The transition from film to digital radiography offers the potential for improved image quality and visibility of anatomical structures and signs of pathology. However, there are more variable parameters in a digital system that must be considered and adjusted for optimum performance.

In this course we will consider the five basic image quality characteristics: contrast sensitivity, blurring, noise, artifacts, and spatial characteristics, but the emphasis will be on the first three which have the greatest impact on visibility.

Contrast Sensitivity. Digital radiography is generally superior to film radiography with respect to contrast characteristics. This is because digital is not limited by the fixed contrast characteristics of film. Because of the wide dynamic range of digital receptors and processing capabilities the contrast window can be optimized for maximum visibility in a variety of anatomical environments, exposure conditions, and viewing requirements.

Blurring. Radiography is the medical imaging modality with the least blurring and is superior to all of the others in providing maximum visibility of anatomical detail and small signs of pathology. This capability is sometimes challenged by the transition to digital radiography because of the blurring produced by the pixel structure and other elements in the digital imaging process. When optimizing a digital radiography system (as in teleradiography) consideration must be given not only to the characteristics of the digital image but to all sources of blurring such as the focal spot, imaging geometry, receptor characteristics, digitizers, and display devices. A model for optimizing conventional radiographic systems based on the concept of equivalent blur was developed earlier and has proved to be a useful tool in conventional radiographic system analysis. The concept of equivalent blur has now been applied to a digitized image and is defined in relationship to pixel size. A general system model for

digital radiography with equivalent blur defined for each component has been developed and used to optimize systems with respect to visibility of detail. The factors affecting the value of this parameter for each component are identified. A scale has been established for each parameter on which a range of operating conditions is identified. With this model it is possible to analyze a specific system and determine the relationship of the various components and digital image characteristics to total system performance. This process makes it possible to identify "weak links" in the system and indicate changes that can be made to produce a more optimized system.

Noise. Quantum noise is a potential problem with digital radiography because of the wide dynamic range of the receptors. This requires special attention to technique and exposure conditions.

Educational Objectives.

1. Identify the parameters of digital radiographic systems that affect image quality.
2. Perform test to determine image quality characteristics.
3. Adjust system parameters to optimize quality and system performance.