pox a few years since lost to the city of Philadelphia, in ways which could be estimated, above $20,000,000. This city a little later was seriously threatened with a similar epidemic, which was effectually stayed, and the health officers were, perhaps, more severely criticised for their work than for any other thing they have ever done. The results, however, have amply demonstrated the wisdom of their action.

"The fact wants to be kept before the public, that as production and commerce and trade are now carried on, few cities can afford to allow a pestilence to invade them. And if it comes to a city, with the natural advantages of soil and climate we have, it is due either to official ignorance or public neglect. There is, perhaps, not a single kind of pestilence which has afflicted any civilized city of temperate climate during the Dark Ages or since, over which we have not now control, if the community act up to the light and knowledge we have; and on the other hand, as business is now carried on, no city can now be so afflicted as many then were, and not be bankrupted and financially ruined."

DISPOSAL OF CITY GARBAGE AT NEW ORLEANS.*

By Rev. HUGH MILLER THOMPSON, D.D.

WE have choice of three ways to rid ourselves of the sewage of a city, but whether we choose water carriage, pneumatic pressure, or the scavenger carts, the garbage still remains. There seems to be no way to remove this but by the shovel and the cart. The question, then, about garbage, does not concern so much its removal from our streets and about our dwellings as the disposal of it after such removal. A favorite method in New York was, and I am not sure but it is still, to use it to fill lots—sunken below the street grade. The deposit of hundreds of tons of mingled ashes, cabbage stalks, rotten potatoes, and other kitchen refuse, mingled with dead cats, rats, and the like, as a foundation for a future dwelling, does not strike one as being a wise sanitary proceeding for the present or the future, nor one that commends itself to the tastes or nostrils of a civilized people. Still, one can see that in such disposal there is an element of economy which commends itself to the merely business mind. The lot needed filling, and kitchen sweepings were a convenient and cheap material. It is not, to the strictly business mind, and especially to the official mind, any part of its business to look further. If, as in New York, where earth and rock are easily obtainable, such a practice was found economical, it is no wonder that in New Orleans, where clean dirt is very scarce, exceedingly dirty dirt should be used in its place.

There was a "dumping-ground," so-called, established back of the narrow city on the edge of the swamp, and thither were brought the dead dogs and cats, the kitchen garbage and the like, and duly dumped. This festering, rotten mass was picked over by rag-pickers and wallowed over by pigs, pigs and humans contesting for a living in it, and as the heaps increased, the odors increased also, and the mass lay corrupting under a tropical sun, dispersing the pestilential fumes where the winds carried them.

But streets needed filling, and lots also, and here, to the official eye of the contractor, was a quarry, ready at hand for the purpose. Will it be believed that, actually, this horrible compound of offal, carcasses of animals, refuse of kitchens and sinks—this mass of reeking abomination—was carried back into the city and used to make streets and fill up hollows; dumped back again before the doors and windows of people who had not been sentenced to death for any crime!

In the letter to the Board of Health upon the subject of a complaint that a street contractor was "burying dead dogs, etc., in the middle of Jackson and Phillips streets," the administrator of improvements (!) defends himself by saying: "It has been a long-established custom to deposit offal, etc., on vacant squares in the various districts of the city. I believe it to be an advantage to place them on some of the low streets, where, mixed with ashes, etc., they can be used in raising the grade of such streets and rendering them passable!"

The officer was only carrying out the traditions of his office, doing as everybody else had done, in thus disposing of offal, garbage, and carcasses, and but for the epidemic of 1878 which followed, it might be going on still.

When the Auxiliary Sanitary Association was formed last year, one of the first practical questions which came before it was the disposal of garbage and offal. That the hitherto prevailing practice of utilizing it for street making and lot filling would not answer, was pretty well settled. Whether the yellow fever of the previous summer was or was not intensified by filth, the association did not care to debate. On the general principle that rotten garbage and dead dogs are not healthy compost for macadamizing the streets of a great semi-tropical city, they determined to dispose of these substances in some other fashion.

There was talk of cremation. It seemed impractical and expensive. There was talk of utilizing the garbage by converting it into a fertilizer—a beautiful and attractive plan, which, clearly, in the rich lands of Louisiana at least, would not pay, and which would still necessitate the use of a "dumping ground" and the handling and picking over of the filth.

There remained the river. It runs by New Orleans with a velocity of from two to four miles an hour. Its depth is between 100 and 200 feet. It is a vast, swift body—the accumulated drainage of half a continent. It was seen that nature had provided, as usual, for man's needs, if only man had the sense to use the provisions. Once in the Mississippi river, the garbage would be sent about its business for good.

The daily accumulation is about five hundred cart loads. The city is narrow and long, having a river front of seven miles, closely built.

The Auxiliary Association built and presented to the city three scows, costing $1,550 each. They are placed at special wharves along the harbor front, and to them the garbage carts are driven, and into them dump their contents. At 4 P.M. each day a tug picks up the scows, tows them two miles down the river below the city, where the garbage is dropped into the stream, and disappears in the devouring jaws of gar, pike, codfish, and the other greedy denizens of the great stream, which attend in countless numbers at their daily dinner hour. What is spared by them is whirled away into the waters, and not a trace of any part of the offensive matters can be discovered four miles below.

The scows are thoroughly washed out by the powerful steam pump of the tug, and, clean, sweet, and odorless, are returned to their respective wharves.

These scows have so thoroughly performed their duty, and have proved themselves, in rough weather, such good sea-boats, that an explanation of their construction may not be amiss.

The scows are 60 feet long by 22 feet beam over all on deck; bottom 50 feet long by 20 feet wide, raking fore and aft 6 feet; depth, 8 feet; dump compartment, or hold, 36 feet long to bulk-head. Capacity, 250 cart loads.

Two doors on each side swing on strap hinges, and are fastened by sliding bolts. It is found that these bolts can be raised without difficulty, permitting the doors to swing freely outward, causing a sudden and complete discharge of the load.

The boats are loaded from a wharf which projects over the boat to the center, fore and aft. When the carts are dumped their contents fall equally into both sides of the hold, the floor of which slopes to each side to an angle of 45 degrees.

It will be seen that, the load pressing against the doors, it is only necessary to raise the bolt in order that the contents should slide instantly into the water.

*Lately read before the American Public Health Association.

ON ROTTING WOOD.

By Professor WM. H. BREWER, of Yale College, and President of the Board of Health of New Haven.

WHILE carrying on a series of experiments on certain physical characters of American woods, some facts have come out in so strong a light, and of so much sanitary interest, that I think it well to bring them before this association, even though the facts be not absolutely new. The aim of the experiments is a quantitative determination of the hygrometric characters of certain woods, the amount of sap contained in green wood at various seasons of the year, the relative amount soluble in cold water of matter contained in green and in seasoned woods, etc.

It is well known that all woods contain certain nitrogenous, organic compounds, known chemically under the general name of *albuminoids*, and that these substances are active in inducing and favoring rot. All chemical methods for the preservation of timber from decay look towards getting this nitrogenous portion into some less soluble condition, or into some combination less liable to chemical change. When green wood is well soaked in cold water, a considerable quantity of such albuminoid matter is dissolved out, remaining in solution in the water. This solution, even when very dilute, is extremely putrescible—more so, indeed, than any person present would deem possible, until he had tried the experiment (and it is an experiment I would advise you to make). The fact is as true of the hardest woods, as maple and locust, as it is of soft wood, like magnolia.

To illustrate: if a few pieces of such green wood, say of locust (I cite this species because it is a hard and particularly durable wood), be carefully freed from bark and all foreign dirt, and put into the purest cold water—even distilled water—and let stand at the ordinary temperature of our climate, or our rooms, if the temperature at times rises to say, by day, 60° or 70° Fahr., the water soon begins to become turbid or opalescent; this opalescence increases, in two to four days a thin pellicle forms on the surface, active putrefaction sets in, along with an abundant growth of the septic ferments, and the liquid soon becomes peculiarly and pungently stinking.

Without any visible evolution of gas, the liquid becomes very offensive to the smell, even when very dilute. The odor naturally varies with the kind of wood used, but in all cases I have tried, it is very rank, I think fully as much so as the same amount of *animal* matter in solution would produce. The intensity and rapidity of putrescence vary, of course, with the temperature, the kind of wood, the degree of concentration of the solution, and probably with the amount of tannin and other similar extractive matters contained in the original wood.

As in the case of other putrefaction, what the gases are which produce the stinking exhalations, we are entirely ignorant. It is probable that they are organic compounds of simpler molecular constitution than the albuminoids which furnished the necessary elements; and it is also probable that, as in other smells, the absolute amount exhaled is very small compared with the results produced on the senses.

If kept long enough, and of sufficient concentration, there is an abundant fungoid growth in the solution, and if kept in the light it grows darker in color, gradually becomes sour to the taste and smell, but continues offensive in odor for a long time, I know not how long, but in bottles partly filled, it certainly continues to smell bad for two years. Where the solution is kept in the dark, the odor seems more offensive than if the decay goes on in the light, but in this direction my experiments have not been nearly so numerous.

In the free air and full sunlight (and that is the condition to which piles and various other wooden structures and vegetable matter in swamps are subjected) along with the putrescence, a white fungous growth begins on the surface of the wood, which rapidly becomes slimy. This forms much more abundantly on the ends of the grain of the wood than on either the radial or tangential sides. If the solution is poured from the wood and kept in a separate vessel, and in the light, it grows dark, as already described, but the fungous growth goes on, modified, of course, by the temperature and the degree of concentration, and it continues offensive for an unknown period, or until the decay has become complete.

If the wood continues to be placed in successive portions of clean water, the soluble matter continues to be extracted for several months, even if the blocks be very small, and the tendency towards putrefaction grows less and less, but only closing after some months, and when the amount of water used has been enormous as compared with that of the wood. Finally, however, the soluble matter appears to be removed, the water then remains clear and the wood ceases to be covered with fungous rowth, at feast to any visible extent.

Timber, when thoroughly water-seasoned, is known to be very durable, and it is probable that it is so merely because of the removal of the soluble and putrescible albuminoids.

Experiments tried with the same woods in sea water and in brackish water (made by mixing two measures of fresh water with one of sea water) show similar sanitary results; they are even actually intensified.

The turbidity begins sooner in sea water than in fresh, in the few cases in which I have tried it, the film on the surface is more abundant, and the smell is more disgusting. The number of experiments, however, are much fewer than with fresh water.

Heart-wood and sap-wood act essentially alike in this matter, the difference is one of degree rather than of character.

The suggestiveness of these facts is almost too obvious to need comment, and yet I will add a word. Vast quantities of wood and vegetable matter, decaying in water or in swamps, are too common.

If piles about our wharves and similar structures do not smell so badly, it is merely because the solution is more dilute. The decay goes on, however, and so with vegetable matter decaying in swamps, saw-dust in ponds, and so on to the end of a long chapter. The trouble has sometimes been attributed to the obvious gases evolved, notably to light carbureted hydrogen, which one may see bubbling up with nitrogen and carbonic acid through the water of ponds where saw-dust or vegetable matter is decaying on the bottom. As I have maintained in a paper read at a previous meeting of this association, I cannot believe that either of these latter gases of decay seriously affects health. These later experiments on woods only confirm the views then expressed.

The exhalations of swamps, or of vegetable matter decaying in still water, is universally regarded as unwholesome in climates where, for a part of the year, at least, the weather is as warm as we have it. So far as I know, there is no exception to this on the whole earth, and hence the general sanitary bearing of the observations here recorded need not be further argued.

DIAMETERS OF MARS.

IN the *American Journal of Science and Arts* for March, Professor C. A. Young, of Princeton, records the results of a series of observations undertaken by him at the opposition of Mars in November last, to determine the planet's polar compression, which, as yet, has never been satisfactorily ascertained. Sir William Herschel made it $\frac{1}{16}$, while Bessel found it insensible. The value $\frac{1}{192}$, deduced by Main at Oxford from his measures in 1862–3, has probably been of late more generally accepted than any other, though by no means without reserve. Hartig, as a result obtained by combining all the double-image measurements made at various European observatories, gives $\frac{1}{96}$. These values, however, being apparently irreconcilable with the planet's known mass and period of rotation, Professor Young, as above stated, undertook the task of measuring the diameter at its last opposition—this being an exceptionally favorable time for such a purpose. The measures were made with a filar position micrometer attached to the nine and one-half inch equatorial of the School of Science Observatory. The object-glass of this instrument (by Clark) is constructed substantially upon the Gaussian curves, and is of the highest excellence. During the past year it has shown repeatedly both of the satellites of Mars, the two outer satellites of Uranus, and the Saturnian satellite Mimas, the last being just at the limit of visibility. The final result obtained by Professor Young was a polar compression of $\frac{1}{81}$. The mean diameter, 20·593", resulting from these observations, when reduced to distance unity, gives 10·068"—a value sensibly identical with that obtained by Prof. Pierce from a discussion of the Washington mural circle observations, and used in the American Ephemeris.

AMERICAN JURASSIC DINOSAURS.

IN the March number of the *American Journal of Science and Arts*, Prof. O. C. Marsh makes known some of the peculiar features in the structure of the *Stegosaurus*, a suborder which includes some of the most specialized Jurassic dinosaurs known. The skull of these reptiles, so far as known, was remarkably small. In the genus *Stegosaurus*, which Prof. Marsh selects for description as a representative of the suborder, the brain was much elongated, and its most striking features were the large size of the optic lobes and the small cerebral hemispheres. The cerebrum was quite small. In comparing the proportionate size of the brain of the alligator with that of *Stegosaurus* the result proves of special interest. The absolute size of the two brain-casts is approximately as 1 to 10, while the bulk of the entire bodies was as 1 to 1,000. It follows that the brain of *Stegosaurus* was only 1-100 that of the alligator, if that of the entire weight of the body is brought into comparison. The two known species of *Stegosaurus* were about 30 feet in length. Their teeth were very numerous and mostly cylindrical in shape, and the entire dental series evidently formed a very weak dentition, adapted to a herbivorous life. The animals were probably more or less aquatic in habit. The most remarkable feature about *Stegosaurus* is the series of ossifications which formed its offensive and defensive armor. These consist of numerous spines, some of great size and power, and many bony plates, of various sizes and shapes. Some of these plates are more than three feet in diameter. The great disproportion in length between the fore and hind limbs, greater probably than in any known dinosaur, would imply that these reptiles were more or less bipedal in their movements on land. The very short, powerful fore limbs, admitting of free motion, may have been well armed with spines, and thus used most effectively in defense. The back was evidently armed as well as protected. When alive, the *Stegosaurus* must have presented, says Prof. Marsh, by far the strangest appearance of all the dinosaurs yet discovered. The remains of these animals came from the Atlantosaurus beds of the Upper Jurassic in Colorado and Wyoming.

THE AGE OF THE GREEN MOUNTAINS.

PROF. J. D. DANA, in the new edition of his Geology, as in the preceding, referred the epoch of the Green Mountains, that is, of the folding, upturning, and crystallization of its rocks, to the close of the Lower Silurian. In the current number of the *American Journal of Science and Arts*, he presents a fuller statement of his reasons for this opinion. By the term "Green Mountains," Prof. Dana means the swell of land with its ridges, about N. 16° E. in trend, which lies between the Connecticut River on one side, and Lake Champlain and Hudson River on the other, and reaching in the south to New York island. All the rocks of the area within these limits are not referable to the range; for it is well known that the "Highland" region of Archæan rocks extends over the most of Putnam County, and the southern border of Duchess County, New York; and that rocks of the same age constitute areas to the east and north of the Highland region, in Connecticut, and also further north in Massachusetts and Vermont. These Archæan areas introduce difficulties into the geology of Western New England. After a somewhat extensive review of the evidence, Prof. Dana sums up his conclusions as follows: (1) The *western* half of the region between the Connecticut River valley and the Hudson River, that is, the western half of the Green Mountain area, is proved to consist of rocks that are of Lower Silurian age, and of one orological system. (2) The Schistose rocks of the *eastern* half in Vermont are to a large extent similar to those of the western. (3) The rocks of the central mountain section in Vermont are, in its northern part, identical schists (hydromica, etc.), with those on the