for our knowledge of which we are mainly indebted to the author's powers of observation. These powers are so rarely at fault that it seems almost ungracious to indicate the only instance in which he appears to have been led into misapprehension; there is one passage in which what, from his succinct description, was obviously a silk-cotton tree has been confused with that—from a phytogeographical point of view—extremely interesting species, the tulip-tree of China. The book is admirably printed, and in its 600 or so pages we have noticed but one typographical error.

THE TELEPHONE IN SURGERY.

IN the *Lancet* of January 30 is published an address by Sir James Mackenzie Davidson, delivered before the Medical Society of London, on the telephone attachment in surgery. By this phrase the author refers to the attachment of a telephone receiver to a probe, or lancet, or other metallic instrument used by a surgeon when exploring a wound containing a bullet or other piece of extraneous metallic matter, in such a way that the sound heard in the telephone when the probe comes into contact with the bullet enables the surgeon to make certain of the position of the bullet in the wound.

As this matter appears to be of real importance at the moment to surgeons in the field hospitals of our armies abroad, we make no apologies for giving our readers a summary of the more salient features of Sir Mackenzie Davidson's address. His attention was first directed to the use of the telephone as an auxiliary in surgery thirty-two years ago, by the accounts of the attempts made by Graham Bell, to determine, by means of the induction balance, the position of the bullet in the body of President Garfield when he was assassinated in 1881. Speaking afterwards of these attempts, and of the difficulties attending the method—which had failed in that notable case to yield satisfactory indications—Graham Bell outlined another and simpler electrical method for the detection of bullets, as follows:—

> It consists of a telephone, to one terminal of which a fine needle is fixed, and to the other a plate of metal of the same nature as the needle. The plate is placed on the limb to be examined, and the needle is thrust in where the bullet is believed to be; and when it strikes the ball a galvanic battery is formed within the body. . . . *This will cause a click to be heard in the telephone each time the bullet is struck.* This is a far simpler apparatus than the induction balance, and one far more easily procured.

This method Sir Mackenzie Davidson tried in 1887 at the Aberdeen Royal Infirmary, in the case of a patient suffering from a revolver shot, using a silver probe joined by a wire to one terminal, and a silver plate, about 6 inches long and 4 inches wide, connected by wire to the other terminal of a telephone receiver. In subsequent years he employed the same method to verify the results of early X-ray localisations, and it enabled surgeons in the South African War to differentiate, as the common probe could not do, between a distorted and broken up Mauser bullet and a fragment of bone. Sir Mackenzie Davidson states that until quite recently he took it for granted that the same metal must be used—as Graham Bell stated—for the probing instrument and for the plate placed upon the patient's skin. But since the outbreak of the present war the difficulty experienced by skilful surgeons in finding bullets in wounds, even after the most precise localisation by means of X-rays, has caused him to experiment further, and to extend the method. Briefly, he finds, as the result of experimenting on different pairs of metals, that there is nothing so satisfactory as a plate of carbon, such as is used in an ordinary bichromate cell, to place upon the moistened skin of the patient as the auxiliary pole. The surgeon's metallic instruments are usually of steel, often silver-plated or nickel-plated. The metals to be sought for are lead, iron (and iron alloys), copper, and nickel. Carbon presents a sufficiently wide difference in its galvanic properties from any of these to render it suitable. The result is enhanced if the solution used to moisten the skin beneath the plate is the solution of iodine employed as a disinfecting agent, since iodine is also an excellent depolariser. A low-resistance telephone is better adapted than the more expensive high-resistance receivers used in wireless telegraphy, giving louder sounds besides being cheaper.

The form of telephone recommended is one with double receivers fixed to a flexible steel hoop that is placed on the head, so that each ear listens to its own receiver, and is protected from extraneous sounds. The operating surgeon places the auxiliary carbon plate upon the patient's moistened skin at some convenient spot near the place where the foreign object is supposed to be situated, and it may be held tightly against the skin by bandage or plaster. If a bare wire of silver is used as probe, it should, of course, be properly disinfected. Or the wire may be wound round an ordinary probe or needle or forceps which is used, or a spring clip may be employed to connect the instrument to the wire connected to the telephone. No battery of any kind is needed, owing to the galvanic action between the carbon-plate and the metal of the bullet. If, under these conditions, the instrument is introduced into the body of the patient, it will on the first contact with the bullet or other metallic body cause a most unmistakable click; while if the probe or scalpel is gently moved along the foreign body so as to make rubbing contact along it, an equally unmistakable rattling sound will be heard. Several examples of successful application, showing the advantages gained by the use of this method, are given by Sir Mackenzie, who states it to be his belief "that the time will come when no surgeon will attempt to remove a deeply embedded metallic body without having this telephone attachment at his command." He makes out an exceedingly good case for this application of the telephone to surgery.

The author's experience and ingenuity in applying X-ray methods to localise the position of foreign bodies are so well known that when he comes forward with improved methods of electric probing, which have the distinguishing merit of the utmost simplicity, we may be sure they will find immediate and extensive application.

GEODETIC SCIENCE.

NO. 3 of the new series of professional papers of the Ordnance Survey contains some excellent notes on the geodesy of the British Isles, by Colonel Close, R.E., which bring the position of geodetic achievement fairly up to date, and incidentally add some historical indications of the processes by means of which our position in the world of geodetic science has been secured. Their usefulness has been increased by the addition of a very ample bibliography of the science, and by simple diagrams illustrating certain special features affecting geodetic levelling, including the principal triangulation of Great Britain, the geographical position of the West European meridional arc, and of the European longitudinal arc. In the section of the pamphlet dealing with standard measurement it is interesting to observe that the national standard yard, which was legalised in 1855, consists of a marked length on a bronze bar bearing a definite relationship to the "international" metre (also a measured length on a bar), which was originally intended to represent one ten-millionth of the length of the earth's meridional quadrant.

Colonel Close's sketch of the various operations undertaken to determine the figure of the earth, dating from Airy's investigations of 1830 to Helmert's determination of 1906, proves incidentally the extraordinary value of the early investigations undertaken with inferior instruments. On Airy's figure the whole of the mapping of the United Kingdom still depends, nor have the results deduced from the reduction of the principal triangulation affected the map values. In the length of 700 miles from Shanklin to the extreme north of the Shetlands Airy's figure gives about four seconds in latitude too much, if we accept Helmert's figure as the criterion. This does not affect the linear accuracy of the map. Three figures were computed by Colonel Clarke (in 1858, 1866, and 1880 respectively) from the data furnished by the reduction of the principal triangulation. They are all in use, either in Africa or America. The mean value in length determined by Clarke of the semi-axis major of the ellipse, the revolution of which about its minor axis produces the spheroid of the earth's surface, is less than that of Airy and only slightly greater than that of Helmert. Colonel Close records his opinion that the probable value is somewhat greater than Clarke's mean.

Many people must have noticed the apparently haphazard way of recording "bench" marks by the Ordnance Survey to indicate altitudes determined by levelling. They are to be found on most unsubstantial walls, on milestones, and even on gate-posts, and they must, many of them, inevitably be unstable. In the section of the pamphlet dealing with levelling, Colonel Close indicates the method by which, in future, such marks will be rendered permanent. Concrete blocks will be sunk on to hard rock foundations at intervals of about twenty-five miles all over the country; a bolt of bronze, with a knob of flint being embedded in the concrete. This section is also of interest as a record of the difficulties experienced in dealing with the adopted datum of mean sea-level. Indian survey investigations have contributed largely to the solution of this troublesome problem. It is in India, too, under Colonel Sir S. Burrard, that the most comprehensive investigations have been made in the matter of the deflection of the level, and the apparent eccentricities of the force of gravity, including the difficult problems which beset the speculative subject of isostasy; but Colonel Close's references to early English methods of determining the value of deflection due to local topography are extremely interesting as a record of the first steps taken in the evolution of this special branch of geodetic science. These plain and intelligible notes on a highly complicated subject, being entirely free from any affectation of technical specialism, should attract a much wider range of scientific interest than is indicated by the title of Ordnance Survey Professional Papers. T. H. HOLDICH.

SCIENTIFIC FACTORS OF INDUSTRIAL SUCCESS.

THE Institute of Industry and Commerce (now the Institute of Industry and Science), so the introductory leaflet states, is a counterpart of a German organisation known as the *Hansa Bund*. How the Hansa Bund arose or by whom and when it originated we have no knowledge. It is a confederation of important German firms for promoting, encouraging, and facilitating German home and foreign trade. It is proposed by similar means, but on somewhat "superior lines," to do the same for British industry, and the directors invite those interested in the development of our industries by the aid of science to enrol themselves as members. A portion of the revenue of each year is to be devoted to scientific research under the supervision of our most eminent men of science. Accompanying this leaflet are a number of brochures touching on the causes and effects of German commercial success and on the remedies for British commercial decline.

If "in the multitude of counsellors there is safety," in the diversity of their opinions there may also arise confusion. Sir W. Ramsay conceives that the main purpose of the Institute is to combat German industrial methods, which are said to be organised on a policy of dishonesty and trickery. This is to be undertaken by the State by adopting something of their methods, or by endeavouring to thwart them. Mr. S. Roy Illingworth, in his pamphet on "The Organisation