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18th INTERNATIONAL CODATA CONFERENCE

Montreal, Canada

September 29 - October 3, 2002



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The Visible Human Project® Image Data Sets From Inception to Completion and Beyond

Richard A. Banvard
National Library of Medicine
Bethesda, Maryland USA

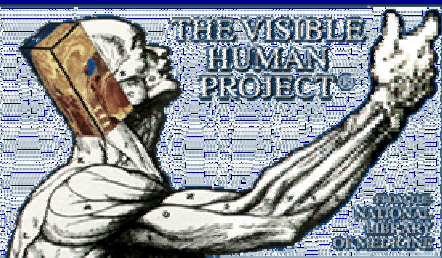


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The Inception

- 1987 - Long Range Plan of the NLM Board of Regents (BOR)

“NLM should thoroughly and systematically investigate the technical requirements and feasibility of instituting a biomedical images library”



The Inception Continues

- 1989 - BOR convenes an Ad hoc Planning Panel on Electronic Imaging

“NLM should undertake a first project, project, building a digital image library of volumetric data representing a complete normal adult human male and female. This ‘Visible Human’ project would include digital images ... of cadavers”



The Inception Gets Serious

- 1991 - The University of Colorado School of Medicine is contracted by NLM
“to acquire the appropriate cadavers and capture the required images”



The Beginning of the Completion

November 28, 1994 - RSNA, Chicago, IL
CBS Evening News



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The Completion

- *November 28, 1995 - RSNA, Chicago, IL*

The Visible Human Female is announced



What is the Visible Human Project? (As Originally Contracted)

- A very large collection of images -
55 gigabytes of **2D** digital medical images
CT & MRI scans and Cryosections
Normal Male 16 gb - 1878 sections
Normal Female 39 gb - 5189 sections
- A “life” of its own - **The Beyond**



An Addendum to the Completion

- *July 2000* - digitized files of 70mm film images taken during the original Male cryosectioning are posted on NLM's ftp server – each of the 1878 color images is approximately 22 Megabytes.



The 'Life' Beyond: How the Image Data is Being Used

- Anatomy, 2D
- Anatomy, 3D
- Animation
- Art
- Biomechanical modeling
 - Prosthesis development
- Controversy
 - Is there a sphenomandibularis muscle?



How the Image Data is Being Used (continued)

- Education
- Endoscopy / Colonoscopy
- Computer vs. Manual Segmentation
- Testing Algorithms
- Virtual Crash Dummies
- Virtual Reality / Simulations



Life After Death?

VISIBLE HUMAN

ROCKY



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The Visible Human Project

- http://www.nlm.nih.gov/research/visible/visible_human.html
- vhp@nlm.nih.gov



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The Visible Human's Future

- Immediate future
- Rest in Pieces
 - Discover 14(10):38-43, October 1993
- March '98 response to Congressional inquiry



Senator Arlen Specter (R-PA)

Chairman, Subcommittee on Labor, Health and Human Services and Education and Related Agencies

“The Visible Human Project is one of the most fascinating enterprises of the Library. Please update us on what activities or projects involving the Visible Human lie ahead.”

- Identification and multilingual labeling of every visible structure in the data set, starting with the thorax of the male as a prototype, and ultimately resulting in an index to the complete male and female.
- Addition of higher resolution data sets for specific body parts where necessary.
- Addition of alternate data sets, normal and pathological to aid in the study of both normal human variation and disease.



Dr. Michael J. Ackerman, Ph.D.
NLM, Project Officer, Visible Human Project

“the larger, long-term goal of the Visible Human Project:
to link the print library of functional-physiological knowledge
with the image library of structural-anatomical knowledge
transparently into one unified resource of health information.”

- Proceedings of the IEEE, vol 86, no.3, March 1998



Cryosection

- Cryo
 - icy cold (from Greek *kryos*)
- Section
 - a part that is cut off (Websters)
- ✘ What it is NOT
 - a 3D slice (as in bologna)
- ✓ What it IS
 - an image file from a digital photograph of a block of ice



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Cryosection (cont.)

- The process
- The result

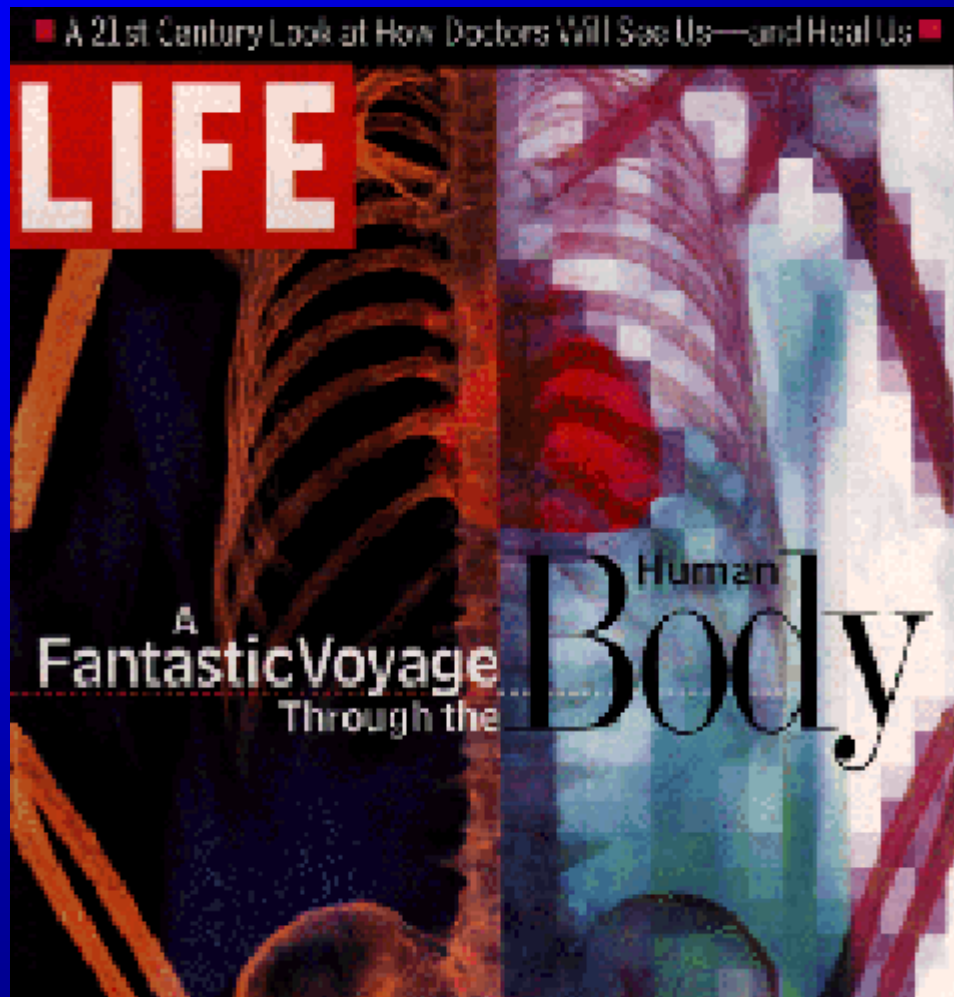


Normal

- No surgeries
- Free of infection or disease
- No traumatic injuries
- Neither obese nor emaciated
- Under 6' tall
- Under 60 years old



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- Alexander Tsiaras, Feb. 1997



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How Images are Used

- Anatomy 2D

University of
Colorado

Web Based Browser
(Links to a website)



[Click image to continue](#)



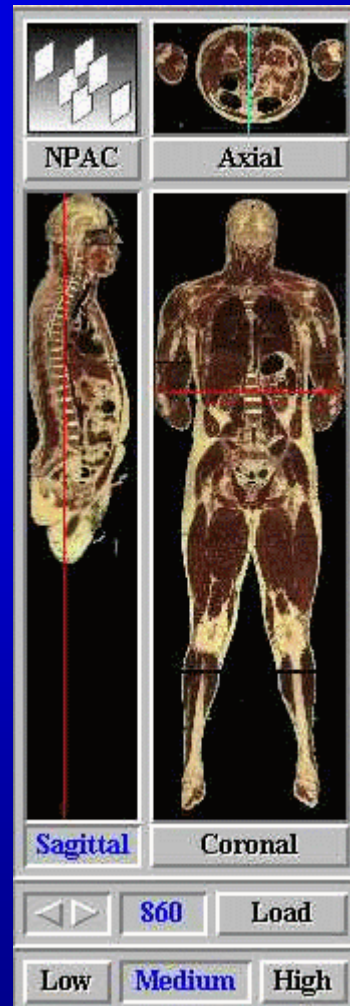
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How Images are Used

- Anatomy 2D

University of Syracuse

Web Based Java Applet
(Links to a website)



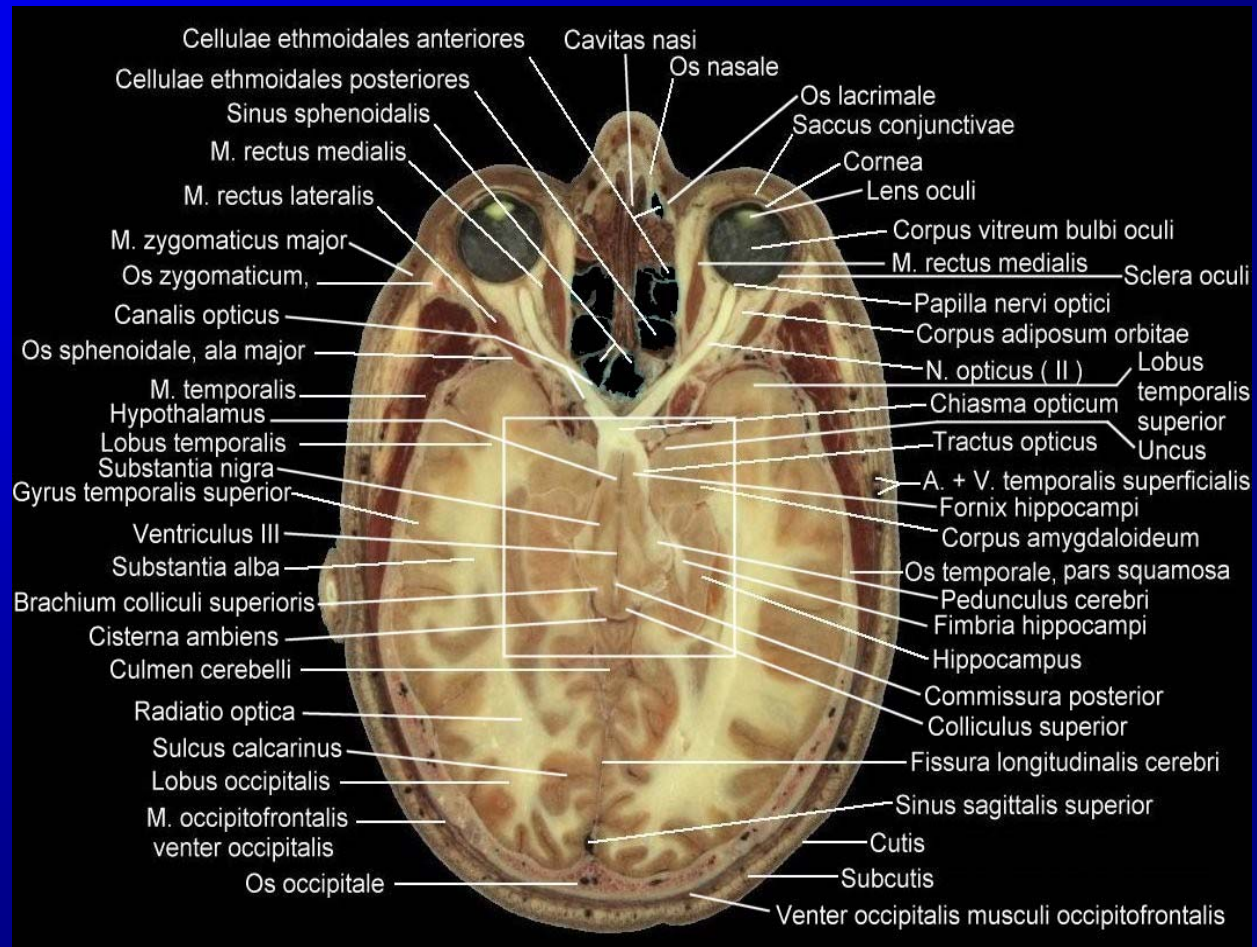
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How Images are Used

•Anatomy 2D

Gutenberg University
Mainz, Germany
Labeled Images



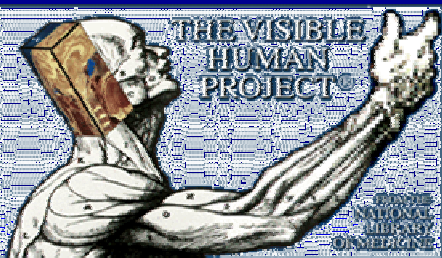
How Images are Used

- Anatomy 3D

University of Hamburg
Hamburg, Germany



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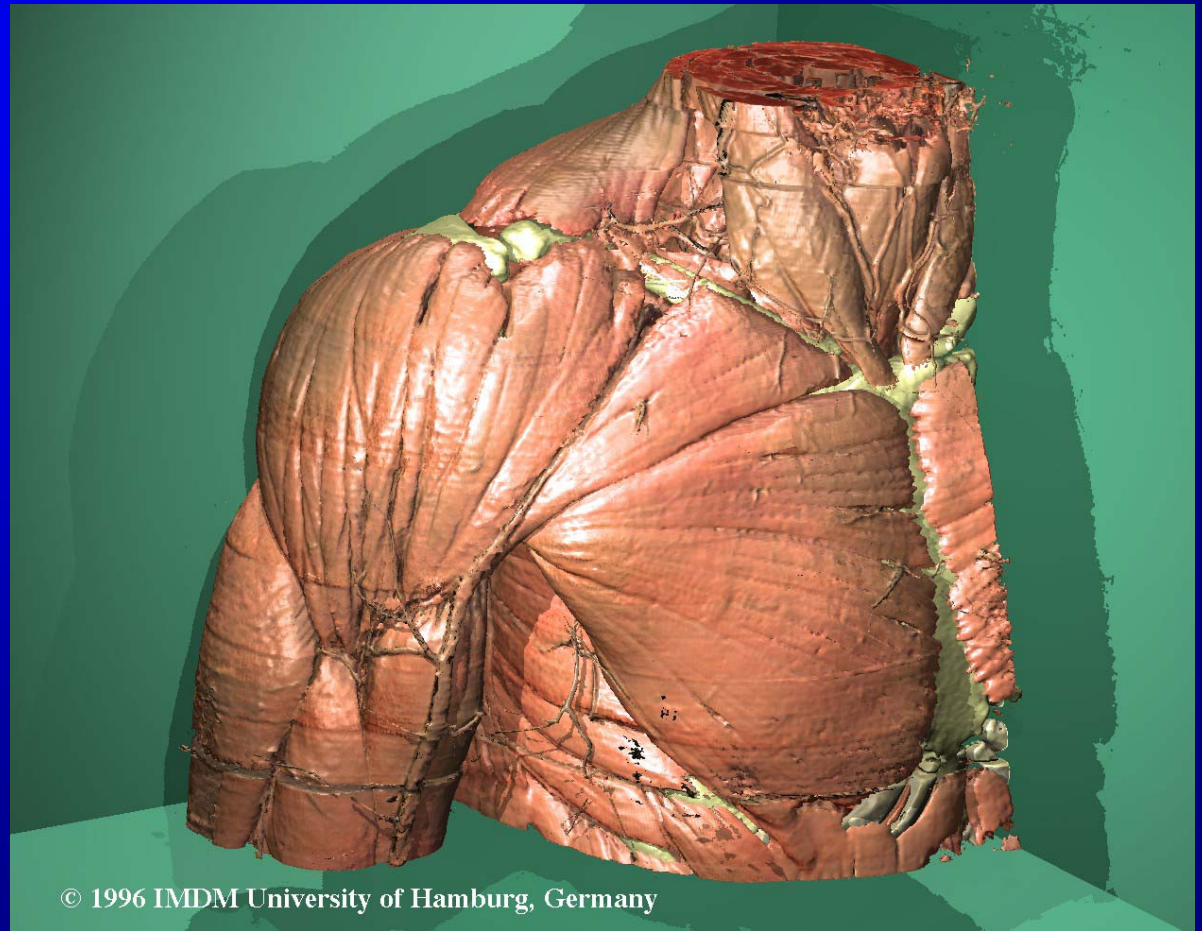


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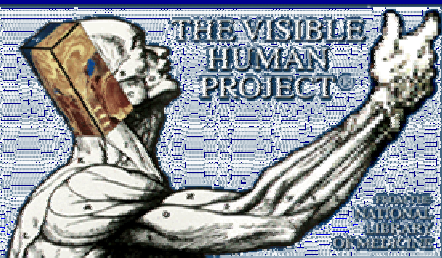
How Images are Used

- Anatomy 3D

University of Hamburg
Hamburg, Germany



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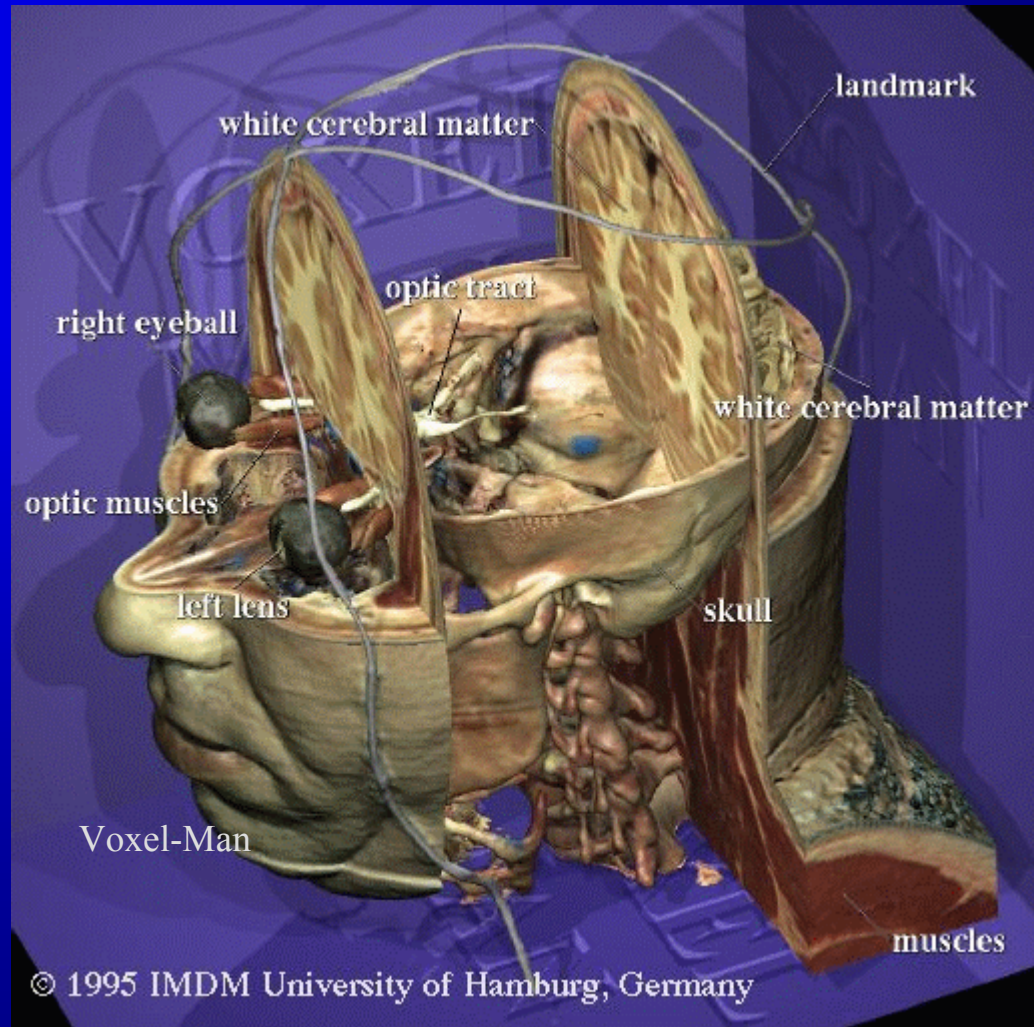


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How Images are Used

- Anatomy 3D

University of Hamburg
Hamburg, Germany



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How Images are Used

- Animation

Engineering Animations, Inc.

Ames, Iowa

Extracting data

Mayo Clinic

Rochester, MN

Large intestine flythrough

Swiss Federal Institute Of Technology

Zurich, Switzerland

Torso flythrough

Mayo Clinic

Rochester, MN

Surgery planning

University of Hamburg

Hamburg, Germany (for this application: place mouse on image, 3D manipulation click and hold, and move up/down or left/right)



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Current Contracts

- Thorax Segmentation and Labeling
- Image Processing Tools
- Atlas of the Head and Neck

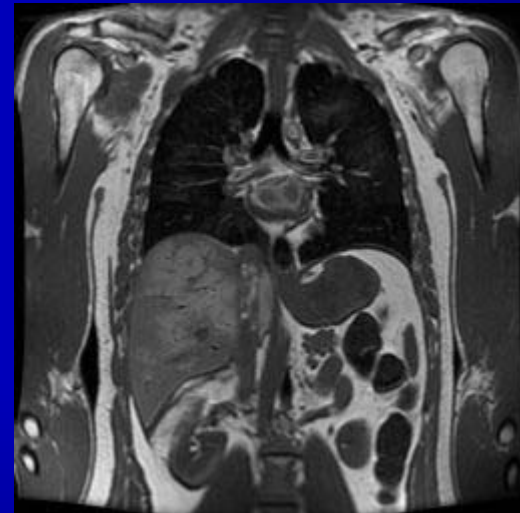


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VHP Diagnostic Medical Images



CT (Computed Tomography)



MRI (Magnetic Resonance)



VHP Cryosection



Click image for video of scan through cryosections

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