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Isotope Tales: Remaining Problems, Unsolvable Questions, and Gentle Successes

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Earth's biomes function and adapt today as climate changes and ecosystems and the organisms within them adapt. Stable isotope biogeochemistry has had a major influence in understanding climate perturbations and continues to be an active area of research on many fronts. Banking on the success of compound specific stable isotope analyses of amino acids, nitrogen, carbon, and hydrogen isotopes continue to reveal subtle shifts in oceanic food webs and metabolic changes in microbes, plants, and animals. A biochemical understanding of exactly how organisms process and partition stable isotopes during metabolism remains unsolved, but is required if this field is to move beyond description to quantitation. Although the patterns of carbon and nitrogen isotopes are fairly well established in the common amino acids, we need to consider specifics: How do shifting metabolic pathways (metabolomics) influence the outcome of stable isotope partitioning? What influence does the gut microflora in animals have on isotopic labeling? What are the intramolecular isotope patterns of common amino acids and what do they tell us? What can be learned with other isotope systems, such as hydrogen? Results and ideas of how to move forward in this field will be presented starting at the molecular level and ending with ecosystems.