menting' leaves revealed the absence of extended bacterial colonies, the presenc of which were naturally to be expected if *bacteria* were the cause of the phenomena in question. The true cause, I have recently established beyond a doubt, is the presence of two kinds of *oxidizing enzymes* in the tobacco leaves. As soon as the Bulletin describing these investigations is published a full review will be given in this JOURNAL.

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THE ANÆSTHETIC EFFECTS OF A SINUSOIDAL CURRENT OF HIGH FREQUENCY.

TO THE EDITOR OF SCIENCE: In your issue of June 3, 1898, I had the honor of communicating an observation on the anæsthetic effects of a sinusoidal current of high frequency. I take the liberty of sending you the following further observations.

a. The anæsthetic effect may be produced by sending the current longitudinally along the the nerve. Thus, a current sent along one of the nerves of the arm can be used to produce anæsthesia in parts of the arm supplied by it. With a pleasant current of about 28,000 alternations per second passing between the elbow and the hand, a needle can be painlessly run into the forearm.

b. At the suggestion of Professor B. Moore, of the Yale Medical School, I applied the current to the tongue, with a view to testing the theory that the sensation of taste may be due to vibratory stimuli. If the theory were true the fluctuations in the sinusoidal current might be expected to produce sensations of taste of various kinds. The experiment showed that fluctuations up to about 29,000 complete periods per second produce no sensations of taste whatever; the only sensation is that of tickling and puckering.

c. It should perhaps have been stated in my original communication that the main purpose of the investigations with the sinusoidal current was to determine the various sensations at different frequencies. They have been determined for two subjects as follows: (1) Threshold of sensation of touch at a frequency of about 480 complete alternations' per second; (2) threshold of disagreeableness at about 840; (3) threshold of pain at about 960; (4) disappearance of pain at about 1,440, followed by a peculiar, agreeable sensation; (5) disappearance of agreeableness at a point not yet determined, followed by a faint sensation; (6) disappearance of sensation at a point not yet determined. For constant conditions these figures are quite constant, the probable error ranging from $\frac{1}{10}$ of 1 % to 4 %.

d. Applying the electrodes to the nerves of the arm in a way to move the muscles of the forearm and hand I find a similar neuromuscular effect. As the current rises in frequency from zero the muscles contract steadily up to a certain point, after which they gradually relax. The process is the same when we start with a high frequency and descend to zero. The phenomenon can hardly be due to a diminished intensity of the high-frequency current.

e. It may be added that the instrument used is a Kennelly alternator run at a very high speed. Similar high-frequency machines have been used by Nikola Tesla, who has not recorded any of the above phenomena; possibly his machines do not produce sinusoidal currents.

f. Using another machine which simply interrupted a galvanic current up to 100,000 times per second I find that above a certain point (not yet measured) the interruptions cease to have any effect other than merely reducing the strength of the current when it is sent through the tissues.

E. W. SCRIPTURE.
YALE UNIVERSITY, NEW HAVEN, CONN.,
February 28, 1899.

NOTES ON PHYSICS.

THE METRIC SYSTEM.

THE Hartford Steam Boiler, Inspection and Insurance Company of Hartford, Conn., has issued a very neat and convenient volume, of 'pocket size,' containing tables for the Conversion of English weights and measures into their metric equivalents, and *vice versa*. It opens with a very interesting discussion of the metric system, which lacks, however, any recognition of the International Bureau of Weights and