Applied Radiation Oncology™ April–June 2024

RadOnc Student Scan

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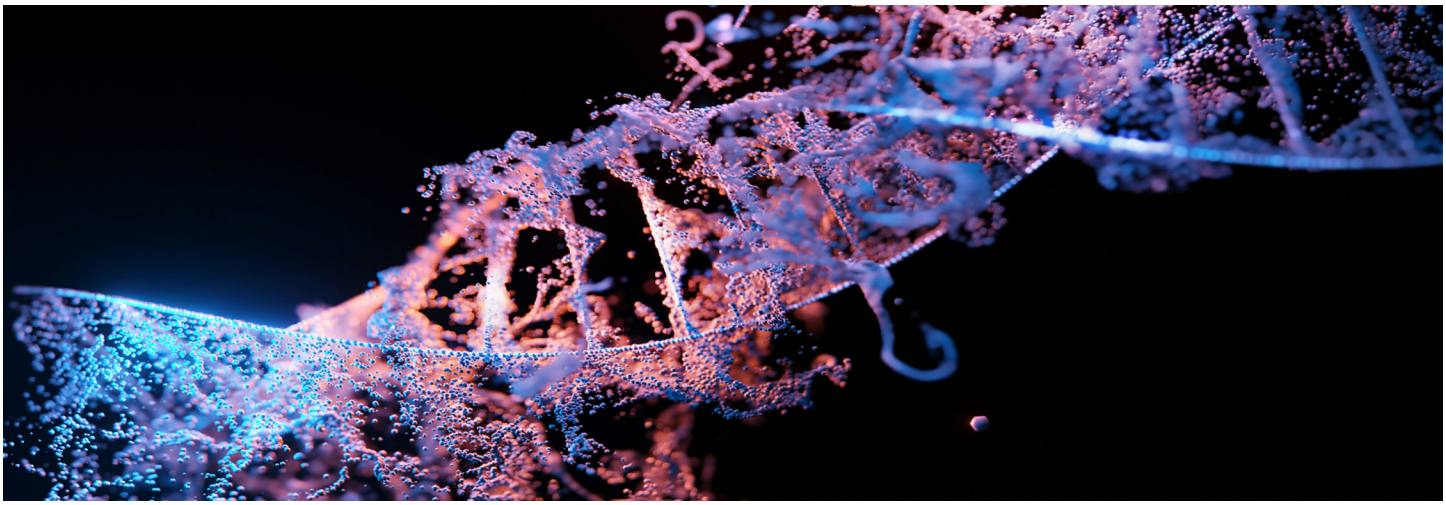

IN THIS ISSUE

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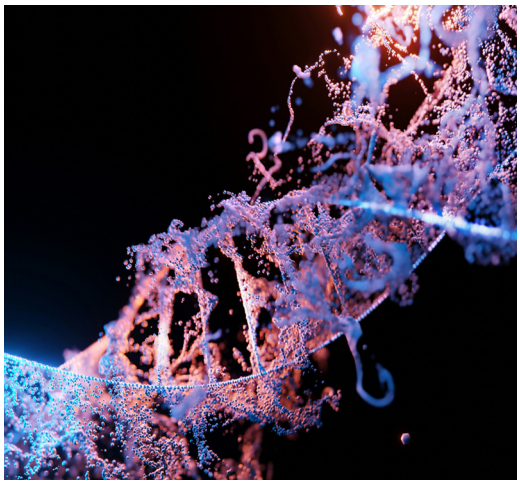
So, You've Stumbled Upon This Specialty Called Radiation Oncology: Where Do You Start?



Radiation oncology is a largely under-represented field in medical school. Unless students have close friends or family involved in the field or personal experience with someone receiving oncologic care, most discover radiation oncology through extracurricular events hosted by interest groups or through patient care consultations with radiation oncologists. Once exposed to the field, they may desire to learn and explore more. This introduction seeks to help students start their journey on the right foot and in the right direction.

Start With the Internet for an Overview

A good start is to begin researching the field. The most accessible and highest-quality resources are available in the medical student pages of the websites of national organizations, such as the American Society for Radiation Oncology (ASTRO), the Radiation Oncology Education Collaborative Study Group (ROECSG), the American College of Radiation Oncology (ACRO), and others. They often feature free lectures that provide introductory overviews of the field geared toward medical students. Additional resources often found on the websites include podcasts, mentorship connection opportunities, virtual rotations, and free membership offers for students.

Get Connected With Mentorship

The next most important step is to find a mentor. Students who attend a medical school with an affiliated radiation oncology residency may wish to contact residents for initial guidance. Residents can often facilitate connections with faculty mentors and potential research opportunities. For students at schools without a radiation oncology residency, searching for local attendings at other institutions and inquiring about academic projects they might welcome assistance on is another good approach. Attending conferences to present research and network with residents and attendings is another great way to find a mentor. Finally, students can request or register for a mentorship through online pairing programs hosted by ASTRO and ACRO.

Find Ways to Obtain Clinical Experience

Beyond mentorship, gaining clinical exposure on how radiation oncologists interact with patients and their team members such as radiation therapists, dosimetrists, and medical physicists is vital to understanding the specialty. One suggestion: shadow a willing radiation oncologist. Some institutions offer radiation oncology electives, which can provide didactics and scheduled clinical exposure. Away rotations to work with faculty at other institutions are also encouraged. These experiences not only offer insight into how practices differ among institutions but also serve to expand a network of mentors and advisors. Away rotations are typically done in the 4th year of medical school and applications can be sent through the Visiting Student Learning Opportunities (VSLO) website or on the individual institution's website. Most applications open in March or April, but some accept applications earlier.

Get Involved With Related Efforts in the Field

Medical students can also incorporate other professional interests into their exploration of radiation oncology. For example, students interested in pursuing a career in medical education might start or lead an oncology interest group or a radiation oncology interest group at your medical school. Another option is to partner with organizations such as the Applied Radiation Oncology (ARO) Future Content Student Committee to generate educational content. Advocacy, quality improvement, business, technology, and other aspects of the field may be best explored under the guidance of a mentor. Regardless of niche, there are plenty of opportunities in radiation oncology.

Interview With a Radiation Oncologist

Jillian R. Gunther, MD, PhD, MD Anderson Cancer Center

Jillian Gunther, MD, PhD, is an associate professor of radiation oncology at MD Anderson Cancer Center. Dr Gunther received her MD and PhD at the University of Illinois at Urbana-Champaign. She completed her residency at The University of Texas MD Anderson Cancer Center before becoming a full-time faculty member in the Hematology Section of Radiation Oncology in 2017. Her primary clinical goal is maintaining and improving outcomes for patients with lymphoma, including decreasing the short and long-term side effects of treatment. She is involved in clinical trials to investigate better treatment options to minimize long-term side effects. Dr. Gunther serves as director of medical student education in the radiation oncology department. In this role, she creates and coordinates research and educational experiences for medical students and those in earlier years of training. As a member of the executive board of ROECSG she co-leads the Undergraduate Medical Education Working Group to promote radiation oncology education and research.

When did you learn about radiation oncology?

I learned about the specialty while on clinical rotations during my third year of medical school. I expressed interest in oncology, and one of my internal medicine attendings encouraged me to explore radiation oncology as an alternative to internal medicine. He thought I might enjoy the field, since I had studied bioengineering as an undergraduate student.

What sparked your interest in radiation oncology?

For me, radiation oncology was the perfect blend of so many aspects of my prior education and training. I loved seeing patients and developing relationships with them during such a trying time. I also loved incorporating technology into daily practice and performing simple procedures like simulations that allow you to be creative. I was attracted to the variety in the daily schedule. I also really appreciated the ways that radiation could be used for both curative and palliative purposes.

What do you believe was the most beneficial clinical rotation(s) to prepare you for your radiation oncology residency?

I think my internal medicine rotation taught me many basic but critical skills necessary for any physician. I learned how to be careful and thorough in working with a patient. I also learned to question and confirm all information given about a patient before deciding upon the most probable diagnosis. Although we less commonly diagnose patients in radiation oncology, we still go through the same process in identifying what might be causing new symptoms or problems. I think it is most important that a radiation oncologist be an excellent physician before [pursuing] anything more specialized.

Which didactic course do you feel prepared you for a residency in radiation oncology?

We didn't really have much, if any, exposure to radiation oncology or even oncology during medical school. I would say again that having a solid understanding of medicine is helpful during any residency, radiation oncology included.

At what point did you decide to pursue a career in the specialty?

I was still debating between medical oncology and radiation oncology until just before ERAS [Electronic Residency Application Service] submission. I ultimately decided that the decision between those two specialties would be difficult even after interviewing and decided to only apply to radiation oncology.

What advice would you offer medical students interested in radiation oncology?

I would encourage any medical student to spend as much time as possible shadowing and completing clinical rotations in the field. Also, try to see the specialty in a few different settings – one specialty can vary dramatically from one position to another. Regarding radiation oncology specifically, I would strongly encourage medical students who are passionate about cancer care to continue to pursue radiation oncology, despite some of the negative press related to job availability.

How many residency programs did you apply to?

I think around 30.

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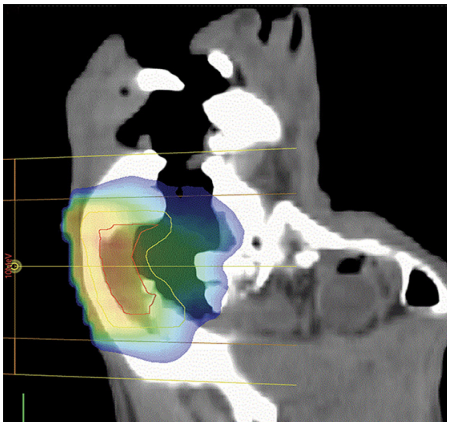
Hot Topics in Radiation Oncology



Reinventing Radiobiology in the Light of FLASH Radiotherapy[1]

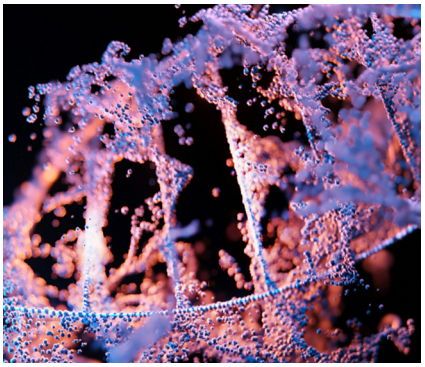
Limoli CL and Vozenin, M-C; Annual Review of Cancer Biology

FLASH radiotherapy has challenged the longstanding belief that delivering high-dose radiotherapy in a matter of seconds does not achieve the same level of tumor control as conventional radiotherapy. In fact, in animal models FLASH consistently achieves comparable tumor control and exhibits advantages in sparing noncancerous tissues. This review explores the brief history of FLASH radiation and provides insight into the hypotheses in the current literature about how this preferential effect might work. While some hypotheses explain how FLASH may be protective of surrounding tissues, few are able to simultaneously justify the isoefficiency of tumor control. One emerging theory posits that decreasing exposure time of circulating blood to the effects of ionizing radiation may be protective in that the inflammation remains more localized to the tumor. Another suggests the altered biochemical composition of the lipid membranes of tumor cells creates a better target than the surrounding normal tissues. The evolving theories and research efforts around FLASH not only challenge the current paradigms of radiation therapy but also point to promising advancements for treating patients.

Recent Advances in Surface-Guided Radiation Therapy[2]

Freislederer P, Kügele M, Öllers M, et al; Radiation Oncology

Radiation therapy relies on achieving near-perfect alignment of the treatment plan, including target and nontarget organs, to minimize radiation exposure to the patient and nontumor organs. Precise positioning can be affected by many variables, including breathing or posture, and can affect the efficacy and safety of treatment. Currently, radiation therapists use daily x-ray imaging, masks, tattoos, and other tools to align patients with the treatment plan. This article discusses surface-guided radiation therapy (SGRT), which uses cameras to scan the body surface for patient movement during treatment to estimate actual tumor movement. Since SGRT tracks surface shifts, the technology is most efficacious for superficial tumors, which demonstrate higher correlation with surface movement. One example is breast tumors, whose proximity to the lungs means that breathing has major effects on beam accuracy. This review article notes other benefits such as decreased set-up time and spared imaging dose relative to image-guided radiation therapy. The authors note several future directions of SGRT, including minimizing the need for tattoos to assist in positioning, and accounting for anatomical changes (such as lymphedema or weight loss) between treatment sessions.



Radiotherapy Reimagined: Integrating Nanomedicines Into Radiotherapy Clinical Trials[3]

DuRoss AN, Phan J, Lazar AJ, et al; Wiley Interdisciplinary Reviews Nanomedicine and Nanobiotechnology

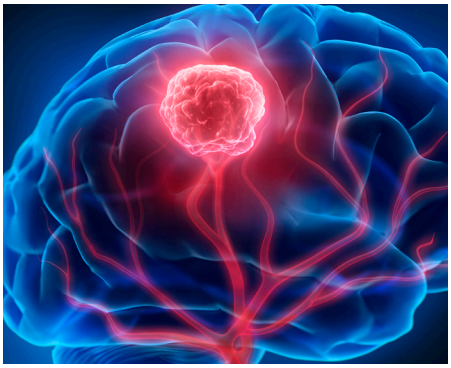
Radioenhancing nanoparticles (NPs) amplify the sensitivity of tumors to radiation therapy and permit treatment with lower radiation doses and increased precision. Nanoparticles are high atomic number elements with electron densities greater than water, which contribute to greater free radical formation and subsequent DNA damage to cancer cells after being injected into tumors prior to radiation. Among the NPs investigated in preclinical trials are agents composed of gold

and titanium, although the most promising NP is derived from hafnium oxide (also known as NBTXR3). Hafnium oxide has received US FDA "fast track" designation and EU approval for use in clinical trials. Radioenhancing NPs are an increasingly important tool for multimodal treatment, necessitating interdisciplinary participation in designing clinical trials that include them. Central to this effort, researchers must consider patient eligibility, study endpoints, and trial feasibility as it pertains to radiotherapy, diagnostic imaging, surgical interventions, immunological impacts, and pathological findings. Patient experience must also be paramount in designing trials using NPs, given the potential burden imposed by additional interventions.

The Sphingolipid-Modulating Drug Opaganib Protects against Radiation-Induced Lung Inflammation and Fibrosis: Potential Uses as a Medical Countermeasure and in Cancer Radiotherapy[4]

Maines LW, Keller SN, Smith RA, et al; International Journal of Molecular Sciences

Pulmonary fibrosis is a restrictive lung disease marked by the common pathology of excess deposition of extracellular matrix in lung tissue caused by many different etiologies. Excess extracellular matrix in lung tissue causing pulmonary fibrosis can be a consequence of infection, environmental exposure, autoimmune diseases, and ionizing radiation. As a potential toxicity of radiation therapy with significant impairment to patients, finding approaches to minimize pulmonary fibrosis secondary to treatment is important. Opaganib is a novel medication being studied for its ability to inhibit key enzymes involved in sphingolipid metabolism. Suppression of sphingolipid metabolism has the potential to reduce inflammatory cytokines and subsequent radiation-induced pulmonary fibrosis. Opaganib has been demonstrated in mouse model studies to reduce pulmonary inflammation and subsequent fibrosis, as well as to improve survival when administered after radiation therapy. On a practical note, opaganib is highly chemically stable and can be formulated via gelatin capsule, allowing for easy administration. Opaganib and other similar sphingolipid metabolism inhibitors are discussed in the context of radiation therapy and have the potential to be used widely to prevent pulmonary fibrosis.



A Study Combining Microbubble-Mediated Focused Ultrasound and Radiation Therapy in the Healthy Rat Brain and a F98 Glioma Model[5]

Fletcher SMP, Chisolm A, Lavelle M, et al; Scientific Reports

Focused ultrasound (FUS) is used to sensitize tumors to radiation therapy via increased apoptosis. Here, FUS was studied in a rat F98 glioma model with varying radiation doses to assess for apoptosis and tumor reduction. Reduced radiation dose to the brain for treatment of gliomas is of particular interest, given its potential to minimize long-term central nervous system side effects. Radiation therapy alone was proven effective at doses of 8 Gy and 15 Gy. When FUS was combined with 8 Gy and 15 Gy doses of radiation to treat rat F98 gliomas, no significant improvement in tumor reduction was seen. However, when FUS was combined with 4 Gy radiation, a lower dose at which radiation alone was insufficient to significantly reduce tumor burden, apoptosis increased by 396% with histological analysis. Despite the promising increase in apoptosis of glioma cells with FUS and the lower 4 Gy dose, only a minimal, albeit significant, increase in survival was observed when compared to rat gliomas treated by 4 Gy radiation alone (median survival 28 vs 27 days, $P = 0.041$). That said, the increased effect of FUS with 4 Gy radiation on tumor reduction was less than that observed with higher radiation dose (8 Gy and 15 Gy) alone, which supports the need for additional investigation of FUS optimization to sensitize gliomas to radiation at lower doses.

EPISODE 3

SBRT vs SABR: Does Terminology Differentiate Treatment Intent in Metastatic Cancer?

Jennifer Matsiu, a 4th-year medical student at Ohio State, and Memorial Sloan Kettering's Dr. Kaitlyn Lapen, discuss confusion and solutions surrounding SBRT vs SABR terminology and its impact on metastatic cancer treatment decisions.

ARO INSIGHTS

Blogs covering today's issues in radiation oncology

Defining Our Lane: The Link Between Climate Change, Cancer Equity, and Radiation Oncology

In many ways, health inequity—differences in health care access and outcomes—and climate change—long-term shifts in temperature and weather patterns—are two sides of the same coin.

Seth Seifert, MA
Third year medical student, Spencer Fox Eccles School of Medicine, University of Utah

Gita Suneja, MD, MSHP
Associate professor, Department of Radiation Oncology, Spencer Fox Eccles School of Medicine, University of Utah

Sarcoma: A Histologic Conundrum

The enigma cloaking a bunch of malignant cells known as a sarcoma has existed since before the first radiation therapy treatment in 1896. And it seems like the more molecular and histologic details we learn as technology and research advance, the more mysteries we uncover.

Kyra N. McComas, MD
PGY4 resident physician, Department of Radiation Oncology, Vanderbilt University Medical Center.

CONTINUED FROM PAGE 3

Jillian R. Gunther, MD, PhD, MD Anderson Cancer Center

What would you recommend as an introductory textbook or other resource for medical students?

I would encourage interested medical students to check out the introductory materials on the ROECSG website.

Did you have a radiation oncology rotation in medical school?

No, I didn't even have any formal oncology clinical training. We didn't have a radiation oncology residency program where I trained, so that certainly didn't help.

What field of medicine did you use as a transitional year?

I completed a traditional internal medicine year. I stayed at the program in the city where I attended medical school to keep things simple.

How do you see the future of radiation oncology?

I think the future of radiation oncology is promising and exciting! Every day, we have a better understanding of the ways that radiation therapy can be beneficial for our cancer patients, both alone and combined with other treatments. Some older indications for radiation are no longer relevant, and that's perfectly fine. In fact, we should continue making advances and questioning the current standards

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2. Freislederer P, Kügele M, Öllers M, Swinnen A, Sauer TO, Bert C, et al. Recent advances in surface guided radiation therapy. *Radiat Oncol.* 2020;15(1):187. https://doi.org/10.1186/s13014-020-01629-w

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Opportunities for Career Development

Radiation Oncology Education Collaborative Study Group (ROECSG)

Includes the following:

- Undergraduate medical education (UGME), graduate medical education (GME), continuing medical education (CME), patient education, and interprofessional education groups
- Annual spring symposiums
- Online resources about global health, clinical information, study materials, and more
- Social media and blogs
- OECSG report (visit roecsg.org/roecsg-report for latest issue)

Learn more by visiting roecsg.org.

Radiation Oncology Virtual Education Rotation (ROVER)

A virtual resource for medical students that includes:

- Networking opportunities to meet radiation oncologists from across the country
- Links to join radiation oncology organizations such as the Association of Residents in Radiation Oncology (ARRO) and ACRO
- Educational videos and materials about radiation oncology
- Books, websites, and more

Learn more by visiting ROVER.

Find a Mentor

The ASTRO website offers students the opportunity to match with a mentor in radiation oncology who can help witih the following:

- Making career choices
- Understanding what to expect in residency
- Learning more about radiation oncology
- Developing leadership skills
- Balancing work/life goals and more

Learn more by visiting astro.org.

ASTRO Annual Refresher Course 2024

ASTRO presents a virtual conference on best practices and emerging trends in radiation oncology:

- Hosted virtually April 17-19
- Courses on topics ranging from treatment methods to new technologies and pediatrics
- Registration required (with a fee)

Learn more by visiting ASTRO Annual Refresher Course.

Upcoming Conferences

Annual ROECSG Spring Symposium
May 31, 2024 | Chicago, IL

World Congress of Brachytherapy 2024
July 10-13, 2024 | National Harbor, MD

American Association of Physicists in Medicine 2024
July 21-25, 2024 | Los Angeles, CA

ASTRO 2024
September 29-October 2024 | Washington, DC

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