**Piwi Matters**

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**Preparation:**

As homework and prior to the case discussion in class, get acquainted with the case.

* Watch the video Piwi Matters (<https://youtu.be/ccbMPvyqpko>).
* Review the following concepts, learn/review some techniques commonly used in this field of study, and answer questions 1-3 in preparation for the case discussion.

In order for Drosophila ovaries to continue producing eggs, they need specialized cells, called germline stem cells. Stem cells have two unique properties – (a) self-renewal – i.e., they are able to divide and (b) differentiation – i.e., they are able to become different types of cells such as cystoblasts, nurse cells, and oocytes (see Box 1).

*Box 1: Concept*

**Stem cells** possess two fundamental properties:

* ability to self-renew and
* ability to produce numerous differentiated progenies.

Stem cells that form gametes (eggs and sperms) are called **Germline Stem Cells** (or GSCs).

Sperm and egg production require a balance between self-renewal and cell differentiation. Self-renewal at the expense of differentiation can cause tumorigenesis, whereas differentiation at the expense of self-renewal can cause germ cell depletion and infertility.

**In GSCS, there are two general types of cell division**:

* asymmetric – that produce a daughter GSC and a differentiated daughter cell (e.g., in *Drosophila* ovary), and
* symmetric – that produce two daughter cells each of which has an equal probability of differentiating (e.g., in *C. elegans* and several *Hydra* species).

Q1. According to the Piwi Matters video, what happens to flies lacking the Piwi protein?

To understand the role of Piwi in *Drosophila* stem cell self-renewal*,* scientists have begun to delete or replace specific amino acid residues in the Piwi protein to produce mutant flies. By observing ovary development in these flies, they can conclude whether the deleted or changed amino acids of Piwi are required for stem cell maintenance.

When Le Thomas et al., compared the fruit fly ovaries with wild-type Piwi (panel A) to that with a specific Piwi mutant (called the YK mutant, panel B) they saw the following morphology. Observe the images included below and answer the following questions.



Q2. Based on the results shown, are the roles of the mutated residues (in the YK mutant of Piwi) required or dispensable for stem cell self-renewal? Explain your answer.

The Le Thomas et al., manuscript explains that in the YK mutations there were 2 point mutations - Y551 was mutated to L and K555 was mutated to E.

Q3. What kinds of interactions may be changed in a structure by:

a. replacing a Tyr (or Y) with Leu (or L) and

b. replacing a Lys (or K) with Glu (or E)?

This case will explore the structure and function of Piwi to understand the molecular basis of the YK mutant phenotype.