Fitness differences suppress the number of mating types in evolving isogamous species

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Sexual reproduction is not always synonymous with the existence of two morphologically different sexes; isogamous species produce sex cells of equal size, typically falling into multiple distinct self-incompatible classes, termed mating types. A longstanding open question in evolutionary biology is: what governs the number of mating types? Simple theoretical arguments imply an advantage to rare types, suggesting the number of types should grow consistently, however, empirical observations are very different. While some isogamous species exhibit thousands of mating types, most have fewer than five.

In this talk, I present a mathematical model to quantify the role of fitness variation -- characterised by different mortality rates -- in determining the number mating types emerging in simple evolutionary models. Our approach is based on a separation of time scales between short-term population dynamics and long-term evolutionary changes. We predict that the number of mating types decreases as the variance of mortality increases. Our analytical results are consistent with existing empirical data and thus provide a potential resolution to this longstanding question.