which included 17 years as a chemistry teacher at Lakewood (Ohio) High School, before coming to Oak Ridge in 1945. In the health-physics division of ORNL he became an internationally known expert in specialized radiation measurements. His careful measurements set new accuracy standards for radiation quantities, and his expertise led to several special assignments such as bomb tests at Bikini and radiation analyses for the US Geological Survey.

After retiring in 1959 from ORNL Bortner started a third career, which lasted 15 years. He did research in radiation physics at the University of Tennessee and directed the laboratory work of several graduate students. In 1966 he moved to Lexington, Kentucky and helped to establish a radiation-physics program in the University of Kentucky physics department. That work involved several graduate students who earned their PhD's in physics and chemistry. In 1970, he and his wife returned to Oak Ridge where he worked as a consultant and as one of the founders of Elographics, Inc.

G. S. HURST
Health Physics Division
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John R. Dunning

John Ray Dunning, who died at the age of 67, was one of the great scientists and engineers of our time. Probably his greatest contribution was the invention of the gaseous-diffusion method of separating U-235 from U-238. He was also one of the original electronics experts in nuclear physics, and one of the first to build a slow neutron velocity selector with a set of rotating discs. Using this and a radium/beryllium neutron source, he demonstrated that the neutrons emitted by a paraffin howitzer were present in large quantities in paraffin and followed a Maxwellian energy distribution. It was he who inspired and performed (with his colleagues) the experiments that were done at the National Bureau of Standards to show that the neutron cross section of orthohydrogen is considerably larger than that of parahydrogen and thus conclusively prove the spin dependence of nuclear forces.

Dunning was responsible for raising the money for Columbia University's first cyclotron, as well as for designing and building it in the basement of Pupin Physics Lab. In order to construct this cyclotron he scrounged components from all parts of the country. It was due to John Dunning's genius as an experimenter that the cyclotron worked; his ingenuity gave Columbia

DUNNING

one of the highest-energy cyclotrons in the eastern part of the United States. So many important experiments were performed with this cyclotron that its major components are now on exhibition in the Smithsonian Institute in Washington.

His other contributions to the developing science of neutron physics were extensive. He was the first in the US to demonstrate the fission of the uranium nucleus. He had already set up equipment to examine the emissions of uranium when the famous seminar took place at Princeton at which Niels Bohr announced the nuclear-fission hypothesis. When the Columbia contingent to this conference returned and informed Dunning of this hypothesis, he used his apparatus to observe enormously energetic fission fragments and thus confirmed the fission hypothesis. Dunning and his colleagues, Eugene Booth, Alfred Nier and A. V. Grosse, separated a small amount of U-235 with a mass spectrograph and demonstrated conclusively that the U-235 isotope was responsible for slow-neutron fission rather than the more abundant U-238. Dunning was also very active in many phases of the Manhattan Project and contributed extensively to the development of all phases of the use of fission for both peaceful and military purposes. During World War II he directed the research at Columbia that produced the gaseous-diffusion plant for isolating the rare isotope U-235 from its chemical twin U-238.

After the war, Dunning mounted a campaign throughout the country to convince government officials that they should continue to support research and development as they had during World War II. He was one of the leading scientists in obtaining government funds to construct the Nevis cyclotron laboratory at Columbia University.

In 1950 Dunning was appointed Dean of Columbia's School of Engineering. He threw himself into a fund-raising campaign that resulted in the construction of the Seeley Wintersmith Mudd and Terrace Engineering Center at Columbia. Dunning retired as Dean of the Engineering School in 1969 after having raised more than $50 million and became the first holder of the Thayer Lindsley Professorship in Applied Science.

Dunning was a man with contagious optimism, boundless enthusiasm and almost infinite energy. He was also an inspired experimentalist who intuitively knew the critical factors in a scientific problem and was able to put together the apparatus to perform the investigation. He had a real flair for getting apparatus to work. On many occasions, his graduate students would give up in dispair when one of Dunning's electronic devices would not function. Dunning could then be found in the laboratory at 2 or 3 a.m. fiddling with the apparatus, and by dawn it was usually working perfectly. Dunning was not a calculating "Dr Strangelove" scientist but an intuitive and inspired performer. His colleagues jokingly referred to the "DOF" or "Dunning Optimism Factor" when planning any project because Dunning always minimized the difficulties and emphasized the accomplishments. However, all admired the ingenuity, enthusiasm and inspiration he contributed to any project, and he will always be remembered with affection.

W. W. HAVENS JR
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Jimmie A. Suddeth

Jimmie A. Suddeth, a physicist at the National Bureau of Standards, died on 1 September. At the time of his death Suddeth was technical assistant to the chief of the Mechanics Division in the NBS Institute for Basic Standards.

Suddeth received a master's degree in physics from Clemson University in 1950, and joined the Electron Physics Section of NBS in 1951. He worked with a team that succeeded in designing, constructing and operating the first electron interferometer. He also contributed to the study of characteristic electron energy losses and, together with Erwin Horl, obtained the first measurements of these energy losses for condensed gases.

In 1960 he turned his talents to scientific administration and served as assistant to the chief of the Atomic Physics Division and its successor, the Optical Physics Division. He recently assumed a similar position with the Mechanics Division. □