

## Methionine as a Precursor of Ethylene—Commentary

Lieberman M, Kunishi A, Mapson LW, Wardale DA (1966) Stimulation of ethylene production in apple tissue slices by methionine. *Plant Physiol* **41**: 376–382

In 1966, Morris Lieberman and his support scientist Alice Kunishi at the then U.S. Department of Agriculture Agricultural Research Service's Pioneering Research Laboratory for Post Harvest Plant Physiology, Beltsville, Maryland, in collaboration with colleagues (L.W. Mapson and D.A. Wardale) of the Low Temperature Research Station, Cambridge, England, published a seminal article in the field of plant hormones, particularly ethylene biosynthesis. This article demonstrated that Met is a precursor of ethylene and was the first to show that ethylene carbons are derived from carbons 3 and 4 of Met. This article catalyzed remarkable interest among plant biologists to elucidate the biosynthetic pathway leading from Met to ethylene (for a historical account, see the classic review by Lieberman, 1979). The same authors had previously standardized the methodology on Met conversion to ethylene in a model system (Lieberman et al., 1965). Many years later, Adams and Yang (1979) identified

1-aminocyclopropane-1-carboxylic acid as an intermediate that proved to be the missing link between Met and ethylene, establishing the following biosynthesis sequence for ethylene: Met → S-adenosylmethionine → 1-aminocyclopropane-1-carboxylic acid → ethylene. Lieberman et al. fed apple (*Malus domestica*) fruit slices [ $^{14}\text{C}$ -Met and the radiolabeled carbons were recovered as  $^{14}\text{C}$  ethylene. Carbon 2 of Met was not incorporated into ethylene. The Met → ethylene conversion increased in tissue slices excised from aged (stored) apple fruit and was enhanced in the presence of oxygen. This article has been cited at least 110 times and is a classic in this field.

### LITERATURE CITED

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- Lieberman M, Kunishi AT, Mapson LW, Wardale DA (1965) Ethylene production from methionine. *Biochem J* **97**: 449–459

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