

The Right-Left Axes

Although *Drosophila* may look bilaterally symmetric, there are left-right asymmetries both in the embryonic hindgut (which loops to the left) and in the adult hindgut and gonads. The mechanism that produces this asymmetry is different from that known to produce left-right asymmetry in vertebrates. Whereas vertebrate asymmetry appears to be regulated by microtubules, asymmetry in *Drosophila* appears to be regulated by microfilaments (Hozumi et al. 2006; Spéder et al. 2006). Very little is known about the formation of the left-right axis in *Drosophila*. If the actin microfilaments are disrupted in the *Drosophila* embryo, many defects occur, and the left-right pattern is randomized. The dextral or sinistral orientation of the gut depends on the activity of Myosin-1, a protein that interacts with these actin microfilaments. Loss-of-function mutations of the gene encoding Myosin-1 (or failure to activate this gene) reverses the body axis (Figure 1; see Coutelis et al. 2013)

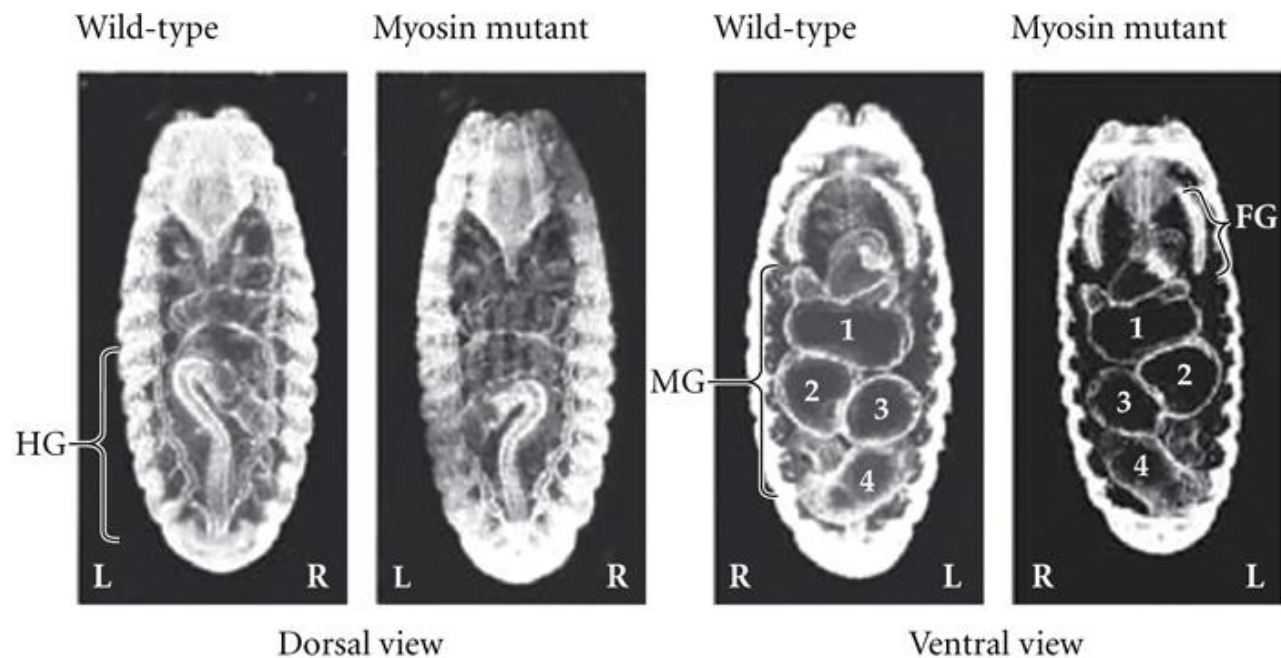


Figure 1 Left-right axis formation in *Drosophila* involves the microfilament cytoskeleton. Mutations in the myosin gene *Myo31DF* can reverse the insect's left-right asymmetry. Here the embryonic gut is seen in dorsal and ventral perspectives, showing that the asymmetry of the gut is reversed in the *myosin* mutant larva. HG, hindgut; MG, midgut; FG, foregut. (From Hozumi et al. 2006.)

Moreover, because the insect embryo is built along the cortex of a yolk-filled cytoplasm, it also has an “inside-out” axis. The outer (apical) part of each blastoderm cell is made from the egg cell membrane, while its inner (basal) membrane contacts the yolk. The *zerknüllt* (*zen*) gene is necessary for the dorsal closure of the insect. In beetles and bugs, using RNAi to eliminate *zen* function causes the embryos to evert, resulting in “inside-out” embryos with their leg rudiments protruding into the yolk rather than outside the embryo (van der Zee et al. 2005; Panfilio 2009).

Literature Cited

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