Global Technologies in Medical Education

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Key Objective of Medical Education

- Learn about diseases
- Learn systematic approach to clinical thinking and *diagnosis*

- CPPT
  - Clinical Pathophysiology and Therapeutics
- Third year medicine clerkship
  - On line didactic series
  - Textbook
    - *Symptom to Diagnosis*
  - Simulation: The Ailing Avatar

Technology allows U of C to deliver this curriculum worldwide

Step 1: Study Disease

- Clinical Pathophysiology and Therapeutics (CPPT)
  - Comprehensive course in disease
    - 4 months long
    - Three days a week
    - 8 hours per day

Typical Day in CPPT

AM	Chronic Obstructive Pulmonary Disease
8:30 - 9:25	Lecture 1: Pathology and Pathophysiology of COPD
9:30 - 10:15	Lecture 2: Clinical Aspects of COPD
10:30 - 11:30 11:30 - 12:00	Lab Session Case 1 Case 2 Discussion Case

PM	Lung Cancer
1:30 - 2:25	Lecture 1: Pathology and Pathophysiology of Lung Cancer
2:30 - 3:15	Lecture 1: Clinical Aspects of Lung Cancer
3:30 - 4:30 4:30 - 5:00	Lab Session Case 1 Case 2 Discussion Case

CPPT Continued

- 180 hours of *recorded* lectures given by experts in field
- 192 web based cases
- LAB CASES AND LECTURES AVAILABLE ON LINE and available to Global Health Affiliates
  - Lectures may be played on computers or I-Pods

CPP Web

- Case material 192 cases
  - Full History and Physical (*not* vignette)
    - Clinical images and sounds
    - Radiology images
    - Gross pathology
    - Microscopic pathology
    - Questions and answers
  - Vertically integrate prior material
  - Vertically integrate future material

Full Histories for each case

CPPWEB NAVIGATION
CPPT Home
TOCPage
Case Info
History
Physical Exam
Initial Questions
Labs/Images/Path
Discussion ?s
Rx-CPPT
Rx-Boards
Background Info
Web Tools
UpToDate
Micromedex
PubMed
Dx Approach
Dx Algorithm
DISPLAY
All
Q/A Only

CARDIOLOGY CASE STUDY 2: VALVULAR HEART DISEASE

HISTORY

CHIEF COMPLAINT:

A 64 year old man presents to the clinic with a chief complaint of exertional Chest tightness for 6 months.

HISTORY OF PRESENT ILLNESS:

He was in good health until six months ago when he started to experience chest tightness when he walked on the treadmill. He noted over this period of time, he had to decrease both speed and the incline to be able to walk without discomfort. He had been treated for hypercholesterolemia for 5 years and he had been told he had a murmur during a routine physical when he was 40.

PAST MEDICAL HISTORY:

PRIOR SIGNIFICANT OR CHRONIC MEDICAL ILLNESS

- Hypercholesterolemia
- Uncharacterized heart murmur

HOSPITALIZATIONS

- None

PAST SURGICAL HISTORY

- No prior surgeries

Physical Exam

- Cases include a comprehensive exam
  - Hundreds of images of abnormal findings
  - Links to wave files of abnormal auscultatory findings
- Radiological images also included

PHYSICAL EXAM

GENERAL APPEARANCE:

The patient appeared well developed, well nourished and in no apparent distress

VITAL SIGNS:

Blood pressure: 175/100 in his right arm, and 170/98 in his left arm, pulse 88 and regular, temperature 37.2, respiratory rate 14

HEENT:

EOMI (ExtraOcular Movements intact), PERRLA (pupils equal, round, reactive to light and accomodation), no hemorrhages or exudates; TMs (tympanic membranes) WNL (within normal limits), pharynx benign, good dentition

LUNGS:

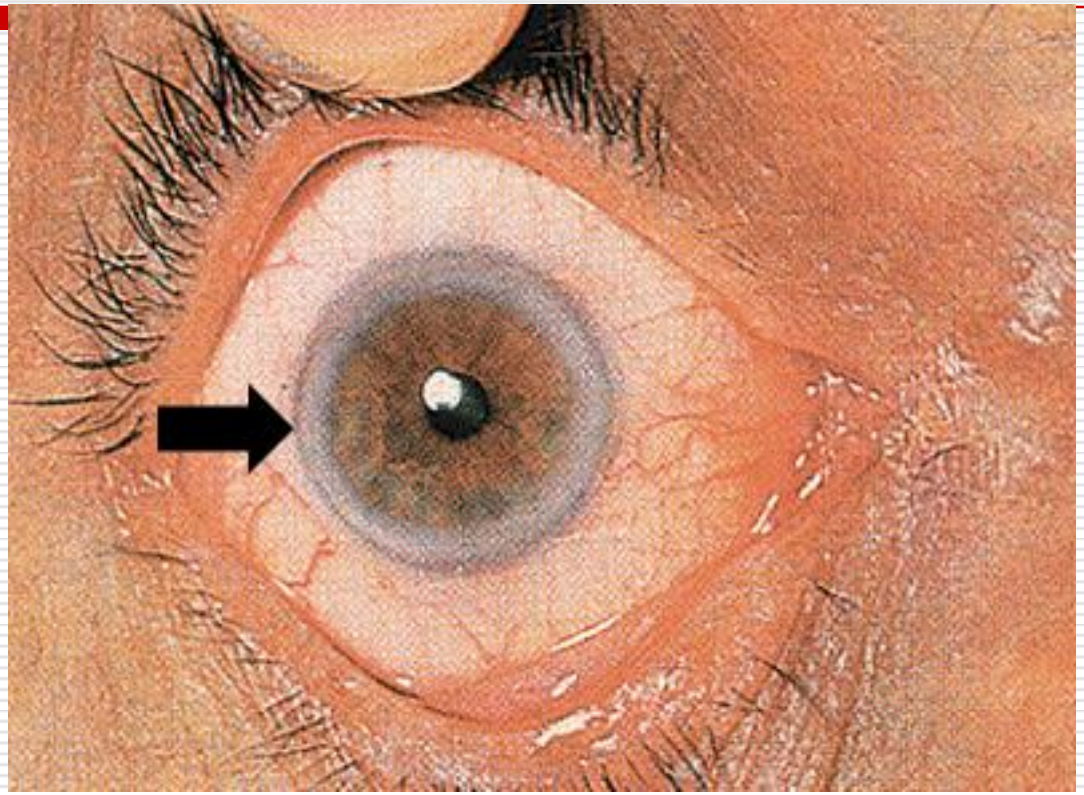
No scars or deformities
No dullness to percussion
Clear to auscultation bilaterally without crackles or wheezes

CARDIOVASCULAR:

The jugular venous pulse was not elevated.
The carotid pulsation was delayed and weak (parvus et tardus).
The precordium was not dynamic to inspection.
The point of maximal impulse was at the anterior axillary line and was sustained.
The first heart sound was normal.
There was a harsh systolic murmur (III/VI) heard best in the right parasternal space with radiation to the carotids.
The second heart sound was diminished in the aortic position, but normal intensity in the left parasternal position.
There was a left ventricular S4.

Radial pulses were delayed as were femoral pulses but were 2+.

Arcus Senilis



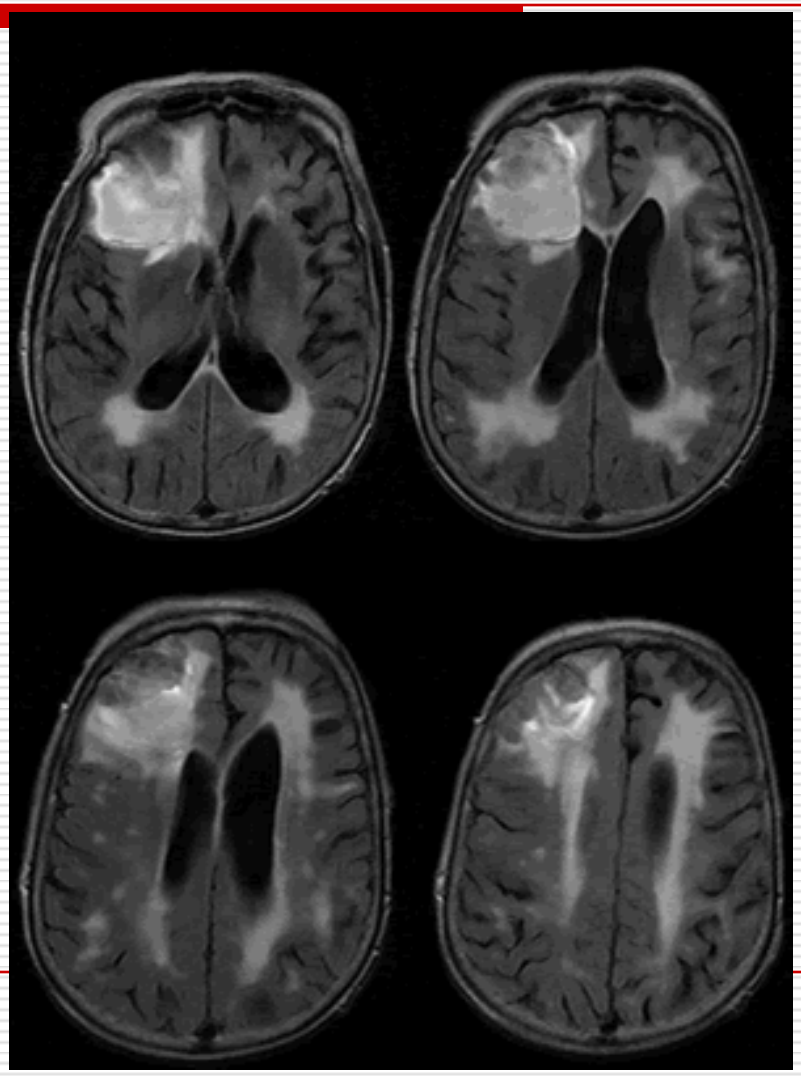
Bell’s Palsy

Other features

- Incorporates radiology images
- Incorporates pathology

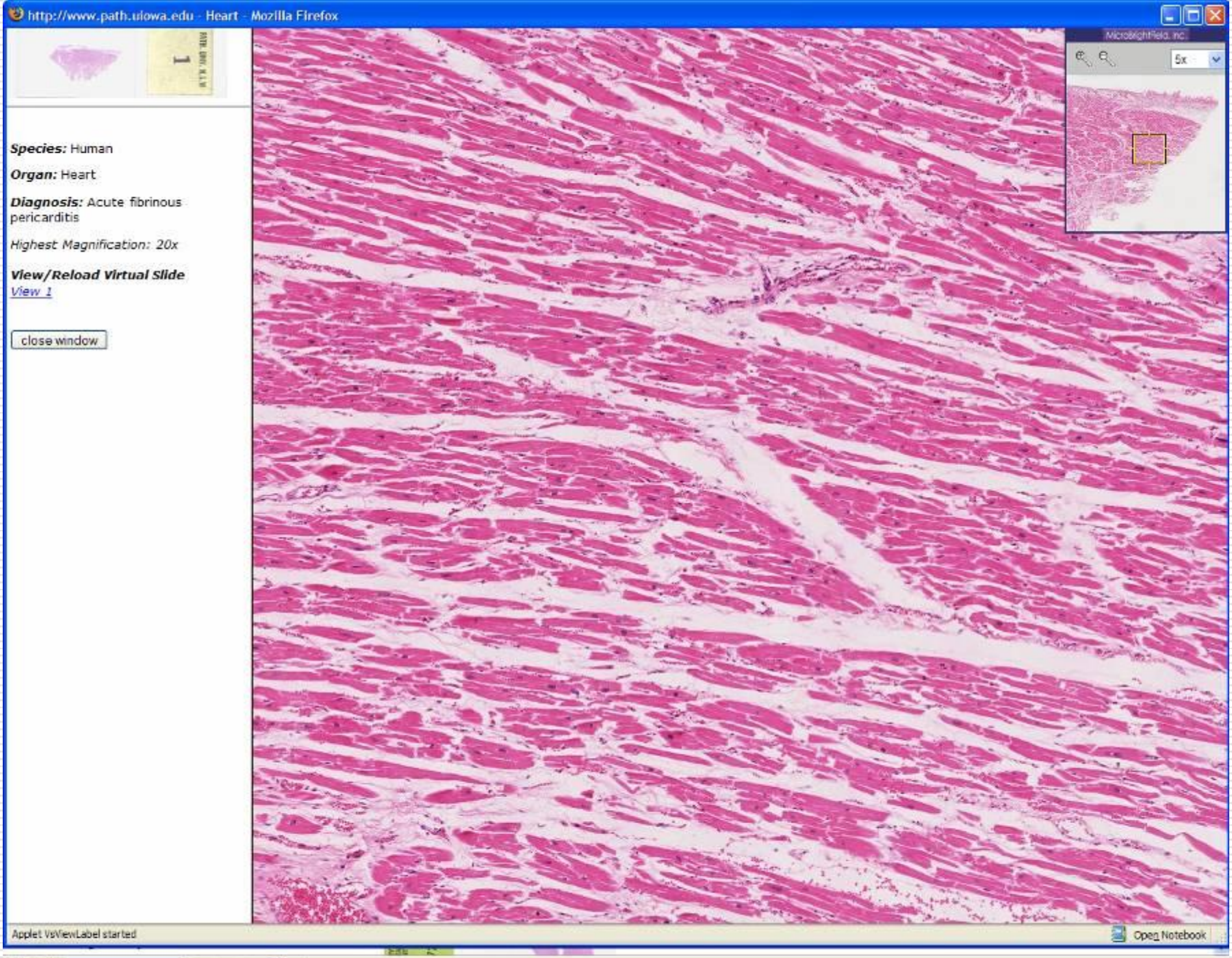
Helical CT scan demonstrating Pulmonary Embolus

MRI demonstrating hemorrhagic stroke



Pathology incorporated into case

- Microscopic Pathology
- Virtual Microscopy
  - Entire slides scanned into database
  - Slide images can be seen at any degree of power on laptop computers
  - Allows optimal images to be added to web
  - Promotes discussion amongst faculty and students


http://www.path.uiowa.edu - Heart - Mozilla Firefox
Species: Human
Organ: Heart
Diagnosis: Acute fibrinous pericarditis
Highest Magnification: 20x
View/Reload Virtual Slide
View 1
close window
MicroBrightField, Inc.
5x
Applet VsViewLabel started
Open Notebook
Find:
Match case

Disease based questions

- Every case imbedded with questions particular to that patient, their disease and the pathophysiology of that disease

Integration CPPT

- Reviews prior basic science material
- Prepares students for future clinical material

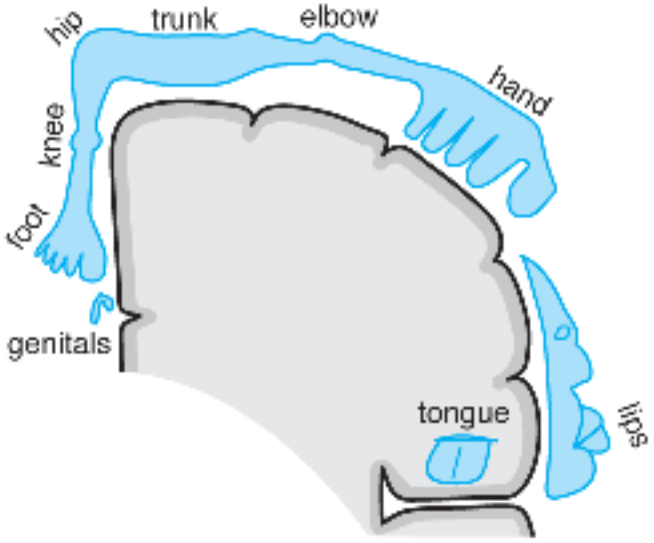
INTRODUCTION TO NEUROANATOMY:

(or perhaps better called, Neuroanatomy for the NonNeurologist!)

This brief introduction to Neuroanatomy is meant to refresh you memory about just a few of the most clinically important tracts. I hope this will be a useful review.

1. Motor Tracts

The motor pathway begins in the motor cortex located on the precentral gyrus. This first motor nerve cell body is call the *upper motor neuron*. The distribution of the motor neurons is layed out in a pattern referred to as the homunculus, pictured below. This is a coronal section through the motor strip.



There are several critical facts to note. The motor neurons that supply the leg lie in the midline between the left and right hemispheres. This area is actually supplied by a different artery (the anterior cerebral artery) than the rest of the homunculus (supplied by the middle cerebral artery). The midddle cerebral artery comes up through the sylvian fissure (which is represented above as the horizontal fissue just below the tongue.).

Pictured below, is the lateral view of the cortex, showing the middle cerebral artery coming out of the sylvian fissure runing along the outside of the cortex where it will supply the moton neurons of the face, arm and trunk and other areas.

Clinical Reasoning Questions
3rd year "Prep"

- **Construct a problem list**
- **Reorganize and prioritize the problem list.**
- **What is your leading hypothesis? What other alternative hypotheses** should be considered?
- Considering your leading and alternative hypotheses **what diagnostic tests would be useful?**

Feedback

Year 2, Winter Quarter 2007-08

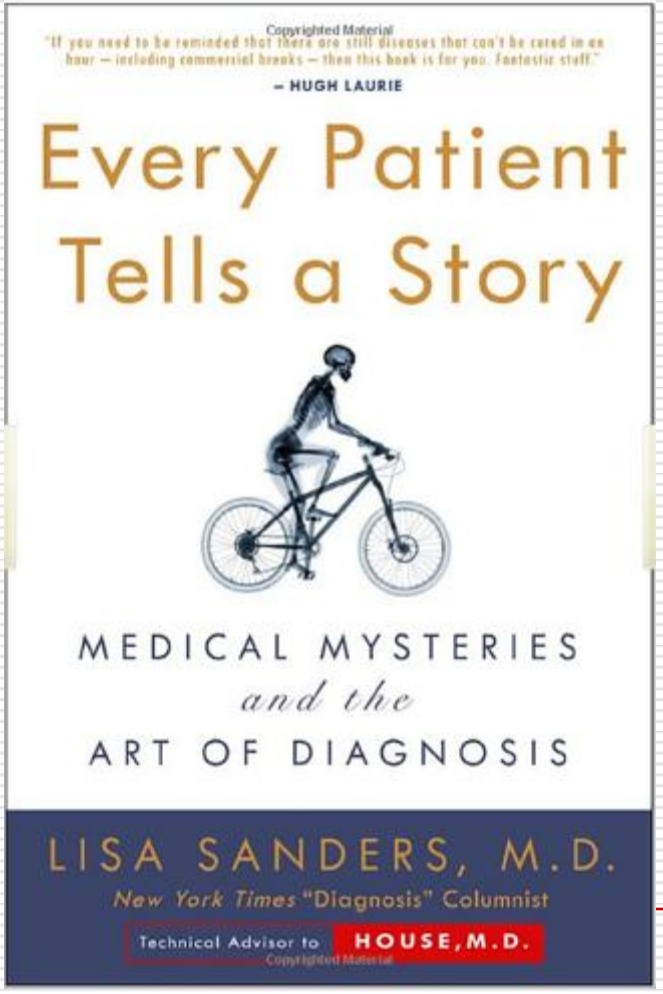
RATING CRITERIA	Winter: Clinical Patho-physiology & Therapeutics I n = 77 (*mean ± sd)	Winter: Clinical Skills 2A: Physical Diagnosis n = 73 (*mean ± sd)	*COMPARISON Average Rating 2nd yr. Courses WINTER 2007-08* (*mean)
Organization of the Course	**4.7**	**3.8**	
Met the objectives stated in the syllabus	4.7 ± 0.51	4.1 ± 0.75	*4.4*
Was well organized	4.7 ± 0.46	3.6 ± 1.14	*4.1*
Value of Material	**4.7**	**3.9**	
Provided student with useful skills, insights, etc.	4.8 ± 0.40	4.2 ± 0.67	*4.5*
Material was constructively challenging	4.7 ± 0.54	4.0 ± 0.81	*4.3*
Assigned readings were valuable adjuncts	4.5 ± 0.64	3.5 ± 0.92	*4.0*
Demands and Expectations	**4.5**	**4.1**	
Material was presented at an appropriate level	4.6 ± 0.59	4.2 ± 0.71	*4.4*
Material was well paced and evenly distributed	4.4 ± 0.76	3.8 ± 1.10	*4.1*
Effort required to learn material was reasonable	4.5 ± 0.66	4.4 ± 0.67	*4.5*
Clinical relevance of material made apparent	**4.9** ± 0.36	**4.6** ± 0.57	*4.7*
Overall, this was an outstanding course	**4.7** ± 0.48	**3.9** ± 0.79	*4.3*

Multi-step process: Step 2

- Learn about diseases

- Learn systematic approach to clinical thinking and *diagnosis*

The scary truth: Diagnostic Errors are common



- NIH Study 1999: 98,000 deaths/y in U.S. due to medical errors
- 10 – 15 % of all patients seeing primary care physicians are given incorrect diagnoses
- *Diagnostic errors* account for 17% of all adverse events

Diagnostic errors

- “The fear of getting it wrong is always present for both doctors and patients. As a result there is a new and growing interest in better understanding diagnostic errors in medicine”.

Why diagnostic failures?

- Clinical Reasoning traditionally taught by mentorship & apprenticeship
  - Work hour limitations dramatically reduce teaching time
  - Most clinicians lack expertise to clearly articulate critical diagnostic reasoning

TIME

- 10 admissions per call night
  - 1994
    - Rounds focus on sickest patients
    - No work hour limitation for residents
    - Attending rounds lasted hours and ended when work is done
  - 2010
    - Strict work hour limitations for residents
    - Attending rounds last ≤ 3 hours and must end by 10:30 AM

- Attending rounds has gone from
  - "What are you thinking?"

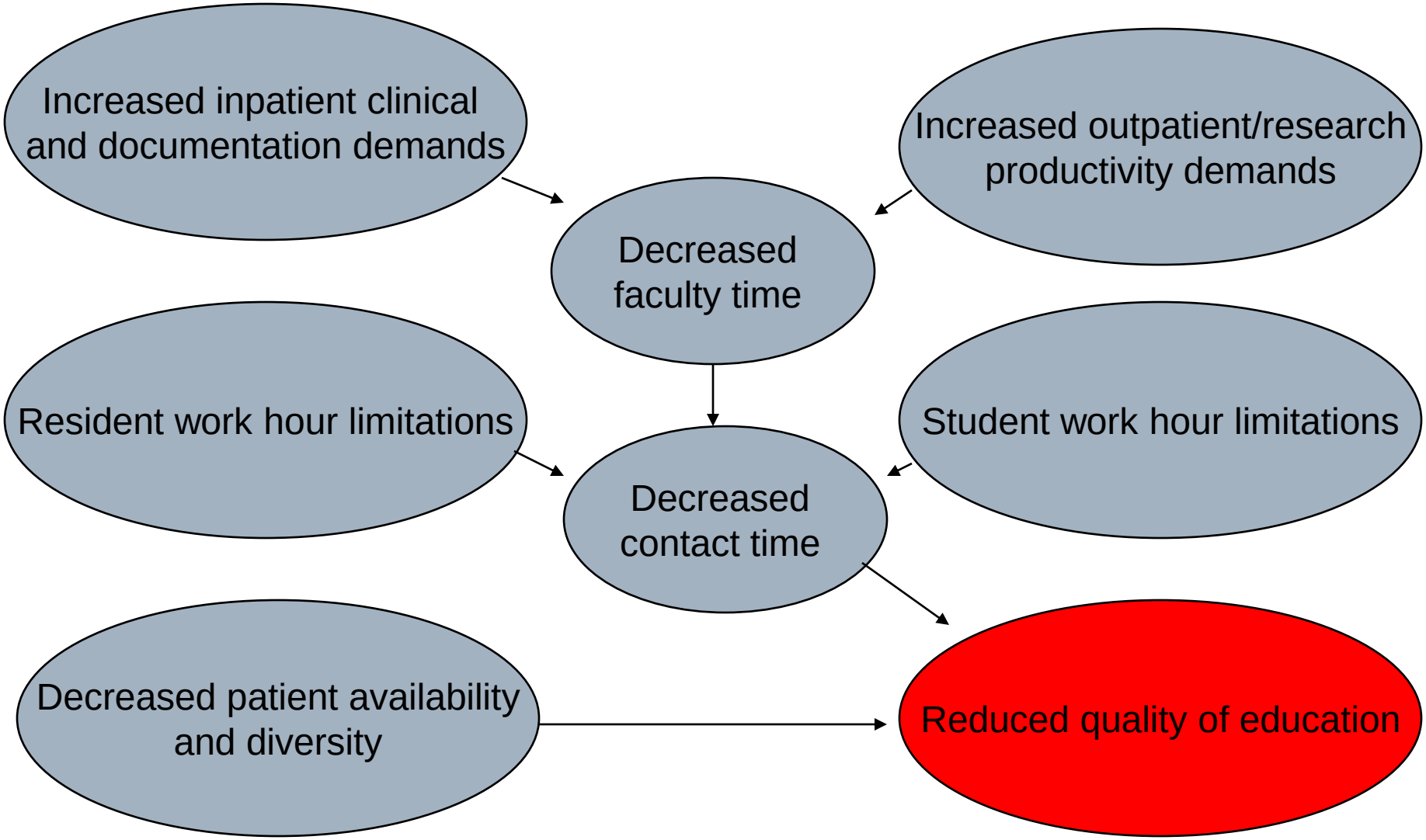
    to
  - "What do you want to order?"

Effect of Duty Hours

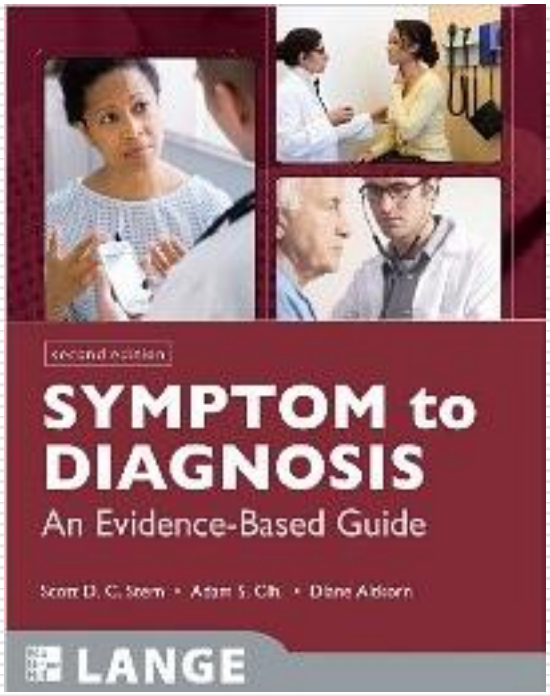
- Resident student contact time ↓ 56%
- % of students having observed history and physical ↓ 40%

Arora, V., et al. Am J Med, 119;12, 1089-1095

The Perfect Storm



Teaching Critical Diagnostic Reasoning Step 2A: The Textbook

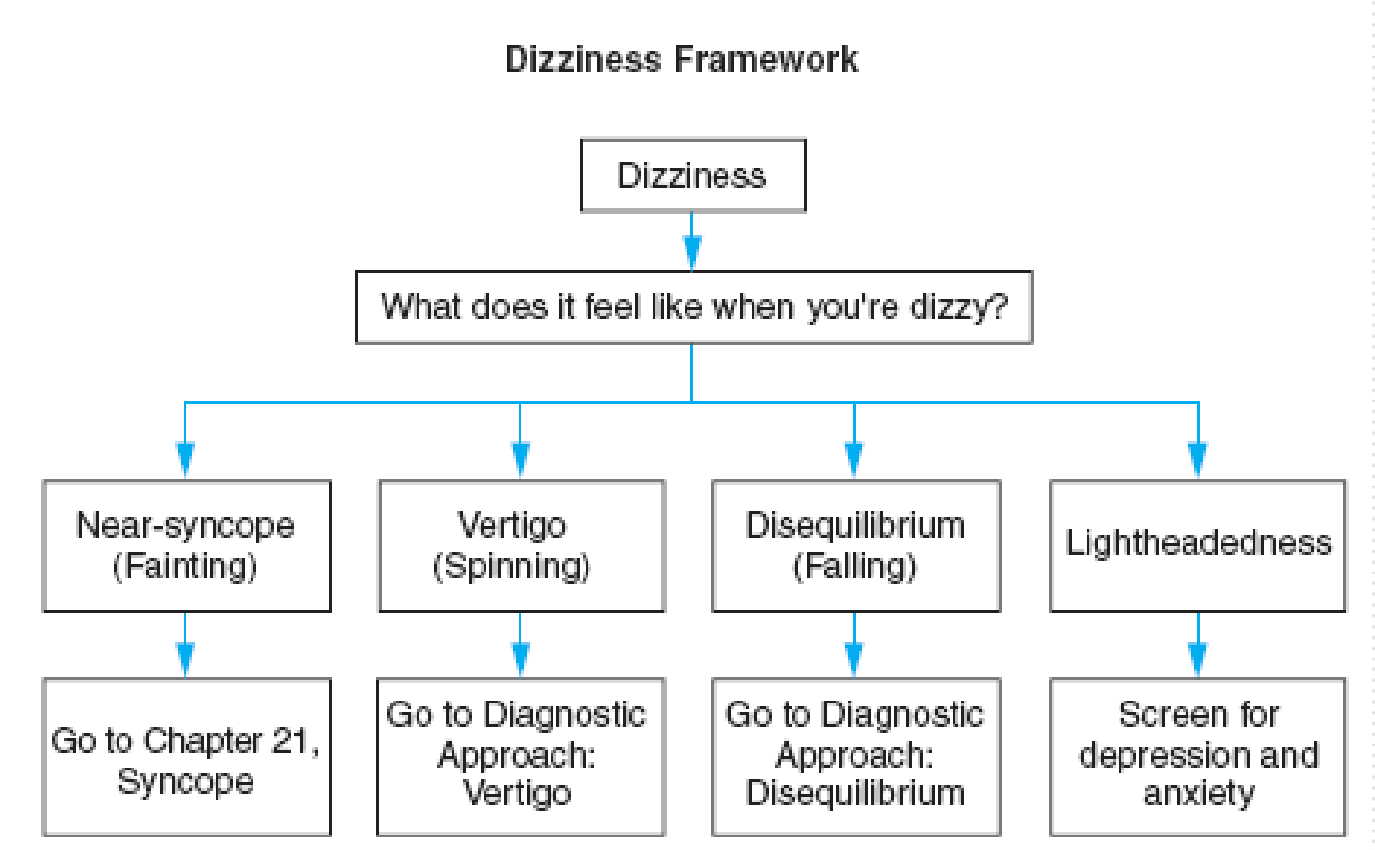


Textbook
Symptom to Diagnosis

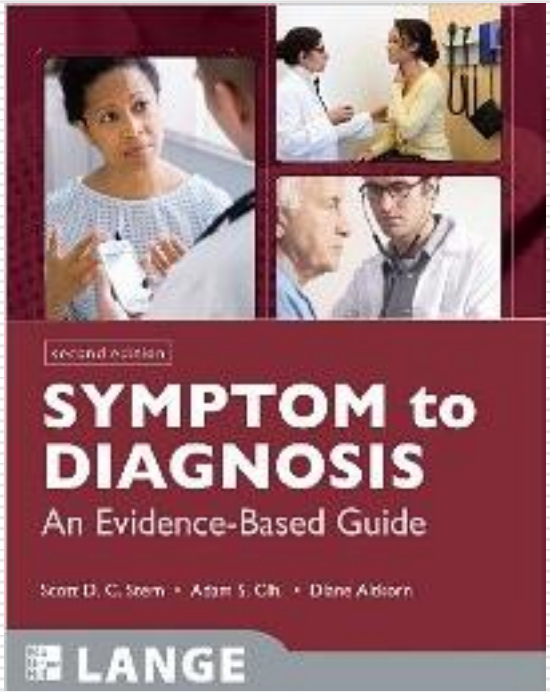
- 28 Symptom based chapters
- Each chapter
  - Summarizes an approach to the differential diagnosis
  - Incorporates clinical cases
  - Provides a summary algorithm
- Reviews over 300 pertinent diseases
  - Textbook presentation
  - Disease highlights
  - Evidence based diagnosis
  - Treatment
- Thousands of lab tests analyzed

Table of Contents & Didactic Series

Differential Diagnosis: Dizziness



Teaching Critical Diagnostic Reasoning Step 2B: Interactive didactic series



- Didactic series compliments book
- Available to GHI affiliates

Step 2C:
Faculty Student Case Seminar

- Students prepare by textbook reading & review of online didactic
- During seminar faculty present unknown cases which students analyze.
- Allows students to utilize their new knowledge and faculty to observe and correct diagnostic reasoning

Step 3: The FUTURE
The Ailing Avatar: A preview

- Computerized simulation to teach clinical reasoning and diagnosis
- The next step in teaching clinical reasoning
- Being developed in collaboration with Argonne National Labs and Türk Telekom
- Expected July 2012

The Ailing Avatar

- Students will interact with computer based sick avatars to:
  - Ask about symptoms
  - Explore the physical exam
  - Generate a differential diagnosis
  - Order and review lab results
  - Come to a diagnosis

Potential Benefits

- Improve critical diagnostic reasoning
- Demonstrate & document competencies
- Increase exposures to important diseases/symptoms
  - Fill gaps in clinical experience
  - Fulfill LCME competency requirements
- Allow medical students throughout the world including resource limited areas to be properly trained in medical diagnosis
- Augment, not replace clinical experience.

Demo

Clinic

ER

Which symptom would you like to see today?

- Abdominal Pain
- Back Pain
- Chest Pain
- Cough, Respiratory Infections
- Change in Mental Status
- Diarrhea
- Dizziness
- Dyspnea
- Edema
- GI Bleed
- Headache
- Jaundice
- Joint Pain
- Renal Failure
- Syncope
- Weight Loss

• 01:15 PM

Text

T

History

PE

LABS

D/ Dx

CONSULT

• 01:15 PM

T

History

PE

LABS

Dx Dx

CONSULT

What brings you here today?

What brings you here today?

Well, my joints have been hurting a lot lately and... I can't even walk around without that hurting!

• 01:15 PM

T

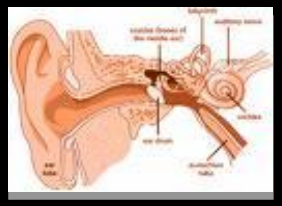
History

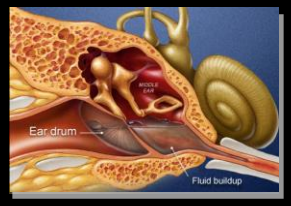
PE

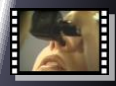
LABS

D/ Dx

CONSULT







Cardiac Procedures
Chemistry Lab
GI Procedures
Hematology Lab
Microbiology Lab
Neurologic Procedures
Pulmonary Procedures
Radiology Procedures
Serology Lab
Invasive Procedures

Tests requested

• AN[redacted]1: 360

Table 23–10. Test characteristics for ANA and DsDNA in the diagnosis of SLE.

Test	Sensitivity	Specificity	LR+	LR–
ANA	99%	80%	4.95	0.01
DsDNA	73%	98%	36.5	0.28

ANA, antinuclear antibodies; SLE, systemic lupus erythematosus.
Adapted from Black ER. *Diagnostic strategies for common medical problems.* Philadelphia: American College of Physicians, 1999:423.

Table 23–11. Common serologies in rheumatologic diseases.

Antibody	Clinical Association
Anti-DsDNA	Nephritis in SLE
Anti–Smith	SLE
Anti-RNP	Raynaud phenomenon and myositis in SLE
Anti Ribosomal P	CNS disease in SLE
Anti SSA/Ro, Anti SSB/La	Sjögren syndrome and skin disease in SLE and Sjögren syndrome
Anti-histone antibodies	Drug-induced lupus
Anti-jo-1	Polymyositis/dermatomyositis
Anti-DNA topoisomerase I (Scl-70), anti-RNA polymerase I and III	Systemic sclerosis (scleroderma)
ANCA	Many vasculitic diseases including Wegener granulomatosis, microscopic polyangiitis, and Churg-Strauss syndrome
Anti-U1 RNP antibodies	Mixed connective tissue disease
Anti-GBM	Anti-GBM antibody (Goodpasture disease)

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History

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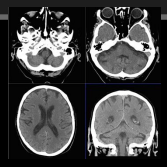

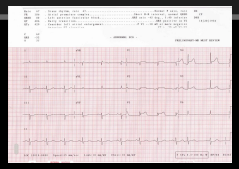

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History
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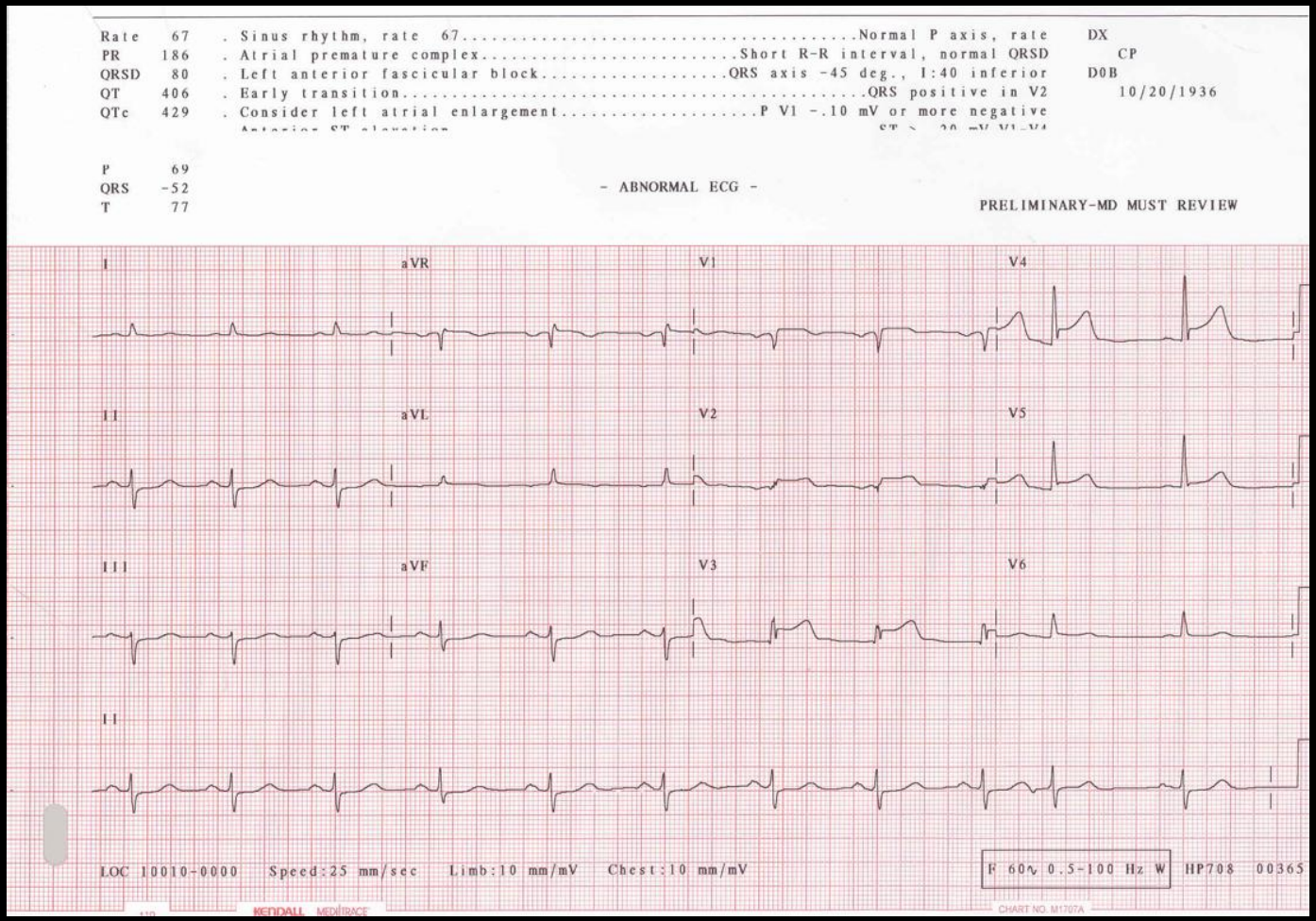

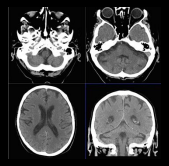

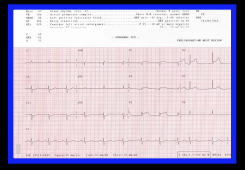

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History

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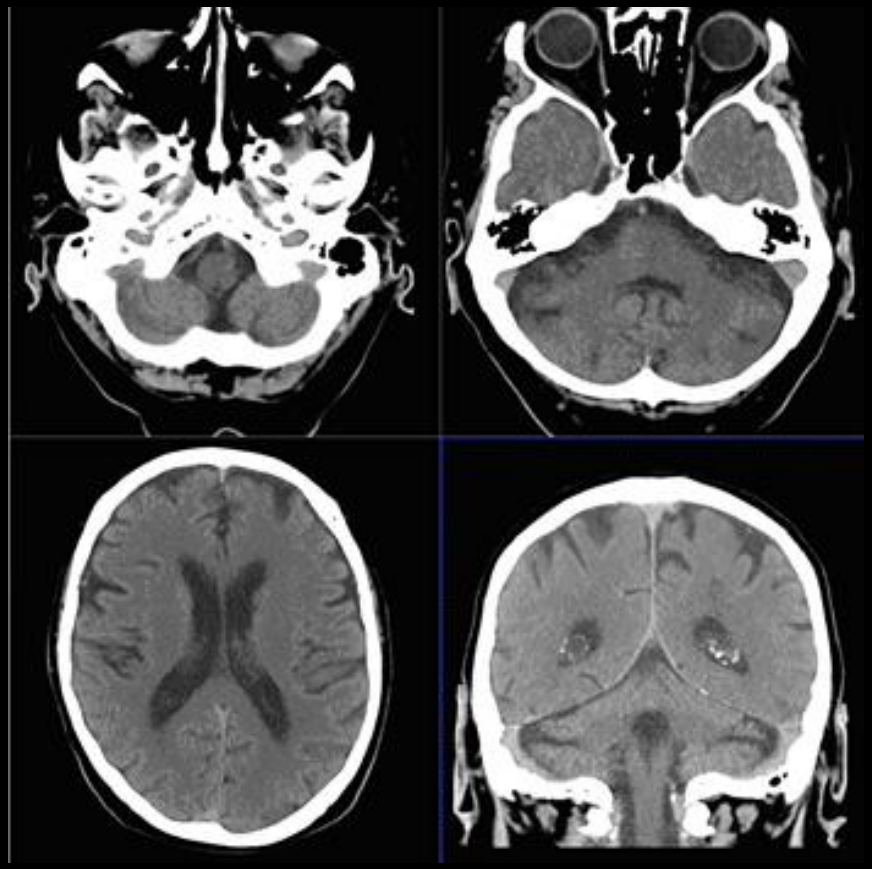
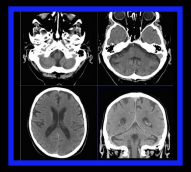
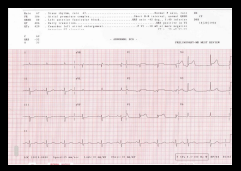
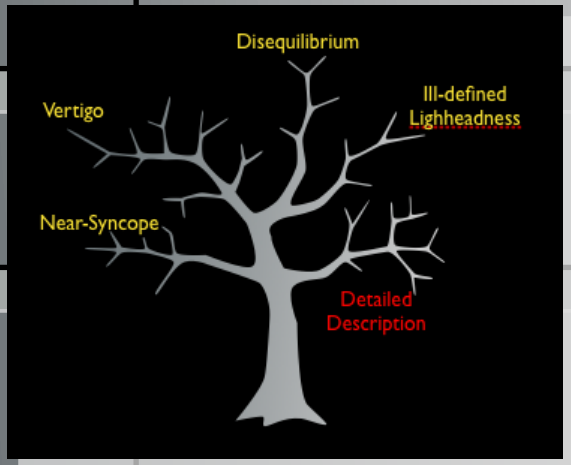






Hypothesis	Clinical Clues	Diagnostic Tests
Lead	**Lead**	**Lead**
Lupus		ANA=1: 360
Alternative		**Alternative**
Must Not Miss		**Must Not Miss**



T

Scoring & Evaluation

Score Card

History Taking		
Pivotal points asked		
Physical Exam		
Correct interpretation		
Diagnoses		
Lead		
Alternative		
Must not miss		
Differential diagnosis match		
Lab utilization		

Global Technologies in Medical Education

- Technology allows for dissemination of innovative teaching tools across vast distances
- Tools at the University of Chicago include
  - CPPT
    - Web cases & lecture series
  - Symptom to Diagnosis
    - Book & Lecture series
  - *Coming soon…**The Ailing Avatar***