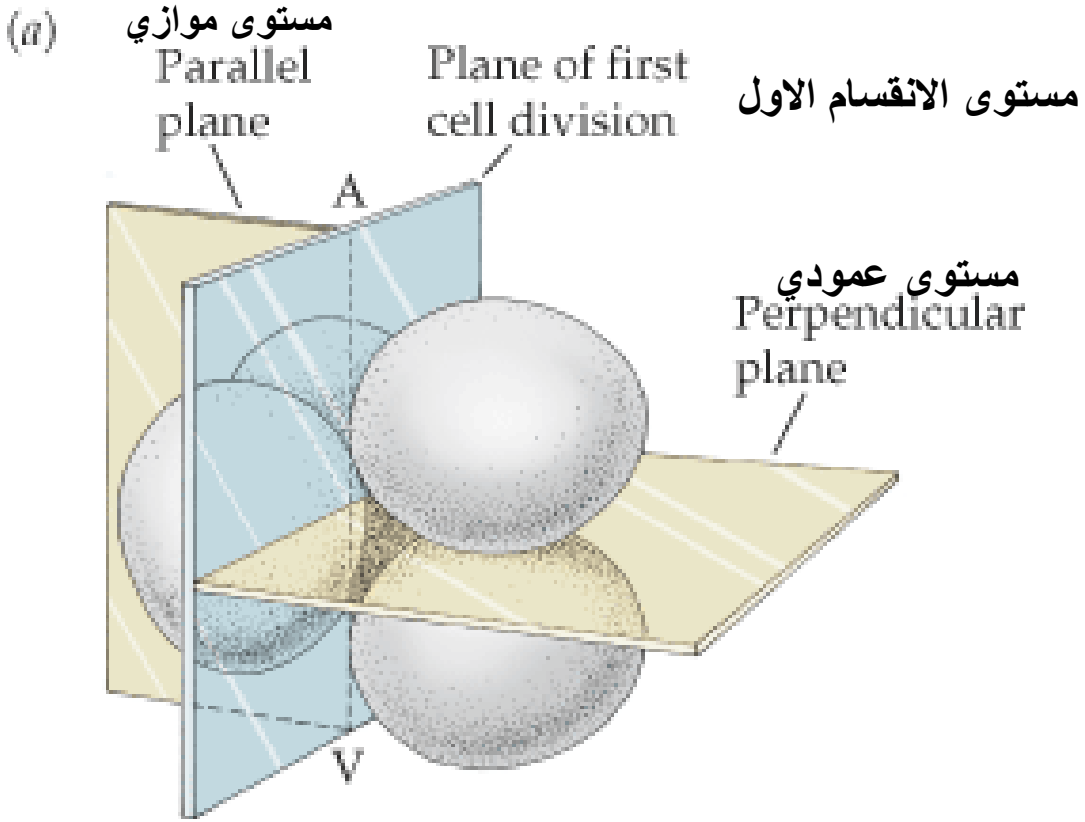
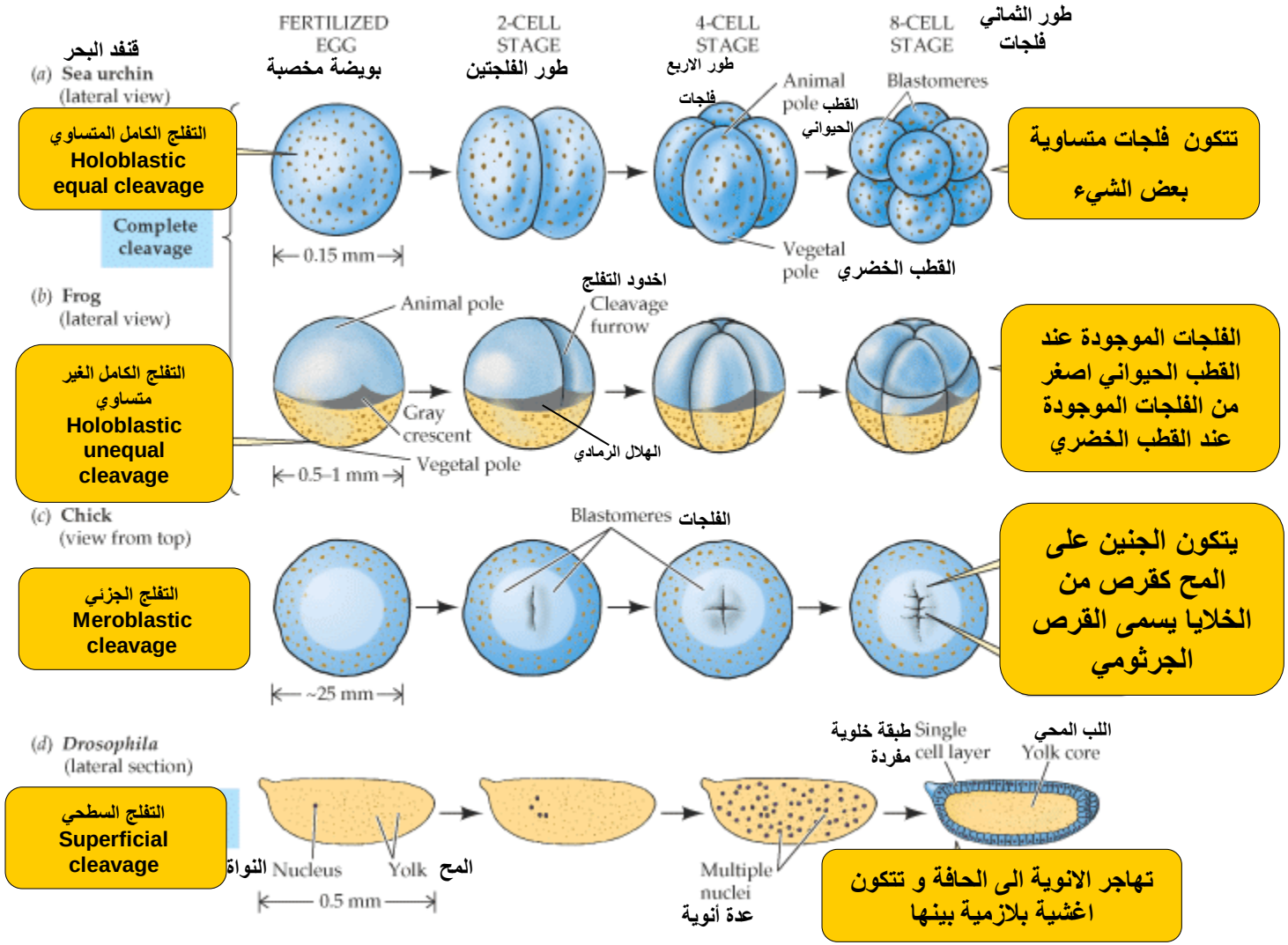
Chapter 4

Cleavage



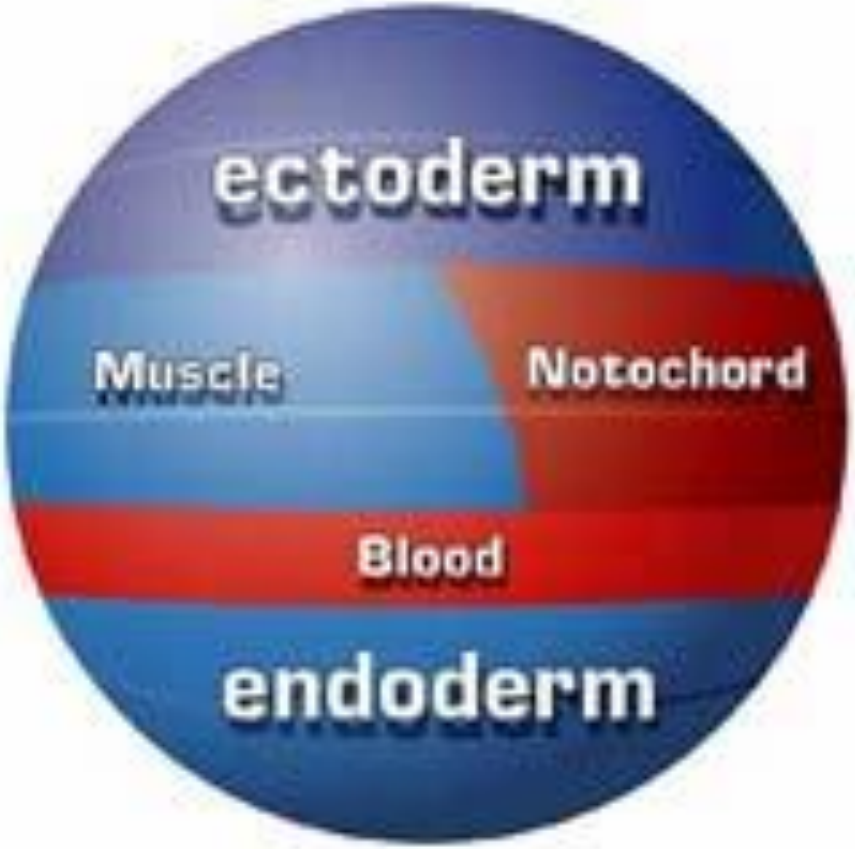
شكل (4 : 2) يبين مستويات التفلج من

(Purves *et al.*, 2003, Life , the science of Biology 7 th ed. Sinauer associates



شكل (4 :3) يوضح انواع التفلج من

(Purves *et al.*, 2003, Life , the science of Biology 7 th ed. Sinauer associates



شكل (4 : 5) يوضح مثال لخريطة المصير لاحد الكائنات في طور البلاستولا

www.learner.org/.../gendev/gendev_8.html

An **epithelium** is a sheet of cells, arranged on a **basement membrane**, each cell joined to its neighbors by specialized junctions, and showing a distinct apical–basal polarity.
Mesenchyme is a descriptive term for scattered stellate cells embedded in loose extracellular matrix.

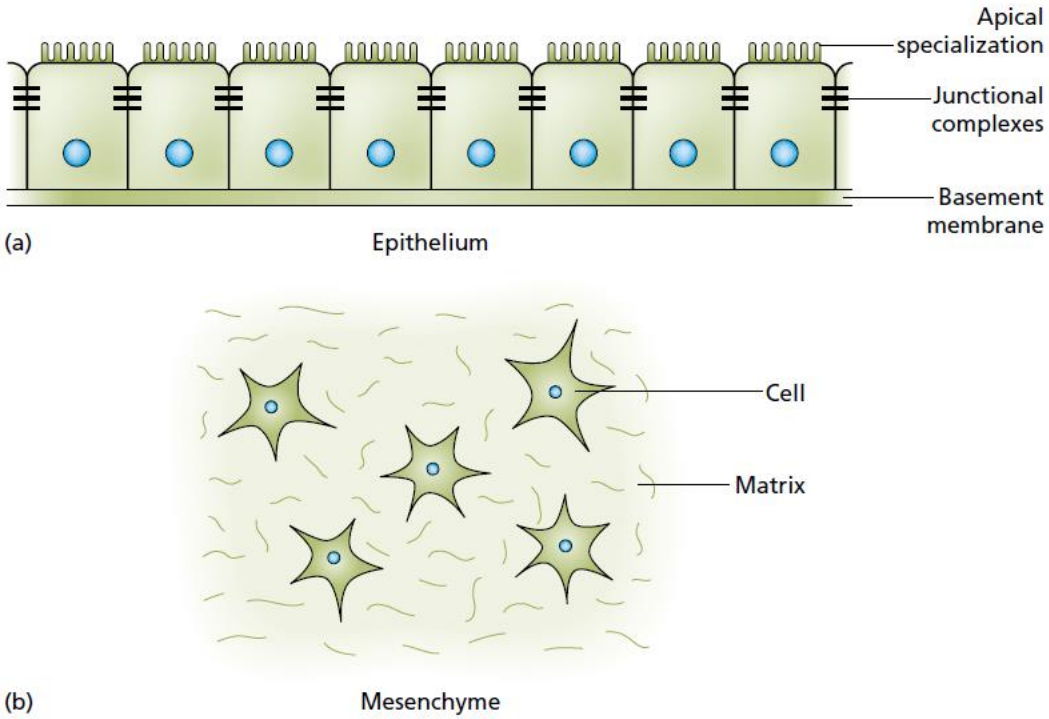


Fig. 2.8 Epithelium and mesenchyme.

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Cell Movement

The mechanism of cell movement is most apparent in fibroblasts moving on a substratum. They extend a flat process called a **lamellipodium** (plural **lamellipodia**) which is rich in microfilaments.

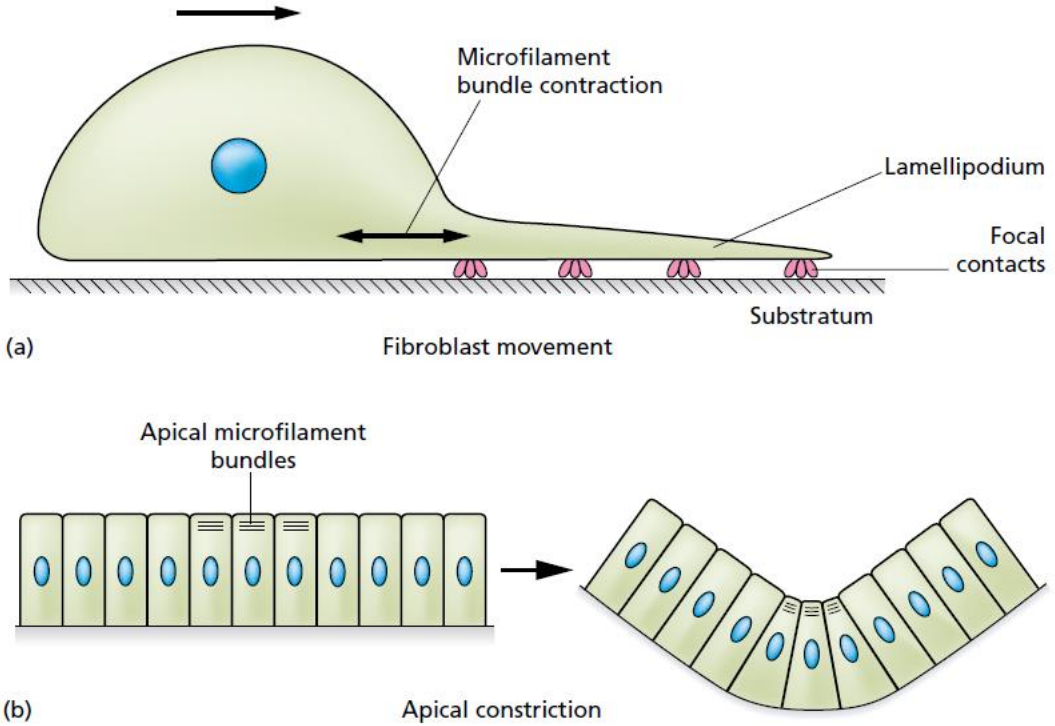

Fig. 2.9 Types of cell movement.

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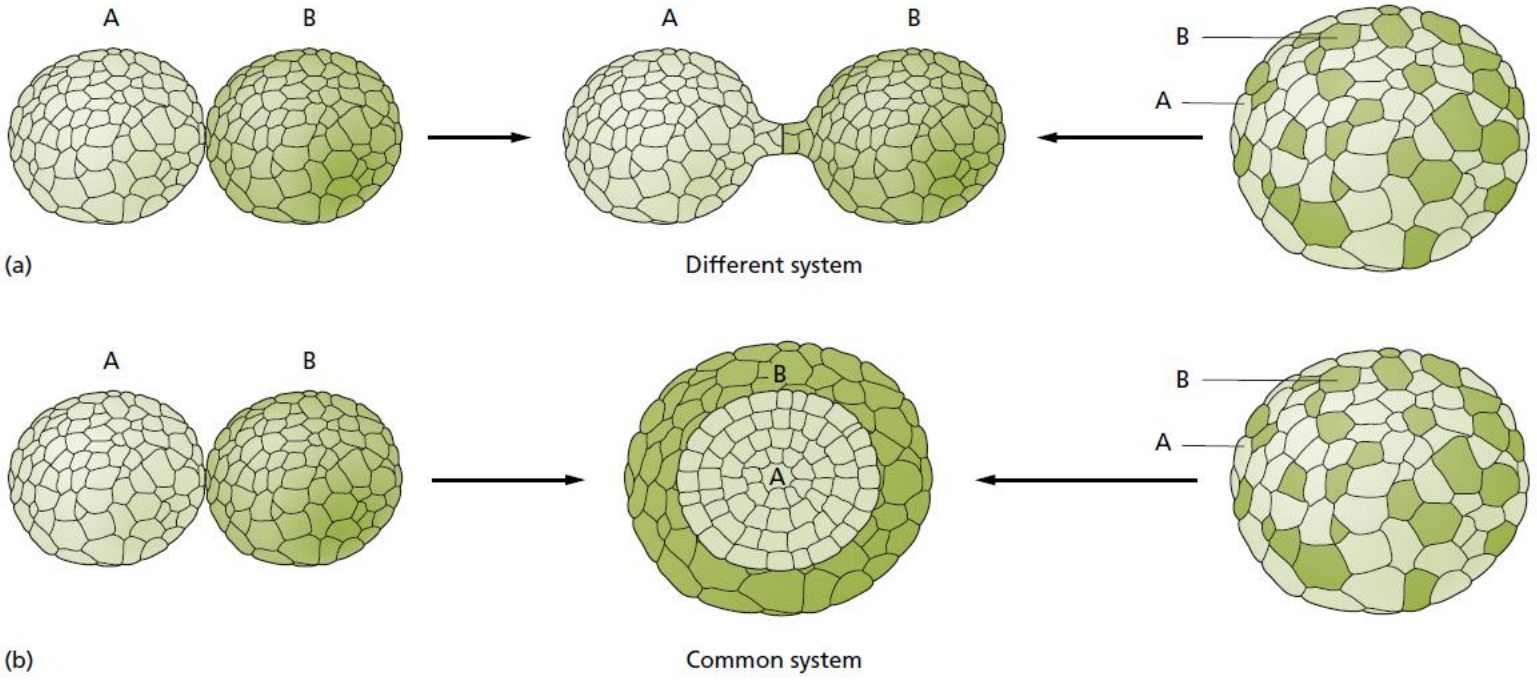

Fig. 2.10 Cell-sorting processes. (a) Cell types A and B each have their own adhesion mechanism, so adhesion A–B<<adhesion A–A or B–B. (b) Cell types A and B have the same adhesion mechanism, but adhesion A–A>B–B and adhesion A–B has the average strength: (A–A + B–B)/2. The center image in (b) represents a section while the others represent surface views.

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Classification of morphogenetic processes

- **invagination:** in folding of a cell sheet to form an internal protrusion or pocket
- **involution:** internalization of a cell sheet by movement led by a free edge

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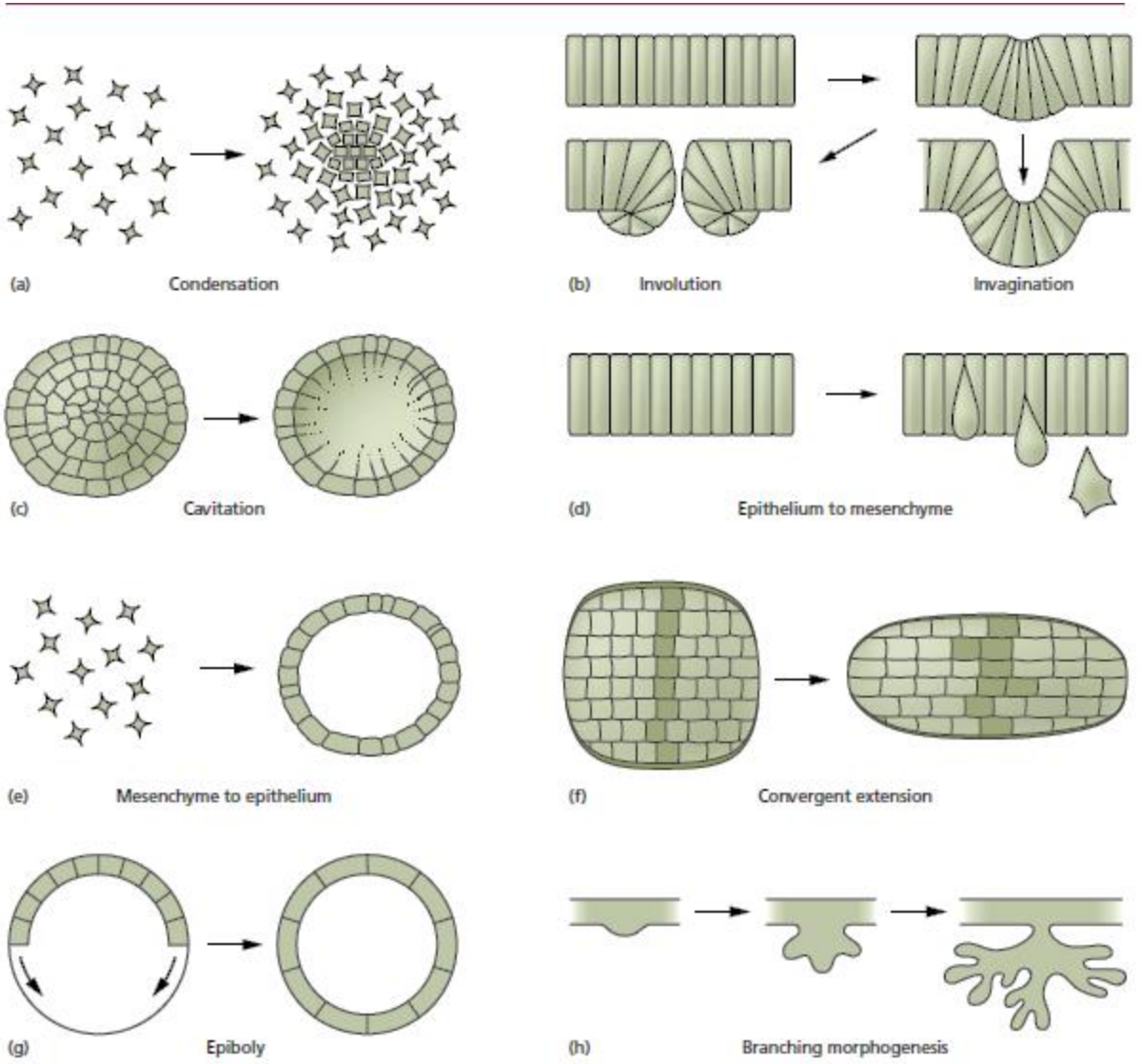

Fig. 2.11 Classification of morphogenetic processes. (a) Mesenchymal condensation. (b) Invagination and involution. (c) Cavitation. (d) Epithelium to mesenchyme transition. (e) Mesenchyme to epithelium transition. (f) Convergent extension. Here a typical file of cells is labeled and the intercalation movements of the cells rearrange the file so that some cells are excluded. (g) Epiboly. (h) Branching morphogenesis.

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Classification of morphogenetic processes

- **cavitation:** formation of an internal cavity in a cell mass
- **condensation:** (1) a dense patch of cells within a **mesenchyme**; (2) formation of such a patch
- **convergent extension:** morphogenetic movement in which a cell sheet elongates and narrows because of active movements of the constituent cells to alter the overall packing arrangement

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Classification of morphogenetic processes

- **branching morphogenesis:** formation of a branched structure by cell movement and/or growth of an **epithelium**
- **epiboly:** active spreading and increase in area of a cell sheet

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Key Points to Remember

- The main processes in animal development are regional specification, cell differentiation, morphogenesis, and growth.
- Whole animal cloning experiments show that the full set of genes is retained by somatic cells. Development therefore involves the control of gene expression.
- Gametes arise from cells of the germ line by meiosis.
- Events at the earliest stages of development involve components preformed in the egg and so depend on the genome of the mother.
- Animal development normally involves an early cleavage stage leading to the formation of a blastula or blastoderm.
- This early cleavage stage is followed by a phase of morphogenetic movements called gastrulation during which the three germ layers: ectoderm, mesoderm, and endoderm are formed.
- Morphogenetic processes include condensation, involution, invagination, cavitation, transitions between epithelium and mesenchyme, epiboly, and branching processes.
- The cell cycle of G1, S, G2 and M phases, is universal but is modified for specialist developmental processes such as meiosis and cleavage divisions. Growth requires increase in size as well as cell division.

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