REVIEWS

PSYCHICAL PHYSICS. By S. W. Tromp. Amsterdam and New York, Elsevier ; London, Cleaver-Hulme Press, 1949. xv, 534 pp. 6os.

O. E. Meinzer, introducing an important paper on water divining published in 1917 by the United States Geological Survey, doubted whether so much investigation and discussion has been bestowed on any other subject with such absolute lack of positive results. Professor Tromp, in this weighty tome on divining phenomena, expresses a similar view, and furthermore characterises the publications of most diviners as lacking in all scientific basis, often containing fantastically imaginative assertions concerning facts. But dowsers have upheld their belief for at least seven thousand years, and some of the facts claimed in more than a thousand publications on divining are considered by Tromp to be true. He argues that the basis required for the study of these facts is more important than the examination of the reality of all the alleged facts themselves, and he therefore undertook investigations into what seemed to be certain basic phenomena underlying divining. These researches were carried out in 1946 and 1947 in the physical and physiological laboratories of Leiden University, and in the laboratory of technical physics at

Delft. Professor Tromp defines divining phenomena with some generality as the group of the most complex physico-chemical phenomena occurring in the world surrounding living matter, and unconsciously perceptible by nearly everybody ; these phenomena are registered by the nervous system and are transformed by biological amplification into perceptible effects. Using this definition, and adopting the general viewpoint advanced in Professor Tromp's earlier book on Neomaterialism, practically all parapsychological phenomena are seen to be included in divining phenomena. The detailed considerations of Tromp, however, are restricted to dowsing with a rod and radiesthesia, although the distinction between these is not very clear.

Professor Tromp notes certain general difficulties which arise in this field. The great attraction of divining to some people is partly due to an unconscious desire to accept blindly any occult method. Many diviners are obviously charlatans. For practical geophysical prospecting, Tromp (speaking with the authority of a Professor of Geology) states that occult methods are useless, and he recommends dowsers to realise this fact. The honest dowser tends to be offended when his results are doubted, but suggestion can play an enormous role in these extremely subtle observations, and one cannot be critical enough when no instrument can be used in the place of the human body. It is clear that all these factors noted by Tromp seriously complicate experiments with dowsers under field conditions, when even the physical and geological variables are often not well defined. The combination of objective and subjective factors would seem to be such as to facilitate the growth of chimerical theoretical structures on largely erroneous experimental foundations. Professor Tromp has avoided these difficulties by isolating under proper laboratory conditions certain well-defined physical stimuli which he found to produce dowsing reflexes ; this approach clearly minimises all disturbing factors except that of suggestion, which was carefully guarded against. The scientific value of the investigations is at the same time increased as these stimuli are identified and simplified, and it is enhanced still further by the precise experimental details given by Tromp and the apparently repeatable nature of his experiments. In these respects the work is in striking contrast to most publications in this field.

Four main basic investigations with dowsers and divining-rods were made. A blindfolded dowser holding a loop-shaped rod could detect a sudden change in a magnetic field of o.ooi oersted, or a magnetic gradient of o.ooi oersted/cm. In a second investigation the change in skin potential of a moving dowser was registered with an Einthoven string galvanometer connected to

electrodes on the two wrists of the dowser. A loop-shaped rod was used, which could rotate freely in two special insulated grips held by the dowser. The loop was connected to one of the electrodes on the dowser's wrist. In these experiments the rod did not turn because of the special grips, but when the dowser entered a dowsing zone, where a normal rod would turn, a change of skin potential, which could amount to 20 mV., was observed. The mere walking of the dowser did not change the level of the Q-peaks in the electro-cardiograms. Similar but less pronounced phenomena were observed with non-dowsers. In a third investigation, local dowsing reactions in houses were related in a striking manner to local magnetic anomalies. In a fourth investigation, small electrostatic charges brought to a divining rod caused a muscular contraction and turning of the rod if the body of the dowser was insulated. The presence of electrostatically charged bodies could also be registered without contact. A weak current through the diviner also produced a reaction. All these experiments are described in detail. To provide a basis for theoretical discussion, the book has a general descriptive section of nearly three hundred pages on the inter-relation of electromagnetic fields and living organisms, and reviews the work of many other investigators of divining, giving about seven hundred references to this topic.

Professor Tromp's summary of the different stimulating forces which, from a theoretical viewpoint, might cause dowsing reactions, reveals a complex picture. The sensitivity of dowsers to electrical stimulation requires a consideration in dowsing experiments of the electrical conductivity and potential gradient in the atmosphere, the conductivity of the soil, earth currents, the electric field of man arising from skin potentials, friction potentials, action currents, brain potentials, and many other phenomena, and perhaps the electric potentials in plants and animals. The sensitivity of dowsers to magnetic gradients requires a consideration of local magnetic anomalies, magnetic variations, and magnetic storms. It may also be necessary to consider, according to Tromp, stimulation by sunlight, ultra-violet light, infra-red rays, cosmic rays, X-rays, acoustic waves, supersonic waves, volatile substances acting on the olfactory cells, and action on the taste cells. Only the electromagnetic, acoustic, and volatile stimulants seem large enough to create a direct excitation of nerve endings in the arm sufficient to stimulate the motor nerves of the arm muscles. A latent period is, however, observed in some experiments between excitation and the appearance of any observable result ; the stimulus is therefore considered to be conducted through the thalamus to the different sensorial areas of the cortex. Thus the

main effects of importance for divining above inanimate objects are changes in the dowser's skin potential, changes in atmospheric electrical conditions, variations in the magnetic field of the earth, changes in electromagnetic radiation, and changes in the electrical potential of the dowser's arm due to curvature of equipotential lines in the atmosphere or approach of the dowswer to an earthed object. The sensitivity of a dowser may be so great, according to Tromp's experiments, that reactions observed over a person lying on a bed still persist above the bed after the person has left it for hours or even days. This effect is stated to vanish if the bed is earthed sufficiently.

The validity of this picture depends largely on Tromp's basic investigations, which at present do not seem to have been adequately confirmed by other workers. Tromp lists twelve of the main disturbing factors which can cause error in dowsing experiments, such as varying contact between the rod and the palm, leakage of electric charge from the body, variations in speed of the dowser, and in his direction with respect to a zone of disturbance, fatigue phenomena, and varying sensitivity of the reception centre. A great many precautions must be taken in dowsing experiments to minimise all these disturbances. Tromp states various precautions, and recommends the construction of a map showing equi-rhabdomantic lines connecting points where the direction and rate of turning of the divining-rod are the same. The interpretation of this map will present further difficulties. It is clear that one would hardly expect any simple relation between rod reactions and the presence of underground water if a dowser is sensitive to all the stimulants and disturbances enumerated by Professor Tromp. Indeed, nearly all investigations of dowsers under reasonably well-defined conditions have failed to reveal such a relation. If, however, the various complications can be so reduced that the map of equi-rhabdomantic lines corresponds to that of isodynamic lines, which would seem possible from Tromp's experiments, particularly those correlating dowsing reactions with magnetic anomalies, one might expect the greatest success of diviners to be in finding highly magnetic ores such as magnetite and pyrrhotite near to the earth's surface, and divining should be successful with many of the deposits in Sweden. A great many corrections are known to be necessary before the data of a magnetic survey can be computed ; Tromp therefore dismisses as unscientific the claims of many dowsers to determine the depth of an ore body by one simple reaction of a rod, and remarks that a great many failures occur in such experiments.

One of the reasons for the possession of dowsing ability is stated to be a low skin resistance. Some dowsers often have a value less

than 50,000 ohms, whereas non-sensitive people have values of 500,000 to 3,000,000 ohms. A number of non-sensitive people could be made sensitive for a short period by washing the palm of their hands with an electrolyte. Thus the findings of Professor Tromp appear to indicate a general effect of magnetic fields on muscular contraction. He summarises a number of experiments by other workers on the effects of magnetic fields on biological systems ; usually, however, the effects appeared with rather large magnetic fields, often over 1000 oersted, whereas Tromp obtained his reactions with very small fields. He suggests that small magnetic forces acting for long periods can create deformations similar to those produced by large fields in a short time, and describes some experiments on the growth of mice in a weak magnetic field, which, although far from conclusive, suggest that the field hampers the development of white mice under normal conditions of temperature (for Holland), but has an opposite effect at higher temperatures. Tromp also describes experiments on the influence of magnetic fields and electric charges on the deviation of a pendulum swinging from the hand of a person. Many writers on radiesthesia have assumed that these deviations indicate the presence of new radiations, but no clear evidence for any of these radiations seem to have been advanced. Tromp considers that all the external forces which can influence the divining-rod also affect the pendulum oscillations, but the pendulum is an even more sensitive detector.

Other sections of the book outline the general background of knowledge useful in comprehending Tromp's theories, including interesting accounts of hypnotism, the directional sensitivity of animals, and a brief note on psychical physics, which enumerates some problems worthy of study in the borderland between chemical biphysics and psychical research, and ends with a plea for co-ordinated work by scientists on these topics.

Several incidental suggestions may be noted. Many of the phenomena observed with physical mediums, such as the appearance of lights and the movement of light bodies, may be simply electrical in origin. Experiments by Oppenheim and Koopman on the production of such effects are described. In connection with the stigmata of wounds sometimes observed, an experiment of Gamgee is mentioned, in which he prepared by electrolysis a colloidal form of oxy-haemoglobin which could traverse normally impervious animal membranes.

Whether further work will confirm or contradict the original findings of Professor Tromp remains to be seen ; but whatever finally emerges, Professor Tromp has made important advances in concentrating his experiments, on the whole, on simple and

well-defined systems (by the standards of this field of work) and he has given sufficient description of method and details of numerical results to enable any competent worker to repeat the experiments without employing particularly gifted paranormal persons.
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