

growth of animals? How can we predict the future energy balance between animals and plants? As the concentration of oxygen has increased during geological ages, animals have developed certain antioxidant defenses. It is important to know whether more or less defense of this sort will be needed for the future. Is the human life span possibly limited even now by the balance between oxygen poisoning and antioxidant defenses? Conversely, what is the relation between physiological adaptations of some organisms to low oxygen pressures and productivity in certain habitats?

Our present oxygen supply presumably came from photosynthetic activity in which the ultimate oxygen source was water. Is the oxygen content of the atmosphere continuing to increase? Is the earth losing more protons than it is gaining from the sun or from cosmic rays? Is the total free water supply in a true steady state or is it increasing from volcanic gases and springs?

The composition of the atmosphere depends on both biological and nonbiological factors, and for this it is necessary for biologists to work with geochemists and geophysicists. What are the effects on the earth's atmosphere of industrialization with its accompanying increase in combustion of coal and oil and production of carbon dioxide? What are the biological effects of increasing nitrogen oxides from internal combustion engines? Is population growth necessarily limited by some environmental factors such as the supply of water, fixed nitrogen, oxygen, or trace minerals? Can we account quantitatively for all the carbon originally present as CH_4 and CN , and now existing as CO_2 or in the form of oil or wood or other organic compounds? What are the turnover rates of all these compounds in the cycles of C, N_2 , O_2 , H_2 , etc?

Two approaches are necessary: (1) The "microclimates" of plants and animals should be studied in respect to local and seasonal variations in CO_2 and other atmospheric constituents. The microclimates are different not only for different kinds of vegetation but also for different parts of a single plant or animal. (2) The macrocomposition of the biosphere of the earth with respect to O_2 , CO_2 , water, temperature, and nitrogen should be studied. Measurements should be made with comparable techniques in many parts of the world. Information is needed to permit estimates of changes within a human generation rather than over geological ages. For atmospheric composition, the measurements made by weather agencies are useful but are limited in numbers and locations of