American Association of Physicists in Medicine

by J. Daniel Bourland, Ph.D.

WHO WE ARE

The American Association of Physicists in Medicine (AAPM) has approximately 4,625 members who practice or are associated with medical physics.

TOP PRIORITIES IN 2001

- Assist in establishing the Institute for Biomedical Imaging and Bioengineering at the National Institutes of Health as a viable funding source for research in imaging
- Recruit and train quality graduate students for careers in medical physics
- Support the professional certification and licensure of medical physicists

Medical physicists work alongside radiation oncologists and others on the radiation treatment team to provide quality assurance for radiation sources, instrumentation, and patient treatments. They also help develop new treatment techniques and provide quality assurance for the dosimetric, anatomic, and geometric models used in computerized 3D-radiation treatment planning systems. Radiation-related medical procedures are increasing, and the demand for well-trained medical physicists is high. To promote the recruitment and training of bright, young physics students into careers in medical physics, AAPM has appointed an ad hoc educational and training committee.

The radiation oncology field is in the midst of "image-based treatment" in which patient images are used to design and validate a radiation treatment regime. Many hospitals and clinics now have computerized 3D-radiation treatment planning systems, which use computerized tomography (CT) or magnetic resonance (MR) imaging for guiding patient treatment. In the near future, nuclear medicine images enhanced by a variety of common and specialized radiopharmaceuticals will be used to provide information on the biological and physiological character of a tumor. These images will be combined with CT and MR images to give the radiation oncologist the best non-invasive picture possible.

AAPM recognizes the importance of molecular-biological imaging, and has recently formed an ad hoc committee to follow this developing field. Advances in molecular-biological imaging will require the collaboration of tumor biologists; medical, surgical, and radiation oncologists; diagnostic and radiation oncology physicists; and computer imaging scientists.

Over the past 15 years, medical physicists have played key roles in the development of 3D-radiation treatment planning. With this approach, the important treatment parameters are modeled in the computer, which mathematically determines the radiation plan. At the same time linear accelerators, which produce the therapeutic radiation beams used in treatment, have incorporated new technology that allows intensity modulated radiation treatment (IMRT). IMRT distributes radiation doses that conform to the shape of the tumor, sparing the normal critical structures in the surrounding area. The radiation oncology field is directing much of its effort towards the clinical development of IMRT.

Whether IMRT, 2D-, or 3D-radiation treatment planning is used, a variety of imaging techniques (including CT, MR, nuclear medicine, plane radiographs, and lymphoscintigraphy) can potentially contribute information to the radiation planning process.

Single photon emission computed tomography (SPECT) images and positron emission tomography (PET) images are already showing great promise in providing metabolic, physiologic, and biologic information about tumor volumes and normal tissue volumes for cancer patients. Radionuclides attached to either metabolites (FDG, methionine) or drugs (misonidazole) can reveal areas of recurrence, cell proliferation, hypoxia, or other characteristics. If tumor environment can be measured by these molecular or biological imaging techniques, and the images incorporated with other anatomical (CT, MR) data, then a radiation treatment plan can be designed that accounts for the measured biologic or physiologic information.

Advantages of this information will best be gained through the use of 3D or IMRT approaches, where the dose can be "painted" to match the biological activity of a region. Such an approach is a dramatic shift from the use of anatomical information only.

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