Two of the multileaf collimator (MLC) systems currently in common use in this country were introduced in the early 1990's by Philips (now Elekta) and Varian. These collimators were designed for simple block replacement, but are now also viewed as convenient tools for intensity modulated radiation therapy (IMRT). More recently, another MLC was introduced as an addition to Siemens' product line. Although these collimators share some characteristics, each has a unique combination of design features. The differences have given rise to endless debate about which system is the "best." This talk will compare the different collimator designs and discuss the dosimetric characteristics for each. The convenience of MLC field shaping has had a major impact on the way radiation therapy is currently practiced. Field shaping can be accomplished in a matter of minutes, and changes can be implemented with ease. However, there is some concern about leaf stepping at an MLC defined edge and the importance of the accompanying dose undulation. Dose distributions will be presented to compare divergent block and MLC defined edges. It is possible to remove the dose undulation at a stepped MLC edge by dithering the field using a series of pre-programmed couch movements. Dose distributions for this technique of smoothing the undulating dose pattern will be presented and compared to block-defined edges. Acceptance testing, commissioning, and routine quality control of MLC systems are important issues for the medical physicist. This talk will present procedures for accomplishing each of these tasks. Systems differ in terms of their effect on the calculation of dose to a point within an irregular MLC defined field. A major factor contributing to this difference is the distance of the collimator from the source of radiation. Methods of dose calculation when MLC is used will also be discussed. The use of MLC for intensity modulated dose delivery is quickly gaining popularity. This application introduces new dosimetry problems that must be addressed. For example, sliding window IMRT requires very exact leaf positioning. Although all manufacturers can control leaf placement with great precision, exact definition of the leaf edge is difficult when the leading end is rounded so that the point where the intensity falls to one-half is hard to identify. Another consideration for IMRT is the build up of leakage radiation relative to traditional treatment approaches. This presentation will include a discussion of these problems.

EDUCATIONAL OBJECTIVES: 1) Compare dosimetric and design characteristics of three multileaf collimator systems in common use in this country. 2) Discuss the problem of dose undulation at stepped MLC edge. 3) Present methods for acceptance testing, commissioning and routine QA for MLC systems. 4) Discuss the effect of MLC on the "collimator factor" when performing dose calculations. 5) Discuss the impact of MLC design features on IMRT dose delivery.