With rapid deployment of image-guided radiation therapy (IGRT), evidence is mounting that daily variations in patient’s anatomy can be quite complicated. A simple couch shift will not be able to correct all non-rigid changes in patient’s anatomy. Adaptive radiotherapy is a replanning process to manage temporal changes in patient’s anatomy or tumor biology. Adaptive radiotherapy can be based on either morphological changes or physiological changes during a treatment course. In addition, adaptive radiotherapy can be applied either online or offline. The potential clinical benefit for online adaptive radiotherapy depends on (1) the size (dose level) of treatment fraction; (2) the length of adaptive treatment process; (3) the probability and magnitude for intra-fraction variations; and (4) the predictability for such variations in future treatment fractions. Online vs. offline corrections will be discussed along with anatomical and functional image-guided adaptive radiotherapy approaches. While technology appears to be the primary obstacle in the present time, the image-guided adaptive radiotherapy process is a natural extension of image-guided conformal radiotherapy. Practical issues in deploying adaptive radiotherapy in routine clinical practice will be discussed using institution’s experience in several prospectively designed treatment protocols.

The learning objectives are:
1. Demonstrate limitations of IGRT and benefits of adaptive radiotherapy
2. Understand various forms of adaptive radiotherapy
3. Understand various factors when choosing adaptive radiotherapy
4. Discuss practical issues related to clinical implementation