

## Section on Fertilization and Development

In sea urchin, the potential difference across the egg cell membrane changes from negative to positive following fusion of sperm and egg. This change is depicted below.

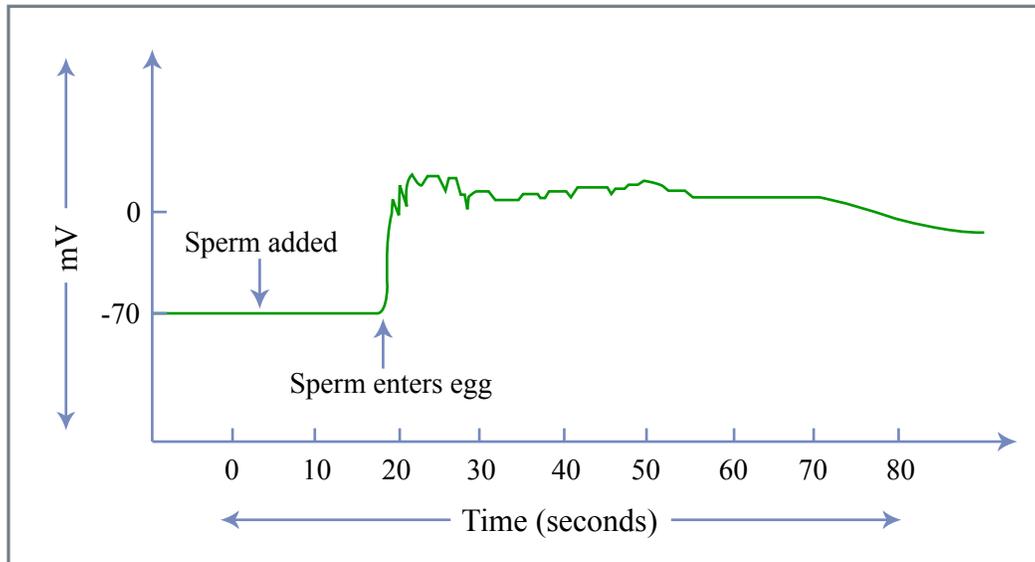


Figure by MIT OCW.

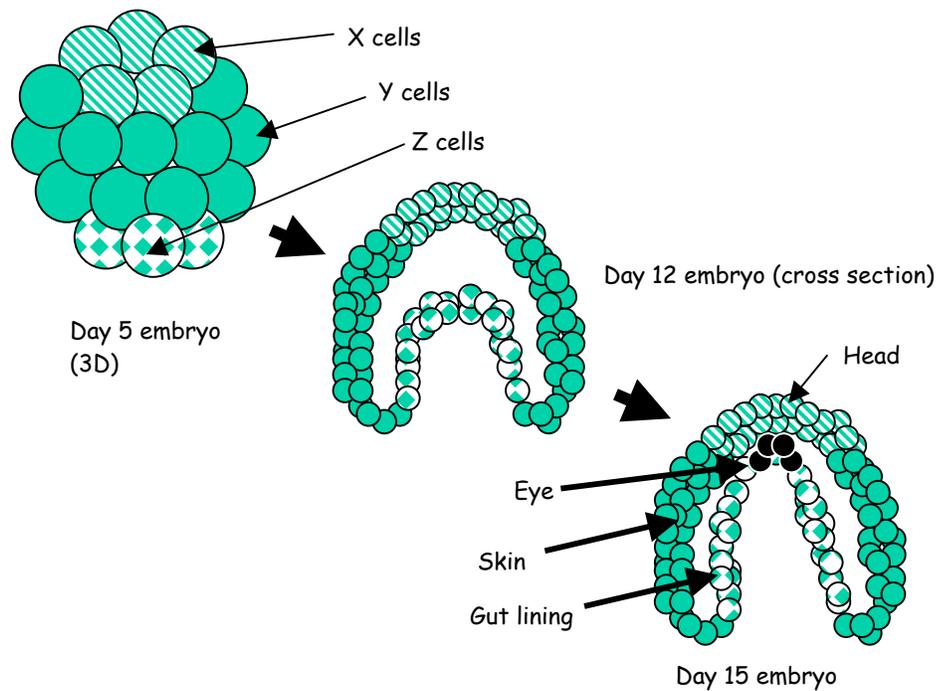
a) The major cause of this change at Time = 20 s is:

- i) Slow block to polyspermy
- ii) Fast block to polyspermy
- iii) Action potential
- iv) Cortical rotation
- v) PTI signaling

b) Which of the following assures species specific recognition of sperm and egg during fertilization? Circle all that apply.

- i) Mammalian plasma membrane
- ii) Mammalian ZP3
- iii) Sea urchin bindin
- iv) Sea urchin cortical granules
- v) Sea urchin sperm flagella PTI signaling

In the following theoretical embryo, it is possible to track the development of the head, eyes, skin and gut lining from three initial types of cells: X, Y and Z.



c) Based on the diagram, give a **one short sentence** explanation for the following experimental results.

i) Removal of Z cells at Day 5 gives rise to a normal organism.

ii) Replacement of all X cells with Z cells at Day 5 gives rise to normal development.

iii) Removal of the involuting Z cells at Day 12 leads to the absence of head structure development.

iv) Placement of an impermeable barrier between X cells and Z cells at Day 12 prevents head formation.

v) Removing X cells at Day 12 prevents head formation BUT NOT eye development.

e) An embryo whose Y cells lack the *Dodo* gene develops normal skin but has undifferentiated Z cells in place of gut lining at Day 15. The gene product of *Dodo* is more likely to be a... (Circle one.)

Ligand

Receptor

G-protein

Cyclin