ing of alimentary lipemia in dogs and rats (5). Furthermore, administration of heparin caused also lipemia clearing although of shorter duration. The assumption that not the high body temperature *per se* but the production of the clearing factor by an intermediary mechanism, possibly release of heparin, induced by the fever is necessary for clearing of the lipemic sera is also suggested by the *in vitro* experiments in which lactescent sera of dogs fed the egg yolk meal failed to clear when kept in water bath of 105°F for 24 hours, a temperature approximately equivalent to that obtained in animals after vaccine and Piromen injection.

Summary. Administration of typhoid and paratyphoid vaccine as well as Piromen caused rapid clearing of alimentary lipemia in dogs which developed fever of 103°F or more. This phenomenon appears to be unspecific and seemingly due to marked temperature rise induced by these agents, since no change of turbidity occurred in animals with fever below 103°F. Administration of protamine sulfate to vaccine-treated dogs prevented clearing of the lipemic sera despite a marked elevation of temperature. No clearing of turbidity occurred when the lactescent sera were kept in water bath at 105°F for 24 hours. It is suggested that high body temperature in the dog may cause release of heparin or a heparin-like substance to produce a lipemia clearing factor.

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Received February 11, 1958. P.S.E.B.M., 1958, v98.

Increased Serum Glutamic-Oxalacetic Transaminase of Monkeys Following Oral Administration of Staphylococcal Enterotoxin.* (23931)

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The symptoms of staphylococcal food poisoning are nausea, vomiting, retching, abdominal cramping of varying severity, and diarrhea after an incubation period of 1-6 hrs. Marked prostration with hypothermia and hypotension may occur(1). However, no histopathology has been observed in animals fed enterotoxin.

This paper reports on serum glutamic-oxalacetic transaminase (GOT) levels of monkeys following oral administration of staphylococcal enterotoxin. Elevation of serum GOT which occurs in several disease states(2,3) is attributed to release of the enzyme into the blood circulation following death of injured cells or increase in cellular membrane permeability(4). The slight, but distinct, rise in serum GOT of monkeys fed enterotoxin suggests cellular injury.

* This work was supported by contributions from various companies and associations of food industries.

Materials and methods. Blood samples were obtained from a leg vein just before enterotoxin was given by stomach tube. These prefeeding blood samples were used to establish normal GOT levels of individual animals. Animals were observed for 5 hrs, vomiting being the criterion of the reaction of monkeys to enterotoxin. Sensitivity of monkeys to enterotoxin varied considerably, some being used for the first time, others having developed substantial resistance through previous feedings of enterotoxin(5). Post-feeding GOT levels were determined on blood drawn about 6 hrs after toxin feeding. GOT assays were made on unhemolysed sera by a method essentially identical to Steinberg *et al.*(6). The Beckmann DU spectrophotometer was used; units are corrected to incubation at 25°C. Sera prepared the day of toxin feeding were kept frozen until used. Sera whose GOT values were to be compared were assayed the

TABLE I. Serum GOT Units Immediately before and 6 Hours after Feeding Enterotoxin and Water.

Monkey	Times vomit	Enterotoxin		Water	
		Before	After	Before	After
1	0	28	61(218)*	28	28
2	3	23	54(235)	22	25
3	1	34	78(239)	39	42
4	1	29	68(232)	33	33
5	0	19	37(195)	18	19

* % of titer before feeding.

same day. Duplicate tests were made with some sera; variations of greater than 4 units were not encountered. Enterotoxin samples which may be antigenically different were prepared from 2 different *Staphylococcus* strains (5). The preparations varied in purity(7), but dosages used were judged capable of causing emesis in about one-half of the animals.

Results. Typical results obtained with "new" monkeys (animals being fed enterotoxin for first time) are presented in Table I. 50 μg of an enterotoxin preparation of 20-25% purity were fed to each animal. Normal variation of GOT was determined after feeding of water on the same group of monkeys 2 weeks after enterotoxin feeding.

Six hrs after enterotoxin is fed to monkeys serum GOT increased approximately 2-fold. Diurnal variation and the effect of handling of animals is insignificant. Similar control experiments of feeding water showed elevation of GOT up to 130% of the original level; one animal out of 24 had a titer 150% above the prefeeding level. Normal GOT titers of monkeys are generally within normal range of GOT values for humans. In our experiments relative increase seems more significant than absolute values since GOT titer immediately before toxin administration is used as the reference value. On this basis, a rise of GOT above 175% of the prefeeding titer has been considered significant.

GOT reached its maximum at about 6-8 hrs after enterotoxin administration and dropped considerably by 24 hrs. Table II shows GOT values of serial samples taken over a 24 hr period. This experiment was done after it had been established that GOT was slightly higher at 6 than at 4 hrs.

The magnitude of GOT rise did not show a correlation with the number of times the animals vomited. Approximately 40% of 28 monkeys which were fed enterotoxin but which did not respond with emesis showed significant GOT elevation. On the other hand, about 15% of 29 monkeys in which vomiting was provoked by enterotoxin showed no significant rise of titer. The number of "new" monkeys available was limited in number. However, regardless of whether enterotoxin induced vomiting or not, these animals reacted much more consistently with significant GOT elevation than animals which had become partially resistant to the toxin. In fact, the greater majority of these "new" animals developed titers from 190-300% of the prefeeding GOT values.

Further evidence that GOT increase is a specific reaction to enterotoxin is illustrated in Table III. Even 3 mg/monkey of a control preparation derived from a non-enterotoxigenic *Staphylococcus* strain by essentially the same purification procedure as the toxin sample of experiment of Table I produced no change in GOT. In contrast, 20 μg/monkey of essentially pure enterotoxin (Strain S-6) induced significant elevation as did 1 mg/monkey of another antigenically different enterotoxin preparation (Strain 196-E).

The nature of response of animals to enterotoxin would indicate fluid loss. This decrease in blood volume does not explain the GOT rise. Prefeeding and 6 hr postfeeding hematocrit values(8) of blood of 3 monkeys fed enterotoxin (emesis in 2) were 44 and 48%, 45 and 50% and 43 and 40%, respectively.

Enterotoxin preparations possess no GOT activity of their own. Addition of enterotoxin to human or monkey serum did not increase GOT activity. Appreciable coagulase

TABLE II. Serum GOT Units Immediately before and at Different Time Intervals after the Feeding of Enterotoxin.

Monkey	Times vomit	Before feeding	Hr after feeding		
			6	10	24
1	(control)	34	38	39	42
2	0	34	76	66	42
3	0	30	36	38	27
4	3	31	90	57	41
5	1	25	36	34	27
6	0	27	67	65	40

TABLE III. Serum GOT Units Immediately before and 6 Hours after Feeding of Non-enterotoxic Control and 2 Antigenically Different Enterotoxin Samples.

3 mg. monkey, control			20 μg/monkey, S-6			1 mg/monkey, 196E		
Times vomit	Before	After	Times vomit	Before	After	Times vomit	Before	After
0	21	23	1	30	54(190)*	1	32	61(191)*
0	31	31	5	39	91(260)	4	34	70(206)
0	23	22	0	38	76(200)	1	30	59(197)
0	23	26	0	21	53(252)	0	24	36(150)
0	30	29						

* % of titer before feeding.

and fibrinolysin present in some of the enterotoxin preparations necessitated GOT assay by a method whereby clarification of the reaction mixture was possible(9).

No significant changes in serum malic dehydrogenase, lactic dehydrogenase, and glutamic-pyruvic acid transaminase were found in monkeys fed enterotoxin.

Discussion. Elevated serum GOT reflects the enzyme release into the blood stream and is a measure of degree of tissue injury(4). In myocardial infarction and acute hepatocellular injury GOT may be 2-20 times or more above normal. The 2-3 fold increase of monkey serum GOT following oral administration of enterotoxin is small compared to that found in the above mentioned diseases, but this may be misleading. If the cells affected by enterotoxin are poor in GOT, then serum GOT rise may be limited. The suggested cellular injury by enterotoxin may be a secondary effect following primary action on the central nervous system; *e.g.* abnormal hypermotility of the gastrointestinal tract resulting in tissue damage. Presence of blood in the vomitus and stools of severe staphylococcus food poisoning cases is suggestive in this respect.

Some toxic reaction to enterotoxin other than emesis is needed before GOT increase occurs. All animals responding with vomiting may not necessarily react with sufficient severity in the required manner; this could explain absence of GOT rise even when animals vomit. Conversely, animals not vomiting after enterotoxin administration may still be reacting to the toxin; *e.g.*, 12.1% of 122 human staphylococcal food poisoning cases did not suffer from vomiting(10). Elevation of GOT could occur in these instances.

The transitory nature of GOT rise can be explained by the short duration of staphylococcal food poisoning symptoms. Although the disease can be extremely uncomfortable the toxemia is seldom fatal, recovery is usually rapid, and no permanent injury results. Release of cellular GOT into the blood stream may occur only during the short acute stage of intoxication giving small, but definite, GOT increase with early maximum titer. The GOT picture is similar following X-irradiation(11).

The evidence presented indicates that increase of GOT is a specific response of the animal to enterotoxin. Since some of the animals not reacting to enterotoxin with emesis show elevated GOT, the monkey feeding test can be made more sensitive by GOT determinations on these animals.

A study should be made of the possible rise of GOT in staphylococcal food poisoning in man. So far, such an opportunity has not presented itself.

Summary. Serum glutamic-oxalacetic acid transaminase activity of monkeys after staphylococcal enterotoxin feeding has been studied. There is an elevation to about 2 to 3 times the prefeeding titer within 6-8 hrs after feeding of the toxin. The observations are discussed on the basis that increased serum transaminase activity is due to release of the enzyme into the circulation by damaged cells.

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Received February 13, 1958. P.S.E.B.M., 1958, v98.

Uterine Growth Promoting Action of Relaxin. (23932)

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Previous reports indicate that relaxin may have an effect upon several metabolic alterations of the uterus of rat, guinea pig and human. These alterations include glycogen and water content(1,2,3), decidual tissue reactions(4,5) and myometrial activity(6-11). We recently reported that large doses of Relaxin augmented wet and dry uterine weights of non-ovariectomized immature rats, and that exogenous relaxin potentiated weight response of uterus of ovariectomized immature rat to a physiologic level of estradiol-17β (11).

These observations raise the question as to the effect of different dosages of relaxin on relative contents of nitrogen, water and non-nitrogenous solids as well as gross wet and dry weights of uteri of immature female rats. The present study is directly concerned with ascertaining these effects.

Methods. Two groups of intact immature albino female rats were injected daily for 3 days and necropsied on the fourth, one group of females 33 days of age at start of experiment, the other group 28 days old. The animals were neither ovariectomized nor otherwise treated so as to change the hormonal balance.

In each of the 2 age groups there were 8 subgroups receiving saline or different doses of relaxin‡ as shown in the table. The 3 daily doses were given subcutaneously in 0.50 ml fluid. At necropsy the animals were weighed, uteri dissected, blotted on paper, weighed, dried at 110°C for 24 hours, and reweighed. The nitrogen content of the dried uteri was then determined by the Kjeldahl method.

Results. Wet and dry uterine weights are summarized in Table I. Weights of animals

TABLE I. Weight Responses to Relaxin of Uteri of Rats not in Estrus Necropsied at 36 Days of Age and 31 Days of Age.

Treatment, total amt Relaxin in mg	Age in days: 31	36	31	36	31	36	31	36
	No. of rats		mg % wet wt		mg % dry wt		% water content	
Saline controls	10	15	45 ± 3.5	47 ± 2.6	7.4 ± .6	7.9 ± .5	85	85
.0002	7		47 ± 1.5		8.3 ± .6		82	
.001	10	10	51 ± 2.4	47 ± 4.6	8.1 ± .8	7.8 ± .6	86	83
.01	10	9	52 ± 2.4	47 ± 3.5	8.3 ± .6	7.1 ± .7	86	85
.1	17	8	58 ± 3.3	50 ± 4.6	9.7 ± .6	8.5 ± .7	85	85
1.0	10	7	64 ± 4.1	52 ± 4.6	8.4 ± .6	9.8 ±1.2	87	86
2.5		15		58 ± 3.2		10.7 ± .6		82
5.0	10	7	63 ± 6.0	66 ± 4.2	10.1 ±1.1	11.4 ± .9	84	86
10.0	8	9	67 ± 7.0	70 ± 3.9	10.6 ±1.6	11.5 ± .9	84	83

* Studies carried out during tenure of Lederle Medical Faculty Award.

† Supported by grant from U.S.P.H.S., N.I.H.

‡ The authors wish to acknowledge generous supplies of relaxin (Cervilaxin®) furnished by The Princeton Laboratories, Princeton, N. J.