Persa Raymond 'P. R.' Bell

Persa Raymond "P. R." Bell, one of the founders of nuclear medicine and a versatile electronics expert, died 10 January 2001 of heart disease in Oak Ridge, Tennessee.

Born on 24 April 1913 just outside Fort Wayne, Indiana, P. R. graduated in 1936 with a BSc in chemistry from Howard College (now Samford University) in Birmingham, Alabama. He repaired radios in several northern Alabama towns to earn enough money to enter graduate studies in physics at the University of Chicago, which he began attending in 1938.

In 1940, P. R. joined the National Defense Research Committee's Project Chicago as a staff member. He worked on high-speed counters for the project. In 1941, he was recruited from Chicago to MIT's Radiation Lab, which worked in secret to develop radar. While there, he discovered the photoelectric effect in silicon.

After the war ended, P. R. joined Clinton National Laboratory, now Oak Ridge National Laboratory (ORNL), where he applied his ingenuity in electronics to invent—with Walter Jordan—the famous A-1 amplifier.

In the late 1940s, P. R. built some of the earliest crude spectrometers using organic scintillators. The first significant units, poor in resolution but still capable of resolving quite complex spectra, used 1.5-inch diameter by 1-inch thick thallium-doped sodium iodide crystals. Development of these units soon led to the use of scintillation spectrometry in the emerging field of nuclear medicine imaging. In 1966, P. R. helped design the large low-background spectrometers used in the Lunar Receiving Laboratory in Houston, Texas.

In 1957, P. R. became an associate director of ORNL's thermonuclear division, where he was instrumental in the design and operation of the DCX-2 mirror machine experiment. By connecting DCX-2 to a new Linc-8 computer from Digital Equipment Co, he did some of the first computer monitoring of plasma physics machines. Although strong radio-frequency oscillations eventually resulted in the termination of the DCX-2 experiment, P. R. noted that the experiment led to important research into the study of vacuum arcs—carbon, lithium, and deuterium—an important tool for work in space.

During a leave of absence from ORNL from 1967 to 1969, P. R. was the manager of the Lunar Receiving Laboratory and chief of the lunar and Earth sciences division of NASA's Manned Spacecraft Center in Houston when the first samples were taken from the Moon during the Apollo 11 mission. In 1969, the lunar material was returned in rock boxes and then studied in a containment vacuum system, which P. R. helped to develop. His innate enthusiasm was evident as he interacted with geologists and chemists during those studies.

PERSA RAYMOND "P. R." BELL

P. R. returned to ORNL in 1970 as the assistant director of the Molecular Anatomy Project. In 1974, he became a member of ORNL's health and safety research division, within the biology division. In both capacities, he was concerned with the computer processing of nuclear medicine images.

After retiring from ORNL in 1978, P. R. joined the Institute for Energy Analysis at Oak Ridge Associated Universities. There, during the 1980s, he began studying, and lecturing on, the problem of global climate change. He was one of the first scientists to point to the melting of methane hydrates as a contributor to greenhouse warming.

P. R.'s accomplishments were recognized in 1964, when he received the Edward Longstreth Medal from the Franklin Institute for his pioneering work in nuclear medicine. In 1976, the bicentennial celebration calendar of Mallinckrodt Inc, based in St. Louis, Missouri, acknowledged P. R., citing that he "founded scintillation spectrometry; plotted [the] first scintillation beta spectrum; developed [a] basis for [the] widespread use of sodium iodide gamma counters; originated [the] 'medical spectrometer'; [and was] active in development of scanning instrumentation."

Although an early onset of macular

degeneration left P. R. legally blind throughout his adult life, he considered this just a minor obstacle to the pursuit of his goals. He was a man of broad interests: Everything in nature interested him, and he threw himself into each project with tremendous energy and enthusiasm. He wanted everyone to share in the wonders of this world and was well known locally for his down-to-earth talks to civic clubs and organizations. He had a great love of music and, in younger days when his eyesight was better, sketching and woodcarving.

P. R. will be remembered for his love of science, his unassuming ways, the love he gave to his wife and son, his kind and gentle nature, and his happy disposition.

ALVIN M. WEINBERG
Oak Ridge Associated Universities
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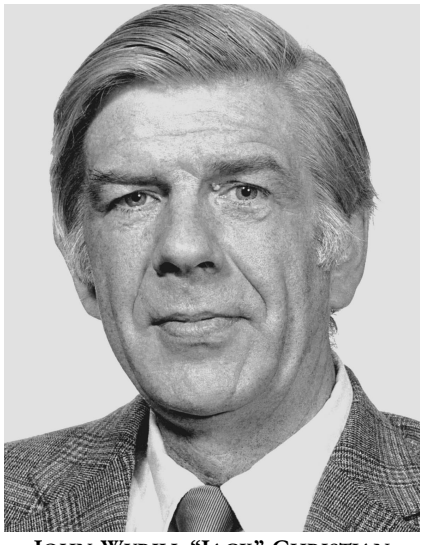
John Wyrill 'Jack' Christian

John Wyrill "Jack" Christian collapsed and died suddenly on 27 February 2001 while doing what he loved best: working in his office at the department of materials, Oxford University, in England. Although he had been suffering from Parkinson's disease for more than 20 years, he was active both socially and academically—the evening before he died, he and his wife had gone to the cinema.

Jack was born on 9 April 1926 in Scarborough on the east coast of Yorkshire, England. At age 17, he went to Oxford University's Queen's College to study physics. He completed the accelerated wartime course with honors two years later. Although a physics graduate, Jack joined William Hume-Rothery's science of metals group in the university's Inorganic Chemistry Laboratory for his doctorate. He worked on the chromium–manganese and cobalt–manganese phase diagrams and was awarded his DPhil in 1949.

Jack found the determination of phase diagrams rather dull, so when "H. R." invited him to stay with the group, he started to look at problems in what was then called metal physics, which fascinated him. In 1951, he published his first important paper, in the *Proceedings of the Royal Society*, on phase transformations, explaining the solid-state transition in cobalt in terms of dislocation theory. International recognition soon followed, and Jack became a leading authority on martensite, an alloy of iron and carbon. A review paper (*Institute of Metals Monograph and Report Series*) with Bruce Bilby in 1956 on martensitic transformations is particularly noteworthy.



JOHN WYRILL "JACK" CHRISTIAN

Jack (known as "Chris" to his students) believed in describing research projects in broad terms, so students were obliged to work out their own inclinations. He was also kind to his students. On one occasion, in the days of mechanical typewriters and rigid submission dates, Jack, on hearing that one of his students was having difficulty finding a typist to do the thesis, offered his services with the words, "I'm two fingered, fast, not very accurate, but I don't charge."

His first research student was the late Z. S. "Bas" Basinski, whose project was on the martensitic-type phase transitions that occurred in manganese–copper and indium–thallium alloys. The transformed structures are heavily twinned and the application of stress gives rise to a reversible deformation, which is now known as the shape memory effect.

It was with Basinski, then in Ottawa, Canada, in 1956, that Jack started his work on the deformation of metals and alloys; their 1960 paper, published in the *Australian Journal of Physics*, on the deformation of iron at low temperatures was the first to show that pure iron had a large Peierls–Nabarro force and that thermal activation was the key process for dislocation glide. On returning to Oxford in 1956, Jack initiated the building of crystal-growing facilities and special mechanical testing machines. His research on the deformation of single crystals of iron and other body-centered cubic (BCC) alloys (especially pure niobium) established that a large Peierls–Nabarro force exists in all crystals with the BCC structure. It also became clear that there was an asymmetry of slip for glide on {211} planes (shear in the twinning sense being easier than the reverse) and at temperatures below ambient, there was a complete breakdown of Schmid's law with the occurrence of anomalous slip. He also established that the screw dislocation was important in the deformation of these materials.

A great reader of the scientific literature, Jack was able to draw together seemingly unrelated theories and show that they were different facets of a common model. The earliest, and probably the best known, example concerns martensite; in 1955, he was able to prove (see *Journal of the Institute of Metals*) the equivalence of the two general phenomenological theories of the crystallography. Later, in 1976, he performed similar research on the structure of interfaces, and in the field of deformation married the rival Peierls–Nabarro and dislocation dissociation models.

Jack was a modest and self-effacing man with a brilliant intellect. In scientific discussion, he listened carefully and courteously to what others had to say, be they visiting world authorities or undergraduates. However, he subjected their comments to a rigorous analysis, never failing to point out any weaknesses in the argument. He also was a lucid, inspiring teacher. One student claims that Jack never answered a question directly in eight years of undergraduate, postgraduate, and postdoctoral supervision. Instead came the dreaded words, "Well, what do you think?" The ensuing discussion not only solved the problem but developed intellectual powers far more than any direct answer could have done.

Jack corresponded and collaborated with many scientists worldwide. He used his sabbaticals to take up visiting professorships across North America; he enjoyed visiting and lectured in India, China, Japan, Australia, and South America. He also was editor or assistant editor of several international scientific journals. Jack was elected a fellow of the Royal Society in 1975.

Jack, with Hume-Rothery and Bill Pearson, wrote the book *Metallurgical Equilibrium Diagrams* (Institute of Physics, London, 1952). However, his passion was his masterwork, *The Theory of Transformations in Metals and Alloys*. A work of immense scholarship, the first edition (Pergamon Press,