

irritation has caused to be poured out of the Haversian canals and spread over the surface of the bone, the periosteum acting as a limiting membrane only.

Again, the bone is destitute of periosteum at those points where tendons are inserted, and yet after removal of dead bones new osseous matter develops as readily from these points as in any other part, and it has already been observed that when the periosteum has been stripped from a portion of bone, fresh cells are thrown out from the interior of the bone and a new layer of bone formed as well as of connective tissue which becomes periosteum.

The author states he has performed subperiosteal excision of the elbow at least sixty times the periosteum being raised from the olecranon and the distant extremity of the humerus in order to preserve the aponeurotic and muscular connections.

Generally a number of small osseous plates are found adhering to the under surface of the periosteum and if allowed to remain produce more or less new bone which restricts the after movements of the elbow joint. If these be carefully removed, as is now the custom of this surgeon, no new bone is formed from the periosteum.

He has also observed that the amount of callus thrown out, in cases of fracture is always greater when the periosteum has been much torn away from the bone than when it remains pretty well intact the periosteum in these cases acting as a limiting membrane. Callus thrown out from a fracture may in certain cases be superimposed on the periosteum, hence not produced by it.

*"Proposition G.—Bone may be regenerated independently of the medulla, which may itself be reproduced."*

A case recorded in support of this proposition is that of a lad *at ten years* who had, besides complete destruction of the ankle-joint and bones of the foot, a chronic osteomyelitis of the tibia.

The interior of the shaft was filled with a dark chocolate pulp mixed with pus which extended from the upper tibial epiphysis to the lower. The cancellated tissue had disappeared and the whole cavity filled with the fluid which flowed out when the shaft was opened into. The cavity was washed out leaving it entirely empty with only a shell of bone representing the cortex, and this shell was composed for the most part of young bone.

In a few months this external layer had become

much thicker and a new medulla had formed in the interior. At the end of eight months the shaft was strong enough to bear the weight of the body while walking and when the patient was questioned four years afterwards it was found he could walk for long distances on it with ease.

*"Proposition H.—The histo-genetic phenomena support the foregoing observations, showing that the periosteum does not generate bone."*

It is acknowledged that the perichondrium which surrounds the cartilage in the long foetal bones does not produce the cartilage. Cartilage grows from the cells and these cells secrete the intercellular substance or matrix. In the ossification of cartilage the process commences at the middle of the shaft of hyaline cartilage and extends towards the extremities. There is first a proliferation of the cartilage cells and calcification of the matrix. This calcified material is absorbed and blood-vessels grow in. Medullary spaces are formed which are filled with cells, and from these osteoblasts thin layers of osseous tissue are produced and cover the trabeculae between the spaces and as these layers thicken the trabeculae are absorbed. Giant cells absorb portions of the intervening trabeculae and thus form the medullary canal.

A layer of cartilage persists at the epiphysis until growth in length has ceased. The perichondrium becomes changed in name to the periosteum but it has nothing to do with generating bone.

The author concludes this exhaustive and exceedingly interesting paper in the following words:—"It may be stated that a study of the whole subject, from histogenesis to experimental inquiry and pathological observation, shows that bone is produced and regenerated by proliferation of osteoblasts, and its development and reproduction can take place independently of the medulla and periosteum. The periosteum acts as a shield, as a protecting limiting membrane, through which the bone receives some of its blood supply, a very important portion being provided by the nutrient vessels. The cells of which the bone is composed are capable of living, separated from periosteum and medulla; they possess the power of proliferation, and consequently of regeneration of osseous tissue."

"These conclusions, if accepted, indicate to the