For radiation oncology, the concept of precision medicine will likely have different meanings for different people, ranging from more technically precise delivery of radiation *vs.* radiation catered to patient-specific or cancer-specific biologic factors.

In the realm of technical precision, advances in imaging have led to more accurate target delineation for radiation planning. An entire special issue of *Int J Radiat Oncol Biol Phys* (volume 102, Issue 4) explores advances in quantitative imaging and physiologic imaging, with articles focusing on positron emission tomography (PET) imaging, magnetic resonance imaging (MRI), and other novel imaging modalities. Imaging that is integrated onto the treatment machine has allowed for more precise localization of treatment targets on a day-to-day basis. Such imaging would include ultrasound, digital photography, orthogonal kV X-ray imaging, computerized tomography (CT) via a kV cone beam CT (CBCT) scan, CT on rails (in which a CT scanner is situated adjacent to the LINAC in the treatment room), MV-CBCT, or megavoltage CT (as used by TomoTherapy® units). Real-time imaging (in the midst of treatment) can also be performed via X-ray (as with Cyberknife® and Vero®), digital videography, 3-dimensional stereoscopic cameras (e.g., Align RT®, humediQ®), radiofrequency transponders (e.g., Calypso® system), and infrared sensors (e.g., ExacTrac® system). The ViewRay® (using Cobalt-60 for treatment) and MRIdian® systems allow for pre-treatment image guidance and real-time tracking with MR imaging (using a 0.35 T magnet). Image-guidance on the treatment machine has also facilitated the development of adaptive radiation therapy (a topic also covered in the aforementioned *Int J Radiat Oncol Biol Phys* special issue). Adaptive radiation planning allows for the evaluation, and potential for modification, of the treatment plan on a day-day-day basis depending on the patient's and tumor's anatomic positioning on that given day.

In the realm of biology (which is the main focus of this book), there has been emerging interest is patient-specific and tumor-specific genetic and phenotypic markers that might allow for more precise treatment delivery. A classic example is human papilloma virus associated oropharyngeal cancer, for which de-intensification of chemoradiation may be warranted (though still being investigated). Predicting the risks of post-radiation toxicity with patient-specific biologic factors may enable more catered treatment delivery (with the radiation oncologist possibly choosing more conformal treatment delivery, dose de-escalation, or recommending against radiotherapy). Classic examples include the association of greater radiotherapy toxicity risks with active auto-immune disease or interstitial lung disease (which may preclude delivery of radiation); patients with neurofibromatosis are at increased risks of cancer induction after radiotherapy. Emerging research evaluating single nucleotide polymorphisms (SNP) and genome-wide association studies have correlated specific genetic patterns with toxicity risks. Multiple other tumor and host genetic and molecular factors potentially predicting cancer response and toxicity risks have been investigated. Researchers from Moffit Cancer Center have developed a radiation sensitivity index that is in its early stages of development. Research from the University of Chicago has focused on genetic predictors or metastatic progression, which might inform treatment strategies for patients with oligometastases, as some are apt to develop widespread disease while others are less apt to do so.

In recent years, targeted drug therapy has had an emerging role in cancer therapy; many of these novel agents interact with radiotherapy in a synergistic manner, particularly check point inhibitors and other immunotherapy agents. There are also potential agents being studied that are specific for radiation-mediated molecular pathways, bridging the concept of targeted-drug therapy into radiation oncology.

This compilation of articles highlights precision medicine in terms of molecular genomics including microRNA expression, proteomics, DNA repair pathways, cellular biology, immunology, predictive biomarkers, inflammatory factors/cytokines and specific molecular pathways. Classic concepts of radiosensitization are also discussed, including radiosensitization with the novel use of nanoparticles. Radiomics – essentially extracting quantitative features from radiographic images – is another burgeoning field that is discussed. Separate sections focus specifically on head and neck cancer, brain tumors, lung cancer, breast cancer, gastrointestinal cancer, urological cancer and lymphohematopoietic tumors, highlighting that many of the advances in precision medicine are cancer-specific. The "*Key Leaders' Opinion on Precision Radiation Oncology*" book with introduce readers to how precision medicine is being integrated into radiation oncology, and provide in depth insight into the advancements in cancer and radiation biology that will bring in a new era of precision medicine.

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