season to deposit its eggs. Ancient mythology is responsible for the legend that Mercury first acquired the idea of the form of the lute or lyre from the general appearance of this turtle; the ridges along the back being suggestive of the strings, and the broad hind feet representing the foot of the instrument. The French name for this turtle is *luth* (a lute).

NATURAL HISTORY NOTES.

Interesting Case of Commensalism.—Dr. Möbius, in his recent work on the fauna of the Mauritius Islands, gives a description of two crabs of most extraordinary habits. Both belong to the family polydectinæ, the species of which have their front claws armed with large teeth. Latreilie, who first named the crab *Polydectes cupulifer*, remarked that a gummy substance was always to be found at the ends of the claws of this species, and Dana described the animal as having always something spongy in its hands. Dr. Möbius has discovered the remarkable fact that these things held in the two claws of the crab are in reality living sea-anemones. These anemones are attached to the immovable joint of each claw, while the teeth of the movable joint of the claw are kept buried deep into the flesh of the sea-anemones, and thus hold them fast, although each anemone can easily be pulled away from its position with the forceps in specimens preserved in spirits. The mouth of the sea-anemone is always turned away from the crab. The same curious combination exists in the case of another species of the same family, but of a different genus, *Melia tessellata*, which also inhabits Mauritius. Professor Möbius gives the following account of the matter: "I collected about fifty male and female specimens of *Melia tessellata;* all of these held in each claw an *Actinia prehensa*. The recurved hooks of the inner margins of the claw joints of the crab are particularly well adapted to hold the actinias fast. I never succeeded in dragging the living actinias out without injuring them. If I left the fragments of them when pulled out lying in the vessel in which the *Melia* was the crab collected them again in his clutch in a short time. If I cut the actinias in pieces with the scissors I found them all again in the claws of the crab after a few hours. It is very probable that the actinias aid the crab in catching its prey by means of their thread-like cells, and that the actinias, on the other hand, gain by being carried from place to place by the crab, and are thus brought into contact with more animals which can serve as food to them than they would if stationary. This is a very interesting case of commensalism."

A Locomotive Dicotyledon.—So far as has been generally known hitherto the power of voluntary locomotion of plants from place to place is confined to members of the lower orders of cryptogams, namely, algæ and fungi; but an interesting case of voluntary motion among dicotyledonous plants, in a species of *Loranthus*, has been discovered by Dr. G. Watt, of the Educational Department, Bengal Lower Provinces. It is only while the seed is germinating that the motion takes place, but the mode of traveling is very peculiar and quite different from that of any other known plant. The plant is a native of Bengal, and like all other members of the genus is parasitical, growing upon a few evergreen trees, particularly upon some species of *Memecylon*. The fruit, like that of its relative, the mistletoe, and nearly all other members of the order, consists of a mass of very viscid pulp surrounding a single seed, and on separating from the parent plant adheres to whatever it may chance to fall upon, and after a time begins to germinate. It is only during the first stage of germination that the motion to be described takes place, and it is evident that the power of being able to move about is to enable the plant to find a suitable place to grow upon. The radicle at first grows out, and when it has attained a length of about an inch it develops upon its extremity a flattened disk, and then curves about until the disk is applied to any object that is near at hand. If the spot upon which the disk fastens is suitable for further development of the plant, germination continues, and no locomotion takes place; but if, on the contrary, the spot should not be favorable, the germinating embryo has the power of changing its position. This is accomplished by the adhesive radicle raising the seed and advancing it to another spot; or, to make the process plainer, the disk at the end of the radicle adheres very tightly to whatever it is applied; the radicle itself straightens and tears the viscid berry away from whatever it has adhered to, and raises it in the air. The radicle then again curves and carries the berry to another spot, where it again adheres. The disk then releases itself, and by the curving about of the radicle is advanced to another spot, where it again fixes itself. Dr. Watt says he has seen this repeated several times, so that to a certain extent the young embryo, still within the seed, moves about. It seems to select certain places in preference to others, particularly the leaves, which in the *Memecylon* are evergreen and very dense. The berries on falling are almost certain to alight on the leaves, and, although many germinate thereon, they have been frequently observed to move off the leaves on to the stems, and finally fasten there.

The Origin of the Cat.—St. George Mivart, in his recent work on the cat, says that the early history of the domestic cat is uncertain. It is not the common cat of zoology which is the wild or native cat, an animal that existed abundantly in the forests in the time of Julius Cæsar and was seen in Wales within the last twenty years. It appears to have come down to us from the Eyptians, being mentioned, Mr. Mivart informs us, in inscriptions as early as 1684 B.C., and being, as well known, an object of religious worship and the venerated inmate of certain temples. It was an emblem of the sun to the Egyptians, and, according to Herodotus, the death of a cat from natural causes was followed by the ceremony of shaving the eyebrows in token of mourning. From Egypt it must have been introduced into Greece, though Professor Rolleston, in his article on cats in Humphry and Turner's *Journal of Anatomy*, considers that the cat of the ancients was the *Mustela fotna*, the "beech" or "stone" marten. It was not a domestic animal among the Hebrews, though it was known to them, as we read in the apocryphal book of Baruch, who lived, it is supposed, in the reign of Jehoiakim, about 600 B.C., that "upon their bodies and heads sit bats, swallows, and birds, and the *cats* also." In regard to the pedigree of the cat, Mr. Mivart traces it from unknown insectivora-like animals, which produced, among other forms, *Arctocyon*. From this, as a root, the carnivorous branch divided into cynoid and arctoid branches—the former developing into the typical *Canidæ;* the latter, after giving off other branches, leading to the *Ursidæ*, and, through *Proclurus*, to the *Viverridæ*, *Hyænidæ*, *Cryptoproctidæ*, and *Felidæ*.

Dr. Andrew Clark on Alcohol.

Dr. Andrew Clark lately delivered an evening address on alcohol, in the Great Portland Street School-rooms, London, to a crowded and deeply interested audience. He said he purposed offering a few informal remarks upon the influence of alcoholic drinks upon health, upon work, upon disease, and upon the succeeding generation. This question of alcohol was of the first importance to us as a nation and as individuals, and hence a great responsibility rested upon those who professed to speak upon it with authority. He ventured to say that he knew something about this question. For twenty-five years he had been physician to one of the largest hospitals in this country (the London Hospital), and there, as elsewhere, it had been a part of his business in life to ascertain the influence which alcoholic drinks exercised upon health, and he had with deep interest and attention striven to get at the truth of the matter. In the first place let him distinctly say that alcohol was a poison, as were also strychnine, arsenic, and opium; but in certain small doses strychnine, arsenic, and opium were useful in special circumstances, and in very minute doses alcohol could also be used without any obvious prejudicial effect upon health. He was not going to discuss what these minute doses were, save to say that they were very minute. A perfect state of health (and it was rarely to be found) could not be benefited by alcohol in any degree, and in nine times out of ten it was injured by it. He said this not as a total abstainer, though he earnestly hoped that all the rising generation would be. Instead of the ideal state of health which might be enjoyed save for the nature of our surroundings, the sins of our parents, and our own sins, there was a sort of secondary health possessed by most of us, and what did alcohol do for this?

He had two answers to give—that this sort of health bore apparently with alcohol better than the other, and sometimes seemed as if benefited by it; and this was exactly the sort of health that formed the great debating ground of different people with respect to the use of alcohol. Secondly, there were some nervous people always ailing, yet never ill, for whom he had a profound sympathy, who seemed to derive great comfort from alcohol, and to these he had sometimes said, "Take a little beer or wine, but take great care never to go beyond the minute dose." He did not defend this, but simply stated it to show what he thought. As to the influence of alcohol upon work, Dr. Clark went on to encourage his hearers to try the experiment of total abstinence, and observe the result in regard to work. Let them, however, try it fairly, and not allow themselves to be deterred from it by the evil prognostications of friends. He was certain that if this experiment were tried each individual present would come to the conclusion that alcohol was not a helper of work, but, on the contrary, a hinderer.

Now as to the effect of alcohol upon disease. He went through the wards of his hospital to-day and asked himself how many cases there were due to natural and unavoidable causes and how many to drink, and he came, after careful thought, to the conclusion that seven out of ten owed their ill-health to alcohol. He did not say that these were excessive drinkers or drunkards—in fact, it was not the drunkards who suffered most from alcohol, but the moderate drinkers who exceeded the physiological quantity. The drunkard very often was an abstainer for months together after a period of intemperance, but the moderate drinker went steadily to work undermining his constitution, and preparing himself for premature decay and death. He had no means of finding out how many victims alcohol claimed each year, but certainly more than three-fourths of the disorders of fashionable life arose from the drug of which he was speaking. Finally, Dr. Clark dwelt upon the heredity of the alcoholic taint, and closed by saying that sometimes when he thought of all this conglomeration of evils he was disposed to rush to the opposite extreme—to give up his profession, to give up everything, and to enter upon a holy crusade, preaching to all men everywhere to beware of this enemy of the race.

Pulque.

BY E. E. RIOPEL, M.D.

Pulque is the national drink of the Mexicans. It is produced by the fermentation of the maguey or *Agave americana*. This plant has been considered diuretic and antisyphilitic. There is no authentic record as to who first made pulque or neutli. Many are the traditions extant among the Mexicans concerning its first manufacturer. It seems, however, to be the more general belief that it was Xochitl, daughter of a nobleman called Papantezin, who lived in the time of Tapancaltzin, eighth king of the Toltecs. From time immemorial pulque has been considered to contain medicinal virtues in a very high degree as well as all the other products of the maguey, and at one time the maguey was even said to hold a spiritual life and was held in reverence. To-day pulque is esteemed by the ignorant classes as having a variety of curative powers, and physicians use it for its alcoholic and nutritive properties. It is held as a stimulant, tonic, and antispasmodic. They recommend it to the infirm, weak, anæmic, and nursing mothers.

ITS COMPOSITION.

It is obtained by fermenting the juice expressed from the central portion of the maguey plant. After expressing the juice between rollers, or, as was formerly done by means of suction, it is carried to the vats for fermentation. These vats consist of raw ox-hides loosely suspended in a strong wooden frame, with the hair on the outside. These hide-made vessels contain the cryptococcus or ferment, which is a residuum of the former fermentations. After a few hours fermentation is fully established and the pulque is drawn off, always leaving a residuum in the vessel for the next fermentation. The liquid obtained from the maguey plant has a density varying from 1·029 to 1·042, and contains in 100 parts 9·553 of sugar, 0·540 of gum and soluble albumen, 0·726 salts, and 89·181 of water, holding in solution resinous matter, fats, albuminoids, starch, dextrine, and glucose.

According to Don Jose Ramos, its salts contain potash, soda, and lime in moderate proportions, and magnesia and alumina as chlorides, carbonates, sulphates, and silicates; hence the great value in which it must have been held in former times and in which it ought to be held at the present day.

From the composition of the juice of the maguey one may have an idea of the therapeutic effects of the pulque, allowing for the change which these constituents may undergo through fermentation. Pulque has no definite proportion of alcohol, for one may readily see from the way it is manufactured that it cannot have any definite standard. It, however, contains a very small proportion of fusel oil and carbonic acid in large quantities. Considering that its manufacture is not based upon any standard of purity, or even with ordinary care, its density cannot be given with any certainty, though it varies from 0·9943 to 1·0200 ("La Esquela de Medicina"). To-day it is attracting the attention of the medical fraternity because of the evil effects upon the liver caused by its excessive use among the lower classes, not, however, in the light of pulque as a compound, but because of the evil effects of the alcohol which it contains. It is, therefore, proposed to adopt some other form of manufacture that a much lower percentage of alcohol may enter into its composition, according to a fixed standard, and thus avoid the evils of alcoholism.—*Therapeutic Gazette.*

Action of Coffee and Sugar on the Stomach.

In a paper presented to the Société de Biologie (*Rev. Méd.*) M. Leven states that coffee, so far, as is often supposed, from accelerating the digestive process of the stomach, rather tends to impede this. When thirty grammes of coffee, diluted in one hundred and fifty of water, is given to a dog, which is killed five hours and a half afterward, the stomach is found pale, its mucous surface being anæmic, and the vessels of its external membrane contracted. The whole organ exhibits a marked appearance of anæmia. Coffee thus determining anæmia of the mucous membrane, preventing rather than favoring vascular congestion, and opposing rather than facilitating the secretion of gastric juice, how comes it that the sense of comfort is procured for so many people who are accustomed to take coffee after a meal? A repast, in fact, produces, in those whose digestion is torpid, a heaviness of the intellectual faculties and embarrassment of the power of thinking; and these effects, and the disturbance of the head, are promptly dissipated by the stimulant effect which the coffee produces on the nervous centers, as shown by experiments with caseïn. Coffee and tea, when taken in excess, are a frequent cause of dyspepsia, for the anæmic condition of the mucous membrane being periodically renewed, a permanent state of congestion is at last produced, which constitutes dyspepsia. Sugar, which with many doctors has a bad reputation, is an excellent aliment which assists digestion, and should not be proscribed in dyspepsia. By experiment, digestion of meat is found to take place much more completely when sugar is added. Coffee exerts both a local and general action, operating locally by means of its tannin, by diminishing the caliber of the vessels, but acting on the general economy by exciting the nervous centers and the muscular system. It renders digestion slower, and is only of good effect by relieving the feeling of torpor after meals. Its injurious action on digestion may be corrected by adding sugar so as to counterbalance its effects on the mucous membrane. This adding sugar to coffee is not only a pleasant practice, but one contributing to digestion.

Nitro-Benzol in Oil of Bitter Almonds.

The oil is mixed with a little alcohol, a solution of pure potash, and a few drops of ferric chloride. The mixture is allowed to stand for some hours, shaken, and distilled, avoiding with great care bumping or spirting, and the direct action of the flame upon any part of the oil. A portion of the distillate, dehydrated, is heated in a test tube with a few fragments of pure potash. If the oil was pure the mixture

remains colorless. If nitro-benzol was present there is produced a dark coloration from the formation of azo-oxybenzol, and as a little aniline is also formed, a few drops of solution of chloride of lime added to the cold mixture produce a violet coloration.—*Enrica Pegna, in Zeitschrift für Analytische Chemie.*

Asphalt.

A lecture on "asphalt" was lately read by Mr. E. B. Bell, C.E., before the members of the Balloon Society, London. The material was, it was shown, a natural production, consisting of from 5 to 15 per cent by weight of pure bitumen combined by carbonate of lime. Although its composition was well known, and the components could be derived in abundance, and at moderate cost, asphalt had not yet been artificially produced with success, either chemically or commercially. Its employment was of the highest antiquity, it having been well known to the Egyptians, Assyrians, and Babylonians, although, curiously enough, no allusion to it was made by Roman or Greek writers, nor could it be found in the works of those classic nations. It appears to have been rediscovered by Dr. D'Eyrinis, who published a work in 1721, enthusiastically advocating its use, not only as a cementitious material, but as a universal panacea in medicine. Dr. D'Eyrinis found out the material while making a geological excursion in the year 1718, in the Val de Travers, canton of Neufchatel, Switzerland, and for nearly a century this was the only mine worked.

In 1838 the first footpaths were made of the material at Paris, and the Seyssel mines were opened; but owing to commercial speculations, asphalt lost favor, and it was not till 1854 that the first Parisian carriageway, that of the Rue Bergère, was paved with it. Since 1871 a very large proportion of the streets of Paris, both the carriage and footways, had been laid with asphalt. The first experiment in London was in May, 1869, when 485 square yards of Threadneedle street were laid with it, and its use had been largely extending. The material was at first used as mastic, boiled on the spot in large caldrons, but latterly it had been found better to use it as a powder, rammed by manual pressure. The present treatment was that the rock was brought to England and stored in the open. It was thrown into a stone crushing machine, and having been reduced to pieces about the size of a walnut, the material fell on to a shute, from the bottom of which an endless chain of buckets carried the material to the hopper of a Carr's disintegrator, in which it was reduced to powder. It was then heated in cylinders over a coal fire.

Each charge consisted of about 2½ tons, and took from two to three hours to attain the requisite temperature, and varied according to the amount of vapor to be driven off, and had to be very delicately regulated. If the material was not sufficiently heated, it would not adhere enough under compression to give the laid surface a hard face. If, on the other hand, it was overheated, the bitumen was fused, and little but comparatively worthless limestone left; as a rule, the heat varied from 220° to 250° Fah., but much was left to the experience of the skilled calciner. The powder was now ready for laying, and owing to its dense, compact nature it would retain the heat for many hours. A concrete foundation having been laid and allowed to set firmly, the asphaltic powder was brought to the street in open carts and spread transversely across the carriageway in widths of from 3 feet to 4 feet, in a thickness about two-fifths above the specified compressed section. It should still have a minimum temperature of 115° Fah. It having been raked with as much regularity as possible over the concrete, the powder was rammed all over with heavy iron, mushroom-headed punners, heated in portable furnaces to a temperature that prevented adhesion. This ramming was the crucial point of the operation, and was at first done very lightly, the pressure being augmented as the material attained solidity. An opening presented itself to mechanicians to devise some mode of mechanical ramming; many plans had been suggested, but at present none had answered. The objection to rollers was that they drove the powder forward in a wave, and the force was not advantageously applied; a steam hammer executed the work better, but the practical difficulty of laying the temporary rails had been fatal to the method. After the surface was compressed by the punners, the surface was seared with a smooth iron, and it was gauged by a long straight-edge, beaten to a uniform level, and the roadway was finally thrown open for traffic as soon as it had cooled to the temperature of the atmosphere.

The lecturer then indicated the advantages of the asphalt as a paving material from the sanitary, mercantile, ratepayers', and humanitarian points of view He thought all would agree that that material was best for roadways which created least dust and mud, presented the most continuous surface, and retained least damp. Dust in itself, apart from its impure character, was injurious to health, and was rendered worse by the deleterious substances contained in it. Asphalt stood foremost, he held, in its imperviousness to filth and moisture, and hence no exhalations could pass through it from the ground below, nor did it suffer any change under moisture. It was also almost noiseless, and although exceeded in this respect by wood, asphalt had not the peculiar rumbling sound which that material caused. To the mercantile portion of the community it was not only commended by its freedom from dust and mud, but from the absence of vibration, and the minimizing of tractile force needed to draw given loads. The unpopularity of asphalt with many engineers and architects arose from the fact that streets were laid with preparations of gas tar, or pitch and limestone, or clay, which resulted in a soft surface during the first year or two, giving off oils by evaporation, and breaking up after two or three years' wear. The cost of cleansing and watering was greatly reduced by the use of true asphalt. Comparisons made by Lieutenant-Colonel Haywood, the City Engineer, showed that one cartload of refuse was swept from every 344 square yards of macadam, from every 500 square yards of granite, from 1,666 square yards of wood, whereas 4,000 square yards of asphalt had to be traversed before a load was obtained. The expense and inconvenience of renewal was also reduced. One of the greatest conveniences for a crowded city was the fact that an asphalt roadway once down, the street need never be blocked for repairs. Cheapside had now been laid for eleven years, and the traffic had never been interrupted for an hour during mending. The watering, again, was reduced to the flushing of the channels with streams of water.

The common objection to asphalt was that it afforded a bad foot-hold to horses. In itself, however, whether dry or quite wet, it was not slippery, but when the air was humid and after slight dirt upon the surface rendered it greasy. Lieutenant Colonel Haywood had proved by statistics that fewer horses fell on asphalt than on granite, and this was confirmed by much independent evidence. Further than this, horses hurt themselves the less by a fall on asphalt than on granite. It was chiefly on the transition from one material to another that accidents occurred, and the true remedy appeared to be to lay all with the same class of paving. In conclusion, the author showed that among the other uses of material were in flooring warehouses and granaries, for which its imperviousness to damp and vermin strongly recommended it.

Sunken Floors.

So few of the floors constructed in new houses are, says the *Building News*, equal to their work, that the attention of architects and builders might be profitably called to the subject. In going over some of the newly-erected houses in the suburbs of London, it is not infrequent that one finds dwelling house floors which have sunken so much in the center as to destroy the comfortable assurance that they are safe. These instances occur chiefly in houses erected by speculative builders, who seem to be under no regulation of any kind in respect of floor timbers. We have noticed serious deflection in the floors of a house rented at over £100 per annum, the consequences of which are cracked ceilings below, opening crevices between skirting and floor, and an uneven surface which makes every table shaky, and prevents large pieces of furniture like sideboards and bookcases being placed against the walls without a considerable propping underneath their front supports. Numerous books on the strength of materials have appeared, but the builder seems to regard such knowledge as merely theoretical, and is generally guided by the sizes of other timbering which he has found to answer. He does not always seem to understand the well established theorem that the strength of two pieces of timber of equal length not always in proportion to the area of cross section.

Many practical builders have a conviction that if a timber as a joist has a larger cross section than another it must be stronger. Thus they fancy a piece of timber 8 inches by 3 inches, which equals 24 square inches in sectional area, cannot be so strong as a piece 5 inches by 6 inches which has 30 inches in area. The fact is, the smaller piece is the strongest of the two if both are placed upon edge, as every one knows who has studied the principles on which the strength of beams depends. It is easy to convince the most practical of this seemingly inexplicable fact. If two beams of like size are placed side by side, the two will resist twice the amount of one of the pieces. This is so self-evident that experiment is not needed to establish the fact; in the same way, three beams will resist three times as much as one, and so on of any number. In plain English, when lengths and depths are equal, a beam of 6 inches in breadth will bear three times as much as one of 2 inches in breadth. It may be shown by experiment quite as readily that the strength increases more rapidly with the depth. In point of fact, another law of proportion is observed—namely, that having two beams of the same breadth and length, but of different depth, the strength increases more rapidly than the depth; thus it is found a beam 9 inches deep bears more than three times as much as one only 3 inches deep. These are very simple statements derived from facts and experiments, and no complex conception of the resistance of certain fibers on both sides of a neutral axis, or equations in algebra, are required to establish them.

In dwellings the load on a floor is chiefly made up of furniture, though this is generally placed, at least the heavier articles, round the walls of rooms. The space occupied by tables and other objects in the center of a room reduces the available standing area, and thus, for all ordinary floors, 70 pounds per superficial foot may be calculated for as the full load in extreme cases. Rules founded upon the resistance of beams to rupture are, however, of little use, as the floors may be seriously affected by deflection, and deflection is directly as the cube of the length. In regarding stiffness, the load per foot has been given by one authority as 90 pounds per foot, including weight of materials; and the rule involving several dimensions is expressed in the formula—

$$c\,l^3 = i\,b\,d^3,$$

from which, by inversion, the distance from centers, the length, the breadth, and the depth of beams, may be found. Thus the first of these will be generally found the most convenient in practice; which may be expressed by—

$$c = \frac{i\,b\,d^3}{l^3},$$

in which c denotes distance apart from centers of beams; l, the length of beam, both in feet; i, a coefficient for the wood used; and b and d, the breadth and depth. It makes all the difference to place joists an inch nearer, though builders like to give as much interval as they can, for economy's sake. Instead of joists being placed 12 inches apart, it is oftener to find them 13 inches or even 14 inches, and the consequence is a scantling which has been found to answer in a well-built house fails when it is introduced with a greater distance or interval. Then, the modern speculative builder's floor is seldom properly stiffened by cross bridging; there is only one row, instead of two or more. Of course no practical man will deny the advantage of bridging his floor joists; it helps wonderfully to prevent deflection under a concentrated load, for the joist immediately beneath the load is relieved of direct strain, and the joists on each side take a share of the weight. Generally it may be taken that a properly bridged floor is capable of sustaining, without mere deflection, twice as much load as the same floor without bridging, so that the cost of the introduction is amply repaid. It is a misfortune the Building Act does not deal with floors as it does with walls, by laying does certain scantlings for the guidance of builders, as a weak deflecting floor in course of time tends to render the house unstable, by acting injuriously upon the walls. Builders might be willing to follow regulation scantlings for their joists and rafters who could not be induced to calculate for themselves, who would scorn the idea of studying moments of resistance, or who would never be able to work out a formula.

Railway Progress in 1880.

Advance sheets of "Poor's Railway Manual" for the current year show that there were added to the mileage of railways in operation last year 7,174 miles, raising the aggregate from 84,225 miles, reported to the Manual, to 93,671 miles. The *Railroad Gazette's* figures make the number of miles of road in operation at the beginning of 1880 greater by 2,272 miles than the Manual states, while the estimate for 1881 is accounted substantially correct.

The Manual's statistics of roads and equipment for the past year show as follows:

	1880.	Increase.	Per Cent.
Miles of road, total	93,671	7,174	8·3
Miles of road reporting.....	84,225 (Dec.)	490	0·6
Miles of second tracks and sidings.....	21,978	1,937	9·7
Miles of steel track..	33,680		
Number of locomotives.....	17,949	865	5·1
Number of passenger cars...	12,789	780	6 5
Number of baggage, mail, and express cars.....	4,786	267	6·0
Number of freight cars.....	539,355	59,165	12·3

By decades the progress of railroad building in this country since 1830, when there were but 23 miles in operation, is summed up as follows:

From 1830 to 1840.....	2,785 miles.
" 1840 " 1850.....	6,213 "
" 1850 " 1860	21,614 "
" 1860 " 1870	22,279 "
" 1870 " 1880.....	40,757 "

The capital, gross earnings, expenses, and net earnings per mile of road, and percentage of net earnings on capital of the railroads of the United States, for ten successive years, have been:

Year.	Stock and Debt.	Gross Earnings.	Expenses	Per Ct. of Ex. to Earn.	Per Ct. of Earn. on Capital.
1871.....	$59.726	$9.040	$5,863	64 8	5 32
1872.	55,116	8,116	5,224	64 4	5 25
1873..	57 136	7.947	5,172	65·1	4·86
1874..	60,944	7,513	4,776	63 6	4 49
1875.....	61,533	7 010	4,425	63·1	4·20
1876.	60.791	6,764	4,228	62·5	4·16
1877..... ...	61.650	6,382	4,075	63·8	3·74
1878..... ...	59.040	6,232	3,847	61·7	3·04
1879.	58.070	6.244	3,670	58 8	4·49
1880.....	60,650	7,307	4,277	58·5	5 00

Capital per mile has varied but little since 1874, at the close of the railroad construction period. Gross earnings per mile decreased continuously from 1871 down to 1878, made very little gain fromt the lowest point in 1879, but in 1880 leaped up at once, becoming the largest for six years. Expenses made a similar leap, yet not so far but that net earnings per mile were the largest since 1871. So the percentage on the capital formed by the net earnings decreased continuously from 1871 to 1877, and since 1877 has increased, and most of all last year, when it became just 5 per cent, which is as good an average as most European countries exhibit; this has been exceeded only in 1871 and 1872.

Fertility of Volcanic Soils.

The rapid and exceptional fertility in volcanic soils, such as those about Mount Etna, has been attributed to a superabundance of phosphoric acid. M. de Gasparin, however, is led to reject this view. An exuberantly fertile garden between Catania and Nicolosi contains, he finds, only two-thousandths of phosphoric acid; fertile land at Nimes and Caen has hardly more than one-thousandth. Other cases are given. The rapid production of the land about Etna he considers to be due mainly to the continuance of muddy formations and the climate, which hastens the decomposition of lava, so that the supply of organic materials is presented or formed with exceptional promptitude.