dynamometer, which in turn was connected by a belt with the dynamo under examination. At a convenient distance from the dynamo were located the lamps and resistances (resistance coils), through which the current furnished by the former was allowed to flow, as well as the various instruments employed in the electrical measurements. Steam for the engine was furnished by a set of boilers located near by, but in a separate building.

"The source of motive power was, as stated before, an Armington & Sims engine, rated, nominally, at about seventy horse-power when supplied with steam at about eighty pounds pressure. The normal speed of the engine was about 275 revolutions per minute, but this could be varied within limits of a considerable range, without any serious interference with the action of the governor.

"For measuring the power supplied to the dynamo, there was employed a dynamometer originally designed by W. P. Tatham of Philadelphia. This instrument was the same as that used some years ago by the committee appointed by the Franklin Institute of Philadelphia to conduct the competitive tests of dynamos exhibited at the Electrical Exhibition held in Philadelphia in 1885. A description of the apparatus will be found in the *Journal of the Franklin Institute*, November, 1885.

"For measuring the current furnished by the machine, there were employed two methods, the full-load current being 400 ampere, — too great for any single instrument in our possession, — a part of this was measured by a Thomson balance, and part by observing the potential difference between the ends of several heavy strips of German silver immersed in oil. The latter method is known generally as the method of fixed resistances, and the apparatus referred to was standardized by observing the difference of potential at its terminals, when a current of known value, as measured by the Thomson balance, was allowed to pass through it.

"In the measurement of electromotive force there was used a Weston voltmeter, received only a few days previously from the laboratory of Mr. Edward Weston, where it had been standardized. This, however, as well as the other measuring apparatus, was, after the completion of the test, carefully calebrated in the physical laboratory of this university.

"It may be stated that owing to the construction of the measuring apparatus employed, and also to the circumstances that a considerable distance separated the instruments used from the dynamo, no magnetic influence could have interfered with the accuracy of their indications. Before measuring the power absorbed by the dynamo, the dynamometer was run without load, in order to determine its own friction. This amount of power consumed was, in all cases, subtracted from subsequent measurements. The friction of the dynamo itself was determined by running it on open circuit, and with the brushes removed.

"The order of making the tests was as follows: first, the dynamometer was run without load; second, the dynamo was run on open circuit, brushes removed (this measurement gives friction of dynamo); third, the dynamo brushes were placed in position (this measurement represents losses due to friction in bearings, losses due to heating of field magnet wires, losses due to reversals of magnetism of armatures, core, and losses due to Foucault currents in the armature). These losses are, for a given speed, nearly constant. After this, the dynamo circuit was made, and measurements of power, current, and electro-motive force at different loads were begun. The following table gives the results of the several determinations.

Current.	Electro-motive force.	Horse Power.	Dynamometer Horse Power.	Loss.	Losses, Friction, Reversals, etc.	Losses Current^2 × Resistance.	Efficiency.
134.8	114.0	20.6	24.97	4.4	4.4	17	82.5
194.1	115.6	30.1	35.3	5.2	4.5	.38	85.2
371.6	98.3	49.0	54.5	5.5	3.5	1.30	89.9
400.0	110.0	58.9	64.7	5.8	4.1	1.50	91.0

"Speed of dynamo, 330 revolutions per minute."

A NEW USE FOR THE PHONOGRAPH.

AT a meeting of the Massachussetts Medical Society on Nov. 20, A. N. Blodgett, M.D., made some interesting remarks on the use of the graphophone or phonograph in taking and recording the clinical history of a patient. As reported in the Boston *Medical and Surgical Journal*, Dr. Blodgett spoke as follows: –

"Some time ago my attention was called to this instrument, about which I had known something, although not in its present state of perfection. It occurred to me that this might be of interest to physicians in various ways, and particularly to those connected with public institutions. As you have seen, by speaking into the mouth-piece a record can be produced upon the yielding cylinder of wax, which will remain permanent, and can be reproduced a great many times.

"Last night Mr. Thomas and I made experiments at the City Hospital on a patient just admitted to the accident room. His clinical history was taken; but it was not in all respects a success, because he had an injury preventing his speaking with much force, it being a fracture of the ribs. But we got a record from an actual patient in an actual examination which was reproducible and could be understood. Later we got another record from a hypothetical patient; namely, one of the house-officers of the hospital, who was questioned in the same way as would be an ordinary patient admitted under circumstances which precluded any previous knowledge of him or his condition. That record was more distinct, could be very well understood, and I am sure any one with a little practice could use this machine in a way to obtain durable and trustworthy records from the lips of the patient.

"An instrument of this kind might be made portable, and a visiting physician in a hospital might give his directions into the funnel, when they would be recorded upon a small cylinder, which can be put upon another machine, and the physician's directions as to treatment or his description of lesions can thus be accurately recorded. This record is got by means of the graphophone, which is used a great deal in conjunction with the typewriter. I know how difficult it is to get full directions in the wards from the visiting physician, and here we have the means of an absolute record. In medico-legal cases I think it would be of great service because the utterances of the patient could be reproduced at an indefinite period afterward, and I should suppose would be evidence in the case."

HEALTH MATTERS.

Hallucinations in Alcoholism.

DR. F. W. MANN, in a paper upon alcoholic hallucination read before the Detroit Medical and Library Association, brings together some facts and theories which are published in the *Physician and Surgeon*, November, 1889: —

"The visual hallucinations of alcoholics are exceedingly varied. They may be hideous, grotesque, or awful, or they may be gorgeous, splendid, or inspiring. Unpleasant features usually predominate, and the patient is puzzled and tormented by the presence of rats, mice, beetles, worms, fleas, and other insects. This condition of zoöscopic hallucination is one of the commonest among the phenomena of alcohol poisoning.

"I do not recall having seen any explanation of the reason why animals enter so largely into the composition of the primary illusions of alcohol. These illusions a little interrogation of the patient will usually substantiate as present. A patient only the other day declared how he saw a rhinoceros, several huge elephants, and strange-looking reptiles browsing in the yard.

"A word should be said on the snake hallucination. Disorders of this kind are associated in the popular imagination with excesses in the use of alcohol. 'Seeing snakes' is in reality not a common experience. The two or three cases we have seen convince us, however, there is some basis for esteeming this one of the occasional retributions of excessive zeal in devotion to Bacchus.

"The snake hallucination is difficult to explain. Disturbances in the peripheral organs of vision seem hardly competent to account for such aggravated symptoms, although there are facts suggesting the plausibility of such an explanation. A patient in a

room where the pattern of the wall-paper or the carpet abounds in geometrical figures and circles, is apt to find these endowed with gyratory movement, and as a result may come to imagine snakes about him. But the usual causes of this hallucination seem central in origin and due to pre-existing imaginative impulse. Why should this impulse assume the snake form? May not the explanation lie in the facts of nascent consciousness? We know that stimuli cannot be co-ordinated without some ganglion through which they are brought into relation. In effecting this co-ordination the ganglion must necessarily be subject to the influences of each stimulus and must undergo a succession of changes. This action and its re-action implying perpetual experiences of resemblances and differences constitutes, according to psychologists, the raw material of consciousness. Therefore, as a corollary of this process, Herbert Spencer asserts, that, as 'consciousness is developed, some kind of instinct becomes nascent.' That there is a nascent instinctive dread of the serpent in man and monkey is obvious. There is every reason for it. The early history of our race abounds with record and tradition of that internecine strife between man and the serpent. We find the serpent permeating all his mythology, a chief feature of his legends, inscribed on his monuments, engraved on his symbols, and worshipped as his God.

"Even before this period the dread of the serpent may have been implanted in our human neuroplasm. Dr. A. E. Brown recently made some experiments in the Philadelphia Zoölogical Gardens, and found that monkeys, who, born and reared within the gardens, had never seen a reptile, yet exhibited great fear and curiosity when a snake was placed in their cage. An alligator or turtle caused no surprise whatever. Other animals, like the ox and the hog, were either perfectly indifferent, or manifested no fear of the snake."

Dr. Frank W. Brown said: "I cannot altogether agree with the Doctor as to the important part taken by nascent consciousness in the creation of these hallucinations. I do not think that nascent consciousness enters largely into the formation of the most common of all forms, primary hallucinations; that is, into those first, simple hallucinations which, if continued (and the majority of them are not), may grow to be more elaborate. Nascent consciousness does, however, have much to do with the elaboration. In the graphic descriptions of the struggles of the legal gentleman it would be interesting to know whether he conceived the snakes before the sentence of the judge, or whether they grew in his construction of that sentence; for in the former case they would be a primary hallucination and in the latter an outgrowth of elaboration. Primary hallucinations, I think, arise largely from misinterpreted perceptions — false cognition. The nerve cells, weakened by continued onslaught of alcohol, no longer possess the power of discrimination: they are content to resolve perceptions in the slightest possible way. Just as in that pathological state characterized onomatopoiesis, where the patient lapses into that simple language which names animals by their sounds, so may the weakened nerve-cells of the alcoholic be content to picture living things at the behest of a suggestive touch.

"Bugs, ants, mice, and rats are common hallucinations, but they are generally found first on the body and then afterwards in the room and on the furniture. The appearance first on the body can be explained on the supposition that the hallucination was created by a dermic sensation, or of formication, which would quickly lead, through imperfect cognition, to the conception of a bug or an ant, and then secondarily manifested as a visual hallucination. When seen first on walls or bed, they may be suggested by the so-called *muscæ volitantes*, not uncommon in delirium. As a refinement of this idea, could not the primary hallucination of snakes be brought about through misinterpretation of a *cutis anserina*, which sweeps coldly, wave-like, and rhythmically over a portion of the body? If this process seems complicated, it might explain the infrequency of snakes as an hallucination. Other hallucinations arising in the way I have indicated can be brought about by the red flashes, dust, retinal irritation, which often precedes active delirium, and which suggest a fire, or, more elaborated, a hell; ringing in the ears, a cataract, etc. As to the part taken by nascent consciousness in the creation of the reptiles in the snake case given by the Doctor, I might say that he has been a witness against himself, in that he has not exaggerated in his vivid description of those miserable forefathers of ours in their sometimes unsuccessful attempts to avoid their most uncanny if not most horrible enemy, and from whom we consequently derive one of our most pronounced examples of nascent consciousness. If, then, nascent consciousness be a leading factor in the production of hallucinations, why do snakes so seldom appear as one of their manifestations?

"As to the suggestions given by figures on carpets or wall-paper, they create illusions, not hallucinations, as their origin deals with defective cognition influenced by the imagination, rather than with the nascent consciousness."

The Sense of Smell.

There is no other cranial nerve which presents so much to puzzle the physicist, the anatomist, and the physiologist as the olfactory. The course of its fibres, from the nasal mucosa to the cortex in the temporo-sphenoidal lobe, is devious and obscure, but the phenomenon of matter of various kinds imparting the sensation of odor by contact with the periphery of the first nerve is still more mysterious. With regard to light and color and all the sounds of the octave, we have long been able to conceive of their reception and differential appreciation by the cortex as due to vibration and variation in vibration rates. The wave theory accounts satisfactorily for these visual and auditory phenomena.

There are some well-known facts concerning the olfactory sense which have always been matters of daily familiarity, but which we have not as yet scientifically interpreted. For instance, as Dr. F. Peterson points out in the *New York Medical Journal*, some odors, though mingled together, can still be dissociated and recognized by the olfactory nerve-ends, whereas others, on the contrary, overwhelm one another, so that one only may be perceived, the others being completely suppressed. This antogonism has been little studied, and has been generally dismissed by the physiologist under the assumption of a chemical process occurring in the mixture. As illustrating this internecine warfare among smells, the odor of almonds conquers that of musk; certain ethereal oils destroy the unpleasantness of iodoform; orris-root is employed against bad breath; sulphuric ether overcomes Peruvian balsam; camphor makes the odors of the oils of lemon and juniper, of petroleum, of cologne, and of onion disappear; and coffee and cloves have the reputation in our drawing-rooms of being inimical to certain spirituous exhalations.

There seems, then, to be a sort of strife between odors of various kinds, a strife inexplicable upon any simply chemical theory; and it is more than probable that the vibratory hypothesis must needs be accepted to account for the sensation of smell as well as for those of light and of sound. Not long ago Professor Haycroft (*Brain*, July, 1888) made some investigations upon the olfactory sense, from which he drew the conclusion that the sense of smell as well as that of taste depended upon the rate of vibration of gaseous particles; and he found, moreover, a relation existing between the molecular weights and vibrations of bodies and the odors which they exhaled.

More recently Dr. Zwaardemaker, of Utrecht (*Fortschritte der Medicin*, Oct. 1, 1889), has been studying the same subject in a manner to throw additional light upon the difficult problem. He has constructed an instrument which he calls an olfactometer. It consists simply of a glass tube, one end of which curves upward, to be inserted into the nostril. A shorter movable cylinder, made of the odoriferous substance, fits over the straight end of this glass tube. On inhaling, no odor will be perceived so long as the outer does not project beyond the inner tube. The further we push forward the outer cylinder the larger will be the scented surface presented to the in-rushing column of air, and the stronger will be the odor perceived.

Should one desire to study the effect of mingling two odors, it is only necessary to saturate the cylinder of the olfactometer with one scented body, and another cylinder with another. By the juxtaposition of the ends of the two cylinders, the lengths being accurately determined, the air rushing in upon inhalation through the tubes must take up and mingle the two odors. Dr. Swaardemaker found by this means that whenever one outweighed the

other, he perceived the one or the other smell, but that when both were in exact equilibrium, either no odor at all was perceived, or at most a very weak and uncertain impression was made, which partook of the qualities of neither of the two substances employed.

But as some sort of union of the gaseous molecules could not be altogether excluded by this method, such as an indifferent osmotic or physical combination preventing sensory perception, it was deemed expedient to make use of a double olfactometer in experiments of this character. The instrument consists merely of two of the olfactometers described above, one for each nostril. By the use of the double olfactometer one may easily convince himself that even in this procedure one odor will overwhelm another, rubber, for instance, causing the smells of paraffin, wax, and tolu to disappear. Even with very strong excitants there is never a mingling of sensations. Either the one or the other odor is distinguished by one or the other nostril, until, by careful equilibration of the two, no sensory effect is at all perceived. Sensibility is absolutely eliminated. Each nasal half becomes in this manner completely insensible to the odor inhaled through it, although its sensitiveness is really the same as before.

We are constrained to believe that there is something in the vibratory theory already applied to sight and hearing, to account for these remarkable facts in the domain of smell, and that is the interference of molecular waves with each other, producing in the former cases darkness and silence, and in the latter temporary anosmia.

NEUTRALIZATION OF THE BACILLUS OF TETANUS. — In June last Professor Sormani of Milan announced to the Lombard Institute of Sciences the results of his experiments on the neutralization of the tetanigenous microbe — results which seemed to justify his conclusion that iodoform, iodol, and corrosive sublimate are absolutely destructive to the bacillus in question. To these disinfecting agents he has, says the *Lancet*, as the result of further experiments, added three more — namely, chloroform, chloral hydrate, and camphorated chloral, the latter being, he alleges, in a marked degree efficacious; while camphor and camphorated alcohol he found inert. On a general review of the whole, however, he gives the preference to iodoform. Seven rabbits were inoculated with materials charged with the tetanigenous virus. From six of these, after an interval of twelve hours, the foreign body was removed during the period of incubation; from the seventh the substance was removed only when the first symptoms of local tetanic convulsions had declared themselves. In all these animals the wound was scraped and thereafter freely medicated with iodoform. The seventh rabbit died of tetanus. Of the first six five were saved. From this Dr. Sormani concludes that medication of wounds with iodoform ought to be practised before the setting in of the first tetanic symptoms. Nevertheless, even during declared tetanus, the application of iodoform to the wound is capable of disinfecting it and of removing from it all trace of virulence. Wounds and sores treated with iodoform, especially wounds or sores contaminated with earth, yield results highly welcome to the surgeon — such medication preventing the access of that fatal tetanic symptom which, having once declared itself, leaves but little chance for skilled interference. Dr. Sormani gave confirmatory proof of his thesis by cases of tetanus in hospital, where iodoform opportunely applied saved the patients, and where, from its use having been unfortunately suspended, two lives were sacrificed.

BOXING THE EARS AND ITS RESULTS. — We would fain hope that, in deference to repeated warnings from various quarters, the injurious practice of boxing the ears, once common in schools, is fast and surely becoming obsolete. It is too much to say that this desirable end has yet been realized. Certainly the recent observations of Mr. W. H. R. Stewart do not give color to any such view. In a pamphlet on "Boxing the Ears and its Results," lately published, and referred to in the *Lancet*, Dec. 21, 1889, he briefly summarizes his own experience in the matter. Notwithstanding the toughness of the aural drum head, its tense expanse will rupture only too readily under the sudden impact of air driven inward along the meatus, as it is in the act of cuffing; and Mr. Stewart shows that in one instance at least this injury resulted from a very slight though sudden blow. Given early and skilled attention the wound may heal very kindly, but if the beginning of mischief be overlooked, as it often has been, further signs of inflammation soon follow, and a deaf and suppurating tympanum is the usual result. There is practical wisdom in the statement that this consequence most readily follows in the case of the poorly developed and underfed children who abound in every board school. In them an earache would probably receive no very strict attention, and disease might for a time work havoc unimpeded. Where chronic suppuration exists already, and it is only too common, a random knock on the ear may, and has resulted, in fatal brain complications. The close connection between ear and brain should never be forgotten, and the reflection that injury to the former organ most easily terminates in total deafness, and in suppuration which may any day take a fatal course, should assist in the preservation of a sometimes difficult patience.

BOOK-REVIEWS.

First Lessons in Political Economy. By FRANCIS A. WALKER. New York, Holt. 12°.

PRESIDENT WALKER in this work has undertaken to bring economic science down to the comprehension of a younger class of students than have hitherto pursued the subject, those from fifteen to seventeen years of age. To accomplish this task is not easy, and the author himself expresses some misgiving as to the success of his undertaking; for he has not treated his theme in a childish, or so-called popular, way, but in a thoroughly scientific manner and with the same closeness of reasoning that is employed in larger treatises. How far his book is adapted to its purpose only actual trial, as he says, can tell; but if the subject can be made comprehensible to such young pupils, we should think this work well fitted to do so. It is perhaps as simple in style as a treatise on economics can be, and it is in the main free from controversial matter. It contains, however, some things that might better have been omitted; such, for instance, as the discussion of the multiple standard of deferred payments, which is of no practical importance, and is out of place in an elementary work.

The book is divided into two parts, the first treating of production and exchange, the second of distribution and consumption, and the various subdivisions are in general well made. President Walker's views are so well known that we need not state them, and in most cases we find ourselves in accord with them. His theory of profits, however, we cannot agree with, and we fail to see the cogency of the reasoning by which he endeavors to support it. He holds that "prices are determined by the productive capability of the lowest class of employers who are actually producing for the supply of the market; and all excess of those prices, over the cost of production in the hands of the more capable men of business, goes to these latter, individually as profits" (p. 222). But it seems to us that prices are determined rather by the higher class of employers, who by superior ability or larger command of capital often force prices down so that the lower class of employers are driven out of business. Moreover, President Walker, like other economists, overlooks the fact that the highest profits, as a rule, are not made in production at all, but in exchange. But though we cannot agree with all the author's views, we shall be glad if his work should be successful in teaching economics in the high schools.

AMONG THE PUBLISHERS.

THE fourth volume of M. Grandeau's "Etudes Agronomiques," just issued, contains a review of British and American agriculture, as represented at the Paris Exhibition.

— M. Victor Giraud, the African explorer, has just published the narrative of his explorations in the African Lake Region from 1883 to 1889. The work contains many illustrations.

— The fifth part of the second volume of the *Internationales Archiv für Ethnographie* has been issued. It maintains in all respects the high level reached by previous numbers. Among the contributions are an article in German, by F. Grabowsky, on death,