Sexual reproduction enables genetic exchange in eukaryotic organisms as diverse as fungi, animals, plants, and ciliates. Given its ubiquity, sex is thought to have evolved once, possibly concomitant with or shortly after the origin of eukaryotic organisms themselves. The basic principles of sex are conserved, including ploidy changes, the formation of gametes via meiosis, mate recognition, and cell-cell fusion leading to the production of a zygote. Although the basic tenants are shared, sex determination and sexual reproduction occur in myriad forms throughout nature, including outbreeding systems with more than two mating types or sexes, unisexual selfing, and even examples in which organisms switch mating type. As robust and diverse genetic models, fungi provide insights into the molecular nature of sex, sexual specification, and evolution to advance our understanding of sexual reproduction and its impact throughout the eukaryotic tree of life.