"Modern Philosophers, to avoid Circumlocutions call that Instrument, wherein a Cylinder of Quicksilver, of between 28 and 31 inches in Altitude, is kept suspended after the manner of the Torricellian Experiment, a Barometer or Baroscope, first made publick by that Noble Searcher of Nature, Mr. Boyle, and imployed by him and others to detect all the minut variations in the Pressure and Weight of the Air."

The mention of the words in connection with the name of Robert Boyle has led me to make a close examination of his voluminous and prolix writings. In Boyle's first publication, 'New Experiments Physico-Mechanical touching the Spring and Weight of the Air,' dated 1660, the words baroscope and barometer do not occur; he uses the common term 'tube,' and often writes of the 'mercurial cylinder.' Nor are these words used by him in his 'Defense of the Doctrine touching the Spring and the Weight of the Air * * * against the objections of Franciscus Linus,' a paper published in 1662.

Their use by the anonymous writer to the *Philosophical Transactions* in 1665 has been shown, and the question arises, who was this person who modestly concealed his name? I believe it was Boyle himself. This eminent man, who was so devoid of personal ambition that he declined a peerage, had a habit of writing about himself and his scientific labors in the third person, and often spoke of himself by fanciful, fictitious names, such as 'Philaretus' (in his fragmentary autobiography) and 'Carneades' (in the 'Sceptical Chymist'). That he should send an unsigned communication to a journal was not surprising, particularly as he had occasion to mention himself.

Be this as it may, my claim that Boyle originated the word barometer does not rest on such slender conjectures as these. One year later than the communication in the *Philosophical Transactions,* Boyle wrote to this journal (dated April 2, 1666) and said, 'barometrical observations (as for brevity's sake I call them),' using the personal pronoun this time. Elsewhere in the same paper are found the terms barometer, baroscope and baroscopical observations.

In his 'Continuation of New Experiments Physico-Mechanical * * * ' of which the preface is dated 1667, occurs the following phrase: 'But though about the barometer (as others have by their imitation allowed me to call the instrument mentioned).' (Boyle's Works, Birch's edition, Vol. III., p. 219, London, 1744.)

This sentence is virtually an admission by Boyle that he had coined the word, since others imitating him had allowed and encouraged him to use the term to designate the tube of Torricelli.

I conclude, therefore, that the word 'barometer' was introduced into our language by the English philosopher, the Hon. Robert Boyle, about the year 1665. Boyle, by the way, was a scholar, and able to use Greek in forming an English word. Finally, I may add that examination of Murray's Skeats' and other standard English dictionaries throws no light on the origin of the word; they merely refer to the *Philosophical Transactions* and give its obvious etymology.

Henry Carrington Bolton.

The Response of the Hearts of certain Molluscs, Decapods and Tunicates to Electrical Stimulation. (Preliminary Communication.)*

The physiology of cardiac muscle of the vertebrates is commonly regarded as differing from that of the skeletal muscle, besides the difference in rhythm, chiefly in these three points, namely, that cardiac muscle can not be tetanized, that a minimal stimulus is at the same time maximal (the 'all or nothing law'), and that, beginning with the systole, the muscle is in a condition of inexcitability, the excitability returning gradually during diastole. While making some observations on the comparative physiology of muscle in certain genera of marine molluscs at the Hopkins Seaside Laboratory in the summer of 1902, the ventricle of the systemic heart of

* From the Hopkins Seaside Laboratory and the Physiological Laboratory of Leland Stanford Jr. University.

Loligo pealii attracted my special attention, because its reactions to electrical stimulation did not seem to fall in line with the peculiarities of cardiac muscle just referred to. The *Loligo* ventricle responded to the interrupted current of sufficient intensity with a continuous, to all appearance, tetanic contraction, minimal stimuli were by no means at the same time maximal; and a refractory period or a state of inexcitability seemed not to be present.

This led to the examination of the hearts of the following invertebrates on these three points:

Tunicata:
- *Clavelina* sp.

Mollusca:
- *Octopus punctatus.*
- *Loligo pealii.*
- *Ariolimax columbianus.*
- *Limax maximus.*
- *Pleurobranchœa* sp.
- *Doris* sp.
- *Janus* sp.
- *Æolus* sp.
- *Haliotis craceropodii.*
- *Haliotis rufescens.*
- *Lucapina crenulata.*
- *Cryptochiton stelleri.*
- *Mytilus californianus.*
- *Mya arenaria.*

Arthropoda:
- *Cancer antennarius.*
- *Brachynotus nudis.*
- *Pachygrapsus crassipes.*
- *Epialtus productus.*

Owing to the delicate structure of the ventricles of *Clavelina* and the nudibranchs (with the exception of a species of *Doris*) their contractions could not be recorded by the ordinary graphic method, but direct observation had to suffice. The ventricles of all the other species worked on were suspended and their reactions recorded by a light lever. But experiments were also performed on the ventricles *in situ,* as check on the graphic record.

1. In all the forms experimented on an intensity of the interrupted current was found to which the ventricles responded with a continuous maximal or supermaximal (as compared to the normal) contraction during its application. By varying the intensity and the rapidity of succession of the shocks superposition and partial fusion of the individual contractions were obtained (except in *Cryptochiton* and in some of the nudibranchs) similar to those of the skeletal muscle of vertebrates. The continuous contraction appeared to be truly 'tetanic' in character, except in case of *Cryptochiton* and some of the gastropods. The intensity of the interrupted current required to call forth the continuous contraction was considerably greater than sufficed to tetanize the body muscles in the same animal.

2. If by the refractory period is meant a state of inexcitability, I have so far been unable to demonstrate its presence in the ventricles of this series, for an intensity of the stimulus can in every case be found sufficient to affect the hearts in any phase of rhythmic contraction; but a period of reduced excitability, maximal during the systole, seems to be present in the case of the decapods, the cephalopods and in several of the gastropods.

3. Nor does the 'all or nothing law' apply to the hearts of this series of invertebrates. But as regards this relation of the magnitude of contraction to the intensity of the stimulus, there is a great difference between the ventricle of *Cryptochiton* on the one hand and that of *Octopus* or *Cancer* on the other. The *Octopus* ventricles seem to come nearest to the vertebrate heart on this point, while the ventricle of *Cryptochiton* in no wise appears to partake of this property of vertebrate cardiac muscle. With the exception of *Cryptochiton* and *Doris* the hearts give uniform beats to stimuli of considerable range in intensity, but increase in the intensity above this range is followed by increase in the height of contraction. In *Octopus* increase in the intensity of the stimulus above a certain strength seems to decrease the magnitude of contraction.

4. If the interrupted current is too weak to produce acceleration of the beats or the continuous contraction, it produces *inhibition in diastole* during its application to the ven-

tricles of *Mytilus, Mya, Haliotis, Lucapina, Limax, Ariolimax, Octopus,* and the decapods examined, very much like the vagus inhibition in vertebrates. In *Ariolimax* and *Mya* the inhibitory effect of single induced make or break shocks is readily demonstrated. If the application of a weak, interrupted current is long continued the ventricle will generally 'escape' from the inhibition during the stimulation. Cessation of the stimulation is generally followed by acceleration in the rate and increase in the magnitude of the beats.

5. The direct current produces make beats, make and break beats, total diastolic inhibition, partial inhibition of beats, acceleration of beats, and increase in 'tone' or a continuous 'tetanic' contraction, according to its intensity and direction, *i. e.,* whether the anode or the cathode is on the auricular end of the ventricles. In *Ariolimax* this difference in the ventricular response, according as the anode or the cathode is on the auricular end, is very manifest even with single induced shocks.

An account of previous investigations touching this subject is deferred to the more complete statement which will accompany the publication of the tracings.

A. J. CARLSON.

STANFORD UNIVERSITY,
January 25, 1903.

CURRENT NOTES ON PHYSIOGRAPHY.

SOUTHERN APPALACHIAN FOREST RESERVE.

'SENATE DOCUMENT 84' is a volume of 210 pages, 75 plates and 3 maps with the following title: 'Message from the President of the United States, transmitting a report of the Secretary of Agriculture in relation to the forests, rivers and mountains of the Southern Appalachian region' (Washington, 1902). 'Southern Appalachian Region' is the page heading throughout. The volume, whatever its name may be, is worth owning, as it presents an unusually well-illustrated account of 'the greatest physiographic feature in the eastern half of the continent,' with special reference to the creation by Congress of a national forest reserve, for conservation of the forest by use, rather than a national park, for conservation without use, as the Secretary of Agriculture puts it (p. 167). Chapters on topography and geology by Keith, hydrography by Pressey and Myers, and climate by Henry give concise accounts of these topics. Many of the plates are excellent. The text and the explanatory titles of some of the plates give, to our reading, too much importance to forest clearing as a cause of destructive floods. There seems exaggeration also in the statement under a fine view of Stone mountain, near Atlanta, Ga. (Pl. XIX.), that 'the ax and fire have removed the forest, and the heavy rains have removed the soil which once covered the larger part of this rocky knob.' It is estimated that not less than 10 per cent. of the region has a slope of less than ten degrees, while 24 per cent. of the region has been cleared. The hill- and mountain-side fields lose their surface soil in five or ten years, and must then be abandoned for new clearings. Native grasses do not suffice to hold the hillside soils, which are therefore often deeply gullied by rain wash. It is evidently out of the question to adopt the practice of terracing the hillsides, as is done by the crowded population of eastern Asia (see a good illustration in *Geogr. Journ.,* XXI., 1903, p. 116).

The Blue ridge, an important physiographic element of the region, is variously described in different parts of the volume; on one page it is 'a fairly well-defined mountain *range*'; on another, its northern part 'consists of ancient *plateaus,*' while upon 'the southern part of the *chain* * * * are situated a few individual peaks and ridges of commanding height'; again, it is a 'steep and well-defined *escarpment,*' and it fronts the Piedmont plateau 'like a *rampart.*' The italics are here introduced to emphasize the versatility of this remarkable *ridge.*

SOUTHERN PATAGONIA.

REFERENCE has already been made in these notes to Hatcher's exploration in Patagonia. Fuller description of his geographical results has now been published ('Reports of the Princeton University Expeditions to Pata-