

FORMS OF EMBRYONIC PRIMORDIA

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LEARNING OBJECTIVES



- To recognise the different derivatives of each of the different forms of embryonic primordia.
- To appreciate how organ-system development is closely related to understanding each of these Primordia.

INTRODUCTION



They are primarily derivatives of the Trilaminar Embryonic Germ Disc layers i.e. Ectoderm, Mesoderm and Endoderm; which are one of the outcomes of Gastrulation

Some are derived from one or two of the layer of the trilaminar germ disc, while some are derived from all the three layers of the embryonic disc.

INTRODUCTION Cont'd



Those with capacity to give rise to multiple structures are described as "Pleuripotent"

However, they all appear before the end of the second month (before end of the 8th week) post-fertilization

INTRODUCTION Cont'd

- One of the primordia (Somites) are useful in the determination of the *Embryonic Age* before the end of the 8th week postfertilization.
- Some of these primordia are partitioned into subparts as they transform into various derivatives.
- The transformations are determined primarily by genetic or hormonal factors.



The Various forms of Embryonic Primordia











The Various forms Cont'd



SWELLINGS/FOLDS

DUCTS

► RIDGES

SEPTUM TRANSVERSUM

The Various forms Cont'd







NEURAL CREST CELLS





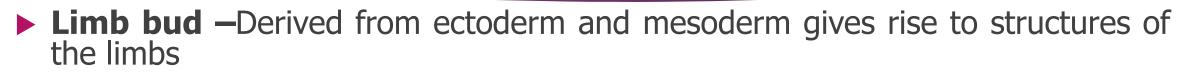


GUT TUBE - Subdivided into Foregut, Midgut and Hind gut; and from it also, arises several embryonic buds.

HEART TUBE —Derived from the fusion of the endocardial heart tubes

NEURAL TUBE – Derived as a major outcome of neurulation





AS "BUDS"

- Dorsal and Ventral Pancreatic buds Derived from the foregut and gives rise to the Pancreas
- Hepatic bud Derived from the foregut and gives rise to the biliary apparatus
- Lung Bud Derived from the end of the Tracheo-Oesophageal diverticulum and gives rise to the Lungs

NOTES ON THE HEPATIC BUD



- The embryonic liver originates from the ventral foregut endoderm, which becomes the hepatic diverticulum, the first morphological sign of the embryonic liver.
- The anterior portion of the hepatic diverticulum gives rise to the liver and intrahepatic biliary tree, whereas the posterior portion forms the gall bladder and the extrahepatic bile ducts.
- At hepatoblasts delaminate from the anterior portion of the hepatic diverticulum and invade the adjacent septum transversum mesenchyme (STM) to form the liver bud



AS "BUDS" Cont'd

Ceacal bud – Derived from the Mid-Gut and gives rise to the Caecum and Appendix

Ureteric bud – also known as the metanephrogenic diverticulum, is a protrusion from the mesonephric duct and gives rise to a conduit for urine drainage i.e. Calyx, Collecting duct, Renal Pelvis, and Ureter

AS "PLACODES"



- Those with capacity to give rise to neurons associated with Special senses and Cranial ganglia are called Nephrogenic Placodes which includes the Cranial placodes.
- Cranial Placodes are divided into *dorsolateral* placodes and the epibranchial or *epipharyngeal* placodes

The "Dorsolateral Placodes"

- Trigeminal Placode gives rise to the cells of the Trigeminal ganglion
- Otic Placode forms the Optic pit and the Otic vesicle giving rise eventually to organs of hearing and equilibrium

The "Epibranchial or Epipharyngeal Placoc

- GENICULATE PLACODE associated with the first branchial cleft and gives rise to the geniculate ganglion and distal parts of cranial nerve VII
- PETROSSAL PLACODE associated with the second branchial cleft and gives rise to the glossopharyndeal ganglion and distal parts of cranial nerve IX.
- NODOSAL PLACODE associated with the third branchial cleft and gives to the nodose ganglion and distal parts of cranial nerve X

OTHER PLACODES



- OLFACTORY (OR NASAL) PLACODE gives rise to the olfactory epithelium of the nose
- LENS PLACODE Influenced by the optic vesicle and gives rise to the lens of the eye.
- ADENOHYPOPHYSEAL PLACODE gives rise to the anterior lobe of the pituitary gland.
- Note that some other Ectodermal Placodes give rise to structures such as like the mammary gland, teeth and hair.

AS "CAVITIES" – COELOMIC CAVITY

- ► A derivative of the lateral plate mesoderm
- ► Formation is influenced by Lateral Embryonic folding
- Partitioned by the thoraco-abdominal diaphragm into Upper thoracic part and Lower abdomino-pelvic part (Peritoneal cavity)
- The Upper thoracic part is further partitioned into the Pericardial and Pleyral cavities by the Pleuro-pericardial folds.

AS "DIVERTICULA"



Metanephrogenic diverticulum (also known as the Ureteric bud) -a protrusion from the mesonephric duct and gives rise to a conduit for urine drainage i.e. Calyx, Collecting duct, Renal Pelvis, and Ureter

Hepatic diverticulum (as described above)

AS "CLOACA"



The terminal part of the hindgut ends in the CLOACA, which is an endoderm-lined chamber that contacts the surface ectoderm at the cloacal membrane and communicates with the allantois, which is a membranous sac that extends into the umbilicus alongside the vitelline duct.

Partitioned into two –the Urogenital Sinus and Recto-anal canal by the Uro-rectal septum which divides the cloacal membrane into the urogenital and anal membrane parts

The "Cloaca" Cont'd

Gives rise to structures of the Urogenital and Digestive system

Urogenital Sinus –Give rise to the Urinary bladder, Urethra, parts of the Vagina (in females), Prostate (in males) and genital glands.

Recto-anal canal –gives rise to the rectum and anal canal.

AS "SWELLINGS/FOLDS"

The Labro-scrotal Swelling gives rise to the Labium Majora (in females) and the Scrotum (in males).

► The Urogenital folds forms the Labium Minora in females



AS "DUCTS" -- the Genital Ducts

Mesonephric Ducts (also known as Wolffian duct)

- In both male and female -gives rise to the Urinary trigone of the Urinary bladder, efferent duct
- ▶ In males, gives rise to the epididymis, vas differens, seminal vesicle.
- In female are its vestiges which include, epoophoron, Skene's gland and Gartner's duct
- Paramesonephric Duct –Gives rise to the Uterus, fallopian tube and part of Vagina

AS "RIDGES"



The urogenital system arises from intermediate mesoderm which forms a urogenital ridge on either side of the aorta.

- The urogenital ridge develops into three sets of tubular nephric structures (from head to tail): the pronephros, the mesonephros, and the metanephros.
- The Gonadal or Genital ridge is the precursor of the Gonads (Testis and Ovary)

The "Metanephric blastema"

- A "renogenic" region within the intermediate mesoderm in the tail of the embryo.
- Secretes growth factors that induce growth of the URETERIC BUD from the caudal portion of the mesonephric duct.
- Forms:
 - Podocytes covering glomerular capillaries
 - Epithelial cells lining Bowman's capsule

The "Metanephric blastema" Cont'd

- Proximal convoluted tubules
- Descending thick limbs of the loops of Henle
- Thin limbs of the loops of Henle
- Ascending thick limbs of the loop of Henle

Distal convoluted tubules

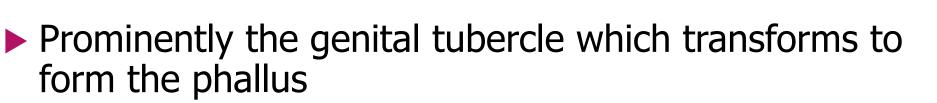
AS "SEPTUM" – The Septum Transversum

The septum transversum is a thick mass of cranial mesenchyme, formed in the embryo, that gives rise to parts of the <u>thoracic diaphragm</u> and the <u>ventral</u> mesentery of the foregut in the developed human being

Gives rise to:

- Central tendon of the Diaphragm
- Ventral mesentery of the Foregut from which arise the leser omentum, visceral peritioneum of liver, and the Falciform ligament.
- Cells of the Liver

AS "TUBERCLE"



- In males, under the metabolite of testosterone, Dihydrotestosteron (DHT), it elongates to form Penis
- In females with the absence of DHT, the phallus regresses and forms Clitoris





Prominently, the Urogenital Sinus as highlighted previously

AS AN "APPARATUS"

Prominently the Branchial or Pharyngeal apparatus

- With component parts that include: Arches, Pouches, Clefts or grooves and Membranes
- Gives rise to most of the structures of the Head and Neck and as such can be said to be pleuripotent

► Each persisting Arch is innervated by a designated Cranial nerve

THE NEURAL CREST CELLS

- Pleuripotent with capacity to give rise to several structures
- Derived from Ectoderm
- Some derivatives include:
 - Ganglia
 - Pigment cells
 - Meninges



AS "SOMITE"

Subdivided in Dermomyotome and Sclerotome

Dermomyotome gives rise to dermis of skin and muscles

Schlerotome give rise to bones of the vertebral column

▶ With the Notochord, gives rise to the intervertebral disc.

REVISION QUESTIONS

- What are the forms of Embryonic Primordia?
- ▶ What are the derivatives of the different forms of embryonic primordia?
- Which of the primordia can be classified as pleuripotent?
- Which of the primordia gives rise to one structure only?
- What influences the differentiation of the Phallus, Mesonephric duct and Paramesonepric duct in males and female?