AAPM Diagnostic Radiology Curriculum

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Committee Members

- Purpose
  ✓ Outline the breadth and depth of scientific knowledge underlying the practice of diagnostic radiology that will aid a practicing radiologist in understanding the strengths and limitations of the tools in practice

- Describes the core physics knowledge related to medical imaging that a radiologist should know when graduating from an accredited radiology residency program

AAPM Diagnostic Radiology Curriculum

AAPM Subcommittee of the Medical Physics Education of Physicians Committee developed the curriculum and published in May 2009

Endorsed by: AAPM Education Council and the Academic Council of the Association of University Radiologists

Where can it be found?

AAPM Diagnostic Radiology Curriculum

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Where can it be found?
The curriculum contains 17 modules covering imaging physics:

- First 9 modules cover basic radiation physics and biology
- Last 8 modules utilize this base information to examine clinical applications of physics to each modality

### AAPM Diagnostic Radiology Curriculum

<table>
<thead>
<tr>
<th>Structure of Atom</th>
<th>Electromagnetic radiation</th>
<th>Particulate radiation</th>
<th>Interactions with matter</th>
<th>Radiation units</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ray production</td>
<td>Basic imaging science &amp; technology</td>
<td>Biologic effects</td>
<td>Uniting radiation</td>
<td>Radiation protection &amp; assoc. regs</td>
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<tr>
<td>X-ray projection &amp; detectors</td>
<td>General radiography</td>
<td>Mammography</td>
<td>Fluoroscopy</td>
<td>CT</td>
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<tr>
<td>US</td>
<td>MRI</td>
<td>Nuclear Mod</td>
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</table>

### Example of a Module

#### Module 8: Biological Effects of Ionizing Radiation

**Fundamental Knowledge**

1. Describe the cell cycle, and discuss the radiosensitivity of each phase.
2. Discuss the probability of cell survival for low-LET radiations.
3. Compare the radiosensitivities of different organs in the body.
4. Explain the effects of massive whole body irradiation and how it is managed.
5. Understand the threshold for deterministic effects, including cutaneous radiation injury, cataracts and sterility.
6. Explain the risk of carcinogenesis due to radiation.
7. Understand the latencies for different cancers.
8. Explain the effects of common drops on radiative sensitivity.
9. Describe the effect of radiation on tumors and tumorgenesis.
10. List the most probable or severe radiation effects at different stages of gestation.
11. Define the principles of how radiation deposits energy that can cause biologic effects.
12. Explain the differences between direct and indirect effects, how radiation effects DNA, and how radiation damage can be repaired.
13. Recognize the risk vs. benefit in radiation uses, and recognize the information sources that can be used to assist in assessing these risks.
14. Describe the different dose response models for radiation effects.

#### Clinical Applications

1. Understand the risks to patients from high-dose fluoroscopy regarding deterministic effects, such as cataracts, radiation injury and carcinogenesis, and the importance of applying radiation protection principles in clinical protocols to avoid damage.
2. Understand the risks to the female breast, especially in girls, from repeated imaging for scoliosis, from mobile chest radiography and CT scans, and the importance of applying radiation protection principles in clinical protocols to minimize future harm.
3. Explain radiation risks to pregnant technologists assisting in fluoroscopic procedures.
4. Explain induction risks to pregnant spouses who are incidentally exposed in mobile radiography ("postmate").
5. Understand the best use of personal shielding and breast shields.

#### Clinical Problem-Solving

1. Plan an interventional procedure to minimize the risk of deterministic effects.
2. Select the most appropriate radiological exam for a pregnant patient.
3. Determine the risk vs. benefit for a new procedure shown at a conference.

#### 1. Learning Objectives

#### 2. Concise Syllabus

- 8.1 Principles of Radiation Biology
- 8.2 Molecular Effects of Radiation
- 8.3 Cellular Effects of Radiation
- 8.4 Radiation and the Cell Cycle

#### 3. Detailed Syllabus

- 8.1 Principles
  - 8.1.1 Linear Energy Transfer
  - 8.1.2 Relative Biologic Effectiveness
  - 8.1.3 Weighting Factors
- 8.2 Molecular Effects of Radiation
  - 8.2.1 Direct Effects
  - 8.2.2 Indirect Effects
  - 8.2.3 Effects of DNA and RNA
- 8.3 Cellular Effects of Radiation
  - 8.3.1 Cell Cycle and Cell Cycle Kinetics
  - 8.3.2 Radiosensitivity of Different Cell Types
  - 8.3.3 Cell Cycle Radiosensitivity
  - 8.3.4 Cell Damage
  - 8.5.4.1 Mitotic Delay
  - 8.5.4.2 Mitotic Death
  - 8.5.4.3 Apoptosis
  - 8.3.5 Cell Survival Curves
  - 8.3.6 Repair
RSNA/AAPM Online Physics Modules

• Where can it be found?
  ✓ http://www.aapm.org/education/webbasedmodules.asp
  ✓ http://www.rsna.org/Education/physics.cfm

RSNA/AAPM Online Physics Modules

• Purpose
  ✓ The RSNA/AAPM Online Physics Modules are designed to educate radiologists and radiology residents about important concepts in physics as identified in the AAPM Physics Curriculum

• These modules are self-guided and include self-testing features to create a comprehensive experience for the viewer

• Each module has been developed by a team of individuals including at least one physicist and one radiologist, and has been peer reviewed for content and quality

RSNA/AAPM Online Physics Modules

• The curriculum contains 44 modules covering imaging physics:

<table>
<thead>
<tr>
<th>Fundamentals</th>
<th>Basic imaging science &amp; technology</th>
<th>Radiation Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3)</td>
<td>(9)</td>
<td>(2)</td>
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<table>
<thead>
<tr>
<th>Radiation Protection</th>
<th>Projection x-ray Imaging</th>
<th>Fluoroscopy</th>
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<td>(3)</td>
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<th>Nuc. Med</th>
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<td>(5)</td>
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• 30 Phase I modules are currently being revised

RSNA/AAPM Online Physics Modules

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RSNA/AAPM Online Physics Modules

Example of a Module

Properties of Modules

- No charge for RSNA/AAPM members (students and residents)
- Approximately 1 hour each
- Always available
- Contain special features (animations, pop-ups, video, etc.)
- Self-paced learning
- Can be repeated
- Pop-up questions and self test
- Certificate of successful completion

Using the Curriculum and Modules together

<table>
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<tr>
<th>Table 1</th>
<th>Modules focusing and Web modules for all curriculum residents for each</th>
<th>Modules focusing on the NIST AO's and Radiological Protection</th>
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Modules Statistics

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