One impression gathered from the pages of this work is the almost religious fervor with which communists are devoted to their peculiar social creeds. Ridicule is unable to turn them aside from their purposes, and repeated failure does not shake their faith. Speaking of the charms which the community at Brook Farm found in their life, and their unwillingness to change it for the 'luxuries of Egypt,' Dr. Shaw remarks: —

"Some such feeling as that seems to be permanently retained by almost all who have ever engaged in community life. It is a notable fact that many of these people who have enlisted in the work of human amelioration have their wits wonderfully quickened thereby, while the one-sidedness of their development tends to deepen and confirm opinions once received. The ill-fated colonies of Robert Owen had passed into the history of 'extinct socialisms' a generation ago; and yet the writer himself might designate one and another and another of the now venerable associates of Owen, still fresh with enthusiasm, and warm with sympathy, for every proposed social reform. The last of the Fourièrist phalansteries disappeared before the war; but many of the men who were engaged in them may still be found wrestling with the problems of co-operation, or pounding away at something more radical. Icaria once numbered its hundreds of disciples. Most of them have disappeared, seemingly swallowed up in the mass of American society; but, if the truth could be ascertained, they would, in all probability, still be found to be communists at heart" (pp. 176, 177).

A second lesson which Icaria teaches, is that the difficulties in the way of a realization of communism have existed largely in the imperfections of human nature. Attempts to erect a social fabric of a new design have shattered, because the building-material was not strong enough to resist the strain to which it was subjected. It is a sweet thing for brethren to dwell together in unity, but truly a most difficult thing. While in Nauvoo, Ill., their first settlement, Cabet early leads one party of Icarians in violent attacks on an opposite party; and the controversy waxes warm and bitter, until a disastrous split separates the two sections permanently. Cabet dies poor and broken-hearted in St. Louis, his adherents are soon scattered, while his opponents found a new settlement in Iowa. But these latter, united in poverty and trial, are unable to endure prosperity; and a young and progressive party, unwilling to accede to the policy of their more conservative elders, effect a separation. Peace and prosperity have never remained long with the Icarians, but they have never ceased to persevere in hope of better things.

One of the most interesting and at the same time touching passages in Dr. Shaw's book is that which describes the beginning of a system of private property, and the relentlessness with which it was suppressed as soon as discovered. It appears that the privilege had been granted each family of cultivating a small plot of ground surrounding the house, in such manner as the members thereof thought good: this was the origin of the question of the 'little gardens' ('*les petits jardins*').

"Everywhere else in the community the Icarian motto (all for each, each for all) was the invariable rule. If, in the one matter of these tiny plots environing their humble domiciles, the Icarians allowed the idea of '*meum et tuum*' insidiously to enter, and if they found a keener enjoyment in the flowers or the grapes because of the forbidden but delicious sense of ownership, we must not condemn them too harshly, nor impeach their communism. There was something noble and pathetic in the manner with which these 'citoyens' and 'citoyennes' put away the accursed thing when they awoke to a realization of the fact that the gardens were introducing a dangerous element of individualism and inequality" (p. 101).

This unpretentious little book on Icaria may be commended as a contribution to social science well worthy of careful perusal. It may be proper to state, in conclusion, that the book was presented by its author to the authorities of the Johns Hopkins university as a thesis for the degree of Ph.D.

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## *THE PHYSIOLOGICAL ANATOMY OF PLANTS.*

THIS is the best sketch of plant-life that we have seen. The author criticises Sachs's view that the cell is merely passive, and shows that we must recognize both the separate individuality of the cell and the corporate unity of the complex plant, though in the higher plants the independence of the cell is largely subordinated to the general weal. He also rejects Sachs's 'Fundamental system' of tissues as being a heterogeneous assemblage, and as in no sense a physiological unity. The right classification of tissues is shown to depend neither on embryology (for mature tissues show no embryological unity) nor on collocation (whether outside or inside the thickening ring), but on their actual structure as related to their functions. Thus the tissues are arranged as protective and nutritive, — the protective including dermal and skeletal (or mechanical) systems; and the nutritive including absorbing, assimilating, conducting, storing, respiratory, and secreting organs. The bulk of the book is occupied with the anatomy of the plant as dependent on its functions.

*Physiologische pflanzenanatomie, im grundriss dargestellt.* Von Dr. G. HABERLANDT. Leipzig, *Engelmann*, 1884. 12+398 p., illustr. 8°.

Under the protective system, we learn that cork and cuticle are a kind of fat, like tallow; the cork being impermeable to changes of temperature, and so securing slowness of freezing and thawing. The special secretions of ethereal oils have also been found by Tyndall to be useful in preventing the escape of warmth by night, and over-heating by day.

The mechanical system includes bast, wood-cells, and sclerenchyme; some parts resisting pulling forces, others resisting pressure. The bast-fibres of many plants surpass iron, and in some cases even steel of equal cross-section, in their power of bearing weights. Before winter the walls of the bast may thicken, becoming collenchyme, and the walls of cambium-cells may also thicken, as a means in both cases of storing food which is given back in spring. As a general rule, stems are strengthened to resist pressure, and roots are fortified against injury by pulling; and hence the circular arrangement of mechanical elements in the one case, and their axial situation in the other. But stems growing in water, and aerial roots, reverse the conditions, and accordingly the structure; so that we come to have root-like stems and also stem-like roots. The venation of leaves is directed to protect them from injury, and sometimes to roll them up, and so minimize evaporation. Some leaves in arid regions have 'water tissue,' with large reservoirs of water for times of drought.

Root-hairs are subsidiary to the surface of the young rootlets for absorbing water, and may occur on underground stems. They abound most in plants inhabiting dry places and in those which transpire freely; and are absent from Coniferae (whose transpiration is low) and from marsh-plants (where the water-supply is abundant).

The special assimilating organs are the palisade-cells of the leaves, the sponge-cells being only subsidiary. But the sponge-cells are important for transpiration; and in beech-trees the leaves in sunshine have much palisade-tissue, whilst those in shade have most sponge-tissue.

On the conducting system (*leitungssystem*) our author makes a wide, and we think a justifiable, departure from current doctrines. According to Sachs, the vessels of plants contain air, and the wood-cells carry water in the substance of their walls (we understand that Sachs has given up this view). Haberlandt shows that the water in the cell-walls is probably fixed as if crystallized; that the spring wood conducts water rapidly, though it is thin-walled; that water has been shown by Höhnel to be in the vessels; that in palms and tree-ferns there is too little prosenchyme to satisfy Sachs's doctrine; and that Sachs's experiments were defective and wrongly interpreted. The wood-cells are merely mechanical, and the water ascends through the vessels and tracheids.

Though the vessels may contain air-bubbles, they do not communicate with intercellular spaces or with stomata, and the low tension of the air in them would favor a suctorial rather than a supplying function. They have water both by day and night. The air appears in them when the day is somewhat advanced; and the alternate bubbles of water and air, like Jamin's tubes, favors Elfving's view of the ascent of the water by 'steps' (as a writer in *Nature* names it). The transverse walls of some vessels (as tracheids) support starch, which is too heavy for fluids; and the thin membranes permit the slow passage of water, but stop the passage of air. In pitted cells or pitted tracheids the diffusion surfaces are enlarged at the pits without the walls being weakened. The wide ducts of rattans afford quick passage for water by diminishing adhesion; whilst water-plants have few closed ducts. The long vessels are for through passage of water, and abound in stems; but tracheids are for local supply, and predominate in leaves of phanerogams and in some cryptogams.

Another part of the conducting system is the conducting parenchyme of the leaves and stem, including the parenchyme of the fibro-vascular bundles, the medullary rays, and the transparent parenchyme around the bundles of the leaves. These cells convey or store carbohydrates, as starch and sugar. Their proximity to the vessels indicates osmotic action, by which water and substances in solution pass out and in; the conducting tissue aids in the transmission of water; and the vessels may aid in the transference or storing of carbohydrates. The conducting parenchyme of the wood-region joins neighboring medullary rays, the contents of which can pass radially in the stem.

The conducting system for the proteids is the cambiform cells and the sieve-tubes, the perforations of the latter permitting the transmission of undissolved substances. Milk-ducts share in the functions of the sieve-tubes, reaching even to the base of the palisade-cells of leaves, and being abundant when the sieve-tubes are few.

The passage of air is by the intercellular spaces. Carbon dioxide can penetrate the cuticle; and both stomata and lenticels can open and close so as to regulate the supply. The stomata of plants inhabiting arid regions are

kept permanently closed, or are protected by ante-chambers; and those of some marsh-plants cannot close at all. In sunny places the air in the intercellular spaces is in motion, and may be observed passing out by the stomata. During the life of the plant, two maxima of transpiration occur: (1) in youth, the air passing through the soft cuticle; (2) in adult life, when it passes by the stomata.

The suggestion of Sachs, that the narrowness of the cells of autumn wood of trees results from tension, is unsatisfactory, because the change from broad to narrow cells is sudden, and the tension upon the young wood is nearly the same in autumn as in spring. How the difference is caused is not known; but it benefits the tree by affording wide channels for a plentiful supply of water for the opening leaves of spring and for the excessive transpiration of summer, and, on the other hand, by providing thickness and strength to meet the stress of winter. G. MACLOSKIE.

## *TROWBRIDGE'S PHYSICS.*

ALL who are interested in the improvement of elementary science-teaching must regard with no little interest the announcement that a physicist of Professor Trowbridge's deservedly high reputation and great experience has taken time to prepare a text-book in physics for secondary schools. 'The new physics' is certainly not of the common type of text-books, and it will be generally welcomed as, in many respects, a new departure.

Exercises in measurement occur from the beginning, and the student is shown the importance of 'finding out things for himself' at an early stage. The book is rich in suggestions concerning the construction and use of simple forms of apparatus, by means of which important physical constants may be determined with some precision. For linear measurement such instruments as the vernier, the spherometer, the cathetometer, and the microscope with cobweb micrometer eye-piece, which are often among the more expensive appliances of a physical laboratory, are described, and their construction so planned as to tempt any enterprising high-school teacher to undertake their manufacture. Several ingenious methods of measuring small intervals of time are introduced, and most of them are so simple that their value can be tested at little expense. By means of these methods the laws of motion are investigated experimentally: in fact, the attempt is made to discover what these laws are, and not merely to verify them. The student is taught how to construct galvanometers and electrometers, and how to use them in electrical measurement. In short, what may be termed the laboratory method of teaching elementary physics is adopted by the author without reserve.

But it is a great disappointment to find a book containing so much that is fresh and original so marred by errors, many of which are really serious. The laudable attempt has been made to put the student in possession of certain principles of prime importance which are generally to be found only in the college text-book, and not always there. In the discussion of some of these, mistakes of considerable magnitude, and statements that are very misleading, have unfortunately found their way into the text. Of these, some of the most serious are to be found in the chapter on moments of inertia. In attempting to calculate, without involving the element of time, the force with which a steel spring strikes a pendulum ball, some inconsistent and extraordinary equations are produced. A little further on the reader will be astonished to find it demonstrated (?) that in a lever the products of each force by the *square* of its distance from the fulcrum are equal; and on this proposition the principle of moments of inertia is allowed to rest. The statement is also made that the radius of gyration is the length of the equivalent simple pendulum; and this error permeates the whole treatment of simple and compound pendulums. In the definition and discussion of equipotential surfaces the false assumption is made that force is constant over such a surface. Preliminary to the consideration of the work done by an electric current will be found a brief discussion of the dimensions of force and work, which is obscure and misleading.

There will be considerable difference of opinion about the propriety of inserting in an elementary text-book such matter as the determination of the value of the ohm in absolute units, the measure of the horizontal component of the earth's magnetism, and the measure of electromotive force by the 'throw' of a galvanometer-needle.

The book is extremely suggestive, and will be found of great use in the hands of the enthusiastic teacher. A second edition will doubtless be free from the numerous mistakes of the present, which can hardly be regarded as a safe guide to one not already tolerably familiar with the underlying principles of the 'new physics.'

*The new physics.* By JOHN TROWBRIDGE. New York, *Appleton*, 1884. 19 + 367 p. 12°.