of separate thymic lobes) were performed in Peking bred ducklings within 36 h of hatching. Test skin grafting was carried out at the age of 25–35 days. The peripheral blood picture was made at intervals given in the Table. Differential cell count was made from 150–200 white blood cells classified as polymorphs, monocytes, small and large lymphocytes. The Table gives the average percentage of small and large lymphocytes from the total of white cells scored. The Student's *t*-test was used for the statistical evaluation of the results. All the ducks were killed at the age of 80 days, checked for possible remnants of the removed organs, and their weight, as well as that of their spleen, was recorded and expressed relatively to the body weight. The Table shows that the extirpation of the bursa of *Fabricius* and thymus led to a transient lowering only of the level of the small lymphocytes in the peripheral blood; in all the three experimental groups the survival of skin homografts from donors belonging to the same population falls into the range characteristic for non-treated controls, showing no effects of the removal of these organs. No higher mortality or reduction of the spleen or body weight in comparison with control birds was observed.

These results seem to be in contrast to those of SZENBERG, WARNER and BURNET[9,10] who found that complete atrophy of the thymic cortex (which was produced in some chickens by their being treated as 12-day-old embryos with testosterone) caused skin homografts to be retained by such birds for prolonged periods, in each case until their death occurring at the latest 24 days after grafting. With regard to the fact that our surgically thymectomized ducks appear fully competent to mount a normal homograft reaction, we feel that the reasons for this difference should be considered. The hormonal treatment of chicken embryos strongly impaired the viability of the hatched birds; even though the histology of their grafts revealed a slight cellular infiltration, the birds were dying with homografts in place. May not this failure differ only quantitatively from the normally rapid homograft rejection in chickens submitted to a similar hormonal treatment which, however, resulted in the atrophy of the bursa only leaving the thymic cortex intact? The more severely affected chickens may not represent quite a suitable system for using the homograft reaction as a measure of their immune capacity for fatal runt syndrome is a more generalized condition which might influence the rate of this reaction even indirectly.

The surgical bursectomy and thymectomy appears to be of some advantage, although a complete removal cannot always be granted (see Table); as, however, the organs cannot be removed in this way until after hatching, the factor of time, when the effect may set in, is to be taken into account. The fact that in different animal species, or even different lines of the same species[11–14], the effect of the neonatal thymectomy considerably differs, might be in agreement with the BURNET's view[15] that the functional development (or maybe capacity) of the thymus within the perinatal period may vary. However, our finding of a normal capacity to reject homografts, as demonstrated in ducks surgically thymectomized at hatching, is not in accord with the BURNET's expectation that such capacity should be lost in similarly treated chickens. As the development of the homograft-rejecting capacity in newly hatched normal chickens is known to be on the average even more advanced than in ducklings, an inhibiting effect of the surgical thymectomy can hardly be expected in the former. We intend, therefore, to follow the effect of removing thymus and/or bursa of *Fabricius* in nidicolous birds which are at a lower stage of their individual development at hatching; should the developmental stage of their immune systems be correspondingly low, pigeons might, for example, be a favourable experimental subject of choice.

Zusammenfassung. Der Einfluss der Exstirpation von Bursa fabr. und Thymus junger Enten wurde zur Erklärung der Bedeutung dieser Organe für die Entwicklung der immunologischen Reaktivität untersucht.

MARTA VOJTÍŠKOVÁ and MARCELA MASNEROVÁ

Institute of Experimental Biology and Genetics, Czechoslovak Academy of Sciences, Prague (Czechoslovakia), April 1, 1963.

[11] B. D. JANKOVIĆ, B. H. WAKSMAN, and B. G. ARNASON, J. exp. Med. *116*, 159 (1962).
[12] B. G. ARNASON, B. D. JANKOVIĆ, B. H. WAKSMAN, and C. WENNERSTEN, J. exp. Med. *116*, 177 (1962).
[13] R. A. GOOD, A. P. DALMASSO, C. MARTINEZ, O. K. ARCHER, J. C. PIERCE, and B. W. PAPERMASTER, J. exp. Med. *116*, 773 (1962).
[14] J. F. A. P. MILLER, Ciba Symp. Transplantation (1962), p. 384.
[15] M. F. BURNET, Brit. med. J. II, 807 (1962).

Effect of Thiourea Treatment on Temperature Selection and Swimming Behaviour in *Phoxinus phoxinus*

Groups of *Phoxinus phoxinus* were immersed in thiourea (0.5 g/l) or aerated water (controls) and kept at either 20°C (± 1°C) or 12°C (average aquarium temperature, range 9–15°C) for four weeks. Temperature selection tests followed.

These tests were carried out in an aluminium tank, heated at one end and cooled at the other, containing water to a depth of 5 inches. Three perspex baffles with large central holes were placed at equal distances along the tank. This system gave a horizontal gradient of about 5°C; the range of the gradient could be adjusted and two (19–23°C and 25–30°C) were used.

Single fish were placed centrally in the tank and a period of 2 h allowed for recovery. Positions were then recorded every 30 sec for 5 min in every quarter of an hour. Observations were continued for 2 h (thus giving a total of 80 positions) or until there had been no change in position for four sets of readings. Results were expressed as a percentage of the total number of observations. Ten tests were made for each group of fish; each of the ten being carried out with a different individual. The rate of change of position also gave an indication of the irritability of the fish and this was recorded as percentage number of times in which the fish remained stationary.

In the tank a fish would remain motionless for a few seconds and then begin to move rapidly and erratically. After a variable period (always less than the 2 h allowed) the fish settled down and became either stationary or exhibited only occasional movements. Fish treated with thiourea were more sensitive to disturbance and moved in short, erratic bursts.

All fish showed the same response when tested at the lower temperatures and selected the highest temperature available; results for those acclimatized at 12°C shown in

Table I. A similar response has been demonstrated by other workers[1-3]. The higher temperatures proved lethal to the control fish acclimatized at 12°C: results of tests on 20°C acclimatized fish are shown in Table II. The controls selected the lower temperatures or, perhaps more correctly, avoided the higher temperatures. This was not shown by the thiourea treated fish.

At lower temperatures the thiourea treated fish were more mobile than the controls. An increase in temperature increased the mobility of the controls so that they became the more mobile group but did not affect the experimental group. A change in behaviour of salmon fry as a result of thiourea treatment has been shown by HOAR et al.[4].

Table I

Group \ T °C	19	20	21	22	23	% no. times stationary
C Acclimatised at 12°C	1.2	1.1	4.7	22.9	70.0	41.6
+ T Acclimatised at 12°C	4.3	17.4	18.2	29.8	30.2	32.8

Table II

Group \ T °C	25	26	27	28	29	30	% no. times stationary
C Acclimatised at 20°C	50.5	33.7	12.4	0.25	0.5	2.6	15.0
+ T Acclimatised at 20°C	38.4	6.7	16.5	20.6	3.4	14.4	38.0

Average of all records. Each figure represents the average of number of times a temperature was selected in ten tests.

The behaviour of the thiourea treated fish could be explained by a loss of temperature perception. However, experiments following BULL's[5] method have shown that these fish can still establish a conditioned reflex to a temperature increase. An alternative explanation depends on the anti-thyroid action of the drug. Thyroid changes affect behaviour in fish[4], and as thiourea augments tolerance to high temperatures[6-8] this may explain the movement of the thiourea treated fish into the higher temperatures. It is suggested that a change in thyroid activity is correlated with changes in swimming behaviour which lead to a variation in the selected temperature.

Résumé. Le traitement par le thiourée a augmenté la mobilité chez *Phoxinus phoxinus* aux basses températures, mais non aux hautes températures. Les cas témoins ont évité les hautes températures; ce qui n'était pas le cas chez les poissons soumis à l'expérience. Ces faits suggèrent une corrélation entre le nouveau comportement et la glande thyroïde.

P. Y. FORTUNE

Department of Zoology, University College of Wales, Penglais, Aberystwyth (Great Britain), December 3, 1962.

[1] J. R. BRETT, J. Fish. Res. Board Can. *9*, 265 (1952).
[2] P. DOUDOROFF, Biol. Bull. *75*, 494 (1938).
[3] E. T. GARSIDE and J. S. TAIT, Can. J. Zool. *36*, 563 (1958).
[4] W. S. HOAR, D. MACKINNON, and A. REDLICH, Can. J. Zool. *30*, 273, (1952).
[5] H. O. BULL, J. mar. biol. Assoc. *15* (N.S.), 485 (1928).
[6] N. V. EVROPEITZEVA, Dokl. Akad. Nauk., U.S.S.R. *68*, 977 (1949); Quoted in G. E. PICKFORD and J. W. ATZ, *The Physiology of the Pituitary Gland of Fishes* (New York Zoological Society, New York 1957).
[7] R. SUHRMANN, Biol. Zbl. *74*, 432 (1955).
[8] P. Y. FORTUNE, J. exp. Biol. *32*, 504 (1955).

2,2'-Dihydroxy-6,6'-dinaphthyl Disulphide (DDD) Diazo Blue B Reactive Granules in the Parathyroid Gland of the Rat and Toad

It is commonly accepted that the parathyroid gland is an endocrine organ which elaborates and releases a polypeptide hormone. Although several intracellular materials have been interpreted as secretion, or its antecedents in the parenchymal cells of the gland[1-7], attempts to demonstrate morphologically parathyroid hormone or a related substance within the cells have not been very successful. During work on chemocytological features of the rat parathyroid gland[8], I have noted the presence of 2,2'-dihydroxy-6,6'-dinaphthyl disulphide (DDD) diazo blue B reactive granules which consist of proteins with sulphydryl and disulphide groups. The granules were seen primarily in the cytoplasm of the parenchymal cells, and additionally on the outer surface of the plasma membrane and within the interstitial connective tissue space including the vascular endothelial cells (Figure 1). Such distribution pattern has led me to the consideration that the granules can pass through the plasma membrane of the parenchymal cells and may thus be associated with the secretory activity of the cells. Therefore, the object of my present work was to examine the morphology of the granules under varied conditions, in an attempt to elucidate their cytophysiological significance related to the elaboration and elimination of hormone in the parathyroid gland of rats of the Wistar strain and toads (*Bufo vulgaris japonicus*).

The method employed in the demonstration of the DDD diazo blue B reactive granules in the tissue was the

[1] G. BOBEAU, J. Anat. Physiol. *47*, 371 (1911).
[2] J. A. ROSOF, J. exp. Zool. *68*, 121 (1934).
[3] A. M. PAPPENHEIMER and S. L. WILENS, Amer. J. Path. *11*, 73 (1935).
[4] E. V. COWDRY and G. H. SCOTT, Arch. Path. *22*, 1 (1936).
[5] A. L. GRAFFLIN, Endocrinol. *26*, 857 (1940).
[6] A. L. GRAFFLIN, Endocrinol. *30*, 571 (1942).
[7] R. J. WEYMOUTH and B. L. BAKER, Anat. Rec. *119*, 519 (1954).
[8] J. HARA and K. YAMADA, Z. Zellforsch. *57*, 360 (1962).