when the bacillus enters the alimentary canal, there must be a degenerated condition of the tissues before it can find lodgment and fructify; that to a healthy person, therefore, the danger is perfectly visionary; that the alimentary canal is the least favorable channel for entrance into the system; that the disease in these cases was so localized as not to affect the flesh in general; that, in any case, the danger to health and life must be extremely small, too small to justify the exclusion from the market or destruction of large amounts of good, wholesome food.

The prosecution pointed out the inherent difficulty of proving, as a matter of fact, and not merely as a matter of opinion, the actual communication of tuberculosis to human beings by the ingestion of the flesh of tuberculous animals; and adduced evidence that the flesh of animals affected with tuberculosis, more or less, and offered for sale for food in Glasgow, is one half per cent in the year.

In summing up the evidence and the arguments, the court held that whether ingestion be or be not the commonest way in which tuberculosis is communicated, it must certainly be regarded as one mode of its communication; except on the footing that the meat was the medium of the transmission of the disease, it would be unnecessary and wasteful to exclude from the food-supply the carcasses of animals suffering from tuberculosis, however generalized and extensive; but the previously existent practice in Glasgow and elsewhere of condemning extensively diseased animals, clearly showed that the transmissibility of the disease by ingestion had long been recognized, and the evidence leads to the conclusion that it would not be proper to trust to cooking as a sufficient protection; that every animal suffering from tuberculosis, however limited in degree or apparently in locality, probably ought to be condemned, and that such condemnation would not cause a loss of food of more than one-quarter of one per cent; but, in the present instances, the disease, having extended to the lympathic glands, was undoubtedly generalized.

The number and character of the witnesses, the clearness of statement of the counsel, the respectability of the court, and the Scotch reputation for shrewd, practical common sense, give the report and result of this trial a considerable interest, as bearing upon the present position of science and practice in regard to the questions involved. Should it ultimately appear, as we see by the published abstract of a paper, to be read at the approaching meeting of the Association of American Physicians, Dr. H. C. Ernst thinks he is in a position to prove, that the milk from a cow suffering from tuberculosis is dangerous as an article of food, no matter where the pathological change may be situated, and that Koch's limitation of the danger to tuberculosis of the lacteal tract was too restricted, then the position of those who condemn the meat, even of locally infected animals, would be greatly strengthened.

THE AIR IN EDINBURGH THEATRES. — An interesting account has been given by Mr. Cosmo J. Burton of the amount of carbonic acid and organic matter in Theatre Royal and Royal Lyceum Theatre in Edinburgh. At the time of the experiments the theatres were by no means full; nevertheless, the temperature was from ten to fifteen degrees above that recorded immediately before the houses were opened, while carbonic acid was multiplied from three to five times. Mr. Burton remarks, as quoted by the *Lancet*, that the vitiation of the air proceeds with extraordinary rapidity at first, but the rate of change soon decreases, till towards the end of the performance the air becomes little or no worse, and, indeed, in a few instances it appeared to slightly improve. The atmosphere of all parts of the theatre was not equally vitiated. The air of the gallery was considerably worse than that of any other part of the house; the amphitheatre, dress circle, and pit did not come in the same order as to degree of impurity in the experiments, but the pit was always worse than the dress circle. The late Dr. Parkes stated that headache and vertigo are produced when the amount of carbonic acid in the air of respiration is not more than from fifteen to thirty volumes per ten thousand, and the experience of some theatres leads to the suspicion that Mr. Burton's results are not special to Edinburgh. The facts as to all theatres ought to be known; for the public had much better lose an evening's enjoyment than submit to the enforced inhalation of a polluted atmosphere for a number of hours.

NOTES AND NEWS.

IT is stated by the *Scientific American* that carefully repeated experiments made by an English navigator at Santander, on the north coast of Spain, showed the crest of the sea waves in a prolonged and heavy gale of wind to be forty-two feet high; and allowing the same for the depth between the waves, would make the height eighty-four feet from crest to base. The length from crest to crest wes found to be three hundred and eighty-six feet. Other estimates of the waves in the South Atlantic during great storms give a height of fifty feet for the crests and four hundred feet for length. In the North Sea the height of crest seldom exceeds ten feet and the length one hundred and fifty feet.

— At a recent meeting of the Paris Academy of Sciences, M. Benger described the curious effects of an electric discharge which struck a silvered mirror during a terrific thunderstorm near Prague, on June 9, 1889. The mirror shows over ten points at which the electric fluid penetrated through its gilded frame, volatilizing and transferring the gold to the anterior face of the glass, while on the opposite side the volatilization of the silver coating produced the most beautiful electric figures. These figures show that there occurred repeated and successive discharges, as also indicated by recent photographs of flashes taken with the oscillating camera obscura.

— In a recent letter from Paris to the *Engineering and Mining Journal*, Mr. George F. Kunz says it may be interesting to know that the following minerals are exhibited in and are for sale in quantity in the Norwegian section of the Paris Exposition at the following rates per pound: Molybdenite, 32 cents; Gadolinite, $2.54; Zircon, $1.27; Cerite, 32 cents; Orthite, 13 cents; Rutile, 20 cents; Thorite, $10.54; Yttrotitanite, 20 cents; Columbite, 94 cents. In reference to the occurrence and the use of vanadic and molybdic acids, both of these acids have until recently been considered rare. Since they, however, replace phosphoric acid in the lead ores of New Mexico and Arizona in the minerals wulfenite, vanadinite, etc., which exist there in quantities, they can be obtained at much less cost than they could before.

— "The great development in electricity will be, I am firmly convinced," said Mr. Edison to an interviewer in Paris, "in discovering a more economical process of producing it. At present we only get from coal consumed about four or five per cent of its latent electricity. The rest is wasted in heating water, expanding steam, pushing pistons, turning wheels, and finally causing a dynamo-machine to operate. A process will ultimately be found for extracting ninety to ninety-five per cent of the latent electricity directly from the coal. Then steam engines will be abolished, and that day is not far off now. Already we can get electricity direct from coal to the amount of ninety per cent, but only for experimental purposes. When I was on shipboard coming over I used to sit on deck by the hour and watch the waves. It made me positively savage to think of all that power going to waste. But we'll chain it up one of these days, along with Niagara Falls and the winds. That will be the electric millennium."

— It is stated in the *Metallarbeiter* that iron can be coppered by dipping it into melted copper, the surface of which is protected by a melted layer of cryolite and phosphoric acid, the articles to be thus treated being heated at the same temperature as the melted copper. Another process consists in dipping the articles into a melted mixture of one part of chloride or fluorine of copper, five or six parts of cryolite, and a little chloride of barium. If the article, when immersed, is connected with the negative pole of a battery, the process is hastened. A third method consists in dipping the articles in a solution of oxalate of copper and bicarbonate of soda, dissolved in ten or fifteen parts of water, acidified with organic gas.

— If London is the metropolis of the land of fogs, there is much consolation to be found in the fact that in spite of its smoke and its fogs it is not only one of the healthiest cities in the world, but is growing healthier every year. According to the official statistics for the quarter ending June last, as stated by a leading London newspaper, the annual deaths are only at the rate of sixteen per thousand. If some overcrowded and notoriously unhealthy dis-

tricts could be eliminated from the calculation, the figure would, of course, drop considerably. Still more remarkable would the sanitary condition appear if the area were confined to the high and airy suburbs in which so large a proportion are fortunate enough to dwell. Londoners have only to contrast this condition of things with the statistics of other capitals, to see how great is the advantage they enjoy. In Paris, which shows a comparatively good record, the mean annual death-rate is 32.1; in Berlin it is 27.5; in Vienna, 26.7; in Munich, 32.9, and in St. Petersburg, 43.7. In Brussels, which appears to be the healthiest of continental cities, it is 18.9. To sum up the case, the death-rate during the quarter in twenty-nine colonial and foreign cities, having an aggregate population exceeding 16,000,000 persons, was 26.6 per 1,000, or more than 10½ persons per 1,000 in excess of the London death-rate.

— The Iowa Academy of Science held its third annual meeting at West Des Moines on Sept. 5. Among the papers presented were the following: "Life History of *Lelandria ignota*," by Mr. F. W. Malley; "The Blue Quail in Iowa," "The Mission of Science," and "Notes on the Geology of North-western Iowa," by Professor J. E. Todd; "Fossils of the Keokuk Beds," by Professor C. H. Gordon; "Pearl Rearing Unios" and "Rearing *Vanessa antiopa*," by Professor F. M. Witter; "Native Forest Trees of Eastern Arkansaw" and "Geology of Eastern Arkansaw," by R. Ellsworth Call; "Geology of North-eastern Iowa," by Dr. P. J. Farnsworth; "Notes on Beggiatoa," by Professor L. H. Parmmel; "Distribution of Hemiptera," by Professor Herbert Osborn; "Is the Plum *Curculio* double-brooded?" by Professor C. P. Gillette; "The Food-fishes of Iowa," by Professor Seth E. Meek; and "The Crystalline Rocks of Missouri," by Professor Erasmus Haworth. Professor Todd also exhibited some volcanic dust from a stratum near Omaha.

— Schemes for irrigation in Upper Egypt have been considered by Colonel Ross, inspector-general of irrigation, with the governors of the provinces and the provincial councils. According to *Engineering*, the area affected by these proposals includes 736,000 acres, of which no less than 250,000 acres were not irrigated or were insufficiently irrigated in 1888. The projects are all based on the idea of going up the river to such a distance that a canal starting at that point shall, when the Nile is at fourteen cubits, take enough water and deliver on the surface a free flow. The present system of canals is being utilized by deepening, widening, and prolonging them, and in many cases only by a change of site of the offtake from the river. The masonry works required will, it is estimated, cost about $900,000, of which $500,000 is required immediately. The junctions and prolongations of canals are estimated to cost about a million dollars. The length of the valley to be thus protected from the effects of a low Nile is 255 miles.

— Mr. William Crookes, in the course of a presidential address to the Chemical Society, said: "The phosphoroscope affords another method of verifying the simple or compound character of a substance. It is well known that the continuance of phosphorescence after the cessation of the exciting cause varies widely, from some hours, as in the case of the phosphorescent sulphides, to the fraction of a second in the case of uranium glass and quinine sulphate. On examining phosphorescent earths glowing in a vacuum tube under the action of the induction discharge, I found remarkable differences in the duration of this residual glow. Some of the earths, after the cessation of the current, remain luminous for an hour or more, whilst others cease to phosphoresce immediately on the stoppage of the current. Take the case of yttrium. As already stated, I succeeded in resolving this earth into several simpler bodies not equal in basicity. While seeking for further proof of the distinct character of these bodies, I observed that the after-glow differed somewhat in color from that which the earth exhibited whilst the current was still passing. Further, the spectrum of the after-glow seemed to show, so far as I could judge by the faint light, that some of the lines were missing. As this phenomenon indicated another difference among the components of yttrium, I examined them in an instrument similar to Becquerel's phosphoroscope, but acting electrically instead of by means of direct light. Under ordinary circumstances it is scarcely possible to perceive any phosphorescence in an earth until the vacuum is so high that the line spectrum of the residual gas begins to grow faint. Up to this point, the stronger light of the glowing gas overpowers the feeble glow of the phosphorescence. But in the phosphoroscope the light of the glowing gas lasts only for an inappreciable time, while that of the phosphorescent earth persists long enough to be distinctly observed. The different bands of the new constituents of yttria do not all appear at the same speed of rotation. At the lowest speed the double greenish blue band of $G\beta$ is first seen, followed next by the dark blue band of $G\alpha$. As the velocity increases, there follows the bright citron-yellow band of $G\delta$, and as the utmost speed approaches the red band of $G\zeta$ is seen, but with difficulty. If lanthanum sulphate along with a little lime is examined in the phosphoroscope, the line of $G\varepsilon$ is visible at the lowest speed; $G\delta$ follows at an interval of 0.0035 second, and the $G\alpha$ line immediately afterwards."

— Professor Frank D. Adams, having been appointed lecturer on geology in McGill University, Montreal, is about to sever his connection with the Geological Survey of Canada.

— A most interesting exhibit at the Paris Exposition, according to *Engineering*, is a recording flash telegraph for military or other purposes. This apparatus, which is exhibited by MM. Ducretet, is in fact a combination of a flashing telegraph and a Morse printer, consisting of a projector fitted with a powerful lamp in the focus of the usual optical apparatus. In front of the lamp and below it and the lenses is a screen, which may be suddenly removed from the front of the lamp by the depression of a key similar to that in use under the Morse system, and this screen may be as suddenly replaced by the release of the key; the flashes, long or short, are therefore transmitted to the distant station by the action of the key exactly in the same way as in transmitting a Morse message. The movement of the key has, moreover, a second action, for it sets into motion or stops the Morse recorder, doing mechanically exactly what the electric current does in the ordinary form of that instrument. As long as the key is depressed a beam of light is continuously projected to the distant station, and a continuous line is drawn on the paper band, and the moment that the key is released the light is obscured, and at the same time the recorder ceases to draw a line on the paper. Thus every flash, whether short or long, as well as the periods of rest, are accurately recorded on the band of paper, and a permanent record is produced of every message flashed through the instrument.

— The "chemin de fer glissant," or sliding railway, at the Paris Exposition, says the *Engineering and Mining Journal*, is the application in practice of an old theory that, by adopting a sled upon rails with water interposed as the carrying medium, the least possible friction would be encountered and greater speed could be attained than by means of wheels. The promoters of the enterprise give the credit of the invention to a French engineer named Girard, who was killed in the Franco-German war, and name as the date of it 1868; but, if we are not mistaken, the idea was advanced some years before this date in England, where it was looked upon as chimerical and impracticable. However that may be, it has now for the first time been tried on a working scale, and in combination with a system of propulsion which, we believe, is novel. The wheels are replaced by four hollow slides, about eight by four inches, one at each corner of the car, fitting upon a flat and wide rail, grooved on the inner surface. To set the car in motion, water is forced by compressed air into the slide, which it raises slightly from the rail, and the propelling force is supplied by a stream of water at high pressure directed from short iron pillars upon paddles fixed underneath the car. The stream of water is supplied automatically by the movement of the car, being shut off in the same manner by the paddle passing out of range. By the time the last car has passed the jet the foremost one has reached the next pillar. The force developed is represented as very great. The train is stopped by shutting off the stream of water that feeds the slides. The experimental line on the Esplanade des Invalides has four carriages, with seating capacity for about a hundred passengers, and to traverse its length, some two hundred and fifty yards, only a few seconds are required. Great speed is claimed for the invention, not less than about ninety miles an hour, and the ability to stop in thirty yards when running at this speed. Gradi-

ents are represented to be no obstacle, sixteen inches in the yard being practicable, and the descent at such an inclination is said to be safe. No doubt the lowness of the centre of gravity, which is little more than two feet above the rails, will reduce the risk of running off the track, but the enthusiastic recommendation of the system by its promoters as peculiarly adapted for elevated railways in cities would not be echoed, we think, by the dwellers and foot passengers in streets traversed by such a line. We do not see how a continual shower bath is to be avoided, except by such an extensive, expensive, and above all, opaque dripping pan as would both require an immense expenditure and create an intolerable nuisance.

— According to the *Journal of Chemical Industry*, the specific gravity of glycerine when used for tempering steel or cast iron may be varied between 1.08 and 1.26 at 15° C. by adding water, according to the composition of the metal. The quantity of glycerine should be from one to six times greater than the weight of the pieces to be plunged into it, and its temperature may be varied from 15° to 200° C., according to the hardness of the metal. The harder the steel to be tempered, the higher should be the temperature of the glycerine. To increase the quenching power of the bath various salts may be added. Thus, when a harder temper is required, protosulphate of magnesia may be added in quantity from one to thirty-four per cent of the liquid, or from one-fourth to four per cent of sulphate of potassium. For a softer temper one to ten per cent of chloride of manganese and one to four per cent of chloride of potassium may be added. The principal advantages to be derived from these methods are: that the temperature of the aqueous solution of glycerine may be varied within wide limits, the boiling point of pure glycerine being 290° C.; and that, owing to the fact that solutions of glycerine dissolve most salts that are soluble in water, the quenching properties may be varied by readily dissolving in the bath such salts as suit the kind of metal to be tempered and the degree of temper required.

— The *Gardeners' Chronicle* reports that at the Paris Exposition many of the South American republics show specimens of the product known locally as *yerba de mate*, or Paraguay tea, the dried and broken leaves and stalks of different species of ilex. It is exhibited in packets and in original bales of green hide. This is the dietetic beverage of about 20,000,000 of people in South America, and its popularity is shown by the exhibits in the various pavilions of the Argentine Republic, Paraguay, Uruguay, Brazil, Chili, Bolivia, etc. It is difficult to get at any reliable returns as to the entire traffic in this commodity, the production of which is carried on in such a desultory and wide manner, and extends over so vast an area of wild country where the holly-trees flourish. In the Argentine Republic the consumption is over thirty-five million pounds, against five million pounds of coffee. In Paraguay the production of mate is about five million pounds; from Brazil there is an export of sixty-five million pounds to neighboring States, while the local consumption is about half as much. This is singular in the great coffee-producing centre of the world, which sends into commerce annually more than half the entire production of coffee. Strong efforts are being made to open a trade with it in Europe, especially in France, where shops advertise and recommend it. Whether this will succeed remains to be seen, looking at the increased production of tea, and the enormous increase in its sale in Europe. Approaching in its chemical composition to coffee and tea, it is asserted that it does not cause wakefulness or prevent sleep. In the rural districts, as well as in the smaller towns, this beverage is considered a regular form of diet, and not, like tea, a mere accompaniment of the breakfast-table. It is sweetened with sugar until it almost becomes a syrup. It is sold at from four to eight cents per pound, and one pound will produce about twenty quarts of infusion. It is sometimes flavored with cinnamon, orange-peel, or lemon-juice.

— At Cambridge, England, during the month of August, about twenty elementary teachers were in residence for a brief visit at Newnham College, and short courses of lectures were started in history, literature, and physiology, which might serve as a useful kind of university extension on a small scale. Full advantage was taken of the interesting lectures in history, literature, physiology, logic, and other subjects. The lecturers and students vied with each other in making their visitors' holiday as happy as possible, arranging walking and boating excursions, impromptu concerts, tea-parties, and other forms of entertainment for them. The so-called old hall, the oldest of the three halls which now form the college, was given up to the visitors, who were under the care of two lady lecturers. The pretty rooms and tasteful decorations, the quiet and beauty which form the charms of an academic life, will doubtless be pleasant memories to those whose ordinary work lies in less beautiful places. It has come to be understood that the university extension gathering will in all probability take place annually at Oxford. It appears that the facilities offered by the place, such as the new schools, the general emptiness of the colleges, etc., are much greater than at Cambridge, and that the number of ladies attending these gatherings is likely to increase in future years. As a means of drawing women together, and giving an impetus to education, these meetings have already proved of great value. They supply an enthusiasm and a desire for knowledge and culture which can only be obtained by the gathering together of teachers and students. The actual instruction given can, of course, hardly be of consequence; but for this purpose the second part of the meeting, extending to the end of the month, during which lecturers continued in greater detail the subjects introduced during Part I., was probably found by the fraction of students who remained for it to have considerable educational value. Mr. Moulton, Mr. Mackinder, Professor Green, Mr. Churton Collins, Mr. Shaw, and Mr. Hewins were the lecturers, who worked out in greater fulness the subjects which they had already dealt with in a more summary fashion. This summer meeting at Oxford was marked by an incident which may in time become quite famous. The debating hall at the Union was for the first time invaded by lady speakers. This is, indeed, a sign of the times, which he who runs may read. In an audience of six hundred a resolution in favour of women suffrage was carried by a majority of three to one. The proceedings took place without official sanction, and were tainted with the grossest illegality; but yet the roof did not fall, as doubtless it should have done had it retained a scrap of reverence for the monastic traditions of old Oxford.

— An interesting series of experiments has recently been carried out by the Dutch State railways, says *Engineering*, for the purpose of ascertaining exactly the relative resistance of various pigments to atmospheric changes and to the corrosive action of sea water. The results have proved that the red-lead paints are less affected by atmospheric influence than those which are composed of the brown oxides of iron, on account of their adhering more closely to the metal, and of their possession of greater elasticity. It was also discovered that any sort of paint afforded an increased protection if the plates were pickled in hydrochloric acid before its application. The prevention of corrosion by salt water was found to be possible by the admixture of the oxide of some electro-positive metal, such as caustic lime and soda; but the efficiency of such a covering diminished when its alkaline properties had been neutralized by the absorption of carbonic acid. Magnesia, however, was proved to be the most serviceable, seeing that it does not absorb carbonic acid; and not only does it protect the iron from galvanic action, but it also does not affect the anti-fouling qualities of the paint.

— In the report just issued by the Oxford University Extension delegates some interesting particulars are given, says the *Pall Mall Gazette*, of the devotion to learning under difficulties which some of the students display. Thus, at Camborne one of the students was a miner, who, after the evening lecture, had to go in the night shift underground. At Burnley, a weaver in a cotton-mill, in order to have more time for study, sacrificed her dinner-hour, and remained at the loom reading between her hours of work. To supplement the regular courses of lectures, and to carry on the work therein begun, an increasing number of reading circles and students' associations have, we see, been formed. Of the latter, one of the most successful is at Exeter. It consists of ladies only, and during the year it has held about twenty meetings for the discussion of literary subjects and the readings of essays, besides arranging for the delivery of ten special scientific lectures. The

movement has received an additional impetus from the generosity of the Marquis of Ripon, Mr. J. G. Talbot, M.P., Mr. F. D. Mocatta, the Rector of Exeter, and other donors, who offered scholarships, lately awarded, to enable poorer students to attend the summer meeting at Oxford.

— Some curious facts bearing on the *morale* of the lower animals are given by a correspondent of the *Revue Scientifique*. One source of animal sociability is a permanent sexual friendliness, making individuals mutually agreeable. Thus in stables without stalls, it is desirable to put animals of opposite sex next each other, to avoid injuries. A mare may be safely put into a field containing a horse unknown to it, but if two unacquainted horses be thus put together they will fight. A stallion, indeed, will sometimes get injury from an unknown mare put into a field with it. Again, the authority of the oldest and strongest in a group of males often favors sociability. In the Spanish *ganaderias*, a horseman will lead about a numerous troop of bulls, by means of five or six bulls who obey him and maintain order. In the Madrid circus the writer saw three of these animals bring to its stall a vicious bull which had ripped up five or six horses and mortally wounded an *espada*. They made a slight movement of the horns, and the creature, after a little hesitation, turned and followed them. Once more, when flocks of wild ducks and geese have to go long distances, they form a triangle to cleave the air more easily, and the most courageous bird takes the position at the forward angle. As this is a very fatiguing post, another bird, ere long, takes the place of the exhausted leader. Thus they place their available strength at the service of the society.

— A recent number of the *China Review* contains a paper by Dr. Macgowan on the alleged avenging habits of the cobra in Indian and Chinese folk-lore. The belief in India is that a wounded cobra which escapes will sooner or later revenge itself on the man who has caused the injury, wherever he may go or whatever he may do. Dr. Macgowan says that this belief is prevalent in Indo-China and China as well as in India. But in China there is also a strong prejudice against killing the cobra, lest its spirit should haunt the slayer ever after. Cobras, therefore, are shunned rather than pursued and attacked. Popular stories of the dire consequences of slaying them keep up the superstition. A high official who had killed one died soon afterwards of some mysterious disease, and the death is attributed to the slain snake; again, the spirit of the snake enters into possession of its slayer, and employs the vocal organs of the latter in uttering imprecations on himself until death mercifully removes him. Dr. Macgowan gives a large number of stories of this character. A number of others refer to the retribution on snake-killers after their own deaths. Gratitude, as well as vindictiveness, is ascribed to snakes, of which some characteristic stories are given. In conclusion, Dr. Macgowan observes that the recently established vernacular press in China furnishes inexhaustible stores of folk-lore. "Paragraphs describing popular superstitions, impossible occurrences, monstrosities, and so forth, constitute a great portion of their matter." In regard to snakes, the marvel is that any are killed at all in China, so many dreadful punishments are supposed to overtake their destroyers; and, indeed, it is considered a work meriting favor here and hereafter to purchase captured snakes and liberate them. Nevertheless, poisonous snakes are not numerous in China, probably because their presence is inconvenient to Chinese farmers, and they are therefore destroyed, folk-lore notwithstanding.

— The following practical suggestions, based on results of experiments at the Indiana Agricultural Experiment Station, are offered by Professor W. C. Latta, in the hope that their application would result advantageously on a very large proportion of the wheat farms of Indiana. (1) Sow less wheat; grow more grass, and better live stock. (2) Select a hardy, prolific wheat, adapted to your soil, and stick to it. Give it good treatment and it will not "run out." Sow not less than six pecks of sound seed to the acre. (3) Plough wheat ground early, and harrow immediately after ploughing. You can thus more easily and more thoroughly pulverize the soil. (4) If ground breaks up cloddy, use heavy roll alternating with some form of harrow or cultivator that will bring clods to surface. (5) If manure or fertilizers are used, mix thoroughly with soil in every case. Use only rotted manure, if any, and apply after plowing. Reserve the fresh manure for the corn crop. (6) Before trying a fertilizer, get the experience and advice of farmers whose soils are similar to your own. (7) Test the untried brands carefully, in a small way, before deciding upon their extensive use. This is the best course, for the reason that even the highest grades often act very differently on different soils. (8) Adopt a rotation of crops suited to your soil and needs. It will increase the yield and improve the quality of your crops, enable you to take better care of your live stock, prevent serious insect depredations and fungous diseases, improve your soil and make it more lasting, and put money in your pocket. (9) Bear in mind that soils and climate vary greatly in different localities, and that these potent factors in crop production will very materially affect the results of your work. Therefore, study your local conditions, and intelligently apply the lessons of this bulletin only so far as they may be suited to your needs and surroundings.

— Information has reached us that Mr. Julien of Brussels, the inventor of the Julien electric traction system in operation on the Fourth Avenue street railway in this city, has been awarded a gold medal at the Paris Exposition, for his storage batteries, over competitors from all parts of the world. This is of importance, being confirmatory of the awards obtained by him for his batteries and system of storage battery traction at Antwerp in 1885, by the international congress appointed by the government to report as to the best manner of propulsion of tram cars; and also at Paris in 1886, and at Brussels in 1888, when the Leopold cross was presented him for his invention.

— Russia is organizing a system of technical schools of a very complete form. The schools are of three classes, lower and middle technical schools, and upper, or, as they are so called, trade schools. The first consist of three divisions, for mechanics, chemists, and builders respectively, and the instruction is strictly technical and manual. The second class is intended for assistant engineers and architects, foremen builders, and agricultural bailiffs. The courses of study cover four years, and the students must have completed their primary education before entering the schools. The subjects of study are drawing, mechanics, applied mathematics, and practical exercises bearing on the industry to be followed. These middle schools are divided into five kinds, technical schools of a general character, schools of chemistry, schools of agriculture, schools of architecture, and schools of mines. Some schools combine two or more of these functions, that of Nijni-Novgorod, for instance, two; that of Moscow, three; that of Krasnovodsk also two, agriculture and mining. None of the courses are simply fanciful, all are practical. For instance, in the school of architecture the time will not be spent in sketching Pantheons or designing triumphal arches, but in planning dwellings of a moderate cost, which shall be sound and durable, well warmed and ventilated, well drained, comfortable, and pleasant to live in. The superior trade schools are intended to produce skilled and intelligent workmen in wood and metal. The minister of instruction calculates that the cost of maintenance of a lower school will be about ten thousand dollars per annum, that of a middle school fourteen thousand five hundred dollars, and that of a trade school about six thousand seven hundred dollars.

— An interesting correspondence has been published between the Magdeburgh Fire Insurance Company and Dr. Stephan, head of the German postal and telegraphic service, respecting the relation between the telephone and the electric fluid, from which it appears that, contrary to the general belief, experience in Germany goes to show that a telephone network rather acts as a protection against lightning than otherwise. For instance, in Hamburg, during the period from 1885 to 1888, there was only one case of lightning in the heart of the city, where the net is very dense, but many others in the suburbs where there is no telephone. In Berlin and other German towns, as well as in Copenhagen, similar experiences are reported. Dr. Stephan, however, points out that the imperial telephone network is being laid with every care, and that the number of lightning conductors is very large.