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EDITORIAL

Reflections on genetics through the looking glass

Neurospora crassa and *N. tetrasperma* are two closely related filamentous fungi that differ interestingly for geneticists. The *N. crassa* 'individual', like ones of most species, including humans, begins its life as a uninucleate cell, but *N. tetrasperma* is one of the exceptional species, a pseudohomothallic fungus, in which an individual begins life as a cell with two nuclei of nonidentical genotype. This gives *N. tetrasperma* the ability to self-mate and produce progeny, whereas humans and *N. crassa* procreate only by mating with other conspecific individuals. Since *N. tetrasperma* individuals contain two nonidentical nuclei, they are called dikaryons (Greek, di+karyon = two nuts). Additionally, rearranged chromosomes are fun to work with, especially translocations, which relocate a segment of one chromosome into another. Geneticist David Perkins found a large number of translocations in *N. crassa* but none was found by anyone for *N. tetrasperma*. Thus, Dev Ashish Giri and Selvam Rekha from my laboratory decided to introgress *N. crassa* translocations into *N. tetrasperma*.

The introgression enabled them to create two kinds of *N. tetrasperma* dikaryons with almost, but not quite, identical genomes. Let us call them Tweedledum and Tweedledee. In Tweedledum, one nucleus type had the normal sequence genome while the other had the translocation genome, whereas in Tweedledee, one nucleus type had a duplication of the translocated segment, while in other it was deficient. Thus, Tweedledums had a copy of every gene in every nucleus, while in Tweedledees some nuclei contained two copies of some genes while others had no copies of them. Self-crossing either Tweedle again produced both Tweedledum and Tweedledee progeny.

Tweedledums can also be constructed in *N. crassa* by inoculating together the normal and translocation strains bearing mutations which create growth requirements. Fungal cells (hyphae) contain tens of thousands of nuclei in a common extranuclear milieu (cytoplasm) sheathed in narrow filaments that grow by elongation and branching, and interhyphal connections create a web-like mycelium. A dikaryon formed via interconnection of the mutant hyphae and mixing of their nuclei can grow on substrate lacking the nutritional supplements. Each nucleus type contributes the information needed to fulfill the growth requirement for which the other is mutant. Tweedledees, dikaryons with duplication and deficiency nuclei, however, cannot be made this way because the deficiency strains are nonviable.

Any phenotypic difference between the Tweedles suggests that the deficiency nucleus lacks a gene whose effects must be localized close to the nucleus expressing it. 'Tethered-effect genes' have not yet been found in any system, but studies have suggested that they may exist. Finding them would have wide implications, even to humans. Some of our cells are multinucleate, such as muscle fibers, and some bone and liver cells. Could they be expressing such genes? The introgressions also uncovered novel hybrid dysgenesis phenotypes (see 2017 *J. Genet.* **96**, 457–463).

I wrote this essay to introduce myself by way of some recent research in my laboratory, after accepting the offer from the Indian Academy of Sciences to serve as the Journal's new Editor-in-Chief. It is an honour to succeed illustrious predecessors. And a privilege to collaborate with the Journal's Associate Editors, Editorial Board Members, Editorial Staff, well-wishers of the Academy, Springer-Nature, and elsewhere, and its many contributing authors, referees and readers, to rejuvenate this venerable institution whose mission, since 1910, is to uncover and disseminate exciting new Genetics.

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