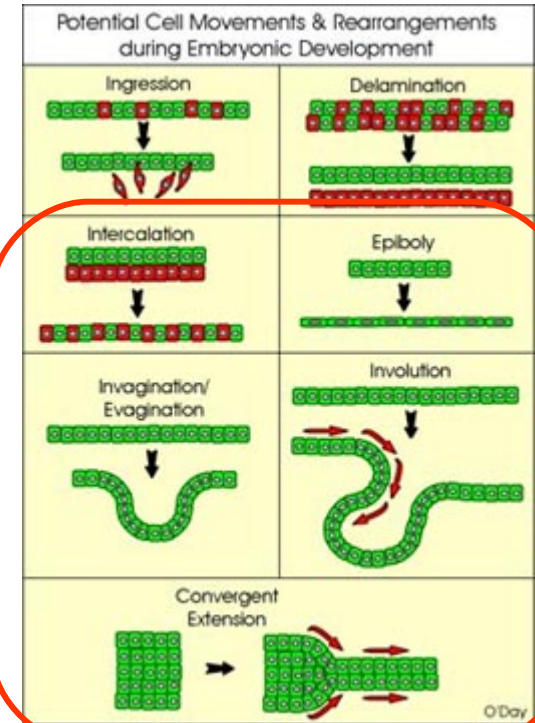
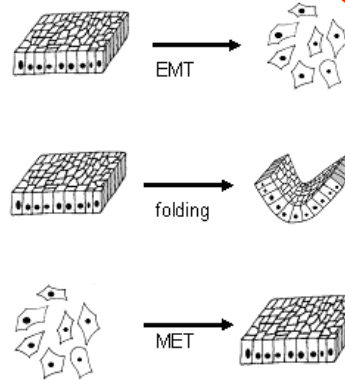
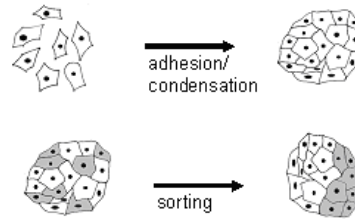
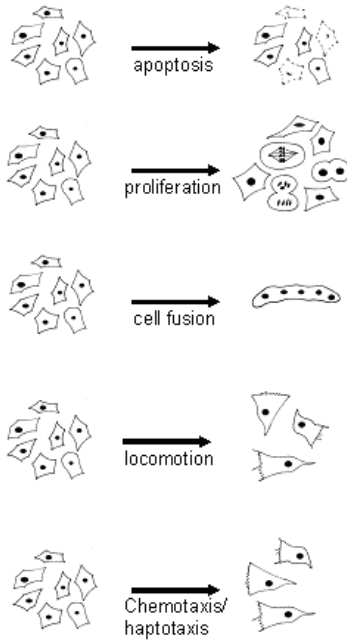


Mechanisms of development: epithelial origami

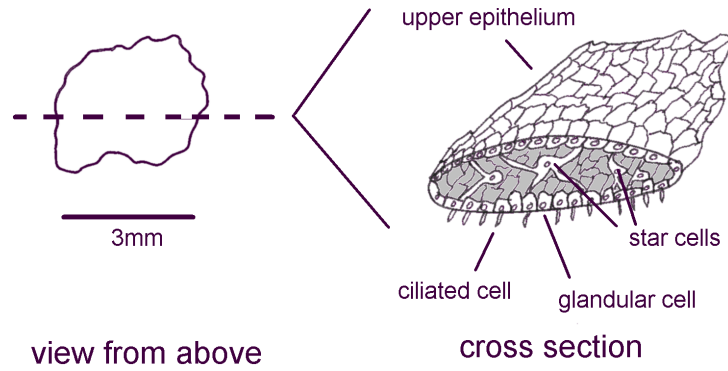


Ten basic mechanisms of animal morphogenesis:

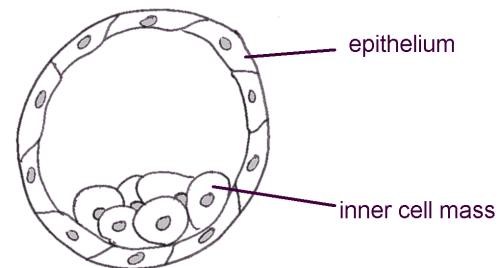


This lecture

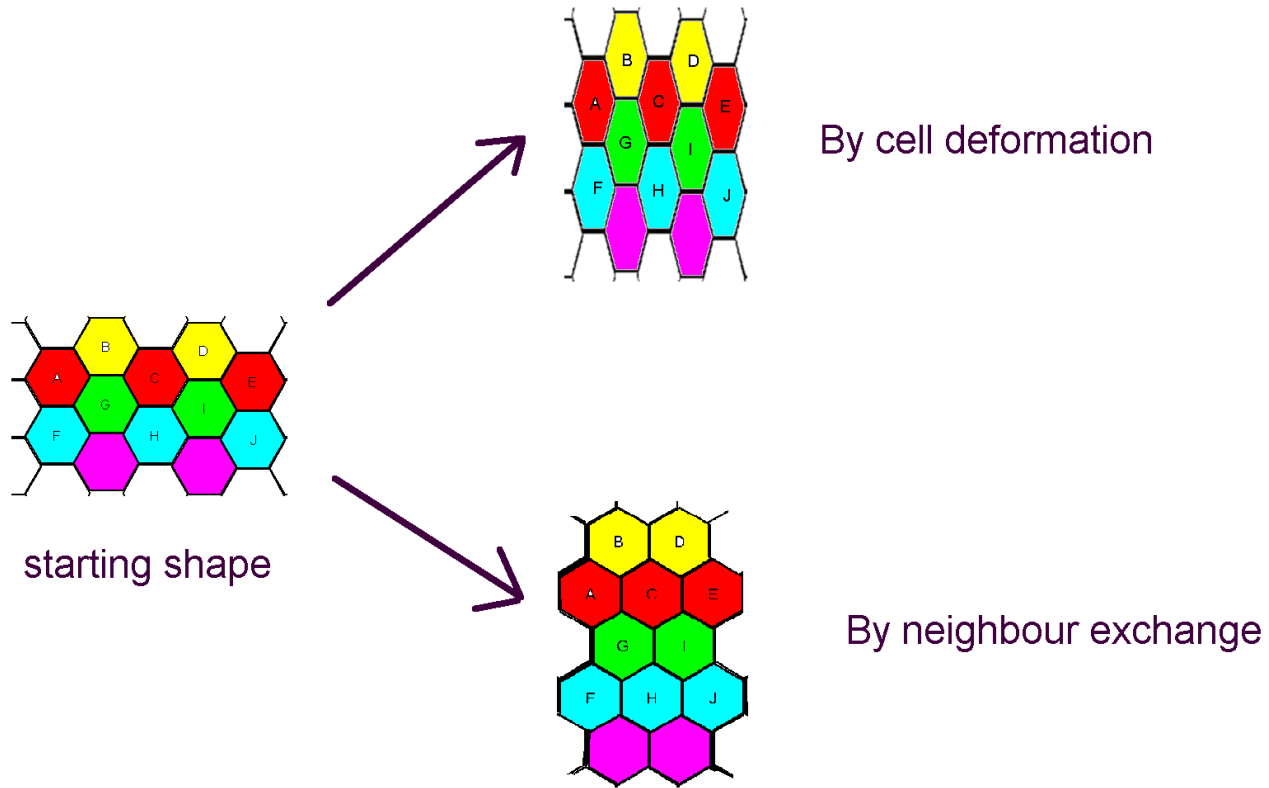
T. adhaerens adult



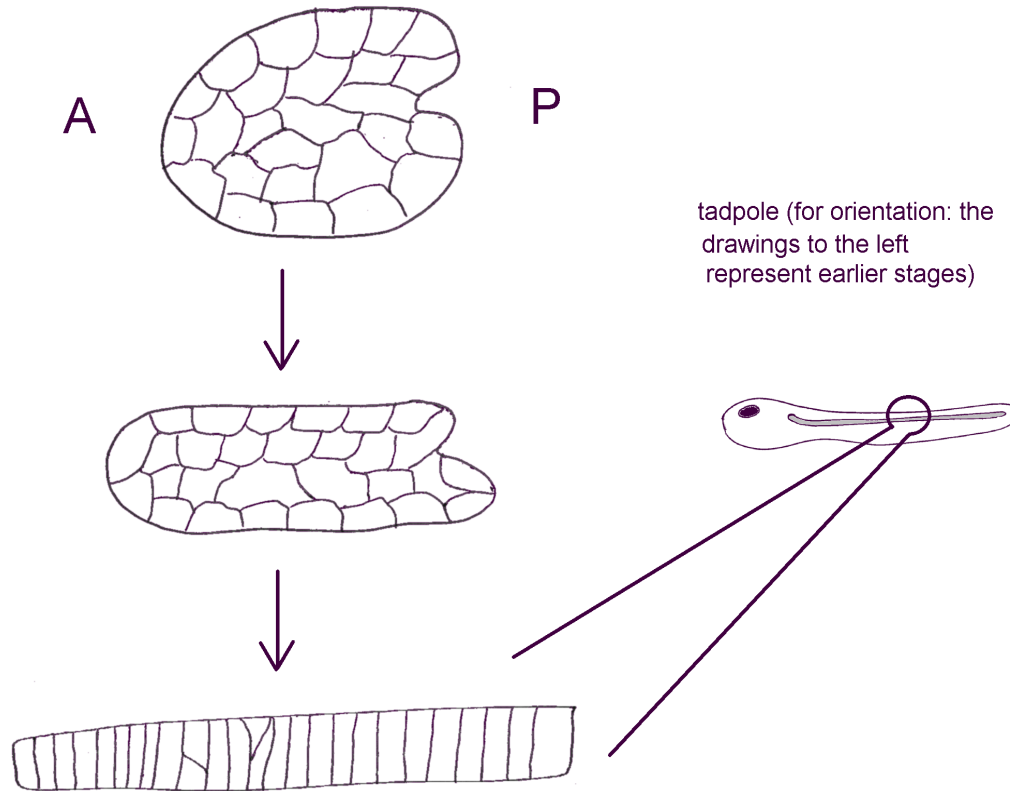
H. sapiens 4-day blastula



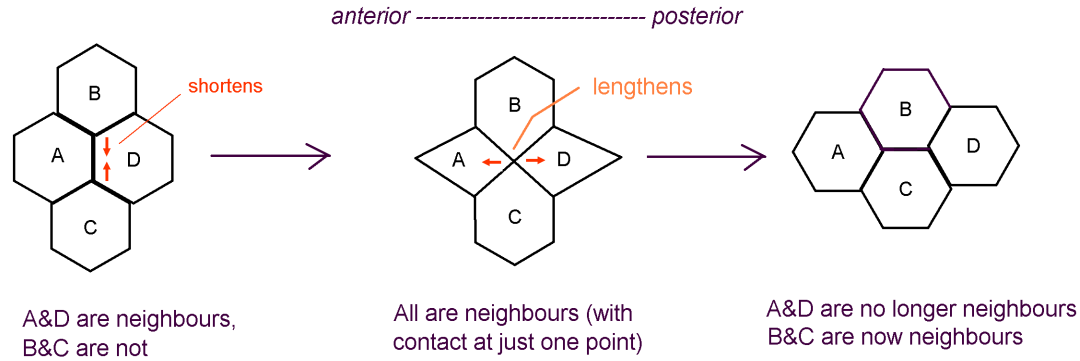
Short and fat to long and thin:



Corella inflata

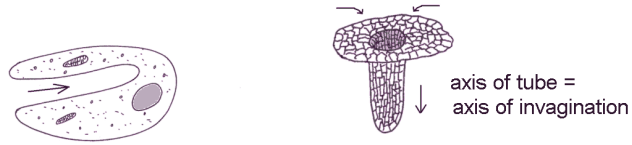


Convergent extension works by some boundaries shrinking while others expand:

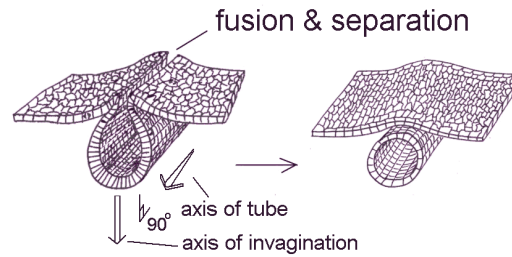


Making tubes:

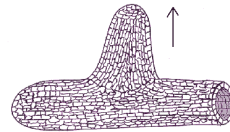
AXIAL
INVAGINATION



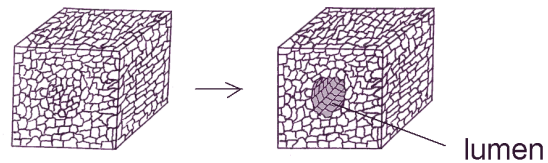
ORTHOGONAL
INVAGINATION



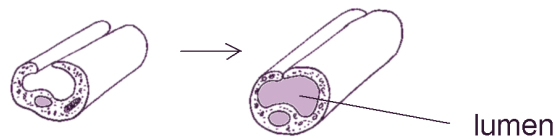
EVAGINATION

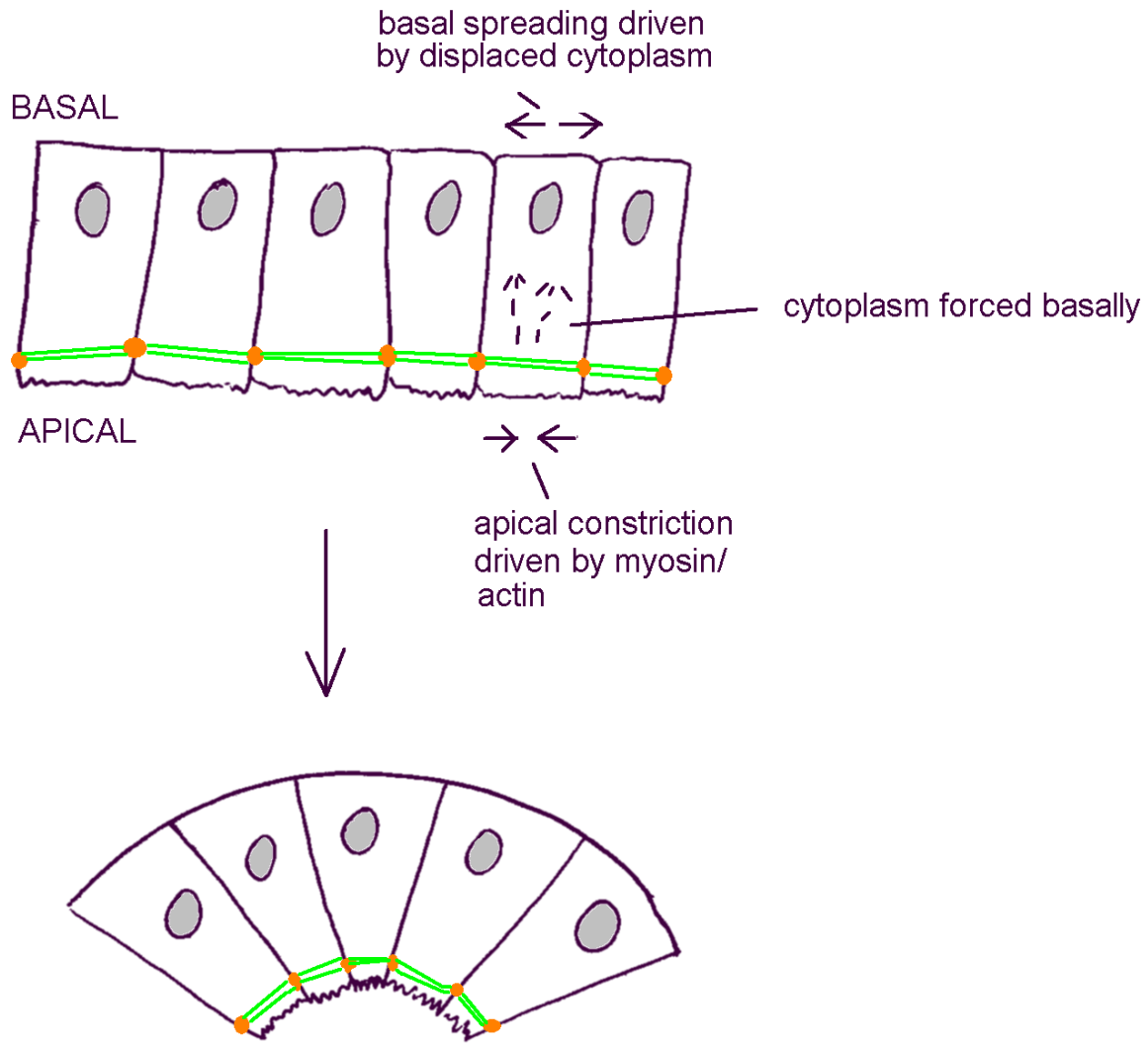


CAVITATION



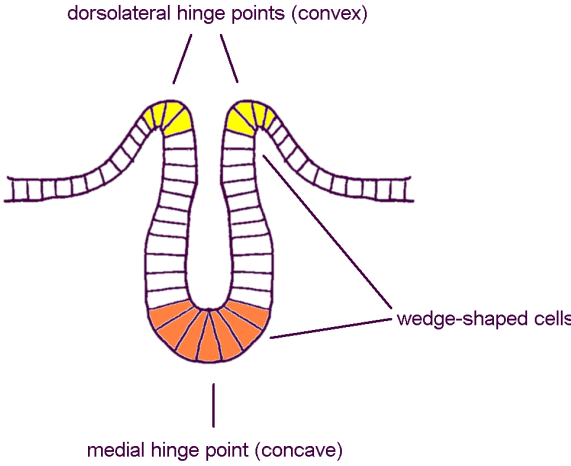
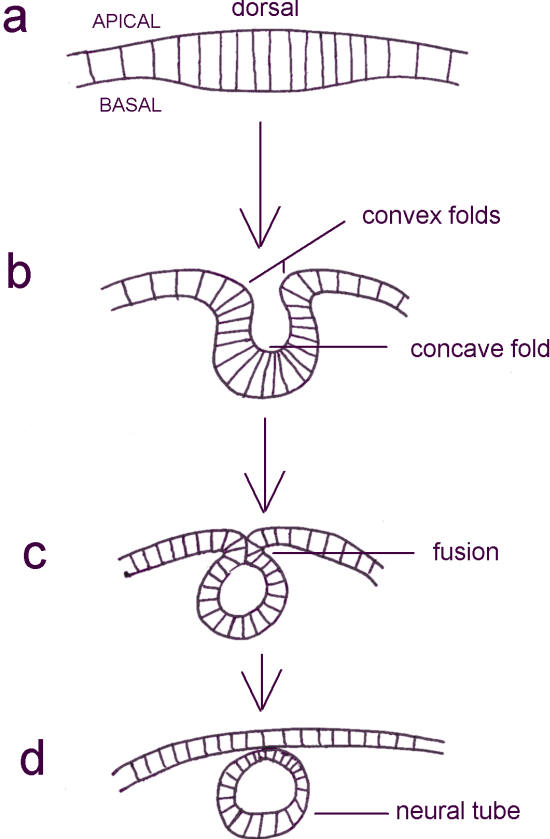
WRAPPING



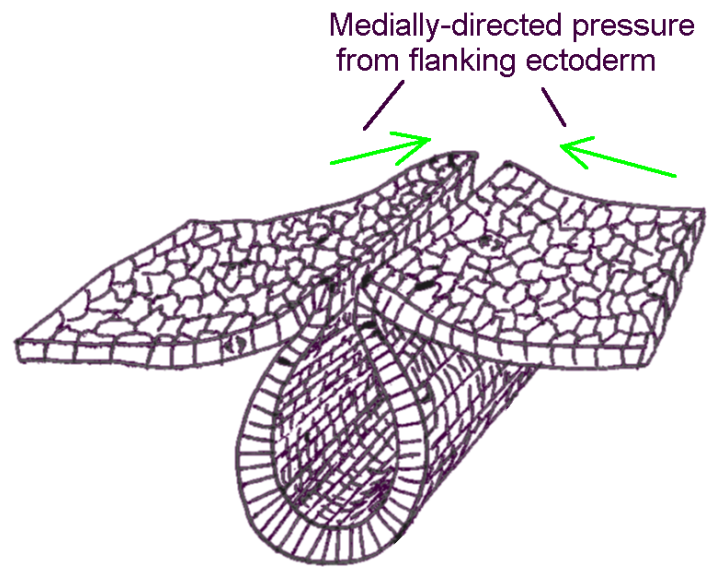


Pic: Davies *Mechanisms of Morphogenesis*

Orthogonal invagination of the neural tube

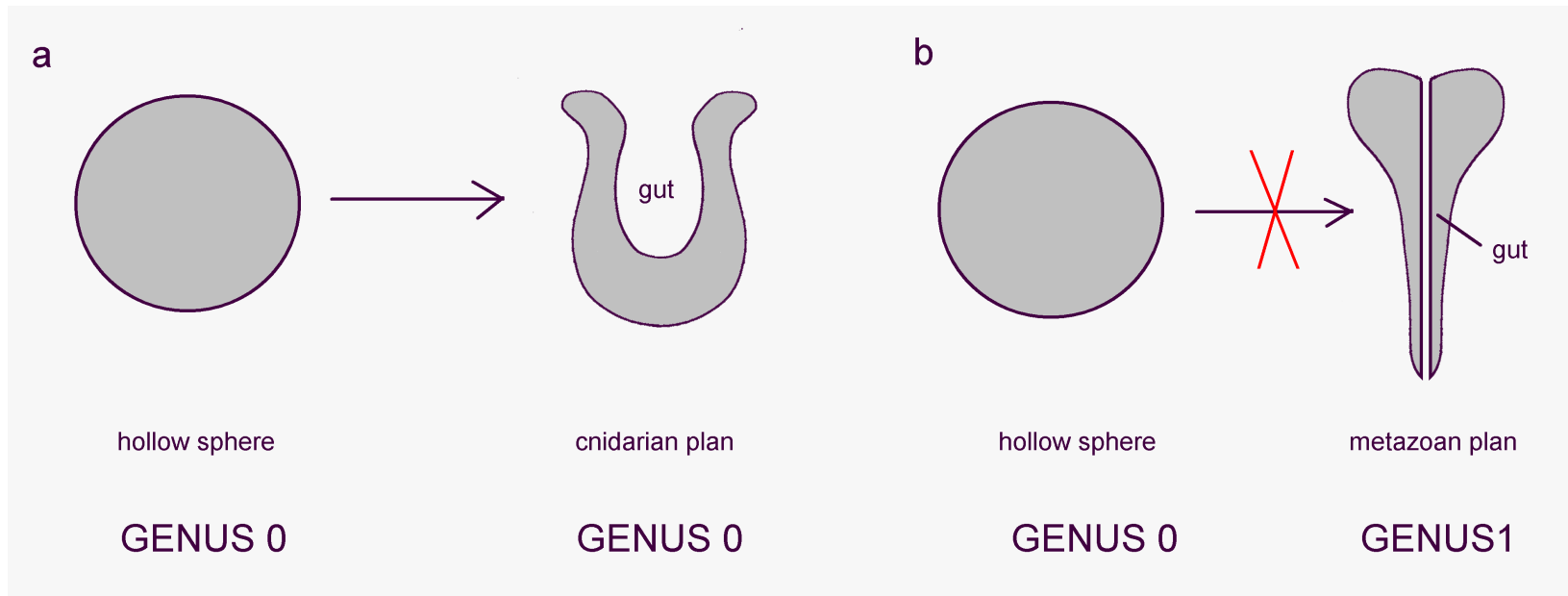


Pic: Davies *Mechanisms of Morphogenesis*

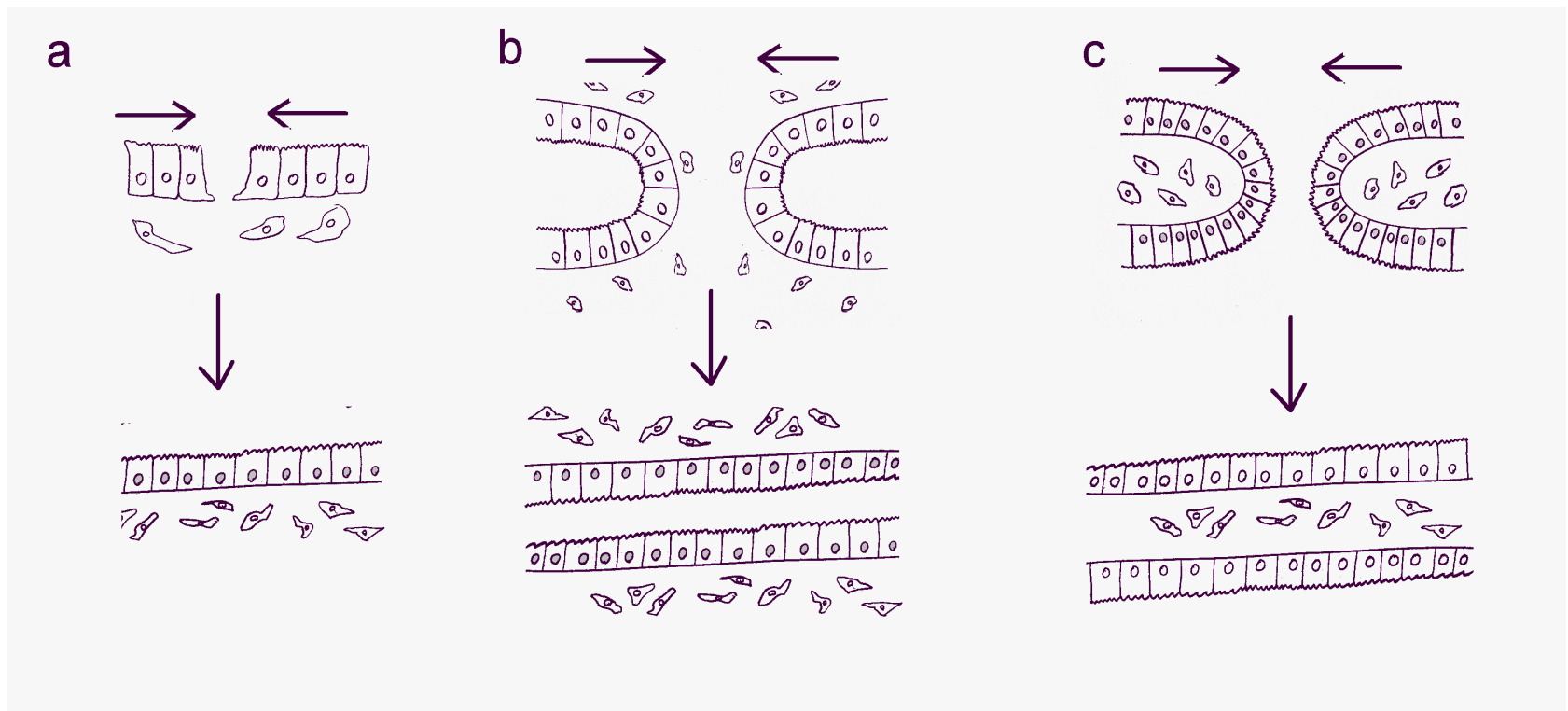


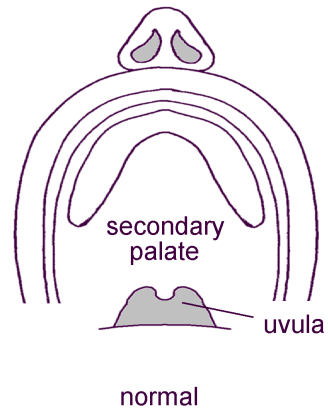
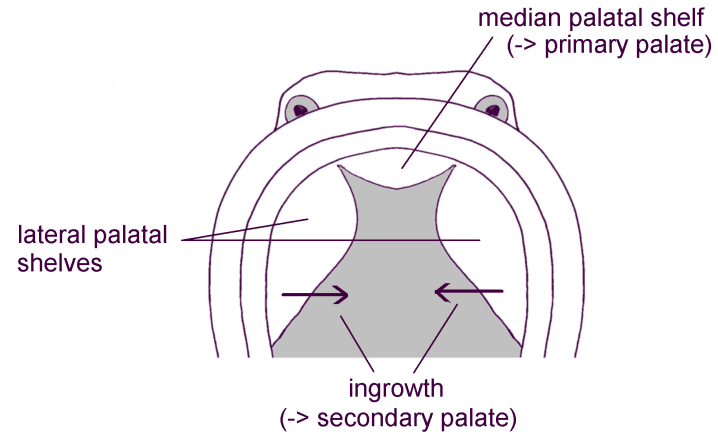
Pic: Davies *Mechanisms of Morphogenesis*

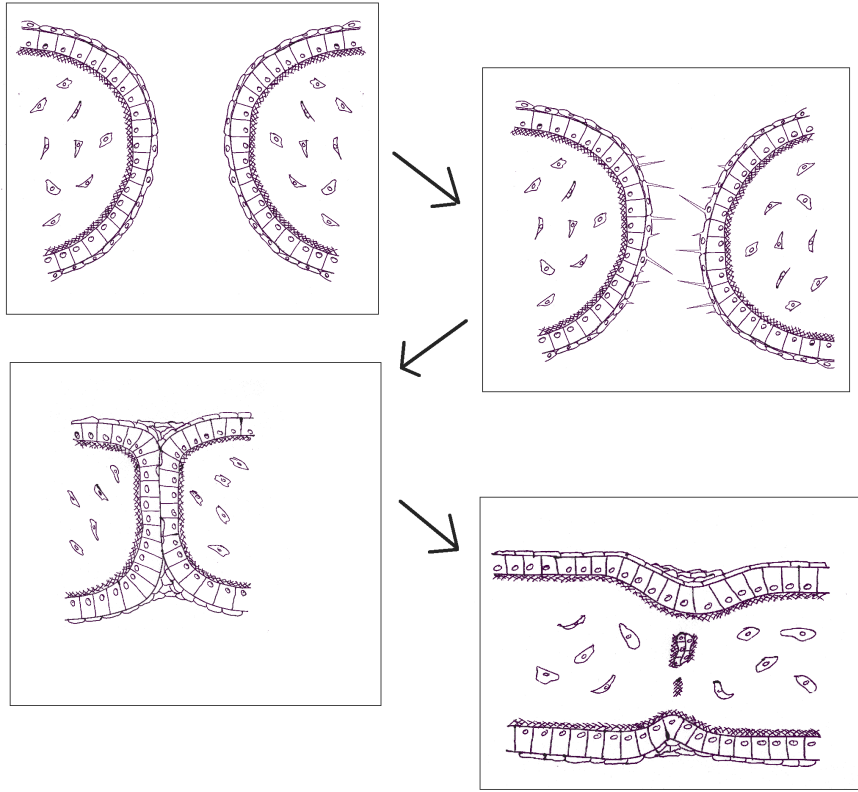
The need for fusion:



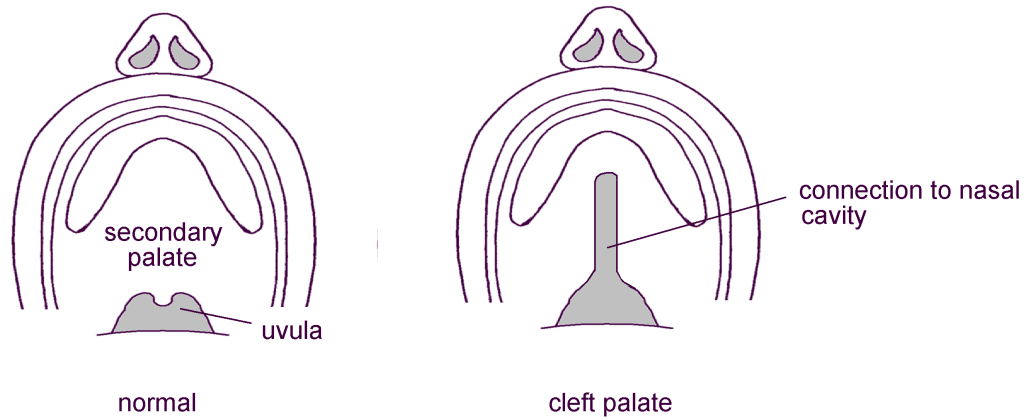
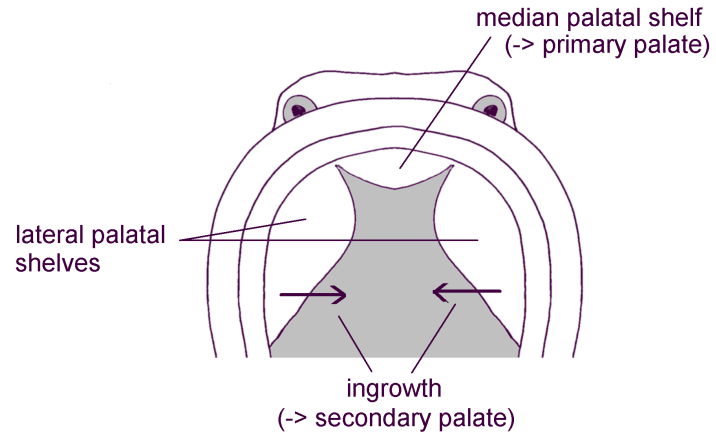
Three ways of fuding (wound healing, tube connection, palate fusion)

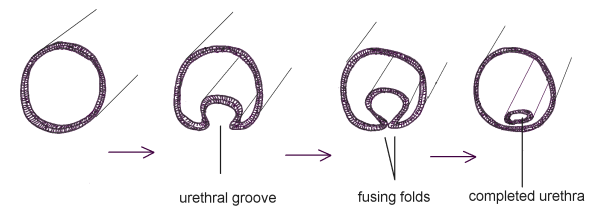
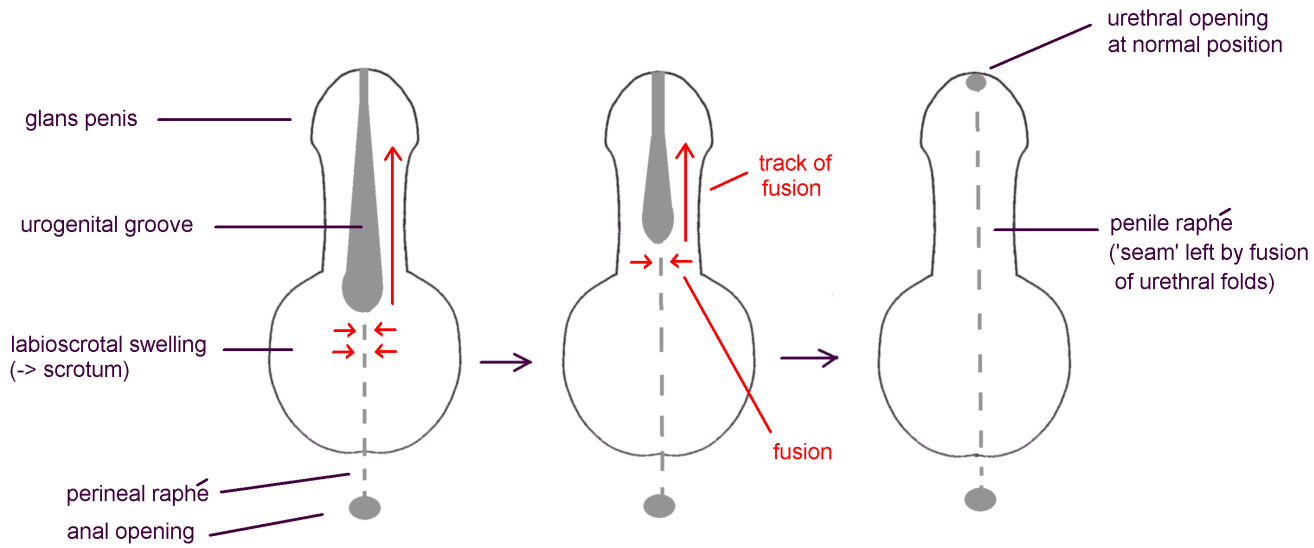
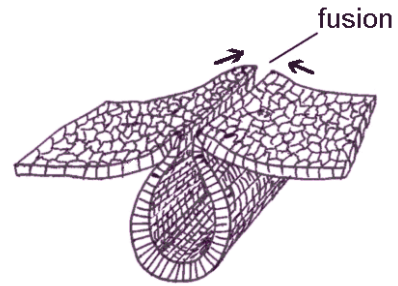






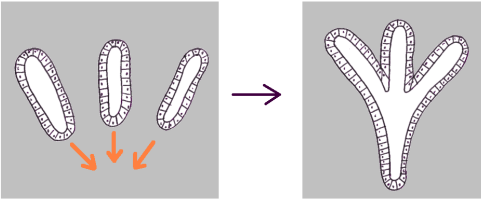
Pic: Davies *Mechanisms of Morphogenesis*



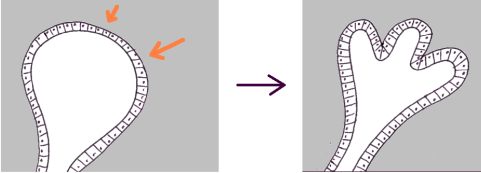


Pic: Davies *Mechanisms of Morphogenesis*

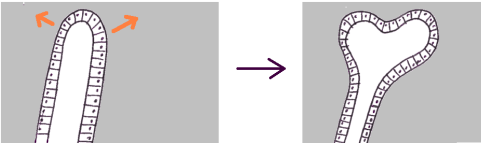
Branching



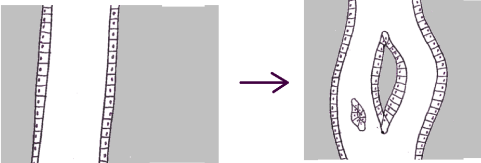
confluence



clefting

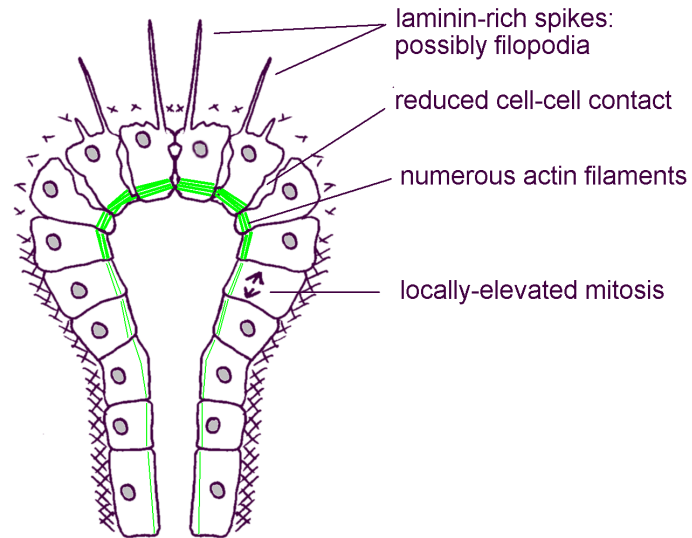


sprouting

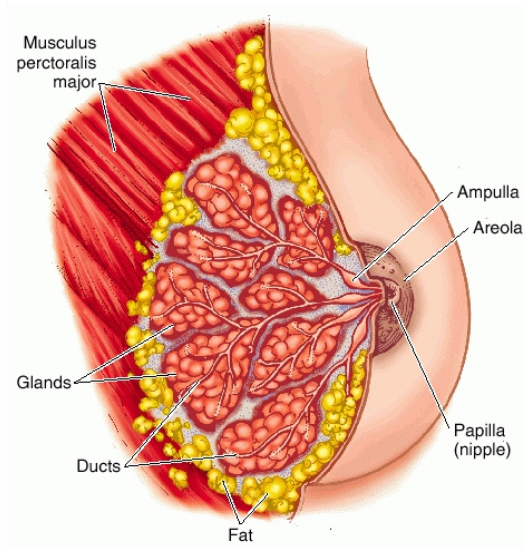


intussusception

The branching tip

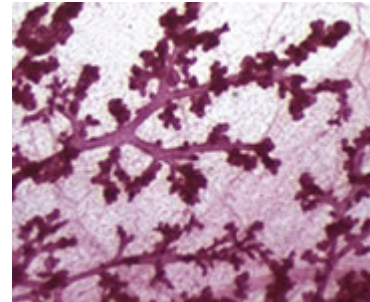
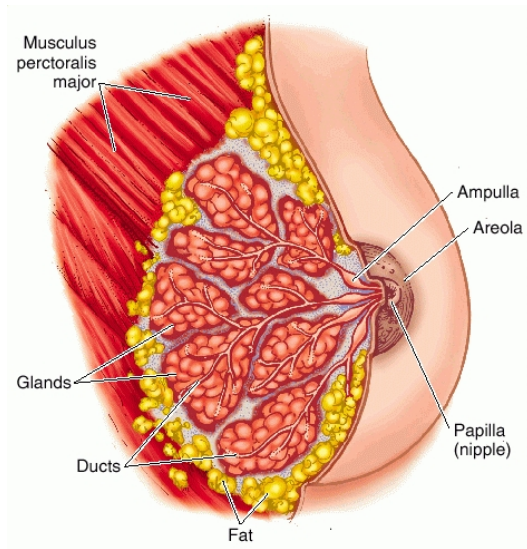


The mammary gland: lots of branched tubules



http://medical-dictionary.thefreedictionary.com/_/viewer.aspx?path=dorland&name=glandula_mammaria.jpg

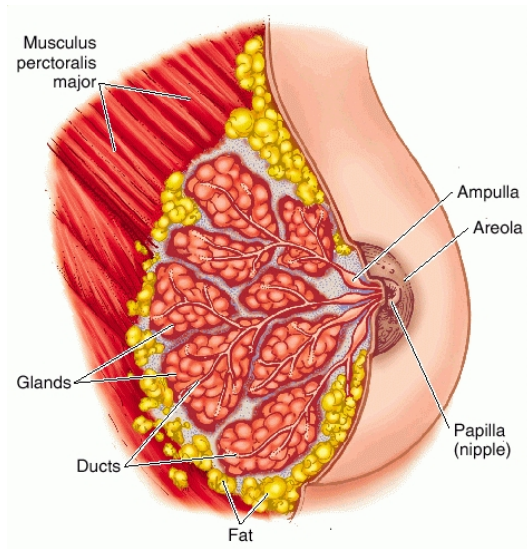
The mammary gland:



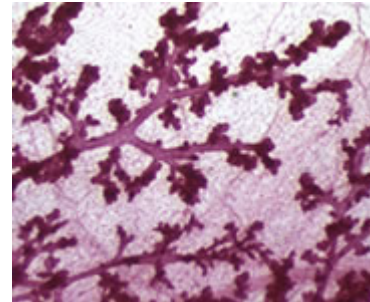
<http://www.breastcentre.manchester.ac.uk/streuli.shtml>

http://medical-dictionary.thefreedictionary.com/_/viewer.aspx?path=dorland&name=glandula_mammaria.jpg

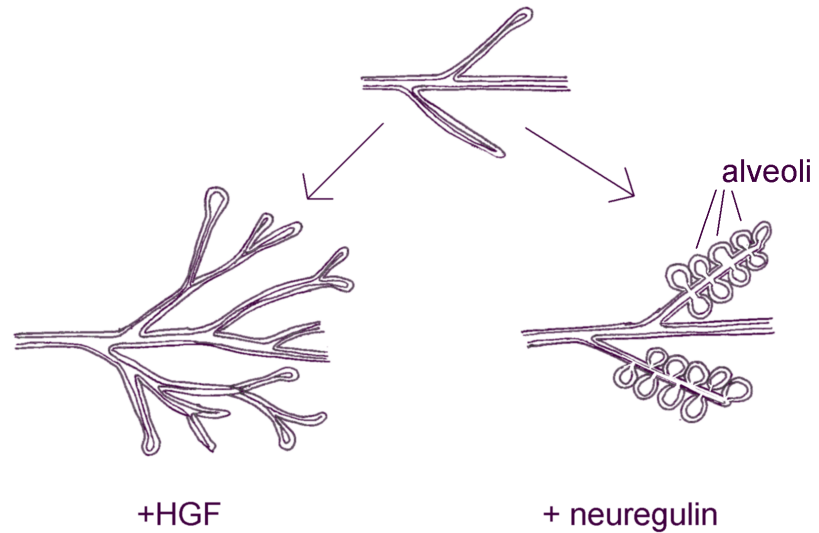
The mammary gland:



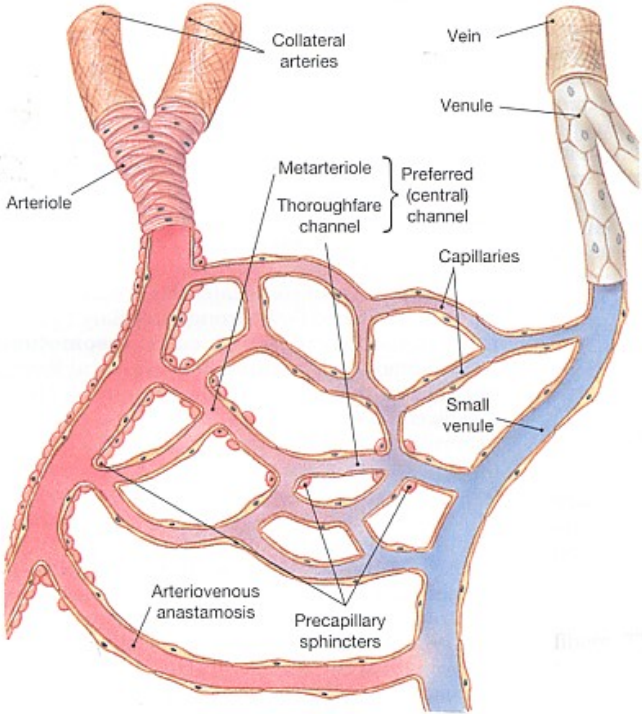
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<http://www.breastcentre.manchester.ac.uk/streuli.shtml>

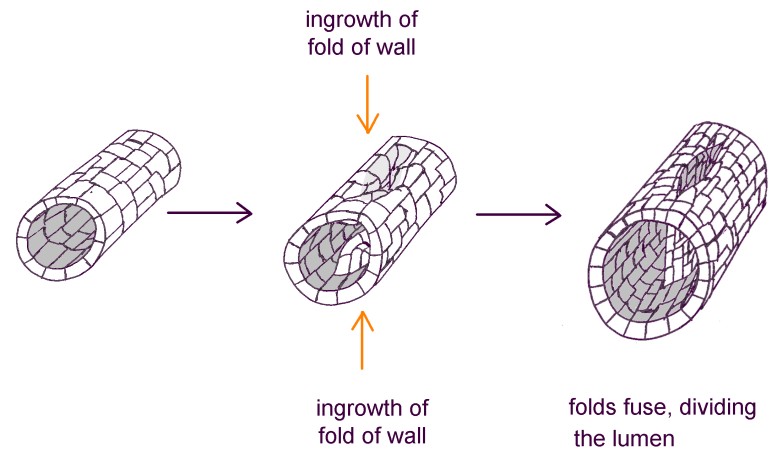
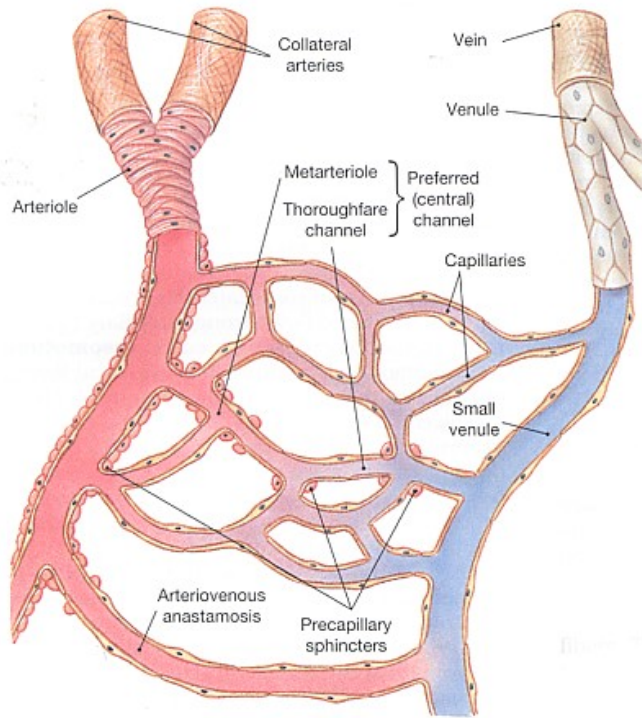


Vascular branching: intussusception

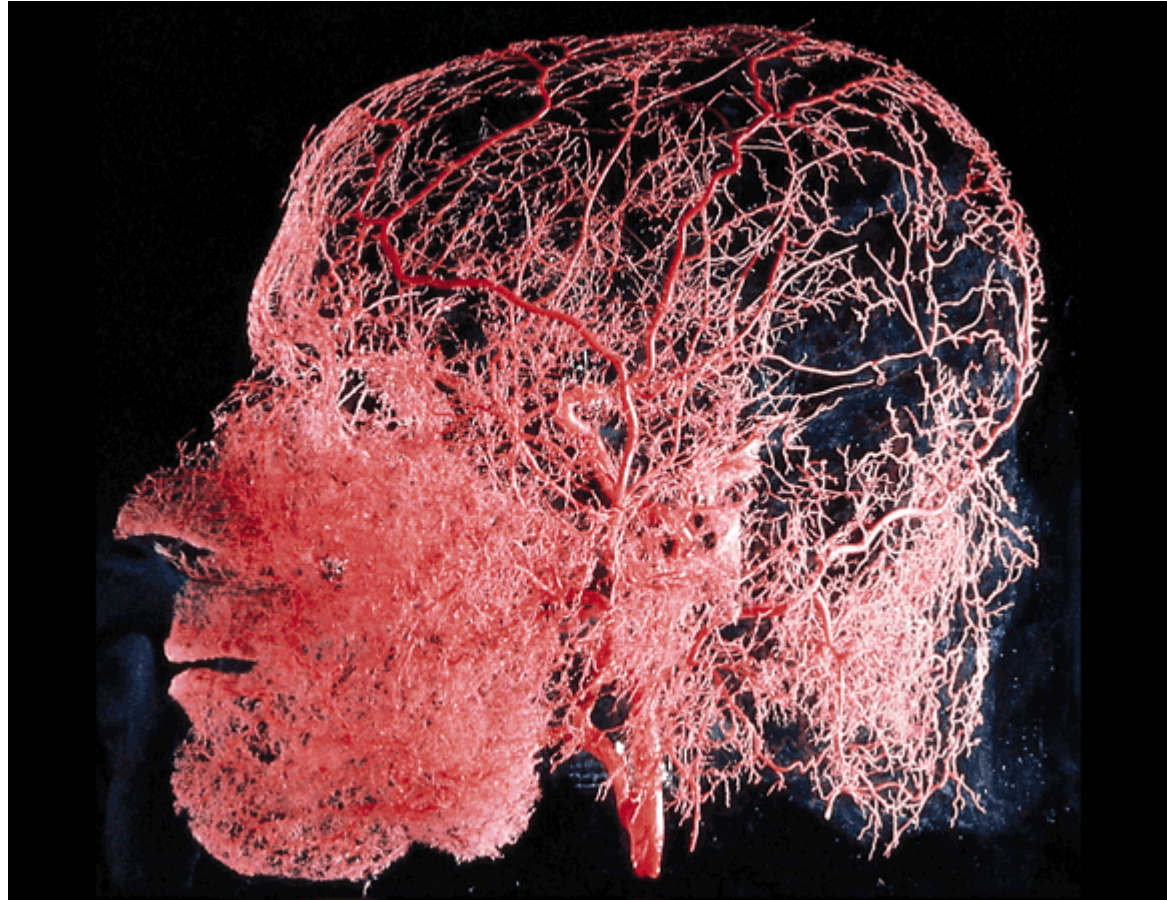
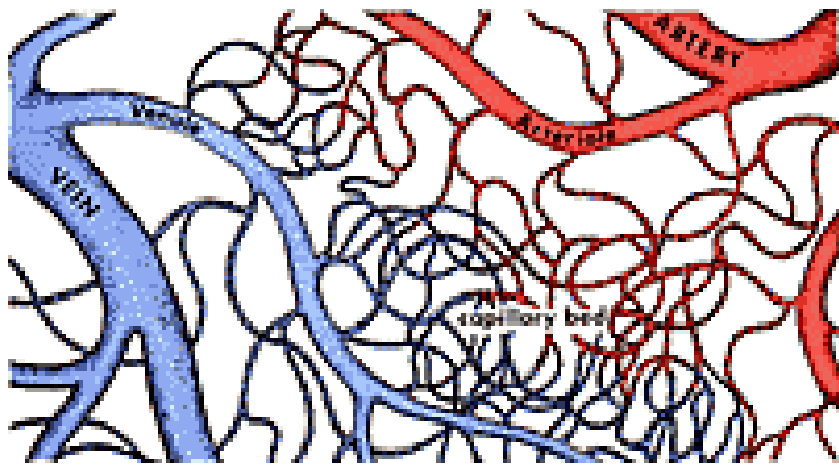


Pic:
http://www.bg.ic.ac.uk/Staff/khparker/homepage/BSc_lectures/2002/_Cardiovascular_Mechanics.html

Vascular branching: intussusception

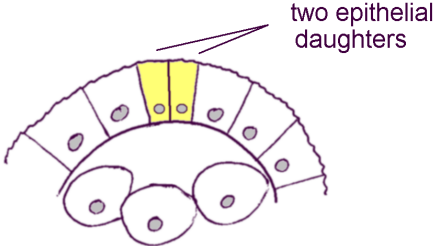
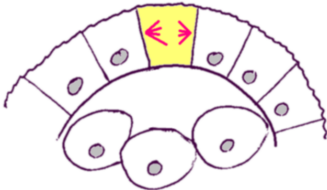


Pic: Davies *Mechanisms of Morphogenesis*

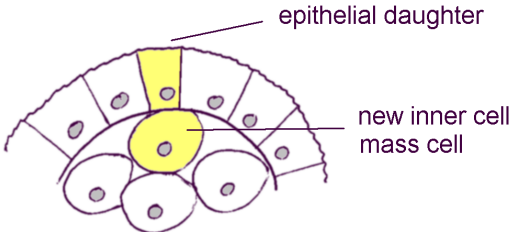
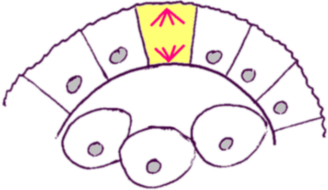


Other mechanisms of morphogenesis: orientated mitosis

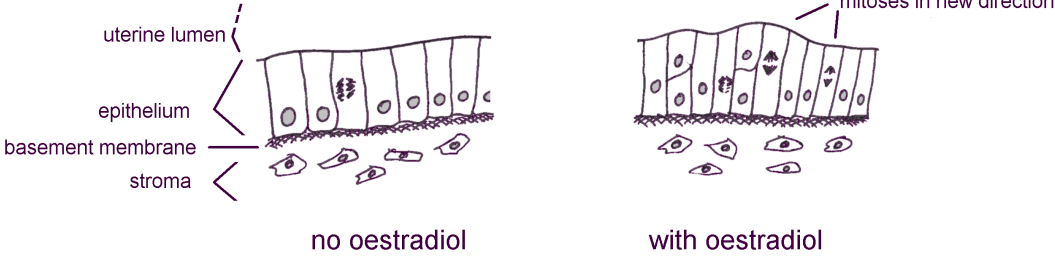
Division within epithelial plane



Division perpendicular to epithelial plane

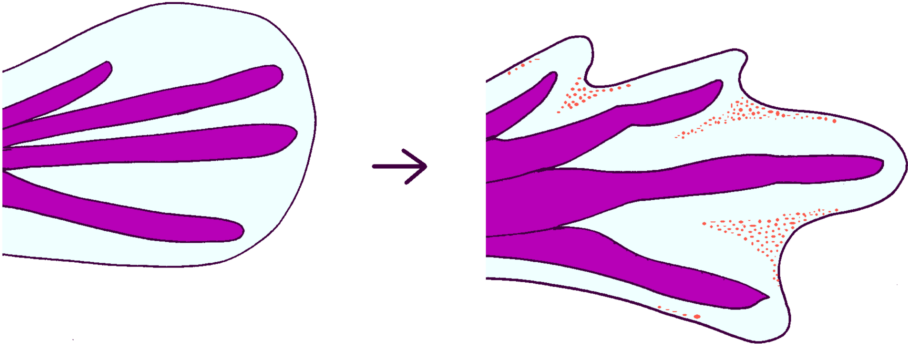


Endometrial thickening in rat:

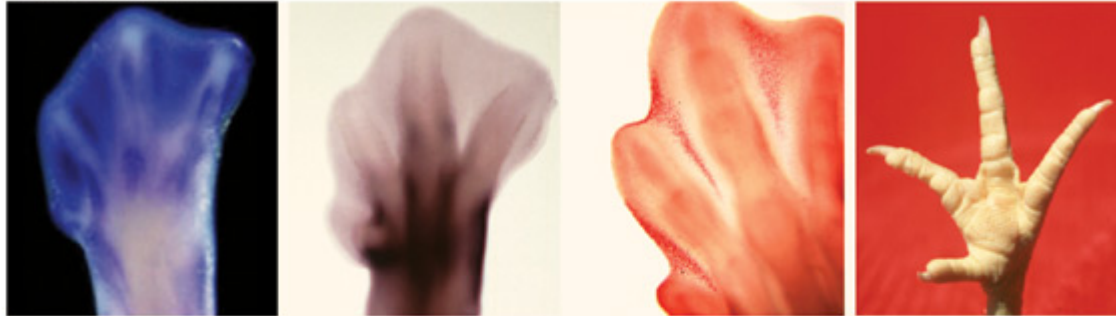


Other mechanisms of morphogenesis: elective cell death

Hands:



Chicken hindlimb



Duck hindlimb



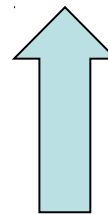
BMP

Gremlin

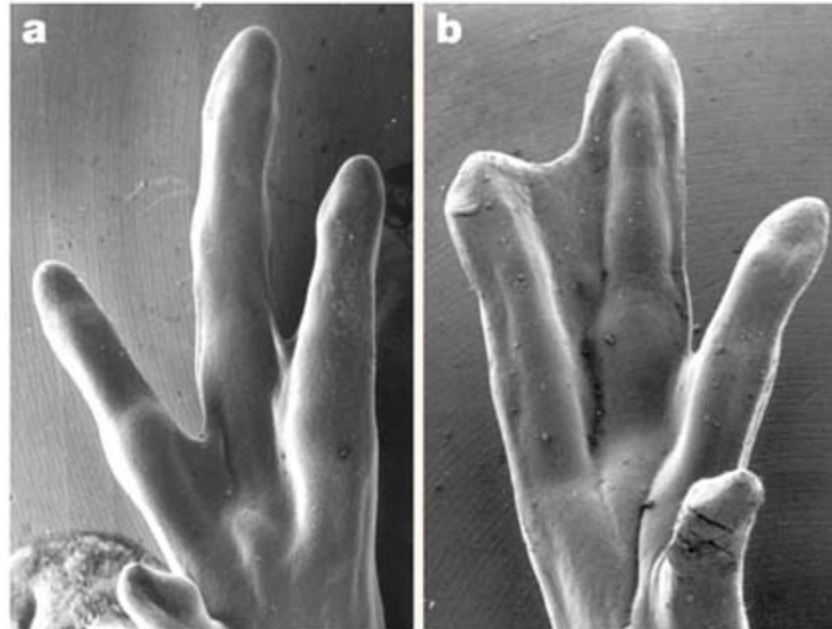
Apoptosis

Newborn

Nature Reviews | **Genetics**



A is a normal chick: b has had Gremlin applied, which has reduced elective cell death:



Summary of the main points of these lectures:

Seen anatomically, morphogenesis of mouse and man follows a set sequence of rather complicated morphogenetic events (lecture 1)

Seen mechanistically, these complicated events rest on a set of about a dozen "simple" events such as cell migration (lecture 2), epithelial folding (lecture 3), cell condensation (not covered much in these lectures) etc.

These 3rd year lectures are designed to make you familiar with the way that basic morphogenetic mechanisms are combined to make anatomy, and how this can go wrong.

If you do 4th year Dev Biol, you will learn how the mechanisms are controlled at a molecular level and the principles by which action of 'dumb' molecules results in 'intelligent' constructive behaviour, on which our development rests (this is a core course of DevBiol4, lasting the whole of semester 1, taught entirely by me).