ican Contributions to Chemistry,” which he afterwards expanded into a considerable volume.

SILO. A modern silo is a pit or erection in which green crops are preserved in an undried condition for fodder. The term is derived from the Greek *σιρός* (Lat. *sirus),* a pit for holding grain. It is only of recent years that *ensilage, i.e.,* the preservation of green food for cattle by partial fermentation in silos, has become an important feature in agricultural economy. In various parts of Germany a method of preserving green fodder precisely similar to that used in the case of sauerkraut (see vol. iv. p. 618) has prevailed for upwards of a century. Special attention was first directed to the practice of ensilage by a French agriculturist, ' M. Auguste Goffart of Sologne near Orleans, who in 1877 published a work *(Manuel de la Culture et de l'Ensilage des Mais et autres Fourrages Verts)* detailing the experiences of many years in preserv­ing green crops in silos. An English translation of M. Goffart’s book by Mr J. B. Brown was published in New York in 1879, and, as various experiments had been previously made in the United States in the way of preserving green crops in pits, M. Goffart’s experi­ence attracted considerable attention. The conditions of American dairy farming proved eminently suitable for the ensiling of green maize fodder ; and the success of the method was soon indisputably demonstrated among the New England farmers. The favourable results obtained in America led to much discussion and to the extensive introduction of the system in the United Kingdom, where, with different conditions, success has been more qualified, but still highly encouraging.

It has been abundantly proved that ensilage forms a wholesome and nutritious food for cattle. It can be substituted for root crops with advantage, because it is succulent and digestible ; milk resulting from it is good in quality and taste ; it can be secured largely irrespective of weather ; it carries over grass from the period of great abundance and waste to times when none would other­wise be available ; and a larger number of cattle can be supported on a given area by the use of ensilage than is possible by the use of green crops.

A silo should have a depth of at least 15 feet, and may either be a pit or a building above ground, provided it is water-tight and, as far as possible, air-tight. The crops suitable for ensilage are the ordinary grasses, clovers, lucerne, vetches, oats, rye, and maize ; but various weeds may also be stored in silos with good, results, notably spurrey, (*Spergula* *arvensis),* a most troublesome plant in poor light soils. As a rule the crop should be mown when in full flower, and deposited in the silo on the day of its cutting. Fair dry weather is not essential ; but it is found that when moisture, natural and extraneous, exceeds 75 per cent. of the whole, good results are not obtained. The material is spread in uniform layers over the floor of the silo, and closely packed and trodden down. If possible, not more than a foot or thereby should be added daily, so as to allow the mass to settle down closely, and to heat uniformly throughout. When the silo is quite filled a layer of straw or some other dry porous substance is spread over the surface, then it is covered with boards, and a pressure of not less than 100 lb per square foot is applied by weighting or other mechanical means.

A silo thus contains, to begin with, a mass of living vegetable cells surrounded with a minimum of oxygen. The activity of the cells continuing, oxygen is absorbed and carbonic acid evolved, and part of the starch of the plants is converted into sugar. In the atmosphere of carbonic acid thus created the acid ferments manifest their vitality, and acetic, lactic, and butyric acids are developed at the expense of the starch and sugar. These chemical changes are accompanied with an evolution of heat, and the temperature of the mass rises, till, when it attains 122° Fahr., the action of the ferments is arrested. Should the heat rise to 150° the vitality of the vegetable cells themselves is destroyed ; and also when the available oxygen is exhausted chemical change ceases and sweet silage is produced. When from excess of moisture or other cause the temperature of the silo does not reach 122° Fahr., the acid ferments are not killed, and they go on evolving chiefly acetic and lactic acids, the results being sour silage. These ferments, requiring nitrogen for their existence, act on the nitrogenous constituents of the plants,

rendering the albuminoids partly soluble, evolving peptones, and by further splitting up producing amides, urea, and ammonia. The production of sour silage is accompanied by much greater trans­formation and loss than is incident to sweet silage ; and in extreme action the material acquires a most disagreeable odour. There is, however, no sharp line of distinction between the two, and both varieties are eaten freely by stock. Frequently a considerable loss occurs around the edges, and at other points where air gets access to the mass, by mildewing. See *Report* of Select Committee.

SILURIDÆ, a large family of freshwater Fishes, flourishing in the present epoch, and represented by a great variety of forms in all the tropical and temperate regions, many of them reaching back into the Tertiary age. The principal characters of this family (termed a “suborder” by some), its position in the system, its geographical distribution, and some of the most remark­able points in the structure and life-history of its members have been already sufficiently noticed under Ichthyology, but we have here to notice more fully the sections into which it has been divided, and certain remarkable forms which were referred to nominally only in that article.

The modifications of the vertical fins, or rather the specialization of certain portions at the expense of others, and the greater or less extent of the branchial aperture form excellent characters for subdividing the Siluroids.

I. In the *Siluridæ Homalopteræ* the vertical fins are exceedingly long, occupying nearly the whole extent of the embryonal fin, and in one genus *(Heterobranchus)* a great part of the dorsal portion retains its embryonic character, being a rayless adipose fin. All the Siluroids of this section belong to the fauna of the Old World and Australia. The rivers and lakes of tropical Africa harbour many species of the genera *Clarias* and *Heterobranchus,—*those of the Nile being known under the name of “Carmoot.” One of the Nilotic species, *Clarias macracanthus,* occurs abundantly in the Lake of Galilee, and, being a long, scaleless, eel-like fish of black colour, with eight long barbels round its broad mouth, was certainly included among those which the Jews were forbidden to eat by the Mosaic law. These fish grow to a length of from 4 to 6 feet, and are eaten by the natives of tropical Africa.

II. In the *Siluridæ Heteropteræ* the dorsal fin has almost or entirely disappeared ; only its foremost portion and a small adipose remnant may be preserved ; on the other hand the anal portion is retained in its whole extent. The gill- membranes remain separate and overlap the isthmus. This section likewise belongs to the fauna of the Old World, and includes, among many others, the species which has given the name to the whole family, *Silurus glanis,* the “Wels”

of the Germans. It is the only representative of the family in Europe, and with the exception of the sturgeon, is the largest freshwater fish of the Continent. It was known to Aristotle, who described it under the name of *Glanis.* It inhabits more the central and eastern portions of Europe than the western, being absent in Italy, Greece, southern Switzerland, France, and those parts of Germany which are drained by the Rhine and its affluents. In general appear­ance it somewhat resembles the burbot. Its head is large