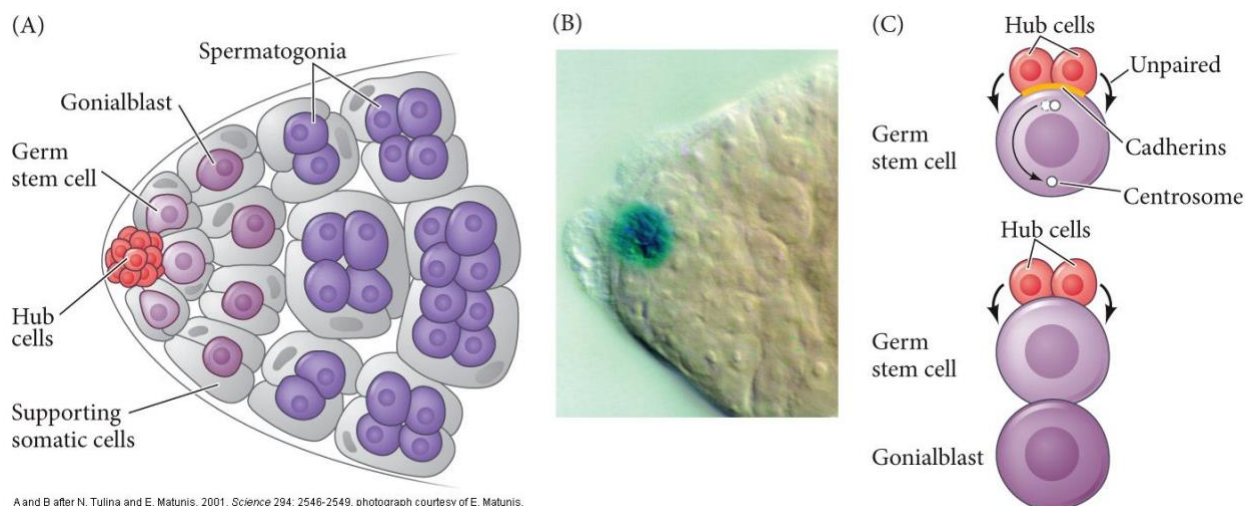


# *Drosophila* Testes Stem Cell Niche

Stem cell niches in the testes of male *Drosophila* illustrate the importance of local signals, cell-to-cell adhesion, and asymmetric cell division. The stem cells for sperm reside in a regulatory microenvironment called the hub (Figure 1). The hub consists of about 12 somatic testes cells and is surrounded by 5–9 germ stem cells (GSCs). The division of a sperm stem cell is asymmetric, always producing one cell that remains attached to the hub and one unattached cell. The daughter cell attached to the hub is maintained as a stem cell, whereas the cell that is not touching the hub becomes a gonialblast, a committed progenitor cell that will divide to become the precursors of the sperm cells. The somatic cells of the hub create this asymmetric proliferation by secreting the paracrine factor Unpaired onto the cells attached to them. Unpaired protein activates the JAK-STAT pathway in the adjacent germ stem cells to specify their self-renewal. Cells that are distant from the paracrine factor do not receive this signal and begin their differentiation into the sperm cell lineage (Kiger et al. 2001; Tulina and Matunis 2001).



A and B after N. Tulina and E. Matunis. 2001. *Science* 294: 2546–2549, photograph courtesy of E. Matunis.

**Figure 1** Stem cell niche in *Drosophila* testes. (A) The apical hub consists of about 12 somatic cells, to which are attached 5–9 germ stem cells. The germ stem cells divide asymmetrically to form another germ stem cell (which remains attached to the somatic hub cells), and a gonialblast that will divide to form the sperm precursors (the spermatogonia and the spermatocyte cysts where meiosis is initiated). (B) Reporter  $\beta$ -galactosidase inserted into the gene for Unpaired reveals that this protein is transcribed in the somatic hub cells (blue). (C) Cell division pattern of the germline stem cells, wherein one of the two centrosomes remains in the cortical cytoplasm near the site of hub cell adhesion while the other migrates to the opposite pole of the germ stem cell. The result is one cell remaining attached to the hub and the other cell detaching from the hub and differentiating.

Physically, this asymmetric division involves the interactions between the sperm stem cells and the somatic cells. In the division of the stem cell, one centrosome remains attached to the cortex at the contact site between the stem cell and the somatic cells. The other centrosome moves to the opposite side, thus establishing a mitotic spindle that will produce one daughter cell attached to the hub and one daughter cell away from it (Yamashita et al. 2003). (We will see a similar positioning of centrosomes in the division of mammalian neural stem cells.) The cell adhesion molecules linking the hub and stem cells together are probably involved in retaining one of the centrosomes in the region where the two cells touch. Here we see stem cell production using asymmetric cell division.

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