EMBRYOGENESIS

Essentially after ovulation when the ovocite is expelled from the ovary the ovocyte moves along in the ovary tube and if there is the fertilization we have the development of the zygote.

zygote goes to several arrangements that are subdivisions of the cell that each time double it self. the zygote remains in the same dimension 150 um and moves along the uterine tube.

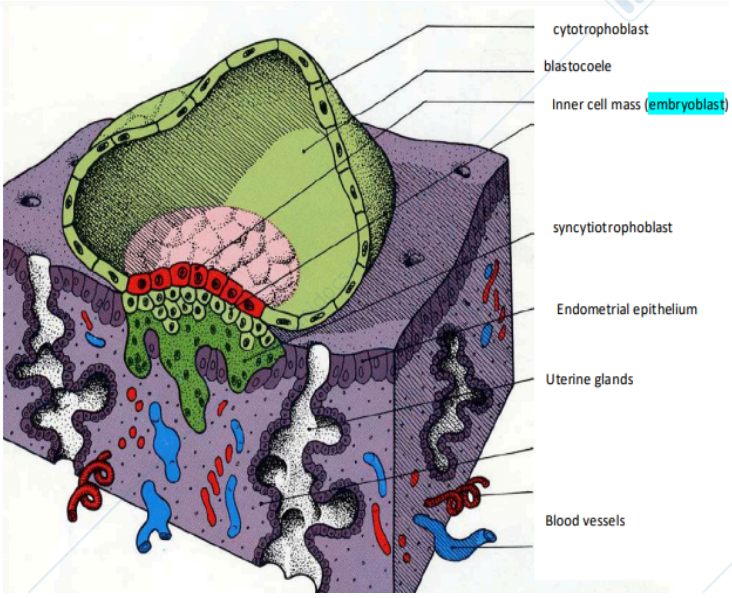
so the cells progressively reduce dimension, when we arrive at a cell that contains 20/16 cells we arrive at a stage that is called morula.

It enters inside the uterus and here the cells start to arrange in a different shape, some of them move to one side and other to another and there is a cavity. This structure is called BLASTULA.

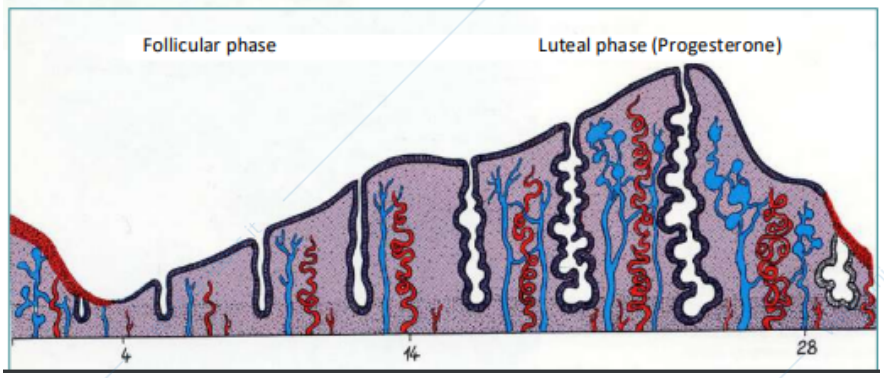
It develops 6 days after the fertilization and arrives at the mucosa of the uterus and we have a stage that is called IMPLANTATION, so the blastocysts are connect to the endometrium.

come è strutturata la blastula:

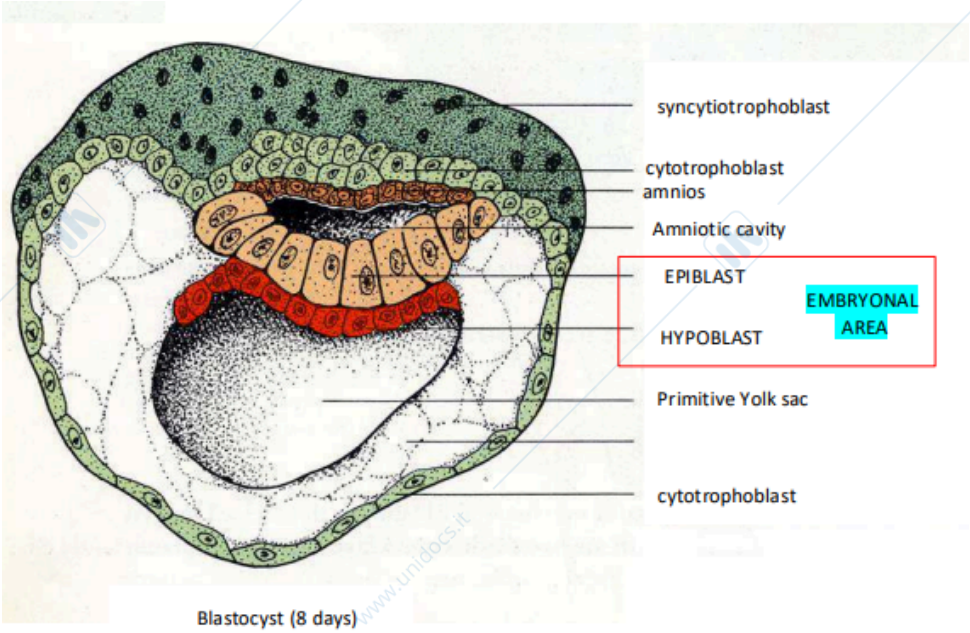
There are some cells that form the wall of the blastula that are called cytotrophoblast, some of the cells that form the wall are directly connected to the cells of the endometrium, and they change name and they are called syncytiotrophoblast and they are able to connect with the tissue of endometrium and embryoblast.



at the level endometrium we have a lot of blood vessels



In the picture sopra there is a representation of how the endometrium changes during the period.



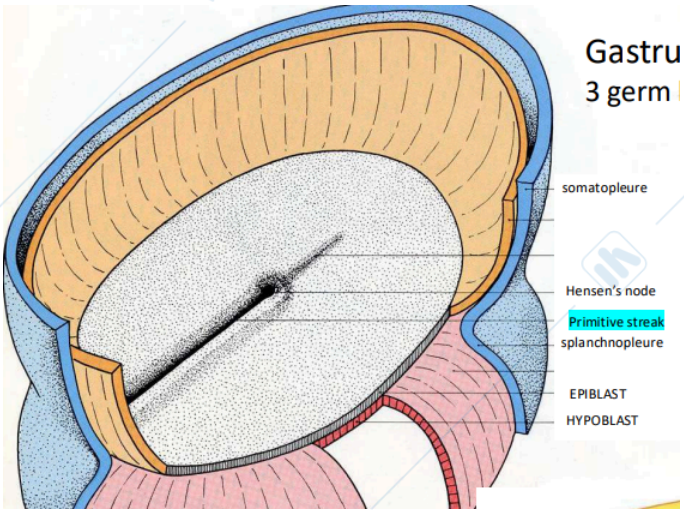
Blastocyst (8 days)

In the luteal phase the endometrium is thicker so is the moment where there is the implantation because there are more vessels and glands that nourish the embryoblast.

So in this stage there are the implantation and there is the inner mass cell that is called embryoblast, a cavity and a wall.

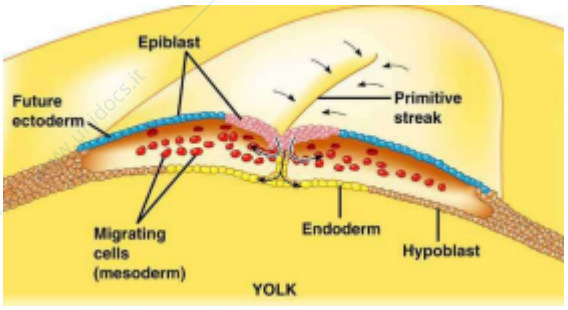
In a couple of day there are two layers because we can see an increase of another cavity that clearly separates the embryoblast from another structure, this two cavities are the amniotic cavity, that stay in the part that is more close to the endometrium, and the other is the yolk sac,at the beginning primitive yolk sac.

What divides these two layers can be divided in two layers, one superior that is called epiblast that is called hypoblast.

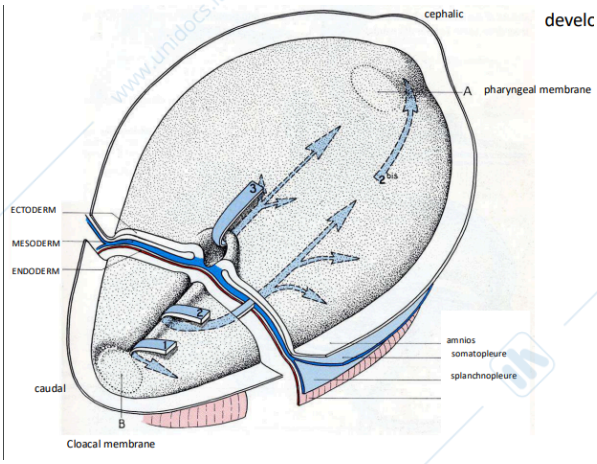


At the end of the second week of development we have an important stage that is the gastrulation, and you recognise it because if you observe the embrional area in particular in the area of the epiblast you recognise a line, this line is called primitive streak and is an important stage of development. because when you see it you have a clear organization of the future embryo because you have a sort of bilateral and symmetric structure because we know that the

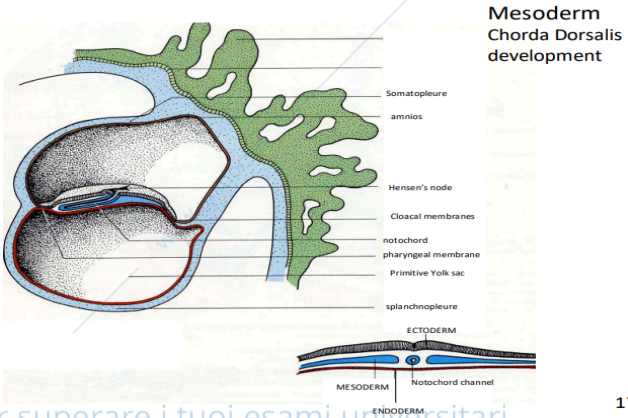
primitive streak divide exactly the embryo in left and right,and also you can recognise a dorsal and a ventral side and at the top you can recognise the hansen node, sp you can recognise a cephalic and a caudal distribution.
So you have everything to recognise the future organisation of the embryo, so this is why you con talk of a bilateral distributionA of the embryo.
Whe are at the beginning of the third week of life.
WHAT IS THIS STREAK?
Is a traffic of cells, you can see a sort of groove and alonge it you have some cells that continue to divide and move literally, so we have some cells tìog the epiblast that divide and substitute the cells of the primitive epiblast.(ectoderm???)



They move literally and form a layer that is called mesoderm, other cells move to the hypoblast and progressively substitute and form a layer that is called endoderm.
In the middle there is a free layer that becomes the mesoderm and the cells that remain are called the ectoderm.
The cells that are more free to move form the mesoderm and move between the two other layers and they reach every part of the future embryo.
At the beginning the primitive streak seems very big and long but progressively at the level of the region of the hensel node you see that the rostral part of this area increase in size, and if you observe in slow motion you can see that at the beginning increase in length and progressively its reduce in length so os shorter. non ho capito niente

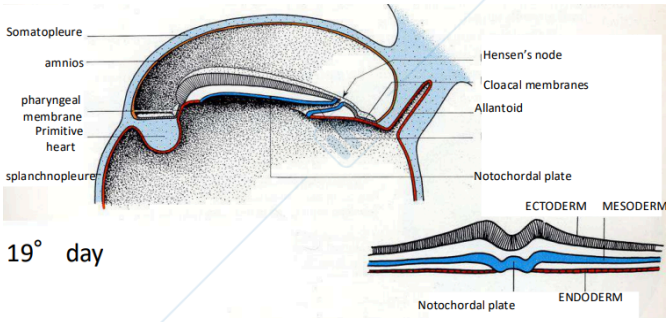


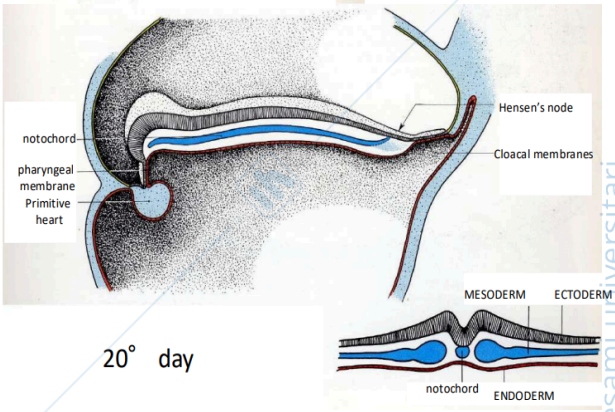
We can recognise two two side in the opposite hollow of the embryo in wich we don't have the presence of the mesoderm, this part is called pharyngeal membrane and cloacal membrane.
That are the future two openings of the body.
Another aspect very important in the development of the embryo is that in the external side you see the primitive streak.



But this region that stay along this region is the future cordal dorsalis of the embryo or nothocord.

This is important because it is a sort of





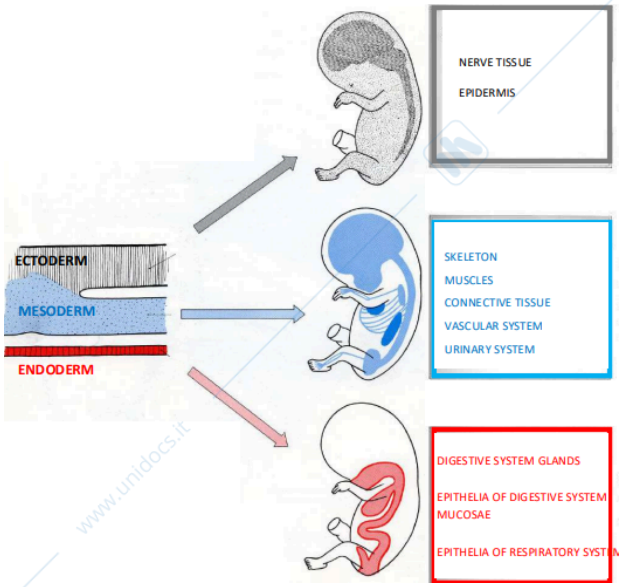
mesodermal structure that stays along the midline and is a primitive axis, and is characteristic of the chordata.

Starting from this point we develop the skeleton.

At the end of gastrulation we have the presence of three germ layers: MESODERM, ECTODERM AND ENDODERM.

At the beginning the embryo os a sort of planar structure, slat.

so we can recognise is—------>



From this germ layers develop all the organs.

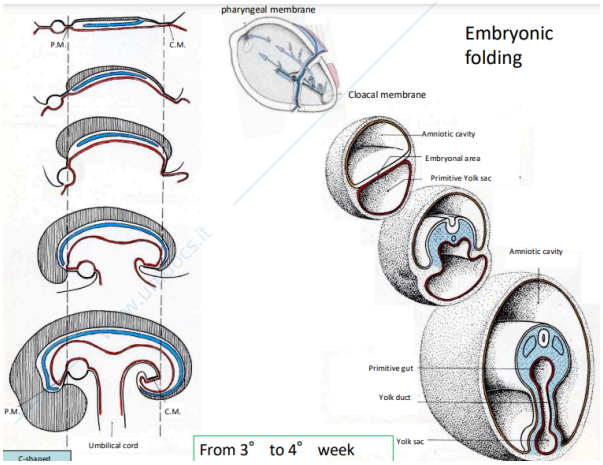
Many structures origin from the mesoderm, the more external layer of the embryo for the more external layer so the skin and the nervous system.

And the endoderm forms the more inner part of the body so the digestive system ecc.

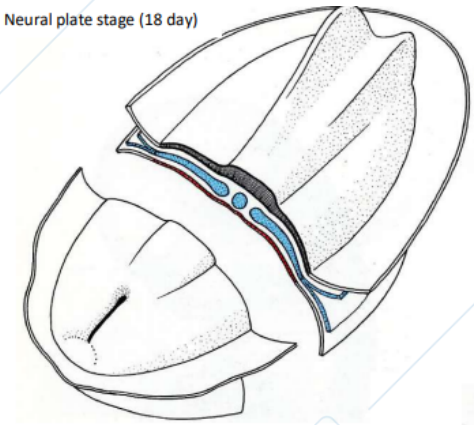
Another aspect to consider is the embryo at the beginnings is flat, gastrulation start at the level of the third week.

After this there is another important part of the development of the embryo that is called embryonic folding.

From a planar structure it becomes a tridimensional structure, foldin means that

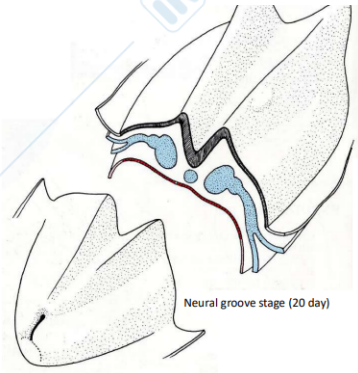


from the planar structure arrives to the typical C-shaped form.
We have a foldin not only in the sagittal plane but also laterally.
During the folding there is an increase of the cephalic part that hrow more faster.
But also laterally you can see that there is a diminution of the primitive yolk saac and a growth of the amniotica cavity that covers completely the embryo.
So on the fourth week the embrio is more similar to a cylindrical form.
During this week in which we have the foldin there are some important stages: the development of nervous system from the ectoderm.

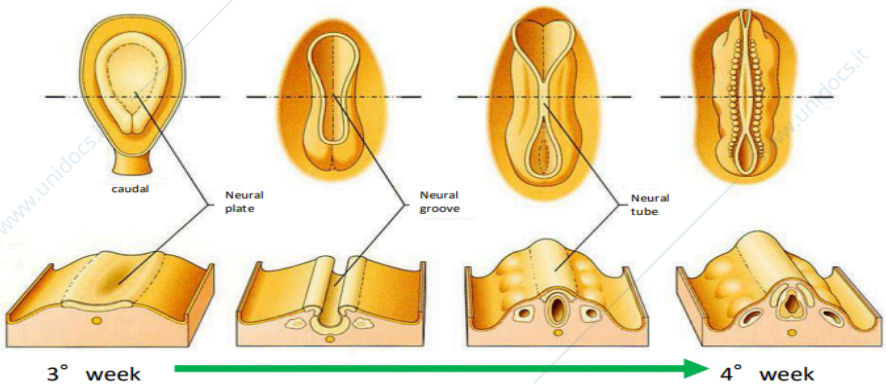


ECTODERM EVOLUTION

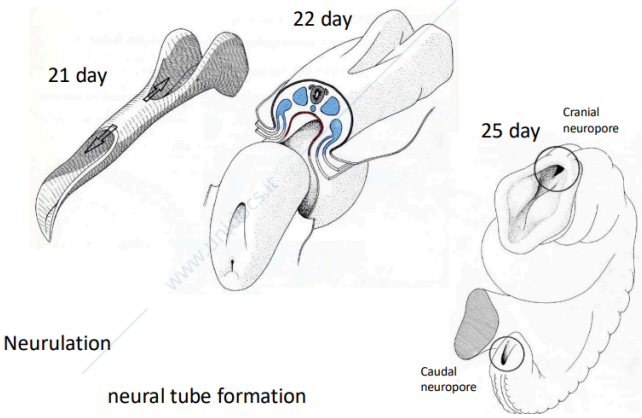
Starting from 18een days of development we have a thinner in the ectoderm that is the starting of the development of the nervous system called neurulation.
So the ectoderm in the midline is more thicker and is called neural plate, in a couple of day the neural plate forms sort of groove with two margins, this stage is called neural groove stage.



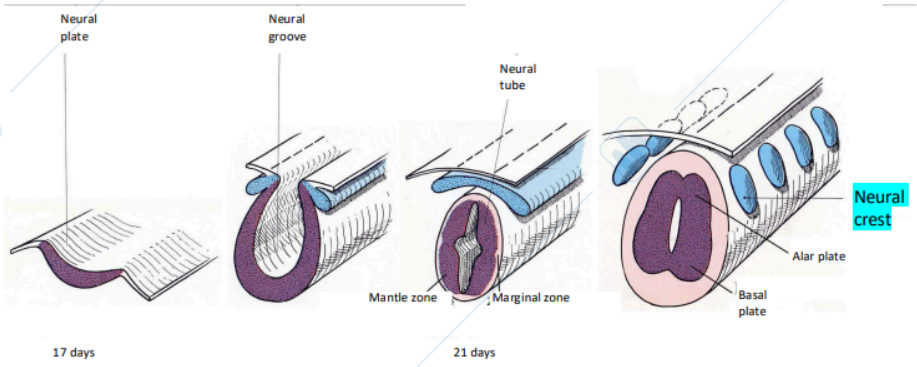
Another way to observe this development is from the top:



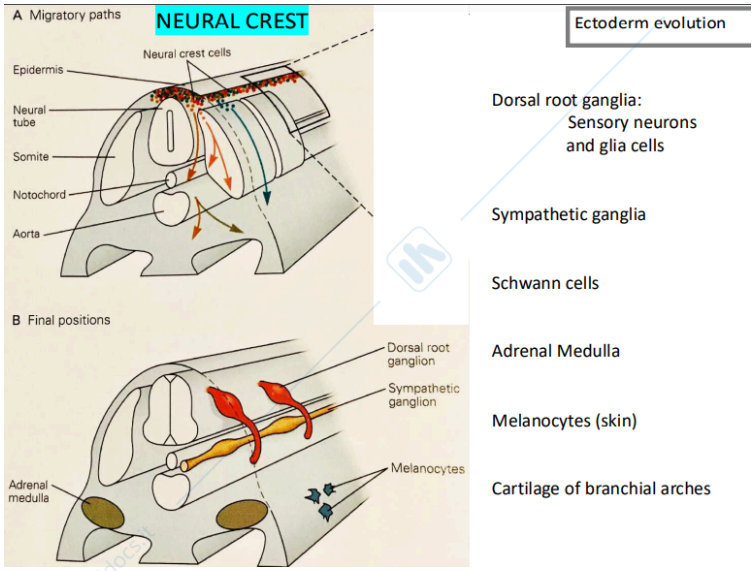
The margins of the groove start progressively to increase in size and meet each other along to the mid line.
And later, you see that this margin proglessively close forming a tube, a hollow structure called neural tube.
This is the beginning of the development of the nervous system, another way to see the margin.



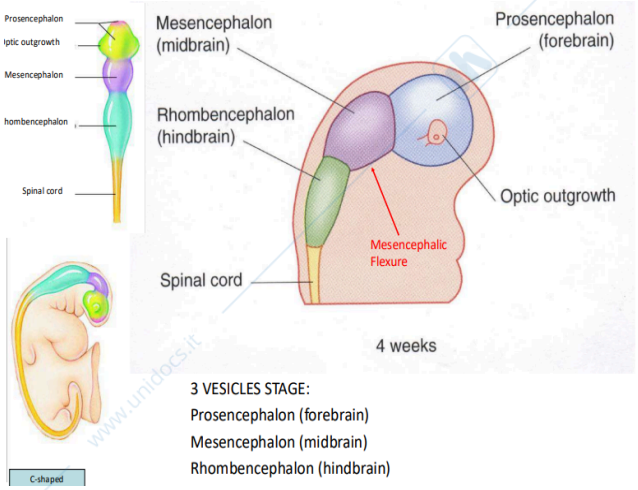
This tube increases in length and passes through all the embryo from the caudal neuropore to the cranial neuropore.
The embryo is a C-shaped structure and is connected to what remains of the yolk sac. the amniotic cavity instead completely the embryo.



During the closure of the groove there are some cells that during the closure are not part of the neural tube and also non part of the ectoderm, they remain laterally during this closure.
They go through a metameric subdivision and are called neural crests.



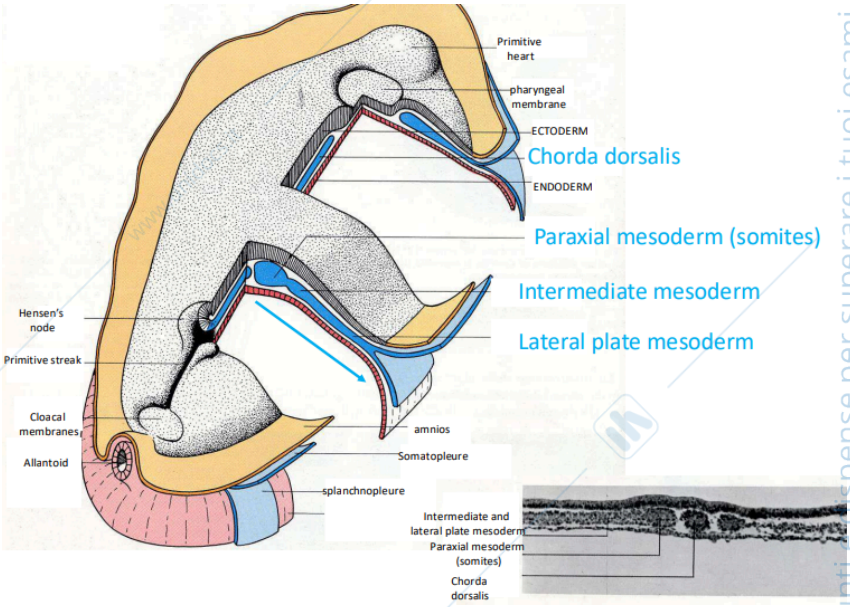
Some of them remain near the neural tube and they will form a part of the neural system that is called dorsal root ganglion.
This dorsal root ganglia contains two types of cells: sensory neurons and glia cells.
Some of the neural crest cells move, remaining more laterally forming the sympathetic glia.
this cells forms specific glia cells that are the schwann cells, some of them megrates more forming the medulla part of the adrenal glans.
some forms some cells of the epidermis that are melanocytes.
So they remain laterally, are not part of the future neural tube but from this group of cells the neural crest forms several part of the organism
The neural tube is a sort of hallow organs that is present in all the length of the embryo so from the cephalic to the caudal part, but during the development of the neural tube is possible to distinguish ezpescalli in the rostral parti there are sort

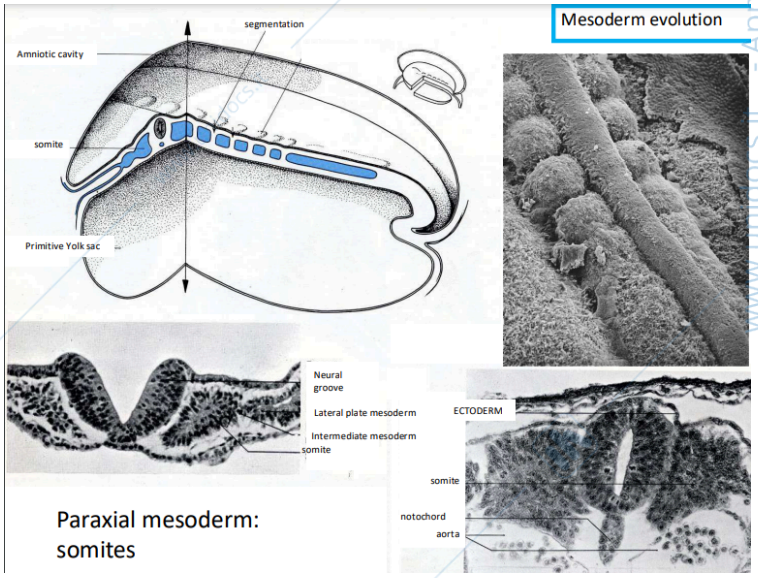


of modification od the neural tube called vesicles
Like a sort of enlargement of the tube, they ar4e visible at fourth weeks of life.
From this vesicles develope the brain.
The more cephalic is called prosencephalon, then mesencephalon and at the end rhombencephalon and are in continuity with the rest of the neural tube that form the spinal cord.

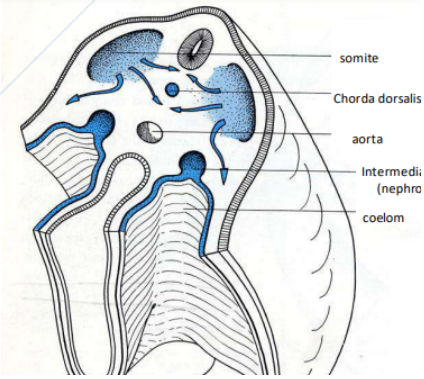
MESODERM EVOLUTION

From the midline where we have the notochord, moving laterally we can see tha paraxial mesoderm, the intermediate mesoderm and the lateral plate mesoderm.
All of this pats form different parts of the embryo.
After there is a sort of metameric subdivision laterally to the notochord that are called the somites start frouth weeks of life
Is important to remember that somites migrate in different part of the embryo.



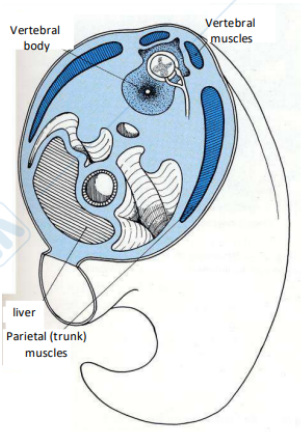


Each somites can be divided in two parts, one stay more dorsal and is called sclerotome and one is more ventral and is called dermomyotome.
Derma means that from this develop the dermatome (dermis) and the myotome (muscles),
So from the somites develope some parts of the tegumentary system and some part of the muscular system.
And some parts of the somytes migrates and surround the notochors and progressively will form part of the



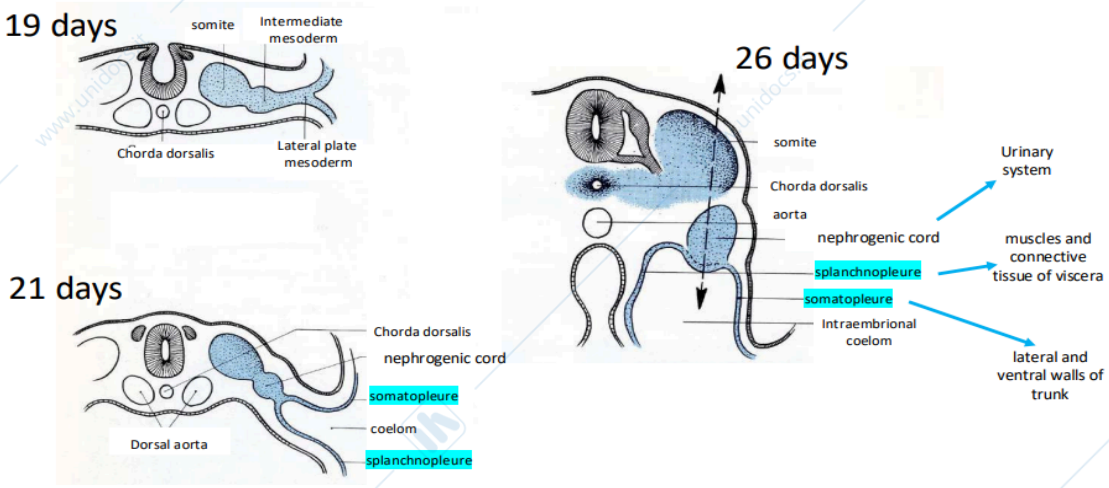
skeleton, this is why we can understood that muscle and skeleton origins from the mesoderm layer.

SO SCLEROTOME WILL FORM PART OF THE SKELETON AND DERMOMYOTOME WILL FORM PART OF THE INTEGUMENTARY AND LOCOMOTOR SYSTEM.



Moving laterally we have another part of the mesoderm that is called intermediate mesoderm.

Intermediate mesoderm mean that stage between the somites and the lateral mesoderm, we can recognise this part:



From the intermediate mesoderm develop the future urinary system.

In the picture at 26 days we can see that the mesoderm surrounds the chorda dorsalis forming the vertebrae.

And the intermediate system is disconnected from the somites and forms another cordon of cells, that is called nephrogenic cord, this is going to form the future urinary system.

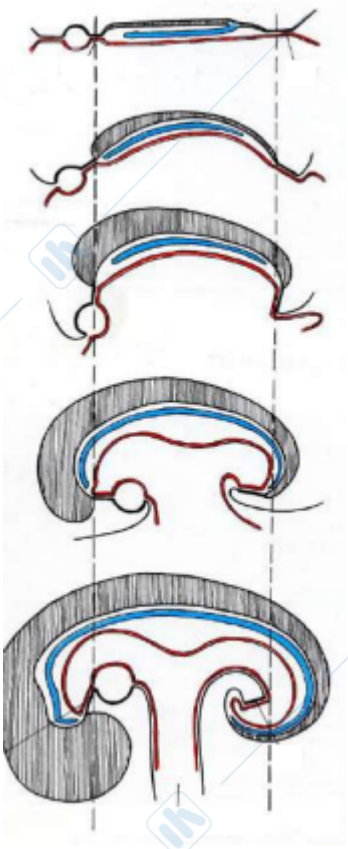
At the end the last part of the mesoderm is the lateral plate mesoderm, this part undergoes to a sort of delamination because we have a sort of opening and divides in two parts.

They are called somatopleure and splanchnopleure, 2 lamine.

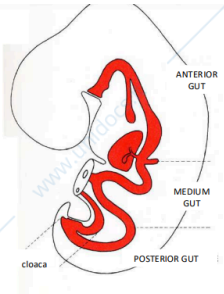
Splanchno means visceral, remains attached to the endoderm, infact will be the part that covers the viscera of the abdominal cavity.

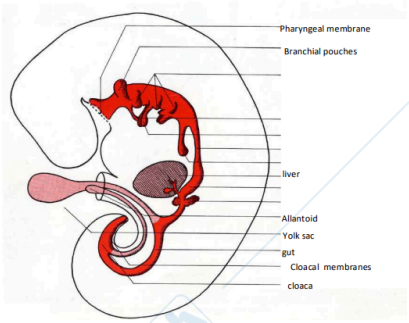
Somatopleura is the layer of the mesoderm that covers the inner part of the trunk, in each of the cavity we have a layer if tissue that is double, one stays attached to the organ and the other stays attached to the wall of the trunk.

ENDODERM EVOLUTION

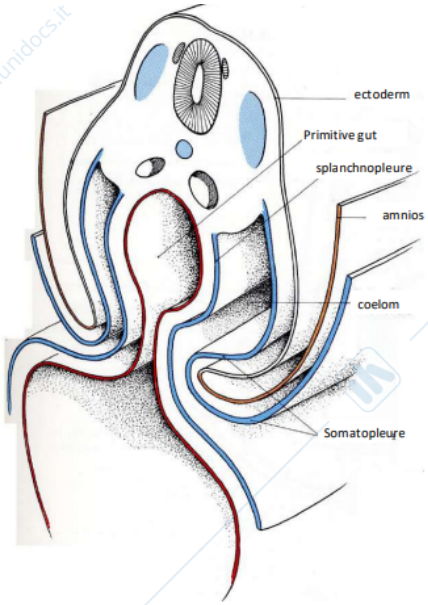


more inner leyar, color red.
during the folding happens that the inner part of the embryo become closed
becoming a sort of an hollow organ.
This part is in continuation to te yolk sac but is a close structure, is a primitive digestive system.

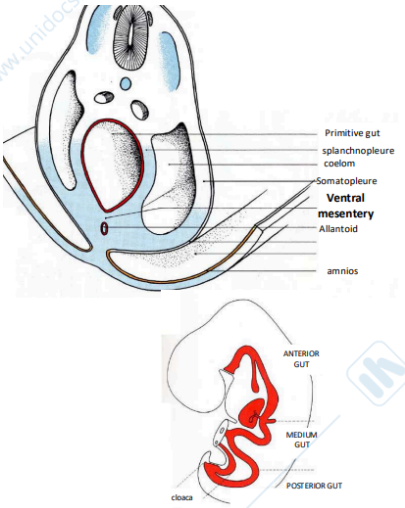




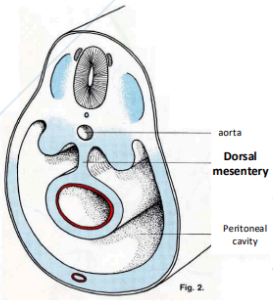
From the endoderm developing the gut, the primitive gut is very different in the embryo respect in the adult.
The adults have different parts, in the embryo we can distinguish only three parts, the anterior the medium and the posterior part.
At the level of the medium gut is in continuum with the yolk sack. the amniotic cavity instead is surrounding the whole body.
The umbilical cord at the beginning is the point of connection between the yolk sac and the embryo. after, when the yolk sac disappear the ombilical cord is attached to the placenta.
what at the beginning was the endoderm become the primitive gut, where only one part is in connection with the yolk sac.



in light blue are colorend the mesoderm that will become the splanchnopleura and the somatopleura.
The splanchnopleura start ot surround the primitive gut, and the somatopleura remain laterally.
This division forms a cavity that is called the celom but then it develops into the pleural, pericardial and peritoneal cavity

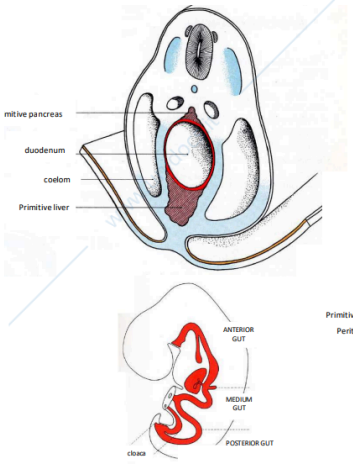


Under-umbilical region

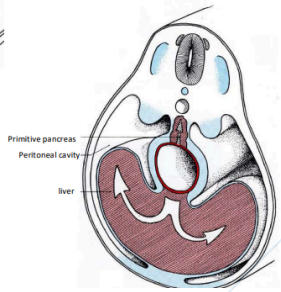


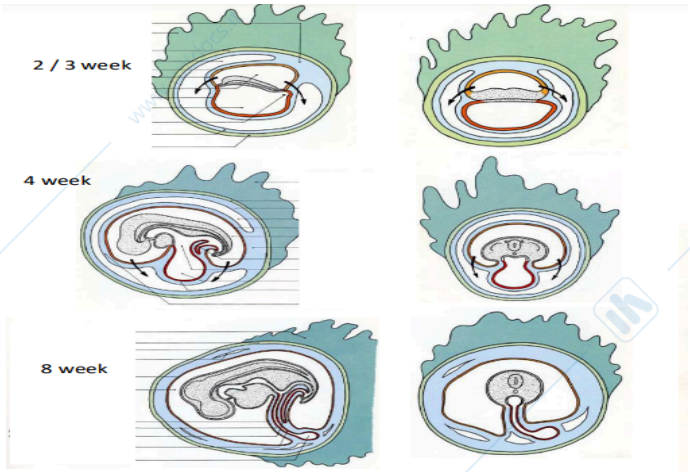
Endoderm evolution

depending on the region of the body.



Over-umbilical region





In the development the first two months are called the embryo stage, the other months are called the fetal stage, the may differns is that the increase in size is for the fetus and the development of the organs are for the embryo.