filtration rate than has been observed might be anticipated if such were the case.

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THE EFFECTIVENESS OF VARIOUS PARTS OF THE SPECTRUM ON THE MARINE TUBIFICID WORM *Clitellio arenarius* (O. F. Müller)

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The reaction times of Clitellio have been measured for white light and four regions of the spectrum all of equal energy content. The four regions are red, 6500-7400 Å, yellow, 5600-6800 Å, green, 4500-5800 Å, and blue violet 3800-4850 Å. The mean reaction times of approximately 90 trials on 50 worms to each of the following, white, yellow, and blue-violet are identical, viz. ca. 1.05 seconds including the reaction time of the observer. This worm also responds to red, though this region of the spectrum affords a much less effective stimulus. Technical difficulties made it impossible to obtain reaction times. To green the reaction time is much shorter than to yellow or blue-violet, the mean being 0.83 seconds including the reaction time of the observer. Thus red is least effective, yellow more effective, green most effective and blue-violet less effective again. Worms which have been exposed to blue-violet for 15 minutes no longer respond to yellow. Such animals do respond to green, however, though much less vigorously than dark adapted worms. These facts are interpreted to mean that the photoreceptors of Clitellio contain but a single photosensitive pigment and that the worm, therefore, does not distinguish different wave-lengths.

DIFFERENT PIGMENTARY TYPES IN CRAGO AND THEIR HUMORAL CONTROL

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Probably no decapod crustacean has a more complex integumentary chromatophore system than does the common shrimp, Crago. In spite of the fact that this crustacean has been subject to as much investigation of its chromatophore system as perhaps any other one yet we seem to know less about it than we do of other commonly investigated forms. We believed it profitable to re-investigate the problem in the light of the discovery that the sinus gland is the source of more than one chromatophorotropic principle[1] and that the commissural ganglia of this form are the sources of another potent chromatophorotropic material.[2]

The chromatophore system of Crago differs from most other macruran chromatophore systems in possessing, among other pigments, melanin. Pigmentary colors present are black, brown, white, yellow, and red in roughly decreasing order of their abundance. From the standpoint of combinations within chromatophores and distribution over the body we have classified the pigments as follows:

Type	Pigments	Distribution
Monochromatic	Black	Form a characteristic spotted pattern over the body
Dichromatic	Black; red	Upon telson and uropods
Trichromatic	Brown; yellow red	Rather uniformly over cephalothorax and abdomen
Tetrachromatic	Black; white yellow; red	Rather uniformly over cephalothorax and abdomen

These four types include the great majority of chromatophores upon the bodies of the Crago we examined, although other odd pigment combinations were present.

Upon the basis of responses of the various pigments in eyestalkless animals to extracts of eyestalks and commissural ganglia we were able to conclude the following:

Pigment	Responses to sea-water extracts
Black (of monochromatic type)	Concentrated relatively strongly by commissural ganglion extract; concentrated relatively weakly by eyestalk extract.
Black (of dichromatic type	Concentrated strongly by eyestalk extract; dispersed strongly by commissural ganglion extract
Black (of tetrachromatic type)	Concentrated relatively weakly by commissural ganglion extract; concentrated relatively strongly by eyestalk extract
Red (of dichromatic type)	Concentrated by eyestalk extract; dispersed by commissural ganglion extract
Red (of tri- and tetrachromatic types)	Concentrated by both eyestalk and commissural ganglion extracts
Brown	Concentrated by both eyestalk and commissural ganglion extracts
Yellow	First concentrated, then dispersed following eyestalk extract injection; Concentrated by commissural ganglion extract
White	Concentrated by commissural ganglion extract; dispersed by eyestalk extract

It is readily seen from the above table that all the pigments are affected by sea-water extracts of both eyestalks and commissural ganglia. Four pigments (white, red and black of the dichromatic type, and yellow) are affected in an opposite fashion by the two and four (the remainder) are affected in the same direction by both. Of the latter the blacks are affected to different relative degrees by the two extracts.

Thus we see that, taking into consideration both color of pigment and physiological response to extracts of certain organs, there are at least eight pigmentary types in Crago.

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UPON THE PRESENCE OF MORE THAN ONE CHROMATOPHOROTROPIC SUBSTANCE IN BOTH SINUS GLANDS AND COMMISSURAL GANGLIA

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After removal of eyestalks and cautery of the stubs to prevent bleeding, Crago gradually, over an hour or so, takes on an intermediate shade and a mottled appearance. This persists for many days If now, the eyestubs are stimulated by touching them lightly with a heated cautery needle, the animals usually pass through a cycle of color change resembling that produced by an injection of sea-water extract of commissural ganglia. This latter response consists of a transitory darkening of the telson and uropods and a general blanching of the remainder of the body. Occasionally, however, a case is seen in which the whole body will darken following such eyestub stimulation. If, on the other hand, stimulation is produced electrically through use of an induction coil the percentage of animals showing the darkening reaction is greatly increased. These results suggest that Crago possess outside of the eyestalks humoral gents adequate to permit the whole gamut of change in shade of body.

Extraction of dried commissures with 100 per cent ethyl alcohol and then the alcohol insoluble residue extracted with sea-water yielded two fractions with different chromatophorotropic properties. The alcohol soluble fraction possessed a very strong body blanching action but no telson and uropod darkening activity. The alcohol insoluble fraction showed relatively less strong body blanching action but had a telson and uropod darkening action. It is not yet possible to differentiate between whether two independent principles are present, or whether a tail-darkening (perhaps also body darkening in the absence of a second antagonistic substance) is gradually converted into a more stable body blanching principle. We have some reason to suspect the latter.

Alcohol extracts of eyestalks of Crago show that the eyestalk principle, which antagonizes the activity of the "tail"-darkening commissural ganglion principle, is relatively insoluble in 100% ethyl alcohol.