shows that only for females were there any significant changes of rise angles, with a lower rise angle in June compared with both December and March. Finally, from Figure 4 it can be seen that there are no significant differences between sexes, or between months, for evening fall angles. Analysis of the sleep diaries produced no intra-subject monthly changes in sleeping times.

Discussion. The peak time change from December to June, being similar in size and direction to the clock change from GMT to BST, may have been due to the clock change between these months. However, the significantly later peak time from December to March, in the males, was within GMT; furthermore, there were no significant peak changes from March to June, across the clock change. In a small pilot study, 2 subjects monitored their temperatures during the GMT to BST change. Although both subjects had peak times in accordance with GMT on the first day of BST, within 2 further days the peak times had reverted to the same time on BST as for GMT previously. Thus it appears that the peak time changes from December to March/June are due to factors other than the clock change. It was found that the times of meals and sleeping in all subjects were remarkably constant against both GMT and BST scales.

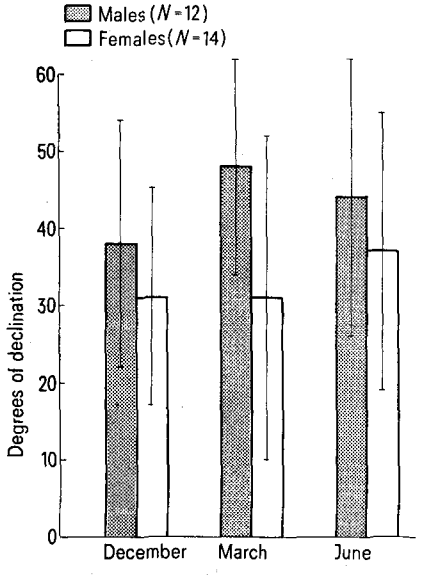

Fig. 4. Means and standard deviations of temperature fall angles (from peak time to 23.00 h).

The extent of daylight in June is 16 h/day, and for December, 8 h/day. If daylight-night time was an important Zeitgeber for the present subjects, then a larger peak time change between these months might be expected. But, artificial light was freely available to the subjects. Eskimos[5] are not so dependent upon the clock time as Europeans, and place much reliance upon the physical environment, particularly daylight and darkness, for time cues. Probably because of a dependence upon clock time, together with a way of life fairly independent of the physical environment, the present subjects may not be using daylight-night as a Zeitgeber to the same extent as Eskimos. This conclusion is supported by a laboratory study[6] where light and dark were systematically varied, however, subjects showed no substantial changes in circadian rhythms, and it was proposed that social Zeitgebers were sufficient to entrain circadian rhythms.

Summary. The circadian change of oral temperature in 26 subjects was compiled for December, March and June. Average peak time delays up to 70 min, and a reduced daytime temperature rise were found in June compared with December.

J. A. HORNE and I. COYNE

Department of Human Sciences,
Loughborough University of Technology,
Loughborough (Leicestershire LE 11 3 TU, England),
23 May 1975.

[6] J. ASCHOFF, M. FATRANSKA, H. GIEDKE, P. DOERR, D. STAMM and H. WISSER, Science *171*, 213 (1971).

Acute Effect of Hypophysectomy on the Natriuresis Following Saline Infusion in Dogs

It has been shown that after hypophysectomy the homeostatic ability to increase renal excretion of sodium following extracellular fluid volume expansion with isotonic saline in rats[1–3] is impaired. A similar effect was seen in the present experiments on anaesthetized dogs, suggesting that the former finding is not restricted to the rat. Thus, the role of the pituitary in the mechanism of the extracellular fluid volume regulation seems to be confirmed in another species.

Material and methods. 17 dogs of either sex (body wt. 7.5–15.0 kg) were anaesthetized by sodium pentobarbital, 25 mg kg^{-1} body wt. i.v. Both femoral arteries, a femoral vein and the ureters (approached by a suprapubic incision) were cannulated. Subsequently, hypophysectomy was performed by buccal route in 8 dogs, whereas only the appropriate incisions were made in a group of 9 sham operated animals. After completion of surgery, ^{51}Cr-EDTA infusion in isotonic saline was started to measure glomerular filtration rate and following a 20 min equilibration period 2 urine samples of 30 min each were taken. Then approximately 2 h after hypophysectomy, or sham operation, extracellular fluid volume was expanded with 0.9% saline at a rate of 0.5% of the body wt. per min. During two 10 min periods a total amount of 10% of the body wt. was infused. The expansion was followed by another 5 urine samples taken at 10 min intervals. Arterial blood samples were withdrawn at the beginning and at the end of the clearance periods.

The completeness of hypophysectomy was verified at autopsy.

Blood pressure was measured in a femoral artery by a damped mercury manometer, sodium concentration in urine and blood samples was determined by flame photometry, and ^{51}Cr activity of the samples was counted in a Nuclear Chicago gamma spectrometer. The experimental data were calculated for 100 g of kidney weight. Differences

[1] B. LICHARDUS and J. PONEC, Experientia *28*, 1443 (1972).
[2] B. LICHARDUS and J. PONEC, Endokrinologie *61*, 403 (1973).
[3] B. LICHARDUS, J. PONEC and I. ALBRECHT, in *Endocrinology*, Proc. 4th int. Congr. Endocrinol. Washington D.C. 1972. (Ed. R. O. Scow; Excerpta Medica, American Elsevier 1973), p. 729.

Effect of extracellular fluid volume expansion with isotonic saline in 9 sham operated and 8 acutely hypophysectomized dogs on arterial blood pressure (BP), urine output (V), urinary sodium concentration (U_{Na}) and excretion ($U_{Na}V$) and on glomerular filtration rate (GFR)

Period	Time (min)	I Non-hypox ($n = 9$)		II Hypox ($n = 8$)		P
BP (torr)						
1	0– 30	126.67 ±	2.50	113.13 ±	5.97	< 0.05
2	30– 60	123.89 ±	2.86	111.88 ±	7.13	ns
3	60– 70	127.22 ±	4.57	114.38 ±	7.82	ns
4	70– 80	126.11 ±	4.70	113.75 ±	8.22	ns
5	80– 90	121.67 ±	3.23	110.37 ±	9.15	ns
6	90–100	116.67 ±	3.54	112.86 ±	7.06	ns
7	100–110	115.56 ±	4.03	110.00 ±	7.94	ns
8	110–120	112.78 ±	4.09	105.71 ±	9.54	ns
9	120–130	113.57 ±	6.05	96.67 ±	8.63	ns
V (ml min^{-1})						
1	0– 30	0.25 ±	0.06	0.27 ±	0.07	ns
2	30– 60	0.31 ±	0.12	0.34 ±	0.10	ns
3	60– 70	3.81 ±	0.80	2.69 ±	0.46	ns
4	70– 80	11.34 ±	1.75	8.34 ±	1.76	ns
5	80– 90	14.23 ±	1.39	11.03 ±	1.92	ns
6	90–100	12.25 ±	1.33	9.32 ±	1.18	ns
7	100–110	8.92 ±	1.18	7.45 ±	1.01	ns
8	110–120	6.87 ±	0.84	6.22 ±	0.72	ns
9	120–130	4.99 ±	0.90	5.53 ±	0.79	ns
U_{Na} (mval l^{-1})						
1	0– 30	96.33 ±	29.65	18.00 ±	5.05	< 0.05
2	30– 60	100.78 ±	42.86	17.75 ±	5.90	ns
3	60– 70	133.00 ±	12.54	54.12 ±	14.55	< 0.01
4	70– 80	129.00 ±	7.07	69.00 ±	9.62	< 0.001
5	80– 90	109.89 ±	7.09	64.00 ±	8.49	< 0.001
6	90–100	107.89 ±	10.95	50.14 ±	9.49	< 0.01
7	100–110	108.78 ±	10.99	37.14 ±	8.97	< 0.001
8	110–120	115.67 ±	12.90	30.71 ±	7.01	< 0.05
9	120–130	111.57 ±	15.36	29.00 ±	9.92	< 0.01
$U_{Na}V$ (μval min^{-1})						
1	0– 30	28.44 ±	11.49	4.31 ±	1.33	ns
2	30– 60	39.22 ±	20.37	3.36 ±	0.83	ns
3	60– 70	506.33 ±	102.48	153.00 ±	59.71	< 0.05
4	70– 80	1423.78 ±	209.35	584.00 ±	175.13	< 0.01
5	80– 90	1585.67 ±	225.64	751.25 ±	183.80	< 0.05
6	90–100	1297.67 ±	200.51	493.71 ±	112.53	< 0.01
7	100–110	940.89 ±	171.77	295.29 ±	97.98	< 0.01
8	110–120	757.78 ±	133.53	192.29 ±	49.35	< 0.01
9	120–130	496.57 ±	69.98	162.83 ±	53.23	< 0.01
GFR (ml min^{-1})						
1	0– 30	53.12 ±	7.82	44.35 ±	12.92	ns
2	30– 60	50.11 ±	8.27	37.12 ±	8.75	ns
3	60– 70	119.58 ±	17.13	116.95 ±	18.41	ns
4	70– 80	78.80 ±	11.35	55.14 ±	4.41	ns
5	80– 90	69.47 ±	5.95	53.70 ±	6.69	ns
6	90–100	65.93 ±	4.30	54.06 ±	9.06	ns
7	100–110	62.71 ±	4.24	46.61 ±	5.70	< 0.05
8	110–120	61.46 ±	5.74	43.87 ±	4.47	< 0.05
9	120–130	56.73 ±	5.85	44.32 ±	4.10	ns

All values are calculated per 100 g of the kidney weight and are expressed as means ± SE. Expansion was completed in the 3rd and 4th periods. ns, non significant.

in the corresponding clearance periods between sham operated and hypophysectomized dogs were evaluated by the Student t-test.

Results and discussion. The results are summarized in the Table. Isotonic extracellular fluid volume expansion increased urine output and sodium excretion in both experimental groups; however, the peak natriuresis in the hypophysectomized animals represented only 50% of that in the control sham operated dogs due to the lower urinary sodium concentration. This difference was not accompanied by changes in either glomerular filtration rate or in blood pressure.

It is concluded that the pituitary plays a role in the mechanism of homeostatic natriuresis resulting from isotonic extracellular fluid volume expansion. Our previous suggestion that a pituitary natriuretic hormone might be involved[1–3] has subsequently been supported by the demonstration of natriuretic activity of neurophysin[4]. On the other hand, other investigators have recently isolated a natriuretic tri-dekapeptide from the posterior pituitary[5]. The role of a pituitary natriuretic hormone seems to be to decrease sodium reabsorption in the distal nephron[6–8], whereas on the basis of free-water clearance studies, it has been established that the decrease of proximal tubular reabsorption during extracellular fluid volume expansion is not dependent on any pituitary hormone[6–8] and its nature is still to be clarified.

Summary. The natriuresis following an i.v. isotonic saline loading corresponding to 10% of body wt. was markedly decreased after acute hypophysectomy, due to lowered urinary sodium concentration, in anaesthetized dogs. A role of the pituitary in such a homeostatic natriuresis is suggested.

L. Szalay[9], P. Bencsáth, L. Takács, J. Ponec[10] and B. Lichardus[10]

2nd Department of Medicine, Semmelweis University Medical School, Szentkiralyi ut. 46, H–1088 Budapest (Hungary), and Institute of Experimental Endocrinology, Slovak Academy of Sciences, Bratislava (Czechoslovakia), 30 June 1975.

[4] A. G. Robinson, M. F. Michelis, P. C. Warms and B. B. Davis, J. clin. Endocr. Metab. *39*, 913 (1974).

[5] J. H. Cort, J. Cort, J. Nováková and J. Škopková, Eur. J. clin. Invest. *4*, 293 (1974).

[6] B. Lichardus and J. Ponec, in *Biochemical Aspects of Renal Function* (Ed. U. C. Dubach; Hans Huber Verlag, Bern, Stuttgart, Wien 1975), p. 240.

[7] B. Lichardus, J. Ponec and R. Turek, Proc. 26th int. Congr. Physiol. Sci., New Delhi 1974, abstr. No. 349.

[8] J. Ponec, B. Lichardus and R. Turek, Physiologia bohemoslov. in press (1975).

[9] This work was performed on the basis of a bilateral treaty on cooperation between the respective Institutions and was supported by the Hungarian and Slovak Academies of Sciences.

[10] Institute of Experimental Endocrinology, Slovak Academy of Sciences, Bratislava (Czechoslovakia).

Circadian Rhythm of Bile Secretion in the Rat

Variations in bile flow during the day have been observed in man[1]. Moreover it is well established that, in the rat, body weight, liver weight, nucleic acids and protein contents, liver microsomal enzyme activity, oxygen consumption and mitochondrial activity, various enzyme activities (enzymes of amino-acid degradation, glycogenesis, carbohydrate and glycogen metabolism) follow a

[1] T. C. Northfield and A. F. Hofmann, Lancet *1*, 747 (1973).