tion of CO_2 from the air is the most reliable way to monitor the atmospheric C^{14}/C^{12} ratio.

Further monitoring of tropospheric C^{14}/C^{12} ratios in both hemispheres indicates that the rate of rise roughly doubled during the period from 1 July 1958 to 1 July 1959. This increase may be due either to a doubling of the stratospheric inventory from about 8×10^{27} to around 17×10^{27} C^{14} atoms or to quite rapid fallout of debris added to the polar stratosphere.

Estimates of the future distribution of bomb-produced C^{14} throughout the atmosphere-biosphere-ocean system have been made; for this purpose a mixing model based on steady-state concentrations of natural radiocarbon was used. The predicted inventories are given in Table 4. From these inventories, combined with estimates of the future effects of combustion-produced CO_2, the C^{14}/C^{12} ratios for the atmosphere and for surface ocean water can be predicted (see Fig. 4). The ratio for the atmosphere of the Northern Hemisphere will rise before 1963 to a maximum of from 1.3 to 1.4 times the pre-bomb value, whereas for surface ocean water the maximum will be between 1.09 and 1.15 times the pre-bomb value and will occur between 1970 and 1975. By 1980 the ratio for the atmosphere will have dropped halfway back to the pre-bomb level, while the ratio for the surface ocean will drop proportionately by about 1990. Early in the next century the combustion-produced CO_2 effect will be dominant in the atmosphere, and the C^{14}/C^{12} ratio will have dropped below the pre-bomb value. As illustrated by several examples, bomb-produced C^{14} can serve as a potential tracer in the fields of soil science, biochemistry, limnology, and oceanography.

Due to continuous spiking of the troposphere with bomb-produced radiocarbon, changes in C^{14} concentration throughout the carbon cycle are now occurring faster, by several orders of magnitude, than changes due solely to radioactive decay. Consequently, processes carried out in from 1 year to 100 years are now measurable, or will be so in the next few years. It is hoped that the examples discussed in this article will stimulate the imagination of scientists in many fields, so that the many potential applications of this world-wide tracer may be realized (*23*).

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23. This article is Lamont Geological Observatory Contribution No. 423.
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Brenton Reid Lutz, Vascular Physiologist

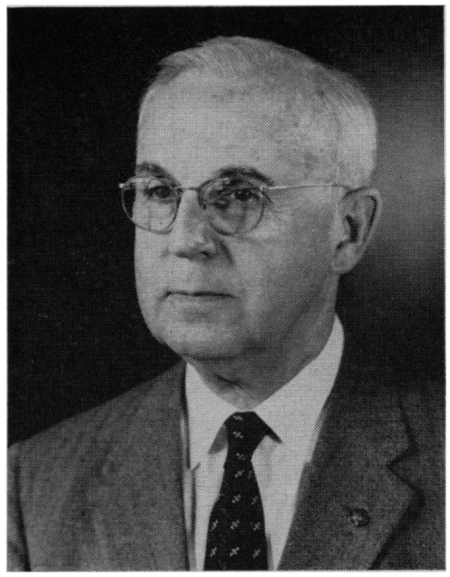
Brenton Reid Lutz was born in Woodlawn, Nova Scotia, on 2 June 1890. He graduated from Melrose High School, Melrose, Massachusetts, in 1909. He attended the College of Liberal Arts and the Graduate School of Boston University, earning the degrees of S.B., A.M., and Ph.D. (1917) in physiology. During his early professional years he was awarded the Jacob Sleeper fellowship at Boston University (1914) and a teaching fellowship at Harvard University (1915–1917). In 1918 he married Edna Baldwin. From 1919 to 1939 he held joint appointments at Boston University in the College of Liberal Arts (from instructor to professor of biology in 1927) and in the Medical School (from instructor to associate professor of physiology in 1930). He succeeded Arthur W. Weysse as chairman of the biology department in 1927. He continued to give, annually, a series of lectures in physiology at the Medical School until 1939.

Lutz made blood-pressure measurements in man with Weysse, who introduced the auscultatory method to America in 1913. He worked with Walter B. Cannon in the physiology laboratory at Harvard Medical School. As a result, he developed a life-long interest in the autonomic nervous system and the cardiovascular system, and he became adept in mammalian surgery and physiological instrumentation.

In World War I, Lutz served as a lieutenant in the Sanitary Corps and pioneered in aviation physiology at Mineola, Long Island, under Edward C. Schneider. An important series of papers was published on the physiological significance of oxygen lack, based on experiments utilizing the rebreather apparatus and the first low-pressure chamber to be used in the United States for pilot training and altitude studies. This research served as the background for the highly organized Altitude Training Program of the Air Force during World War II.

Because of his boyhood association with the sea, Lutz developed an interest in the cardiovascular physiology of marine animals, especially elasmobranchs. He spent several summers at marine stations, including Mt. Desert Island, Bermuda, and Naples. He became an authority on the respiratory and circulatory physiology of fishes. He proposed, with Leland C. Wyman, the evolutionary concept of the carotid sinus mechanism, based on demonstrations of the existence of baroreceptors in the branchial-arch blood vessels and their embryological derivatives in dogfish, *Necturus*, frog, and cat.

For several years he worked under Frederick H. Pratt at Boston University School of Medicine during the development of the all-or-nothing concept for skeletal muscle. Pratt and Marion Reid were using Ranvier's lymph sac preparation, the retrolingual membrane of the frog, for micromanipulative studies of single muscle fibers. Lutz recognized the potential of this preparation for micromanipulative and cinephotomicrographic research on small blood vessels in living subjects. He spent several months in Copenhagen in the laboratory of August Krogh, Nobel laureate renowned for his work on small blood vessels and for his monograph "Anatomy and Physiology of the Capillaries." Upon returning to Boston University, Lutz began an intensive investigation of the neuromotor mechanism of the small blood vessels in the retrolingual membrane. He used microelectrodes to



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stimulate the small vasomotor nerves, and he took motion pictures through the microscope to record significant vascular responses. In 1940, Lutz was the producer (with George P. Fulton) of perhaps the first critically edited and fully titled motion-picture film on small blood vessels, designed to be presented as a scientific paper before a professional society. This monochrome silent film, *Control of Small Blood Vessels*, is still in demand as a teaching aid 20 years after its release and in spite of the existence of newer Kodachrome films on related subjects, prepared by his colleagues. During this work he became convinced that Krogh's Rouget-cell concept of capillary contractility is not valid, at least as a general principle, and that capillaries are not contractile in higher vertebrates. He discovered the sphincter-like activity of the smooth muscle cells which occur at the point of origin of small precapillary arterioles from the supplying arteriole. He demonstrated that such "vascular sphincters" may be regulated by the perivascular nerve plexus, since stimulation of nerve components with a microelectrode produced a marked vasodilation.

Lutz collaborated with Fulton, his student, in the use of the cheek pouch of the golden hamster as a living laboratory for microcirculatory studies and for investigations of problems of growth, especially with reference to the role of the vascular system.

He was a member of the American Physiological Society, the American Association for the Advancement of Science, the New York Academy of Science, the American Association of Anatomists, and the American Zoological Society. He was a senior charter member of the Microcirculatory Conference. His honorary awards included election to Phi Beta Kappa, Sigma Xi, and the American Academy of Arts and Sciences. In 1950, he was named first university lecturer at Boston University.

Although he retired in 1957, as emeritus professor, Lutz continued to work in the department of biology as principal investigator on a grant from the National Heart Institute in support of research on the role of the microcirculation in hypertension. The training of graduate students and the premedical preparation of future doctors were outstanding features of his highly productive career. His untimely death interrupted the completion of a paper on comparative vascular patterns, written in collaboration with a college senior working as an honors student on a National Science Foundation Undergraduate Research Participation Program. Lutz built a two-man teaching program in biology into a vigorous department of balanced teaching and research. He will be long remembered by his colleagues and especially by his students, who owe him so very much.

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