PET SCRIPT

Narrator: *Positron Emission Tomography, or "PET" scanning is a medical imaging technique that brings together biology, physics and computing to create images of your body at work. PET is an extremely powerful and sensitive imaging technique which is very useful in the detection of cancer and in the diagnosis of other diseases, particularly in the brain and heart. Christele has volunteered to run through a scan procedure to show us how it works.*

Christele: I'm Christele, and I'm going to go through a PET scan procedure to see what it's like. They won't actually run the machine on me since it involves radiation, but I'll get to see what it is all about. The machine you will see here is a PET scanner combined with a CT scanner…it is normally used to find cancer in people's bodies. I checked in with the receptionist at the desk and soon a technologist came to get me and get me ready for the scan. She explained what I would experience here...

N: *Unlike techniques like X-Ray or MRI, PET doesn't just show structures...it uses radioactively-tagged molecules to create a digital image of processes happening in a body's cells and tissues. PET scans like this one are based on injecting patients with radioactive sugar, so there are a few steps to get a patient ready, like making sure they have been fasting and checking their blood sugar.*

Like other imaging techniques, a PET scanner is like a super expensive and sophisticated digital camera: it detects a form of light on a sensor and creates a digital image. Unlike an X-Ray, where radiation is passed through a body to a detector on the other side, PET uses radiation from inside the body to create the signal. As is the case with the machine you will see here, PET is often combined with CT scanning in one machine, providing the structural views of CT with the body function imaging of PET.

C: I got changed into some comfy clothes, and then it was time to prepare me for the injection. In my case, they just pretended to do it, but in real life they would set up an IV line into the blood stream so they can inject me with radioactive sugar.

N: *Glucose is a sugar that is used by all cells of your body for energy and other processes. The glucose used in PET scans is tagged with radioactive fluorine...the patient's body treats it just like glucose, except this glucose now shines with energy that a PET scanner can create an image from! Some cells use more glucose than others...cancer cells are heavy users and this makes them 'shine' brighter on a PET scan.*

C: The tech went away to prepare the radiation for injection. The injection part was a little creepy...she used a shield for herself since she interacts with the radiation every day...she assured me that the dose a patient gets is small and would be broken down and peed out quickly.

Once the injection is done, people just lay around for an hour while the glucose moves through the body...they don't want their muscles to start using the glucose. The technologist told me she would watch on a camera and get me after an hour. They sometimes give patients a diuretic so they pee out some of the radiation...a full bladder can obscure things in the scan.

The technologist helped get me get in place for the scan...she laid me on a bed that will move into the machine and made sure that I was positioned so that all parts of my body would be visible to the camera. She explained that they would normally do a quick CT scan for a picture of my body, and then a

PET scan from my eyes to my thighs which would take a little longer...this would pick up the signal from the radioactive sugar.

N: *The CT part of the machine emits and detects X-Rays that will pass through the patient and the PET detects gamma rays emitted by the radioactive glucose. The particle physics of PET are confusing, but as the radioactive fluorine atoms attached to the glucose molecules decay, they release positrons, which will annihilate with electrons producing pairs of gamma rays. Confusing? Yes, but just picture the resulting gamma rays as light and the PET scanner as a digital camera and you get the idea. If lots of radioactive glucose molecules have been concentrated in a tissue, then there will be more gamma rays emitted from that area and they will appear brighter, or hotter on the resulting image.*

C: Once I was positioned properly, she went to her control room and slowly moved me into place. It was a little cramped inside the machine, but it was good to know the technologist could see me and talk to me from the control room. The whole scanning process took about a half hour...when it is done, computers create 3D images of the data. The technologist would check the images to make sure they're clear and send them to the viewing station for a doctor to review.

This doctor will take about an hour to go through the images, comparing the CT and PET scans to identify the presence and location of cancer.

N: *Here you can see the doctor sliding between the two views to identify hot spots that might be cancerous cells. 'Hotter' cells show up brighter…sometimes up to fifty times the brightness of normal tissue…a ten times increase in brightness is a good indication of cancer and may require further treatment. These hot spots line up with lymph nodes that are visible in CT, which suggests that cancer cells are growing there: they think this may indicate a type of lymphoma. The doctor will save images of interest and make detailed notes for his diagnosis. These results would be sent to the patient's doctor and oncologist to determine the next steps in treatment.*

PET scanning brings together physics, biochemistry, biology and technology to create detailed images of cell and tissue function in the body. When disease affects tissues, their biochemistry changes and radioactive molecules can be used to track those changes. Especially when combined with CT scanning, PET is an incredibly powerful tool in the treatment and diagnosis of cancer and other diseases, helping us to visualize and identify abnormal or diseased tissue.