ment of nearly one-fourth of an inch on the surface of the stem; (3) the healing was complete in the interior, but the line of section was plainly visible under the microscope; (4) there was a displacement of the vascular bundles corresponding with the surface displacement; (5) the epidermis dried and shrank away before union could be completed, and there was thus left a V-shaped groove which extended completely round the stem, and demonstrated the completeness of the section in the first instance.

In the Redpath museum of McGill college there is a most interesting case of an old blaze on a beech-tree, which, in the course of a few years, came to be completely covered by the new growth. The specimen came originally from Belle Rivière, county of Two Mountains, and was discovered when cutting up the tree for firewood. It was exhibited before the Montreal natural history society, at its meeting in April, 1882; but no special description of it was published.[1] It is therefore thought desirable to figure and describe it here (see preceding page).

The figure, as blazed, is shown in the accompanying drawing; and its general character shows that it was probably made by one of the early Catholic missionaries, who little dreamed that it would be so effectually preserved. An examination of the stump showed by actual count at least one hundred and sixty rings of annual growth external to the blaze; and the size of the original tree is still clearly defined, showing that it was four inches and a half in diameter.

Two impressions are to be observed, — one representing the original marking; and the other, a cast from it, made by the overgrowing wood; both being very clearly defined. We have to note the following: —

1. That the figure was cut with a knife, as shown by occasional incised lines; though the outer cast, being in black, at first leads one to the belief that a hot iron was employed. Upon closer examination, however, it seems more probable that the black or carbonized portion was the result of slight decay, the decayed portion being subsequently covered up, and thus producing the appearance described.

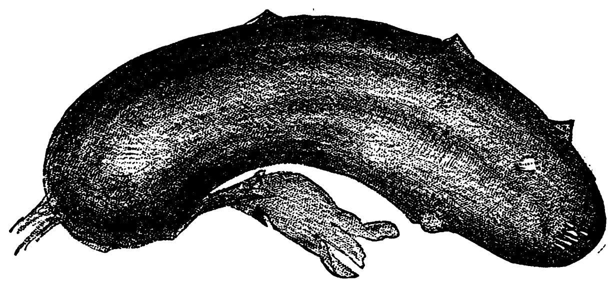
2. That the destruction of the bark and cambium was strictly confined to the lines of the figure, the intermediate portions still retaining their vitality and power of growth.

3. As now seen, the figures of the original blaze are defined by a stronger localization of coloring-matter in the wood, along the entire outlines, as shown in the drawing.

4. This offers a very good illustration of the tendency of active vegetable tissues to heal over abraded surfaces, and repair injury, the degree of reparation depending upon (*a*) the special vigor of the plant, and (*b*) upon the extent of the surface injured.

[1] Canadian nat., new ser., vol. x. no. 4, p. 238.

In 1879 I discovered a very interesting case of adhesion in a cucumber growing in the plant-house. My attention was not called to it until in an advanced stage of development,



FLOWER GROWING UPON A CUCUMBER.

as represented in the drawing, which is of full size. As is here seen, the monstrosity literally consisted of a flower growing upon a well-developed cucumber. As shown in the figure, the abortive flower was borne on a conspicuous peduncle, which became merged at its base with the base of the cucumber. The entire relation of parts would seem to indicate that there must have been two axillary flowers which became united in the early formation of the buds; one of them subsequently developing normally, while the growth of the other was largely arrested. D. P. Penhallow.

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THE NATAL OBSERVATORY.

Mr. Edmund Neison, the government astronomer at Natal, submitted to the colonial secretary, in June last, his report on the Natal observatory, whose establishment has been mainly due to the active exertion of Mr. Escombe. It was decided to found the observatory in time to obtain observations of the then approaching transit of Venus of 1882; and, on being applied to, Mr. Gill, the astronomer royal at the Cape, furnished an estimate of the cost of a suitable establishment. A generous sum was secured at first by private subscription; and in June, 1882, the sum of three hundred and fifty pounds was voted by the corporation of Durban toward the expense of founding the observatory, and the next month this was supplemented by a special vote of five hundred pounds by the legislative council. In all, a sum of about nineteen hundred pounds was contributed.

Under the superintendence of Mr. Robert Pett, of the Cape observatory, the new establishment was constructed, and the instruments erected. On the 1st of December, Mr. Neison took possession of the observatory as astronomer to the Natal government, and subsequently the observatory was taken over by the government of the colony. It lies on the south-west corner of the land originally granted for the use of the botanic gardens, and is a substantially built, rectangular red-brick building with cement facings, and carries a light wooden upper structure, forming equatorial and transit rooms. At present, there being no protection from the direct rays of the sun, the substantial walls of the observatory become so hot in the day, that it will be difficult to obtain proper observations until the building is completed by the erection of a veranda to shield the walls, and prevent their becoming so intensely heated. Having become thus raised in temperature during the day, the walls, owing to their massiveness, require the greater portion of the night in which to cool ; and during this time they give rise to convection-currents of heated air, which render it difficult to secure satisfactory observations with any of the instruments.

At the time of Mr. Neison's report, the principal instruments of the observatory were : a fine eight-inch equatorial (by Grubb), the gift of Harry Escombe, Esq. ; a high-class three-inch transit instrument, purchased by the government; an excellent sidereal clock, originally constructed for the Royal observatory, Greenwich, and at present lent by the Transit of Venus commission to the astronomer; and two chronometers, the one a sidereal, and the other a mean time. Mr. Neison describes these instruments, and reports their satisfactory performance. The observatory is at present without the usual equipment of meteorological instruments, but they will be obtained from England in the course of the spring.

Mr. Neison remarks upon the necessity of having proper steps taken for transferring in a regular manner to the Natal government the observatory and its site. It is built on ground originally assigned for a botanic garden, with the understanding that a sufficient space should be set aside for the purpose as might be deemed sufficient by the astronomer, though no written agreement to that effect was thought necessary. Owing to the nature of the ground, — a hillside covered with brush, — it is imperative that the astronomer (for the time in charge) should have every authority and complete control over the ground to the north and north-east of the observatory, which must be his chief observing-region; for otherwise he may be seriously hampered in carrying on his scientific work. The trees and other vegetation upon the surface of the ground have a far greater influence upon astronomical observations than in merely cutting off the view of a small portion of the heavens; this influence extending over the atmosphere for a considerable distance above them, owing to their liability to establish air-currents and tremors which are fatal to accurate observations. Experience has shown it to be not unfrequently necessary to clear the ground of particular kinds or groups of trees and shrubs, which establish such currents from being out of harmony in temperature and radiation-constants with the surrounding surface. Pines, laurels, and rhododendrons have had, on this account, to be removed from the environs of more than one observatory. Even the watering of the ground will give rise to most injurious convection-currents at times. When the moisture is general, as after a rain or heavy dew, it is of far less consequence; but when it is partial, as in watering plants, each plant sets up its own convection-current, and thus causes objects to appear most unsteady when seen through the air above, and so ruins accurate observation. Taking all things into consideration, Mr. Neison regards it as certainly most unwise to cramp the observatory and its future by confining the site set apart for its use to a smaller area than three hundred by seventy yards, both measured horizontally. A mere partial control or divided authority over this area, or any portion of it, would be unwise; for it would be sure to lead to complications and conflict of authority — if not in the immediate future, for a certainty at no long-distant date.

The Natal observatory has taken vigorous measures for the distribution of time-signals throughout the colony. At one o'clock every day a signal is sent to the central telegraph-office at Durban, from which it is distributed all over the colony, firing a time-gun and dropping a time-ball at Maritzburg, and also one at the Point, Durban. It is proposed to extend this system by the addition of a time-gun in the centre of Durban; to establish time-balls at Newcastle and Stanger; and, in connection with the Natal harbor board, to establish a system for properly regulating and rating ships' chronometers, similar to that already in existence at Liverpool and elsewhere.

In observing the transit of Venus the astronomers were moderately successful, no observations being undertaken outside of the usual optical ones. Copies of all the observations have been duly transmitted, through her Majesty's astronomer at the Cape, to the Transit of Venus committee at Burlington house, London.

With regard to tidal reductions, it has been arranged with the Natal harbor board that the tidal observations which are being made at Natal shall be reduced in the colony under the superintendence of the observatory, and proper tidal-tables constructed.

With reference to the future work of the observatory, it is proposed to take advantage of every opportunity for carrying out a series of observations of the moon, with a view of obtaining data for perfecting the tables of the motion of our satellite. The duty of making standard meridian observations of the moon is fully carried out at the Royal observatory, Greenwich, and partially at the Radcliffe observatory, Oxford, and at the U. S. naval observatory, Washington ; but, for obtaining the full information necessary for properly discussing these observations so as to make them available for perfecting the theory of the motion of the moon, it is necessary that a considerable number of auxiliary observations should be made. These, it is proposed, should be made at the Natal observatory with the greater facility, as all the lengthy mathematical analysis necessary for their reduction has already been executed by Mr. Neison himself. The principal subjects already taken up at the observatory are the following: —

1°. The determination of the exact amount of the parallactic inequality in the motion of the moon by means of observations of the position of a crater near the centre of the lunar surface.

2°. The determination of the exact diameter of the moon by observations of pairs of points near the limb.

3°. The effect of irradiation and its variations upon the apparent semi-diameter of the moon.

4°. The systematic variation in the apparent place of the moon produced by the irregularities on its limb.

5°. The real libration of the moon by a method independent of the errors caused by abnormal variations in the apparent semi-diameter of the moon.

The first investigation is in continuation of the one already commenced at the Arkley observatory, England, and will be carried out with the additional co-operation of the observatory of Strasburg, Germany. Arrangements are being made to obtain the co-operation of the Cape and other observatories in the investigation of other of the above subjects.

ECONOMY OF FUEL IN IRON-MANUFACTURE.

As the price of iron falls, every item in the cost of its production is more and more carefully scrutinized, — the quality of the ore, the cost of transportation, the labor used at the various steps in the process, the accessories and mechanical appliances, the rapidity of working, the quantity of fuel to the ton of pig-iron produced, and the cost of the fuel. Of all these, the cost and quantity of fuel used are, perhaps, receiving the largest share of attention from the iron-men just at present.

One coal-saving device is the Gjers soaking-pit. Formerly the huge ingots of steel from the Bessemer converter were allowed to cool, and were again heated before rolling them into steel rails. The efforts to roll them while still hot failed, owing to the fact that the core might still remain fluid while the outside shell of the ingot was cooling even below the rolling-heat. The Gjers soaking-pit is a hole in the ground, walled with bricks, in which the ingot of steel is placed until it has uniformly cooled to the rolling-heat, thus saving the reheating-furnace. It is claimed that the Gjers soaking-pit saves sixty-seven tons of coal to a hundred tons of rails. Again: at the South Chicago works the pig-iron is run directly from the blast-furnace into the Bessemer converter; while the usual practice in most works has been, and still is, to allow the pig-iron to cool, and to melt it again in a special furnace for the Bessemer converter.

The above processes save in the *quantity* of fuel; while, on the other hand, a large saving in the cost of fuel is looked for in the improved methods of coking and in the recovery of the valuable by-products. It seems quite generally admitted, that a good system of coking, which will save the tar-oils and the ammonia, will pay all the coking-expenses.

The great national economy will be better understood from figures. In the year 1880, in the United States, 2,752,000 tons of coke were produced from 4,360,000 tons of coal by the old-fashioned beehive oven. Two years ago the figures for Great Britain were 7,000,000 to 8,000,000 tons of coke from nearly 13,000,000 tons of coal by beehive ovens. This quantity of coke could have been produced by the Simon-Carvès system of coke-ovens from 10,000,000 tons of coal; effecting a saving of 3,000,000 tons, and also a saving of the coal-tar and ammonia by-products.

The beehive oven, which takes its name from its form, is a low, square chamber with dome-shaped top; has an opening for escape of gases at the top, and a door in the side through which to admit the air, to charge the coal, and to discharge the coke. The burning is regulated by opening and closing the side-door, and all the gases go to waste at the top. The Simon-Carvès system of ovens consists of a row of chambers side by side, with combustion-flues in the parting-walls and under the floors. The waste-gases are burnt in these flues, and liberate heat enough to distil the gases of the coal. These gases, before entering the combustion-flues, are passed through condensing-apparatus, where the tar and ammonia by-products are saved. The two ovens, therefore, work upon totally different principles. The beehive cokes by slow combustion, sacrificing a portion of the coal by the door, as well as the by-products: the Carvès simply distils. The beehive saves 60% to 65% of the coal as coke: the Carvès saves 75%. The beehive oven produces a very fine coke, in long, columnar, hard, silvery, porous masses: the Carvès gives a dark, dense, heavy coke. And it is here that the iron-master hesitates; for he likes the silvery, porous beehive coke for making iron, and does not yet accept the dense, heavy coke of the Carvès oven.

Jameson has invented an oven which is known by his name, and which is essentially a beehive oven, with a suction-pipe entering at the bottom instead of the roof-outlet for gases. The products of combustion are drawn by an artificial draught through the pipe; and, after being carried through apparatus for the condensation of the by-products, this gas is available for any purpose. The actual yield from a ton of coal has been estimated to be: sulphate of ammonia, 10 pounds; oils, 8 gallons; gas, 12,000 cubic feet; coke, 67% to 69%. The tar from this oven is lighter than water (specific gravity, .960), and consists mostly of oils, boiling between 250° and 300° C., of little value as burning-oils, and of secondary value as lubricants. Paraffine is present, and both toluine and xyline in small quantities, but no benzine. A portion of the oils breaks up into phenols, which, so far as investigated, give colors of little stability. Neither naphthaline nor anthracine is present, both valuable as sources