FUNGAL GENETIC ANALYSIS

Flexible switching

New research published in *Cell* shows that switching on and off members of a family of adhesion genes in *Saccharomyces cerevisiae* is linked to morphological development.

The *FLO* gene family of *S. cerevisiae* encodes cell-wall glycoproteins. *FLO11* is usually the only *FLO* gene expressed in the strain used by Halme *et al.* Four silent *FLO* genes, *FLO1*, *5*, *9* and *10*, are located in subtelomeric regions. *FLO11* expression is required for surface adherence, filament formation and sliding motility. Expression of different individual *FLO* genes radically alters cell-adhesion properties. Variation in surface-gene expression is a common tactic used by pathogens to evade the host immune response. Now, Halme *et al.* show that genetic and epigenetic mechanisms vary *FLO* gene expression.

Using immunofluorescence and a transcriptional reporter, Halme *et al.* showed that *FLO11* expression was variegated — some cells express it, others don't. Pedigree analysis showed that switching was reversible. Moving *FLO11* to a new location prevented switching — showing that *FLO11* switching was position-dependent, but switching was also shown to be *FLO*-promoter specific. The authors suggest that Sfl1p recruits Hda1p to silence *FLO11*. So, *FLO11* regulation is both promoter-dependent and position-specific — this was a surprise because most previously characterized position-silencing-dependent switches are promoter-independent. Plus, because *FLO11* is ~46 kb from the telomere, this is the third example in *S. cerevisiae* of a telomere-independent silencing mechanism — it might be more widespread in yeast than previously thought.

What about the reservoir of silent *FLO* genes? Mutations in the *IRA1* and *IRA2* genes — the yeast Ras GTPase-activating proteins — which are inherently unstable, unlike the rest of the yeast genome, switch on and off silent *FLO* loci. Once silent *FLO* genes are switched on, epigenetic regulation imposes flexibility onto the phenotype-switching mechanism.

In diploid cells, switching *FLO11* expression on and off correlated with the ability to form filaments. Epigenetic and genetic control of *FLO* expression and morphology could be important in pathogenesis — in *Candida albicans* white-opaque phenotype switching is necessary for full virulence. Switching might allow members of the colony to sample new niches, without committing each cell to a new, and potentially less advantageous, phenotype.

Susan Jones

References and links

ORIGINAL RESEARCH PAPER Halme, A. *et al*. Genetic and epigenetic regulation of the *FLO* gene family generates cell-surface variation in yeast. *Cell* **116**, 405–415 (2004)

IN BRIEF

INDUSTRIAL MICROBIOLOGY

Engineering *Escherichia coli* for efficient conversion of glucose to pyruvate

Causey, T. B. *et al. Proc. Natl Acad. Sci. USA* **101**, 2235–2240 (2004)

For industrial purposes, the main microorganisms involved in the microbial production of pyruvate — mutant strains of the yeast *T. glabrata* and *E. coli* — both require precise regulation of the culture conditions, and the associated production costs are high. This paper reports on the development of an *E. coli* strain, strain TC44, which, by the appropriate combination of mutations, gives a high yield of pyruvate from glucose and only requires simple mineral salts as nutrients.

BACTERIAL VIRULENCE

Clustering of Nck by a 12-residue Tir phosphopeptide is sufficient to trigger localized actin assembly

Campellone, K. G. *et al. J. Cell Biol.* **164**, 407–416 (2004)

Enteropathogenic *E. coli* attach to intestinal epithelial cells and induce attaching and effacing (A/E) lesions. One of the main features of A/E lesions is the pronounced alteration to the cytoskeleton directly beneath the attached bacterium that results in the formation of an actin pedestal. Now, Campellone *et al.* report that Tir is the only translocated bacterial effector protein that is required for pedestal formation. Additionally, they have pinpointed a key domain of just 12 amino acids in the carboxyl terminus that is sufficient to induce actin tail formation.

INNATE IMMUNITY

Inactivation of a *Pseudomonas aeruginosa* quorum-sensing signal by human airway epithelia

Chun, C. K. *et al. Proc. Natl Acad. Sci. USA* (17 Feb 2004)
doi: 10.1073/pnas.0308750101

P. aeruginosa is the main cause of respiratory tract infections in cystic fibrosis patients. Here, Chun *et al.* demonstrate that an activity associated with differentiated mammalian airway epithelial cells can inactivate the *P. aeruginosa* quorum-sensing signal molecule 3OC12-HSL. The inactivation of this host defence mechanism could be an important factor in chronic bacterial infections.

VIROLOGY

The AU-rich RNA recombination hot spot sequence of brome mosaic virus is functional in tombusviruses: implications for the mechanism of RNA recombination

Shapka, N. & Nagy, P. D. *J. Virol.* **78**, 2288–2300 (2004)

This study shows that RNA from a tombusvirus, an RNA virus that is pathogenic to plants, carrying a well-defined recombination signal from a different plant virus, brome mosaic virus, undergoes frequent recombination in both plant and protoplast cells. The recognition of the same recombination signal by different viruses could promote interviral recombination.