Love and Death

What good was science if it didn't make a difference? Computer advances for their own sake are academic. Early in my career I felt it was important to see my skills applied directly to benefiting others.

In 1975 I had that chance. I was working at Los Alamos, New Mexico for Digital Equipment Corporation (DEC). DEC had many computers at the Los Alamos National Laboratory (LANL). Many were used for nuclear research, such as for mathematical modeling of what happens when a thermonuclear bomb explodes. My feelings about The Bomb were that it was a necessary evil during those cold war days. I hoped we would never need to use it, but I believed we needed to have a nuclear capability. Using the computers at LANL allowed our scientists to work on thermonuclear bombs using mathematical equations instead of having to build them and test them so often. The fewer real explosions that were necessary, the fewer radioactive byproducts the environment would have to deal with. So I was okay with the overall mission of LANL.

More interesting to me than mathematical computer simulations which happened at the Central Computer Facility was some work happening a few miles away from the main computer complex. At a facility called the Los Alamos Meson Physics Facility (LAMPF), a linear accelerator was being used for many experiments with mesons. Mesons are subatomic particles which have an unusual property. When they reach the decay point in their atomic life, they decay incredibly quickly and give up all their energy almost instantly. This decay is so fast and so predictable that it allows many interesting experiments.

Mesons are created at one end of a long tunnel. They feel the pull of a magnetic field and start down the tunnel. As they move into the accelerator, they feel ever-increasing magnetic pulls and the speed of the meson stream increases. After they have traveled a half mile down the accelerator, they are traveling at 0.86 times the speed of light, or about 160,000 miles per second. They are also nearing the end of their life.

The experiment that I was closely related to used this beam in an interesting way. When these mesons are traveling at these speeds, before they decay they are capable of penetrating many materials. Human bodies represent no barrier at all, and the subatomic particles can stream through flesh or bone easily. There is no damage to the cell structure when this happens, as long as the mesons do not decay and spontaneously give up all their energy.

But when they do give up their energy, it happens so quickly that, even traveling at 160,000 miles per second, the energy is given up as the mesons travel only a millimeter or so. If that happens when the beam is inside a human body, wherever that decay occurs is instantly burned by the energy released by the meson's decay.

This capability has many obvious applications. Think of a patient with a brain tumor in the center of her brain. The small, cancerous clump of cells in the her brain is malignant. How can it be destroyed? Often it is surgically inoperable; cutting chunks of the central brain out with a scalpel requires cutting through the outer layers of the brain, which might save the patient's life but turn her into a vegetable.

What about conventional radiation therapy? Can a beam of radiation be used to burn out the tumor? Not really, because that would burn a tunnel all the way through the brain to get to her tumor.

But what if you had a beam of mesons which traveled very fast and gave off no energy until they reached a critical point in their existence, at which time they gave up all their energy in an instant? This beam could pass harmlessly through the skull and outer layers of the brain and just at release all the energy right inside the tumor, killing the cancerous cells right where they were. The possibilities for treating formerly inoperable cancers were exciting, and I was thrilled to be a part of the computer support for the work at LAMPF.

One of the things I was responsible for was the computer that controlled the chair that the volunteer cancer patients would sit in. It was critical that the meson beam hit the right spot in the patient, and if by any chance the patient moved, the chair would have to move in the other direction to keep the same absolute point in the patient's body at the terminal point of the beam. For example, in the case of a brain tumor, if the patient's head moved forward, the chair would have to move back. This was controlled by a PDP-11 computer, one of several I was responsible for. At the time I worked on primarily computer hardware; my software work was more out of personal interest than part of my job. But I was interested in how the software for the chair worked and spent a lot of time at LAMPF studying and learning real-time control systems on my own.

It felt very good to be part of LAMPF's cancer project. Many experiments were run on various objects. Then pig flesh was tested, as the cell biology of pigs is very close to that of humans. Finally, the day came for the first humans to participate in the experiment. This was a bittersweet experience for me. I was excited to learn that we would finally have real patients which maybe we could help. But I was wrong. We had real patients, but there would be no chance that the beam would save them.

The people we got were volunteers. All were terminally ill cancer patients. None of them had any hope of living more than a few months. All other cancer therapies had been exhausted, because if there was hope of saving these people with conventional therapies, they would be on those programs. No, these people were those who had already accepted their death, and wanted to spend their last months doing something useful, perhaps so others could survive. The typical patient had several cancers, and their work under the beam would be confined to research on one type or location of cancer. Perhaps one percent of the patient's cancer would be successfully eradicated as part of an experiment – one tumor in a brain region or on an intestinal wall, perhaps – while the other 99% of the cancer continued to spread and kill.

It was very hard for some of the LAMPF staffers to face the new arrivals that first day. In fact, many didn't show up. They couldn't deal with meeting people – real live humans – who wouldn't be alive that much longer. They couldn't deal with the prospect of working with many people, day after day, knowing that someday soon each and every one of them would die. The experimenters and support staff were okay with the inanimate objects, and they were okay with the pigs, but real people with personalities and dreams and memories and thoughts of what could have been – facing them was too tragic for some.

I didn't have a problem with meeting those first patients. I was forever hopeful. So were

they. Even though they knew the beam would not be used to attempt to cure them, they also knew that many great researches in cancer would be at LAMPF. They hoped that just maybe there would be an outside chance that one of the cancer specialists participating in the experiments would notice something about their cancer and be able to recommend some magical obscure treatment that their own physician might have missed.

For me, being around these patients was an uplifting experience. They were more positive and "up" than most anyone at LAMPF. They had already accepted their imminent death, and they were determined to get the most out of the time they had left. They refused to let themselves get depressed, especially in public, where it seemed they always pulled together to support each other and to cheer one another up. Their infectious love of life spread to the rest of the LAMPF staffers eventually, and many bonds were made. Camille was one such lady. Very up, and very positive. She refused to let her cancer be an issue. If you wanted to be her friend, and she hoped you would be, there could be nothing beyond clinical discussions of cancer. As a patient, she would discuss her cancer and her reactions to the treatment. But as a friend, she wanted to talk about the art festival down in Santa Fe, or what new movie was showing at the theater, or about going for a hike in the high Jemez Mountains behind Los Alamos. She wanted to do more, see more, be more.

There were others just as committed to making the most of every moment. Paul was another young man, about the same age as Camille. Their friendship grew quickly over a few short months. In fact, they fell in love. There was constant activity in both of their lives, both personally and with experiments at the beam at LAMPF. In fact, it was the beam at LAMPF that brought them together, and it was the chair, controlled by my PDP-11 computer, that they shared even before they knew one another.

Perhaps that is why when they decided to get married, they chose to have the ceremony at LAMPF in the small room at the end of the accelerator where the experiments had taken place. The room was almost always busy, including weekends. But there was one day coming up when no experiments were scheduled. So in a candle-lit ceremony among a small group of friends in a small room full of powered-down computers and an odd-looking chair, Paul and Camille were married that Christmas evening of 1974.

