material thus collected. The fishes have already been described in the Report of the U. S. Fish Commission just published; and of the other forms which were sent to the various universities for examination and study, Dr. Hargitt reported on the material received here. The collection comprises the 'Alcyonaria,' and among the forms were several genera new to American waters, and six species new to science. The descriptions of all these will be published in the Reports of the Fish Commission during the present summer.

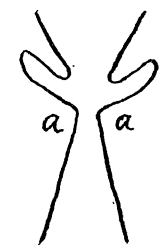
PHILIP F. SCHNEIDER.

DISCUSSION AND CORRESPONDENCE.

THE LARYNX AS AN INSTRUMENT OF MUSIC.

IN the *American Journal of Science* for April, 1901, Vol. XI., p. 302, an account was given of some speech curves that confirm the view that vowels are usually produced by intermittent puffs of air and not by vibrations of the form generally supposed. The following conclusions were reached: (1) The movement of the air in the mouth cavity is a free vibration and not a forced one; (2) the impulses from the larynx in making vowels are of the nature of explosive openings or sharp puffs of air. It was shown that the characteristic mouth tones in vowels are generally inharmonic to the larynx tone. The elaborate vowel tracings of Professor Hermann (Königsberg) and the late ones of Dr. Pipping (Helsingfors) had already proved that in song the mouth does not reinforce an overtone of the cord; my curves showed the same condition for ordinary speech. Similar results have been obtained by Boeke (Alkmaar), Bevier (New Brunswick), Donders (Utrecht), Merritt (Cornell), Samojloff (Moscow), and others, and can be seen in plates published by Nichols and Merritt (Cornell). The proof is on all sides complete and incontestible that Willis's theory ('Camb. Philos. Trans.,' 1830) of vowel formation is the correct one and that the theory of Wheatstone ('Lond. and Westm. Rev.,' 1837) is erroneous. Although the adoption of the Wheatstone theory led to numerous investigations and secondary hypotheses by Grassmann, Helmholtz and others, its phonetic difficulties were never overcome.

It was also pointed out that the structure of the larynx practically forbids any consideration of the vocal bands as membranous reeds. The accompanying figure is an outline section of the



vocal muscles (*aa*) whose vibrations produce the tone in song and speech. They bear no resemblance in structure or action to membranous reeds. When they are brought together by the action of the arytenoid cartilages, they close the passage of the larynx until forced apart by the air pressure. When this occurs a puff of air is emitted and they close again. The sharpness or smoothness of the puff is regulated by the contraction of the various portions of the thyro-arytenoid muscles which compose the vocal bands. The puffs in their physical forms resemble those that can be produced by a siren disk with differently shaped openings (Seebeck).

Structures of the nature of the vocal bands yield to the air pressure and vibrate wholly or mainly by a side movement, and not by the flap or lateral movement of membranous reeds. Professor Ewald (Strassburg) has illustrated their action by constructing cushion pipes. That the vibratory movement affects the bands through most of their depth is shown by the nodal lines seen with the laryngo-stroboscope of Oertel (Munich). Helmholtz's statement: "Im Kehlkoffe spielen die elastischen Stimmbänder die Rolle membranöser Zungen. Sie sind von vorn nach hinten gespannt, ähnlich den Kautschukbändern * * *," was based on the anatomical and physiological knowledge of the time at which he wrote the first edition of the 'Tonempfindungen.'

Professor Le Conte (California) in SCIENCE for May 17, N. S., Vol. XIII., p. 790, points out that he had already said that the larynx 'cannot be likened to a stringed instrument nor

to a reed-pipe,' and suggests the resemblance between the vocal band action and the lip action in blowing a horn. Whether the lips in blowing a horn vibrate laterally as reeds or by compression as cushions, I am unable to say; they may quite possibly vibrate in a manner different from that assumed by Helmholtz.*

E. W. Scripture.

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New Haven, Conn.

PHYSIOLOGY IN THE SCHOOLS.

To the Editor of Science: Judging from the letter of S. W. Williston in your issue of May 24th, people must acquire their mental growth much more rapidly in Kansas than they do in the East. If I were confronted in an examination for the degree of doctor of philosophy with the question 'Why does the human body cease to grow about the twenty-fifth year?' I should think there were strong grounds for suspecting the examiner of endeavoring to show what I did not know, even at the price of asking questions whose answers I could not know. Yet we are told that this question has been asked of candidates for the State teacher's certificate. The theory of accelerated mental development is furthermore strongly supported by the apparent fact that children are expected, by the time they finish with the grammar school, to know about pleurisy, the respiratory center, residual air, appendicitis, *meatus auditorius* and the *motores oculi.*

If mental development is anywhere as rapid as these facts would suggest, there can, of course, be no criticism with regard to the consideration of these questions in physiology at the time indicated.

If, however, children generally show about the same rate of mental development as I have observed in the East, the writer would like to suggest that if less time were consumed in the contemplation of useless details of anatomy, relieved by worse than useless rambles into pathology, and more in the plain, common sense, practical study of the conditions of healthy living, teachers would no longer learn in examination papers that 'the body should be bathed frequently, should be bathed at least once a year.' There is, in fact, a horrible suspicion in the mind of the writer that something else than the text-book is at fault.

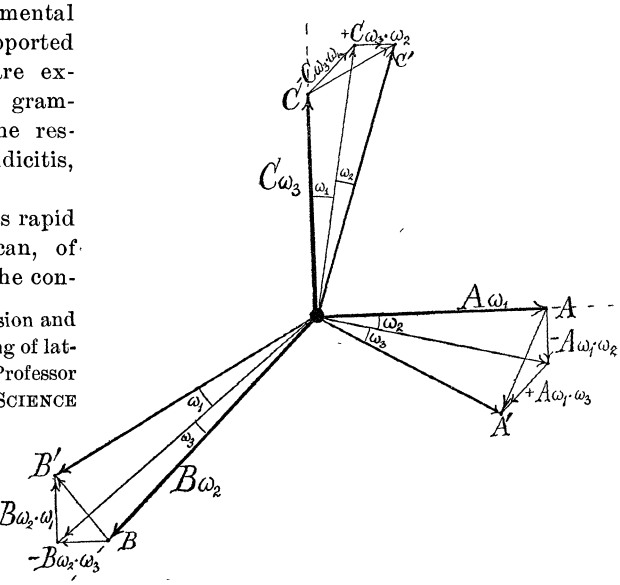
Theodore Hough.

Massachusetts Institute of Technology,
May 25, 1901.

SHORTER ARTICLES.

THE GENERAL EQUATIONS OF ROTATION OF A RIGID BODY.

After writing my brief note on the top, * it occurred to me that the same method might be used to derive the Eulerian equations of rotation briefly and at once, in a way almost pic-



* Misunderstanding the point under discussion and supposing that Professor Le Conte was speaking of lateral vibrations of the lips and vocal cords, Professor Webster (Clark Univ.), replies to him in Science for May 24, N. S., Vol. XIII., p. 827, that the action of the lips and the vocal cords had already been explained by Helmholtz and that his description of 1862 'has never needed any improvement or correction.' Professor Webster asserts that he regards the simple *model* of a membranous reed pipe with a sheet of rubber in lateral vibration as 'a very convincing demonstration of the mode of action of the larynx.' He also classifies elastic cushions as 'reeds.'

* This Journal, May 31, 1901.