

firmed with much greater exactness by Boussingault, whose careful culture-experiments showed that plants do not use the free nitrogen of the air, that they will flourish in soil artificially deprived of organic matter if nitrates are added, that all the carbon in the plant is derived from carbon dioxide, and that various alkaline salts (sulphates, phosphates, &c.) are indispensable to vigorous growth. These were the chief results established, after much vacillation, at the date 1860.

Even the most easy-going observers could not fail to notice that many flowers open and close with the growing and waning light of day, that many leaves have a position at night which is different from that which they have at noon, that many plants climb by their stems, like the hop, or by their leaf-stalks, like the clematis, or by their tendrils, like the pea and the vine. Of such movements, as well as of others less obvious, there are records in ancient works.

Movement
and Feeling
in Plants.

Yet the history of the subject can hardly be called instructive until within the Victorian Era. There were hundreds of isolated observations, but few experiments; there was almost no success in distinguishing the different kinds of movements (*e.g.* growth-movements and periodic movements); and almost no one succeeded in taking a comprehensive or unified view of the subject.

John Ray (1693) puzzled over the case of the sensitive plant which had been imported from America, and directed particular attention to the influence of temperature on the opening and closing of flowers, and even on the bending of stems towards the light; the French Academician Dodart deserves credit for first detecting any problem in the familiar fact that a stem grows away from, and a root towards, the centre of the earth; and Stephen Hales tackled the general question of the conditions of growth.

About 1750 Linnæus constructed his floral clock—an arrangement of flowers opening and closing with regular periodicity—which made a strong impression on the popular imagination, and he seems to have been the first to apply the term “sleep” to the nocturnal changes