

## 28. Meiotic recombination

1 unit, Scott Keeney, October 8, 2025

### Meiosis

- Chromosome segregation mechanics

- Physical connections: sister cohesion + reciprocal recombination (crossover)

- In yeast: starvation response

- Meiosis is error-prone in humans

### Recombination mechanism

- Double-strand break model

- Holliday junction resolution

- Evidence: physical analysis, mutants (*rad50S*, *spo11*)

- Evolutionary conservation: Spo11, Dmc1, etc.

Double-strand breaks are distributed nonrandomly across genomes

### Papers

#### Discussion Paper:

Baudat F, Buard J, Grey C, Fledel-Alon A, Ober C, Przeworski M, Coop G, de Massy B. (2010) PRDM9 is a major determinant of meiotic recombination hotspots in humans and mice. *Science*. 327:836-840.

#### Review Paper:

Lam, I., and Keeney, S. (2014). Mechanism and regulation of meiotic recombination initiation. *Cold Spring Harb Perspect Biol* 7, a016634.

*Additional papers can be found in Appendix I*

### Supplementary Papers: Appendix I- Meiotic recombination

Holliday, R. (1964). A mechanism for gene conversion in fungi. *Genet. Res.* **5**: 282-304.

Szostak, J.W., Orr-Weaver, T.L., Rothstein, R.J., and Stahl, F.W. (1983). The double-strand break repair model for recombination. *Cell* **33**: 25-35.

Schwacha, A., and Kleckner, N. (1995). Identification of double Holliday junctions as intermediates in meiotic recombination. *Cell* **83**, 783-791.

Keeney, S., Giroux, C.N., and Kleckner, N. (1997). Meiosis-specific DNA double-strand breaks are catalyzed by Spo11, a member of a widely conserved protein family. *Cell* **88**: 375-384.

Nagaoka SI, Hassold TJ & Hunt PA (2012) Human aneuploidy: mechanisms and new insights into an age-old problem. *Nat Rev Genet* 13:493-504.

Hinch, A.G., Zhang, G., Becker, P.W., Moralli, D., Hinch, R., Davies, B., Bowden, R., and Donnelly, P. (2019). Factors influencing meiotic recombination revealed by whole-genome sequencing of single sperm. *Science* 363.