nerve innervated the grafts, muscle activity was close to the normal pattern.
The finding that synchronous, coordinated movements can be produced in 2 adjacent hindlimbs by single but different lumbar spinal nerves without nerve-branches grown back (3 animals with deviated S10; 2 animals with deviated S9, figures 1 and 2), is of particular importance. Anatomically, these 5 cases support the conclusions of Hollyday and Mendell[4] that in *Xenopus* individual motor neuron pools are able to produce homologous response. Thus innervation of homologous muscles in normal and grafted hindlimbs is not provided by branching of motor neuron axons, a fact which is also seen in animals with branches from deviated nerves contributing to the normal hindlimb's innervation: branches from S9 caused nothing but muscle contractions in the thigh; branches from S8 lead to muscle contractions in the hip (5 cases) and visible movements (flexions) could be detected only in the hip (3 cases).
If we consider coordinated movements of normal hindlimbs, no matter which form of partial innervation by remaining lumbar nerves exists, it is surprizing that only grafts innervated by lumbar nerve S8 showed no motility at any joint. This observation, together with previous data on deviated hindlimb nerves in *Xenopus*[10], strongly supports the assumption that the innervated periphery of the grafts is unable to alter the function of the respective spinal centres[9]. The frequent occurrence of coordinated movements after S9 deviation can possibly only be understood by the assumption of selective mechanisms bringing about specific nerve-muscle connections[11]. But: 'No evidence is available on the ability of anuran (i.e. *Xenopus* and *Rana*) nerves to selectively innervate or reinnervate particular muscles' (Mendell and Hollyday[12]).

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2 Present adress: D. Kleinebeckel, Institut für normale und pathologische Physiologie, Robert-Koch-Strasse 39, D-5000 Köln 41 (Federal Republic of Germany).
3 P. Weiss, Arch. mikrosk. Anat. EntwM. *102*, 635 (1924).
4 M. Hollyday and L. Mendell, Exp. Neurol. *51*, 316 (1976).
5 D. Kleinebeckel, University of Cologne 1974 (unpublished).
6 S.R. Detwiler, Neuroembryology. An Experimental Study. Macmillan, New York 1936.
7 G. Andres, A. Bretscher, F.E. Lehmann and D. Roth, Experientia *5*, 1 (1948).
8 P.D. Nieuwkoop and J. Faber, Normal table of *Xenopus laevis*. North Holland Publ. Comp., Amsterdam 1967.
9 G. Czéh and G. Székely, Acta physiol. hung. *40*, 287 (1971).
10 D. Kleinebeckel, Wilhelm Roux Arch. *185*, 1 (1978).
11 R.F. Mark, Br. med. Bull. *30*, 122 (1974).
12 L. Mendell and M. Hollyday, in: Frog Neurobiology, p. 793. Springer, New York 1976.

Effect of pylorus ligation on gastric mucosal mast cell population in normal and adrenalectomised albino rats

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Summary. Pylorus ligation in normal albino rats acts like a stressor leading to degranulation of mast cells in gastric mucosa, thereby decreasing their number. This decrease is less pronounced when pylorus ligation is done in adrenalectomized rats. This implies that action of a stressor on gastric function involves the adrenal steroids which liberate the powerful gastric stimulant histamine from gastric mucosal mast cells.

The interrelationship between adrenal cortex, stress and gastric secretion is well-documented[1-3], however, its exact mechanism is not well-understood. Further, it has been postulated that histamine liberators release histamine from locally present mast cells[4-6].
The mucosa of rat's glandular stomach has a high mast cell population with profuse histamine content. Humoral[7] and neural influences[8] degranulate the mast cells resulting in their losing metachromasia and hence undergoing reduction in number[9].
The present experiment is planned to study the effect of stress in the form of pylorus ligation on gastric mucosal mast cell population in normal and adrenalectomized albino rats.
Materials and methods. 30 healthy albino rats of either sex, weighing between 100 and 150 g and housed in separate cages, were divided into 3 groups of 10 rats each.
Group 1 served as control. Food and water were given ad libitum for 7 days. Solids were withheld on the 8th day. The animals were sacrificed on the 9th day and their stomachs were removed for histological processing.
Group 2 formed control-Shay group. All the rats were maintained on food and water ad libitum for 7 days followed by total starvation for the next 24 h at the end of which period the rats were subjected to pylorus ligation by the method of Shay[10]. 6 h after the operation the animals were sacrificed and their stomachs were removed for histological processing.
Group 3 formed adrenalectomy-Shay group. All the 10 rats in this group were subjected to bilateral adrenalectomy by the method of Venning. They were maintained on solids and saline ad libitum for 7 days and only on saline for the next 24 h. The rats were then subjected to pylorus ligation as in group 2. 6 h later the animals were sacrificed and the stomachs were removed for histological processing.
The glandular portion of the stomach from each rat was fixed in 4% aqueous solution of basic lead acetate for 48 h. Routine histological procedures followed and 10 µm thick sections were made and stained in 1% aqueous solution of toluidine blue for 1 min. The mast cells in the mucosal layer could be readily identified by the metachromatic purple stain against bluish background. A calibrated ocular micrometer was introduced into the eye piece of the microscope and the mast cells were counted under high power objective and expressed for 1 mm^2 of the gastric mucosa.
Results. The table shows: 1. Pylorus ligation in normal rats (group 2) has resulted in a highly significant decrease ($p = 0.001$ or less) in mast cell population when compared to control rats (group 1). 2. Pylorus ligation in adrenalecto-

mized rats (group 3) has once again produced a significant decrease (p = 0.03) in mast cell population in comparison to control rats, but the decrease is less marked than in case of group 2. 3. The mast cell population in adrenalectomized Shay rats (group 3) is significantly greater (p = 0.001 or less) than in Shay rats with adrenals intact (group 2).

Discussion. Pylorus ligation in normal rats acts like a stressor leading to degranulation of mast cells in gastric mucosa, thereby decreasing their number. This decrease is less pronounced in rats devoid of adrenals. This implies that the action of stressor on gastric mucosal mast cells is mediated through adrenal glands. In light of available literature[1,11], it can be inferred that stress acts via hypothalamus and anterior pituitary on adrenal cortex which secretes glucocorticoids and the latter in turn degranulate the mast cells leading to a decrease in their number. In the absence of adrenals, the mast cell degranulation is comparatively less and hence many remain to take up the stain leading to an increase in their population. Degranulation of mast cells lead to histamine liberation and this potent secretogogue can explain stress-induced gastric hypersecretion and peptic ulceration.

Decrease even in absence of adrenals in group 3 rats, can be attributed to extra-adrenal factors involved in stress syndrome[8]. It is logical to conclude from these observations that a stressful stimulus like pylorus ligation involves the adrenal glands and the gastric mucosal mast cells, in its action on gastric secretion.

Effect of pylorus ligation on gastric mucosal mast cell population (MCP) in normal and adrenalectomized albino rats

Group (10 rats in each group)	MCP ± SE	p-value
1 Control	255 ± 7	1-2: < 0.001
2 Control-Shay	189 ± 9	1-3: 0.03
3 Adrenalectomy-Shay	233 ± 6	2-3: < 0.001

1 S.J. Gray, Am. J. dig. Dis. *6*, 355 (1961).
2 J. Vasantha Kumar, A.K. Ganguly and O.P. Bhatnagar, Indian J. Physiol. Pharmac. *21*, 50 (1977).
3 A.K. Ganguly and O.P. Bhatnagar, Can. J. Physiol. Pharmac. *51*, 748 (1973).
4 C.F. Code, Fed. Proc. *24*, 1311 (1965).
5 H. Selye, P. Jean and M. Cantin, Proc. Soc. exp. Biol. Med. *103*, 444 (1960).
6 W. Feldberg and J. Talesnik, J. Physiol., Lond. *120*, 550 (1953).
7 S.S. Sathiamoorthy, A.K. Ganguly and O.P. Bhatnagar, Experientia *32*, 1300 (1976).
8 A.K. Ganguly, S.S. Sathiamoorthy and O.P. Bhatnagar, Q. J. exp. Physiol. *63*, 89 (1978).
9 T. Rasanen, Acta path. microbiol. scand., suppl. 129 (1958).
10 H. Shay, S.A. Komarov, S. Fels, D. Meranze, M. Gruenstein and H. Siplet, Gastroenterology *5*, 43 (1945).
11 S.J. Gray and C.G. Ramsey, Recent Prog. Horm. Res. *13*, 583 (1957).

The influence of the sex-hormone testosterone on body temperature and metabolism of the male Japanese quail *(Coturnix coturnix japonica)*

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Summary. Testosterone causes a significant body temperature decrease in male quails. Oxygen consumption/g b.wt remains the same, however.

Up to now, relatively little is known about the effect of sex-hormones on the body temperature and metabolism of birds. Observations point to sex specific differences in body temperatures[1,2] as well as decrease in the metabolism of castrates[3,4]. In this experiment, we investigated the qualitative influence of the male sex hormone, testosterone, on the physiological parameters stated above.

Materials and methods. The test animals (the Japanese quail, *Coturnix coturnix japonica*) were 3-4 months old. They were kept at 20 °C when exposed to long days (15 h light:9 h dark) as also when exposed to short days (9 h light:15 h dark). At this constant temperature, oxygen consumption was measured (measuring instruments: Beckman G2 oxygen analyser, Hartmann u. Braun Uras 2T and Magnos 2T; testing time: in darkness between 16.00 h and 08.00 h). Body temperature was measured cloacally with a digital thermometer designed by Testotherm KG. 'Testoviron' and 'Testoviron-Depot' (Schering AG/Berlin) were used as testosterone-substitutes.

Results. 1. Body temperature: There are highly significant sex specific differences concerning body temperature (male: 41.8 ± 0.20 °C, female: 42.1 ± 0.15 °C). Castrated male quails (K) kept under long day conditions display a

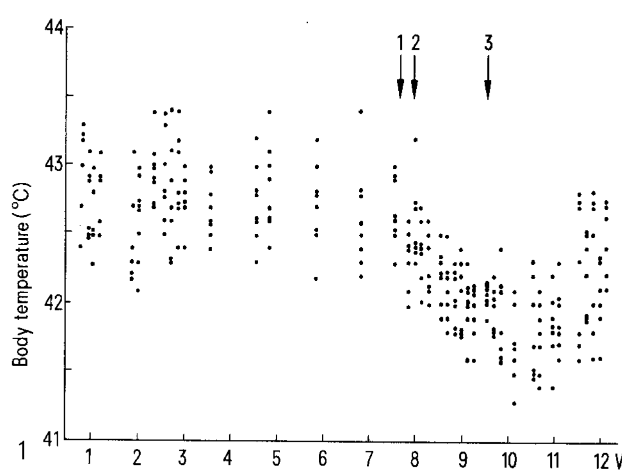

Fig. 1. Body temperature of castrated male quails before and after testosterone-substitution. The dots show single values measured (n = 8). The arrows show when Testoviron injections were given. Arrow 1: 1 mg Testoviron, arrow 2: 25 mg Testoviron-Depot and arrow 3: 12,5 mg Testoviron-Depot. The injections were given i.m. in the breast muscle.