How to distinguish mitochondrial mutations from nuclear mutations

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Background

Mitochondria are normally transmitted through the maternal (protoperithecial) parent. Cytoplasmic inheritance can thus be distinguished from mendelian inheritance of chromosomal genes by making reciprocal crosses and showing that the trait in question is not transmitted when it is present in the male (fertilizing) parent. Mutant mitochondria, and mitochondrial plasmids, are also capable of vegetative transmission when heterokaryons are formed. The first mitochondrial mutants in Neurospora (Mitchell and Mitchell 1952, Mitchell *et al.* 1953) involved respiratory defects resulting from mitochondrial deletions. Individual mitochondrial genes were subsequently identified that involved either the respiratory chain, ATP synthesis, or the translational apparatus (reviewed by Griffiths *et al.* 1995. Griffiths 1996. See also Appendix 4 in Perkins *et al.* 2001, and http://www.bioinf.leeds.ac.uk/~gen6ar/newgenelist/genes/start_mit.html).

Mitochondrial plasmids resemble mitochondrial mutations in their mode of transmission (reviewed by Griffiths 1995). Exceptions exist where mutant mitochondria or mitochondrial plasmids of paternal origin have been recovered in progeny (May and Taylor 1989, Yang and Griffiths 1993). Transmission of mitochondrial plasmids from the male parent is normally blocked by heterokaryon incompatibility (Debets and Griffiths 1998). Even when strains are heterokaryon incompatible, interstrain fusion of hyphae may occur transiently and permit the transmission of mitochondrial plasmids (Debets *et al.* 1994). Invasion, transport, and replacement of mitochondria following hyphal fusion in *N. tetrasperma* has been described by Lee and Taylor (1993).

Procedure

- Reciprocal crosses
  See *How to make a cross*. See *How to use per-1 to establish parentage in reciprocal crosses*.
- Heterokaryons
  See *How to make heterokaryons in Neurospora crassa*.

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