“Inside The Human Heart”

The Visible Heart® Laboratory and The Atlas of Human Cardiac Anatomy
A Partnership with Organ Donors and Their Families and LifeSource

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Disclosures:

Consultant for Medtronic, Inc. and research support.

I enjoy giving such lectures on the novel use of these gifted hearts and heart/lung blocs!
Objectives:

Describe how donated organs and tissues impact medical research:

• We have reanimated human hearts and heart/lung blocs to obtained novel imaging of functional cardiac anatomy.

• Specimens have been perfusion-fixed (become permanent specimens) which have been imaged, modeled and platinized.

Recite two significant advances linked to medical research:

• We have developed the free-access on-line website, “The Atlas of Human Cardiac Anatomy”

• We have created a unique library of specimens that we gift back to all that want to learn from them.
The Visible Heart®: General Procedures

- Cardioplegia
- Removal, w/ great vessels
- Cannulation
- Langendorff Perfusion / 4 Chamber modes
- Visualization of anatomy and/or devices


Types of Animal Hearts Reanimated:

Porcine hearts: > 1200
Ovine hearts: 12
Mini-pig hearts: 10
Canine hearts: 11

Reanimated Human Hearts:

58 since 1999

Human heart footage is made possible because of the generous individuals whose hearts were donated for research purposes to LifeSource. Their final act of generosity will enhance understanding of the inner workings of the human heart and contribute to lifesaving advances in cardiac medicine.

Reperfusion *In Vitro*: defibrillation

- Unique cross-over perfusion system.
- Preload and afterload chambers (hydraulics)
- Need to disassemble and reassemble each day.
- Can be reconfigured.
- Continue to make improvements.
- Allows for multi-modal imaging


Differences in Perfusion Methods:

From 1892 till his death in 1908, Langendorff was professor and director of the physiological institute at the University of Rostock.

4-Chamber Working Mode

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Multimodal Imaging:

Analysis of the Tissue-Device Interface: An Active Fixation Lead in RV

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Pacing a Human Heart with a 4396 Lead
Know your Anatomy: RAA

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Atrial Fibrillation:
Comparative Imaging: Aortic
CoreValve Implantation:

Direct Visualization of a CoreValve Implantation

Human Heart – 1 Lung Reanimation:
Heart/Lung Multimodal Imaging:

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Human Heart – 2 Lungs Reanimation:

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Views Inside Pulmonary Arteries: Human Heart 295 (10/21/2013)

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Views Inside Pulmonary Veins: Human Heart 295 (10/21/2013)

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CMR of Perfusion Fixed Hearts:

These images were from a preserved human heart diagnosed with congestive heart failure (HH70) and were acquired using a slice thickness of 1 mm in a 3T Siemens scanner. The in-plane resolution of the images ranges from 0.3 mm to 0.5 mm.

Short Axis View:  
4-Chamber View:

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LV Volume Calculations:

M. Bateman
C. Rolfes
S. Howard
B. Howard
I. Ankonvich

Paul A. Iaizzo, PhD
3D Modeling of Cardiac Vasculature:

U of MN’s Medical Device Center: Virtual Prototyping Lab
U of MN’s Medical Device Center:
ASD   HH 143
Coronary Stenting: Provisional Technique
If “A picture is worth a 1000 words” then these images?

Bandschapp O, Goff RP, Mallin G, Loushin M, Iaizzo PA: The path of a pulmonary artery catheter visualized through a beating human heart

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VHL Summary and Collaborations:

- The Visible Heart® methodologies is a functional *in vitro* system that allows for novel imaging: isolated human hearts or heart/lung blocs will typically beat on its own for 5-7 hours.

- This opportunity has lead to the development of the unique educational tool, the free-access website: “The Atlas of Human Cardiac Anatomy”

- We maintain a library of over 250 perfusion-fixed human hearts, normal and diseased, MRI and CT dicom files available for collaborative research. This library is open to students, researcher, clinicians, industry or anyone who wants to learn more about heart anatomy.

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Visible Heart® Lab

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Acknowledgements:

http://www.vhlab.umn.edu/index.html

The Organ Donors and their Families
LifeSource
U of MN Anatomy Bequest Program
Special Issue on Cardiac Anatomy: *Journal of Cardiovascular Translational Research*: Iaizzo PA, Anderson RH, Hill AJ (editors) Volume 6 Number 2, April 2013

Thank you!

Paul A. Iaizzo, PhD