named Winston Churchill. There in the Sudan, at an advance-base surgical hospital, portable X-ray equipment was used in some 60 cases. In this area, where the temperature rose to 122°F in the shade, the X-ray apparatus had to be packed in felt saturated with water every two hours to keep it operative. The batteries were charged by two soldiers generating electricity on a tandem bicycle. (I want you to know that I rarely tell this story as I do not want to give certain people the impression that large amounts of electricity can be generated by bicycles. This would give the nuclear power field still another source of competition.)

Although machine-generated X-ray radiation was quickly adapted to medical uses after its discovery, the use of radiation from radioisotopes, natural and later man-made, was a little longer in coming. But, as I hope to point out, it was well worth waiting for.

I will not review for you the whole story of the discovery of natural radioactivity by Bequerel or the Curies' discovery and subsequent work with radium. I think this is all well known to most of you. For more than 30 years, X rays and radium continued to be the only sources of radiation used in medical diagnosis and therapy. During this period an understanding of radiation and radioisotopes was built up by the work of many great scientists—Thompson, Rutherford, Soddy, Hahn, Cockcroft and Walton, the Joliot-Curies, and others. Significant as all their work was in understanding the atom and laying the foundation for the Nuclear Age, it did not have any direct application in medicine. The great step in this direction—and it was a giant one indeed—followed Ernest O. Lawrence's invention of the cyclotron in 1929. The cyclotron, rapidly developed in the 1930's, allowed us to create a number of new radioisotopes, many of which were to be useful in biological and medical work. I said "us" in mentioning the production of these new isotopes because I had the extreme good fortune to be one of a group of young scientists at the University of California at Berkeley at the time of Lawrence's work and was able to use his cyclotron in my work in nuclear chemistry. Artificial radioactivity was new then, and in those days we were able to produce a new radioisotope every month or so. I was personally most concerned with learning more about the nucleus of the atom, but we were kept aware of the utilitarian aspect of our work by the requests from our biological and medical colleagues for new radioisotopes.

As early as 1935 the radioisotopes produced in the cyclotron were being used as tracers to make new biological explorations. On one oc-