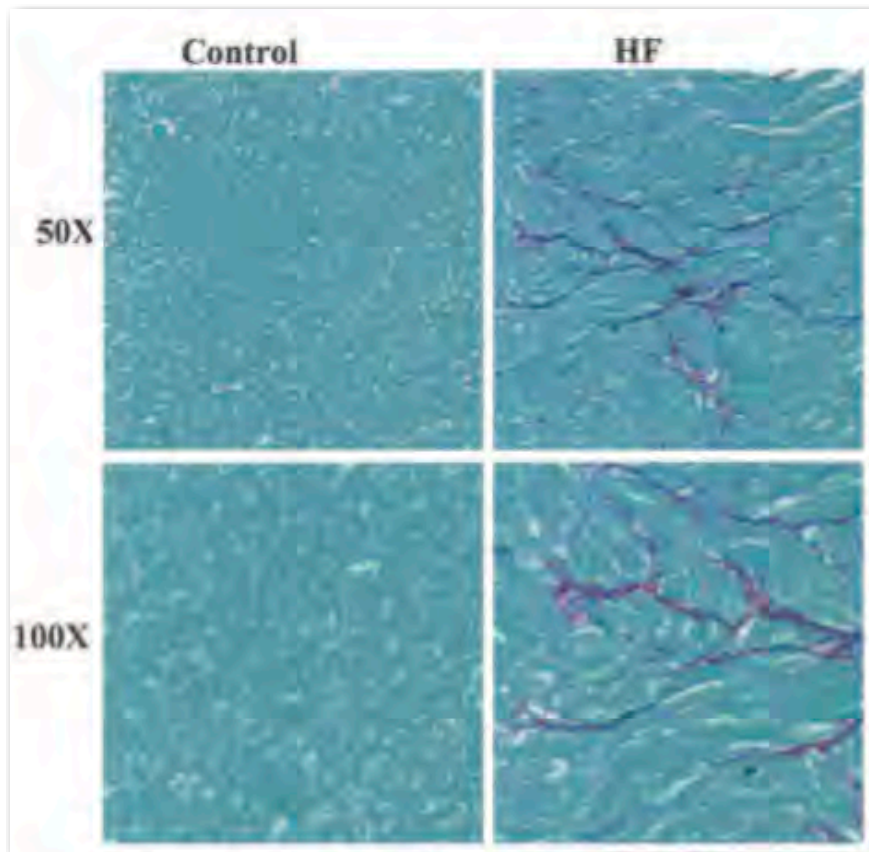

Greg Gardner

Koji Higuchi

Alan Morris

Josh Cates

Simulation: What Causes AFib?

Substrate

+
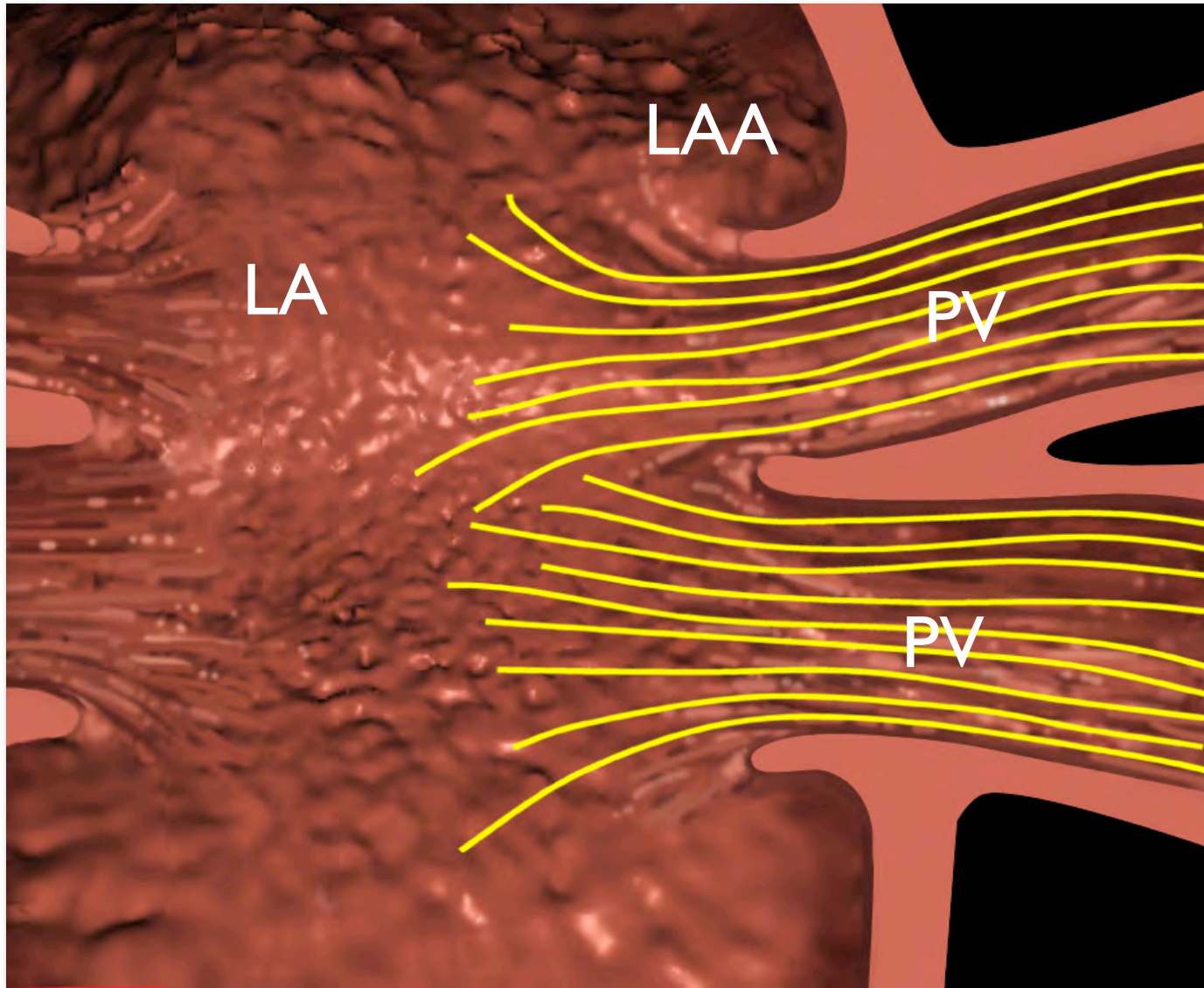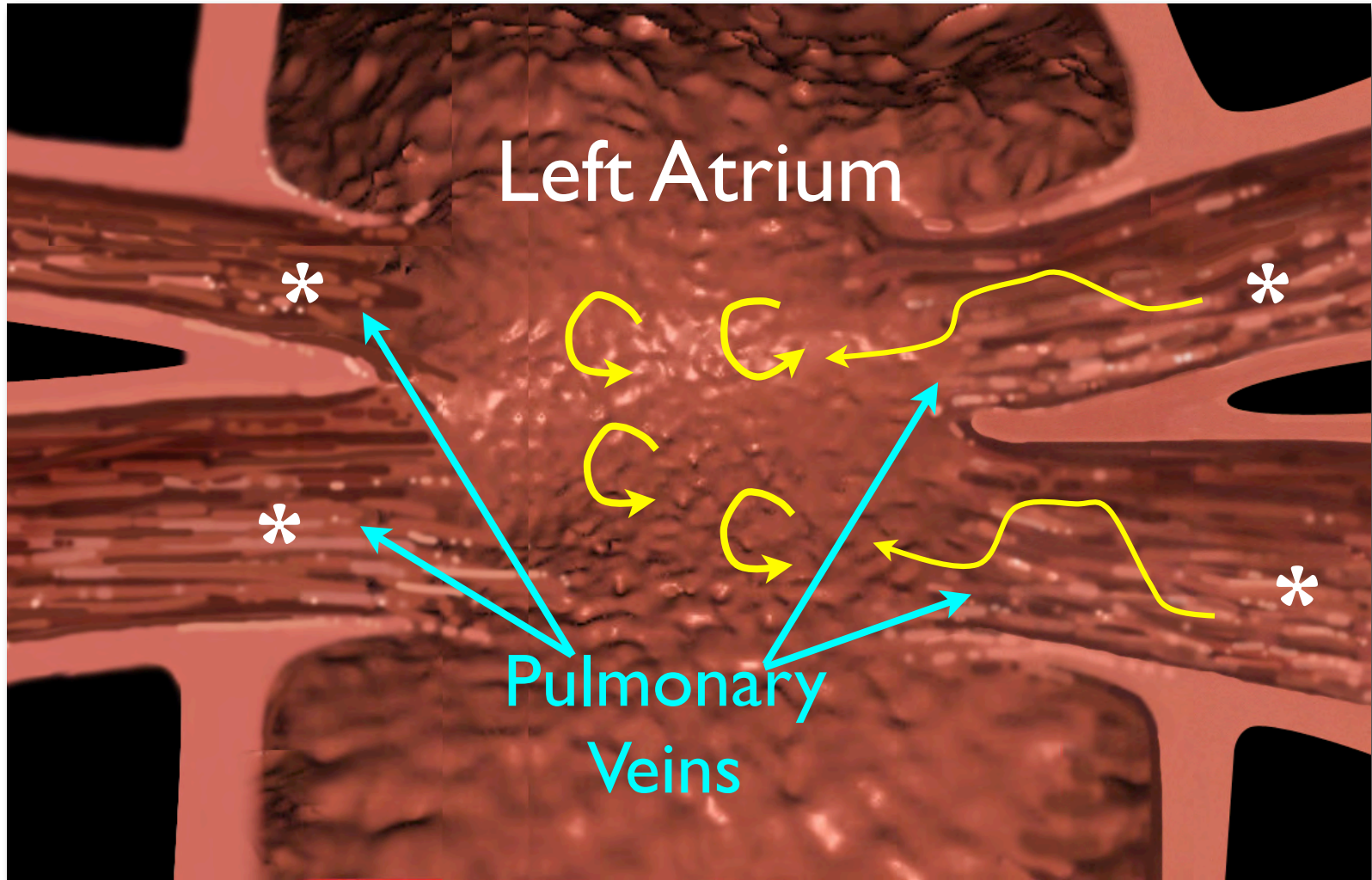
Trigger

Subsrate:Fibrosis

Lee KW, et al. Circ. 2006: 1703-1712.

Complex Propagation

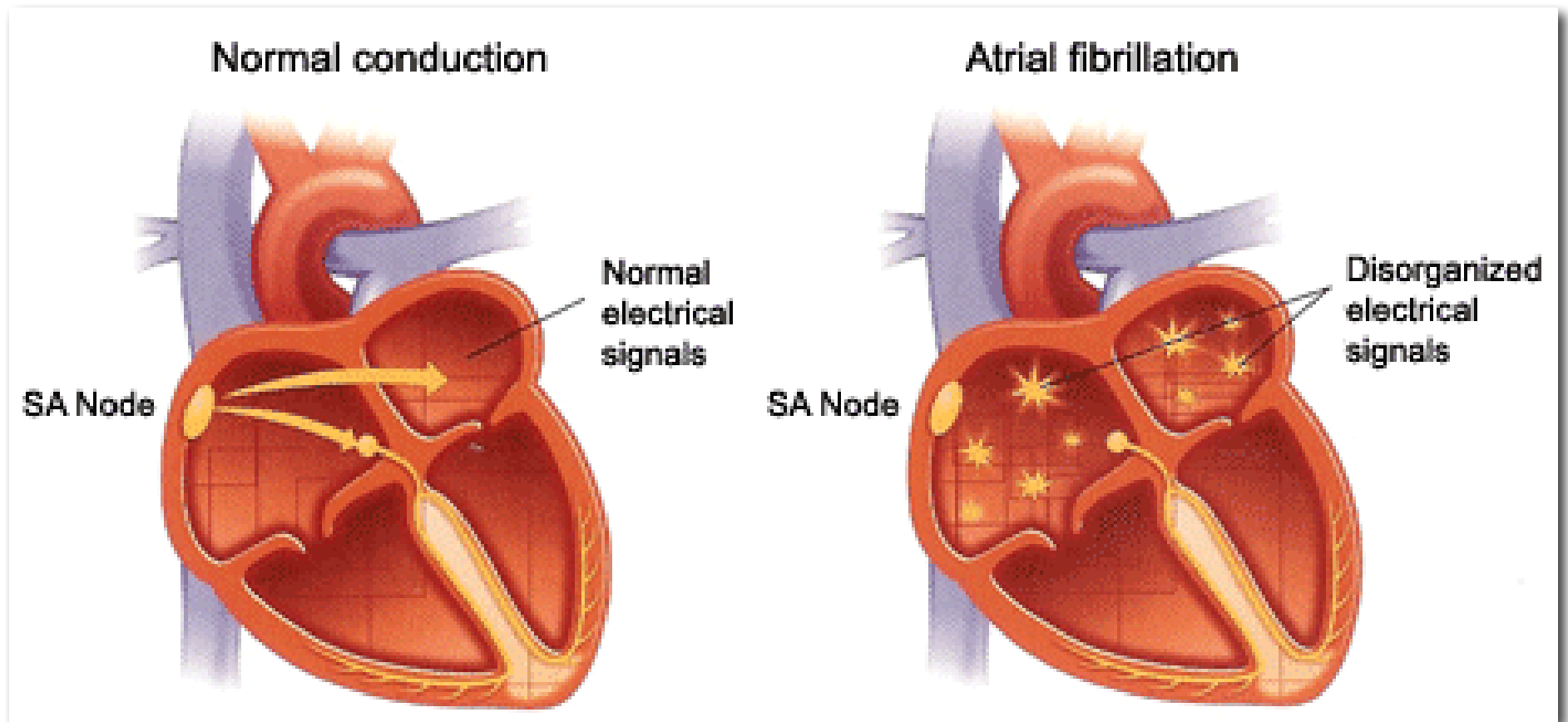de Groot, ... Allessie MA. Circ. 2010: 1674-1682.
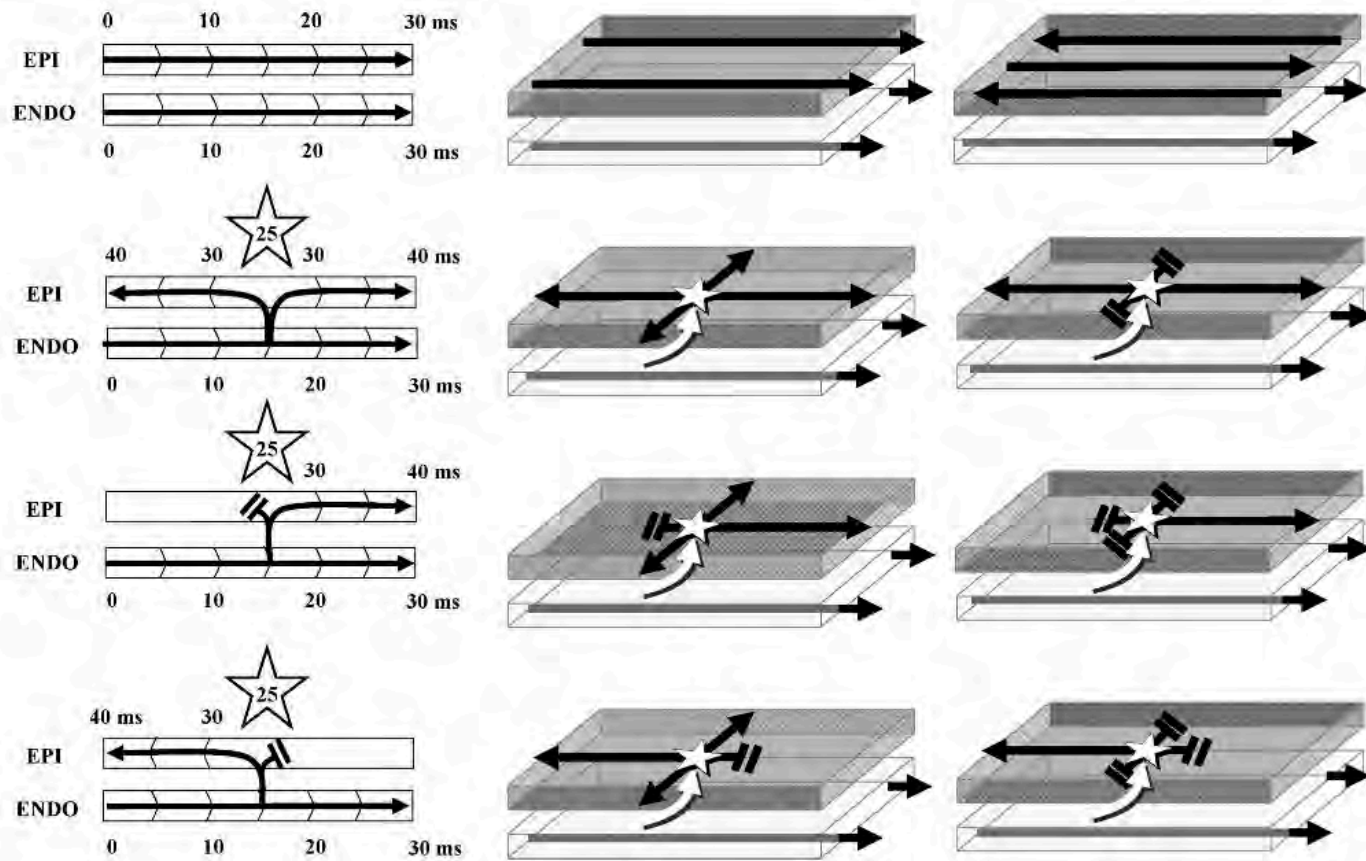
Substrate: Extension of muscle sleeves
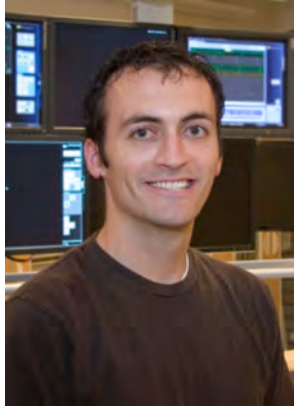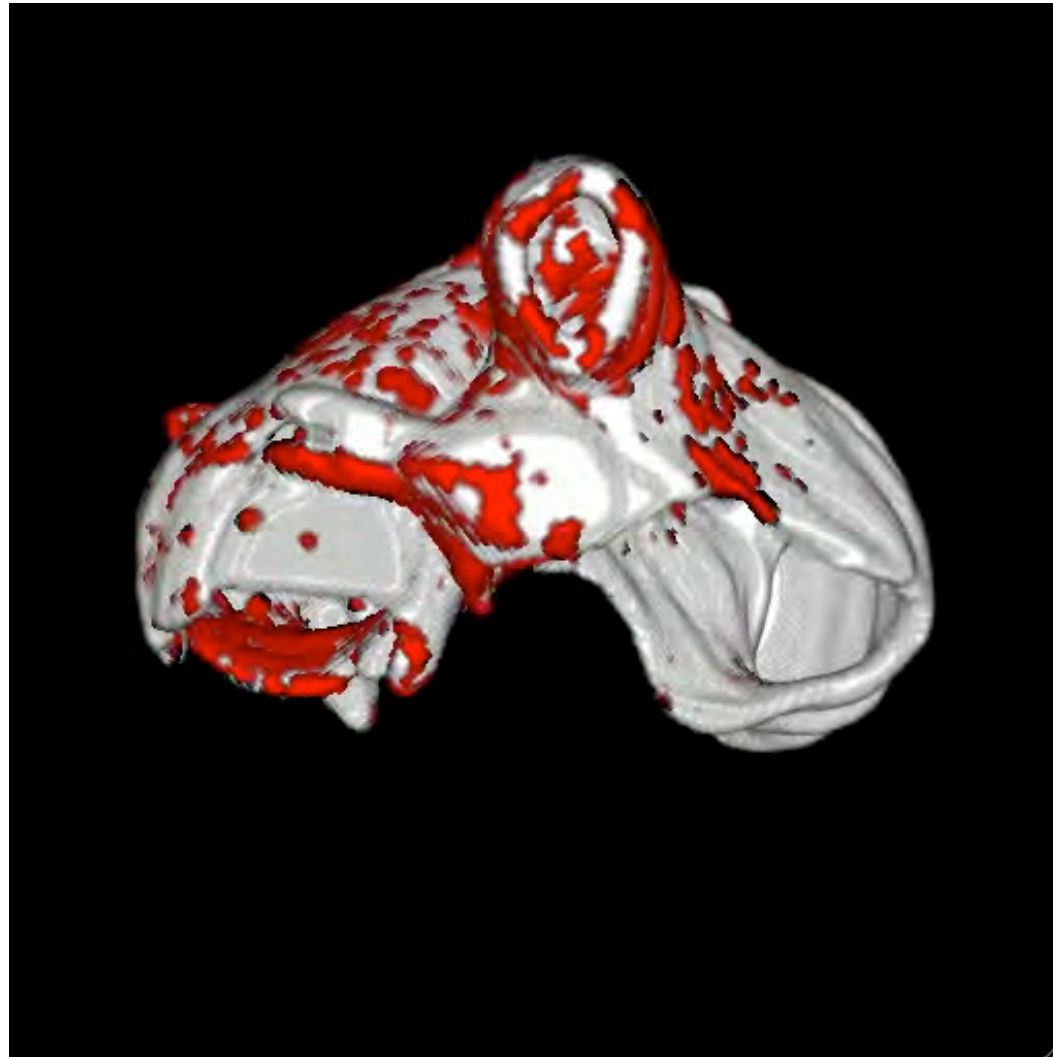
Triggers

Clinical Result

Patient Specific Models of AF

Josh Blauer

Natalia Trayanova

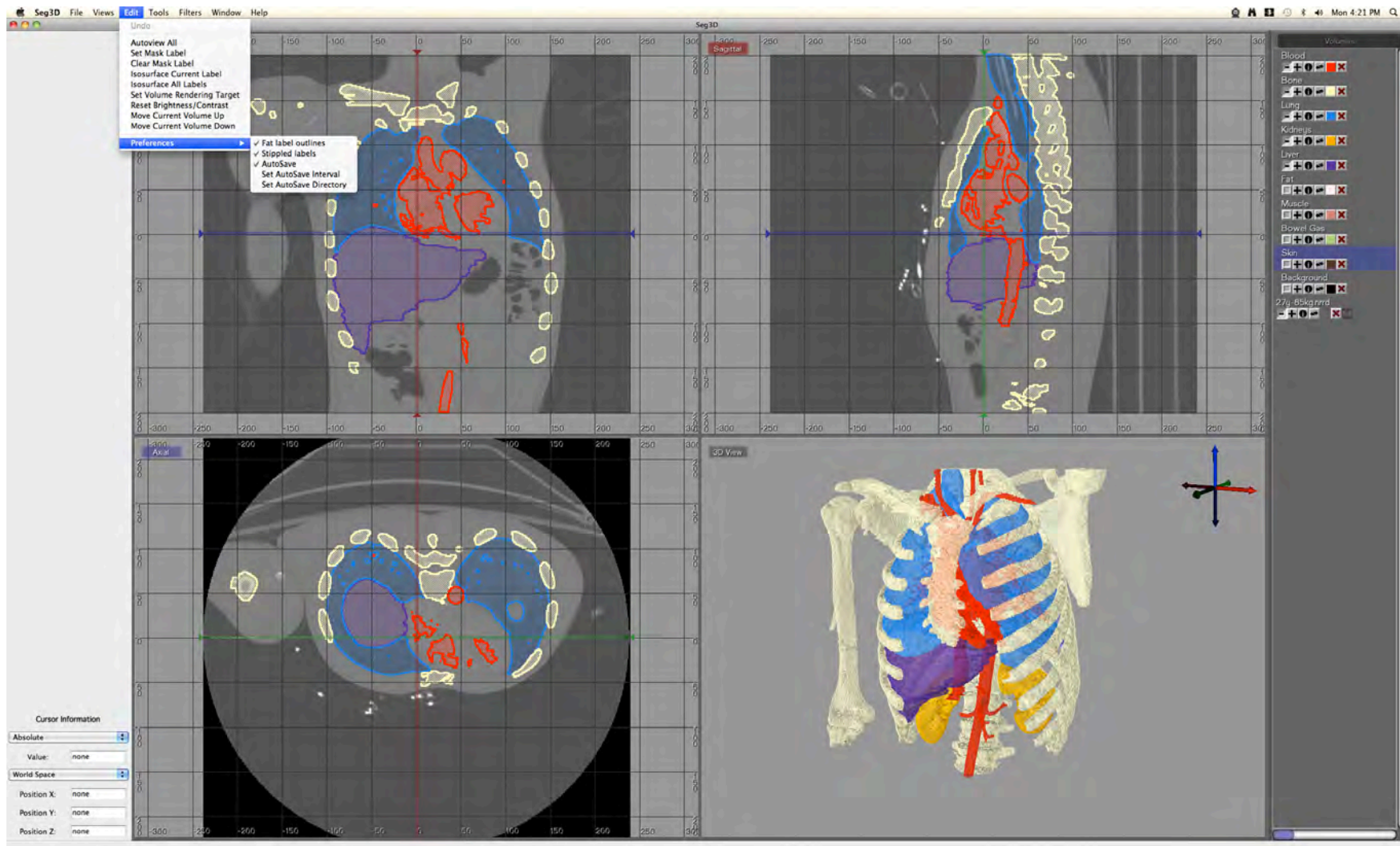Kathleen McDowell

Segmentation

Goal: Identifying Structures
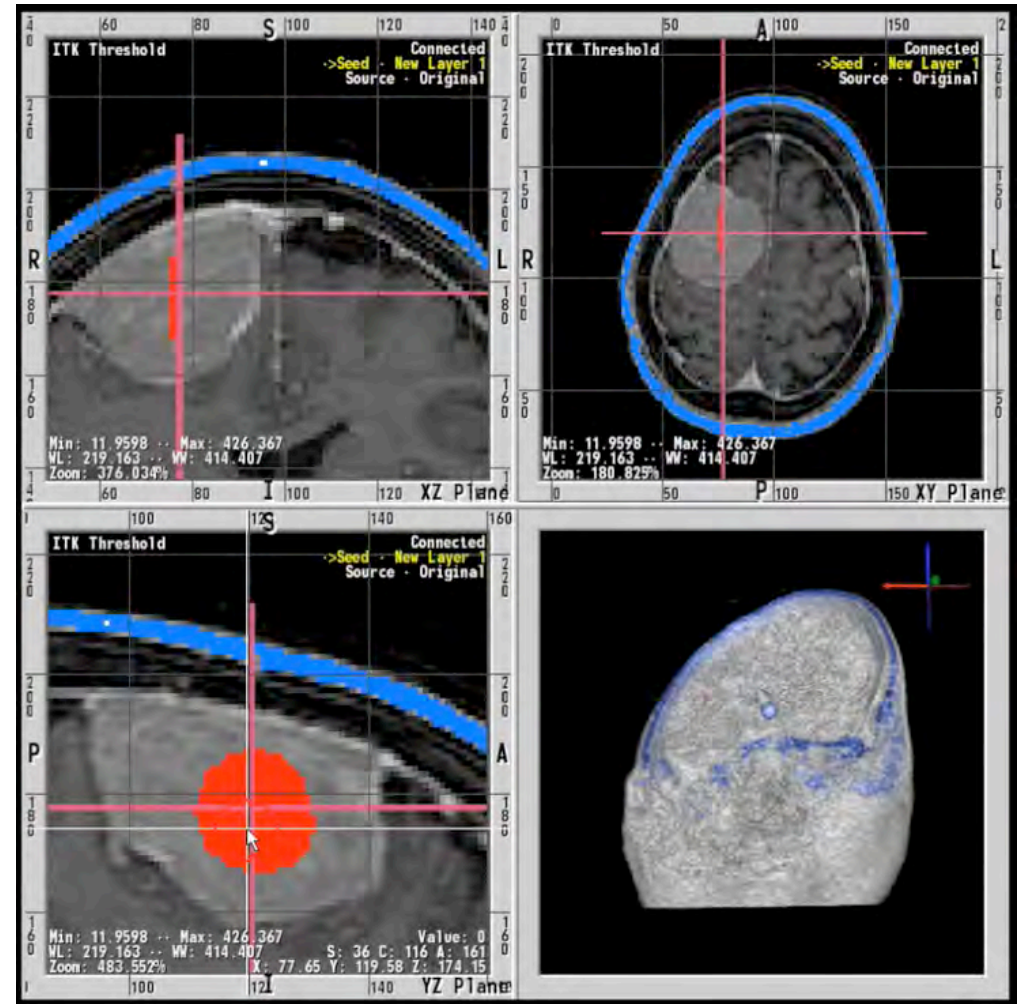
Segmentation in the Real World

Say No To Manual Labor!

Important things* are handcrafted

* things that matter

UTAH BEER

Photo Courtesy Chris Detrick/The Salt Lake Tribune

WE MAY LIVE IN A DESERT, BUT WE'RE NOT DRY

Seg3D - 3D Segmentation

www.seg3d.org

ITK: Insight Toolkit

www.itk.org
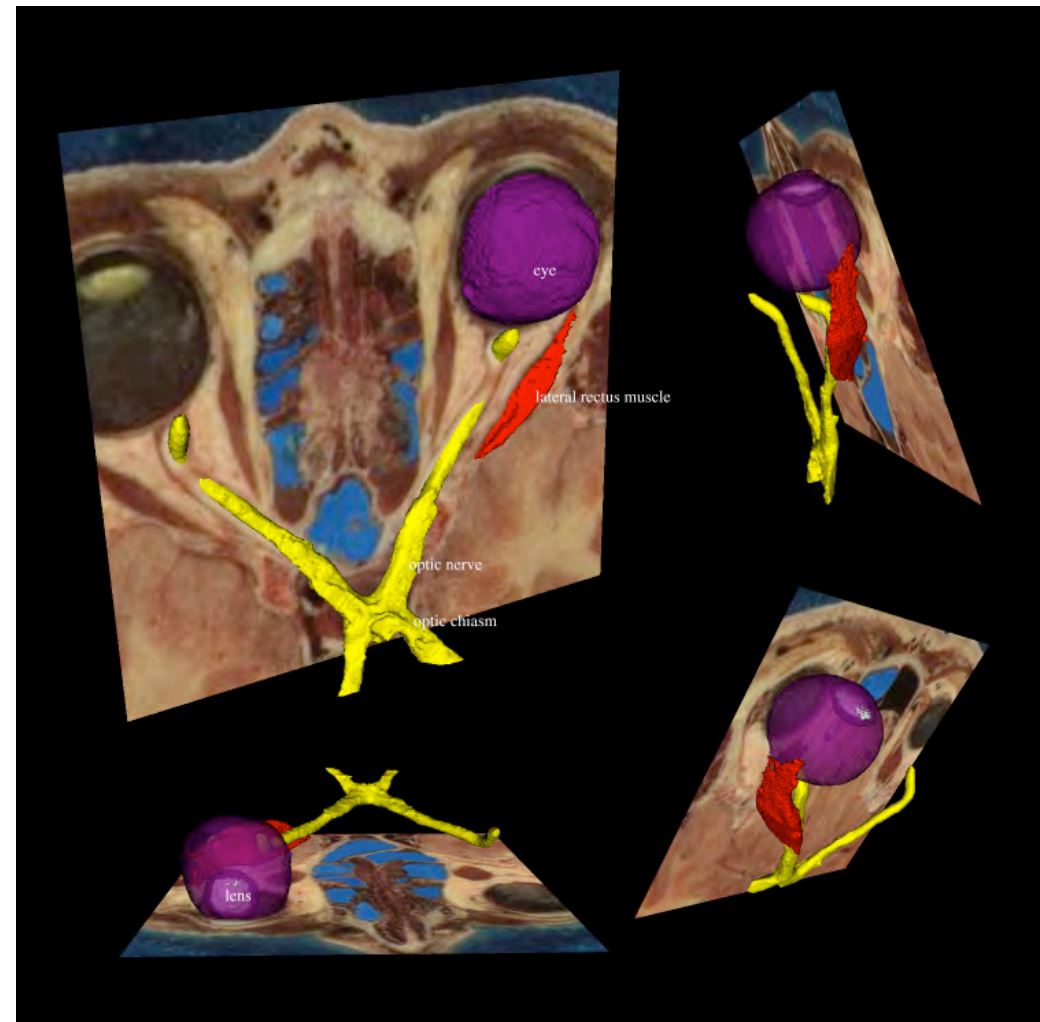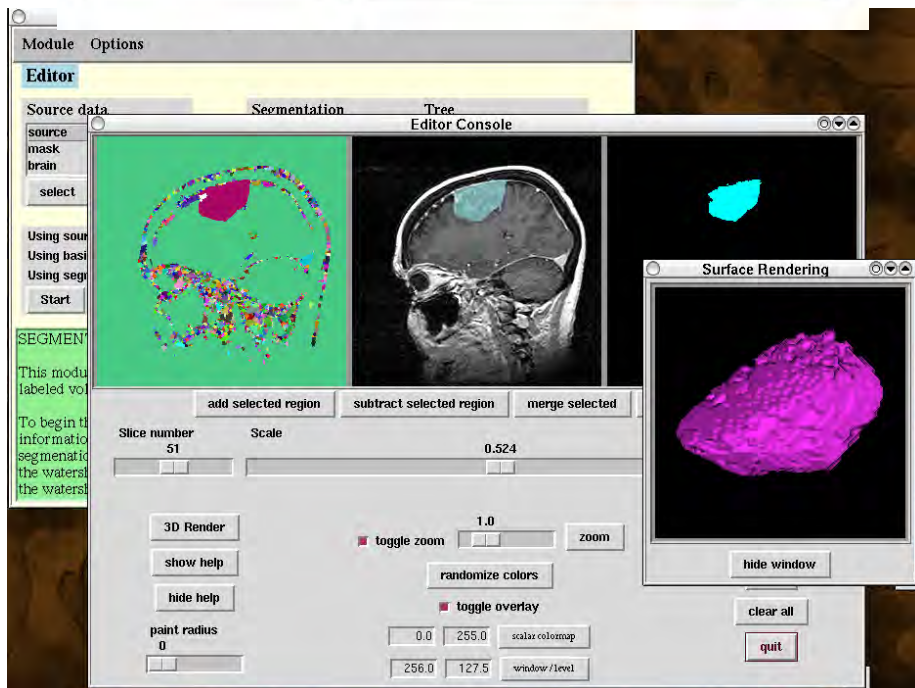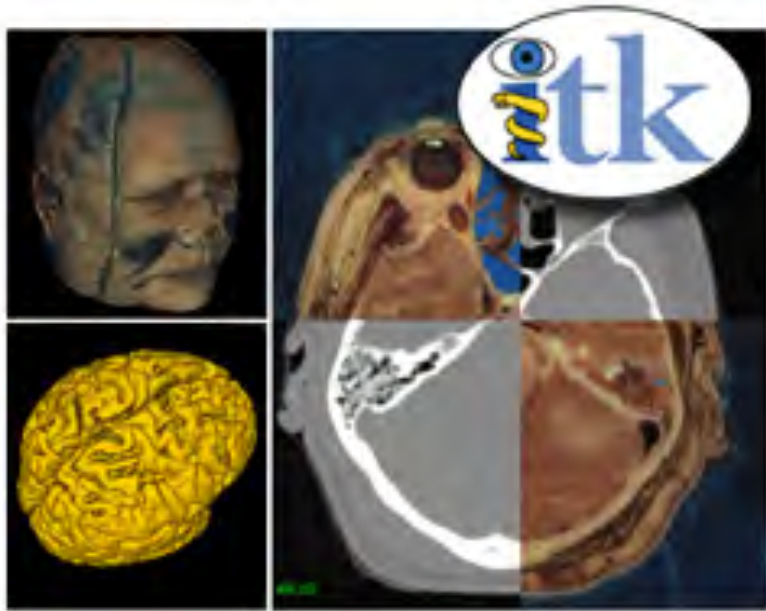
Seg3D: Introduction

Seg3D: In Action

Seg3D: Layers

Seg3D: Measurements

Seg3D: Volume Visualization

Seg3D: Provenance

www.sci.utah.edu   **carmacenter.org**