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RadOnc Student Scan

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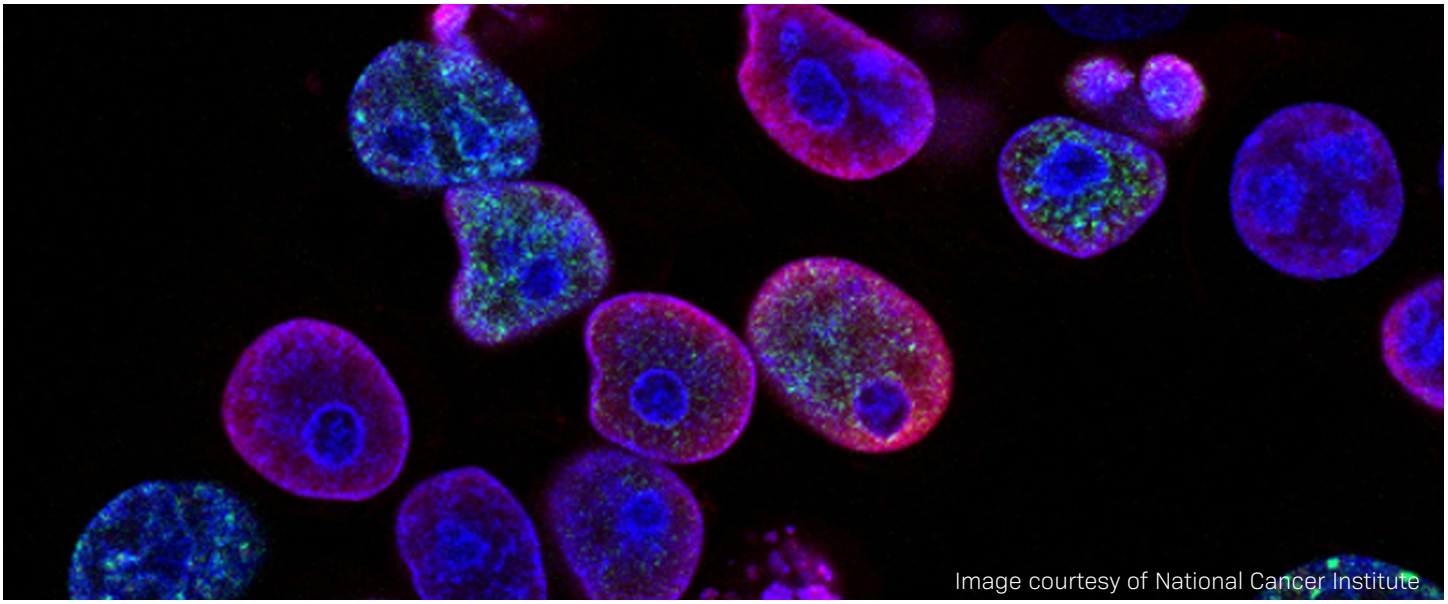
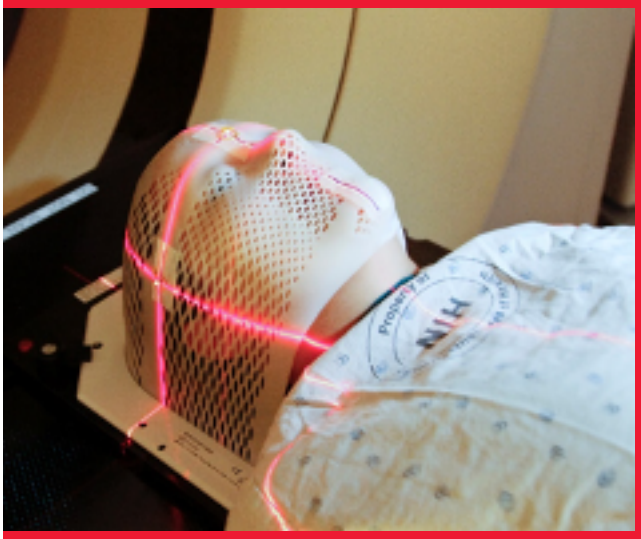


Image courtesy of National Cancer Institute

IN THIS ISSUE

How is radiation produced?



Radiation is created by a linear accelerator (LINAC). The LINAC uses microwave technology to accelerate electrons in a component of the machine called the "waveguide." These accelerated electrons then collide with a heavy metal target producing high-energy x-rays. The x-rays are shaped to the patient's tumor by a multileaf collimator as they are emitted from the LINAC's gantry, which can rotate around the patient. The patient's body is positioned on a movable treatment couch with the assistance of lasers for accurate irradiation.[1]

How does radiation affect the body?

Radiation therapy consists of various types of ionizing radiation including photons (most common), electrons, protons, carbon ions and neutrons. Each type of radiation travels through the body and deposits in the target tissue differently. The unique physical interactions of different ionizing radiation can be manipulated to improve the therapeutic window of radiotherapy. The therapeutic window depends on the extent of damage to normal structures, differences in DNA interactions between cancer and normal cells, and the cell cycle phase of the cancer cells. To ensure safe delivery of radiation, knowledge of these factors is incorporated into the treatment plan by a team of specialists including a radiation oncologist, medical physicist, radiation therapist and dosimetrist.[2]

Radiation Oncologist Clinical Responsibility

Consultation

The initial evaluation of a new patient includes reviewing all previous medical records, focusing particularly on pathology and radiology. Multidisciplinary conferences are often used as a means for all physicians included in oncology care to review patient details and discuss potential treatment options to provide cohesive and connected care to patients. Staging is a key component of each patient's consultation and is critical to the decision-making paradigm.

Simulation

A simulation is used to simulate treatment delivery. Patients are brought into a room that usually has a CT scanner that is used to set patients up in immobilization devices. Patients are then scanned, often using a multitude of different devices to maximize reproducibility, minimize movement or even evaluate tumor activity (PET). The physician works with a radiation therapist to establish this set-up and obtain the planning images. These images are then sent to the treatment planning software for planning.

Treatment Planning

Once the treatment planning images are electronically transferred, the images are often fused with MRI or PET images. The physician works with both dosimetrists and physicists in this step of patient care. Physicians will usually contour tumor volumes and establish the areas that need to be treated, while at the same time defining avoidance structures that need to have dose restricted. This is when the radiation dose and fractionation is determined as well as treatment delivery type, such as 3-D conformal, intensity-modulated radiation therapy (IMRT), or volumetric-modulated arc therapy (VMAT).[3]

Treatment Management

Once treatments have started, the physician will meet with patients on a routine basis, monitoring and managing any treatment-related effects while also closely monitoring setup and delivery, ensuring that no modifications are needed. Depending on the dose and total number of treatments, the frequency can vary from every visit for those receiving stereotactic radiosurgery or stereotactic body radiation therapy, to once every five days for those receiving standard fractionation treatment.

Follow-up

After treatments have completed, the radiation oncologist will continue to closely follow patients. The purpose of the follow-up is to evaluate for evidence of recurrence or metastasis while managing any late side effects.

"Even though [my patients] are going through a difficult time in their lives, they are incredibly resilient and that's what I find so inspiring."

— Dr. James Richardson, radiation oncologist

Hot Topics in Radiation Oncology

Radiation Therapy Under the Falling Bombs: A Tale of 2 Ukrainian Cancer Centers

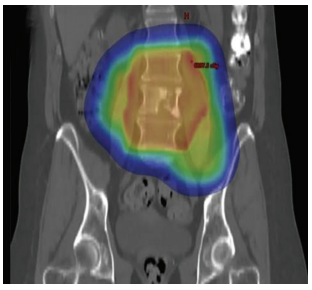
Advances in Radiation Oncology, Nataliya Kovalchuk, PhD; Ruslan Zelinskyi, MS; Andrii Hanych, MD; et al.

This editorial discusses the intersection between healthcare and politics, describing the implications a war can have on a country, its facilities, and the potential care that physicians are able to provide their community. Specifically, it concerns Russia's invasion of the Ukraine on February 24, 2022, and how according to the Ukraine's Ministry of Health, during the initial 100 days of the war, 600 healthcare facilities sustained damage, 105 of which are beyond repair.[4]

Burnout in Radiation Oncology Physician Workforce: The Effect of Mindfulness and Fulfillment

Advances in Radiation Oncology, Jacob Eckstein, MD; Zaker H. Rana, MD; Sahar Caravan, BSc; et al.

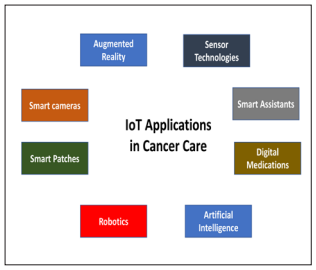
This article discusses the relationship between burnout, mindfulness, and fulfillment in the discipline of radiation oncology and how it compares with other specialties. Findings include that radiation oncology physicians experience less burnout in contrast to their colleagues in other specialties. Behaviors and activities including mindfulness, professional fulfillment and spending time with loved ones were powerful factors that protected against burnout.[5]



Shingles After a Single Fraction of Radiation for Ewing Sarcoma

Applied Radiation Oncology, Vinayak Ahluwalia, BSE; Sana Dastgheyb, MD, PhD; Mark Diamond, MD, PhD; et al.

This is an interesting case study about a 61-year-old woman with a history of diffuse large B cell lymphoma, who was treated with R-CHOP for 6 cycles. MR imaging of an L4 vertebral body lesion with canal and foraminal stenosis demonstrated Ewing sarcoma on bone biopsy. After the administration of dexamethasone therapy, RT was started. Following the completion of RT, chemotherapy was concurrently added. One day after beginning radiation, the patient complained of lower back pain with a right-sided band-like distribution, which corresponded to a dorsal root ganglion dermatome. This highlights an important takeaway for radiation oncologists to be aware of the possibility of alpha herpes virus reactivation in their patients and to both screen and counsel their patients regarding this potential serious side effect.[6]



Practical Applications of the Internet of Things in Radiation Oncology

Applied Radiation Oncology, Nikhil G. Thaker, MD, MHA, MBA; Brian De, MD; Chirag Shah, MD; et al.

This review article examines the transition of traditional care delivery models to digital health models and the implications this can have in radiation oncology. Such technologies include therapeutic augmented reality, wearable technologies, smart voice assistants, digital medicines, robots with AI capabilities, continuous and Bluetooth-enabled monitors, and smart cameras. These innovations are set to improve disease prevention and population health initiatives as well as high-acuity care such as cancer care.[7]

Environmentally Sustainable Radiation Oncology: Can We Turn the Tides?

Applied Radiation Oncology, Julie R. Bloom, MD; Justin D. Anderson, MD; Kyra N. McComas, MD; et al.

This editorial describes how radiation oncology residents have come together to advocate for the participation in the transition to sustainable practices within the field of radiation oncology through the creation of CHEST- Climate Health, Equity and Sustainability Taskforce. They have included 10 areas of focus, which include: to develop and disseminate climate health and oncology educational tools, quantify GHG emissions associated with current radiation therapy, reduce clinical and procedural waste, and practice sustainable resource consumption.[8]

Interview With a Radiation Oncology Resident

Dr. Jason Burton is a PGY-2 resident at Oregon Health and Science University in Portland, OR. He was raised in the Midwest in an Air Force family before relocating to Southern Utah during high school, a desert paradise that he considers home. After attending Brigham Young University and studying biophysics, Dr. Burton completed a dissertation utilizing novel 3D-imaging techniques at Baylor College of Medicine. He went on to pursue a career in medicine and discovered that radiation oncology was the perfect fusion of his professional interests. He completed a preliminary medicine year at Dartmouth-Hitchcock Medical Center prior to moving to the Pacific Northwest. Dr. Burton has preliminary interests in GI, lymphoma, pediatrics, and palliative specialties, with a current research focus on medical student education.

What advice do you have for a medical student interested in radiation oncology?

Spend some time in the clinic. It is the only way to know and understand what the field really is. Ask the residents if they are happy with their decision.

How many residency programs did you apply to?

89. Virtual applications made that easy.

Is there a good introductory radiation oncology textbook for medical students?

I don't know of one off the top of my head, but there is a great YouTube series on an overview of radiation oncology. Dr. Dan Golden uploaded them; the first one is "Lecture 1 – Introduction to Radiation Oncology." I believe there are 4.

Did you have radiation oncology rotations in medical school?

I did, but not as part of my school. We had no radiation oncology residency, so I used an elective period to rotate with an outpatient radiation oncology group.

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

Internal medicine.

How do you see the future of radiation oncology?

I think the future is bright. Radiation continues to play a growing role in many disease sites while targeting techniques improve, decreasing toxicity rates.

Is there any advice or comments you would want to give to medical students interested in the field of radiation oncology?

Rotate in a department, you will know quickly if it is for you. For me, it is a great combo of radiology, psychiatry and oncology.

How did you connect with an attending/staff to get your research started?

I found my mentor through a random SDN search, but most radiation oncology attendings are very kind and have open door policies; email one at your institution.

What made you pursue the topic of interest you researched?

I wanted exposure in the field, as it was a new specialty to me.

Did you do research in undergraduate or graduate school prior to medical school?

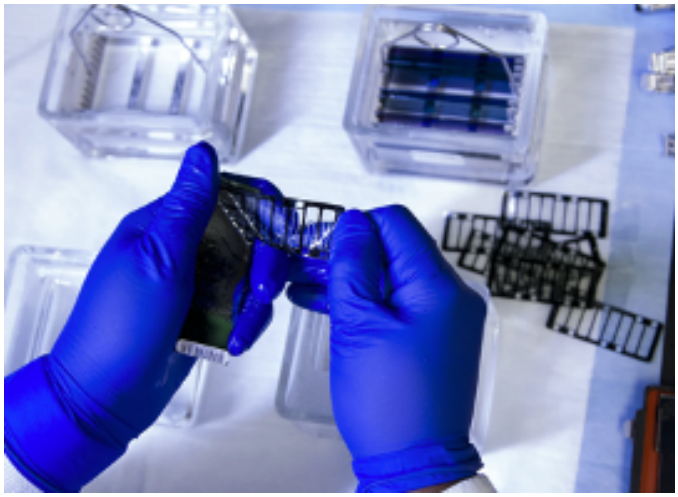
Yes, cell oncology work in undergraduate. PhD in 3D optical imaging techniques.

Opportunities

Stanford Radiation Oncology Clerkship
The application acceptance period is July 1-31, 2023

MSKCC Clinical Radiation Oncology Elective
For deadline information, contact medstudent@mskcc.org

Duke School of Medicine Radiation Oncology Clerkship
See elective calendar for application timeline



Upcoming Conferences

International Conference on Radiation Oncology, Radiobiology, and Medical Physics (ICRORMP)
March 20-21, 2023 | Doha Qatar and Virtual

2023 Radiosurgery Society Scientific Meeting
Mar 23-25, 2023 | Orlando, FL

2023 ASTRO Annual Refresher Course
April 26, 2023 | Virtual

American Society for Radiation Oncology (ASTRO)
Oct. 1-4, 2023 | San Diego

References

1. 2022 Radiological Society of North America, Inc. (RSNA). https://www.radiologyinfo.org/en/info/linac

2. Maani EV, Maani CV. Radiation Therapy. [Updated 2022 Oct 24]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022. https://www.ncbi.nlm.nih.gov/books/NBK537036/

3. Berman AT, & Kharofa J. (Eds.). (n.d.). Home – American Society for Radiation Oncology (ASTRO). https://www.astro.org/uploadedFiles/Affiliates/ARRO/Future_Residents/IntroToRO.pdf

4. Kovalchuk N, Zelinskyi R, Hanych A, et al. Radiation therapy under the falling bombs: a tale of 2 Ukrainian cancer centers. *Advances Radiat Oncol.* 2022;7(6): 101027. https://doi.org/10.1016/j.adro.2022.101027

5. Eckstein J, Rana ZH, Caravan S, Sharma R, Potters L, Parashar B. (2022). Burnout in radiation oncology physician workforce: the effect of mindfulness and fulfillment. *Advances Radiat Oncol.* 7(6),100971. https://doi.org/10.1016/j.adro.2022.100971

6. Ahluwalia V, Dastgheyb S, Diamond M, Lee I, Paydar I, Cengel K. Shingles after a single fraction of radiation for ewing sarcoma. *Appl Radiat Oncol.* 2022;11(2):35-38.

7. Thaker NG, De B, Manda S, Royce TJ, Beriwal S. Practical applications of the internet of things in radiation oncology. *Appl Radiat Oncol.* 2022;11(2):7-17.

8. Bloom JR, Anderson JD, McComas KN, Tam A, Lichter KE. Environmentally sustainable radiation oncology: can we turn the tides? *Appl Radiat Oncol.* 2022;11(2):46-47.

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