phate of sodium, and left the aluminium fluoride ready to be reduced. The advantages of this process were that all the materials were treated at a comparatively low temperature. The vessel in which the aluminium fluoride was heated, as well as the vessel in which the re-action took place, was lined with cryolite, so that there was no danger of impurities being imported into the aluminium which was the result of the process. The low temperature was very much easier managed than the high temperatures of which Mr. Anderson had spoken.

On the chairman asking what temperature was necessary, Mr. Siemens replied about 900° (Celsius), just above a dull red. The process, of course, required the action of sodium, and the inventor was engaged in experimenting upon a new process to prepare this; but, as the necessary patents had not yet been taken, he was not at liberty to describe it in detail. At a short distance from Hanover the factory was at work producing aluminium on a commercial scale, though it was not on the magnificent scale of Mr. Castner's; but the process was extremely simple, and the extremely clever way in which the by-products were used promised exceedingly well for the process.

Mr. W. Boby said it appeared from the tables that 263 pounds of coal were used to produce 1 pound of aluminium; and this, to his mind, seemed a very formidable figure. He was himself connected with a rival process for manufacturing aluminium, which was in practical work, by the use of the electric furnace. This process did not produce pure aluminium; but one of the great and important uses of aluminium was as an alloy. If you got a pure aluminium, it was an extremely light metal, and it was very difficult to alloy it with iron. In the Cowles process the aluminium was produced in the furnace, and it was alloyed with iron, and came out in the proportion of 12 or 16 per cent of aluminium to the entire mass of the product. The aluminium in the alloy may be considered pure, as we know the other constituents. It was reduced from a hard white clay known as bauxite. The interior of the furnace was 5 feet long and 2 feet deep. They had a dynamo, which gave a current at 60 volts of 5,000 ampères, and it was conveyed through the furnace by means of carbon electrodes. The charge of bauxite and broken iron was put into the furnace, which was luted with charcoal to resist the heat, the current was turned on, and in an hour and a half they tapped the furnace and got out the charge of alloy. In the mean time the bauxite had become reduced from the intense heat in the furnace. There was a certain admixture of carbon in the charge, which formed a resistance to the current, and enabled it to diffuse heat through the charge. About 200 pounds of aluminium were produced per day. In answer to the chairman's question as to the percentage of the silicon which the alloy of iron contains, he could not tell the exact percentage, but he knew it was not a large one. In the copper alloy, in making 10 per cent bronze, the percentage was about .5.

Mr. Oliver J. Williams asked whether Mr. Anderson knew any thing of Brin's aluminium process, which he understood produced aluminium alloy from clay at a very small cost.

Mr. Anderson, in reply to Mr. Riley, said that wrought iron had been cast into large ingots, and the Germans had a cast-wrought iron; but it was new to him to hear that small and delicate castings, such as those exhibited, had been made without the use of aluminium. He did not think it could be done. Bauxite was a species of clay, and they had to pick out a material which had the greatest purity. If you could get it at a reasonable price, it was better to use a pure material than one which was impure, and have to get out the impurities afterwards. In steel a fractional percentage of carbon made a wide difference in the quality. He was not surprised, therefore, to find that aluminium would produce wonderful effects in the quality of the casting, and yet be scarcely distinguishable in the product. He was sorry to hear from Mr. Jeans that aluminium was not likely to be used very extensively in steel castings, and thought he was mistaken in this respect.

Mr. Jeans said what he meant to say was that the quantity of steel castings made in England up to the present time was so small, that the quantity of aluminium to be used would be comparatively small, at any rate until the production of castings had extended.

Mr. Anderson said that the production of steel castings was increasing immensely every day. Aluminium would be used for the following reason: that when one made a bad steel casting it was a desperate job to get rid of it. It was very important to be sure that the castings made were sound; and, when aluminium could be obtained pure, it would come very much into use. It was no use making impure aluminium. It was quite possible, with a little extra expense, to get aluminium containing only one per cent of impurity. French aluminium had had the pre-eminence in this respect up to the present, but the purity of the French material had not exceeded 98 per cent. If aluminium could be got at 99 per cent of purity, or even a little above this, it would be an invaluable material for the manufacture of fine wire for making into braid, as it did not tarnish. The process referred to by Mr. Siemens was a very interesting one, and the only objection to it was the use of cryolite. The Aluminium Company were doing their best to get rid of the use of cryolite.

Mr. Siemens said the cryolite was a by-product of the raw product; it was made from the sulphate of aluminium.

Mr. Anderson thought that any process which would produce the metal on a large scale, and cheaply, would be a great advantage. He was not aware that any aluminium was made of a greater purity than 98 per cent, or at a lower price than 40 shillings per pound. His paper had nothing to do with the electrical process for making aluminium alloy.

BOOK-REVIEWS.

Suggestive Therapeutics: a Treatise on the Nature and Uses of Hypnotism. By H. BERNHEIM, M.D. Tr. by Christian A. Herter, M.D. New York and London, Putnam. 8°. $3.50.

HYPNOTISM is no longer a novelty. Its long apprenticeship among the charlatans has been served; the ill name it gained during the days when pretension took the place of proof has been outlived; its apparent contradiction to the recognized laws of physiology has been minimized, if not removed. It holds a recognized place as a psychological method, as an extension of the domain of medicine, as a most promising field of scientific psychological advance. However interesting would be the history of the steps by which this favorable change of aspect has been accomplished, it must for the present be dismissed with the remark that it was in France that the movement grew and prospered, and it is to French scientists that most of our knowledge is due. The object of Dr. Bernheim's work is to give an exposition of the present appearance of the topic, especially with reference to its application to practical medicine.

At the risk of repeating what is well known, it must be prefaced that students of hypnotism are divided into two camps, — the school of Paris, of which Dr. Charcot is the leader; and the school of Nancy, represented by Dr. Bernheim. The former recognize three stages of hypnotism marked by constant physiological characteristics, transition from the one to the other of which is obtained by physical means; they believe, too, in the action of the magnet upon hypnotic patients, regard the appearances in hysteria as typical of hypnotism, and in part lay claim to such abnormal effects as the action of drugs at a distance. The school of Nancy may be characterized as "suggestionists," for this is the keynote of their view. They regard the phenomena as psychical in origin, recognizing no physical effects except as they act upon the mind; and they see differences of degree in the various stages of hypnosis, but no sharp distinctions of kind; furthermore, they assimilate the appearances to natural sleep, repudiating all claims to supernatural effects.

In this work of Professor Bernheim's we have the best exposition of the Nancy school, — a view, it should be added, that is daily gaining ground, and has received the sanction of almost all the German, Swiss, and Italian investigators, who have critically examined both views. No work is better suited for translation into English; and, with the translation of Binet and Féré's "Animal Magnetism," the English reader is favorably situated for gaining a clear insight into this enticing study. The arrangement of the book is capable of improvement. After explaining the modes of producing the state, the various degrees of its intensity, the *rôle* of

memory in the process, a chapter is devoted to a rather miscellaneous description of the appearances in a typical subject. The relation of these facts to the influence of mind over body is next ably discussed, and this is followed by a study of suggestion in the waking state. Here the exposition is interrupted by a controversial chapter, and the course of thought again changed to afford room for a brief historical sketch. Theoretical considerations conclude the first portion of the work. Part II. consists of a careful analysis of over one hundred cases in which the curative effects of suggestion were illustrated, with some account of the nature of the action in such cases. These cases are derived from the most various types of disease, and prove, that, in the hands of a careful expert, this means of betterment and cure is most valuable. Instead of filling out the skeleton plan of the work just given, it may be more serviceable to the prospective reader to illustrate the chief results of this laborious study.

The hypnotic condition is found to be only a somewhat extreme case of natural sleep. Every night we place ourselves in an accustomed attitude, seek a monotonous course of ideas, and will to go to sleep. It is auto-hypnosis. In artificial hypnotism the sleeper remains subject to the control of an operator, because that is the dominating idea in going to sleep. From this it follows that no one can be hypnotized totally against his will: the patient must have some notion that something unusual is to happen. Time and again has an operator, unknown to the subject, willed the latter to sleep, but to no purpose. Just as in sleep the will is subdued but not extinguished, so in hypnotism the patient is not totally in the hands of the operator. An act shocking to the moral susceptibilities must be insisted upon, and repeatedly, before it is executed. Nor is the individuality of the subject lost. His past attainments are all that can be drawn upon: no new power is developed, but the hidden recesses of the unconscious are ransacked.

A distinctive point is the memory the subject retains of what was done during the hypnotic condition. In all the deeper stages, upon awakening, nothing is recalled: the interval is a complete blank. But Dr. Bernheim most ingeniously shows that the knowledge is latent only, not lost. By careful hinting, the subject can be made to recall all that happened; and, if a suggestion be given that he is to recall what happens, then remembrance is complete. It is at this stage that the medico-legal interest centres. The unconsciousness of the victim would be the safeguard of the criminal. Not only this, but a suggestion can be given that hours, days, or weeks after awakening, the subject is to commit some outrage, and insist that it was done of his own free choice. In some cases "retro-active" suggestions are possible. The subject is told that he has been a witness to certain acts. He assimilates the incident to his experiences, elaborates it, and is certain of his testimony. The Tisza-Eslar affair is a case in point. The judicial complications arising from these facts have yet to be satisfactorily solved.

Hypnotism magnifies the action of the mind upon the body, shows that processes usually beyond voluntary control or influence can by extreme attention be psychically influenced, wounds can be made and cured, the pulse be slowed or quickened, and even stigmata be produced. Here lies the essence of all the mind-cures; and it is only by a conscientious study of all such facts that mental healing can be placed upon a sound basis. Hypnotic cures act by keeping up a hopeful disposition, by focusing the attention on the object of cure, by dispelling worry, — all naturally efficacious processes. It is avowedly impotent in cases of organic lesion, but finds its special application in cases of impairment of nervous function.

Finally, hypnotism illustrates the extremely subtle steps of unconscious suggestion. The least change of facial expression, indicative of surprise, of gratification, of anxiety, is enough to give the clew to a sensitive subject. In this way many observers have been misled into attributing to physical or more mysterious influences what they have unconsciously suggested. This fact makes this field of study at once fascinating and treacherous. It requires peculiar talents and great shrewdness.

Such are a few of the main points which hypnotism has contributed to a scientific psychology. This contribution is of the greatest value, and especially when contrasted with the pernicious tendencies of the uncritical and sensational consideration of the same phenomena thereby displaced. While great credit is due to Dr. Charcot and his associates for introducing the scientific era into hypnotism, and braving the contempt that such a step involved, equally great is the merit of the school of Nancy for relieving the phenomena of much of their mystery, and adding in every direction to our knowledge of these valuable conditions.

Natural Inheritance. By FRANCIS GALTON, F.R.S. London and New York, Macmillan. 8°. $2.50.

MR. GALTON hardly needs an introduction to American readers. His researches into the heredity of genius, his study of the predominant traits of English scientists, his invention of composite photographs, together with a large number of interesting and original memoirs, have made his name and work known wherever new applications of scientific methods are appreciated. In the present work the author takes up the general problem of the processes of inheritance, upon special aspects of which he has expressed his views upon various occasions. His data are derived from entries according to the plan of the "Record of Family Faculties." This, it will be recalled, is a convenient book for the recording of the chief physical and mental characteristics of an individual, his parents and grandparents, his brothers and sisters, his own children, and so on. Prizes were offered for the most complete sets of such records; and from the answers to this competition for the prize, as well as from measurements taken at the Health Exhibition, Mr. Galton is able to deduce a few important and many subsidiary results.

A prominent feature in the present work is the application of the "probability curve" to the facts of physical variation, — an attempt to apply mathematical conceptions in the field of biology, and to found a science of biological statistics. We know that if a large number of men be measured, and the number of men between equal differences of height, let us say to each inch, be counted, the result will be somewhat as follows: the largest number of men will be found in the inch of height containing the exact average height of all the men measured, and to either side this number will very rapidly decrease as we depart from the average. What the probability curve does is to predict this rate of decrease, and to tell us how many men will be found at each degree of variation from the mean result. The test has been applied to quite a number of physiological characteristics, and with success; the numbers actually recorded, and those which the mathematical formula requires, being in fair agreement. Wherever phenomena depend for their exact appearance upon a large number of minute causes, no one of which has a considerable effect, this law seems to dominate. "It reigns with serenity and in complete self-effacement amidst the wildest confusion. The larger the mob, and the greater the apparent anarchy, the more perfect is its sway. It is the supreme law of unreason."

A point of particular interest in this curve is the point above and below which there is an equal number of measurements. This point — known as the probable error, because, if instead of measurements we were classifying errors, it would be the error we as often exceed as fall short of — in a sense determines the entire curve, and the comparison of the probable errors of two homogeneous curves is all that is needed to show their complete similarity and difference. It is by such methods and comparisons that Mr. Galton reaches his results, and it is just because his results are founded on such careful and ingenious methods that they can be regarded as reliable and valuable.

The chief outcome of the inquiry is the establishment of the law of regression towards a mean. If we take the height of the father and the height of the mother multiplied by 1.08, — the ratio of male to female stature, — draw the mean between the two, and call this the height of the "mid-parent," then the height of the child will be nearer to the average of the race than the height of the mid-parent, and will be so in a constant ratio determined as one-third; that is, the child will, on the average, be one-third less exceptional than his mid-parent. It is found, too, that the difference between the heights of the father and mother is an unimportant factor; the children of parents differing much in height and those of parents very similar in height being the same, provided the average height of the parents be the same in the two cases. Upon this basis, Mr. Galton has constructed a device by which we set weights