A tonic component in the motility of the upper urinary tract (renal pelvis-ureter)[1]

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Summary. In isolated muscle strips of porcine renal pelvis and ureter, the calcium antagonist nifedipine ($3 \cdot 10^{-7}$ moles/l) completely suppressed spontaneous phasic mechanical activity and the phasic components of an adrenaline-induced activation (P-component). In the presence of nifedipine, adrenaline induced in pelvis preparations (but not in the ureter) a tonic contraction (T-component) which was on average 61% of the control reaction (SD ± 26%; n = 35).

The motility of renal pelvis and ureter is described as a phasic-peristaltic type of movement[2–5]. Recently the differentiation between phasic and tonic contractions in the smooth muscle system was improved by the finding that some substances of the group of so-called calcium antagonistic drugs are able to suppress phasic or tonic activations selectively. This led to the concept that in smooth muscle 2 chemically different calcium activation systems exist, which have been called the P-system (mainly responsible for phasic activity) and the T-system (mainly responsible for tonic activity), respectively[6]. Using the new tool of selective P-blockade, it was found that some phasically active tissues (e.g. guinea-pig taenia coli) contain a P-system only. However, in other tissues with pronounced phasic-rhythmical activity (e.g. guinea-pig portal vein and uterus), an additional tonic type of activation (T-component) could be unmasked under P-blockade[6]. Since tonic mechanisms in the strict sense (mediated by the T-system) are mainly found in organs with a reservoir function, it appeared worthwhile to test whether such a mechanism exists in the musculature of the renal pelvis.

Material and methods. Muscle strips of 10–25 mm in situ length and a cross-sectional area of 0.3–1 mm^2 were dissected from the renal pelvis and ureter of 8 domestic pigs and from 3 rabbits. They were mounted in thermostatically controlled organ baths which were filled with modified Krebs solution, equilibrated with 95% O_2 and 5% CO_2, pH 7.4, 35 °C. Tension development was recorded using mechano-electrical transducers and a direct recorder. Up to 8 preparations, taken from various regions of the pyeloureter of the same animal, were investigated simultaneously. The following drugs were used: nifedipine (Bayer), adrenaline (Hoechst), sodium nitroprusside (Merck), papaverine (Pharm. Fabrik Hameln), tetrodotoxin (Sigma) and propranolol (Rhein-Pharma).

Results and discussion. As shown in the example of figure 1, renal pelvis preparations produced regular rhythmic activity with a frequency of 5–10/min. Cumulative application of adrenaline led to an increase of contraction frequency and to an increase in tension which appeared similar to the development of a tetanic contraction in skeletal muscle. Nifedipine ($3 \cdot 10^{-7}$ moles/l) completely inhibited the spontaneous rhythmic activity, and under these conditions adrenaline induced a purely tonic contraction which attained a maximum of 61 ± 26% (mean ± SD, n = 35) compared with the control reaction. This shows that the adrenaline reaction under normal conditions cannot be interpreted as a tetanic summation of phasic contractions; it is instead a summation of phasic contractions (P-component) and a tonic activation in the strict sense (T-component). The great variability in the magnitude of the T-component (between 20 and

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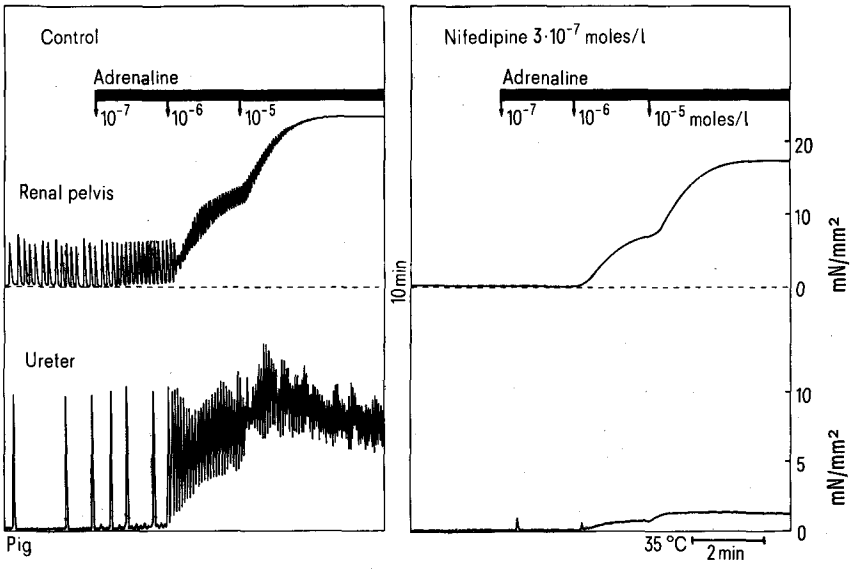

Fig. 1. Mechanical activity of isolated preparations of renal pelvis (above) and ureter (below) of a domestic pig. The effect of cumulative application of adrenaline, under normal conditions (left) and after application of nifedipine $3 \cdot 10^{-7}$ moles/l (right). Calibration in milli-Newton, mN. Pelvis preparation: 10 mm, 3.2 mg; ureter preparation: 15 mm, 4.8 mg.

100%), in the preparations which were excized from different regions of the renal pelvis, possibly indicates that the T-mechanism is particularly pronounced in special parts of the pelvic musculature. The adrenaline reactions were not significantly altered by application of tetrodotoxin ($3 \cdot 10^{-6}$ moles/l) or propranolol (10^{-5} moles/l). Isolated strips of ureteral smooth muscle exhibited very slow spontaneous phasic activity, and responded to an increasing concentration of adrenaline with a progressive increase of contraction frequency, sometimes with a fusion of the single contractions giving the appearance of an incomplete tetanic contraction (figure 1). In contrast to pelvis preparations, the adrenaline reaction of ureter was virtually completely inhibited by nifedipine.

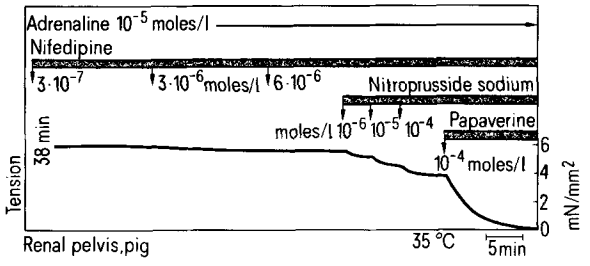

Fig. 2. Mechanical activity of an isolated muscle preparation of porcine renal pelvis, nifedipine-resistant part (T-component) of the adrenaline-induced activation. Inhibitory effects of nitroprusside sodium and papaverine. Preparation: 13 mm, 6.6 mg.

An increase of the nifedipine concentration from $3 \cdot 10^{-7}$ moles/l to $3 \cdot 10^{-6}$ or even $6 \cdot 10^{-6}$ moles/l produced only a slight additional reduction of the T-component of the adrenaline reaction in pelvis preparations (figure 2), which indicates the high specificity of nifedipine in suppressing the P-activation in this type of smooth muscle.

Nitroprusside sodium, an effective antagonist of the T-activation in some tissues[6,7], had only a partial inhibitory effect on the T-activation of porcine renal pelvis. Papaverine suppressed the T-activation completely, as also observed in other preparations[6].

In the renal pelvis and ureter preparations of 3 rabbits, such a nifedipine-resistant adrenaline reaction was not observed. Furthermore, no indication for the existence of such a tonic component was found in earlier studies in pyeloureter preparations of guinea-pig and rat[8]. This suggests that the tonic component of renal pelvis musculature may have a special functional significance in larger multipapillary kidneys. First measurements in human preparations indicate that the results obtained with porcine preparations are also qualitatively valid for man. It appears likely that disturbances of the T-mechanism may contribute to special discorders of human urodynamics, and, consequently, that a differentiated pharmacological treatment of P- and T-components may be useful in therapeutics.

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Oviposition rhythm of individual *Drosophila melanogaster*[1]

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Summary. Individually-housed *Drosophila melanogaster* show a gradual bimodal rise in egg production with a major crest shortly after dusk. The crest drifts toward noon after 2 to 3 days. The rhythm is hourglass.

Oviposition rhythm in *Drosophila melanogaster* is reported to occur at dark or dusk[2-5] as well as during midafternoon or before dusk[6]. Perhaps the method of collecting eggs influences results[6]. Several collections per day disturb the flies without providing the constant conditions necessary to study rhythms. A number of flies in one chamber may also disturb each other thus lowering egg production[7] and preventing constant conditions for each individual. An amorous male may disturb a female in her oviposition behavior when pairs are used. Consequently, it was desirable to test individual, mated females. My results are different from all other reports. I show the rhythm to be bimodal with the major crest initially at dusk. Individuals show a drifting or shifting of the peak towards noon.

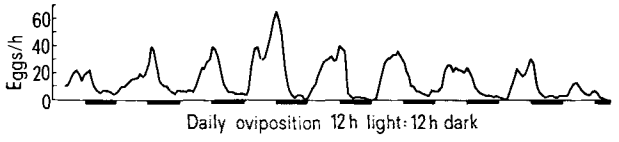

Fig. 1. A daily oviposition rhythm lasting 9 days on a 12L:12D regimen. Data from 18 surviving flies. Plot is a 3-point moving average. Note the minor peak during the dark phase.

Methods. A clock motor moves a conveyor belt at the rate of 72 cm in 24 h. A Plexiglas food tray on the belt has 25 lengthwise channels about 1 mm wide and 5 mm deep. The tray is about 15 cm wide and 84 cm long. Food is pressed into the channels. The food consists of 100 ml vinegar, 100 ml reconstituted frozen grape juice (Welch), 15 g viable dry yeast, 30+ g dried mashed potato (enough to make a paste).

In a stationary position above the tray are 25 vertical chambers made from glass tubing (ID 4 mm, OD 6 mm and 10 cm long) cemented to a metal plate. Each chamber is bisected by a channel below. There is just enough clearance to prevent escape of the individual fly and to allow protruding eggs to pass underneath the chambers. An aluminum rivet caps each tube. A ceiling of wet

1 I thank L. Cutkomp for the use of his facilities and material help during the initial stages of this study.
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