Lecture 21 Mouse (Mus musculus)
A Model for studying human diseases

Read 552-555

Fig. 13.1-13.3

Table E.1

TABLE E.1 Comparison of Mice and Humans

Trait	Mice	Humans
Average weight	30 g	77,000 g (170 lb)
Average length	10 cm (without tail)	175 cm
Genome size	~3,000,000,000 bp	~3,000,000,000 bp
Haploid gene number	~50,000	~50,000
Number of chromosomes	19 autosomes + X and Y	22 autosomes + X and Y
Gestation period	3 weeks	Average, 38 weeks (8.9 months)
Age at puberty	5–6 weeks	Average, 624–728 weeks (12–14 years)
Estrus cycle	4 days	Average, 28 days
Life span	2 years	Average, 78 years

Synteny Between mouse and human genome

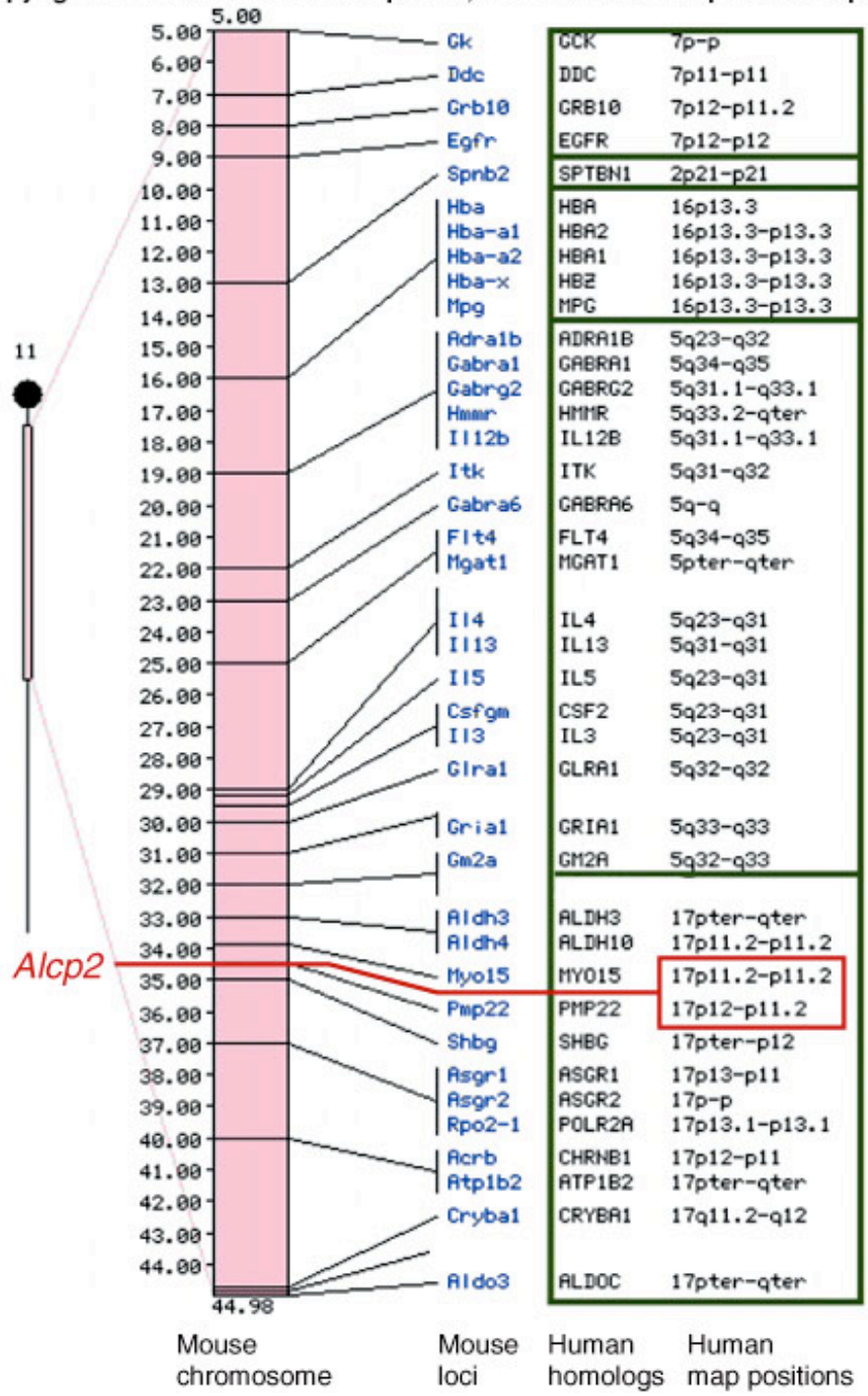
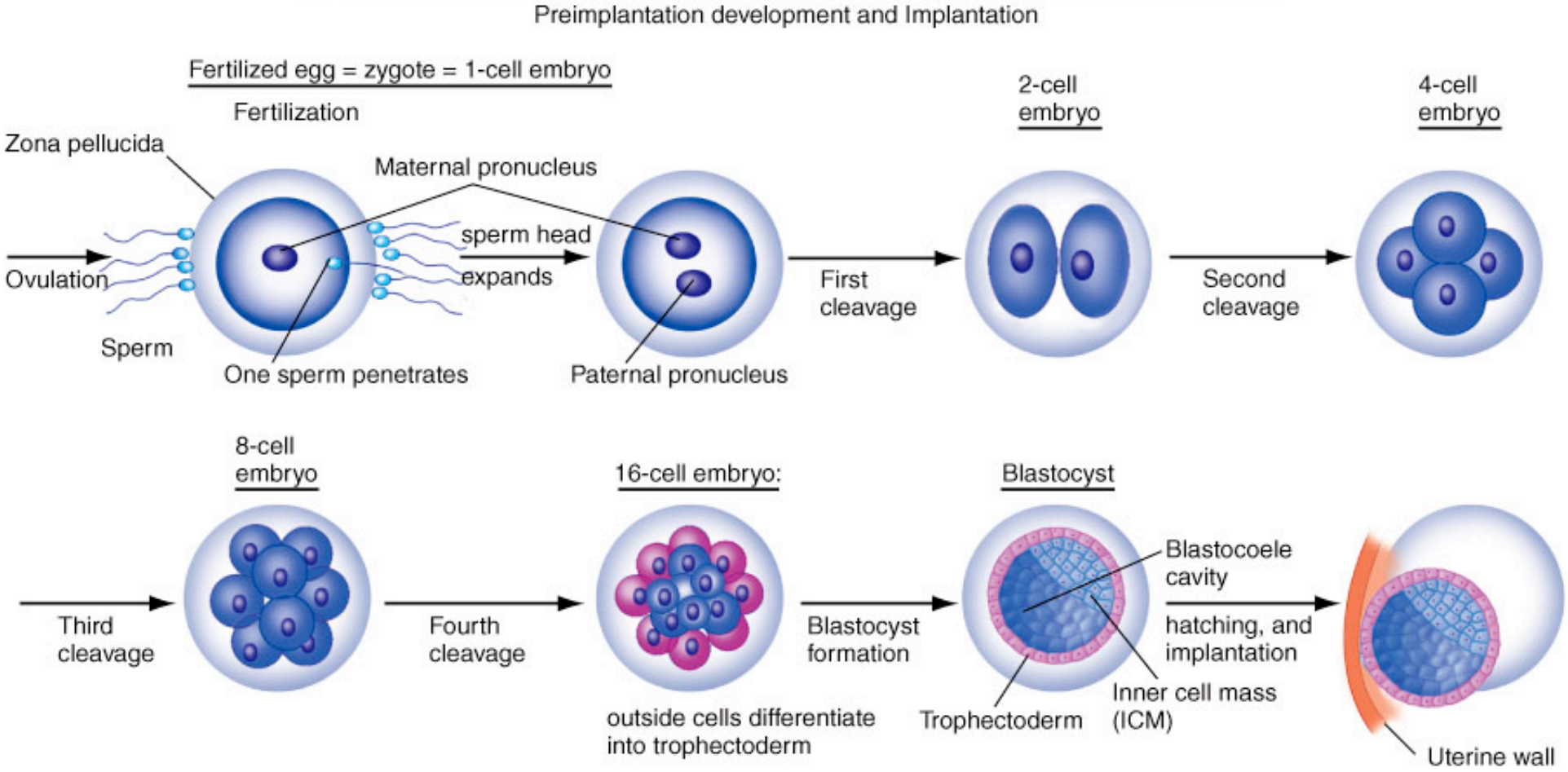


Fig. E.3

Fig. E.5

Mouse embryogenesis



Cleavage stage cells are totipotent

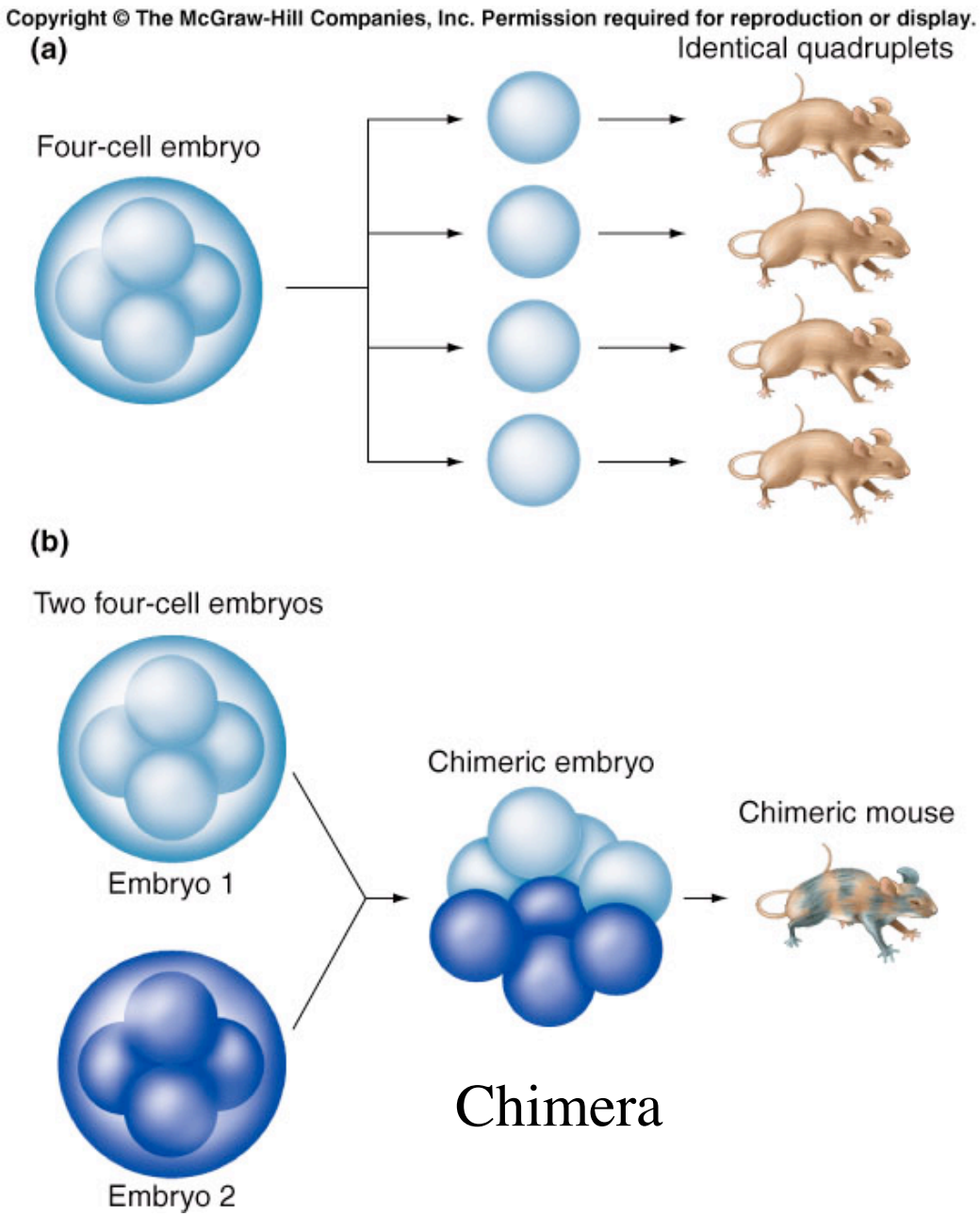
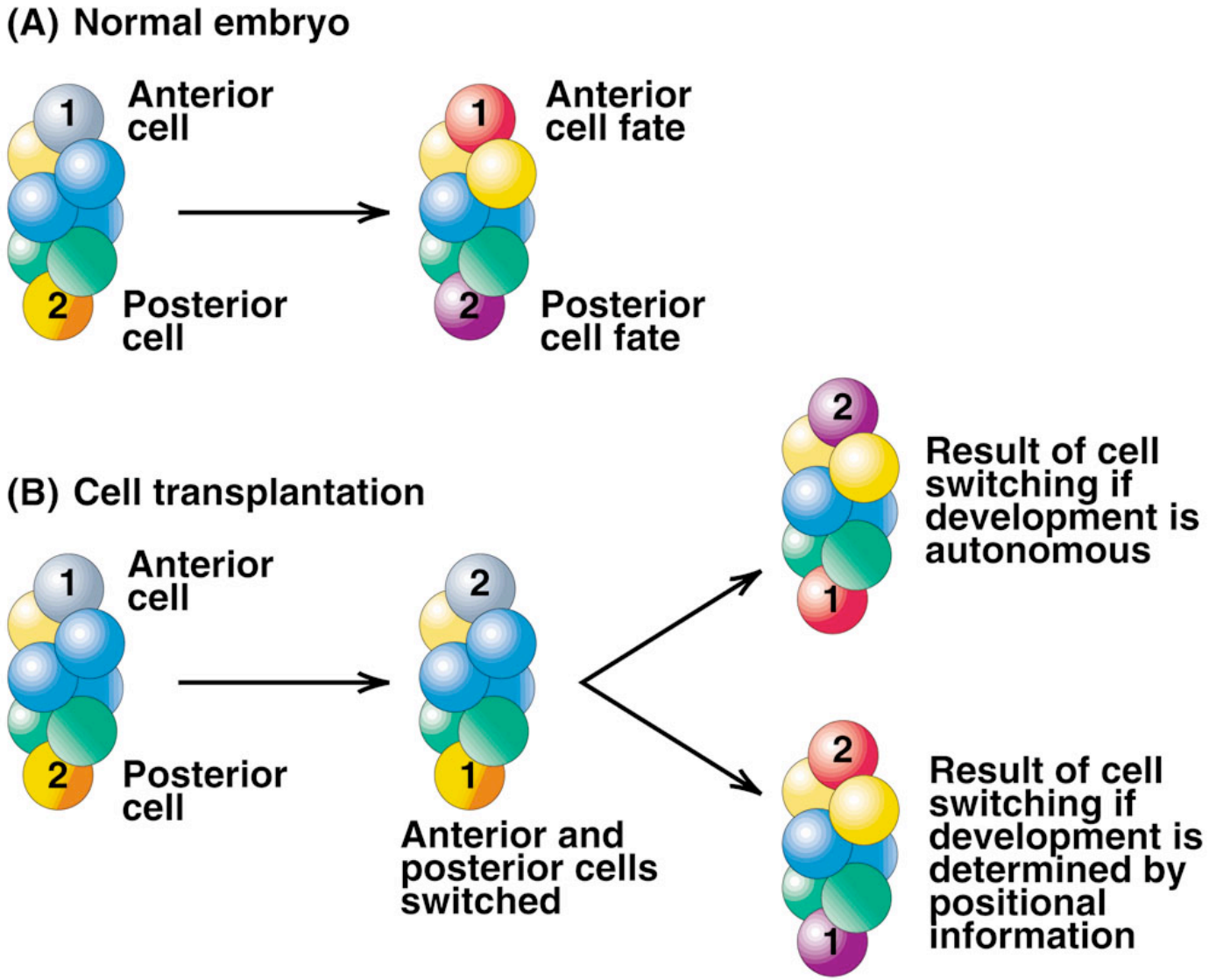
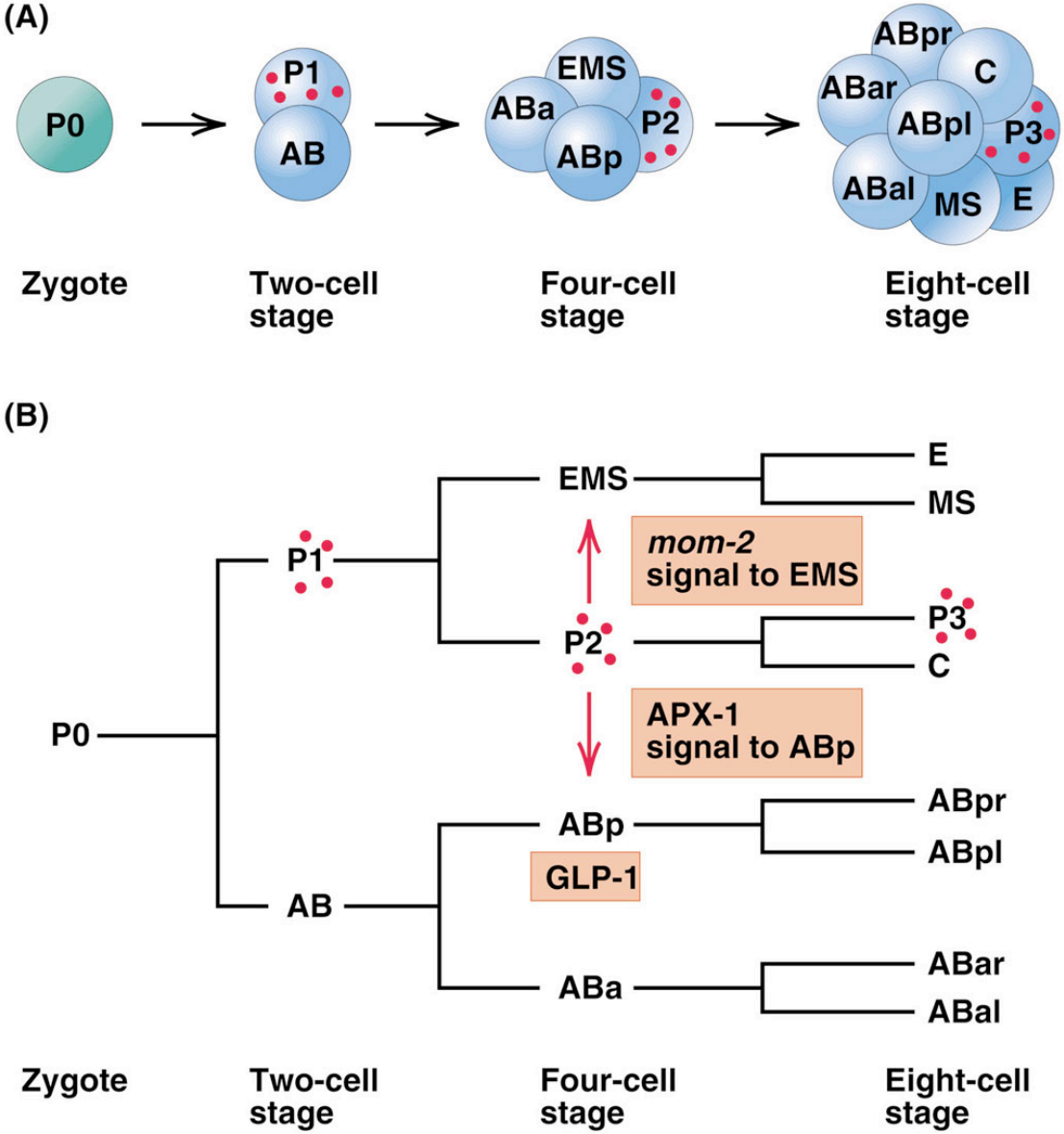


Fig. E.6

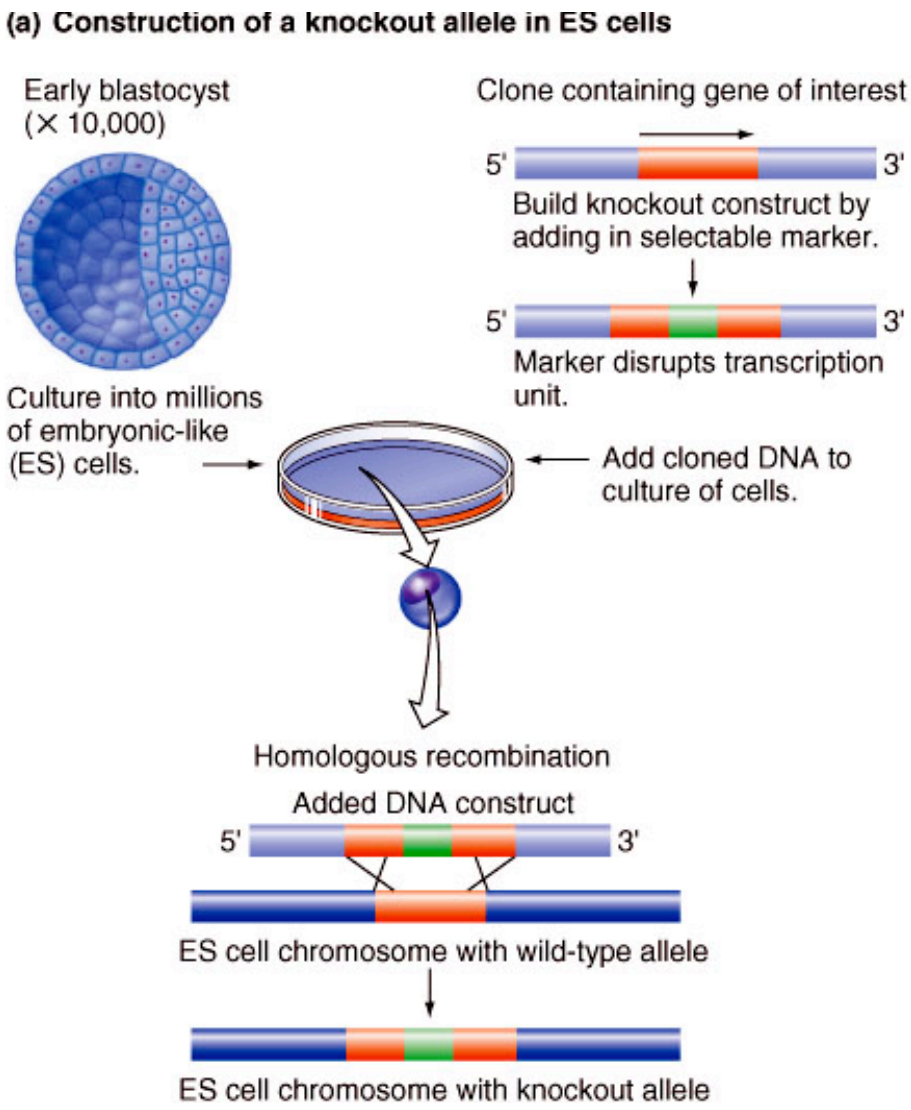
Use of cell transplantation during early embryonic development to ascertain the timing of fate determination

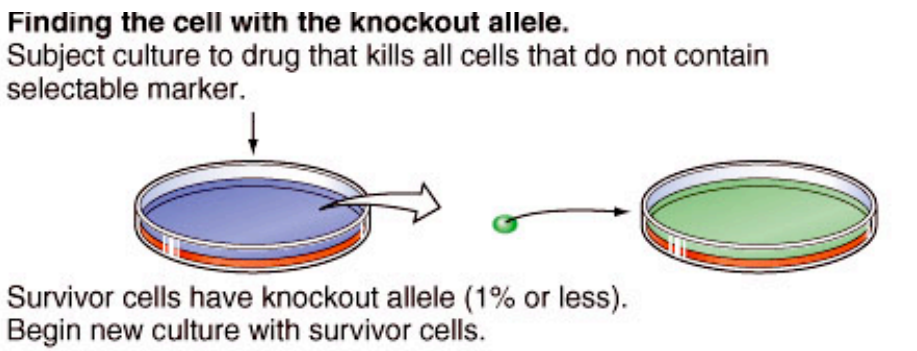


The first 3 divisions during the development of the worm *Caenorhabditis elegans*



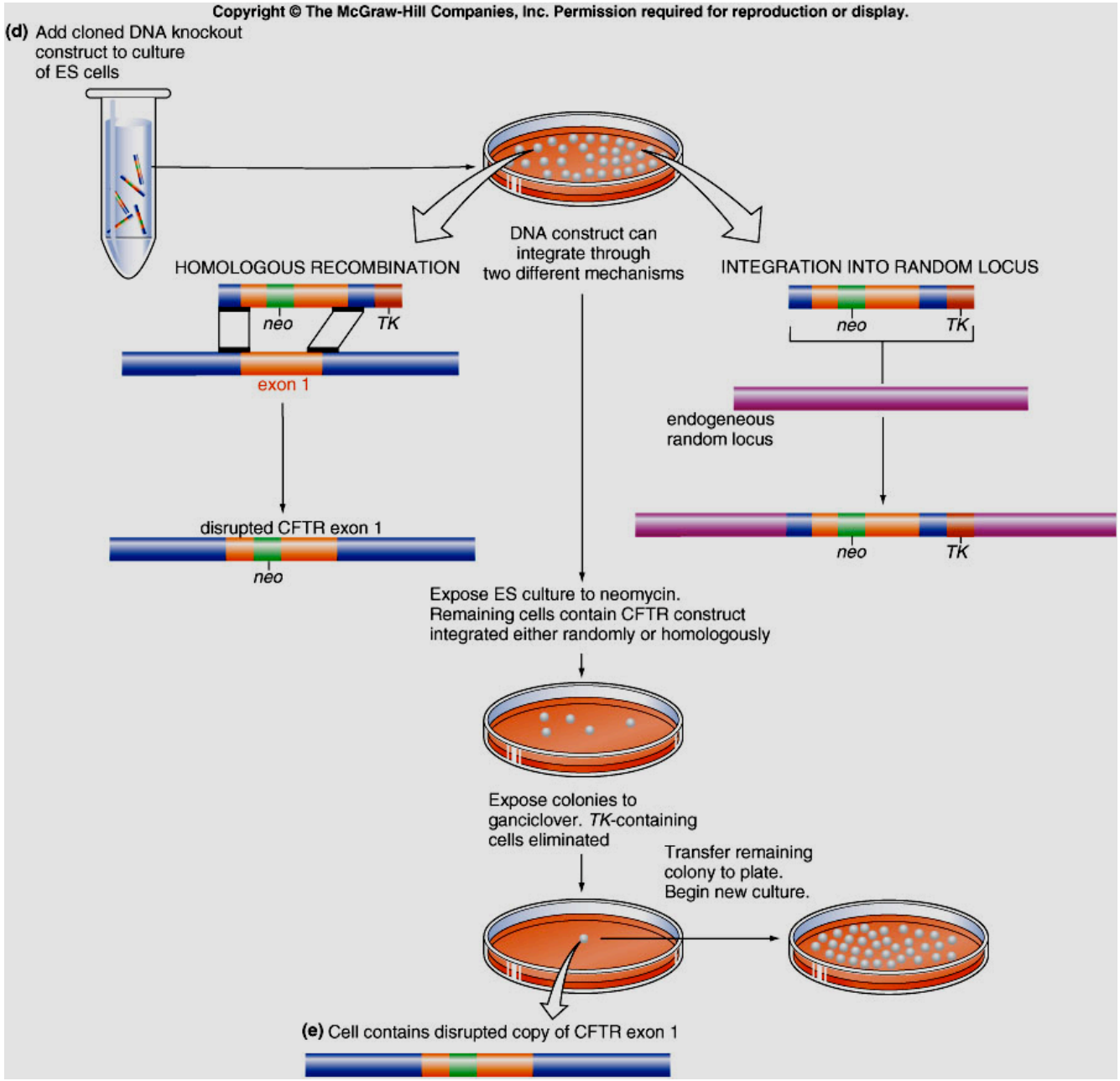
Knocking out a gene in ES cells





(b)

Fig. E.14d-e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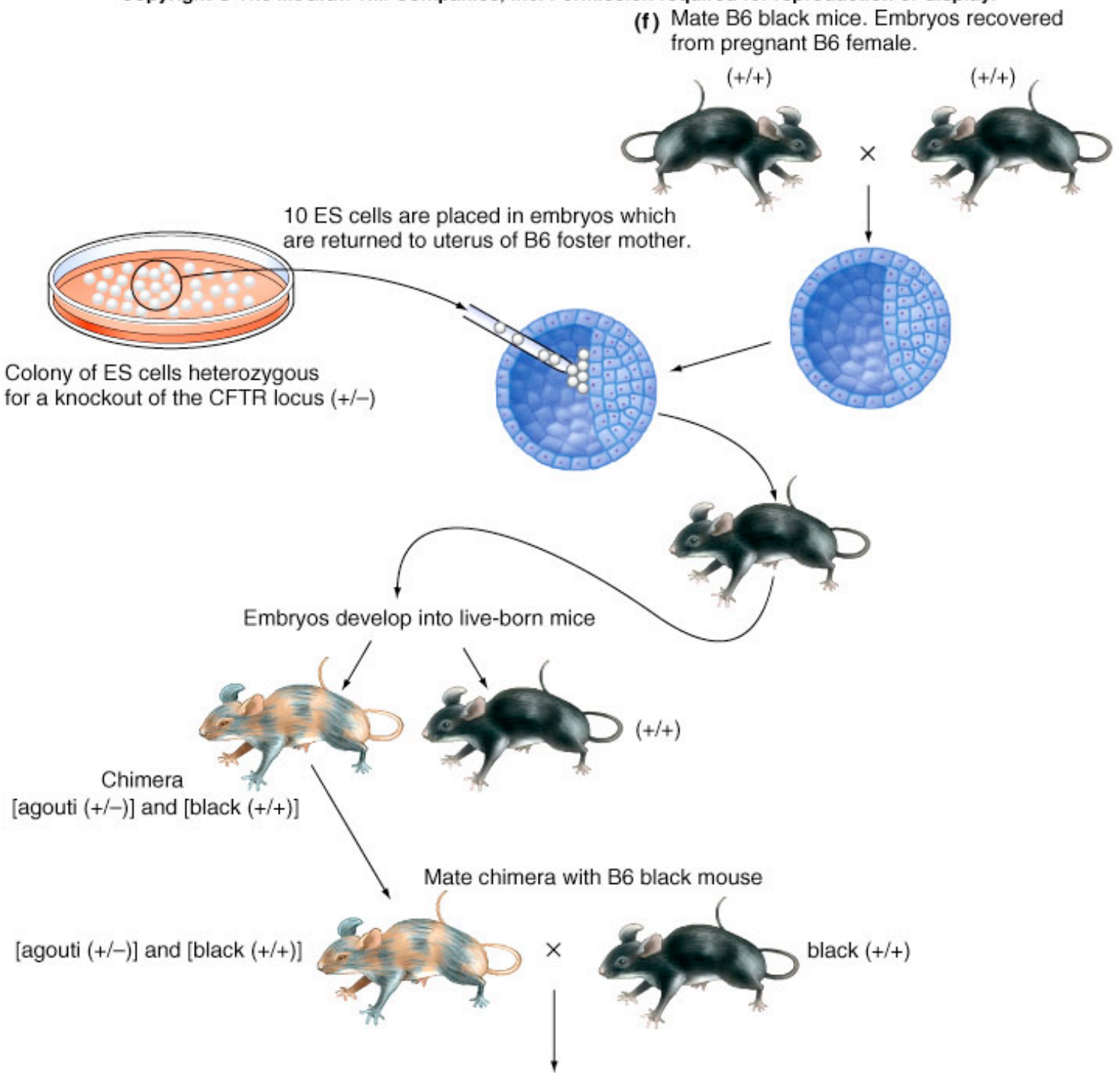
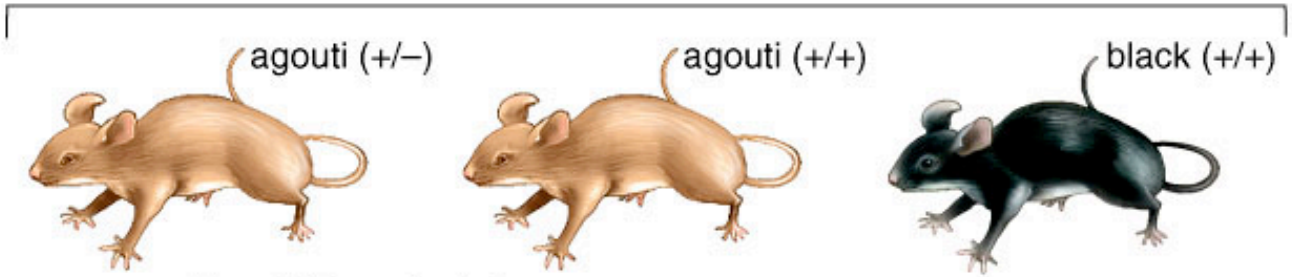
(d) Add cloned DNA knockout construct to culture of ES cells
DNA construct can integrate through two different mechanisms
HOMOLOGOUS RECOMBINATION
neo
TK
exon 1
disrupted CFTR exon 1
neo
INTEGRATION INTO RANDOM LOCUS
neo
TK
endogeneous random locus
neo
TK
Expose ES culture to neomycin. Remaining cells contain CFTR construct integrated either randomly or homologously
Expose colonies to ganciclover. TK-containing cells eliminated
Transfer remaining colony to plate. Begin new culture.
(e) Cell contains disrupted copy of CFTR exon 1

Fig. E.14f



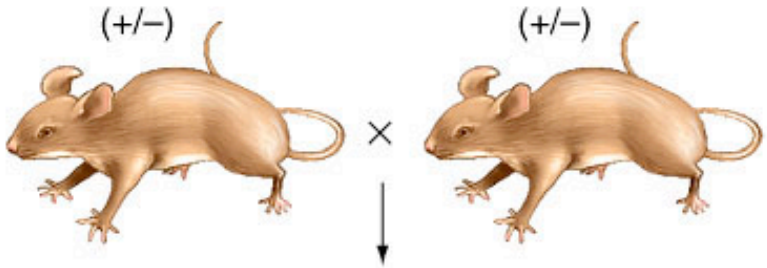
(g)

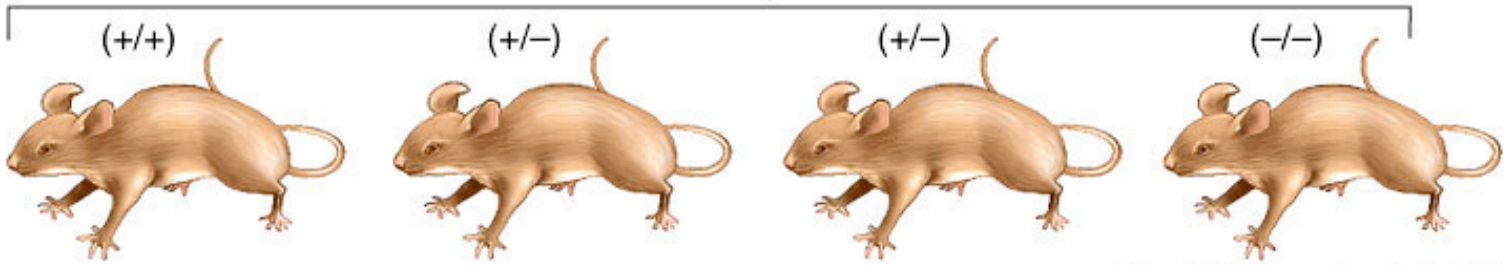
Three types of offspring



(h)

Use DNA analysis to identify male and female agouti animals that are heterozygous for the knockout allele of CFTR (+/–) and breed them together





Offspring homozygous for mutant allele serve as models for CF disease state.

Use DNA analysis to identify offspring homozygous for knockout allele to serve as models for cystic fibrosis disease state

Fig. E.15

HOX genes: Comprehensive example

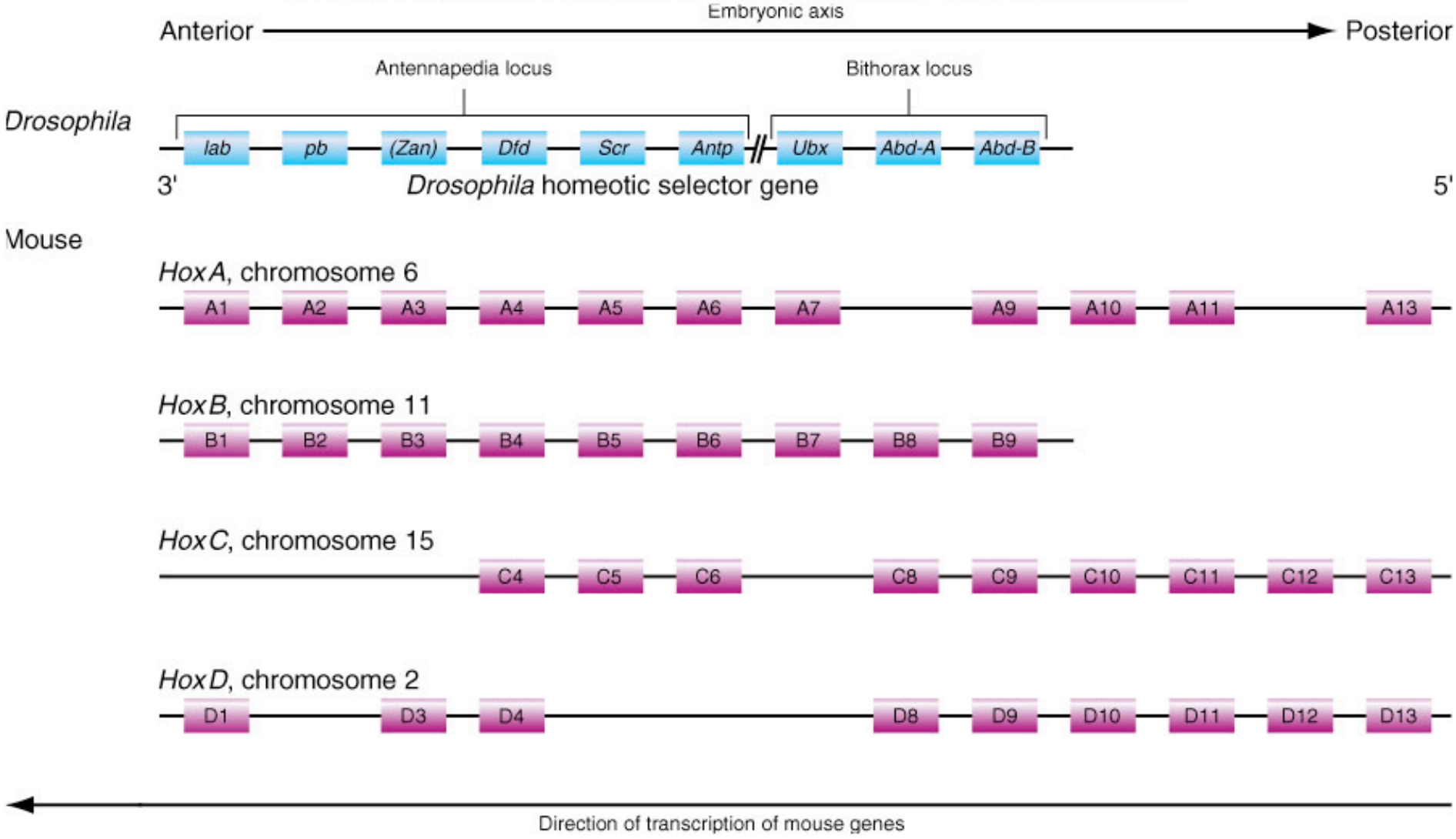
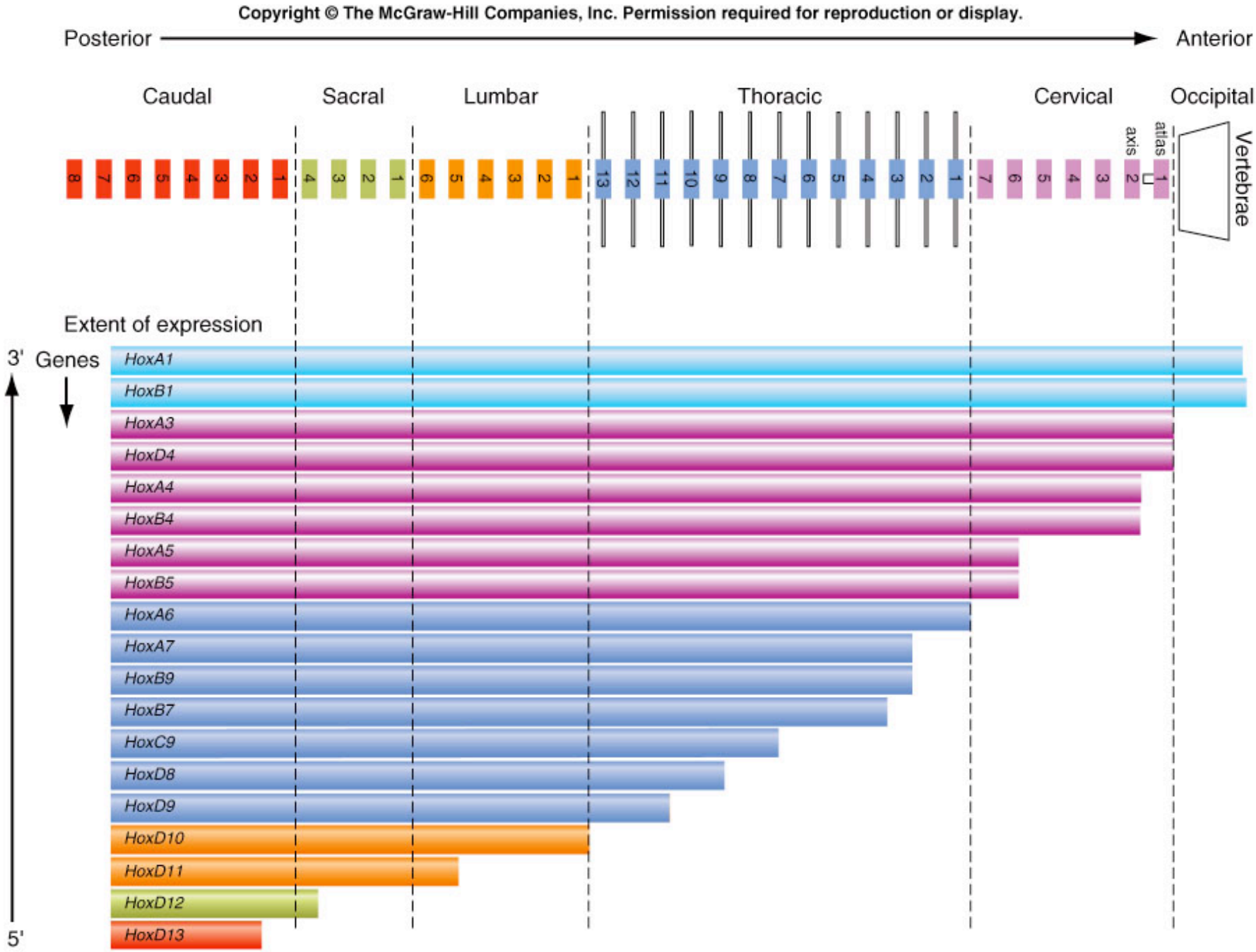


Fig. E.16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Posterior
Anterior
Caudal
Sacral
Lumbar
Thoracic
Cervical
Occipital
atlas
axis
Vertebrae
Extent of expression
3'
Genes
5'
HoxA1
HoxB1
HoxA3
HoxD4
HoxA4
HoxB4
HoxA5
HoxB5
HoxA6
HoxA7
HoxB9
HoxB7
HoxC9
HoxD8
HoxD9
HoxD10
HoxD11
HoxD12
HoxD13

Fig. E.17