

Foot-and-Mouth Disease.

THE ravages of foot-and-mouth disease in Great Britain during the past few years, though now, happily, declining, yet lend great importance to the discovery of methods of prevention and cure less drastic than the slaughter of all affected animals. Although in its second progress report,¹ the Foot-and-Mouth Disease Research Committee is unable to prescribe certain means of prevention and cure, the results already achieved suggest that in the future such may be discovered; thus the experiments described on methods of destroying the virus and on immunity to it in animals point the way to possible means by which these ends may be successfully accomplished.

Work on the disease is hampered by the fact that the causative agent has not yet been seen, nor has it been cultivated on artificial media. Further, it appears that there are at least two types of the virus, and infection with one, though producing immunity to this type, usually does not result in immunity to the other. The virus can only be recognised by the effects it produces in a susceptible animal such as the guinea-pig, which is chiefly used for this purpose. The same animal also serves as a useful source of the virus, since after several passages through guinea-pigs, the fluid obtained from the vesicular lesions of the disease contains virus of a very high potency, as shown by the fact that the fluid may still be infective when diluted even to 1 in 10 million.

The spread of infection of foot-and-mouth disease must depend on the natural resistance of the virus and the presence of susceptible animals. Various species which might carry the infection to cattle have been examined: rats and rabbits are relatively resistant; lesions can be produced by inoculation, but the disease does not spread from one animal to another. Cats, dogs, and hedgehogs can also be infected: no contact infections were seen, although the mortality among kittens and puppies was very high. Birds, however, were found to be insusceptible to inoculation. It is therefore probable that infection of cattle does not, at any rate easily, take place by contact with other animals: in fact, cross-infection experiments with guinea-pigs were negative unless the vesicles on the guinea-pig's feet were opened and allowed to discharge over the fodder, etc., of the cattle.

A large number of experiments were performed on

the survival of the virus under a variety of conditions. It was found that in buffered phosphate solutions of neutral reaction, potency was only slowly lost in the cold: in 50 per cent. glycerine, containing a little of the phosphate solution, the virus may also remain active for more than six months. When dried on glass slides the virus soon lost activity, especially if kept in a moist atmosphere, but on other materials the potency might be retained for a longer period, especially on hay or an infusion thereof. Carcasses of guinea-pigs, cattle, and pigs may remain infective for several weeks, especially the bone marrow. Burial with lime or salting of the carcase does not alter the period of infectivity in this tissue. The virus is destroyed by exposure to a temperature of 55° C. for about twenty minutes, by light, but not easily by chemical reagents: the most useful antiseptic is probably 0.1 per cent. commercial formalin, which always destroys it in two days at 26°-27° C.

Immunity is produced by an attack of the disease, which in the guinea-pig lasts about four months and in cattle about a year. After this period, 'partial' immunity is still present, since intracutaneous inoculation of the sole of a foot in the guinea-pig will produce local lesions, whilst intramuscular inoculation is quite ineffective. In the susceptible guinea-pig, as in cattle, there is always a difference between different sites of inoculation in the ease with which infection can be produced: thus intracutaneous inoculation or scarification of the mucous membrane of the mouth is a much more certain means of infecting than intramuscular injection. Complete passive immunity in the guinea-pig has not been produced, the injection of serum from a recovered animal giving only 'partial' immunity. Complete (active) immunity by inoculation of living virus can be produced, but the results are not very certain and an actual attack of the disease may result. On the other hand, inoculation with a formalised vaccine regularly produces 'partial' immunity in the guinea-pig, and 'complete' immunity may follow a further inoculation of living virus: this formalised vaccine is being tested for its protective powers in cattle against natural infection with foot-and-mouth disease. Another method which may be of use in the protection of cattle is to inoculate first with serum and then with the living virus. These observations suggest possibilities of the ultimate protection of farm animals, which are encouraging and may form the basis of future work along these lines.

¹ Ministry of Agriculture and Fisheries. Second Progress Report of the Foot-and-Mouth Disease Research Committee. Pp. 117. (London: H.M. Stationery Office, 1927.) 3s. net.

Recent Studies of Skilled Performances, with Reference to the Transfer of Training.¹

By Prof. T. H. PEAR.

THE popular descriptions of a person as 'clever with his hands,' or 'clever with his head,' raise some intricate problems for physiology and psychology, and in the sphere of applied science, for education, industry, and sport. For the latter vague phrase the concept of 'intelligence' has been substituted, with substantial empirical support. Tests of intelligence give results which correlate highly with each other. For the former phrase, attempts to substitute the concept of 'motor ability' (strictly speaking, of motor capacity) have met with unforeseen

and interesting difficulties. For while there seems ample evidence for the existence of a 'general intelligence,' the results of simple tests for isolated motor performances as far as possible excluding intelligence, show extremely low or even negative correlations with each other. Results along these lines corroborating earlier work by Wissler have been obtained by F. A. C. Perrin and Bernard Muscio. Moreover, in these investigations there seems to be no support for a belief in the correlation between simple motor abilities and 'intelligence.'

From such results, far-reaching inferences have been drawn, as that there is no 'general motor

¹ Substance of a paper read before the Manchester Literary and Philosophical Society on April 26.

capacity,' no 'motor type' of person, and the practical conclusion that tests for ability in any performance give valid results only when the test performance is identical with that for which the test is being administered.

It is possible to offer an alternative explanation of these results, based upon the suggestions of Sir Henry Head. The test involves the simplest muscular co-ordinations, many of them confined to limited parts of the body. Intelligence was deliberately excluded so far as possible from the tests used by Muscio. Consequently the bodily mechanisms involved in the test performances may have required comparatively low levels of the nervous system. The test results would not exclude the possibility that a higher, more complex power may use and co-ordinate these simple mechanisms in ordinary 'skilled' performances.

In this connexion it is important to consider the rôle of the motives in acquiring muscular skill. It cannot be assumed that those motives urging university graduates and undergraduates (the performers in these tests) to do their very best in a simple, apparently trivial, and often boring motor test are identical with those producing keenness in a test of intelligence.

There appear to be reasons for restricting the word skill to more complex motor performances, a skilled human action being described as a highly integrated learned adjustment. The above tests would then be described as of simple motor *abilities*.

Another method of investigating the problem of 'motor ability or motor abilities' is to reset it in the form of the 'transfer of training.'

Subjects may be intensely trained in some definitely skilled activity, so that their curve of practice shows a considerable rise over a long period. It may then be discovered whether the undoubted ability gained in the test activity has been transferred to apparently closely related performances. Such an investigation obviously requires controls of a kind which cannot be described here.

Though much work upon the relation of general to specific training has been done with regard to such powers as memory, sensory discrimination, etc., little is known of this problem as it relates to skill. Recently, C. E. Beeby has investigated the transfer of ability between performances requiring the use of one or both hands. He found an *initial positive transfer* which gradually diminished with further practice until it became a *final negative transfer* or interference. The actual amounts of transfer (initial and final) in his tests were the same whether it took place from (a) one hand to the other, (b) a double-handed action to one of the single-handed movements comprising it, (c) a single-handed to a double-handed action. He concludes that the only transfer was of general mental attitude. There was no evidence of positive transfer of specific habits of manipulation. Nothing but interference was shown between these specific habits. This it is which explains the final negative transfer as distinct from the initial positive transfer, due to 'carry over' of mental attitude.

An extensive investigation into the transfer of motor training is being carried out, under the auspices of the Industrial Fatigue Research Board, by J. N. Langdon and Edna M. Yates. Certain experimental conditions (such as adequate motivation of the learners, a skilled performance as the test-activity, the training of controlled subjects under comparable conditions, the simultaneous provision of analytic tests) being strictly observed, it is possible that the results will be of interest to psychology, industry, and sport.

University and Educational Intelligence.

CAMBRIDGE.—Mr. H. E. Woodward, Trinity College, has been appointed University lecturer in engineering. Dr. C. M. Yonge, Edinburgh, has been elected Balfour student. The Faculty Board of Mathematics proposes the restoral of the title 'Stokes Lecturer' to be attached to one of the University lectureships in mathematics.

The report of the Committee for Geodesy and Geodynamics gives the result of the pendulum observations made in July 1921 by Mr. G. Manley on Sabine Island. Helmert's value for g at sea-level at latitude $74^{\circ} 32' 19''$ N. is 982.849. Sabine's determination gave 982.785, while Manley's value is 982.888. The larger value of g is what would be expected at an island station, judging from other observations elsewhere. The pendulums used by Mr. Manley in Mr. Wordie's expedition to East Greenland are the same as those taken with the Scott expedition to the Antarctic. It is welcome news that the Ordnance Survey and the Geographical Section of the General Staff propose to co-operate in a gravity survey of Great Britain.

Research studentships are advertised at Pembroke College, the Stokes studentship in mathematical or experimental physics, physical chemistry or the study of physical laws in relation to living matter; at Clare College, the Denman Baynes studentship in mathematics, physics, or chemistry; and at Peterhouse, the Charles Abercrombie Smith studentship for research in any approved subject.

EDINBURGH.—As Munro Lecturer for the present year, Prof. G. Baldwin Brown is delivering a course of ten lectures during this term on "The Activities of Prehistoric Man in their Relation to the Origins of the Arts."

On June 6 and 7, Dr. H. H. Dale delivered the two Cameron prize lectures for this year, taking as his subjects "The Nature and Action of Insulin" and "Capillary Circulation and its Chemical Control."

Mr. Thomas Cowan, of Leith, has offered the University a sum of £40,000, the interest of which is to be used to meet administration and maintenance costs of the University hostel with which his name is to be associated through previous gifts to the University.

OXFORD.—Prof. A. M. Carr-Saunders of Magdalen College, professor of social science at the University of Liverpool, has been appointed Herbert Spencer Lecturer for 1928.

A RESEARCH fellowship of the value of £500 is being offered by the Australian Federation of University Women to women graduates of British universities, excluding those of Australia, Tasmania, and New Zealand. The fellowship is for research in biology, anthropology, geology, economics, or colonial history. Applications must be received by June 30, by the Secretary, British Federation of University Women, Crosby Hall, Cheyne Walk, S.W.3.

A LIMITED number of research scholarships in technology, each of the value of not more than £100, will be awarded by the Manchester College of Technology in July next. Research may be undertaken in any of the following departments:—mechanical engineering, electrical engineering, municipal and sanitary engineering, applied chemistry, textile industries, photographic technology, printing, and industrial administration. Forms of application, returnable by, at latest, July 6, may be obtained from the Registrar of the College.