Since January, 1892, all of the thermometers verified at the Central Physical Observatory at St. Petersburg have been referred to the hydrogen gas thermometer at Sevres as a standard.

The thermometers verified between January, 1877, and January, 1892, require the following (additional) corrections, in order to reduce their readings to this standard: —

Temperature.	Correction of the mercurial thermometers.	Correction of the spirit thermometers.
+ 40° C.	— 0.16° C.	— 0.2° C.
+ 35	— 0.16	— 0.2
+ 30	— 0.15	— 0.2
+ 25	— 0.14	— 0.1
+ 20	— 0.12	— 0.1
+ 15	— 0.09	— 0.1
+ 10	— 0.07	— 0 1
+ 5	— 0.04	0.0
0	0.00	0.0
— 5	— 0.03	0.0
— 10	— 0 02	0.0
— 15	0.00	0.0
— 20	+ 0.01	0.0
— 25	+ 0.06	— 0.3
— 30	+ 0.07	— 0.6
— 35	+ 0.14	— 0.8
— 40	+ 0.25	— 1.1
— 45	——	— 1.4
— 50	——	— 1.6
— 55	——	— 1.8
— 60 C.	——	— 2 0

I wish also to mention the differential thermometer corrections described by Leyst in Wild's *Repertorium für Meteorologie*, Band. XIV., in which the temperature of the thread of mercury, when read, is different from that of the bulb, to which it is referred. Two cases are cited. 1. For a maximum thermometer, with separated thread (as, for instance, the Negretti and Zambra form), the thermometer is read at a different temperature from that at the time of maximum temperature, when the separation took place. For the ground-surface temperature at Nukuss, Leyst finds for a summer day a correction of + 0.73° C., and that for the average of three summer months a correction of + 0.51° C. must be applied to counteract this error. For the air temperatures the corrections ranged from + 0.10° C. to + 0.20° C. in the cases cited by Leyst. 2. The temperature of the thread of mercury and that of the bulb is not the same in the case of the wet-bulb thermometer, when the difference in the temperatures of the wet- and dry-bulb thermometers does not vanish. Ordinarily, the thread is warmer than the mercury in the bulb. At a temperature of 30° C., and a humidity of 50 per cent, there was a correction of – 0.30° C., which means, for this case, an error of 0.5 millimeters in the absolute humidity, and of 2 per cent in the relative humidity.

TO ANTHROPOLOGISTS.

DEPARTMENT M of the World's Columbian Exposition includes all subdivisions of anthropology and history, although generally known as the "Department of Ethnology."

The anthropological portion of the department is subdivided into the following principal sections:

1. The Ethnographical Exhibition of Native American Peoples. The representatives of these peoples will be living in their native habitations on the grounds set apart for the purpose along the eastern shore of the Lagoon immediately north of the Anthropological Building.
2. The general Ethnological Exhibit in the building.
3. The general Archæological Exhibit in the building, and the casts of the several portions of the ancient ruins of Yucatan on the grounds in front of the main northern entrance to the Anthropological Building.
4. The general Exhibit of Ancient Religions, Games, and Folklore.
5. The Anthropological Laboratories on the northern gallery of the building. These laboratories will include special rooms devoted to physical anthropology, criminal anthropology, psychology, and neurology, and will be furnished with instruments and apparatus used in research, which will be carried on during the Exposition. The laboratories will also contain diagrams, charts, and tables illustrating various researches, particularly those relating to the physical characteristics of the native American peoples, and the comparison of the same with other races. There will also be diagrams illustrating the physical characteristics and the mental and physical development of school children in North America.
6. An Anthropological library covering all subdivisions of anthropology and allied sciences. For the purpose of making this library as perfect as possible and to enable students and educators to become acquainted with the mass of literature upon the subject, it is expected that authors, societies, museums, and publishers will contribute their books and papers relating to anthropology or any of its subdivisions, such as archæology, physical anthropology, psychology, neurology, ethnology, ethnography, primitive and ancient religions, myths, legends, folk-lore, languages, primitive art, primitive manufactures, etc., etc. The transactions, memoirs, journals, and proceedings of anthropological, ethnological, and archæological societies and museums, and the special papers ("reprints," "separata") of authors, are particularly desirable. There will be printed as soon as possible a full subject and author catalogue of the library. This catalogue will receive a wide circulation, and as it is intended that it shall be a reference catalogue for students and libraries, the publisher and price of each book and paper known to be for sale in any country will be given. The library will be carefully and properly arranged in book-cases in the room devoted to it, and will be under the special charge of assistants of the department, who will permit the volumes and papers to be referred to in the room and will give information as to their price and how to obtain them of agents, societies, and publishers. It will thus be seen that it is the intention to make known through this library the works of all writers upon anthropology so far as possible and that thousands of persons specially or cursorily interested in the subject will have an unrivalled opportunity of finding just the books and papers they wish to obtain.

The library will, after the close of the Exposition, be placed in the permanent Memorial Museum of Science, which is to be established in Chicago. It is therefore particularly requested that each contribution be sent to the Anthropological Library with a presentation slip stating that it is presented to the Columbus Memorial Museum, and the same will be duly acknowledged by the proper authorities when placed in the Museum Library after the close of the Exposition. In cases that may occur when contributions to the library are sent for use during the Exposition only, all such books or papers must be distinctly indicated by the words "to be returned" written over the name and address of the owner or sender, and all so marked will be returned free of expense at the close of the Exposition. Every book and paper should be marked with the name and postoffice address of the sender. The books and papers should be sent by mail unless too bulky, in which case by express and should be addressed, World's Columbian Exposition, Department M, Anthropological Building, Chicago, Ill.

GOLDSMITHS INSTITUTE ENGINEERING SOCIETY.

SIR FREDERICK BRAMWELL'S PRESIDENTIAL ADDRESS.

AT the opening meeting of the session of the above society the president gave his inaugural address. Mr. Lincham occupied the chair, and, after an introduction, Sir Frederick said: —

Mr. Lincham, ladies, and gentlemen: I am much flattered at being selected as president of the Goldsmiths Institute Engineering Society. I am an old member of the Goldsmiths Company having been connected with it some fifty years, and am a past prime-warden. I have to congratulate you upon the progress you have made, and am informed that, though your society has been in existence but a few months, you now number over 100 members. You have two principal objects in view, one of which only has been pursued up to the present, viz., the visiting of engineering works, in which you were accompanied by Mr. Lincham, who has explained that which you were witnessing, a point of very great advantage to yourselves. I may say here that I think you are very highly indebted to the head of Section A for his valuable suggestion in starting the society. That during the season you have visited such places as the Arsenal, the Hydraulic Power Company at Wapping, the Tower Bridge, Messrs. Simpsons' Loam Moulding, Messrs Penn, Maudslay, the Deptford and City Electric Lighting Stations, and one steamboat, the "Dunnotar Castle."

Henceforth you are not only to continue this branch of your study, but you propose to prepare papers for reading and discussion, and to obtain the friendly services of persons competent to lecture upon engineering and cognate subjects. Now I find great difficulty in addressing you. I need not enlarge upon the importance of engineering; your presence shows you appreciate that. I hardly like to give you history, although within my own active work since my apprenticeship there has been so great a change, in mechanical engineering especially, as to afford me means for an ample chronicle.

Perhaps I may be pardoned for alluding to my early work-shop days. There were then no railways to and from the city; the Greenwich Railway was only under consideration. Most engines used steam of no more than 3 pounds pressure. There was no planing machine, no slide lathe. If an engine-crank had to be turned, the pin was tooled first, and then the shaft afterwards, by means of a hanging tool, and the throw was much what it pleased Providence to make it, so that in a double-cylinder engine it frequently happened that the two throws were not exactly the same. Boilers were fed by a feed-head, and if the pressure became greater than three pounds, the water was ejected, and thus became a sort of safety-valve.

The notions regarding steam pressure were very vague. I have a great regard for a very interesting old book, "Belidor's Architecture Hydraulique," in which I read of a boiler, erected in France, having a heavy superstructure to keep down the pressure, and much the same construction was used in the boiler at York Rd., Charing Cross, which supplied London with water. Sir William Siemens used to say that this load of masonry was clearly for the purpose of providing a large number of missiles in case of an explosion. When quite a child I was taken by my nurse to see the water-wheels at London Bridge, which were also used for the water-supply, and even at that early date engineering had a great fascination for me. Everything then was different. The opportunities for technical learning, other than those from apprenticeship, were simply nil; that is now quite changed. This institute is sufficient to show it. You may learn and learn well, and it would be to your eternal shame if you did not; but I want you, in the pride of your strength, not to deal hardly with the older hands, but to remember that, though they had not the advantages, they made the progress, and must have had very much in them to do this when we consider their resources. One great advantage of instruction in principles is this — aspiring inventors need not attempt impossibilities. Suppose a man were to say, "I have a machine that will produce marvellous results if you will concede for its purposes that two and two make five, as I say they do." His friends would probably call in a doctor or conduct him to a lunatic asylum. But this method of stating the case is not so very absurd. Much labor has been spent on inventions, which were impossible, but where, from want of instruction, the impossibility did not make itself apparent — where the two and two could not easily be seen, which it was endeavored to make into five. The learning of the principles of mechanics will show that you cannot get more work out of a machine than you put into it, and will thus put a stop to useless inventions. Let us consider the connection of the past with the present by the great examples of progress. Boiler pressure has increased from three pounds to 150 pounds, and these pressures have been utilized by engines of continually increased expansion with single, compound, and triple cylinders. The triumphant position of the steam-jacket, though many times questioned, is worth noting. First used by Watt, he does not appear to have been aware of the principle involved. Forced draught, by which I mean a closed stoke-hold (not the closed ash-pit, which is very old); very curiously this adjunct to marine propulsion was seen by me at work in the United States as long ago as 1853. I spoke of it on my return, but no attention was paid to it until the principle found application in torpedo boats. I will read from my note-book for 1853: —

"Oct 11, 1853. Camden and Amboy railway steamer 'Richard Stockton.' Tonnage 651. Two boilers on each after sponson, machinery made in 1852 by Haslem (?) and Hollingsworth, Wilmington, Delaware. Wheels 22 feet in diameter, 9 feet wide. Boiler $\frac{5}{16}$ of an inch thick, proved to 55 pounds, to work at 39. Actual pressure 25 pounds. Boilers have two fire-places in each; they burn anthracite coal; each one has a powerful donkey working a blower, which is on deck, and which blows into the boiler-room, the door being kept shut, and the stoker under pressure." The object of the arrangement was to prevent a tongue of flame coming from the fire in case the door should be left unlatched.

Large steamers were constructed on most unsatisfactory principles in the early days. Nothing could have been more unlike a box girder or braced structure than the wooden built ships, but the present double bottoms and iron decks form probably as good specimens of girders as can be made, competent to carry, without straining, their own weight and that of their cargoes, while the points of support are changed at every movement by the force of the waves. I may mention also the great advances in the speed of ocean steamers, and wish I had time to describe carefully to you how much we owe to the late Mr. William Froude, who, by means of his admirable paraffin models, showed how to predict with absolute accuracy the performance of the full-sized vessel. The material employed was very easily worked, and could be remelted for further models.

Another great feature in the engineering of to-day is that of making subterranean communications by means of tunnelling with the aid of shields and compressed air. The Thames tunnel was the earliest of these great works, and the shield was in several sections, so that each could be advanced separately by a screw-jack, but there was no compressed air and the difficulties were very great, for in some places an artificial soil had to be constructed by tipping in clay. I was shown these works when in progress by the eldest Brunel. Compressed air was introduced by Sir Thomas Cochrane (afterwards Earl Dundonald), who took out a patent in 1830 (No. 6018). I knew him very well; he was a clever engineer, but, not being trained, he sometimes made mistakes in detail. His patent was for "Excavating, sinking, and mining," and included "an apparatus for compressing atmospheric air into subterranean excavations, so that its elasticity may counteract the tendency of superincumbent water or moist earth to fill such excavations," and he refers to "the undertaking which is now executing beneath the river Thames at Rotherhithe."

Now let me say a few words about electricity and its present condition. Faraday was the great author, and to him we owe the science of electrical engineering, although his discoveries have been considerably developed by many other great workers, whose names are legion, one of the greatest of these being my late valued friend, Sir William Siemens, who, though he died some eight years ago, I cannot now mention without bitter regret. You have often been told that a little learning is a dangerous thing. This is a great mistake. Learn all you can; it is only a shallow knowledge of everything as your end and aim that is wrong. Sir William Siemens used to say, "Learn one thing thoroughly, and after that a little of everything." The development of practical electricity began with the telegraph, and I remember how astonished we all were when a murderer was captured by its aid; but telegraphy is fast giving way to telephony. Electric arc-lighting was first shown at the Exhibition of 1862, applied to light-houses. Since then it has been much further developed, but the incandescent system of Edison and Swan is, after all, the most useful extension of electric lighting. I do not want to introduce political economy, but when the advance or hindrance of engineering is due to parliamentary interference, the science deserves your study. Several years ago, when the time was ripe for general electric lighting, Mr. Joseph Chamberlain, then president of the Board of Trade, introduced an act to enable electric lighting companies to be formed, but, at the same time, provided that city authorities might buy up their concerns at the end of twenty-one years at the mere cost of the material; while, should they not be then pleased to use their right, it should occur again at the end of every seven years. Only recently a change was made, on the discovery that the act was a direct hindrance to speculation, for in effect it meant, "We will let you run the risk when the scheme is not paying, but will take it as soon as you have made it successful." The vicious principle is still retained, but the same has been extended from 21 to 42 years. The result I need hardly tell you. You see it in the general installation of electricity throughout the metropolis, and electric principles I hardly need describe to you. The dynamo gives a continuous low tension current, using, in its simplest form, two wires for its transmission, but the three-wire system is one of the most remarkable advances. A high-tension current traverses the mains, and is transformed to low-tension when entering the houses, the saving in copper being thereby enormous, while, by a switch arrangement, we can use the current at will for lighting or for power. But you yourselves saw the largest and most interesting example of this method of distribution when you visited the Deptford generating station of the London Company.

Electric welding is another application of primary importance, using either the two plates themselves as poles, or one plate as pole, and what we might call a "soldering bit" for the other pole. This method is extensively employed at Sheffield for repairing steel castings, and with great success. When I was apprenticed, there was used for similar purposes a metal known as "Beau Monteague" (laughter), and from your faces I gather it has not been entirely forgotten. It was not a method of repairing, however, only one of deceiving. I wish I had time to tell you of present-day steel manufacture, but I will simply say that, whereas it was formerly made in pounds, it is now produced in hundreds of tons.

I am now about to extol myself. The Gifford injector caused very great interest from the first, if only because its action seemed impossible of comprehension. I was myself the first to give a complete explanation of that action without the aid of mathematics. (Hear, hear). My contention was that the whole thing might be summed up in the single word "concentration," and to show this I devised an arrangement by which a head of water left one vessel and entered another, rising almost to the same height, by simply shaping the opposite nozzles with such care as to concentrate the pressure upon the smallest possible area. A similar example is that of an armor-piercing projectile. A blunt-ended shot will be flattened still further, but a hard-pointed one will receive very little deformation in entering the plate.

To close with a few remarks on technical education. For the first eight years of its existence I was chairman of the executive committee of the City and Guilds of London Institution. I am now a vice-president, but have not time to take an active share in the management. I am glad, however, to know of the good that it is doing and of its recognition of merit in those which go up for examination. I am glad to find that, even in this very early period of the existence of your society, Mr. Walter Grant has succeeded in obtaining the bronze medal of the Institute and third position in the country for mechanical engineering, while the same student has obtained a Queen's prize in advanced machine drawing, which is granted, I am told, to only a few top men. (Loud cheers). I have some further notes placed in my hand with regard to the success of other students of Section A, from which I find that in three advanced subjects (steam, mechanics, and machine drawing) there has only been one failure in each, equivalent to 12 per cent, while the grand total of all its subjects represents a success of 82 per cent, a result of a very gratifying character, which is greatly due to the excellent instruction which Mr. Lincham has given you. (Loud and continued applause.)

A vote of thanks was next proposed by Mr. Redmayne, which was carried unanimously.

Sir Frederick briefly tendered his thanks, and the proceedings terminated.

ON THE GROWTH OF THE RATTLE OF CROTALIDÆ.

BY S. GARMAN, MUS. COMP. ZOOL., CAMBRIDGE, MASS.

SINCE the appearance of the article on "The Rattle of the Rattlesnakes" and its evolution, Bull. Mus. Comp. Zoöl., XIII., No. 10, Aug., 1888, the study of these crotalidæ has been continued with the purpose of securing rates of growth and other particulars not fully determined at the time of publication. As the final report may be delayed for a time it seems proper in this place to refer in advance to several items which have in some extent been questioned by other writers. The point to which attention is specially directed is the acquisition of new joints in the rattle. In regard to this, variations occur in the time; none have been noticed in the method. In all cases observed the growth of a new button, causing the appearance of a new ring or joint, was connected with the process of sloughing. Growth was first detected at the time of the advent of the whiteness in the eye and under the epiderm in general. This whiteness was evidence of dermal growth, which on the tail seemingly was prolonged a little after the eye had become clear or until the slough was cast. Possibly the apparent prolongation was due to a mere pushing back and hardening of the newly-grown button. The preparation for sloughing was in each instance preceded by the whitish appearance under the outer cuticle, as was stated in the above-mentioned bulletin. The milkiness, as it might be called, lasted longer on specimens kept in the shade than on others exposed to the sunshine.

A few extracts from notes on several individuals will, without further comment, suggest the results obtained.

The first case is that of a large banded rattlesnake, *Crotalus horridus*, on which the whiteness was visible on eye and button August 17. There was no mistaking the fact that the epiderm of the button was being pushed back to become a section of the looser portion of the rattle. By the 26th of the month the button was becoming darker, though the eye was still somewhat clouded and remained so until the 30th. At this date the eye was bright and clear and the new button had become dark colored and was seen to have pushed back the recent slough as the newest ring or joint of the series. It was not until September 4 that the slough was stripped from the body; it had previously separated from the new ring.

Another case is that of a prairie rattler, Massassauga, *Sistrurus catenatus*, on which the milky appearance was seen September 12. It was then but slight on either eye or button. Two days later it was very intense; by the 19th of the month it had become almost obsolete. Only about half of the new button was visible behind the small scales at that date. This snake sloughed on the 24th The newly exposed button was whitish; it became dark rapidly when placed in the sunshine.

A third case to mention is that of a snake, of the same species as the latter, kept on very short allowance of food, by which no doubt sloughing was much retarded. This one did not show the milkiness until December 11. The whiteness vanished about the 23d, and the slough was put aside on the 31st. It came off nearly entire, the exception being less than half an inch, which remained attached to the anterior edge of the newest ring.

In all cases under observation a new ring has been gained with each sloughing, whether it occurred in the fall, the winter, or the spring. The snakes are still in keeping to determine the greatest number of sloughs in a season and other points. Thus far the later studies have given very little reason indeed for modifying the conclusions published in the above-mentioned article.

CURRENT NOTES ON ANTHROPOLOGY.—XXIII.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Language of Craniology.

"SPHENOCEPHALIC, tetragonic, dolicho-meso-brachycephalic, hypsicephalic, metrio-cephalic, hypo-stegobregmatic, hypsionchobregmatic, cremnoopistocranic, chamelnogathic, euryzicic, chameprosopic, platyrrhine, chameconch, orthognathic, hyperplatopic"!!