tention to one fundamental point in my position which the latter failed to grasp upon first reading.

Dr. Thurston quotes me in the following words: "The much-discussed 'Second Law of Thermodynamics' takes the form: 'The entropy of the world tends to a maximum and the temperature to a minimum.' It is, however, pointed out, etc."

These words are correctly quoted (page 35), but their significance has been directly reversed by omission of the context. The statement of the second law just quoted is given by me as itself a quotation of its heretofore accepted form, for direct contrast with my own statement of it, which will be found (on pages 25 and 35, with elaboration and explanation in the intervening pages) in words which may be condensed into the following, for present purposes:

"That while any given quantity of energy tends, so long as it exists without transformation, to fall in intensity, and never the reverse, *yet* the secondary form of energy into which that quantity may at any time find itself transformed possesses a degree of intensity which is *entirely independent of that of the original quantity*, and which is *the maximum permitted by circumstance*. In other words, energy tends downward in intensity during untransformed existence and upward during transformation."

This necessarily denies *in toto* the doctrine of the dissipation of energy. It affirms, on the contrary, that as much exaltation of energy is constantly going on as there is of depression of energy. In short, the total fund of intensity or availability of the energy of the universe is as constant as is the universe's total fund of mass, or as is its total fund of the product of the two, energy itself.

The availability of the energy of the solar system is, of course, being steadily dissipated. But progress in astronomy has generations ago passed the point when observations confined to the solar system suffice for the establishment of fundamental principles such as these.

The new statement of the second law takes on especial importance as being, if true, one link in the chain of evidence confirming the unity of the universe, the modern idea of which was so interestingly referred to recently by Professor Newcomb. The doctrine of the dissipation of energy necessarily excluded any possibility either of the universe being infinite and eternal in its extent or of its being one with the solar system. The new statement not only is consistent with those ideas, but it is implied by or implies them, whichever end of the sequence the thinker may prefer to regard as the natural origin.

SIDNEY A. REEVE.

THE JUDITH RIVER BEDS.

THE reader of Professor Osborn's recent note in SCIENCE on the 'Age of the Typical Judith River Beds' would be led to infer that I had either denied or questioned the Upper Cretaceous age of these beds. Since this note places me in an entirely false position on this question, I wish to offer the following brief remarks by way of explanation.

1. I have never even so much as questioned the Upper Cretaceous age of the Judith River beds. The point I raised was as to their stratigraphic position within the Upper Cretaceous relative to the Pierre.

2. Osborn's statement that since Cope, Cross, White and Dana have referred these beds to the Upper Cretaceous, they therefore overlie the Pierre is unwarranted, since these authorities and American geologists generally have heretofore included everything from the Dakota to the Laramie in the Upper Cretaceous. Would Professor Osborn place the Dakota, Benton and Niobrara above the Pierre because those same authorities have referred these deposits to the Upper Cretaceous?

3. All who are familiar with the literature on this subject know that the Judith River beds have been referred to different ages by Hayden, Meek, Leidy, Cope, Marsh, White, Stanton, Cross, Lesquereux, Newberry and others, varying from Lower Tertiary on the one hand, to Lower Cretaceous or Upper Jurassic (Wealden) on the other, and that, therefore, Osborn has *not* 'abundant authority for the statement that among geologists of the United States there has never been any ques-

tion as to the Laramie or Upper Cretaceous age of the typical Judith River Beds.'

4. Since Hayden's stratigraphical observations near the mouth of Little Rocky Mountain Creek do not harmonize with the paleontological correlations of Drs. White and Stanton at the mouth of the Judith River, and since no one has ever revisited the first locality and reversed Hayden's determinations by a reexamination of the stratigraphy, I believe the exact stratigraphic position of the Judith River beds remains unsettled and that it is premature to assert that 'the true Judith River beds certainly overlie the Ft. Pierre and are of more recent age,' although this is now very generally believed and may eventually prove to be the case.

J. B. Hatcher.

BOTANICAL NOTES.

VEGETABLE GALLS.

These curious growths, which result from the action of two organisms, have not received the attention of botanists which they deserve. That they develop because of the presence of some insect, or as a consequence of the sting or puncture of another insect, does not make them less vegetable in nature. A prickly gall on a rose leaf is a rose structure as truly as the rose fruit is, and its growth and development are as properly the objects of study by the botanist as are the growth and development of any other plant structures.

Mr. Edward Connold, an English botanist, has recently brought out a most interesting book on 'Vegetable Galls,' which must help to direct the attention of botanists to this neglected field. By means of fine half-tone reproductions of photographs he shows more than one hundred galls and their variations, and to these he has added descriptions which bring out quite methodically their structural characteristics, and their relation to the causal parasites. In treating the subject the author groups galls into: (1) Root galls, (2) stem galls, (3) leaf galls and (4) flower and fruit galls. Of the first he illustrates six kinds by as many plates. Among the thirty-one plates of stem galls perhaps the most suggestive are numbers 23 and 24, which show galls on the twigs and stems of *Salix cinerea* caused by the larvæ of *Agromyza schineri*, and which so closely resemble the early stages of the 'diamonds' on the 'diamond willow' of the Great Plains as to suggest similarity of origin. Of leaf galls there are no less than sixty-three plates, representing a great number of different forms much like those found on leaves in this country. Twelve plates are given to the illustration of the galls on flowers and fruits, including two in which the galls are the familiar 'plum pockets' due to the presence of the minute fungus *Exoascus insititiæ*.

A similar work should be undertaken in this country. Mr. Connold has set a good example, showing us how to illustrate as well as how to treat the subject. No doubt the text is capable of improvement, and yet we should not object to a work in which the text was patterned directly after that found in the English book. Here is an open field for some of our active young botanists to enter.

POPULARIZING THE STUDY OF FUNGI.

Any book which increases popular interest in any department of botany should be welcomed by scientific men, even though the treatment may not be quite like that in works designed to be used by students and professors in the colleges and universities. No doubt those of us who belong to the latter class are quite too much inclined to measure the value of every book by our own needs and standards. We commend the book which meets our wants and which is so written that it seems to be addressed to us or our students, and too often we deem of little value the book in which we find nothing new for ourselves, although it may appeal directly to many other people who know less about the subject. That there are some popular books which are simply atrocious is true, and the present writer has been obliged to denounce them in strong terms, and yet it is an open question whether even the worst of these are wholly bad. With their crude drawings and barbaric coloring, they may appeal to certain classes of untrained minds much more than the ele-