Harold Clayton Urey (1893-1981)

Columbia Chemistry Professor Harold Urey experimentally proved the existence of deuterium in 1931. Urey won the 1934 Nobel Prize in Chemistry, and the American Chemical Society Gibbs Medal, for this discovery. Early that year Urey had conceived and worked out a method for concentration of a possible heavy hydrogen isotope by distillation of liquid hydrogen. The fractional distillation was done in collaboration with Brickwedde at NBS in Washington DC; 5 liters of liquid hydrogen was distilled down to 1 cc. Urey detected deuterium by its predicted spectrum in a discharge through the gas of this concentrated residue. High resolution atomic hydrogen spectra in the visible were obtained on a new 21 ft. spectrograph in the basement of Pupin Hall. The critical data clinching the discovery were taken by Urey and his assistant George Murphy on Thanksgiving Day 1931. Urey shared his Nobel Prize money with his collaborators, giving one quarter each to Murphy and Brickwedde

Urey was a son of small town, pre-industrial America; he once told colleagues that the first time he saw an automobile was at age 17 in rural Montana. After graduating from high school, he taught in small country schools for three years, before working his way through the University of Montana. He studied thermodynamics as a PhD student with G. N. Lewis at Berkeley, and then spent a year studying quantum theory in Europe with Niels Bohr, returning to the US in 1924. He apparently was the first Berkeley educated PhD chemist to win a Nobel Prize. He joined the Columbia Chemistry Faculty at age 36 in 1929, after 5 years at Johns Hopkins where he collaborated with F. O. Rice among others. He was a pioneer in application of quantum mechanics to molecules, and wrote **Atoms, Molecules, and Quanta** in 1930 with A. E. Ruark. At Columbia he was founding editor of the Journal of Chemical Physics, and Chair of the department in 1939-1942. When he obtained a research grant from the Carnegie Institution after his Nobel Prize, he spontaneously shared the money with I. I. Rabi, thus enabling Rabi to build his first molecular beam machine. Urey lead isotope separation studies in Havemeyer Hall,

as part of the Manhattan Project during World War II. After the war, he moved to the University of Chicago, before "retiring" to the Scripps Institute at age 65 in 1958. Here he helped build the University of California at San Diego as a new research university. In retirement at UCSD, he published 104 research papers, many focused on understanding earth's moon. At the time of Sputnik in the late 1950s, Urey lead the effort to convince the newly established NASA agency to initiate moon exploration. He was a friend of Einstein, Rabi, Bohr, Szilard, Fermi, Teller, Franck, Joe Meyer, and Maria Groeppert Meyer.

In the 1930s Urey systematically found practical ways to concentrate isotopes, and used these isotopes to probe chemical reactions. He collaborated with Washburn of NBS in obtaining heavy water in bulk by electrolysis. His PhD student T. Ivan Taylor explored isotope effects in surface reactions, and joined the Columbia Chemistry Faculty after the war. With PhD student Mildred Cohn he explored O^{18} exchange reactions between water and organic compounds; she later joined the faculty at the University of Pennsylvania Medical School and pioneered the biological use of oxygen isotope tracers.

In the late 1940s Urey conceived and demonstrated the "paleotemperature" isotopic thermometer – which is now universally used to analyze climate warming and cooling cycles. By measuring the O^{16}/O^{18} ratio in carbonate minerals, and in ice as a function of depth in snow field core samples, one can determine the temperature at the time of formation. This method uses temperature effects in isotopic ratios in evaporation of sea water(and subsequent condensation as rain and snow), and in the equilibrium between water and carbonate ion. He and colleagues developed mass spectrometric methods to measure the isotopic ratio to 2 parts in 10^4. After 1950 his interests turned to the chemistry of the planets, and he is credited with initiating rigorous study of "cosmochemistry", a term that he himself coined. In 1953 he and PhD student Stanley Miller performed a famous experiment on amino acid synthesis via electrical discharge, in gases thought to be present in the earth's original reducing atmosphere.