rel resulted in the pruning of over two hundred branches. A great many other trees showed equal evidence of the relish of squirrels for the seed, which they all obtained in the same wasteful manner; but this destruction can last only a short time, as the fruit falls very promptly when ripe.

Wm. Trelease.

Madison, Wis., May 24.

The claims of political science.

Is there any valid reason why political science should not take its natural place among the sciences? That it has no such place is evident from the fact that it is almost wholly excluded from all the scientific journals that profess to be devoted to all the sciences. How many articles on political science have ever appeared in the *American journal of science*, in *Nature*, in *Science?* Can any other science be named of which the same can be said? It seems to be assumed that all that is ever said about national affairs must necessarily be of a partisan character, and be said, not for the sake of truth, but to serve some political party or private interest. Yet any one who has any faith in humanity must admit that a large amount of disinterested political work is being done. Those who deny this for the present will generally admit it for the past, and the present is always becoming the past. But, even if this were not the case, it would still be true that scientific politics is theoretically possible.

Most sciences are more or less practical; i.e., they furnish the principles which underlie the useful arts. From pure science to pure art there are always three somewhat distinct steps. The first is the *discovery* of scientific principles; the second is the *invention* of the methods of applying these principles; and the third is the actual *application* of the principles. The first two or the last two of these steps may sometimes be so intimately blended as to render it difficult to detect the line of demarcation between them; but theoretically the three steps are always present.

If, therefore, there is a political science, this must also be true of it. We will assume that there is such a science; that the operations of a state constitute a department of natural phenomena, which, like other natural phenomena, take place according to uniform laws. The pure science, then, consists in the discovery of these laws. The intermediate, or inventive, stage embraces the devising of methods for controlling the phenomena so as to cause them to follow advantageous channels, just as water, wind, and electricity are controlled. The third stage is simply the carrying-out of the methods thus devised.

Political science is one of the cases in which, in its present state at least, the first and second steps are very much blended. They are both embraced in legislation, which includes both discovery and invention. Yet the pure investigator is not entirely wanting; and the *ideal politician* or statesman would correctly represent the first stage, or pure political science. The executive branch of government fairly coincides with the third, or pure art, stage. The judiciary is properly legislative or inventive; but, in fact, it often performs executive or technologic functions.

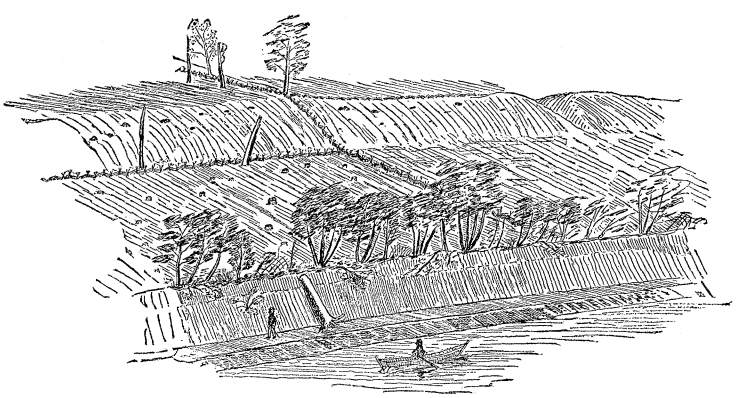
Why, then, does not politics form a legitimate subject of scientific investigation? Why might not its discussion in strictly scientific societies and journals be permitted and encouraged? And would not this be one of the best checks that could be set to the mad surge of unreasoning partisanship that now fills the columns of the public press?

It will probably be replied, that, the moment a scientific man should attempt to discuss current political issues, he would lose his scientific attitude and spirit. Were he to do so, he would certainly forfeit the respect and confidence of scientific men; but this would be contrary to our hypothesis that the discussion be scientific.

Lester F. Ward.

Some Indiana glaciology.

In *Science*, No. 22, I gave some account of certain glacial scratches in Montgomery county which showed a trend approximately at right angles to the direction of the first, or at least a former glacier. Since that date I have made a more thorough study of the region with much better instruments, and the results are worth recording. In the short note referred to, it is stated that Sugar Creek, a large eastern tributary of the Wabash, has a general south-westerly course through the county, about parallel with that of the Wabash, twenty or thirty miles to the north. In the bed of this stream there are glacial scratches, indicating a movement parallel with its course, referred to the first or Lake Erie glacier, whose course across the state, up the Maumee and down the Wabash, has been plainly shown. In the north-eastern part of the county, near the junction of Sugar and Lye creeks, the former stream runs along a ledge of subcarboniferous sandstone, which forms its northern bank. This



ledge is from three to five feet above average water-level, has no representation on the southern bank, and is exposed for perhaps a mile. Upon uncovering its surface, it is found to be planed as smooth as a floor, and deeply and closely grooved with glacial scratches, which trend directly across the stream and the course of the old glacier. The sandstone is, for the most part, fine-grained; but in some places it contains numerous small geodes, which beautifully indicate the direction of flow, each having a struck side to the north, and a protected sandstone ridge to the south. On top of the platform there lies a typical moraine, whose trend, being about at right angles to the scratches, indicates a terminal moraine. A section showed the following results: stiff blue clay, with

scratched pebbles and small bowlders, six to eleven feet; fine sand and gravel to the top of a terrace, five feet; height of moraine above terrace, forty feet. The terrace platform spoken of is about eight hundred feet wide. (The accompanying sketch indicates these features, as seen from the creek.) At three stations along the ledge, a large area of the platform was uncovered for the purpose of measuring the angle of direction over as long lines of striation as possible. Repeated observations, corrected for magnetic variation, gave the following result: at the eastern station the direction of the scratches was N. 27° 50′ W.; a little over half a mile west, they were N. 23° 50′ W.; about an eighth of a mile farther west, N. 22° 30′ W. These differences were very unexpected, and hence great care was taken to obtain them accurately. Such angles would indicate a focal point only a few miles to the north-west. In looking over the topography of northern Indiana, it is a remarkable fact, that a ridge of limestone extends across the state, running with the Wabash valley in its eastern section, but striking more westerly in the western part of the state, leaving the Wabash to the south. North of this east and west ridge is a region of marshes and deep sand-deposits, extending to the northern boundary: south of it are more drift-deposits, but not so deep. It seems very probable that a former extension of Lake Michigan found its southern boundary in the neighborhood of this ridge. As the converging lines of our glacial platform seemed to find their centre in the neighborhood of this ridge, it seemed to suggest some relation between them. The first overwhelming flow was parallel with the ridge, and so we find the lower scratches in the Wabash and in Sugar Creek. But afterwards, in the retreat of the great glacier, there seem to have been some local centres along this ridge, which sent out small fan-shaped glaciers with rapidly diverging lines. No other explanation seems to satisfy the angles obtained in this case. Virtually nothing has been done in this state in the way of collecting the facts of the drift; and there is every indication that our relation to the Great Lakes and the peninsula of Michigan, besides the internal features already indicated, present some very interesting and important problems. The legislature of a great educational state cannot yet be induced to appropriate a dollar for any survey which does not deal with the location and thickness of coal-seams and limestone-beds.

JOHN M. COULTER.

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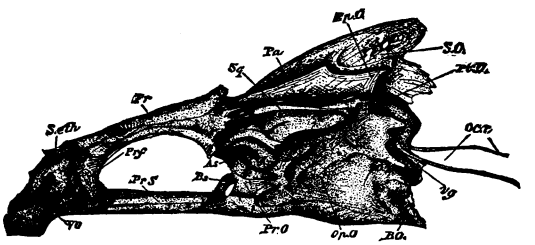
Osteology of Micropterus salmoides.

I was very sorry to find from reading Mr. McMurrich's letter in *Science*, No. 69, that its author had derived nothing but the most erroneous ideas from my description of a pair of free ribs at the base of the occiput of Micropterus (*Science*, No. 65).

As Mr. McMurrich remarks, it was unfortunate that he was not able to dissect a specimen of the black bass, for the very good reason — which applies more particularly to anatomy — that one should certainly examine, in any case, structures under consideration, before publishing about them, and advancing suggestions as to what they may possibly be. Even where an author specifies that he has not seen the thing whereof he writes, people are often misled. On the other hand, I was glad to see the interest these structures awakened, and will look forward with no little pleasure to Mr. McMurrich's observations upon them, after he has had an opportunity to make a thorough examination.

As an anatomical description is made far clearer when accompanied by a drawing of the parts discussed, I determined, upon seeing Mr. McMurrich's letter, to follow that rule in the present instance, in my reply to it. To this end, I selected from my private collection a very fine cranium of Micropterus, with a pair of well-developed ribs attached to it. From this specimen I made the drawing that illustrates this letter.



Left lateral view of cranium of Micropterus salmoides, showing a pair of ribs at the occiput (from nature, half size, linear). *Seth*, supra-ethmoid; *Fr*, frontal; *Sq*, squamosal; *Pa*, palatine (not well in sight); *Ep O*, epiotic; *SO*, super-occipital; *Pt O*, pterotic; *Ocr*, occipital ribs; *vg*, foramen for vagus; *EO*, ex-occipital; *BO*, basi-occipital; *Op O*, opisthotic; *Pr O*, pro-otic; *Ptf*, post-frontal; *A s*, ali-sphenoid; *B s*, basi-sphenoid; *Pr S*, para-sphenoid; *Prf*, pre-frontal; *Vo*, vomer.

From this it is very evident that these ribs are not 'portions or rudiments of the supraclaviculae,' but really have all the characteristics of the ribs upon the atlas and axis. I have never found epipleural appendages attached to them, as I believe may occur on the first two ribs of the column. Dr. Sagemehl, in his valuable paper on the cranium of Amia (*Morphologisches jahrbuch*, ix.), is very explicit in what he says about the co-ossification of the three vertebrae with the basi-occipital of this ganoid; and if this author had been aware of such a state of affairs as I here figure, in any of the Teleostei, he certainly would have brought it forward in connection with the discussion of that subject. They are two very significant facts, that these ribs in Micropterus articulate *beyond* the vagus foramen, and that they are apparently constant. I have since found similar structures in a specimen of Orcynus thynnus, and rather suspect it in the Scombridae, though the specimens at my command, illustrating this latter group, were so poorly prepared, I could not satisfy myself in regard to them. It will be of great interest and importance to examine, in this particular, forms more or less nearly related to Micropterus, and the young of all, at various stages. Of their nature, I think it may be said without doubt, that they are a pair of true ribs, agreeing in all important particulars with the abdominal ribs, as seen in the pairs on the atlas and axis; that they belong to the same series, and articulate with the occiput, to which they belong; and that they are a constant character.

I should be rather surprised to find that these structures had not been noticed before, occurring as they do in a form that has received so much attention, from an anatomical point of view, as Orcynus. Then, too, taking into consideration the morphological significance that attaches to them, one would look for at least a mention of such a condition in the text-books of Owen, Huxley, Gegenbaur, Parker, or others; but such I have failed to find, and the embryologists seem also to have overlooked them. Sir Richard Owen would certainly have had occasion to mention such a pair of ribs in his method of treating the osteology of the piscine skull.

R. W. SHUFELDT.

Washington, June 2.