and half the yellow. The violet screen absorbs strongly from about 33 to 70, that is, the orange and the yellow. The sodium line at 50 is therefore absorbed by both screens. Thus in the presence of sodium the red, green and blue colors imparted to the Bunsen flame by certain elements and compounds may be readily detected by means of the screens. Certain colors transmitted by one screen are absorbed by the screens together.

The strontium and the lithium flames appear deep red through the violet screen but give no color through the blue screen. Barium and boron give a vivid green through the blue screen, and only a faint green through the violet screen. Volatile calcium salts impart a strong greenish-yellow color to the flame as seen through the blue screen, but through the violet screen the color appears a pale red. Through the combined screens the flame has a tinge of green. The color flashes out only at the moment when the salt is becoming incandescent. Potassium gives through the blue screen an intense blue-violet color; through the violet screen the outside of Bunsen flame is violet and the inside violet-red; through both screens the flame appears as through the violet screen, but less bright, and with red predominating. These colors are very characteristic. The copper chloride flame appears bright blue fringed with green through the violet screen, brilliant green through the blue screen, and a paler green through both screens. The flame color of phosphoric acid is green through the blue screen, light rose color (violet-red) through the violet screen and pale green through both screens.

In getting these flame reactions from non-volatile compounds it is, of course, necessary to use some flux or acid that will produce a volatile compound of the element sought. A silicate containing potassium may be powdered, and decomposed in a sodium carbonate bead on a platinum wire. The resulting potassium carbonate is volatile. The phosphate minerals apatite, lazulite and wavellite give the phosphoric acid reaction readily if powdered, taken up on a moistened loop of platinum wire, heated and then treated with concentrated sulphuric acid and again heated. The reaction is transient.

A screen 3×5 inches consisting of three colored strips, one blue, one violet and one blue over violet, suitable for general laboratory use, has been made for the writer by Mr. G. M. Flint, Cambridge, Mass., price 20 cents.

Such a screen is conveniently handled and is so delicate a means of identifying the elements usually sought by means of the spectroscope that its use greatly facilitates the work of laboratory instruction in qualitative analysis and mineralogy.

In case lithium light free from sodium light is wanted for use in optical mineralogy the violet screen is a very serviceable filter.

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The Scombroid Fishes

In a recent paper "On the Anatomy and Classification of the Scombroid Fishes"[1] C. Tate Regan proposes to remove the family Carangidæ (with other families of more or less possible scombroid affinities) from its time-honored position among the scombroid fishes, and place it among the percoids.

This comes somewhat as a shock to many ichthyologists, who, while having doubts as to many of the so-called scombroids, have believed the family Carangidæ to be unquestionably a scombroid family. Mr. Regan writes of the family Carangidæ as follows:

> The more generalized members of this family (*Seriola*, *Naucrates*) have the anatomical characters of the Serranidæ, there being nothing in the structure of the cranium, vertebral column or pectoral arch to differentiate them from the latter, whilst genera like *Scombrops* and *Pomatomus* (*Temnodon*) connect the two families. In the Carangidæ the caudal peduncle is more slender, the caudal fin more widely forked, and the hypural embraced to a greater extent by the bases of the caudal finrays than in the Serranidæ, but the close relationship of the two families is evident.

[1] *Ann. and Mag. Nat. Hist.*, Ser. 8, Vol. III., January, 1909.

In the evident close relationship of the family Carangidæ to the percoid fishes the present writer wholly agrees. In working over the osteology of the scombroid fishes, he has found no character as yet by which these can be sharply and entirely separated from the percoid fishes.

This, however, is nothing new. It is well known that the carangoids merge more or less completely with the percoids, and so involve the rest of the scombroids. But it does not appear from Mr. Regan's paper why the other scombroids should not follow the family Carangidæ into the group of percoid fishes. His definition of the scombroids does not show characters to exclude the family Carangidæ. The following is his diagnosis of the suborder Scomberoidei as it stands with the carangoids left out:

> Air-bladder without open duct. Maxillaries more or less attached to non-protractile premaxillaries, which are typically produced and pointed anteriorly. Cranium with the orbito-rostral portion elongate and the postorbital portion abbreviate; parietals separated by the supraoccipital; no orbitosphenoid; basisphenoid present; prooties giving rise to an osseous roof to the myodome. Vertebral column of solid centra which are co-ossified with the arches. Pectoral arch attached to the cranium by a forked posttemporal; no mesocoracoid; pterygials more or less regularly hourglass-shaped, 4 in number, 3 of them attached to the scapula. Pelvic fins with a spine and 5 soft rays, or variously reduced, thoracic or subthoracic in position, the pelvic bones attached to the clavicles.

These characters with a few minor exceptions are characters of the percoid fishes and spiny-rayed fishes in general, including the carangoids. These exceptions are:

> Maxillaries more or less attached to non-protractile premaxillaries, which are typically produced and pointed anteriorly. Cranium with the orbito-rostral portion elongate and the postorbital portion abbreviate.

Oligoplites (family Carangidæ) has non-protractile premaxillaries, which are about as much produced and nearly as pointed as in the genus *Scomber*. Regan himself (in a footnote) finds an exception to the pointed premaxillaries in *Luvarus* (a scombroid). The character of the abbreviated postorbital portion of the cranium has many exceptions. The following are examples that are readily at hand; many more and perhaps better ones might be found. Of the family Scombridæ *Auxis, Rastrelliger* and *Scomberomorus* have the postorbital portion of the cranium scarcely abbreviate or the orbito-rostral portion elongate. Furthermore, the following carangoid and percoid fishes have these portions as much abbreviate and elongate, if not more so: *Trachurops, Gnathanodon* and *Selene* of the family Carangidæ, and *Aphareus, Orthopristis* and *Priacanthus* of different percoid families.

On the other hand, the more generalized members of the family Carangidæ have as many anatomical characters of the scombroids as of the percoids, and the well-known characters which have always appeared in connection with them (here repeated) possess enough weight to prove a closer affinity to the former than to the latter group. Scales small and cycloid; preopercle entire in the adult; caudal peduncle very slender; the caudal fin widely forked; a caudal keel and finlets sometimes present and "the hypural embraced to a greater extent by the bases of the caudal fin-rays than in the Serranidæ" (as Regan points out). Their general appearance, which should not be entirely ignored, is in favor of a closer relationship to the scombroids.

And so it appears that if the scombroids and percoids are kept apart the family Carangidæ will have to remain a member of the former group. The alternative is to consider them as one group.

The typical representatives of the scombroids and percoids are very different and they have been considered apart because they apparently form such natural groups; the scombroids centering about the family Scombridæ, and the percoids about the family Serranidæ. But the important characters that might separate them all have exceptions, and the other characters are insignificant.

Jordan and Evermann in "Fishes of North and Middle America"[2] arrange the scombroids

[2] *Bull. U. S. Nat. Mus.*, No. 47.

and percoids with the berycoids and other less important groups together under one suborder. This suborder is subdivided into "groups" so called doubtless to express a separation of convenience rather than of exactness. The following two paragraphs appear respectively under the groups Scombroidei and Percoidea.

Scombroidei.—This group of mackerel-like fishes is not capable of exact definition, its deviations from the ordinary type of spiny-rayed fishes being various and in various directions, so that no set of diagnostic characters will cover them. The group is not a suborder as the term is generally understood; it is incapable of simple definition, and in its divergence some members approach to other groups more nearly than to extreme or even to typical members of their own. The group is, however, a somewhat natural one, as by the common consent of ichthyologists its different types have always been kept near each other in the system of classification.

Percoidea.—A group of fishes of diverse habits and forms, but on the whole, representing better than any other the typical acanthopterygian fish. The group is incapable of concise definition, or, in general, of any definition at all; still, most of its members are definitely related to each other, and bear in one way or another a resemblance to the typical form, the perch, or more strictly, the sea bass of Serranidæ.

Dr. Jordan in his "Guide to the Study of Fishes" (Henry Holt & Co., New York, 1905) places the percoids and scombroids together in a suborder, excluding the other groups before associated with them, but still considering them under separate group names. This seems to be for the present the most rational treatment of the subject.

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LUMINOUS TERMITE HILLS

Many years ago, while in the Amazon region, I found that the termite hills, which are there such a conspicuous feature in many localities, are luminous at night. My first acquaintance with this phenomenon was made in the vicinity of Santarem, Brazil, upon a nocturnal walk through the forest. In the company of some natives I was following one of the narrow paths which lead to the scattered habitations. The darkness beneath the canopy of foliage was absolute and progress was only possible by the "feel" of the ground under foot. Suddenly there appeared through the foliage a luminous area composed of innumerable points of phosphorescent light which appeared to shift and fuse into each other, thus forming more brilliant patches which were constantly resolving themselves and again appearing. This light suggested the steady diffused glow of the familiar "fox fire" rather than the more brilliant display of the fire-flies, yet the slow and confused movements which seemed to pervade the whole luminous zone were strongly suggestive of insects. Upon my expression of surprise the natives replied laconically, "cupim," the native name for termite.

The luminous area was indeed one of the large termite hills which are scattered through those parts of the forest not subject to inundation. These termite hills rise from the ground in an irregular conical mass to a height of from five or six feet to perhaps ten or twelve. They are constructed of clay and are exceedingly hard. The mounds are perfectly bare of vegetation and on that account have a characteristic appearance of newness. Afterwards I frequently saw these luminous termite hills and they added in no small degree to the mystery and charm of the tropical nights. I remember one display of particular splendor, seen when visiting at a house which commanded a view over a large clearing. Numbers of termite hills were scattered over the clearing, and at night, when these all glowed and scintillated upon the black forest background, the spectacle was one never to be forgotten.

Unfortunately I took it for granted that such a conspicuous phenomenon must be well known to naturalists and so did not investigate it. Since then I have searched the available literature on termites and on luminous insects and have questioned entomologists and botanists in the vain hope of obtaining information on this subject. The phenomenon appears to have remained unknown to naturalists. The only references to it that I