Charles H. Bennett

Charles H. Bennett was born in 1943, the son of music teachers Anne Wolfe Bennett and Boyd Bennett. He graduated from Croton-Harmon High School in 1960 and from Brandeis University, majoring in chemistry, in 1964. He received his PhD from Harvard in 1970 for molecular dynamics studies (computer simulation of molecular motion) under David Turnbull and Berni Alder. For the next two years he continued this research under the late Aneesur Rahman at Argonne Laboratory.

Since coming to IBM Research in 1972, he has worked on various aspects of the relation between physics and information. In 1973, building on the work of IBM's Rolf Landauer, he showed that general-purpose computation can be performed by a logically and thermodynamically reversible apparatus, which can operate with arbitrarily little energy dissipation per step because it avoids throwing away information about past logical states; and in 1982 he proposed a reinterpretation of Maxwell's demon, attributing its inability to break the second law to the thermodynamic cost of destroying, rather than acquiring, information. In collaboration with Gilles Brassard of the University of Montreal he developed a practical system of quantum cryptography, allowing secure communication between parties who share no secret information initially, based on the uncertainty principle instead of usual computational assumptions such as the difficulty of factoring, and with the help of John Smolin built a working demonstration of it in 1989.

Other research interests include algorithmic information theory, in which the concepts of information and randomness are developed in terms of the input/output relation of universal computers, and the analogous use of universal computers to define the intrinsic complexity or "logical depth" of a physical state as the time required by a universal computer to simulate the the evolution of the state from a random initial state. In 1983-5 as visiting professor of computer science at Boston University, he taught courses on cryptography and the physics of computation.

In 1993 Bennett and Brassard, in collaboration with Claude Crepeau, Richard Jozsa, Asher Peres, and William Wootters, discovered "quantum teleportation," an effect in which the complete information in an unknown quantum state is decomposed into purely classical information and purely non-classical Einstein-Podolsky-Rosen (EPR) correlations, sent through two separate channels, and later reassembled in a new location to produce an exact replica of the original quantum state that was destroyed in the sending process. In 1995-7, working with Smolin, Wootters, IBM's David DiVincenzo, and other collaborators, he helped found the quantitative theory of entanglement and introduced several techniques for faithful transmission of classical and quantum information through noisy channels, part of the larger and recently very active field of quantum information and computation theory. Recently he has worked on the capacities for quantum channels and interactions to simulate one another and the tradeoffs among communications resources.

He is an IBM Fellow, a Fellow of the American Physical Society, and a member of the National Academy of Sciences. He is married with three grown children. His wife, Theodora M. Bennett, recently retired from directing a housing mobility program in Yonkers. His main hobbies are photography and music.