

### Development Section Answers

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.

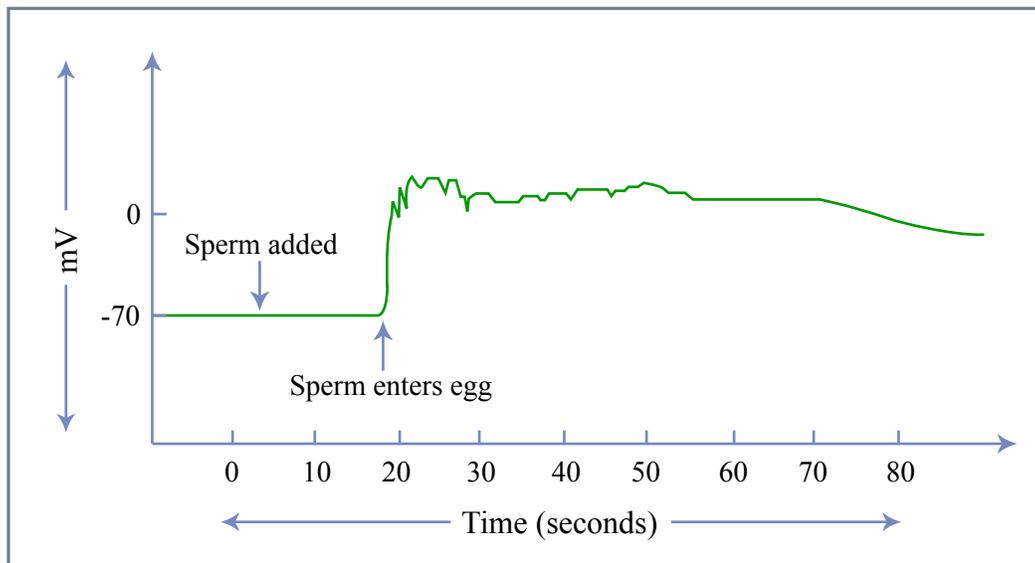


Image by MIT OCW.

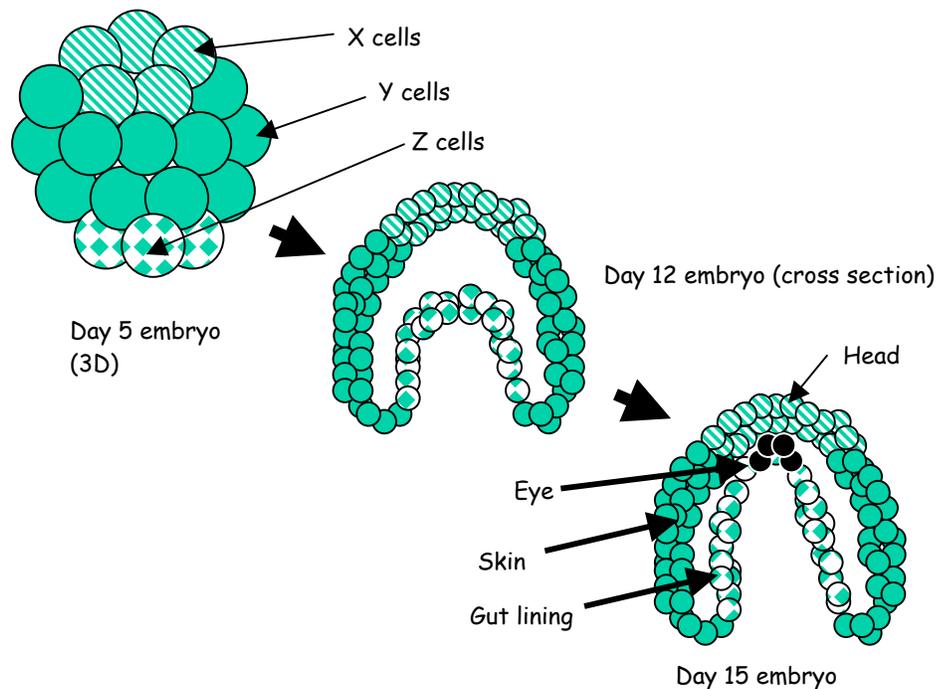
a) The major cause of this change at Time = 20 s is:

- 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.  
*Other cells compensate for loss of Z cells.*

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

*At day 5, the Z cell is still pluripotent to form head.*

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

*Z cells contact X cells during involution and stimulate formation of the head.*

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

*An inducer (or morphogen) is responsible for stimulating head development.*

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

*Eye development occurs independently of head development or X cells.*

d) 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(n)... (Circle one.)

Ligand

Receptor

G-protein

Cyclin