enlarge, and divide. These processes of growth may persist to some degree even after the derivatives show indications of differentiation into specific kinds of cells. It is, therefore, difficult to delimit the meristem proper from its recent derivatives, and the term meristem is often used broadly to designate not only the cell complexes that show no evidence of specialization but also those whose future course of development is partly determined. The development of meristematic derivatives into mature cells is also gradual. Some activities characteristic of mature tissues (photosynthesis, starch storage) may occur while these tissues are still developing. Such overlapping of adult and juvenile characteristics makes it impossible to delimit precisely the different stages of development.

CLASSIFICATION OF MERISTEMS

Apical and Lateral Meristems

One of the most common groupings of plant meristems is based on their position in the plant body. This classification divides the formative tissues into *apical meristems*, that is, meristems located at the apices of main and lateral shoots and roots, and *lateral meristems*, that is, meristems arranged parallel with the sides of the organ in which they occur. The vascular cambium and the cork cambium (or phellogen) are lateral meristems (figs. 1.2, 1.3).

Primary and Secondary Meristems

Another classification divides the meristems into primary and secondary according to the nature of the cells that give origin to these meristems. If these cells are the direct descendants of the embryonic cells that never ceased to be concerned with growth, the meristems are called primary. If, however, the cells first differentiate and function as members of some mature tissue system, then again take up meristematic activity, the resulting meristem is called secondary. This classification of meristems is no longer popular because it is based on the obsolete concept that cells returning to a meristematic state undergo a profound readjustment—a dedifferentiation—and that they reacquire the meristematic potentialities. Although experimental studies with living tissues and cells (Gautheret, 1959) indicate that the meristematic and the histogenetic potentialities of cells are affected by their development as members of certain tissue systems, the degree of such physiologic differentiation is highly variable, and no means have been found as yet to distinguish between an acceleration of meristematic activity that had never ceased and a resumption of such activity after a period of inactivity.

The classification of meristems into primary and secondary on the basis of their origin is not employed in this book. The expressions *primary meristems* and *secondary meristems* are used only if it is necessary to indicate the relative time of origin of the meristem in a given plant or one of its organs. This classification is related to the corresponding distinction into primary and secondary parts of the plant body (chapter 1). The fundamental parts of this body, its root and stem axes, their branches and appendages, constitute the primary parts, and they originate from primary meristems. The additional tissues that may be formed after primary growth are secondary. These tissues may arise from distinct meristems—secondary meristems—or by diffuse meristematic activity, the diffuse secondary growth (Tomlinson, 1961). If this classification is correlated with the topographical classification, the apical meristems correspond to the primary meristems, the lateral to the secondary meristems.

In descriptions of the primary differentiation at the apices of root and shoot, the initiating cells and their most recent derivatives may be distinguished, under the name of *protomeristem* (Jackson, 1953), from the partly differentiated but still meristematic subjacent tissues, and the meristematic tissues are segregated according to the tissue systems that are derived from them (pl. 14*A*). These tissues are: the *protoderm*, which differentiates into the epidermal system; the *procambium* (also called *provascular tissue*), which gives rise to the primary vascular tissues; and the *ground meristem*, the precursor of the fundamental or ground tissue system. If the term meristem is used broadly, the protoderm, the procambium, and the ground meristem are referred to as the primary meristems (Haberlandt, 1914). In a more restricted sense, these three cell complexes constitute the partly determined primary meristematic tissues (Foster, 1949).

The terms protoderm, procambium, and ground meristem serve well for describing the pattern of differentiation in plant organs, and they are correlated with the equally simple and convenient classification of mature tissues into the three systems, epidermal, vascular, and fundamental, reviewed in the first chapter. It seems immaterial whether the protoderm, the procambium, and the ground meristem are called meristems or meristematic tissues as long as it is understood that they are tissues whose future course of development is partly determined.

Intercalary Meristems

The term *intercalary meristem* is used to designate an actively growing primary tissue region somewhat removed from the apical meristem. The word intercalary implies that the meristem is inserted between