

# Math's Role in Evolution



Michael Desai

Associate Professor of Organismic and Evolutionary Biology and of Physics

## CURRENT RESEARCH

### Mathematical predictions can lead to positive health outcomes

Evolution is central to human disease. For example, cancer develops due to specific mutations that accumulate within a cell, while viruses such as influenza or HIV are constantly evolving in order to evade our immune system and continue infecting human hosts. Dr. Michael Desai, Associate Professor of Organismic and Evolutionary Biology at Harvard University, aims to understand how fast evolution can act and what it is capable of. By combining basic theoretical work and experimental evolution in budding yeast, he and his team develop mathematical models of evolutionary dynamics and population genetics that can be tested and verified. The goal of Dr. Desai's research is to lay a basic foundation for understanding the role of evolution in many natural populations, including important viral and microbial pathogens.

Dr. Desai's lab is one of the only groups working on basic questions in evolution with a combination of theoretical and experimental approaches. This has given them a unique approach to key problems. By making predictions based on mathematical models and testing them using budding yeast as a model system, Dr. Desai is providing a statistical understanding of what evolution can accomplish on a given timescale, with what probabilities. He explains, "while some fields there are technical road blocks that limit progress, in evolutionary biology we are limited only by our understanding of how to interpret the enormous influx of data that has resulted from technical advances in sequencing technology." The task ahead of Dr. Desai and those in his field is to sift through a vast amount of sequence information from evolving populations, which has become very easy to collect, in order to understand the factors...

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## AFFILIATION



Harvard University

## EDUCATION

- Ph.D. in Physics 2006, Harvard
- A.B. in Physics in 1999, Princeton

## AWARDS

- Simons Foundation Investigator in the Mathematical Modeling of Living Systems
- Alfred P. Sloan Foundation Research Fellowship
- Lewis-Sigler Fellowship, Princeton University

## RESEARCH AREAS

Life Science, Evolution, Genomics / Congenital

## FUNDING REQUEST

Your contributions will support the continued research of Dr. Michael Desai, of Harvard University, as he combines basic theoretical work with experimental evolution in budding yeast to make sense of evolutionary dynamic and population genetics. Donations will fund the necessary personnel required for both theory and experimentation in addition to costs of lab equipment and supplies. In total, Dr. Desai's lab requires about \$500K/year in direct costs. Join Dr. Desai and his team in solving mysteries about evolution and the effect they have on our lives.