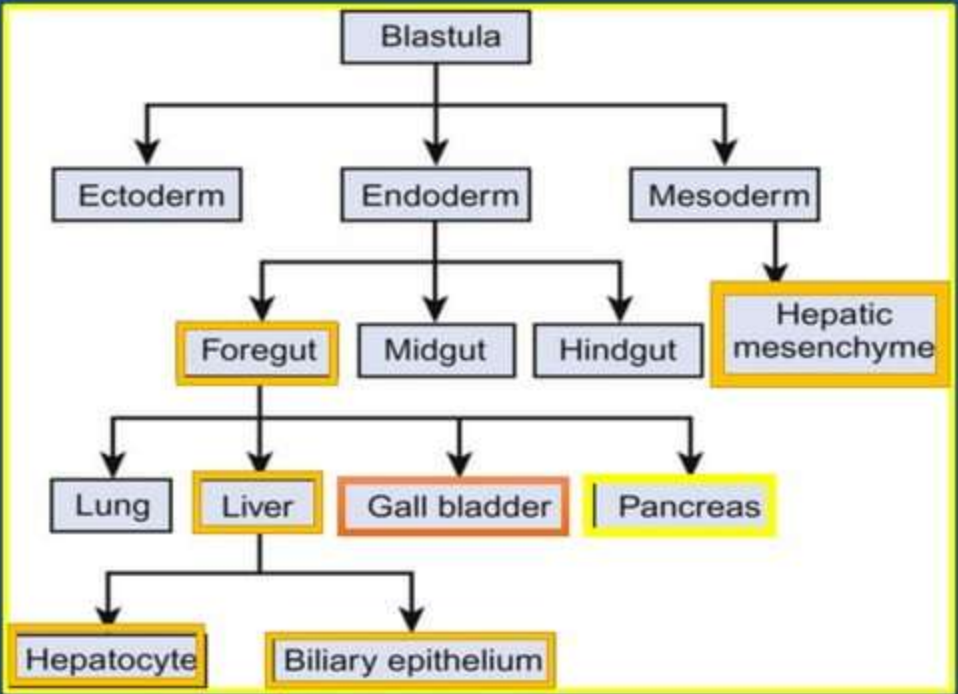
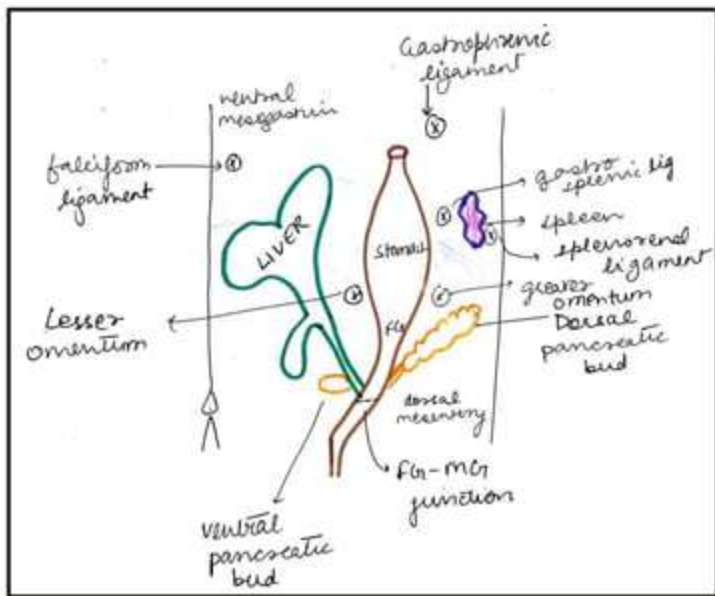


DEVELOPMENT OF LIVER, PANCREAS, SPLEEN AND EXTRA-HEPATIC BILIARY APPARATUS







LIVER EMBRYOLOGY

3rd week of gestation

3rd month of gestation



Foregut
(Duodenum)

Gall bladder

Hepatocytes

Endodermal cells



- Intrahepatic bile duct formation
- Secretion of bile

1. ENDODERMAL
BUDS



Hepatocytes &
intrahepatic
biliary system

2. SEPTUM
TRANSVERSUM
(MESODERM)



Connective
tissue (Glisson's
capsule), Kupffer cells
and blood vessels

3. VITELLINE &
UMBILICAL VEINS



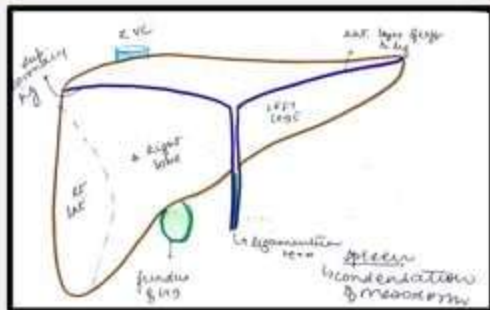
Sinusoids

4. VENTRAL
MESENTERY



Lesser omentum,
falciform, coronary
and triangular
ligaments

Sources from
which Liver
develops-



Stages of development of liver

1. Formation of hepatic bud (3RD week of I.U.L.)

- Hepatic bud arises from ventral border of terminal part of foregut.

2. Growth of hepatic bud

- Ventral and cranial growth in ventral mesogastrium of hepatic bud
- Reaches septum transversum

3. Division of hepatic bud

- Division into: pars hepatica (left and right hepatic ducts; hepatic trabeculae) and pars cystica (forms gall bladder)

4. Formation of hepatic SINUSOIDS

- Formed by hepatic trabeculae

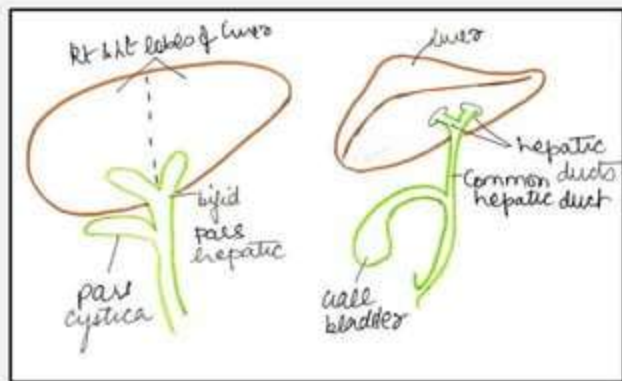
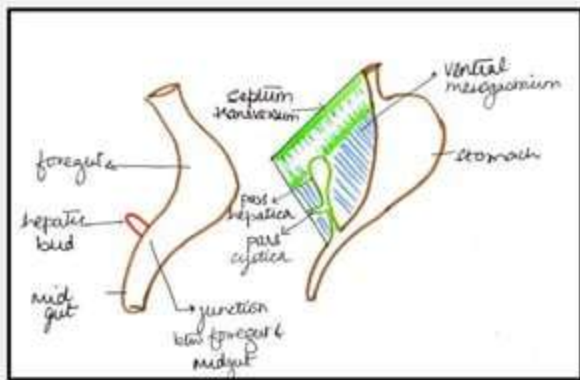
5. Formation of bile canaliculi

- Intrahepatic biliary passages formed

6. Formation of peritoneal ligaments

7. Development of falciform ligament and lesser omentum

8. Formation of triangular and coronary ligaments



Developmental anomalies of liver

ANTERIOR ASPECT OF LIVER SHOWING REDEL'S LOBE



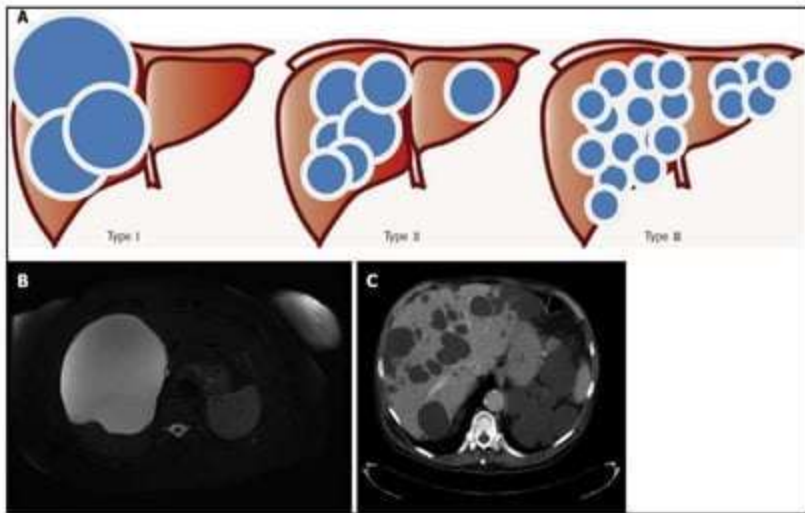
RT. PARASAGITTAL SECTION THROUGH
RIGHT LOBE OF LIVER AND RT. KIDNEY

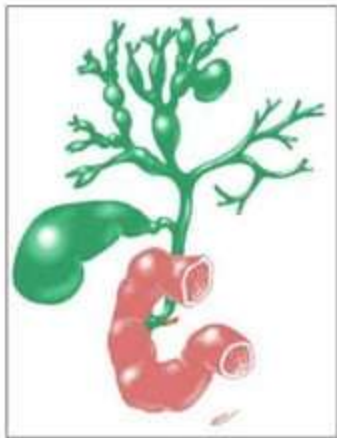


- **Riedel's lobe**
- Downward tongue-like extension of the right lobe of liver.

Polycystic liver disease

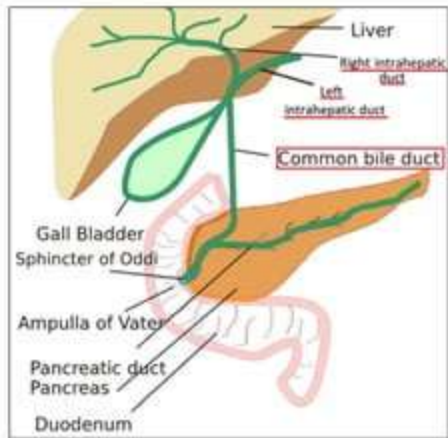
Due to failure of union of intra-hepatic biliary canaliculi and ductules with extra-hepatic bile ducts.





Caroli's disease

Involves congenital cystic dilatation of intra-hepatic biliary tree.



Intra-hepatic biliary atresia

A failure of development of intra-hepatic biliary system (atresia).

Congenital hepatic fibrosis

- Inherited fibrocystic disease
- Produces portal hypertension

Other anomalies-

One lobe or a part of may be absent.

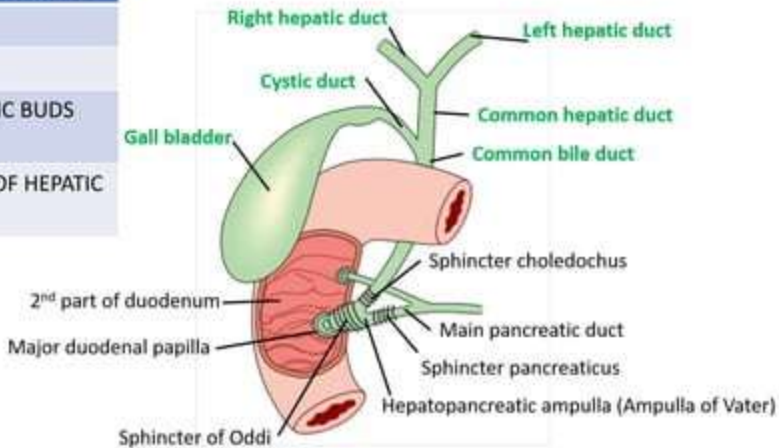
An extra lobe may be present.

Complete liver may be rudimentary.

Ectopic liver tissue may be present in the lesser omentum or falciform ligament.

DEVELOPMENT OF GALLBLADDER AND EXTRA-HEPATIC BILIARY DUCTS

PART	EMBRYOLOGICAL SOURCE
GALL BLADDER	CYSTIC BUD
CYSTIC DUCT	CYSTIC BUD
RIGHT AND LEFT HEPATIC DUCTS	PRIMITIVE HEPATIC BUDS
COMMON BILE DUCT	PROXIMAL PART OF HEPATIC BUDS



EHBA is endodermal in origin

ANOMALIES OF GALLBLADDER

Agenesis of gall bladder

Sessile gall bladder (absence of cystic duct).

Septate gallbladder

Double gall bladder

Intra-hepatic gallbladder

Floating gall bladder



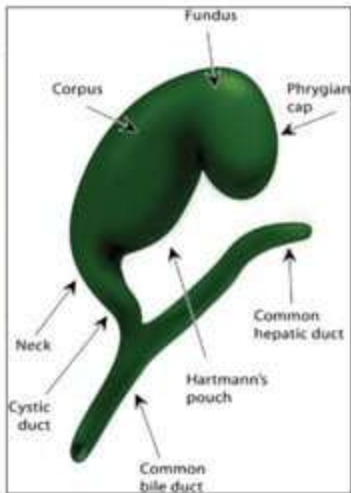
SESSILE GB



SEPTATE GB

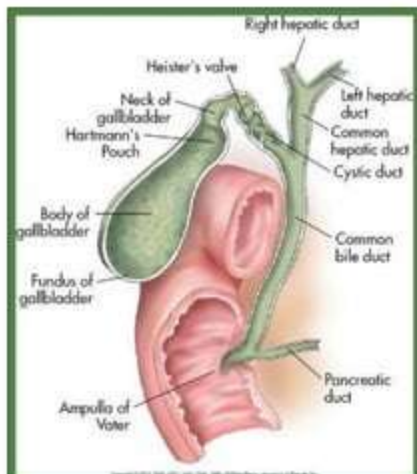
Phrygian cap

GB with fundus folded on top



Hartmann's pouch

Outpouching of neck of gallbladder.



ANOMALIES OF EXTRAHEPATIC BILIARY DUCTS

1. Atresia of ducts

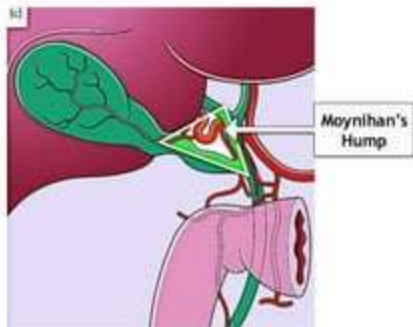
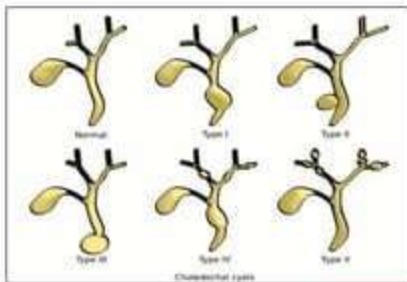
2. Accessory ducts

• CHOLEDOCHAL CYST

- Area of weakness in the wall of bile duct and gives rise to obstructive jaundice.
- CC have been classified into five subtypes radiologically

• MOYNIHAN CYST

- Hepatic artery lies in front of CBD forming a caterpillar like loop.



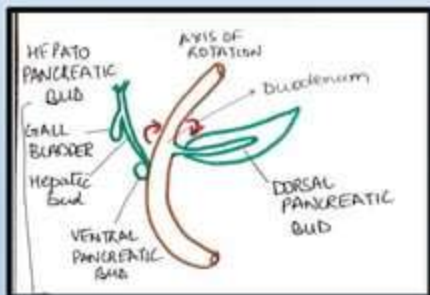
DEVELOPMENT OF PANCREAS

The pancreas develop from the two buds

Ventral bud

Arises hepatic diverticulum

lower part of head and
uncinate process



Dorsal bud

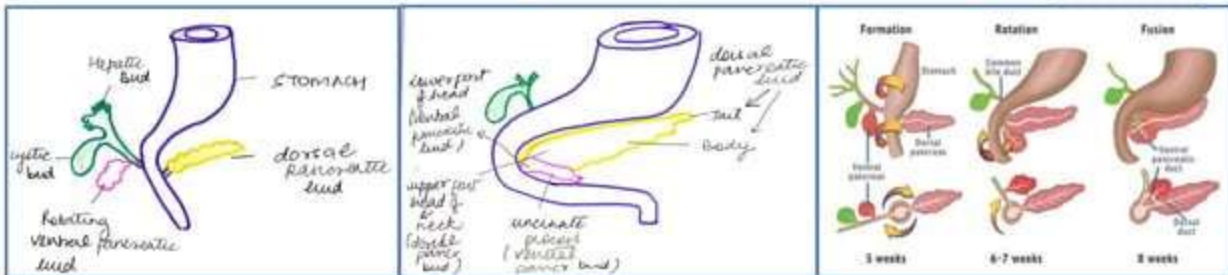
Arises from dorsal aspect of
the duodenum

Upper part of head, neck,
body & tail

Rotation of buds

Rotation of duodenum brings ventral pancreatic bud with CBD to the right of duodenum and dorsal to the left of duodenum.

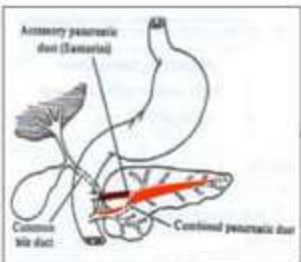
Continuous differential growth of duodenal wall brings the ventral pancreatic bud closer and proximal to the dorsal bud.



Development of pancreatic ducts

Main pancreatic duct

(Wirsung): from Duct of ventral pancreas and distal part of duct of dorsal pancreas (proximally)

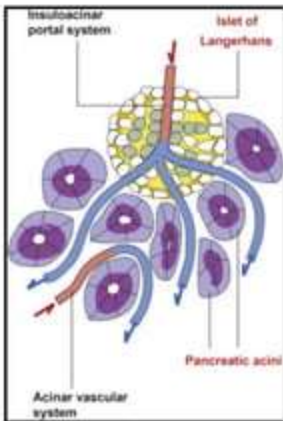


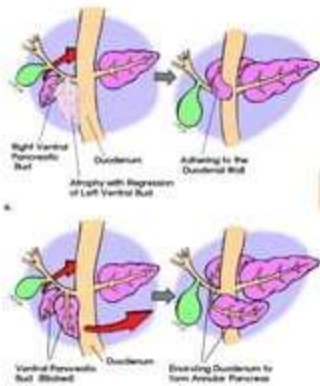
Accessory pancreatic duct

(Santorini): from the proximal part of the duct of the dorsal pancreas (distally)

Development of pancreatic acini and islets

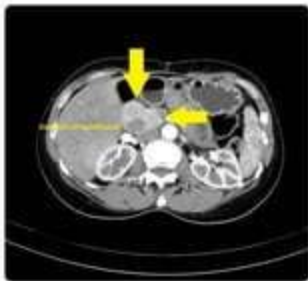
- Both of ventral and dorsal pancreatic buds branch enormously.
- At the end of branch, pancreatic acini appear.
- Some cells of pancreatic duct get separated and form islet of Langerhans by third week.





ANNULAR PANCREAS

- Second part of duodenum is surrounded by a ring of pancreatic tissue.
- Failure of rotation of ventral pancreatic bud may result in annular pancreas.
- May cause duodenal obstruction
- May result in polyhydramnios in the intra-embryonic life.
- Radiograph of abdomen shows double bubble appearance due to gas in stomach and proximal part of duodenum.





- PANCREATIC DIVISUM
 - Failure of fusion of dorsal and ventral pancreatic buds.
 - Pancreas divisum is sometimes associated with [choledochal cysts](#) or intestinal [malrotation](#).

DEVELOPMENT OF SPLEEN

Develops in dorsal mesogastrim

Formation of spleniculi

Fusion of spleniculi

Lobulated development of spleen (splenic notches)

Formation of ligaments (gastrosplenic & lienorenal)

Change in splenic position

Haematopoiesis

ANOMALIES OF SPLEEN

1.ACCESSORY SPLEEN

- Failure of fusion of spleniculi with the main splenic tissue



2.Lobulated spleen

- Incomplete fusion of spleniculi produces lobulated spleen.

3.Right-sided bilaterally or isomerism is characterised by asplenia or hypoplastic spleen, whereas left-sided bilaterally characterized by polysplenia.



Thank you