animal 2 on the 35th day, animal 3 on the 38th day and animal 4 on the 42nd day. Animal 5 was taken directly from the breeding colony and was 54 days of age when killed.

The tibia and the tail were removed from the dead animal and preserved in a 50% alcohol-water solution until the desired photographs could be made. For the X-ray photographs, the 6 tibiae and the 6 tails were arranged above a single X-ray photographic plate and X-rayed simultaneously. For the "line test" photographs, the bones were prepared in the usual manner and individual photographs were taken.

Through such photographs and other observations, we are led to believe that both X-ray and "line test" made of the caudal bones of the rat are reliable indices of the degree of ossification. The caudal bones appear to offer some advantages over the tibia or the femur in certain respects, but do require greater pains in the preparation for "line testing" than does either the tibia or the femur. Some of these advantages are: (a) the caudal bones are both more easily and more effectively X-rayed, (b) the caudal bones offer a series of zones of calcification instead of a single zone, and (c) the caudal bones offer possibilities of removing segments for "line test" during the progress of the experiment. While such advantages may be important considerations in certain phases of research, it is not suggested that the caudal bones replace the tibia or the femur in the conventional method of determining the state of ossification.

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Formation of Bone by Periosteum After Experimental Infarction by Embolism of Femur in Rabbits.

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Some authors ascribe osteogenic potentialities to the periosteum and feel that it is important for normal nutrition of bone and for repair of injuries to the cortex. Others have observed no nutritional disturbance or decrease in bone regeneration in the absence of periosteum or after experimental fractures, partial resections and drill holes. There is also no uniformity among observations made after transplanting this tissue. Failure of bone formation by the periosteum does not demonstrate that it may not occur under proper conditions. It, therefore, seems desirable to accumulate more data on periosteal osteogenesis and to devise better methods for studying changes in bone.

Infarcts have been produced in the femur of young and adult rabbits by injecting through its nutrient arteries a particulate suspension of charcoal in 5% gum acacia. Interference with the blood supply to the femur by interrupting the vessels outside the cortex did not, however, produce noteworthy changes except in very young rabbits. The bones were removed for examination from 20 hours to 150 days after operation, fixed in 10% formalin and decalcified by 4% nitric acid. Histologic sections were then cut from celloidin blocks and stained with hematoxylin and eosin.

The charcoal emboli produced marked necrosis of the medullary tissues and inner one-fourth to one-half of the cortex. This was followed by the formation of a wide layer of compact new bone outside the cortex that seemed to envelop the infarcted portion of the shaft and it was always well delimited from the pre-existing living bone by a narrow straight line of demarcation. Its thickness varied from a few layers of bone cells to that of the original cortex, and the outer edge was irregular. More marked osteogenesis and revascularization of necrotic bone occurred at the attachment of muscles and tendons. In some regions there was necrosis of the entire thickness of the cortex without new bone formation as if some of the soft tissues about the femur had been infarcted inadvertently. The structure of the new periosteal bone was essentially like that of the cortex but its haversian systems were more irregularly arranged and the bone cells varied in size and shape. The tissues were also slightly less compact due to more abundant and larger canaliculi and blood vessels. Within the medullary canal near the ends of the infarcted regions, new endosteal bone replaced the inner devitalized cortical bone. In places the combined thickness of old cortical and new periosteal and endosteal bone was 3 times that of the cortex of the control femur.

This layer of new compact bone was definitely and regularly delimited from the original cortex and its origin from the periosteum was substantiated by the prolific production in the presence of abundant nutrition and by the paucity of new osseous tissue where the periosteal blood supply was diminished. Interference with nutrient blood vessels outside the cortex did not produce sufficient nutritional disturbance of the bone to require or stimulate periosteal osteo-

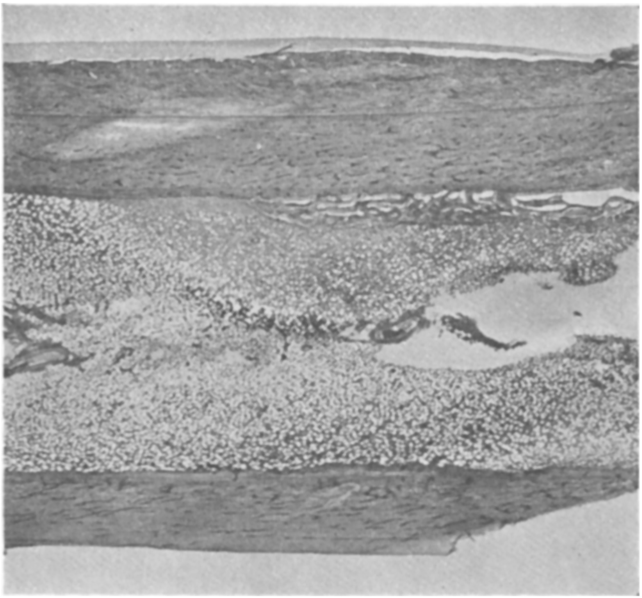

FIG. 1.
Marked periosteal and endosteal osteogenesis in the shaft of a rabbit's femur 49 days after infarction by charcoal emboli (H. and E. x11).

genesis. Mechanical injuries, such as fractures and partial resections of bone or periosteum, which are commonly used in studying bone regeneration, interrupt the continuity or interfere with the nutrition of the structures so that it is difficult to determine the relative importance for healing of the various tissues. Infarction by emboli prevents collateral circulation in the medullary canal and produces necrosis of those tissues that do not receive blood from the periosteum without interrupting the continuity of cortex or periosteum. Necrosis in the inner layers of the cortex and formation of new compact bone in the periosteum after infarction of the medullary tissues alone, and the presence of necrosis of the entire bone with the absence of new osseous tissue after infarction of both the medulla and periosteum, emphasize the necessity of periosteum for viability of the outer portion of the cortex as well as for osteogenesis outside this compact layer.