*Results and discussion.* The results are shown in the table. The enzyme activity was present in the haemolysates of all the species tested; it varied from 0.109 µmoles/min/g Hb in sheep red blood cells to 2.36 µmoles/min/g Hb in the mouse red blood cells. When the results are placed in the order from low to high values, the following sequence results: sheep and goat, rabbit, cat, rat, man, guinea-pig, dog and mouse. It is interesting to note that the 2 ruminant species examined have comparatively much lower enzyme activity, are known to have very low activity of glucose-6-phosphate dehydrogenase and have a basically different carbohydrate metabolism.

The role of SDH in the metabolism of human red blood cells has been studied recently[2-5]. The significance of fructose, the end product of the reaction catalyzed by SDH, is increasingly being recognized. The ability of fructose, but not of glucose, to enhance incorporation of inorganic phosphate into 2,3-diphosphoglycerate (2,3-DPG) in the presence of adenosine and inosine suggests that fructose is not being metabolized purely by the glycolytic pathway[5]. It has also been shown recently that fructose infusion has 2 opposing effects, a right shift in the oxyhaemoglobin dissociation curve due to the Bohr effect and left shift due to lowered levels of 2,3-DPG[6]. Certainly the results presented here, showing a wide variation in the activity of SDH in the red blood cells of different mammalian species, should stimulate further research to help understand the interrelationship of sugars, 2,3-DPG and oxygen transport.

1 H.G. Hers, Biochim. biophys. Acta *37*, 120 (1960).
2 A.D. Morrison, R.S. Clements, S.F. Travis, F. Oski and A.I. Winegrad, Biochem. biophys. Res. Commun. *40*, 199 (1970).
3 S.F. Travis, A.D. Morrison, R.S. Clements, A.I. Winegrad and F.A. Oski, Br. J. Haemat. *27*, 597 (1974).
4 O.C.O. Barretto and E. Beutler, J. Lab. clin. Med. *85*, 645 (1975).
5 J.D. Torrance, J. Lab. clin. Med. *82*, 489 (1973).
6 E. Standl and H.J. Kolb, Eur. J. clin. Invest. *6*, 121 (1976).

## Velocity gradient and contraction frequency of the pyeloureteral system[1]

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*Summary.* An optical detection method, using video imaging, is used to quantitatively record the frequency and velocity profile of the renal pelvis of the rabbit. It is demonstrated that concentric waves originating at the periphery of the pelvis have an initial velocity of 3.2 cm/sec, accelerating toward the pelviureteral junction reaching a final velocity of 6.4 cm/sec.

Visual observations of the exposed surface of the pyeloureteral system demonstrate[2] that upper urinary tract contraction waves originate along the perimetry of the renal pelvis. These observations are visualized as a concentric wave propagating towards the pelviureteral junction. A qualitative examination of the propagating wavefront indicates that the speed of contraction within the renal pelvis is increasing. This paper presents quantitative data demonstrating the existence of velocity gradient within the renal pelvis.

*Methods.* Kidneys were obtained from 12 female New Zealand rabbits weighing 4–6 kg. The anatomical preparation and dissecting procedures to expose the renal pelvis have been described in Gosling and Constantinou[2]. In order to maintain a stable and constant oxygenation of the preparation the renal artery was catheterized and perfused at 2 ml/min with Krebs solution using a peristaltic pump. The surface of the renal pelvis thus exposed was immersed in Krebs solution to a depth of 1 cm and secured. A video camera equipped with a telephoto lens was focussed on the surface of the renal pelvis in such a way as to visualize a complete quadrant of the field (figure 1).

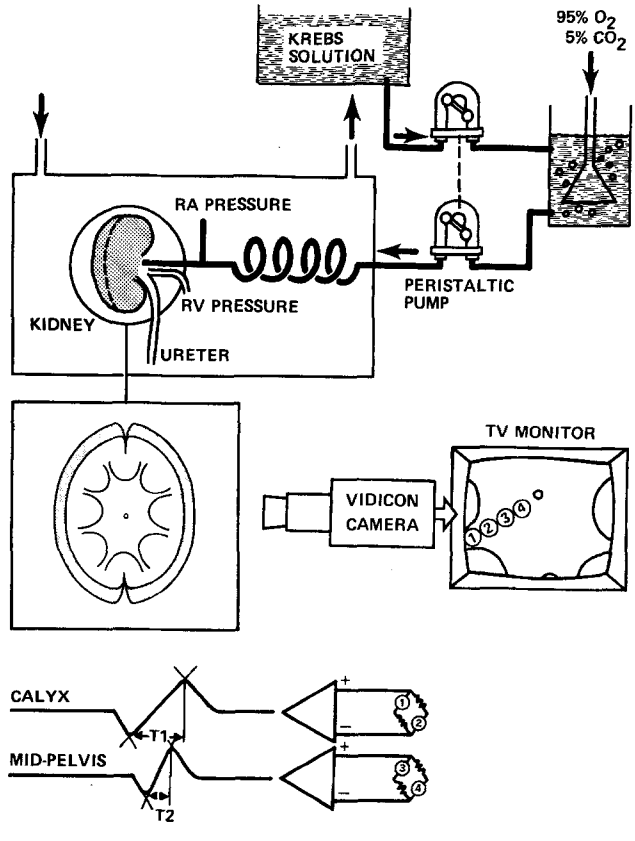


Fig. 1. System for the perfusion and optical recording of the frequency and velocity characteristics of the intrapelvic contractile characteristics. The surface of the renal pelvis is shown in the square box on the left corner. The kidney is perfused with Krebs solution and contractile waves can be visualized. The area of the pelvis is magnified using a telephoto lens and TV camera. Contraction waves can be seen on TV monitor and detected using bridge photocells 1–4. The velocity of contraction between the passage of a wave between each pair of photocells is recorded on an oscilloscope and plotted on a recorder.

The image obtained from the video camera was displayed on a TV monitor. Upon the surface of the monitor a photocell array of four cells was placed linearly to cover the entire field from infundibulum to pelviureteric orifice.

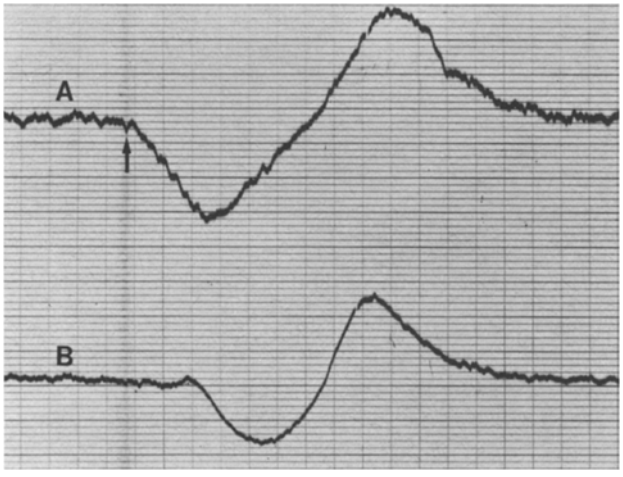


Fig. 2. Record showing the change in optical density of the pelvis as a contracting wave transverses its surface. Trace A demonstrates the photocells located at the calyceal terminus while trace B, the mid pelvis. Note that the contraction is first initiated at the A calyx, shown by the arrow. The mid pelvis responds 2.1 sec later. Note also that the total time taken to transverse the 2 top photocells is 6.8 sec while the photocells at the mid pelvis, 4.6 sec. As the 2 photocell detectors are equidistant this time difference demonstrates that the velocity of the wave accelerates within the renal pelvis.

Each pair of photocells, wired in a bridge configuration, were connected to a recorder.

*Results.* Observation of the TV monitor shows that the origin of renal pelvic contractions is located at the extreme periphery of the renal pelvis. Changes in the reflective properties of the surface of this structure due to the propagating contraction can readily be detected by the photocells. Figure 2 demonstrates a typical recording thus obtained. The first pair of photocells records the incidence and the speed of propagation of renal pelvic contractions transversing the screen at the 2 points. The incidence of pyeloureteral contraction can be computed from each biphasic ensemble obtained. The speed of propagation is derived by measuring the time taken for the peak of contraction to transverse across the 2 photocells (figure 2, A). Similarly, the same parameters are measured at the mid pelvis with the remaining 2 photocells (figure 2, B). The velocity change by the contractile wave transversing across the cells located at the calyx to mid pelvis can thus be measured. The results show the existence of a velocity gradient of $2.1 \pm 0.3$ cm/sec/cm along the renal pelvis.

*Discussion.* The use of an optical system for the measurement of the contraction frequency and velocity gradient of the pyeloureteral system has the distinct advantage of enabling the observer to record the properties of the system without interfering with the movement of the tissue. In addition, such a system can be used to record the variation between different areas of the multicalyceal system simultaneously.

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2 J.A. Gosling and C.E. Constantinou, Experientia *32*, 266 (1976).

## Tissue specific biochemical alterations prior to spinning in the eri-silkworm, *Philosamia ricini*

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*Summary.* Silkgland, fatbody, hemolymph and midgut of eri-silkworm present tissue specific turnover in their biochemical correlates in preparation for spinning of the cocoon which is followed by larval-pupal transformation.

Information about most of the biochemical alterations involved during development of holometabolous insects is based on studies made on the homogenates of whole insects[2,3]. However, recent investigations have stressed the need of tissue specific studies to explain the metabolic processes during insect development[4-6].

The functional role played by individual tissue seems to be of vital physiological significance, particularly in relation to cocoon formation[7-9]. Accordingly, the present investigation was planned to find out the changes in certain biochemical correlates in different tissues of 5th instar larvae of eri-silkworm, *Philosomia ricini,* in order to understand the possible metabolic processes involved in the preparation for the spinning of the cocoon.

*Materials and methods.* The larvae of *Philosamia ricini* were reared at $27 \pm 1$ °C. The removal of the tissues and their fractionation for total free amino acids, protein, RNA and DNA and their quantitative measurements were made according to the procedures already described by Singh and Singh[10]. All the determinations of OD were made on an 'Elico' spectro-colorimeter, and the data were expressed as per unit DNA of the tissues. But for hemolymph it was per unit volume of the bodyfluid.

*Results and discussion.* Metamorphosis in holometabolous insects is accompanied with complex physiological and biochemical processes responsible for morphogenetic activity in different tissues. Moreover, such metabolic processes are further significantly affected prior to and during the process of moulting when the 2 concurrent processes of histogenesis and histolysis proceed together. The changes observed in the level of total free amino acid, protein content, RNA and DNA in fatbody, silkgland, midgut and hemolymph of *Philosamia ricini,* prior to spinning, have been presented in the figure. Generally all the tissues mentioned above exhibit a tendency towards continuous enhancement in the levels of various biochemical components throughout the growth and development of 5th instar larvae and reach the maximum at the time when spinning of the cocoon starts. Thus there is an increased level of biosynthetic activity, presenting close interrelation between the different tissues.

Figure A presents such changes in biochemical parameters in fatbody of last instar larvae. While protein content from an initial level of 30 µg/DNA rises to about 40 µg/DNA on day 3 after, which an approximately similar level is maintained till the end of 5th instar; the RNA content of the