C. elegans

Vulval Development

Prof Sahu

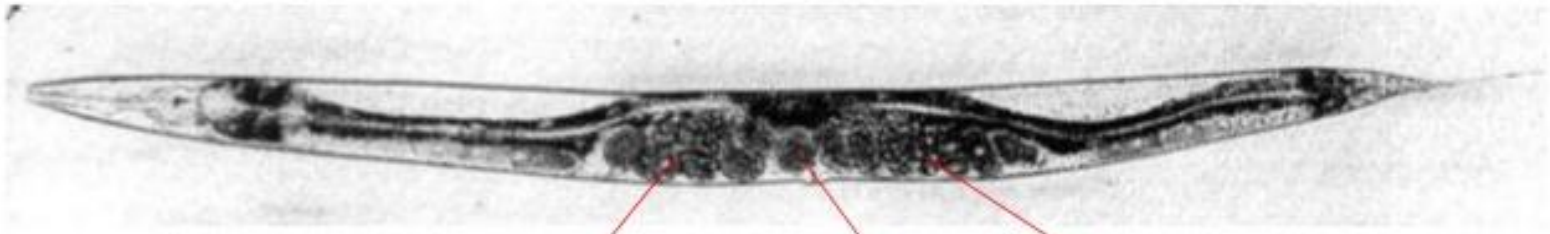
Adult *Caenorhabditis elegans*

Why *C. elegance ?*

- ✓ C. elegans is easy to grow in the laboratory and has a short generation time.
- ✓ The worm is transparent at all stages of its life cycle, so internal examination is possible without killing the animal.
- ✓ This nature of the worm has enabled to monitor the entire developmental process of the worm at the cellular level.

- ✓ Every cell division in the pathway from fertilized egg to adult worm has been identified.
- ✓ The complete connectivity of the 302 cells that comprise the nervous system of the worm has been mapped.

Caenorhabditis elegans



Egg cells vulva Egg cells

1mm

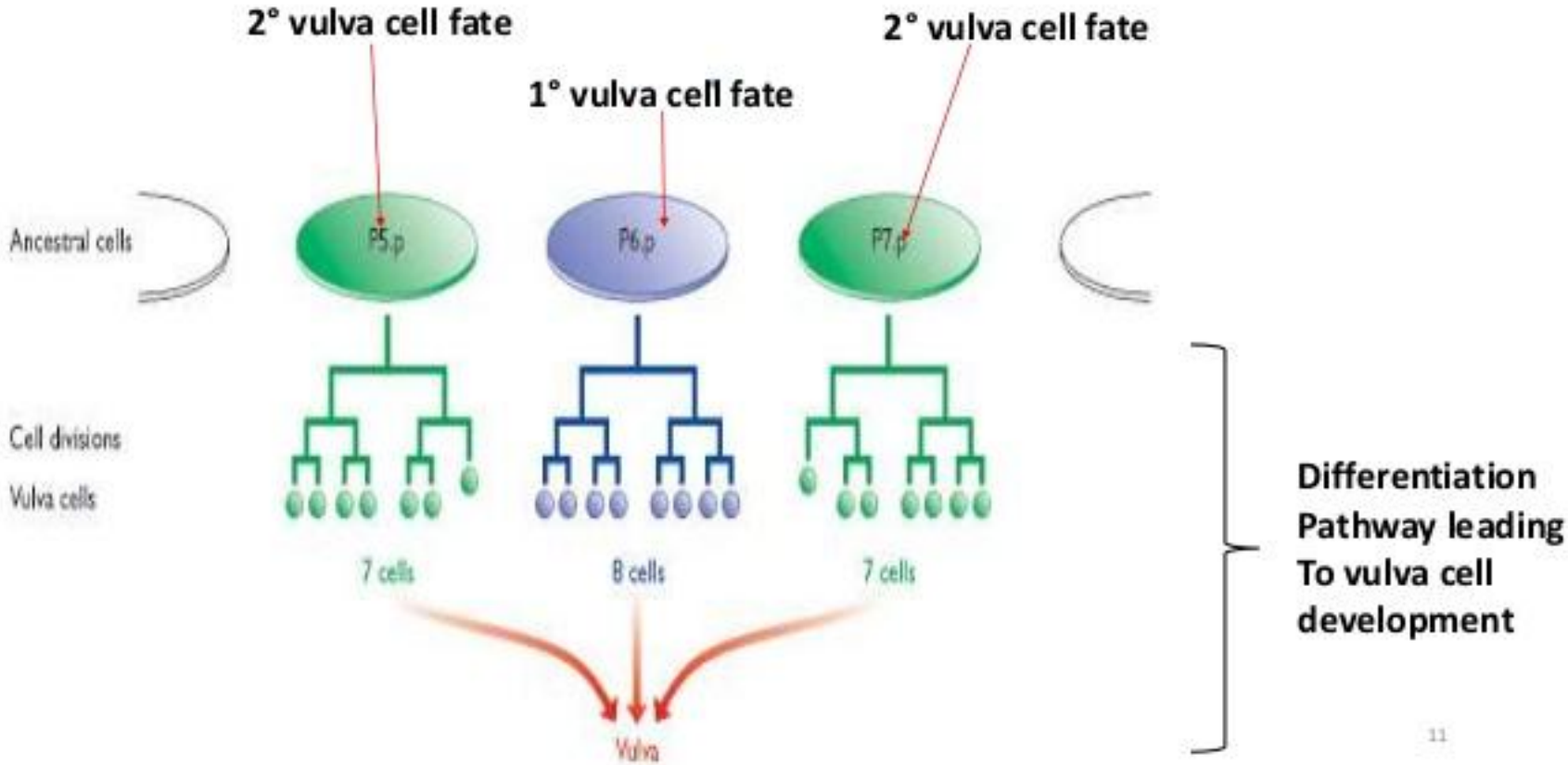
What is vulva development?

✓The hermaphrodite vulva is simple organ consisting of 22 cells that are formed during the post-embryonic development.

Vulva Development

- ✓Most C. elegans worms are hermaphrodites, meaning that they have both male and female sex organs.
- ✓The vulva is part of the female sex apparatus.
- ✓ The adult vulva comprises 22 cells which are the progeny of three ancestral cells

- ✓originally located in a row on the undersurface of the developing worm.
- ✓ The central cell, called P6.p, adopts the 'primary vulva cell fate' and divides to produce eight new cells.
- ✓The other two cells - P5.p and P7.p - take on the 'secondary vulva cell fate' and divide into seven cells each.


2° vulva cell fate
1° vulva cell fate
2° vulva cell fate
Ancestral cells
P5.p
P6.p
P7.p
Cell divisions
Vulva cells
7 cells
8 cells
7 cells
Vulva
Differentiation Pathway leading To vulva cell development

- These 22 cells then reorganize their positions to construct the vulva.
- A critical aspect of vulva development is that it must occur in the correct position relative to the gonad.
- If the vulva develops in the wrong place then the gonad will not receive sperm and the egg cells will never be fertilized.

- The positional information needed by the vulva progenitor cells is provided by a cell within the gonad called the anchor cell.
- The anchor cell secretes an extracellular signaling compound that induces P5.p, P6.p and P7.p to differentiate.
- This signaling compound is the protein called LIN-3, coded by the lin-3 gene

- LIN-3 forms a concentration gradient and therefore has different effects on P6.p, the cell which is closest to it, and the more distant P5.p and P7.p Therefore, P6.p adopt the primary cell fate whereas P5.p and P7.p take on secondary cell fates.
- Its been proved that isolated cells adopt the secondary fate when exposed to low levels of LIN-3.