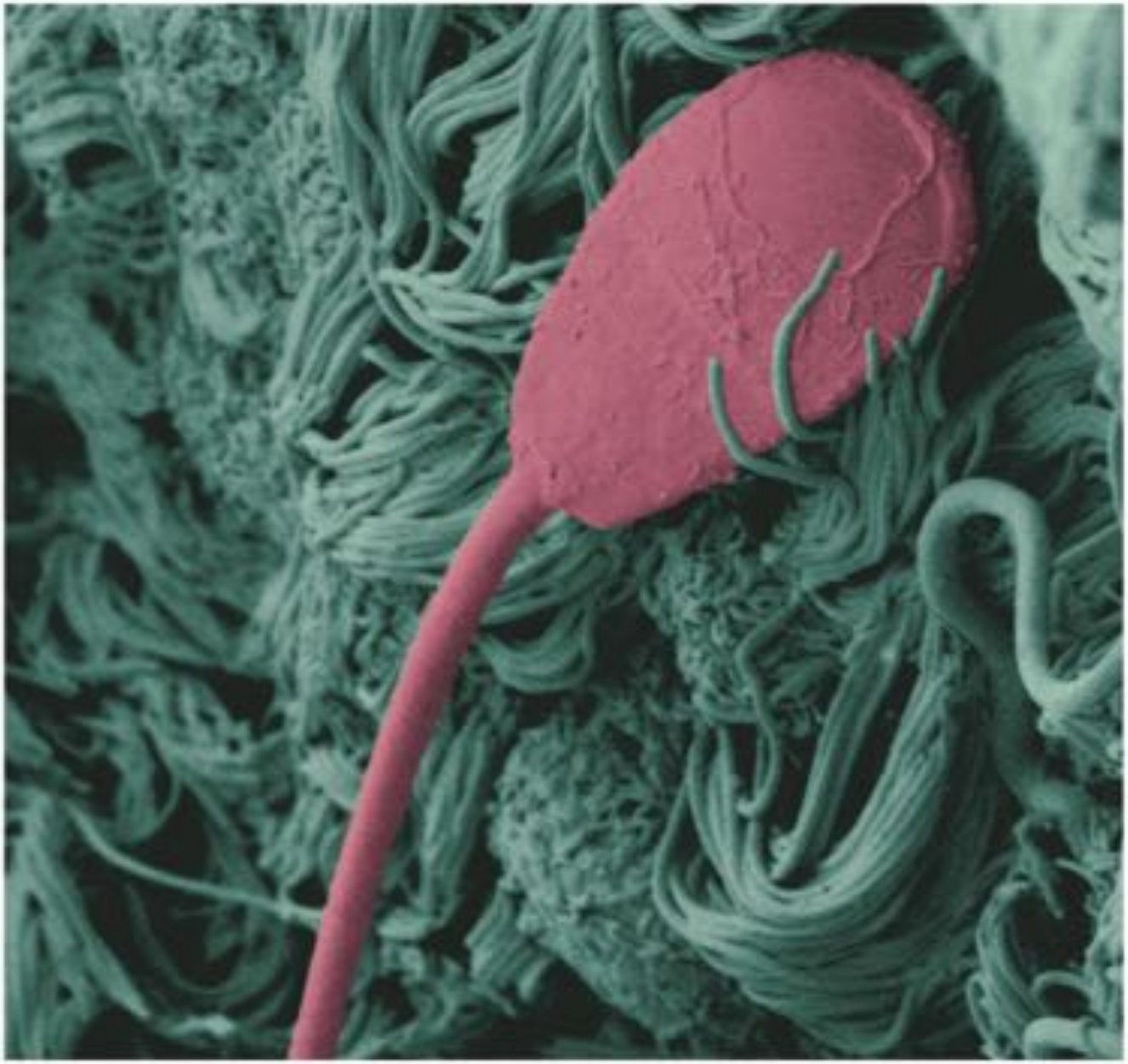
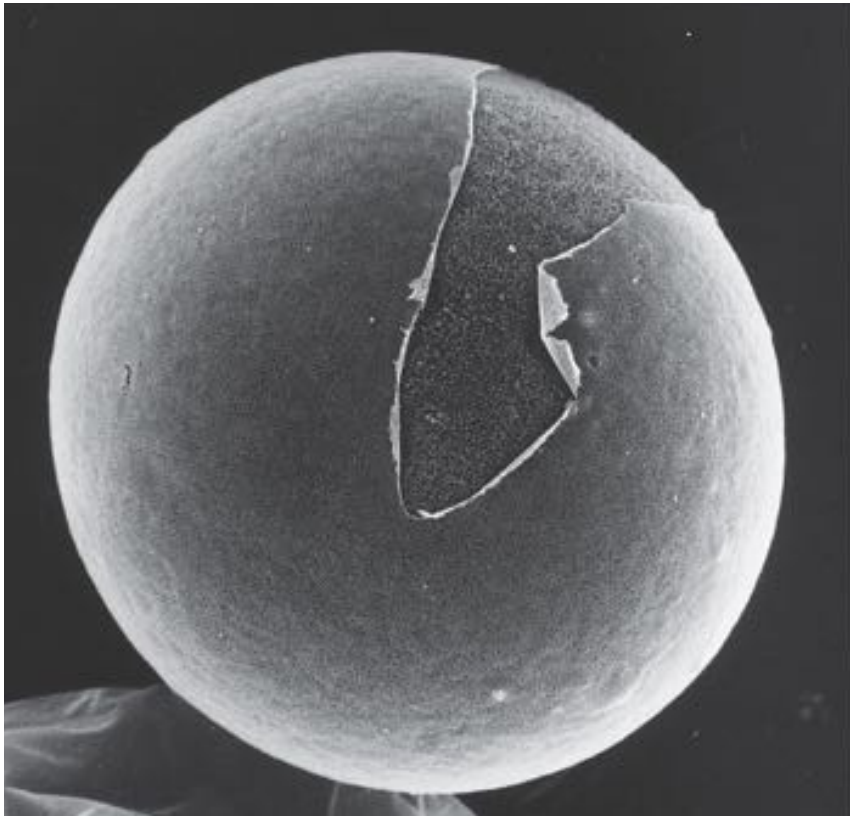
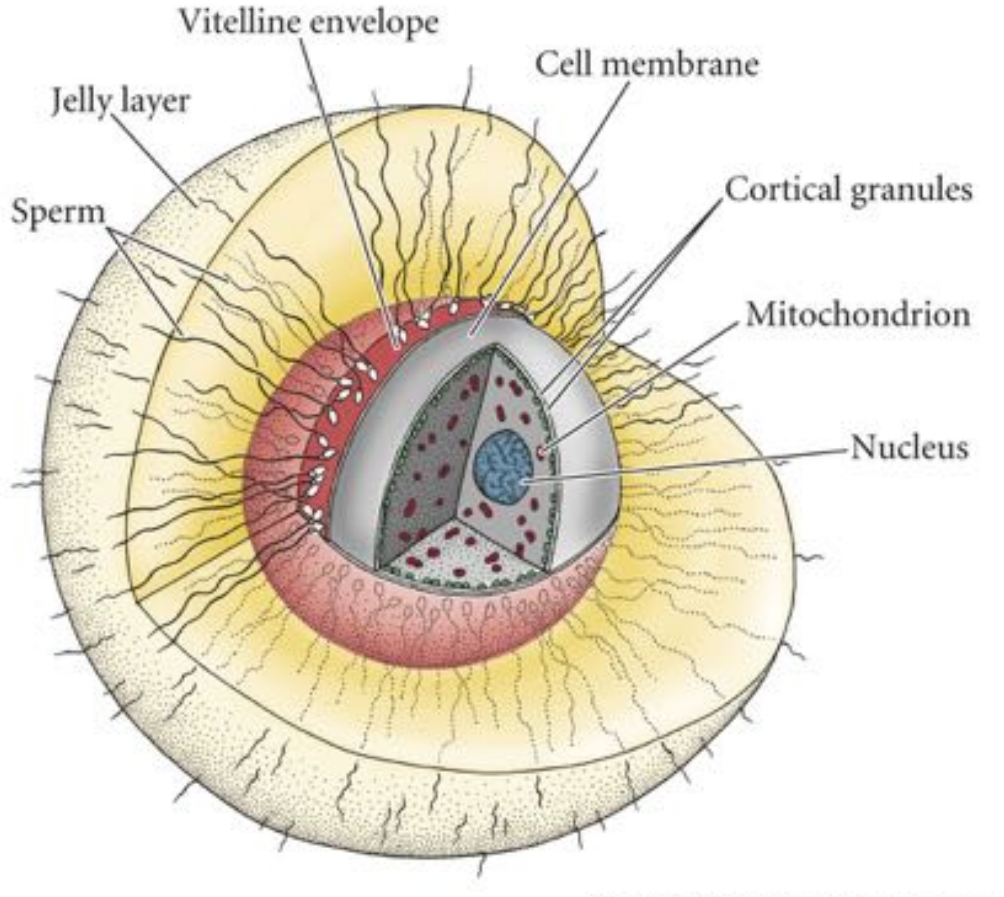
FERTILIZAÇAO



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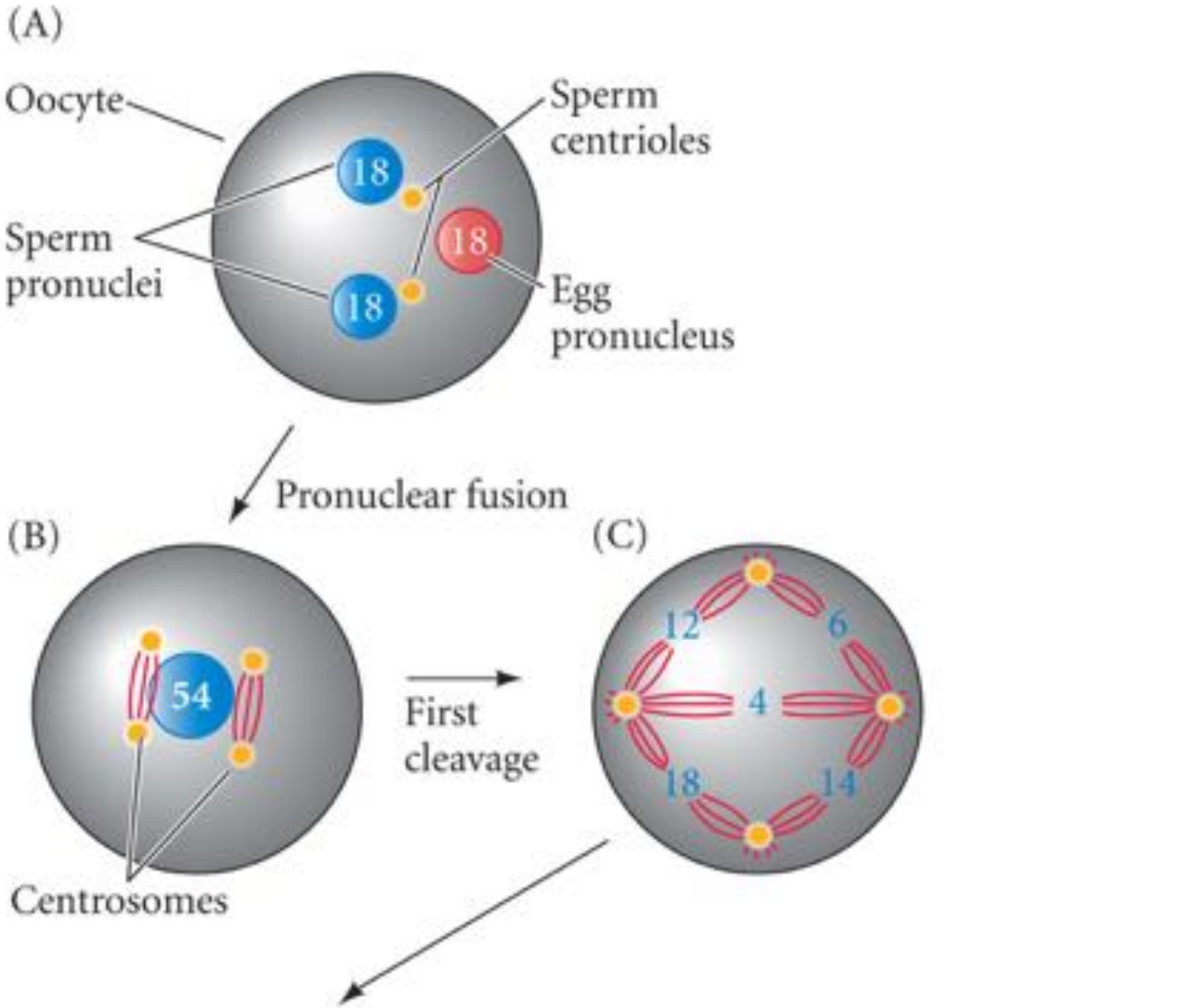
Estrutura do ovo de ouriço antes da fertilização





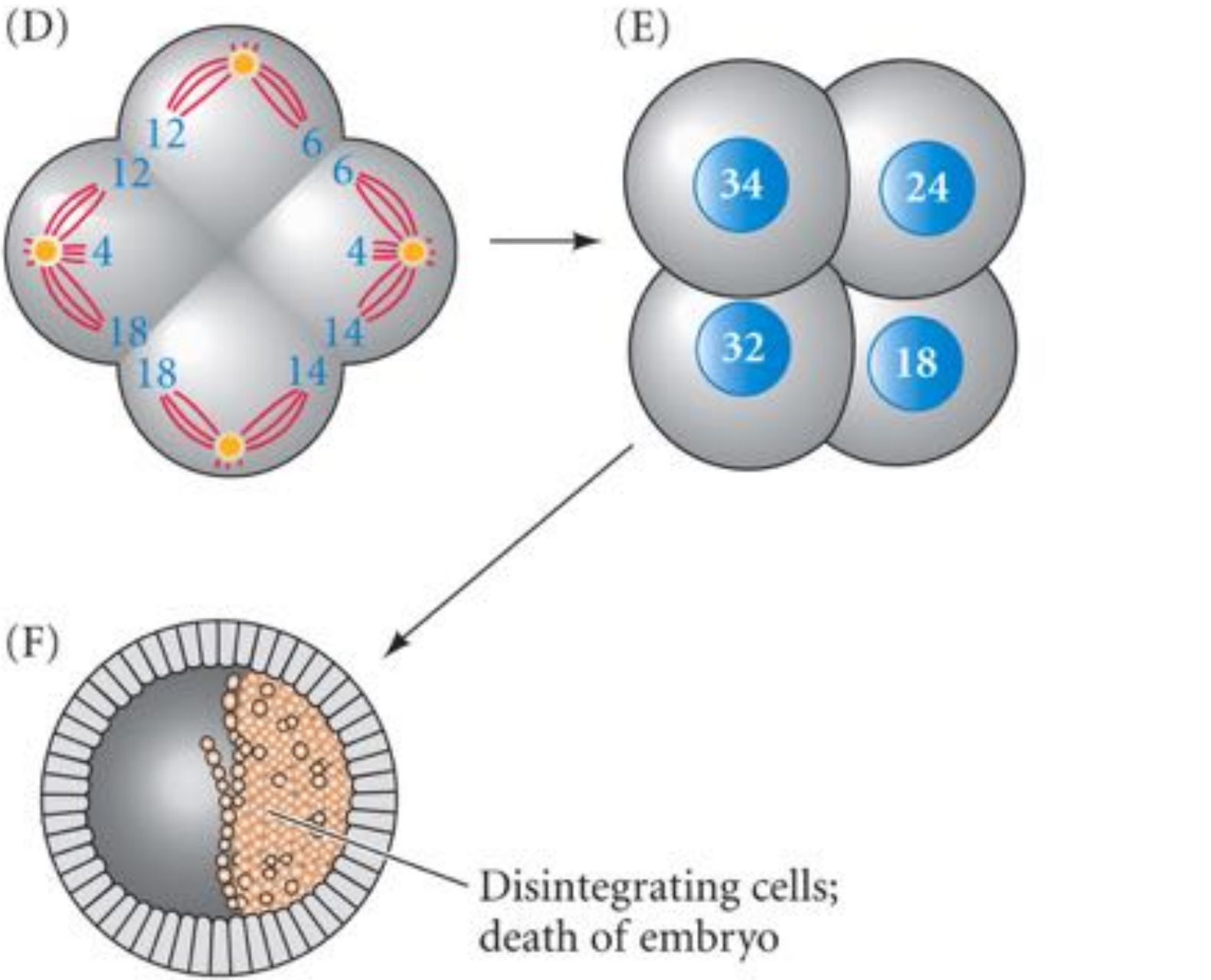
¿O qué ocurre cuándo varios espermatozoides ingresam ao ovo?

Desenvolvimento aberrante no ovo dispermico de ouriço (Parte 1) - POLISPERMIA



DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.16 (Part 1) © 2006 Sinauer Associates, Inc.

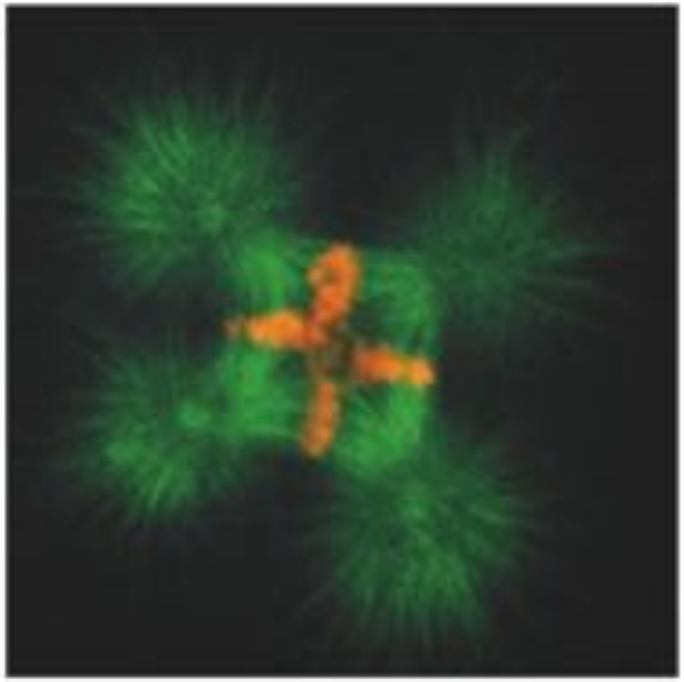
Desenvolvimento aberrante no ovo dispermico de ouriço (Parte 2) - POLISPERMIA



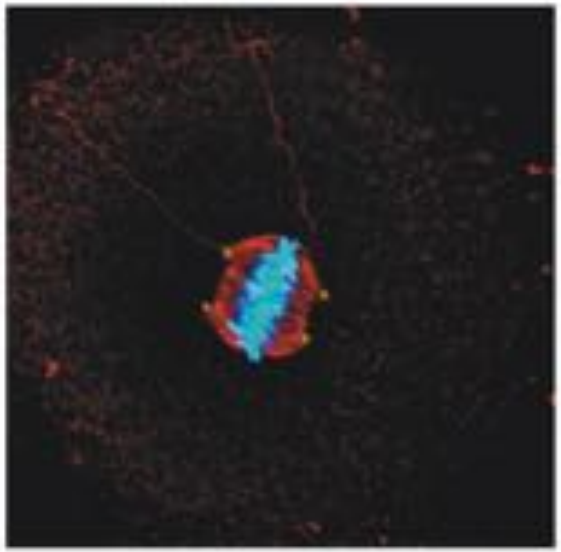
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Desenvolvimento aberrante no ovo dispermico de ouriço (Parte 2) - POLISPERMIA

(G)



(H)



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TABLE 7.1 Events of sea urchin fertilization

Event	Approximate time postinsemination*
EARLY RESPONSES	
Sperm-egg binding	0 seconds
Fertilization potential rise (fast block to polyspermy)	within 1 sec
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Calcium increase first detected	10 sec
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Increase in pH (remains high)	1–5 min
Sperm chromatin decondensation	2–12 min
Sperm nucleus migration to egg center	2–12 min
Egg nucleus migration to sperm nucleus	5–10 min
Activation of protein synthesis	starts at 5–10 min
Activation of amino acid transport	starts at 5–10 min
Initiation of DNA synthesis	20–40 min
Mitosis	60–80 min
First cleavage	85–95 min

Main sources: Whitaker and Steinhardt 1985; Mohri et al. 1995.

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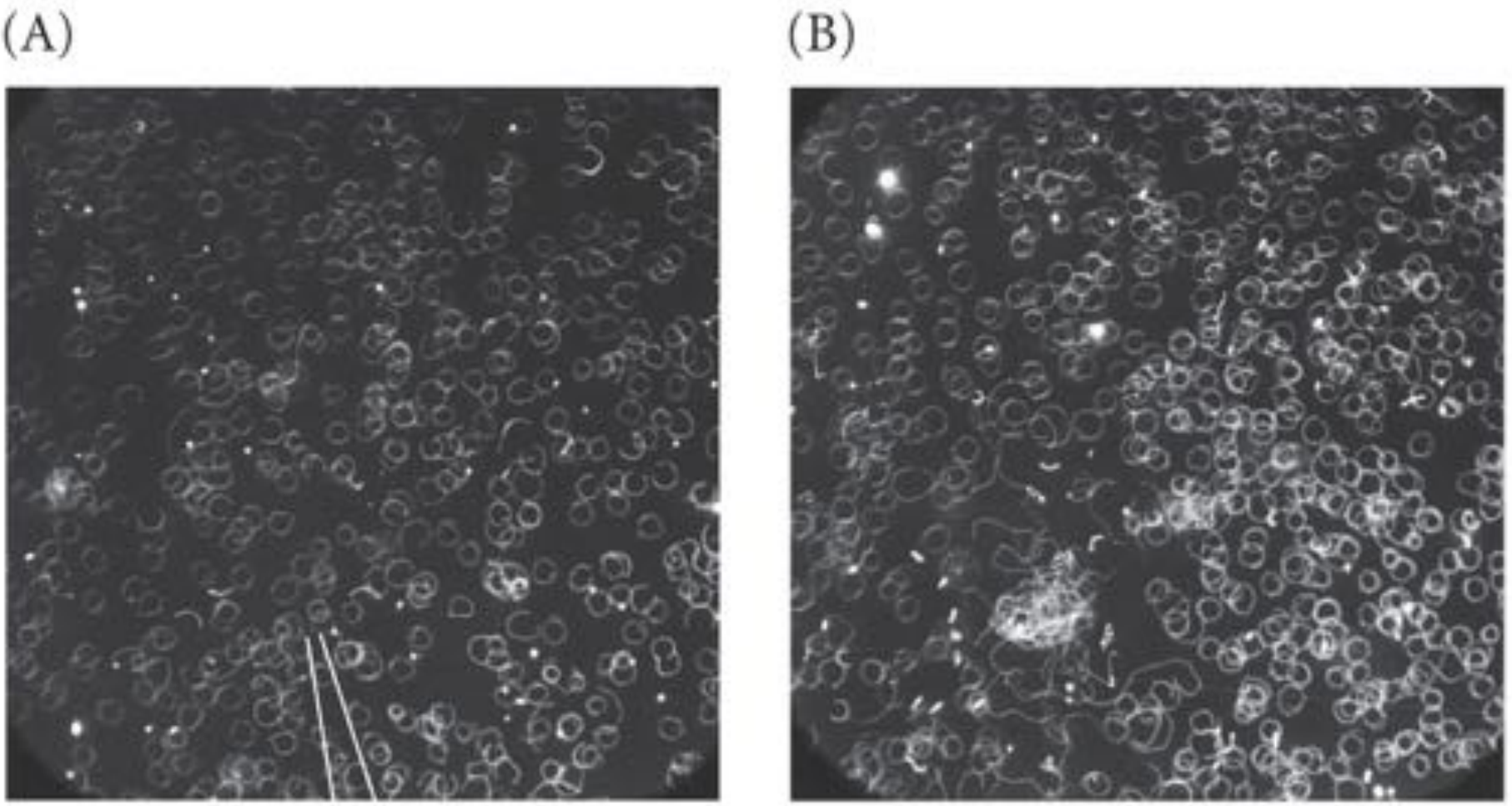
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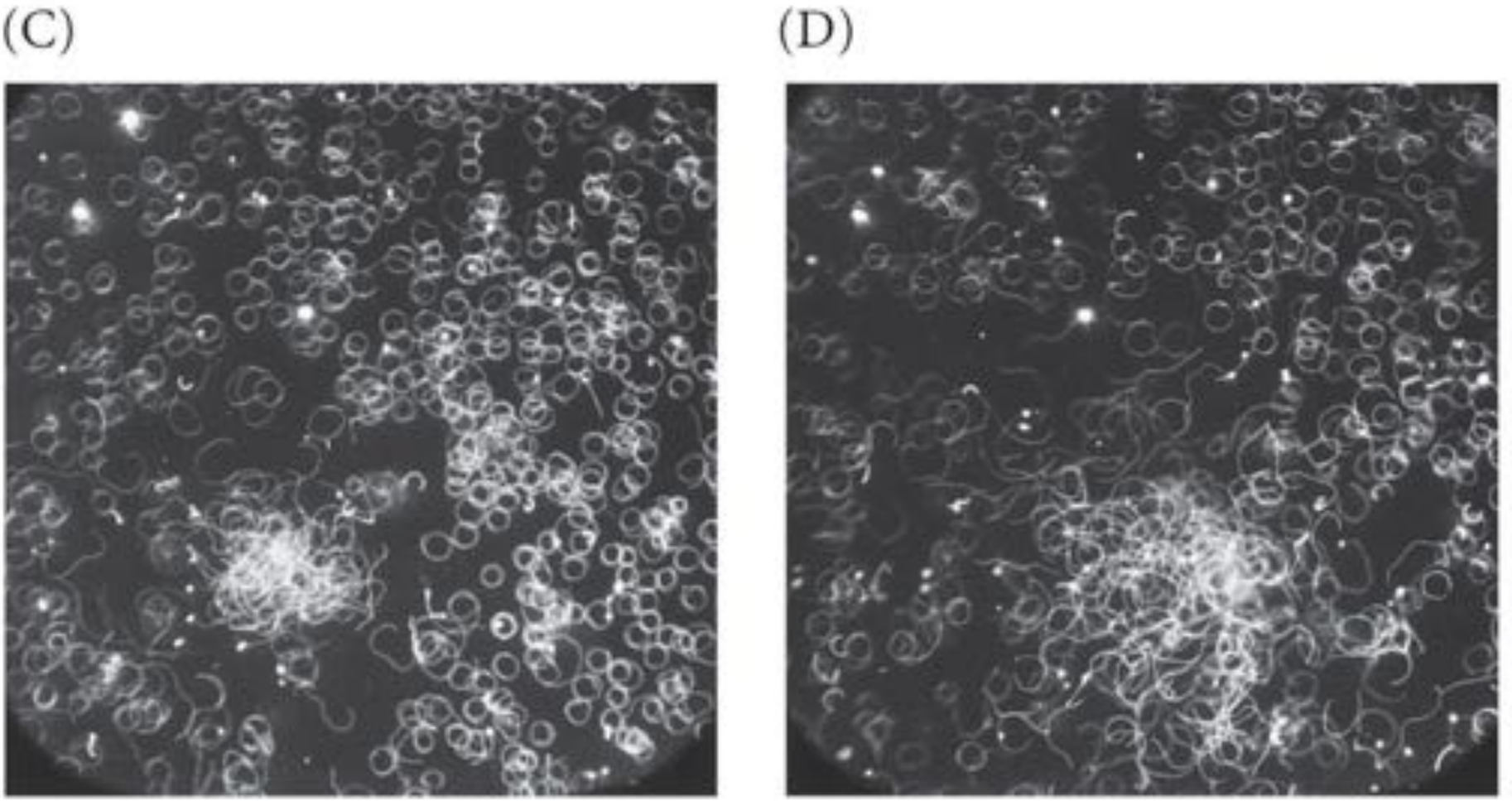
Quimiotaxia em esperma do ouriço *Arbacia punctulata* (Part 1)



Molécula de quimioatração: resact

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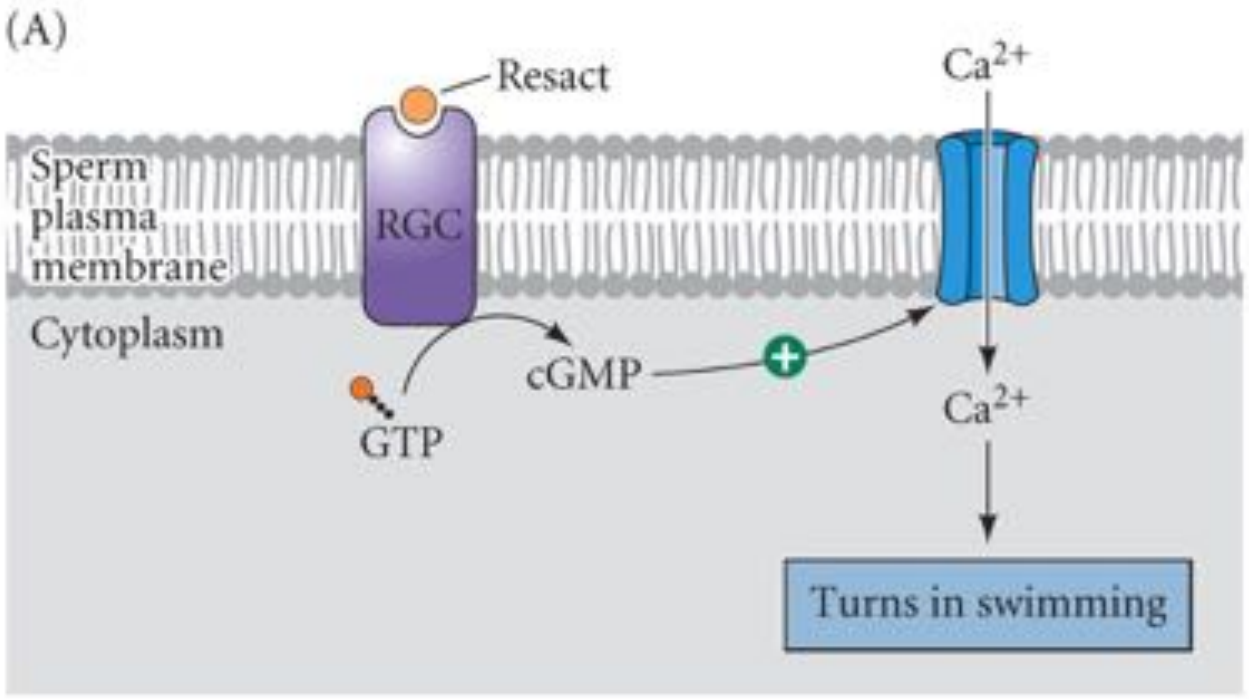
Quimiotaxia em esperma do ouriço *Arbacia punctulata* (Part 2)



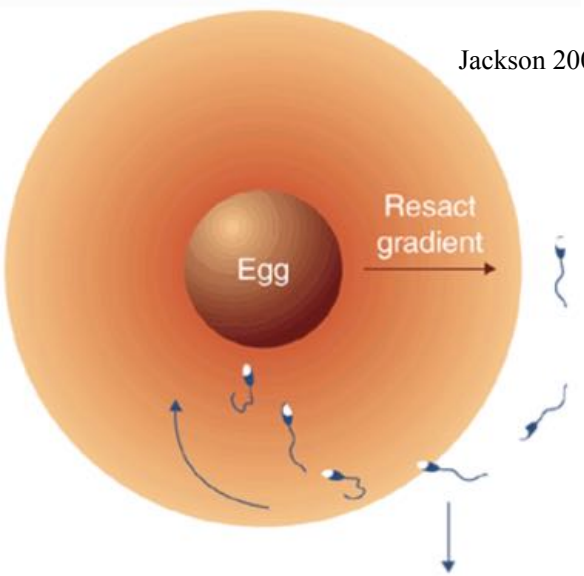
Molécula de quimioatração: resact

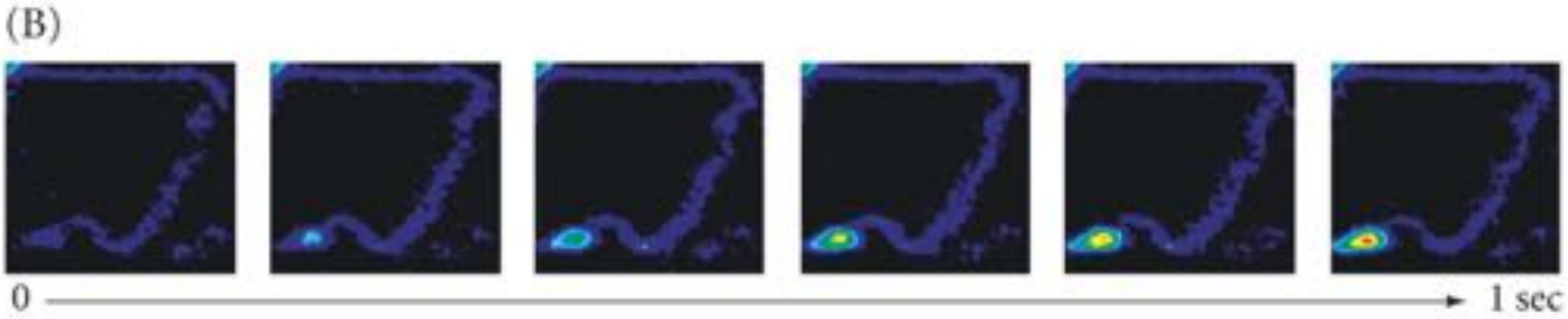
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Modelo de peptidos de quimiotaxis na esperma de ouriço



Jackson 2003

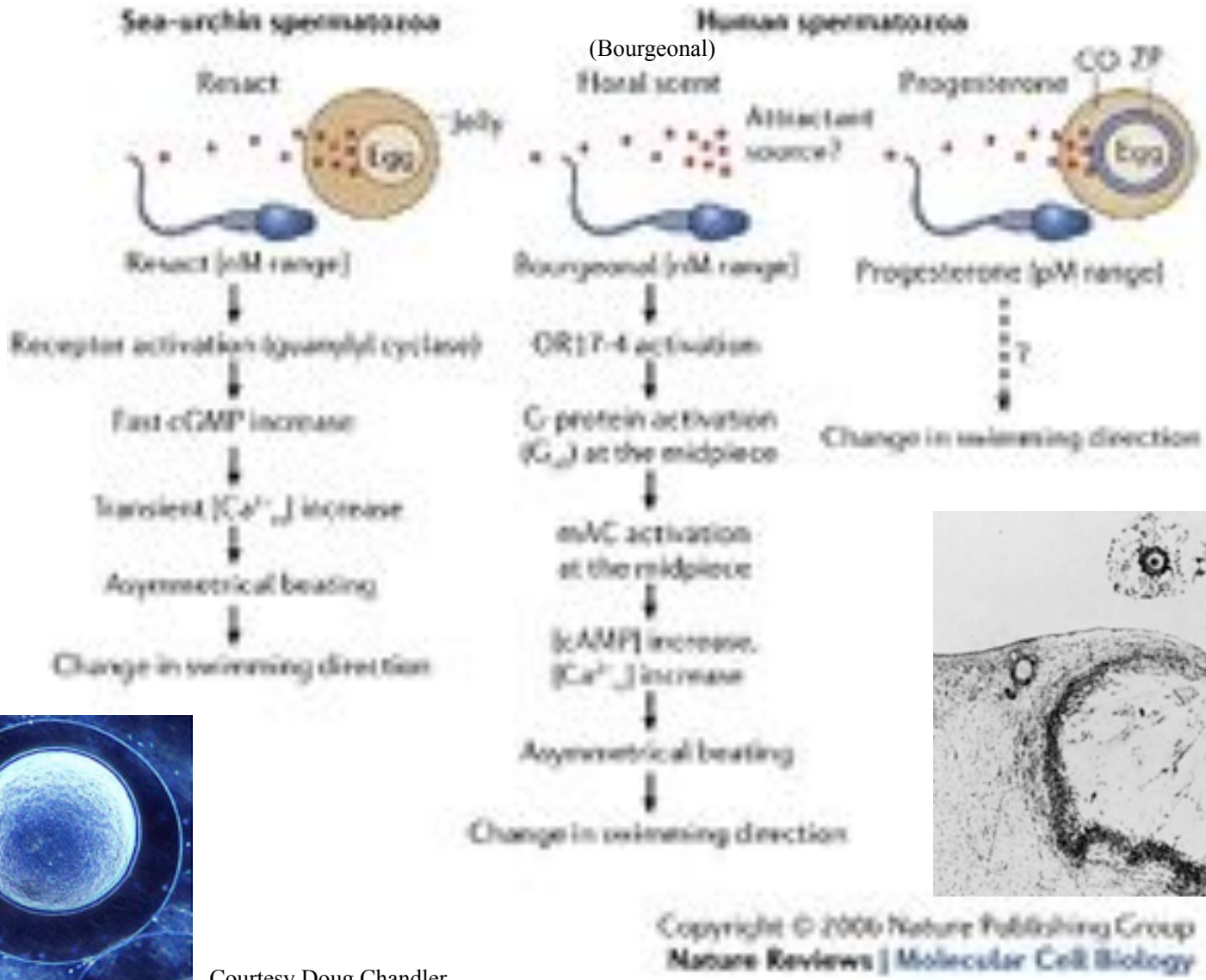


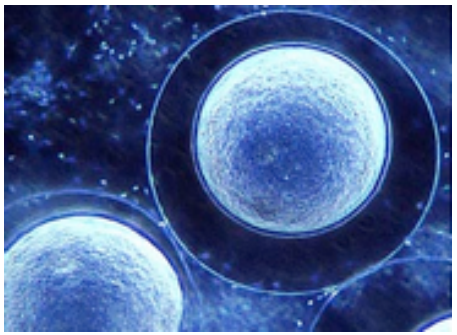


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http://www.youtube.com/watch?v=-uZyfZ2x9Aw

Chemoattractants





Courtesy Doug Chandler

Blandau, 1970

Eisenbach *et al. Nature Reviews Molecular Cell Biology* **7**, 276–285 (April 2006) | doi:10.1038/nrm1893

nature REVIEWS MOLECULAR CELL BIOLOGY

TABLE 7.1 Events of sea urchin fertilization

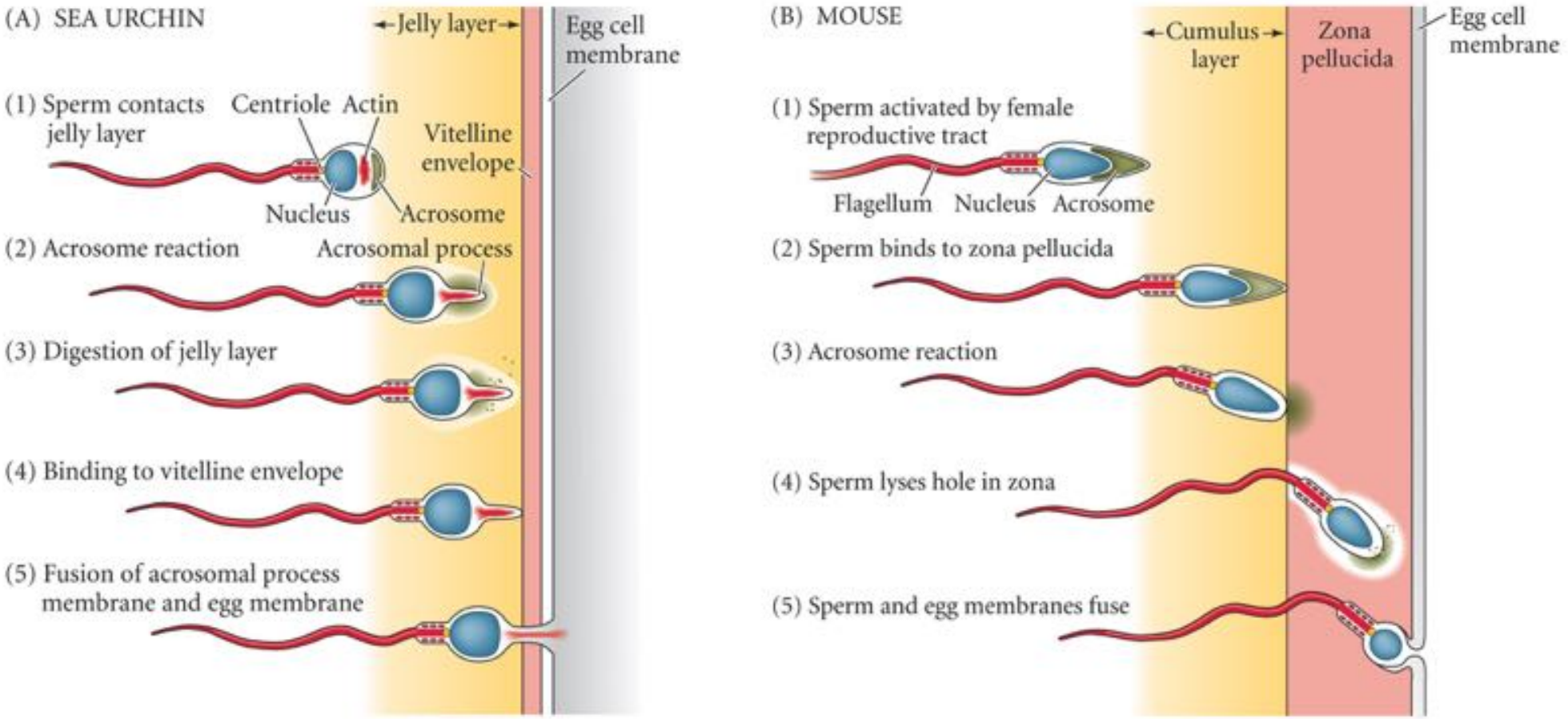
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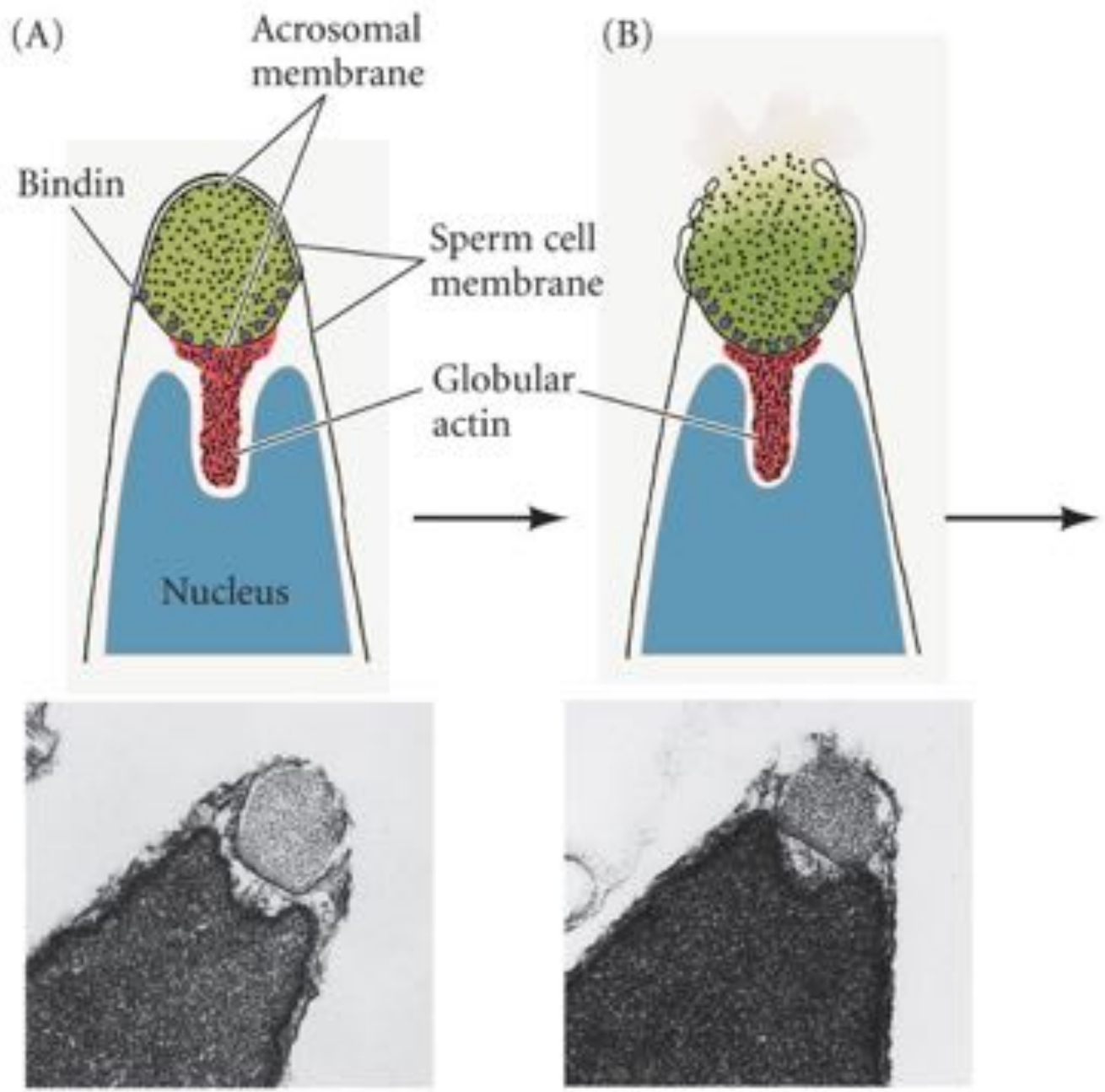
*Approximate times based on data from *S. purpuratus* (15–17°C), *L. pictus* (16–18°C), *A. punctulata* (18–20°C), and *L. variegatus* (22–24°C). The timing of events within the first minute is best known for *Lytechinus variegatus*, so times are listed for that species.

DEVELOPMENTAL BIOLOGY, Eighth Edition, Table 7.1 © 2006 Sinauer Associates, Inc.

Summary of events leading to fusion of egg & sperm plasma membranes in urchin and mouse

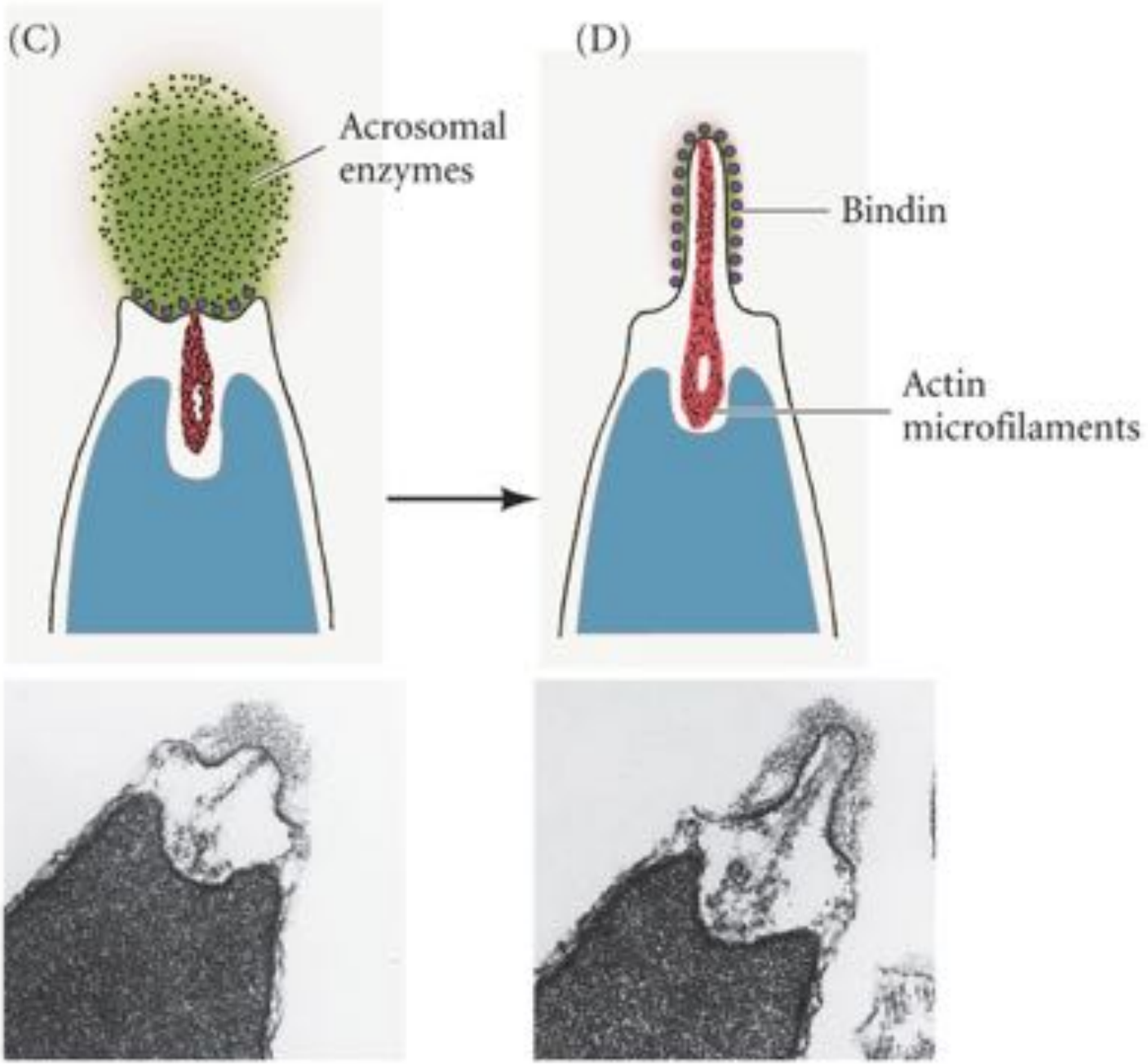


The acrosome reaction in sea urchin sperm (Part 1)



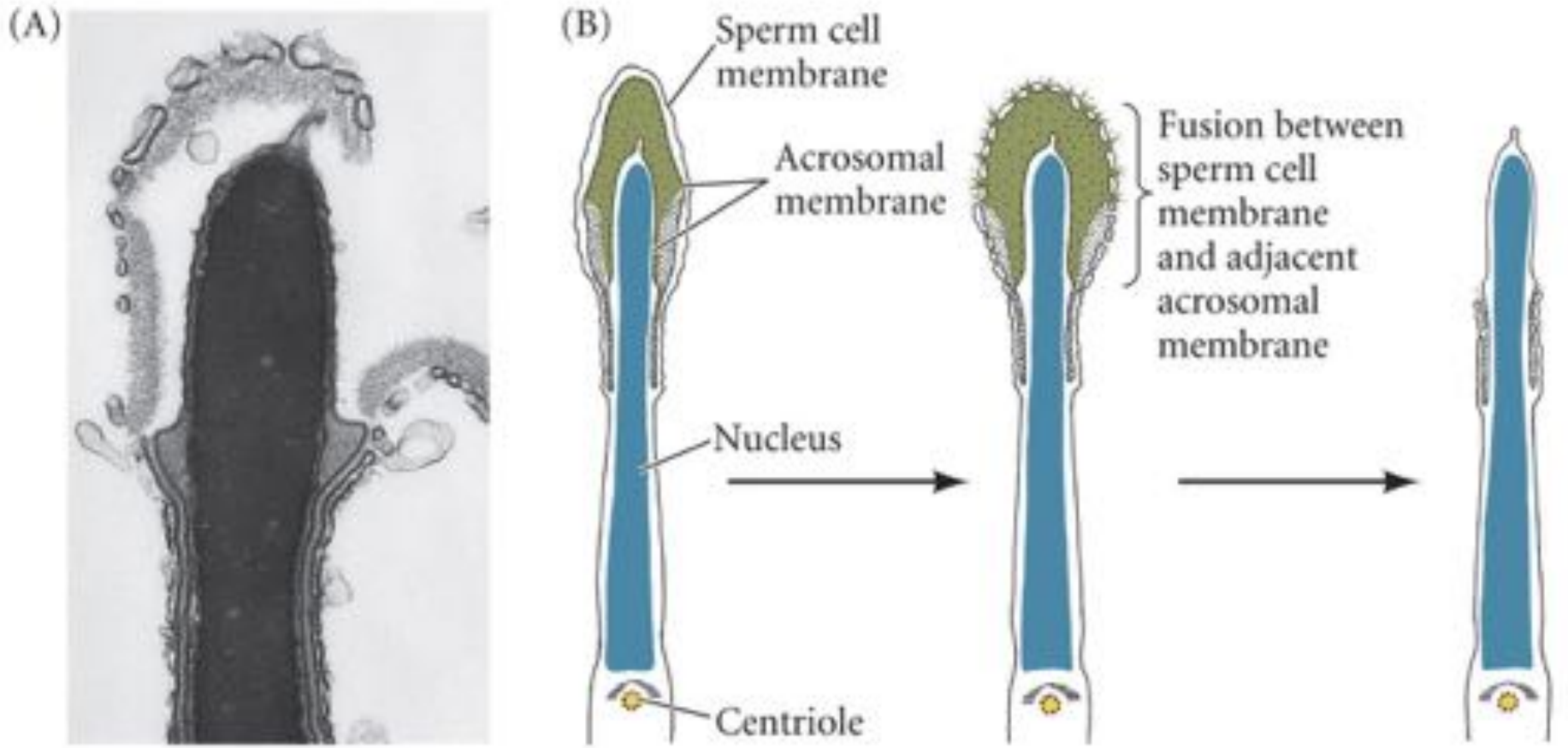
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The acrosome reaction in sea urchin sperm (Part 2)



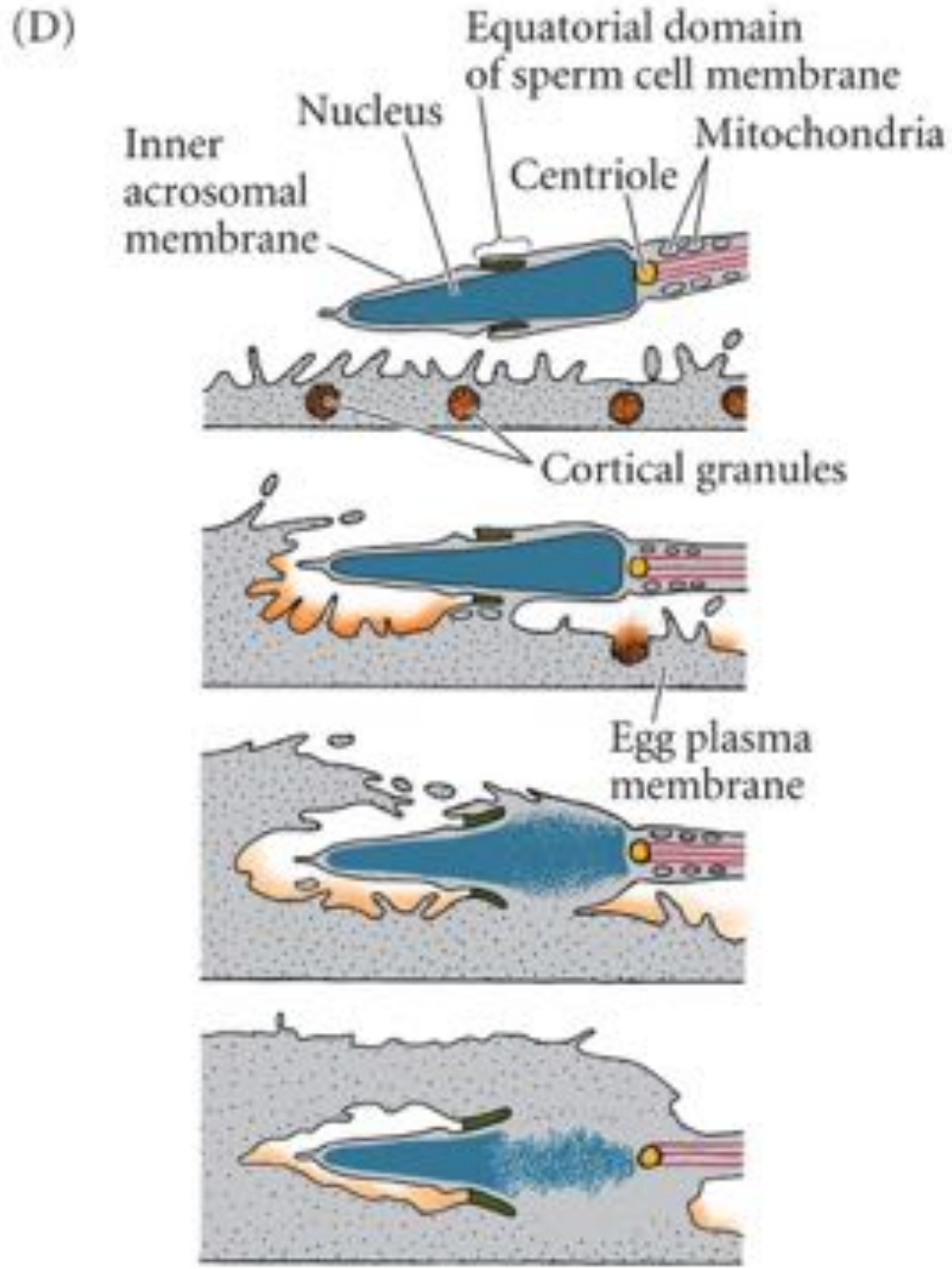
DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.11 (Part 2) © 2006 Sinauer Associates, Inc.

The acrosome reaction in hamster sperm



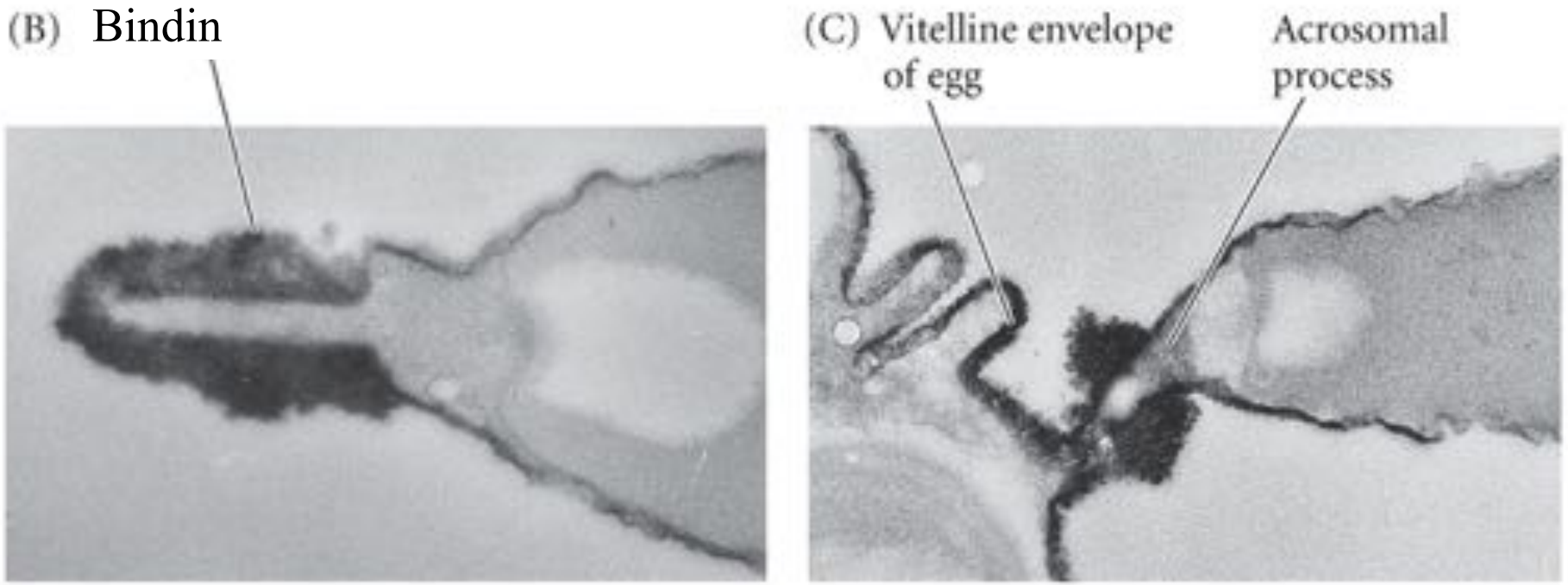
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Entry of sperm into a golden hamster egg (Part 2)



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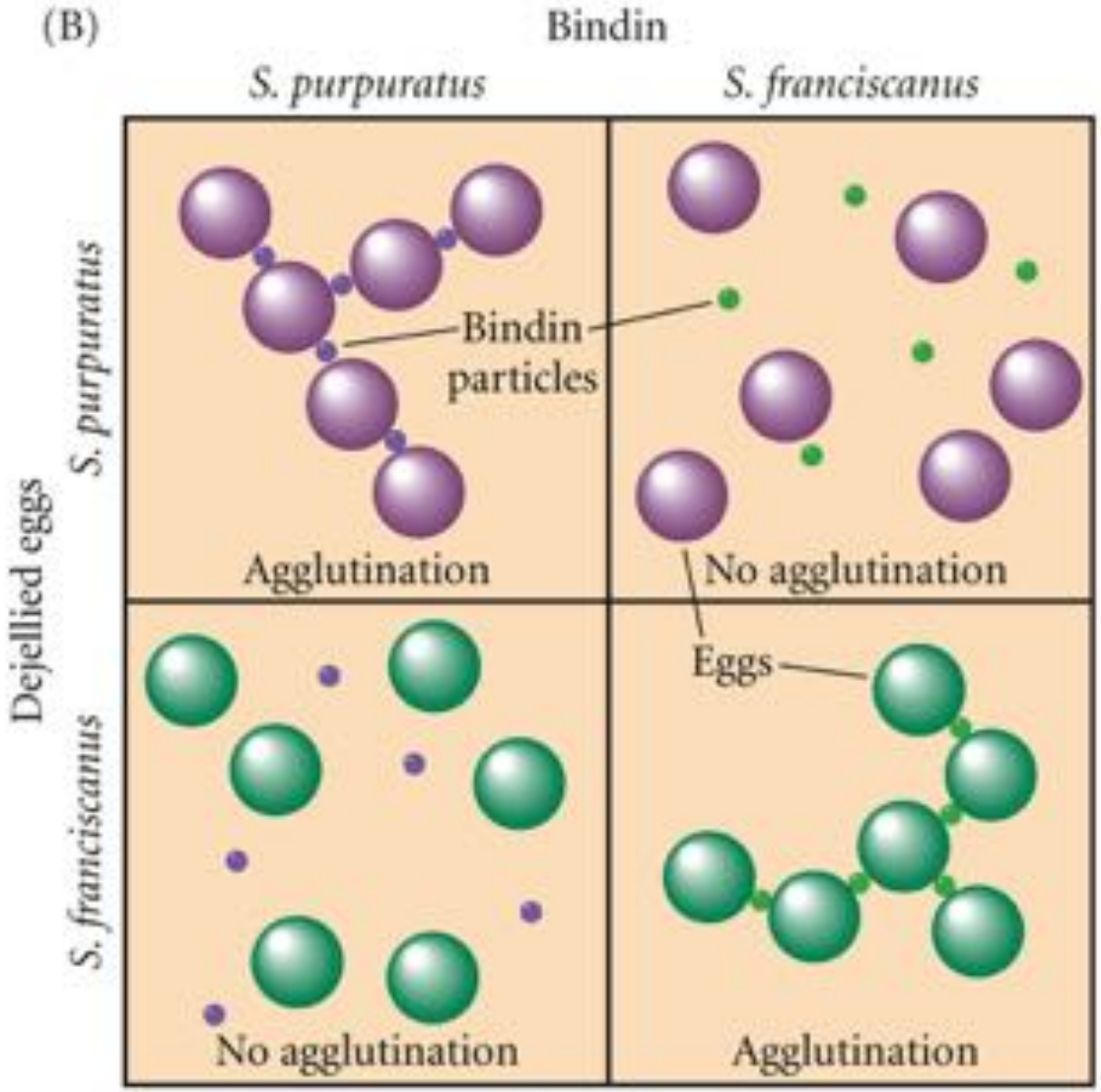
Localization of bindin on the acrosomal process (Part 2)



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Species-specific binding of acrosomal process to egg surface in sea urchins





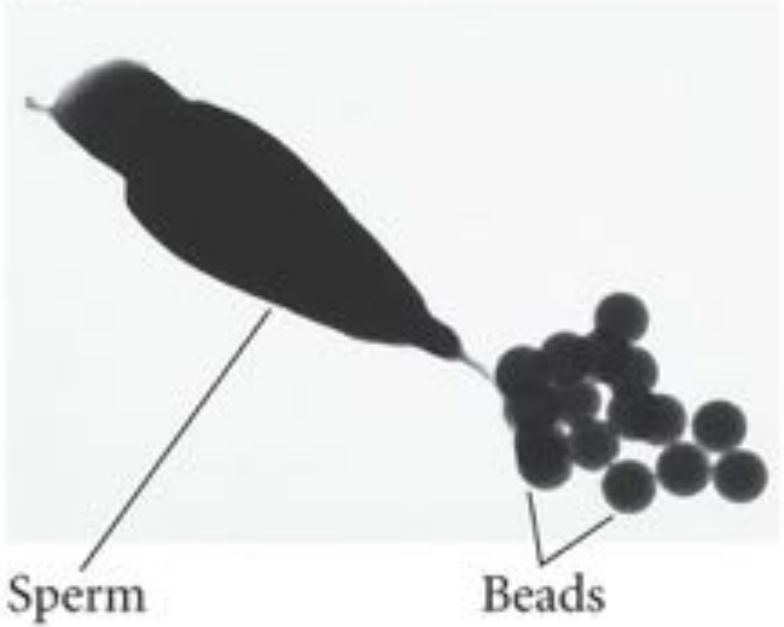
DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.12 © 2006 Sinauer Associates, Inc.

Bindin receptors on the egg

(A)

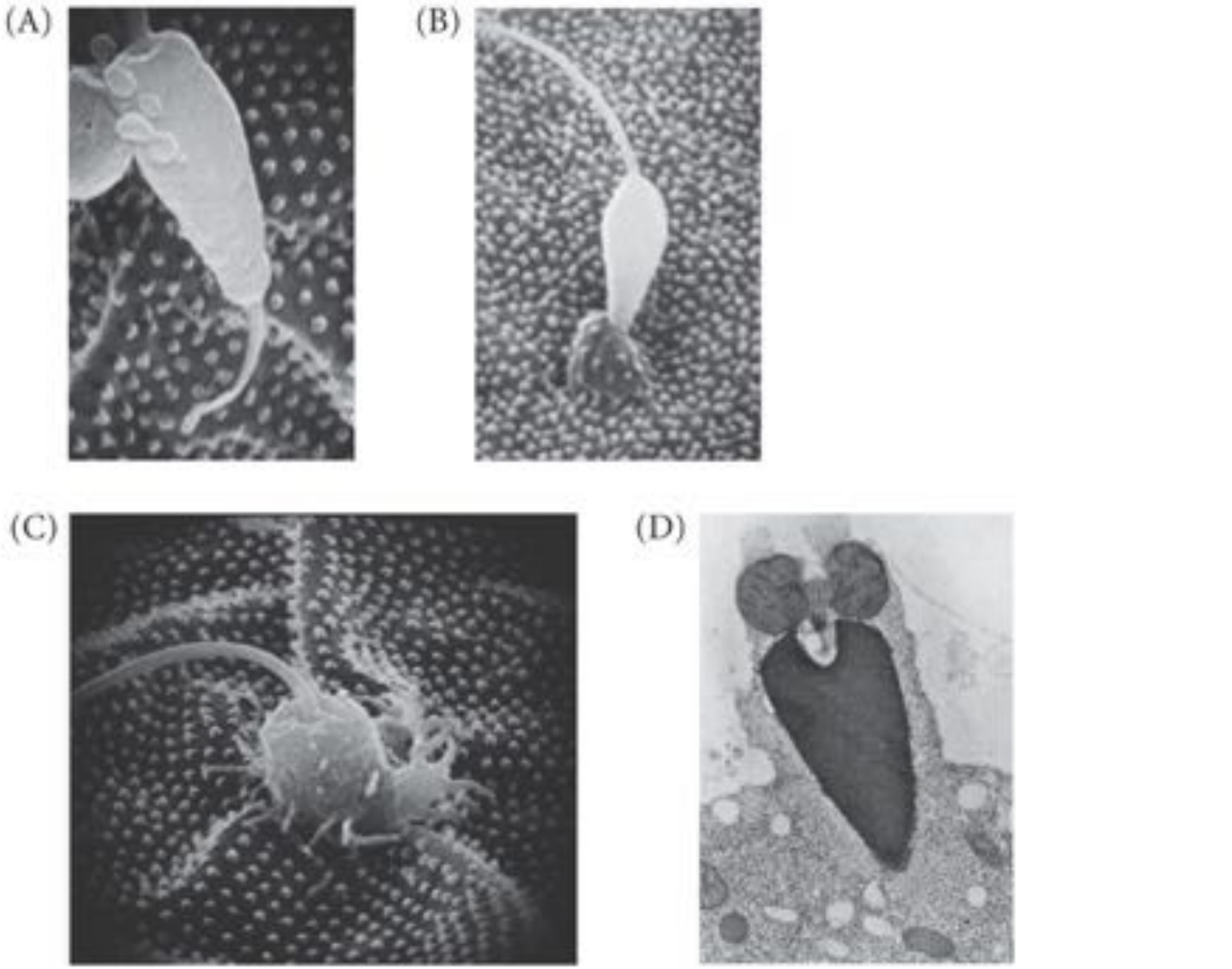


(B)



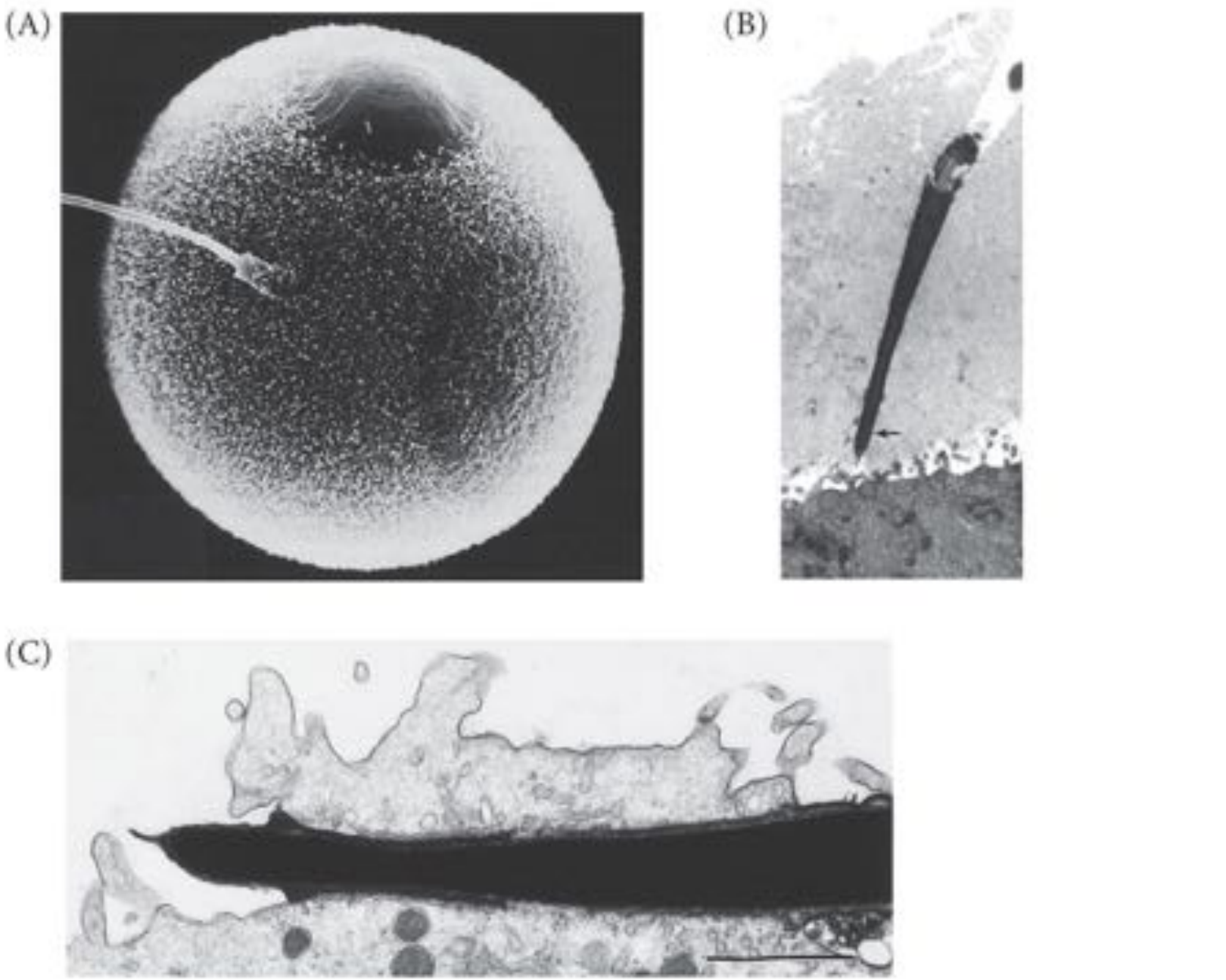
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Scanning electron micrographs of the entry of sperm into sea urchin eggs



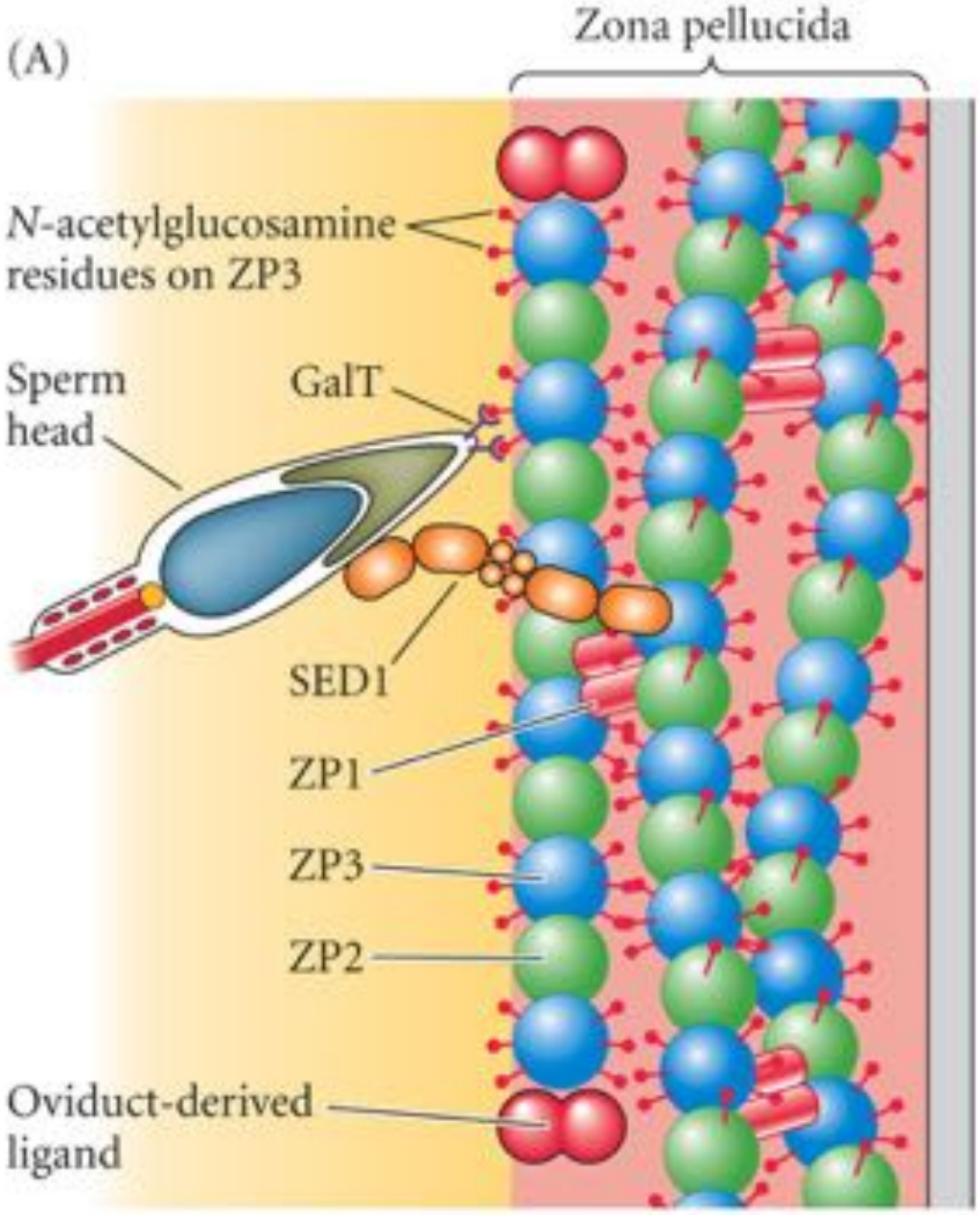
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Entry of sperm into a golden hamster egg



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Sperm-zona binding in the mouse

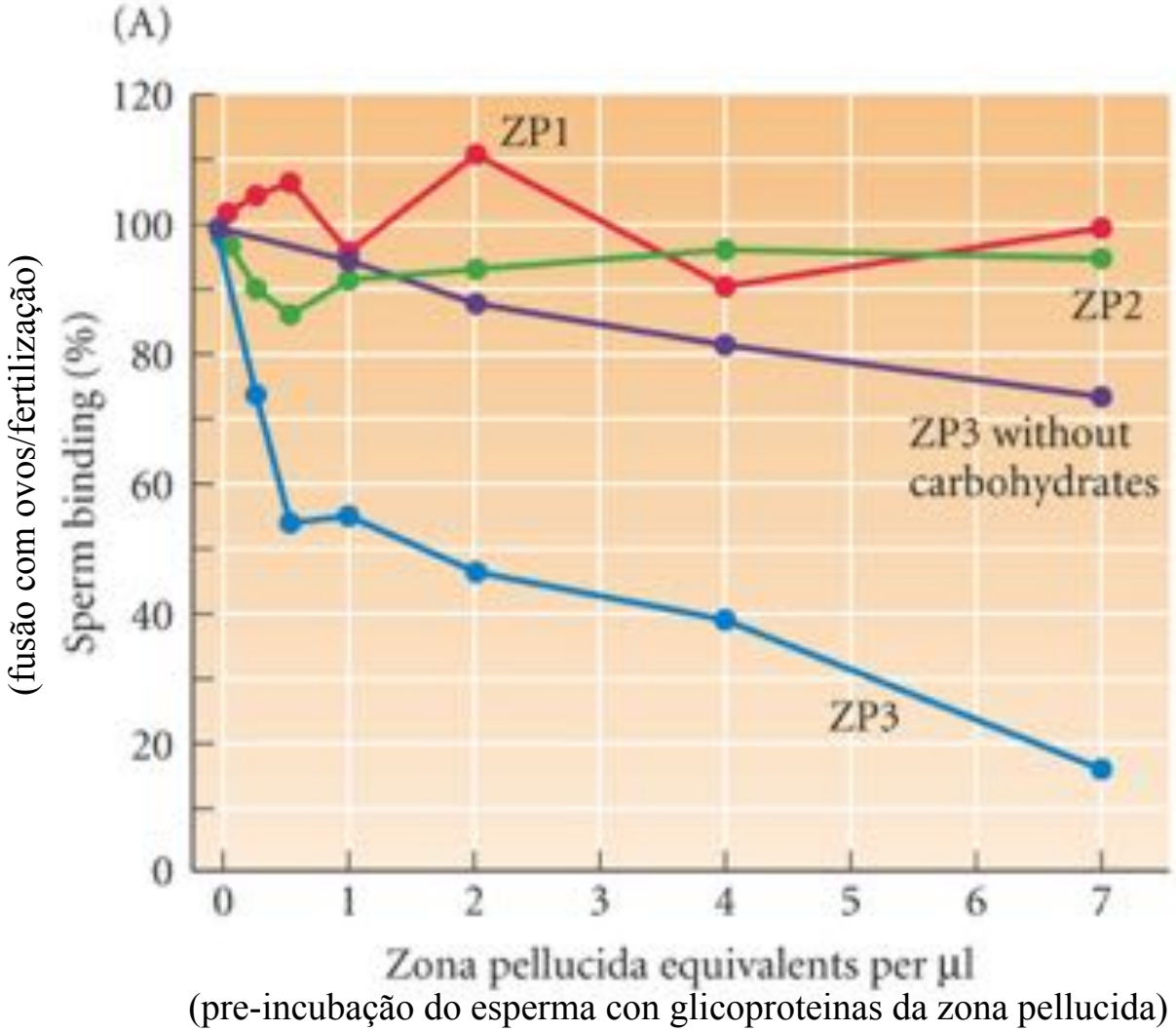




Pense num experimento para comprobar a funcão e especificidade dos residuos de azucar de ZPs no reconhecimento?

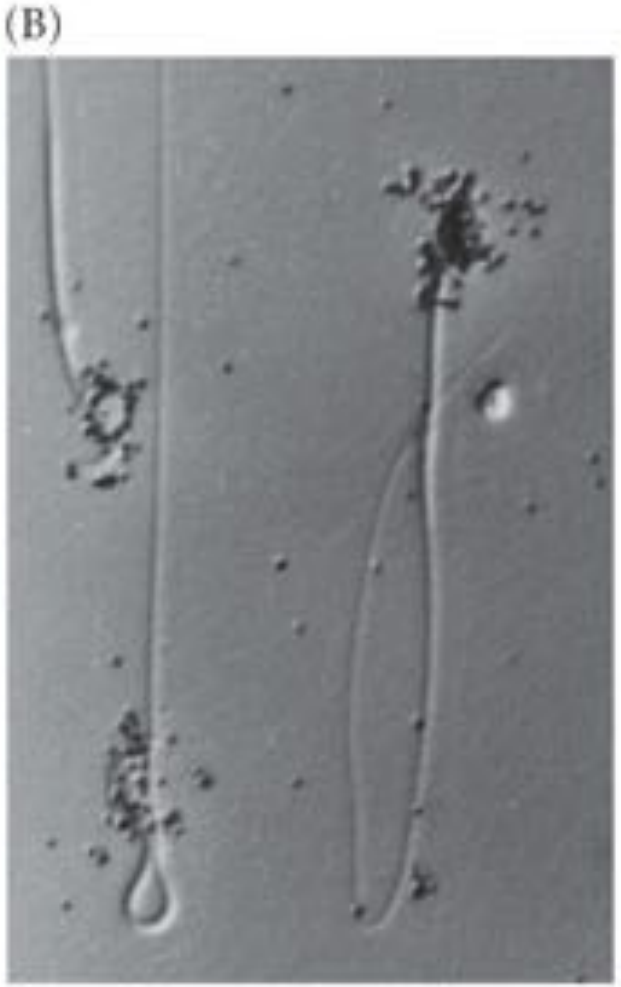
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Mouse zona protein 3 (ZP3) binds sperm



(fusão com ovos/fertilização)

(pre-incubação do esperma con glicoproteinas da zona pellucida)



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TABLE 7.1 Events of sea urchin fertilization

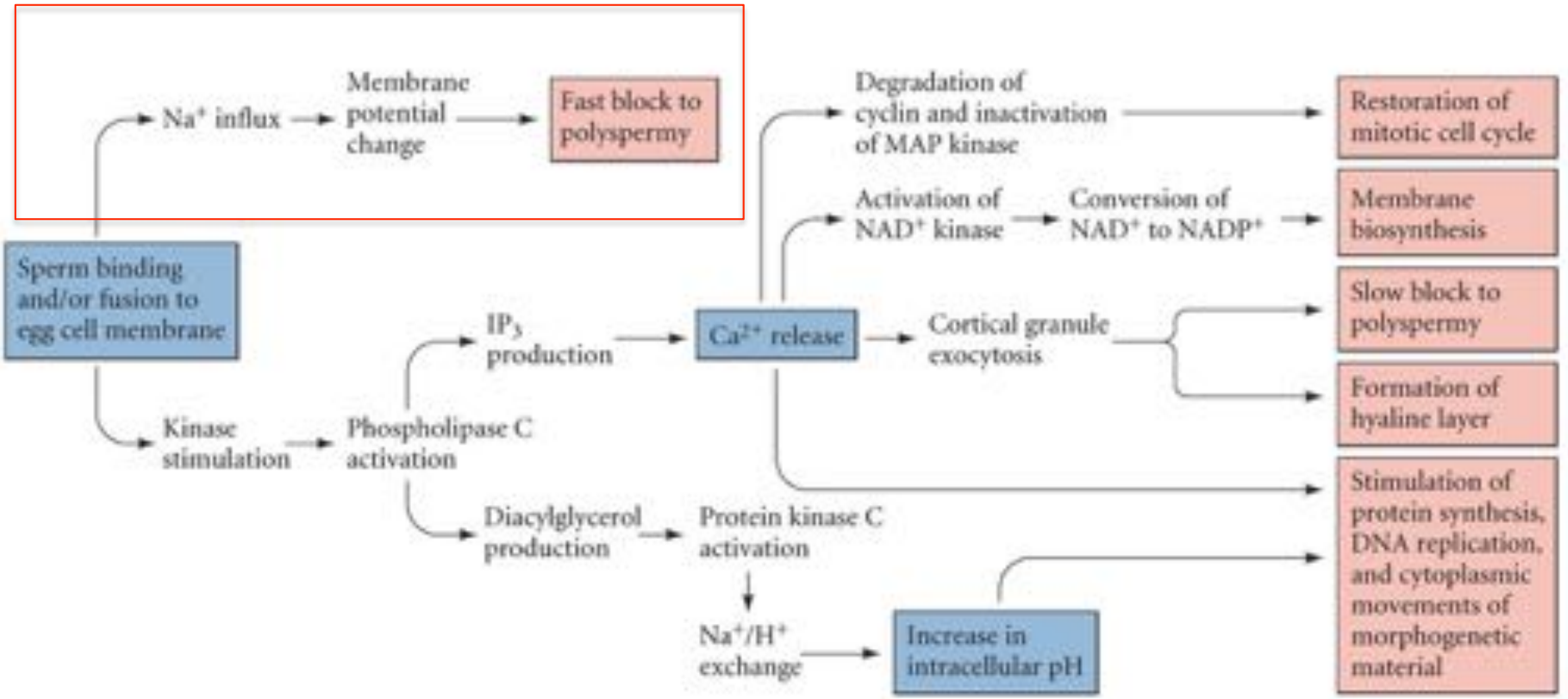
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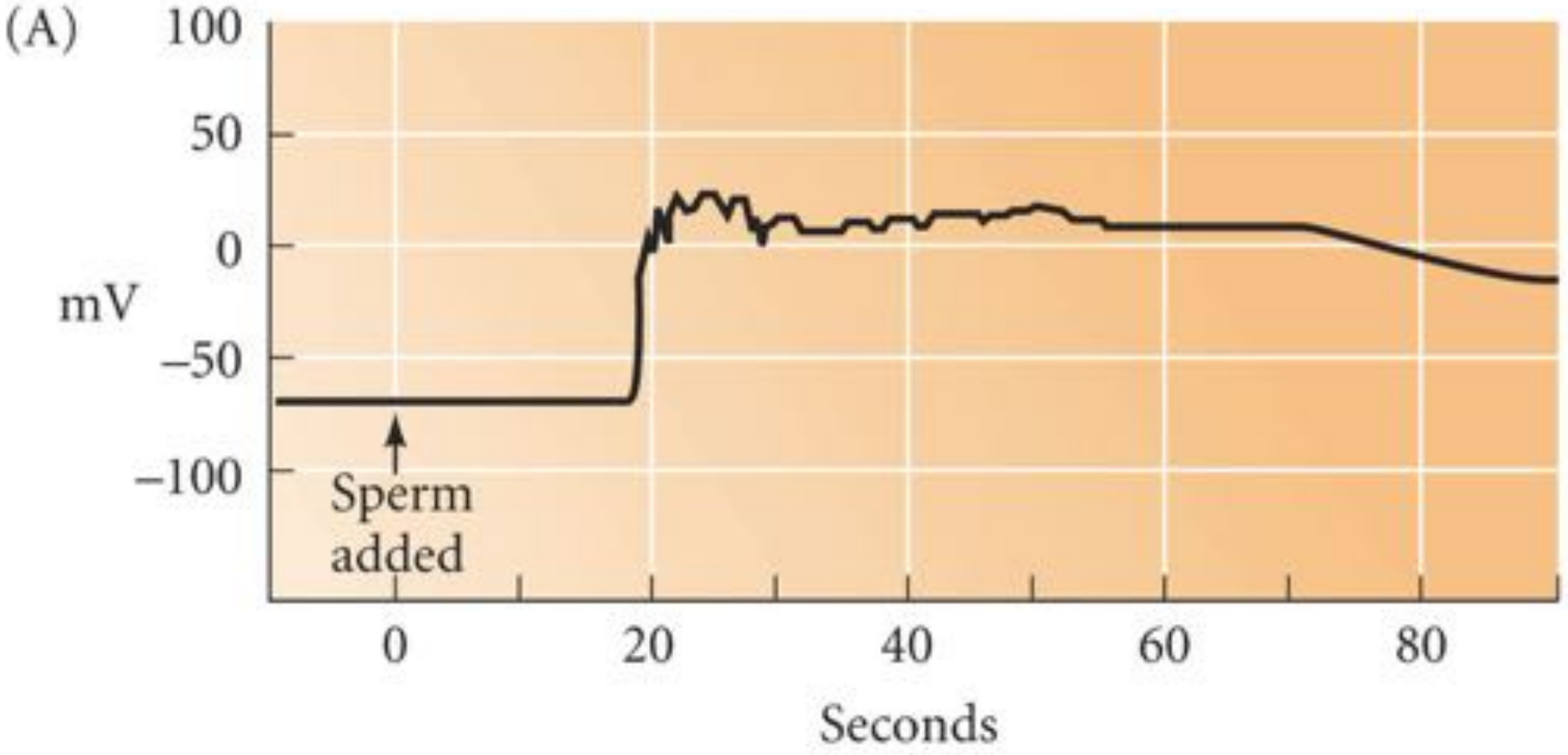
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Postulated pathway of egg activation in the sea urchin



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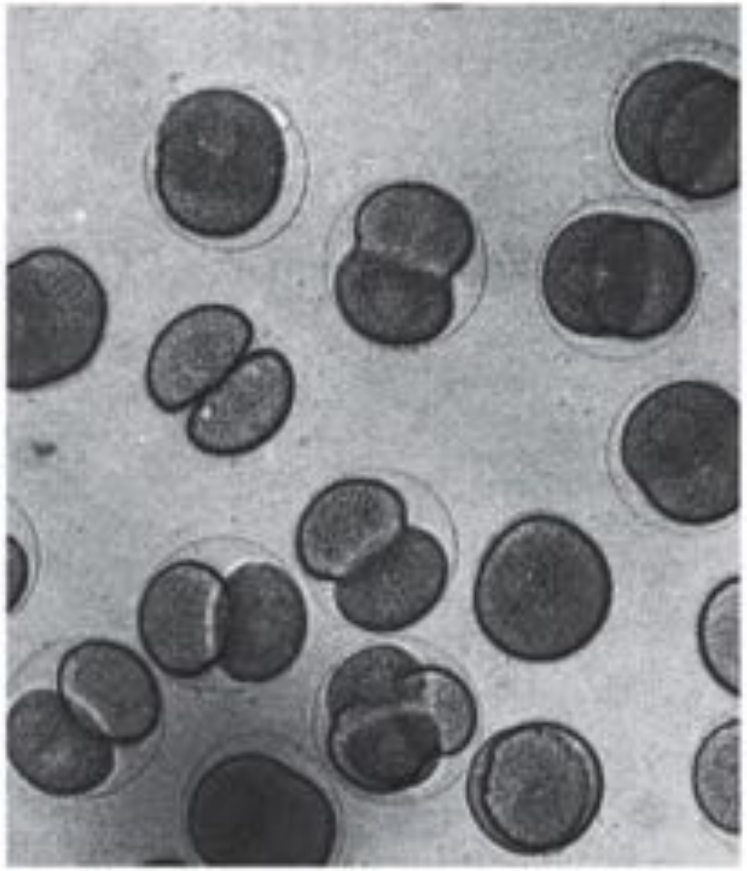
Membrane potential of sea urchin eggs before and after fertilization (Part 1)



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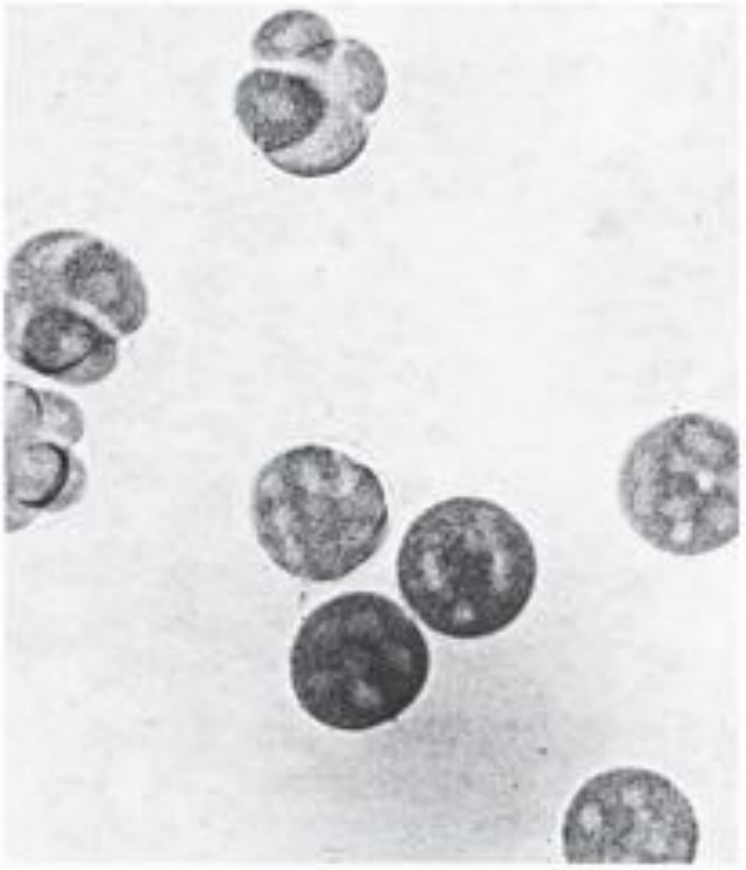
Membrane potential of sea urchin eggs before and after fertilization (Part 2)

(B)



Control (490 mM Na+)

(C)



Medio bajo en sodio (120 mM)

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Membrane potential of sea urchin eggs before and after fertilization (Part 3)

(D)

Na^+ (m*M*)	Percentage of polyspermic eggs
490	22
360	26
120	97
50	100

DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.17 (Part 3) © 2006 Sinauer Associates, Inc.

TABLE 7.1 Events of sea urchin fertilization

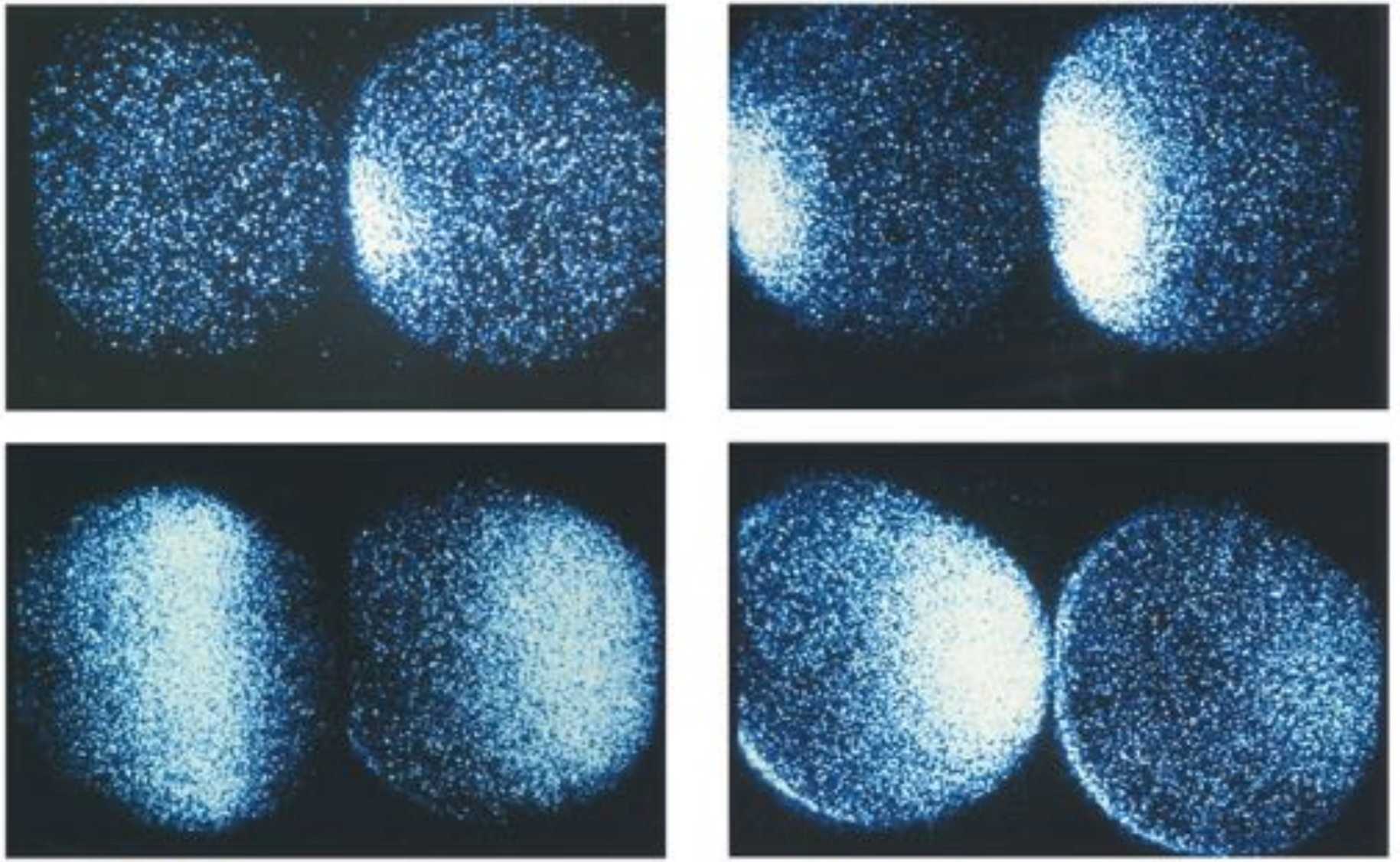
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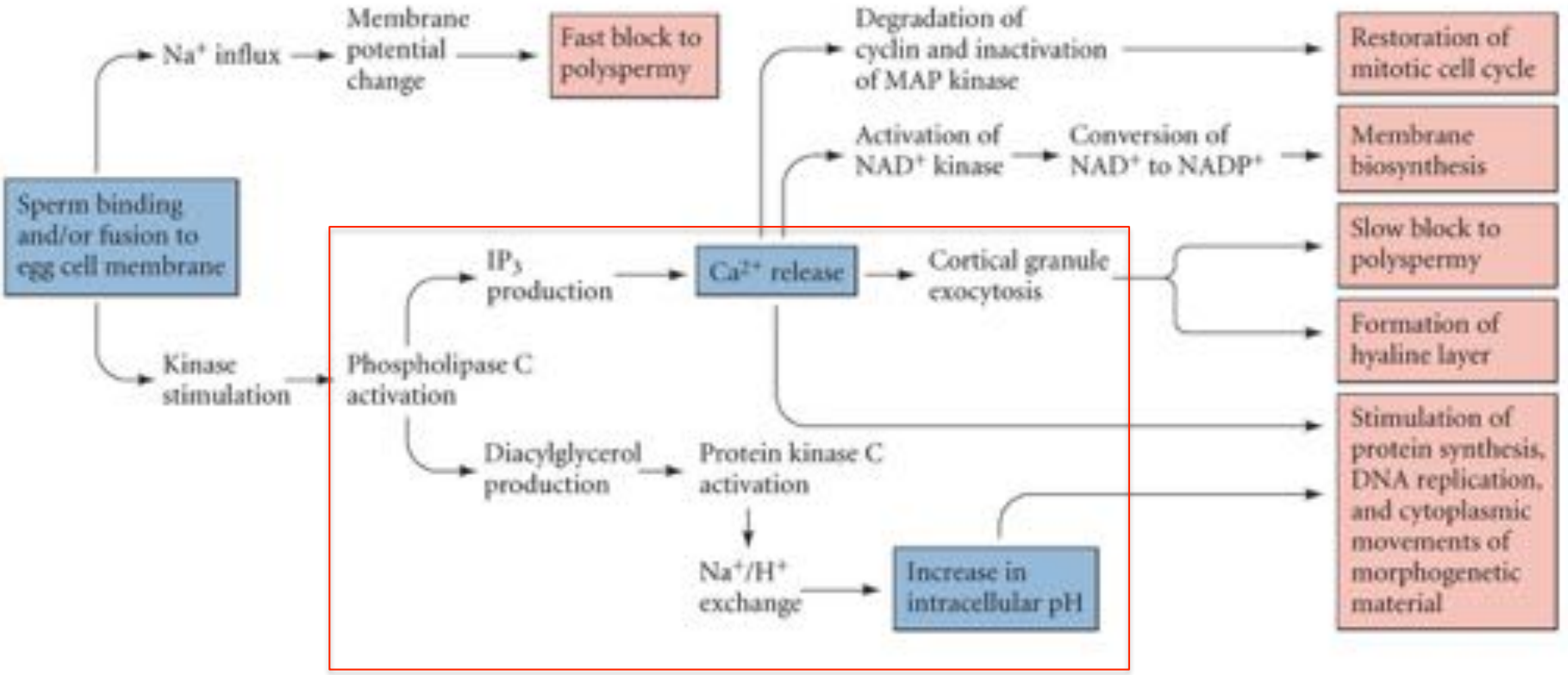
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Wave of Ca^{2+} release across a sea urchin egg during fertilization



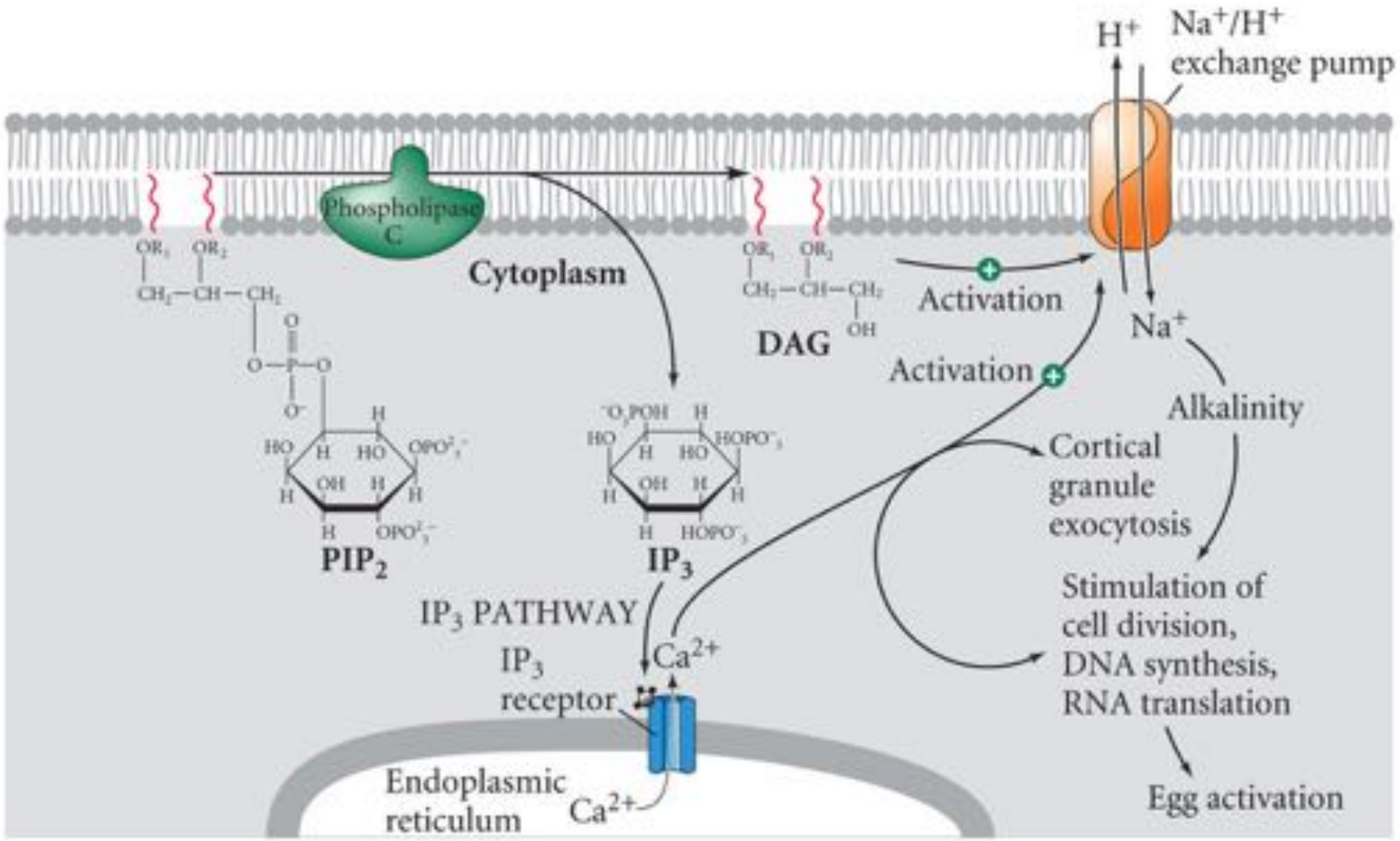
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Postulated pathway of egg activation in the sea urchin



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The roles of inositol phosphates in releasing calcium from the endoplasmic reticulum and the initiation of development



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TABLE 7.1 Events of sea urchin fertilization

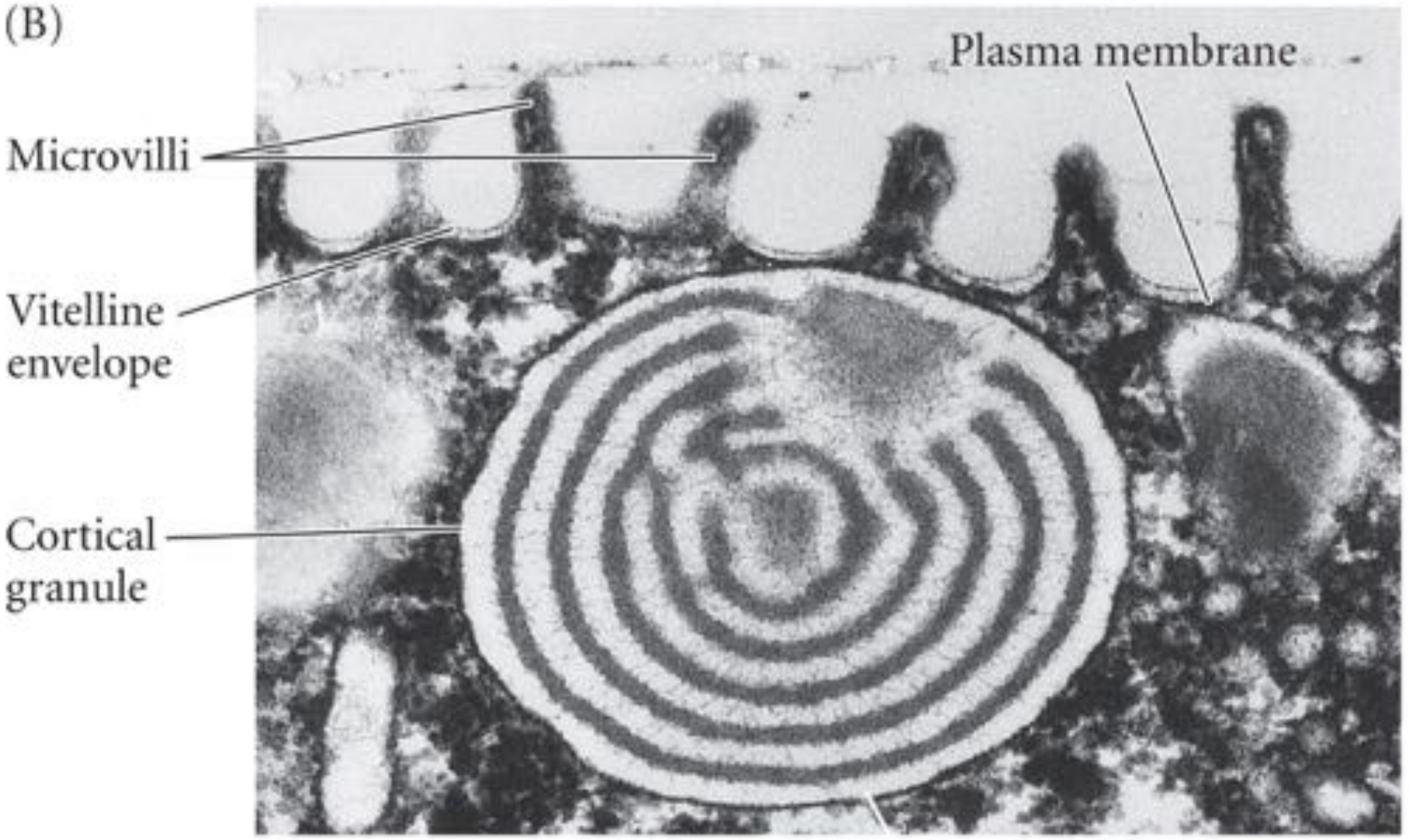
Event	Approximate time postinsemination*
EARLY RESPONSES	
Sperm-egg binding	0 seconds
Fertilization potential rise (fast block to polyspermy)	within 1 sec
Sperm-egg membrane fusion	within 1 sec
Calcium increase first detected	10 sec
Cortical granule exocytosis (slow block to polyspermy)	15–60 sec
LATE RESPONSES	
Activation of NAD kinase	starts at 1 min
Increase in $NADP^+$ and NADPH	starts at 1 min
Increase in O_2 consumption	starts at 1 min
Sperm entry	1–2 min
Acid efflux	1–5 min
Increase in pH (remains high)	1–5 min
Sperm chromatin decondensation	2–12 min
Sperm nucleus migration to egg center	2–12 min
Egg nucleus migration to sperm nucleus	5–10 min
Activation of protein synthesis	starts at 5–10 min
Activation of amino acid transport	starts at 5–10 min
Initiation of DNA synthesis	20–40 min
Mitosis	60–80 min
First cleavage	85–95 min

Main sources: Whitaker and Steinhardt 1985; Mohri et al. 1995.

*Approximate times based on data from *S. purpuratus* (15–17°C), *L. pictus* (16–18°C), *A. punctulata* (18–20°C), and *L. variegatus* (22–24°C). The timing of events within the first minute is best known for *Lytechinus variegatus*, so times are listed for that species.

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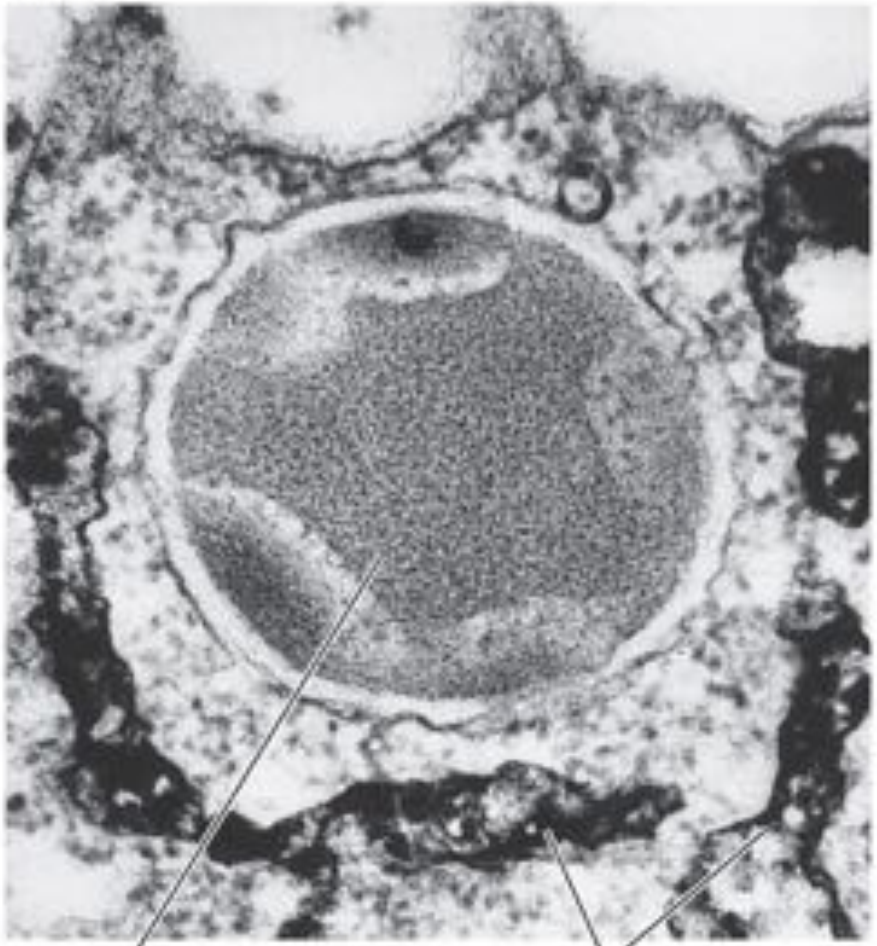
The sea urchin egg cell surface



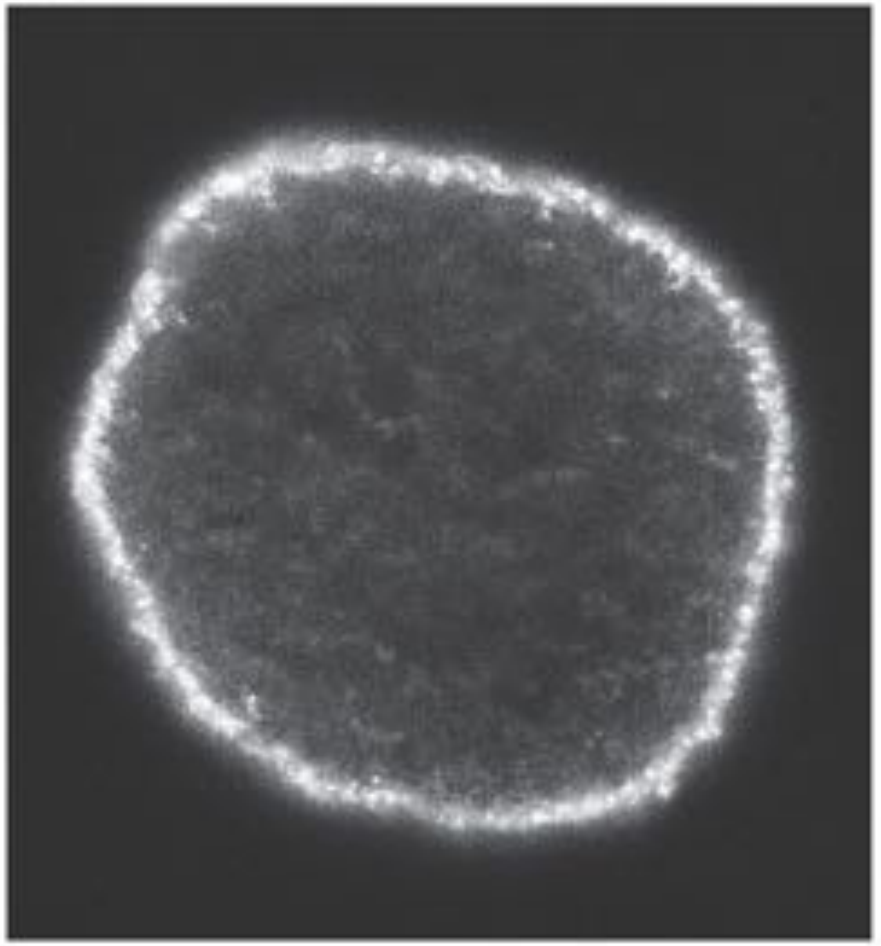
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Endoplasmic reticulum surrounding cortical granules in sea urchin eggs

(A)



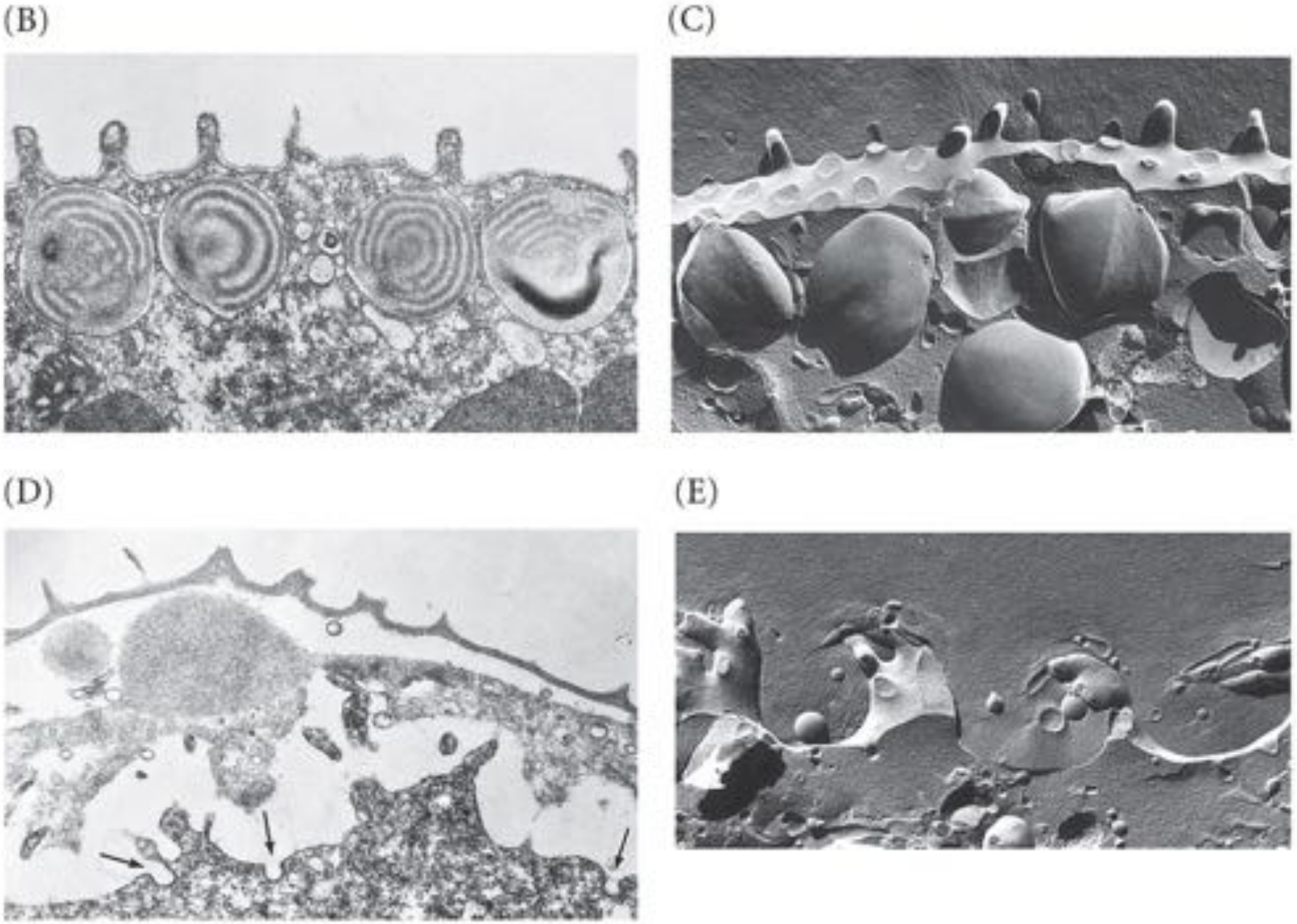
(B)



Canales Ca+ dependientes

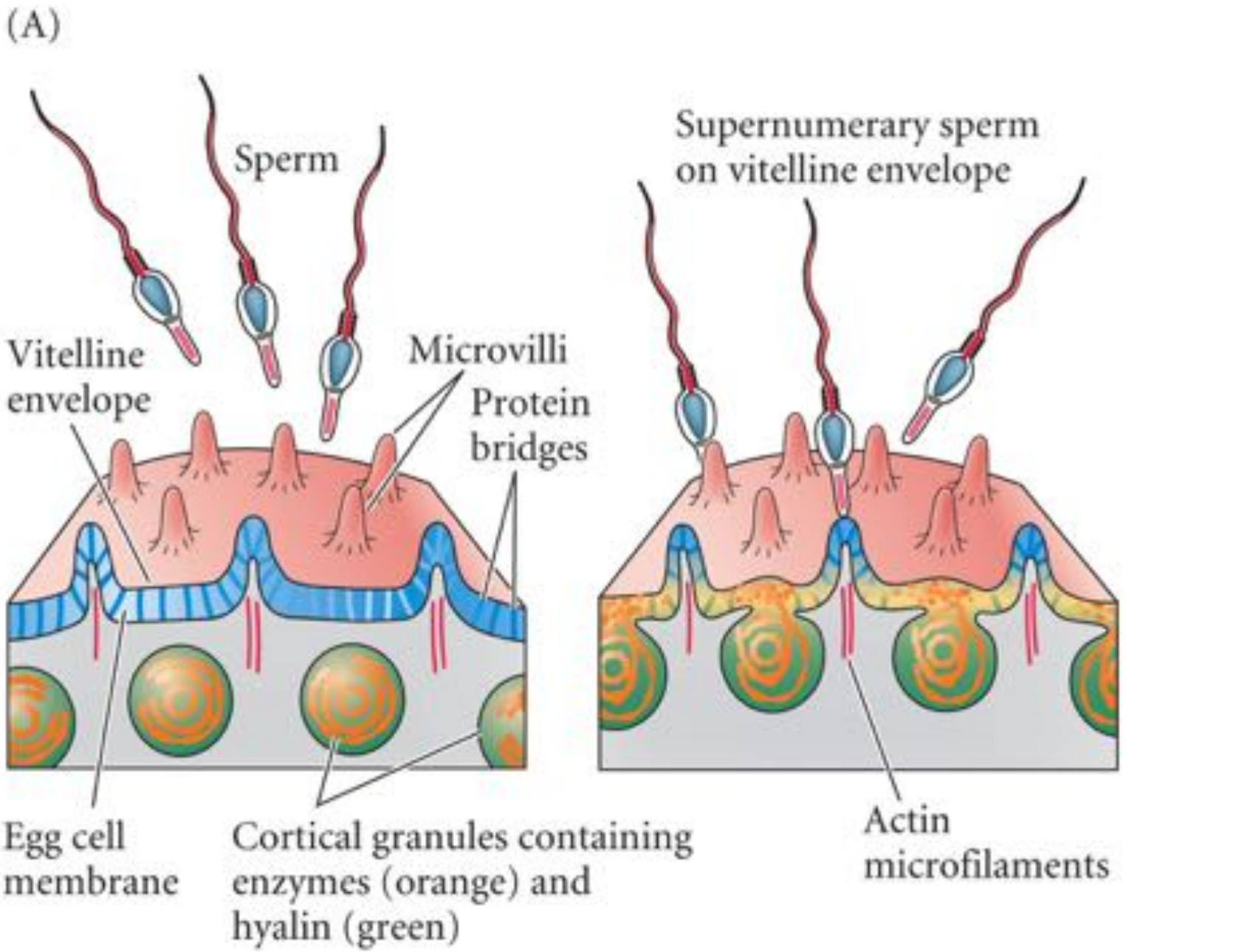
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Cortical granule exocytosis (Part 3)



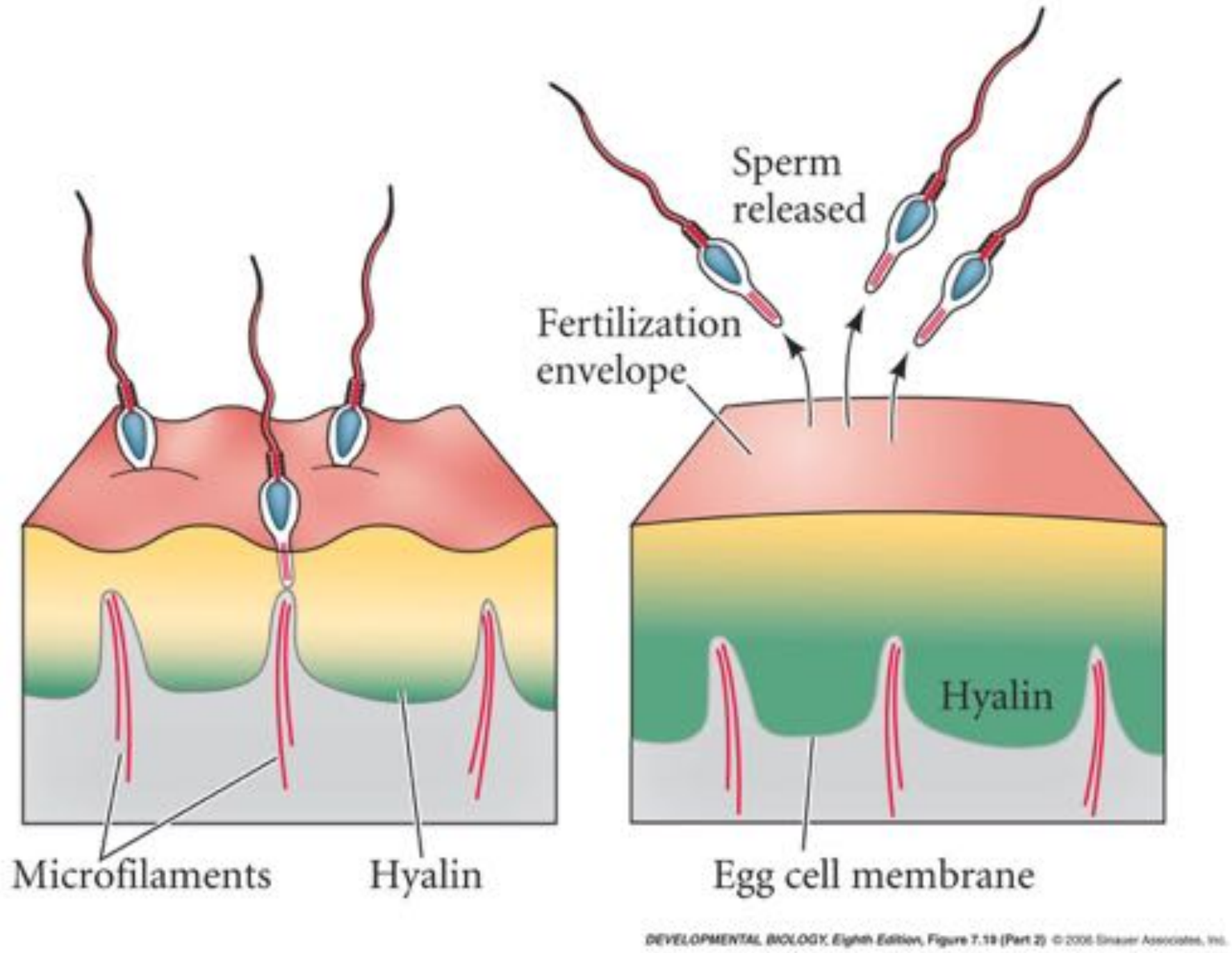
DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.19 (Part 3) © 2006 Sinauer Associates, Inc.

Cortical granule exocytosis (Part 1)



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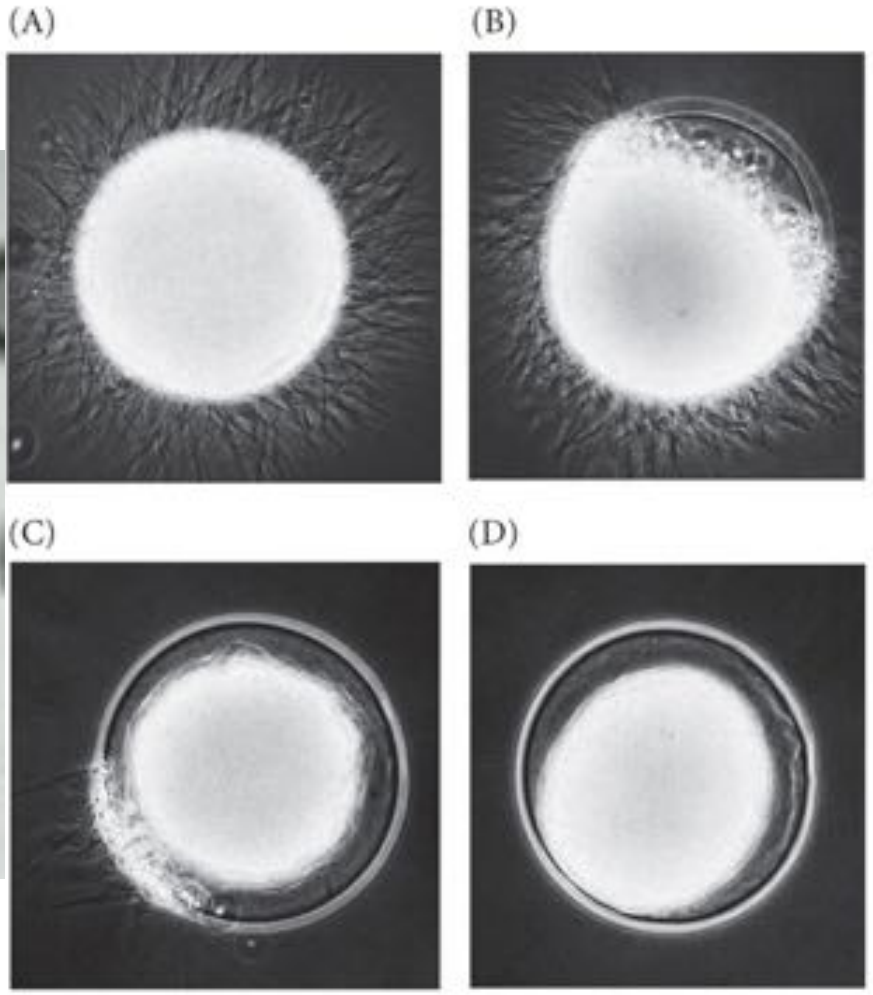
Cortical granule exocytosis (Part 2)



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Formation of the fertilization envelope and removal of excess sperm





DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.18 © 2006 Sina

TABLE 7.1 Events of sea urchin fertilization

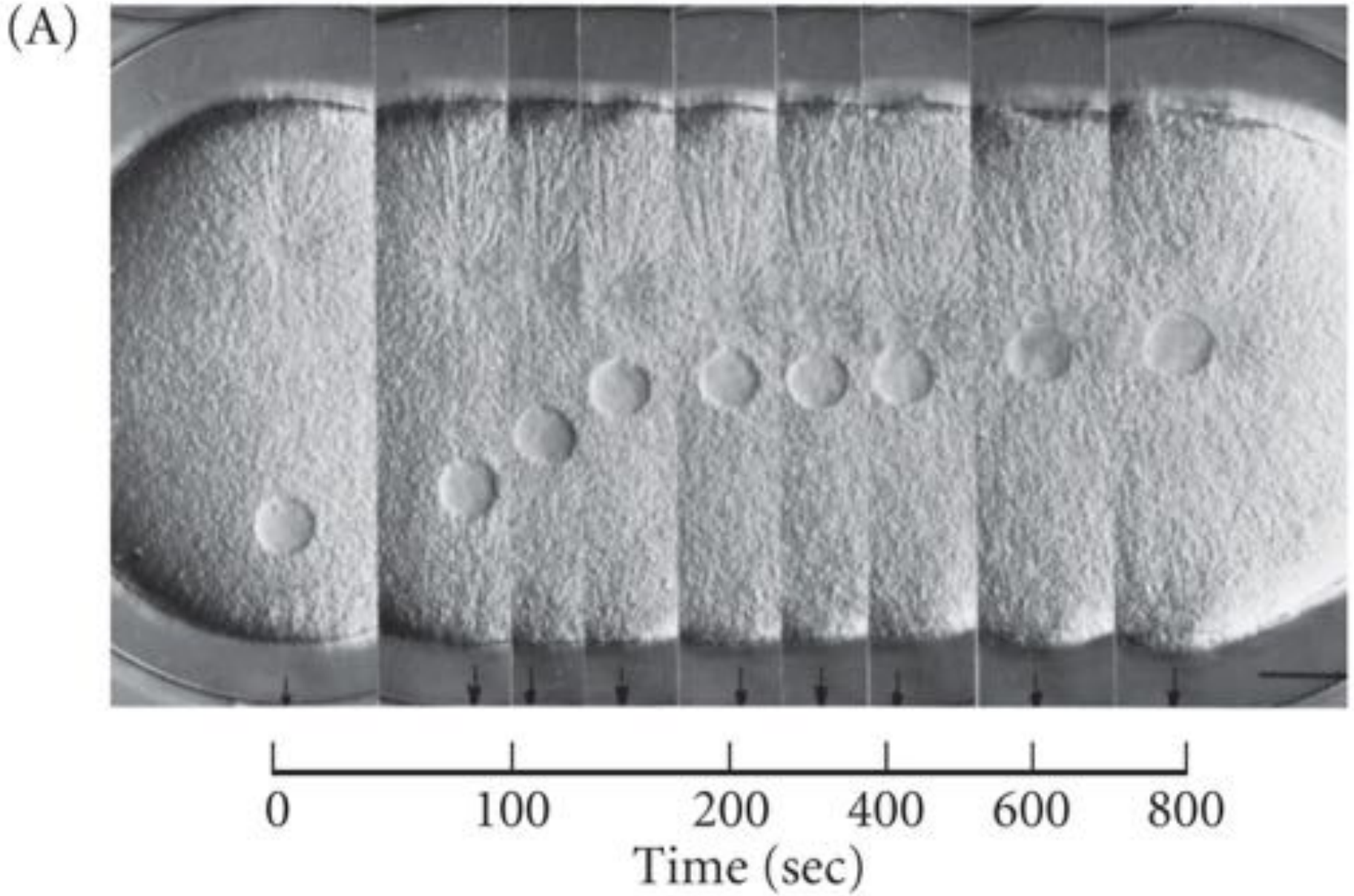
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Increase in pH (remains high)	1–5 min
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Initiation of DNA synthesis	20–40 min
Mitosis	60–80 min
First cleavage	85–95 min

Main sources: Whitaker and Steinhardt 1985; Mohri et al. 1995.

*Approximate times based on data from *S. purpuratus* (15–17°C), *L. pictus* (16–18°C), *A. punctulata* (18–20°C), and *L. variegatus* (22–24°C). The timing of events within the first minute is best known for *Lytechinus variegatus*, so times are listed for that species.

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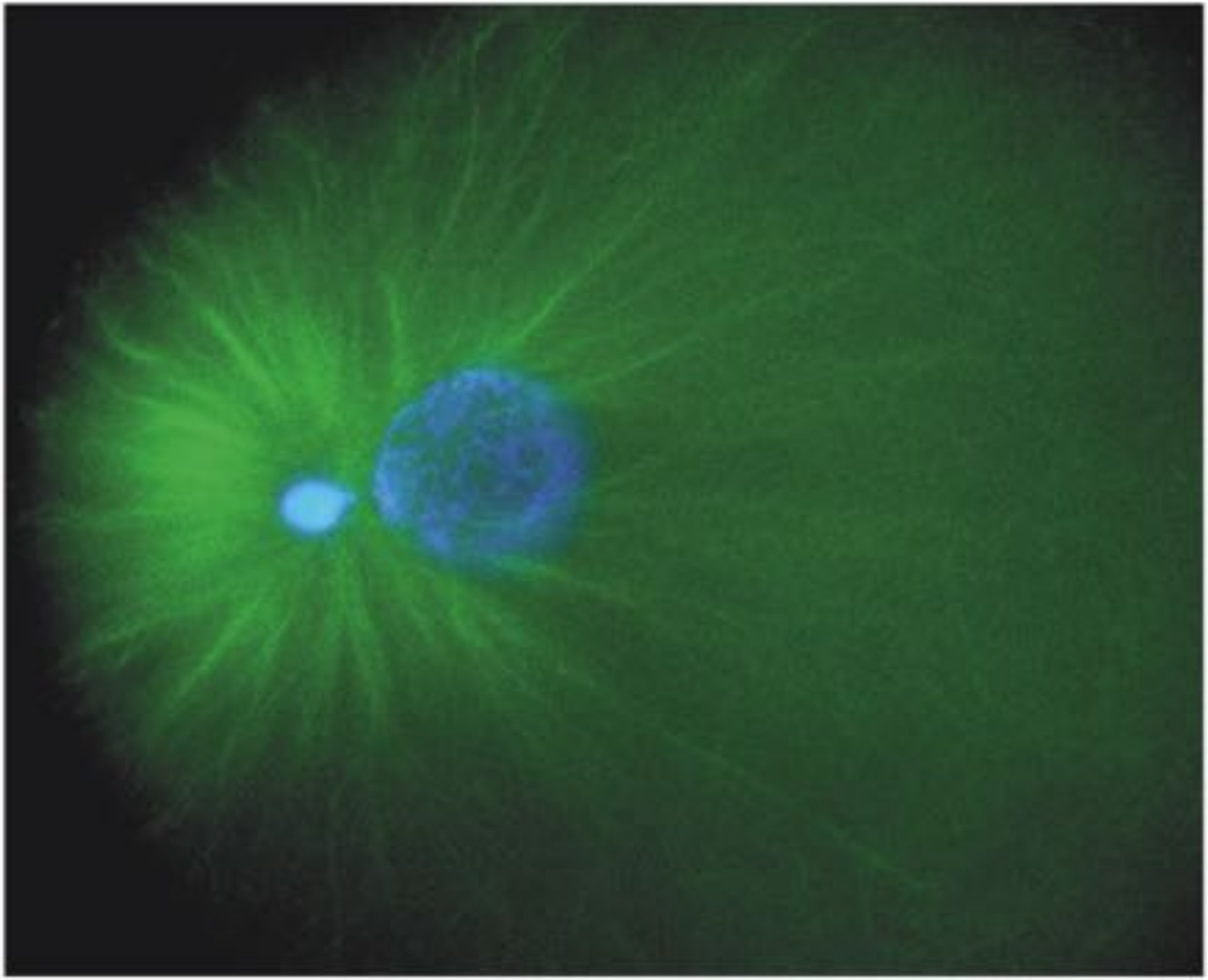
Nuclear events in the fertilization of the sea urchin (Part 1)



DEVELOPMENTAL BIOLOGY, Eighth Edition, Figure 7.27 (Part 1) © 2006 Sinauer Associates, Inc.

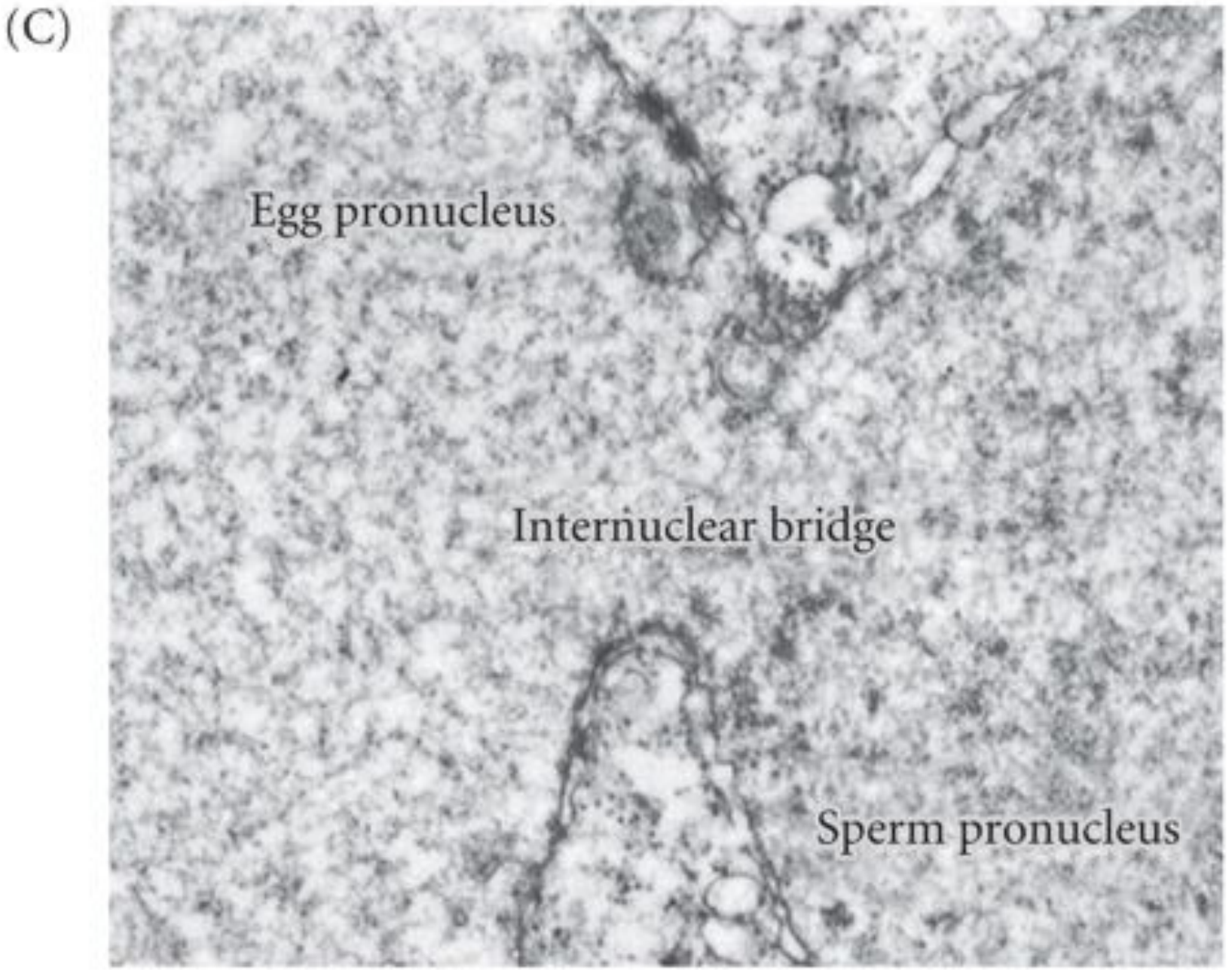
Nuclear events in the fertilization of the sea urchin (Part 2)

(B)



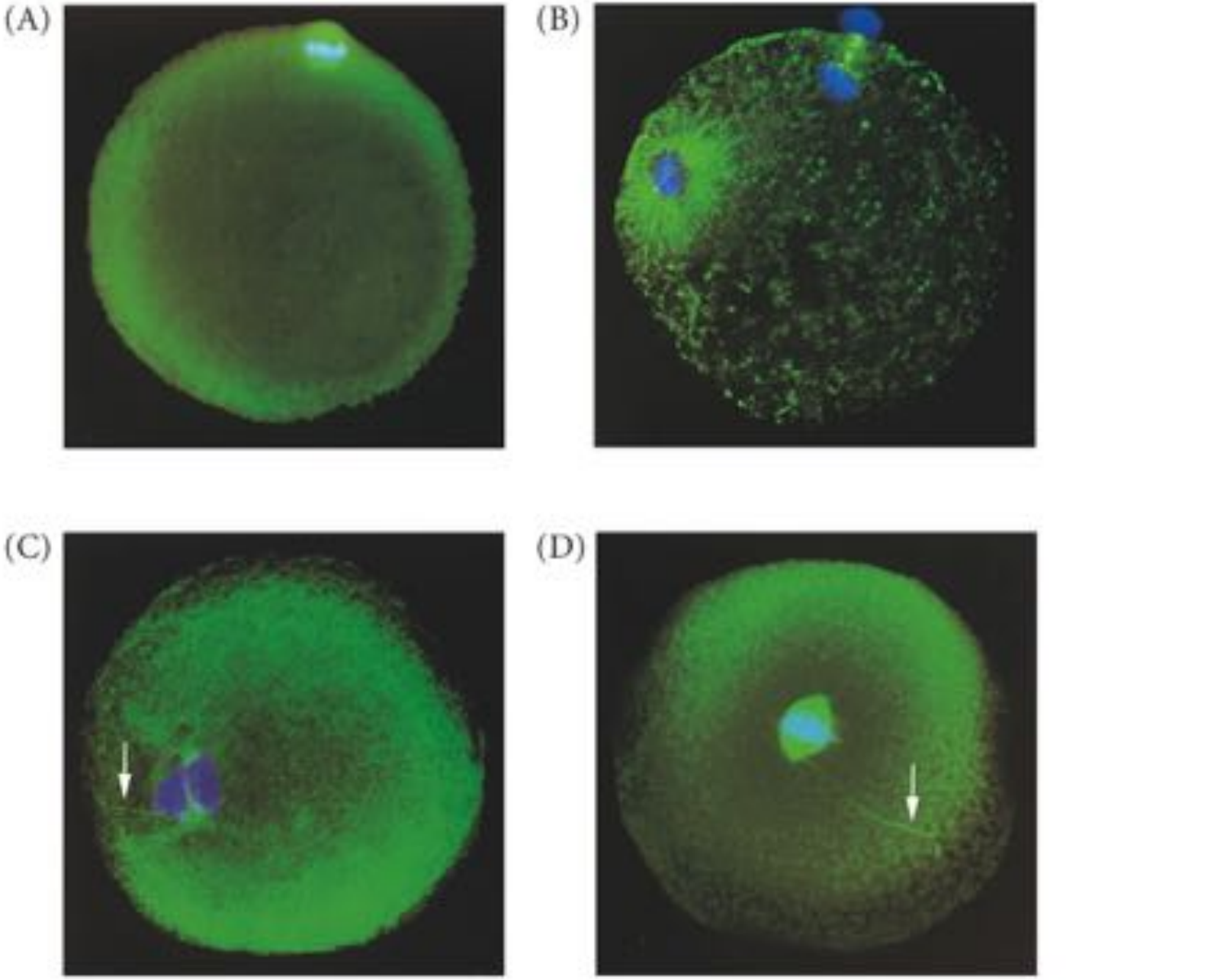
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Nuclear events in the fertilization of the sea urchin (Part 3)



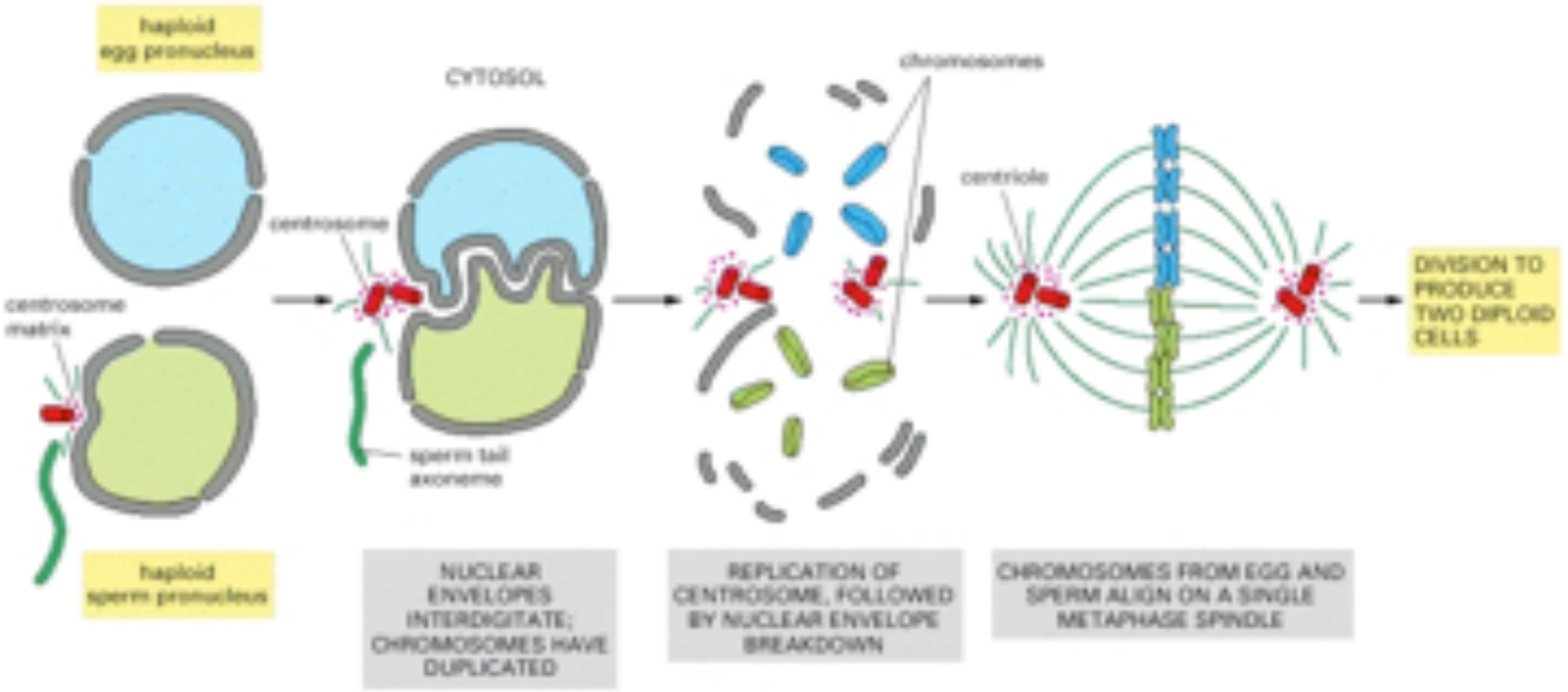
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Pronuclear movements during human fertilization



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Fusión de prónucleos



Alberts, Molecular Biology of the Cell

TABLE 7.1 Events of sea urchin fertilization

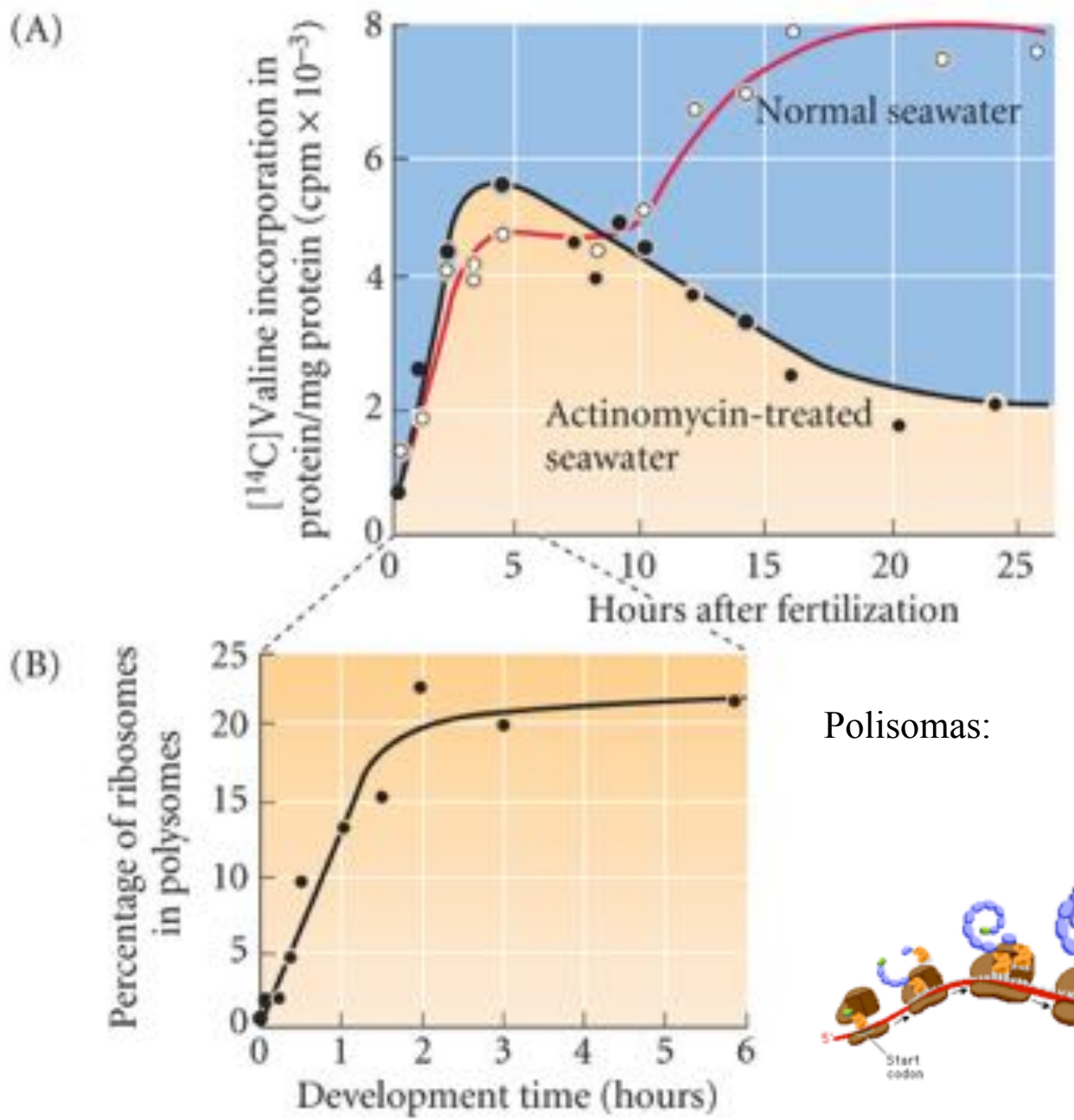
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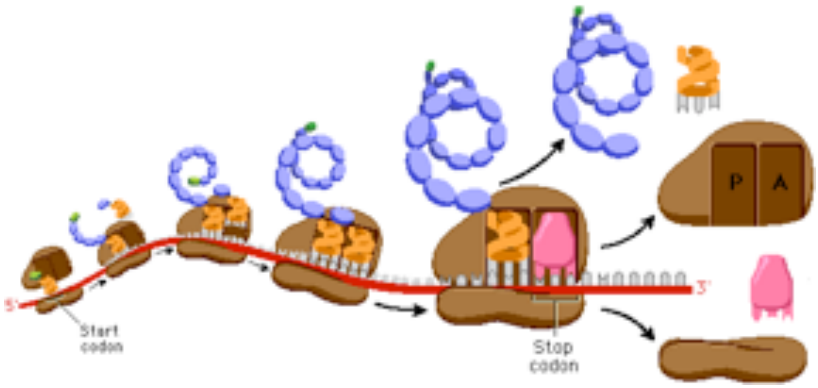
*Approximate times based on data from *S. purpuratus* (15–17°C), *L. pictus* (16–18°C), *A. punctulata* (18–20°C), and *L. variegatus* (22–24°C). The timing of events within the first minute is best known for *Lytechinus variegatus*, so times are listed for that species.

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A burst of protein synthesis at fertilization uses mRNAs stored in the oocyte cytoplasm



Polisomas:



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