"As typhoid-fever is a greater calamity than Texas fever, as Asiatic cholera is more to be dreaded than hog cholera, so do we need a department of public health more than a department of agriculture, a bureau of vital statistics more than a bureau of animal industry.

"The death-rate of twenty-six of the principal cities of America, with a population of 9,873,448, is 20 per 1,000. I think it morally certain that this rate could be reduced by means and methods now known to sanitary science to 16 per 1,000, and probably still less than that. The death-rate for London for the year 1888 was 18.5 per 1,000. This can be still further reduced. That of New York and Brooklyn for the same year, taken together, is 25.5 per 1,000; New York, 25.9; Brooklyn, 23.7. The death-rate of these two cities, if reduced to that of London, would secure a saving of 7 per 1,000, or annually 15,986 lives. These lives are public wealth.

"But this is not all. For one death annually two persons are sick during the entire year, or, in other words, there are two years of disabling sickness to one death, 31,972 years in New York and Brooklyn of sickness, preventable sickness, annually. The value of these years of sickness cannot be reached with accuracy; but the wages lost on account of sickness, the cost of care and maintenance during sickness and convalescence, and the money-value of the lives destroyed, considering them only as machines, will, in New York and Brooklyn, reach annually into the millions. I venture to suggest to the business-men of these cities that this loss is enough every year to buy a great railroad or to build and subsidize a fleet of ocean-going steel steamships."

The session continues through Friday, while the sanitary exhibition will continue for some weeks.

PROGRESS OF CHINA.

MR. R. S. GUNDRY read a paper on "Industrial and Commercial Progress in China" to the British Association last month. Premising that the wide differences in character and habits of thought between Europeans and the Chinese made it difficult to convey to an English audience an accurate impression of the situation, the paper, as reported in *The Scottish Geographical Magazine*, went on to sketch the leading features of Chinese industry and commerce in so far as they concerned, and had been affected by, foreign enterprise. Beginning to move at a time when she had been defeated in a foreign war, China's first efforts were to provide herself with the warlike material which experience had shown her to be so powerful: hence the early construction of arsenals and steamers. The beginnings of telegraphs, and the acceptance in principle of railways, were due also, in a measure, to warlike stress in connection with Kulja and Tongking; and mining was recognized largely as a means of providing for all this additional expenditure. But imperfection of knowledge, jealousy of foreign supervision, and a disorganized condition of finance, which involves venality and harassing taxation, retard a progressive movement, to which the *literati* who constitute the mind of the nation are still as a body disinclined. The imperial finances, too, have been strained by a series of wars, rebellions, and disasters; and distrust of their officials prevents native capitalists from investing money in enterprises with which the officials persist in meddling. The great staples of tea and silk are severely menaced by the competition of India and Ceylon in the one case, and of southern Europe in the other; and the Chinese are slow to accept improved methods of preparation which would enable them to hold their own. China tea is heavily handicapped also by taxation, in competition with its duty-free rival. Fiscal hinderances, imperfect communications, and consequent cost of transport, have much to do with the slow development of trade. But the wide prevalence of domestic industry, and difficulties of exchange caused by the demonetization of silver, tend also to check the anticipated growth of demand for European manufactures. There seems every prospect that more railways will shortly be constructed, and that machinery will be tentatively admitted for purposes of industrial manufacture; but much time, a more widespread desire for progress, and radical financial reform, will be required before China is likely to rival Japan in the completeness of its transformation.

JADE IN BURMAH.

ACCORDING to a recent official report from Burmah, the jade-producing country is partly enclosed by the Chindwin and Uru Rivers, and lies between the 25th and 26th parallels of latitude. Jade is also found in the Myadaung district, and the most celebrated of all jade deposits is reported to be a large cliff overhanging the Chindwin, or a branch of that river, distant about eight or nine days' journey from the confluence of the Uru and Chindwin. Of this cliff, called by the Chinese traders "Nantclung," or "difficult of access," nothing is really known, as no traders have gone there for at least twenty years. Within the jade tract described above, small quantities of stone have been found at many places, and abandoned quarries are numerous. The largest quarries now worked are situated in the country of the Merip Kachins. The largest mine is about 50 yards long, 40 broad, and 20 deep. The season for jade operations begins in November, and lasts till May. The most productive quarries are generally flooded, and the labor of quarrying is much increased thereby. In February and March, when the floor of the pit can be kept dry for a few hours by baling, immense fires are lighted at the base of the stone. A careful watch is then kept in a tremendous heat to detect the first signs of splitting. When this occurs, the Kachins attack the stone with pickaxes and hammers, or detach portions by hauling on levers inserted in the cracks. The heat is almost insupportable, the labor severe, and the mortality among the workers is high. The Kachins claim the exclusive right of working the quarries, and there is not much disposition on the part of others to interfere. Traders content themselves with buying the stone from the Kachins. The jade is then taken by Shan and Kachin coolies to Namia Kyankseik, one long day's journey from Tomo. Thence it is carried by dug-outs down a small stream, which flows into the Tudaw River, about three miles below Sakaw, and down the Tudaw River itself to Mogaung.

MENTAL SCIENCE.

New Experiments upon the Time-Relations of Mental Processes.

IN the preceding issue of this department an account was given of certain experiments measuring the time of re-action to words, both simply and when the movements of the five fingers were associated respectively with five words or five general classes of words. The results revealed a striking difference, according as the attention is directed to the sensory factors of the process and their appreciation, or the motor factors and their execution. The latter is a much briefer act, and seems to require a quite different series of mental processes from the former. To the theories explaining these and other facts we shall recur in this study. Dr. Münsterberg continues the work by applying similar methods to the study of association, judgments, and in general more complex operations.

I. As the more mechanical process in every association consists in hearing and understanding a spoken word and in speaking a word, we can easiest measure how much time is needed to accomplish this part of the process by measuring the time intervening between the speaking of a word by the experimenter and the repetition by the subject. Throughout this study there are two subjects, M and R; and in addition to the time there is given in parentheses the average variation, *v*, which marks the relative constancy, regularity of the process measured. As the words used in later experiments were both monosyllables and others, these were introduced at the outset, care being taken by the experimenter when calling a polysyllabic word to press the key in speaking the last (or the last accented) syllable, and by the subject always to press the key when speaking the first syllable of his reply-word. The simple repetition of a word, then, was accomplished by *M* in .403 of a second (*v*, .060); by R, in .362 of a second (*v*, .070).

II. Here, instead of repeating the called word, one re-acts by calling as quickly as possible a word associated in any way whatever with the first; that is, an ordinary "association-time." M does this in .845 of a second (*v*, .140); R, in .948 of a second (*v*, .170). The shortest time was for "gold-silver" (.390 of a sec-

ond); the longest, for "sing-dance," "mountain-level" (from 1.100 to 1.400 seconds).

III. Instead of accepting the first association formed with the call-word, the experimenter requires a word bearing a definite relation to that word. What this relation is to be is announced just before the call-word itself. The relation is always such as to admit of several replies. Such general rubrics as, given a country to name a city in it, or given a general term to name a particular instance of it, sufficiently well describe what was wanted. However, the same rubric was not repeatedly given in succession, as Cattell had done (for this gives too much scope for preparing the answer), but all kinds of relations were employed in an arbitrary order. This "limited" association occupies M .970 of a second (*v*, .200), and R 1.103 seconds (*v*, .210); or .125 and .155 of a second longer than II. The shortest times were found, rather suggestively, in naming an instance of "a German wine, — Rüdisheimer;" "a number between 10 and 4, — 6;" "a Greek poet, — Homer;" — all between .450 and .600 of a second. The longest were "beast of the desert, — lion;" "French author, — Voltaire;" "a drama of Goethe, — Götz;" — between 1.200 and 1.500 seconds.

IV. Here the associations were still further limited, there being in each case only one correct association: it is in the nature of question and answer. Though, of course, the question was not asked in full, it was easily understood as such; nor was the query such as to immediately suggest an evident answer. The average time was, for M, .808 of a second (*v*, .180); for R, .889 of a second (*v*, .140); or .162 and .214 of a second shorter than III. It thus takes longer to name *a* drama of Schiller, than *the first* drama of Schiller. Times between .400 and .600 of a second were, "Three times four, — Twelve;" "On what river is Cologne? — Rhine;" "In what season is June? — Summer;" "In what continent is India? — Asia." The longest times, 1.100 to 1.300 seconds, were needed to answer the following questions: "By what author is Hamlet? — Shakspeare;" "What is the capital of Baden? — Karlsruhe;" "What is the color of ice? — White;" "Who was the teacher of Plato? — Socrates." These times seem to be influenced by momentary fluctuations of the mind as well as the intrinsic difficulty of the question.

V. As in IV., there is but one correct answer: but this is not obtained simply as an act of memory, but some process of comparison and judgment must be gone through after the question is proposed; e.g., "Which is larger, — a lion or a mouse?" "Who is greater, — Hume or Kant?" First the general nature of the comparison is announced, then the special terms to be compared. An actual test shows no difference in time when the correct answer was the first and when it was the second of the two terms. M's average time was .906 of a second (*v*, .180); R's, 1.079 (*v*, .220) seconds. Most quickly answered (.600–.800 of a second) were, "What smells better, — cloves or violets? — Violets;" "Who is greater, — Virgil or Ovid? — Virgil;" "What is prettier, — woods or mountain? — Mountain." It took longest (1.200–1.500 seconds) to answer, "What is healthier, — swimming or dancing? — Swimming;" "What of Goethe do you know better, — drama or lyric? — Lyric;" "What is more difficult, — physics or chemistry? — Chemistry."

VI. This variation consisted in employing the same general line of questions as in the foregoing, but preceding the question with a series of about a dozen words of the same general class as the two to be compared, and mentioning the two among the number. Thus, "Apples, pears, cherries, nuts, peaches, grapes, strawberries, dates, figs, raisins: which do you like better, — grapes or cherries? — Cherries." The questions were prepared in advance, and read as monotonously as possible. The result was, for M, .694 of a second (*v*, .130); for R, .659 of a second (*v*, .160); or .212 and .420 of a second shorter than V., — certainly a striking result. Among the shortest times (.400 to .600 of a second) were "[mentioning twelve composers] Who is greater, — Glück or Bach? — Bach;" "[twelve capitals] Which is more important, — Rome or Madrid? — Rome." Among longest times (.800 to 1.000 second) were "[ten classical dramas] Which is more taking, — Götz or Tasso? — Götz;" "[ten colors] Which goes better with blue, — yellow or green? — Yellow."

VII. Here we combine III. and V. Instead of first asking, "What is a drama of Goethe?" (III.), and then "Which is the finest of Goethe's dramas, — Götz, Faust, etc.?" (VI.), we ask at once, "Which is the finest of Goethe's dramas?" the subject having first to recall what the dramas are, and then to make his choice. For this, M requires .962 (*v*, .180), and R 1.137 (*v*, .160), seconds; or only .008 and .034 of a second more than in III. The shortest times (.600–.700 of a second) were in answering "What is the pleasantest odor? — Rose;" "Which is the most important German river? — Rhine:" the longest (1.400 to 1.600), in answering "Who is the most difficult Greek author? — Pindar;" "Who is your favorite French writer? — Corneille."

VIII. By adding a comparison to the process in VII., we have the scheme of VIII.: e.g., "Which is the more westerly, — Berlin, or the most important German river? — [answer] Rhine;" or, "What letter comes first in the alphabet, — L, or the initial letter of the name of the prettiest tree? — [answer] Beech." This very complex process engaged M for 1.844 seconds (*v*, .370), and R for 1.866 seconds (*v*, .340). Here the variations in the difficulty of the questions and the alertness of the individual become rather important. A still more complicated scheme was attempted, but the results proved too variable. The questions were of this type: "What is more impressive, — Shakspeare's finest drama, or Wagner's finest opera? [answer] Lohengrin." The result for M was 2.197 seconds (*v*, .970); for R, 2.847 seconds (*v*, .720). It is the scheme of VIII. with case VII. in each term of the comparison.

IX. This bears the same relation to VIII. that VII. does to IV. The type of query would be, "Which lies more westerly, — Berlin, or the river on which Cologne is situated [it is a comparison in which one term is reached by the substitution of a concrete for a generally described term]?" or, again, "Which is less, — 15, or 20 — 8?" "Who lived later, — Klapstich, or the author of 'Lear'?' The times were, for M, 1.291 seconds (*v*, .180); for R, 1.337 seconds (*v*, .230). These times are .553 and .529 of a second less than VIII., although the differences between VII. and IV., which have the same relation pair to pair, were only .154 and .248 of a second.

X. This is IX. preceded by a series of words of the same category as the terms of the comparison: e.g., the experimenter first calls twelve names of parts of the body, and then, "Which is larger, — the hand, or that with which one smells?" "[ten colors] Which is lighter, — blue, or the color of sulphur?" Here we have the same process of shortening the time as in VI. The times are 1.153 seconds for M (*v*, .170), and 1.145 seconds for R (*v*, .210); or .138 and .192 of a second less than IX. The results of the ten cases are based upon about 800 experiments.

Finding the current theory[1] entirely unable to explain these results, Dr. Münsterberg attempts an explanation upon the principle "that a stimulus begins to have an effect before the latter is consciously perceived," and that "the process consists in the re-awakening of the effects of previous stimuli, so that it is shortened by any circumstances tending to call up these reproductions in advance of the stimulus." We must note that all these associations are really of the form of judgments. When we are asked to associate a word with a given word, we really do not answer with the first impression that may be passing through our minds at that particular moment; but we give a word called up by the former, and the relation to which we more or less clearly recognize. The question is, "Name a word standing in some relation to the following word;" and our answer is, "This word answers this description." Every such judgment, again, is the assertion of identity between two objects standing in different associative relations. When we say the beech is the prettiest tree, we mean that the thing that from one aspect we call and recognize as a beech, and the concept which from another aspect we describe as the prettiest tree, are one and the same.

The mind can be placed in more or less favorable attitude for the calling-up of these association ties, and thus the time as measured be shortened; and again the calling-up of certain associative

[1] The theory as represented by Wundt would require the limited association to take longer than the unlimited, because it involves the latter and something more; but IV. requires less time than III. or II. Again, as VII. is composed of III. and V., we should get the times by the addition of these two times; but this gives far too large results. Other discrepancies could easily be pointed out.

links may in itself be a sufficient means of appreciating the appearance of other closely related trains of thought. Under this general position, it remains to interpret the following four characteristics of the results, which may be regarded as the most essential outcome of the study: first, the time of a limited association is longer than the time of a free association (III. is longer than II.); second, univocal association (where the answer is limited to one) is less than the limited, or even than the free (IV. is less than III. or II.); third, by reading a series of words belonging to the same category as the words to be compared, the time of the mental process is much shortened (VI. is less than V., and X. than IX.); fourth, the combination of any two or three factors in the same process takes less time than the sum of the times needed to perform each of the factors separately (VII. is less than the sum of III. and V., less the time of I., which is counted twice). The first fact is not new, and is explained by considering that in both cases, III. and II., several associations present themselves to the mind, but that, while any one of them will answer in II., some may have to be rejected (or the association impulse inhibited) in case III. The second fact is more striking, and seems to mean that the mind does not run over the general category and select the one answering to the particular relation, but takes the nearest and usually prominent association of the limited character. Irrelevant associations do not consciously reach the focus of apperception. The third fact brings out the mechanism of preparation. When a series of words is read, and we know we are to compare some two terms of the series, we anticipate the general kind of comparison, and so shorten the process. We throw out all those associations with the terms in question other than those which they have in common with the series of words read. The fourth fact accentuates the importance of the position that the mind can do more than one thing at a time. If each mental process had to be finished before the next one is begun, such acts as reading ahead, as forming a sentence or an argument while speaking other words, would be impossible. The results distinctly show how the various processes overlap in time, and form that rich complexity of inter-associated and mutually dependent fators that is the charm as well as the strain of mental labor.

THE NATURE OF NEGATIVE HALLUCINATIONS. — M. J. Foutan has recently devised an interesting method of showing that in hypnotism the physiological processes remain, while their psychic interpretation is altered. If a subject be told that he sees nothing red, every thing of this color falls out of his mental horizon, and we have an ordinary instance of a negative hallucination. If, now, the red object viewed be a red light, and if we suggest to the subject that when a bell is sounded he will again be restored to normal vision, and if as the bell is sounded the light is put out, the subject sees a light of the complementary color, green, just as he would have done when normally viewing a red light. While the brain refuses passage to the sensation of red, the retina is impressed with it, and re-acts to it, just as though the action were normal in every respect.

ELECTRICAL NEWS.

The Telephone on Railways.

THERE has been in use on the Austrian State railways a portable telephone that can easily be attached to a passing wire so as to place the trainmen in connection with the neighboring stations. An exhibition of the apparatus was recently made before a number of Austrian railway-men on a line running from Hüttelsdorf to Purkersdorf, with satisfactory results.

THE DURATION OF A LIGHTNING-FLASH. — The researches of Trouvelot, Colladon, and Dufour have shown that the duration of a lightning-flash is not infinitesimal, but that the flash lasts a measurable time. For instance: if one sets a camera in rapid vibration, and exposes in it a plate so as to receive the impression of the flash, it is found that the impressions appear widened out on the negative, showing the negative to have moved during the time the flash was in existence.

ARTHUR WINSLOW has entered upon the duties of State geologist of Missouri, with headquarters at Jefferson City, and the work of the survey is now begun.

BOOK-REVIEWS.

The Struggle for Immortality. By ELIZABETH STUART PHELPS New York, Houghton, Mifflin, & Co. 16°. $1.25.

THIS book is characteristic of the times, and could not have been written at any other period. The authoress is a Christian of the new liberal type, — a type so different from the old that it seems another thing, — and she is a passionate believer in immortality. She presents her views and arguments in an epigrammatic style and generally with clearness, and her book is certainly entertaining. Unhappily she is a pessimist of a rather extreme type, declaring expressly that there is far more pain than pleasure in this life, and consequently, that, if there is no other life before us, God is not good. She admits, however, that with rare exceptions men cling tenaciously to this life, which seems very strange if it brings a surplus of pain. She insists that there is more in man than material forces can account for, and adduces the phenomena of hypnotism and telepathy in support of this claim. Her theory of immortality is as set forth in the following passage: "Immortality is not a right, but a privilege. . . . This gift is offered to you or me upon conditions which we can accept or deny at will. The founder of our religion makes, we may say that he constitutes, the conditions. Everlasting life is, in fact, according to this religion, bestowed by Jesus Christ upon the human soul. The consequence of declining this gift and its conditions would seem to be logically, if not theologically, wrapped in the phrase 'everlasting death'" (p. 137). This means, if we understand it, that, if we live like Christ in this world, we shall live forever in another and happier one; but if not, we shall be annihilated. Hence arises a "struggle for immortality" analogous to the struggle for existence here, in which we may win or lose according to our conduct. This seems to us rather singular doctrine; yet there is much in the book that is both true and valuable, and it will serve to some extent as an antidote to the prevailing spirit of negation.

A Dictionary of Electrical Words, Terms and Phrases. By EDWIN J. HOUSTON. New York, The W. J. Johnston Co. 16°. $2.50.

THE need has long been felt of some work that should give good definitions of the terms which have come into use in the electric science and practice that have been brought into existence mainly within the past ten or twenty years. The larger dictionaries are too slow in adopting new words to serve this special purpose. In fact, some of the terms defined in Houston's "Dictionary" may be out of use, and no longer words in any proper sense as conveyors of ideas, by the time they figure in Worcester or Webster. Such is the march of language with those who are creating apparatus and phenomena never before existing. It is unnecessary to introduce the chief editor of this electrical dictionary to our readers. Professor Houston is too well known to need this. What he has done in the dictionary is, first, to give a concise definition of each word or phrase, and then a brief statement of the principles of the science involved in the definition, that it may be clear, in so little trodden a field, just what the definition means. This statement is frequently illustrated by appropriate cuts. To some extent the short explanations make the work encyclopedic in its character.

This is a first edition, and it may be that the difficulty of introducing a phrase under the most appropriate catch-word, so that it may be readily found, has not been completely overcome; yet such an elaborate system of cross-references has been introduced as to overcome this trouble to a great extent. We must say we have found it satisfactory in use so far.

The publishers are to be commended for the large number of illustrations they have placed at Professor Houston's command.

AMONG THE PUBLISHERS.

THERE is announced to appear Nov. 2, 1889, and each Saturday thereafter, *Nature*, a weekly journal for the gentleman sportsman and naturalist, to which the contributing editors will be William C. Harris, Charles Hallock, Charles Barker Bradford, and J. Charles Davis. The articles will include sketches about all kinds of game-hunting; sketches about all kinds of game-shooting; sketches on