Dr. Lynn Wilson,Radiation Therapy for Cancer Treatment October 11, 2009Welcome to Yale Cancer Center Answers with Drs. Ed Chu and Francine Foss, I am Bruce Barber. Dr. Chu is Deputy Director and Chief of Medical Oncology at Yale Cancer Center and he is an internationally recognized expert on colorectal cancer. Dr. Foss is a Professor of Medical Oncology and Dermatology and she is an expert in the treatment of lymphomas. If you would like to join the conversation, you can contact the doctors directly. The address is canceranswers@yale.edu and the phone number is 1888-234-4YCC. This evening Francine welcomes Dr. Lynn Wilson. Dr. Wilson is Professor, Clinical Director, and Vice Chairman of Therapeutic Radiology at Yale School of Medicine.Foss Can you tell us a little bit about radiation therapy and how it differs from our common thoughts of radioactivity?Wilson Radiation therapy is something that's actually been used to treat cancer patients for nearly a hundred years. There are several different terms that mean the same thing; radiation therapy, radiation oncology, or the department here at Yale which is referred to as therapeutic radiology. These all really mean the same thing, and radiation that we typically hear about on television or in the public media may refer to things at power plants or other unusual circumstances, but the kind of radiation therapy that we do in medicine is very well regulated and specifically targeted, in most cases, toward tumors or a malignancy. There are some situations where we use it to treat noncancerous conditions, but it's very well focused and treatment plans are very well designed, so that things are very closely regulated. It's much-much different when it's used in medicine compared to other non-medicinal applications.Foss Can you give us a little history about the use of radiation therapy in medicine?Wilson X-rays were discovered over 100 years ago, and things were fairly rudimentary in the beginning because we weren't able to aim things in a very particular direction, we were still learning about it. As things evolved over the years, technology has become more advanced and we started to use what's called a linear accelerator. A linear accelerator is what we know today as the standard form of applying radiation to cancer patients. The linear accelerator is a device which accelerates an electron at very high speeds down a short course that interacts with the target, which produces a photon, or an X-ray, and that X-ray comes out of the machine and can strike a tumor within a patient, and in terms of the size of that X-ray or how energetic it is, or how deep it goes into the patient can all be decided and regulated by the physician.Foss So the kinds of machines that you are using for radiation therapy are very different then X-ray machines?Wilson Very different. An X-ray machine basically sends an X-ray out and goes through a patient3:05 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 and on the other side of the patient is the target, and it can capture that image; that would be a diagnostic type of X-ray. All of the radiation that I, or anyone in our department here at Yale uses, or anyone who is doing radiation oncology, it would be used for a therapeutic purpose as opposed to a diagnostic purpose.Foss There are a number of different ways that radiation therapy is used, and I understand there are also radioactive elements that we give to patients, could

you talk a little bit about the types of radiation therapy?Wilson Sure, there are three major types. External radiation, which we call teletherapy, is the kind of treatment that would come from that linear accelerator, where a patient is on a table and the beam, X-ray, or photon as we call it, comes out of the machine and strikes the tumor within the patient. That's the majority of the type of radiation that's used to treat cancer patients. There is another form of treatment referred to as brachytherapy, which is the use of radioactive sources that can come in several different forms. They can be very small seeds, in the case of a prostate cancer implant for example, and brachytherapy refers to the application of radioactive sources very close to the tumor, or next to, or implanting the tumor. A third form of therapy is where we give a systemic, or an agent which can go completely around the patient's body, perhaps in the blood circulation, and there are radioactive isotopes that are attached to antibodies that seek out certain malignant cells in the body. That's a systemic form of radiotherapy, but the most common form that we use is the linear accelerator.Foss We also use radiation elements in diagnostic testing in common diagnostic testing in say thyroid cancer treatment, as well as in MUGA scans that we do to look at heart function.Wilson That's a bit different, those are radioisotopes though, and they are targeted to certain tissues. In the case of thyroid cancer, there are a couple of different things, you can have a diagnostic scan which may show us the activity that's going on in a particular thyroid tumor where its lighting up for example, as it appears on the scan, and then there can be therapeutic uses in thyroid cancer of radiation as well, but the primary type of radiotherapy we use is teletherapy, its commonly referred to as external beam and that could also be used in the thyroid, for example. We have these different choices that we can use and it can get rather complicated, but that's why the residency-training program is rigorous and fairly lengthy because there is a lot to learn and there are a lot of different applications and lot of different choices.Foss What kinds of cancer do you use radiation therapy for?5:45 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3Wilson Almost all of them, and there are some that are a little more radio-responsive than other types, but really all cancerous cells will be responsive to radiation. Some are exquisitely responsive to radiation, and we would use just radiation alone, for example, in the treatment of a patient with a certain type of problem. Other malignancies can be better treated by a combination of radiation with systemic agents, or chemotherapies, for example. The answer is really most, or nearly all malignancies will be sensitive to radiation. The question is, are they sensitive enough for us to use just radiation alone, or do we need to combine that with another systemic or chemotherapy agent to have a better chance of curing the patient?Foss Is radiation therapy used at the beginning as a first therapy for cancer or is it used later, or both?Wilson Both. Sometimes it's used as an initial or first therapy, and then that would be followed by chemotherapy. Today, since we have moved toward personalized cancer therapy where we are trying to target that patient or that type of cell directly with very-very specialized treatment programs, and this falls into the area of selected chemotherapies, we often

combine radiation and chemotherapy together for the best results. There are some situations where we might give chemotherapy first in a patient with lymphoma, for example which are many of your patients, and then we might follow that with radiation which we refer to as consolidative treatment, and the doses can be different. Sometimes we use a very high dose when it's used initially, but there are some disorders where we use radiation alone and the doses are very low, so it depends on cell type and the clinical situation, and that's what makes this complicated. The answer to your question is really all three, before, together, and perhaps after.Foss In fact, if you go really far back in time, one of the first cancers that was cured with radiation therapy was Hodgkin's disease.Wilson Right.Foss Even today radiation therapy is a main part of the therapy for many lymphomas.Wilson That's right, and that's changed a bit as the systemic therapies have become more advanced, new developments and better targeting, and we also are better today at making the diagnosis, and learning more about where these diseases might be harbored inside the patients body. Systemic therapy and radiation have both come a long way over the last 40 to 50 years.Foss We have heard that term, radiation sensitizer, when we talk about certain kinds of8:09 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 chemotherapy drugs, could you talk a little bit about that whole concept of a radiation sensitizer and how often you employ that in your treatment of patients?Wilson For example, in head and neck cancer there are some early stage head and neck cancers that are very-very well treated with radiation alone. The tumors are very responsive and it's not necessary to add anything to help that radiation do its job, but in more advanced head and neck cancers, for example, we can use relatively high doses of radiation to solve the problem but when we get to certain dose levels we begin to get into a problem where the side effects of the treatment become fairly significant. So over many years we have introduced radiosensitizing drugs that make these cells a bit more sensitive to the radiation so that we can still use high doses of radiation, but don't need to push so hard that patients get such bad side effects from the radiation that the treatment essentially becomes worse than the disease. What's nice about cisplatin, for example, is it not only has activity by itself against the cancer cells, but also has radiosensitizing properties and can do things to those cancer cells that make them more sensitive to radiation then they would be without the exposure to a drug like cisplatin, and that's just one example, there are many.Foss This touches on an important point that we often talk about on the show, which is the multi-modality approach for many cancers. It sounds like with solid tumors in particular we have surgeons, a radiation therapist, and a medical oncologist, could you talk a little bit about the multidisciplinary approach and how it applies to radiation oncology?Wilson The multi-modality or multidisciplinary concept is really-really important for the patient for several reasons. Here at Yale, for example, the patient can come and be seen by multiple specialists in one visit. For example, in our practice you may see the patient in the morning and then I will be seeing the patient immediately afterwards, and we may have the patient see a surgeon after that. It's really

one visit for the patient and that helps with logistics. The other advantage is that all of the physicians and specialists that are involved will typically meet perhaps later that day regarding the patient's that have all been seen in this multidisciplinary consultation. We review all of the pathologies, all of the X-rays together, and we are literally all together in the same room going over each patient's case. It really provides a high level of carefully coordinated care for the patient so that everything is well understood and we can reach a consensus, and it's really excellent for the patient. Now in a setting where that's not available, certainly a patient could see a radiation oncologist, a medical oncologist, and a surgeon, but the visits may be spread out over several weeks and those physicians may not even work in the same building as each other, so that can in a way cause some challenges in communication and often that can work, but there is no better substitute then to be able to see all of the physicians in one visit and those physicians are11:10 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 actually working with each other, working together on that patient's particular case that day and have accessed all of the same information in real time.Foss These multidisciplinary clinics have only come about over the last four to five years, prior to that we weren't really thinking in those terms when we treated patient's with cancer. Can you talk a little about how the multi-modality approach applies say after the patient is treated moving forward in the follow-up, do you still see those patients?Wilson Yes, we do, and that's very important because as we have more experience under about belt, so to speak, having patients as cancer survivors and doing better and having better clinical outcomes, the patients are always at risk for a couple of things. One is long term side effects from treatment, so we see them frequently and observe them for conditions that may come up that are related to the treatment so that we can intervene rapidly to try to help with any problems or counsel the patient regarding these issues. Of course there is also the issue that patients are doing better, more patients are being cured the first time around from their cancer, and with some malignancies patients are at risk to not only have that malignancy come back again, but also may be at risk for a second cancer that may come up, so we have to monitor them carefully. A head and neck cancer patient, for example, is at an increased risk for lung cancer, typically if they have a smoking history, and so we evaluate these patients in the follow-up as part of a multidisciplinary program as well. They don't always have to be seen by all the physicians and we are sensitive to not having a patient have inappropriate or unnecessary doctor appointments, but we all follow patients very closely and they are often seen in these multidisciplinary settings. If there is a problem or there is something new that's diagnosed, the value of this is that we have all the consultants together so that we can put our heads together immediately for that patient without delay.Foss Lynn, can you talk a little bit from a patient's point of view about the logistics? Say a patient sees you and needs to get radiation therapy, what happens next?Wilson There are a couple of options for that. If it's someone who has an emergent problem, for example, there is bleeding from a tumor or they are very uncomfortable

because of pain or they are having a breathing problem from a lung cancer, in that situation, I would be called to see the patient, and we would see the patient immediately and start treatment very urgently, that day. That's one scenario, that's fairly unusual, but we are prepared to manage that for the patient if it happened. What typically happens is we see the patient in a consultation, they will see other specialists regarding the problem, typically that day, in a multidisciplinary program here at Yale, and we would formulate a treatment plan that day among the physicians for the patient. This will then be communicated to the patient from one or more of those physicians, and with respect to radiation therapy, we would then plan to have the13:57 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 patient come in for what's called simulation. That might happen the next day, or several days later, and we take the patients logistics into account as well. We want to try to give them appointments that work best for them. During the simulation process, that's really where the design of the radiation treatment begins, and in our program that patient gets a specialized CAT scan, although its an easy CAT scan because they generally don't need to swallow any material or get an intravenous injection but sometimes we do that, and we use those images from that scan to carefully plan their radiation treatment which will then begin within one to several days later as coordinated, depending on what the multidisciplinary plan is.Foss Thank you Lynn. I would like to talk a little more in detail about some of the long-term effects of radiation when we come back from the break. You are listening to Yale Cancer Center Answers and we are discussing radiation oncology with Dr. Lynn Wilson.Foss Welcome back to Yale Cancer Center Answers. This is Dr. Francine Foss and I am joined by Dr. Lynn Wilson, Professor of Therapeutic Radiology at the Yale School of Medicine. Lynn, we have talked a little bit about the logistics of radiation therapy with the simulation and the treatment planning. Can you tell us a little bit about the long-term complications and the immediate complications of patients who are undergoing radiation therapy?Wilson Certainly, and managing those complications is critical to a successful treatment program. There is not one set of side effects or complications that would happen for any one patient with any kind of malignancy. It really depends on what part of the body the problem is in, sometimes the age of the patient and what they can tolerate, what we call their performance status, and how well they are doing before we start treatment. Some of the very common side effects of radiation that we see in all patients are some level of fatigue, although usually that's relatively minor, if we are treating something in the head or brain area, we can see hair loss. Usually with any type of radiation it's from external beam, so we will see some irritation of the skin, not typically a sunburn type of effect, but some irritation or perhaps16:47 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 dryness of the skin. There are some treatments that we do, for example gamma knife treatment, which is a very-very specialized treatment that we have had at Yale for many-many years that we use to treat brain tumors or metastatic lesions in the brain. That technology is developed in such a way that treatment

is given very quickly and with extremely minimal side effects, and often even without any hair loss. If we are treating a problem in the lung, sometimes patient's can get an irritated or sore throat, or trouble swallowing. We spent a lot of time trying to design and customize these treatment programs for each patient so that we can avoid these side effects to the greatest extent possible. Many years ago, when we didn't have the kind of technology that we have now, because it was not available at any centers, we would set up beams and aim them at tumors, but it was very-very difficult for us to avoid very critical structures such as the heart or the esophagus, and that example you brought up of Hodgkin's disease many years ago when radiation alone was used to treat Hodgkin's disease, it was a very successful program, but the radiation fields were very large and came with quite a bit of toxicity; now we can avoid that. But there can be gastrointestinal side effects, in some cases, depending on how much intestine or bowels are in the field, but these are things we try to take into account. Most patients do very-very well and can have a very-very minimal side effect profile. Those are the kinds of things that might happen during the treatment course. Longer term, sometimes patients can develop scar tissue, but again we try to counteract that by deciding on what sort of fractionation schedule, or how often the patient should come for treatment. If we give very large doses of radiation over a very short time, just a couple of days, that patient is at a slightly increased risk for long term complications of scarring, to give one example, or fibrosis, or a complication in the bowel. Whereas if we gave treatment to the same area, but spread it out over many visits, say a month, or five weeks, the chance of having a longer term complication is really-really minimized, and these are general recommendations, but these hold true. That gets us to the reason of how long it takes to give radiation, and that's one of the main reasons that many of the fractionation courses are quite long and spread out of over many weeks, seven to eight weeks for example, nine weeks in some of the lymphoma treatment that you and I work with when we use total skin electron beam. I could give enough radiation in several days to probably manage the problem, but this long-term side effect profile will be much higher.Foss That gets to an important point that I wanted to touch on, which is the technology that is involved in radiation therapy. I have been down to your department, and I have been very impressed, obviously, by the big machines, but also by the tremendous amount of computer work and time that goes into planning these treatments, it's a very complicated procedure?Wilson It's extremely complicated, 20 to 25 years ago we had these linear accelerators so we had good technology, but much of it was more driven by human beings, it wasn't nearly as19:51 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 computerized. Still to this day we have radiation therapists on staff who are right on site with the patient at the linear accelerator at all times, and we have several of those staff members present at all of our linear accelerators, but things have become really technically advanced in the age of electronics and this is good for two reasons. One, we are able to deliver radiation more precisely then we ever have been before through the use of onboard imaging,

and on our linear accelerators we actually have the ability to do what's called a cone beam CT scan as part of the treatment program, and that helps us to delineate that the treatment field is going exactly where we want it to and to really document. Now, we are starting to take tumor motion into account, but there is a tremendous amount of computer and electronic capability and technology behind these treatments, but the staff member, the actual human being, is also essential to everything going well.Foss I have also heard about the use of PET imaging and other ways of actually imaging a tumor so that you can more precisely delineate the tumor. Is this going to be part of the future in terms of radiation therapy, using these kinds of labels or tags to precisely isolate the tumor cells?Wilson Not only is it going to be a big part of the future, but we use it now. To pick another example for lung cancer, every patient that we evaluate at Yale who has lung cancer will be getting a PET scan. They have either had one before we meet with them, but if not, we get it both for diagnostic purposes, and it's absolutely essential in the treatment planning of their care. We don't want just anatomic definition, we also want metabolic information, how active is that tumor? Sometimes the metabolic information for a PET scan, for example, will give us additional information that's useful in treatment planning compared to just a static CT scan image, and also as part of imaging, every patient that would get lung cancer treatment at Yale will have what's called a four dimensional CAT scan, and that's a special CAT scan that actually takes the motion of the tumor into account. That's important because if we have a lung tumor, everyone is breathing, that tumor is going to move, it may move a little bit in some patients, or it may move quit a bit, several centimeters, or an inch or two in other patients, and we need to take that motion into account. We are not interested in just setting up a radiation field that's sort of big enough to just account for the motion, as might have been the case many years ago before we had these kinds of technologies, but now we take that into account, and again, it gives us another advantage in being able to very precisely target these tumors and account for that motion every single day while the patient is undergoing treatment.Foss Sitting here as a person who does chemotherapy as a medical oncologist, I feel as though what I am doing is fairly primitive, because I inject a drug into a patient and I am not exactly22:35 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 sure where that drug is going to go. It sounds like you have a much better handle on being able to treat tumors effectively with radiation therapy.Wilson We have done really well in terms of both how we devise the treatment plans, IMRT, for example is a technique that has been available at Yale since the mid to late 90s, where we use many-many radiation beams that all converge on a single target and often motion isn't so much involved with that problem, but its again a way to deliver treatment that's in a highly precise manner so that we can avoid side effects. When we are treating a head and neck cancer patient, for example, we would like to avoid the side effects of a dry mouth. That may not sound like such a problem but it's a major side effect in the treatment of head and neck cancer and with the use of IMRT we can often

completely avoid that problem because we can exclude the parotid gland, the gland that makes our saliva. There are two of them and we can avoid them, or at least one of them as part of our treatment program. Even as recently as in the mid 90s, we couldn't do that. Those parotid glands would get treated as part of the therapeutic package and that added to patient side effects, but we are able to target better, and we can deliver treatment more carefully with more definition, and we can take tumor motion into account which we were not able to do years ago. 4-D CT is a relatively new technology we have at Yale and have been using it daily for several years now, and then of course your point about the PET scan and bringing that into the armamentarium. I am not talking about just having a PET scan that we look at on a computer and say, there is the problem, I kind of know where it is. We actually take the PET scan information electronically loaded into our computers and superimpose those images over that four dimensional CT scan and plan for that patient as an entire package, so that's the level of detail that we are using when we are planning these cases for patients.Foss Can you talk a little bit about research and your particular research interest?Wilson We are certainly well recognized as one of the most well funded NIH research programs in radiation oncology in the United States, and have been for many years. There are several kinds of research that go on in our department. There is basic or laboratory research that's happening, it doesn't involve patients, where scientists are trying to make new discoveries relating to perhaps radiation sensitizers, types of cell lines that can respond to different kinds of radiation in new sorts of ways and all sorts of basic laboratory research that's happening. Another major form of research that's happening in the department is clinical research, where patients are part of clinical trials or clinical investigations where we are trying to answer questions by looking at patients that we have treated over many years and studying their results, and we have a variety of clinical trials that are involved that include the use of radiation, and many of them chemotherapy as well, that are available to patients right now.25:28 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3Foss I know that Lynn, you are one of a very few number of radiation therapists in the country that does a specialized kind of treatment called total skin electron beam radiation, and that's specifically for patients with a rare disease called cutaneous T-cell lymphoma, that I also study. Could you comment a little bit about that specialty?Wilson Total skin electron beam therapy is extremely complicated. It's one of the most complicated treatments that we do in all of radiation oncology. The reason its complicated is because if you can imagine all of our skin folds and the nooks and crannies, how do we really get a good dose of radiation that's relatively as equal as possible to every spot around the body in a way that's not toxic for the patient or doesn't cause other problems for them internally? This is why it's complicated. We are one of the busiest centers literally in the world. Many patients, as you know, come to see you and I from other states, sometimes other countries, and the total skin program has been in place for over 30 years at Yale. The technology was initially developed at Stanford University and then quickly was adopted

here shortly thereafter. We have treated many-many patients with this technology. Everyday we have patients at Yale receiving total skin electron beam therapy and so we have a really dedicated program with therapists that know a lot about this particular kind of treatment, and physicists who are involved in the calibration of the machine doing certain measurements for each patient, and so that's a highly-highly specialized kind of radiation that's not given at many centers. All centers are capable of doing it, but its so technically complicated there are only probably a handful of even academic centers in the United States that have enough expertise in this to have the kind of volume, or that even do more then ten cases a year. We do many more than that.Foss This is a treatment that could be curative for these patients as well. Can you talk a little bit about your success for this disease?Wilson That's right. There are many different forms of the disease, as you know, and there are different kinds of skin lymphoma. Radiation treatment is a highly successful treatment for these patients. All of these patients respond to radiation. It's a matter of who is going to have a complete response, and this gets to the point of how we combine therapies. Often we will do radiation treatment, but sometimes that will be followed with the systemic agent, or given concomitantly with the systemic agent, or will follow it with another kind of therapy to maintain reemission or cancer control for the patient, but patients do very-very well with this treatment. Certainly, the patients with earlier stage disease do better then patients with more advanced disease, but even those with very advanced disease, with tumors on the skin or involvement of their blood with the disease, there is a role for total skin electron beam therapy in certain patients. Since this treatment is so successful for these folks that have, and28:18 into mp3 file http://www.yalecancercenter.org/podcast/oct1109-radiation-therapy.mp3 have suffered with this problem for many years, that's one of the reasons that we are a big referral center for this disease.Foss Lynn, I would like to say one thing about that and that is that a lot of times people don't really appreciate the value of this kind of treatment, even if it is palliative, even if the patient has a recurrence of their disease. These patients are so symptomatic and they get better so quickly with total scan radiation therapy. I think its very valuable part of our treatment and approach for these patients.Wilson I agree, and again, what's nice about our program is that the treatment is literally skin-deep, or perhaps touches on the tissues just below the skin surface. Patients do not get an upset stomach, they don't get breathing problems, and in fact they get minimal fatigue, very low level fatigue if they even get it. Patients can drive, go about their social and professional routines and the treatment is very-very safe. In fact, we don't even worry about bone marrow toxicity or effects on the blood counts; we get one blood count at the beginning of the therapy so that we have it documented and we don't have any troubles. It's well tolerated and is an excellent palliative treatment. ReconnaissanceFoss Thank you very much Lynn. This has been a really fascinating discussion about radiation therapy. You have been listening to Yale Cancer Center Answers, and I would like to thank my guest Dr. Lynn Wilson for joining me this evening. From Yale Cancer Center this is Francine Foss wishing you a safe and

happy week.If you have questions or would like to share your comments, go to yalecancercenter.org where you can also subscribe to our podcast and find written transcripts of past programs. I am Bruce Barber and you are listening to the WNPR Health Forum from Connecticut Public Radio.