Many-body perturbation theory, coupled-cluster theory, and configuration interaction are investigated, with particular emphasis on the problem of correlation. The correct treatment of the correlation problem is of utmost importance in describing the behavior of many-electron systems. It was suitable for many-electron theory. This theory became the basis for coupled-cluster methods in molecular quantum chemistry, and remains the state-of-the-art method for accurate electronic structure calculations.

The development of the coupled-cluster theory was initiated by the work of W. K. Brueckner and H. Goldstone in the 1950s. These authors recognized that certain terms in the Rayleigh-Schrödinger perturbation series had to be included to obtain correct results. However, the number of terms that needed to be included increased rapidly with the size of the system, and it became clear that a systematic approach was needed.

In 1978, J. Bartlett and G. D. Purvis, working at the University of Florida, Gainesville, developed the coupled-cluster singles and doubles (CCSD) method. This method is based on the idea of using a series expansion in the perturbation theory of correlation, and includes all single and double excitations from the Hartree-Fock determinant. The CCSD method has been extensively used in computational chemistry for its accuracy and flexibility.

Since then, many improvements and developments have been made to the coupled-cluster theory, including the inclusion of triple excitations (CCSDT), quadruple excitations (CCSDTQ), and so on. These developments have led to the establishment of CC theory as a cornerstone in modern electronic structure theory.

The coupled-cluster method has been widely used in computational chemistry for the past three decades, and it has been shown to provide highly accurate results for a wide range of molecular systems. It is currently the method of choice for accurate electronic structure calculations, and its long-term impact on the field of computational chemistry cannot be overstated.