becomes by this discovery the oldest living type of vertebrata. E. D. COPE.

Philadelphia, Feb. 28.

### Artificial production of rain.

I give below an instance which came under my own observation, of the artificial production of rain, which may be interesting, read in connection with the article in *Science*, No. 55.

Many years ago, during my residence in Virginia, the whole of the eastern portion of that state had been suffering one summer from a long-continued drought. For several months not enough rain had fallen at any one time to moisten the ground to the depth of half an inch. The atmosphere was gray, and full of dust. The sun, even at noonday, was 'shorn of his beams,' and could be looked at directly without paining the eyes. The temperature was not unusually high; but the weather was very oppressive, being what is called in the country, 'muggy.' One of my neighbors had several months before cut down, and left lying where it fell, a young forest of scrub pines from a field of about forty acres in extent. These pines had, of course, become, during the long drought, completely dry. One August morning, the meteorological conditions remaining exactly as they had been for months before, my neighbor caused fire to be set to this clearing at several points on the circumference at the same time. The fire ran over the whole tract with wonderful rapidity. An immense column of inky smoke rose perpendicularly (there was no wind) to a great height. Upon reaching a stratum of air of its own density, the black column spread out horizontally into the form of a gigantic mushroom, rapidly changed color from jet black to gray, and soon thunder was heard in the top of the ascending and spreading column. The fuel was gradually consumed, and the smoke ceased; but the cloud continued to spread, and rain began to fall in a little more than an hour from the time the clearing was fired.

The thunder gradually ceased; but rain continued to fall until sunset, when the sky cleared. For the remainder of the season, showers and rain-storms occurred with ordinary frequency, as if the conditions favorable to the continuance of the drought had been permanently broken up. Observations of temperature, the dew-point, and of the barometer, would have been valuable; but I had unfortunately no instruments at hand for obtaining them.

While the artificial production of rain can have no economical importance, — depending, as it necessarily must, upon many meteorological conditions, which, to be effectual, must be synchronous, — yet an example of a rainfall of several hours' duration, which was undoubtedly produced by an ascending column of heated air artificially supplied, seems worthy of record. L.

### Annual growth of the 'Tree of heaven.'

I have in the cabinet of Cumberland university two remarkable shoots of Ailanthus glandulosus, Desf., a description of which may be of interest to botanists. They grew in a lot near one of the university buildings during the summer of 1883. They sprang from small stumps, and are entirely the growth of one season. They give the following measurements: —

No. 1. — Length, 10 feet 6 inches; circumference at base, 5.1 inches; circumference at middle, 4.13 inches.

No. 2. — Length, 11 feet 1.5 inches; circumference at base, 4.1 inches; circumference at middle, 3 inches.

J. I. D. HINDS.

Lebanon, Tenn.

## *GOUVERNEUR KEMBLE WARREN.*

IN the death of Gen. Gouverneur Kemble Warren of the Corps of engineers, U.S. Army, the country has lost not only one of the ablest military leaders developed by the civil war, but also a scientific man of high attainments, whose life was devoted to profound investigations connected with several of the most important works of internal improvement undertaken by the general government.

He was born on Jan. 8, 1830, at the little village of Cold Spring, upon the Hudson, where his surroundings were all calculated to excite a love for the military service in the mind of an active and intelligent boy. West Point lay in plain sight from his home. The old field-works of the revolution, grass grown and crumbling, were associated with his earliest recollections; and the charm thrown by Washington Irving over this classic ground of American history entered into and stimulated his youthful imagination to ideas above the prosaic monotony of every-day life in the nineteenth century. The Mexican war added fuel to the flame; and at the early age of sixteen he sought and obtained an appointment as cadet at the Military academy. He was graduated in 1850 with very high class rank, and was at once assigned to the corps of topographical engineers.

The great problem then beginning to attract attention was the Pacific railroad. The recent discovery of gold in California, and the consequent rush of immigration to the west, demanded increased facilities for transit across the continent; but a broad belt of wilderness, intersected by lofty ranges of mountains, and almost unknown, barred the way. It was in this field that the young officer did his first important scientific work.

Congress made large appropriations for exploring several routes between the Mississippi River and the Pacific Ocean; and the work, under the direction of Gen. (then Capt.) Humphreys, was performed by officers of U.S. engineers. As usual in such cases, the results were expected at once; and Lieut. Warren, who had already shown his ability on the surveys of the Mississippi delta, was detailed as principal assistant in the general office at Washington.

His duties were twofold. He assisted Capt. Humphreys, then laboring under great pressure, in digesting the preliminary reports, in investigating the various problems connected with railroad transportation, in making the comparative estimates of cost, and in preparing