Meet Radiation Oncologist Simon Powell

Dr. Powell's research interests include the role of DNA repair deficiencies in human breast cancer; breast cancer genetics and the function of BRCA1 and BRCA2 proteins; and the optimization of radiation therapy planning and delivery for both early-stage and advanced breast cancer.

Summary

Simon Powell leads the Department of Radiation Oncology and focuses in his research on the treatment of breast cancer, including the role of DNA repair deficiencies in breast cancer and breast cancer genetics.

Simon Powell, Chair of the Department of Radiation Oncology, took time recently to talk about his own research as well the collaborative investigations undertaken by Memorial Sloan Kettering's Imaging and Radiation Sciences Program (IMRAS), of which he is a member. IMRAS focuses on looking at how the effects of radiation in cells can be observed by imaging and other biological measures — and how the information gained can be used to *improve patient outcomes.*

One of the reasons I joined Memorial Sloan Kettering Cancer Center was because of the great opportunities here to do translational and multidisciplinary cancer research. An outstanding example of this is our Imaging and Radiation Sciences program (IMRAS).

The program focuses on looking at how the effects of radiation — in cells, in mouse models, and in people — can be observed by imaging and other biological measures. Knowing as much as possible about how a tumor responds to radiation enables us to more accurately guide treatment decisions and develop new treatment strategies. IMRAS reflects collaborative investigations across the Department of Radiation Oncology, the Department of Medical Physics, the Molecular Imaging and Therapy Service, and the Department of Radiology.

Imaging has made it possible to evaluate how effective radiation therapy is, both during and after treatment. Sophisticated technologies that already exist give us a lot of information about how a tumor is responding, but IMRAS members are working to develop even more advanced tools to image the effects of radiation on cells — tools that we hope to eventually translate into use in patients.

For example, the presence of hypoxia (a low concentration of oxygen) in tumors is common, and tumor hypoxia is known to compromise the effectiveness of radiation and chemotherapy. IMRAS members are investigating the biological underpinnings of tumor hypoxia imaging and are working on novel imaging methods to measure hypoxia status before, during, and after treatment. The more precisely we can identify and quantify tumor hypoxia, the more we'll be able to improve patient outcomes.

How Genetics Affects Radiation Response

Another field of great interest to us is radiation genomics. Broadly speaking, radiation genomics recognizes that when you irradiate people they don't all respond the same way. Just as there are genetic factors that control the way people respond to drugs, there are genetic factors that influence the way they respond to radiation. So both genetic and tumor-specific factors may contribute to the way a tumor responds to a fixed dose of radiation. Ultimately, we want to understand in real patients, exposed to real doses of radiation, why some respond well and others poorly.

A project in my laboratory is aimed at learning more about this variation in radiation sensitivity. We've taken lymphoid cell lines from individuals whose entire genomes have been sequenced and we've irradiated them. Then we've looked at the way the cells handle the radiation. What we see is a spectrum of response that exactly mirrors what we observe in people.

Then, because these genomes are fully known, we can do association analyses. These are genome-wide association studies to attempt to relate what it is about the radiation-sensitive or resistant people that makes them sensitive or resistant. We're doing these studies in collaboration with colleagues in Memorial Hospital's Clinical Genetics Service and the Sloan Kettering Institute's Computational Biology Program and are looking to discover whether there are common parts of the genome that associate with radiation sensitivity or resistance.

Understanding these variations will help radiation oncologists make the best treatment decisions for each patient. For example, if we know a tumor has built-in radiation resistance mechanisms we might choose any one of a number of options — we might not use radiation at all, perhaps use a higher dose, or use a drug to make the tumor more radiosensitive.

We're entering a new and exciting era in radiation oncology, and these are just several of the many initiatives and research efforts under way at Memorial Sloan Kettering.

This profile was featured in Memorial Sloan Kettering's 2012 Annual Report.

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