

Residents Training - 2006-2007

First Year

Class will meet four times per week (Monday – Thursday) beginning in September. Classes start September 25, after Physics Boards. Classes are in Room 1R31 (Barton Research building).

Attendance

The resident is expected to attend all regular lecture and laboratory sessions. Attendance at the Board Review is optional. Obviously critical patient care takes precedent over class attendance. However, residents in other years of training, and especially faculty, should be aware that a given resident is expected in a lecture at the scheduled time and should be prepared to cover for that resident at that time. The resident should be prepared to be somewhat assertive, if necessary, to insure that he or she does not miss a scheduled lecture

Basic Physics

Instructor- Michael Hall, M.S.

- Units of Measurement important to radiological sciences
- Atomic structure--a review
- Electricity and magnetism
- Measurement of radiation and radioactivity-
- Sources of ionizing radiation
- X-ray production
- Radioactivity
- Particulate radiation interaction with matter
- E.M. radiation (quantum theory)
- E.M. radiation interaction with matter
 - absorption and attenuation
 - radiation dose
 - detection
 - film
 - ionization

- scintillation
- thermoluminescence

Radiographic Physics

Instructor- Michael Hall, M.S.

Plain film radiography

- X-ray equipment
- X-ray production
- X-ray film
- Film screen combinations
- Image quality
- X-ray shielding

Mammography

- Anode / filter combinations
- Image quality
- Equipment design
- Digital mammography
- MQSA

Fluoroscopy

- Image intensifier (II)
- Video images
- Automatic Brightness control
- Fluoro safety and radiation protection

Digital radiography

- Digital communication
- Binary representation
- Digital images
- DICOM
- Analog to digital conversion (ADC)
- Nyquist frequency and aliasing

- Convolution filters
- Window and level
- Digital detectors

Radiation Protection – Radiation Biology

Instructor – Max L. Baker, Ph.D.

- History of Radiation Biology / Radiation Protection
- Radiation Units
- Sources of Exposure
- Maximum permissible doses
- Interactions with matter
- Radiation chemistry
- Radiation genetics
- Cellular radiobiology - the survival curve
- Cellular radiobiology - modifiers of the radiation response.
- Tumor biology - cell kinetics
- Tissue and organ sensitivity
- The acute radiation syndrome
- Radiation accidents – Patient management
- Radiation accidents - Hospital preparation
- Recent accidents and their management
- Radiation and the fetus
- Protection of the pregnant patient
- Late effects of radiation - cancer, cataracts, life shortening
- Protection of the radiologist / radiographer
- Personnel monitoring
- Risk / benefit aspects of radiation exposure
- Review RSNA Radiobiology Syllabus

Written exam in Physics for all residents who have not taken the Physics Boards is the RAPHEX (June of each year).

Reviews of past Raphex exams are held for several sessions prior to the Raphex exam.

Summer Lecture Schedule

**Instructors- Tony Baker, M.S., Michael Hall, M.S.,
Ronald Walker, M.D.**

Lectures through the summer are held at 1:00-2:00 PM in 1R31 in place of regular noon conferences. Review sessions using past RAPHEX exams, recall question etc. begin in August for those taking the Boards in September.

Topic	Subject
Basic Review of First year Physics (Hall)	Ionizing Radiation Radiation Sources Radiation Interactions
Radiation Detection and Measurements (Hall)	Principles Units
Nuclear Medicine- Physics and Instrumentation (Hall-Walker)	Radioactive Decay NaI(Tl) Detectors Nuclear Imaging PET Counting Statistics Internal Dosimetry Quality Control Licensure

CT-
Physics and Instrumentation (Hall)

Equipment Design
Image Reconstruction
Hounsfield units
Image Display
Artifacts/Dosimetry

Ultrasound-
Physics and Instrumentation (T.Baker)

Wave Mechanics
Transducer Designs
Measurement
Attenuation
Reflection/Refraction
Imaging Instrumentation
Non-Imaging Artifacts

NMR/MRI-
Physics and Instrumentation

Basics of NMR
Spin relaxation and
Principles of MRI
MRI sequences
and contrast

Recommended Texts

Radiation Biology

Hall, E.J., and Giaccia, A.J., Radiobiology for the Radiologist, Sixth Edition. Lippincott Williams and Wilkins, Philadelphia, 2006.

Mettler, F.A., Jr., and Moseley, R.D., Medical Effects of Ionizing Radiation, Grune and Stratton, New York, 1985.

Radiation and Measurement

Martin, J.E. and Lee, C. Principles of Radiological Health and Safety, John Wiley and Sons, New Jersey, 2003.

Radiographic, CT, Ultrasound and MRI/NMR Physics

Bushburg, J.T., Seibert, J.A., Leidholdt, Jr., E.M. and Boone, J.M. The Essential Physics of Medical Imaging, Second Edition, Lippincott Williams and Wilkins, 2001.

Curry, T.S., III, Dowdey, J.E., and Murry, R.C., Jr., Christensen's Introduction to the Physics of Diagnostic Radiology, Fourth Edition, Lea and Febiger, Philadelphia, 1990.

Nuclear Medicine Physics

Cherry, S.R., Sorenson, J.A., and Phelps, M.E., Physics in Nuclear Medicine, Third Edition, W. B. Saunders Co., Philadelphia, 2003.

Ultrasound Physics

Hedrick, W.R., Hykes, D.L., and Starchman, D.E., Ultrasound Physics and Instrumentation, Third Edition, Mosby Yearbook, St. Louis, 1995.

Board Review

Brownie, S.V., and Shahabi, S. Editors, Radiological Physics Examinations (RAPHEX) 2000-2005, Advanced Medical Publishing, Madison, Wisconsin.

Huda, W. and Slone, R. Review of Radiological Physics, Second Edition, Lippincott Williams and Wilkins, Philadelphia, 2003.

Nickoloff, E.L., Radiology Review - Radiologic Physics, Elsevier Saunders, Philadelphia, 2005.

Revised September, 2006