THE EMPLOYMENT OF MICA IN CONDENSERS. — Most of the condensers supplied for electrical measurements are made of sheets of tinfoil, separated by thin layers of mica. It is important to know whether the capacity of a condenser made in this way is constant, or whether it varies with the duration and amount of the charge. M. Klemencic has studied the specific inductive capacity of mica, on which the capacity of the condenser depends. He used two sheets of the mineral .5 of a millimetre and .1 of a millimetre in thickness respectively, making two condensers with them, and comparing their capacity with that of a standard air-condenser, using different periods of charge and discharge, and different electromotive forces. The following table gives the results obtained: —

Electro-motive Force of Charge.....	Sheet of .5 of a Millimetre.		Sheet of .1 of a Millimetre.	
	t=.00026 sec.	t=20 sec.	t=.00026 sec.	t=20 sec.
1 Daniell.....	6.62	6.89	6.54	6.99
2 "	6.72	—	6.48	—
4 "	6.66	—	6.46	—
6 "	6.68	6.94	6.45	7.00
1 "	6.67	—	6.46	—
1 "	6.66	—	6.45	—

M. Klemencic also studied a condenser of .15 microfarads capacity formed of 19 sheets of mica of 15 centimetres square, with tinfoil between them. In the following table the figures under t_1 represent the time of charge; under t_2, the period between charge and discharge. In one case 12 Bunsen cells were used in charging; in the other, 1 Daniell.

t_1	12 Bunsen t_2		1 Daniell t_2		
	.007 s.	2 s.	007 s.	2 s.	60 s.
.002	3.494	3.478	3.572	3.543	3.461
.300	3.501	3.486	3.600	3.577	3.495
1.200	3.532	3.530	3.620	3.611	3.575
60.000	3.538	3.532	3.637	-	3 584

The numbers in the different columns are the ratios of the capacity of a standard air-condenser to those of the mica-condenser. If we take the values for $t_1 = .3$ s., and $t_2 = 60$ s., we will have about the actual case in practice, and none of the other values differ from it by more than one per cent: so, if M. Klemencic's results are correct, we can depend upon mica-condensers within that limit.

MENTAL SCIENCE.

Association by Contrast.

M. PAULHAN (*Revue Scientifique*, Sept. 1) calls attention to the widespread application of the law of contrast. This law he formulates as saying that every psychic state tends to be accompanied (simultaneous contrast) or followed (successive contrast) by an opposite state. An excellent instance of it in sensation is that of complementary colors; but it is equally applicable to feelings, thoughts, and beliefs. A physiological homologue is shown in the fact that a contraction of a muscle is not accomplished without the simultaneous innervation of its antagonistic muscle. The flexors are always opposing the extensors, and *vice versa*, and it is a properly adjusted opposition of the two that results in an accurately co-ordinated movement. In the higher psychic states the state must usually be long, and maintained with some difficulty, to have the contrast appear. In all hesitation we see a balancing of opposites, each argument *pro* at once calling up a parallel argument *contra*. The introduction of a new set of ideas at once arouses an opposite train of familiar thoughts. Objections that at first seem trivial and not worthy of attention gather force by brooding over them. Again: all knowledge is relative, and epithets must be compared with their opposites: 'little' suggests 'big,' and 'big' is only relative to the 'little.' People differ very much in the readiness with which they take suggestions, in the difficulty with which the opposite train of thoughts arises. In hypnotism this 'contrasting' power is at a minimum, and very rarely does a concept suggest its opposite. In normal natures combativeness plays very variously important *rôles*. Morbid instances of this mode of mental action are also to be found. Griesinger records a case of a lady constantly saying just the opposite of her intentions. Some insane patients personify these contrast associations into internal voices controlled by rebellious spirits constantly suggesting the opposite of what they ought to do. Kussmaul describes a state as dysphrasia in which the emotion is opposed to the words expressing it, and so on. All this illustrates the wide scope of this association by contraries, which same trait we recognize in its extreme moral-intellectual side as contrariness.

The principle of successive association finds an equally broad field of application. Its elusory illustrations are particularly good in sight (complementary colors, after-images), but are also present in taste (as when any thing tastes sour after eating sweets) and in almost all types of sensations. But we can find the same law in emotional states. Depression is the recognized after-effect of too jovial dissipation. In hypnotism there seems to be a definite alternation from one emotion to its opposite, that suggestion, or, according to some, the stimulation of a magnet, can excite. In fact, all such phenomena can be regarded as governed by the universal law of rhythm, one state recurring at regular intervals, filled in with states of an opposite character. Sleeping and waking, inspiration and expiration, illustrate the physiological aspect of the law. Darwin brings the sentiment of remorse following upon cruelty under the same law.

Under marked conditions such alternations of emotion are extremely frequent, and lie at the root of the hysterical diathesis. Periodic insanity showing exaltation followed by depression, the assumption of unworthy habits by most respectable patients, passionate outbreaks in peaceably disposed patients, — all these are not infrequent. Cases of dual consciousness are perhaps only intensified instances of such successive contrasts. In incipient insanity the dearest relations are often the objects of most intense antipathy.

Such phenomena of successive contrast as depend for their effect upon the presence of an interval since the experience was last made, are equally varied, and equally numerous. Eating after long hunger, re-union after long separation, success after long struggle, enjoyment after much care, — all these give especially great pleasure. Pleasures too often partaken of pale, and need the spice of contrast for their relish. Again: a privation always suggests a longing. When we are deprived of a convenience, we feel the need of it most. When circumstances prevent the realization of our wishes, the displeasure is at a maximum: witness homesickness. The fatigue of one set of emotions brings on the opposite set, perhaps; when continued too long, any state tends to lessen in intensity. Sometimes the feelings flit between sorrow and joy, and we have a curious mixture of the two, — a selfish comfort and a trying sympathy. All such considerations suggest, however sketchily, the existence of an underlying psychophysic law that makes the union of opposite psychic states especially significant.

HYPNOTISM AND CRIME. — Hypnotism as an aid to crime has been variously discussed in France from both the medical and the legal side, with the general conclusion that legislation is needed to cover the most palpable employment of it. The fact that a hypnotized subject can take and execute a criminal suggestion made by another, and yet be really innocent of any immoral intent, is beyond all doubt; and this fact has led observers to the conclusion that the blame must rest upon the giver of the suggestion. An additional precaution which the true originator of the crime might take would be to give a suggestion forbidding the subject to reveal to any one the name of the suggester or the fact of the suggestion. On the contrary, he was to say and feel that the act was committed of his own accord. This complicated the legal aspect of the question very seriously; but further experiments have shown that the instigator of the crime would not be so entirely safe, after all. M.

Jules Liégeois, who has studied most carefully the legal aspects of hypnotism, suggested to a lady subject that she take a pistol and shoot a certain Mr. O. She acted out the suggestion perfectly, not knowing that the load was a blank cartridge. When again hypnotized, she admitted the crime and defended her action. Another gentleman now gave her the suggestions (1) that when the instigator of the crime enters the room she should go to sleep for two minutes; (2) on awakening, she should fix her eyes upon the man constantly until allowed to desist; (3) she should then stand in front of him and attempt to conceal him. When M. Liégeois entered the room, she fell asleep, and did all that was asked of her, thus revealing the instigator, though told by him not to do so. Professor Bernheim induced a subject to steal, and forbade him to mention that he had been told to do it. The patient said he stole because the idea occurred to him, but, when told to go up to the true criminal and say, "Please sing me the Marseillaise," he did so. It seems, then, that the subject will do nothing that he has been categorically forbidden to do, but that he will succumb to an indirect mode of revealing the true instigator of the crime. This certainly aids the courts; but it is a question how far it will be of service when the true criminal is not present, and whether additional suggestions in the first instance will not considerably interfere with the reliability of later testimony. Its further development will be watched with great interest by all students of the scientific aspects of mental phenomena.

PSYCHIC EFFECTS OF HASHEESH. — Mr. A. M. Fielde has recently recounted his experiences under the influence of hasheesh. He smoked the hasheesh until he felt a profound sense of well-being, and then put the pipe aside. After a few minutes he seemed to become two persons: he was conscious of his real self reclining on a lounge, and of why he was there; his double was in a vast building made of gold and marbles, splendidly brilliant, and beautiful beyond all description. He felt an extreme gratification, and believed himself in heaven. This double personality suddenly vanished, but re-appeared in a few minutes. His real self was undergoing rhythmical spasms throughout his body: the double was a marvellous instrument, producing sounds of exquisite sweetness and perfect rhythm. Then sleep ensued, and all ended. Upon another occasion sleep and waking came and went so rapidly that they seemed to be confused. His double seemed to be a sea, bright, and tossing as the wind blew; then a continent. Again he smoked a double dose, and sat at his table, pencil in hand, to record the effects. This time he lost all conception of time. He arose to open a door: this seemed to take a million years. He went to pacify an angry dog, and endless ages seemed to have gone on his return. Conceptions of space retained their normal character. He felt an unusual fulness of mental impressions, — enough to fill volumes. He understood clarivoyance, hypnotism, and all else. He was not one man or two, but several men living at the same time in different places, with different occupations. He could not write one word without hurrying to the next, his thoughts flowing with enormous rapidity. The few words he did write meant nothing. This experience admirably illustrates the close relationship between states of real insanity and transitory affections induced by psychic poisons.

BOOK-REVIEWS.

Elementary Political Economy. By EDWIN CANNAN. London, Henry Frowde. 16°. (New York, Macmillan, 25 cents.)

THIS little book is designed to set forth the rudimentary truths of political economy, and in some respects it is quite successful. Though containing only a hundred and fifty pages, it touches most of the fundamental facts and doctrines of the science, and explains some of them as clearly as could be expected in so small a compass. It is divided into three parts: the first treating of production; the second, of exchange and distribution; and the third, of the economic functions of the State. Mr. Cannan, however, seldom uses the familiar terms 'production' and 'distribution,' but employs roundabout expressions instead, — a practice that seems to us the reverse of commendable. He also avoids the term 'wealth,' using the phrase 'useful material objects' instead, and this phrase is repeated through his pages almost *ad nauseam*. Another fault in a work meant for beginners is the obscurity of the style in certain parts, as, for instance, in the sections on profits and wages; though in other parts the style is quite clear. Some important topics, too, such as the law of agricultural rent, are overlooked. The book seems to have been rather hastily prepared, and, in spite of some excellent qualities, is not what an elementary treatise on economics ought to be.

Report of the Geological Survey of Ohio. Vol. VI. Economic Geology. Columbus, State. 8°.

THE sixth annual report of the State Geological Survey of Ohio appeared early in the present year. The material for publication was partially ready in 1885, entirely so in 1886, and should have been published in 1887. This furnishes another illustration of the many difficulties with which science has to contend in bringing the results of its work before the public, when dependent upon legislative action.

Valuable matter accumulates, and remains in the hands of the publisher for long periods, which, if presented to the public at once, would be of great assistance to workers in other fields, and oftentimes prevent time and money being spent on questions which had already been solved.

The present volume is devoted entirely to economic geology, and principally to the subjects of oil and natural gas, nearly six hundred pages out of about eight hundred being taken up with descriptions of their modes of occurrence, their geological relations, and the methods of obtaining and handling them. Much of the matter has already been made public in a preliminary abstract by the State geologist and various papers in scientific journals.

The whole work teems with facts which are not only of interest to the scientist, but of great advantage to the practical workers in coal and gas as well.

After a general review of the geology of the State, in which its formations are shown to extend from the Trenton limestone as a base to the Upper Barren Coal-Measures, the more prominent theories of the origin of gas and oil are discussed, and compared with the phenomena observed in the Ohio fields. Discarding entirely the theory of chemical origin, it is maintained that petroleum is derived from organic matter, more largely vegetable than animal, but both; that it is derived from both shales and limestones; and that in the Ohio fields it has been produced at normal rock temperatures, and not by distillation. "The stock of petroleum in the rocks is already practically complete," is the reply to the question, so often asked, "Is the supply inexhaustible?"

Till 1884 the Trenton limestone was not considered a productive oil-bearing horizon. The discoveries of that year, however, in western Ohio, at once gave it a high rank. Beginning with the Findlay field, where the discovery was first made, and where, out of eighteen wells complete to April, 1886, but one had proved non-productive, the work extended through other portions of the State, the areas next in order of importance being the Lima and Bowling Green fields. The quality of the gas compares more than favorably with that of Pennsylvania; it furnishes a very valuable fuel; and its discovery has greatly increased the development of manufacturing interests in that section, while the growth of population has been correspondingly rapid.

In the eastern portion of the State, the oil-producing rock is the Berea grit, a subdivision of the sub-carboniferous. Its structural features, however, are not such as to favor the accumulation of paying quantities of gas or petroleum; and, although a very large number of wells have been sunk, with few exceptions they are entire failures.

In the central counties and those bodering Lake Erie to the north-east, the Ohio shale furnishes a small but very persistent flow of gas, which has become of considerable economic importance. But while this shale is also rich in oil, it is not obtainable in sufficient quantities to make it valuable.

A separate chapter is devoted to a description of the Macksburg oil-field, one of the earliest to be worked, and still very productive. The productive area is confined to a small anticlinal in the Berea grit, outside of which all wells have been complete failures.

Of the methods of drilling, and the care of the wells during