

Practice Genetic Problems PMB 220

1. In working with a haploid organism, you cross a purple strain (*ad*⁻) strain of mating type (A) and a white (*ad*⁺) strain of mating type (B). If *ad*⁻ and *ad*⁺ are alleles of one gene and the A and B alleles are an independently inherited gene on a separate chromosome pair, what progeny do you expect to obtain and in what proportions?

2. Wild-type strains of the haploid fungus *Neurospora crassa* can make their own tryptophan. An abnormal allele *td* renders the fungus incapable of making its own tryptophan, and thus it is a tryptophan auxotroph (tryptophan must be added to the media to allow the mutant to grow). A mutation at a second, unlinked locus, *su*, suppresses the Trp⁻ phenotype of the *td* mutant so that it can grow on unsupplemented medium.
 - a. If a *td; su* strain is crossed with a genotypically wild-type strain, what genotypes are expected in the progeny and in what proportions?

 - b. What will be the ratio of tryptophan-requiring progeny to tryptophan independent progeny from this cross?

3. In a haploid yeast, a cross between a strain requiring arginine (*arg*⁻), adenine(*ad*⁻), but not nicotinic acid (*nic*⁺) or leucine (*leu*⁺) and a strain that does not require arginine (*arg*⁺) or adenine (*ad*⁺), but which does require nicotinamide (*nic*⁻) and leucine (*leu*⁻) produced sexual spores and 20 of these were isolated at random. When the resulting cultures were tested on various media, they give the results shown below, were Arg means arginine is added to the medium, Ad, means adenine is added to the medium, Nic means nicotinamide is added to the medium and Leu means leucine is added to the medium. + means the colony grew and – means that it did not.
 - A. What can you say about linkage among these genes? B. What is the origin of culture 16? (Hint: write out genotype for each culture).

| | | | | |
|---------|-----|-----|-----|-----|
| | Arg | Arg | Arg | Ad |
| | Ad | Ad | Nic | Nic |
| | Nic | Leu | Leu | Leu |
| Culture | | | | |
| 1 | + | + | - | - |
| 2 | - | - | + | + |
| 3 | - | + | - | + |
| 4 | + | - | + | - |
| 5 | - | - | + | + |
| 6 | + | + | - | - |
| 7 | + | + | - | - |
| 8 | - | - | + | + |
| 9 | + | - | + | - |
| 10 | - | + | - | + |
| 11 | - | + | - | + |
| 12 | + | - | + | - |
| 13 | + | + | - | - |
| 14 | + | - | + | - |
| 15 | - | + | - | + |
| 16 | + | - | - | - |
| 17 | + | + | - | - |
| 18 | - | - | + | + |
| 19 | + | + | - | - |
| 20 | - | + | - | + |

4. Which of the following linear asci of *Neurospora* shows gene conversion at the *arg-2* locus?

| 1 | 2 | 3 | 4 | 5 | 6 |
|-----|-----|-----|-----|-----|-----|
| + | + | + | + | + | + |
| + | + | + | + | + | + |
| + | arg | + | + | arg | arg |
| + | arg | arg | arg | arg | arg |
| arg | arg | arg | + | + | arg |
| arg | arg | arg | arg | + | arg |
| arg | + | arg | arg | arg | arg |
| arg | + | arg | arg | arg | arg |

5. A strain of *Neurospora* with the genotype *AB* is crossed to a strain with genotype *ab*. Half of the progeny are *AB* and half are *ab*. Explain these results.
6. In a haploid organism, the *C* and *D* loci are 8 map units apart. From a cross *Cd* X *cD* give the proportion of each of the following progeny classes (a) *CD* (b) *cd* (c) *Cd* (d) all recombinants.