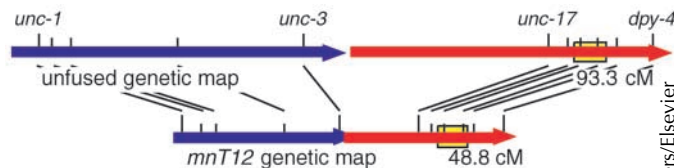


Research Roundup

One crossover is enough

When it comes to crossover recombination during meiosis, once is usually enough. Most worm chromosomes form one and only one crossover between homologues during meiosis I, and other eukaryotes spread out their crossovers so that only a few form. Now, Kenneth Hillers and Anne Villeneuve (Stanford University, Stanford, CA) find that the worm's once-only rule applies even to fusion chromosomes that contain nearly half of the genome.

The fusions—between either two or three worm chromosomes—resulted in a shrinkage of the genetic map, so that the giant chromosomes showed an average of one crossover each. This suggests that crossover formation is not sequence specific, and that the mechanism that inhibits for-



Fusing worm chromosomes shrinks the genetic map.

mation of more than one crossover can spread over entire enlarged chromosomes.

The spreading capability is tempered in heterozygotes. In these cases, with one giant chromosome lined up with its two unfused partners in a trivalent, about half of the meioses had one crossover per trivalent, and half had two crossovers (one crossover for each of the two original [unfused] chromosomes). Spreading fails completely when the middle of three chromosomes can no longer line up with a triple fusion giant chromosome.

In both double and triple fusion homozygotes, as with wild type, there were very few instances in which no crossovers formed. Hillers suggests that the mechanism that ensures this result—at least one crossover—may lead inevitably to only one crossover. For example, Nancy Kleckner (Harvard University, Cambridge, MA)

has proposed that chromatin condensation occurring during pairing of chromosomes may exert tension along the lengths of chromosomes, with this tension promoting crossovers. A single recombination event would then release that tension and greatly reduce the likelihood of further recombination. The current results, say Hillers, are consistent with this idea, because they imply a role for the chromosomal axis in transmitting the crossover signal. ■

Reference: Hillers, K.J., and A.M. Villeneuve. 2003. *Curr. Biol.* 13:1641–1647.

The sex–love connection

Sea squirts have finally shown us what we had always hoped was true: there is some connection between love and sex. That connection, or at least a connection between heart cell and germ cell development, comes at the very earliest stages of a sea squirt's life, according to Brad Davidson and Michael Levine (University of California, Berkeley, CA). They suggest that the two developmental events may also be connected in vertebrates.

Davidson selected the sea squirt *Ciona intestinalis* for his study of heart development because, he says, it is “one step before becoming a vertebrate.” It has some of the advantages of the fruit fly—genetic manipulability, and relatively little genetic redundancy—but as a urochordate is in the last branch before the chordate lineage yielded vertebrates.

He used the genome sequence of *Ciona* to analyze possible homologues of fly and vertebrate heart genes. Many of the candidate genes had the expected expression in heart precursor cells.

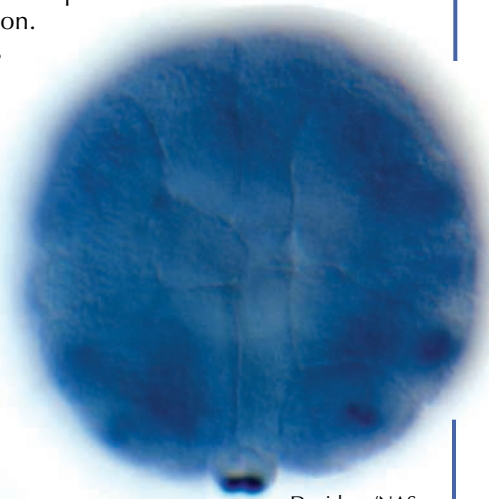
The heart precursors can be traced all the way back to a pair of cells at the 32-cell stage—a pair of cells that also gives rise to germ cells. At this 32-cell stage, neighboring cells are already turning on mesoderm genes. Davidson suggests that the known repressive effect of germ plasm reserves some potential muscle cells for use in the heart rather than these other mesodermal tissues. In the next division, the heart precursors separate from the germ cell precursors, and both

are free to follow their individual fates.

This temporary repression may be *Ciona*'s way of coping with its rapid development—“a way of separating things spatially rather than temporally,” says Davidson.

Despite difficulties with fate maps in more complicated organisms, he is looking for signs of linkage between germ cell and heart cell development in vertebrates. At the very least, he says, there are other instances where the time of separation from the germ line could be used as a way to determine cell fate. ■

Reference: Davidson, B., and M. Levine. 2003. *Proc. Natl. Acad. Sci. USA.* 100:11469–11473.



Davidson/NAS

Germ cells (dark blue) in a sea squirt affect heart development.

