Internet2 and Visualization Technologies: Digital Anatomy

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- 1950s ………..   ~1,000 hours

- 1990s ………..   ~180 hours

- 2004 …………..   ~100 hours

- 2020 ………….. ???? !

Not enough anatomists

The Importance of Anatomy in Health Professions Education and the Shortage of Qualified Educators

RS McCuskey, SW Carmichael, DG Kirch

Academic Medicine (2005) 80: 349-351

Students are digital natives

- Today's medical students and house staff have learned medicine at a time when the *Internet* has become a common and comprehensive information resource.

- Digital resources and web resources will be critical to their learning.

Radiology is a rich source of digital images

Digital images from radiology

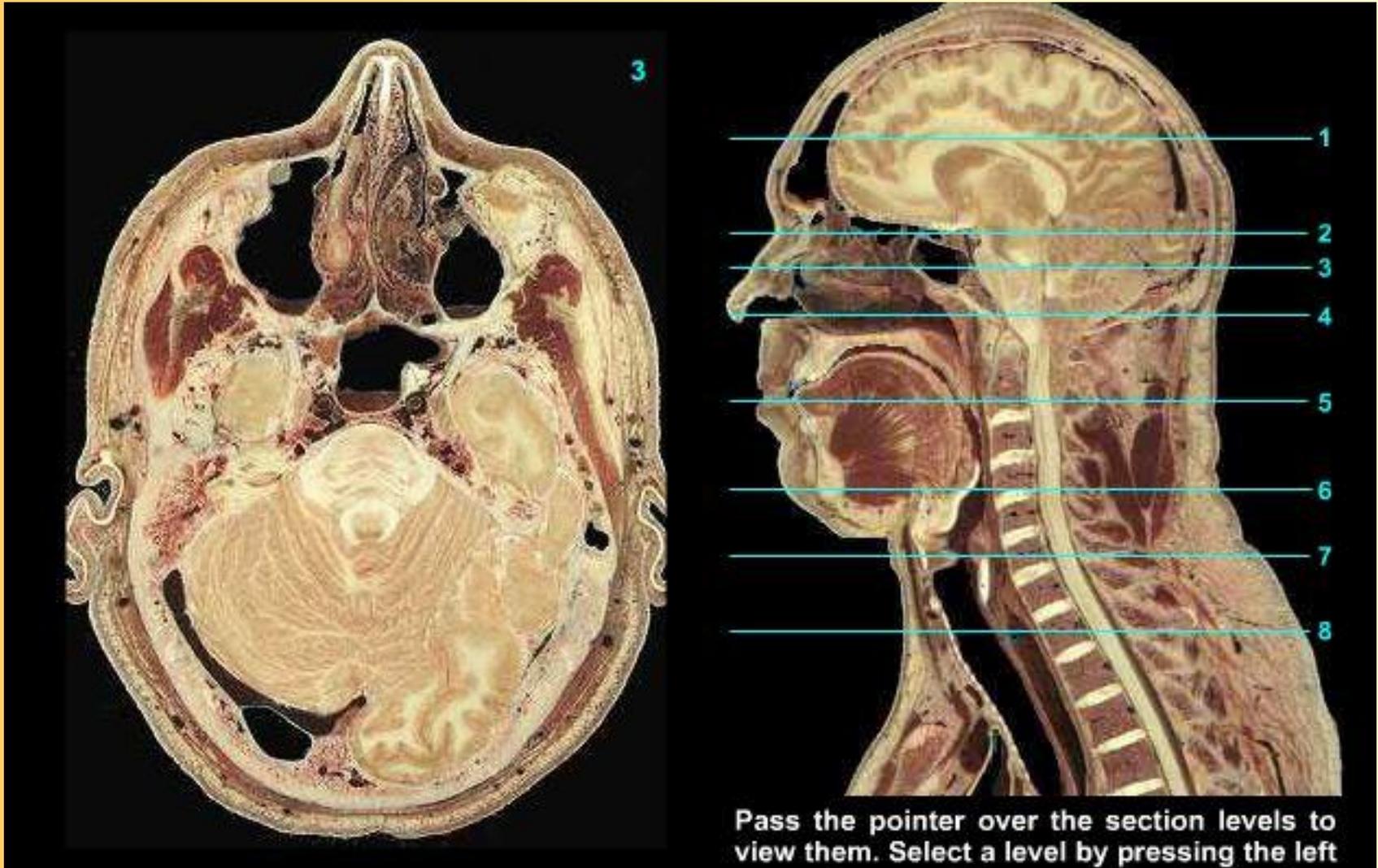- Radiology departments generate many gigabytes of clinical images every day.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

QuickTime™ and a
TIFF (Uncompressed) decompressor
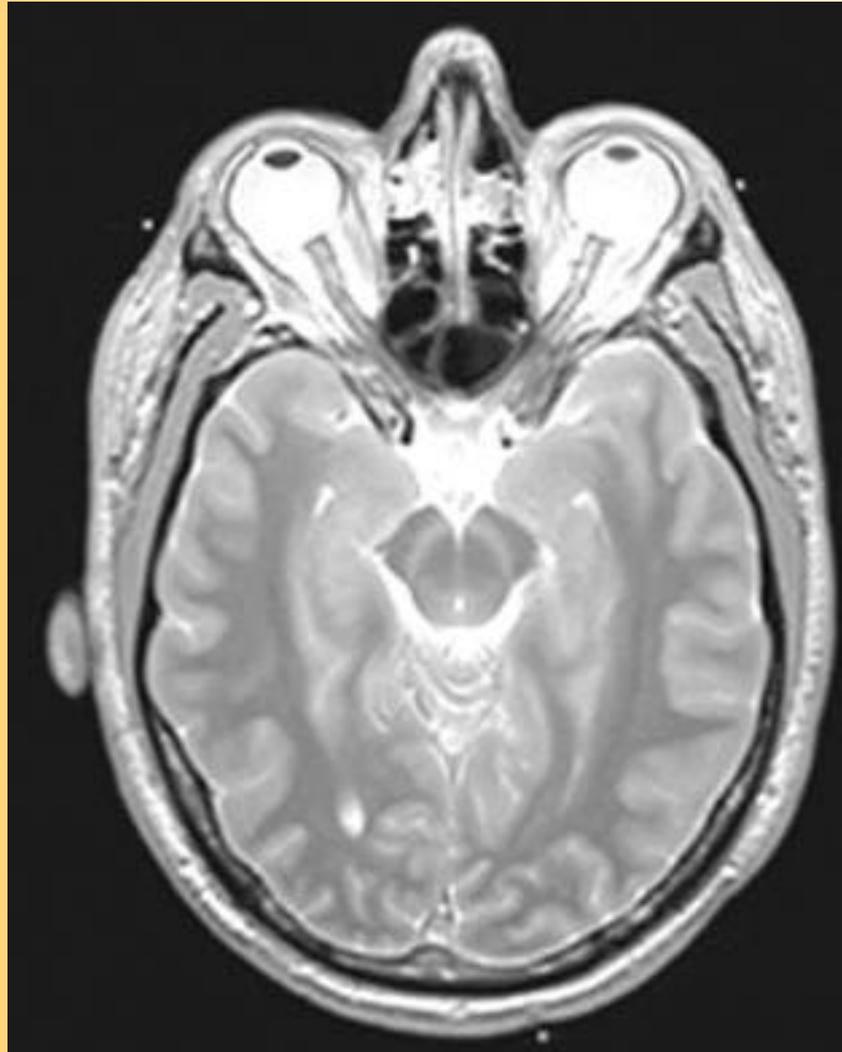are needed to see this picture.

Cross-sectional images are used for
3D reconstruction of anatomy

Cross-sectional anatomy

Pass the pointer over the section levels to view them. Select a level by pressing the left

Dev: Stanford University

Photographic cross-sections

- Object (teeth) embedded in resin
- Microgrinding removes thin layer
- Photograph taken of exposed section

Dev: Stanford University

Constructing anatomy from slices

- Slices are stacked vertically
- Bone outlines are extracted from each slice
- The outlines are smoothly connected
- http://www.barre.nom.fr/medical/index.html

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QuickTime™ and a
TIFF (Uncompressed) decompressor
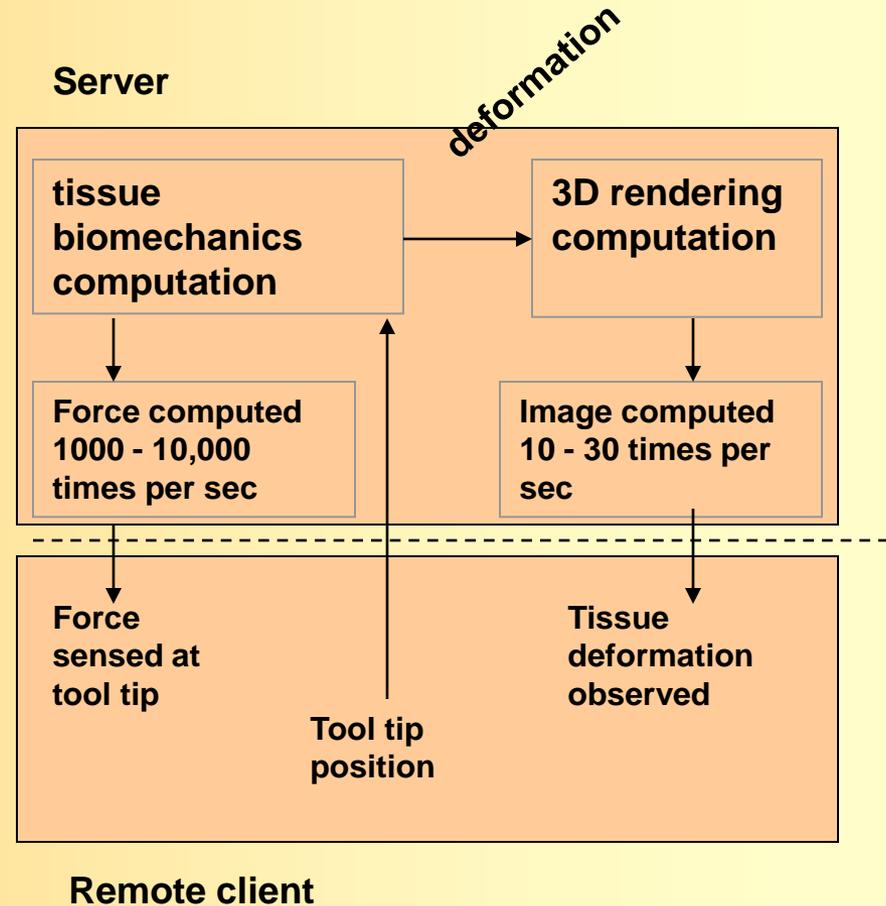are needed to see this picture.

3D anatomy used for surgical simulators

Anatomy for surgical simulator
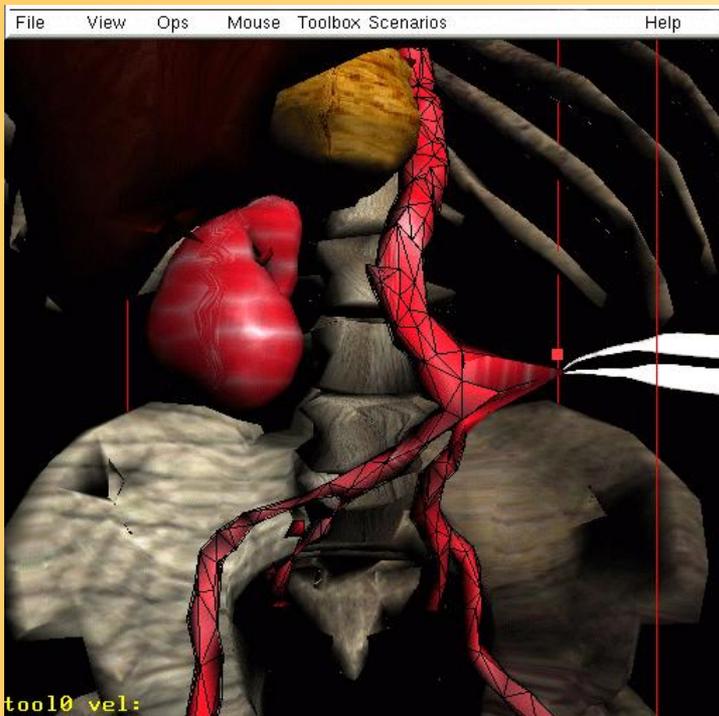

Digital Anatomy

Simulation over Internet2

Server

deformation

| tissue biomechanics computation | → | 3D rendering computation |

| Force computed 1000 - 10,000 times per sec | | Image computed 10 - 30 times per sec |

Force sensed at tool tip

Tool tip position

Tissue deformation observed

Remote client

Dev: Stanford University

Special collections & rare images

- Many countries and regions have unique and rare anatomic collections that are being lost
- Collections developed by anatomists, biologists and physicians specific to each country
- Region-specific diseases, such as tropical diseases
- Collections of importance to anthropologists or archaeologists

1500 exquisite high resolution stereo pairs of dissection images

– originally available in 1950s via View Master

– now on the Web

- Hand dissection photographed at 5 degree rotation

Virtual Pelvis Museum - Manchester, UK

http://www.hpv.informatics.bangor.ac.uk/Sim/Pelvis/index.html

Showed conditions for Caesarean section surgery after "rickets"

TIF
are ne

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Internet2 supports
real-time interaction and
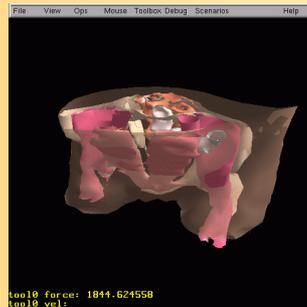# collaborative learning

Remote teaching of anatomy

California and Australia doing simulated surgery

Shared simulation over Internet2

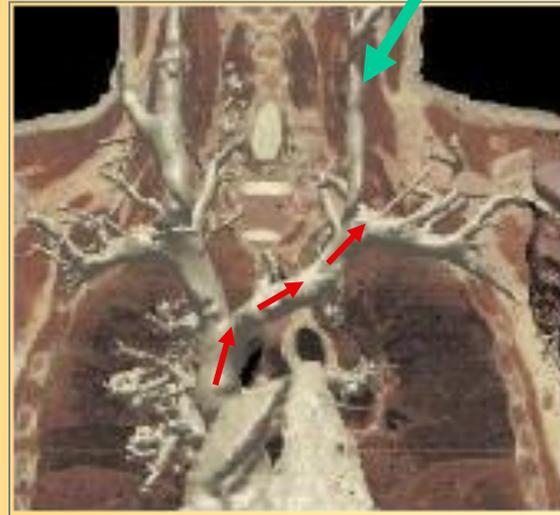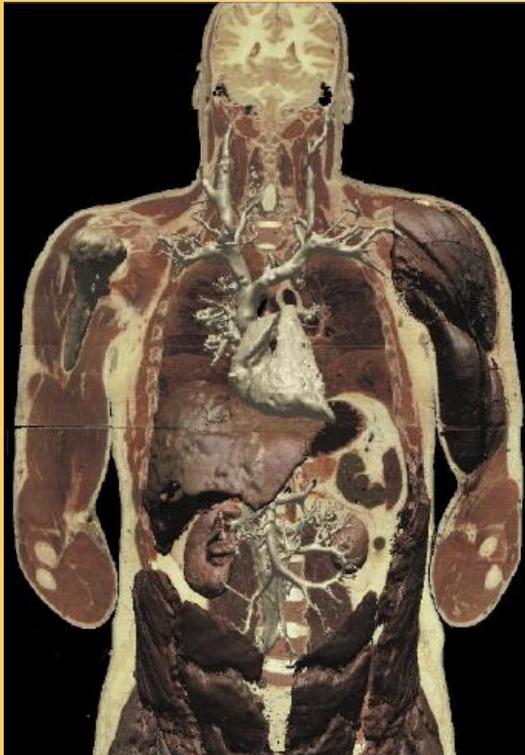**3D visualizable, palpable model, with deformation**

Frame buffer on the Net

Image is pushed to any client who logs on

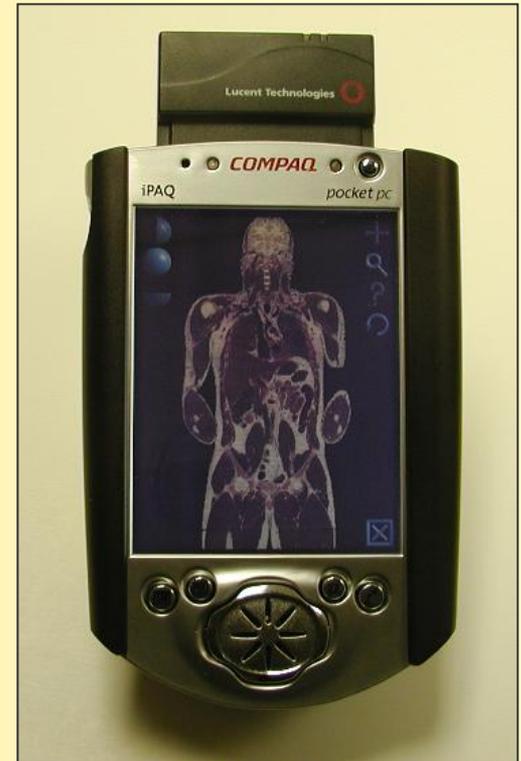**All clients have cursor control of surgical tools**

Client   **Client**   **Client**   **Client**

Dev: Stanford University

Ubiquitous Human Anatomy

Left Carotid Artery

Creating structures of interest with Internet2 access

Wireless Access

Dev: Stanford University

iAnatomy.stanford.edu

iAnatomy
Digital Anatomy Network Channel

SUMMIT

About

Collaborators

Getting Started

Technical Specs

Schedule

Downloads

iAnatomy is Launching on June 22, 2005.

Join the first event: Using Remote Stereo Viewer
More...

Self Study Sessions

FreshKnee
(UW/LAX)
Skull
(UW/LAX)

Group Sessions

Mission

iAnatomy brings together 21st century cutting-edge virtual reality technology and time-tested, cadaver-based, anatomy instruction in global virtual classrooms. Teaching / learning experiences are organized as events that link together multiple geographically remote client workstations via a server. The client stations utilize custom applications to collaboratively view and interact with virtual anatomy. iAnatomy is a by-product of SUMMIT's HAVNet project which is funded by the Scalable Information Infrastructure (SII) from National Library of Medicine (NLM).

Conclusion

- Digital anatomy is essential for future medical education

- Radiology is a rich source of digital images

- Cross-sectional images are used for 3D reconstruction of anatomy

- 3D anatomy used for surgical simulators

- Many countries and regions have unique and rare anatomic collections that are being lost

- Internet2 supports rich real-time interaction and collaborative learning

Thanks for your attention!

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