son,[6] and Haggard and Greenberg,[5] *i. e.*, that the formation of methemoglobin by methylene blue and its combination with CN removes the latter from the blood stream is untenable. Furthermore, the objection of Henderson[6] that methylene blue because of methemoglobin formation cannot be used in CO poisoning is also baseless, since the catalytic action of methylene blue as a reversible oxidation-reduction dye is responsible for recovery of the animal, and not its ability to form stoichometric equivalents of methemoglobin.

7472 P

Relative Growth in the Pacific Edible Crab, Cancer magister

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Analyses of the form in various organisms have been presented in recent years by Huxley and his students. Certain related findings incidental to a study of the life-history and growth of the Pacific Edible Crab (*Cancer magister* Dana) are here given. The data include measurements of various linear dimensions (carapace length and width, length of chela, length of the first walking leg, length and width of the sixth and seventh abdominal segments in both the male and female) of 1804 crabs. The analysis has shown the relation of various sexual differences to the onset of sexual maturity and has suggested certain correlations between body proportions and the size attained by the species.

Treated by Huxley's method of plotting the logarithm of the part on the logarithm of the whole[1] (here usually the carapace width) in most cases one or more straight lines are obtained. The slopes of these lines are the values of k, the differential growth ratio. The nature of this constant may be seen from the following formula. If the plot may be fitted by a straight line the equation of this will be

$$\log p = \log a + k \log w$$

where p represents the part considered, w the whole, here the carapace width, and a and k are constants. Transforming, this becomes

$$p = aw^k$$

The values obtained in *Cancer magister* range from 0.93 to 1.61.

[1] Huxley, Julian, Problems of relative growth, 1932.

These do not differ greatly from unity, representing isogony or growth with constant form; they should be contrasted with the values found by Shaw[2] and Huxley in *Inachus, Carcinus* and *Pachygrapsus* which range between 0.32 and 3.15.

The differences between the sexes in the edible crab are of 2 kinds. Differences in the primary sexual organs and in certain of the secondary sexual characters are present in the earliest post-larval stages. With the onset of sexual maturity other secondary characters change in one or the other sex producing differences, or differences already present may become accentuated.

An analysis of the relation of carapace length to carapace width may serve to illustrate the second type of change occurring with sexual maturity. Through most of the size-range the males and females do not differ significantly, the plot giving a k of 0.94 indicating that in both the male and female the growth in length is proceeding rather less rapidly than the width. At a width of 10 cm., however, the points representing the females begin to differ significantly from those for the males which continue with the slope mentioned above. The females now show a length greater in proportion to the width. This changed relation is very definite and in records of moulting may permit the crab to be identified as mature while the shell just quitted is clearly immature in proportions.

This evidence is corroborated, for example, by the growth in width and length of the 7th abdominal segment in females and by the difference in growth ratios between the 6th abdominal segments in males and females at this size. Independent evidence from mating and the measurement of ovigerous females indicates that these changes in form correspond to the attainment of sexual maturity.

It is a striking fact that this species, which is one of the largest of the true crabs and so numerous as to support an extensive commercial fishery from San Francisco to central Alaska, should be characterized by low degrees of heterogony or change of form with growth. Of the crustaceans studied as exhibiting marked heterogony nearly all are of small size. We may cite the fiddler crab *Uca* in which the growth of the claw shows a k of 1.6 (Huxley) and *Inachus* 2.6 (Shaw).

Huxley has pointed out the consequences of the increase of size in a form such as *Uca pugnax* should the chelae continue at the same ratio (about 1.6). With an increase from 3.6 to 24 gm., which is still a relatively small size for a crab, the claw would come to equal all the rest of the body.

[2] Shaw, M. E., *Brit. J. Exp. Biol.*, 1928, **6**, 145.

The study of *Cancer magister* furnishes the opposite side of the picture, a species eminently successful as indicated by numbers and of large size (reaching a maximum of about 8½ inches and 3 lb.) in which form changes relatively slightly and slowly. That a high negative correlation exists between the degree of heterogony and the final size in a species will be clear to anyone examining an extensive collection of crustacea. Unusual and bizarre form can only result from markedly heterogonic growth and such species are almost invariably small. We have no data justifying speculation on the causal relation involved.

7473 C

Experimental Production of "Cretinism" by Thyro-Cytotoxin.

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This work* was undertaken to ascertain if a condition simulating cretinism might be obtained by the injection of a "thyro-cytotoxic" serum into young rabbits. We were stimulated to make such a study in view of the work of Hektoen and Schulhof,[1] who were able to prepare an "antithyroglobulin", and of Portis,[2] Yates,[3] and MacCallum,[4] who studied the histology of the thyroid after injecting "thyrocytotoxic" sera.

The antigen was prepared as follows: Healthy adult rabbits were anesthetized and bled. The thyroid was then perfused *via* the carotids with normal saline solution, the thyroid being gently massaged occasionally, until the perfusate returned clear. The total time of perfusion was about 45 minutes. The thyroid was then removed, minced and ground in a mortar with prepared sand and normal saline. The suspension was permitted to stand overnight, after

* This work was started by Dr. Paul H. Kanai (who had collaborated in a previous study with Doctors Hektoen and Dragstedt[5] and whose untimely death ended his work on an attempt to produce cretinism *in utero* by thyro-cytotoxic serum. He was successful only in showing by the precipitin reaction that the antiserum passed through the placenta of rabbits).

1 Hektoen and Schulhof, *J. Am. Med. Assn.*, 1923, **80**, 386.

2 Portis, *J. Inf. Dis.*, 1904, **1**, 127.

3 Yates, *Univ. Penn. Med. Bull.*, 1903, **16**, 195.

4 MacCallum, *Med. News*, 1903, **83**, 820.

5 Hektoen, Kanai, and Dragstedt, *J. Am. Med. Assn.*, 1925, **84**, 114.