Use of many beam angles and conformal beam shaping adds to the time, complexity (and expense) of treating a patient with photons, but avoids the expense and complexity of a proton accelerator. It has been established that protons are superior for cases where a tumor is close to a critical body structure, but clinical trials are still needed to compare optimized photon therapy with proton therapy with respect to long-term tumor control and severity of side effects for other tumor types. Results will influence the design of proton facilities, particularly if it is shown that the tumors best treated by protons are in parts of the body that can be targeted without using a gantry.

Just as techniques used in proton therapy spurred improvements in photon therapy, research in heavy ion therapy will benefit the more mature forms of hadron therapy. Beam scanning technology has already been discussed. Because gantries are impractical for heavy ion therapy, isocentric techniques will be developed for precise treatment of sitting or standing patients. Computerized axial tomography (CT) devices have already been developed to image upright rather than recumbent patients. Isocentric treatment of upright patients will make a significant contribution to lowering the cost of hadron therapy by eliminating not only the cost of building large gantries, but also the costs of shielding the gantry rooms.

The concept of using particles with high biological effectiveness and/or Bragg peak energy-deposition properties to improve cancer treatment is especially interesting to the accelerator physicist looking for practical applications of basic research. It intrigues the radiation oncologist who is seriously interested in providing better treatments for cancer patients. Good progress will be made only if physicists and oncologists both understand the requirements and practical limitations of each specialty.

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