the time of his arrival at Kong, — a period of six months and a half, — he must have traversed from seven hundred to a thousand miles. Judging from this fact, it would take him at least a year to complete his proposed tour from the city of Kong, and his return to the same. We must not be surprised at not having heard from him : that may be due to a lack of opportunity for sending messages.

Having given this description of the journey of Capt. Binger, we can but wish that it may terminate as well as it has begun.

GUSTAVE EIFFEL.

BEFORE proceeding to speak of the Eiffel Tower in detail, *Engineering*, in its issue of May 3, in which is a noteworthy survey of the opening Paris Exhibition, takes occasion to say a few words about Gustave Eiffel and his works. Born at Dijon in 1832, he passed brilliantly through the Ecole Centrale, and commenced the active pursuit of his profession in 1855. One of his first works was the completion of the foundations of the great railway-bridge of Bordeaux by means of compressed air,— a system then but little known in France. After this work, M. Eiffel constructed a large bridge over the Nive at Bayonne, and two others at Capdenac and at Florac.

In 1867 he was intrusted by M. Krantz, the commissioner-general of the Paris Exhibition of that year, with the task of checking experimentally the calculations made for the large buildings. In 1868 he constructed, under the direction of M. de Nordling, engineer of the Orleans Company, the viaducts with iron piers, upon the line between Commentry and Gannat. It was in these viaducts that he first employed the system consistently followed by him afterwards, of wrought-iron braced structures, instead of cast-iron columns or masonry piers. A little later he introduced, with great success, a system of launching bridges from their site of erection on the ground across the piers previously built to receive them. His first attempt in this direction was in 1869, with the Sioule viaducts, followed by another at Vianna, in Portugal, where iron girders more than 1,800 feet in length were launched into position. Then came the viaduct of Tardes, near Montluçon, which was launched at a height of 328 feet above the ground, over piers 340 feet apart.

M. Eiffel was the first among French engineers to employ the system of erecting bridges of great span without scaffolding, by building out the structure piece by piece. His first work of this class was at Cubzac, near Bordeaux, where he crossed a river with a bridge 236 feet span without any staging. At Tan-an, in Cochin China, he erected in a similar way a bridge of 262 feet span. Of arched bridges built in the same manner, the most important, until it was surpassed by the viaduct of Garabit, was the great bridge over the Douro, at Oporto, the central span of which is 534 feet, and the rise of arch 138 feet, the height of rails above the water-level being no less than 200 feet. But he surpassed himself in the Garabit viaduct, where an arch 541 feet span crosses the torrent of the Truyère 400 feet above it. Among the other great engineering works carried out by M. Eiffel must be mentioned the Pesth railway-station ; the Szegedin bridge ; the principal façade of the Paris Exhibition of 1878 ; and the dome of the Observatory at Nice, 75 feet in diameter, and weighing more than 100 tons, which floats within a circular trough, so that the effort required to move it is almost inappreciable. Scarcely less remarkable as an engineering work, and as a triumph of the founder's art, is the gigantic statue of Liberty, modelled by Bartholdi, and presented by France to the United States, where it now stands lighting the entrance to the harbor of New York.

The great series of locks which were to have formed a sort of giant staircase for the passage of ships across the Isthmus of Panama was elaborated as to design, and considerably advanced as to execution, when the great work collapsed. From the foregoing rapid sketch, it will be seen that few engineering constructors have carried out so many important and original works as M. Eiffel ; and the success which has uniformly attended him was a guaranty for the stability and beauty of his latest effort, the Column of the Republic, and his own monument.

Of course, the idea of a tower of gigantic height is not a new one. Not to mention the efforts of the early engineers which had the unexpected result of inventing foreign languages, there are three better authenticated and more recent proposals than the instance in which the sons of men said, "Go to, let us build us a tower whose top may reach unto heaven, and let us make us a name." The earliest was that of the splendid but eccentric genius Trevithick in 1833 ; then came the proposal of the well-known American engineers, Messrs. Clarke & Reeves, who offered to construct for the Philadelphia Exhibition, in 1876, a tower, 1,000 feet in height, of wrought iron, and about 150 feet in diameter at the base. Finally, in 1881, a M. Sebillot proposed to light Paris electrically by a 1,000-foot tower.

Excepting the American project, none of these schemes had any practical value, but the proposal of Trevithick is worth referring to here. He suggested, in a letter published in the *Morning Herald* of July 11, 1832, that the passing of the Reform Bill should be commemorated by a gigantic tower made of cast iron, 1,000 feet in height, 100 feet in diameter at the base, and 12 feet in diameter at the top. It was to be set upon a stone plinth 60 feet high, and was to have a capital 50 feet in diameter, supporting a colossal statue. The shape was to be that of a cone, and an internal cylinder 10 feet in diameter was to run from the ground to the top of the structure. Trevithick proposed that the tower should be composed of 1,500 symmetrical segments, with internal flanges around their edges for bolting them together. Each segment was to be pierced with a large circular opening for lessening the weight and reducing the wind-pressure. The total weight was to be about 6,000 tons, and each of the cast-iron panels was to weigh about 3 tons. The contract price offered for the castings was £7 per ton, the total estimate of expense was under £80,000, and Trevithick undertook the erection of the column in a period not to exceed six months. Passengers were to be raised to the top of the tower in the central cylinder, which was to be fitted with a piston providing accommodation on its upper surface for twenty-five persons ; and the piston was to be raised from the bottom to the top by compressed air forced into the cylinder, and controlled by suitable valves. Fortunately for the memory of Trevithick, this scheme remained upon paper.

The Eiffel Tower is the natural development of the class of work upon which its constructor has been occupied for so many years. It was the direct outcome of a series of investigations undertaken by M. Eiffel in 1885, with a view of ascertaining the extreme limits to which the metallic piers of viaducts could be pushed with safety, this special line of investigation having reference to a proposed bridge with piers 400 feet in height and 140 feet of base. The idea of the great tower followed, preliminary plans were prepared, and calculations made by two of M. Eiffel's principal engineers,—MM. Nouguier and Koechlin,—and by M. Sauvestre, architect. Naturally, the leading principle followed was that adopted by M. Eiffel in all his lofty structures ; namely, to give to the angles of the tower such a curve that it should be capable of resisting the transverse effects of wind-pressures, without necessitating the connection of the members forming these angles, by diagonal bracing. The Eiffel Tower, therefore, consists essentially of a pyramid composed of four great curved columns, independent of each other, and connected together only by belts of girders at the different stories, until the columns unite towards the top of the tower, where they are connected by ordinary bracing. Iron, and not steel, was used in the construction throughout.

MENTAL SCIENCE.

Psychic Cures.

OUR first record of the practitioners of the healing art describes them as invested with the priestly function, thus making the cure of physical ills a result of intellectual and religious influence. When reading the records of the past in the light of modern knowledge, we can trace almost at every point the very marked influence of mental states in the cure, sometimes described as miraculous, of disease. The repute of drugs altogether harmless, or of the physician who gave the drug, is often due to the successful action of the patient's own belief upon his susceptible system. And quite as truly are the wonderful cases of the infliction of ills by

secret curses and superstitious rites to be accounted for upon the same principle.

In more recent times the success of a host of quack remedies, supported by quasi-scientific proofs, is to be referred to the same influence of mind upon body. The existence of such influence, and its great power for good or ill, is fully admitted by modern science; its practical application has, however, been left almost exclusively to charlatans and empirics. Naturally the physician has encountered the general fact of mental influence, and more or less unconsciously profited by its benefits; but the outspoken recognition of psychic states upon physical ills has been rare, owing to the idangering of one's reputation to which such a step would lead. The result has been that a special sect, ignorant of all rational physiology, has taken up the valuable kernel of truth, and surrounded it with an enormous shell of fantastic doctrines, semi-religious and altogether unscientific, in which the original kernel is warped quite out of recognition.

In recent years the question has assumed a more scientific aspect, owing to the light shed upon it by the researches in hypnotism. In this condition, in which suggestions are obeyed with abnormal readiness, it has been shown that functions ordinarily beyond voluntary control can be influenced, and thus a way be opened up for acting upon disturbed functions and diseased conditions. With a sensitive subject, a burn can be suggested at the spot where a coin touches the skin, and the inflammation, the scar, and all, will result. Further, if the suggestion be given that of two wounds the one will heal very quickly and the other slowly, one may find the inflammation almost entirely gone from the one on the following day, while on the other it will be evident for days or even weeks. If nature's process can thus be hastened or retarded, though in a somewhat abnormal condition it is true, why should it not be possible to systematically utilize this power in the case of real ills? Isolated examples of such attempts can be pointed out. Dr. Esdaile in India performed many operations in which hypnotism was the only anæsthetic used, and Dr. Liebault of Nancy has for many years been treating his patients by hypnotic suggestion whenever it seemed desirable. The writer has recently had an opportunity to witness the well-systematized procedures of two physicians at Amsterdam — Drs. Van Renterghem and Van Eeden — in the same direction. These physicians regard hypnotism as a form of sleep very variable in intensity, and passing imperceptibly into a normal sleep. They find a very large percentage (about 75 per cent or more) partially susceptible to its influence, and make no claim beyond the power to appeal by this means to natural restorative processes where the usual means of treatment have been of little avail. The process is a gradual one, and the suggestion must be very frequently repeated before a complete cure is effected. There is no element of the mysterious about their proceedings, but simply a methodical attempt to test the powers of mental influence upon physical ills.

As just noticed, they recognize different degrees of hypnotic sleep, and regard the memory that the subject retains of what has been done during the hypnotic condition as a convenient point of distinction between them. In the lightest sleep the patient remains fully conscious of what has been going on, and can give an accurate account of it. When the sleep is deeper, his remembrance is vague, and hints must be given in order to recall the events. In the deeper sleep all recollection is gone. Of 178 persons, only 7 could not be hypnotized, and 79 were thrown into a deep sleep. The procedure is very simple, and depends entirely upon the acceptance of a suggestion. The eyelids are closed and held for a moment, the patient being told to go to sleep; or the patient fixates the physician's eye for a moment, with the same result. A breath upon the eyelids, or touch upon the nose, easily awakens the sleeper. While in this condition, the suggestions are given that the pain will be gone, that the power to move a paralyzed limb will return, that sight or hearing will improve, that hallucinations will not recur, and so on, to suit the requirements of each case. In cases of paralysis the limbs are moved for the patient, gradually extending the range of the movement, and suggesting the same motions to be effected voluntarily by the patient. In cases of partial blindness, exercises in seeing and distinguishing different objects are made under hypnotic suggestion. In brief, each case must be treated individually; and it requires the utmost tact, aided by a pleasing and impressive manner, to accomplish the best results. To the effects of such indirect suggestions, every candid physician will testify.

As to the time of cure, this depends upon the special malady and the individual. Sometimes a single suggestion will suddenly effect an almost complete cure, while in other cases the progress is very slow. The more gradual cures are to be preferred as being more in harmony with nature's methods. The kinds of disease most readily yielding to this treatment at once suggest the processes here involved. Hysterical affections make up a considerable portion of the cases treated; and in these the combined psycho-physiological disturbance is more mental than physical. But paralysis, rheumatic troubles, palpitations of the heart, digestive irregularities, and nearly all the ills that flesh is heir to, are found upon the list of successfully treated cases. They are all, however, functional troubles. In cases of organic trouble it is evident that restoration is not more possible by this method than by another. The difficulty is, that severe functional troubles may take the appearance of being organic, especially in cases of complicated disease. It must be admitted, however, that the benefits of hypnotic treatment have a much wider extent than what are generally understood by hysterical affections. Of 162 cases treated, 91 are regarded as restored to health, 46 have improved, and only 25 have been treated without avail. The main point at issue will probably be the permanence of such cures. The question has not been studied sufficiently long to admit of a positive answer, but the proper basis for a conclusive verdict is rapidly being accumulated. As far as the evidence goes, it points to as large a percentage of permanent cures as is effected by treatment by any other method. Cases are not unknown in which, after all skill has been applied, a sudden shock or accident has effected a complete and permanent restoration. The sudden cures of hypnotism may be regarded as affiliated with this class. The far more numerous gradual cures are naturally subject to relapses, and repeated suggestion is necessary to continue the progress.

Another point that will not fail to be raised is the danger incident to such methods. The dangers are real, and of many kinds; but they are all such as, in the hands of a skilful physician, are reduced to a minimum. The avoidance of unpleasant suggestions, an easy awakening from the sleep, the suggestion that no one else but the physician can hypnotize the patient, — all contribute to a successful result.

The entire question is one that the future must decide; but it should be recognized that attempts are now in progress to clear this very fertile field of the weeds that have grown upon it, and cultivate it assiduously for the advancement of science and the benefit of mankind.

BOOK-REVIEWS.

The Primitive Family in its Origin and Development. By C. N. STARCKE. (International Scientific Series.) New York, Appleton. 12°. $1.75.

THE object of this work is to set forth the nature of the family as it exists in the most primitive form known to us, and, so far as possible, to trace its origin and the course of its development. To accomplish this end, the use of the comparative method is of course essential; and hence the author takes us over the whole field of savage life, and gathers proofs and illustrations from every quarter of the globe. Mr. Starcke's views on many of the subjects treated are opposed to those hitherto prevalent, and his book is largely a polemic against the writers with whom he disagrees. Thus it has been quite commonly held that in many tribes, if not in all, the earliest state of society was one of promiscuous intercourse between the sexes, and evidence of this has been believed to exist in the widely diffused custom of reckoning descent through the mother alone. Mr. Starcke denies all this, and maintains that "the social life of man begins with the partially aquatistic family, and the family group which is ruled by the father in virtue of his physical superiority. . . . Clans are subsequently formed which, as their internal cohesion increases, gradually pass from the paternal