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### Toward the domestication of slime

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## Toward the domestication of slime

### Abstract

Toward the domestication of slime

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slime is particularly suitable for cell fractionation, and as such, could be a powerful tool in understanding the molecular biology of *N. crassa*. With this in mind, we have developed simple genetic and microbiological techniques for handling slime.

Natural history. Slime is stored as a component of the heterocaryon FGSC #327 [fz;sg;arg-1, cr-1, aur, os-2A, tol(N83), pan-1(5531)a] at  $-20^{\circ}$  C. Slime can be resolved from this heterocaryon by filtration concentration in a liquid medium (medium A) using Vogel's salt solution, 10% (w/v) sorbose, 2% (w/v) sucrose, 2 mM arginine, 50  $\mu$ g/ml chloramphenicol, 50  $\mu$ g/ml streptomycin, and 100 units/ml potassium penicillin G (Emerson 1963 *Neurospora* Newsl. 4: 19-20). Stock cultures can be maintained in liquid medium B (1x Vogel's salt solution, 7.5% (w/v) sorbitol, 1.5% (w/v) sucrose, 2 mM arginine, and antibiotics as used in medium A) medium B solidified with agar. Cells from stocks of slime recently resolved from heterocaryon FGSC #327 can form heterocaryons with cells from filamentous strains of like mating type (A) and with cells from strain FGSC #1949 [tol(N83), pan-1(5531)a]; these "young" slime cells can also fertilize the protoperithecia formed by filamentous strains of opposite mating type (a). Continuous cultivation of slime cells by serial transfer twice weekly to shaken liquid medium results in the loss of both heterocaryon-forming capacity and male fertility within two months.

Growth of newly resolved stocks of slime in shaken liquid medium is erratic, and as Emerson noted (1963 *Genetica* 34: 162), the wall-less slime cells (spheroplasts) and wall-like cell debris tend to form large irregular aggregates. By filtration through spun glass wool at each successive transfer to fresh medium, stocks can be obtained which grow as a homogeneous suspension of spheroplasts; such trained stocks have characteristic and reproducible logarithmic growth rate constants (cf. Woodward, V.W. and C. K. Woodward 1968 *Neurosp.* Newsl. 13: 18).

Occasionally, in older liquid stock cultures, the spheroplasts become filled with vacuoles and, microscopically, resemble soap bubbles with little protoplasm. When this occurs, other properties characteristic of younger stocks also become altered. Such stocks should be discarded.

Microbiological methods. Spheroplasts from cultures of slime which are growing exponentially in liquid medium B can be plated on agar-solidified medium B with 100% recovery: cell suspensions are gently spread out on the surface of the solid medium and the excess liquid is allowed to slowly diffuse into the agar. When a suspension of spheroplasts is agitated for two minutes with a Vortex Genie, the number of potential colony-forming units doubles; when the suspension is agitated for longer intervals, the number of colony-forming units declines. Single colonies of slime can be transferred to fresh solid medium with a sterile toothpick; this technique can be used to streak out individual cells of a colony or to prepare a "grid" of 50-100 colonies per 9 cm plate. After two days growth on solid medium at  $33^{\circ}$  C, groups of colonies can be accurately replica plated with velvet-covered blocks, as is routinely done with bacteria or yeast.

Standard methods for treating *Neurospora* conidia with ultra-violet light give high rates of killing of slime spheroplasts. Preliminary results indicate that this treatment can be used to induce new mutations directly in slime.

Construction of the compatible mixed mating type heterocaryon H2 A/a [fz (no #); sg (no #); arg-1 (B369), cr-1 (B123), aur (345081), os-1 (B135) A + tol (N83), pan-1 (5531)a]. In a heterocaryon, slime does not lose male fertility; a mixed mating type heterocaryon offers the further advantage that only the slime component will act as the male parent in appropriate crosses. The compatible mixed mating type heterocaryon H2 A/a is prepared as follows. Slime (FGSC #326) is grown on solid medium B for one week at  $33^{\circ}$  C. Slime cells are then suspended in liquid medium B without the arginine supplement and mixed with dry conidia from strain FGSC #1949 [tol, pan-1(5531)a]. The mixture is placed in the center of a 9 cm petri plate containing solid medium B without arginine. The tol mutation suppresses A/a heterocaryon incompatibility (Newmeyer 1968 *Genetics* 60: 207); we find that the probability of heterocaryon formation is increased by incubation at a high temperature ( $33^{\circ}$  C). Once formed, the heterocaryon is transferred to agar slants of standard Vogel's minimal medium; the cultures are incubated at  $33^{\circ}$  C, allowed to form conidia, and then stored at  $-20^{\circ}$  C.

We have deposited a stock of strain HZ A/a with the FGSC.

Crossing slime and slime heterocaryons with filamentous strains and the recovery of slime progeny. In crosses involving slime, true slime segregants have never been recovered (Emerson 1963 *Genetica* 34: 162). Therefore, a filtration enrichment procedure is used in preference to total isolation for recovery of slime progeny. The non-slime parent strain is induced to form protoperithecia on standard synthetic crossing medium. The protoperithecia are fertilized with spheroplasts from a young slime stock or with conidia from strain H2 A/a. Ascospores are collected in water and washed twice by gravity sedimentation through 6% (w/v) potassium sodium tartrate to remove any associated conidia or hyphae. Without prior heat shock, the washed ascospores are suspended at  $1.5 \times 10^4$  spores/ml in 150 ml of medium C (1x Vogel's salt solution, 10% (w/v) sorbose, 2% (w/v) sucrose, 0.02% (w/v) Difco agar,  $4 \times 10^{-3}$  M furfuryl alcohol, antibiotics as used in the other media, and appropriate nutritional supplements). The 150 ml culture is incubated in a 500 ml Erlenmeyer flask in a gyro-rotatory shaker (130 rpm) at  $30^{\circ}$  C. Each day, the culture is filtered to remove filamentous progeny. During the first two weeks, the porosity size of the filter is gradually reduced using various combinations of gauze-type cheesecloth and spun glass wool as filter materials. After ca. 2-3 weeks, 10 ml of the culture, which should be "cloudy" with spheroplasts, are diluted in 40 ml of medium B (with appropriate supplements) in a 125 ml Erlenmeyer flask; this secondary culture is incubated in a gyro-rotatory shaker at  $30^{\circ}$  C and filtered every other day through four layers of spun glass wool. After ca. two weeks, samples of the culture are agitated with a Vortex Genie (to increase the proportion of homocaryotic spheroplasts), plated out on solid medium B and incubated at  $33^{\circ}$  C for three days. As noted by Emerson (ibid.), colonies of "slime-like" strains have a superior crust and subsurface hyphae. On the other hand, colonies of true slime strains have a wet-appearing surface and do not form hyphae. Individual colonies of the latter type are transferred to 13 X 100 mm cul-

ture tubes containing 0.5 ml of liquid medium B, dispersed with a Vortex Genie, and incubated at 33° C. The volume of each culture is slowly increased to 3 ml by daily additions of fresh medium. Strains of the desired genotype(r) are stored at -70° C using the method of Creighton and Trevithick (1973 Neurosp. Newsl. 20: 32) and/or at -20° C in a heterocaryon.

To date we have recovered true slime strains with markers on LG-IL (cys-11), LG-IR (nuc-1) or LG-VR (pho-2).

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