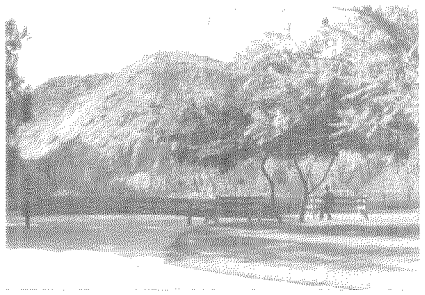
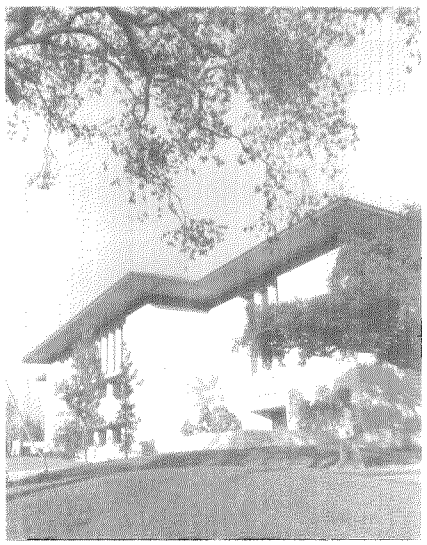
Random Walk

Scenery Changes

The area at the corner of Wilson Avenue and San Pasquel Street on the Caltech campus has seen a lot of changes in the past three years, beginning in 1979 with removal to new sites of two old houses....



...Then the earth-moving machinery took over, and for a long time the view was dominated by a massive pile of dirt, referred to as Mt. Hood in honor of Leroy Hood, a many-titled biologist who will direct the cancer center in the new building about to emerge as...



...the Braun Laboratories in Memory of Carl F and Winifred H Braun. The building, which was dedicated on December 13, will house eight major research groups in cell biology and chemistry. E&S *plans to report on some of that work in March.*

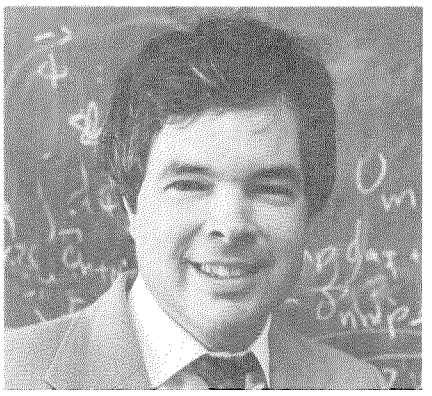
Kenneth Wilson

A SMALL PIECE of ice in a warm room doesn't remain solid very long. It soon turns into a structureless puddle of water that in no way resembles the hard crystalline substance from which it came. Such a transformation is called a phase transition, and Caltech alumnus Kenneth Wilson, PhD '61, who is now at Cornell University, has received the 1982 Nobel Prize in physics for his contributions to understanding how that transition comes about.

Coming to such an understanding has occupied the minds of physicists for at least a century, and in the search for a solution they have found many examples of the phenomena. The puddle of water, for instance, undergoes another phase transition if it is heated enough to turn to steam. And at no stage does the substance give any hint that it can assume other forms. Magnets are another example; they suddenly lose their magnetism when heated above a certain temperature and regain it when cooled below that temperature. Many substances change their ability to conduct electricity when cooled below a characteristic temperature. Moreover, the manner in which these substances change their properties in the course of phase transition shows remarkable regularities, which is not to say that the process is simple to describe. Obviously, these phenomena result from the movements of atoms and molecules and the interactions between them, but a theoretical explanation of what is going on has proved elusive.

Wilson went about solving the problem in a very ingenious way and was able to announce his results in several fundamental papers published in 1971. "Instead of a frontal attack," said the citation of the Swedish Academy of Sciences, "he developed a method to divide the problem into a sequence of simpler problems in which each part could be solved." This method, called "renormalization group method," uses mathematical concepts and techniques that, for the first time, permit detailed calculations from fundamental principles that correctly account for many of the experimental observations. Further, Wilson's theory provides an understanding of why the changes that occur in a phase transition show regularities that actually do not depend on the detailed properties of the substance in question.

At Caltech, Wilson did most of his



work under Murray Gell-Mann, now Millikan Professor of Theoretical Physics and winner of the1969 Nobel Prize, and some of Gell-Mann's insights played an important role in Wilson's thinking. While Wilson was a student, Gell-Mann and Francis Low (now of MIT) evolved a method for solving a problem totally unrelated to phase transitions, but Wilson was able to see that it was applicable. Wilson has, in fact, a reputation for mathematical ability amounting to genius, and it started early. He is reported to have been able to calculate cube roots in his head by the age of eight.

Benjamin Widom of Cornell and Leo Kadanoff of the University of Chicago also made important contributions to Wilson's thinking, and Michael Fisher of Cornell, a well-known authority on phase transitions, provided him with criticism and advice at all stages of his work. He collaborated with Fisher in one of the most striking applications of the new ideas, and in 1980 he and Fisher and Kadanoff shared Israel's $100,000 Wolf Prize in Physics.

An earlier — and continuing — contributor to Wilson's achievements is his father, Caltech alumnus E. Bright Wilson (PhD '33), who has been a distinguished professor of chemistry at Harvard, where Kenneth did his undergraduate work.

A member of the Cornell faculty since 1963, Wilson became a full professor in 1970 and the James A. Weeks Professor of Physics in 1974. He has won the American Physical Society's prestigious Heinemann Prize and the Boltzmann Medal in statistical mechanics from the International Union of Pure and Applied Physics. He was elected to the National Academy of Sciences in 1975. Wilson was a Fairchild Scholar at the Institute in 1976, and he received Caltech's Distinguished Alumnus Award in 1981. He is the 19th Caltech alumnus or faculty member to be awarded the Nobel Prize. □ —*JB*