strength of the stimulus applied to the ventral root. As the stimulus was increased the inhibition appeared abruptly at approximately 0.1 V, and increased little further with further increases in stimulus strength. The threshold of α-motor fibres with the present stimulating arrangements is 50–150 mV[12] so that most if not all the inhibition was due to stimulation of α-motor fibres rather than of fusimotor fibres, which have a higher threshold. All 5 units studied with graded stimuli were inhibited by shocks around the presumed α-threshold and no definite evidence was obtained of increasing inhibition on further increasing the stimulus intensity. However, the variability of the responses was such that a slight, or variable, superadded inhibition on exciting fusimotor fibres has not been excluded. In this respect, it is interesting that ECCLES, FATT and KOKETSU[13] failed to find any additional effect on RENSHAW cells with stimuli strong enough to excite 'small motor axons'. Thus it may be concluded, in agreement with ELLAWAY, that antidromic inhibition of fusimotor neurones may occur on occasion and that it is primarily due to stimulation of α-motor fibres.

Résumé. On a enregistré des décharges de 17 fibres fusimotrices dont on suppose l'existence dans les filaments de racines ventrales des chats décérébrés. 8 fibres ont été inhibées par stimulation répétée de la portion centrale isolée du reste de la racine ventrale. Ces résultats montrent qu'il existe une inhibition antidromique dans les neurones fusimoteurs.

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University Laboratory of Physiology, Oxford (England), 8 July 1968.

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Swelling in Tissues of Nephrectomized Rats

It is known that the water content of different tissues becomes modified after the inhibition of their metabolism[1], or when disturbed by distemper or thirst[2-4], the process being partly governed by the osmotic concentration present in the cells in vivo[5]. In a previous study into the electrolyte composition of nephrectomized rats' tissues, we made some calculations on cellular osmolarity[6]. It appeared that, depending on various tissues and conditions, the cellular concentration of particles with restricted diffusibility was increased. Accordingly it may be expected that the water content of cells should increase if (1) the above-mentioned cell osmolarity has augmented (as for example in case of a higher uremic catabolism), (2) membrane permeability has not essentially altered and (3) metabolism has been inhibited. To check this suggestion we examined the swelling of muscles of nephrectomized and control rats.

Material and method. After having nephrectomized rats bilaterally, a group of them was water deprived and another group drank ad libitum. Cube sugar was offered as food. Sham-operated and untreated animals kept under similar circumstances served as controls. 2–3 days later, using ethyl ether as narcotic, rats were decapitated and both the soleus and the extensor dig. l. muscles were carefully prepared off the bones and soaked at 5 °C for different periods in Ringer's saline. In the following, an account will be given on the changes in the water content deduced from the difference of muscle weights before and after soaking.

Results and discussion. After 4.5 h soaking the weight increase of M. soleus of the nephrectomized rats was

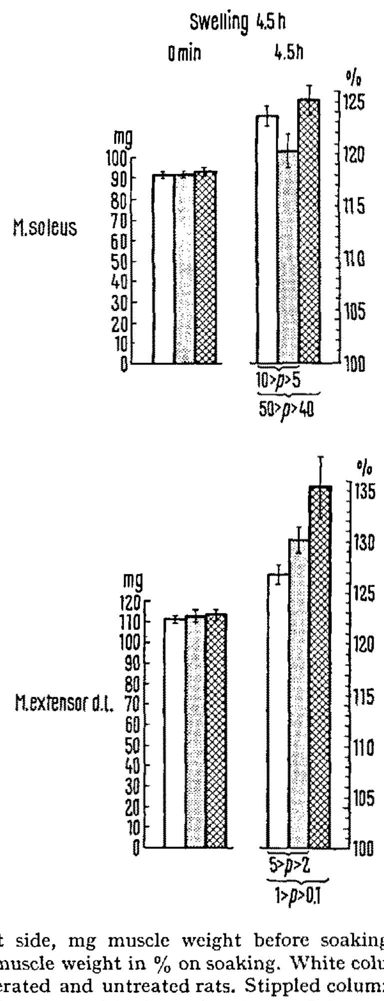

Fig. 1. Left side, mg muscle weight before soaking. Right side, changes of muscle weight in % on soaking. White columns: Muscles of sham-operated and untreated rats. Stippled columns: Muscles of nephrectomized rats drinking ad libitum. Columns with oblique squares: Muscles of thirsting nephrectomized rats.

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			4.5 h			80 min	
			In vivo		In vitro	In vivo	In vitro
			Water supply	Serum-NPN mg%	Muscle weight mg after swelling/ 100 mg of muscle weight before swelling	Serum-NPN mg%	Muscle weight mg after swelling/ 100 mg of muscle weight before swelling
M. soleus	Normal and sham-operated		a	46.5 ± 1.2	123.8 ± 1.1 (27) A	44.7 ± 1.5	113.4 ± 0.8 (34) a
	Nephr-ex		b	219.0 ± 12.2	120.4 ± 1.7 (14) B	237.7 ± 9.2	116.2 ± 1.2 (18) b
			c	286.3 ± 16.0	125.2 ± 1.5 (13) C	330.1 ± 13.7	114.1 ± 0.7 (18) c
M. extensor dig. l.	Normal and sham-operated		a	46.5 ± 1.2	126.7 ± 1.0 (20) D	44.7 ± 1.5	110.4 ± 0.7 (34) d
	Nephr-ex		b	219.0 ± 12.2	130.1 ± 1.2 (14) E	237.7 ± 9.2	114.1 ± 1.0 (18) e
			c	286.3 ± 16.0	135.3 ± 3.0 (13) F	330.1 ± 13.7	113.1 ± 0.6 (18) f

Mean ± S.E. of the mean. No. of cases in parentheses. A–B, $10 > p > 5$; A–C, $50 > p > 40$; D–E, $5 > p > 2$; D–F, $1 > p > 0.1$; a–b, $5 > p > 2$; a–c, $60 > p > 50$; d–e, $1 > p > 0.1$; d–f, $2 > p > 1$. [a] Drinking ad libitum and thirsting combined, [b] drinking ad libitum, [c] thirsting.

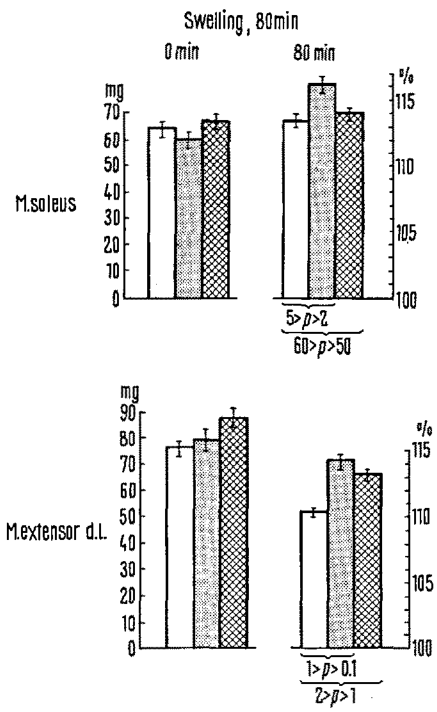

Fig. 2. Left side, mg muscle weight before soaking. Right side, changes of muscle weight in % on soaking. For explanation see Figure 1.

similar to that of the controls; the weight gain of the extensor muscles, however, was considerably larger especially in the case of the thirsting anuric animals (Table and Figure 1).

In the present experimental uremia there is little likelihood that membrane permeability would change so as to allow only a smaller passive electrolyte transport. As water diffuses freely through biological membranes[7] it is suggested that more osmotically active particles were present during an inhibition of metabolism in the extensor muscles of anuric rats than in those of their controls, causing a bigger transfer of water, while in the case of M. soleus these particles diffused out during soaking – though they could have been there in vivo – and therefore displayed no osmotic effect.

In another series the same muscles of anuric and control animals were soaked for only 80 min in cold saline. Combined muscle data of thirsting and water-supplied rats were grouped according to the degree of uremia and compared with those of the controls (Table and Figure 2). It can be seen that after 80 min soaking, in the case of a fairly grave uremia water uptake of both muscles exceeded that of the controls, in grave conditions, however, only that of the extensor muscles.

Thus it looks as if permeability concerning osmols with restricted diffusibility of the diseased rats' M. extensor was more or less preserved at both moments, while that of the soleus muscle was earlier impaired on account of the inhibition of metabolism.

In this instance we can also see that permeability of muscles will increase while uremia grows worse (higher levels of serum NPN): a significant part of osmols with restricted diffusibility must have got out into the medium, since water uptake by the soleus muscles did not differ from that of the controls, and in the case of the M. extensor it was also smaller than in a less severe anuria, though it did exceed that of the controls. A part of such osmols is neither Na nor K and may probably belong to the decomposition products with higher molecular weight deriving from the uremic breakdown of metabolism[6,8].

Zusammenfassung. M. soleus und M. extensor dig. l. nephrektomierter Ratten nehmen Wasser aus einer kalten Ringer-Lösung auf. In 80 min übersteigt die Schwellung bei beiden Muskeln, in $4^1/_2$ h nur bei M. extensor die der Kontrollen. Die Permeabilität der erforschten Muskeln war in einer mittelschweren Urämie verhältnissmässig beibehalten, in schwerem Zustand aber geschädigt.

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[8] The skilful assistance of Miss E. GRÁSZ and Mrs. A. RÁLISCH was highly appreciated.