Table 1. CONCENTRATION OF CORTISOL IN PLASMA (ng/ml.) AND TISSUE (ng/g) OBTAINED BY NEEDLE BIOPSIES IN THE GLUTEAL REGION OF PATIENTS

	Females		Males	
Age in years	Plasma	Tissue	Plasma	Tissue
22–36	123·1 (8) 85–225	81·3 (8) 31–180	129·4 (8) 69–221	59·1 (8) 40–72
52–66	102·8 (9) 71–169	56·9 (10) 26–101	137·6 (11) 65–254	76·8 (11) 0–159
22–36 and 52–66	112·4 ± 10·4 (17)	67·7 ± 9·2 (18)	134·2 ± 12·6 (19)	69·4 ± 7·3 (19)
37–51	117·5 ± 13·8 (12)	37·8 ± 10·4 (12)	140·5 ± 15·7 (13)	53·4 ± 10·6 (13)
P	> 0·7	< 0·05	> 0·7	> 0·2

In the upper part of the table are given mean values and range, in the lower part mean ± standard error of the mean. Figures in parentheses indicate number of experiments.

therapy were excluded from this study. The results are presented in Table 1. The average concentration of plasma cortisol showed no significant variation with age or sex, but individual variations were considerable. These data are in agreement with the results of other investigators. In contrast, the tissue concentrations of cortisol show a marked decrease in females aged 37–51, that is, the menopausal years. Only a few patients in this group had "normal" or high tissue concentration of cortisol. There was a statistically significant difference between this group and the other two groups of females ($P < 0.05$). No such difference was noted in males.

The present work offers evidence that tissue levels of cortisol are decreased in a state of presumed oestrogen deficiency. It has been known previously (for references see Plager, Schmidt and Staubitz[1]) that the exogenous administration of oestrogens and the increased oestrogenic activity of pregnancy are associated with increased plasma cortisol levels, protein bound as well as unbound. There have been no signs of hypercorticism, however, and consequently concentrations of cortisol in tissue were presumed to be within normal concentrations. As stated by Plager *et al.*[1] the theory of a relation between unbound plasma cortisol and tissue cortisol is not consistent with all observations, and the proportion of unbound to total plasma cortisol may be of greater importance, but there have been no direct investigations of concentrations of cortisol in tissue. The present observations do suggest that concentrations of cortisol in tissue are dependent on oestrogenic stimulation and this requires further investigation. The mechanism is obscure; our results, however, confirm that measurement of the total concentration of plasma cortisol does not give a correct impression of the concentration of cortisol in peripheral tissues; for example, in the connective tissue of the skin.

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JENS SCHOU
JENS JANSEN
EIGILL HVIDBERG

Department of Pharmacology,
20, Juliane Mariesvej,
and the University Hospital,
Medical Department A,
University of Copenhagen.

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PSYCHOLOGY

A Singular Lack of Incidental Learning

MORE than 200 people have been asked to recall the positions of the letters on a telephone dial, including all the staff of the Applied Psychology Research Unit (APRU), and not one has succeeded in performing the task. 151 of these people were tested formally and will accordingly be termed "subjects". The subjects were first given a sheet of paper on which were inscribed ten circles arranged in the pattern of the telephone dial and were requested to fill in the digits. Following this they were given a sheet with a further dial with the digits correctly inscribed. On this they were requested to fill in the letters. If, as many subjects claimed, they had no idea at all where the letters were, they were requested to guess, or, in the extreme, to design their own telephone dial. Finally, a recognition test was given comprising twelve dials which had either been popular responses in preliminary tests or seemed plausible. All but one of these were required to be eliminated. The subjects, mostly members of the APRU Subject Panel, were divided into two groups, the smaller group consisting of people who had recently lived in London or had employment as switchboard operators. This sub-group was supplemented by a group from Birmingham and constituted a sample of forty-five "experienced" subjects who frequently use the letters when making local or trunk calls. The "normal" group contained 106 subjects, forty-seven of whom had no telephone in their homes.

Thirty-five of the normal group (30 per cent) and five of the experienced group (11 per cent) reproduced the digits incorrectly. Twenty-two of these began with 0 in place of 1 and moved all the digits up, and eighteen put the digits clockwise, eleven with 0 in the correct place. A slightly higher proportion of those without telephones in the normal group mistook the digits.

No one succeeded in correctly recalling the letters. Partial learning was estimated by considering the following features of the letters on a dial:

(*a*) they are ordered and run anti-clockwise, largely in threes (termed hereafter "admissible"); (*b*) O goes with 0—(*O*); (*c*) 1 has no letters with it—(1); (*d*) Q goes with O (on some dials it is absent)—(*Q*); (*e*) Z is absent—(*Z*).

Seven of the experienced group (15·5 per cent) and forty-one of the normal group (38·6 per cent) did not fulfil condition (*a*) and were excluded from the further analysis. They included three subjects who wrote

① ATU; ② BSV; ③ CRW; ④ DQX; ⑤ EPY;

⑥ FOZ; ⑦ GN; ⑧ HM; ⑨ IL; ⓪ JK; which

has a pleasant if unusual pattern, and nine subjects who had the letters running clockwise but otherwise ordered. Of the remainder the number who correctly recalled the features are given in Table 1.

Table 1

	Total No. of subjects	Admissible	No. with feature correct 0	1	*Q*	*Z*	Total No. of features correct
Normal	106	65	12	4	5	10	31
Experienced	45	38	16	6	4	10	36

As expected, the experienced group produced a higher proportion of admissible dials, and had a higher proportion of the features correct.

In the recognition test two of the twelve examples were termed "correct", one with and one without the Q. Only ten of the normal group selected one of the correct responses, compared with nine of the experienced group. Neither of these figures differs significantly from chance. Half the recognition dials had no letters in the digit 1 position, but only thirty-three of the normal group selected one of these. This is significantly less than chance ($P < 0.001$). Twenty of the experienced group recognized this feature. Eight of the twelve dials had O with 0, but only forty-four of the normal group selected one of these dials compared with thirty-one of the experienced group. The normal group again performed worse than chance ($P < 0.001$). It would seem, then, that despite any residual memory the Post Office dials are not as the population would expect.

Subjects were asked to indicate their confidence in their responses to the recognition and recall tests by writing a digit from 1 for complete confidence to 5 for certainty that the response was incorrect with three intermediate categories of variable uncertainty. Sixty-three of the normal group were certain that their responses in the recall task were incorrect; no subject wrote 1. In this group only two subjects were confident they had recognized the correct dial (both unjustifiably); seventeen were certain they were incorrect. Seven of the experienced group were confident they were correct, of whom three in fact were.

One of the observations for which proponents of reinforcement theories of animal learning have difficulty in accounting is that animals appear to learn without motivation[1]. Another observation which old-fashioned behaviourists find unreasonable is that monkeys will perform complex tasks merely to be allowed to look out of a window—to satisfy their general curiosity[2]. It is thus of some considerable theoretical interest that so many people are incapable of recalling the layout of the digits of a telephone dial and that an almost negligible proportion of those tested were able to recall even individual features of the letter distribution or to recognize these features. It is clear that memory for the letters is better among those who, as a group, most frequently use them, but even this group performs badly in view of the amount of experience they must have had. For reasons of incidental learning or curiosity, better performance might have been expected. One possible explanation of these results may lie in the amount of time it takes for the dial to return to the resting position. In this time one can search for the next letter or digit and anticipation may in fact be a hindrance.

J. Morton

MRC Applied Psychology Research Unit,
15 Chaucer Road,
Cambridge.

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Monocularly Evoked Electroencephalogram Potentials : Influence of Target Structure presented to the other Eye

The average evoked electroencephalogram potentials (EP) in humans are reduced in amplitude if the flashing target is structured instead of uniformly illuminated[1]. Furthermore, if the flashing stimulus is presented to one eye, the EP is decreased when the other eye sees a steadily illuminated target instead of a dark field[2,3], or when the image moves instead of remaining stationary on the retina[2]. These effects were attributed to the increased complexity of the presentation, which absorbs more cortical capacity and leaves less to participate in the evoked response. The question arises whether the EP elicited by monocular flash stimulation is sensitive enough to reveal changes related to the target structure presented to the other eye.

A troposcope was used to present light flashes generated by a sound-shielded Grass stroboscope to the right eye at a rate of 3·6/sec. The flashes illuminated a circular diffusing area subtending 20° in the visual field. This stimulus remained constant for all viewing conditions, except that the lamp was operated at different intensities depending on the tolerance of each subject. The ancillary optics reduced the light intensity by a factor of 1,000. The other arm of the troposcope presented to the left eye a 20° circular target continuously illuminated by tungsten light. The luminance in the plane of the pupils was 0·3 mlamberts. The left and right target areas were aligned so that they appeared superposed. Four different circular targets (three only with some subjects) were used —a blank field, a central black dot, an erect cross, and an erect grid of seventeen equally spaced lines along each axis. The dot and the lines all subtended 5 min of arc. The subjects were instructed to fixate carefully the centre of the left target. The targets were presented in sequence, each for 45 sec, and an interval of 100 sec was allowed for recovery after each run; during this period the subject was responsible for changing the target. Each target was shown at least five times during one experimental session. The results were collected and processed for seven female subjects (22–28 years of age). All the results presented here were collected from one experimental session with each subject. During the session, the subject was alone in a darkened sound-attenuating room with a constant background of pseudo-white noise. The pupil of the right eye was maximally dilated and both eyes were adapted for 30 min to the low ambient level of illumination in the room.

Beginning 15 sec after the start of the repetitive light flashes, 100 amplified EP were averaged from parieto-occipital electroencephalogram leads from each hemisphere in two channels of a *CAT* computer. The averaged results were then transmitted to a digital computer for processing.

The EP averaged during bilateral stimulation can be influenced by many experimental conditions; changes of vigilance and attention on the part of the subject are important, as is the significance of the flashing target. The flash parameters can be rigidly controlled, and vigilance and attention can be maintained at a fairly constant level in co-operative subjects by complete regularity of experimental regime, shielding from extraneous influences (such as sudden noises), shortening the length of each run as much as possible, and providing the subject with an active part to play in the experiment in the rest periods between runs.

Correct subjective superposition of the two images was also found to be critical; if the two images are presented to non-corresponding retinal areas, the resulting EP is quite different from that generated when the stimulus areas are superposed (Fig. 1, *A* and *B*). Accurate fixation was

Table 1. ROOT MEAN SQUARE VALUES FOR THE AVERAGED EVOKED POTENTIALS FROM BOTH HEMISPHERES OF ALL SEVEN SUBJECTS IN THE DIFFERENT VIEWING CONDITIONS

Target	Subject 1 RMSμV	Subject 1 P	Subject 2 RMSμV	Subject 2 P	Subject 3 RMSμV	Subject 3 P	Subject 4 RMSμV	Subject 4 P	Subject 5 RMSμV	Subject 5 P	Subject 6 RMSμV	Subject 6 P	Subject 7 RMSμV	Subject 7 P
Left hemisphere														
Blank	—		—		—		3·338		0·927		2·132		3·050	
										0·02		0·06		0·02
Dot	2·808		3·567		2·552		—	(< 0·01)	0·720		1·849		2·579	
		< 0·01		0·03		< 0·01				*		0·07		0·05
Cross	2·321		3·056		1·968		2·414		0·848		1·606		2·160	
		0·10		0·20		0·20		0·05		*		< 0·01		> 0·45
Grid	2·191		2·916		1·895		2·139		0·867		1·377		2·141	
Right hemisphere														
Blank	—		—		—		2·033		2·376		2·410		2·556	
										*		< 0·01		0·09
Dot	2·292		2·200		2·950		—	(< 0·01)	2·384		1·976		2·322	
		< 0·01		0·05		< 0·01				0·02		< 0·01		0·02
Cross	1·916		1·821		2·624		1·354		2·106		1·589		1·869	
		*		*		0·41		< 0·01		< 0·01		0·05		< 0·01
Grid	1·938		1·864		2·594		1·147		1·833		1·476		1·277	

The entries under P indicate the t test significance of the decrease between neighbouring root mean square values. An asterisk marks those points where an increase occurred. The two P values in parentheses give the significance of the root mean square decrease between next neighbours. For further explanation see text.