reduce TSH secretion and a subsequent reduction in thyroid activity. Such an interpretation appears consistent with observations that a physiological level of estrogen prevents reduction in TSR following ovariectomy and only increases thyroid activity if the adenohypophysis is intact(5).

Summary. 1) Effect of ovariectomy and replacement with 1 μg estradiol benzoate (EB) and/or 3 mg progesterone (P) upon daily thyroxine secretion rate (TSR) has been studied in mature rats. 2) Ovariectomy reduces TSR approximately 33% within 2-6 days postcastration. Increasing the interval to approximately 90 days between ovariectomy and TSR determination did not result in a further reduction in TSR. EB alone and with P prevented decrease in TSR following ovariectomy but P alone had no effect. 3) It is suggested that ovariectomy reduces the circulating estrogen level which, in turn, may reduce thyrotropin secretion and, subsequently, lower daily TSR.

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Effects of Age, Sex and Line on Serum Alkaline Phosphatase of the Chicken.* (25415)

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Serum alkaline phosphatase has been studied to some extent in the chicken. Its level has been reported to be higher in the young chicken than in the adult(1,2), and higher in the laying hen than in the adult male(1,3,4). Gutowska *et al.*(5) reported serum alkaline phosphatase in high producing hens to be higher than that of poor producing ones. However, other workers(1,6) reported that it bears no relation to rate of egg production. Several workers(1,4,6) have observed no significant difference between the phosphatase values of laying and those of non-laying females. A high line for serum alkaline phosphatase has recently been developed by selection based on activity of the enzyme measured at 6 weeks of age in a random bred population of White Leghorn chickens (Wilcox and Shaffner, unpublished). The present study was conducted to determine to what extent, if any, the high line differs from its random bred control at other ages. This might in turn also provide information as to the physiological nature of genetic modification in the activity of this enzyme. The present work was undertaken also to elucidate the effects of age and sex on serum alkaline phosphatase in the chicken.

Materials and methods. Males and females of a high serum alkaline phosphatase line and a random control line of White Leghorn chickens were used. The birds were fed *ad libitum*. Blood was taken at different ages from 10 males and 10 females randomly selected from

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TABLE I. Effects of Age, Sex and Line on Serum Alkaline Phosphatase of the Chicken.

	High line				Random line			
	♂		♀		♂		♀	
Age, wk	Body wt, g	Alkaline phosphatase*	Body wt, g	Alkaline phosphatase	Body wt, g	Alkaline phosphatase	Body wt, g	Alkaline phosphatase
0	38	71.6 ± 9.3†	37	68.9 ± 2.0	36	69.4 ± 4.7	36	74.4 ± 3.2
1	60	437.5 ± 41.7	62	401.9 ± 42.4	60	398.4 ± 46.8	62	272.7 ± 34.5
2‡	119	589.4 ± 77.2	114	439.0 ± 83.9	118	350.2 ± 56.7	108	282.0 ± 44.8
3‡	194	364.0 ± 75.4	175	265.6 ± 31.6	204	274.2 ± 31.6	181	167.8 ± 15.1
4	263	158.8 ± 25.2	250	107.3 ± 19.0	281	133.6 ± 19.7	252	91.6 ± 17.8
6‡	480	105.4 ± 14.8	421	54.3 ± 10.8	463	40.7 ± 4.8	444	35.5 ± 6.3
8‡	682	117.2 ± 17.7	559	72.5 ± 10.3	639	73.7 ± 12.9	539	58.0 ± 10.2
10‡	954	60.1 ± 13.5	752	47.6 ± 7.6	985	38.0 ± 5.4	752	20.4 ± 2.0
14‡	1473	18.9 ± 1.6	1061	18.3 ± 2.0	1477	16.5 ± 1.3	1056	12.4 ± 1.7
18	1711	22.6 ± 2.3	1330	33.4 ± 3.6	1830	21.6 ± 1.4	1278	28.7 ± 4.1
22‡	1900	18.8 ± 1.5	1623	27.8 ± 3.0	2086	12.4 ± 1.1	1653	16.8 ± 2.2
26‡	2286	22.7 ± 1.5	1802	32.7 ± 2.3	2371	14.7 ± 1.3	1789	20.9 ± 3.3
30	2372	13.9 ± 1.9	1911	23.4 ± 2.7	2497	9.0 ± .7	1799	22.9 ± 2.4
34	2408	13.2 ± 2.6	1914	22.0 ± 1.4	2517	6.4 ± .6	1841	20.0 ± 1.9

* Expressed as mM of nitrophenol liberated/liter of serum/hr.
† Mean of 10 birds and stand. error.
‡ Indicates statistically significant line differences of combined data from males and females.

each line. At ages below 14 weeks it was taken by heart puncture from different sets of birds. After 14 weeks of age it was taken from the wing vein of the same 10 males and females. Serum alkaline phosphatase was determined by the method of Bessey *et al.*(7). Serum separated from blood of the chicken was incubated with the para-nitrophenyl phosphate substrate, pH of which was adjusted to 10.3-10.4, for 30 minutes at 37°C. The unit of alkaline phosphatase activity was expressed as mM of nitrophenol liberated per liter of serum per hour. Duplicate analyses were made on each blood sample.

Results. Results are summarized in Table I. Serum alkaline phosphatase level increased rapidly after hatching in both lines, until it reached a peak at 2 weeks of age. Thereafter in the male it continued to decrease and reached a low level in the adult, whereas in the female it decreased with advancing age until 14 weeks of age. At 18 weeks of age serum alkaline phosphatase of the female increased somewhat, but subsequently decreased gradually with advancing age. Values at 34 weeks of age represent only one-twentieth of peak value in the female, and one-fiftieth in the male.

No sex difference was observed at hatching time in either line. In the period of 1-14 weeks of age serum alkaline phosphatase was always numerically higher in the male than in the female. These differences are statistically significant at 6 and 8 weeks of age in a high line, and 1, 3 and 10 weeks of age in a random line. However, in the period of 18-34 weeks of age the difference between sexes was reversed, and alkaline phosphatase in the female was always numerically higher than that in the male. The differences are statistically significant at 30 and 34 weeks of age in both lines, and at 18, 22 and 26 weeks of age in a high line. This high value in the female appears to be related to egg production in this period, as most of the hens started egg production during 22-26 weeks of age, and all of the hens used here were laying at 30 and 34 weeks of age. The value in non-laying hens 35 weeks of age, which had started egg production but stopped the production, was low (6.5 ± 1.3 units, average of 4 birds), compared with 20-22 units in the laying hens at approximately the same age.

Although the variation of serum alkaline phosphatase with age was similar in both lines, the value for the high line was always numerically higher than that for the random bred line, except at hatching time. These differences were statistically significant in most cases from the age of 2 weeks to 26 weeks. No difference in body weight was observed between the 2 lines.

Changes in serum alkaline phosphatase level due to age correspond well with growth

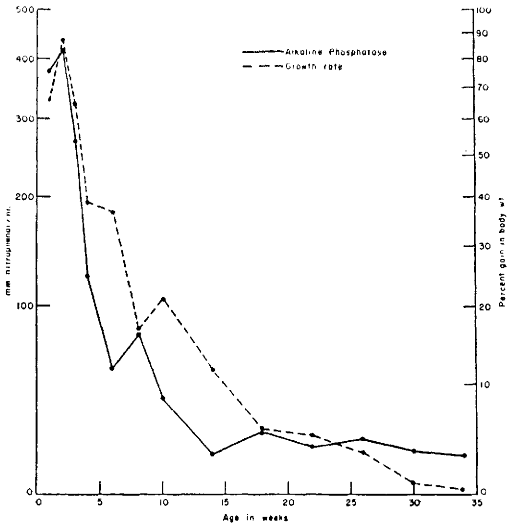

FIG. 1. Relation of serum alkaline phosphatase level of blood serum to growth rate expressed as % gain/wk.

rate expressed as percentage gain per week (Fig. 1). Both alkaline phosphatase level and percentage gain per week reached a peak at 2 weeks of age and decreased rapidly with advancing age.

Discussion. The present study demonstrates that serum alkaline phosphatase level is extremely high in the young chicken and reaches a low level in the adult. These changes correspond well with growth rate, and may be due to differences in bone formation, since this organ is known to be a source of serum alkaline phosphatase(9,10). The higher alkaline phosphatase activity usually observed in serum of the growing male in our experiments may be related to its faster growth. Serum alkaline phosphatase in the laying hen is significantly higher than that of the cock and non-laying hen as shown by the present work. This observation is in disagreement with the results of Common(1) and others(4,6) who found no significant difference between laying and non-laying hens. The difference between adult males and females is difficult to explain, since injection of estrogen decreases serum alkaline phosphatase in the chicken(8). It could possibly be due to a higher activity of the thyroid or to a higher demand for calcium for egg shell formation. It has been noted that calcium deficiency increases serum alkaline phosphatase in the chicken(1).

A numerical line difference was observed in all ages of the chicken except at hatching time. This indicates that in a line bred for a high level of alkaline phosphatase at 6 weeks of age the increased level is largely present at most other ages in the growing bird, and also in adult fowl.

Summary. Serum alkaline phosphatase was found to be higher in most cases between 2 and 26 weeks of age in a line bred for high alkaline phosphatase than in a random bred control line. The level in the male was higher than the female during the growing period, but lower at later ages. There were no differences due to line or sex at hatching.

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