applied (sometimes apparently by contrast with the characteristic colour). Thus all wines which are not of some red tint are loosely styled *white wines*, though their real colours are various shades of yellow, golden, and orange. Again, light-coloured hats, usually light gray, drab, or brown, are often styled *white* hats, probably in contrast with the black chimney-pot hat so common in England. The colour-term *green* with the figurative sense of "fresh," is applied to unseasoned timber and to freshly-quarried stone.

Metals.—Whilst some few metals have a sufficiently striking colour to give rise to a special colour-name—*e.g.*, *coppery*, *bronze*, *brazen*, *golden*, *aureine*, *steel-blue*, *leaden*, *iron-grey*, *argent*, *silvery*, the most of them have a general similarity of tint, and are loosely called *white* (probably in contrast to the coloured metals), whilst a mere tinge of blue in some of them leads to their being called *blue* (*e.g.*, lead, zinc, steel).

Curious applications occur in trade names: thus, *white metal* is used of any cheap alloy resembling silver in appearance; *white brass* is a whitish alloy of copper and zinc; *gray iron* and *white iron* are cast iron whose fracture is grey or white; whilst *white lead*, *zinc white*, *white arsenic* are the white oxides of the metals in question; *red lead* is the red oxide of lead, and *black lead* is really plumbago (which resembles lead only in its property of marking paper); *white*, *yellow*, *orange*, and *red*, when applied to gold, denote alloys of gold in which the golden colour is modified *slightly* in the directions indicated; *red-short* is an epithet descriptive of malleable metals which are brittle when hot.

Blue and Black.—There is a curious confusion between *dark blue* and *black* in both English and Hindústání. Thus, in English there are *blue-black*, *invisible blue* (both used of a very deep blue almost black), *black and blue* (applied to a bruise), *black as ink* and *inky black* (although most inks are nowadays blueish) often applied to rain-clouds (nimbus) and to the deep indigo blue of the deep sea, quite like the Hindústání phrase *kálá páni* (*lit.* black water) used of the sea. Dark blue cloth is by some (even by ladies) habitually called *black*; the writer has also known *black*berries miscalled *blae*berries (by a Scotchwoman), although *blae* is literally blue; this is quite like the Hindústání word *kálá*, which is used for both *black* and *dark blue*, especially in cloth. This confusion is curious in English, wherein the terms *jet-black*, *jetty*, *coal-black*, exist for a true black. In the melody, "The Coal-black Rose," the colour is attributed really to a person of the name of Rose.

Physical States.—Colour-terms are applied to physical states, sometimes in an exaggerated sense (the name of a bright colour being ascribed to any faint tint of the same), and sometimes in a special and almost inexplicable sense.

Thus we speak of *the black death*, *as black as death*, *black looks*, *looking as black as thunder*, *scarlet fever*, *yellow fever*, *jaundice*, *turning green with sickness*, *being beaten black and blue*, *blue with cold*, *a fit of blue devils*, *pale* or *white with illness* or *with loss of blood.*

Mental, &c., States.—The connection of colour terms with mental and moral emotions, conditions, and actions, is curious and often inexplicable.

Thus *black* is associated with the idea of evil—*e.g.* the *blackest of lies*, *black as sin*, *blackened with crime*, *as black as the devil*; and also with degradation in both English and Hindústání—*e.g.* to *blacken one's face* (Hind. *munh kálá karná*) implies disgrace in both languages. Again *black*, *purple*, *crimson*, *red*, *scarlet*, *pink*, *livid*, *pallid*, and *white* are all ascribed to rage; whilst *crimson*, *red*, and *scarlet* are also ascribed to shame, in both cases doubtless from their effect on the hue of the cheek. Further *crimson*, *red*, and *scarlet* are associated with crime (probably from their connection with blood), and also with sin generally—*e.g.* *red-handed*, *sins as scarlet*, the *scarlet woman*, &c. Next *black*, *yellow*, and *blue* are all used of depression of spirits—*e.g.* in the words *melancholy*, *atrabilious*, *jaundiced*, a *fit of the blues*. Again, *green* and *verdant* are used of the freshness of youth and of the state of a novice, and in this use both these colour-terms are oddly attributed to the eye; whilst *green* is also applied to (unusual) freshness in old age. The terms *green*, *blue* (*e.g.* a blue funk), *pale*, *pallid*, *livid*, *ashy*, *gray*, and *white* are all used as descriptive of fear; similarly the words χλωρος (commonly translated *green*) in Homer and *zard* (commonly translated *yellow*) in Hindústání are used of fear.

Again, *blue* is sometimes associated with religious feeling, and also with literary or scientific pursuits among women, *e.g.*, *blue-stocking*. Lastly, *white* is associated with the idea of good (perhaps in contrast to black, which goes with evil), *e.g.* *white lie* (*i.e.* a slight or venial lie), to be *whitewashed* (*i.e.* freed from debt), and extreme *whiteness* is associated with purity (probably from the pure whiteness of snow) *e.g.* *sins shall be as white as snow*, *white-robed angels*, &c.

Summary.—With such a looseness in the use of colour-terms in modern English and Hindústání as exemplified above, it seems (to the writer) that it is hardly possible to draw inferences as to the strength of the colour-sense in either the past or present from the (supposed) correct or incorrect application of colour-terms by other nations. Paucity of colour-terms is probably fair evidence of a poor colour-sense, whilst an abundance of the same is probably good evidence of a fine colour-sense. Viewed by this test, the colour-sense evidenced in the Homeric poems is certainly poor, and that of the natives of India is also poor compared with that of modern western nations; as to the latter, it may be said that a great development of colour-sense is now going on, and much more rapidly than in the past, judging from the frequent additions to the stock of dyes and pigments of late years, especially since the discovery of aniline and its derivatives.

Natives of India.—The author of "Light from the East on the Colour Question" considers that there is a "highly-developed colour-sense among the natives of India," and adduces the Indian coloured textile fabrics and works of art as evidence of this. This does not agree with the present writer's experience from a residence extending over twenty-three years in North India. The textile fabrics have certainly a good blending of colours; the cloth dyes and colours laid on pottery and other art-productions are also often beautiful. But the cloth-workers, dyers, potters, and other artisans in colours, and the educated classes, are the few among whom the colour-sense is well developed, and they are few among the 250,000,000 of India. The colour-terminology of Hindústání is poor, especially out of the classes above-named. Moreover, in the writer's experience the eyesight of the uneducated masses in India is defective in every way. They have great difficulty in threading a needle, in reading small type or small MS., also in reading at all except in a strong light, in discriminating colours, and (strangest of all) in making anything out of a picture, engraving, or photograph. This last defect is at first sight most surprising to an Englishman: it would seem as if a certain "picture-education" were necessary to develop a "picture-sense." A villager in India, or a quite uneducated servant, will sometimes examine a picture sideways, or even upside down, and will hazard the most incongruous ideas as to the subject, even when it is that of an object quite familiar to him.

ALLAN CUNNINGHAM

ENSILAGE

WE have observed with satisfaction, if we may be allowed to say so, the increasing attention which is being devoted to the subject of ensilage in this country, not only in view of the importance of this method of storing fodder as an auxiliary to the farmer, but because it evokes discussions which tend to the diffusion of the teachings of biologic science, and to widen the search after natural knowledge. The harvesting of ripe crops has become stereotyped by custom reaching back into the dim past; the practice of ensilage, on the other hand, involves a view of plant life which is not only foreign to our agricultural traditions, but is based upon less obvious teachings of nature, and it therefore demands a more intelligent cooperation of human industry. Notwithstanding these features, which make it a serious innovation, the unprejudiced acceptance of the system and the impartial spirit in which it is being practically investigated, testify to the growth of scientific culture amongst our agriculturists and to the general interest taken by them in the more recondite discussions of natural science which cannot fail to be widened by the study of the profound problems presented by the subject of ensilage. In contributing to the study of these we shall do so rather as observer than investigator, and as the text of our discussion we shall take Mr. Fry's excellent little work on "Sweet Ensilage." Whatever the fate of the theory of the silo expounded by the author—and it is certainly a bold excursion into the *terra incognita*—he furnishes us with a good and clearly expressed working hypothesis for the regulation of the system to the production of "sweet" ensilage, to which his efforts as an agriculturist have converged, he has sought a warrant in the teachings of vegetable physiology, and the theoretical account of the silo which has resulted may be stated in broad outlines as follows:—The crop to be ensiled is cut in the full vigour of the growth of the plant; the tissues of the plant do not die, but continue to exercise their organic functions for some time after being deposited in the silo. The rise of temperature which ensues in the silo is due to what the author terms "intercellular oxidation," or, from what we gather from the context, to the oxygen respiration of the cells.

In consequence of this increased temperature and its maintenance for a sufficient time, the cells of the plant are deprived of organic activity. The life of the plant under the restricting conditions of ensilation, induces an "intercellular fermentation," which manifests itself in one direction by the trans-generation of sugar into alcohol, the sugar being derived from the starch of the plant by hydrolysis. In regard to this function the author goes so far as to say: "When these transgenerations in the silo have been performed, the functions of the vegetable cells are at an end and they become inert and moribund." The formation of acetic acid in the silo, as also of lactic and other acids, are referred to ferment actions. The parasitic organisms present in the original mass are reduced to inertness by exposure to the elevated temperature produced in the silo, provided this is sufficiently high; nor can they resume their functions when the temperature falls to within the limits favourable to life. The ensiled matter, therefore, having attained and maintained for a sufficient time this suicidal temperature, is thenceforward without the pale of organic change. If, however, from any cause—the author gives prominence to two: viz. insufficient robustness of the cells and too large a proportion of water, which conditions, *e.g.*, are correlated in an immature growth—this critical temperature (at or about 50° C.) should not be reached, then the contents of the silo will, on cooling, become the prey of the bacterial life which has survived, and is ready to avail itself of favourable conditions for active development. The latter conditions determine the production of "sour" silage, the former of "sweet." In the chapter on the chemical composition of silage, in which analyses of various products are given, special attention is directed to the relatively high proportion of albuminoid to amide nitrogen in those which may be ranged in the latter class, as indicating their superior feeding value.

As a necessary preliminary to our discussion of the phenomena of the silo, in which we shall follow the lines thus laid down by Mr. Fry, we will review a few of the more prominent features of the chemistry of plant life, which no writer on this subject can afford to leave out of consideration.

That they have been considered, to some extent, in the account of the silo above detailed, is evidently due to Mr. Fry's position as an agriculturist writing for agriculturists. The practical purpose of his investigation and description of ensilage was only attainable by aiming at *a* probable truth to the exclusion of the whole truth. Our attempt will be to do justice to such an aim and its results, at the same time to aid in maintaining the scientific perspective of the question.

Many fruitless definitions of the supposed ultimate distinctions between a plant and an animal have from time to time been advanced; and while the controversies to which they have given rise have but little interest to those who take the broader view of classification, still there are certain very marked distinctions between the vegetable and animal worlds, considered each as a whole, which are independent of all views as to their abstract import and of all attempts to reduce them to a typical expression. First, in regard to synthetical activity and the power of appropriating carbon and nitrogen—the characteristic elements of living matter—the position of the vegetable world is anterior to that of the animal; or, to attempt a definition, the synthetical work of plants is ultimate, that of animals proximate. Secondly, nitrogenous or proteid substances are not essential constituents of the more prominent structures, *i.e.* the fibrous skeleton of a living plant, whereas the tissues of the animal are largely composed of such compounds. With regard to the functions of the protoplasm of the vegetable as compared with those of the animal organism, we may quote Michael Foster ("Physiology," 2nd ed., 343):—"It is not unreasonable to suppose that the animal is as constructive as the vegetable protoplasm, the difference between the two being that the former, unlike the latter, is as destructive as it is constructive." Thirdly, the synthetic activity of plants does not cease with the cessation of life, but persists in some measure in the substances which it has built up. We use the term "synthetic" here in a wider sense. The vast aggregations of the vegetable life of past ages with which we are so familiar in so many forms sufficiently illustrate our meaning; and the study of the everyday work of the redistributing agencies of Nature upon moribund vegetable matter, will prove the same refractory relationship—the possession of a power of resisting change under their influence not possessed by animal matter. Resolution takes place to a certain extent, in degree depending upon the circumstances of its deposition, and the surrounding physical conditions, but there is always to be observed the tendency to *accumulate* the characteristic element carbon, at the expense of the oxygen and hydrogen; we have every reason to regard the processes by which this result is attained as a self-contained re-arrangement of the matter and energy, localised in and by the plant during its life, and as the result, therefore, of the same activity. The life-history of a perennial plant also points to a high endowment of the molecules which are built up into its permanent parts; for these are not, as in the animal, subject to perpetual removal and renewal, but fixed and permanently localised. At the same time they run a long course of adaptation to the ever-changing condition of the structure which they compose, for which the necessary energy must be either concurrently or aboriginally supplied, or, as is probably true, both conditions of supply obtain. The study of the chemistry of liquification, and of the fate of moribund vegetable matter, therefore proves the possession of a high degree of intrinsic energy by plant substances, and the tendency to retain this energy in the form of derived compounds in which the carbon is proportionately accumulated.

Let us consider this endowment of energy of plants from a point of view more nearly that of the subject of these remarks—viz. the formation of the seed in an annual. We take it that every cell is impressed with the striving, so to speak, to bring about this result. In regard to the energy necessary, again we may conceive a storing up in the earlier processes of elaboration, together with a continuous supply from the external world. Supposing, now, the organic existence of the plant arrested by cutting during the period of inflorescence; the one supply is cut off, but what becomes of the other, the intrinsic energy and tendency of the organised matter in this direction? Analogy leads us to conclude that it flows on, expending itself on an unattainable end, until it fails from failure of the co-operative supply.

Now if this account of the relationship of the matter and energy of plants is generally true, we think they demand first consideration at the hands of investigators of ensilage. Mr. Fry attributes the rise of temperature in the silo to "intercellular oxidation." We think the term a good one, as it points to intrinsic oxygen exchanges. But we gather from the context that the oxydation referred to is at the expense of atmospheric oxygen. We think this qualification weakens the value of the term in diverting attention to a cause inadequate to produce the result. How much oxygen is contained or is supplied to the silo? Supposing it completely burned to carbonic anhydride and all the resulting heat effective in raising 100 times its weight of water 30° C. in temperature, is this sufficient on the most favourable calculation to raise the whole mass to 60°–70° C., the temperature which usually obtains? Why does the temperature continue to rise for some weeks after the crop has been ensiled, when from all causes the supply of oxygen must continually diminish? Apart from these considerations the conditions of the matter in the pit are surely unfavourable to oxidation by atmospheric oxygen, chiefly in the impediments to gaseous circulation and the absence of light. As we wish to confine ourselves to suggestions and to avoid statements of opinion, we do not hazard any conclusions on this point, but we ask for a comparison of the considerations drawn from the study of the intrinsic energy of plants with those from their relationships to the external world, in regard to this first phenomenon of the silo.

In regard to Mr. Fry's theory of "intercellular fermentation," we again think the term conveys a wider truth than his exposition. As an agriculturist he recognises two main kinds of ensilage products—sweet and sour—and we have already alluded to his account of their production.

Now, on what does this terminology turn, in as far as it is correlated with the chemical composition of the silage? Upon quantities of certain constituents which are a small fraction of the whole. It is, on the other hand, an axiom with the chemist, in his study of reactions, not to be led away by issues which are obviously subordinate. From a number of considerations which follow directly from the previous discussion, the cellulose fabric of the plant studied comparatively with the changes which it undergoes in the silo, is best calculated to throw light on the general nature and tendency of these changes. These changes involve a commerce of molecules, if we may use the expression, of which the appearance of small quantities more or less of particular acids or other compounds are minor results. We prefer the term "intercellular *commerce*" as less specialised than "fermentation"; and and in so far as the problems involved are essentially chemical, we think a study of the matter changes from this point of view in the order pointed out by relative quantity and permanence of relationship to the plant structure, is better calculated to elucidate the nature of these transformations.

In regard to sour ensilage, and the view of it as resulting from bacterial fermentation, we have little to say. The study of the life of such organisms under the very peculiar circumstances of the silo has been thus far very slender. From the later researches of Nägeli and others, which have considerably modified the theory of anærobic fermentation as propounded by Pasteur, we are inclined to attach less weight to this probable factor of the changes in the silo than Mr. Fry.

Generally speaking, and as he admits, the whole subject needs a very exhaustive investigation, and as we would point out, on the widest basis, and altogether independently of its special bearings upon agriculture The scientific method must be followed, even though in particular experiments the silage were rendered unfit for food. The factors of the result must be caused to vary artificially that their influence may be severally measured. The silo may be heated in any suitable way, the organic matter may be sterilised as regards parasitic germs, substances may be added to modify the reactions, and many other and similar self-suggestive means employed to test particular issues. In conclusion we revert to our original text, and we congratulate Mr. Fry on having laboured well in a good cause. As an agriculturist he has exceeded in his investigations what was to be expected; but in his endeavour to give a scientific account of the silo simultaneously with the agricultural, we think he has disposed of the complications of the subject by repressing their consideration. It is to the somewhat thankless task of reproducing certain of these that we have addressed ourselves, with the view, as already stated, of aiding to keep the subject in its true perspective.

NOTES

THOMAS DAVIDSON, LL.D., F.R.S., of Muirhouse, Midlothian, died, from an attack of lung disease, at West Brighton, on the 16th inst., in his sixty-ninth year. Dr. Davidson, who was so well known in the scientific world, more especially for his work on the "Fossil Brachiopoda," was a Fellow of the Royal, the Geological, and many other learned Societies, foreign as well as British. In 1851 he began his description of the "British Fossil Brachiopoda," which has been published from year to year by the Palæontological Society, the concluding supplements having appeared in the last volume of that Society in December 1884. Numerous memoirs on similar subjects have been published in the *Transactions* of several scientific Societies. Recently Dr. Davidson prepared a "Report on the Brachiopoda dredged by H.M.S. *Challenger* during the Years 1873–76." At the time of his death he was engaged upon a further monograph on recent Brachiopoda, the first part of which is now appearing in the *Transactions* of the Linnean Society. Dr. Davidson latterly resided at Brighton, and notwithstanding his other scientific avocations he devoted a considerable portion of his time to the perfecting of the town museum.

PRESIDENT CLEVELAND'S invitation to Prof. Agassiz to assume the direction of the United States Coast Survey has been hailed in America as an assurance that the new administration will encourage scientific work, and is not indifferent to survey, but is desirous of placing it under a head whose name and character would be a guarantee of success. The health of the Professor precluded his acceptance of the post; but beyond this he is of opinion that the guidance of the Coast Survey requires an expert. The problems to be decided, the methods to be employed, the men to be engaged, should, he thinks, be determined by one who knows the business. Any other person would be in danger of failure. In concluding an article on the subject *Science* says:—"The correspondence of Secretary Man-