experimental conditions to the proximal 10% of the rat small intestine is difficult to reconcile with a physiologic role of "releasing factor" in absorption of vit. $B_{12}$ in the rat. This is so because the major site of adsorption of vit. $B_{12}$ in the rat is not the first portion but rather the middle of the small intestine(6,7, 8,9). However, "releasing factor," like intrinsic factor, might normally be secreted into the lumen of the bowel proximal to the locus of its function in promoting assimilation of intrinsic factor-bound vit. $B_{12}$. Thus, although vit. $B_{12}$ is normally absorbed in the human ileum, the defective vit. $B_{12}$ assimilation in tropical sprue and idiopathic steatorrhea(10, 11,12) may be related in part to a reduction in "releasing factor" output by the atrophic jejunal mucosa. At any rate, the species-related activity of this "releasing factor" for the rat suggests that it does play a physiologic role, as does the finding of similar species-related "releasing factor" activity in human ileal mucosa extract(2). The fish tapeworm, *Diphyllobothrium latum,* also appears to be a source of a material which will release vit. $B_{12}$ from either human or hog intrinsic factor(13, 14) presumably to the advantage of the parasite. What, if any, relation there may be between this "releasing factor" and that in rat or human small intestine is undetermined.

*Summary.* Vitamin $B_{12}$ bound to rat intrinsic factor concentrate was made dialyzable by the supernate of the homogenate of only the proximal 10% of the rat small intestine. Since the major site of absorption of vit. $B_{12}$ in the rat is the mid-ileum, the present finding throws doubt upon, but does not exclude, the possible physiologic role of such "releasing factor" in absorption of vit. $B_{12}$ by the rat.

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## Comparative Physiology of Sweat.* (27503)

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Abundant evidence is available that human sweat is hypotonic to plasma(1). The concentrations of sodium and chloride in normal human sweat usually do not exceed 60 meq/l and potassium concentrations are usually between 10 and 15 meq/l. There is little difference in the electrolyte composition of human palmar and human body eccrine sweat(2). Morphologically, the body eccrine and palmar eccrine sweat glands have similar secretory

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and duct segments although the ampullary areas show some differences(3).

Based on his findings that the concentration of sweat electrolytes rose with increasing secretory rate, Schwartz(4) postulated that the hypotonic nature of human sweat was the result of reabsorption of electrolytes in the sweat duct.

That the foot pad of the cat secretes sweat as a result of cholinergic stimuli was demonstrated by Dale and Feldberg(5). Aside from this, little is known about the physiology of these sweat glands. A review of the literature indicates that no studies of the composition of this sweat are available, as already noted by Weiner and Hellman(2).

*Methods.* The sweat of 5 adult mongrel cats (anesthetized with chloralose and urethane) was collected under a vapor barrier. The collection apparatus consisted of a chamber shaped like a half cylinder (11 mm long with a diameter of 11 mm) open at both ends into which fitted snugly a similarly shaped lucite plug. The chamber of the collection apparatus was fixed to the washed skin surface with collodion following which the filter paper§ (previously weighed in a tared vessel) was placed on the skin within the chamber. The lucite plug was then inserted into the chamber thus applying the filter paper against the skin surface. The upper end of the plug and chamber was sealed with stopcock grease.

Sweating was induced by intradermal or subcutaneous administration of 2 mg of methacholine chloride. After 30 minutes the chamber was removed and the wet paper was reweighed. This method was also applied to the human palm although no anesthesia was used. The sweat was leached in 6 ml of an aqueous solution of 0.1 N $H_2SO_4$ and .014 N $Li_2SO_4$. For analysis of human sweat, 2 ml of diluent were used. Serum samples were obtained from the cats during the time of sweat collections. Sodium, chloride, and potassium were performed as previously described in this laboratory(6) and $CO_2$ content performed by the method of Van Slyke(7).

*Results.* Table I shows the chloride concentration in 5 humans to range from 26 to 61 meq/l. Because one of the errors in determination of concentrations of electrolytes in sweat results from evaporation of water before chemical analysis, the finding in our studies of the usual hypotonic nature of human sweat suggests that our method of collection did not result in significant evaporative loss. Table I also shows the values obtained in sweat from the cat foot pad. It is apparent that this secretion is a hypertonic solution of sodium and potassium chloride and differs markedly from human palmar sweat. Serum concentrations (in meq/l) in these 6 animals were: Chloride 110-122 (mean 117); sodium 148-155 (mean 152); $CO_2$ content 16.4-22.8 (mean 20.8); and potassium 2.4-4.4 (mean 3.3).

TABLE I. Concentrations (in meq/l) of Chloride, Sodium, and Potassium in Sweat Obtained from 5 Cats and Chloride Concentrations in Sweat from 5 Humans. Human sweat sample size prevented determination of sodium and potassium.

| | Amount of sweat obtained (mg) | Concentrations (meq/l) | | |
|---|---|---|---|---|
| | | Chloride | Sodium | Potassium |
| Human 1 | 20.9 | 25.6 | | |
| " 2 | 18.4 | 60.7 | | |
| " 3 | 8.2 | 27.8 | | |
| " 4 | 18.3 | 51.0 | | |
| " 5 | 18.3 | 31.3 | | |
| Cat 1 | 14.7 | 135 | 143 | 27.8 |
| " 2 | 14.8 | 150 | 185 | 11.4 |
| " 3 | 23.8 | 146 | 181 | 21.9 |
| " 4 | 21.5 | 139 | 175 | 24.2 |
| " 5 | 11.2 | 150 | 172 | 30.6 |

*Discussion.* Munger(8) and Munger and Brusilow(9) have shown that the cat sweat gland has a shorter duct segment than the human gland. Electron microscopy indicates that this duct has fewer mitochondria. Furthermore, the secretory segment of the cat sweat gland is not coiled at the junction of the skin and subcutaneous tissue, as in the human(3), but extends somewhat tortuously deep in the subcutaneous tissue(9).

Although the actual active transport sites in sweat glands are unknown, the differences in tonicity between human sweat and cat sweat, and the evidence of a rudimentary duct in the cat glands support the suggestion that hypotonicity of human sweat is the result of reabsorption of electrolytes in a distal site, *e.g.*, the duct. The absence of such a reab-

§ Schleicher and Schuell #589 Green Ribbon.

sorptive mechanism would lead to the elaboration of fluid which is more representative of "precursor fluid" as in the case of the slightly hypertonic cat sweat.

Whether or not the morphologic differences in the secretory coil between man and cat have a functional counterpart is difficult to say. It is possible to speculate that because the human sweat duct extends into the secretory coil(3) and is, therefore, in close proximity with the most proximal elements of the glandular apparatus, some passage of electrolyte from duct to precursor fluid may take place. In the cat such a possibility would be precluded because the duct terminates just as the secretory coil appears in the subcutaneous tissue(9).

*Summary.* A method for collection of sweat under a vapor barrier from animal foot pad is presented. The average electrolyte composition of sweat from the cat foot pad was found to be (in meq/l) sodium 171, chloride 144, and potassium 23.2.

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## Renal Extraction of Monosubstituted Guanidines.* (27504)

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A reduction in the maximum capacity ($Tm_D$) of the renal tubule to secrete iodopyracet (Diodrast®), and related substances, is the earliest and most characteristic impairment of renal function in essential hypertension. It has been suggested that $Tm_D$ is the terminal step in a metabolic sequence, and that this impairment may represent deficiency of a phase of tubular metabolism antecedant to the process of excretion itself(1). The present studies were undertaken in an attempt to devise conditions under which one of the known synthetic functions of the renal tubule might also be evaluated as an index of early impairment in hypertension.

The renal arterial-venous concentration difference of glycocyamine was studied in man because the kidney in man appears to be the source of arterial glycocyamine(2). Since synthesis of glycocyamine utilizes arginine and in view of the fact that renal tissue from some species has the ability to synthesize arginine from citrulline(3) the renal extraction of arginine was also studied. Previous studies in man have however indicated negative renal extraction (output) of arginine as well as glycocyamine(2).

*Methods.* Subjects were 25 male patients with hypertensive or urologic disease (Table I) admitted to the V. A. Hospital, Richmond, Va. Twenty-two were studied in connection with the V. A. Cooperative Study of Antihypertensive Drugs(4), of whom 14 were eventually included in the study, and 10 of whom received drug therapy prior to the present studies. Patients ingested 1500 ml water during 2 hours preceding study. Right renal venous catheterization was accomplished by Seldinger's technic, with position of the catheter ascertained fluoroscopically, and verified

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