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Perspectives on genetic resources at the Fungal Genetics Stock Center.

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Abstract

The Fungal Genetics Stock Center has been banking and distributing resources for work with genetically characterized fungi since 1960. While most of the collection consists of strains of *Neurospora*, an NIH model filamentous fungus, the past fifteen years has seen the collection expand to include plant and human pathogenic fungi. The use of the resources in the collection has grown over the last 10 years as well, reflecting both a growth in research using standardized materials as well as the development of new materials through molecular genetic technology. This growth is not limited to newly deposited materials, however, and includes renewed interest in particular classes of strains with characteristics that were not recognized when they were originally deposited. One significant example is the use of strains carrying the *osmotic-2* lesion in *Neurospora crassa*. This, and other utilization trends, underscores the need to provide strong support to the continued and expanded biobanking effort in the US.

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The Fungal Genetics Stock Center (FGSC) was established in 1960 amid the concern that important materials used in the original elucidation of the one-gene-one-enzyme hypothesis would be lost when researchers retired or moved on to other projects (McCluskey, 2003). Since that time, it has grown to include nearly 15,000 *Neurospora* strains and over 1,000 *Aspergillus* strains in addition to 1,300 other fungi and 48,000 genetically engineered mutants of Magnaporthe. Unique among culture collections, the FGSC has endeavored to provide the most recent materials for working with organisms in the collection and holds and distributes cloning vectors, cloned genes, gene libraries and related material. These are especially useful when the organism in question requires special handling or permits.

While these modern materials have been popular, there have been numerous occasions where materials that have been in the collection for many years suddenly take on increased importance. One clear example of this is the renewed interest in strains of *Neurospora crassa* carrying the *osmotic-2* lesion. The FGSC holds 66 *N. crassa* strains carrying mutations leading to sensitivity to high salt concentrations. There are eleven named osmotic loci in *Neurospora* and *os-1* occurs in 38 different strains. The *os-2* lesion occurs in only eight strains, the first of which was deposited in 1968. These strains were ordered infrequently through their early years at the FGSC (Figure 1). In 1999, however, Xu and colleagues reported at the 20th Fungal Genetics Conference (Zhang et al., 1999) that strains carrying *os-2* were resistant to phenylpyrrole fungicides. This work was later published in *Applied and Environmental Microbiology* (Shang et al, 2002) and has been cited over 60 times in 5 years.

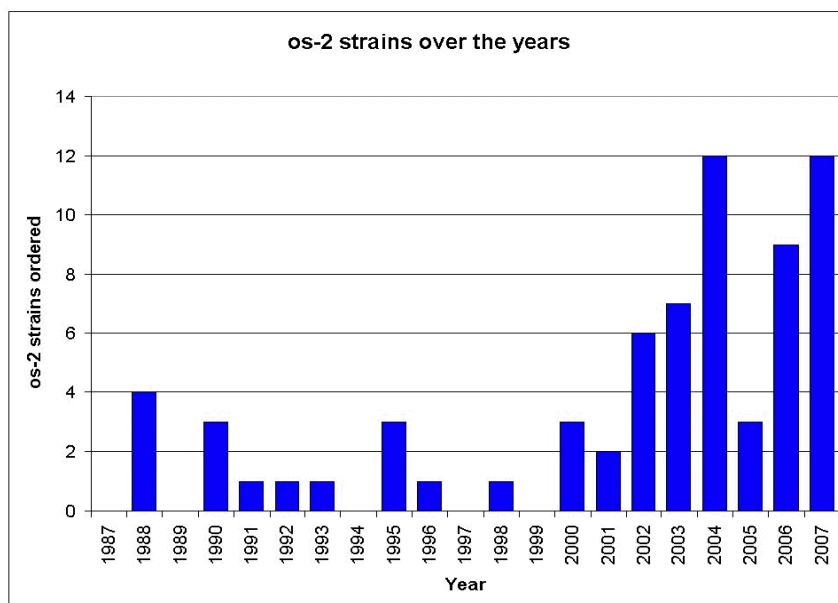


Figure 1. Orders for strains carrying the *os-2* lesion in the last 20 years.

Prior to the 1999 report of the fungicide resistance of *os-2* mutants, these strains were used primarily as genetic markers for mapping studies. After this information was presented, requests for strains carrying *os-2* jumped over 300%. By way of contrast, strains carrying other osmotic markers have shown only a 29% increase over the same period (Figure 2). These orders came from 32 different investigators in 12 countries.

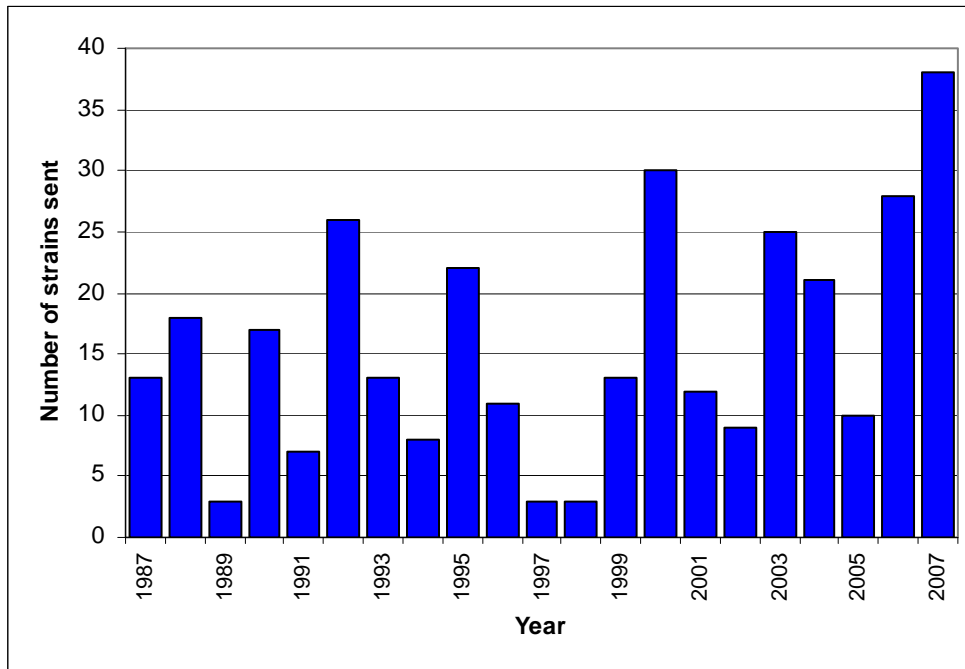


Figure 2. Orders for strains carrying any osmotic lesion over the last 20 years.

The impact of the finding that the original *os-2* mutant is resistant to fungicides has spilled over into the usefulness of modern molecular genetic tools. The FGSC is part of an NIH program project to systematically delete every gene in the genome (Dunlap et al., 2007). The most commonly ordered strain from this program is one carrying a knockout of the *os-2* gene (Table 1).

Mutation	Number of orders
NCU07024.2 (<i>os-2</i>)	15
NCU06182.2 (MAPKK kinase)	14
NCU05495.2 (hypothetical)	13
NCU03164.2 (hypothetical)	12
NCU07221.2 (histidine kinase)	10
NCU02057.2 (putative kinase)	10
NCU04834.2 (phytochrome)	8
NCU02133.2 (<i>sod-1</i>)	8
NCU02815.2 (<i>os-1</i>)	8
NCU03894.2 (putative kinase)	8

Table 1. Most commonly ordered *N. crassa* Knock-Out mutants.

While the strains carrying *os-2* were used by some investigators prior to the demonstration of their fungicide resistance, they were not among our most popular strains. Between 1987 and 1998, the FGSC distributed over 12,500 strains whereas only 15 *os-2* strains were distributed. Had we been required to keep only strains that were among our most well utilized, we might have chosen to 'de-accession' these osmotic mutants. Given the impact of the modern research with them, losing these strains would have been a significant setback to the progress of research into fungicide resistance.

While some existing material in the biological repositories may not show obvious and immediate value, there is no way to predict what their value may be to future researchers. The incremental cost of maintaining additional strains is small (Baker, 2004) and trivial compared to the potential cost of repeating past work or overlooking important opportunities. This example demonstrates the need for continued support for bio-banking activities including those at the FGSC.

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