vis, which is considerably enlarged, in order to be able to support the usually robust hind limbs. To judge by the great width presented by the medullary canal, the spinal marrow must have been much swollen in the sacral region, and have furnished very large nerves to a limb that was strongly developed and moved by extremely powerful muscles.

The ribs are highly developed, and their size shows that the thoracic region was very ample, and that consequently the lungs must have been large.

As the food of the dinosaurs was very varied, the form of their teeth is, as may be seen, entirely different according to the types examined. The flesh eaters, such as the megalosaurus (Fig. 1), had strong, cutting teeth, which were crenulate at the edges. The maxillaries, as well as the intermaxillaries, were armed with such teeth, and these must have been formidable. The herbivora, such as the iguanodon (Fig. 2), the vectisaurus, the laosaurus, and the hypsilophodon, had maxillaries that were provided with teeth admirably arranged for cutting and grinding. These teeth became worn out, like those of existing herbivorous mammals, and were indefinitely replaced, that is to say, as soon as one of them was worn out, another one succeeded it. What is not found in existing reptiles was a motion of the jaws, as in the ruminants of our epoch, in order to allow the teeth to grind food. The size of the apertures and channels through which the nerves passed shows that there existed soft lips and cheeks, without which the mastication of food would have been entirely impossible.

The hadrosauri, which were herbivora, had their teeth arranged in several rows that formed, through wear, a grinding surface in the form of a checker board. In the herbivora which have been grouped under the name of ornithopodia the intermaxillaries were not provided with teeth, and the same was the case with the extremity of the lower jaw, which was very likely armed during life with a horny beak; by means of which the animal cut off the buds and leaves that constituted its food.

Many dinosaurs had naked skin. In others, that are designated as stegosauri, the body was protected by bony shields and by spines.

We are acquainted with dinosaurs of all sizes, from the gigantic atlantosaurus of the Rocky Mountains, which attained a length of at least 80 feet, down to the nanosaurus, which was scarcely as large as a cat.

The secondary epoch, in which the dinosaurs lived, has justly been entitled the reign of reptiles. It was then that this group reached its maximum development. The mammals were very puny during this epoch, and were represented solely by the most inferior kinds. The dinosaurs seem to have then played upon the surface of the globe the role that the large carnivora and herbivora do now; but, while mammals have always gone on improving until they already offered at the end of the Tertiary epoch the magnificent development which we now see, reptiles have gone on continuously diminishing in importance. The higher animals have gradually excelled beings of a less perfect organization.

Dating from the Triassic epoch, the dinosaurs were already represented by so diverse types that it seems as if these were the descendants of animals that existed at a more remote epoch. It was at the end of the secondary epoch that these animals disappeared forever without leaving any descendants. They were unable to adapt themselves to the new conditions of existence that were imposed upon them, and they died, while the mammals, on the contrary, daily proceeded more toward the highest types.

The temperature was high during the Jurassic epoch, and uniform throughout the earth, as demonstrated by the existence in the north of Europe of corals comparable with those of the Gulf of Mexico or the South Sea. During the upper Jurassic epoch our country must have been cut up into lagoons, marshes, and frequently inundated estuaries. These privileged localities had a richer and more varied vegetation than the mountainous portions. Here grew large ferns with leathery fronds, while the declivities and uplands were covered with plants that approached the pandani, araucariæ, and cycads, and having almond-like seeds that formed the food of the herbivorous dinosaurs of the epoch.

If, through the admirable discoveries that have been made in recent years, we endeavor to bring to life again the fauna of the upper Jurassic period in the United States, we shall find one that is no less rich and strange than that of the Old World. Here we have, amid araucariæ and cycads, the gigantic stegosaurus, with a body clothed with bony plates and spines, that formed a powerful armor for it, and with fore legs much shorter than the hind ones; the compsonotus, with fore paws equally as well developed as the hind ones; and the strange flying reptiles, the pterodactyls (Fig. 3).

Among the animals found in the Rocky Mountains, the strangest beast is doubtless the brontosaurus, of whose skeleton we give a restoration according to Prof. Marsh (Fig. 4). This animal reached a gigantic size; living, it must have weighed at least thirty tons! The head is remarkably small for an animal of such a size. The brain, which is extremely small, indicates a slow and stupid beast. The neck is long, flexible, strong, and very mobile, the legs are massive, and the bones solid. The animal walked after the manner of our present bears, its body was entirely naked, its habits more or less aquatic, and it must have frequented muddy swamps pretty much as the hippopotamus does. Its food consisted of plants that grew in the water or near the banks.

Not far from the French frontier, between Mons and Tournay, in Belgium, is located the Bernissart coal mine. In order to reach the bed of coal it is necessary in that country to excavate the earth to a certain depth, and traverse strata which were deposited subsequent to the formation of the valuable combustible. In making researches at Bernissart for extracting coal, some wealden strata were encountered in a valley that dated from the beginning of the Cretaceous epoch, and that was afterward filled through the movements of the earth. Fishes by hundreds, crocodiles of unknown types, and gigantic reptiles here lay buried at a depth of almost 1,150 feet, nearly in the spot where they formerly lived. They were buried in mud, and lay pellmell along with the plants that grew upon the ground that they had trod at an epoch so remote as to exceed all imagination. These gigantic animals thus brought to light, thanks to the persevering researches of De Paux and Sohier, were dinosaurs belonging to the genus iguanodon, the first remains of which were found by Mantell in 1822.

It is to the labors of Boulenger and Van Beneden, and especially to those of Dollo, that we owe our knowledge of one of the strangest beings that ever existed in olden times. The discovery of the Bernissart iguanodon—an animal whose entire skeleton is now known—has thrown an absolutely new light upon the structure of a whole group of herbivorous dinosaurs.

Everything, in fact, is strange in the iguanodon (Fig. 5). Its stature, as well as its gait, is well calculated to astonish the naturalist who is acquainted with existing reptiles only—beings which are very puny as compared with animals that lived in former times.

The Bernissart iguanodon measures nearly thirty-three feet from the end of the nose to the tip of the tail, and, when standing upright upon its hind legs (the attitude that it assumed in walking), it rose to more that thirteen feet above the level of the ground. The head is relatively small and much compressed, and the nostrils are spacious and as if partitioned. The temporal fossa is limited by a bony arch, above as well as below—a character entirely exceptional in existing reptiles. The extremity of the jaws must likely have been provided with a beak designed for cutting the large ferns and the cycadaceæ that grew upon the margins of the lagoons and marshes into which the earth was cut up. The teeth, which are crenulate at the edges, indicate an essentially herbivorous diet, and they were replaced as soon as worn out. The neck must have been very mobile. The ribs, which are strong, indicate vast lungs. The fore limbs, shorter than the hind ones, terminate in a five fingered hand. The thumb is provided with a large spur, which must have been a formidable weapon. The hind limb, which is digitigrade, is provided with but three fingers, which were probably connected by a web. The pelvis more closely resembles that of birds than that of existing reptiles. The tail, a little longer than the rest of the body, is about sixteen feet in length, and consists of nearly fifty vertebræ. It is much compressed laterally, like that of the crocodiles, and must have served as a rapid and powerful means of propulsion.

"The circumstances under which the Bernissart iguanodons were found show, as Mr. Dupont has pointed out, that these animals must have lived in the midst of marshes and upon the banks of a river. It is consequently not surprising that they had aquatic habits.

"Granting that the iguanodons passed a portion of their existence in water, we can imagine, by the aid of observations made upon the crocodile and *amblyrrhyncus* (a large marine lizard of the Galapagos Islands), two very different modes of progression of our dinosaur in the liquid element.

"When it was swimming slowly, it made use of its four limbs and its tail. If, on the contrary, it wished to move forward rapidly in order to escape its enemies, it placed its fore limbs against its body, and made exclusive use of its hind ones and of its caudal appendage. In this mode of progression, it is clear that the smaller the fore paws are the more they are hidden, and consequently the less resistance they offer to the movement of the animal in the water. In confirmation of this, we observe that, among the forms that swim in the manner just stated, the fore limbs are so much the smaller in proportion as the beast is the more aquatic.

"The iguanodons walked on the ground by the aid of their hind legs only; in other words, they were bipeds after the manner of man and of a large number of birds, and were not jumpers like the kangaroo; moreover, they did not rest upon the tail, but allowed it simply to drag.

"But, it will be said, just now, in speaking of aquatic life, you compared the iguanodon with the crocodiles; yet the latter are not adapted for an erect attitude. What need, then, had the iguanodons of a bipedal walk if they had analogous habits? It appears to us, on the contrary, that standing upright must have been a great progress, and for the following reason:

"These animals, being herbivorous, had to serve as prey to the carnivora of their epoch; and, on another hand, they remained in the midst of marshes. Among the ferns by which they were surrounded they would have observed the approach of their enemies with difficulty, or not at all; but, standing upright, they were enabled to look about them to a considerable distance. Upright, too, it was in their power to seize their aggressor between their short, but powerful arms, and to bury their two enormous spurs into its body. These spurs, it is probable, were provided with a cutting edge.

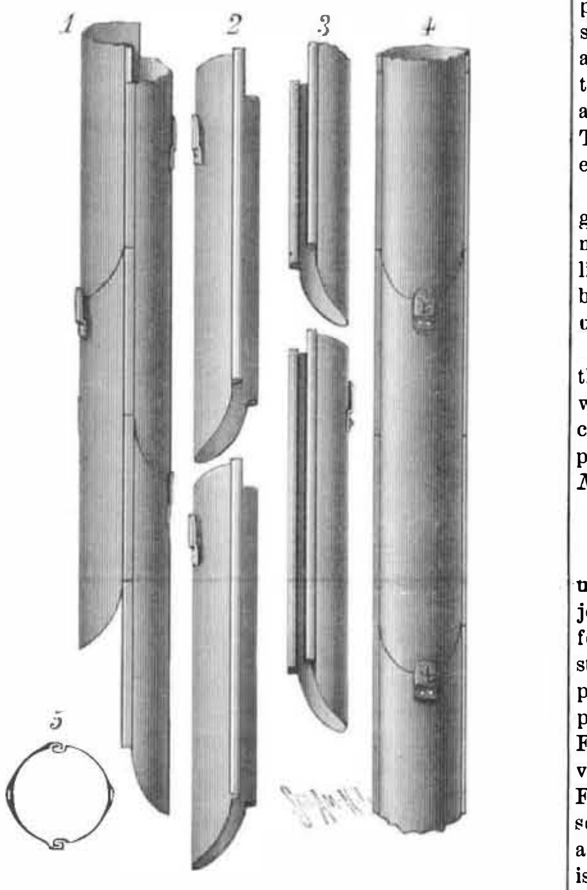
"The difficult progression of the crocodile upon the ground has been described by all travelers, and there can be no doubt that the long tail of this animal contributes not a little to its awkward gait. The transformation of this cumbersome organ out of water into a balance was, it seems to us, a happy modification.

"Finally, the bipedal walk must certainly have allowed the iguanodon to more quickly regain the river or lake in which it disported than would a quadrupedal walk that was continually interfered with by numerous aquatic plants that played, after a manner, the role of brushwood."*—*Science et Nature.*

IMPROVED STOVE AND OTHER PIPES.

The pipe shown in the accompanying engraving is made up of sections fitting together by longitudinally sliding lock-joints, the ends of the sections being formed with projections for overlapping. By this method of construction a very strong pipe is obtained, time and labor are economized in putting it up, and space saved when storing or transporting it. Fig. 1 is a side view, showing the lock-joint. Figs. 2 and 3 show the sections detached. Fig. 4 is a front view, showing the transverse joints and metal catches; and Fig. 5 is a cross section. The longitudinal edges of each section are bent to form a half-lap folding or sliding joint, as very clearly indicated in Fig. 5. One end of each section is cut square across, and the other end is extended, so that when two sections are united, end to end, this projection will pass under a sheet or cast metal catch, upon the squared end of the adjoining section; if considered desirable, the catches can be made ornamental. Elbows for such a pipe may be similarly constructed, or the pipe may be fitted with the common elbow. The parts are so assembled that the transverse joints will be in the middle of each section. The sliding longitudinal joints readily fit one within the other, and give the pipe increased strength, so that it may be connected for a longer distance than a riveted pipe without the necessity of holding it to the ceiling or elsewhere by wire.

This invention has been patented by F. L. Hirschmann, M.D., of Norway, Mich.



HIRSCHMANN'S IMPROVED STOVE AND OTHER PIPES.

Training of the Young.

A remark made in one of the papers read before the recent Woman's Congress in Baltimore suggests an interesting argument in favor of the kindergarten. It is well known that, in its development, each new born being passes through very much the same stages that his ancestors have been through before him. Even after birth the growth of the child's intelligence simulates the progress of the human race from the savage condition to that of civilization. It has been shown by Preyer, and others who have studied infant development, that a faculty which has been acquired by the race at a late stage is late in making its appearance in the child. Now, reading and writing are arts of comparatively recent achievement. Savage man could reap and sow, and weave, and build houses, long before he could communicate his thoughts to a person at a distance by means of written speech. There is, then, reason to believe that a child's general intelligence would be best trained by making him skillful in many kinds of manual labor before beginning to torture him with letters; and the moral to be derived is, that primary instruction should be instruction in manual dexterity, and that reading and writing could be learned with pleasure and with ease by a child who had been fitted for taking them up by the right kind of preparation. The argument is a novel one, and it certainly seems plausible.—*Science.*

* L. Dollo, Les Iguanodons de Bernissart.

The Boring of Marine Animals in Timber.

Prof. McIntosh lately delivered a lecture on this subject before the International Forestry Exhibition, Edinburgh. He began by stating that the burrowing of marine forms was a feature familiar to every zoologist, for scarcely a dead shell could be dredged from the sea bed that was not perforated by boring sponges. In the same way the surface of the limestone rooks of our southern shores was riddled by those sponges. So far as at present known, sponges bored only in calcareous substances, and there was a difference of opinion as to whether the agent in boring was the spicules or the soft animal jelly of the sponge.

As regarded the boring of the purple sea urchins in gneiss and granite, the teeth were the main agency in the perforations. The group of annelids included many boring and burrowing forms, some perforating sand and others earth; while many bored in aluminous shale, sandstone, limestone, shells, and various substances. Each form, moreover, made a characteristic tunnel in the rock, so that the borer could in most cases be determined. None, however, bored wood, and though pieces of telegraph cable had been several times sent him, with accompanying annelids as the depredators, in no instance had the lecturer been able to connect them with the injury. There could be little doubt that those forms performed a useful function in the disintegration of dead shells and in corroding the surface of calcareous and other rocks

The crustaceans and the mollusks were groups that were conspicuous in the perforation of wood and allied materials. Of crabs, the *Cheluria terebrans*, a form less familiar to Scottish zoologists than to their southern colleagues, was in xylophagous powers even more destructive than the common Scotch boring crab—the gribble—its excavations being considerably larger and more oblique. Though the gribble—*Limnoria lignorum*—must have been familiar to observers from a very early period, it was first described by Dr. Leach only in 1811, when Mr. Robert Stevenson, the celebrated engineer, found it burrowing most destructively in the large beams of Memel fir supporting the temporary beacon on the Bell rock. Other logs of pine on the rock were reduced at rate of about an inch a year, and the house timbers were so much destroyed by the gribble that many stood clear of the rock, supported only by the iron bolts and stanchions. It attacked all kinds of submarine woods; and the late Dr. Coldstream, Leith, had told them that in 1825 so extensive were the ravages of this creature that many of the piles of Trinity Chain Pier had to be replaced after four years' service, and studded all over with broad headed nails from the base to the limit of high water mark.

Having described the structure of the gribble and its mode of boring, the lecturer said it had also acquired the habit of perforating the protecting envelopes and gutta percha in which submarine telegraph cables were sheathed. The work of the burrowing crabs, however, was quite overshadowed by the far more serious encroachments which the boring shell fishes were capable of making in timber and similar substances, as well as in rocks of various kinds. Prof. McIntosh pointed out the boring of the pholas and date shells in rocks, and went on to describe the destruction caused by xycophaga, which was to be seen in the deep water off the Firth of Forth, and elsewhere in England and Scotland. It was, he said, a little bivalve shell fish or mollusk, intermediate in structure between the stone boring pholas and the strictly wood boring teredo. There was very little externally in the wood attacked by this form to attract attention, except the presence on the surface of minute apertures, which indicated the points by which the young animals had entered; but on breaking open the wood the adults were found in smooth tunnels in every fragment large enough to afford a lodgment.

The most conspicuous genus of wood borer, however, was the teredo, or ship worm, species of which occurred in every ocean. In the tube of the teredo the annelid (*Nereilepas*) was often found, and some observers maintained that it was the destroyer of the teredo, but the lecturer had some hesitation in subscribing to that theory. The very same species of annelid occurred abundantly along with the common hermit crab in the shells of the great whelk, and the association of annelids with other forms in tubes or elsewhere was extremely common; but it was not for the purpose of preying on their neighbors, though the bodies of their hosts were in many cases softer than those of the teredo; they were what zoologists called messmates—dwelling in association with other animals. The object in life of all the species of teredo was to bore ceaselessly into timber, the tunnels in which varied from one to two feet in length in the case of the common teredo to fully a yard in the great teredo.

Prof. McIntosh then gave a brief outline of the history of the teredo, which appeared to be mentioned for the first time in the Knights of Aristophanes, and said that the French and Dutch suffered much more seriously from its ravages than we did. The theories that had been brought forward to explain the mode by which marine animals perforated material so different as wood, limestone, wax, granite, and aluminous shale, might be ranged round two great centers—the chemical and the mechanical. The advocates of the chemical theory seemed to take it for granted that the borings occurred chiefly in calcareous substances, and with propriety, therefore, they made their solvent an acid.

That notion, however, was unable to explain the perforations in media totally impervious to such action, while no trace of acid was found in many borers; and while present in some, it was likewise characteristic of other marine animals that did not bore.

The mechanical theory, again, supposed that the animals perforated by means of shells or gritty particles in the case of mollusks, of teeth in sea urchins, bristles in annelids, and horny processes in certain sea acorns and gephyreans; but they were left in doubt concerning the extensive and wonderful excavations of the sponges, the bryozoa, and the rest of the cirripedes. Alluding to the methods of protecting submarine timber from the ravages of such animals as he had been speaking of, Prof. McIntosh said different kinds of wood were mentioned as being impenetrable by such boring action, but so far none had been successful. There were many preparations for the treatment of the wood before immersion. Soluble bitumen, silicated lime, and various compositions had each in turn been tried externally; while silicate of lime, creosote, and other fluids had been forced, under great pressure, into the tissue of the woods. The experiments of the Dutch Commissioners, who investigated the matter, had led them to the conclusion that no external protection other than metallic sheathing or the studding of the wood with broad headed nails would be successful in resisting the attacks of these borers, while the only impregnation they found reliable was creosoting.

In conclusion, Prof. McIntosh pointed out that while the Dutch, French, and other commissions had done material service in regard to the best means of protecting timber from the attacks of borers, the subject was by no means exhausted. On the contrary, it would form a fitting object for research at the marine laboratories which at last, he was glad to say, were being established on our coasts. That ceaseless boring of wood was not, however, an unmitigated evil. The masses of timber swept seaward by many foreign rivers would prove a serious impediment to navigation if the marine borers did not slowly but surely accomplish their dissolution. In the same way the relics of many a ship in the depths of the sea were disposed of, and even utilized for the increase of animal life, which was, directly or indirectly, connected with the food of fishes, and, consequently, with the welfare of man. The lecture was illustrated by a series of spirit and dry preparations and colored drawings.

Bavarian Beer.

Consul Horstmann, of Nuremberg, in a recent report, gives a very interesting account of the beer industry and consumption of Bavaria. To persons who have traveled through that beer guzzling country the statistics of the quantity of beer manufactured and consumed by its people can hardly be credited, but from the source the information is derived, its correctness cannot be denied.

Breweries were in existence in Bavaria previous to the founding of the city of Munich by Henry the Lion in 1158, but up to the fifteenth century the principal drinks of the inhabitants were mead, a fermented mixture of water, honey, and various fragrant herbs, and Bavarian wines. One of the first breweries established at Bavaria was at Weihenstephan in the year 1146, by the Bishop of Freising. In 1370 there were but three breweries in Munich, which number, in the course of two centuries, had increased to fifty-three. In the sixteenth century wheat beer was introduced into Munich from Bohemia, and threatened in the beginning to supersede the brown beer; but the opinion soon began to be held that white beer was not wholesome, and, moreover, it was contended that the consumption of wheat for that purpose would soon drain the country of that cereal, and there would be none left for other purposes. Different measures were taken to restrict the brewing of white beer, all of which proved failures, and eventually the Duke of Bavaria took to himself the sole right of brewing it, and thus was established the royal white brewery, which exists to the present day.

In 1881 there were 5,482 breweries in Bavaria, or rather more than one to every thousand inhabitants. In Munich the smaller breweries have been gradually swallowed up by the larger establishments, and there are now 29 breweries in the city, the largest of them using about 364,000 bushels of malt, and producing about 7,000,000 gallons of beer annually. Most of the beer produced in Bavaria is consumed in the country itself, only about seven per cent being exported, the principal cities taking part in this export being Munich, Kulmbach, Nuremberg, and Erlangen.

In the making of this beer two methods are in general use, the one by a process of infusion, the other by a process of decoction. The object of the mashing is not only to extract the sugar and the dextrin which is contained in the malt, but also to produce sugar and dextrin from the existing starch, with the help of the so called diastase of the malt and a temperature of 167° Fah. The process of infusion and of decoction differ from each other in the manner in which the temperature of the mash is raised to the proper degree for producing sugar. In the first named process the mash is brought up to the proper temperature without any part of it reaching the boiling point. In the process of decoction, which is the one universally practiced in Bavaria, the mash is brought up to the required temperature by putting a part of it in the kettle and heating it to the boiling point, and then conducting it back to the rest of the mash, so that the whole reaches a temperature of 125° Fah. A part is then put a second time in the kettle and boiled, and again returned to the rest of the mash, so that it reaches a temperature of 167° Fah. The proper temperature is generally reached by twice boiling a part of the mash, although in some few breweries it may be done in three successive boilings. This process takes more time, and requires greater attention, than the heating of the whole to a certain temperature, but better results are obtained by it. It produces a beer richer in dextrin, while by the method of infusion a beer is produced containing less dextrin but more alcohol. The Bavarian winter beer contains about 4 per cent. and the summer beer 4·5 per cent of alcohol, while porter contains from 6 to 7 per cent, and ale 6 to 9 per cent of alcohol.

The malt used for Bavarian beer is obtained partly from Bavaria itself and partly from Hungary, and the hops are mostly of Bavarian growth, these being universally acknowledged as the best. Consul Horstmann says that Bavaria takes the lead of all nations in the consumption of beer, the average annual consumption being 260 quarts per head of population, compared with 125 in England, 165 in Belgium, and 45 in the United States; and he estimates that at Munich the annual consumption reaches the enormous figure of 470 quarts for each person, or about one quart and a third daily.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Eastern District of Michigan.

PATENT PROCESS FOR MAKING BEER.

Brown, J.:

Where a patent clearly shows and describes a machine whose use necessarily involves the production of a certain process, no other person can afterward patent that process. The first patentee is entitled to his mechanism for every use of which it is capable, even though he did not foresee all of them.

An imperfect description, coupled with an incomplete drawing, is insufficient to invalidate a patent.

Business circulars which are sent only to persons engaged, or supposed to be engaged, in the trade are not such publications as section 4,886 of the law contemplates, and in a contest of priority will not afford a basis for a claim of prior invention as against a patentee.

The Meller & Hofmann patent, May 20, 1879, held to be anticipated by the Pfandler patent of July 2, 1878.

United States Circuit Court.—Southern District of New York.

ARNOLD *vs.* PHELPS *et al.*

Ashcroft reissued patent July 25, 1871.

Wheeler, J.:

A claim to the process of maturing and browning coffee by subjecting it in its uncured condition to the direct action of steam is not infringed by the application of heat only to the coffee in that condition, even though the heat generates steam from the moisture in the coffee. The steam cannot be omitted and the process be the same. Bill dismissed.

Automatic Arctic Exploration.

The Chicago *Current* says: Probably the most wonderful thing in connection with the whole sad history of Arctic exploration is the recent discovery of an ice floe in the waters of Davis' Strait—west of Greenland—which had drifted from a point in the Arctic Ocean northeast of the Lena delta—where the crew of the Jeannette divided into three parties and took to the open waters—to the southernmost point of Greenland, and north again to Baffin's Bay. Upon this floe were a corpse and many indubitable relics of the expedition, including an article of wearing apparel marked with the name of Seaman Noros, who, it will be remembered, in company with Seaman Nindermann went a few miles ahead of poor De Long, and lived to write the most extraordinary experience ever penned by a human hand. Had these two simple seamen been able to tell, in the Siberian tongue, that their comrades were only eleven miles back, the whole De Long party would have lived to join Melville and Danenhower.

Now the floe discovered by the Greenlanders has, perhaps crossed directly over the North Pole. From the Jeannette floe to the southern point of Greenland, in a direct line across the Pole, is 3,500 miles, but by way of the northern shore of Asia and Europe—past Cape Northeast, Nova Zembla, Spitzbergen, and Iceland, and north again into Baffin's Bay —would be a distance of at least 6,000 miles. Scientifically, the life of a moving ice floe for so many years, and its migration from one side of the world to the other, ought to furnish suggestions and data more valuable than all the other fruits of polar research combined. Self-registering meteorological apparatus, and possible gauges of the miles traveled, may in the future reveal to the investigators what the sacrifice of thousands of lives has otherwise failed to discover.

The Cheapest Antiseptic.

M. Pasteur anticipates that bisulphide of carbon will become the most efficacious of all antiseptics, as it is also the cheapest, costing but a fraction of a penny per pound in large quantity. It is also the best insecticide known, and for this purpose may, perhaps, be useful to preserve woodwork in tropical countries. Some idea of the use it is already put to may be gathered from the fact that over eight million pounds of the substance are used annually to check the ravages of phylloxera. Carbon bisulphide, as first produced, is about as foul smelling a compound as it is possible to find; but it is capable of purification till all offensive odor is removed, and it is sufficiently pure in smell almost to mix with a perfume.