Evaluation of 3-D treatment plans is often limited to inspection of dose distributions in 2-D, or at most, to analysis of dose-volume histogram (DVH) statistics. In the last several decades, biological models have been developed that use 3-D dose-volume information as input. The purpose of the models is to predict the normal tissue complication risk or tumor control probability and, so, can be used to "score" plans based on an index of risk versus cure. First, the predictive power of the models is assessed through analysis of complication or control data before they can be considered reliable for clinical treatment planning. Consequently, model parameters may need to be adjusted. Aspects of the models may be used in the design of dose escalation trials to gather normal organ tolerance data in a safe and systematic fashion. Finally, biological indices can be used in cost functions in inverse planning systems to aid in the determination of the "optimal" treatment plan.

This refresher course will attempt to elucidate the:

1) Analysis and correlation of 3D dose distributions with complication or tumor control data;

2) Description and use of biological models to design and evaluate treatment plans;

3) Development of cost or score functions (with biological indices) for treatment plan optimization.