groove when the knee is extended. Above and behind the lateral epicondyle is an area for the origin of the lateral head of the Gastrocnemius, above and to the medial side of which the Plantaris arises.

The **articular surface** of the lower end of the femur occupies the anterior, inferior, and posterior surfaces of the condyles. Its front part is named the **patellar surface** and articulates with the patella; it presents a median groove which extends downward to the intercondyloid fossa and two convexities, the lateral of which is broader, more prominent, and extends farther upward than the medial. The lower and posterior parts of the articular surface constitute the **tibial surfaces** for articulation with the corresponding condyles of the tibia and menisci. These surfaces are separated from one another by the intercondyloid fossa and from the patellar surface by faint grooves which extend obliquely across the condyles. The lateral groove is the better marked; it runs lateralward and forward from the front part of the intercondyloid fossa, and expands to form a triangular depression. When the knee-joint is fully extended, the triangular depression rests upon the anterior portion of the lateral meniscus, and the medial part of the groove comes into contact with the medial margin of the lateral articular surface of the tibia in front of the lateral tubercle of the tibial intercondyloid eminence. The medial groove is less distinct than the lateral. It does not reach as far as the intercondyloid fossa and therefore exists only on the medial part of the condyle; it receives the anterior edge of the medial meniscus when the knee-joint is extended. Where the groove ceases laterally the patellar surface is seen to be continued backward as a semilunar area close to the anterior part of the intercondyloid fossa; this semilunar area articulates with the medial vertical facet of the patella in forced flexion of the knee-joint. The tibial surfaces of the condyles are convex from side to side and from before backward. Each presents a double curve, its posterior segment being an arc of a circle, its anterior, part of a cycloid.[1]

The Architecture of the Femur.—Koch[2] by mathematical analysis has "shown that in every part of the femur there is a remarkable adaptation of the inner structure of the bone to the machanical requirements due to the load on the femur-head. The various parts of the femur taken together form a single mechanical structure wonderfully well-adapted for the efficient, economical transmission of the loads from the acetabulum to the tibia; a structure in which every element contributes its modicum of strength in the manner required by theoretical mechanics for maximum efficiency." "The internal structure is everywhere so formed as to provide in an efficient manner for all the internal stresses which occur due to the load on the femur-head. Throughout the femur, with the load on the femur-head, the bony material is arranged in the paths of the maximum internal stresses, which are thereby resisted with the greatest efficiency, and hence with maximum economy of material." "The conclusion is inevitable that the inner structure and outer form of the femur are governed by the conditions of maximum stress to which the bone is subjected normally by the preponderant load on the femur-head; that is, by the body weight transmitted to the femur-head through the acetabulum." "The femur obeys the mechanical laws that govern other elastic bodies under stress; the relation between the computed internal stresses due to the load on the femur-head, and the internal structure of the different portions of the femur is in very close agreement with the theoretical relations that should exist between stress and structure for maximum economy and efficiency; and, therefore, it is believed that the following laws of bone structure have been demonstrated for the femur:

"1. The inner structure and external form of human bone are closely adapted to the mechanical conditions existing at every point in the bone.

"2. The inner architecture of normal bone is determined by definite and exact requirements of mathematical and mechanical laws to produce a maximum of strength with a minimum of material."

The Inner Architecture of the Upper Femur.—"The spongy bone of the upper femur (to the lower limit of the lesser trochanter) is composed of two distinct systems of trabeculæ arranged in curved paths: one, which has its origin in the medial (inner) side of the shaft and curving upward

[1] A *cycloid* is a curve traced by a point in the circumference of a wheel when the wheel is rolled along in a straight line.

[2] The Laws of Bone Architecture. Am. Jour of Anat., 21, 1917. The following paragraphs are taken almost verbatum from Koch's article in which we have the first correct mathematical analysis of the femur in support of the theory of the functional form of bone proposed by Wolff and also by Roux.