peoples are stained but little. Their petroglyphs were pecked into deeply stained rock surfaces, but the pecked figures, for the most part, remain fresh.

Locally, however, two generations of petroglyphs occur on the same cliff face, and the older may be stained. In southeastern Utah, the older set of petroglyphs commonly includes the square-shouldered conventionalized human figure of geometric outline that is believed to date from pre-pottery or earliest pottery times (*2, 3*).

At such places, the exact dates remain uncertain, but the chronology is clear. First, there occurred extensive deposition of desert varnish, and this predated an occupation that may predate pottery. This occupation was followed by deposition of more varnish, and this deposition was followed by the occupation known as Developmental Pueblo—A.D. 500 to 900.

The younger varnish that formed during the interval between the occupations was deposited about the same time as one of the alluvial formations in the Colorado Plateaus. Presumably this was a pluvial period more or less at the beginning of the Christian Era. The older varnish may be as old as late Wisconsin in age.

It is suggested, therefore, that the principal deposits of varnish on the Colorado Plateaus were formed during the wet periods, and as such they can be useful in deciphering the stratigraphy of late Pleistocene and Recent deposits and events.

References

1. J. D. Laudermilk, *Am. J. Sci.* **21** (5), 51 (1931).
2. A. P. Hunt, *Univ. Utah Anthropol. Papers* **14**, 179 (1953).
3. A. V. Kidder and S. J. Guernsey, *Bur. Am. Ethnol. Bull.* **65**, 198 (1919).

22 March 1954.

Growth, Food Utilization, and Thyroid Activity in the Albino Rat as a Function of Extra Handling

William R. Ruegamer* and Lewis Bernstein
Veterans Administration Hospital, Denver, Colorado

John D. Benjamin
Child Research Council, Denver, Colorado

In an earlier paper (*1*) we reported, as has Weininger (*2*) more recently, that albino rats that were given extra handling by the experimenter showed significantly greater weight gains than animals that were unhandled or were handled only for routine experimental procedures. From the findings of these earlier studies, it could not be determined whether the differences in weight gains were due to better physiological use of the food consumed or to greater quantities of food consumed. The present study, suggested by Benjamin, is one of a series of attempts to resolve this question and to make preliminary explorations into the mechanisms whereby these physiological differences are mediated.

In our first experiment, 42 weanling male albino rats of the Denver University strain were obtained in nine litters. Using a table of random numbers, the animals were assigned to an extrahandled and an unhandled group in such a manner that both groups had the same number of rats from any one litter. The animals were housed in individual cages with wire mesh bottoms and sides. Purina food pellets and water were supplied *ad libitum,* and equal quantities of fresh lettuce and vitamin supplements were given each rat once each week. To minimize any temperature or environmental differences between the location of the cages on the rack, both the cages and the rack were rotated once each week. The extrahandled animals were removed from their cages for a period of 10 min each day and were individually petted. The unhandled animals were never touched during this period. Semiweekly records were kept of the animals' growth, food consumption, water consumption, fecal pellet excretion, and general state of activity.

At the end of the 5-wk experimental period, the animals were injected intraperitoneally with 50 μc of I^{131} and 24 hr later were sacrificed with chloroform anesthesia. Each rat was suspended from a ringstand by its tail, and a measurement was made from the tip of the nose to the anus for carcass length. The thyroids were removed intact and still fastened to a very small portion of trachea, for radioactive assay. Various organs, such as the liver, kidney, and spleen, were wet weighed, and finally, the whole carcass, except for the tail, was ground in a meat grinder until a homogeneous sample resulted. Samples of these whole carcasses were then weighed carefully and assayed for moisture, fat, and protein.

Our data indicate that there was no statistical significance between the amounts of food eaten by the two groups; nevertheless, the animals in the extrahandled group showed a mean weight gain of 122.8 g compared with 108.1 g for animals in the unhandled group, a difference significant at the .001 level of confidence, and substantiating our findings in previous pilot studies. The ratio of grams food consumed per gram weight gain averaged 4.82 for the extrahandled animals and 5.49 for the unhandled, the difference being significant at the .001 level of confidence.

It appears, then, that we have evidence of better growth and utilization of food by the extrahandled animals. Growth, in this instance, bears the connotation of greater over-all increase in carcass weight, including a larger skeleton. Carcass analysis indicated that both groups of animals exhibited approximately the same percentages of fat and moisture on a 100 g of body weight basis and that the extrahandled rats had, indeed, grown more than the unhandled animals. No significant differences were observed between the weights of kidneys, livers, or spleens.

In addition to the grams of food per gram weight gain ratio, there is other evidence of superior food utilization by the extrahandled animals. The unhandled animals excreted a mean of 3017 fecal pellets, while the extrahandled animals excreted a mean of

2705 pellets, a difference significant at the .001 level of confidence. The ratio of number of fecal pellets per gram of food consumed gives a similarly significant difference.

It was daily observed that the extrahandled animals exhibited much more activity and curiosity than the unhandled group. The extrahandled animals spent more time scampering about their cages and watching other activity going on. The unhandled animals generally sat in one position for long periods of time, often facing a corner of the cage.

In our second experiment, 36 male weanling animals of the Sprague-Dawley strain were distributed at random from previously weight-segregated groups; consequently, the average initial weight in each group was the same. Using Sprague-Dawley rats should indicate whether or not a species difference in reactivity exists and whether or not it is possible to obtain the same physiological differences with rats that are not necessarily litter mates. In general, our findings substantiated those in our first experiment, with one exception: the unhandled animals of the Denver University strain drank significantly more water than the extrahandled animals of the same strain. We were unable to repeat this finding with Sprague-Dawley rats in our second and third experiments.

In a third experiment, 48 male Sprague-Dawley weanling rats were randomly divided into four groups: a handled group, individually caged; a handled group, with three animals to a cage; an unhandled group, individually caged; and an unhandled group, with three animals to a cage. The size of the cages of the grouped animals was approximately 3 times that of the individual cages. Again, our data indicate that the findings in our first experiment can be substantially repeated, whether the animals are individually caged or caged in groups. A direct comparison between the extrahandled animals caged individually and those caged in groups of three is not possible at this time, since two investigators were involved.

The increased growth and better utilization of food observed for the extrahandled animals indicated a possible difference in the thyroid activity of these two groups. It is fairly obvious that our findings cannot be a function of differences in the amount of exercise received, since the unhandled animals were much less active and should, by this reasoning, have gained more weight. Our data (Table 1) show that in all three of our experiments, the thyroids of the unhandled animals were in a more active state than those of the extrahandled animals, as indicated by the differences in percentages dose uptake of I^{131} ($P = .001$). This increased thyroid activity on the part of the unhandled animals, whether or not it is a function of differences in anxiety level, may well be an important mediating factor in the production of the observed differences in growth and food utilization. Comparable studies of other endocrine functions are indicated for further clarification of the psychophysiological relationships involved.

Table 1. Comparison of the thyroid activities of extrahandled and unhandled laboratory rats. Two investigators (A and B) performed the experiments with handled (H) and unhandled (U) rats.

	No. animals per group	Avg. percentage dose I^{131} taken up by thyroids			
		A-H	A-U	B-H	B-U
Test 1	10	3.48	3.93	3.21	3.94
Test 2	12			3.20	3.51
Test 3	12	2.60	3.80	2.97*	3.32*

* The animals in these tests were housed three animals to a cage.

References and Notes

* Now at Veterans Administration Hospital, Syracuse, New York.
1. L. Bernstein, *Psychol. Bull.* **49**, 38 (1952).
2. O. Weininger, *Science* **119**, 285 (1954).

24 March 1954.

Occurrence of Both Caoutchouc and Gutta in Additional Plants

H. M. Leeper and Walter Schlesinger

Wm. Wrigley Jr. Company, Chicago 11, Illinois

Since it was reported that chicle (the resinous exudate of *Sapota achras*) contains both caoutchouc and gutta (*1, 2*), the question has been raised whether other plants also produce both cis- and trans-polyisoprene. Examination of samples of about 50 coagulated latexes from other lactiferous trees has revealed several other examples of the presence of both of these polymers. They are shown in Table 1, together with other pertinent data on the samples.

The procedures used in the analysis were similar to those previously reported for the separation of caoutchouc and gutta from chicle (*2*). A 10- to 15-g sample of the coagulated latex was dried at 60°C under vacuum. The dried sample was weighed into a tared extraction thimble and extracted in a Soxhlet extractor with reagent-grade acetone for 48 hr. The thimble was then dried at 60°C under vacuum, usually overnight, and reweighed. From the loss in weight, the percentage of acetone solubles was calculated.

The dried, extracted, acetone-insoluble residue, together with portions of the extraction thimble adhering to it, was suspended in 40 ml of benzene and allowed to stand at approximately 25°C for 48 hr. It was then heated to 35°C for a few minutes and centrifuged. The clear supernatant was decanted; 80 ml of ethyl acetate was added to it, and the mixture was allowed to crystallize overnight in the refrigerator at 5° to 10°C. Gutta separated as a white or off-white precipitate. It was filtered, air-dried, and weighed. The yield of gutta was calculated from this figure.

To the benzene-ethyl acetate filtrate from the pre-