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THE COLOR CHANGES OF ELASMOBRANCH FISHES

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Very little work has been done on the color changes of elasmobranch fishes. In 1921 Schaefer reported in an appendix to an extended article on the color changes in flatfishes that the skates Raja clavata and Raja batis showed on being tested no such changes. A little over a decade later Lundstrom and Bard (1932) described striking color changes in the dogfish Mustelus canis and showed that in this fish the secretions from the pituitary gland were accountable for the dark phase of this fish. The light phase of Mustelus was studied in 1933 by Parker and Porter who in a paper now in press (1934) have demonstrated that this coloration is induced by the direct action of nerves. In the course of the work on dogfishes opportunity was found to test the possibility of color changes in the common skate Raja erinacea which was available in the laboratory at that time.

Two individuals, indistinguishably dark brown, were placed one in a white-walled sea-water tank illuminated from above and the other in a similar black-walled tank. After eighteen hours the skate in the white tank was light brown and that in the black tank was dark brown. The fishes were then transferred each to the other tank. After the light skate had been in the dark tank nine hours it became decidedly dark, but the dark skate after an equal interval in the light tank remained dark. Twelve hours later, however, this fish had become very light and of a hue that could be described as pinkish white. At this stage in the tests unfortunately the mate of this light fish died.

The light fish, now extremely pale in tint, was transferred to the black tank. In two hours it had darkened considerably and in twelve hours it was again dark brown. In consequence of the need of the tanks for other experimental work, tests on this skate had to be discontinued. Enough, however, had been observed on these two fishes to justify the conclusion that Raja erinacea, like Mustelus canis, is subject to reasonably striking color changes. From this standpoint it would seem desirable to retest the European forms previously reported on by Schaefer to ascertain whether upon close examination they, too, might not show color changes.

[1] Contribution No. 37.

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ON OVERLAP

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In "Abilities of Man" Spearman[1] pictures overlap between specific abilities by overlapping areas somewhat analogous to the famous Euler circles of logic. From the testing point of view one might think of overlap as arising if questions from a test for one ability were found by accident or by intent upon a test for some other ability. The analytical resolution of a test into the general and a specific as $\mathbf{a} = r_{ag}\mathbf{g} + \sqrt{1 - r_{ag}^2}\,\mathbf{s}_a$ with the condition of non-correlation (orthogonality) imposed on $\mathbf{g}, \mathbf{s}_a, \mathbf{s}_b, \ldots$ suggests that overlap is presumably a vectorial rather than a scalar phenomenon. As, however, the condition for overlap is that the tetrads do not vanish[2] and as the tetrads taken as a group involve all the tests, it might seem that the question as to overlap or non-overlap became one involving the mutual relations of all the tests, a sort of tensorial phenomenon.

If we had in advance non-correlating tests for $\mathbf{g}, \mathbf{s}_a, \mathbf{s}_b, \ldots$ any test $\mathbf{u}$ could be written at once as[3]

$$\begin{aligned}\mathbf{u} &= \mathbf{u}.\mathbf{g}\mathbf{g} + \mathbf{u}.\mathbf{s}_a\mathbf{s}_a + \mathbf{u}.\mathbf{s}_b\mathbf{s}_b + \ldots \\ &= r_{ug}\mathbf{g} + r_{usa}\mathbf{s}_a + r_{usb}\mathbf{s}_b + \ldots,\end{aligned}$$

the components of $\mathbf{u}$ along the orthogonal vectors $\mathbf{g}, \mathbf{s}_a, \mathbf{s}_b, \ldots$ would be known and any residual component of $\mathbf{u}$ would be orthogonal to $\mathbf{g}, \mathbf{s}_a, \mathbf{s}_b, \ldots$ and dependent on further specific factors. It is, however, supposed that $\mathbf{g}, \mathbf{s}_a, \mathbf{s}_b, \ldots$ are not given in advance but are to be determined (so far as determinable) by the intercorrelation analysis of $\mathbf{a}, \mathbf{b}, \ldots$. If there be three tests the question of overlap between their specifics does not arise because three tests (given that certain inequalities are satisfied) are always resoluble into one general and three specifics.