soldiers and statesmen for many decades, the Americans now seem ready to commemorate their literary and scientific heroes. John Harvard and Abraham Pierson, whose real likenesses perished long ago, have risen in bronze upon the greens at Cambridge and New Haven. The statues of Joseph Henry and Benjamin Silliman stand near the scenes of their activity. Examples like these should be imitated throughout the land. Those who have rendered great services to science and education should receive due recognition from those who have profited by their labors. Only let us pray to be spared such commonplace monuments as are to be seen in abundance in London. Let us rather study the memorial statues which have of late years been placed in the cities of Germany, Holland, France, and other continental countries. Better no monuments than those which give positive pain to the beholders, and which will some day be lowered, like the Iron Duke from his lofty arch, when taste and skill are more highly developed.

LETTERS TO THE EDITOR.

The oldest living type of vertebrates.

It is necessary to add a little to the discussion of Chlamydoselachus in order to give readers of *Science* a just idea of the case as it now stands. On hearing the evidence presented in my paper at the Philadelphia meeting of the American association, Professor Cope gracefully conceded that he had mistaken the affinities of Didymodus, and agreed with me in the conclusions that the two genera belonged to different orders, and that, judging from the teeth alone, the nearest known allies of Chlamydoselachus were Cladodonts of the subcarboniferous and middle Devonian. The shapes of the bodies of the extinct Cladodonts are yet unknown. What has been considered the closest approach to a determination of their skeletal structure is that of Dr. Traquair, based on the resemblance of a single, partly visible, and imperfect tooth of Ctenacanthus costellatus. Professor Gill has accepted the doctor's idea, and classified the sharks, fossil and recent, in accordance (*Science*, iii. 346). The lateral curvature near the apex of the tooth is rather against the determination, and the character of the base is not known. The weight of the evidence does not seem to favor the conclusion that Ctenacanthus is a Cladodont. The tooth resembles that of Rhina as much. Until we are tolerably certain in regard to the extinct (the unknown), it is about as well to assume that it in some degree resembled the recent (the known). In a revision of the arrangement of Gill, the Xenacanthini should be taken from his Lipospondyli to form a new order, the Cladodonts removed and placed with the Selachophichthyoidi, and the definitions revised in several cases to accord with structure. The result would appear thus:—

Xenacanthini, Pleuracanthus, Didymodus, and allies, prototypes of bony fishes.

Selachia. Galei.

1. *Lipospondyli*, including the true Hybodonts, but excluding the Cladodonts.
2. *Selachophichthyoidi*, including Chlamydoselachus and the Cladodonts, but excluding Didymodus; changing the definition from "vertebral condition unknown, and with teeth having fixed bases," to "vertebrae partially or imperfectly developed, notochord persistent, and teeth with broad backward expanded bases."
3. *Opistharthri*, the Notidanidae; changing the expression, "which alone exhibit these peculiarities in the existing fauna," to read, "which share many of their peculiarities with the preceding."
4. *Proarthri*, Heterodontidae.
5. *Mesarthri* (Anarthri Gill), most sharks; changing the statement, "palato-quadrate apparatus not articulated with the skull," to read, "pterygo-quadrate articulated or connected with the skull in the orbit by the trabecular elbow." The name 'Anarthri' is manifestly inappropriate, since few of the genera are without the articulation.
6. *Rhinae*, Rhinidae; changing the definition so that "with the palato-quadrate apparatus not articulated with the skull" shall read, "with the pterygo-quadrate articulated with the skull in the orbit by the trabecular elbow."

S. Garman.

Cambridge, Nov. 17.

Water of crystallization.

The first accompanying illustration (fig. 1) is taken from a photograph of plumes produced by the crystallization of water. In the appendix of Tyndall's work on light will be found an illustration (fig. 2) of the

Fig. 1.

same phenomenon which is explained in the following letter from the late Professor Joseph Henry to Professor Tyndall.

"Accompanying this, I send you a photograph at the request of Prof. S. H. Lockett of the Louisiana state university, of which the following is his explanation:—

"'In my drawing-room I kept a wash-basin in which to rinse out the color from my water-color brushes.

This color gradually formed a uniform sediment of an indefinite tint over the bottom of the basin. On the night of the 26th of December last, which was an unusually cold one for this climate, the water in the basin froze. On the melting of the ice the next day, the beautiful figure you see on the photographs was left in the sediment. I carefully poured the water from the basin, let the sediment dry, and thus perfectly preserved the figure. It has been accurately photographed by an artist in this city. The negative is preserved; and, if you would like to have any more copies, they can readily be obtained.

"'We are not much accustomed, in this warm country of ours, to the beautiful 'forms of water;' and this has struck me as a little remarkable, and worthy of being kept.'

"The fact that the results have been produced by colored sediment indicates a method of exhibiting the effects of crystallization in an interesting manner."

Professor Tyndall refers to this as a 'surprising case of crystallization,' which it most certainly is.

Some years ago a glass-crystallizing dish was filled with Ohio-river water, which at certain stages carries in suspension a large quantity of yellow clay, and allowed to settle for several days, forming a thin yet firm deposit on the bottom of the dish. During a very cold night the water in the dish was frozen, and the sediment figured as herewith represented. The ice was melted, water removed, and the sediment dried. I have this remarkable specimen in my possession to-day, just as it was originally formed.

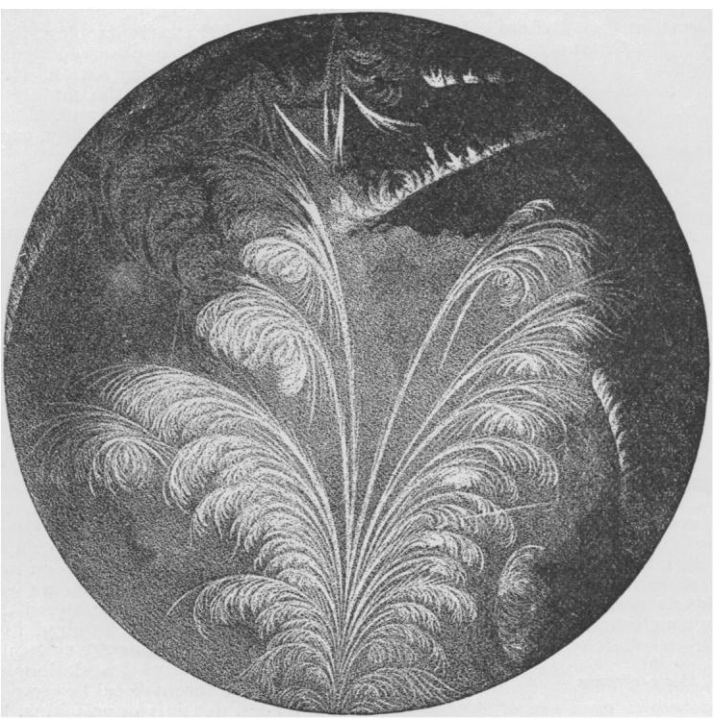

FIG. 2.

WM. L. DUDLEY.

Cincinnati, O.

An open polar sea.

In one of your September numbers (No. 86), there was a letter from Lieut. Ray on this subject, which, I think, needs some elucidation. Mr. Ray questions the existence of an open polar sea, on account of the low temperature of the water found by the last American polar expedition. What has the temperature of water to do with its greater or less freedom from ice in arctic climates? The temperature of maximum density of sea-water being lower than the freezing-point, the formation of sea-water ice is impeded, as the colder water is not the lighter. If, however, ice forms on sea-water, it is because, 1°, the specific gravity near the freezing-point differs much less (about one-third as much) from degree to degree than near 70°; so colder water has not so strong a tendency to arrange itself according to specific gravity as warm water, and may freeze, especially with cold winds from the land; 2°, at the close of summer the upper layers are generally much less salt than the lower, on account of the fresh water coming from melting ice, and from rivers swelled by the melting snow (this is especially the case in many inland seas of the northern hemisphere, and to a less degree in the southern hemisphere; such an arrangement of the waters allows the upper strata to be colder and yet lighter, and thus is very favorable to the formation of ice); 3°, after ice begins to form, it increases both from below, on account of the cold penetrating the ice, and from above, on account of the freezing of waves, spray, etc., on the surface of the ice.

Now, when the second condition, the most powerful (at least, for the beginning of the formation of sea-ice), is absent, or present only in a small degree, the conditions for the formation of field-ice or sea-ice are lacking, or only present on a small scale. This is more often the case in the high latitudes of the southern hemisphere than in the northern; because in the southern the seas are deeper and more open, and receive little river-water, the temperature of the air and sea is below the freezing-point to about 62° south, and the icebergs reach that latitude without melting.

If the north pole is surrounded by open, deep water, and if the temperature of summer there is lower than at the stations where observations have been made in the northern hemisphere (both suppositions will be granted as possible), there do not exist conditions so favorable for the formation of field-ice as on the north coast of Asia and North America, as there will be no brackish water of a low specific gravity near the surface. Thus there may be relatively open water near the north pole, not warm,