northern hemisphere. The second, as well as the first, of these roots appears to represent stable conditions, and thus a depression revolving with high speed in a clockwise direction in the northern hemisphere is dynamically possible. In practice evidently such a condition could not get started on a large scale, as the rotation of the earth would inevitably cause the turning movement to commence in the normal direction. On a small scale, however, eddies round corners of houses or precipitous headlands might evidently be set up with revolution in either direction. It appears from the above that such rotation once started may, under favourable conditions, persist and develop into a dust whirl or tornado, with revolution either clockwise or counter-clockwise according to the direction of the initial impulse. One cannot impress too strongly on all observers of such phenomena the importance of noting in which direction the rotation is taking place. J. S. DINES.

66 Sydney Street, S.W.3, December 5.

Fuel Economisers.

WITH regard to the fuel economiser designed by Prof. C. V. Boys, and described in NATURE of November 28 (p. 249), I may mention that I have lately been making experiments in the same direction. In the arrangement tested by me the economiser consisted of a large rectangular metal box fixed over the upper part of the grate. The products from the fire were led by a horizontal flue above the fire into the lower part of the box, in which they ascended and heated it, after which they were drawn back to the chimney by a flue over the one by which they entered. The result was a considerable increase in the efficiency of the fire, but on removing the box to make some check readings under ordinary conditions it was found that the arrangement was impracticable. The flues were so coated with soot that it was evident that the box would require to be too frequently taken out for cleaning to make it worth adopting; and I fear Prof. Boys's arrangement will be liable to the same disadvantage. I should, however, mention that the coal used by me was not good, and was very smoky.

With regard to the objectionable appearance of these economisers, I may state that their appearance can be improved by painting them with suitable colours, as it is not necessary to use black. All paints—with the exception of aluminium—with which I am acquainted radiate equally well for heat of wave-lengths given out at the temperatures employed. White, or any colour, is as good as black for the purpose. The same remarks apply to colours with which hot-water radiators may be painted. The colour which harmonises best with their surroundings may be used without reducing their efficiency.

A great deal of the heat lost in the ordinary loosely fitted-in fire-grate might be saved if the fitting in was modified in the following way:—The bottom of the chimney is closed by a large sheet of metal, so as to make the fireplace-opening into a closed chamber; the grate is drawn forward two or three inches to allow of free circulation of air into and out of this chamber at the back of the grate, while the fire is provided with a chimney passing through the sheet of metal forming the roof of the chamber. By this arrangement the air heated by the hot back of the grate, which now goes up the chimney, would be sent into the room. In new grates it might be advisable to increase the amount of heat communicated to the grate by the fire, and also to increase the back surface of the grate by projections, flanges, etc. Great as the heat losses are in room-fires, it is admitted by all that it is our kitchen-ranges which are the great coal consumers and where improvement is most urgently called for. JOHN AITKEN.

Ardenlea, Falkirk, November 30.

THE trouble of cleaning referred to by Dr. Aitken has not in practice been found more than a minor inconvenience, and provision to make this easy is incorporated in the design. I agree with Dr. Aitken that, considering the radiating power alone, there is nothing in the colour, but it is desirable to employ an "enamel" stoved on so as not to smell if the temperature is raised, and I do not know that this can be done equally well with colour. While saving of fuel is most important and urgent at the present time, equable distribution of heat about a room has also its advantages, and it remains to be seen if this result brought about by my device will not itself more than compensate hereafter for the presence of the unobtrusive, if somewhat plain, heat interchangers—or "heavenly twins" as they were called by the first to benefit by their presence. C. V. BOYS.

A Mistaken Butterfly.

IN NATURE of September 5 last an Australian correspondent notes the attraction of the blue knob of a hatpin for a butterfly. When playing golf in Gulmarg (Kashmir) this summer I was frequently put off by a large butterfly settling on the ball just as I was making a stroke. I make a point of keeping my ball white and clean, and the butterflies evidently mistook it for a white flower. S. ROBSON.

Prince of Wales College, Jammu,
October 27.

CHEMICAL CORRELATION IN THE GROWTH OF PLANTS.

WHEN the apical shoot of a fir tree is broken off or injured, it is a familiar fact that one of the lateral branches below changes its direction of growth in order to take the place of the original apical shoot. The change of direction is accompanied by greater vigour of growth. These phenomena attracted the attention of Errera,[1] who suggested, as the reason why the lateral shoots do not tend to grow vertically while the apical shoot is intact, the possibility that the latter might produce inhibitory substances of a chemical nature which travel downwards to the other parts of the tree. Direct evidence was not then available, but the hypothesis has since received confirmation from certain experiments by Dr. Jacques Loeb, who appears to have been unaware of Errera's suggestion.

Although the phenomena are of general occurrence, Dr. Loeb found the tropical plant, *Bryophyllum calycinum*, an appropriate one for the purpose of investigation. The stem carries a series of buds, each in the axil of a leaf, while the leaves themselves are also provided with buds in notches around their edges. Under ordinary conditions all these buds are dormant. But they can be made to grow by various procedures. The common experiment of taking a willow shoot, cutting off the leaves and suspending it horizontally in moist

[1] Brit. Ass. Reports, 1904, p. 814. "Conflits de préséance et excitations inhibitoires chez les végétaux,' Bull. soc. roy. botan. belgique, vol. xlii., 1904; reprinted in "Œuvres Physiol. Gén.," p. 101. (Bruxelles, 1910.)

air, can be repeated with this plant. It is found that the apical buds begin to grow first, while none of the others do so. The result, as pointed out,[2] may be explained in two ways: either a bud, when it begins to grow, sends out inhibitory substances towards the base of the stem, or the young growing bud absorbs the whole of some material requisite for growth. This latter explanation appears to hold in the case of the leaf buds, as will be seen later; but the following experiment shows that the former is the correct one for the stem: A piece of stem is laid horizontally. All the leaves are removed, with the exception of the two at the apical node, the petioles of which are left. So long as these petioles remain, the buds in their axils do not grow, but those in the next node below will commence to grow, and when the petioles have wilted and fallen off, the apical buds also begin to grow. Now, if the inhibiting effect of the apical buds on the more basal ones is due to the circumstance that those which grow out first take all the available supply of some necessary material, the buds in the node behind the apical one, since they grew out first, should continue to outstrip in growth those of the apical node which started later. If, on the other hand, the effect is due to an inhibitory substance sent towards the base by the growing bud, the most apical bud should soon outstrip those behind, because the apical buds send out inhibitory substances towards the next lower buds, while they themselves receive none. The actual result is in favour of the latter view. As soon as the petioles have dropped off, their axillary buds begin to grow, and not only rapidly outstrip in size those below, but even retard or stop their growth altogether.

If the effect is due to an actual chemical substance, the inhibitory effect should be in proportion to the size of the growing bud. It is scarcely possible to test this with the apical bud itself, but it can be done with the grown leaf, which also sends out similar material. This is carried by the sap which flows in the same half of the stem as that to which the leaf belongs. A stem is again laid horizontally, and all the leaves are removed except the two of the apical node. No shoots are produced so long as the leaves remain. If one leaf is removed, its axillary bud grows. The following experiment is then made: Twelve stems are taken, and all the leaves except one of the apical ones on each stem are removed, together with the free axillary bud opposite the leaf which remains. Six stems are placed with the leaf upwards, six with the leaf downwards. In the former case no shoots develop, except sometimes that in the second node behind the leaf, on the *lower side* only. In the latter case shoots develop either in the two lateral buds of the node behind the leaf or on the upper side of the second node behind the leaf. The interpretation is that the inhibiting substances, while flowing on the side of the stem where the leaf is, have also a tendency to flow downwards by gravity. If the stem behind the leaf contains only one node, no shoot grows, even when the leaf is below the node. A large leaf sends out a large enough mass of inhibitory substance to flood the buds. But if the leaf is reduced to one-tenth its size, then shoots are formed in the node behind the leaf. That the inhibitory effect of the leaf is not due to its withdrawing nutritive material from the stem is shown by the fact that the petiole left attached to a leaf remains fresh, but wilts if left attached to the stem without the leaf. The nutritive material is therefore sent by the leaf to the stem, not *vice versa*.

The fact that it is the apical bud that begins to grow first is given the following tentative explanation. When the leaves are first removed, the inhibitory substances are present everywhere, but continue to flow towards the base. Hence the most apical node is the first one to become freed from their presence, and when its buds grow they form anew the inhibiting substance which prevents the growth of the more basal buds.

No reference has yet been made to the collateral phenomena of the growth of roots. Observations were made on this point also, and indicated that the leaf sends out material which *favours* the growth of roots. This hormone may be the same as that which inhibits the growth of leaf buds.

In the earlier papers a number of experiments were described which indicate that the growth of the buds in the notches of the leaf is dependent on the amount of some material supplied by the leaf, since the growth is proportional to the mass of the leaf to which the bud is attached.[3] The part played by the direction of the currents in the leaf is also pointed out. The most recent statement of the author's results[4] is that the production of new shoots by a piece of stem is in direct proportion to the mass of a leaf left attached, and hence to the mass of growth material sent out by the leaf. The apex of an intact plant sends inhibiting substances, preventing the buds below from growing.

A theory of geotropic curvature is put forward,[5] in which the growth of the lower side of a stem placed horizontally is explained by the accumulation there of growth-promoting substances. The author[6] appears to hold that the assumption of a "stimulus" due to gravity is unnecessary. But there is experimental evidence that the perception of gravity is a separate phenomenon from the production of the curvature, so that the purely chemical effect by mass action would not be able to explain all the facts.

It should be noted that the production of inhibiting substances is a conception arrived at in the later stages of Dr. Loeb's work, so that some of the interpretations given in the earlier papers may require revision.

It is of interest that as definite a case of corre-

[2] "The Chemical Basis of Axial Polarity in Regeneration." By Jacques Loeb. *Science*, N.S., vol. xlvi., p. 547. (1917.)

[3] "Rules and Mechanism of Inhibition and Correlation in the Regeneration of *Bryophyllum calycinum*," *Botan. Gazette*, vol. lx., p. 249. (1915). "Chemical Basis of Correlation. I. Production of Equal Masses of Shoots by Equal Masses of Sister Leaves in *Bryophyllum calycinum*," *ibid.*, vol. lxv., p. 150. (1918.)

[4] "The Law Controlling the Quantity and the Rate of Regeneration," Proc. Nat. Acad. Sci., vol. iv., p. 117. (1918.)

[5] "Influence of the Leaf upon Root Formation and Geotropic Curvature in the Stem of *Bryophyllum calycinum* and the Possibility of a Hormone Theory of these Processes," *Botan. Gazette*, vol. lxiii., p. 25. (1917.)

[6] "The Chemical Basis of Regeneration and Geotropism," *Science*, vol. xlvi., p. 115. (1917.)

lation by chemical messengers between organs in plants as that found by Prof. Starling and the present writer in the case of the pancreatic secretion in animals seems to be made out.[7]

W. M. BAYLISS.

THE PREVENTION OF VENEREAL DISEASES.

THE Executive Committee of the National Council for Combating Venereal Diseases, of which Lord Sydenham is president, has put forth a number of proposals for meeting the danger of a large increase of venereal diseases among the civil population when the troops are demobilised. The *Times* of November 25, in commenting upon the recommendations, states that there will be about 300,000 infected men on demobilisation. These will be distributed to every part of the British Empire, carrying with them the germs of infection. Rural districts in Great Britain and in the Colonies which have hitherto been free or comparatively free from these diseases will consequently suffer seriously.

There are thirteen proposals of the Executive Committee for preventive and curative treatment, but here it is intended to deal with the third recommendation only, namely, "Some means should be devised whereby medical practitioners are encouraged to diagnose venereal disease in patients, and also to give early preventive treatment." The only meaning which can be attached to this solitary proposal for prophylactic treatment is that the patient, having exposed himself to infection, should (if and when the opportunity offers) apply to a doctor encouraged to diagnose venereal disease, who would tell him what course to pursue to eradicate the disease, or possibly what he might have done to avert infection in the past, or how to avoid it in the future.

Medical science has shown that the two venereal diseases, syphilis and gonorrhœa, are due to specific living germs, which when once they are implanted in the tissues of the body are extremely difficult to eradicate. It is too late in a number of cases to avoid serious consequences if the patient has to wait for a diagnosis even by an experienced practitioner, although modern improved methods of curative treatment can do much. If science be consulted rather than sentiment, the *earliest treatment* would be advocated, such as the use of germicidal disinfectants in portable form as soon after exposure as possible to kill the organisms before they can enter the tissues of the body. This prophylactic treatment was first shown to be effective by experiments on animals, and such a method of prevention applied to human beings, first publicly advocated in a letter to the *Times* by Sir Bryan Donkin, is supported by a great number of medical authorities. It has long been adopted by the Navy, and has recently been introduced by the Army.

In *Public Health*, the official organ of the Society of Medical Officers of Health (No. 12, vol. xxxi., September, 1918), there are some interesting and important articles proving the value of earliest treatment in the prevention of venereal disease. Space is too limited to give full details, but the following results speak for themselves: Capt. Walker, of the Canadian Medical Forces, at a conference in Paris, stated that before the introduction of earliest disinfectant treatment the incidence of venereal diseases amongst the 5000 officers and men on leave in Paris during August and September, 1917, was 20 per cent. From November, 1917, to the end of March, 1918, after the introduction of immediate disinfection, only 3 per cent. of infections occurred. Capt. Walker, from his experience, strongly urged (1) prophylaxis for men, (2) prophylaxis for women, (3) a separation of the moral from the medical side of the question.

Likewise the experience of Col. Elgood at Port Said, and of the Australian and New Zealand forces, shows that this earliest disinfection is the most efficient, though not *absolutely* efficient, method of preventive treatment, because neither drunkenness nor indifference and carelessness on the part of the individual can be controlled. The arguments against the application of this earliest treatment to the civil population are twofold: (1) The injury to the individual and collective moral sense; (2) the impossibility of inducing the local authorities to advocate its practical application. As to these points, we may remark:—

(1) It is doubtful whether the fear of contracting venereal disease quenches the fire of sexual passion of youth or makes the viciously inclined virtuous. Again, there is the sentiment that such measures advocated by public authorities would be an incentive to vice, but against this must be placed the misery and suffering to countless innocent women and children which would arise if an efficacious mode of prevention is rejected upon moral grounds.

(2) During recent times necessity, and alarm for the future of the race, have swept away many prejudices, and, therefore, it is not surprising to find that the Warrington Town Council by a resolution has advocated the adoption of this earliest treatment, and copies of the same were forwarded to the President of the Local Government Board and the councils of the county boroughs of England and Wales. Well may the official journal of medical officers of health, commenting upon this resolution, assert that as a practical preventive measure this is undoubtedly the most important step that has been taken up to the present.

WORK AT THE NATIONAL PHYSICAL LABORATORY.

SINCE the opening of the National Physical Laboratory in 1902 remarkable growth has taken place not only in its material resources of buildings and equipment, but also in the number of the staff employed. The Annual Report[1] recently

[7] "The Chemical Regulation of the Secretory Process," Proc. Roy. Soc., vol. lxxiii., p. 310. (1904.)

[1] The National Physical Laboratory. Report for the Year 1917–18. (H.M. Stationery Office, 1918.) Price 2s. 6d. net.