of smaller stones, originally perhaps 19 in number, and from 6 to 9 feet high, the highest being in the middle, and inside these, and in front of the highest trilithon, is a flat stone, about 17 feet long and 3 wide, which is commonly called the altar stone, though, if sacrifices were ever offered there it would have been much more convenient to have had a smaller but higher altar standing upon this slab. There is a small stone lying inside the small inner horseshoe, which has two hollows and seems therefore to have been intended to rest upon two small upright stones, but no stones suitable for its support now exist, and it is possible that this stone may have stood on two small stones on the slab already mentioned, and may have been the actual altar. It has, however, been thought that it was the capstone of a small trilithon which stood in the middle of the open side of the horseshoe formed by the large trilithons, but there is no evidence as to its original position or use or as to the former existence of any small trilithon.

The smaller stones or bluestones as they are called were brought from a great distance — Devonshire, Wales, or Ireland — but the larger stones forming the outer circle and the great trilithons were obtained from the surrounding plain. Nine of the inner bluestones and nineteen of the outer ones remain, some standing and some fallen; twenty-four of the stones of the outer circle are represented by standing or fallen stones (including fragments), and six of its lintels or cross-stones are still in position; of the trilithons two are complete and the other three are more or less ruined, though all the stones of which they consisted are there, some broken, some entire.

The circles are surrounded by a slight ditch and bank, 300 feet in diameter, from which an avenue defined by earthen banks leads in a northeasterly direction for about 1800 feet, when it divides into two branches, the most northerly of which leads towards a space enclosed by earthen banks and called by Stukeley the "Cursus." Just inside the ditch and bank are two barrows, on opposite sides of the circles, and so placed that a line from one to the other passes through the centre of the circles. There are also two single stones near the inner circumference of the ditch placed like the barrows on opposite sides of the circles and so that a line from one to the other passes through the centre of the circles. At the point where the avenue joins the ditch there is a large stone lying flat, and nearly 100 feet along the avenue stands a rough stone, called the "Friar's Heel," in such a position that anyone standing on the flat stone called the "altar," already mentioned, may see the sun rise over its tip, or nearly so, on Midsummer morning, a fact which is generally verified by several people every year. It has been said that the flat stone between the Friar's Heel and the circles formerly stood upright, and hid the former from the latter, and that the coincidence as to the sunrise was therefore not intentional; but if the flat stone ever were upright the sun would have appeared to rise over it, and if neither stone existed the whole arrangement of the circles and avenue would still direct attention to the northeast or midsummer sunrise quarter.

Stonehenge has been attributed to various peoples, ranging from Atlanteans of 10,000 B.C., to Danes of the ninth century of our era, and numerous suggestions have been made as to its object. Two or three archæologists of late years have endeavored to show that it is merely the skeleton of a vast tower of dry or uncemented masonry, and the visitor must form his own idea as to the probability of this view. Burials would seem to have taken place in the centre, as bones and iron armor were dug up there in 1620, but this does not show that burial was the only or even the chief object for which the circles were constructed. Perhaps the view that best fits all the facts is that a circle or circles with avenue and outlying stones so arranged as to make it suitable for sun-worship existed here in very early times, and that long afterwards, in the dark period between the Roman rule and the Saxon domination, certain murdered Britons were buried in the circles, which were restored and re-arranged as a monument to their memory. Stonehenge, while it has much in common with the other British circles, has also so many points of difference from them, that it seems as though it must have had a special history of its own.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

What is Biology?

ORIGINATING from the time of the appearance of Dr. Campbell's book[1] on biological instruction, a discussion is for the present time being held. Professor C. MacMillan opened this discussion in some very interesting articles,[2] the main feature of these being a sharp criticism of the way in which biological science has been and is taught in the colleges and universities. Mr. Francis H. Herrick[3] has tried to save the reputation of the biological departments in pleno. As the question of a clear and logical definition of the term biology meets with some of my own considerations, I should like to make a few remarks on this side of the point; the position of botanical science in the scientific institutions being merely a question of power laid in the hands of the director or professor of such institutions, I shall leave this in better hands.

It would be well, indeed, if we could get a logical definition of biology, and if we could succeed in removing from the text-books the old definition that "biology is the science of living things." Doing this, we would avoid much confusion, especially among the students — and there are many of them yet — who think that the physiological science is still a well established branch of natural science, and not merely a subdivision of a more or less heterogene "biology."

LaMarck used, first of all, the word biology, and, afterwards, from 1802 to 1822, G. R. Treviranus wrote a very remarkable book,[4] defining biology as the philosophy of living nature. Singularly, the idea of the range of living nature has, in the course of time, been limited, instead of broadened; so we see how the scientists of old times saw, in the fire, a manifestation of life. Oken, in his "System der Biologie," adopted the definition of Treviranus, while the second and third quarters of this century created physiological schools that fought against the "natural philosophers," and brought forth an experimental physiology.

When the profound thinking of Ch. Darwin (not especially of all his pupils and successors) caused a world-wide sensation, and cast new light upon natural history, the term became rather limited instead of broadened, and, in fact, from an evolutionary standpoint, we cannot, as has been done,[5] regard biology as "the science of living things." Biology has grown up with the teachings of Darwin, it is closely connected with evolutionary ideas, and, logically, appears to us in view of these teachings; therefore, we must frame our definitions in accordance therewith.

Huxley's view of the matter was taken up, and has been followed ever since, though now and then it has been modified. One of these modifications appears in a very reputable textbook,[6] biology being defined as "the science which treats of the properties of matter in the living state;" physiology, however, is "the science of action and function, essentially dynamical." I am sure that we could point out many instances of action and function that would never be classified under the heading of physiology or even biology, nay, "*general* biology." On the other hand, I doubt if physiological science is really characterized by the word dynamical; in other words, if "physiological action and function" necessarily presupposes something "dynamical."

[1] John P. Campbell, "Biological Teaching in the Colleges of the United States," Bureau of Education, Circular of Information, No. 9, 1891.

[2] Botanical Gaz., xvi., p. 301, 1892 (see also pp. 260 and 336). Science, April 7, 1893, p. 184.

[3] Science, April 21, 1893, p. 220.

[4] Biologie oder Philosophie der lebenden Natur., Vol. 1-6, 1802-1822.

[5] Huxley, "On the Study of Biology (Lectures on Evolution)." See "Humboldt Library," No. 36, 1882, p. 37.

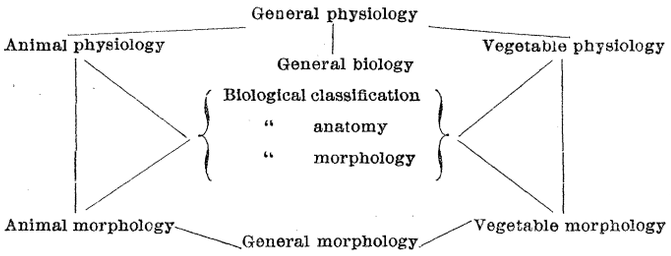
[6] Sedgwick and Wilson, "General Biology," New York, 1886, pp. 7-9.

We have had for several hundred years the term physiology, which is the science of the life-phenomena.[1] There is no reason why we should not retain this name, and use it as it has been used ever since the revival of science in the sixteenth century. Biology is of later origin, it was born with evolution, and it is merely a branch of the all-embracing physiology. Biology does not consist of the entire sum of life-phenomena; it is the branch of physiology which treats of *the mutual relationship of the forms of organized matter, especially in view of the theories of adaptations and of natural selection.*

I wish to confine my remarks as far as possible to vegetable biology, and here I shall invite your attention to a very important paper by F. Delpino,[2] who regards biology as the main basis of Darwinism, and points out its importance for the theories of plant metamorphosis. With reference to the latter, we find that Warming[3] will admit only the "definition of metamorphosis" into the biology. Goebel[4] explains the state of affairs very logically in these words: "Biology regards the parts of the plants as if they were not limbs (in morphological sense), but organs, or tools," and thus he mentions one feature of biological investigation, namely, the study of correlation.

If physiology is placed at the head of natural science, and biology in its proper place as a branch thereof, we shall be able to see more distinctly how to reach the ideal, namely, the comparative physiology of animals and plants, for which so much material has been accumulated that we are able to grasp many important features of *life in general.* I have repeatedly[5] referred to this fact, but it will be admitted that the *fundamental definitions* must be logical and not ridiculous.

How biology, in the true and limited sense, branches out into the other departments of botany, I have shown in the following table. We have two features of living things: form and function, and, accordingly, the morphology and the physiology. The table shows



how we get a biological classification, or a comparative systematic botany, or zoölogy. Biological morphology is practically a morphology which deals with adaptations of the different forms to certain ends and comparatively regarded. Biological anatomy is teaching the structural adaptations in animals and plants from a comparative standpoint.

To apply biological characters and features to the systematic part of either zoölogy or botany will tend to make the registration of species and forms more valuable to physiology.

Probably it seems trifling to write quite elaborately about a question of definition. If, however, our fundamental definitions shall be not merely *adaptations for the extension of private power and influence,* we must consider them well. This is not only a question of logical consideration, but of scientific principles.

J. CHRISTIAN BAY.

Missouri Botanical Garden, April 27.

[1] See J. von Sachs, "Vorlesungen über Pflanzenphysiologie," 1887, p. 3.

[2] Fondamenti di Biologia vegetale, I.; Prolegomeni (Revista di Filosofia scientifica, Milano., I., 1880, No. 1, pp. 58-90). See Botanisches Centralblatt, vol. ix., 1882, pp. 333-335.

[3] Warming, in Meddelelser fra den bot. Forening i Kjoebenhavn, I., 192.

[4] Pflanzenbiologische Schilderungen, I., 1889, Introduction.

[5] See Science, March 24, 1893, p. 162; Bot. Gazette, xvii., 1893, p. 105; Biologisches Centralblatt, xiii., 1893, p. 38.

Epidermic Forms of Mental or Nervous Diseases or Disorders.

IT is very desirable that certain data should be gathered on "epidermic forms of mental or nervous diseases or disorders.' As an example of what is meant, I would instance "The Children's Crusade," which occurred in Europe; the persecution of certain individuals supposed to be possessed of witches in New England, and chorea, or St. Vitus's dance, occurring among school children; panic is another form very common, especially at the present day.

Could any of the readers of *Science* furnish me with any information of occurrences which have come under their notice or which they may have read about? They are certainly very common, for one reads of them very often in the daily papers. If some of your "live" readers would consider this subject seriously, and send so full reports as possible, they would not only be doing a personal favor, but would certainly be contributing toward an interesting and important collection of scientific facts.

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Color of Flowers.

I HAVE just seen Miss Neal's question in your issue of March 31, 1893, as to how to preserve the colors of flowers when pressing them. If some of your readers have not already sent a better recipe, the following may be found useful.

Immerse the stem of the fresh plant in a solution of 31 grains of alum, 4 of nitre, and 186 of water for a day or two, until the liquid is absorbed, then press the plant in the usual way, sift some dry sand over the flower, and submit to a gentle heat for about twenty hours.

I have found this process pretty successful. A. B STEELE.

Edinburgh, Scotland, April 28.

The Aurora.

IN my contribution to *Science,* April 7, on the above subject, no mention was made (as required by Dr. Veeder in his reply in the issue of April 28) of a particular instance of want of coincidence between auroral display and solar disturbance at the eastern limb, for the following reasons: First, because I have, so far, considered each phenomenon as being dissociated, or rather not connected in the manner stated; second, because I do *not* think it possible to point out such a want of coincidence with the very liberal limits of time evidently comprised in the term "eastern limb" by the advocates of this theory; and, third, amidst the bewildering number of instances, which must occur between even dissociated phenomena of such frequent occurrence, even when the limit spoken of is of reasonably brief duration, it is possible (most probable) that coincidence will be mistaken for cause. That this coincidence is not so great as claimed, seemed to me to be indicated by the results mentioned as obtained by Greenwich, as also by the same conclusion arrived at by Professor Ricco, as mentioned by Dr. Veeder; surely this is a fair assumption to make, if discussion of the same or similar records give results so widely different?

Personally, I do not wish to take any part in this discussion. Dr. Veeder's theory has constantly appeared in the press and by pamphlet without any attempted refutation; believing it to be founded on false premises, I have felt called upon to act as censor, failing any one else.

Granted a very large number of coincidences between auroral displays and the position of a disturbed area at the eastern limb of the sun; if Dr. Veeder will place a limit of, say, twenty-four hours for the term "eastern limb," and consider occurrences beyond this as not being coincidences, I believe he will find that there are as many auroras (I should be inclined with this limit to say, very many more) which occur without this particular solar source of energy as with it. Again, allowing *any* interpretation of the term "eastern limb," and, applying the same interpretation rigorously throughout, I think it will be found that the proportion of coincidences will increase from the minimum sunspot period to the maximum, and that this coincidence will vary