j10 Cyclical diplobionic life histories of spore-shedding higher plants < for example, that of a fern >

When the legend becomes a fact, print the legend,
—says the newspaperman in *The Man Who Shot Liberty Valance*.[1]

A fern is a spore-shedding higher plant. This manner of reproduction is a feature of all simpler types of plants as for example *Ulva* (a green algae). However a fern (***Figure j10.1***) is a higher plant in that it has vascular tissue. This means that a fern can circulate sap and survive times of drought that would kill a non-vascularized plants such as *Ulva*. Why do ferns, which have great diversity, not cloth hillslopes but live only where the ground, in which they are rooted, is shaded and almost continuously damp?

All plants have an alternation of generations that can undergo cell division and growth for propagation. One generation propagates asexually and the other generation propagates sexually.

The familiar fern is the generation that propagates asexually by shedding spores. That is, the familiar fern is a sporophyte (spore producing plant). Spore cells (germ cells) have half the genetic code of the other cells (somatic cells) of the sporophyte. A shed spore must undergo independent growth in order to mature. The plant, which the spore grows to become, is a gametophyte (gamete producing plant). The fern gametophyte is without vascular tissue and is therefore aquatic in its needs. It has the appearance of a tiny heart-shaped leaf. Its discovery, by William Jackson Hooker (1785-1865), and description, in his *Plantae Cryptogamicae*, 1816, ended what was long a mystery to pteridologists (those who study ferns): How do ferns reproduce sexually? The gametophyte which bears the fern's sexual organs is not familiar to most people because it can only grow in the natural environment where ferns can be found, and not where people can grow a fern that they have transported from there and which they water only occasionally. The gametes that are produced, must swim in a film of moisture on the underside of the gametophyte to meet and unite as a zygote. This zygote grows into the familiar fern.

In genetic terms, the vascularized sporophyte (the familiar fern in this case) is the diploid generation and the non-vascularized aquatic gametophyte is the haploid generation. In no plant species is the haploid generation vascularized. This has the result that the spore shedding plants are not truly freed from the water because the vascularized generation must live where the free living aquatic generation does. (This problem was solved by the evolution of pollen-shedding plants that propagate by shedding seeds). ❑

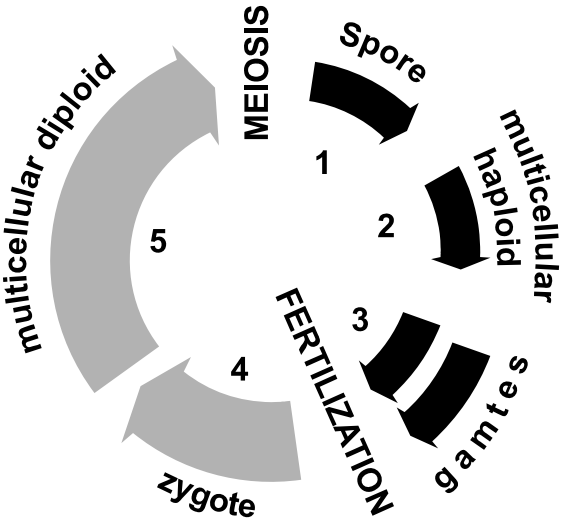

Figure j10.1 [3] **The cyclical diplobionic life history of a fern** (five stages).

The fern's life history is diplobionic in that its haploid gametophyte and diploid sporophyte generations exist each as separate free-living stage.

Stage 5 is the familiar fern which is a higher plant (has vascular tissue). On the undersurface of a fertile fern leaf (sporophyll) one can find a series of round dots (each is a sorus, which is a cluster of many tiny sporangia).

Stage 2 is a tiny heart-shaped gametophyte. This generation does not have vascular tissue.