Clinical Specialty

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Secondary

Chapter #55150

Sequim High School

Washington State

Oncology

Gel Electrophoresis

Career Summary

An oncologist is a medical professional who studies or treats various types of cancer. There are a variety of jobs in this specialty, each with differences in skill sets and responsibilities. I will be focusing on the role and career of a medical oncologist, while also including some information on pediatric medical oncologists and hematologist-oncologists, two sub-specialties I have an interest in.

Medical oncologists diagnose patients with cancer and treat them based on detailed pathology, the stage/severity of the cancer, the type, and where it is in the body. They may use targeted treatments such as chemotherapy or biological and hormonal therapies. In addition, the care of a medical oncologist includes treating side effects of patients and helping to maintain their well-being. Pediatric oncologists treat cancer in children, which means they have the additional job of explaining diagnoses and procedures not only to the patient but also to the parents. Hematologists-oncologists specialize in cancers of the blood, such as leukemia and lymphoma, but it is not uncommon for them to also treat patients with non-cancerous blood disorders, such as sickle-cell anemia or hemophilia.

Oncologists need to establish strong relationships with their patients, keep up to date on new research, and be able to collaborate with other medical professionals, all to help their patients recover. Cancer preys on every organ in the body, so oncologists must have a working knowledge of medicine and anatomy beyond just oncology. Oncologists tend to form stronger, deeper connections with their patients, and spend much more time on patient education than other doctors. Oncologists answer all their patients' questions, help them understand what is happening in their bodies, educate

them on treatment options, help them through the treatment process, and check in on them even after remission.

Those are some of the over-arching qualities that make a good oncologist. There are many skills an oncologist uses in their everyday responsibilities. These include performing physical examinations, collecting medical information, doing research, educating patients, supporting patients, and coordinating with other doctors of different specialties.

Most oncologists work in clinics, hospitals, and healthcare centers, as well as some private practices and research facilities. According to a study published on NCBI, oncologists work an average of 57.6 hours and see a mean of 52 patients per week. However, the hours an oncologist chooses to work are variable and depend on location, desired income, and level of education.

According to a study by the Journal of Clinical Oncology, 44.7% of oncologists were found to be burned-out based on the Maslach Burnout Inventory. This makes sense due to the lack of oncologists available, plus the emotional toll of harsh treatments and possible deaths of patients these doctors form relationships with. However, despite these drawbacks, 82.5% of oncologists were satisfied with their career and 80.4% were satisfied with their specialty in their career, and a recent Medscape survey showed that 96% of oncologists would choose the same specialization if they got the chance to redo their education. The satisfaction in this career comes from a mix of factors, such as the rewarding work of saving lives, good financial compensation or income, and an environment that provides appreciation and respect.

Education and Employment

To become an oncologist, many years of education and special training are required. First, an undergraduate degree, followed by a medical degree, an internal medicine residency, and an oncology fellowship. This process can take 10-14 years, possibly longer if pursuing additional specialties that require fellowships for certification. Before you can even begin medical school, it is required to take a test called the Medical Colleges Admissions Test, or the MCAT. After finishing college, residencies, and fellowships, the United States Medical Licensing Examination is next to obtain a medical license, which can cost $100-$1500 depending on the state and needs to be renewed every 2-4 years. Oncologists have the opportunity to join professional organizations such as the American Society of Clinical Oncology (ASCO) or the National Cancer Institute (NCI) to get access to professional development resources, conferences, workshops, newsletters, as well as presenting opportunities to connect with others in the profession.

Pediatric oncologists require an additional 3 years of residency training in pediatrics, 3 years of fellowship training specific to pediatric oncology, plus certification from the American Board of Pediatrics. Similarly, hematologist-oncologists require additional training and experience to earn their specialization.

Medical oncology is predicted to grow 7% in the next decade, and hiring prospects are especially good in low-income or rural areas due to the lack of specialized healthcare professionals. As for the salary, it can vary greatly based on location, specialty, education, and other similar factors. Most often, the salary is around $300,000 per year but can range from $200,000 to $400,000 a year.

Interview Summary

I had the opportunity to interview Dr. Binay Shah at the Sequim Cancer Center. Not only is he a well-respected oncologist, but he also is the president and co-founder of the Binaytara Foundation, a non-profit aiming to “Advocate, Educate, Innovate to Improve Healthcare.” The foundation started in Nepal, similar to Dr. Shah himself, and has held multiple conferences, built hospitals, and improved health and cancer care in many areas that are underprivileged and poor. Dr. Shah got his medical degree from B.P. Koirala Institute of Health Sciences in Dharan, Nepal, then went on to complete his Internal Medicine residency from Long Island College Hospital in Brooklyn and completed a Hematology-Oncology fellowship from the University of Illinois at Chicago. Below are the questions I prepared, excluding the questions I didn’t get the chance to discuss.

- What made you agree to this interview with me?
- I saw in your bio you said that “Ever since I was a small child I wanted to help others.” How did you decide that becoming a doctor was the best way to do that?
- What was the best part about medical school?
- Why did you pick oncology?
- What do you think about “Dr. Google’s” frequent cancer diagnoses?
- How is practicing medicine in the US different from medicine in Nepal?
- Why did you decide to work in Sequim?
- How do you think your religious outlook impacts your work?
- How many hours a week would you say you work, including the work you do for the Binaytara foundation?

Dr. Shah comes off as very wise, with great insights on life and practicing medicine. One of the first questions I asked was about his thoughts upon seeing the email I had written to him requesting an interview. He informed me that he has had many students interview or job shadow him, and he enjoys seeing students interested in healthcare so he can share his experience with them. When I asked him about differences in practicing medicine in the United States versus Nepal, he told me that it's very similar, because people, illnesses, and basic needs do not change much when a manmade border is crossed. People in America can get lung cancer just as someone in India can, but the difference is the resources available to treat them. Another insight I appreciated is how the process of becoming a doctor varies in different countries. Dr. Shah completed 4-5 years of medical school after high school and then completed one year of residency, which is much shorter than America and something I didn't know.

As for my humorous question about "Doctor Google", his response focused on the fact that more medical information is accessible to millions of people, which gives them the power to understand when something is wrong and how to get treatment. I was interested to hear why he was working in Sequim, a small town that's a couple of hours away from any major cities when he could be in Seattle. He told me that because of all the extra work he does for his organization, he can only work as an oncologist part-time, and on one of the occasions he was in Seattle for a conference or foundation work, he heard about a little town with a brand new cancer center who needed a part-time professional. Sequim allowed him to be close to the airport and the city while working and getting a break from the concrete jungle. Overall, if I become an oncologist one day, I hope to exude the intelligence, wisdom, and passion that Dr. Shah displays for his medical and philanthropy work.

Gel Electrophoresis Skill

Certain DNA sequences or mutations in an individual's genome may put them at an increased risk of cancer. For example, the BRCA1 and BRCA2 tumor suppressor genes were found to increase the risk of breast cancer by 80% if a mutation was inherited. With that much-increased risk, it's extremely important to test for these genes, especially if there has been a history of breast cancer in the family. A common way oncologists may test for these gene mutations is through gel electrophoresis, a method used to compare DNA lengths and analyze particular genes.

For this procedure, the agarose gel has already been cast and the DNA samples have already been collected, centrifuged, amplified through PCR, and cut with restriction enzymes. So, the checklist will consist of inserting the samples, running the gel, and analyzing the results.

Clinical Specialty Skill Checklist

Competitor #: _____ Judge's Signature: _____

Reference: "Detection of Breast Cancer" Kit **Author:** Ward's Scientific

Skill: Gel Electrophoresis	**Judge Comments**
1. Clean the workspace using a disinfectant to prevent cross-contamination.	
2. Use a micropipette to move 10 microliters from sample tube one into lane one of the gel. *Be careful to not pierce the bottom of the well or overload the well.*	
3. Repeat step three for all five remaining sample tubes, injecting each sample into its respective well. a) Discard the used micropipette tip and get a new one after every use to prevent the DNA from mixing.	
4. Place the loaded gel on the gel tray and in the center of the chamber, positioning the well-side closest to the negative, or	

black, end of the chamber.	
5. Add 350 mL of a running buffer solution (I will be using 1X TBE) by pouring it carefully until the buffer is 2 mm above the top of the gel.	
6. After checking for and cleaning up any spills, slide the cover onto the electrophoresis chamber and connect the color-corresponding cords, starting with red and then black.	
7. Plug in the power supply at set it to 125 V, then turn on the power supply.	
8. When the loading dye has neared the edge of the gel, or after 25-30 minutes, turn off and unplug the power supply.	
9. Wait 10 seconds, then disconnect cords first from the power supply and then from the chamber.	
10. Gently remove the gel from the chamber, open the cover of the transilluminator, and place the gel on the surface. a) The transilluminator is not safe to look at uncovered while on, so keep it off while placing the gel.	
11. Put the cover back down over the gel, turn off the lights, and turn on the transilluminator to see the DNA bands. b) For long-term storage, add several drops of dilute stain and put them in a self-sealing plastic bag.	

Each lane should have multiple bands going down the gel. When these bands match up from one lane to another, this means their base-pair amount is the same and usually suggests that the two samples contain the same gene. Additionally, using a standard marker DNA sample with already known base pair lengths allows analysis of the relative lengths of the rest of the samples.

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