HEALTH MATTERS.

THE THERMAL DEATH-POINT OF BACTERIA. — Dr. George M. Sternberg, U.S.A., the well-known bacteriologist, has been for some time experimenting on the thermal death-point of pathogenic micro-organisms. He has published his results in the *American Journal of the Medical Sciences*. All the tests were made with moist heat, ten minutes being the time of exposure to the given temperature. The absence of growth after eight or ten days is regarded by Dr. Sternberg as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed. No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and the lowest temperature is given which has been found, in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more; but the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions: (*a*) the temperature required to destroy the vitality of pathogenic organisms varies for different organisms; (*b*) in the absence of spores, the limits of variation are about 10° C. (18° F.); (*c*) a temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid-fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases; (*d*) a temperature of 56° C. (132.8° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature); (*e*) a temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested; (*f*) it is probable that some of the bacilli which are destroyed by a temperature of 60° C. form endogenous spores, which are also destroyed at this temperature.

THE HERNDON SCARLET-FEVER EPIDEMIC. — During the past year Dr. Klein of England investigated an epidemic of scarlet-fever the origin of which he believed that he could trace to a herd of cows at Herndon. This investigation of Klein demonstrated that the affected animals were suffering from a disease which was communicable to healthy ones, and also to man by inoculation. It was considered to be distinct from cow-pox; and the weight of evidence seemed to indicate that it was scarlet-fever, and that the milk from animals infected with the disease could communicate it to those who drank it. These conclusions of Klein's have been published broadcast throughout the world, and have been generally accepted. Since this report, the agricultural department of the privy council has authorized another expert, Professor Crookshank, to investigate the subject. He has done so, and has made his report. His conclusions differ entirely from those of Klein. He believes that the Herndon disease was not scarlet-fever, but cow-pox; and of course the epidemic, or rather outbreak, of scarlet-fever near London had no connection whatever with the disease which affected the Herndon cows. Which of the two experts is correct, time alone can decide. Dr. Klein is not a novice in investigations of this kind, and is not likely to be led into such a serious error as the report of Crookshank would seem to indicate. Klein saw the affected cows at Herndon; Crookshank did not, and based his opinion solely on the description of the disease as given by Klein and others. The result of the controversy will be watched with interest by the scientific world.

CONTAGIOUSNESS OF LEPROSY. — The question of the contagiousness of leprosy has again been raised by the action of the board of health of Philadelphia in fining a physician one hundred dollars for not having reported two cases of that disease which were under his care. The editor of the *New York Medical Journal*, in commenting on this subject, claims that there is a mass of incontrovertible evidence to be found in medical literature which ought to place its contagiousness beyond question. In the Sandwich Islands the physicians believe strongly in its communicability, and a number of instances are given which confirm this belief. One of these is that of a Belgian priest who lived in the leper settlement for the purpose of nursing and otherwise caring for those who, having the disease, were here isolated. The result is, that the priest himself is now a victim of the disease. The medical attendants of these outcasts will not go near them without having their hands protected by gloves. The editor of the journal quotes the opinions of other writers who agree with him in his views, and refers to the report of the English commission appointed by the Royal College of Physicians in 1867, which holds that leprosy is not contagious. He concludes by saying, "In the face of all this reliable evidence, a reasonable doubt can scarcely be entertained of the contagiousness of leprosy. In its power of contagion, leprosy may well be, as it often has been, compared to syphilis, and, like that disease, it is frequently contracted through sexual intercourse, and is also just as frequently transmitted to the offspring."

EXPLORATION AND TRAVEL.

Stanley's Expedition.

Petermann's Mitteilungen gives a brief review of the events that have taken place in Central Africa since Stanley's departure from the camp at the Yambunga rapids on the Aruvimi. On the 2d of July, Stanley sent news from Mabode, on the Aruvimi, which was brought to Leopoldville by the steamer 'Stanley.' Since the beginning of July the steamer 'Stanley' has made only one trip to the Aruvimi. On the day of her return, Aug. 17, Major Barttelot, who commands the camp at Yambunga, had no news from Stanley. As Tippo-Tip had not sent the promised troops from Stanley Falls, Barttelot was not able to leave his camp and follow Stanley. After a thorough repair of the steamer, the 'Stanley' left Leopoldville on Nov. 15 for Bangala. After her return she will convey Captain van der Velde to Stanley Falls, where he will establish a new station near Tippo-Tip's village. Therefore we may expect to hear of the events on the Upper Kongo towards March.

Unfortunately the King of Uganda has again cut off the connection between Emin Pacha and Zanzibar, and the reason for his hostility is his fear of Stanley's expedition. After the latter had left Zanzibar, the British consul-general had sent a letter to King Mwanga in order to inform him of the object of the expedition. This letter, which reached Uganda in June, fell into the hands of the Arabs, who were hostile to the Europeans who tried to suppress the slave-trade. They presented it to King Mwanga, and read it to him to suit their purpose. They said the letter informed the king of Stanley's intention to attack the kingdom with an army of two thousand men in order to revenge Bishop Hannington's death. The well-known missionary, Rev. Mr. Mackay, tried to disperse the king's suspicion by informing him of the real contents of the letter; but, as he was accused of being himself an ally of Stanley's, he had to leave the country in which he had lived for nine years. On Aug. 2 he arrived at Msalala, on the south shore of the Victoria Nyanza, where the missionary Gordon had a station. The latter, who was agreeable to King Mwanga on account of his relationship to General Gordon, went to Uganda. The king, however, still suspecting Stanley's intentions, made war upon Kabrega, king of Unyoro, who, he feared, would join Stanley in order to gain his independence. The result of this war is not yet known. But in consequence of this war the messengers who were sent to Casati with letters of credit were prevented from reaching him. It will be remembered that two of Tippo-Tip's men were sent in February of last year on this errand. They went from Zanzibar to Tabora, crossed Karagwe, and reached Kasinga, near the Muta Nsige, in the middle of May. They were, however, unable to enter Unyoro, as it was said that Mwanga had attacked the latter with an army of two hundred thousand men. Having staid two months in Kasinga, they returned to Zanzibar, their means having become exhausted.

In December the news was received in Zanzibar that Stanley had reached Wadelai early in September, and that the passage from Mabode to the Nile was extremely difficult. The messenger who carried the report to Zanzibar was not despatched by Stanley, but learned the news from Arabian traders: therefore it is doubtful whether the report is true. The telegraph said some days ago that news had been received by Dr. Schweinfurth in Cairo, but this highly improbable report has been since denied by Schweinfurth himself.

Antarctic Regions. — The British Government has refused the request of the Australian colonies to grant a subsidy to the proposed Antarctic expedition which was to be organized by a joint effort of the Australian colonies in case the British Government should support the undertaking. This decision will probably postpone the resuming of Antarctic exploration for an indefinite time. Although it is not probable that results of great commercial value will be obtained by an expedition of this kind, the scientific objects are so great that this new delay must be greatly regretted.

ELECTRICAL SCIENCE.

Electricity directly from Heat.

Attempts to generate electric currents, by utilizing the fact that magnetic metals lose their magnetic properties when sufficiently heated, have been made for some years. It is only recently, however, that such experiments have been made on a practical scale, and with any promise of ultimate success. When we consider that in the most economical source of electricity, the dynamo-electric machine, we transform the energy of our fuel to the energy of steam under pressure, then through the steam-engine to mechanical work, and finally by the dynamo to the energy of electrical currents, losing energy in each transformation, our ultimate return being perhaps ten per cent of the energy expended; when we add to this the complication and expense of a steam-plant, — it would seem that, even if our means of direct conversion is not so economical as the dynamo, yet if it have any reasonable efficiency, and is simple of construction, it would supplant the older method.

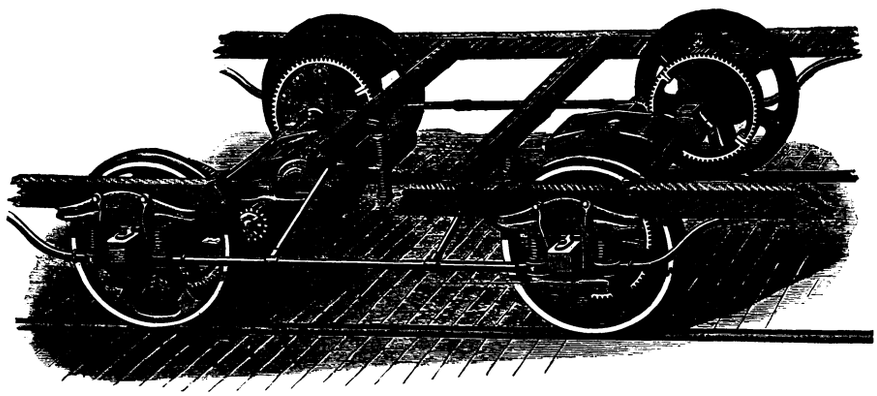
In August of 1887 Mr. Edison read before the American Association for the Advancement of Science a paper on pyromagnetic generators. Briefly the principle on which his machine was built is this. If a piece of iron wrapped with wire be put between the poles of a magnet, a number of lines of force will pass through it, and therefore through the coils of the wire, depending directly on the strength of the magnet and on the magnetic permeability of the iron. Now, it is well known that the permeability of iron becomes very nearly zero when it is raised to a bright red heat: so, if we heat the iron, the lines of force through it will decrease, and this decrease will cause an electro-motive force in the coil of wire. When the iron cools, there will be an increase of lines of force, causing an electro-motive force in the opposite direction. Mr. Edison's machine, built on this principle, consists of eight horse-shoe magnets arranged in a circle, the poles facing inward; and between the poles of each is a roll of thin laminated iron covered with asbestos and wrapped with wire: we will call these the armatures. This is placed over a furnace, and beneath it revolves a half-circle of fire-clay, which shields half of the armatures from the heat. If this shield be turned continuously, half of the armatures are being heated while the other half are being cooled; and the electro-motive forces in the two halves, which would be in opposite directions, are added by a commutating arrangement on the shaft of the shield. A blast of cold air assists the cooling of the armatures.

In his paper, Mr. Edison gave no data as to the performance of the machine, except the statement that a generator to feed thirty incandescent lamps would weigh two or three tons.

Nothing has been heard lately of this generator: it will naturally take time to perfect it and make it practical.

Within the last month, however, attention has been called to a machine using the same general principle as that of Mr. Edison, but differing greatly in detail, — an invention of M. Menges of the Hague.

One form consists of a Gramme ring within which is a stationary electro-magnet. The two are horizontal, and are separated by a considerable air-space: this space is filled by a zigzag ribbon of iron extending around the inner circumference of the ring, with which it revolves. Now, if this ribbon of iron be cold, most of the lines of force will pass through it from one pole to the other of the magnet: few will go through the armature. If, however, the ribbon be heated at points at right angles to the poles, the magnetic resistance will be increased, and most of the lines of force will pass through the armature: there will be no motion, since every thing is perfectly symmetrical. If, now, the heat be applied to the ends of the same diameter at points forty-five degrees from the pole, the symmetry disappears, and there will be a rotation. Now, the Gramme ring rotating in a field of force will generate currents as in an ordinary dynamo-electric machine. In reality, then, we have a motor-dynamo arrangement, the former transforming the energy of heat into motion, the latter transforming the energy of motion into electrical energy.



THE SPRAGUE STREET-CAR ELECTRIC MOTOR.

Both the 'pyromagnetic generators' of Mr. Edison and M. Menges are an advance on previous machines of this type. It is difficult to see, however, how, in their present form, either can produce any very considerable quantity of electrical energy, with any reasonable size of apparatus. The publication of reliable figures on the performance of these machines would be of great interest.

Sprague Electric Railway in Richmond. — There was opened for traffic on Feb. 2 an electric street-railroad that from the extent of the plant, the difficulties overcome, and the perfection of equipment, marks a decided advance in electric traction. The Union Passenger Railway system in Richmond extends from the eastern to the western part of the town, having a total length of track of eleven miles. The road has many curves of short radius. There are grades that reach ten per cent, while there are combinations of curves and grades even more difficult than the steepest of the grades. In one case there is a thirty-foot curve on an ascent of seven per cent. In addition to this, but a small part of the length is through paved streets, and in wet weather the mud is so bad that in some places it completely covers the rails. The road is equipped with forty large sixteen-foot cars. Beneath each car are two 7½-horse power motors, one geared to each pair of wheels. The current is taken from an overhead wire by a wheel or trolley of sheet brass fixed on the end of a rod which holds it up underneath of and in contact with the wire. This rod is fixed on trunnions, and is fitted with springs that give a gentle pressure at the contact. The motors, nominally 7½-horse power each, are capable of developing over ten-horse power when necessary. They