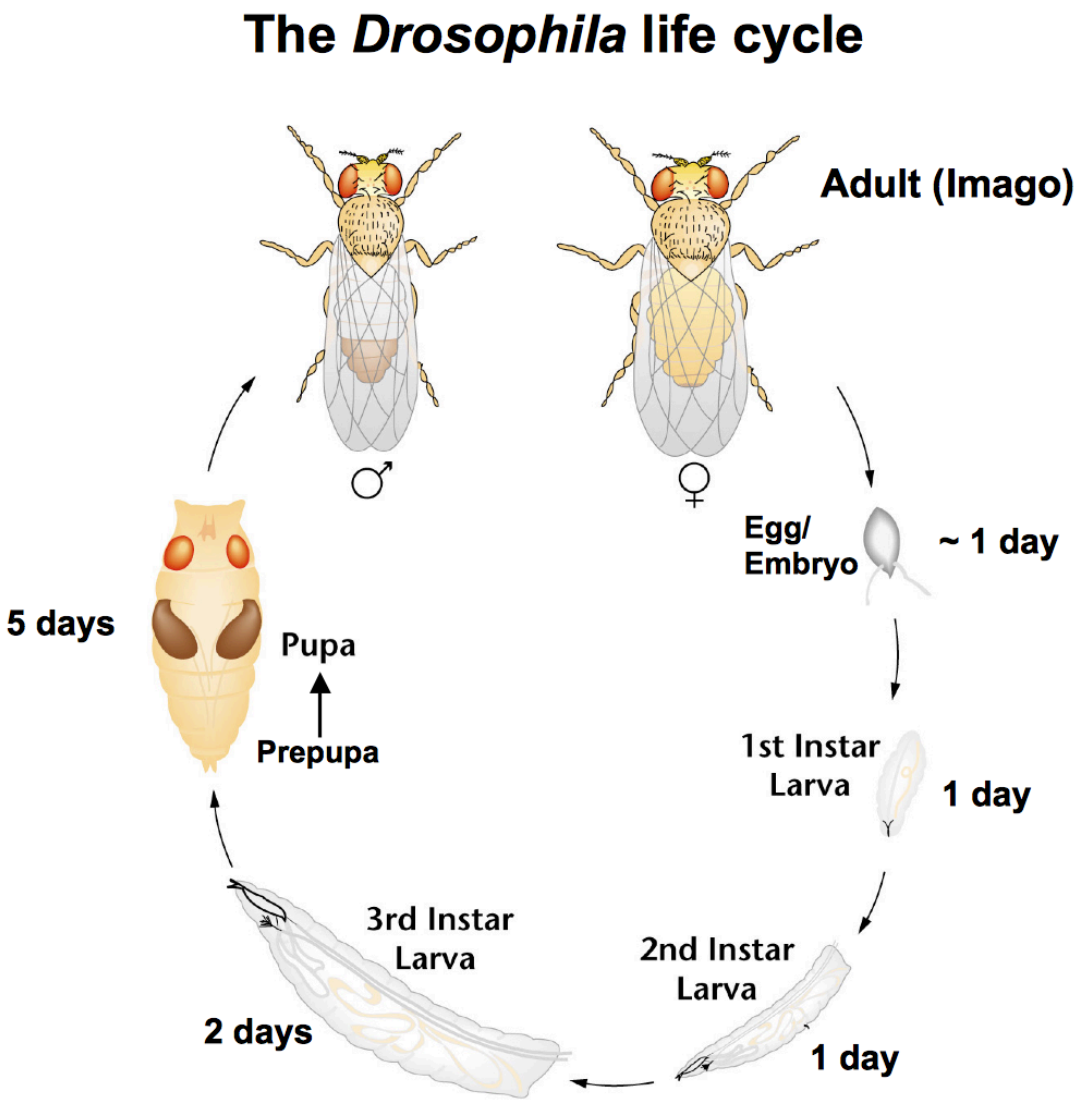
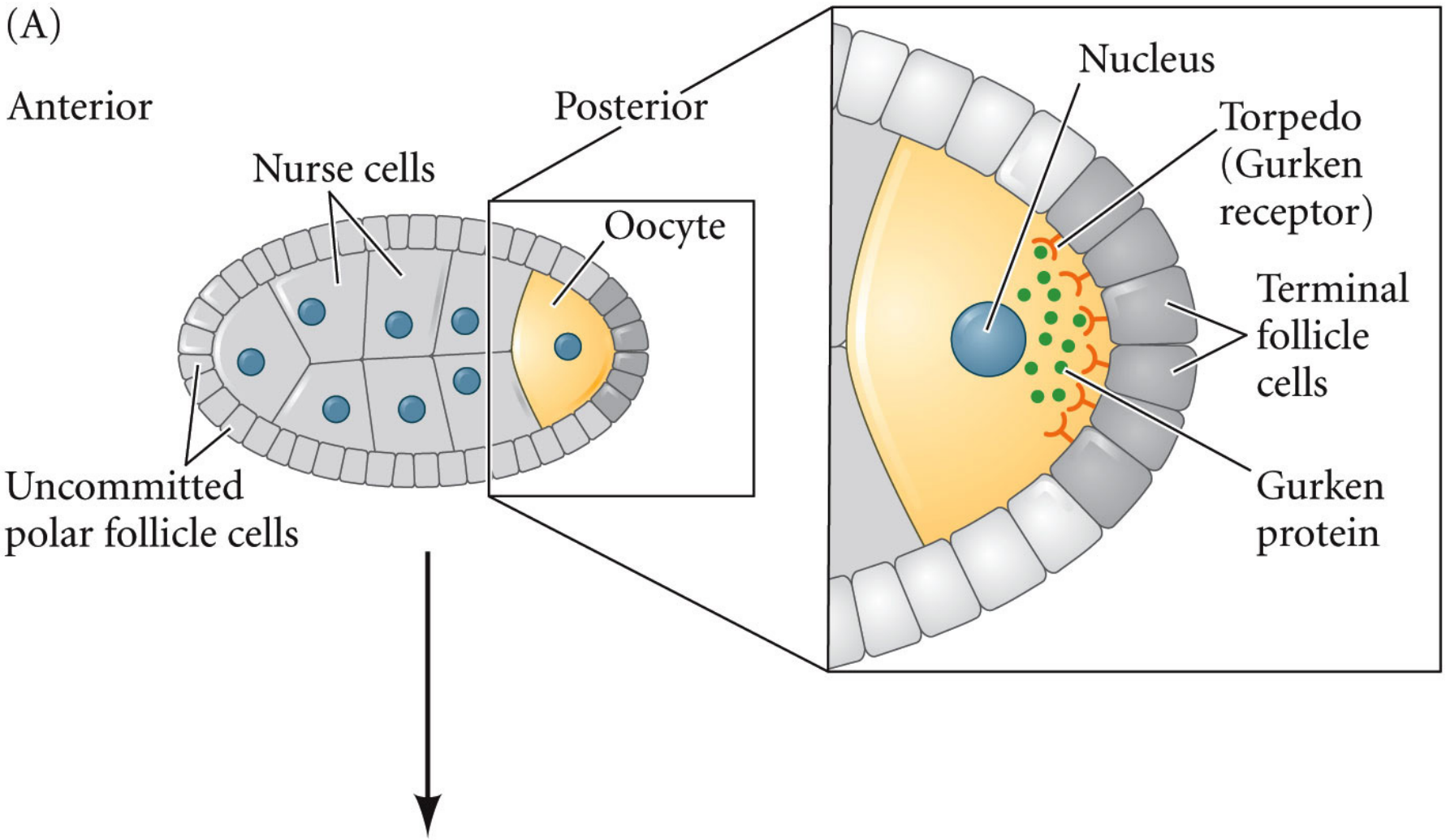
Essay guidelines

- A) 10 pages excluding refs (text double spaced, references single spaced).
- Use 5-10 primary references from the literature
- Nature, Cell, Science, Genes and Development, Development, Developmental Biology, Mechanisms of Development, Developmental Cell.
- Attempt to synthesize and analyze the papers (try NOT to provide a catalogue)
- Use numbered referencing system in the text.
- Can use ONE diagram or data figure
- Due date: Thurs March 28 th by 5pm- hard copy

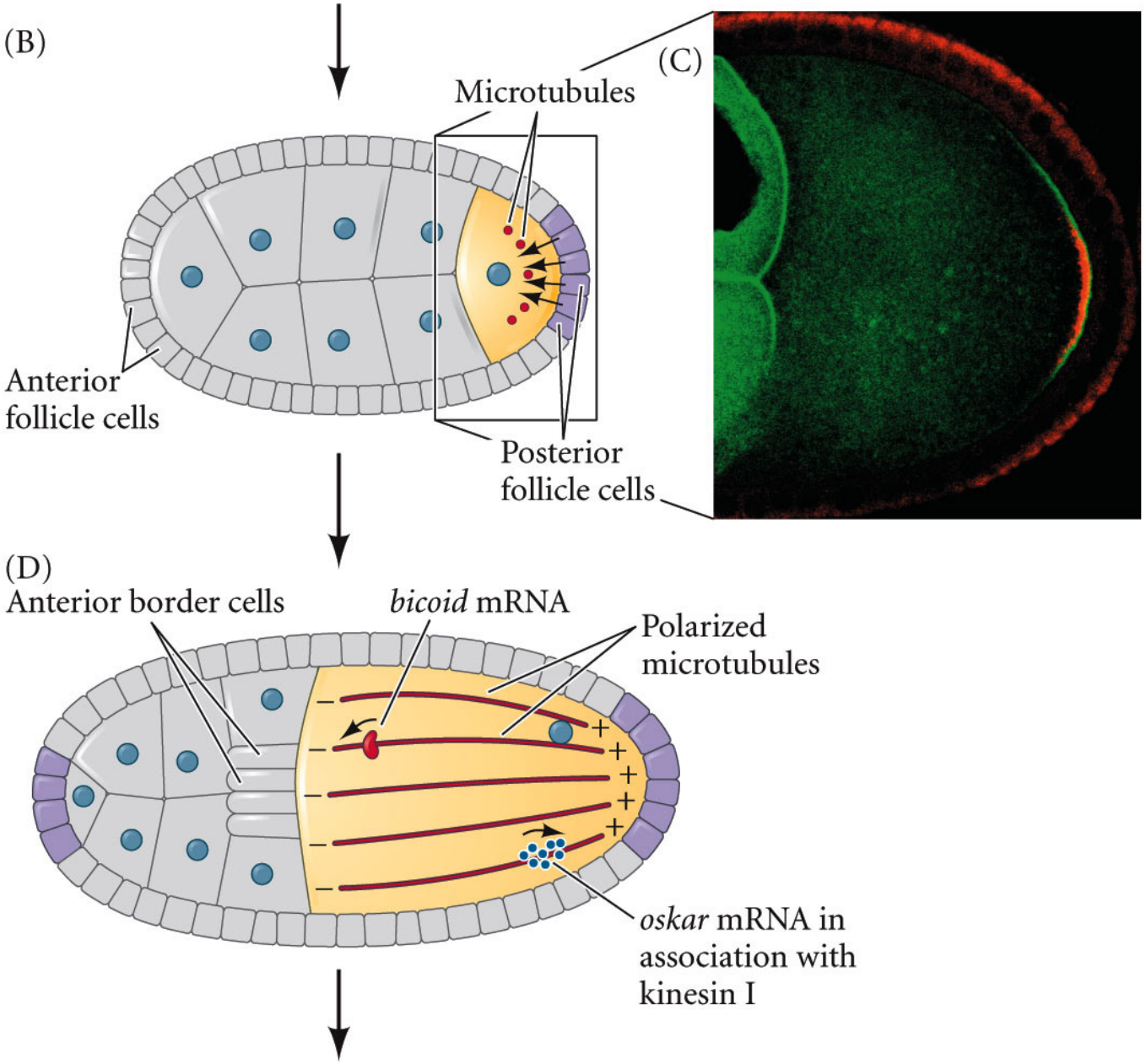
Drosophila gastrulation- molecular basis of A-P axis development Gilbert Ch 9 pp278-303 in e11, Ch 6 The genetics of axis specification in Drosophila p 179-215 in 10th e or 9th Edition 203-237



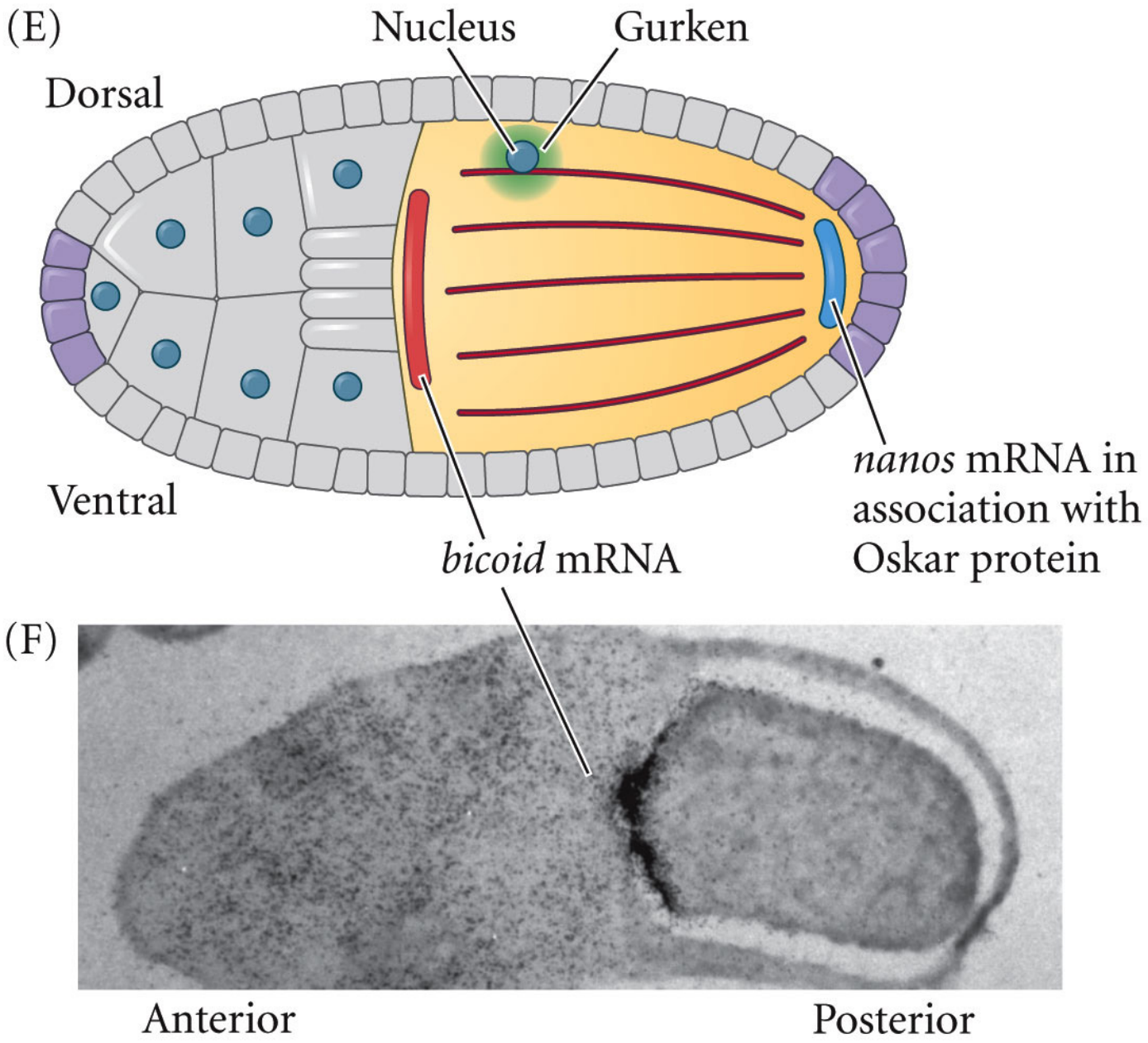
Origins of anterior –posterior polarity in *Drosophila Melanogaster*



***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.7 (Part 1)**



DEVELOPMENTAL BIOLOGY, 9e, Figure 6.7 (Part 2)

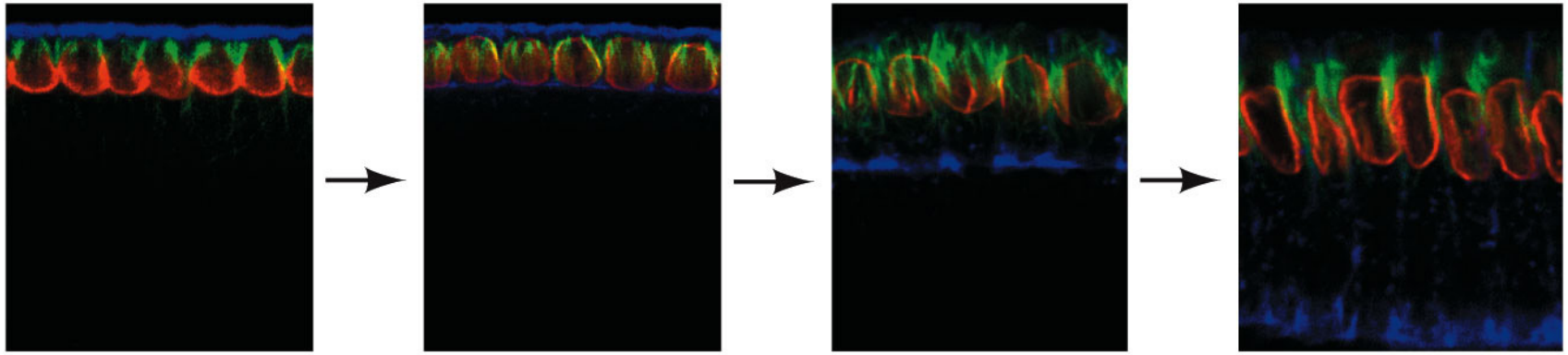


***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.7 (Part 3)**

Mid- blastula transition

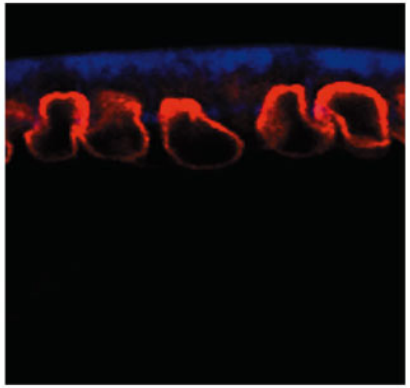
Microtubules (green) microfilaments (blue) nuclei (red- Kugelkern protein)

(A)



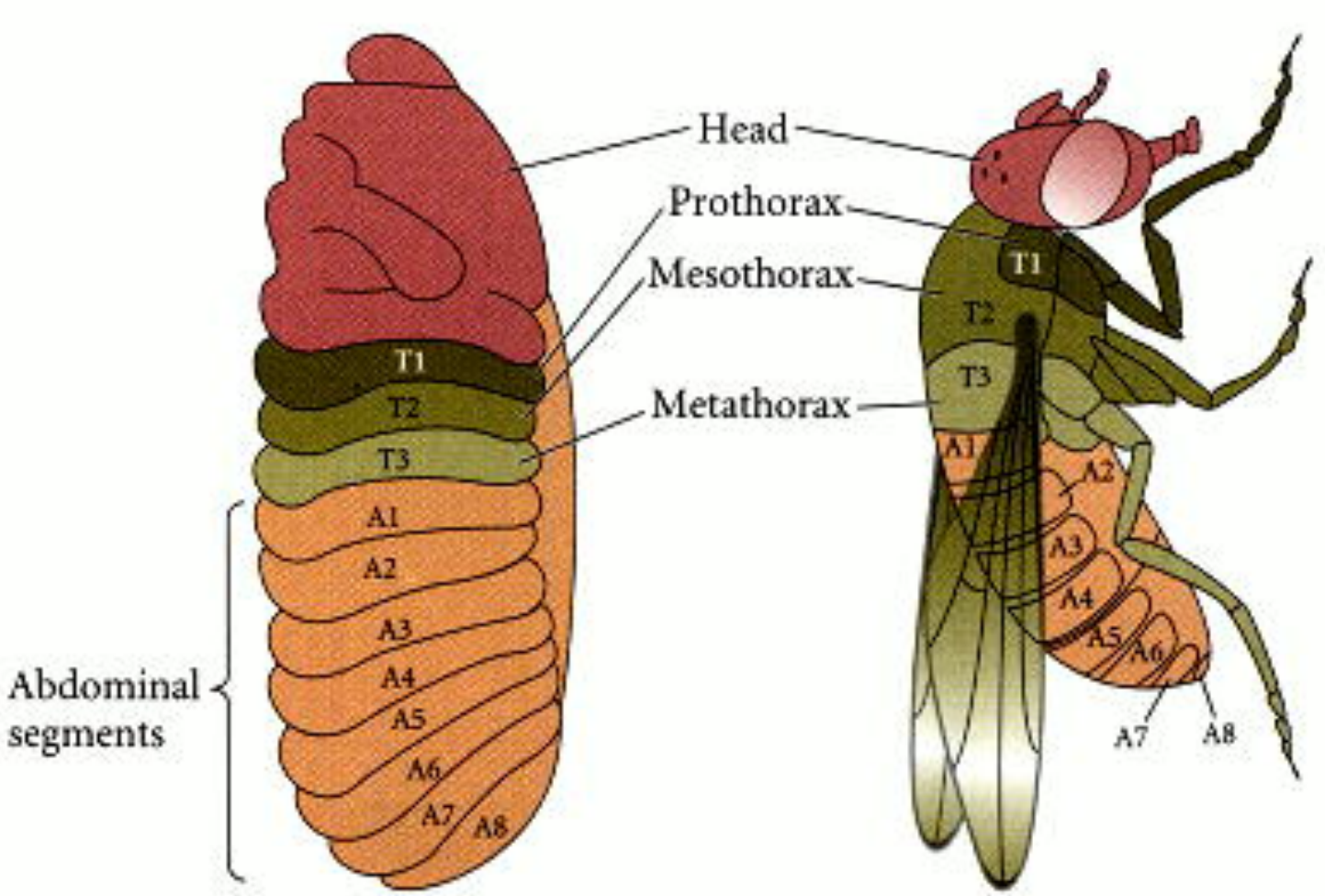
(B)

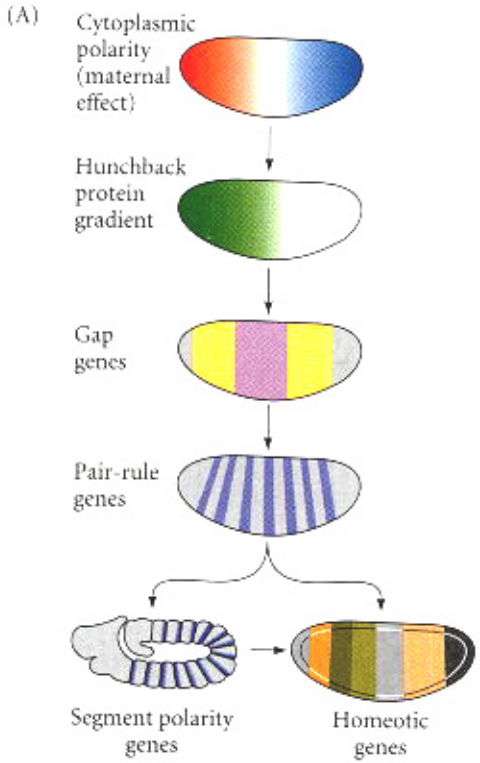
Nocadozole
(microtubule block)



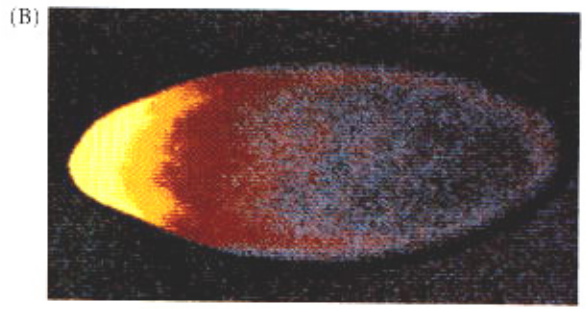
***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.3 (Part 1)**

Comparison of larval and adult Drosophila

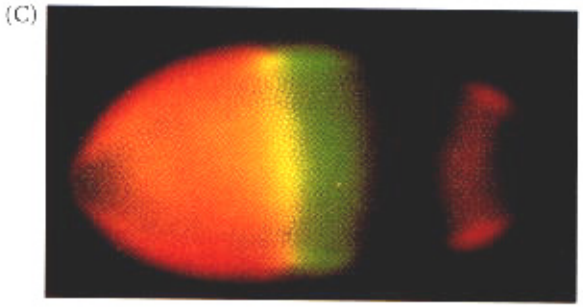




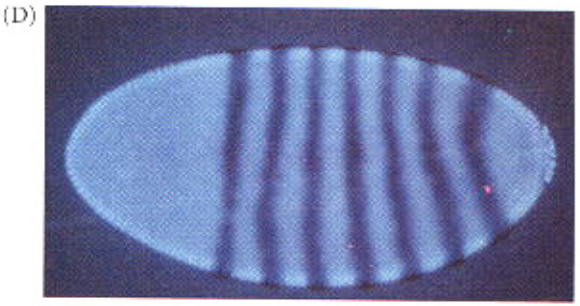
Nusslein Volhard and Wieschaus Nobel prize 1995



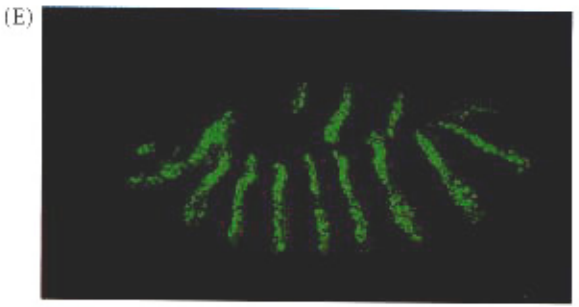
Bicoid (yellow)



Hunchback (orange) Kruppel (green)



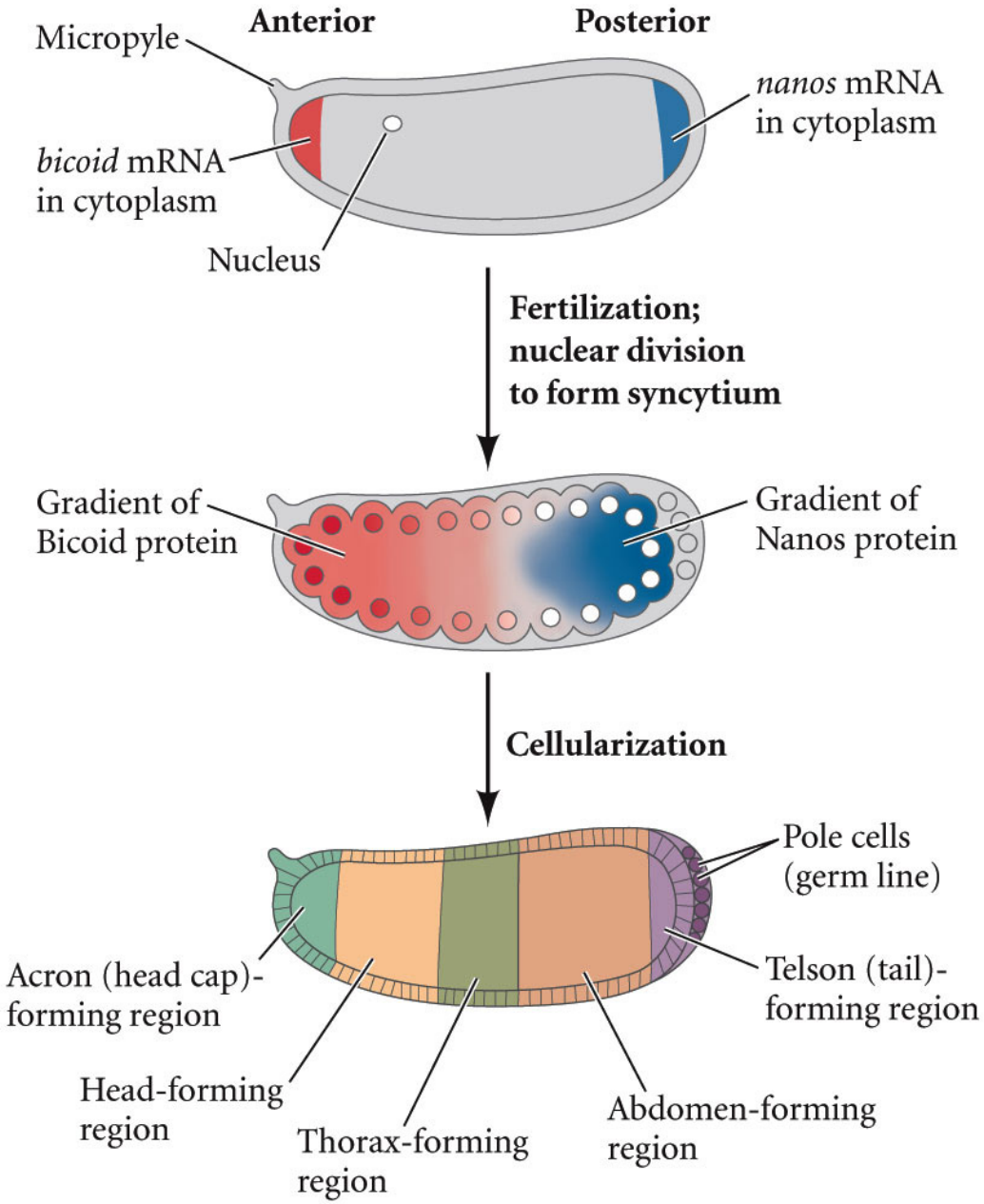
Fushi Tarazu (Dark Blue)



Engrailed (green)

Drosophila segmentation genes

- Gap: *Kruppel (Kr),knirps (kni), hunchback (hb), giant (gt),tailless tll),*
- Pair rule: *even skipped (eve),hairy (h), runt (run), fushi tarazu (ftz)*
- Segment polarity: *engrailed (en),wingless (wg),cubitus interuptus (ci),hedgehog (hh),armadillo (arm), patched (ptc)*
- Homeotic genes: *Antennapedia (Antp), Deformed (Dfd), Ultrabithorax (Ubx)*

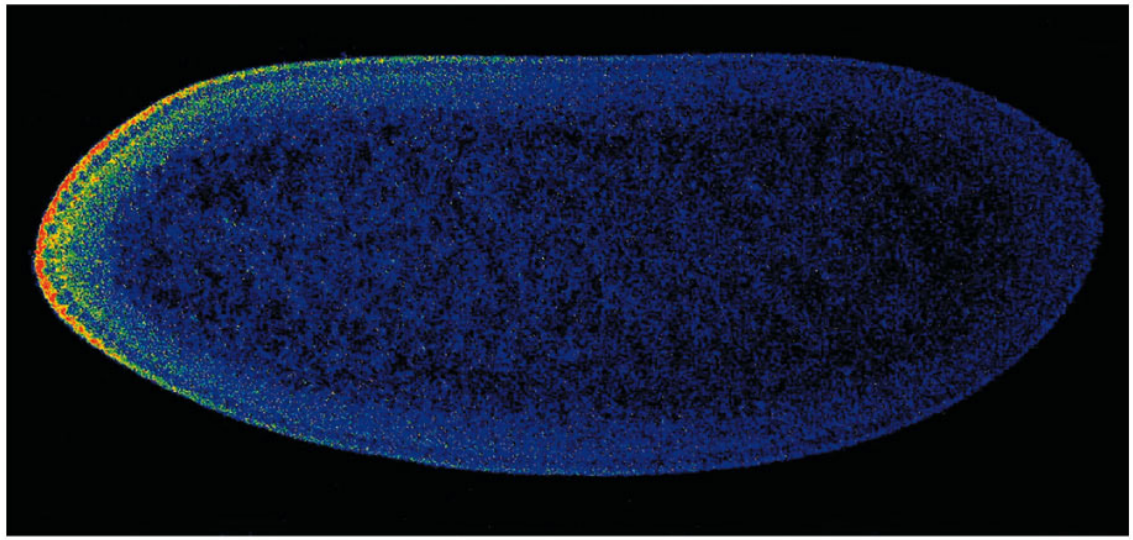


***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.19**

Figure 6.21 *Bicoid* mRNA and protein gradients shown by in situ hybridization and confocal microscopy

(A) mRNA

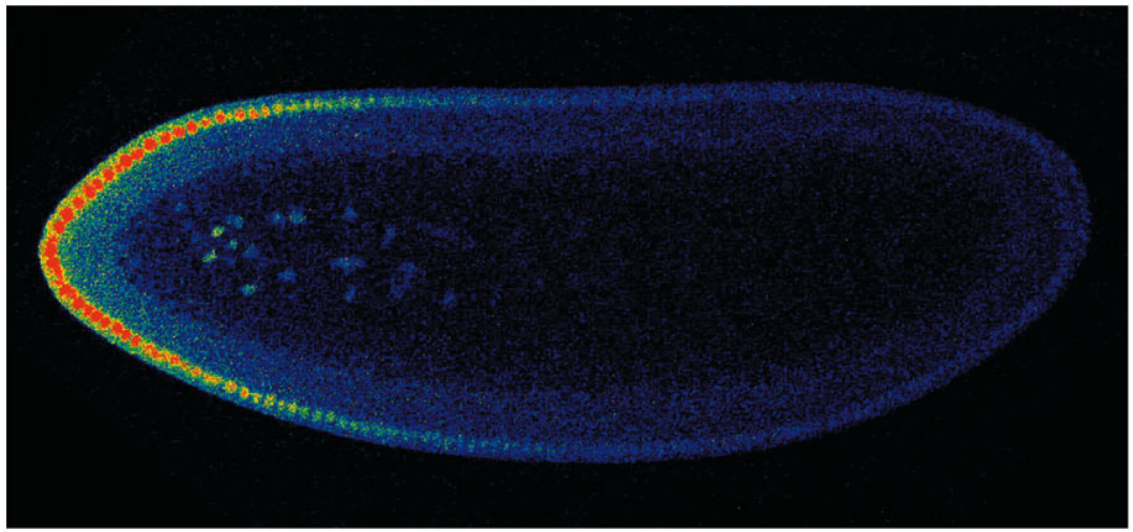
Anterior



Posterior

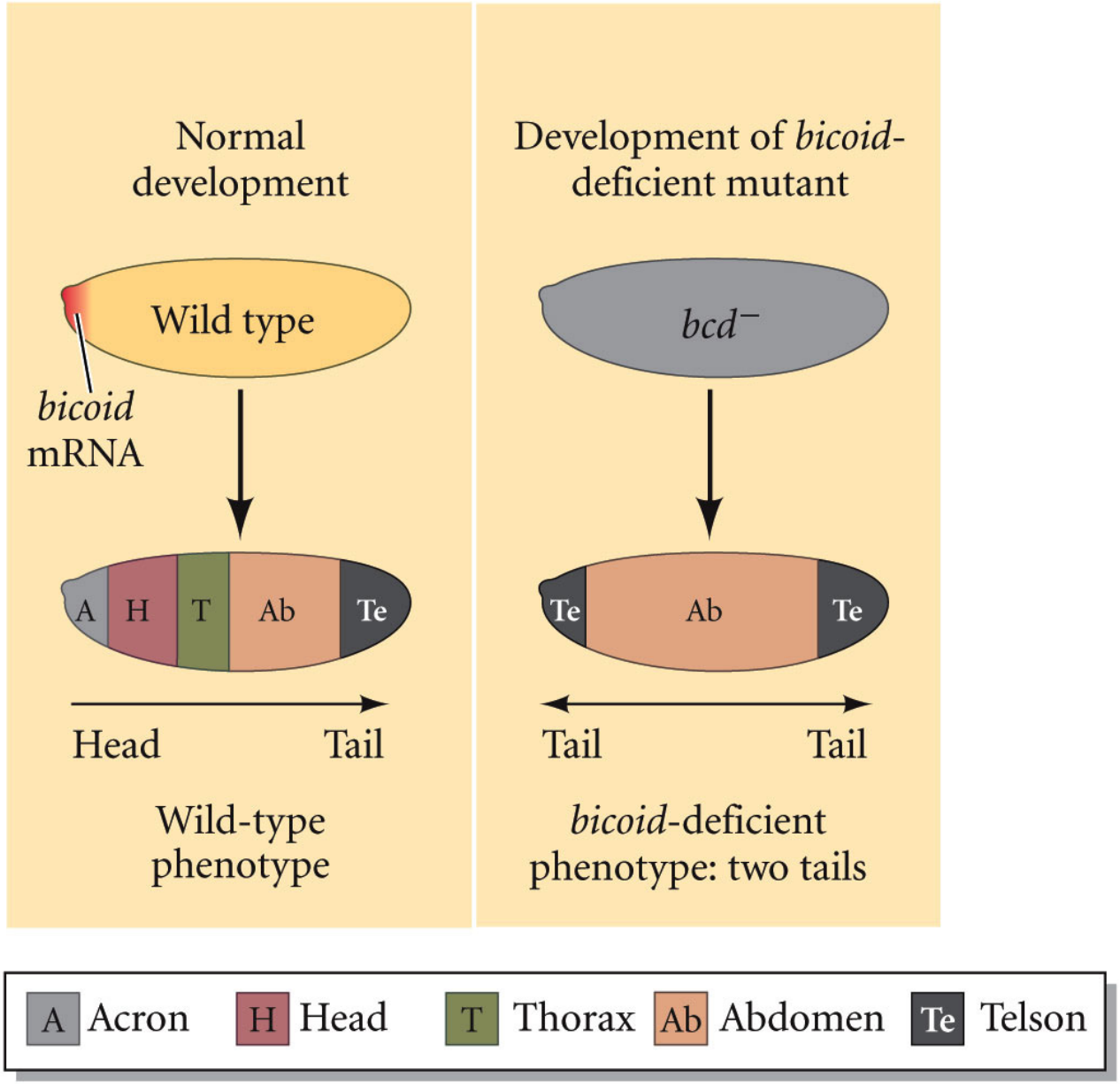
(B) Protein

Anterior

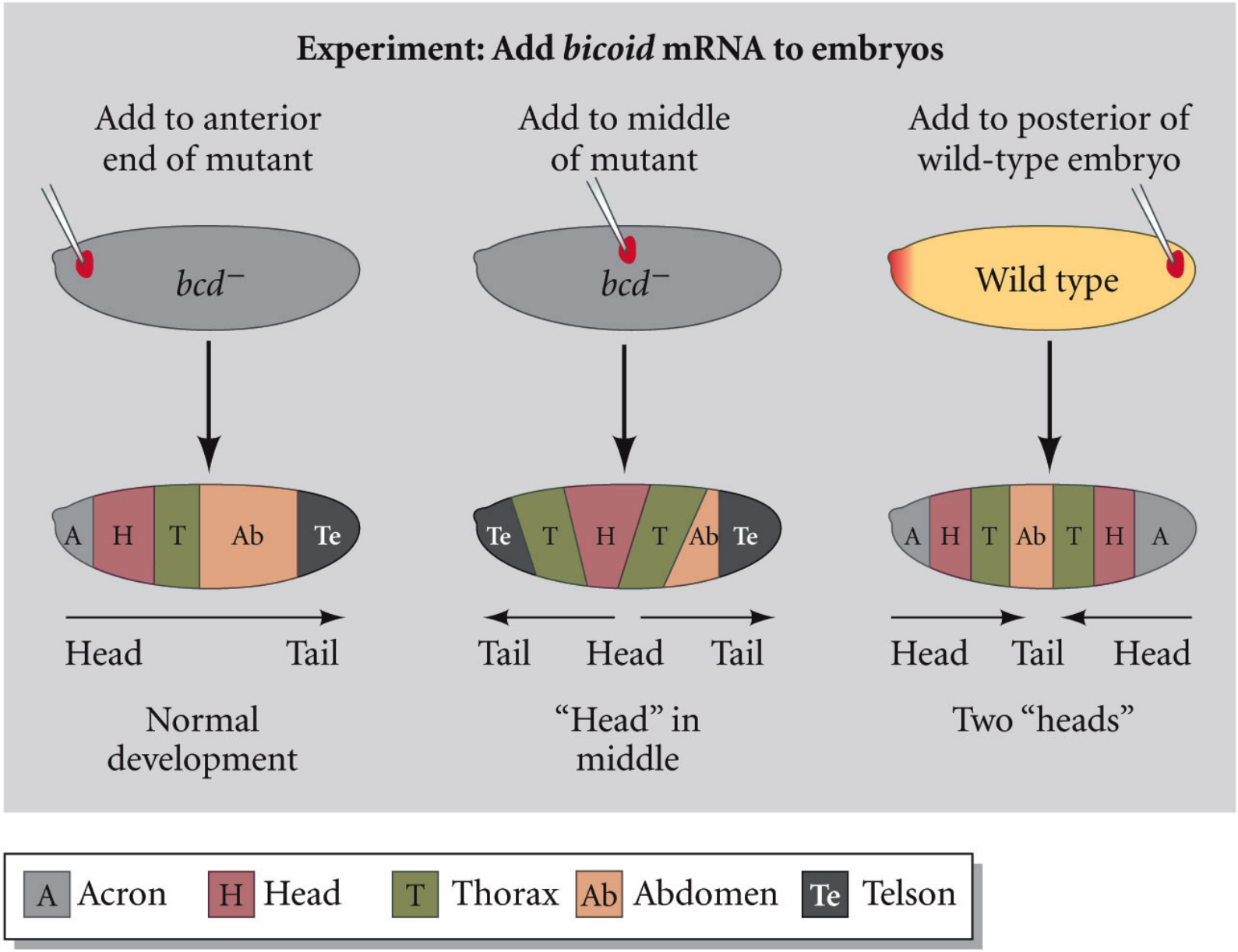


Posterior

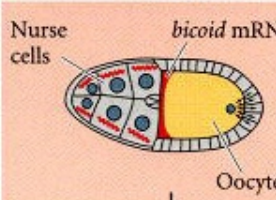
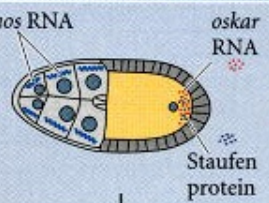
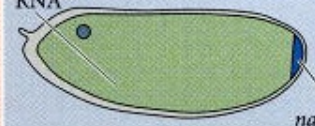
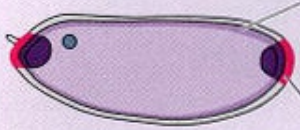
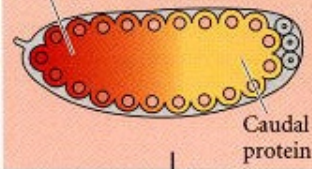
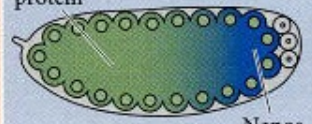
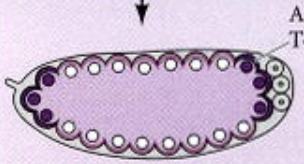
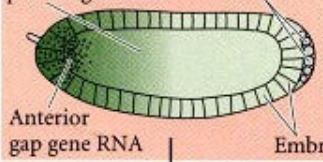
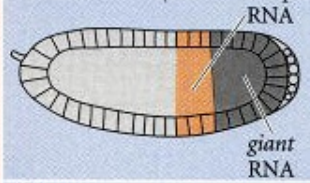
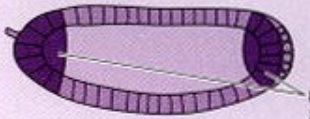
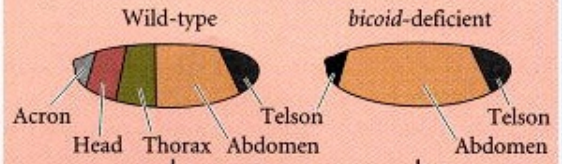
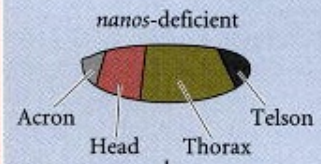
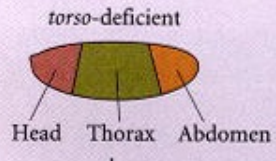
***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.21**

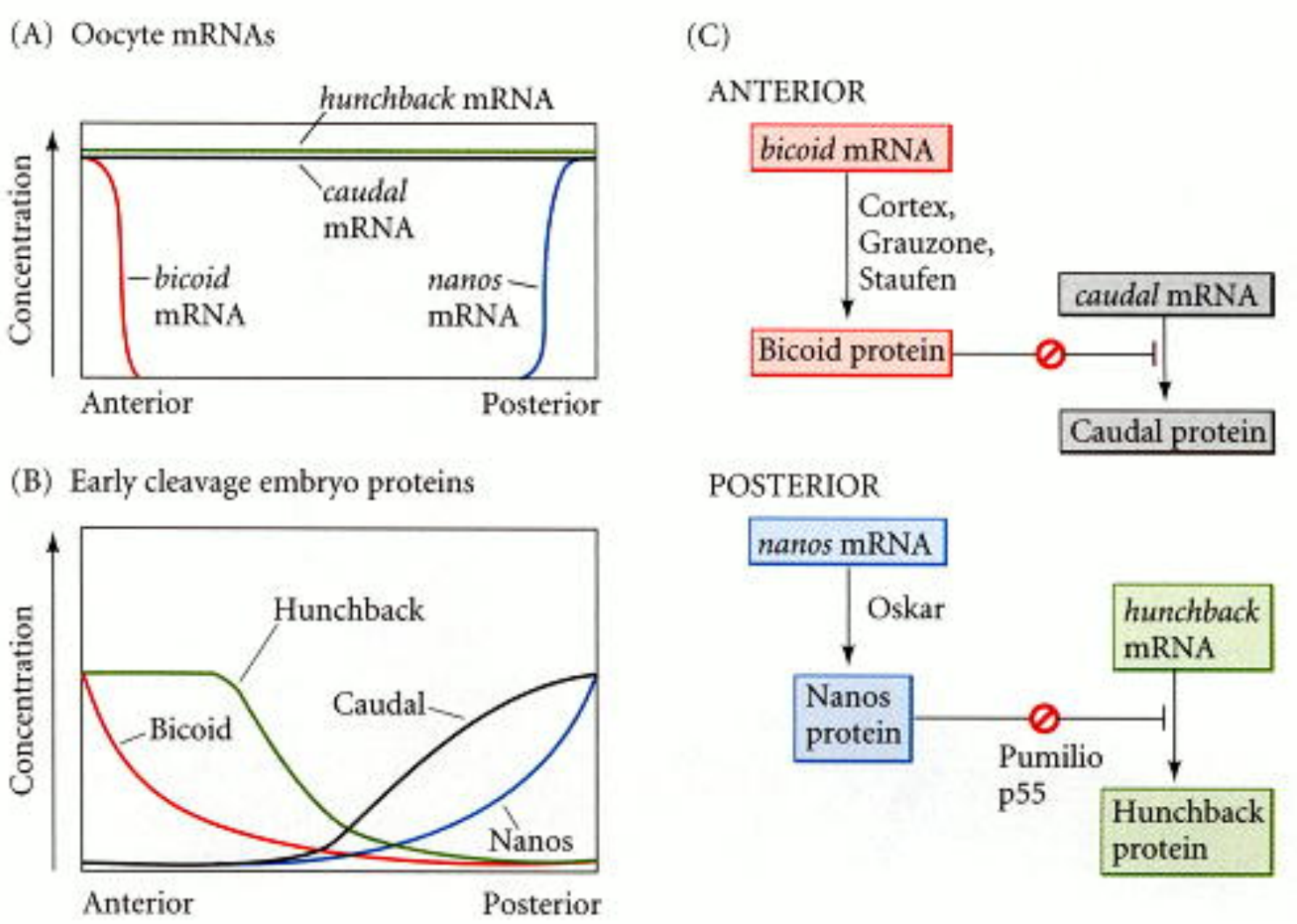


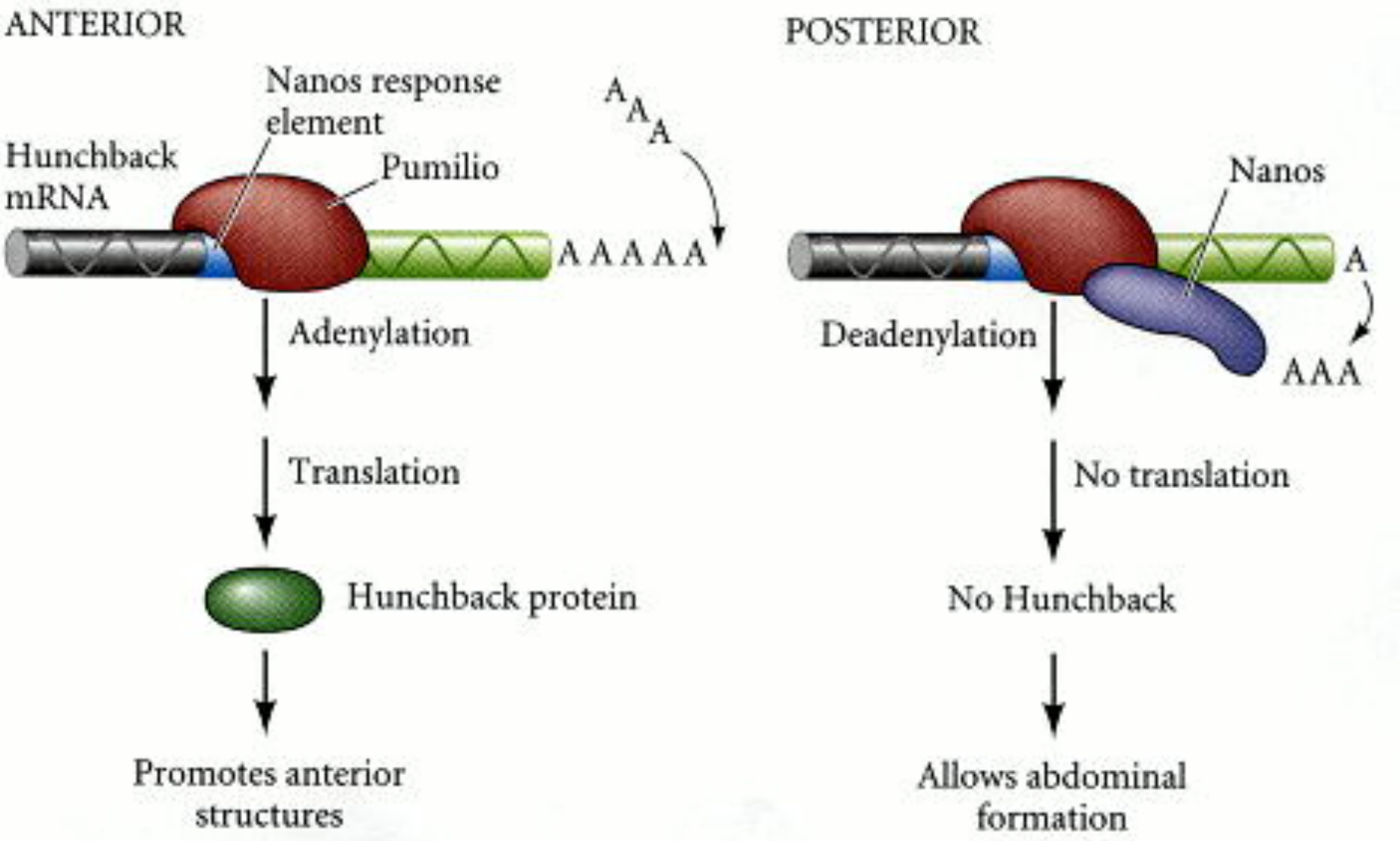
DEVELOPMENTAL BIOLOGY, 9e, Figure 6.20 (Part 1)

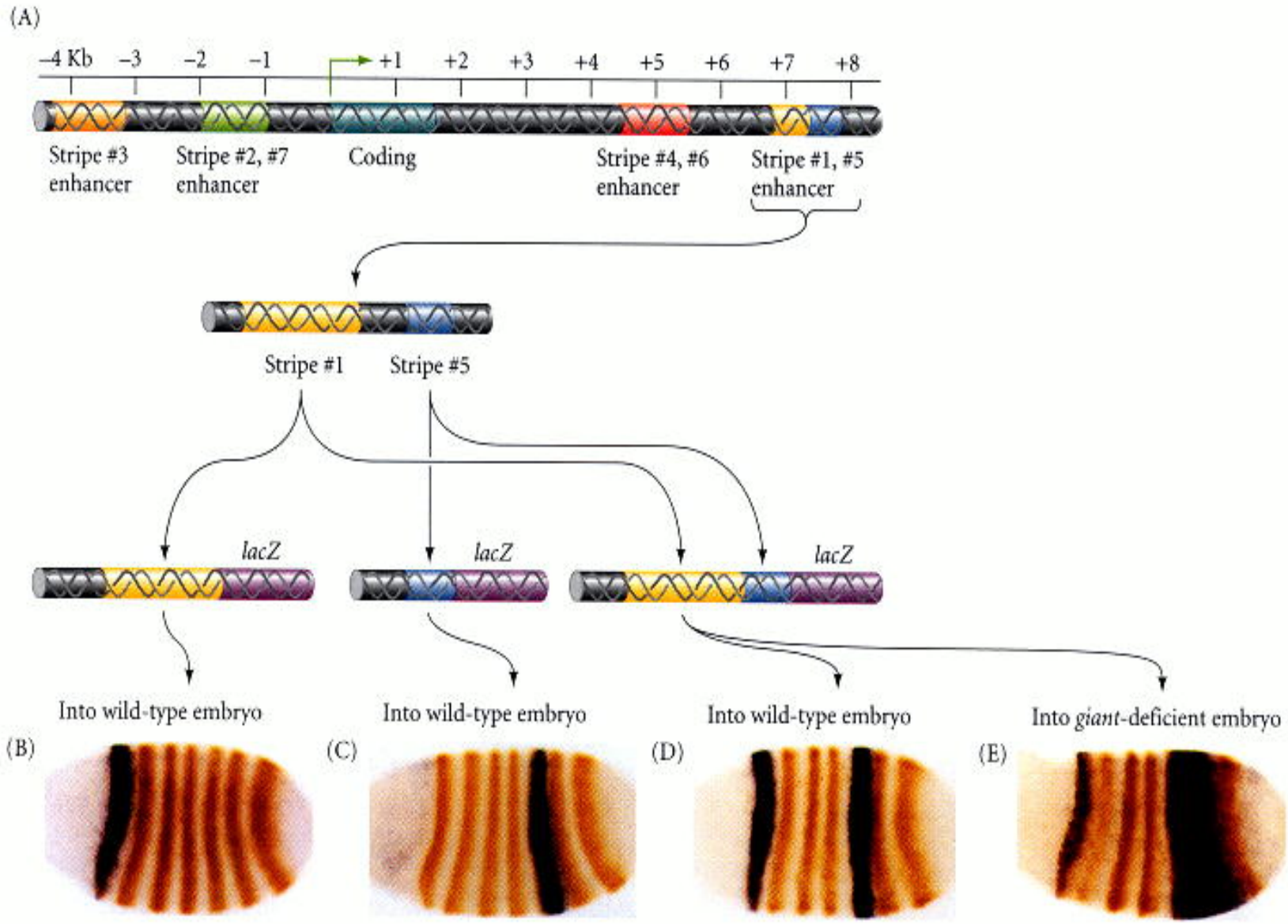


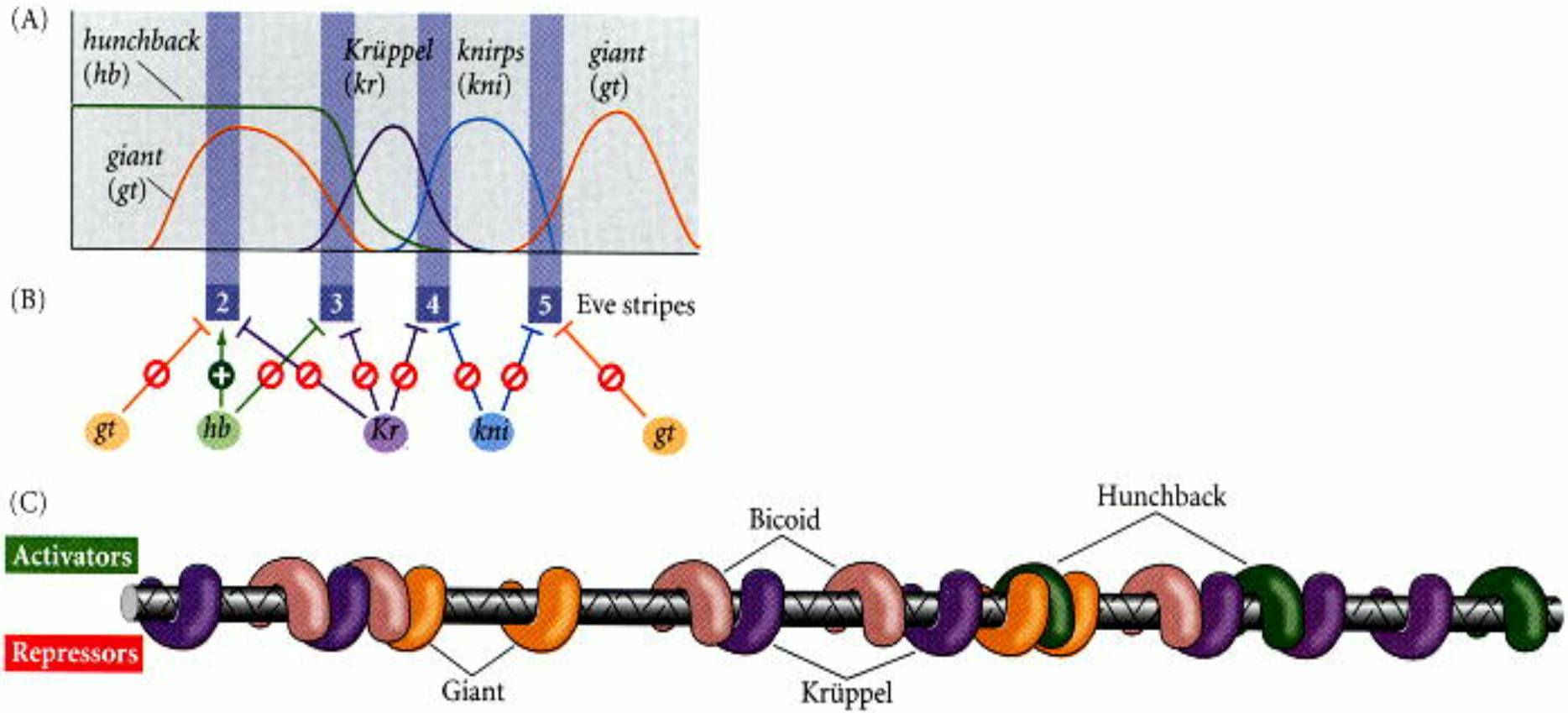
***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.20 (Part 2)**

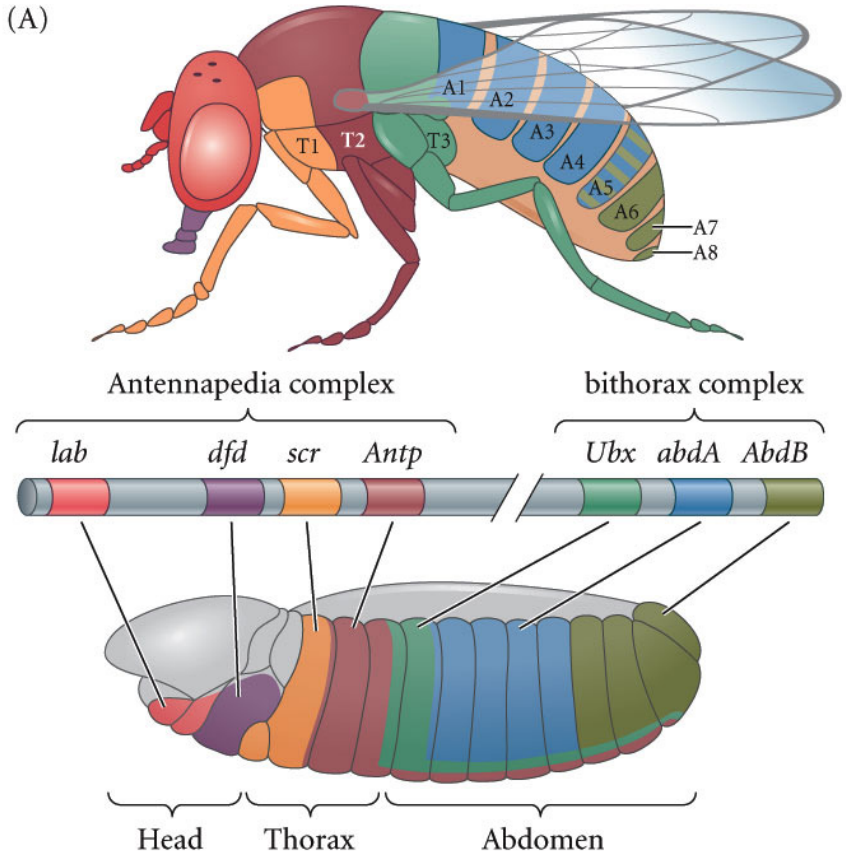
STAGE	ANTERIOR: BICOID	POSTERIOR: NANOS	TERMINAL: TORSO
Mid-oogenesis	 Ovarian nurse cells secrete *bicoid* mRNA into oocyte; oocyte nucleus interacts with posterior follicle cells	 **Ovarian nurse cells secrete posterior "scaffold" to bind *nanos* mRNA**	 **Ovarian follicle cells make Torso-like protein at anterior and posterior tips**
Completion of oogenesis	 *bicoid* mRNA localized in anterior by products of *exuparantia* and *swallow*, nucleus migrates to the dorsal anterior region	 ***nanos* mRNA secreted by ovarian nurse cells localized to posterior pole**	 **Torso-like activates Torso at tips**
Syncytial blastoderm	 *bicoid* mRNA translated and forms protein gradient; it represses *caudal* mRNA translation	 ***nanos* mRNA translated and blocks translation of *hunchback* message in posterior of embryo**	
Cellular blastoderm	 Bicoid protein activates anterior gap genes such as *orthodenticle*, *buttonhead* and the *hunchback* gene	 ***nanos* activates posterior gap genes (such as *knirps giant*)**	 **Torso activates terminal gap genes**
Regional specification			
External phenotype			


(A) Oocyte mRNAs
hunchback mRNA
caudal mRNA
bicoid mRNA
nanos mRNA
Concentration
Anterior
Posterior
(B) Early cleavage embryo proteins
Hunchback
Caudal
Bicoid
Nanos
Concentration
Anterior
Posterior
(C)
ANTERIOR
bicoid mRNA
Cortex, Grauzone, Staufen
caudal mRNA
Bicoid protein
Caudal protein
POSTERIOR
nanos mRNA
Oskar
hunchback mRNA
Nanos protein
Pumilio p55
Hunchback protein


ANTERIOR
Nanos response element
Hunchback mRNA
Pumilio
AAA
AAAAA
Adenylation
Translation
Hunchback protein
Promotes anterior structures
POSTERIOR
Nanos
A
AAA
Deadenylation
No translation
No Hunchback
Allows abdominal formation

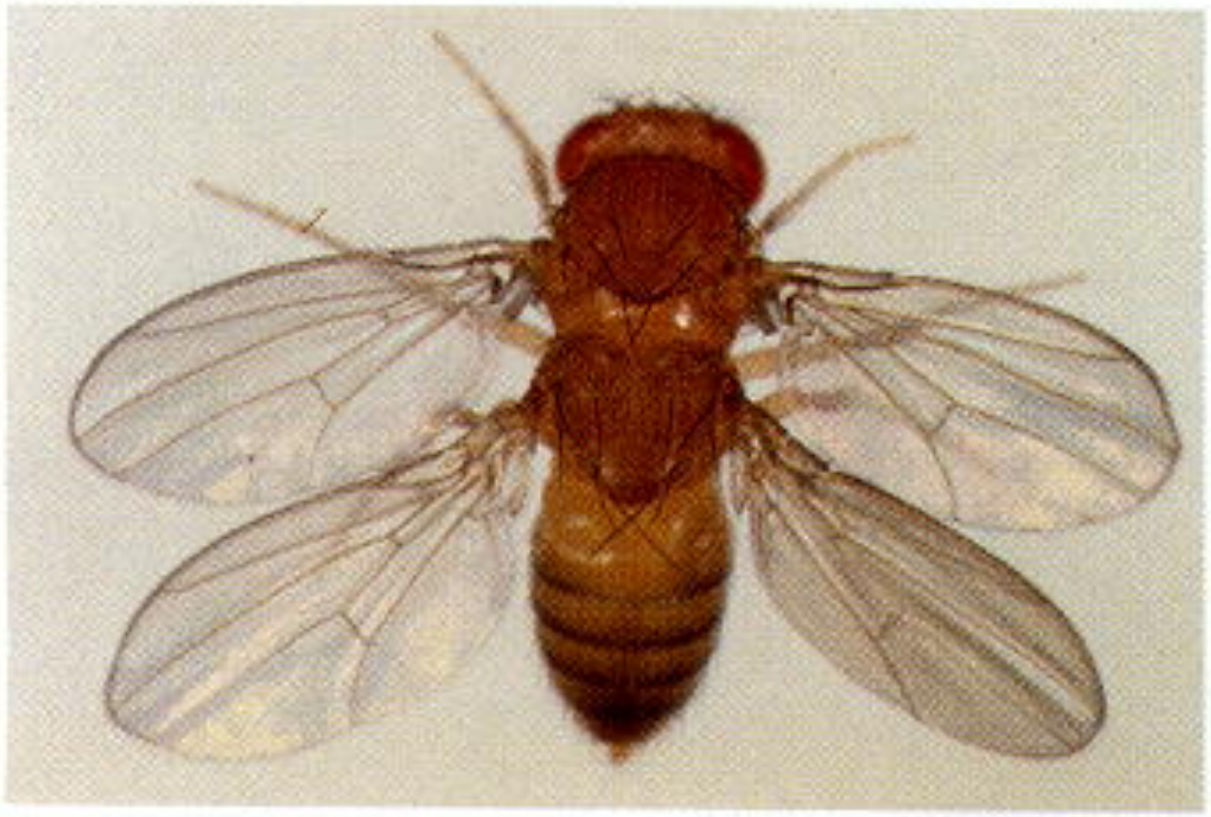

(A)
–4 Kb
–3
–2
–1
+1
+2
+3
+4
+5
+6
+7
+8
Stripe #3 enhancer
Stripe #2, #7 enhancer
Coding
Stripe #4, #6 enhancer
Stripe #1, #5 enhancer
Stripe #1
Stripe #5
lacZ
lacZ
lacZ
Into wild-type embryo
Into wild-type embryo
Into wild-type embryo
Into giant-deficient embryo
(B)
(C)
(D)
(E)

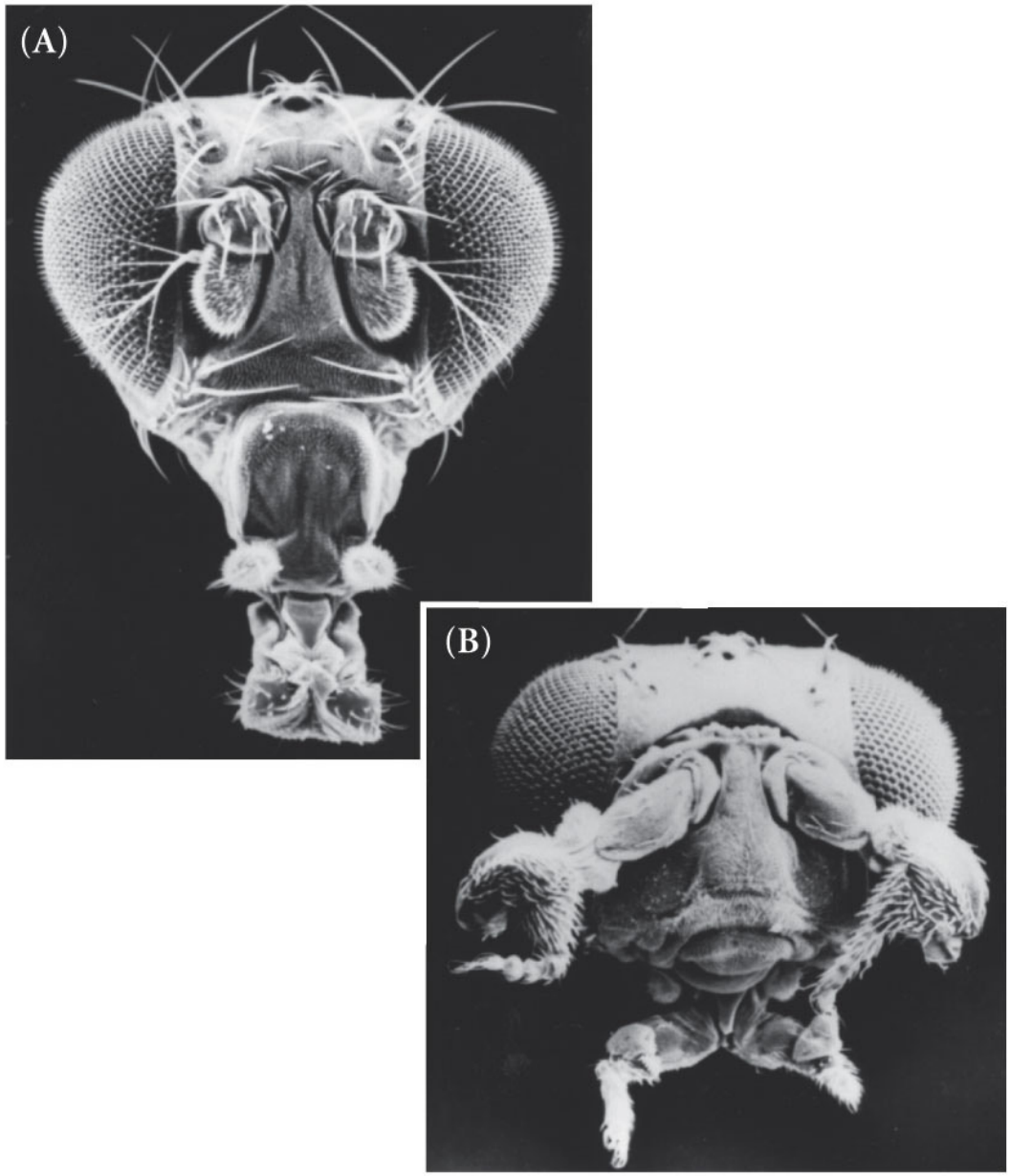

(A)
hunchback (hb)
Krüppel (kr)
knirps (kni)
giant (gt)
giant (gt)
(B)
2
3
4
5
Eve stripes
gt
hb
Kr
kni
gt
(C)
Activators
Repressors
Bicoid
Hunchback
Giant
Krüppel



DEVELOPMENTAL BIOLOGY, 9e, Figure 6.35

Ubx mutant fly

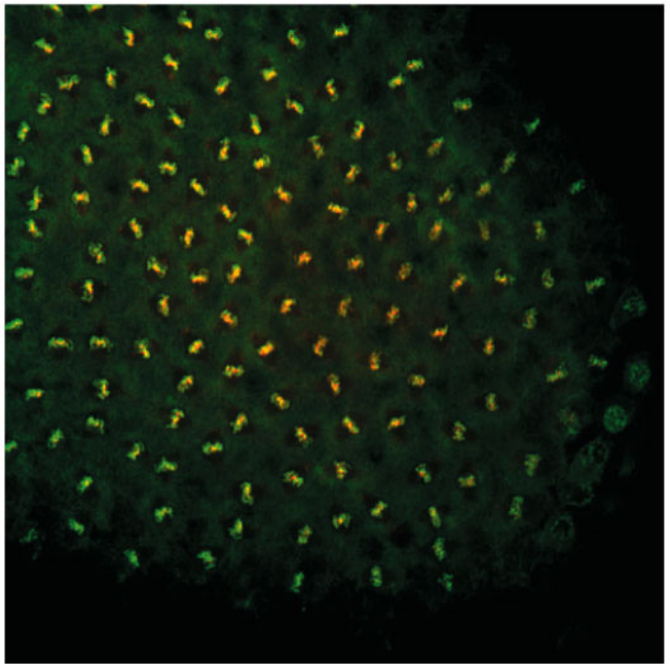




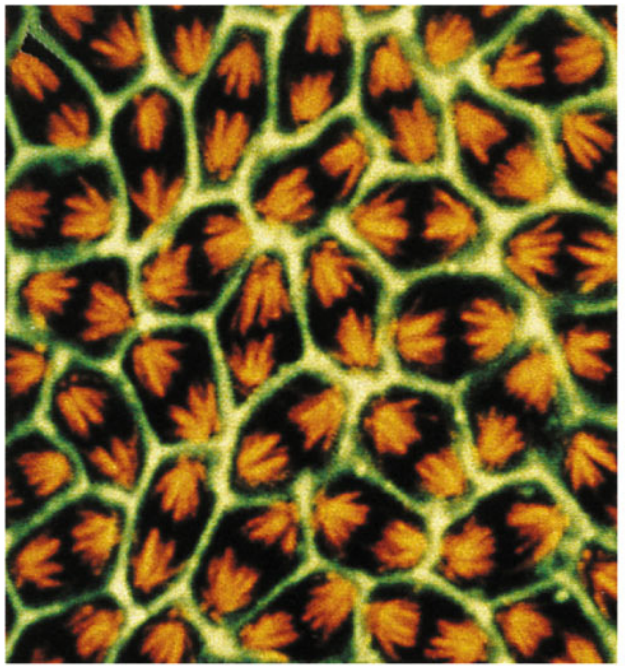
***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.37**

Figure 6.2 Nuclear and cell

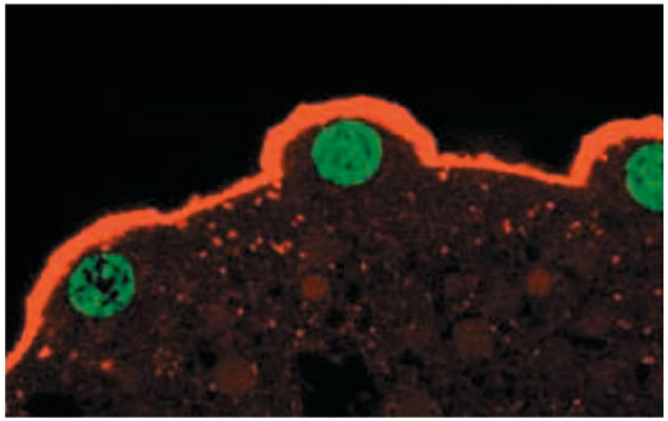
(A)



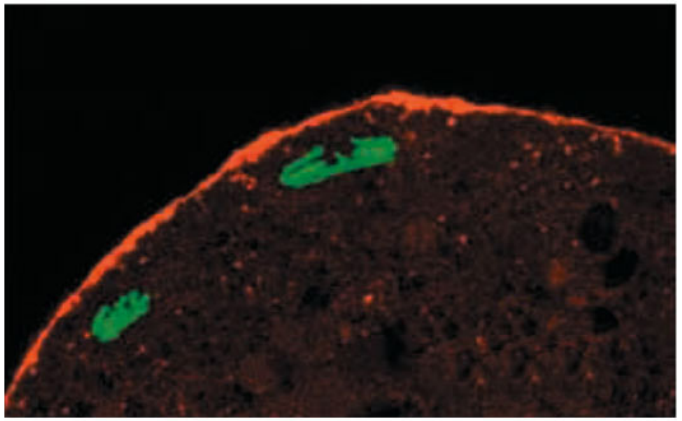
(B)



(C)



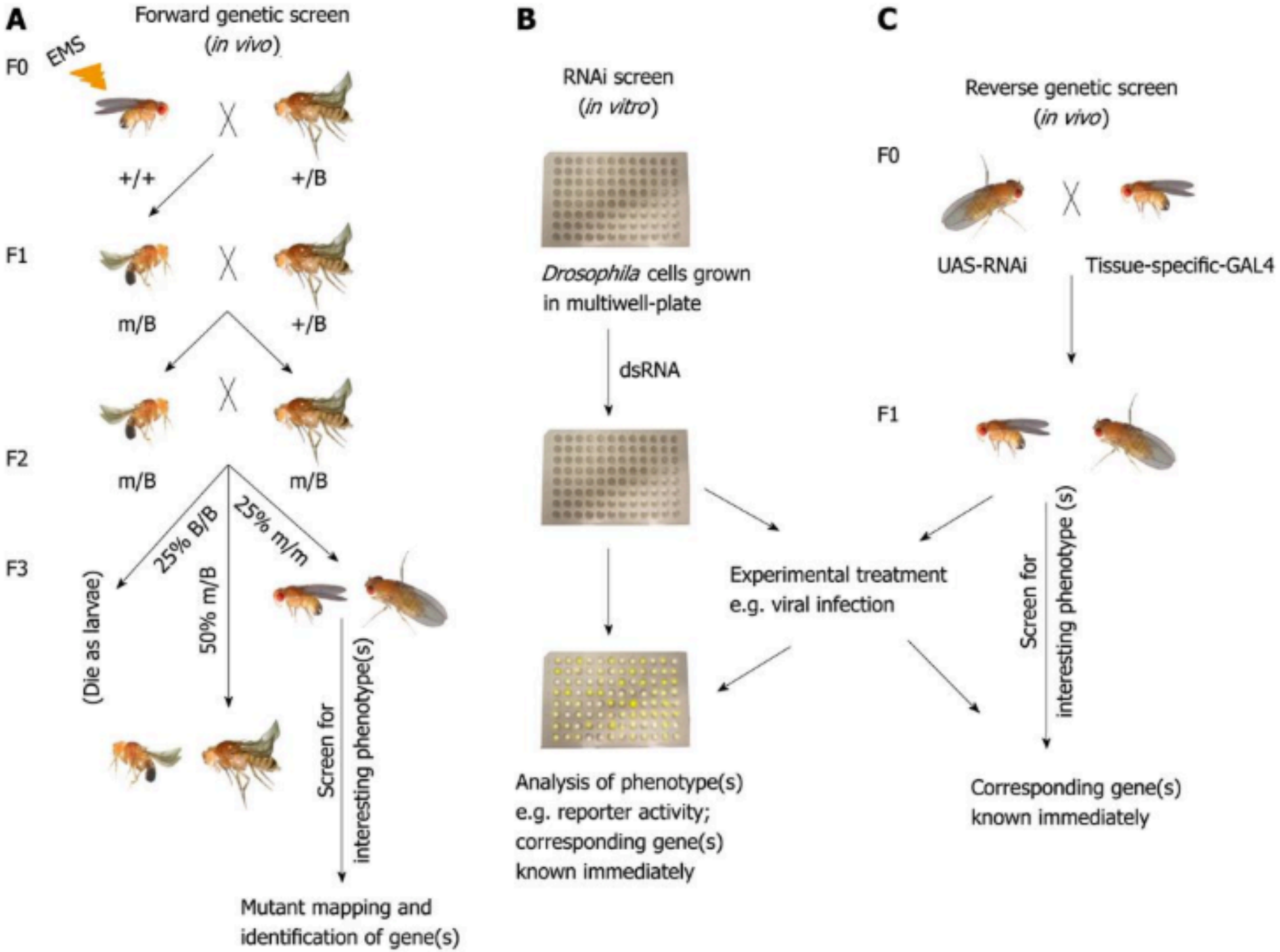
(D)

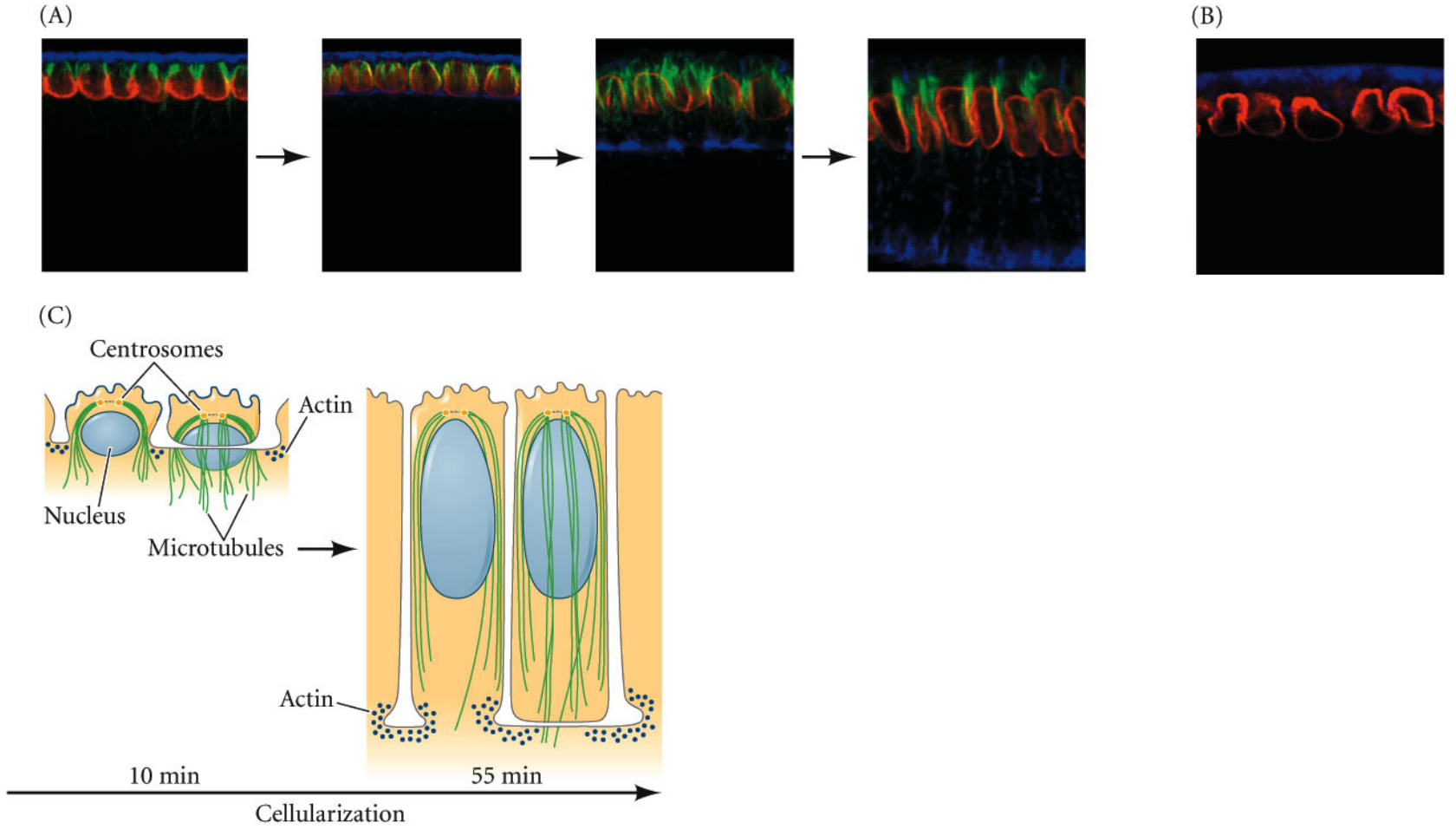


***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.2**

(B)

***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.6 (Part 2)**


A
Forward genetic screen
(in vivo)
F0
EMS
+/+
+/B
F1
m/B
+/B
F2
m/B
m/B
F3
25% B/B
25% m/m
50% m/B
(Die as larvae)
Screen for
interesting phenotype(s)
Mutant mapping and
identification of gene(s)
B
RNAi screen
(in vitro)
Drosophila cells grown
in multiwell-plate
dsRNA
Experimental treatment
e.g. viral infection
Analysis of phenotype(s)
e.g. reporter activity;
corresponding gene(s)
known immediately
C
Reverse genetic screen
(in vivo)
F0
UAS-RNAi
Tissue-specific-GAL4
F1
Screen for
interesting phenotype (s)
Corresponding gene(s)
known immediately

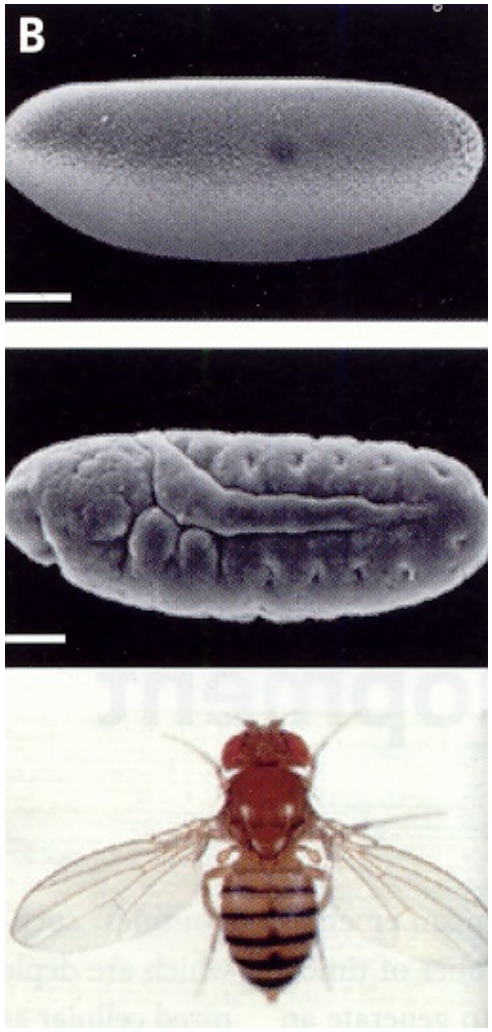


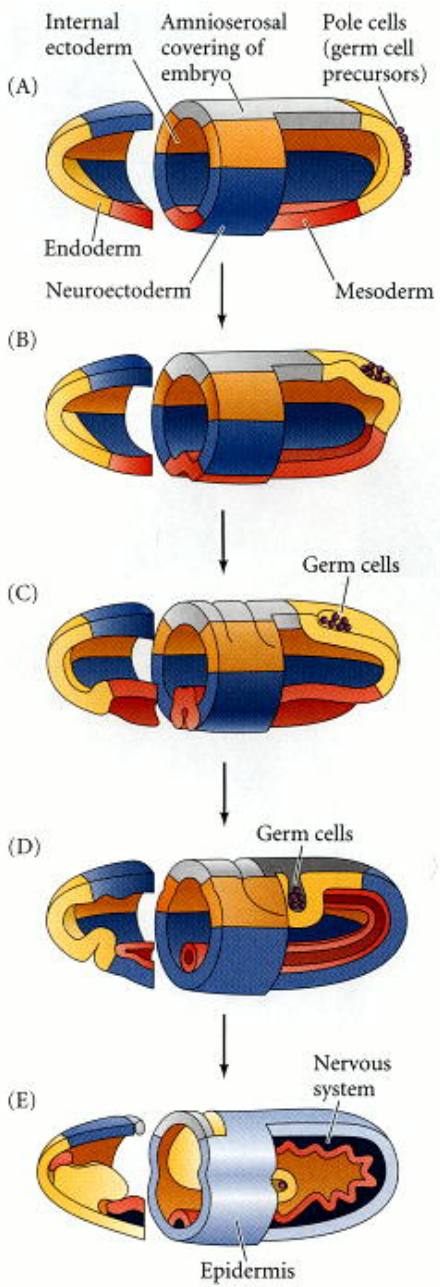
***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.3**

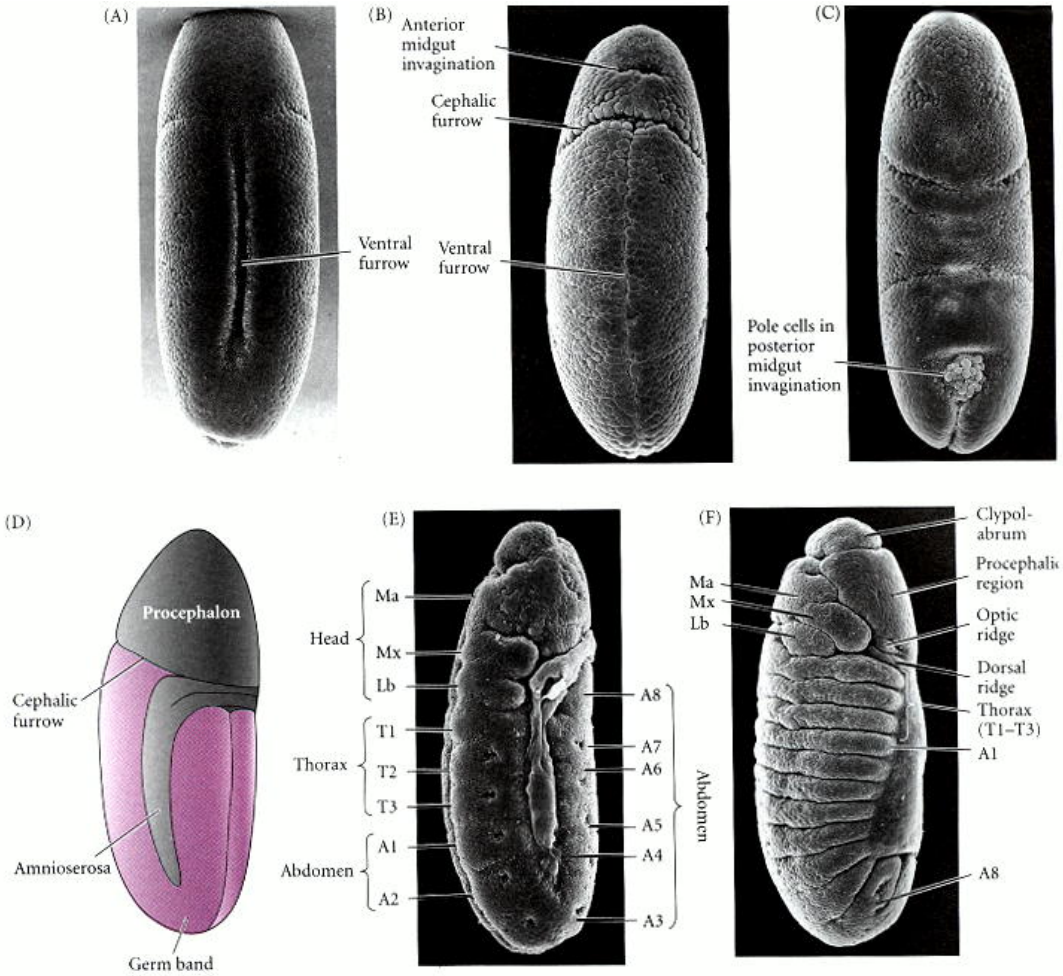
Drosophila gastrulation- molecular basis of A-P axis development

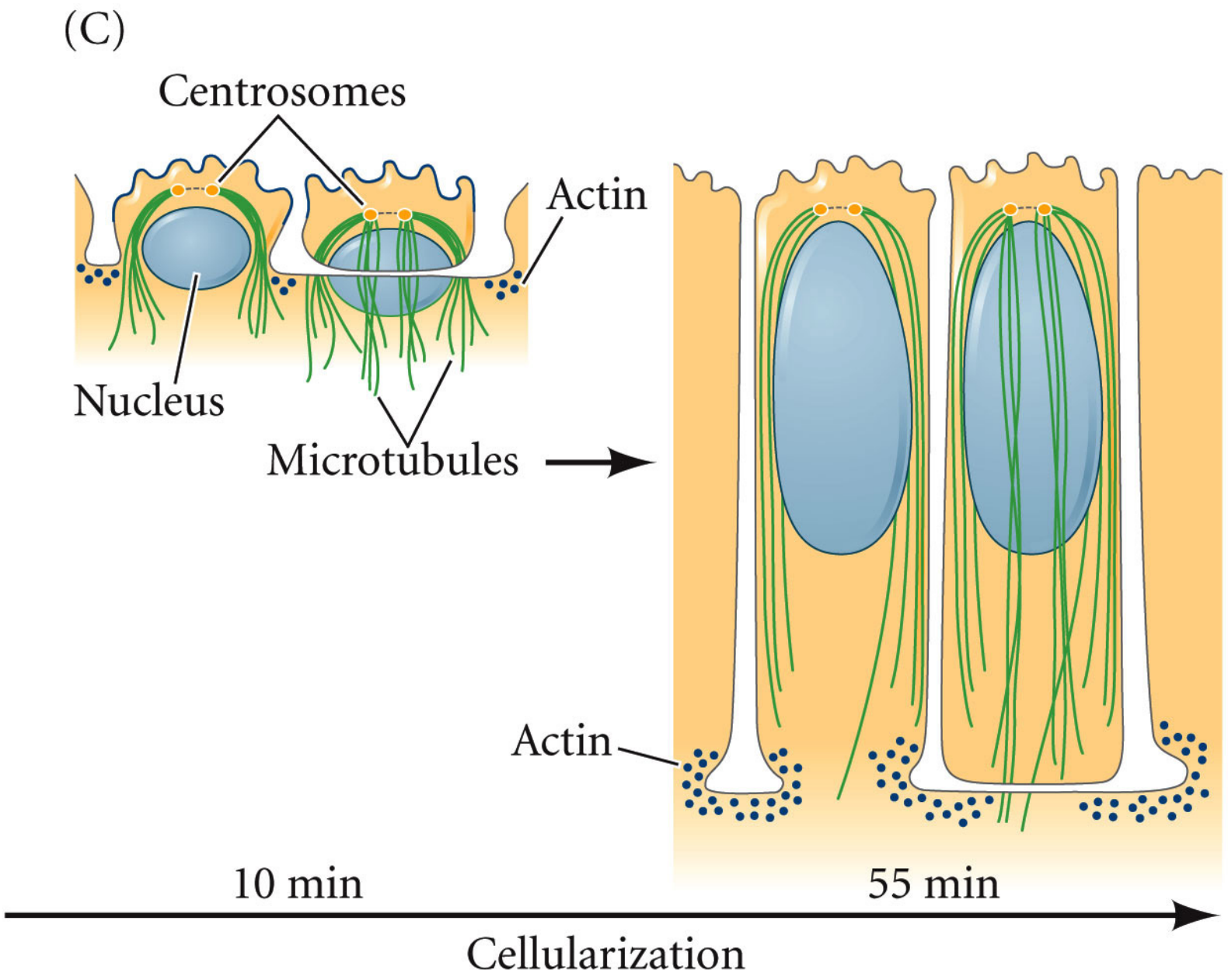
Gilbert Ch 6 The genetics of axis specification in Drosophila p 179-215 or 9th Edition 203-237

Fruit fly
Drosophila melanogaster




Internal ectoderm
Amnioserosal covering of embryo
Pole cells (germ cell precursors)
(A)
Endoderm
Neuroectoderm
Mesoderm
(B)
Germ cells
(C)
Germ cells
(D)
Nervous system
(E)
Epidermis


(A)
Ventral furrow
(B)
Anterior midgut invagination
Cephalic furrow
Ventral furrow
(C)
Pole cells in posterior midgut invagination
(D)
Procephalon
Cephalic furrow
Amnioserosa
Germ band
(E)
Head
Ma
Mx
Lb
Thorax
T1
T2
T3
Abdomen
A1
A2
A8
A7
A6
A5
A4
A3
Abdomen
(F)
Clypol-abrum
Procephalic region
Ma
Mx
Lb
Optic ridge
Dorsal ridge
Thorax (T1–T3)
A1
A8
(G)
Anterior segment



***DEVELOPMENTAL BIOLOGY,* 9e, Figure 6.3 (Part 2)**