tape recordings of the thermal noise with a harmonic analyzer, and to F. V. Hunt and S. S. Stevens of Harvard University and J. L. Stewart of the U.S. Naval Electronics Laboratory, San Diego Calif., for helpful discussions of these experiments.

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Effects of Methimazole on Thyroid and Live Weights of Cattle

Interest in the potential usage of different goitrogenic agents, especially thiouracil, in livestock and poultry production is manifest in the large number of investigations that have been made during the past 15 years, many of which are cited by Sykes *et al.* (*1*). Most investigators have studied the use of thiouracil in reducing basal metabolic rate in animals for purposes of either stimulating fattening in meat-producing animals or bringing about a more efficient over-all usage of the respective rations fed. Although some success has been achieved with thiouracil in reducing metabolic rate in animals (*2*), nevertheless other, unfavorable features have been noted in connection with its administration, such as its unpalatability and its tendency to slow rates of growth; hence, no general use of goitrogens in animal feeding has thus far been made. The objectives of the investigation described in this report were to determine the amount of a potent synthetic goitrogen, methimazole (1-methyl-2-mercaptoimidazole, or Tapazole) (*3*) necessary to bring about enlargement of the thyroid in cattle and to observe the influences of methimazole upon appetite, live-weight gains, and efficiency of feed utilization when it was fed to growing and fattening beef animals.

Thirty steers, weighing about 975 pounds each, were divided into six groups and full-fed a mixture of corn, hay, and protein supplement containing stilbestrol, a growth-promoting substance for beef cattle reported earlier (*4*). The rations were alike except for the amounts of methimazole added to the respective rations. Groups 1a and 1b received no methimazole, whereas groups 2, 3, 4, and 5 received rations that contained methimazole in the following percentages: 0.0017, 0.0035, 0.0052, and 0.0070, respectively. These levels corresponded to 200, 400, 600, and 800 mg per animal per day. The feeding experiment was carried out during the late fall and early winter season, during which the temperature was below freezing much of the time.

The results are presented in Table 1. Thyroid weights were rather variable within groups, but on the average they increased with each level of methimazole fed, the highest level producing thyroids approximately four times the size of those in the control cattle. The increased weights of the thyroids of the cattle in this study suggest that the levels of methimazole fed were sufficiently high to inhibit thyroxin secretion. The improvement noted in over-all feed utilization might be explained on the basis of a lowered thyroxin secretion and thus a lowered metabolic rate, whereby a higher percentage of the ration was converted into cattle live-weight gains. Live-weight gains were excellent in the cattle receiving methimazole, and in all cases these gains exceeded the gains made by the control animals. The maximum stimulation in gain by lots was 22 percent, and the average stimulation amounted to 11 percent. No depression in appetite accompanied the feeding of methimazole; rather, the cattle receiving the goitrogen consumed an average of 3 percent more feed than the control cattle. Over-all feed utilization was increased by the methimazole as much as 13 percent, with an average increase of 7 percent. The quality of meat produced by the inclusion of methimazole in the ration was indistinguishable from the quality of meat of the control cattle on the basis of federal grades and dressing percentages.

It was interesting to note that methimazole did not depress appetite, whereas thiouracil usually inhibits appetite and results in lowered rates of growth in almost all species of animals. This apparent discrepancy in the action of these two goitrogens is believed to be due to the unpalatableness of the thiouracil or to its greater toxicity at equivalent dosage levels. In earlier cattle experiments in this laboratory (*5*) it was impossible to feed sufficiently high levels of thiouracil to depress thyroid activity appreciably without at the same time decreasing feed consumption and rate of live-weight gain.

Table 1. Results of adding methimazole to the ration of cattle in a 79-day experiment.

Item	Methimazole added				
	Lot 1 None	Lot 2 0.0017%	Lot 3 0.0035%	Lot 4 0.0052%	Lot 5 0.0070%
Av. initial wt. of cattle (lb)	976	977	981	976	985
Av. final wt. of cattle (lb)	1209	1245	1226	1258	1222
Av. daily gain (lb)	3.0 ± 0.1*	3.4 ± 0.2	3.1 ± 0.1	3.6 ± 0.1	3.1 ± 0.2
	Av. daily ration				
Cracked corn (lb)	17.7	19.1	18.1	19.0	18.0
Alfalfa hay (lb)	6.0	6.0	6.0	6.0	6.0
Supplement (lb)	1.0	1.0	1.0	1.0	1.0
Total (lb)	24.7	26.1	25.1	26.0	25.0
Feed/100-lb gain (lb)	837	770	804	726	831
Dressing percentage	59.8	58.1	59.5	59.5	60.0
	Federal carcass grade				
Choice	4	3	2	1	2
Good	6	2	3	4	3
Av. wt. of cattle thyroid (g)	29 ± 3	35 ± 5	65 ± 10	70 ± 8	123 ± 18

* Standard error of mean.

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Electron Microscopy of the Anaplasma Body: Ultrathin Sections of Bovine Erythrocytes

Anaplasmosis is an infectious disease of cattle. However, it has been recognized in another species (ovine) on one occasion in the United States (*1*). The acute or peracute form of the disease is

seen in adult cattle and frequently terminates fatally. Symptoms of the disease are elevated body temperature, anemia, anorexia, atony of the rumen, accelerated respiration and pulse, pale mucous membranes, constipation, depression, icterus, and weakness, and abortions often occur in advanced pregnancies. During the febrile period as many as 77 percent of the circulating erythrocytes contain bodies referred to as anaplasma bodies. Young calves develop a mild form of anaplasmosis; however, a splenectomized calf will develop acute or peracute anaplasmosis. Cattle which have recovered from anaplasmosis are immune to the disease but are permanent carriers. Minute amounts of blood from such cattle will reproduce anaplasmosis when injected into a susceptible bovine.

The etiology of the disease has not been established, but it is generally assumed that the anaplasma body is the etiologic agent of anaplasmosis. This body is generally considered to be a protozoan and is designated *Anaplasma marginale* (*2*). The anaplasma bodies are characteristically located at the periphery of the erythrocyte (Fig. 1 top left) and vary in size from 0.2 to 0.9 μ, the larger ones being composed of eight spherical "sporoid" bodies of equal size (*3*). They are said to be devoid of cytoplasm (*4*). The suggestion has been made that the anaplasma body is constituted of tightly packed submicroscopic elementary bodies and that the parasite undergoes multiple division instead of binary fission (*5*). A previous study by one of us (L.E.F.) demonstrated an ultrafiltrate of blood to be infective, thereby suggesting that the anaplasma body is a viral inclusion (*6*). The results of this investigation are presented to define better the nature of the anaplasma body.

Whole blood was drawn into a dry 10-ml syringe from the external jugular vein of a splenectomized calf affected with anaplasmosis. Seventy-seven percent of the erythrocytes contained anaplasma bodies. The blood was transferred immediately into a fixative composed of 1-percent osmic acid in a Veronal-acetate buffer, buffered to *p*H 7.4 (*7*) and maintained at 5°C. The fixation times used were 5, 10, 15, 20, and 30 minutes. Following fixation, the fixative was decanted from the cells and the cells were washed with distilled water and dehydrated with increasing concentrations of methyl alcohol. The cells were then embedded in a 1:3 mixture of methyl and butyl methacrylate. Sections of the embedded cells were cut on a Porter-Blum ultramicrotome at a thickness of 1/20 to 1/40 micron by means of a glass knife. The sections were mounted on copper grids with a Formvar film and viewed in an RCA EMU 3 electron microscope. Fixation for 20 minutes was found to be optimal.

With the electron microscope the anaplasma body is seen as a clear space at the margin of the erythrocyte, containing from one to seven masses of dense particulate matter (Fig. 1 top right and bottom left). The masses comprising the anaplasma bodies measure from 0.2 to 0.7 μ in diameter. The larger masses are seen in bodies containing single masses, while smaller ones are seen in bodies containing mutliple masses. The dense particulate matter typically consists of a central mass and a peripheral ring separated by a clear zone in which are seen a variable number of strands connecting the central mass and peripheral ring. Figure 1, bottom right, at greater magnification, demonstrates the particulate composition of the anaplasma body. The size of the particles is approximately 100 A. None of the organelles of a cell have been seen in the bodies—such as nucleus, mitochondria, and endoplasmic reticulum.

These observations (*8*) support the idea that the etiologic agent of anaplasmosis is a virus.

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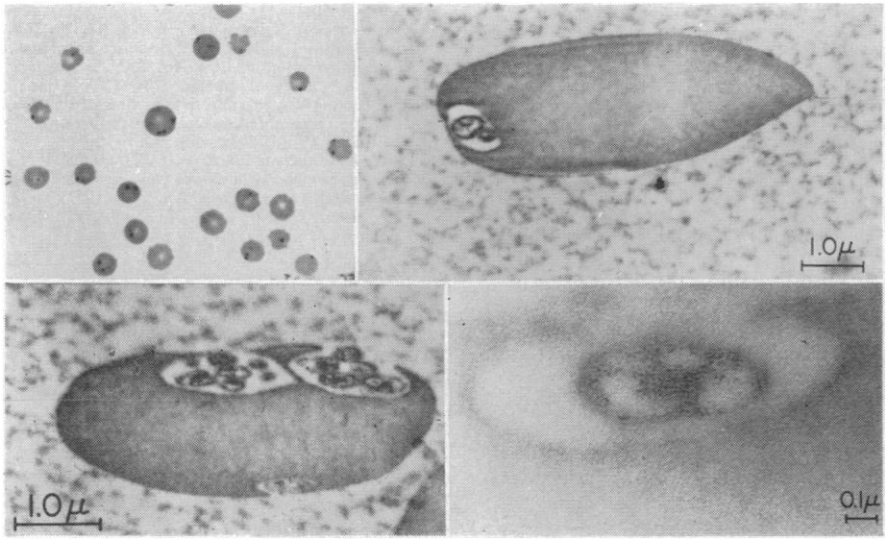

Fig. 1. (Top left) Peripheral blood smear with Giemsa stain (about × 730); (top right) anaplasma body in erythrocyte; (bottom left) anaplasma bodies in erythrocyte; (bottom right) anaplasma body in erythrocyte.

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Spray Mechanism of the Cockroach Diploptera punctata

The cockroach *Diploptera punctata* (Eschscholtz) has a remarkable pair of glands, the secretion of which contains a mixture of *p*-benzoquinone and two of its derivatives (*1*). Each gland consists of a cluster of secretory cells surrounding a dilation of the trachea leading to the second abdominal spiracle. The secretion is stored within the tracheal dilations and is ejected through the second abdominal spiracles when the roaches are agitated, anesthetized, or otherwise disturbed (*1*).

The very fact that disturbance elicits ejection suggests that this secretory apparatus is defensive in function. This contention was confirmed by a recent series of experiments (*2*), the main results of which are presented below.

The secretion of *Diploptera,* like that of other arthropods that also secrete quinones, imparts an intense bluish-black coloration to acidulated KI-starch paper (*1, 3*). This indicator paper affords a convenient means of recording the direction, range, and degree of dispersion of the secretory discharge. Individual roaches, fastened to fixed rods and adjusted so that they assumed normal stances on sheets of indicator paper,