normal. Low values were also obtained in hearts that showed microscopic changes, inflammatory or degenerative, from patients that had died of infectious disease.

We have previously noted[5] the drop in creatine content of infarcted heart muscle with experimental animals. Four human cases have shown the same changes. Table II shows the creatine values for the infarcted areas from human hearts, compared with the values from non-infarcted portions of the heart.

TABLE II.
Coronary Occlusion.

	Creatine mg. %		Solids %		Dried mg. %	
Ht. Wt.	Good	Infarcted	Good	Infarcted	Good	Infarcted
610	122	41	23.45	18.0	520	228
350	104	61	21.95	15.05	497	405
800	100	52	19.7	18.2	558	318
900	151	31	19.15	17.25	788	180

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Embolic Staphylococcus Arthritis and Endocarditis in Rabbits.

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There have been many clinical and experimental studies of arthritis and its associated conditions. The results and hypotheses set forth, however, are confusing and conflicting, especially regarding etiology and mechanism of production. Experimental inflammatory reactions have been produced within joints by intra-articular and intravenous injections of virulent and attenuated micro-organisms, bacterial toxins and various chemical agents. It has been postulated by various authors that the localization of a focus may be influenced by trauma, allergic responses and by the particular structure of joint tissues.

Studies of the blood supply and infarction of the femur in rab-

[5] Decherd, G., Herrmann, G., and Davis, O., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 547; Herrmann, G., and Decherd, G., PROC. SOC. EXP. BIOL. AND MED., 1935, **32**, 1304.

bits[1] demonstrated that a suspension of charcoal and agglutinated staphylococci, living or dead, can act as arterial emboli and produce septic or aseptic infarcts in bone. These infarcts occurred regularly beneath epiphyseal and articular cartilages due to end-capillaries between ossifying columns of calcified matrix and to relative poor collateral circulation to subchondral tissues. Since some of the septic infarcts were accompanied by exudative arthritis, it seemed desirable to investigate further the relationship of joint infection to embolic disturbances in contiguous bone and cartilage structures.

Healthy growing rabbits (500 to 2000 gm.) were given intravenous (ear vein) injections of fully virulent, partially sterilized and killed agglutinated and non-agglutinated saline suspensions of a hemolytic *staphylococcus aureus* made from 24-hr. agar-slant cultures. The organism was obtained from the blood stream of a man with a subperiosteal abscess. Agglutination and partial or complete sterilization were produced by one to 5 drops of N/10 sulphuric acid per cubic centimeter of suspension. The amounts injected, singly or in divided doses, ranged from 0.0025 (virulent) to 1.5 cc. (killed suspension) depending upon the size of the animal, the effects desired and upon the amount of acid and the time added before injection. The animals died or were killed from 1 to 115 days after the first injection and all abnormal bone, joint and viscera tissues were taken for histologic study. A pure growth of staphylococcus, similar to the strain injected, was obtained from all foci cultured.

All the rabbits that received living organisms and survived the septicemia more than 2 days developed marked exudative arthritis in one or more joints with destruction of articular cartilage and subchondral bone. The joints were distended markedly by exudate and many had associated necrosis and separation of one or both adjacent epiphyses. The joints most commonly affected were the knee, hip and ankle. In the more chronic experiments the joints tended to heal; in a few this was complete but with residual rough articular surfaces, thick fibrous capsules and limited motion. There were also gross lesions of the heart, especially the mitral leaflets, in 53% of the animals. These ranged from small endocardial vegetations to marked suppurative pericarditis. The parenchymatous visceræ had no significant changes or a few scattered abscesses not larger than 2 mm. in diameter. This was conspicuous by contrast

[1] Kistler, Gene H., *Arch. Surg.*, 1934, **29**, 589; *Surg., Gynec. and Obst.*, 1935, **60**, 913.

with the changes in the joints and structures of the heart. One animal that received 0.1 cc. of a partially sterilized and agglutinated suspension in a single dose and survived 11 days, had 21 joint and 2 endocardial foci without changes in the liver and with only 3 miliary abscesses of the kidneys. Rabbits that died within 2 days after injection had swollen, hyperemic parenchymatous visceræ, often hyperemia of the epiphyses, increased sanguinous joint fluid and hemolysis staining of the tissues generally.

The most marked and numerous focal changes were obtained with suspensions of cocci well agglutinated and partially or almost completely sterilized by the acid, which permitted relatively large single and repeated doses and the production of chronic lesions. It was difficult to judge the dose of virulent non-agglutinated organisms for amounts as small as 0.0025 cc. produced death without localized suppuration. Sterile agglutinated and non-agglutinated suspensions aggregating 1.5 cc. produced no significant changes in any tissues.

Histologic preparations of joint and contiguous bone tissues after decalcification demonstrated marked exudate in the joint space, edema and hyperemia of the synovia, varying degrees of necrosis and repair of articular cartilage and focal necrosis of subchondral bone, as produced previously by septic arterial infarction of the femur. The bone abscesses beneath articular cartilage produced necrosis of the cartilage; those in the metaphyses spread along the epiphyseal cartilage plates, partially separated the epiphysis from the diaphysis and entered the joint near the attachment of its capsule. This association of a subchondral abscess with suppurative arthritis was demonstrated in all tissues examined. The septic infarcts were present also beneath many articular and epiphyseal cartilages without arthritis and beneath cartilage not contiguous with joints. It seems very probable that the peculiar structure and blood supply of growing bones and the susceptibility of these to infarction are important in the production of acute exudative arthritis. This is substantiated clinically by the great predominance of exudative arthritis in children over adults. The organism used was in no sense specific and similar changes were produced by a staphylococcus obtained from a cutaneous carbuncle.