creatic, splenic, and thyroid tissue; brain-tissue was negative. Kidney-antiserum, tested with these autolysates, gave negative or unsatisfactory results. Only very low dilutions of the renal autolysates were reactive but precipitation occurred in high dilutions (1-100,000) of the hepatic autolysate.

Summary. Precipitins for blood proteins disappeared from the circulating blood of rabbits immunized with renal and hepatic tissue as soon as these antigens are exhausted from the injected-tissue depots. The exhaustion of the tissue-proteins usually takes a much longer time. This provides a method for the preparation of tissue-antisera. Extracts of fresh liver and kidney do not give precipitative reactions with the antisera, but the autolyzed products of these organs do. Liver-autolysate seems to have an antigenic factor in common with the autolysate of kidney, pancreas, spleen, adrenals, and thyroids. Kidney-autolysate has an antigenic factor in common with liver but not with any of the other above-mentioned organ-autolysates.

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Effect of Inorganic Phosphorus on Bone Growth and Repair.

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That the feeding of inorganic phosphorus will produce transverse lines or bands of increased density in the metaphyses of growing long bones has been demonstrated by means of roentgenograms by Phemister[1] and subsequently by various observers. This "phosphorus band" has been thought to be a "growth arrest line," but the hypothesis has not been proved. Such lines have been observed only where longitudinal growth has taken place. They are not produced by supplements of Vitamin D without phosphorus.

We observed in the roentgenograms of a few young patients who were receiving phosphorized cod liver oil, dense new bone about areas of healing fractures or osteotomies of long bones. The callus about the osteotomy site, along the edges of the chisel cut, appeared to show an increase in density similar to the phosphorus lines in the metaphyses of the same bones.

[1] Phemister, D. B., *J. A. M. A.*, 1918, **70**, 1737.

These observations suggested the possibility that phosphorus might be causing an increased density in the new bone that was being formed through callus, and hence that such bands were not limited to the phenomenon of long bone growth. Such a possibility could be explained upon a basis of retardation of the formation of provisional callus, stimulation of osteogenesis, or excess deposition of inorganic phosphorus similar to retention of lead in the bones of patients suffering from lead poisoning. The demonstration of these transverse phosphorus lines at the site of fractures or osteotomies of growing bones also reopened the question of whether or not some longitudinal growth of long bones might occur from the cartilaginous callus of the healing fracture. Because of interest in these questions, which had been stimulated by the aforementioned observations, the following experiment was undertaken:

Twenty-nine rabbits from 5 litters, 8 to 12 weeks old, and 2 adult rabbits from a sixth litter were used. The right tibia of each animal was fractured in mid-shaft and immobilized in a plaster cast for 2 weeks. Half of the rabbits of each litter were given from .0006 to .003 g of inorganic phosphorus in the diet daily. Four litters received this supplement in the form of phosphorized cod liver oil mixed with their food. Two litters were given daily a pill of yellow phosphorus. When .003 g of phosphorus in cod liver oil was mixed with the daily food ration, the rabbits refused to eat. Roentgenograms of both lower extremities were taken each week. An animal and its control mate were killed each week after fracture and the entire tibia prepared for microscopic study.

By the end of the second week, transverse lines of increased density could be demonstrated by the roentgenograms, in the juxtaepiphyseal regions, of all of the animals receiving phosphorus, except the adult rabbit. These lines also were present in the microscopic sections. Similar transverse lines did not appear at the site of the healing fractures. There was no clinical, roentgenographic, nor microscopic evidence that the feeding of phosphorus had any effect on the rate of healing, the quantity or quality of callus formed. There was no evidence in the roentgenograms that any longitudinal growth of bone occurred from the cartilaginous callus of the healing fractures.

Measurements of the normal tibias showed an average decrease in rate of longitudinal growth of the bones of the animals receiving phosphorus, as compared with those on the stock diet without this supplement. This observation would seem to support the theory that the so-called phosphorus band is, in reality, a "growth arrest line."

The results of this experiment and reëvaluation of the earlier roentgenograms seem to justify the conclusion that the lines of increased density which we observed in the roentgenograms at the site of repair of fractures, osteotomies or bone defects simply represented formations of cortical bone and had no definite relation to the phosphorus the patients were receiving. They were not growth or growth arrest lines.

Conclusions. 1. In the experimental animals, the feeding of inorganic phosphorus in doses large enough to cause transverse metaphyseal lines, has no demonstrable effect on the roentgenographic or microscopic appearance of the healing of fractures. 2. Transverse bands of increased density which may be produced at the juxta-epiphyseal region of growing children or animals by the feeding of phosphorus are probably "growth arrest lines" similar in their etiology to those produced by acute diseases such as scarlet fever.

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Increase of Bactericidins in the Serum of Cattle Following Recovery from Infection with *Brucella abortus.**

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Results given previously[1] have shown that bovine serum displayed a greater bactericidal activity against *Brucella abortus* than did a comparable amount of whole blood. Trials have accordingly been made to determine whether an increase in the titer of the serum bactericidins was to be found in individuals which had recovered from an infection with this organism.

The technic employed was essentially the same as that previously described.[1, 2] The serum was taken from (a) cows which had previously been artificially infected with *Br. abortus,* and from whose blood practically all agglutinins for the organisms had disappeared (*i.e.,* "recovered") and (b) from other animals which, insofar as

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1 Irwin, M. R., Beach, B. A., and Bell, F. N., *J. Inf. Dis.*, 1936, **58**, 15.

2 Shrigley, E. W., and Irwin, M. R., *J. Immunol.*, 1937, **32**, 281.