definitely degenerated and only a few cells were normal in appearance. It was evident that exposure to x-rays and incubation for 24 hours caused marked degenerative changes in the thymic cells.

Suspensions from bone marrow of rabbits were radiated with 1000r and incubated. No differences were observed in the unstained cell counts of radiated and non-radiated suspensions. The granular cells of the bone marrow, unlike the lymphocytes of the thymus and spleen, were apparently resistant to radiation.

The leukocytes of normal human blood were radiated with 1000r and incubated for a period of 7 days. The number of eosin-resistant cells in the radiated suspensions decreased at a more rapid rate than those in the non-radiated suspensions. A study of smears of blood cells in suspensions indicated that the neutrophilic polymorphonuclear leukocytes were destroyed by incubation for 2 to 3 days, the lymphocytes were killed by radiation plus incubation but the eosinophilic leukocytes were resistant to both radiation and incubation.

Suspensions were prepared of the leukocytes from the blood of 12 patients with leukemia. Unstained cell counts and smears indicated that the leukocytes of lymphocytic leukemic blood were radiosensitive in 4 of the 5 cases, but the cells of myelogenous leukemia, in all 7 cases studied, were resistant to the action of 1000r.

The effect of various factors on the radiosensitivity of lymphocytes was studied. It was observed in preliminary experiments that x-rays had no definite effect on lymphocytes when the radiation and incubation occurred under anerobic conditions.

Summary. Suspensions of lymphocytes were derived from the thymus and spleen of rabbits and from normal and lymphocytic leukemic blood of patients. Radiation with 1000r and incubation at 37°C, caused the death of the lymphocytes after a latent period of 3 hours. Radiation with as little as 50r had a minimal cytocidal effect on thymic lymphocytes. In contrast, granulocytes in suspensions from the spleen and bone marrow of rabbits and the leukocytes of myelogenous leukemic blood of patients were resistant to radiation with 1000r. It appeared that radiation and incubation had a delayed cytocidal action on lymphocytes but not on granulocytes *in vitro*.

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Adaptation to Changes in Environmental Humidity at Constant Temperatures.

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Much attention has been given in recent years to the physiological reactions associated with climatic changes. Special interest was focused on the response of the body to a sudden change in one or another factor in the climatic environment (temperature, humidity, barometric pressure), rather than to its behavior in a given environment. It is assumed that these adaptation reactions may throw light on the regulations occurring in the body during acclimatization. Bazett, Sunderman and Scott[1] studied the alteration in the blood volume in humans, and Burton, Scott, McGlone and Bazett,[2] the alteration in heat exchange and in the partition of heat loss, following changes in temperature condi-

* Died on September 23, 1944.

1 Bazett, H., Sunderman, F. W., and Scott, J. C., *Amer. J. Physiol.*, 1940, **129**, 69.

2 Burton, A. C., Scott, J. C., McGlone, B., and Bazett, H., *Amer. J. Physiol.*, 1940, **129**, 84.

tions. Gelineo[3] and Lee,[4] investigated the basal metabolism of rats and rabbits, respectively, following changes in environmental temperature. Silvette[5] described the effect of changes in the barometric pressure on the urine excretion of rats.

The study reported in this paper deals with a third climatic factor: relative humidity. In this investigation we studied the effect of sudden changes in relative humidity at constant temperatures on water intake and on the urine, Cl and N excretion of rats.

Method. The experimental rats were kept in metabolic cages, two in each cage. These cages were placed in closed tin containers immersed in a water bath of a constant temperature of 28°-30°C. The containers were aerated by a constant current of air which was passed first through a bottle of sulfuric acid or a bottle of water, according to whether a low or high relative humidity was desired. The stream of air was regulated to give a temperature of 28°-30°C and relative humidities of 10%-20% and 80%-100% respectively in the cages.

The animals received a diet of the following composition: Casein 13%, rice flour 63%, butter or vitaminized margarine 8%, olive oil 2%, Marmite 10%, salt mixture 4%. Food and water were given without limit. The water was served from a glass tube inserted in bottles placed in an inverted position on top of cage; the aperture of the tube was so small that water could be removed only by licking. This arrangement made it possible to measure fairly accurately the quantity of water consumed by each pair of rats during a given period. The urine was collected in test tubes attached to the funnel of the metabolic cages. Every two days we measured the quantities of water consumed and of urine excreted and determined the Cl and N content of the urine.

The animals were kept at a given set of conditions for 2 to 3 weeks, until there were only small variations in the amounts of urine, Cl, and N excretion. At this stage the rats were transferred from the "dry" container to the "humid" and from the "humid" to the "dry" and the tests continued. In this way no changes were affected in the conditions under which the animals were kept with the exception of the single variable humidity.

Results. The results are represented in Table I. It can be seen that:

a) when rats acclimatized to a "dry" atmosphere are transferred to a "humid" one, they react with a statistically significant increase in the excretion of urine, Cl, and N. This effect is noted during the first days after the transfer and continues for 4-8 days. The increased urine excretion is not accompanied by a larger water intake.

b) on the other hand, rats acclimatized to a "humid" environment consume about 19% more water after being transferred to the "dry" cages. The daily amounts of urine, Cl, and N excreted are diminished. This decrease, however, is very irregular and does not appear to be statistically significant. The effect, so far as it does occur, is seen only during the first days after the transfer and disappears after about one week.

The results obtained evidently represent a reaction of the organism to a sudden change in external conditions and disappear again after the body has adapted itself to its new environment. It is noteworthy, that the effect observed after transfer from a "dry" to a "humid" environment, *viz.* increase in excretion of water, Cl, and N, is similar to that following stimulation of the thyroid gland. It seemed, therefore, likely, that the sudden change in the surrounding conditions from "dry" to "humid" activated the thyroid gland. If this assumption is correct, then thyroidectomized rats should not react in a similar manner to such a change. To test this hypothesis the experiments—change from "dry" to "humid"—were repeated with thyroidectomized rats. Each experiment was carried out with two thyroidectomized rats, the normal rats of the same age and sex serving as controls; the two sets were kept in the same tin container. The results are

[3] Gelineo, S., *Bull. Acad. Sci. Math. Nat. Belgrade, B.*, 1940, **6**, 149; *cit.* Carpenter, T. M., Energy Metabolism, *Ann. Rev. Physiol.*, 1941, **2**, 144.

[4] Lee, R. C., *J. Nutr.*, 1942, **23**, 83.

[5] Silvette, H., PROC. SOC. EXP. BIOL. AND MED., 1942, **51**, 199.

TABLE I.
The Influence of Change in Humidity Conditions at Constant Temperatures.
(Each number represents the average value per rat per day for a period of 7 days before and 7 days after the change in condition.)

	Period before the change				Period after the change			
	Water cc	Urine cc	Cl mg	N mg	Water cc	Urine cc	Cl mg	N mg
	Normal rats, Dry → Humid							
No. of exper	26	26	26	18	26	26	26	18
Mean (M)	17.6	4.0	18.2	50	18.0	6.3	28.0	87
Standard deviation, σ	4.19	1.60	8.19	21.6	4.98	3.23	9.64	36.4
Standard error, ϵ	0.82	0.32	1.60	5.1	0.98	0.63	1.90	8.6
Increase in water intake:	not significant				R*	0.26	P†	0.8
" " urine excretion:					R	3.2	P	0.01
" " Cl "					R	4.0	P	0.01
" " N "					R	3.7	P	0.01
	Normal rats, Humid → Dry							
No. of exper	19	19	19	13	19	19	19	13
(M)	13.7	4.0	18.7	48	16.3	3.4	15.9	39
σ	3.41	2.08	9.45	31.3	4.08	1.98	7.26	21.7
ϵ	0.78	0.48	2.17	8.7	0.94	0.45	1.66	6.0
Increase in water intake:	significant				R	2.1	P	0.05
Decrease in urine excretion:	not				R	0.9	P	0.4
" " Cl	"				R	1.0	P	0.3
" " N	"				R	1.0	P	0.3
	Thyroidectomized rats. Dry → Humid							
No. of exper	4	4	4	4	4	4	4	4
(M)	15.0	4.2	18.0	55	14.5	4.1	18.0	57
σ	4.69	1.62	4.85	13.0	5.69	1.47	3.84	9.75
ϵ	2.35	0.81	2.29	6.5	2.86	0.74	1.92	4.87
Decrease in water intake:	not significant				R	0.1	P	0.9
" " urine excretion	"				R	0.1	P	0.9
" " N	"				R	0.8	P	0.5

* R: $\frac{M_1 - M_2}{\sqrt{\epsilon_1^2 + \epsilon_2^2}}$

† P: Probability of occurring by mere chance.

shown in Table I. It appears that thyroidectomy abolishes the effect noted in normal rats following transfer from "dry" to "humid."

Discussion. The effect described by us is not the result of the prevailing humidity conditions in themselves; it is rather the reaction of animals adapted to a certain humidity to a sudden change in these conditions. It may be said, therefore, to represent a phenomenon of acclimatization. Since thyroidectomized rats did not react to a change in humidity, it would appear that the reaction appearing after transfer from a lower to a higher humidity was due to a stimulation of the thyroid gland.

Summary. (1) Rats acclimatized to a certain environmental temperature and relative humidity (10%-20% and 80%-100% respectively), were transferred to cages with a lower or higher humidity respectively, the temperature remaining constant at 28°-30°C. After transfer from "humid" to "dry" the daily output of urine and Cl and N excretion decreased during the first few days in about 50% of the experiments. On the other hand, transfer from "dry" to "humid" was followed in 80% of the experiments by a marked increase in urine output and Cl and N excretion. This effect also lasted only a few days. (2) Thyroidectomized rats did not show the reaction appearing in normal rats after transfer from "dry" to "humid" conditions. (3) It is, therefore, concluded that, with the

temperature constant, changing the environmental humidity from "dry" to "humid" activates the thyroid gland. This activation represents an adaptive reaction of the body to the sudden change in the surrounding humidity.

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Two New Salmonella Types Belonging to Somatic Group D.

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A. *Salmonella napoli.* This type was represented by 10 cultures, of which 4 were isolated from cases of gastro-enteritis in United States soldiers, 3 from apparently normal soldiers and 3 from Italian civilian food-handlers. The first culture to be typed was isolated by Captain W. H. Ewing of the 15th Medical General Laboratory from a fecal specimen of an Italian civilian food-handler. The micro-organism possessed the cultural and biochemical characteristics of the *Salmonella.* Acid and gas were produced from arabinose, dulcitol, glucose, maltose, mannitol, rhamnose and xylose. Inositol, lactose, salicin and sucrose were not fermented. Sodium citrate and dextrotartrate were utilized. Gelatin was not liquefied. The organism produced hydrogen sulphide but did not form indol.

Examination of the somatic antigens of *S. napoli* showed that it belonged to group D of the Kauffmann-White classification. Alcoholized suspensions were agglutinated to the titre of *Salmonella gallinarum* antiserum and absorption of the serum with *S. napoli* removed all somatic agglutinins for the homologous strain. Somatic antigen I was found to be lacking in 6 strains, but was demonstrated in 4 by the use of an appropriate dilution of *Salmonella senftenberg* antiserum. The somatic antigens of *S. napoli* are [I], IX, XII. . . .

When the flagellar antigens of *S. napoli* were examined it was found that the bacterium displayed α-β phase variation. Phase I was flocculated by *Salmonella* H antiserums containing agglutinins for antigen 1 . . . When tested with absorbed serums possessing the factors v, w, z_{13} and z_{28} respectively, it was agglutinated only by z_{13}. In absorption tests it completely removed H agglutinins from *Salmonella uganda,* phase 1, antiserum. The antigens of phase 1 of *S. napoli* are 1, z_{13} . . .

Phase 2 of the microorganism was agglutinated to titre by serums derived from the β phases of *Salmonella abortus-equi* (e, n, x, z_{16}, z_{19}) and *Salmonella glostrup* (e, n, z_{15}, z_{17}, z_{19}) respectively. It also was agglutinated by e,h antiserum. When tested with absorbed serums possessing factors for h, n. . ., x, z_{15}, z_{16}, z_{17} and z_{19} respectively, it was agglutinated by n. . ., x, and z_{16}. Absorption of *S. abortus-equi,* β phase, antiserum by *S. napoli,* phase 2, left agglutinins for the homologous strain as well as for the β phase of *S. glostrup.* However, a serum derived from the second phase of *S. napoli* was completely absorbed by *S. abortus-equi,* phase 2. The second phase of *S. napoli* behaves in very much the same way as do *Salmonella abortus-bovis* ([I], IV, XXVII, XII. . .: b—e, n, x . . .) and *Salmonella lomalinda* (IX, XII . . .: a—e, n, x . . .), both of which have deficiencies in their β phases not explained by the lack of antigen z_{19}. The 2nd phase of *S. napoli* may be expressed as e, n, x, z_{16} . . . .

The diagnostic formula of *S. napoli* is [I], IX, XII . . . : 1, z_{13} . . . — e, n, x . . . .

B. *Salmonella italiana.* This type was represented by two cultures. The first was sent to us by Lieutenant Colonel Robert Hebble of a General Hospital. It was isolated from an Italian civilian who had experienced repeated attacks of severe bloody diarrhea. This culture was also examined by Major Kingston S. Wilcox of the Army Medical