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Black C C, Jr. Photosynthetic carbon fixation in relation to net CO_2 uptake. *Ann. Rev. Plant Physiol.* **24**:253-86, 1973. [Dept. Biochem., Univ. Georgia, Athens, GA]

Based on specific biochemical, structural, and physiological features green plants are divided into three photosynthetic groups C_3, C_4, and CAM. [The *SCI*® indicates that this paper has been cited over 240 times since 1973.]

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"1965 through 1971 were renaissance years for plant biology. Photosynthesis is the dominant process in plants and during these years the thinking of plant biologists regarding photosynthesis was drastically restructured. New pathways of photosynthetic CO_2 fixation were discovered, but discoveries were not limited to CO_2 fixation. Rather we learned also about CO_2 loss via photorespiration. As we expanded our thinking, other fields of plant biology such as anatomy, taxonomy, and ecology began to integrate with biochemistry and physiology. This was an exciting era as essentially every field of plant biology was drawn into a renaissance.

"Let's quickly follow the major discoveries of these years. In 1965-1966 we learned that sugarcane had a new pathway for photosynthetic CO_2 fixation, the C_4 cycle.[1,2] In the next five years over 200 plants were found with C_4 photosynthesis and it was learned that within a given genus some species are C_4 while others are C_3.[3]

"In 1966 a neworganelle, broadly called a microbody, was isolated from plants. Microbodies were shown to function as glyoxysomes in fat conversion during fatty seed germination in 1967 and as leaf peroxisomes during photorespiration in 1968.[4]

"1965 to 1968 witnessed the acceptance of photorespiration as a major CO_2 loss process in C_3 plants (= 30% of the rate of leaf photosynthesis).[4] 1966 to 1970 resulted in establishing the lack of detectable CO_2 loss in intact leaves of C_4 plants even though photorespiration occurred within the green bundle sheath cells of C_4 leaves.[5,6] In 1971 it was discovered that RuBP carboxylase also possessed oxygenase activity and synthesized P-glycolate, the substrate for photorespiration.[7]

"1968 to 1971 witnessed the re-kindling of studies on CAM plants which fix most of their CO_2 *at night*[3] .In 1968 it was realized that C_4, C_3, and CAM plants have quite definite types of leaf anatomy which were related to their capabilities for fixing net quantities of CO_2 and efficiently utilizing water.[3] Also in 1968 many C_4 plants were recognized as the worst weeds in agriculture (e.g., crabgrass, nutsedge, and pigweed) while others are among the most productive plants in the world (e.g., sugarcane and corn).[8]

"These and other discoveries resulted in the formulation of a framework for dividing plants into groups, namely C_4, C_3, and CAM, based on specific characteristics. This framework allowed one to reevaluate in an interpretative manner literally hundreds of manuscripts, some published ten decades ago, within a logical pattern. I did this in the 1973 manuscript. These new insights also formed a foundation for many subsequent experiments throughout plant biology which no doubt accounts for this manuscript being cited regularly.

"Simply stated, I was privileged to have the chance to participate in and to glimpse the beginnings of a renaissance in plant biology and the 1973 article was my interpretative and integrative recording of these early but continuing events. A good general review of the subject is given in *CO_2 Metabolism and Plant Productivity."* [9]

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3. **Hatch M D, Osmond C B & Slatyer R O, eds.** *Photosynthesis and photorespiration.* New York: Wiley-Interscience. 1971. 565 p.
4. **Hogg J F.** The nature and function of peroxisomes (microbodies, glyoxysomes). *Ann. NY Acad. Sci.* **168**:209-381, 1969.
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8. **Black C C, Chen T M & Brown R H.** Biochemical basis for plant competition. *Weed Sci.* **17**:338-44, 1969.
9. **Burris R H & Black C C eds.** *CO_2 metabolism and plant productivity.* Baltimore: University Park Press. 1976. 431 p.