by the medium or by the manager in conformity with a set of arbitrary rules laid down by generations of spiritualists for reasons into which we need not enter here. The séances are of the nature of performances at which the 'investigator' takes his place in a 'chain' of believers, who see that he does not violate the rules, which are framed in such a way that any real investigation is impeded. Can Dr. Tillyard tell us of any single medium who can produce some simple raps, under conditions which render their normal production impossible? He will doubtless reply by stating that 'supernormal' phenomena are subject to certain conditions and it is only under certain conditions that they occur. This appears reasonable, but Dr. Tillyard's experience is too slight for him to be able to recognise that the conditions are not "just exactly what the researchers choose to make them" (NATURE, September 11, 1926, p. 370), but what the medium plus his manager or employer have chosen to make them.

In this respect the cordial invitations which are so often extended to prominent persons are highly suggestive. It is now becoming a common thing when a new medium appears for his or her manager to invite scientific men in other spheres of work, journalists, actors, etc., to be present at the 'experiments.' Great care is taken to prevent the systematic attendance of critical psychical researchers and others with much experience of mediums, for these are not likely to be impressed by the trappings of a pseudo-investigation, and are also acquainted with those sources of error which, from their very nature, must remain unknown to the ordinary scientific worker, who has not specialised in this line of inquiry.

There is a good case for the scientific study of what are called supernormal phenomena. The difficulty lies in obtaining the opportunities for any such investigation under conditions satisfactory to those whose experience leads them to adopt a critical attitude towards the problems in dispute.

E. J. DINGWALL.

73 Corringham Road,
London, N.W.11.

The Egyptian Shadouf and the Rate of Human Work.

THE interesting paper by Drs. Haldane and Henderson in NATURE for August 28, p. 308, merits emphasis on two or three points. Above all, the mechanical beauty of the shadouf, in spite of its crude construction, deserves notice. It will be observed that trunnion bearings, which would wear and need lubrication, are replaced by almost frictionless hinges in the form of ropes. These ropes, in addition to their antifriction qualities as hinges, confer an important property on the system, namely, elasticity.

In short, the shadouf is a pendulum, and almost without doubt the men who work it move with it in its natural free period. If this is so, it would constitute a remarkable anticipation of recent developments in Germany, where many reciprocating machines have been constructed on resonance principles with marked gain in efficiency.

About the middle of last century, when most cranes and winches were operated by hand, it was necessary, for purposes of design, to have some standard of human activity. A widely accepted figure for such work was one-tenth of a horse-power or 3300 foot-pounds per minute. D. K. Clerk, a respected authority of that period, gave this rate as "the average net daily work of an ordinary labourer at a pump, a winch or a crane, for eight hours a day." "For shorter periods, from four to five times this rate may be exerted." Taking the rate given by Clerk for eight hours, we have 1,584,000 foot-pounds per day, in close agreement with the shadouf worker's 1,550,000 foot-pounds.

As to exteme rates of activity for short periods, comparisons are most difficult. Probably the highest rates are exhibited by professional wrestlers and strong men, whose feats are sometimes performed at a rate of the order of four horse-powers.

H. S. ROWELL,
Director of Research,
Research Association of British Motor and Allied Manufacturers.

Chiswick, W.4,
August 30.

THE figures of 4290 foot-pounds per min. for raising water, and 4230 foot-pounds per min. for raising earth, given by Dr. Haldane and Prof. Yandell Henderson in NATURE of August 28, as examples of the rate at which work can be kept up for lengthy periods, are confirmed by the common experience of hill climbers. A man of average weight, dressed in climbing kit, and carrying a load of, say, 15 or 20 lb., may be assumed to weigh about 180 lb. To walk uphill at the rate of 1250 feet per hour, at low or moderate altitudes, is quite ordinary; while 1500 feet per hour is generally considered as distinctly fast. Such figures would apply to persons in good training, and to ascents lasting for, say, 4 hours. The rate to correspond with 4200 foot-pounds per min. would be 1400 feet per hour.

It would be interesting to measure the rate of oxygen consumption of persons walking uphill for lengthy periods; for given rates of ascent and for various gradients; and to compare the results with figures obtained from the same individuals working an ergometer in a laboratory. The question of gradient cannot be entirely ignored. Clinometer measurements of Alpine paths indicate that the economic gradient is about 18°, or 1 in 3. It certainly lies between 16°, which is unnecessarily flat, and 20°, which is uncomfortably steep.

P. J. H. UNNA.

4 Dean's Yard,
London, S.W.1,
August 31.

Antagonistic Action of Electrolytes and Permeability of Membranes.

THE problem of the antagonistic action of electrolytes in biological systems has attracted attention for a long time, but a similar effect on inorganic colloidal systems has been investigated only in recent years. This study has, however, thrown considerable light on the mechanism of such antagonistic action, and we are now probably able to give a rational explanation on the basis of these physico-chemical investigations. About a decade ago Clowes (*Jour. Phys. Chem.*, **20**, 407, 1916) showed that a marked analogy exists between the transformation of an emulsion of oil-in-water into an emulsion of water-in-oil, or of blood plasma into a blood clot, or of a casein suspension into a casein clot. In all these cases salts of calcium promote and alkalis and salts of sodium inhibit the transformation of a system consisting of a non-aqueous phase dispersed in water into the reverse type of system, consisting of water more or less perfectly dispersed in a non-aqueous phase, and the ratio in which given electrolytes, say