ated cows or sheep is not grossly injurious or toxic to the canine when it is ingested. These results were confirmed in other species, that is, in albino rats and chicks when they were fed the flesh or selected organs from irradiated animals (*8*).

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21 March 1955.

Inheritance of High Total Carotenoid Pigments in Tomato Fruits

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The red-colored variety Webb Special has been observed to have approximately twice the amount of total fruit pigments that are found in normal red tomato varieties. Genetic variation in the color of tomato fruits depends basically on the interaction of two nonallelic genes: red, r^+ _ t^+ _; yellow, rrt^+ _; tangerine, $r^+ - tt$; and light tangerine, $rrtt$. Table 1 indicates the extent of variation in total carotenoids in the four basic color classes. For analytic procedures, see (*1*). These data confirm those reported by several workers (*2*). The dominant gene r^+ is necessary for production of carotenoid pigments in quantity, while the gene t^+ and its recessive allele t determine the qualitative nature of the pigment system. The dominant gene t^+ produces the lycopene, beta-carotene system found in red and yellow fruits, while the recessive allele t produces the zeta-carotene, prolycopene system found in tangerine and light tangerine fruits.

Crosses were made between Webb Special and the pale-yellow variety Snowball and the tangerine variety Orange King. Table 2 presents the F_2 segregation for the two crosses. The high-pigment segregates are relatively easy to classify, since the increased fruit pigmentation appears to be positively associated with a dark-green plant and fruit color.

The high-pigment character segregated as if it were conditioned by a single recessive gene in the Webb Special × Snowball cross. The 15 : 1 ratio obtained in the Webb Special × Orange King cross indicates that two nonallelic recessive genes are necessary for high-fruit pigmentation. Progenies of all the high-pigment F_2 segregates were classified and observed to breed true for high-fruit pigmentation in the F_3 generation.

The two recessive high-pigment genes from Webb Special have been designated tentatively as hp_1 and hp_2. The recessive high-pigment gene isolated from Snowball has been designated as hp_1. Progress is being made in the isolation of the hp_2 gene. Data in Table 2 indicate that the two nonallelic genes for high pigmentation are inherited independently of the r^+ and t^+ genes. The hp_1 and hp_2 genes also appear to be independent of the y^+ gene that conditions fruit skin color.

It is of interest to note that Snowball, which has the lowest total pigments of any variety tested, has one of the two recessive genes necessary for high-fruit pigmentation. An interaction of the two recessive genes (hp_1 and hp_2) is necessary to obtain the quantitative increase in carotenoid pigment production. The individual functions of the two nonallelic genes have not been determined. The two genes appear to have little or no qualitative effect on the two pigment systems conditioned by the r^+ and t^+ genes. Pigment production in the yellow (rrt^+t^+) genotype is markedly reduced, even in the presence of the two high-pigment genes. The quantity of pigment produced appears to be slightly increased over that of the normal yellow varieties.

The practical implications of increased pigmentation in tomato fruits are important. This is especially true of the red-fruited varieties. The consumer demands a deep-red color in processed tomato products as well as in the fresh fruit. The lycopene and the beta-carotene contents are both increased by the high-pigment genes, which thus increase the nutritive value of the tomato fruit as well as the visual appearance.

Table 1. Variation in total carotenoid pigment content of tomato varieties (mg/100 g fresh weight).

Variety	Flesh color	Genotype	Total carotenoids
Rutgers	Red	$r^+r^+t^+t^+$	6.76
Stokesdale	Red	$r^+r^+t^+t^+$	7.12
Webb Special	Red$^+$	$r^+r^+t^+t^+$	12.96
Orange King	Tangerine	r^+r^+tt	7.36
Golden Jubilee	Tangerine	r^+r^+tt	7.00
Snowball	Yellow	rrt^+t^+	0.12
Golden Queen	Yellow	rrt^+t^+	0.24
U of I Acc. 36	Light tangerine	$rrtt$	1.08
U of I 1007-129-54	Light tangerine	$rrtt$	0.70

Table 2. F_2 segregation for fruit color and high pigmentation.

	Normal pigment			High pigment			
	Red	Yellow	Tangerine	Red	Yellow	Tangerine	Total
Webb Special × *Snowball*							
Observed	174	57		48	17		296
Expected	9	3		3	1		
$\chi^2 = 1.514$, 3 degrees of freedom, $P = 0.50–0.70$							
Webb Special × *Orange King*							
Observed	69		25	7		1	102
Expected	45		15	3		1	
$\chi^2 = 1.404$, 3 degrees of freedom, $P = 0.70–0.80$							

In addition, the fruits of the high-pigment selections exhibit a high degree of firmness. Whether this is because of a close association of independent genetic factors or because of a pleiotropic effect of one or both of the high-pigment genes has not yet been determined.

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21 February 1955.

Unusual Value for Protein-Bound Iodine in the Serum of the Opossum

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Apparently the last comparative study of serum protein-bound iodine (PBI) was made by Taurog and Chaikoff in 1946 (*1*). Since then the analytic procedure has been changed radically (*2*). Moreover, recourse to the *Handbook of Biological Data* (*3*) reveals no information concerning PBI values for the rabbit, the hamster, the sheep, or the opossum. Therefore, it was deemed important that the knowledge concerning, normal PBI values (the easiest obtainable assessment of circulating thyroid hormone) in experimental animals be extended and brought up to date. Our studies reveal that the level of PBI in the serum of the opossum is extremely low. This article is concerned with certain aspects of this result. In addition, the PBI values that we have obtained for the rabbit and the hamster supply information that was previously lacking.

Blood was obtained by cardiac puncture from three monkeys (*Cynomolgus*), four rabbits, 15 rats (Sprague-Dawley), five hamsters (*Cricetus auratus*), three opossums (*Didelphis virginiana*), three white leghorn chickens, and five guinea pigs. Jugular blood was withdrawn from three stallions directly upon slaughter at a local slaughterhouse and from a ewe housed in our animal room. In each case the respective serums were pooled and several analyses (from three to seven) were performed in duplicate upon the specimens, which were stored at 4°C between determinations. All animals were in the postprandial state when examined, and the season was summer. The method of analysis was essentially that of Barker *et al.* (*2*).

Table 1 provides the results of the analyses for PBI in the serums of the various animals used. It can be noted that the opossum serum was strikingly low in PBI. Values found for the rabbit and hamster (two specimens for which values do not appear in the literature) were in the so-called normal range. The values observed for the chicken are in good agreement with those reported by Taurog and Chaikoff (*1*). The concentration of PBI found in the rat serums are in the range noted by Taurog and Chaikoff (*1*), Halmi and Barker (*4*), and Klitgaard *et al.* (*5*). Serum PBI values for the guinea pig and the sheep are in close agreement with those disclosed by Young *et al.* (*6*) and Weeks *et al.* (*7*), respectively. Values for the horse and the monkey are in the range indicated in Albritton's *Handbook* (*3*). Thus it is clear that the technique is reliable and reproducible in our hands. Human blood samples analyzed also gave values in the range noted by Barker *et al.* (*2*) to be normal.

It is surprising to note that the opossum possesses a very low protein-bound iodine level (0.4 μg percent). In the absence of other data in the literature, it is pertinent to note that Hartman (*8*) calls attention to the fact that the body temperature of the opossum is peculiarly low—about 95° to 97°F, as established by Selenka in 1887 and more recently by Wislocki (both referred to by Hartman). Burke (*9*) also found that the rectal temperature of the opossum is about 95°F. Hartman points out that with this body temperature, the opossum alone "fails to fit into the chart of body size-temperature relationship of the animal series from the finger-sized shrew to the elephant" and that there is no explanation for this instance of nonconformity.

Immediately, therefore, one is struck by the association pointed out here between the low PBI values (reflecting a low titer of circulating thyroid hormone) and low body temperature. A comprehensive study of

Table 1. PBI values obtained from the serums of several animals.

Animal	PBI (μg percent)
Horse	3.6 ± 0.4
Monkey	6.0 ± 0.7
Sheep	3.7 ± 0.3
Rabbit	3.3 ± 0.5
Rat	4.5 ± 0.4
Guinea pig	2.5 ± 0.5
Hamster	3.5 ± 0.4
Opossum	0.4 ± 0.2
Chicken	2.6 ± 0.3