Radiation Safety for Beginners

If you want to see how well you have designed an educational course, then you should try teaching it to someone totally ignorant of the subject. And *he* was that man, who in his natural state, was totally devoid of the general scientific education that warms and comforts most humans involved in biomedical research.

In other days or places, they may have called him a guinea pig. At one time, he was referred to as an "English Major." Fate, however, brought him to the scientific community and placed his office alongside a radiology research lab. Then, through ignorance as much as intelligence, he signed up for the standard course in Radiation Safety. So after being subjected to this experiment, having fully consented to the procedure and knowing that this course has been taught before to countless numbers of scientists and physicians, he reports that there were very few lasting effects.

Is that good or bad?

The presentation was not what he had expected. Slides, videos and poorly photocopied reproductions of already uninspiring pamphlets were presented to almost one hundred newcomers crammed into a small amphitheater.

At an institution such as his, brimming with laboratories equipped with most of the latest instrumentation, the radiation safety course was held in a carpeted conference room.

There was the presumption, he believed, that students had or would eventually be exposed to the so called laboratory realities, and therefore were not in need of practical explanations or demonstrations. Perhaps that is true. It is also a possibility that a basic course in radiation safety might do well to assume a certain degree of ignorance on the part of students.

Assuming that your audience is composed of beings other than nude mice might be a dangerous assumption. For this scientifically-naive person, though, it meant only a slight discomfort at the beginning, which did not last. There may have been others in his situation, but even if everyone there was experienced in working with radiation, the anecdotal nature of the presentation would have tended to fill them with a certain amount of complacency as to the reasons for their attendance.

It began in confusion, followed quickly by the general perception that, apart from a physical presence at the lecture, not much would be expected of those attending the course.

The registration form, which was received 2 months prior to the date of the first class listed Room 203 in the teaching pavilion as the location of the class. At the appointed time however, it was empty. An old note, taped to the door, noted that classes originally scheduled for 203 would meet in 302, but that room was also empty.

In the office on the first floor, the receptionist just shook her head when asked for assistance.

Finally, desperate, he called the general number of Radiology and was curtly told that the location had been changed two months ago.

"I was never notified," he huffed and puffed.

"All of the permit holders were notified," was the reply. Which is to say, that the two or three department heads' secretaries received a one-page memo. Indifference is contagious: someone yawns and soon everyone joins in.

He was not, however, the only one wandering about the empty brick building in search of Radiation Safety. At least a dozen others in the same predicament trundled onto the shuttle bus to the campus across the river.

Once in the auditorium, there was one final scare. As he got out his notebook and settled into a seat at the back of the room, the words of the lecturer filtered through, and for a brief moment he was convinced that he had rushed in to the wrong room.

"Women and Radiation: The Perils of Fluorine," would have been a plausible title for the lecture he was hearing. It was not, but judging from the stream of anecdotes that were spilling from the lecturer's lips, it was a distinct possibility.

There was the time, the radiologist chuckled, when a lady geneticist splashed a certain radionuclide into her eyes. "Where were your protective glasses," the speaker recalled admonishing the individual.

Then there was a video showing a female technician knocking a tray filled with ^{131}I on the lab floor, and a few dozen frames later, another woman cutting her hand on a broken vial.

In between there was a cursory explanation of the differences between Curies, Becquerels, rads and Roentgens.

The presentation reminded him of an "I Love Lucy" episode only Ricky was not a band leader at the Copa Cabana, he was a researcher at Los Alamos in the fifties, and Lucy worked at the new watch factory in town, painting the

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luminous numbers on the faces of alarm clocks. But when all of Ricky's experiments start to go wrong at the same time . . .

Don't worry, the narrator hinted at this point, it all works out in the end. Sure enough, Lucy's hair turned a brilliant shade of red, Ricky's paper about the contamination of workers at the watch factory was accepted by the *New England Journal of Medicine*, and another eight dozen radiation safety diplomas were sent out in the house mail.

In the end, this scientifically-naive person was left with an uneasy feeling and several nagging questions. Did any of the students leave with a real understanding of the ways in which radiation safety practices could be enhanced, or how easily they are abused? Would the six hours spent in the conference room equate to any difference in the habits of the researchers?

This particular course did not attempt to make practical applications of the anecdotal material presented, generally downplayed concerns about radiation, and reinforced the widely held belief that the course is only held to meet the minimum requirements of the NRC.

It seemed to him that the course had missed what should have been its two most important targets: improving safety for workers and easing the apprehensions of an increasingly radiophobic public.

Some questions were answered, but many more were raised.

Strange, he muttered out loud, that in this age, when the public's fear of disease is widely recognized as being very nearly equal to the actual effects of disease on that same public, that so little attention is paid to minimizing those fears—to demonstrating methods for improving the public perceptions of radiation-based research.

While it may be true that the majority of those attending radiation safety courses are well aware of the scientific basis for the utility of radiation materials in research and the dangers of radiation exposure, very few are totally at ease in disseminating that information to the public, and many are completely unaware of the connection between the two—the need to protect their physical person from harmful exposure and to protect the institution from potentially damaging public relations disasters.

If the public is neither satisfied nor confident that it is being protected, then however confident the individuals working with radiation are—they are in danger.

Nuclear Industry Magazine recently published a piece entitled "Radiation Phobia—It Could be Hazardous to Your Health" (*1*), which details the rise of incidences of radiation phobia in hospitals and, more important, in the minds of taxpayers: which may be directly related to the inability of states to license low-level radiation disposal sites.

Of course, conversely, overconfidence on the part of the medical and research community personnel could endanger the well-being of the public, or at least feed the phobia.

"In the absence of facts," Dr. H. William Strauss commented in this journal nearly two years ago, "the 'glowing ghost' rules supreme" (*2*). We may have gone beyond that phrase today. It may be that in our present political environment even the facts are not enough. In the absence of a concerted and focused effort to make the case for the effectiveness and safety of radiation in medicine, much of medical research may be in jeopardy.

Informal interviews with nearly a dozen individuals from several major institutions, all of whom have recently taken their institutions' radiation safety course, confirmed that the case cited here is not an isolated one, but appears to be part of a widespread malaise that may be called, for want of a better word, indifference. Not indifference on the part of the individuals, though that is certainly part of it, but mainly on the part of the institutions. The small hospitals and university medical centers often do not offer a radiation safety course. In other larger institutions, the course may only be offered to residents as part of an overall radiation science course, or is only available on an intermittent basis. When the course is offered on a regular basis, that may mean twice, perhaps three times a year.

When the courses are offered, they are general overviews of the scientific basis of radiation, with perhaps a film strip or two on the proper procedures for handling radiation. There is perhaps little difference, apart from the particular instruments and radionuclides, between what is being taught today and what was taught 30 years ago. An abstract published in the *Journal* in 1961 (*3*) covers the subject in this manner:

> The control of radiation exposure is discussed as affected by current recommendations of accepted regulatory agencies . . . Routine accepted clinical radioisotope techniques are discussed from the safety viewpoint of the patient, physician, laboratory and hospital personnel. In addition problems of instrumentation, records, waste disposal, incineration and transportation are presented and possible solutions offered.

Sound familiar? Hopefully the course at your institution covers at least these basics. But in 30 years things have changed. The mildly frightening giant ants and spiders of 1950s films, which represented both the public's fear and amusement toward all things "radioactive," have been transformed into far more menacing, insidious creations: creatures that cannot be so easily handled.

So what should be done? For starters, let's take the whole thing more seriously. It is clear that the courses might be organized much differently. They should perhaps be a kind of laboratory within a laboratory. That is, a laboratory

should be set aside for education purposes only, and while students would participate in real-time activities within that lab, they would also be subject to orchestrated activities outside of their control. There would be, for example, interruptions during the course, when deliveries of radionuclides would be made or visitors would pass through (munching on apples, perhaps). The final day of the course would be interrupted by a radiation safety inspection. There might also be demonstrators and problems with animals. The mistakes that are made with radiation are usually not due to a lack of scientific knowledge on the part of the researcher or technician, but to a lack of concern or ignorance of the proper procedures.

Perhaps, to further address the cost of such a program, radiation safety, animal welfare, and biological safety procedures could be combined in one course.

This kind of course should also be offered with enough frequency so that the numbers involved could be kept to a minimum, and individual attention paid to everyone taking the course.

Is such an effort really necessary? The risks associated with working with radiation are in some ways similar to the concerns of individuals working with biological hazards. Radiation safety involves issues of permissible emissions, contamination, restricted areas, public disclosure, and waste disposal. While basic radiation safety courses should not attempt to frighten students about these aspects of the work, a casual approach to their education is a commitment to disaster. Once educated in a more thorough manner, an institution would be justified in penalizing individuals responsible for safety violations.

Clearly, there has to be a new commitment to this kind of educational process. We should recognize, however, that there is already a commitment on the part of the public to more closely scrutinize and regulate our branch of medicine.

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REFERENCES

1. Warren A. "Radiation phobia: it could be hazardous to your health." *Nuclear Industry Magazine* Fall 1991.
2. Strauss HW. The glowing ghost [Editorial]. *J Nucl Med* 1990;31(2):3A.
3. Fields T. Radiological safety and protection [Abstract]. *J Nucl Med* 1961;21:125.