in the field will look in vain for a chapter on the various species of *Nicotiana*, such as the historical short-day *N. tabacum* "Maryland mammoth" or the long-day *N. sylvestris*, or one on *Hyoscyamus niger*. However, these are mentioned in several places in the introductory and concluding chapters.

The bulk of the book is devoted to the description and discussion of the flowering mechanisms in the chosen examples, each species being presented by a specialist. The great number of data and references packed in each of these physiological monographs are easily accessible since all the chapters follow the same sequence of presentation, from the historical introduction to the chemical, histochemical, and ultrastructural changes (if known) at induction. Particularly useful are the details given on growing techniques, which sometimes include unpublished work, for example in the chapter on *Xanthium* by F. B. Salisbury. In short, these chapters constitute a rather unique reference book for workers engaged in the field, on which further work can be based.

Aside from this major contribution, the first chapter of the book presents an interesting historical sketch containing data not widely known or acknowledged, such as Tournois's contributions to the discovery of the photoperiodic effect in plants.

The last chapter presents the thoughts and conclusions of the editor on "the nature of flower induction." These are certainly thought-provoking, not only for a detail in wording (the term "evocation" is suggested for the induction of the shoot apex and contrasted to "induction," which is restricted to changes occurring in the leaf only), but also for several unorthodox views worth pondering. Evans remarks first that the flower stimulus is a general stimulus which initiates or increases the activity of many processes in apical meristems, from an increase in ribosomes to one in RNA and DNA. He builds up evidence around the rather earthshaking statement that, even in so-called "qualitative" photoperiodic species, "the induced state is a quantitative one" (p. 462). He observes that, in general, there are two classes of stimuli: those which promote and those which inhibit the inductive process. In some species (such as *Xanthium*) the positive stimulus predominates, in others (as in *Fragaria*) the inhibitory one may be dominant, and in still others (such as *Lolium temulentum*) the effects are balanced. Furthermore, the idea is advanced that one of the cardinal points of the florigen theory may be illusory, namely that the floral stimuli of long-day plants and short-day ones are identical. According to Evans, this point is not as well established as it seems, and floral stimuli in the two physiological classes may be different.

In summary, Evans's book is very valuable both for the quantity of pertinent facts which make it an important reference manual and for the critical views which are presented on the flowering process and which are necessary to shake this field out of its present stagnation.

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Channeling of Particles

The Observation of Atomic Collisions in Crystalline Solids. R. S. NELSON. North-Holland, Amsterdam; Interscience (Wiley), New York, 1968. xiv + 282 pp., illus. $16.50. Defects in Crystalline Solids, vol. 1.

One of the prominent developments in the past six years in the study of atomic collisions has been the realization that the regular nature of crystal lattices can exert a large influence on the interactions of energetic charged particles. For example, if a beam of million-electron-volt protons is aligned with a crystal axis or plane, the crystal atoms can steer the MeV charged particles along the lattice structure. Under the right conditions, this steering or channeling effect can reduce the yield of close-impact processes such as nuclear reactions, x-ray emission, and Rutherford backscattering events by one or two orders of magnitude. In the case of heavier incident ions, such as gallium or antimony, the range of well-channeled particles can be increased by an order of magnitude over the range in noncrystalline solids. Consequently, an understanding of the basic phenomena is necessary for such diverse uses as fabrication of semiconductor devices by ion implantation and measurement of nuclear cross sections.

In this book, Nelson gives straightforward and easy-to-follow descriptions of the influence of the crystal lattice on atomic collision phenomena. This is demonstrated most vividly in the transmission of MeV particles through thin crystals. By placing a photographic film at a distance behind the sample, one can see directly the influence of the crystal axes and planes on the trajectories of the energetic particles through the samples. By use of color film, an estimate can be made of differences in energy loss under various channeling conditions.

Nelson develops theoretical concepts along with experimental results for the range of heavy ions where energy loss due to collisions with lattice atoms is important as well as for interactions of lighter projectiles, where losses due to electron collisions are dominant. He includes a major discussion of the subsequent motions of the recoiling lattice atoms and the various features observed in sputtering experiments.

There is a thorough account of experimental work on channeling up to mid-1967. The close-impact studies (Rutherford scattering and the like) which have contributed greatly to our present quantitative understanding of channeling are presented, but receive less emphasis. For example, there is little discussion of the quantitative aspects of dechanneling, which occurs when particles are scattered out of a well-channeled trajectory as they penetrate deeper into the crystal. Also, the more recent application of the channeling effect to the study of disorder and the lattice location of dopant atoms is mentioned only briefly.

This book provides a useful introduction to the subject of atomic collisions in solids. However, the reader should be aware that there are some inconsistencies in the discussions of channeling. The emphasis on various aspects of research on atomic collisions is not well balanced, for predominant emphasis is placed on the work done at Harwell, with a large portion devoted to the author's investigations. As an overview of the Harwell work in this field, this is a good summary and does provide cross-ties to work at other laboratories where indeed major investigations of atomic collisions and channeling have taken place. Historical development, one of the predominant themes of the book, is presented from a very personal point of view and does not reflect the relative importance of contributions of other groups.

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