length to weight in percent of each group over the 10 day treatment period. A liver factor other than arginase might possibly have been responsible for this growth phenomena; however, it is known that the procedure for arginase extraction and purification from beef liver produces a substance of relative high purity(5). Therefore it was assumed that the active factor could have been arginase.

Summary of results. 1. Animals receiving arginase treatment did not die of their implanted tumors during the 21-day period. The controls (Group "A") and those receiving arginine (Group "B") died within this period. 2. Those animals receiving arginine indicate a tumor length weight ratio increase of 7.9% over group "A". 3. The group receiving arginase (Group "C") exhibited a 28% decrease in size as compared to the controls in group "A". 4. The ratio of tumor length to weight was 26% lower in the group receiving arginase. 5. Tumor specific volume (tumor length to weight) is offered as an accurate tumor measurement method.

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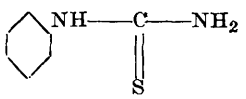
Ability of Infants to Taste PTC: Its Application in Cases of Doubtful Paternity. (18569)

HUGO M. CARDULLO AND L. EMMETT HOLT, JR.

From the Department of Pediatrics, New York University College of Medicine and the Children's Medical Service, Bellevue Hospital, New York.

In 1930 while working with phenyl thio carbamide (PTC), Fox(1) observed that the compound was tasteless to some individuals but extremely bitter, even to the point of nausea, for others. Approximately 40% of the subjects tested were "taste blind" to this material. He investigated a number of chemically similar substances and concluded that the characteristic taste of PTC and related compounds was due to the C = S linkage, *viz.*:



He postulated that this difference must be an inherent property of the individual's saliva, a concept recently proved by Cohen and Oydon(2). The observations of Fox were promptly confirmed and extended by others. Snyder(3) studied 440 individuals from 100 families and observed an incidence of 68.5% tasters (T) and 31.5% non-tasters (t), and Blakeslee(4-6) investigating 103 families, encountered 66.5% tasters and 33.5% non-tasters. The ability to taste PTC appeared to follow Mendelian laws, tasting being an inherited as a dominant characteristic and non-tasting as a recessive. Thus, the union of two tasters invariably produced tasters and the union of non-tasters produced all non-tasters. The union of a taster and a non-taster may produce both tasters and non-tasters, but if the offspring is a taster, at least one parent must be a taster.

It occurred to us that the ability to taste PTC might profitably be applied in cases of doubtful paternity. Before doing so, however, it would be necessary to establish: (1) that the ability to taste PTC was differentiated at an early age and (2) that it could be satisfactorily determined by an objective test. The observations of Fisher, Ford and Huxley(7) on chimpanzees indi-

1. Fox, A. L., *Proc. Nat. Acad. Sci.*, 1932, v18, 115.
2. Cohen, J.. and Oydon, D. P., *Science*, 1949, v110, 532.
3. Snyder, L. H., *Science*, 1931, v74, 151.
4. Blakeslee, A. F., *Proc. Nat. Acad. Sci.*, 1932, v18, 120.
5. Salmon, T. N., and Blakeslee, A. F., *Ibid.*, 1935, v21, 78.
6. Blakeslee, A. F., and Salmon, T. N., *Ibid.*, 1935, v21, 84.

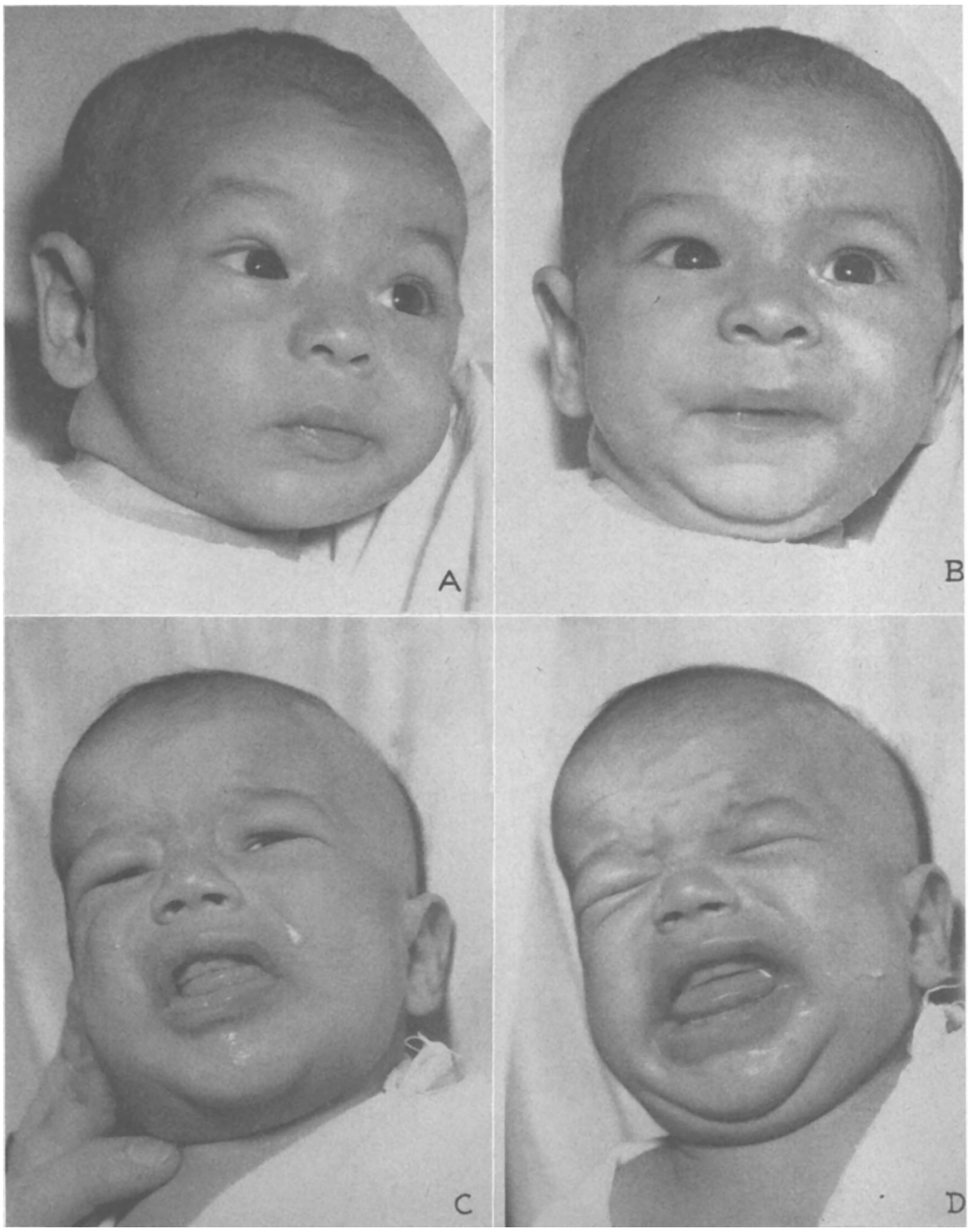


FIG. 1.
Response of infants to phenyl thio carbamide. A—negative; B—1+ (suggestive); C—2+; D—3+.

cated that tasters and non-tasters could readily be identified in these animals and encouraged us to undertake similar observations on infants.

By instillation of 0.5 cc of a dilute solution of PTC with a medicine dropper between the

7. Fisher, R. A., Ford, E. B., and Huxley, J. H., *Nature*, 1944, v154, 669.

lips of infants it was found that certain infants showed no response (Fig. 1A), whereas others showed a definitely unfavorable response which could be graded + to ++++ according to its severity: 1+ indicating merely salivation or a few "mouthing" movements (Fig. 1B), 2+ definite grimacing (Fig. 1C), 3+ a reaction which began with salivation, progressed to grimacing and ended with crying (Fig. 1D) and 4+ when retching was added to the picture. Reactions from ++ to ++++ were considered positive. Each test was repeated several times and controlled by the administration of distilled water in similar manner. It was surprising how readily the ability to taste PTC could be detected by this means even in premature infants. The dilution of PTC employed is a matter of importance in making such tests, since the ability or inability to taste is not absolute, the percentage of tasters increasing when concentrated solutions are used; only a small percentage of individuals give no taste reaction when PTC crystals are placed directly upon the tongue. Blakeslee(4) recommends a dilution of 1:5,000 for routine testing and Riddell(8,9) a 1:20,000 dilution. In the studies here reported a 1:10,000 dilution was employed. Although it is known(5) that variations of 4- to 10-fold may occur in the threshold of individuals tested upon different occasions, the data in the literature testify to the conclusion that such a dilution is satisfactory for dividing the world of tasters from that of non-tasters. In addition to demonstrating the ability of the young infant to taste PTC we were interested in determining whether the ratio of tasters to non-tasters was similar to that reported in adults. Statistical calculations indicated that a sample of 93 babies would have to be studied in order to obtain significant results. This number of infants was accordingly tested. Of these 18 were premature, 37 were full term infants under one week of age and 38 were full term infants ranging from one week to 2 years of age. There were 43 males and 50 females in the group. The racial distribution was too uneven for any analysis.

TABLE I. Response of Infants to 1:10000 Dilution of Phenyl Thio Carbamide.

Age group	Tasters		Non-tasters	
	No.	%	No.	%
Prematures, 1-7 days	11	61.1	7	38.9
Full term, <1 wk	23	62.2	14	37.8
1 wk-2 yr	23	60.5	15	39.5
Total	57	61.3	36	38.7

Results. The results shown in the accompanying table indicate that 57 infants (61.3%) were tasters and 36 (38.7%) non-tasters. Age did not appear to affect the distribution. The incidence of tasters among the males (60.5%) was similar to that among the females (62%).

Discussion. The results indicate that the ability or inability to taste PTC is present at birth, and can be demonstrated by using a 1:10,000 dilution of the drug. By this procedure the ratio of tasters to non-tasters in infants was found to be similar to that reported in adults.

The practical value of this test in establishing paternity or non-paternity would appear to be the situation in which the child is a taster and the mother a non-taster, a situation which may be expected to occur in about 20% of cases of disputed paternity. Only a tasting male could be the father of such a child.*

Summary. Phenyl thio carbamide is known to divide the adult population into 2 groups, those capable of tasting its intense bitterness (T) and those to whom it is tasteless (t). The capacity for tasting or failing to taste the compound is inherited according to Mendelian laws. It is demonstrated that the ability to taste or not to taste this compound is demonstrable in early infancy and it is suggested

8. Riddell, W. J. B., *Trans. Ophth. Soc.,* 1939, v59, 275.

9. Riddell, W. J. B., and Wybar, *Nature,* 1944, v154, 669.

10. Boyd, W. C., *Science,* 1950, v112, 153.

* At the time this work was undertaken we were not aware that any medicological application of the ability to taste PTC had been made. However, it has recently come to our attention that evidence of this kind was employed in France. Lamy, M., Pognan, C., Schweissguth, O., and Fauvert, D. Exhibit at 6th International Pediatrics Congress, Zurich, July 1950.

that such data can be profitably employed in cases of doubtful paternity in situations where a tasting child is born to a non-tasting mother.

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The Use of I^{131} Red Cell Plasma Ratio as a Measure of Thyroid Function.* (18570)

KENNETH G. SCOTT,† JAMES C. REAVIS,‡ WM. W. SAUNDERS,‡ AND WILLIAM E. WHITE. (Introduced by Joseph G. Hamilton)

From the Radioisotope Unit, Veterans Administration, Fort Miley, San Francisco.

Chemical analyses have shown that the normal chloride content of the red blood cells is approximately 190 mg % and that of plasma approximately 365 mg %(1). This gives a ratio of 0.51 for $\frac{\text{RBC chloride}}{\text{plasma chloride}}$. Similar analyses of cells and plasma in persons treated with bromides give a similar ratio for RBC bromide/plasma bromide(2). It has been noted that chloride, bromide and iodide pass rapidly across the red cell membrane *in vitro* and there is no reason to doubt that equilibrium is reached rapidly *in vivo*, as well(3). Rall *et al.* have shown from *in vitro* studies in human blood that the red cell plasma ratios for iodide and chloride were 0.67 and 0.59, respectively(3). As would have been expected from a consideration of the chemical similarities and mean ionic radii of iodide as well as of chloride and bromide ions, we have noted from *in vitro* studies that iodide ion does give an RBC/plasma ratio similar to that of the other two halides, namely about 0.5(4,5). It has been well established that the degree of conversion of inorganic iodine to protein-bound iodine and the appearance of the latter in the blood stream is an index of thyroid activity. I^{131} has been used as a tracer by a number of investigators to follow protein-bound iodine levels of the plasma and its relationship to types of thyroid disease(6,7). In the past, it usually has been necessary to employ laborious analytical methods to obtain a reliable separation of the protein-bound iodine in the plasma from the inorganic iodine fraction.

In the studies to be described in this report, it was found that inorganic iodine penetrated the red cell rapidly. However, the cell membrane apparently is relatively impermeable to large protein molecules containing labeled iodine. Therefore, the concentration of iodine in red cells, using I^{131} as a tracer, may be used as an index of the inorganic iodine content in the blood. The red cell activity will, therefore, indicate how much of the total plasma activity is due to inorganic iodine and how much is protein bound. The varying red cell plasma ratio at different times following a test dose of I^{131} is the result of the organic binding of I^{131} by the thyroid and/or the removal of protein-bound iodine from

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† Division of Radiology, University of California School of Medicine, San Francisco and Crocker Laboratory, University of California, Berkeley.

‡ Stanford University School of Medicine, San Francisco.

1. Everett, Mark R., Medical Biochemistry, 2nd Ed. New York 46, Paul B. Hoeber, Inc., P. 585.

2. Everett, Mark R., Medical Biochemistry, 2nd Ed. New York 46, Paul B. Hoeber, Inc., P. 614.

3. Rall, J. E., Marschelle, H. P., and Albert, A., PROC. SOC. EXP. BIOL. AND MED., 1950, v74, 460.

4. Jacobs, M. H., *Ann. N. Y. Acad. Sci.*, 1950, v50, 825.

5. Unpublished data.

6. Myant, N. B., Pochin, E. E., and Goldie, E. A. G., *Clin. Sci.*, 1949, v8, 109.

7. Friedburg, A. S., Ureles, Alvin, and Hertz, Saul, PROC. SOC. EXP. BIOL. AND MED., 1949, v70, 679.