



Spring 2004

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### Recommended Citation

Finkelstein, Susan I. (2004) "The Power of Yeast Genetics," *Bellwether Magazine*: Vol. 1 : No. 59 , Article 14.

Available at: <https://repository.upenn.edu/bellwether/vol1/iss59/14>

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# The Power of Yeast Genetics

By Susan I. Finkelstein

It's the stuff of beer and bread. For thousands of years, this fungus has been instrumental in producing and conserving food because of its ability to ferment glucose to ethanol and carbon dioxide. But most people do not know that this simple, single-celled organism also is a powerful model system for biological research. Cheap and easy cultivation, short generation time, detailed genetic and biochemical knowledge gained through many years of research, and ready application of molecular techniques for its genetic manipulation—all make this versatile organism highly suitable for the study of basic biological processes relevant to many other higher organisms, including humans.

Although yeast cells are obviously much simpler than humans, they follow the same basic principles of reproduction: first, cells must accurately duplicate their chromosomes and segregate them to opposite poles of the cell, and then the cells physically split into two, yielding a new generation of genetically identical cells. Errors in cell division can result in cellular death, lead to developmental defects, or cause cancer. Indeed, a major hallmark of cancer cells is unrestrained cell division, which is why cancer is often considered a disease of the cell-division cycle. Thus, to understand the molecular mechanisms of cancer, it is critical to resolve the processes that regulate cell division.

The laboratory of **Frank Luca**, assistant professor of animal biology, uses multidisciplinary approaches, including yeast genetics and cellular and molecular biology, to study cell-cycle regulation of eukaryotic cells (those with dis-

tinct membrane-bound nuclei). Working with yeast, Dr. Luca discovered the “Mob” gene family, which encodes essential proteins that regulate critical aspects of cell division and cell development.

Yeast cells offer several advantages over human cells for cell-cycle research. Yeast divide much more rapidly and are less complex than mammalian cells. Yeast, for example, divide every 90 minutes and contain only two Mob proteins, while the most rapidly dividing human cells divide every 24 hours and express up to seven Mobs. Moreover, the yeast genome is much easier to manipulate *in vivo*. Yeast genes can be mutated to alter the function of any protein. The observed cellular consequences of gene mutations help reveal the function of the encoded proteins. “With yeast, we can perform a lot of molecular and genetic ‘tricks’ to identify important regulatory pathways. And nearly everything we learn is transferable from yeast to humans,” explains Dr. Luca.

Thus, researchers are able to conduct experiments in yeast that elucidate biochemical signals that control growth and division in human cells. Use of model organisms, such as yeast, is critical for cancer research. Thus far, Dr. Luca's work reveals that yeast Mob proteins are components of conserved regulatory circuits that ensure the proper timing and fidelity of cell division. His work has led to several models regarding the function of human Mob proteins that his lab is currently testing.

So, can lowly yeast hold the key in eventually discovering a cure for cancer? “Well, we're con-

centrating on diagnostics first,” responds Dr. Luca. “Like a malfunctioning automobile, you can't effectively fix it unless you know something about how it works. At this point, we're just trying to understand how normal cell division works. It is our hope that our work will identify novel targets for the development of new anti-cancer drugs.”

## Hot Weather Tips

Here are some tips to keep pets healthy during the hot weather:

Dogs and cats need a cool, shady place to sleep in during hot weather and access to plenty of clean, fresh water. Feeding time should be moved to the cooler hours of the day. Older animals have a harder time in hot weather, be sure they have a comfortable, cool place during the hottest hours of the day.

Do not take the dog jogging during the day in hot weather as the animal will overheat quickly. If you want to go running with your pet, do it very early in the morning or at night when it is cooler. Even then, if it is hot and humid, don't do it.

Heatstroke is life threatening for dogs. Signs to watch for are: heavy, loud breathing, staggering gait, bright red gum tissue and tongue. If heatstroke is suspected, seek veterinary care quickly as this is a medical emergency.

## Dermatology Clinic Offered at New Bolton Center

Horses, like people and other animals, may suffer from skin disorders. Similar to cats and dogs, they may manifest allergic diseases (most commonly to insects) with the development of skin lesions, including intense itch, hives, and bumps. To assist the clinicians at New Bolton Center in the treatment of equine skin diseases, faculty veterinary dermatologists offer appointments for horses and large-animal patients twice monthly at New Bolton Center.

**Drs. Rosario Cerundolo** and **Daniel Morris**, board-certified veterinary dermatol-

ogists and assistant professors of dermatology at the School, and dermatology residents **Drs. Jeanne Budgin** and **Karen Farver**, hold clinics at New Bolton Center two Thursdays each month. All are based at the Matthew J. Ryan Veterinary Hospital, where they treat companion animals and special species. The clinicians have an interest in equine skin disorders and look forward to consulting on cases with the NBC staff.

Appointments for consultation with the Dermatology Service at New Bolton Center may be made by calling 610-444-5800.



Itchy horse.