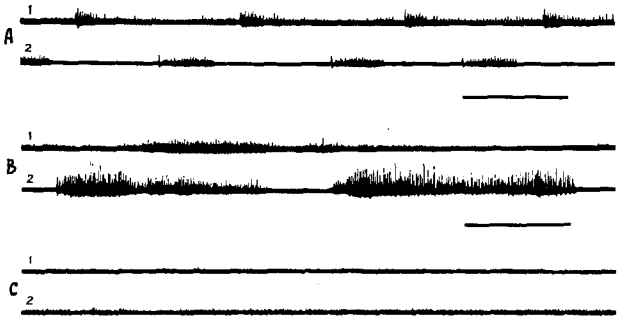
nerve (B_2) become more powerful and longer. In the same manner, discharges of the spinal ventral roots (B_1) also become more powerful and longer.

Records C were obtained during hyperventilation. In accordance with apnea evoked by hyperventilation, the inspiratory discharges of the phrenic nerve disappear (C_2). In the same manner the discharges of the spinal ventral root also disappear (C_1).



Electrical activity from a filament of the ventral root S_1 (1) and from the phrenic nerve (2). A, during normocapnia; B, during asphyxia; C, during hypocapnia.

Thus the 'locomotor discharges' of the ventral roots are always in accordance with the discharges of the respiratory centre. They become more powerful when the inspiratory discharges of the respiratory centre become more powerful and disappear when the discharges of the respiratory centre disappear. Consequently the locomotor discharges which are recorded in the ventral roots of the motionless animals are probably the result of irradiation of excitation from the respiratory centre to the spinal mechanism generating stepping movements. There is no basis for the hypothesis of a special pacemaker for stepping.

БЫВОДЫ. «Локомоторные разряды», регистрирующиеся в передних корешках спинного мозга обездвиженного флаксседилом животного, являются результатом иррадиации возбужденияа из дыхательного центра. Они не могут служить доказательством наличия спинального пейсмейкера шагания.

S. I. Frankstein, V. V. Lisin and L. N. Sergeeva

Institute of Normal and Pathological Physiology, Academy of Medical Sciences, Baltijskaya 8, Moskwa (USSR), 1 July 1974.

An Experimental Investigation into the Traversing of Ventricle by Gut in the Unionid Bivalve, *Lamellidens corrianus*

Disposition of heart in relation to alimentary canal varies in molluscs. The heart is either dorsal or ventral to the gut, or, as in the majority of lamellibranchs and rhaphidoglossans, it is penetrated to varying degrees by the hinder portion of intestine.

In the fresh-water mussel, *Lamellidens corrianus*, the ventricle of the heart is traversed all along its length by the hind-gut. An attempt has been made here to seek some physiological explanation for this structural arrangement in the mussel, by means of experiments designed as shown in the Figure.

The first type of experiments were planned with a view to establish whether bathing of gut by blood helps in the nutritional physiology of the animal by permitting a direct absorption of digested nutrient material from the gut into the blood contained within the ventricle. The gut was ligatured about $^1/_2$ cm prior to its entry into the pericardium, and 2 sets of experiments were then performed.

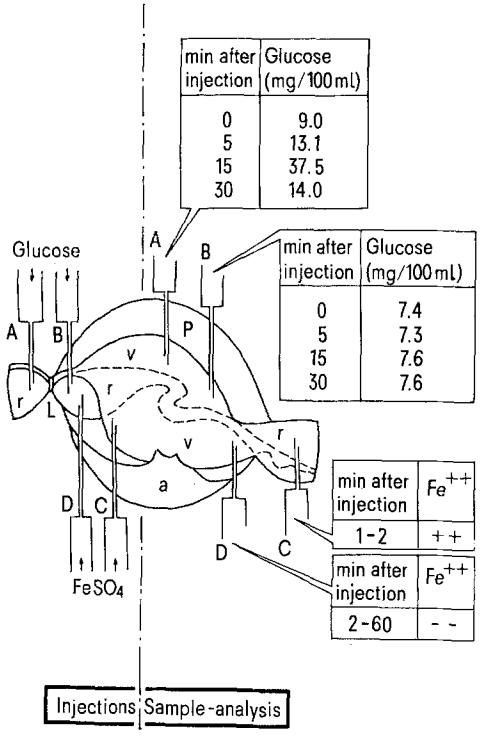
In the first set, glucose solution (20 mg/ml) was injected into the gut in the portion just anterior to the ligature; and glucose-content was estimated in samples of blood tapped from the ventricle till 30 min after glucose injection (A in the Figure). Since the ligature did not allow entry of injected glucose into the portion of gut traversing the heart, any possibility of its direct absorption from hind-gut into ventricular blood was eliminated. Any rise in blood sugar level within the ventricle would, therefore, be due to entry of glucose into ventricular blood through the usual absorption channels of the body.

In the second set, glucose was injected into the portion of gut just posterior to the ligature, and blood samples were collected and analyzed for sugar as in the first set (B in the Figure). In this case, since the injected glucose was not permitted by the ligature to enter any portion of the digestive tract except the one lodged within the heart, any glucose coming into the ventricular blood would have come not via the usual routes but by direct absorption from the hind-gut.

On comparing the 2 sets of results, it is noticed that while uptake of glucose by blood through the usual absorption channels is appreciably high, the blood sugar level rising 3–4-fold within 15 min, there is no direct absorption of nutrient from gut into blood within the ventricle, the blood sugar level remaining almost unchanged. Thus, there is no evidence that nutrition in *L. corrianus* is enhanced by any direct absorption of nutrients from the alimentary canal into the ventricular blood. Functional importance of the piercing of ventricle by gut, therefore, does not appear to lie in these quarters.

Keeping this in view, another type of experiments was planned in order to find out if lodging of alimentary tract within the ventricle permits excretion of undesirable matter directly from ventricular blood to rectal lumen. Experiments were set up as in the aforesaid cases; and saline solution was slowly pushed into the lumen of gut just posterior to the ligature till it completely replaced the rectal contents. Thereafter, about 0.05 ml of the solution filling the rectal lumen was tapped, and was found to give negative results when tested by potassium ferricyanide for ferrous ions. Two sets of experiments were then conducted.

In the first set, ferrous sulphate solution (5 mg/ml) was injected into the ventricle, and contents of rectum were frequently tapped and chemically tested for the presence of ferrous ions (C in the Figure). A significant amount of ferrous ions could be detected in the gut-content samples after a couple of min of introducing them into the ventricle. This shows that ferrous ions are transported from ventricular blood to rectal lumen.



Deliberations for establishing the physiological significance of the piercing of ventricle by gut in *L. corrianus*. Injections: 0.5–1.0 ml in both types of experiments. a, auricle; L, ligature; p, pericardium; r, hind-gut; v, ventricle.

In the other set, ferrous sulphate was introduced in the portion of gut just posterior to the ligature, and blood samples, frequently tapped from the ventricle, were tested for ferrous ions (D in the Figure). The blood samples did not show the presence of ferrous ions even after 1 h of administration of ferrous sulphate solution, thus demonstrating that ferrous ions are not transported from rectal lumen to ventricular blood.

On comparison of the 2 sets of results, it can be said that since ferrous ions could be transported only from blood to rectum and not vice versa, their transport across the rectal wall is not likely to be passive in nature. So, while no direct absorption of nutrients, like glucose, occurs from hind-gut into blood within the ventricle, there is a rapid and selectively oriented transport of harmful material, like ferrous ions, directly from blood to rectum. It is, therefore, felt that passage of hind-gut through the ventricle in *L. corrianus* has some specific role in elimination of undesirable and harmful elements, thus enhancing the excretory efficiency of the mussel. This appears to have been possible due to some oriented permeability properties of the rectal wall.

Résumé. Les résultats suggèrent que le passage de l'intestin dans le cœur de *Lamellidens corrianus* facilite le transfert des éléments peu désirables du sang directement dans l'intestin.

ARUN S. NARAIN[1] and MAHESH P. SINGH

Department of Zoology, University of Gorakhpur, Gorakhpur (U. P., India); and Department of Pathology, King George's Medical College, Lucknow (U. P., India),
18 March 1974.

[1] Suggestions from Dr. A. B. DAS, Professor of Biological Sciences, University of Sambalpur, are acknowledged with thanks.

Effect of Insulin upon Renal Amino Acid Transport in Lambs

Active transport of amino acids by several mammalian tissues appears to be regulated by hormones[1]. For instance, in the rat insulin stimulates uptake of certain neutral amino acids into the muscle cell[2]. In the rat liver, cellular uptake of amino acids seems to be enhanced by both insulin[3] and glucagon[3,4]. Since it has not yet been established whether these hormones have an effect upon renal amino acid transport, we have studied uptake of the non-metabolizable α-aminoisobutyric acid by kidney cortex slices of lambs and sheep as affected by insulin and glucagon respectively.

Methods and material. Kidneys of 11 young lambs, 1–6 days old, 5 lambs aged 9 weeks and 5 sheep, aged 2.5–4 months were used for the experiments. 3 of the lambs aged 9 weeks had been fed milk[5] all the time, whereas 2 of these animals in addition to milk[5] had been fed hay and concentrate (33.3% soybean meal, 30.8% beat bulb dried, 16.7% barley, 16.7% oats, 2.5% salt-vitamine-mixture) up to the 6th week of age. From there on milk had been withdrawn. The young lambs had been fed milk[5]. The sheep had received hay, concentrate and maize silage.

The kidneys were removed under anesthesia (i.m. 1 mg Rompun[R,6] and 2.5 mg Ketanest[R,7]/kg body weight) and put between ice cubes. Immediately thereafter kidney cortex slices, 0.3–0.5 mm thick, were made with a Stadie-Riggs microtome. Thereupon the slices were preincubated for 10 min at room temperature in a 250 ml Erlenmeyer flask containing 100 ml KREBS-HENSELEIT[8] bicarbonate puffer (pH 7.4). Then 4 slices per flask were transferred to 50 ml Erlenmeyer flasks containing 5 ml Krebs-Henseleit bicarbonate puffer with 0.065 m*M* ^{14}C-labelled α-aminoisobutyric acid (specific activity: 0.769 mCi/m*M*ol). The flasks were filled with the appropriate gaseous phase (O_2:CO_2 = 95:5) and then closed with rubber stoppers and agitated (120 oscillations/min) for 80 min at 37 °C in a Köttermann metabolic incubator. At the end of the incubation, the slices were rinsed with saline, blotted on filter paper, weighed, transferred into counting vials and solubilized with 1.5 ml sample solubilizer (Soluene[R] 350,

[1] *Biochemical Actions of Hormones* (Ed. G. LITWACK; Academic Press, New York and London 1970), vol. 1, p. 197.
[2] *Handbook of Physiology*, Section 7: *Endocrinology* (American Physiological Society, Washington, D.C. 1972), vol. 1, p. 327.
[3] J. W. CHAMBERS, R. H. GEORG and A. D. BASS, Molec. Pharmac. *1*, 66 (1965).
[4] J. K. TEWS, N. A. WOODCOCK and A. E. HARPER, J. biol. Chem. *245*, 3026 (1970).
[5] Milk-replacer for lambs, Bayerische Milchindustrie GmbH. Landshut.
[6] Bayer, Leverkusen.
[7] Parke-Davis.
[8] H. A. KREBS and K. HENSELEIT, Hoppe Seyler's Z. physiol. Chem. *210*, 33 (1932).