preparations were transplanted to tissue culture. In these growing transplanted cells, however, only diploid metaphase plates were observed. These methods for determining the chromosome complement of already-enlarged and virtually non-dividing cells were thus only moderately successful. The evidence of polyploid chromosomes, however, and the shift in proportion of 2n and >2n cells does suggest that the enlarged cells may have more chromosomes than the normal cells. The mechanism of the increase in chromosome number may involve non-disjunction of chromosomes but proof for this remains to be obtained.

Summary. Administration of pharmacologic doses of the sympathetic amine, isoproterenol, to adult female rats resulted in a progressive enlargement of the gland with duration of treatment. Although this enlargement is the result of hypertrophy of acinar cells as well as proliferation of these elements, marked mitotic activity was generally confined to the early days of treatment (1-5 days) whereas hypertrophy was initiated almost immediately and persisted throughout the period of isoproterenol-administration. During the early phase of marked cellular proliferation, chromosome counts from squash preparations of tissue indicated that greater-than-diploid (>2n) as well as diploid (2n) cells were present. Furthermore, the proportion of 2n to >2n changed with time in a highly suggestive way, *i.e.*, at 1-2 days, when mitotic activity was increased above normal, but low, 2n cells predominated; at 3 days, when mitotic rate was maximal, equal numbers of 2n and >2n cells were observed; and at 4-5 days, when mitotic rate dropped, the >2n cells were most evident. Culturing the hypertrophic cells (14 days of IPR treatment) produced only 2n cells. Measurements of nuclei of the enlarged cells, estimations of DNA content by visual examination, and the occurrence of polyploid cells in definite ratios with time all suggest the existence of polyploid nuclei in the enlarged glands.

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Effects of Hemorrhage on Intestinal Absorption and Secretion. (32190)

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Several lines of evidence indicate there are functional similarities between the intestine and the renal tubule. Histologically both consist of columnar epithelial cells with microvilli. Both can reabsorb substances against electrochemical gradients and can create osmotic pressure differences between the interstitial space and respective lumens. There is also evidence that there is a similarity of the regulation of salt and water transport across these two organs. In dogs with thoracic vena cava

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constriction, where aldosterone titer in the blood is high, both kidney and gut reabsorb more salt anad water than normal(1). Administration of DOCA also increases the amount of salt and water transport across the gut and kidney(2). ADH increases the volume of solution absorbed from the intestine and mercurial diuretics suppress the volume of water transported across gut and kidney (3,4). The purpose of this study was to determine if a similarity of regulation occurs under altered physiologic states which affect the endogenous secretion of ADH and mineralocorticoids. Hemorrhage was chosen because of its pronounced effect of increasing reabsorption of salt and water by the nephron(5) and its effect on ADH and aldosterone secretion(6,7).

Materials and methods. Dogs, dewormed on the day of arrival, were maintained on animal quarters diet for at least 3 days following the deworming. The 3-day waiting period is adequate for regrowth of epithelial cells(8). No differences in absorption were found between animals used after 3 days and those used after longer waiting periods. Food was withheld 24 hours before the experiment. Water was allowed *ad lib*. The animals were anesthetized with nembutal, 30 mg/kg. Twenty inches of terminal ileum were exposed, flushed with warm saline and closed at both ends. The segment was kept warm and moist in the abdominal cavity.

All periods of determining absorptive capacity of the intestine began with flushing the intestine with the test solution, either isotonic $MgSO_4$ or distilled water, and emptying the segment by gentle milking. Recovery of the flush solution was within 5%. Fifty milliliters of the test solution were next placed in the intestine and four 4 ml samples withdrawn at 15 or 20 minute intervals beginning at zero time. The segment was then emptied and the volume of remaining solution determined in a graduate cylinder. All solutions were at body temperature. Sodium and chloride concentrations were determined.

After the first period the animal was hemorrhaged 25% of its blood volume, estimated as 8% of body weight, and sodium and chloride concentrations in the gut fluid followed for a second period. The blood was heparinized and reinfused at the end of the second period. Ion concentrations were then followed for a third period.

Sodium concentration was determined by flame photometry (Beckman Instruments) and chloride concentration determined titrimetrically by a modified Van Slyke method (9). Average difference between duplicate determinations of Na was 2% and Cl 3%. The amount of sodium and chloride transported were calculated from these values and the net change of the volume of water.

Results. The average values of the determined and calculated parameters are given in Table I. After hemorrhage there is a decrease in the final concentration of sodium and chloride in the intestinal lumen which is reversible after reinfusion of the withdrawn blood. This is the case whether $MgSO_4$ or distilled water is placed in the intestinal lumen. The volume of solution reabsorbed from the lumen decreases slightly after hemorrhage and decreases further after reinfusion of blood if distilled H_2O was initially present. The volume of fluid entering the intestine when $MgSO_4$ is in the lumen increases after hemorrhage and remains increased after reinfusion of blood. The amount of sodium and chloride entering the lumen when distilled water is present remains constant after hemorrhage but increases after reinfusion of blood. The amount of sodium and chloride entering the lumen when $MgSO_4$ is present decreases after hemorrhage and increases toward control levels after reienfusion of blood.

Discussion. The values of most of the parameters studied returned toward control levels indicating there is a reversible effect initiated by hemorrhage which prevents salt loss and/or increases salt reabsorption by the gut.

There are two possible explanations for the decreased concentration of salt in the lumen after hemorrhage. One is that the passive influx of salt into the lumen from the blood decreases and the other that the active transport of salt previously diffused into the lumen increases in the reverse direction. Both of these could be occurring simultaneously.

Decreased blood flow to the gut, which oc-

TABLE I. Average Values of Ion Concentrations and Amounts Entering Intestine During Period.

	Time	(Na) meq/l (±SE)	(Cl) meq/l (±SE)	Vol of fluid absorbed, ml (±SE)	Amt Na secreted, meq	Amt Cl secreted, meq
			$MgSO_4$ in lumen (4 exp)			
Period I	0	.0 (.0)	.9 (.5)			
	15	33.1 (10.8)	36.0 (10.0)			
	30	45.4 (7.8)	45.9 (10.3)			
	45	62.1 (7.1)	57.6 (10.3)	—5.0 (4.7)	3.04	2.84
Period II	0	2.4 (1.4)	4.3 (2.4)			
	15	21.2 (6.6)	24.3 (6.9)			
	30	33.2 (8.5)	*34.8 (7.8)			
	45	*49.2 (4.2)	*46.0 (8.2)	**—10.8 (4.6)	2.54	2.36
Period III	0	2.2 (1.3)	3.0 (1.7)			
	15	29.4 (10.9)	31.8 (7.6)			
	30	44.6 (6.6)	42.0 (8.9)			
	45	56.6 (8.2)	54.1 (9.6)	—6.0 (3.2)	2.75	2.70
			Distilled H_2O in lumen (5 exp)			
Period I	0	4.9 (1.8)	5.6 (1.6)			
	20	61.7 (7.7)	73.3 (7.3)			
	40	114.1 (7.1)	114.5 (5.5)			
	60	153.7 (7.6)	142.8 (4.8)	25.8 (2.4)	2.16	2.08
Period II	0	6.8 (2.7)	9.2 (2.9)			
	20	58.6 (10.1)	59.8 (9.4)			
	40	**83.8 (6.0)	***89.5 (6.7)			
	60	**106.9 (7.4)	**117.7 (6.7)	21.4 (3.6)	2.13	2.10
Period III	0	3.6 (1.6)	4.5 (0.4)			
	20	66.2 (6.6)	74.6 (7.9)			
	40	108.3 (7.1)	111.1 (4.0)			
	60	137.1 (4.4)	136.8 (1.8)	*14.6 (4.9)	3.76	3.52

*, **, *** Indicates differences significant at the 5%, 1% and 0.1% level respectively, with periods II and III compared to period I at similar times. A negative value of the volume of fluid absorbed indicates a net increase in the gut lumen.

curs during hemorrhage, might be expected to reduce the rate of diffusion into the gut by reducing the amount of salt delivered. Reduced diffusion solely due to a reduced blood supply does not seem to occur since the initial rate of the concentration change (0-20 minutes) is the same before and after hemorrhage when distilled water is present in the gut lumen. Distilled water has an injurious effect on the gut mucosa(10) and therefore active transport of salt from the gut would be reduced as compared to active transport when isotonic $MgSO_4$ is present. When isotonic $MgSO_4$ is present the concentration difference of corresponding samples between period I and II is constant after 15 minutes. The above considerations indicate that movement of salt into the intestine does not change after hemorrhage but that movement of salt from gut to blood is increased after hemorrhage. Subsequent experiments under conditions where net absorption of salt occurred indicated the flux of Na^+ from lumen to blood is altered under conditions of altered salt absorption(11).

Since decreased blood flow to the gut also decreases the amount of O_2 delivered, active transport would be expected to decrease. Movement of salt from gut to blood is generally considered active. Hemorrhage may therefore, have a regulatory effect which conserves salt by increasing the rate of active transport.

Summary. Hemorrhage causes reduction in the final concentration of salt in the intestinal lumen when the initial solutions are salt-free distilled water or isotonic $MgSO_4$. The final concentrations increased toward control levels upon reinfusion of the withdrawn blood. The response indicates a functional conservation of salt in the the body under conditions of blood volume reduction.

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Energy Metabolism of Rats Born and Raised in a Low Pressure Pure Oxygen Environment.* (32191)

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Little work has been done concerning energy balance in low pressure normoxic environments. Dines and Hiatt(1) reported normal growth rates, oxygen consumption and food consumption in rats maintained 24 days in pure oxygen at 196 mm Hg absolute. On the other hand, Agadzhanyan *et al*(2) reported that rats kept in an oxygen environment at 198 mm Hg absolute for 100 days lost up to 35% of their body weight the first half of the experiment. Increased growth rate during the second half, however, resulted in greater total gains than in the controls.

Carbon dioxide production of humans was reported decreased in an oxygen environment at 226 mm Hg absolute(3). Oxygen consumption of humans was also decreased in an oxygen environment at 380, 226, and 155 mm Hg absolute with mice showing a similar decrease at 170 mm Hg absolute(4). In more recent work, however, no decrease in oxygen consumption could be detected in humans breathing pure oxygen at 380 or 266 mm Hg absolute(5), or in mice breathing pure oxygen at 226 mm Hg absolute(6).

The present experiment was designed to measure food intake, growth rates, digestibility, and to obtain an estimate of the metabolic rate of rats during a 6-week period in a normoxic nitrogen free environment.

Methods. Charles River CD* strain male rats were used as experimental subjects. All experimental animals were born and maintained in the low pressure normoxic environment until sacrifice. Breeding and care of animals at altitude have been described earlier (7).

Experimental animals were maintained in an altitude chamber having an interior volume of about 300 cubic feet. The chamber was equipped with a man lock, to allow entry without a change in environment. Total pressure was automatically controlled at 210 mm Hg absolute. Humidity ranged from 40-50% with $CO_2 < 2$ mm Hg. Chamber and room temperature was maintained at 76 $\pm$ 1°F. Chamber oxygen levels were $\geqq$97% of the total dry gas. Control animals were born and maintained at ground level in the same room as the altitude chamber.

Six altitude and 6 control rats were sacrificed at 21 days of age to provide an estimate of whole body energy at start of the experiment. Ten experimental and 10 control male rats were placed individually in metabolism cages at 21 days of age and remained there for 6 weeks. The chamber was entered twice weekly, during which time the rats were transferred to clean cages, and the old cages removed for collection of feces, urine and

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