

LETTERS TO THE EDITOR.

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The Definition of Entropy.

THERE is, I fear, a difficulty in drafting Prof. Bryan's definition so as to be clear as well as accurate. This arises when the definition is first given with reference to the entropy of the working substance, because the non-available energy is not necessarily a portion of the energy of the substance. The terms available energy, free energy, bound energy, and non-available energy are continually used loosely in thermodynamics as if they referred to portions of the energy of the working substance. I know from experience the difficulty of defining the entropy of the working substance in terms of dissipation or degradation, without reference to the state of things outside the substance, and in a paper on the factors of heat I adopted the notion of reduction of "transfer credit," so that increase of entropy went with lessening of capacity for transforming heat into work with change of volume. In my book on "Entropy" the whole treatment is essentially from the dissipation or degradation point of view, but entropy is first defined in connection with the irreversible increase of entropy in an isolated system. It is thus defined: "Increase of entropy is a quantity which, when multiplied by the lowest available temperature, gives the incurred waste."

May I say that I am exceedingly glad to find Prof. Bryan treating the subject from the same point of view, as it is strong evidence that my treatment is essentially right.

41 Palace Court, W.

J. SWINBURNE.

MR. SWINBURNE has directed attention to an obscure point in my letter of November 10 which is calculated to produce quite the contrary impression to what I intended. In defining available energy relative to a given temperature, it was not my intention to exclude work that the system was capable of producing by expansion or otherwise without using the reversible engines, and instead of "maximum amount of energy" I meant maximum amount of work. By work I refer to ordinary mechanical energy as opposed to what Mr. Swinburne calls "waste energy." The point to which I wished to direct attention was the desirability of basing a definition of entropy on non-available energy, and the use of the term "relative" in this connection, or at least some equivalent language (as implied in my words, "The definition may be stated somewhat as follows").

So far as I am able to judge, both from Mr. Swinburne's book and from some correspondence with the author, it would appear that the conclusions to which I am being led by independent working in regard to entropy agree closely in many substantial points with those at which he has arrived. Since the controversy referred to there have been one or two papers published on the subject by other writers with which I altogether disagree.

G. H. BRYAN.

Craniology of Man and the Anthropoid Apes.

In reading Mr. Macnamara's Hunterian oration of February, 1901, I find these words:—

"Prof. Deniker in his work on the embryology and development of the anthropoid apes has shown that in consequence of the early closure of the anterior sutures of the skull of these animals the fore part of their brain does not increase beyond the size it had attained at the end of the first year of life; but in man these sutures do not consolidate until a much later period, so that the anterior lobes of his brain are enabled to expand, and actually become far more perfectly developed than the corresponding lobes among anthropoid apes."

This being so, I ask:—

(1) Has the experiment ever been tried of keeping the sutures of an infant ape open by artificial means? And if it has,

(2) Has the brain been found to expand and become more perfectly developed?

For if so we should expect the ape to manifest an intelligence not far short of that of a man.

A. T. MUNDY.

IN answer to Mr. A. T. Mundy's questions, it seems to me that it would be impossible in a young living ape, by artificial means, to prevent his frontal suture from closing, and if we could succeed in keeping it open I question if any marked increase in the size of the animal's frontal lobes would augment his intellectual capacity. It is not only the great size of man's cerebrum as compared with that possessed by anthropoid apes which gives him greater intellectual power, but, as I have stated in the passage quoted by Mr. Mundy from my Hunterian oration, the frontal and parietal lobes of the human brain are "far more perfectly developed than the corresponding lobes among anthropoid apes." This is especially the case with respect to those motor and psychical areas of man's cerebral convolutions which control his power of intelligent speech; these areas of the brain are deficient in the anthropoid apes. It is probable that man's ability to make use of articulate language, and through this means to think, has led to the great development of the psychical elements of his brain. A comparison of the size and conformation of the cranium of Tertiary man with that of existing Englishmen is an indication of the length of time it has taken for the human cerebrum, and therefore intellect, to reach its present stage of evolution. Man and anthropoid apes we hold to be derived from a common ancestral stock; the former, under the action of natural selection and other causes, including, I think, not only an inherent capacity of cerebral but also of cranial growth, have gradually developed, whereas anthropoid apes, from arrest of cranial and cerebral growth, have not reached the standard attained by human beings; the difference between these two orders of beings, however, is one of degree, and not of kind.

N. C. MACNAMARA.

November 26.

Pinnipedia a Sub-order of Cetacea!

ONE is so much accustomed to encounter strange assertions in regard to zoology in the non-scientific Press that one takes little notice of them; but when one reads under the head of "Science," as may be read in this day's *Athenaeum* (p. 767), a reviewer of Mr. Millais's "Mammals of Great Britain and Ireland" complaining of that work that "Nowhere is it stated, as it should be, that the Sub-order Pinnipedia belongs to the order Cetacea," one is tempted to ask to what end have writers on classification laboured, if such an assertion as this is to pass unchallenged? If, by a slip of the pen, "Cetacea" was written for "Carnivora," one can sympathise with the reviewer, for all are liable to such unhappy accidents; but the general drift of his remarks seems to forbid that charitable construction, for in the preceding paragraph it is expressly stated that the Carnivora, except the Mustelidae, are dealt with in the volume.

F. Z. S.

December 3.

The Late Mr. Assheton Smith.

THE man of ample means, and who is a lover of living creatures, has a great opportunity. Mr. Assheton Smith had this opportunity, and he used it not only to gratify his own pleasure, but to share it with others. There was nothing that he liked better than to go the round of his park with a guest, and to point out and discuss the characters and habits of the animals which he had gathered together from various quarters of the globe. With the late squire such a ramble was no ordinary treat. One felt, too, that in this man the beasts had a true friend, that he had studied them and knew their ways, and that he would do his utmost to make their lot as happy as possible. To such a man science owes a great debt. Not only does he afford the student an opportunity of studying animals in favourable circumstances, but he is able to place material at the disposal of the laboratory and museum when these animals have paid nature's last demand. For a number of years I have had the good fortune to act, as it were, as prosector to his menagerie, and both my students and I have been able to carry out not a few studies in comparative anatomy. Sometimes, playfully, he would accuse me of possessing the "evil eye," as he said that an animal was not likely to survive long should I express a desire to have it eventually