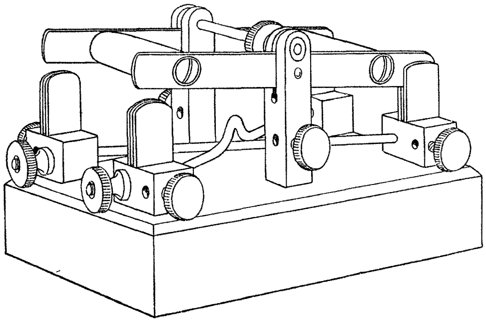
and pole changer. It is in fact a universal key. No mercury is used.

The central binding posts are prolonged upwards and each is slotted to receive a brass bar which is pivotted in the slot by a horizontal pin. The brass bars are held parallel by two rubber rods which serve as handles. When the bars are depressed to one side or the other, they engage between plates of spring brass set into brass blocks each of which carries a binding screw. Cross wires enter these blocks, as shown in the figure. At one end the cross wires are soldered into the blocks, thus making an electrical contact. The two blocks at the other end are perforated by rubber cores or 'bushings' through which the cross wires pass. The cross wires, therefore, make no electrical contact with these blocks. When a contact is desired, the screw borne on the head of each cross wire is turned until its face presses against the brass block outside the bushing. In this position the key serves as a pole changer, commutator, or 'Wippe.'



A brass cross bar unites the central posts. At one end this cross bar does not make electrical contact with the post, but passes through a rubber bushing clearly shown in the figure. Contact is secured by turning a screw upon the cross bar until the face of the screw presses against the post outside the bushing. When this contact is made the instrument may be used as a short-circuiting key.

W. T. PORTER.

HARVARD MEDICAL SCHOOL.

SOME NOTES ON THE MYODOME OF THE FISH CRANIUM.

MYODOME is a term given by Dr. Theo. Gill to the tube at the base of the cranium of fishes for the reception of the rectus muscles of the eye.

It is formed by an inner longitudinal wing springing from near the middle of the prootic, or near the center of the radiation of the structural fibers of the prootic, and meeting its opposite fellow separates the myodome from the brain cavity.

It has been variously called eye muscle tube, canal or vacuity, and Cope instead of considering the vacuity itself considered the walls forming it, thus: 'basis cranii double,' meaning a double floor to the cranium with a space (the myodome) between; 'basis cranii single,' or myodome absent. With the former term he often coupled the phrase, 'with a muscular tube,' meaning the vacuity was extended backwards in a tube in contradiction to its ending blindly.

The following matter was suggested to me by a few lines in an excellent paper recently published by Dr. W. G. Ridewood (*Proc. Zool. Soc. London,* 1904, Vol. II., p. 60) as follows:

> No value can be ascribed, so far as I can see, to a feature upon which Cope has laid some stress (*Trans. Amer. Phil. Soc.*, N. S., XIV., 1871), namely the double or simple nature of the basis cranii. This refers, so far as I understand his writings, to the separation of the parasphenoid from the prootic floor of the cranium by the eye muscle vacuity. The character is one which is very difficult of application; and it is a matter of individual opinion whether such a form as *Clupea* is to be regarded as having a simple or double bases cranii, for here the parasphenoid is produced backwards into a pair of large lateral wings, the space between them freely open below.

From the second sentence quoted, I should judge that Dr. Ridewood considers the myodome to be interposed between the floor of the cranium and the parasphenoid, rather than separated from the brain cavity. Or, in other words, that he considers the roof of the myodome to be the homologue of the cranial floor of forms having no myodome.

This does not seem to me to be the correct conception. That the floor of the myodome is the true cranial base and that the roof of it is simply a septum of secondary development would seem probable from the following evidence: (1) The lower edges of the prootics behave in exactly the same manner, whether or not the myodome is present. The prootics meet at the median line above the parasphenoid and form the floor of the brain cavity or myodome, as the case may be, or they end at the outer edges of the parasphenoid, the latter forming the floor. Perhaps, when the myodome is present the prootics meet in fewer cases than when it is not, but both conditions of the prootics are common with both conditions of the myodome. (2) In some forms when no myodome appears in the dried skeleton, if a fresh or alcoholic specimen be examined, a sheet of connective tissue may be found separating the eye muscles from the brain cavity. This tissue is attached to the prootics exactly as the bony shelf is, and possibly the ossification of the shelf takes place in it.

If this be so it explains why the myodome is of no more value in classification than it is, as there would be little difference between a connective tissue septum and the same tissue replaced by ossification. How great a proportion of the forms having no myodome have the connective tissue septum I do not know.

Looking at the matter in this light there seems little difficulty in my mind in deciding whether *Clupea* has a myodome. Any cavity between the prootic shelf and the lower symphysis of the prootics, or between the shelf and the parasphenoid, as the case may be, should be regarded as a myodome. I do not see the application of the fact that the parasphenoid is open below in *Clupea*. It is but a difference in degree between the forms where the myodome is open only posteriorly and where it is entirely open below. There are forms with the condition of the opening intermediate between these two extremes. Of course, the fact that the myodome is open below leaves only a single cranial base interpreted literally, but it could not be considered under the head of 'basis cranii single,' as it is the primary floor that is missing.

In examining a large number of fish specimens with these problems in view I also had for consideration two other problems in connection with the myodome, but unrelated to the above.

Vrolik[*] states that the prootic is not pierced by the facial and trigeminus nerves when the myodome is absent, in the forms he has investigated (*Gadus, Silurus* and *Lophius*). I can add my testimony as to the correctness of these conclusions so far as the forms quoted are concerned, but in the following forms, which have no myodome, the prootics are pierced by one or both the fifth and seventh nerves: *Tetraodon, Chilomycterus, Lycodes, Dormitator, Opsanus, Brosme,* and perhaps all of the family Blenniidæ (six genera were examined).

On the other hand, I know of no form having the myodome well developed, which has the prootics unpierced.

The second point I would touch upon is that the dichost (= basisphenoid of Huxley) is always absent when the myodome is. I know of no case where it is at all ossified when the myodome is absent, though there is often a connective tissue septum in this region continued forward as the interocular septum.

Nearly always the dichost is connected with the edge of the prootic shelf, or roof of the myodome, but that the shelf is not necessary to it is shown by *Esox,* where it is attached to the parasphenoid at its lower end and is free above. In this case the prootic shelf does not extend very far forward. This problem should be examined in connection with the connective tissue myodome septum as its ossification is probably of the same sort.

EDWIN CHAPIN STARKS.
STANFORD UNIVERSITY,
January 19, 1905.

BOTANICAL NOTES.

LIFE HISTORY OF THE PINES.

LAST October Professor Dr. Margaret C. Ferguson, of Wellesley College, published in the 'Proceedings of the Washington Academy of Sciences' (Vol. VI., pp. 1–202) an important paper entitled 'Contributions to the Knowledge of the Life History of Pinus, with Special Reference to Spermogenesis, the Development of the Gametophytes and Fertiliza-

---

[*] Vrolik, 'Studien über die Verknocherung u. d. knochen des Schädels d. Teleostei,' *Niederland. Arch. f. Zool.*, Bd. I., 1873.