Foreword

Théodore de Saussure was the last of the early pioneers of photosynthesis research. He filled in the gaps in the basic understanding of photosynthesis and presented the first concise summary of the field in his 1804 book *Recherches chimiques sur la Végétation,* which is translated into English here for the first time.

De Saussure's work was built on the achievements of his predecessors in plant-nutrition research. In the early 17th century, Jan van Helmont had shown that plants obtain very little of their dry matter from the soil, contrary to the prevailing view. Van Helmont concluded, instead, that plant dry matter is composed mostly of "transmuted" water rather than of soil. In the early 18th century, Stephen Hales demonstrated that "air" is fixed in plant matter, but, at the time he was working, knowledge of the atmosphere was so limited that he was unable to distinguish one kind of gas from another. In the early 1770s, Joseph Priestley discovered the fundamental fact that plants and animals exist in an interdependent relationship mediated by gases: Plants "purify" air that has been "vitiated", or corrupted, by the breathing of animals or burning of candles, and that animals, in turn, thrive in the restored air. In the last quarter of the 18th century, Antoine-Laurent Lavoisier and his colleagues made great strides in chemistry, which enabled rapid advances in knowledge about photosynthesis and plant nutrition during this period. The discovery that the atmosphere is not a homogeneous substance but instead is composed of a number of gases was of great importance for this unfolding understanding of plant nutrition. At about this same time, Jan Ingen-Housz established that light is necessary for plants to thrive and to produce oxygen, and Jean Senebier provided the insight that carbon dioxide is taken up in the production of oxygen by plants.

De Saussure showed that water is a component of plant dry matter (a fact that van Helmont had inferred but not conclusively demonstrated), thus enabling completion of the basic, overall equation of photosynthesis. De Saussure also showed that plant carbon comes mainly from atmospheric carbon dioxide rather than organic carbon in the soil. Further, he showed that plants obtain their minerals from the soil rather than from "transmutations" of other substances by a vital force within the plant, and that minerals are essential for plant growth.

Two German translations of de Saussure's book appeared during the 19th century. This first English translation now makes it readily accessible for English-speaking students, researchers, and other readers who are not familiar with French or German.

Jane F. Hill, known to me for several years as an accomplished historian of photosynthesis research, has written a beautiful introduction for this book (see Translator's Introduction) that places de Saussure's book in a historical context. This introduction, as well as additional supplementary material in the book, incorporates editorial and other suggestions that I made on draft versions of the manuscript. The introduction provides an account of the gradual replacement of primitive ideas about plant nutrition by the more accurate information supplied by the early pioneers, culminating in the work of the last of these early researchers, de Saussure. The fate of the book is also addressed, beginning with its positive initial reception, which was followed by neglect of its fundamental conclusions until their revival by Jean-Baptiste Boussingault and Justus von Liebig in the mid-19th century. The introduction describes how, despite some errors due to the relatively primitive state of knowledge and experimental methodology in de Saussure's day, the book is now widely recognized as a classic and a basic document in the development of the understanding of photosynthesis and plant nutrition. Finally, the life and scientific career of de Saussure are traced in detail.

In Chap. 10, Jane F. Hill presents succinct summaries of each of the nine chapters of de Saussure's book; in addition, she has provided at the end of the book three very important appendices, which provide conversions of units of measurements, a glossary of terms, and fleshed-out bibliography for most of the approximately 100 authors cited by de Saussure in his text.

I end this *Foreword* by making a reference to the Preface (pp. xxiii–xxvi), and three editorials (pp. 5–35) in a 2005 book *Discoveries in Photosynthesis*, edited by Govindjee, J. T. Beatty, H. Gest, and J. F. Allen, Springer, Dordrecht; they provide a link to the many discoveries and discoverers in photosynthesis research since de Saussure's pioneering work.

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