chondrium and the cartilage, by the *intramembranous* mode of ossification just described. There are then, in this first stage of ossification, two processes going on simultaneously: in the center of the cartilage the formation of a number of oblong spaces, formed of calcified matrix and containing the withered cartilage cells, and on the surface of the cartilage the formation of a layer of true membrane bone. The second stage consists in the prolongation into the cartilage of processes of the deeper or osteogenetic layer of the perichondrium, which has now become periosteum (Fig. 79, *ir*). The processes consist of bloodvessels and cells—**osteoblasts**, or **bone-formers**, and **osteoclasts**, or **bone-destroyers.** The latter are similar to the giant cells (myeloplaxes) found in marrow, and they excavate passages through the new-formed bony layer by absorption, and pass through it into the calcified matrix (Fig. 80). Wherever these processes come in contact with the calcified walls of the primary areolæ they absorb them, and thus cause a fusion of the original cavities and the formation of larger spaces, which are termed the **secondary areolæ** or **medullary spaces.** These secondary spaces become filled with embryonic marrow, consisting of osteoblasts and vessels, derived, in the manner described above, from the osteogenetic layer of the periosteum (Fig. 80).

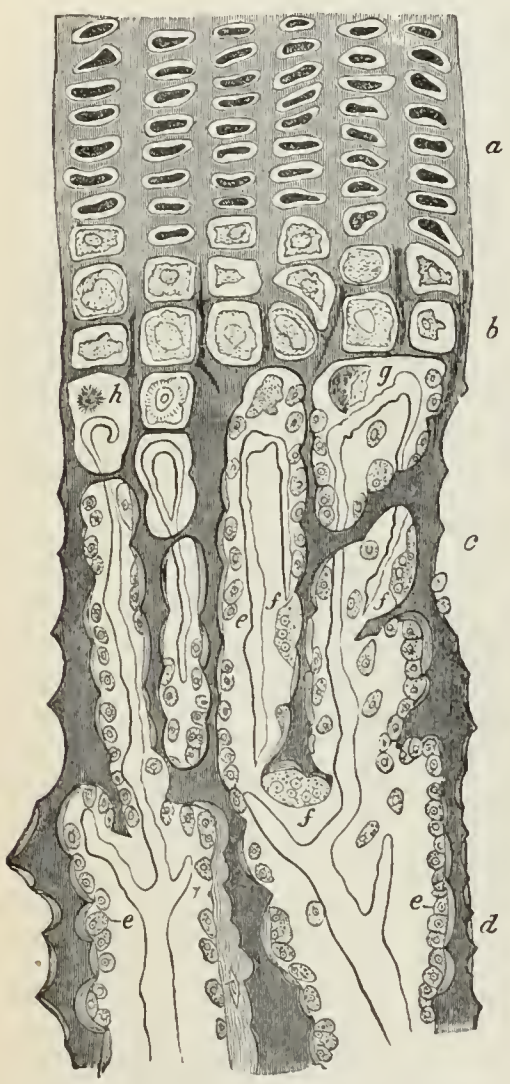

Fig. 80.—Part of a longitudinal section of the developing femur of a rabbit. *a*. Flattened cartilage cells. *b*. Enlarged cartilage cells. *c*, *d*. Newly formed bone. *e*. Osteoblasts. *f*. Giant cells or osteoclasts. *g*, *h*. Shrunken cartilage cells. (From "Atlas of Histology," Klein and Noble Smith.)

Thus far there has been traced the formation of enlarged spaces (secondary areolæ), the perforated walls of which are still formed by calcified cartilage matrix, containing an embryonic marrow derived from the processes sent in from the osteogenetic layer of the periosteum, and consisting of bloodvessels and osteoblasts. The walls of these secondary areolæ are at this time of only inconsiderable thickness, but they become thickened by the deposition of layers of true bone on their surface. This process takes place in the following manner: Some of the osteoblasts of the embryonic marrow, after undergoing rapid division, arrange themselves as an epithelioid layer on the surface of the wall of the space (Fig. 81). This layer of osteoblasts forms a bony stratum, and thus the wall of the space becomes gradually covered with a layer of

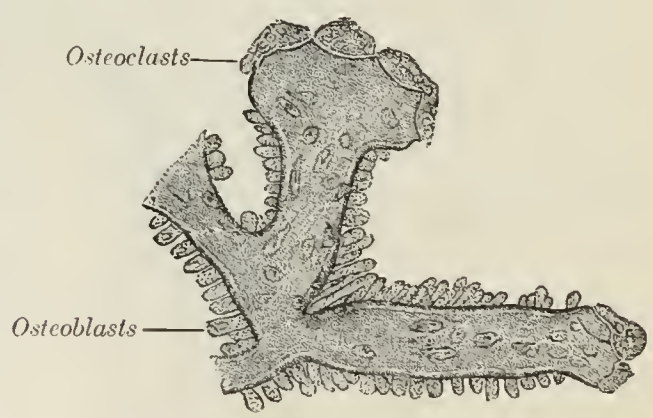

Fig. 81.—Osteoblasts and osteoclasts on trabecula of lower jaw of calf embryo. (Kölliker.)

true osseous substance in which some of the bone-forming cells are included as bone corpuscles. The next stage in the process consists in the removal of these primary bone spicules by the osteoclasts. One of these giant cells may be found lying in a Howship's foveola at the free end of each spicule. The removal of the