How to determine whether a strain will undergo senescence.

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Background

Standard wild type laboratory Neurospora strains and most strains obtained from nature are able to grow indefinitely. Vegetatively propogated cultures are virtually immortal, with a potential for unlimited growth. Deleterious mutant genes and gene combinations are expected eventually to accumulate and slow or terminate growth even in normal growing, nonsenescent cultures. Occasional outcrossing can purge the genome of the accumulated defective genes, but in the absence of genetic recombination, deleterious mutations are expected ultimately to result in death of a serially propogated normal culture. Exceptions are known, however, where the potential for unlimited growth is severely limited and death of a culture occurs dramatically after only a brief period of clonal growth following origin from a single ascospore. These short-lived cultures are said to undergo senescence. Senescent strains have been obtained that originated by mutation in the laboratory, others were recovered from nature. The genetic basis of short-term senescence may be either mendelian (chromosomal) or nonmendelian (mitochondrial). The first example in Neurospora was due to mutation of the chromosomal gene natural *death* (*nd*) in a laboratory strain (Sheng 1951). Examples found subsequently in isolates from nature include both mitochondrial and chromosomal types. Mitochondrial-determined senescence may or may not involve mitochondrial plasmids (Griffiths and Yang 1993). Senescence induced by plasmids involves insertion of a nongenomic element into mitochondrial DNA, followed by displacement of normal mitochondria by those with the inserted molecules (Bertrand *et al.* 1985).. Senescence triggered by nuclear genes involves intramolecular recombination and deletions in mitochondrial DNA resulting in respiratory defects (Seidel-Rogol *et al.* 1989, Bertrand *et al.* 1993, D'Souza *et al.* 2005). For a general review of fungal senescence, see Griffiths (1992).

Procedure

Senescence is revealed by the inability of a strain to continue growing through extended culture, either in race tubes (Ryan *et al.* 1943) (e.g., Sheng 1951, Griffiths and Bertrand 1984), or in serial transfers to slants (e.g., Griffiths *et al.* 1986, Navaraj *et al.* 2000). Nuclei containing a recessive senescence-determining mutation are present in heterokaryotic condidion in some wild strains. These have been recovered as homokaryons by plating mitochondria (Pandit and Maheshwari 1993). See *How to measure and monitor linear growth* rate, *How to separate the components of a heterokaryon*. See *How to obtain microconidia, How to plate conidia and ascospores*.

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