botany to which he did not materially contribute. His earlier papers, scattered through the volumes of botanical journals and of the publications of learned societies (a collected edition was published in 1892-93), are of great and varied interest. Prominent among them is the series of “ Keimungsgeschichten,” which laid the foundation of our knowledge of microchemical methods, as also of the morphological and physiological details of germination. Then there is his resuscitation of the method of “ water-culture,” and the application of it to the investigation of the problems of nutrition; and further, his discovery that the starch-grains to be found in chloroplastids are the first visible product of their assimilatory activity. His later papers were almost exclusively published in the three volumes of the *Arbeiten des botanischen Instituts in Würzburg* (1871-88). Among these are his investigation of the periodicity of growth in length, in connexion with which he devised the self-registering auxano­meter, by which he established the retarding influence of the highly refrangible rays of the spectrum on the rate of growth; his researches on heliotropism and geotropism, in which he introduced the “ clinostat ”; his work on the structure and the arrangement of cells in growing-points; the elaborate expcri- mental evidence upon which he based his “ imbibition-theory ” of the transpiration-current; his exhaustive study of the assimilatory activity of the green leaf; and other papers of interest. Sachs’ first published volume was the *Handbuch der Experimentalphysiologie der Pflanzen* (1865; French edition, 1868), which gives an admirable account of the state of knowledge in certain departments of the subject, and includes a great deal of original information. This was followed in 1868 by the first edition of his famous *Lehrbuch der Botanik,* by far the best book of its kind. It is a comprehensive work, giving an able summary of the botanical science of the period, enriched with the results of many original investigations. The fourth and last German edition was published in 1874, and two English editions were issued by the Oxford Press in 1875 and 1882 respectively. The *Lehrbuch* was eventually superseded by the *Vorlesungen über Pflanzenphysiologie* (1st ed., 1882; 2nd ed., 1887; Eng. ed., Oxford, 1887), a work more limited in scope, but yet covering more ground than its title would imply; though it is a remarkable book, it has not gained the general recognition accorded to the *Lehrbuch.* Finally, there is the *Geschichte der Botanik* (1875), a brilliant and learned account of the development of the various branches of botanical science from the middle of the 16th century up to i860, of which an English edition was published in 1890 by the Oxford Press. As a teacher Sachs exerted great influence, for his vigorous personality and his ready and lucid utterance enabled him not only to instruct, but to fire his students with something of his own enthusiasm.

A full account of Sachs’ life, and work was given by Professor Goebel, formerly his assistant, in *Flora* (1897), of which an English translation appeared in *Science Progress* for 1898. There is also an obituary notice of him in the *Proc. Roy. Soc.* vol. lxii. (S. H. V\*.)

SACHS, MICHAEL (1808-1864), German Rabbi. He was one of the first of Jewish graduates of the modern universities, taking his Ph.D. degree in 1836. He was appointed Rabbi in Prague in 1836, and in Berlin in 1844. He took the conservative side against the Reform agitation, and so strongly opposed the introduction of the organ into the Synagogue that he retired from the Rabbinate rather than acquiesce. Sachs was one of the greatest preachers of his age, and published two volumes of Sermons (*Predigten,* 1866-1891). He co-operated with Zunz (*q.υ)* in a new translation of the Bible. Sachs is best remembered for his work on Hebrew poetry, *Religiose Poesie der Juden in Spanien* (1845); his more ambitious critical work *{Beiträge zur Sprach- und Alterthumsforschung, 2* vols., 1852-1854) is of less lasting value. His poetical gifts he turned to admirable account in his translation of the Festival Prayers *{Mahzor,* 9 vols., 1855), a new feature of which was the metrical rendering of the medieval Hebrew hymns. Another very popular work by Sachs contains poetical paraphrases of Rabbinic legends *{Stimmen vom Jordan und Euphrat,* 1853). (I. A.)

SACK, a large bag made of a coarse material such as is described under Sacking below. The word occurs with very little variation in all European languages, cf. Gr. *σáκκos,* Lat. *saccus,* Fr. *sac,* Span. *saco,* Du. *zak,* &c. All are borrowed from the Hebrew *sag,* properly a coarse stuff made of hair, hence a bag made of this material. Most etymologists attribute the widespread occurrence of the word to the story of Joseph and bis brethren in Gen. xliv. The Hebrew word itself is probably Egyptian, as is evidenced by the Coptic *sok.* Apart from its ordinary meaning, the word is used as a unit of dry measure, which has varied considerably at different times and places and for different goods; it is the customary British measure for coals, potatoes, apples and some other goods, and is equivalent to three bushels. From the end of the 17th to the middle of the 18th century the sack or “ sacque ” was a fashionable type of gown for women, having a long flowing loose back—hanging in pleats from the neck. It is still used as a tailor’s or dressmaker’s term for a loose straight-back coat. The Fr. *sac* meant also pillage, plunder, whence *saccager,* to plunder a town, especially after it had been taken by assault or after a siege. There is no doubt that it is an extension of “ sack,” a bag, with a reference to the most obvious receptacle for booty. The slang expression “ to give the sack,” “ to get the sack,” of a person who has been turned out of a situation or been given notice to leave is an old French proverbial expression. Cotgrave gives *On luy a donné sa sac et ses quilles,* “ he hath his passport given him, he is turned out to grazing, said of a servant whom his master hath put away.” The *New English Dictionary* finds the expression also in 15th-century Dutch.

It remains to distinguish the name, familiar from English literature of the 16th and 17th centuries, of a Spanish wine, which was of a strong, rough, dry kind (in Fr. *υin sec,* whence the name), and therefore usually sweetened and mixed with spice and mulled or “ burnt.” It became a common name for all the stronger white wines of the South.

SACKBUT, Shakbusshe, Sagbut, Draw or Drawing Trumpet (Scotland, *draucht trumpet)* or Flat Trumpet (Fr. *saquebute, saqueboute, cacbοuc, trompette harmonique;* Ger. *Posaune, Busaun, Pusin, Zug-Trommet,* Ital. *tromba da tirarsi* or *tromba spezzata;* Span. *sacabuche;* Dutch *bazuin Schuifftrompette),* the earliest form of slide trumpet, which afterwards developed into the trombone. As soon as the effect of the slide in lengthening the main tube and therefore pro­portionally deepening the pitch of the instrument was under­stood, and its capabilities had been fully realized, the develop­ment of a family of powerful tenor and bass instruments followed as a matter of course. It is not known exactly in what country the principle of- the slide was first discovered and applied to musical instruments; if it be not an Oriental device, then the credit is probably due to the Netherlands or to South Germany before or during the 13th century.

The early history of the sackbut is among the most interesting of all instruments. Various attempts have been made to fix the etymology of the word as derived from Span. *sacabuche* through French. The Rev. F. W. Galpin@@1 suggests a derivation from *sacar,* to draw out, and *buche,* identical with *bucha* (Lat. *buxus),* used in the sense of a tube or pipe originally of boxwood. To accept this etymology would be to lose sight of the fact that all the technical names applied to the sackbut in various languages directly acknow­ledge its descent from the buccina (*q.ν),* with the exception of Italian, in which the recognition is indirectly made through the synonym *tromba.* A clue to the etymology of *sacabuche* is afforded by the well-known fact that not only did the Arabs after the conquest introduce oriental musical instruments by way of Spain to western Europe, but the Arabie names also clung to the instruments in many cases. The Arabs had a military trumpet they called *Βuk* or *Buque,* a word they had borrowed from the Christians,@@2 and it is mentioned in a musical treatise of the 14th century (Escorial MS. 69) among the musical instruments then in use in Spain. It has been claimed on philological grounds that England derived her knowledge of the sackbut from France, but the oldest known form of the word in English is *shakbusshe,* which occurs in the accounts of Henry VII.

@@@1 “ The Sackbut, its Evolution and History,” in *Proc. Mus. Assoc. London* (1906-1907).

@@@2 See Edw. W. Lane, *Arabic-English Lexicon* (London, 1863), bk. i. pt. i. p. 276.