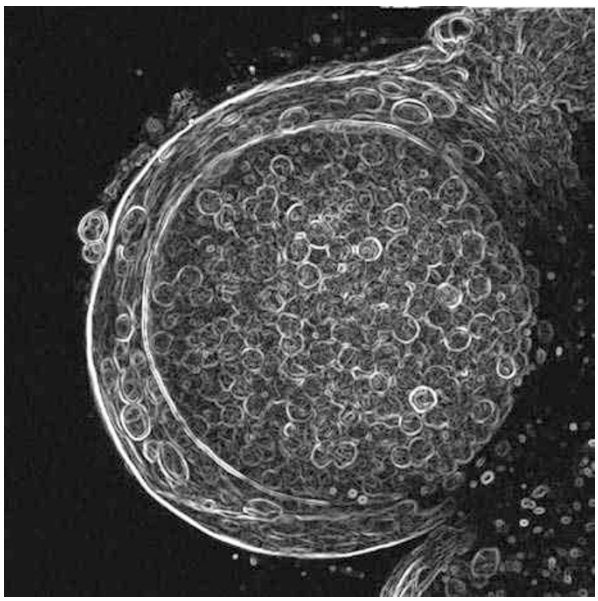
MICROBIAL GENETICS

Social amoebae get ready for sex

> The identification of the *mat* locus opens the way for the use of sexual genetics in *D. discoideum*.

Most eukaryotic microorganisms carry out sexual reproduction during their life cycles. Although significant progress has been made in the study of mating for several fungal species, little is known about sexual reproduction in protists. Now, writing in *Science*, Bloomfield and colleagues report the identification of a genetic locus that determines the three mating types in the social amoeba *Dictyostelium discoideum*.

D. discoideum can reproduce by growth and fission of single cells, which can also pass through an asexual developmental cycle upon starvation, producing 'slugs' that differentiate into fruiting bodies; these in turn produce spores that germinate to yield new amoebae. However, under certain conditions, two cells of different mating types can fuse to yield a diploid zygote that ultimately forms a dormant macrocyst. The macrocyst undergoes meiosis and numerous mitoses, and finally germinates to release haploid amoebae.



Confocal micrograph of a *Dictyostelium discoideum* macrocyst, with protective walls surrounding hundreds of cannibalized amoebae trapped in vacuoles inside the cytoplasm of the dormant zygote. Image courtesy of G. Bloomfield, Medical Research Council, Cambridge, UK.

Previous work indicated that a single genetic locus probably determines the three mating types (I, II and III) in *D. discoideum*. When the authors separately hybridized genomic DNA from four type I and six type II *D. discoideum* strains to a DNA microarray derived from the genome of a type I strain, they found one gene that was present in all type I organisms and absent from all type II strains. This gene, which they called *matA*, encodes a small protein of unknown molecular function. A *matA*-deficient mutant could not form macrocysts with type II cells. The researchers then sequenced the same locus from a type II strain and identified three genes: *matB*, *matC* and *matD*; *matB* is homologous to *matA* (their gene products have 60% identity), whereas *matC* and *matD* encode unrelated proteins. After confirming that the locus was >98% identical in all type II strains, the authors transferred this type II locus into the *matA*-deleted type I strain. The resulting strain could mate with type I cells but not with type II cells, showing that the expected gender switch had occurred. The same locus in type III strains consists of two genes, *matS* and *matT*, which are homologous to *matC* and *matD*, respectively (their gene products have 50% and 80% identity).

The authors then expressed various *mat* genes in the *matA*-null mutant and found that mating types I and III are determined by a single gene (either *matA* or *matS*, respectively), whereas the type II system is a hybrid of the other two and requires the co-expression of *matB* and *matC* (homologues of *matA* and *matS*). The *mat* locus of *D. discoideum* does not resemble any known sex-determining loci in other organisms, although homologous genes are present in related species.

The identification of the *mat* locus opens the way for the use of sexual genetics in *D. discoideum*. These findings may therefore represent a significant leap forward in those disciplines that use this organism as a model to study, for example, cell differentiation and motility, chemotaxis, phagocytosis and host–pathogen interactions.

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ORIGINAL RESEARCH PAPER Bloomfield, G. *et al.* Sex determination in the social amoeba *Dictyostelium discoideum*. *Science* **330**, 1533–1536 (2010)