the colliculus as to occasion a late negativity there, and a corresponding positivity at upper levels. This will explain certain records of an apparent second-phase potential greater in amplitude than the first phase. Furthermore in the rabbit, where an earlier potential is assignable to larger fibers, at a specific level deep in the colliculus the apparent second phase is replaced by a series of spikes, as occurs in Therman's[1] record from the medulla.

It is obvious that the positive spike may be affected by all activity radiating out from the central region, while the negative spike can be considered to have two components, one the potential assignable to the field in general, like the positive spike, and one assignable to the specific fibers with which the electrode is in contact. If the latter are injured, this component may be reversed in sign, and the record is the algebraic sum of the two components. A corresponding injury in the region of positive potential will, however, affect but a small fraction of the elements responsible for the positivity, with a resulting disparity of positive and negative amplitudes. The reversal may, therefore, occur at any depth, depending on the position of synapses, the degree of injury, and the geometry of the conducting system as a whole.

13005

Water and Electrolyte Metabolism in Diabetes Insipidus.

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In view of the fragmentary information concerning the salt and water metabolism in diabetes insipidus,[1] the following data on the serum protein, water, sodium, potassium and chloride and the urinary output of these elements on known intake in a case of severe but uncomplicated diabetes insipidus may be of interest. The patient was an unmarried Chinese woman of 20 with a history of the disease for 3 years. Various investigations including X-ray of the skull and blood Wassermann reaction gave no clue as to the etiology of the condition. On a regimen of full hospital diet and fluids as desired, her water intake and urine output amounted to 16 liters

[1] Therman, P. E., *J. Neurophysiol.*, 1941, **4**, 153.

[1] Talbott, J. H., Coombs, F. S., Consolazio, W. V., and Pecora, L. J., *Arch. Int. Med.*, 1940, **66**, 607.

a day and her weight was maintained at 53 kg. The metabolic results, presented in Fig. 1, may be epitomized as follows:

1. *Effect of moderate water restriction and increasing salt intake while on a "solid" diet.* From Dec. 14 to 17, a constant diet containing rice, pork, eggs, vegetables and fruits, totaling 1,300 calories, was served, together with 2 g of sodium chloride. The water intake (distilled water) was limited to 10 liters a day. There was moderately severe thirst, accompanied by a sharp drop in body weight and negative water balance. Serum dehydration was evidenced by a decrease of serum water from 91.8 to 90.5%, and an increase of serum protein from 6.22 to 7.50% on Dec. 16. Serum sodium increased from 141.4 to 151.1, and chloride from 107.9 to 111.6 m. Eq. per liter. Serum potassium remained unchanged. While the urinary sodium and chloride approximately equalled their respective intakes, there was a loss of potassium. When the same regimen was continued, these changes tended to wear off so that by Dec. 18 her control body weight was partially regained, and water balance was maintained, and evidence of hemoconcentration disappeared.

An attempt was made to increase the sodium chloride intake to 4 g per day on Dec. 18-20, but the thirst became intolerable, quantitative consumption of the diet was impossible, and vomiting occurred on several occasions. The partial starvation resulted in marked nitrogen loss and irregular electrolyte intake, but the water balance was maintained and serum composition preserved.

2. *Effect of increasing salt intake while on a liquid diet and constant water intake.* From Dec. 21, a constant liquid diet consisting of rice gruel, orange juice and cow's milk with added sugar (total calories, 1,440) was employed. The total daily fluid intake was made up to 10 liters on which the patient felt comfortable. The sodium chloride intake, starting with 2 g, was progressively increased to 8 g per day. This was well tolerated, but the body weight showed a definite decrease, although the urinary output was not excessive in comparison with the intake. The serum sodium was elevated from 138.9 to 144.5, potassium from 2.98 to 3.98, and chloride from 99.0 to 103.3 m Eq per liter as the sodium chloride intake was progressively increased. The urine sodium and chloride output exceeded their intake only when the salt allowance was 2 g, but fell short of the intake on higher levels of salt allowance. The potassium balance was negative throughout, related partly to the prevailing negative nitrogen balance and partly to a probable loss of intracellular water.

3. *Effect of pitressin.* While on the same regime of liquid

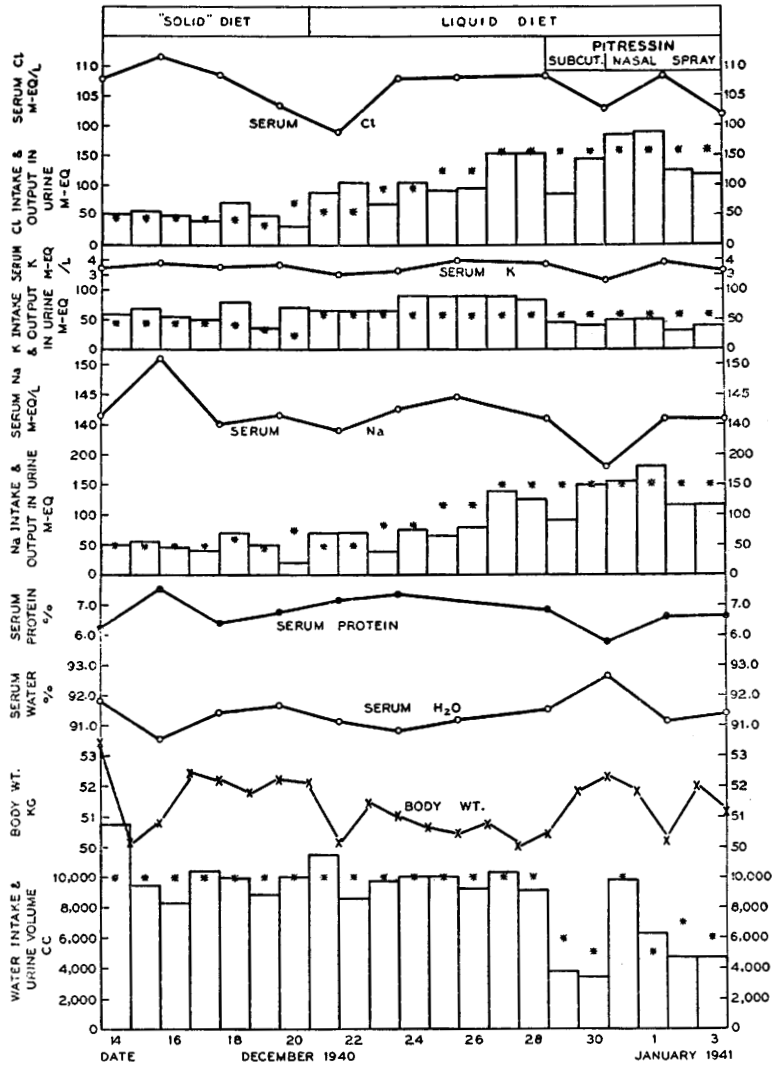

FIG. 1.

Effect of water restriction, varying levels of sodium chloride intake and pitressin on the water, sodium, potassium and chloride metabolism in diabetes insipidus. Asterisks indicate intake and columns output in urine.

diet with 10 liters of fluid and 8 g of sodium chloride, the patient was given 0.5 cc (10 pressor units) of pitressin (Parke, Davis) hypodermically every 6 hours on Dec. 29-30. Immediately the urine output was reduced to 3360-3680 cc, and the water intake voluntarily decreased to 5000-5900 cc, giving a positive water balance as well as an increment in body weight. There were un-

mistakable signs of hemodilution. Plasma volume increased from 2060 cc (Dec. 29) to 2480 cc (Dec. 31), serum water from 91.5 to 92.6%, serum protein decreased from 6.84 to 5.77%, and hematocrit from 40 to 35%. Serum sodium fell from 140.9 to 133.0 m Eq per liter. Likewise there was a fall in serum potassium and chloride. Sodium and chloride balances were positive on the first day of pitressin injections, and potassium balance was positive throughout. Nitrogen balance became less negative.

When pitressin in the same dosage was given as nasal spray on Dec. 31-Jan. 3, the result on the first day was not satisfactory because of improper administration of the drug, but the data on the subsequent 3 days indicated that the efficiency of intranasal administration was not definitely inferior to that of subcutaneous injection.

Summary. The data presented indicate that in diabetes insipidus the serum water and electrolyte concentrations are maintained normal by reason of the unlimited water exchange. Water restriction or sodium chloride ingestion tends to produce negative water balance, hemoconcentration, augmented sodium and chloride levels in the serum, and loss of potassium from the body. Such changes tend to decrease in extent with elapse of time in spite of continued water restriction and salt ingestion. Pitressin rapidly restores the water and electrolyte concentrations of the serum and probably of other body fluids to normal and this is accomplished on a much lower level of water exchange.

13006 P

Effect of Hibernation on Rate of Eruption and Dentin Apposition in the Ground Squirrel Incisor.

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No studies have been found on the relationship of hibernation to growing teeth. The purpose of this investigation was to determine the effect of hibernation on the rate of eruption and dentin apposition in the thirteen-lined ground squirrel. This animal was selected because of ready availability, ease of artificial induction of hibernation and continuous eruption and apposition of dentin of the incisor.