AUR 2012: Teaching in the new curriculum

Teaching to a computer-based multiple choice format: What candidates must know

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Residency Program Director
Stanford University Department of Radiology
Review:
New ABR exams

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<th>Exam of the Future Timeline</th>
<th>Core Exam</th>
<th>Certifying Exam</th>
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Core exam
Certifying exam
I. The Core Exam

• Will be given September 30-October 4, 2013
  • Subsequent years will be offered in late June
  • Last full Oral exam in June, 2013
• Covers all of diagnostic radiology
• Physics integrated: “Clinically-oriented physics”
• Comprehensive, categorical exam
• Candidates must pass all categories
## 18 Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tr>
<td><strong>Organ systems (10)</strong></td>
<td>MSK, Thoracic, GI, Urinary, Neuro, Pediatrics, Cardiac, Reproductive/Endocrine, Breast, Vascular</td>
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<td>Physics, Safety</td>
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Radio-isotope safety exam (RISE) for AU eligibility status is included as virtual section of the Core Exam.
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Core Exam 2013+
Nuts and Bolts

•~630 items
• Two 1.5 day sessions during a single week
  AM Day 1: Registration
  PM Day 1 and AM Day 2: Exam
• Examination center(s)
  • Chicago center (near O’Hare)
  • Tucson ABR office
• Fail 1-5 categories = Condition
• Condition Exams: June/October
• Fail > 5 categories = Fail exam, must re-take entire exam
Core Exam: Content

• 100 question practice test promised before 1/2013
• Image-rich (unlike current written)
  • 40% fact recall (like current written)
  • 60% higher level (like current oral)
• Differential diagnosis, Management
• Mostly MCQs, may include new question types
2. Certifying Exam

Will be first administered in October, 2015
Contains FIVE parts (but questions will appear in random order)

<table>
<thead>
<tr>
<th>Non interpretive skills (Required)</th>
<th>Things every physician should know</th>
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<tbody>
<tr>
<td>Essentials (Required)</td>
<td>Things every diagnostic radiologist should know</td>
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<tr>
<td>Clinical Practice Areas (3 self-selected CPAs)</td>
<td>Things this specific radiologist should know</td>
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</table>
Two required modules:

1. Noninterpretive Skills:
   - General topics of importance to the practice of radiology, such as radiation safety, recognition and management of contrast reactions, error prevention, communication skills, professionalism, ethics, and other aspects of practice.

2. Essentials of Diagnostic Radiology:
   - Basic knowledge that every radiologist should know, such as recognizing child abuse, pneumothorax, shock bowel, and subdural hematoma.
Clinical Practice Areas (CPA)

- Candidates can choose any combination of CPAs
- Items will vary in both difficulty and scope
  - Level 1: basic
  - Level 2: advanced
- Candidates selecting a CPA more than once will receive a higher proportion of level 2 items
13 Clinical Practice Areas

- **Organ systems:**
  - MSK, Cardiac, Thoracic, GI, Urinary, Repro/Endo, Neuro, Peds, Breast

- **Technology:**
  - US, VIR, Nuclear Radiology

- **General**
Certifying Exam: Nuts and Bolts

• ~300 items
• 5-hour exam (one half-day)
• September/October time frame
• Exam center(s): Chicago, possibly LA
• Exams offered October/February
Certifying Exam: Scoring

- Scored as Pass / Fail

- Required modules (2) must each be passed individually

- Elective modules (3) must be passed as a group

- If any of these three decisions is Fail, must re-take entire exam
Fail Certifying Exam

• Have 5 years to pass Certifying Exam after they first qualify

• Additional year of training is required if Certifying Exam not passed w/in 5 years
How to Prepare?

Exam format

• Some students have difficulty with multiple choice exams in general

• Specific difficulty with computer based exams

• Likely correlates with USMLE scores

• Suggestions: Residents should self-identify, or use ACR in-service
Core Exam: Review Sessions

- Physics content
  - Should focus on practical applications
  - Physics instruction for residents: integrate into rotations in addition to separate conference series?
- American Association of Physicists in Medicine
- AAPM Learning Modules: rsna.org/education/physics.cfm
## AAPM modules

### Fundamentals
- Atoms, Radiation, and Radioactivity
- Interactions of Radiation and Tissue
- Radiation Measurements and Units
- X-Ray Tubes and Spectra

### Basic Imaging Science and Technology
- Evaluation of Medical Image Quality
- Foundations of Medical Image Quality: Contrast, Sharpness, and Noise
- Image Display
- Image Perception and Performance Evaluation Including CAD
- Image Processing and Reconstruction
- PACS

### Radiation Biology
- Basic Radiation Biology
- Radiation Effects

### Radiation Protection
- Fundamentals of Radiation Protection
- Radiation Dose and Risk
- Radiouclide Dosimetry and Nuclear Regulations

### Projection X-Ray Imaging
- Basic Concepts in Radiography
- Basics of X-ray and Mammographic Systems
- Digital X-Ray Imaging
- Image Quality and Dose in Mammography
- Image Quality and Dose in Radiography
- Radiographic Image Receptors

### Fluoroscopy
- Fluoroscopy Systems
- Radiation Dose and Safety in Interventional Radiology

### Resources
- Physics Curriculum Link
- Acknowledgements
- Return to the RSNA Resource for Residents Page
- Return to the AAPM website
- Return to RSNA.org
1. Excitation & Ionization

Charged particles, such as alpha, beta plus, and beta minus particles, transfer kinetic energy to materials through the processes of excitation, ionization, and through radiative losses (also called bremsstrahlung). Excitation and ionization are the result of coulombic (charge-dependent) interactions between incoming charged particles and orbiting electrons. Radiative losses are the result of collicular interactions with the nucleus of an atom.

Excitation occurs when an incident charged particle transfers energy to an orbital electron in the target. This causes the electron to shift position to a higher energy state. However, the energy transferred is not sufficient to remove the electron from its shell. Subsequently, the electron will de-excite (i.e., return back to a lower energy state) resulting in the emission of electromagnetic energy usually in the form of infrared radiation (heat).

Ionization occurs when an incident charged particle transfers enough energy to an orbiting electron to eject it from the atom. This results in the formation of an ion pair consisting of the positively charged atom and the negatively charged ejected electron. Ionization can only occur when the energy transferred to the orbiting electron exceeds the electron shell binding energy.

The formation of an ion pair in air requires 33.7 eV of energy. A single incident electron with 34 keV (34,000 eV) of energy can potentially produce 1000 ionizations in air if all the incident energy is converted to ion pair creation. Because of their innate charge, electrons, positrons, alpha particles and protons are known as directly ionizing agents. Other forms of radiation, such as neutrons, X-rays, and gamma rays, deposit energy in atoms through different mechanisms that may result in the removal of orbital electrons and are therefore classified as indirectly ionizing.

When an ionization event results in the removal of an inner shell orbital electron, a void is left in the electron configuration. Outer shell electrons will cascade inward to fill the vacancy. This results in the emission of an X-ray. The energy of the X-ray is equal to the difference in binding energies between the two shells. As binding energies are unique to a given atom, the X-rays are said to be "characteristic" X-rays. For example, the K-shell binding energy of tungsten is 89.6 keV. When a K-shell atom of tungsten is ionized, an electron vacancy is left in the K-shell. If this vacancy is filled by an electron from the outermost shell of tungsten, with little binding energy, an X-ray with 89.6 keV of energy will be emitted. This X-ray energy is characteristic of tungsten because different atoms will have different shell binding energies. Electrons can transition between various shells: K, L, M, N, etc., resulting in a series of possible X-ray emissions with specific characteristic X-ray energies that are determined by the differences in binding energies between the two energy shells.

In some instances, characteristic X-rays are not emitted when an electron transition from an outer shell to an inner shell occurs. Instead, the transition energy is transferred to a second orbital electron, resulting in its removal from the atom. This process is known as Auger...
Core Exam: Review Sessions

• Diagnostic content
  • 40% fact recall—even though image-rich, reasonable to study topics prevalent on previous written exam
  • 60% resembles oral boards—standard board review
• New resource: Core study guide on theABR.org
Core exam study guide: Checklist of topics

Gastrointestinal Imaging

1) Pharynx
   a) Benign diseases
      i) Zenker diverticulum
      ii) Foreign bodies
      iii) Trauma
   b) Motility disorders

2) Esophagus
   a) Benign diseases
      i) Diverticula
      ii) Trauma
      iii) Esophagitis
         1) Reflux
         2) Infectious
         3) Caustic
         4) Drug-induced
      iv) Barrett's esophagus
      v) Rings, webs, strictures
      vi) Varices
      vii) Benign tumors and tumor-like conditions
      viii) Extrinsinc processes affecting the esophagus
         1) Pulmonary lesions
         2) Mediastinal structures
         a) Hiatal hernia (types, significance)
   b) Malignant tumors
      i) Squamous
      ii) Adenocarcinomas
      iii) Other malignant tumors
         1) Lymphoma
         2) Kaposi
      3) Metastases (lymphatic and hematogenous)
   c) Motility disorders
      i) Primary motility disorders
      ii) Secondary motility disorders
      d) The postoperative esophagus

3) Stomach
   a) Benign diseases
      i) Diverticula
      ii) Gastritis
         1) Erosive
Certifying Exam: Resources

- Non-interpretive skills and Essentials
  - Study guides to be posted on theABR.org
- Clinical practice modules
  - Study guides at theABR.org
  - CME, SAMs— materials from ARRS, RSNA, etc.
- Practice-based learning
- Society-produced educational modules
General review books

Useful broad, high level outlines
Case review books

- Practice from single image review, w/o scrolling through whole case
- ARRS Case-based review books
- LWW “Teaching files”
- Case Reviews (Mosby)
- RadCases (Thieme) print + online cases
DVD/MP4 Programs

- UCSF Review course
- UCSD Review course
- Duke Review course
- U Wash Review course
- Others
Online self-study:
Cases

• ACR Case-in-point
• Aunt Minnie Case of the Day
• ACR Learning file
This is a 3-day-old female with multiple congenital anomalies. An ultrasound examination of the brain was performed (Image 1, Image 2 and Image 3).
Are my residents reading?

- Reading log in their Learning Portfolio
- Self-assessment (Learning Portfolio)
- ACR in-service scores
- Mock orals
- Radprimer?
Amirsys: RADPrimer

RADPrimer Learning Portal for Radiology Residency Program Directors

Create learning experiences that correspond to lesson plans throughout the 11 core disciplines. Assign learning modules and quizzes. Track results by individual assignment, resident, or program year. Assess on-call readiness by core discipline. Identify issues early with on-demand access to real-time resident performance. Up-to-the-minute reports document resident progress and accomplishments.

RADPrimer Academic Administrative Module Features
- Track resident learning progress by year, assignment, or rotation
- Assign quizzes to 11 core disciplines
- Monitor assigned quiz scores and completion dates
- Document study time by discipline
- Summary report documentation for ACGME record
- Compare program vs. national scores
- Access for all faculty members

Testimonial

"As a former Program Director, I really wish I had RADPrimer when the RRC came around. It would have made the onerous task of documenting resident learning so much simpler."

— Paula J. Woodward, MD

Contact

To have an Amirsys representative contact you, please fill out the following form (the * indicates required information):

Name: *

Email: *

Phone:

Residency Program: *

Comments:

Submit
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Created on March 15 2012
Conferences: What Program directors can do

• Ensure coherent didactic curriculum

• Monitor resident progress more closely

• In-service tests after each rotation and each year?

• Interactive lectures: Active learning

➢ Audience response systems
Audience Response Systems

• Smartphone polling: e.g.: Pushone

• New iPhone / iPad based systems:
  ➢ ResponseWare (Turning Technologies) $$$
  ➢ PollEverywhere
  ➢ RSNA 2011: Diagnosis Live! Session
  ➢ Build your own
Conclusion: Preparing residents for the EOF

• PD’s must monitor learning closely starting early in residency

• Need to improve the efficiency of resident education
Thank you!

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