Mitochondria are vital, semi-autonomous organelles that provide energy for life and a trigger for death. Comprising of at least six compartments: outer membrane, inner boundary membrane, inter-membrane space, cristal membranes, inter-cristal space, and matrix, mitochondria have a complex, dynamic internal structure. This internal dynamism is reflected in the pleomorphy and motility of mitochondria. Mitochondria contain their own DNA (mtDNA), encoding a small number of vital genes, but this role as a genetic vault is not compatible with the role of mitochondria in bioenergetics since electron transport results in the generation of reactive oxygen species (ROS) that induce lesions in the mtDNA. Despite the highly dynamic nature of plant mitochondria there is little specific scientific evidence linking mitochondrial dynamics to organelle and cell function. Two exceptions to this are the changes in mitochondrial dynamics that are early events during the induction of cell death programmes, and the extensive mitochondrial fusion that occurs before cytokinesis, although in both cases the roles of these events are a matter for conjecture. I will summarise our current knowledge of the genetic control of mitochondrial dynamics and discuss how dynamic mitochondria might influence cell physiology via the promotion of the interaction of mitochondria with each other, and with other cellular organelles and structures.