the doors of the school-house close in the afternoon upon the school-children, they should literally close out from them all that pertains to school until the opening next morning. A teacher should be a teacher, not simply a mere hearer of recitations. Lessons should be learnt and taught at school, never at home."

SCIENTIFIC NOTES AND COMMENTS.

IN Botany, we have to record the appearance of the long-expected book by Darwin on insectivorous plants. Although much has been written about such plants both in Europe and this country, the present work far surpasses any previous publication in the number and variety of the experiments and the accuracy of the results recorded. The observations are confined principally to members of the Droseraceæ and Lentibulariaceæ, the greater part of the book being devoted to an account of experiments on *Drosera rotundifolia* (common sun-dew), *Dionæa muscipula* (Venus's fly-trap), and *Utricularia neglecta*. In the first-named plant the upper surface of the somewhat concave leaf blades is covered with glandular hairs, which secrete a sticky substance at their tips, by means of which insects are caught. If an object is placed on the hairs in the centre of the leaf, an impulse is communicated to the radial hairs which causes them to bend over until their tips touch the object. If an object is placed on a hair remote from the centre, the other hairs bend over toward it. At the same time that the hairs bend, the secretion from their tips increases in quantity and becomes acid. The rapidity with which they converge over an object is found to depend on the chemical character of the object itself, nitrogenous bodies acting more powerfully than non-nitrogenous bodies. No substances affect the hairs so strongly as salts of ammonia, and the amount of phosphate of ammonia required to cause the hairs to bend is so incredibly small that, were it not for the accuracy of Darwin's record, one would be inclined to doubt the fact. By means of the secretion nitrogenous substances, as insects and pieces of meat, are softened and dissolved, whereas little or no effect is produced on non-nitrogenous substances. Although the chemical analysis of the secretion is difficult, owing to the small amount produced by any plant, judging by its power of dissolving different substances, Darwin concludes that it is very closely allied to, if not identical with, the gastric juice. After dissolving digestible matter which has been caught, the hairs straighten themselves into their original position; when an indigestible body is caught, the hairs recover their position much more quickly. Whereas the hairs of Drosera are adapted for catching small insects by means of a sticky substance, the two lobes of the leaves of Dionæa are furnished with three highly-sensitive hairs, which when touched cause the lobes to shut up quickly. The margins of the lobes are furnished with teeth, which interlock as the lobes come together, and imprison any insect on the leaf, unless it be very small. An acid secretion is then poured out by glands on the upper surface of the leaf, and digestion takes place as in Drosera, but the process is more difficult to observe than in the last-mentioned plant, since the leaf is folded together. In both Drosera and Dionæa, although the hairs are sensitive when touched, they do not seem to be affected by falling drops of rain or by strong currents of air. The species of *Utricularia* catch their food by means of little traps on the leaves, and the insects caught slowly putrefy. Frequent reference is made throughout the book to experiments by Cauley, Mellichanho, and Mrs. Treat on American species of insectivorous plants.

LA COUR has devised a very ingenious use of the tuning-fork for transmitting signals on telegraph lines, which promises to become of great importance. It is based on the well-known fact that if a given fork be made to interrupt an electric circuit by its vibrations, and the intermittent current thus produced be passed through a series of electro-magnets, each in connection with a fork of different rate, only that fork will be thrown into vibration which is in unison with the first one. Practically the time required to do this is a small fraction of a second. The advantages of this method are numerous. Not only may many receiving instruments at one station be operated, each by its own key, through a single wire, but many different stations in the same circuit may be operated, that one alone receiving the message which has the requisite instrument. Moreover, many signals may in this way be transmitted over the same wire at the same time, and many despatches sent simultaneously to as many stations. All this may be done, too, without affecting the line for its ordinary use, and independent of atmospheric and terrestrial currents.

IN reference to the variable colours of stars, we notice that in the *Uranometria*, composed in the middle of the tenth century by the Persian astronomer Al Sûfi, and which has been recently published by the Imperial Academy of Science at St. Petersburg, under the editorship of Schjellerup, it is stated that at the time of his observations the star Algol was reddish—an epithet applied also by him to the stars Antares, Aldebaran, and a few others. Most of these exhibit a reddish aspect in the present day. Algol, however, appears at present as a white star, without any tinge of colour. This change of colour is of great interest, and, indeed, highly significant, when taken in connection with the fact that the apparent brightness of Algol is subject to a periodical fluctuation of remarkable and, in fact, inexplicable character. Spectroscopic analysis has most plausibly suggested that in many cases the established variability in brightness of stars is due to such internal changes in the body of the star as bring a different class of chemicals to the surface, giving rise thereby to a variation in intensity of the light, a variation in its colour, and a change in the spectrum lines and bands. The observed changes in the colour of Algol, therefore, are quite in accordance with this theory. It may be added that Sûfi speaks of the great nebula in Andromeda as generally known in his day, so that Simon Marius (1612) can no longer be considered as its discoverer. Sûfi likewise records the position of the new variable star near Alpha Virginis, which has been recently discovered by Professor Schmidt, of Athens. Dr. Tempel, of Florence, calls attention to a nebula first discovered by him in 1860, which he considers without doubt to be variable. It is close to the star Merope, of the Pleiades, and can now be seen with a telescope of four inches aperture.

THE necessity of loosening the soil in the cultivation of root-crops is nicely illustrated by some experiments of Bretschneider on the growth of sugar-beets. It is well known that Knop, Sachs, Wolff, and others have raised large and normally-developed plants, particularly of corn, oats, barley, and buckwheat, not only in artificial soils of pure quartz sand moistened with solutions containing the essential soil ingredients of plant food, but also in such solutions with no soil at all. In experiments with sugar-beets, however, Bretschneider met with no success either in the artificial soils or in the solutions. Several repetitions of the experiments, in which organic matter and clayey substance in the form of artificially prepared humus and zeolitic silicates were mixed with quartz sand, brought little better results, either in a glass house or in open air. Finally, after eight or nine annual trials, the effect of loosening the soil was tested. Beets were grown in a mixture of quartz sand and artificial zeolites moistened with the nutritive solution. The soil was stirred from time to time to make room for the enlargement and penetration of the roots, and for access of atmospheric oxygen. The result was a yield that could hardly be excelled in the most favourable field culture.

MR. POCKINGTON states that he has examined by polarised light some specimens of hardened glass prepared by himself according to De la Bastie's method. Having prepared a small cube in this manner, its sides were ground, planed, and polished, and on examination by the polariscopic apparatus it became at once evident that the contraction of the exterior of the mass must exert a powerful compressing force upon the interior. The outer surface of the glass can be made, according to his experiments, nearly twice as hard as ordinary glass. On grinding away either surface it is evident that the interior of the mass consists of ordinary glass, being little, if at all, harder than before the application of De la Bastie's process, and subject to fracture in the ordinary way. There appears to be a limit beyond which the opposite surfaces cannot be unequally removed without producing such phenomena as, under the polariscope, show the existence of unsymmetrical tensions; but there is practically no limit beyond which both surfaces may not be simultaneously removed, as is shown by dissolving away the softer portions by means of hydrofluoric acid.

MR. W. WHITEHORN has communicated to the Physical Society of London some experiments on the electric conductivity of glass. He shows that, although a perfect non-conductor at ordinary temperatures, yet glass, when heated to redness, allows the electric current to pass freely. Even at the temperature of boiling water, a slight amount of electricity is conveyed by it. The resistance at a temperature of 165° C. is nearly forty times that observed at a temperature of 300°. The glass used by Mr. Whitehorn contained oxides of lead, thereby making it a better insulator than other kinds of glass.

POISON OF TOBACCO.—Science has sped another dart at the peace of the tobacco smoker. It has heretofore been made known that nicotine, hydrogen-sulphide, and cyanogen exist in the smoke of tobacco; but now Dr. Krause, of Annaberg, declares that he has found in it carbonic oxide, a principle never before detected in the substance. The quantity of the oxide and of carbonic acid differs according to the kind of cigar used, and the way of filling the pipe, etc. The manner in which the smoke is drawn, whether by strong or weak inhalations, also influences the products by affecting the combustion. From twelve experiments made by Dr. Krause, it appears that the quantity of carbonic oxide varied from 5.2 to 13.8 in 100 of smoke, the average being 9.3. As the consumer of the weed never give out all the smoke, but takes a portion of it into his lungs, a certain amount of carbonic oxide poisoning is inevitable. "The more awkward the smoker," said Dr. Krause, "the more rapidly will the action of the carbonic oxide make itself felt ; hence the evil early studies in smoking, the results of which are commonly ascribed to nicotine.