SCIENCE

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FRIDAY, MAY 25, 1888.

THE DISCUSSION in the New York City Board of Education concerning the succession to Superintendent John Jasper is attracting very general attention. This is necessarily so, because the position of superintendent of schools in New York City is one of great influence and power, and its incumbent ought to be one of the foremost educators of the country. He can mould or make more characters and more intelligences a hundred times over than the most powerful college president. His voice should be heard in educational gatherings, and his counsel should be sought all over the country. He should inspire and lead on his great army of teachers to greater efforts for success in their work. He should be a wise, careful, and unprejudiced administrator. The present incumbent of this great post has held his position for nine years, and during the whole of that time the schools of New York City have been looked upon with contempt by all qualified students of public education. From the standpoint of organization and system, they are magnificent, but they are not educational. Rigid technical requirements and an awful dread of a preposterous marking system rule teachers and pupils alike. Every natural instinct, every activity of the pupil, is recognized only to be crushed and held in check. Superficial results such that they may be estimated in fractions of a per cent are the end and aim of the scholastic exercises. Examinations, inspections, and marks recur with fearful tirelessness; and above and behind them all sits the city superintendent, — a mere calculator of results and percentages. He is unknown to the educators of the country; his face and voice are unfamiliar to every educational gathering. His teachers have no meetings or institutes worthy the name. At least two-thirds of his assistants are disqualified for their positions by age or incapacity. It is freely charged that base and unworthy motives find play in many official actions. More definite charges of other kinds, all turning upon the inefficiency and delinquency of the present administration, have been made in the Board of Education and elsewhere. For these reasons, vigorous and effective opposition is being made to the proposition to continue indefinitely this state of affairs. All fair-minded men, and especially all educators who realize the importance of the New York city schools, should support in this crisis those members of the Board of Education who are making this fight for a principle. This is no time for personal considerations nor for petty jealousies. Argument should turn on the highest good of the schools alone. That that can be best served by a radical reform in present methods of administration and discipline, is obvious.

AFTER AN INTERVAL of about eight months, news has been received from Major Barttelot, commander of the camp at Yambuga Rapids, which confirms the favorable view regarding the state of affairs in Central Africa, taken by all who have watched the events closely. The cable reports the following message: "No news from Stanley since I wrote, toward the end of October. Tippo-Tip went to Kasongo on Nov. 16, but in March he had procured only two hundred and fifty carriers. Jameson has gone to Kasongo in order to hasten the despatch of three hundred and fifty carriers more, which Tippo-Tip promised to furnish. Jameson will be back here on May 14. I cannot leave until June 1. I shall pass Stanley Falls Station, where I shall leave an officer with all that is not absolutely necessary. All are well. — Barttelot." This news was brought by Mr. Ward from Barttelot's camp to Stanley Pool, but we fail to learn how he descended the river. The important facts we learn from this despatch are these: that the fear that Tippo-Tip might have betrayed Stanley, which was entertained by many people, was groundless; that Barttelot has had no difficulty in obtaining provisions for his men; and that the Arabs of Stanley Falls are again friendly towards the whites. All these are reassuring facts, and we may assume that ere long we shall hear of Stanley's safe arrival at Lake Mvutan. It is useless to speculate what he is going to do next.

COMMANDER JOHN R. BARTLETT, who for the past six years has been chief of the Hydrographic Office of the Navy Department, has been relieved from duty, and granted leave of absence for a year. He will accept the superintendency of the Union Street Railroad of Providence, R.I., a position which was offered him several months ago, and which has been held for his decision. A proposition was made not long ago to make the Hydrographic Office one of the regular bureaus of the Navy Department, with an officer at its head nominated by the President and confirmed by the Senate. This has been defeated by the opposition of naval officers, which has been provoked to some extent, it is believed, by jealousy. The defeat of this movement undoubtedly caused Commander Bartlett to ask to be retired. Before Commander Bartlett took charge of the Hydrographic Office, it was scarcely more than a depository for the charts of vessels. He has made it, under Commodore Walker, one of the most useful and important branches of the government. Its sailing-charts are most highly prized by mariners of all nations, and its Pilot Chart is the best published anywhere in the world. It has received frequent recognition by learned societies of Europe, and from the leading naval officers of foreign countries. By the establishment of branch offices at several of the most important ports on the Atlantic coast, it has succeeded in getting into very close relations with the merchant marine of the country, and in securing from it a great fund of the data of which it has made valuable use. The Hydrographic Office, under Commander Bartlett, was the first to direct attention to, and press upon, mariners the use of oil to smooth the waves of the sea during or after storms. By persistently calling attention to it, and publishing upon the Pilot Chart the reports of masters of ships who had successfully used it, the subject was forced upon the attention of navigators, until no properly equipped captain will now go to sea without his supply of oil and the means of using it. The logs of all incoming vessels are carefully examined, and all unusual phenomena are noted. In this way the history and movements of storms have been traced, plotted upon charts, and published, thus adding very greatly to the scope of meteorological science. Water-spouts have been described, and the accounts of them given by the officers of different vessels collected and compared; so that much has been added to what was previously known about them. Hurricanes have been traced, and the accounts of the officers of different vessels which encountered them have been collated and compared; so that the laws that govern them are now better understood than they were before. In this way the Hydrographic Office has become one of the most important of the government scientific bureaus. Lieut. George L. Dyer, assistant hydrographer, who has been associated with Commander Bartlett from the beginning, and has been a most efficient assistant, has assumed charge of the office, and will continue in the place until an appointment is made.

MYTHOLOGY AND AMERICAN MYTHS.

MR. JEREMIAH CURTIN, of the Bureau of Ethnology, read a paper on this subject before the Anthropological Society of Washington recently. "Mythology," he said, "is sometimes called the science of myths; but no man, I think, who knows the present condition of mythology would venture to call it a science. To begin with, there is no agreement as to the origin or meaning of a myth among any considerable number of men occupied either in explaining or studying mythology. The masters disagree, and the disciples are at swords' points. How can you have a science when you are not agreed as to the nature of its subject-matter? The question, 'What is the origin and nature of the story to which the name "myth" is given?' is answered in a variety of ways, — proof positive either that the true answer has not been given, or, if given, students of mythology are unable to perceive it. To go no farther than England, we find two different answers given to the question, in the form of two different theories.

"The first of these theories may be called the 'theory of oblivion;' the second, the 'theory of confusion.' Max Müller's theory of oblivion is founded on the hypothesis that men did not and could not make myths till they had forgotten who the chief actors in these myths were; that myth-makers only began to work when they had no means of knowing what they were working with, or with whom they had to deal in making up their stories; Müller's dictum being, 'It is the essential character of a true myth that it should no longer be intelligible by reference to a spoken language.'

"Herbert Spencer's theory of confusion is founded on the supposition that myths owe their origin to a confusion in the minds of primitive people, who worship their own earthly and natural ancestors under the guise of beasts, birds, reptiles, and plants, because these ancestors, when alive, received the names of beasts, birds, reptiles, and plants, and, after being dead two or three generations, were confounded with those creatures or plants. So the people who began by worshipping the ghosts of ordinary human beings, their own fathers, fell to worshipping wild beasts, snakes, birds, and insects, from whom they thought themselves descended by the ordinary process of fleshly generation. To fill out the whole list, men, if their ancestors came from the east, were descended from the sun; if from beyond the sea, they were descended from the sea; if from a mountain, the mountain was their ancestor. This theory is discussed with as much seriousness as if it had foundation or proof in the world, as if it had ascertained facts to support it.

"Besides these two theories, we have a method of studying mythology which is ably explained by Andrew Lang, author of the article 'Mythology' in the 'Encyclopædia Britannica.' According to this method, Aryan mythology had its beginnings when the ancestors of our race were in the same condition as the ancestors of the American Indians and other contemporary uncivilized races of the earth, when they began to make their myths; and therefore all that seems anomalous to us, all that Müller calls silly, senseless, and savage in Aryan mythology, is a survival from times when the Aryans were in the same stage of thought and development as the men who made the savage myths: consequently Aryan myths are to be explained by comparison with myths of savage races, and by a study of man in the sum of his manners, ideas, and institutions.

"England cannot tell us at present what a myth is. Though England has one of the finest myth-fields in the world to work in, Englishmen have done little in collecting myths, except in a desultory fashion — nothing toward collecting them in their integrity, with all their details, and in such groups that they would throw light on each other. Now, can we in this country describe the nature and origin of a myth? The Bureau of Ethnology has a collection of at least fifteen hundred stories obtained directly from the Indians of North America. Many of these stories are true myths from the earliest period. The collection is an important one, the largest yet made in any country, so far as known, and I believe also the most valuable. Now, if we were asked to tell what myths are, we should be safe in answering, 'We can tell what the oldest and simplest myths in the Bureau of Ethnology are.' My answer, based on the myths I have collected and on those I have examined, would be, myths are stories in which the characters are represented as persons who brought about by their activity every thing that took place in the world of the senses and imagination of the men who framed the stories.

"The myth-persons are always and without exception non-human. They appear as animals, including birds, fishes, reptiles, insects, and sometimes shells, stones, plants, and fruits, all of which are persons; for in myths there are as many persons as there are individual entities. There is another very important category of persons, — the seasons; certain processes in nature; certain objects in nature, as the sun, moon, and stars; the four cardinal points; the highest point in heaven, and the lowest point under the earth. Many of these, on account of not belonging to the animal personages, became assimilated and confounded with men sooner than the others. These animals of mythology are the reputed ancestors of the Indians who have totems, and, I believe, of all the primitive people of the earth who have totems. The spirits of these animals are the familiars or attendant spirits of the medicine-men among all Indians, whether they have totems or not. The Indians of California have no totems, but their medicine-men are aided by animal or elemental spirits. The myth characters, though appearing as persons having volition and desires, eating, drinking, and living the ordinary lives of men, have wonderful powers and peculiarities. In certain directions they are unconquerable, and bring about all the things in nature observed by the myth-makers. This is the true source of the grotesque and strange things in mythology. Thus we find a person performing all the acts of a nature power, and at the same time entering into such relations of love, hatred, enmity, and friendship as exist among men; becoming the husband or wife of another nature power or process, or being the offspring of two nature powers. These myth characters are armed only with weapons and appliances of men in an early stage of development. There is no correspondence between the alleged cause and the visible effect: but, to compensate for their outward and evident insufficiency, these weapons have a magic virtue; and the persons using them, powers beyond comprehension, and peculiar to themselves. These persons are represented as doing things which no living agent could ever do, which only the forces of nature do. On the other hand, the forces of nature are in myths represented as doing the things that only men do. When to these two features are added the customs, ways of thinking, and social habits of the early myth-makers, there is plenty of room for the most ludicrous and unheard-of adventures, as well as cruel and revolting deeds.

"The earliest myths are the simplest in structure, and the persons in them are those that come under the observation of primitive man soonest: animals, objects, and processes in nature belong to this category. Later, because more complicated, and involving the participation of these forces, are the creation myths, with which are intimately connected myths concerning the origin of the arts necessary for the maintenance of life; games; forms of dress and ornament; the observances necessary to obtain the favor and assistance of the elemental powers or spirits, who, in nearly all cases, are represented as animals, birds, reptiles, etc., of pre-human time, or, as the Indians phrase it, 'of a world before this.' But, no matter in what forms they are presented, they are always called people. The same term is applied to them as to the Indians of to-day, — among the Iroquois Senecas, *ongwe;* among the Modocs, *maklaks;* among the Yana, *yana;* and so on, through every stock in America.

"But before proceeding further, it is best, perhaps, to give in condensed form the myth of the birth of thunder and lightning. The characters in this story are, Wimaloimis (grisly-bear maiden); Sula pokaila (mountain-trout old woman); the thigh-bone of the western red-tailed hawk; and Walokit and Tumukit (lightning and thunder), born of the grisly bear.

"The Grisly Bear comes to the house of the Trout, and asks for a night's lodging. Next morning she tries to eat up the Trout; but the latter turns into water, and escapes. Now, the Grisly Bear sets up her home at that place, and, finding a thigh-bone of the red-tailed hawk, hangs it up in the centre of her house, looks at it continually, and from looking becomes pregnant. She brings forth twins. Walokit (lightning) is born first. The moment he is born, she turns to eat him up; but he, prophetic in mind, knows her thoughts, and flashes up so brightly that she is frightened, and drops him. Next, Tumukit (thunder) is born. She tries to swal-

low him; but the infant roars so loudly, that she, terrified almost to death, rushes out of the house, and away on to a mountain, which is called Grisly Mountain to this day. At the birth of the twins the thigh-bone became a hawk, and flew away to the sky. The Trout comes to the deserted twins, and rears them. The boys call her grandmother. When grown up, they are anxious to know who their mother and father are. The old Trout said, 'Your mother is Grisly Bear, a bad woman. She tried to eat me up, tried to eat you up as soon as you were born. She is living on that mountain over there now. She is a bad woman. But your father is a good man: he is Lade herrit' (the red-tailed hawk).

"The brothers go in search of their mother, find her. She pretends to be fond of them, tries a second time to eat them, again is frightened and runs away. Later the brothers find her, and this time they kill her. Then they go home, purify themselves after the matricide, and set out to look for their father. 'He is up in the sky,' said Sula pokaila (the old trout), 'but before you go, here is a cup of trout's blood. The cup will always be full, no matter how much you take out. This will always give you strength.' They went up to Nomhlestawa, who lives in Olelpanti (above in the high), who said, 'Stay with me. I will employ you when I need you.' He gave Thunder large balls, which he tied to his ankles; and they make a great noise now, as he runs through the sky. In the tones of Thunder is heard the voice of a Grisly; for he resembles his mother, and inherited her voice. But Lightning is like his father: he flashes with brightness as he goes.

"This is the account of how lightning and thunder were born into the world, — a beautiful myth, true and easily understood, — a myth of great value, for it reveals with the utmost clearness the process of genuine myth-making.

"Compare this with the Sanscrit myth of the creation of Indra's thunderbolt (I quote from memory): Vritra, at the head of his immense host, pursued Indra and the Celestials in every direction. Then Indra and the gods went to Brahma, and stood before him with joined hands. Brahma said, 'Every thing that ye seek is known to me. I know your desire: you want to kill Vritra. Now, I will tell you how to do it. There is a high-souled and great Rishi named Dadhichi. Go all of you to him and ask a boon. Say ye to him, "For the good of the three worlds give us thy bones." Renouncing his body, he will give you his bones. With these bones of his, make a weapon, which you will call *vajra*, capable of destroying every enemy. With this weapon will Vritra be slain.' They went to the holy hermit, who lived in a jungle on the bank of the Saraswati, and begged the boon, which was granted. The Rishi gave them his body, and left it of his own volition. They took the bones and carried them to Twashtri (the celestial artificer), who was filled with joy when he knew what they wanted, and, going to work, made of the bones the thunderbolt, *vajra*, which he gave to Indra, who, armed with it, went at the head of the Celestials to attack Vritra, at that moment occupying all the earth and the heavens. After a terrific encounter, and after he had borrowed strength from all the Celestials, Indra hurled the *vajra*, and Vritra, great as a mountain, fell headlong. His host fled, and took refuge in the sea.

"In the American myth there are few, if any, doubtful elements. The characters tell their own story. The Sanscrit myth is an interesting example of how similar results may be worked out in different ways in two mythologies.

"If American myths are used to test the value of the two theories in England to which I have just referred, it will appear with reference to the first, — Max Müller's theory, — that mythology does not owe its origin to any action of language whatever; neither to a disease of language, nor to the influence of language on thought. The framers of the earliest myths — the myths on which succeeding ones were fashioned, and from which characters and materials were borrowed in after times; the myths which were preserved with the greatest care, and are most sacred in the minds of the people to whom they belong — were men who described what they saw in the most direct manner. The earliest myth is a simple narrative in which the names of the actors were understood in all cases: in most cases they are understood down to the present day. Whatever difficulty there may be in interpreting such myths was not caused by linguistic influence.

"In a later period of myth-history, linguistic influence is apparent; in particular cases it may be great, in some mythologies more prominent than in others; but it is never a main factor, never a predominant element, never the parent of mythology.

"If American myths are to be used to test the second theory, — that of Herbert Spencer, — which affirms that mythology, no matter what forms it may assume, is simply a worship of the ghosts of human ancestors, who, through the influence of language or some other causes, came to be mistaken, some of them for animals, plants, mountains, seas, sun and moon, while others grew in time to be the gods, the divinities of their race, it will be shown that there is no such ancestor-worship as that in America. There is an ancestor-worship, however, which is universal, and which I believe can be demonstrated by the mythology of every race on earth, if that mythology is only interpreted faithfully, and if we arrive at its inward and true thought.

"There is an ancestor-worship in America which is the worship of elemental or nature powers, which, as animals or in their own names as powers or objects in nature, are the myth-persons, the totems, or non-human ancestors, of the North American Indians, — the protectors, the guides, the enlighteners, of those whom we call 'medicine-men,' but who, as represented by the best among them, were the sages and philosophers of their race. That there were such, we know from myths which they constructed, and which we have received from their descendants.

"This ancestor-worship is the worship of the various manifestations in nature which primitive people noted and named, in all cases having significance for them. They worshipped in detail, and mainly, though by no means exclusively, in its external aspects, that which the man of our day worships as one which acts not merely in the universe outside, but in his own breast, — that Power men of the highest civilization and of every creed call 'Father,' and say that they descended from it. The Indians say that they are descended from manifestations of that same Power, are the children of those manifestations. We say, 'Our Father who art in heaven, give us this day our daily bread.' They say in their fashion, and according to the most ancient and sacred utterances of their race, 'Our fathers, give us this day our food,' using the plural where we use the singular. The Indian, therefore, stands precisely on the same line as the most enlightened man of the nineteenth century; with this difference, that he is nearer the beginning of the line, and sees in detail the Power which we see in unity.

"The work already done by the Bureau of Ethnology is small, if compared with what remains to be done before we can have a science of mythology on clearly demonstrated and symmetrically arranged facts; but it is a very large and important work if compared with what preceded it, and it shows, as no other work has been able to show, the nature of the task before us. When we shall have completed our collection of myths in the leading, if not in all, the American linguistic stocks, and obtained all the possible variants of each myth, we can make our final contribution to the science of mythology, which can never be founded without the American contingent.

"If much remains to be done in this country, there is still more to be done in Europe Asia, and elsewhere. Lang, in his article on 'Mythology,' omits the mythologies of the Celts and Slavs because so difficult and so little known. Now, the Celts are remarkable for the great extent of their recorded mythology, which has extended largely into English and other national literatures of Europe, though the fact is not generally known. Chaucer and Spencer have drawn much from Celtic sources. King Lear, Queen Mab, and other Shakspearian characters, are Celtic; and, if we consider the efforts made to destroy their language, the Celts of Ireland have a great number of living myths. The Slavs, though they have very few myths of ancient record, have within the territory they occupy more myths still existing in the minds of the people than all the rest of the nations of Europe taken together.

"Of Hindu mythology, little is known outside the Sanscrit, which, though extensive beyond any known mythology on record, has not been utilized to an extent at all commensurate with its value. The rest of Asia is practically unknown. Chinese mythology is as a sealed book; and it must have immense treasures with its so-called 'ancestor-worship,' the origin of which is undoubtedly misunder-

stood. I have said that we must obtain the complete mythologies of each linguistic stock of America, and we must work until we have shown what the characters of the myths of each stock really represent. This done, each stock is to be compared with that most nearly related to it, and then a general comparison of all. The final result will be a scientific American mythology. If the Aryan field is worked in a similarly careful manner, we shall have a complete Celtic, Teutonic, Greek, Slavonic, Persian, and other mythologies, and, finally, Aryan mythology as a whole.

"There still remain Africa, Australia, and the Pacific Islands, where there are materials of the highest value for the completion of mythologic science and the history of the human mind, — materials which are perishing every day, and which will never be collected if missionaries and travellers are to collect them. You could no more make a collection of myths through the agency of missionaries and travellers than you could make a geological survey of the United States if you depended on the voluntary and intermittent efforts of missionaries and travellers, some having, but most not having, definite ideas about geology or topography.

"Though mythology is as nothing on Wall Street in comparison with geology, the time, I think, is coming when a good number of men will place it higher; because mythology is to the history of the human mind what geology is to the history of the earth, — documentary evidence of the character of its different epochs. Even now there are few persons who would say that the earth on which he treads is better than man. You remember the words of the great poet, —

> "'The cloud-capp'd towers, the gorgeous palaces,
> The solemn temples, the great globe itself,
> Yea, all which it inherit, shall dissolve,
> And, like this insubstantial pageant, faded,
> Leave not a rack behind.'

"When that time comes, it will be found that the only real, the only permanent, results achieved on earth were those relating to the human mind."

SCIENTIFIC NEWS IN WASHINGTON.

Phonographs, Graphophones, etc.; Curious Experiments with Jets of Water. — Replenishing Rivers with Shad. — More about the Water-Spouts. — United States Fish Commission Work on the Pacific Coast.

Instruments for Recording and Reproducing Speech.

PROF. ALEXANDER GRAHAM BELL read, at the last meeting of the Fortnightly Club, a paper upon recent inventions for recording and reproducing speech, exhibiting, to illustrate what he said, some of the latest and most curious devices that have been produced. He explained the nomenclature of the subject as he thought it ought to be used, by saying that a phonograph is an instrument for making a record of speech; phonogram, the record so made; and graphophone, an instrument for reproducing speech from a phonogram. In some cases the phonograph and graphophone are the same in most of their parts, but in many they are entirely different.

Professor Bell exhibited the graphophone, of which a number are now in practical use, and which, in its essential parts, is similar to Edison's phonograph. The record is made on a cylinder covered with wax or paraffine, and the speech is reproduced by conducting the sounds to a diaphragm connected to an open trumpet-shaped instrument, or, by wires to devices placed upon the ears, vibrations corresponding to those that were produced when the record was made.

A modification of these instruments was shown, in which the record was made upon a pasteboard disk revolved upon a shaft in a horizontal plane. The upper surface of the disk is covered with wax, upon which a similar impression to that on the wax-covered cylinder is made by a stylus connected with a diaphragm which is caused to vibrate by the sound of the voice. The record is a spiral groove cut in the wax. The reproduction is obtained in a manner similar to that used in the cylindrical machine. The principal advantage which this form of the instrument is expected to present over the older, cylindrical form is in the greater facility of multiplying copies. Electrotypes are much more readily made from the flat disks than from the cylinders. From these electrotypes other disks covered with wax, and that with tinfoil to prevent sticking, obtain the spiral impression by pressure of the former upon the latter; and when one of these duplicates, the tinfoil having been removed, is put into the instrument, the reproduction of speech is as perfect as from the disk on which the original record was made.

The most interesting and curious part of Professor Bell's paper related to experiments based upon investigations and discoveries made by Dr. Chichester Bell in regard to the effects of sounds upon jets of fluid. It is well known that if a jet of fluid, like water, is placed in sound-waves, it is not only sensitive to them, but it reproduces them as the string of a musical instrument, tuned in unison with that of another, will vibrate, and reproduce the tones given out by the first. It is not easy to hear the sound or speech reproduced by the jet of water. The former mode was to connect the hearing-tube with a rubber diaphragm placed in the jet of water, which is discharged perpendicularly from above, at a given pressure, from a very small orifice. When the rubber is held very close to the orifice, the sound reproduced is very faint; but, as it is moved away, it increases in volume until the point of maximum loudness is reached; then it diminishes again until near the point where the stream begins to break; and then it is broken up, and is entirely unintelligible. As the sounds to be reproduced by the jet have to be made in the same room, and very near to the jet of water, it is very difficult for any but a practised ear to detect the one from the other.

In order to make this more satisfactory, Dr. Chichester Bell made the following experiment. Substituting two platinum wires for the rubber diaphragm with a small piece of some non-conducting substance inserted between their ends, he placed this in the jet at the point where the largest volume of sound has been found to be reproduced. These wires being connected with an electric battery, and a telephone placed in the circuit, it was possible to have the speaker and listener almost any distance apart. With this apparatus, speech was not only reproduced, but with increased volume: the jet of water not only spoke, but acted also as a microphone to magnify the sounds it made.

Upon these experiments were based those which Professor Bell explained to the club. The jet of water, somewhat colored, was discharged upon a glass plate placed in it at the point from which the greatest volume of sound was known to issue in reproducing speech. This caused the jet to spread out in a thin film over the plate. The under side of the glass was covered with an opaque substance in which there was a small slit through which a small amount of light could pass. Behind the slit a moving piece of photographic paper was placed, upon which the record was made. Then a person spoke over the plate, and the result was a very curious line upon the photographic paper. When this line was transferred to gelatine in the ordinary way, it was found that a series of elevations and depressions was produced, which could be felt with the fingers, and from which an electrotype could easily be made. This showed that the sound-waves, striking the film of water on the glass, caused constant changes in the thickness of the latter, and thus caused a variation in the intensity of the light that passed through the slit. From such a record as this, it will probably be a simple problem to reproduce the speech. Professor Bell exhibited specimens of the original record upon the photographic paper, of the negative that is made for the transfer to the gelatine, and of the gelatine after the transfer had been made. The possibility of developing from these experiments an instrument for the reproduction of sounds that may be superior to any yet made is what makes them so interesting.

Shad-Hatching.

The shad-hatching by the United States Fish Commission this year is confined to four stations, — one at Fort Washington, on the Potomac; one at Havre de Grace and another at Battery Island, on the Susquehanna; and one on board the 'Fish hawk,' on the Delaware. The season for taking eggs will continue until the last week in May or the first week in June; and the number of eggs captured this year up to May 19 was far greater than had been taken at the same stations at the corresponding date of 1887, when the

whole number for the entire season was more than 200,000,000. The three rivers are now yielding from 12,000,000 to 15,000,000 eggs daily. The commission is also giving attention to the moving of eggs and the hatching and planting of young shad in the rivers that flow into the South Atlantic and the Gulf of Mexico: 30,000,000 eggs will be disposed of in this way this season.

Whatever opinion may be held of the other work of the United States Fish Commission (and the importance of all branches of its work is coming to be universally recognized), its success in increasing the supply of shad in the rivers to which it has given its attention, and in introducing it where it did not before exist, has been demonstrated beyond question. The value of shad taken in the United States in 1887 was $325,000 greater than in 1880, and this in spite of the fact that the market-prices of the fish are now much lower than formerly. Shad can be bought on the wharves in Washington for from ten to twelve dollars per hundred, and at retail in the market for twenty-five cents each. Before 1884 the retail price of similar fish was seventy-five cents each. The increase first became noticeable in 1884.

The Water-Spouts of April.

Science republished, about six weeks ago, one of the charts of the Hydrographic Office, showing the location of a great number of water-spouts observed in the western Atlantic in March and early in April. Since that time many more detailed reports have been received; and among them one of the most interesting is that made up from the log of the steamer 'Pavonia,' and from the testimony of eye-witnesses who were on board of her. The following is the substance of that report. The spout formed south-west of the ship, and travelled in a north-east direction, making it necessary for the 'Pavonia' to change her course in order to avoid it. Its movement was at the rate of thirty miles an hour; and from the time it was first seen, until it burst near the vessel, only ten minutes elapsed. Its rotary motion was against that of the sun. The agitation of the sea at the base was tremendous, so that the ship was greatly affected by it when the water-spout passed near. The wind at the time was a light breeze from the south. As the water-spout passed, the ship experienced a perfect whirlwind for about a minute. The water-spout broke off the starboard bow, and this was accompanied by a great deluge of rain, vivid lightning, and heavy thunder; and chunks of ice fell upon the decks of the 'Pavonia,' irregular in shape, as though broken from a block, many of them from four to six inches in diameter. As the water-spout broke, the wind shifted to the south-west, and increased to a moderate gale. The cloud hung very low, and the water-spout took the form of an hour-glass. A terrific roaring noise was heard as it passed the ship, and, as it went along, it threw the water to a height of sixty feet at least, and churned it up into a mass of foam. There was no evidence of ascending or descending currents. The water appeared to be lifted bodily into the air, and held there until the water-spout broke near the vessel. No observations of barometer or thermometer were made.

United States Fish Commission Work on the Pacific Coast.

The United States Fish Commission steamer 'Albatross,' Capt. Z. L. Tanner, arrived at San Francisco last week, and, as soon as she is fitted out, will start on her summer cruise. She has been ordered to cruise from Kodiac to and along the Aleutian Islands, for the purpose of studying the fishing-grounds of the Alaskan coast. The most important fish found there is the cod. Captain Tanner is instructed to make a careful and systematic study of the whole coast, not only hydrographically, but for the purpose of determining the kinds of fish to be found there, the limits of their distribution, and their abundance. He is also to make a thorough study of the fauna of the sea and its distribution over the sea-bottom. Important results are anticipated from this summer's cruise of the 'Albatross.'

ELECTRICAL SCIENCE.

Edison's Improved Phonograph.

THE first phonograph made by Edison, in 1878, differed from many inventions — for example, the telephone and telegraph — in that it was not the result of a process of evolution, and it was not almost simultaneously discovered by different investigators. As it was first exhibited, it consisted of a diaphragm to which was fastened a needle whose point pressed against a strip of tinfoil: the tinfoil was rolled around a cylinder, which was rotated by hand, and which had, besides its motion of rotation, a forward motion on a screw, so that the needle traced a spiral on the surface of the foil. When the diaphragm was spoken to, the cylinder being at the same time turned, the needle made a record on the foil; the number and depth of its indentations depending, of course, on the vibration of the diaphragm, and therefore on the sound it received. When the needle was made to traverse the record again, it transmitted vibrations to the diaphragm similar to those it had received, reproducing the original sound. There were several disadvantages in this first instrument: the reproduction was by no means perfect, and the mechanical arrangement was not convenient. Mr. Edison has, however, continued his investigations on the subject, and has lately produced an instrument that leaves little to be desired as far as faithfulness of reproduction goes. There is no radical change in principle. In place of the tinfoil, wax cylinders are used, and they are uniformly rotated by an electric motor. The instrument is so arranged that words can be repeated that are not understood. The wax cylinders are of different sizes. One of two inches in diameter, four and a half inches in length, and one-eighth of an inch thick, will contain from one thousand to twelve hundred words, and can be used over ten or twelve times, a turning-tool in front of the diaphragm shaving off the old record. The accuracy with which sounds, vocal and instrumental, are reproduced is remarkable. On May 12 an exhibition of the phonograph was given at the New York Electric Club, and Mr. Gilliland described the history of the invention. Various applications were shown, and a number of different sounds reproduced. There is no doubt that the phonograph can accurately record all varieties of sound, from the human voice in ordinary conversation to a brilliant piano concert. The records are portable and easily reproduced, and the field of application of the instrument must be wide.

DYNAMO AND STEAM TURBINE. — A combined dynamo and steam turbine that has been in use in England for some time, has recently been introduced into the United States for ship-lighting purposes by the United States naval authorities at Newport, R.I. The armature of the dynamo is connected directly to the shaft of the turbine, which revolves at the extremely rapid rate of ten thousand revolutions per minute. The turbine works on the general principle of Helmholtz's double siren, except that instead of two disks there are perhaps fifty, arranged on horizontal axes; the steam entering at the middle, and exhausting at the ends. While this is in all probability not economical, it is extremely compact, — a very important consideration on board ship, where space is valuable and belting is objectionable. The electro-motive force of the dynamo is kept constant by an electric governor which regulates the throttle valve of the turbine. The extremely high speed necessitates the best possible lubrication: the bearings are long, with ample oil-channels.

PRIESTMAN'S PETROLEUM-ENGINE. — The London *Electrical Review* contains reports of tests of this engine made by Sir William Thomson, Sir Samuel Canning, and others. The reports are most flattering. Tests were made of engines giving six-horse power at the driving-pulley, with the result that the consumption of oil was about 1.7 pints per horse-power per hour, while they need very little attention. To quote a part of Sir Samuel Canning's report: "We consider that there is a great field of usefulness for this motor, and especially in America, where gas averages something like 7s. 6d. per thousand cubic feet, and where, owing to the vast expanse of the country, it is very difficult to get motive power in more or less inaccessible localities; . . . for isolated electric light installations, and even larger operations of the kind, and for every use to which a gas-engine can be put, with the special advantage of being capable of employment where gas cannot be utilized." The engine is run by the petroleum vapor, which is exploded in the cylinder, as is the gas in the cylinder of a gas-engine. There must, of course, be a water-jacket to the cylinder, to prevent excessive and dangerous heating. Let us consider what the cost of isolated lighting would be, using this engine, as compared with gas. An

ordinary gas-burner uses over six feet of gas per hour: one mechanical horse-power at our oil-engine can supply twelve corresponding incandescent electric lights; or 1.7 pints of oil must be compared with 72 feet of gas; roughly, 24 pints of oil will equal 1,000 feet of gas. The quality of oil used cannot cost as much as ten cents per gallon: at that price the oil for our engine will compare with gas at thirty cents per thousand. To this we must add about fifteen cents for breakage of lamps, making forty-five cents per thousand. The amount to be added for interest and deterioration depends entirely upon the amount of light used: for an ordinary household, using four or five thousand feet of gas a month, this item might amount to a dollar a thousand at a very liberal estimate, making the total cost one dollar and forty-five cents a thousand at the outside, and giving all the advantages that incandescent lighting offers, — greater health, convenience, comfort, and beauty, with the use of small motors for various domestic purposes.

Accumulator Tests. — The London *Electrician* contains the following: "Prof. von Waldenhofen has recently carried out at the Electro-Technical Institute a comprehensive series of experiments with the storage-cells of the Fahrbarky and Schenck, Reckenzaun and Julien type. The chief object of the experiments was to ascertain the efficiency of each type, especially for tramway purposes, and to eliminate errors in estimating the degree to which the cells had been charged or discharged. The experimenter based his investigation on three measurements; viz., the electro-motive force on open circuit, the density of the electrolyte, and the potential difference when at work. The efficiency of the Reckenzaun accumulator was found to be 89.3 per cent for quantity, and 80.5 per cent for energy. For the Julien accumulator, the figures were respectively 89.7 per cent and 83.4 per cent; whilst the Schenck-Fahrbarky accumulator gave 91 per cent efficiency for quantity, and 78.5 per cent for energy." These figures are interesting; but as the efficiency of any accumulator varies greatly with the rate of discharge, decreasing as the discharge rate increases, it would be well to give with the efficiencies the rate of discharge at which they were obtained. As the experiments were for tramway-work, however, we may assume that rather heavy currents were used: this being the case, the tests are most encouraging.

The Bently-Knight Electric Tramway in Allegheny City. — This line is about four miles in length, and employs both overhead conductors and conduits. In both cases there is a complete metallic circuit, neither the rails nor earth being used as a return. The road is difficult, with one grade of 9¾ feet in 100 feet for a distance of 400 feet, and numerous others; the average rise in a distance of 4,900 feet being 295 feet, — over six per cent. Two fifteen-horse power motors are used under each car, connected with the axles by spur-gearings. There are at present four cars running, with two more to be added shortly.

HEALTH MATTERS.

State Medicine.

At the meeting of the American Medical Association held in Cincinnati during the present month, Dr. H. P. Walcott, chairman of the State Board of Health of Massachusetts, delivered the annual address on State medicine. For the following abstract of the address we are indebted to the *New York Medical Record*: —

Dr. Walcott first related briefly the history of the State Board of Health of Massachusetts, which was established by legislative action in 1869. Its duties were at first advisory rather than executive; but, in proportion as public intelligence in sanitary matters was quickened, the functions of the board were enlarged, until now it is charged to some extent with the power of enforcing the rights of the people to pure air, soil, water, and food, and preventing and punishing any violation of them. It is also intrusted with the business of gathering information concerning any matter pertaining to public health, and diffusing such information among the people. Among the chief of its duties in this connection is the investigation of the causes and the prevention of infectious diseases. A comparison of the mortality statistics will show in a measure the effect which all this work has had upon the health of the people. The number of deaths from all causes, in proportion to the population, has changed but little during a period of thirty-six years, ending with 1886; but the percentage of deaths from zymotic diseases has almost steadily decreased, during the period that the State Board has been in existence, from 25.6 to 19.0; there has also been a general tendency, though less marked, in the direction of a decrease of deaths from constitutional diseases. The classification of preventible diseases is as yet not well defined; and year by year, as the experience of sanitarians becomes widened, a larger and larger number of affections are found to be the result of influences that can be removed. This fact is illustrated in the case of consumption, the prevalence of which was shown twenty-five years ago by a former president of this association, Dr. H. G. Bowditch, to be largely influenced by conditions of soil, moisture, and land-drainage. The most marked reduction has occurred in the case of small-pox, which is a disease that is absolutely preventible by means of vaccination and re-vaccination. In demonstration of the saving of life in consequence of better sanitary conditions, the speaker offered a comparison between the results of ovariotomy and those following the labors of an intelligent and efficient board of health. The largest number of deaths in Massachusetts in any one year from ovarian dropsy was 51. In the single city of Somerville the death-rate has been reduced, since the organization of a municipal board of health, from 22.86 to 16.68 per thousand. Thus the adoption of sanitary measures has saved more lives in one year, in a community of thirty thousand people, than could have been restored to health in the same period in a State of nearly two millions of inhabitants, by an operation which is justly regarded as one of the greatest triumphs of American surgery. In has been said by Dr. Russell of Glasgow that nothing is more conspicuous than the helplessness of the individual, under the conditions of civilized life, to secure the physical basis of health. How can any single individual in a crowded city detect and remove all possible causes of disease in the water, food, sewerage, and air contamination? There is no help but in co-operation on the most extended scale possible, — individual, municipal, State, and national. The individual must be compelled to give up the liberty to injure his neighbor; the city must be restrained from converting into a sewer the river which supplies water to the villages that cluster about its banks lower down in its course; no State should permit its own causes of disease, whether they are persons or things, to be transported into another State; lastly, the general government should take cognizance of those causes of disease which can be controlled by no other power. A sufficient safeguard will never be established by voluntary associations on the part of persons, towns, States, or even nations. How, then, shall we organize for the protection of the public health? For the individual, the speaker maintained: "Let the State give him some assurance that the legally used title of physician designates a person sufficiently qualified to give advice for the prevention and cure of disease; establish, by direct provision of State law, local health authorities for each village, town, city, or county; and, to control all these local organizations, let there be a State board, clothed with ample powers." All arguments that have been used for the existence of State health authorities, Dr. Walcott believed, are also available for the creation and support of some central health authority. The question of form of this organization is one that may be left to the law-making powers. A board in which every State was represented might be cumbersome, but it could easily delegate its powers to a small and compact executive committee during the intervals between the necessarily infrequent meetings of the full board. The only alternative to this seemed to the speaker to be a single officer at the head of a bureau in connection with some one of the departments at Washington. This central authority, however constituted, should have ample means for investigating into the State boards of health. There is still in legal existence a national board of health; but, through the neglect of Congress, it is in a state of hopeless lethargy. This board entered upon its work with every promise of success, and it demonstrated that local, State, and national health authorities could profitably and harmoniously unite in suppressing an epidemic of yellow-fever, and preventing its spread from State to State; yet this did not save it from practical extinction. The failure of the board to survive the unjustifiable attack made upon it was due in great measure, the speaker thought, to its organic form, embracing, as it did, members

of the army, navy, and marine-hospital service, and having a totally insufficient State representation.

In conclusion, Dr. Walcott urged the proper organization of some central health authority, whether in the form of a bureau of health or a board of health; provided, only, that some part of the great resources of the nation might be turned to the protection of that greatest of all property, human life. The address was referred, with the thanks of the association, to the Committee on Publication, from the section on State medicine.

Too Many Medical Students.

The president of the American Medical Association, Dr. A. Y. P. Garnett of Washington, took for the subject of his presidential address 'The Mission of the American Medical Association.' Its paternal relation to the entire profession of the United States imposes upon it duties and responsibilities of the gravest character. He said: "Taking a retrospective view through nearly half a century of existence, we have no reason to be discouraged. But, while we feel gratified by contemplation of the fruits of our labor in the past, it is obviously important that we should not be flattered into a belief that we have accomplished our mission, and permit ourselves to lapse into supine indifference with regard to a pre-eminently important object which remains to be worked out through the instrumentality of this association. I refer, gentlemen, to radical and thorough reform in the present system of medical education in the United States." He submitted the following propositions: —

"*Proposition First.* That a standing committee, to be called the Committee on Legislation, shall be appointed for each State and Territory, and the District of Columbia, to consist of five members of the medical profession in good standing, three of whom shall have no official connection with any medical school or college, whose duty it shall be to carry out, as far as possible, the following instructions:

"*a.* Each one of said committee, or a majority thereof, shall attend the sessions of their respective Legislature from time to time, as their duties may require, for the purpose of using all honorable means looking to the reduction of medical schools in the United States, and the consequent diminution of the annual number of graduates; that, as a practical measure to this end, they urge the passage of a law requiring that in the future granting of charters for creating medical schools there shall be a clause in every such charter requiring that all schools or colleges thus created shall demand a full term of four years' study before granting a diploma thereof, and that no student shall be admitted to matriculate who has not passed satisfactory examination, oral and written, in the ordinary branches of academic study; and, further, that any college failing to show a greater number than fifty matriculates annually for three consecutive years shall forfeit its charter and be abolished.

"*b.* That they use all diligent efforts to secure an ordinance creating in each State and Territory where no such board at present exists, and in the District of Columbia, a board of medical examiners, which shall have no connection with any medical school, and which shall be required to examine all applicants for license to practise medicine in the States, Territories, and the District; and that any person who may be detected practising any branch of the healing art without a license granted by the said board shall be subject to such penalties as the law may provide.

"That this committee may be authorized by statute to select and nominate to the governors of the States, Territories, and the District of Columbia, seven competent learned members of the medical profession, to constitute such a board of examiners, who shall have exclusive power to issue licenses to practise the art and science of medicine and surgery.

"*c.* That the chairman of the said committee of five be required to submit at each annual meeting of the association a report embracing a full statement of what has been accomplished by each.

"*Proposition Second.* That the faculties of the several medical schools within the limits of the United States be once more urgently requested to call a convention at some central point for the purpose of consultation and adopting some general and uniform system of medical education, more comprehensive and rigid in its requirements, and more in accord with the spirit of the age and advanced progress of medical science, suggesting four years' term of study, the requirements of a preliminary education including some knowledge of the classics; that any college or school which shall refuse to enter into such arrangement as may be decided upon by the said convention shall be excluded from all connection with the American Medical Association, and its alumni shall not be recognized as members of the regular profession."

OLEOMARGARINE IN MASSACHUSETTS. — The Legislature of Massachusetts has passed a law prohibiting the sale of oleomargarine in that State. The State Board of Health advised the Legislature against the passage of the bill, holding that oleomargarine was not injurious to health.

THE TYPHOID BACILLUS. — Another epidemic of typhoid-fever has been traced to infected drinking-water, the typhoid bacillus having been discovered in the water. The outbreak occurred in a boarding-school at Quimper, France, one-sixth of all the inmates being attacked, and one in eleven dying.

THE NUMBER OF MEDICAL STUDENTS. — The *British Medical Journal* gives the following as the number of medical students in the following universities in the winter session just elapsed: in Vienna, 2,287; Munich, 1,369; Berlin, 1,316; Würzburg, 956; Leipzig, 794; Prague, 566; Graz, 501; Griefswald, 471; Breslau, 382; Freiburg, 350.

MENTAL SCIENCE.

Reflex Speech.

ACTS performed at first with great effort, by constant repetition become so thoroughly ingrained in the nervous system that they are performed without the slightest effort, or even may be performed in spite of a more or less strong effort to resist them. When this occurs, an originally voluntary act is said to have lapsed into the automatic or reflex stage; the act has become mechanical; and pressing the proper key will produce the appropriate re-action. In a recent issue of the *Journal of Mental Science*, Dr. G. M. Robertson calls attention to the fact that there exists a large number of colloquial phrases that have become automatic. Speech, though at first learned with great difficulty, becomes the most natural channel for expressive movements. We are daily asked, "How are you?" and as frequently reply, "Very well, thank you." And the best proof of how very automatic and unreflective this answer is, is given by the innumerable cases in which this is said even when we are not well. This is present in a perfectly healthy mind, but it remains obscured. When we are excited or confused, or, better still, absent-minded, the phenomenon becomes more prominent. Ask an absent-minded friend, "How are the family to-day?" or "How is your brother Tom?" and he tells you, "They are well, thanks;" and immediately adds, "What *have* I been saying? Why, my father is laid up with gout," or "Tom has broken his arm."

All reflexes are controlled in health, but appear in exaggerated forms in disease. This speech-reflex becomes very marked in dementia, where there is a gradual breakdown of the mental structure, and, as is the universal law, the highest, least stable products are the first to decay. The power of intelligent speech is lost or enormously reduced, but the more deeply acquired habit of automatic responses is retained. One such demented patient showed practically no intelligence: he never even asked for food or drink. He underwent a severe surgical operation without saying a word, but his reflex speech was preserved. Here are samples of it: "How are you?" — "Oh, just about the ordinar', thank ye." — "How are you feeling to-day?" — "Oh, pretty weel, thank ye." — "How's all with you?" — "I'm doin' pretty weel." — "You're not so well to-day?" — "I don't think I am." — "How's the wife this morning?" — "Oh, she's very weel, I'm thinkin'." — "Will you take your hands away?" — "Yes, I'll do that." Intelligent though these answers seem, they were not so; for he was all the while suffering from a serious illness, he knew nothing about his wife, and, though he promised to keep his hands away, he did not do so.

Another patient named Ross, though chattering all day, had really no intelligent speech. Within a minute he would say such incoherent nonsense as, "If you would just come be! Oh, dear, dear! Oh! that is the whole clash. That's what! Oh, dear, dear me!" and so

on. The only phrase with meaning here was "dear me!" — a reflex phrase. But in such simple talk as the following, Ross could take a part: "Well, Ross?" — "Weel, sir." — "How are you?" — "Very well, sir." — "It's a fine day, Ross." — "It is that." — "Ross?" — "I hear, sir." — "You're not well to-day?" — "Oh! I don't know." — "Good-by, Ross!" — "Good-by, sir!" The attendant could not get a sensible word out of him, and was much surprised to hear how well the patient could talk to Dr. Robertson, neglecting to notice that the latter was careful to ask for reflex phrases.

In some cases the answers will not be appropriate to the query. "It's a rainy day," will be answered by, "No, I'll no do it;" "What day is this?" by "Oh! but that is not right;" and so on. From his study, Dr. Robertson concludes (1) that actions seemingly intelligent may be mainly automatic, or reflex; (2) that in speech we have present all the causes leading to a reflex action; (3) that in health such speech-reflexes are exhibited, but under special circumstances they come into prominence; (4) that in some forms of mental disease this reflex is exaggerated; and (5) that the path of reflex speech is well organized, and strongly resists destruction.

RE-ACTION TIME FOR TEMPERATURE AND TACTILE SENSATIONS. — M. v. Vintschgau and E. Steinach (*Pflüger's Archiv*, xliii. 2324) have made a very extended series of experiments upon the time necessary to perceive the contact of an object on the skin, as well as the time necessary to feel a cold and a warm object. They have improved the method of making such tests, and the times they report agree well with those of former workers. They summarize the results of their work thus: finely sensitive portions of the skin, such as the cheek, have a greater re-action time than portions of less sensitiveness; differences of 2° to 4° C. in the temperature of the stimulating object do not influence the time of re-action; repeated cold applications diminish sensibility for cold, and lengthen the re-action times for cold; increase of bodily temperature does not increase the sensibility for warmth, nor decrease the re-action time; the time necessary to perceive warmth as well as cold on the hand is longer than on the face; an impression of warmth or cold is more quickly perceived if applied to the right side of the face than to the left; it takes longer to perceive a sensation of temperature than one of simple pressure, and longer to perceive warmth than cold; indisposition lengthens the re-action time for pressure.

AN INSTRUCTIVE CASE OF WORD-DEAFNESS. — Dr. Bianchi has recently described (*Revue Philosophique*, March, 1888) a case of this peculiar trouble that beautifully illustrates the relative independence of the several sensory factors of language. Our language consists primarily of a receptive power of hearing and understanding words, and an expressive power of articulation. To this is added, at a later period, the receptive power of seeing and understanding printed characters, and the expressive power of writing. Disease may deprive one of the use of any one of these four factors, leaving the others almost intact; while the probability of the loss of the one bringing with it the loss of the other depends on how independently each has been cultivated, and on individual differences. A person who writes little, and has to translate spoken into written language, will probably lose the power of writing with the power of speaking; but one who is accustomed to have his thoughts flow off the tip of his pen may retain this power when he becomes aphasic. Dr. Bianchi's case is that of an intelligent young merchant who was stricken with paralysis, and, after recovering from his attack, was found unable to understand words. His intelligence seemed unimpaired. He appreciated that he was spoken to, and appealed to a bystander to answer for him. He could appreciate and make himself understood by gestures. He could hear a watch ticking at quite a distance, and was in no way deaf. He never spoke. If his name, 'Arthur,' was shouted to him with the gesture that he was to repeat it, he did so in parrot-fashion, but evidently without appreciating that it was his name. By thus teaching him syllable by syllable, he learned to say, "*Buona sera!*" ("Good-evening!") and said it on all occasions, whether appropriate or not. He was similarly taught such words as 'bread,' 'water,' and so on. He could write, but apparently only under dictation. If you placed a pen in his hand, he would write words without meaning; but if asked the question, "From what country are you?" he would write, "From what country." At first he was totally unable to understand what was written, but he was gradually taught to do so, though he could not read the words he had been taught to speak.

THE 'VISUAL AREA.' — One of the main points of discussion between Ferrier and his opponents is with reference to the location of the sight-centres in the cortex of the brain. Ferrier places it in the angular gyrus, while others maintain that it is localized exclusively in the occipital lobe. Dr. Schäfer has repeated these experiments on dogs and monkeys (*Brain*, 1888), and found the centre to be entirely in the occipital lobe. Moreover, the centre of each hemisphere is connected with half of the retina of each eye. He explains Ferrier's results by an injury to the fibres running beneath the angular gyrus to the occipital lobes. These results bring pathological and experimental evidence into agreement. Dr. Schafer did not find, as Ferrier claims, that injury to the temporal lobes caused deafness, but was able to support by a single case Ferrier's localization of the sensations of touch in the *gyrus fornicatus*.

BOOK-REVIEWS.

An Elementary Geography of the British Isles. By ARCHIBALD GEIKIE. London and New York, Macmillan. 24°. 30 cents.

THE present little volume is the first of a series of geographies which the author is about to publish, in accordance with the principles laid down in his admirable book 'The Teaching of Geography.' The text-book contains carefully selected facts which will not overburden the memory of the child. Each place, each town, and each hill is mentioned in connection with some historical fact or physical phenomenon. This will prove a help as well for the teacher as for the child. The author emphasizes rightly that a text-book can be no more than a guide to the teacher and to the learner, and he assumes that the former will use the facts and hints presented in this book according to the principles set forth in his discourse on the 'Teaching of Geography.' Thus the present volume is an exemplification of the former; and we imagine a teacher who will use both together will find the study of geography one in which the pupils take the greatest interest, and from which they derive great benefit regarding their powers of observation, and love of nature. We may mention here incidentally the interesting scheme of the Scottish Geographical Society, undertaken in part at the instance of Geikie. Schools are invited to examinations in geography, and the examination-papers are drawn up so admirably that they will have a great influence in remodelling the methods used in Scottish schools. We recommend a perusal of the results and methods of the examination, which are published in the May number of the *Scottish Geographical Magazine*, to teachers of geography. We take exception only to one point in Geikie's method. It is the introduction of far-reaching anthropogeographic theories in elementary teaching. It seems to us that these theories have not sufficient meaning and foundation, without a knowledge of certain psychological and historical facts, to be of much use to a child.

Society in Rome under the Cæsars. By WILLIAM RALPH INGE. New York, Scribner. 16°. $1.25.

THE present volume is a concise and useful review of the manners and customs of the Romans at the time of their greatest power, and will be read with great interest by all who have no leisure to study the works of Friedländer and others, from which Inge's book is a compilation. The author has arranged his material well, and presents it in a very readable form. Religion, philosophy, and morality occupy the first place. Then follows a short chapter on the social influence of imperialism in the first century. Literature and art, as well as the social organization and the daily life of the various classes, are fully described. The book does not claim to give any new results. The essay obtained the Hare Prize at Cambridge in 1886. It may be recommended to all who take an interest in the history of civilization, treating, as it does, in an adequate form, one of the most remarkable chapters of the history of mankind.

Stieler's Hand-Atlas. Gotha, Justus Perthes. f°.

IT is now six years since the last edition of this great work has been issued. Since that time the commercial development of certain regions, and the additions to our knowledge of others, have been so great, that the atlas did not meet the demands of the day: therefore the new edition, the first instalment of which has just been issued, is highly welcome. It is hardly necessary for us to dwell upon the fact that the technical execution of the maps is artistic and accurate. In the last edition of the atlas a few of the older plates, which were somewhat worn, and not as perfect as the newer ones, were retained; but these are now altogether eliminated. We consider it a great improvement of the maps, that the shading all along the coast which is intended to show the water has been discarded, and that a delicate blue tint has been introduced instead. The first instalment contains two new maps, — one sheet of the new four-sheet map of Italy, and one of the four-sheet map of Austria. The relief of Italy is presented here for the first time in an atlas in a clear form, and, what is more, representing the real configuration of the land instead of the old conventional forms. It is founded upon the surveys of the Italian Department of War, which are rapidly being pushed forward. In order not to disturb the impressiveness of the physical features, the railroads are shown as formerly projected roads were generally shown.

The first sheet of the map of South America may serve as an example of the care with which corrections have been made on the old plates. The sheet embraces north-eastern Brazil and French and Dutch Guiana. The interior of the Province of Pernambuco is entirely new, the northern tributaries of the San Francisco being for the first time shown in their real form. While the old maps showed a series of hills running from north to south, we observe now a well-defined ridge forming the watershed between the provinces of Pernambuco and Ceara. In other places, rivers which were shown in solid lines on the old maps, are shown in broken lines on the new ones, indicating that our knowledge is not so complete as was formerly assumed. We observe this particularly in the province of Grao Pará; and farther up the Amazon we see, to our surprise, the course of the Rio Trombetas entirely changed, although it was thought that its course was well known. The administrative boundaries of the provinces of Brazil have also undergone important changes.

The atlas, when complete, will contain ninety-five sheets; the map of the moon, and a few general maps of the old edition, being left out in order to gain room for new detail maps. The following maps have been added to the atlas: two sheets showing the eastern portion of Austria, a four-sheet map of Italy, a general map of the Balkan Peninsula and four special maps of the same, a map of Africa in six sheets, and western Canada. Besides this, the maps of Germany, Austria, Denmark, and Asia Minor have been replaced by new engravings.

A Synopsis of Elementary Results in Pure Mathematics. By G. S. CARR. London, Francis Hodgson. 8°.

THIS volume of more than nine hundred royal octavo pages is a handbook which must be extremely useful to every one engaged in either teaching or applying mathematics. As its title implies, it is principally a collection of results, more especially of theorems and formulæ. For example, the section devoted to the integral calculus, which comprises more than one hundred pages, contains a complete synopsis of all the ordinary integrals, both definite and indefinite, with brief indications of the method of deriving them. The statements are models of condensation, being at once clear and concise. Especial attention seems to have been devoted to the typographical arrangement, which is extremely clear; the words, numbers, and formulæ which are first to catch the eye, and are principally to be used, being printed in large, bold type, while the indications to be subsequently examined are in finer type.

Notwithstanding the general excellence of the book, it seems susceptible of many improvements, both in its plan and in its details. It cannot displace the text-book, nor is it intended that it should: hence it would have been well to omit all matter for which the student would naturally go to his text-book, as well as that for which no book is needed. This is especially the case with the chapter on elementary geometry, and with large portions of the chapters on trigonometry, which might have been omitted or greatly condensed without diminishing the usefulness of the work. Notwithstanding that the brief demonstrations are concise in the extreme, many more are given than have any appropriateness in the book. In most cases it is only the result, and not the proof, which the person using the book will want, and when he does want the latter he will generally know where to find it. More space might, then, have been devoted to advanced subjects, which are not sufficiently developed.

In detail the defects are very numerous, considering the amount of labor and care which seems to have been devoted to the work. The astronomical and physical constants at the beginning of the book are so far from embodying the latest results as to be worse than useless to any one wanting precise values of constants. In the factor-tables it seems almost ridiculous to see a mathematician give *zero* as the smallest factor of a prime number. It should have been unity, if given at all; but Burckhardt's plan of indicating prime numbers by a dash is much more convenient. Among the subjects insufficiently treated are regular solids (no mention is made of sympolar relations), trigonometric series, and determinants. What is given of the calculus of variations might as well have been omitted entirely.

The term 'eliminant' being almost entirely replaced by 'resultant' in mathematical language, the former should not have been used to the exclusion of the latter. In Section 1628 an invariant is described as multiplied by the modulus of transformation, when in fact the co-efficient may be any power of that modulus. In Section 1637, Cor. 2, it is stated, that, if any quadric is resolvable into two factors, the discriminant vanishes. But this is not true of the binary quadric, which is the most common one.

We should naturally suppose that great care had been taken in the printing: it is therefore surprising to see in equation (4) of Gauss's trigonometric formulæ, p. 190, '$\cos \frac{1}{2} c$,' printed in bold type, instead of '$\sin \frac{1}{2} c$.'

These defects are not to be considered as materially detracting from the value of a most excellent piece of work, which should be welcomed by all teachers of mathematics. S. N.

NOTES AND NEWS.

ONE method of disposing of the surplus water of the Mississippi River that has been proposed has been to construct an outlet for the flood-water through Lake Boyne. Capt. S. S. Leach, Corps of Engineers, formerly secretary of the Mississippi Commission, explained to the Senate Committee on the Improvement of the Mississippi River, last Saturday, why this plan is not feasible; in fact, he characterized it as preposterous. He said that such an outlet would increase the velocity of the river at New Orleans by at least twenty-five per cent. Already it requires the best engineering skill to prevent the banks at that point from being washed into the river. If the velocity of the flow should be increased twenty-five per cent, he said, no expenditure of money would make them retain their place. Captain Leach also explained the plan upon which the Mississippi River Commission is now working. He estimated that a system of levees from the mouth of the river to the head of navigation, protecting all points that need additional protection, will cost three million dollars, and that thirty millions would be needed to establish a ten-foot channel through the same length of the river.

— The Hydrographic Office has received a number of reports of peculiar colorings of the sea, of which the following are the most interesting. The captain of the British steamer 'Kathleen' reports, that April 23, latitude 36° 25′ north, longitude 48° 10′ west, he passed through about five miles of discolored water. It had the appearance of sulphur floating on the surface. The captain of the American bark 'John J. Marsh' says, that April 27, in latitude 35° 34′ north, longitude 74° 50′ west, his ship passed through a patch of water as white as milk, the edge of which was distinctly marked, and which was not phosphorescent. The extent of it was about three miles in longitude and five miles in latitude. He found no bottom by sounding at thirty-five fathoms. The sky was clear, and the stars shone brightly, at the time. The officers of the British steamer 'Lero' report, that April 25, in latitude 35° 04 north, longitude 58° 16′ west, their ship passed through a wide

field of discolored water, in patches, each patch being about one hundred yards long and two hundred yards wide. The water had an appearance similar to that over a shoal. That night the sea was remarkably phosphorescent, and the ship was evidently passing through the same kind of water.

— Capt. H. Parsell of the R. M. S. 'Britannic,' reports, that on April 12, at about 8 h. 17 m. 43 s., A.M., he observed a comet bearing east (true). The altitude of the nucleus was 15° 20′ 20″; eye, 33 feet; latitude 4° 24′ north; longitude, 68° 14′ west. He continued to observe it every night until he arrived at Queenstown. What was also probably the same comet is reported by Capt. E. W. Owens of the British steamship 'Iowa' as having been observed April 9 at 3 o'clock A.M. He was in latitude 40° 30′ north, longitude 36° west. The comet was seen bearing east, with its tail in a southerly direction. Its altitude was 15°. Local time was used.

— The proposed transfer of the Coast Survey from the Treasury Department to the Navy will probably be provided for at the present session of Congress. The Senate committee has already made a favorable report; and the sub-committee of the House Committee on Naval Affairs, to whom the subject has been referred, is understood to be favorable to it.

— The Senate, on Monday, passed a bill appropriating $17,500 for making the west end of the Smithsonian Institution building fire-proof. A citizen of the United States, who has long resided abroad, proposes to give to the Smithsonian Institution a large collection of armor from the middle ages, — some of it connected with most famous historical names, — including horse-armor, helmets, swords, and all the paraphernalia of ancient warfare. These objects, numbering about five thousand, have been collected at great expense, and the collection is one of the most valuable of the kind in the world. The condition of the presentation is that the Smithsonian Institution furnish a fire-proof building for its protection.

— Prof. Alexander Graham Bell will sail for Europe June 2. He has been invited to appear before the British Royal Commission now engaged in making an inquiry into the best methods of caring for and educating deaf-mutes. It may be remembered that several years ago Professor Bell presented a paper, at a meeting of the National Academy of Sciences, on the formation, through the intermarriage of deaf-mutes, of a deaf variety of the human race, and gave some important statistics to show that a much larger percentage of the children of deaf parents are deaf than of those whose parents possess the sense of hearing. This paper attracted wide attention, and gave rise to very interesting discussions both here and abroad. The Royal Commission has requested Professor Bell especially to give to it the results of his subsequent investigations and studies upon this branch of the subject, and he has devoted much time to the preparation of facts and figures in regard to it. He will also give the commission the result of his studies of other divisions of the subject.

— The summer session of the Chautauqua College meets at Chautauqua July 6. The college has two departments, — the summer session, at which only special work is done; and the correspondence department, which has a full college course, and works during the college term. The present session of the latter is just closing with four hundred and twenty students.

— At the meeting of the American Philosophical Society, May 4, Prof. C. V. Riley, the entomologist, called attention to some grave errors in the published minutes of the earlier meetings of the society. He remarked that the public, as well as the most competent authors, had always believed that the Hessian-fly — that pest of wheat-culture — was introduced during the Revolution by Hessian troops. Dr. H. A. Hagen of Cambridge has argued against this belief, and, further, that the species was not imported from Europe; one of his most potent arguments being that based on the early minutes of the Philosophical Society, which, as communicated to him (Hagen) by one of the secretaries, Mr. H. Phillips, jun., and as published, make mention of the Hessian-fly in 1768, or before any Hessian troops landed. The statement of the secretary, as also the published minutes, turn out to be absolutely erroneous on these points, as, upon consulting the original records, Professor Riley found no mention of the Hessian-fly prior to 1791. In all previous cases 'the fly,' or 'the fly in wheat,' or 'the fly-weevil,' are the terms used; and it is susceptible of positive proof that these terms referred to totally distinct insects, belonging to a different order, and still called the weevil, viz., *Sitophilus granaria* and *S. oryzæ*. It is a most interesting illustration of grave and misleading error, resulting from carelessness in what appear to be trifles.

— The thirteenth session of the Sauveur College of Languages will be held at the University of Vermont, Burlington, Vt., commencing July 9, and continuing six weeks. After the close of the last session of the Sauveur Summer College of Languages in Oswego, N.Y., it was resolved to hold the thirteenth session this year at Burlington, where they spent the summers of 1884 and 1885. The want of accommodations, which caused the college to leave there in 1885, has been supplied. Oswego treated the college in the most friendly manner from the first to the last day of their stay there. Yet there was missed something which Oswego, with its commercial bustle and activity, could not give; namely, the quiet, rural character of the former home at the foot of the Green Mountains.

— The Prince of Monaco is about to publish the scientific results of the cruises of the 'Hirondelle' in the Atlantic Ocean in a magnificent illustrated volume in folio. The work will be edited by the prince and Jules de Guerne, zoologist of the expedition, while specialists have charge of the various departments. The prince invited correspondence with scientific societies and institutes for exchanging periodicals and marine or fresh-water specimens.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Experiments in Vision again.

MR. HYSLOP, in his interesting letter on this subject (*Science*, No. 274, p. 217), asks for verification of his results. In my case, when his two circles are combined by convergence, there is not the least alternation of images, but, on the contrary, a complete combination and a single horizontal ellipse, whatever be the degree of inclination of the planes of the circles to one another, provided the inclination to the median plane be the same. But the binocular ellipse will seem inclined to one side or the other if there be the least want of symmetry in the inclination of the two planes. This is obviously the necessary result of the law of corresponding points.

I cannot think, however, that so good an observer and so skilful an experimenter as Mr. Hyslop could mistake this for alternation of the two images. I therefore suppose that his eyes are more independent of one another than mine. JOSEPH LECONTE.

Berkeley, Cal., May 14.

Composite Portraiture of the Insane.

WITHIN the last year considerable advances have been made in composite photography; and especially Professor Stoddard, by his articles in *The Century*, has done much to give us new types. Most studies in composites have been confined, up to this time, to normal individuals, and, so far as the present writer is aware, no attempts have been made to secure composite types of insanity. The accompanying composites were made by the Notman Photographic Company of Boston, from negatives taken by the writer in November, 1887. The composite of general paresis is made from the portraits of eight patients, — three females, and five males. General paresis, being an organic brain-disease (softening of the brain), furnishes an unusually good field for the study of the decay of the mental faculties; and the patients making up this composite were all in the second stage of the disease, when it was beginning to destroy the finer lines of facial expression. A comparison of the composite of paresis with that of melancholia — eight subjects, all men — will show the characteristic differences between the two diseases. The eyes of the composite of paresis have a fixed and staring look, showing clearly a diminution of intelligence, and differing entirely from the expression of the other composite, where

the expression is sad and thoughtful, but by no means lacking in intelligence. Of the patients suffering from paresis, one of the women and three of the men had had apoplectiform seizures; and the average duration of the disease at the time of photographing, was, in the women, two and one-third years, and in the men one and three-fourths years. The average duration of paresis, before it terminates fatally, is usually stated to be between three and four years. Of the patients making up the composite of paresis, all, with the exception of one woman, were in good general physical

COMPOSITE OF EIGHT PATIENTS SUFFERING FROM MELANCHOLIA

condition, and able to go out walking, and join in the usual round of asylum-life: and this one woman was still able to go out walking on pleasant days, but was not so vigorous as the others.

The composites seem fairly to represent the physiognomy of the two diseases; and that of paresis has been spoken of by several alienists as being a typically characteristic face. The well-known look of easy-going complacency of paresis is strongly shown in the portrait.

COMPOSITE OF EIGHT PATIENTS SUFFERING FROM PARESIS.

Mental diseases offer an excellent field for the study of types, and it is to be hoped that further work in this line may give a more just conception of the typical expression in the different forms of mental disease than has hitherto been obtained from portraits of individual cases. The portraits were first published in the *Journal of Nervous and Mental Disease*, and are reproduced here in the hope that they will prove of interest to others than the medical profession.

WILLIAM NOYES, M.D.

New York, April 13.

The Significance of 'Variety' and 'Species.'

THERE is no question in biology more significant, or more difficult to answer, than what constitutes a species. Upon the answer hinges the question of evolution, and more particularly the theories of Darwin. In spite of an immense amount of discussion, no answer has ever been given to the question which is in any degree satisfactory. Certain it is that no definite amount of difference can be regarded as enough or as too much to constitute a difference between two species. The term 'species' is compatible with a great amount of unlikeness on the part of varieties, or equally compatible with extremely small differences between species. Our pigeons form an example of the first class; and many species of insects, of the second. In the former we find within the limits of a single species an immense variety, the differences between the varieties sometimes surpassing that between different families in a state of nature. In the latter we have many species so closely like each other as to require an expert to see any differences at all. It is plain to every student that the term 'species' is a variable one, and its limits cannot be found in any definite amount of anatomical variation. And yet, after all has been said concerning the indefiniteness of the term, every one will recognize that the word 'species' does mean something, and expresses some fact in nature; that even though, according to Darwinism, a species is merely an exaggerated variety, yet there is a difference between a species with many varieties and a genus with many species. The latter indicates, as every naturalist feels, a more fundamental difference of some sort, even though to all appearances the differences may be less. Darwin did not regard the various pigeons as forming different species, in spite of their unlikeness.

This is not the place for a discussion of this matter, which would involve the whole work of Darwin and his followers. There is one suggestion, however, brought first prominently into notice by Romanes (*Nature*, August, 1886), which has not received the attention it deserves, at least in this country. The suggestion is briefly this: that differences between species are due to the accumulation of differences in the sexual organs, entirely independent of anatomical differences. This idea does not belong exclusively to Romanes, for it was independently suggested by at least three others prior to the publication of the paper of Romanes (CATCHPOLE, *Nature*, xxxi. p. 4; BELT, *Naturalist in Nicaragua*; and myself, *Evolution of To-day*, p. 41). Romanes alone, however, expanded the view, and took upon himself to defend it against the criticisms which were abundantly offered. In so doing he referred to the principle of natural selection in such a way as to rouse the enmity of many who revered Darwin's name and work, by claiming that Darwin did not explain the origin of species at all, but only the origin of adaptation. In thus seemingly attempting to belittle Darwin's discovery and relegate it to a very subordinate position, Romanes called upon himself a severe criticism from many who refused to see in his 'Physiological Selection' any thing new or important. These criticisms, though certainly showing that Romanes had overrated the value of his principle in removing the difficulties in the way of the production of new species, did not by any means show that this principle was not an important factor. The idea is certainly new to literature; and, although it may have been hinted at by others, no one before Romanes formulated it so as to draw a clear distinction between anatomical and sexual variations. Whether or not the idea be regarded simply as a particular application of the principle of natural selection, as some of the critics claim, is entirely immaterial to the value of the conception. There is nothing in Darwin's writings to indicate that he had entertained the thought that species are due to the selection of sexual variations, while varieties are due to the selection of differences not necessarily sexual. This idea, whether we regard it as an instance of natural selection or not, certainly deserves careful study as promising to help in the solution of the puzzling problem of species.

There is no fact which has given rise to more discussion, or has seemed to offer such difficulties in the way of Darwin, as the alleged sterility of species when crossed. Many were the experiments, and vast the amount of evidence collected, by Darwin for the purpose of showing that the sterility of hybrids is not a law; and he did conclusively show that there is no absolute bar thus.

separating species, for many cases were found where species were fertile when crossed. The broad fact remains, however, that, in spite of many exceptions, the rule is that different species, when crossed, do not produce fertile offspring; and I do not think this conclusion is doubted by any one. Though the difficulty is lessened by the experiments on cross-breeding, it is not removed; but the difficulty does not lie exactly where it is usually put. The difficulty is not that species are sterile when crossed, but that varieties, however diverse they may be, are always fertile. It is not difficult to understand why the descendants from a common form, should, by the principle of divergence of character, become so unlike each other as to be incompatible with each other when crossed. The difficulty lies rather in the fact that in all the experiments of breeders there has been no approach toward the production of sterility between the varieties produced. Breeders have succeeded in profoundly modifying animals, and in producing a great number of diverse varieties. Sometimes these varieties show greater differences than are shown by separate genera or families of wild animals. And yet there is no tendency observable toward the production of sterility among these varieties, perfect fertility being the universal rule. To explain why a large amount of structural difference in domestic varieties should be accompanied by complete fertility, while in a state of nature very slight differences should be attended by sterility, in many cases at least, is to my mind the only difficulty arising in connection with the sterility of hybrids.

As an explanation of these facts, it has been pointed out that domestication has a direct effect upon the reproductive powers of animals, sometimes producing sterility, and sometimes increased fertility. This factor has been suggested, therefore, as explaining why the varieties of domestic animals have not become infertile. But the differences to be explained are very great. Most excellently was this matter illustrated by Professor Clark at the last meeting of the American Society of Naturalists. For illustration he used a large number of mounted specimens of pigeons obtained from different fanciers, and a series of mounted sparrows which may be found everywhere. Among the pigeons the greatest profusion of color, size, shape, length of bill, etc., was observable, all within the limits of the same species; while among the sparrows a sharp eye was required to see any differences between species, and sometimes between genera. Allowing what we will for the effect of domestication, it is a remarkable thing that the fantail and powter will breed together perfectly well, so that care must be taken by the breeder to keep them separate; while the different species of sparrows with such close resemblance do remain perfectly distinct. Of course, also, the existence of varieties in nature cannot be due to domestication. All of these facts seem to indicate that some different process has been at work in the production of species from that which has given rise to these very diverse varieties.

Now, all of this class of facts receives a ready and natural explanation in the hypothesis suggested above. All domestic varieties have been artificially preserved by man, and he has naturally selected for preservation such peculiarities as are particularly pleasing or useful to him. It is plain enough that he has not included in his selection peculiarities of the sexual organs: for these are frequently not visible, and have never been the object of improvement on the part of the breeder. Plumage color, shape, size, strength, swiftness, etc., have all received attention; but I have yet to hear of a single instance where sexual variations have been selected. Certainly this has not been done in the pigeons, or dogs, or other animals, where such great diversity has been found compatible with perfect fertility. There can be no doubt that the sexual nature is just as truly subject to variation as any other part of the body. Every one knows of variations in fertility, in size and shape of sexual organs, in sexual passions, all of which plainly indicate, that, though not so evident to observation, variations in the sexual system are as abundant as elsewhere. Further, it is evident that sterility of species when crossed must be due to some differences in the sexual organs or sexual elements which prevents proper fertilization or proper growth after fertilization. Is it not, then, a natural conclusion that an accumulation of sexual variations will result in sterility, while any accumulation of other variations will not necessarily have the same effect unless they are also accompanied by sexual variations? Under artificial breeding there have been produced anatomical varieties based upon structures which have had no necessary connection with the sexual nature, and hence the varieties have not become sterile. On the contrary, the uniform conditions of experiment, the rejection by the breeder of individuals which have shown abnormal sexual instincts, have tended to prevent the development of any sexual differences sufficient to produce sterility.

Under nature, however, the conditions have been very different. There has been no rigid conforming of selections to anatomical differences. Hardships, famines, surplus of food, etc., have all had their effect; and there is no part of the body so soon affected by such changes as the reproductive system. Animals have had every opportunity for the free exercise of every passion, and thus differences in the reproductive system have come in for their share in accumulation by natural selection, or otherwise. Romanes is indeed inclined to think that such variations will be specially favorable for preservation, since they will tend to prevent crossing of unlike individuals. This is, however, doubtful; but it is plain enough that they will have a much more favorable chance for preservation than they do have under domestication. By variation in this direction there may thus be produced species which will be sterile when crossed, and yet with very small anatomical differences. On the other hand, there may be varieties which would differ widely in anatomical characteristics, and yet be perfectly fertile when crossed. The difference between a highly variable species and constant species would be thus due to the readiness with which variations in the reproductive system are produced and preserved. Where the reproductive system is constant, there may arise a highly variable species; but where the reproductive system is highly variable, there will be a tendency to the production of numerous closely allied species. All of this will lead to a new understanding of the significance of species as groups of animals in which variations have largely affected the sexual organs, with sometimes great and sometimes little change in other parts of the body. In varieties, on the other hand, variation may have affected any other part of the body to almost any degree, but has not affected the sexual system. This understanding is somewhat different from that of Darwin, since it does not regard a species simply as an exaggerated variety. Sometimes it may be so, since anatomical and sexual variations may accompany each other. Sometimes, however, a species may be produced directly by sexual variation, without passing through any prominent stage, in which it is a simple variety. Variety and species are therefore independent, being founded on different kinds of variation.

A discussion of this hypothesis is not possible here, the design of this note being simply to call the attention of American naturalists anew to the subject, and to state the hypothesis as it lies in the mind of the writer. It would be a very important series of experiments if some one who has opportunities for experimental breeding would undertake the production of a distinct species by selecting sexual rather than anatomical variations. Such a series of experiments might solve the question of the origin of *species*.

H. W. CONN.

Middletown, Conn., May 15.

The Ohio Mounds.

THE evidence brought to light by the explorations of the Bureau of Ethnology bearing upon the authorship of the typical ancient works of Ohio, leaves scarcely a doubt that these structures are to be attributed to the Cherokees. The chain connecting the Cherokees of modern times with the builders of these celebrated works seems to be so complete as to leave no break in which to thrust a doubt.

These explorations have also thrown some light on the so-called clay 'altars' of the Ohio mounds, rendering it probable that they were places for torturing prisoners of war, — the chief 'sacrifices' the Indians were in the habit of making. Strange as it may seem, the chain of evidence on this point reaches into actual history.

The ancient works of Ohio are attributable to at least four, but probably more tribes.

CYRUS THOMAS.

Youngsville, Penn., May 14.