of the business—the science of forestry has as yet made great strides. A beginning has been made, but forestry cannot hope to take its real place in the economy of the nation or of the Empire as a whole until the public has become educated and has accepted its aims and objects, alike from the economic and amenity points of view.

E. P. STEBBING.

Science and Psychical Research.

The History of Spiritualism. By Sir Arthur Conan Doyle. In 2 vols. Vol. 1. Pp. xiii+342+8 plates. Vol. 2. Pp. vii+342+8 plates. (London, New York, Toronto and Melbourne: Cassell and Co., Ltd., 1926.) 42*s.* net.

THE recent publication of two large volumes entitled "The History of Spiritualism" by Sir Arthur Conan Doyle is perhaps a suitable occasion on which men of science may once again turn their thoughts in a direction in which many more of them are probably interested than would be willing to admit it. Spiritualism is a cult, a faith, or perhaps even a full-blown religion, the central tenet of which is sufficiently well stated by Sir Arthur (vol. 2, p. 263) in the following words:

"A belief in the existence and life of the spirit apart from and independent of the material organism, and in the reality and value of intelligent intercourse between spirits embodied and spirits discarnate."

Spiritualism as a religion does not come within the confines of the subjects which a scientific periodical like NATURE may appropriately discuss. But right through the warp of Sir Arthur's book, though by no means carefully distinguished, and most certainly very unscientifically handled, runs the woof of psychical research, which is, or at any rate purports to be, the *scientific* study of what are called *supernormal phenomena*. These phenomena are of two kinds—(*a*) *physical*, such as telekinesis, or movement of solid objects without contact; independent voice, or the production of sound recognisable as that of the human voice and recordable objectively on a dictaphone; the formation of the substance known as ectoplasm or teleplasm; psychic lights and cold breezes; formation of structures invisible except by the reflection of ultra-violet rays; and so on: (*b*) *mental*, such as clairvoyance, clair-audience, automatic script, telepathy and other similar types of phenomena not involving the use of material objects.

Many years ago, when this question of psychical research was brought to his notice, Huxley replied, "Supposing these phenomena to be genuine, they do not interest me." We are sorry to be obliged to have to record so unscientific a remark from so great a man, and even sorrier to have to admit that Huxley's attitude is still that of the great majority of biologists at the present day. The opinion of any man, however great, or of any body of men, however influential, on a subject which they deliberately refuse to investigate, either because it "does not interest" them, or because of a preconceived idea that the phenomena involved are necessarily fraudulent, is really not worth much. It is a sad commentary on human nature that, even at the present day, when the reality of some at least of these phenomena has surely been put beyond the shadow of a doubt by the work of such men as Lodge and Richet, no scientific man can take up the study of psychical research without 'losing caste' and undergoing either secret or more or less open persecution from his fellows. Truly, we have not got very far from the Middle Ages after all, and there is a very real danger that organised science in the twentieth century is taking its seat in the very chair from which it once drove the medieval church. "E pur si muove" applies equally to the movement of the earth round the sun or to the movement of a levitated table upwards against gravity without visible support. The former was no more incomprehensible and no less anathema to the medieval church than the latter is to-day to organised science. But the spirit of to-day is different from that of the past, and martyrdom no longer wins many converts. Modern Galileos may undergo persecution for what they hold to be the truth, but the modern world will soon forget them in the hurry and rush of modern life, and the truths for which they suffer will perish with them unless they can be presented in such a form as to appeal to the reason of mankind.

It is just here that a great danger lies. The history of the world is full of evolutionary failures; for every organism, Nature selects a path from which there is no turning back. The advance of science during the past seventy years has been definitely along the road to materialism. Though the pace has somewhat slackened and many an anxious glance is now being turned backwards, yet the impetus is still driving us forward mainly in the same direction. For hundreds of years mankind looked to religion to lead them along the right path. Now, in the western world, their gaze is fixed on science. It is certain that, for the next hundred years at any rate, where science leads, there mankind will follow. Are we, the men of science, the leaders of mankind, so absolutely sure of the path along which we are travelling?

Pilate's question "What is Truth?" has never yet been answered, and perhaps it never will be. It is, however, the duty of science to search diligently for truth and to leave no avenue unexplored in which it may be found. The broad highway may lead us to

destruction, even if it appears well marked out and easy to travel upon. The neglected side-path, foul with mire and overgrown with noxious weeds, may be the real entry into the Promised Land, for which we are searching. But because of the foul mire, and because of the noxious weeds, organised science refuses to explore this side-path, in spite of the fact that a few brave spirits, more adventurous than the rest, a Crookes, a Lodge, a Richet, have penetrated into the thicket and returned to report both progress and promise.

The present writer cannot claim the experience either of a Lodge or a Richet in the study of psychical research. His interest in the subject is one of comparatively recent growth and arises chiefly from dissatisfaction with the adequacy of present-day biological theories to explain life in acceptable terms. He can, however, claim sufficient experience to be able to say, with both Lodge and Richet, that a clear case has been made out for psychical research, and that it is the duty of science to recognise the genuineness of the phenomena and to attempt to explore them. Fraud exists, and always has existed, in all branches of human affairs. It is even blatantly active in biology, to judge by the remarks passed quite recently by leading British and American biologists on the work and character of a certain Austrian professor. Let fraud and cheating be exposed, certainly, wherever it exists; but is that any reason for refusing to accept as a recognisable branch of science any subject in which fraud has been found?

It appears to the writer that the best avenue of approach for men of science to make on this subject is the study of the so-called physical phenomena. Either these are entirely fraudulent (that is, due to conscious or subconscious cheating on the part of the medium), or else they extend the realm of physics beyond the boundaries explored at present. Take, for example, one of the simplest and most easily experienced of the physical phenomena, that of *cold breezes*, which generally precede any manifestation of greater energy in a séance. It has been maintained that this effect is purely subjective, that the sitters imagine they feel the cold owing to the tense situation created in the mental atmosphere of the séance room. In the National Laboratory of Psychical Research, two very accurate thermographs have recently been installed. One of these is placed against the wall of the room, far from the sitters, while the other records the changes which occur in the temperature of the closed cage of the Pugh table in which phenomena occur during sittings with the medium Stella C. in red light.

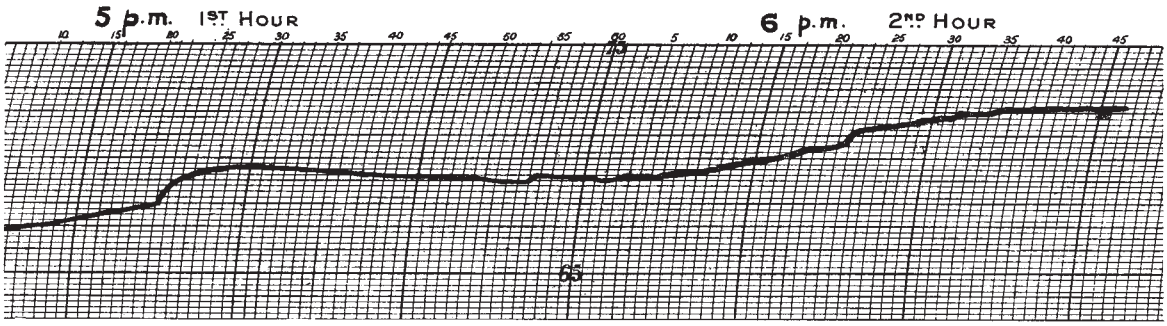

FIG. 1.—Thermograph record inside Pugh table. Temperature at 5.10 P.M., before beginning of séance, 67° F. Red light throughout.

5.23 P.M. Stella goes into trance. Marked rise in temp.
5.30 to 5.55 P.M. Steady fall in temp.
5.55 P.M. Electric bell with contact inside closed cage was rung vigorously four times within a minute or two. Note irregularity in thermograph record.
6.24 P.M. Bright light flashed inside cabinet.
6.29 P.M. Zither pushed partly out of opening in Pugh table.
6.33 P.M. Two very fine blue flashes inside Pugh table.
6.42 P.M. Stella comes out of trance.

Note.—Cold breezes preceded each of these phenomena. Other phenomena were also recorded at 5.39, 5.42, 5.48, 5.51, 5.58, 6.01, 6.05, 6.07, 6.10, 6.16, and 6.18 without any sudden variation of thermograph record.

The control thermograph record taken separately on the wall of séance room, about 10 feet from the medium, showed a steady rise in temperature without any marked changes in gradation from 67° F. at 5.10 P.M. up to 69·5° F. at end of séance.

Normally, when a number of people sit in a closed room, the temperature mounts steadily upwards; this is also the case for the temperature of the séance room as recorded on the wall during a sitting. But the record of the temperature inside the Pugh table shows a steady rise at first, followed by a fall during the production of supernormal phenomena, as in the accompanying record (Fig. 1); there are also several marked sudden changes at points where special phenomena occurred. These careful experiments prove the objective nature of the cold breezes and present us with a purely physical problem, which is surely worth solving. It is not an extravagant hypothesis which finds an explanation for the production of 'supernormal' physical phenomena in the withdrawal of heat from the circle of sitters, such heat being turned into some other form of energy, possibly of a kind not yet investigated officially by science!

The so-called 'physical' phenomena of mediumship

should be of interest to biologists as well as to physicists, because, if they are genuine, they offer an avenue towards the study of the control and manipulation of matter by mind which is at present unique in its character. The invisible operators who apparently control the more striking phenomena of mediumship claim that they are able to draw out from the organism of the medium 'psychic stuff,' by the moulding of which they can produce at will the phenomena of independent voice, levitation, materialisations of portions of their personalities, and so on. We who have seen these things done under conditions precluding deliberate fraud are not fools, but in full possession of keen faculties. Every man who witnesses these phenomena and becomes convinced of their reality has only two choices before him. He can, as numbers have done, keep quiet and say nothing about it, thereby preserving the respect of his fellow-scientists and committing the sin against the Holy Ghost, namely, turning his back on truth when he has recognised it; or he can, like Sir Oliver Lodge, speak out the truth boldly and allow his reputation to drop in the estimate of his fellow-men. The writer ranges himself alongside Sir Oliver, well knowing what is in store for him in consequence. This article is a plea for a wider and more generous outlook on the part of science towards these phenomena. Science has nothing to fear from fraud; it need only go on applying its experimental method to any problem, and a solution will shape itself in time, either in the form of an overwhelming proof of the fraudulent production of the phenomena, or pointing towards the existence of genuine supernormal results.

The mind of man seems to have reached out so far in recent years that it has almost succeeded in exploring the entire limits of its own cage. Is it to rest in the belief that there is nothing at all outside that cage, or may it, so to speak, extend a cautious paw outside the bars and begin to feel its way towards a realisation that there may be another world outside? Psychical research may perhaps afford the only possible way of exploring the unknown territory outside the cage.

R. J. TILLYARD.

Civil Aviation in the United States.

Civil Aviation: a Report by the Joint Committee on Civil Aviation of the U.S. Department of Commerce and the American Engineering Council. Pp. xvii + 189. (New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd., 1926.) 12*s.* 6*d.* net.

IN Europe rapid developments have been made in the application of aircraft to commercial uses. In the United States, however, air transportation, in spite of many conditions naturally favourable, has not achieved a development commensurate to the opportunities.

The Department of Commerce and the American Engineering Council, recognising this deficiency, have for some time past gathered information relating to this matter. A joint committee was formed in June 1925, to make a comprehensive survey of the economic aspects of aviation throughout the world, and to recommend the measures necessary to encourage a national development of commercial aviation in the United States. All available sources of information on this subject have been examined by the committee, including the attitude of American business interests and the experience of aircraft operators.

In the report before us, which here deals comprehensively with the situation, the committee lays down first and foremost the development of the commercial side of aircraft as of vital importance both to industry and to national defence. Whilst stressing the fact that development must mainly depend on private initiative and enterprise, the committee maintains that provision of facilities essential to this development is a public responsibility, and, if these facilities are provided, direct subsidies to civil aviation in the form of money grants are both unwise and unnecessary.

Certain fundamental difficulties, the committee maintains, are retarding the development of this venture in the United States. Broadly speaking, they are intimately associated with the lack of an established Government policy to encourage civil and industrial uses of aircraft; with the lack of commercial aircraft and equipment best adapted to commercial operation; and with the consequent want of public and business confidence and support.

After due consideration of the large part played by the commercial department and by big businesses in this field, the committee recommends a number of far-reaching proposals which, if adopted, would undoubtedly make a ground-work for a vast new development eminently suited to the geography of the United States. It is proposed that Congress should enact a civil aeronautic law providing for the establishment of a Bureau of Civil Aeronautics in the Department of Commerce; that is to say, it is to be completely dissociated from the military or naval wing. It would be the function of this bureau, among other duties, to regulate civil air navigation, license pilots, and inspect machines; to develop, establish, and take over air routes and facilities, and generally to encourage and promote the aircraft industry on the civil side.

The committee, moreover, recommends that the several States should authorise their municipalities to acquire landing fields out of public funds and to lease them when necessary. Great stress is laid on the fact