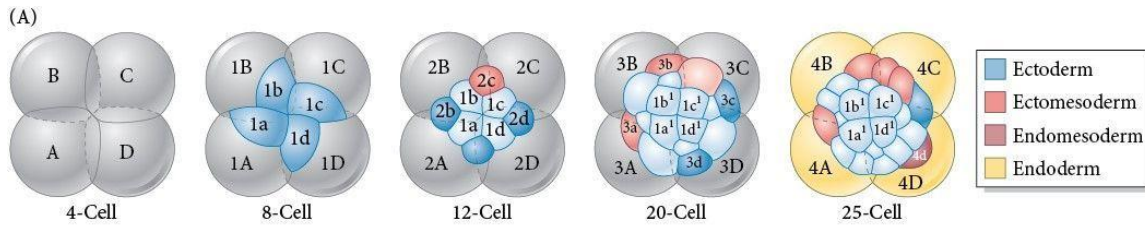


The Snail Fate Map

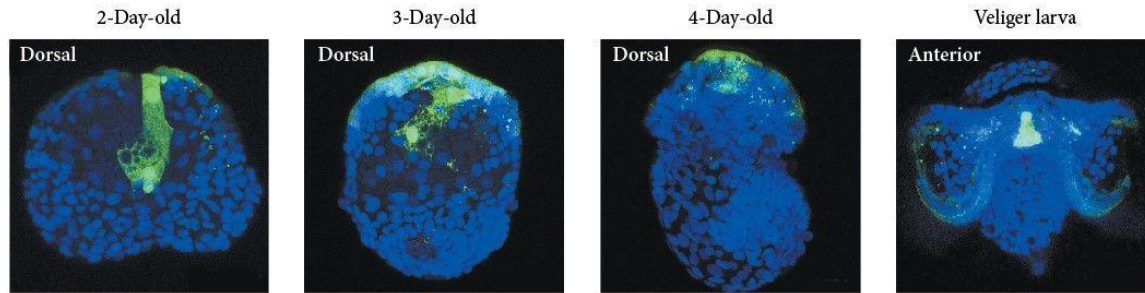
Sturtevant and the genetics of snail coiling

Detailed fate maps (see Chapters 1 and 2) have greatly advanced our knowledge of spiralian development. The fate maps of the gastropods *Ilyanassa obsoleta* and *Crepidula fornicata* were constructed by injecting large polymers conjugated to fluorescent dyes into specific micromeres (Render 1997; Hejnol et al. 2007). The fluorescence is maintained over the period of embryogenesis and can be seen in larval tissues derived from the injected cells. More specific results, showing divergences between snail species, have been obtained using live imaging (Figure 1; Chan and Lambert 2014; Lyons et al. 2015).

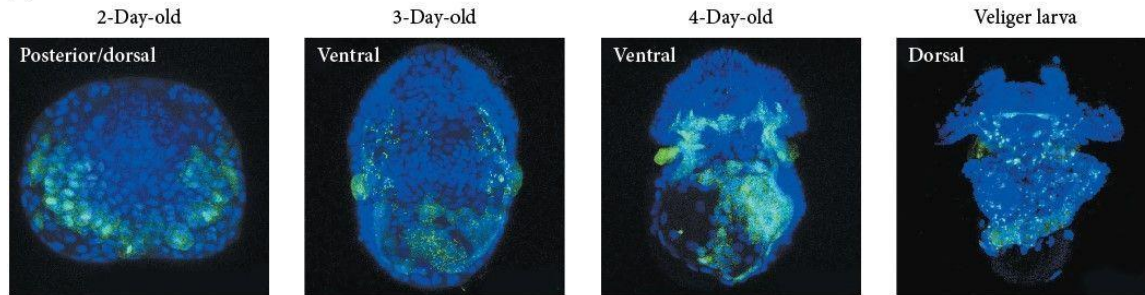
In general, the first-quartet micromeres (1a–1d), supplemented by some cells from the second and third quartets, generate the head ectoderm, while the nervous system comes largely from the first- and second-quartet cells (see Figure 1A). Fate maps confirm that the mouth forms in the same location as the blastopore. The endoderm comes from macromeres A, B, C, and D. The mesoderm comes from two sources: cells from the second and third quartets contribute the larval and adult musculature (ectomesoderm), while the majority of the mesoderm—the larval kidney, heart, primordial germ cells, and retractor muscles—comes from a particularly remarkable cell, the 4d blastomere (see Figure 1C). This highly conserved spiralian blastomere is critical for establishing the placement of the mesoderm and for inducing the formation of other cell types (Lyons et al. 2012). It is the cell most directly affected by the coiling mutation mentioned in Chapter 9 of the textbook.



(B) 1b blastomere



(C) 4d blastomere



After: J. J. Henry and K. J. Parry, 2008. *Dev Biol* 313: 181-195. J. Q. Henry et al. 2007. *Integr Comp Biol* 47: 855-871. B and C from Chan and Lambert 2014, photographs courtesy of the authors.

Figure 1 A) Generalized fate map of the snail embryo. The first two cleavages establish the A, B, C, and D quadrants. The micromere quartets (1a–1d and 3a–3d) are generated and divide to produce a “micromere cap” atop the yolky macromeres. The macromeres (3A–3D) produce most of the endoderm, while the apical micromeres generate the ectoderm. Specific tier-2 and tier-3 micromeres (this differs in different species) form the ectomesoderm, while the endomesoderm (heart and kidney) are generated by the 4d cell, which is often formed when the 3D cell divides ahead of the other macromeres. (B,C) Fate maps can be made by injecting tiny beads containing fluorescent dye into individual blastomeres. When the embryos develop into larvae, the descendants of each blastomere are identifiable by their fluorescence. (B) Results when the 1b blastomere of the snail *Ilyanassa* was injected with GFP. (C) Results of injecting *Ilyanassa* blastomere 4d.

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