Rampant recombination and reassortment during dictyostelid sex

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The last common ancestor of eukaryotes was a sexual organism. This means that cell-biological and regulatory architectures of early eukaryotes were adapted to meiotic as well as mitotic division cycles, and these cells were also evolving in response to sexual selection, likely most intensely in the form of competition between gametes. Our current understanding of sex is heavily skewed by a focus on a few highly derived (but very important to us) lineages, so the implications of the sexual nature of eukaryotes remain very unclear. I will present evidence concerning mycetozoan protists that challenge conventional views on sex. We have recently found that gamete fusion in *Dictyostelium* as well as *Physarum* retain some of the ancestral machinery, and proposed that components controlling the transition from the haploid to diploid phase in *Dictyostelium* preserve deep homology with the machinery in fungi and plants. However in mycetozoa sex has surprisingly communal aspects with no strong block against multiple fertilization events, resulting in unusual recombination and reassortment among genomes. I will discuss how sexual selection acting on endosymbionts as well as core nuclear genomes might have influenced the rapid evolution and diversification that occurred early in the history of eukaryotes.