

We were unable in our work to parallel Germán's results in the case of all the species which he claims produce creatinine. This we believe to be due to the fact that the ability to produce creatinine is a characteristic which may easily be lost by bacteria just as is the power of producing indol.

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Regeneration of bone from periosteum.

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In an endeavor to establish the factor that periosteum plays in the regeneration of bone, the following experiments were performed on the ribs of rabbits.

Several experiments consisting merely of a subperiosteal resection of the rib showed after 20 days a cartilaginous-like material filling the entire space; while after a longer time complete filling in with bone.

The next endeavor was to isolate the periosteum so as to prevent bony elements from growing in to the periosteal space.

In one experiment the rib ends were capped with lead—after 12 days no evidence of regeneration. This method was discarded as it was thought better to try and raise the rib from its periosteal covering without severing the ends, and isolate it by sewing muscle beneath the raised rib.

In 10 experiments of this nature the results uniformly showed a tendency for bone to grow in at the angle where the rib was raised from its periosteal bed. In one experiment after 59 days the whole area was filled in by bone, although in another after 8 months there was only a small spicule of bone growing in at the sternal side. In only one experiment after 26 days was an isolated island of bone found, free from connection with bone elements.

Although this does not prove the point sought, it at least emphasizes the tendency of bone to grow in the direction of existing periosteum.

At this stage it was noticed that there was a difference at times in bone regeneration and it was suggested to try the effect

of blood clot. The experiment was performed in the same way as the previous one except that blood clot was placed in the periosteal gutter left by the raised rib. After periods of 48, 44, 39, 23, and even 14 days, the whole area was found to be occupied by a calcareous material. Two ribs in the same animal were similarly treated with the exception that in one no blood clot was used. The one containing blood clot showed considerably more bone formation. This showed the marked increase of bone in the presence of blood clot.

In order to rule out ingrowth of bone from the side, the following method was resorted to. Extensive resections of a rib from near the vertebral junction, to and including about 1 cm. of costal cartilage. Hot paraffin was poured in at the vertebral and sternal sides, allowing a free gap between. This gap was filled with blood clot and all sutured in place. In four experiments of this nature there always was found calcareous material, separated grossly from any bony tissue. A few experiments without blood clot were used as controls to the last. These showed some calcareous material. In one particular instance considerable bleeding was noticed at the end of operation, and in this case a heavy bony deposit occurred. Thus the factor of post-operative hemorrhage might explain discrepancies of results of these experiments and those of other experimenters.

An interesting point was noticed in cases where costal cartilage was dissected away, in that there was an especially marked tendency for regeneration of bone at costal cartilaginous junction. If we consider this junction as an epiphysis it is remarkable that we should get so much regeneration after its destruction, evidently from the periosteum.

In these experiments the periosteum has been considered as one usually leaves it after surgical removal of bone. In conclusion it appears that periosteum under certain conditions has the power of regenerating bone, especially in the presence of blood clot. Also, that it always exerts a stimulating effect on bone formation.