

# DEVELOPING VALUABLE PHYSICS KNOWLEDGE FOR RADIOLOGY RESIDENTS

Perry Sprawls

Emory University, Atlanta, and Sprawls Educational Foundation, [www.sprawls.org](http://www.sprawls.org)

**Abstract—** Physics is the foundation science of radiology and medical imaging. A comprehensive conceptual knowledge is required to enable physicians, especially radiologists to obtain required diagnostic information with the various imaging modalities and methods. The visibility provided by each image is determined and controlled by a combination of image characteristics that depends on the selected imaging modality, method, and procedure protocol factors. A set of educational resources have been developed and provided here that can be used by medical physicists teaching in radiology residency programs. It provides residents with physics knowledge that is needed early in the residency program and develops interest and appreciation for additional physics instruction.

**Keywords—** Controlling image Visibility, Teaching Radiologists, Perceptions of Physics.

## I. INTRODUCTION

Medicine, as practiced by physicians, is the application of science along with clinical knowledge and experience to prevent, detect, diagnose, and manage the treatment of diseases, conditions, and injuries for the benefit of society. Each of the sciences is supported by professional scientists with that specialization who conduct research, support clinical applications, and teach other medical professionals including physicians. Examples of these sciences include anatomy, physiology, microbiology, epidemiology, and **physics**.

Physics is the foundation science of radiology and radiologists require a comprehensive knowledge of physics to support clinical activities, especially when using the modern and often complex imaging modalities and methods.

## II. PHYSICS EDUCATION FOR RADIOLOGY RESIDENTS

During residency programs radiologists learn the physics of medical imaging that is taught by medical physicists. These courses for radiology residents might vary among institutions and countries but often follow a curriculum developed by professional organizations and requirements for program certifications.

These curricula generally provide a comprehensive coverage of physics, but they face a variety of challenges and perceptions including the following:

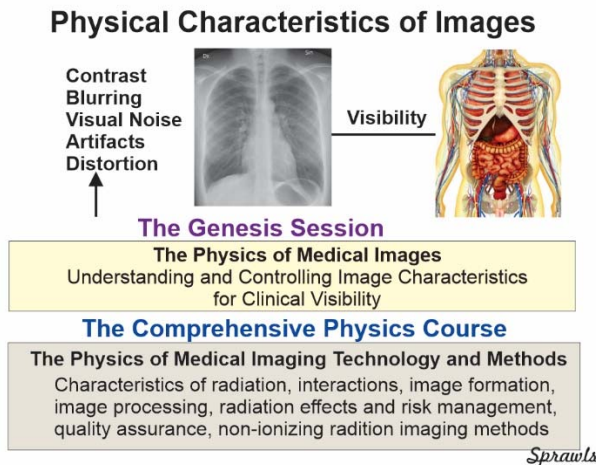
- Physics does not relate to real clinical radiology
- Physics is boring
- Physics classes interfere with clinical activities and learning
- The only reason to learn physics is to pass the certification examinations
- Physics teachers do research and physics things but do not understand clinical radiology
- Some radiology faculty consider physics classes an interference with clinical activities that should not be in the normal daily schedule.

These are issues that must be considered by medical physics educators in providing physics education for radiology residents. A general principle of effective education is to provide learning opportunities at the time and place where they are needed to perform specific functions, for example in performing medical imaging procedures. For radiologists this includes an understanding of the *physical characteristics of medical images* that affect clinical visibility and how to control and optimize image characteristics through the selection of imaging modalities, methods, and especially the procedure protocol factors. That

knowledge is developed throughout a residency program but is most effective if a foundation of specific physics knowledge is developed at the beginning of the program.

### III. THE GENESIS SESSIONS

That can be achieved with the initiative described here--a "short course" designated as the *Genesis Sessions*. It is not a replacement for the comprehensive physics course but supports it by developing an interest and appreciation for physics by the residents, and it demonstrates the value of medical physicists in the practice of radiology as illustrated here.



A medical image is the link between *physics* and *clinical medicine*. It is the item used by physicians, especially radiologists, to detect, diagnose, and guide the treatment of many diseases, injuries, and health related conditions. For an image to be of value it must provide adequate visibility of the anatomy and conditions within the human body. Visibility is the highly significant and necessary physical characteristic of an image that applies to every clinical procedure. It is determined by a combination of image characteristics as illustrated. These characteristics and the resulting visibility are in general determined and can be controlled by a radiologist through the selection of imaging modalities, methods, and procedure

protocol factors, but this requires a good knowledge of the image physical characteristics very early in the residency experience.

Genesis is a *beginning* and is an appropriate designation for the program described here--to provide very specific physics learning activities at the very beginning of radiology residency programs. This can be accomplished with a few classroom/conference sessions that are designated as the Genesis Sessions and separate it from the more comprehensive physics courses to be provided later in the program.

The Genesis Sessions within a radiology residency program make several important contributions. First, they are developing physics knowledge that has immediate clinical applications and is interesting and perceived to be of value by residents. These Sessions demonstrate the relationship of physics to clinical medicine with a concentration on image characteristics and visibility. They can create a desire among residents to learn more physics and look forward to the more comprehensive courses.

Resources for adding a Genesis Session to a residency program are provided in the *Addenda*. These include a curriculum overview, a text for residents to study, and PowerPoint visuals to be used by physics educators.

#### Addenda to the Journal:

1. Text – *Understanding and Optimizing Visibility in Medical Imaging Procedures*
2. Curriculum Overview
3. Visuals for Classroom Discussions

Visuals for teaching this course can be downloaded from: <http://www.sprawls.org/resources/genesis/index.html>

#### **About the Author**

Perry Sprawls, Ph.D. is a clinical medical physicist and educator. Currently he is Distinguished Emeritus Professor at Emory University in Atlanta and provides a variety of open access educational resources through the Sprawls Educational Foundation: [www.sprawls.org](http://www.sprawls.org)

Contact: [sprawls@emory.edu](mailto:sprawls@emory.edu)