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The Dangerous Twins

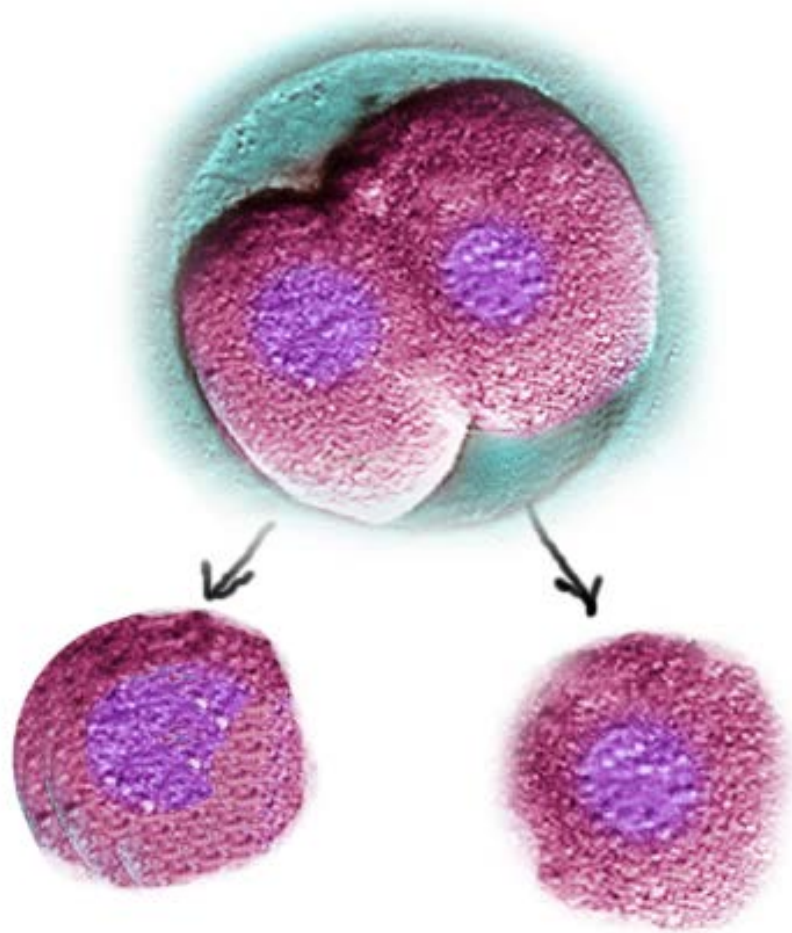
separated and conjoined

The origin of twins:

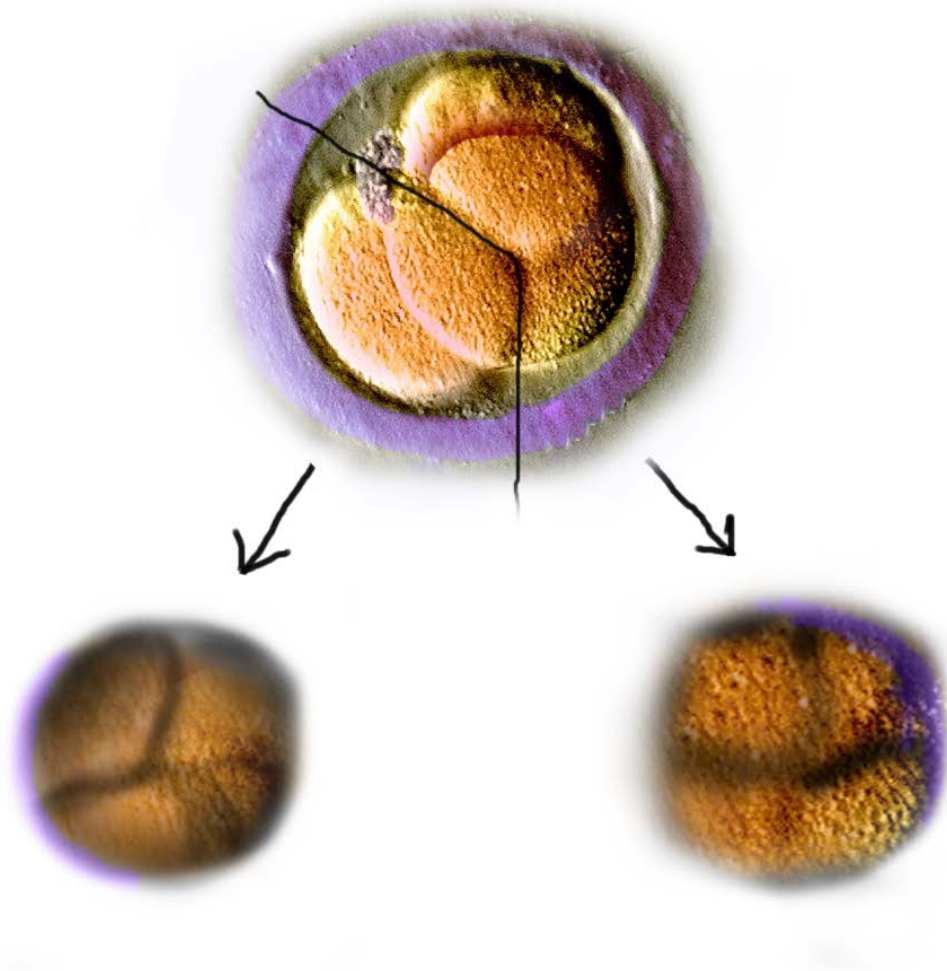
A – Dizygotic twins (from two oocytes), each has an unique genom and each gives rise to a **separate gestational sac**. If **two separate gestational sacs** are present, the twins may be monozygotic or dizygotic.

If the twins are of different sex, they are always dizygotic

B – Monozygotic twins (from one oocyte) both have the same (identical) genom, which gives rise into **one gestational sac**. The twins are monochorionic. Monochorionic twins are biamnial or monoamnial.



Monozygotic twins originating from two first separated blastomeres



Monozygotic twins originating from morula (two groups of early blastomeres) gives rise to two gestational sacs

Classification of twins:

A – Equal separated twins

1. dichorial
 - a) monozygotic
 - b) dizygotic (most frequent)
2. monochorial (always monozygotic)
 - a) diamnial
 - b) monoamnial
 - c) with vascular anastomoses (TTTS – twin to twin transfusion)
 - d) acardial (TRAP – twin reversed arterial perfusion syndrome)

B – Conjoined twins (always monozygotic, monochorial and monoamnial)

1. isopagi (equal conjoined twins)
 - a) originating from peripheral fusions of two germ discs
 - b) originating from duplications of axial structures
2. heteropagi (unequal conjoined twins)
 - autosit (main twin), heterosit (parasitic twin)

Conjoined twins:

A – Peripheral fusion of two germ disks (eight limbs)

B – Duplication of axial structures (face, head, vertebral column, external genitalia)

Peripheral fusions of two germ discs (eight limbs)

Pagi
monocephali
syncephali dicephali
cephalothorocopagi
thoracopagi
thoracoabdominopagi
abdominopagi
abdominoomphalopagi
divergent abdominopagi
pygopagi
sacropagi
ischiopagi



monocephalothoracopagus



monofacial syncephali



cranioccipitopagi



thoracoomphalopagi



pygopagi



divergent abdominopagi
(one affected by sirenomelia)



Duplications of axial structures

(duplications with less than eight limbs (4 – 7)
(sironemelia represents two limbs))

Duplicated

monocephalic diprosopia

syncephalic diprosopia

monocephalic divertebral tripodus

syncephalic dibrachial tripodus

syncephalic dibrachial dipodus

dicephalic dibrachial dipodus

dicephalic dibrachial tripodus

dicephalic dibrachial tetrapodus

dicephalic tribrachial tetrapodus

dicephalic tribrachial tripodus

dicephalic tribrachial dipodus



dicephalus tetrabrachialis
dipodus



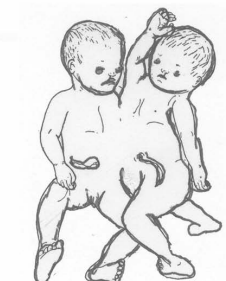
monocephalus dipygus
dibrachialis tetrapodus



syncephalus dibrachialis
dipodus



dicephalus dibrachialis
dipodus

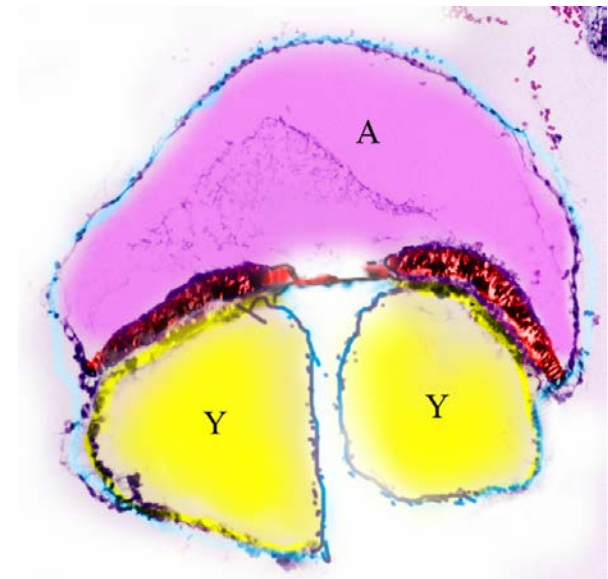
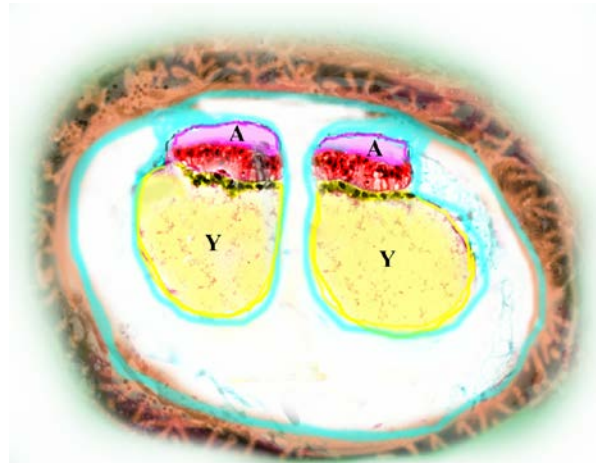
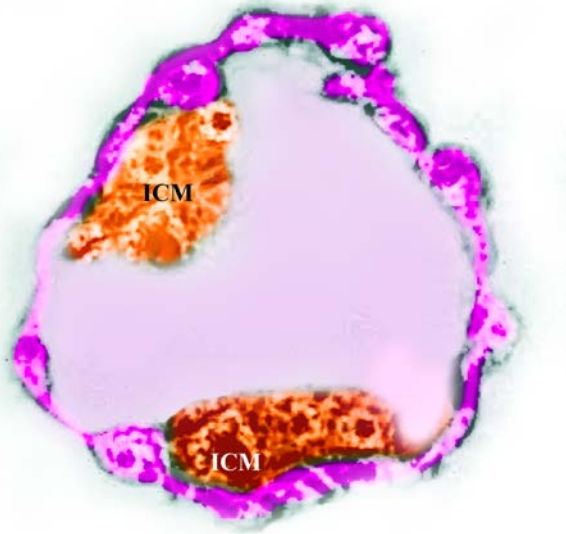


dicephalus tribrachialis
tetrapodus

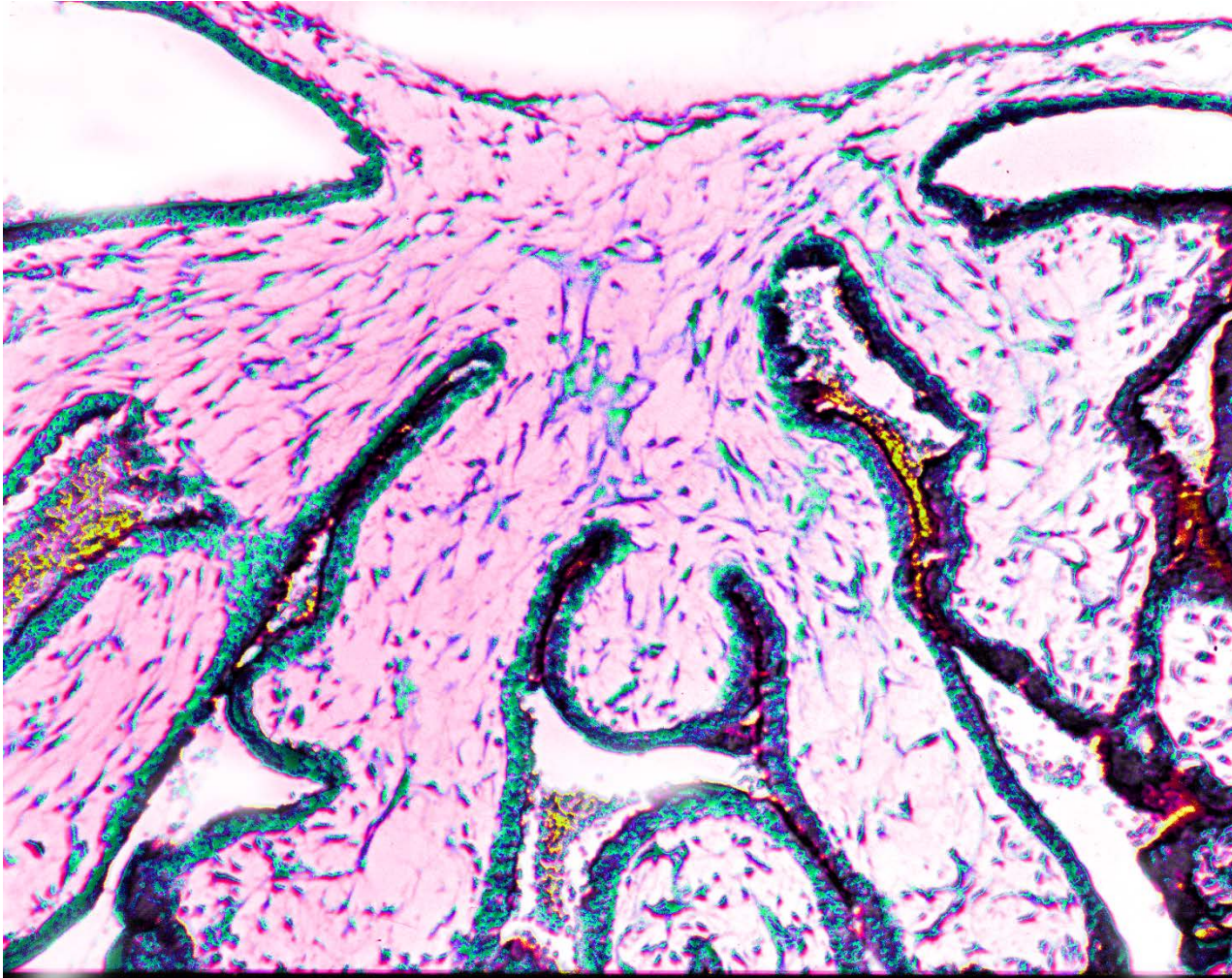


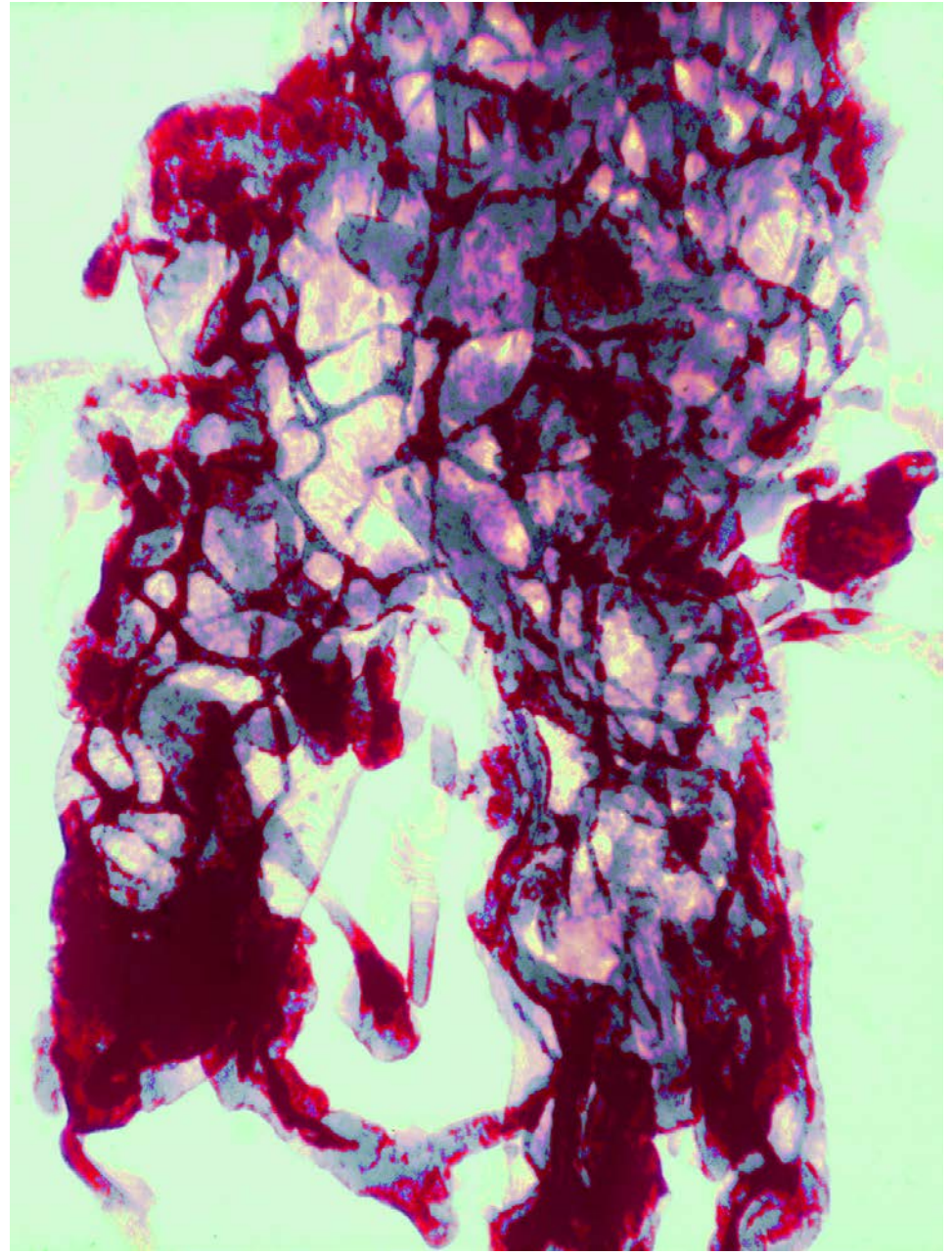
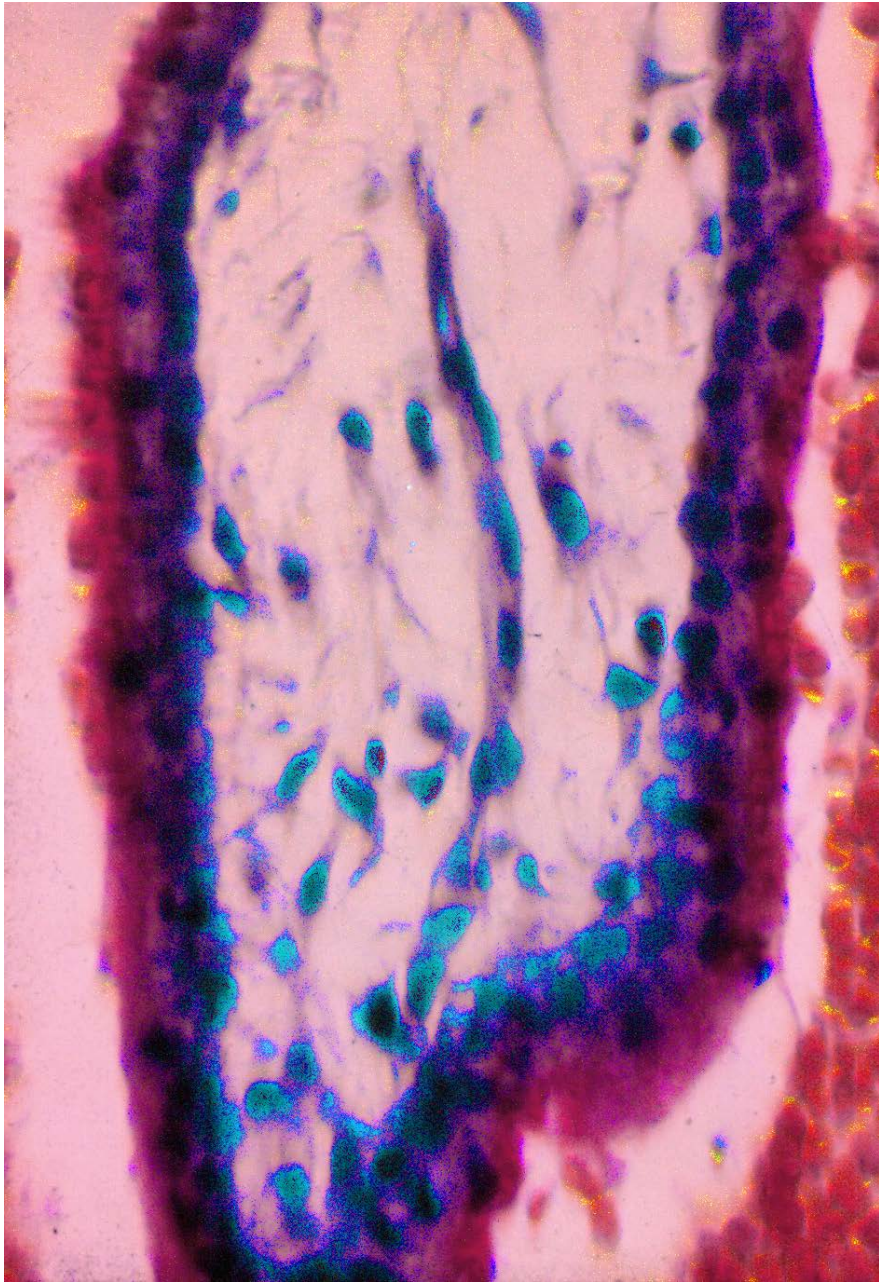
Monozygotic twins

Monozygotic twins originating from a single blastocyst with two embryoblasts gives rise to a **single gestational sac and two germ disks** located between two amnionic sacs and a single yolk sac, gives rise to two separated germ disks with separated (biamniotic) amnionic vesicles or separated or attached two germ disks located within a common amnionic sac which may develop into conjoined twins.

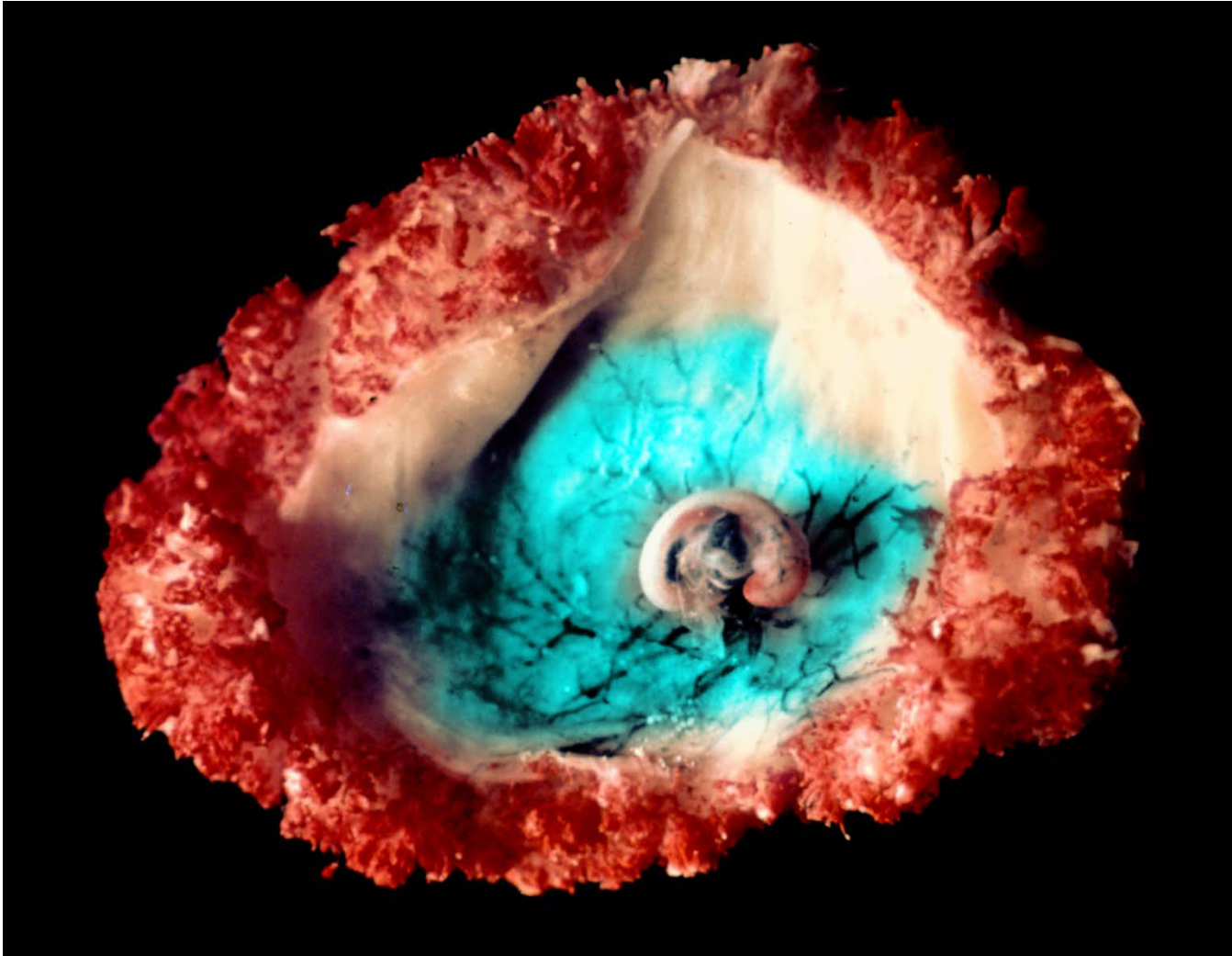


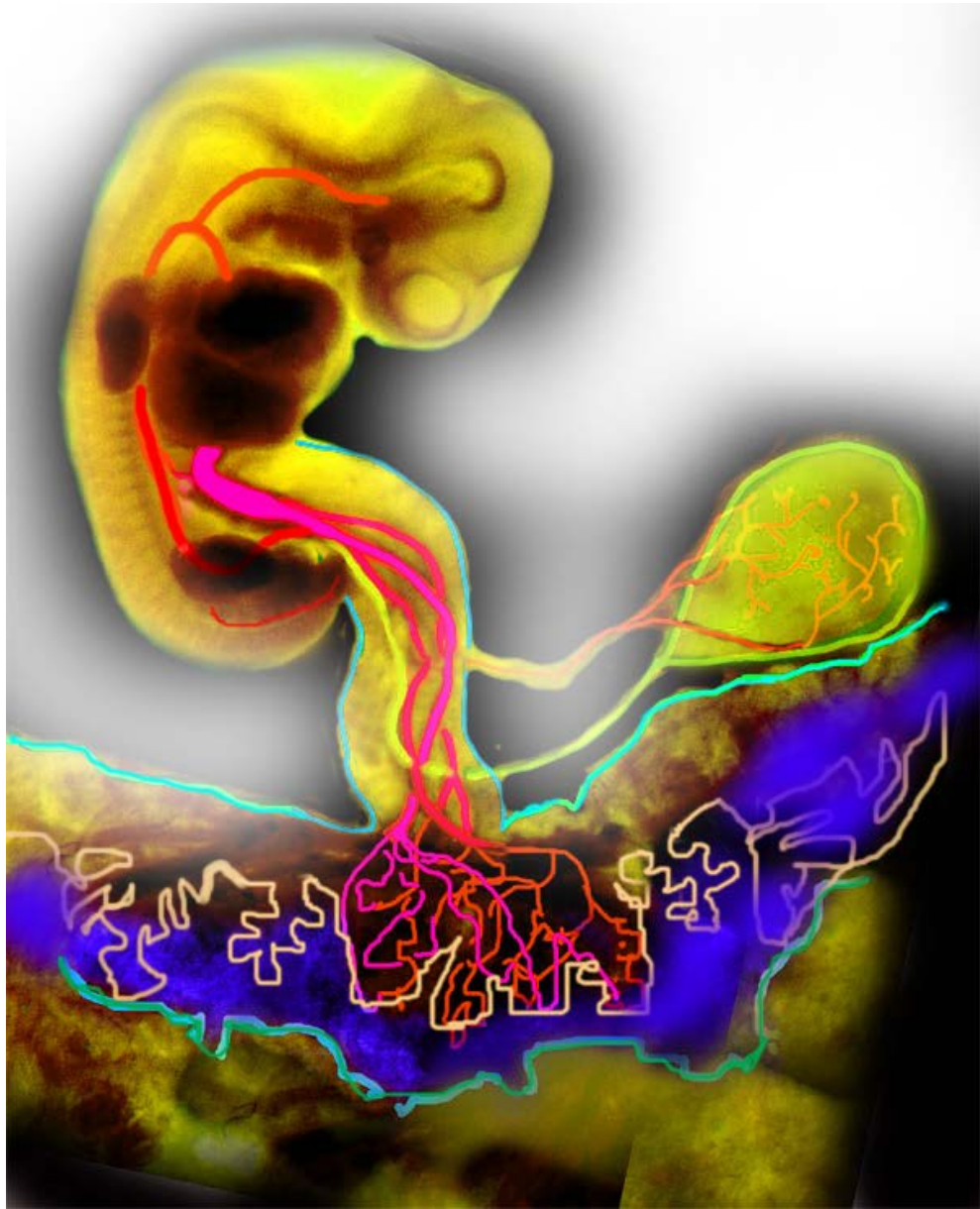
Vascularisation of the chorion begins on days 17-18 and gives rise to a single capillary net





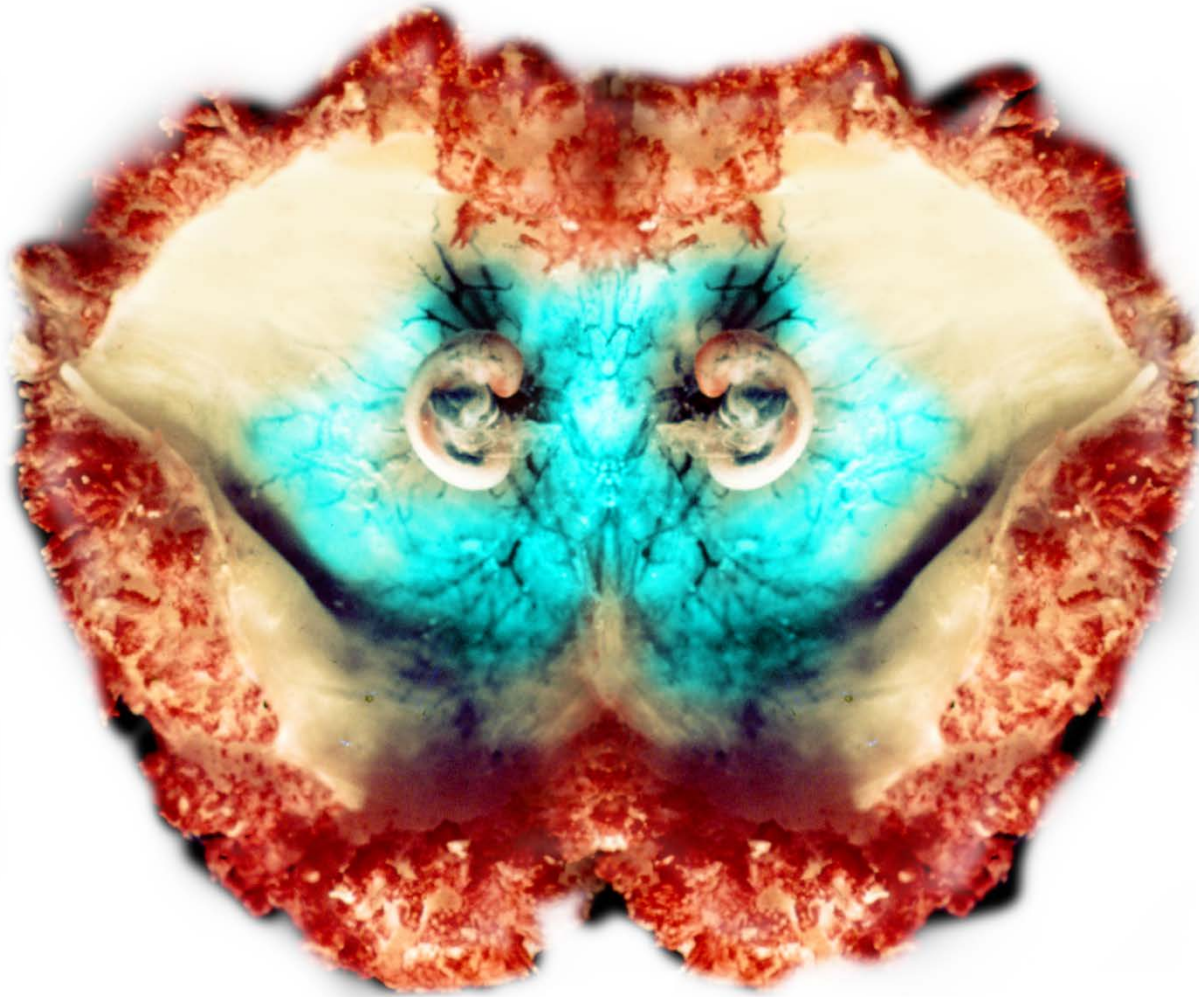
The fluid or blood is pumped into the capillary net by heart loop at the end of the 4th week (gestational 6th week) after conception. The area supplied by the embryonal blood changes into **the chorion frondosum**, the unsupplied area changes into **the chorion laeve**.



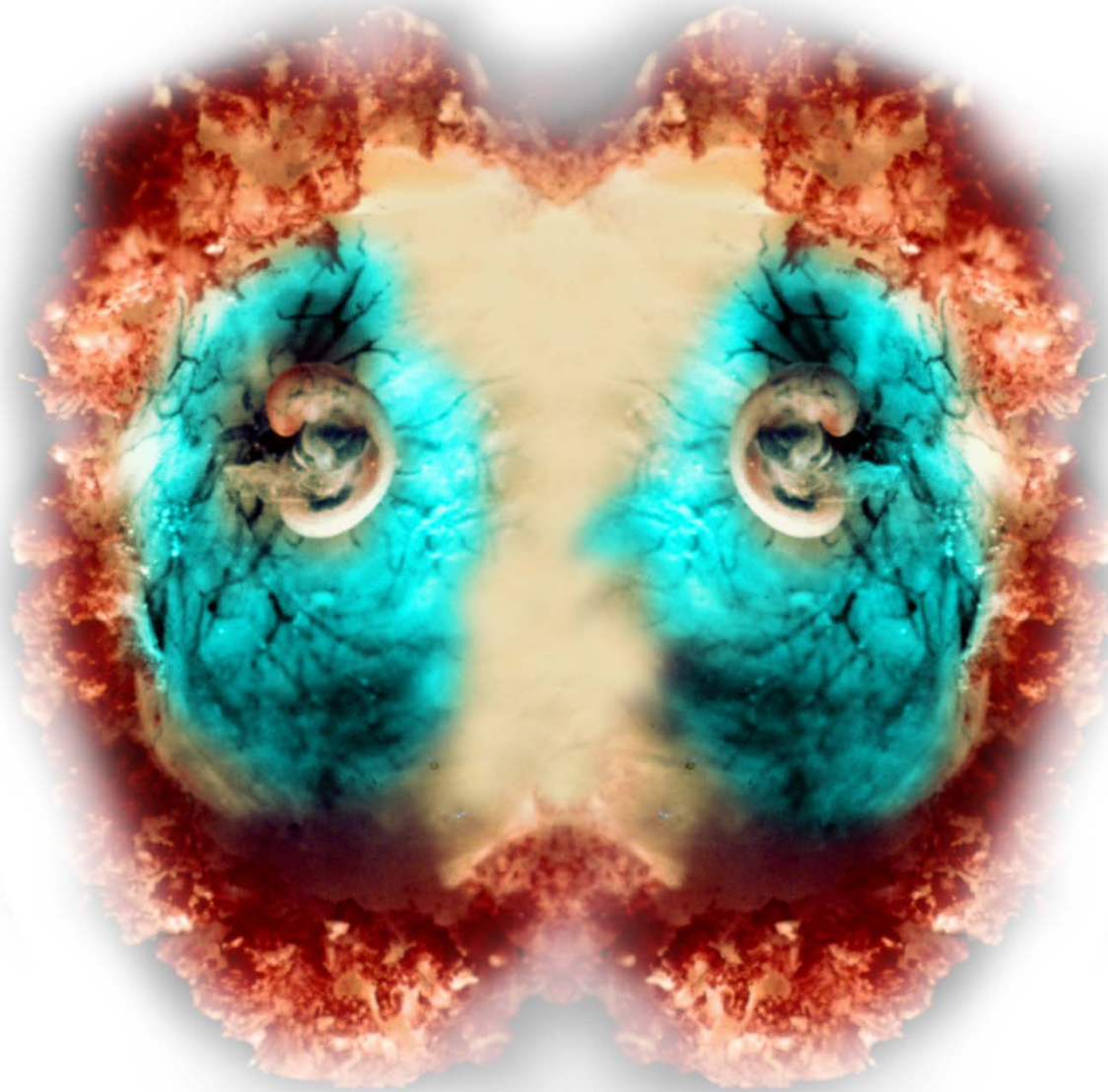


If the change of the chorion into the placenta is related to the blood circulation. In case of two separated embryos and fetuses there are two different areas transforming into **the villous chorion**.

The areas may be isolated, contacting or overlapping or fusing. This is related to the delineation of the placenta by the marginal sinus which is characteristic for the placental border. Therefore **twins with a single chorion (monochorionic) may be biplacental or monoplacental**.



Monochorial monoplacental twins

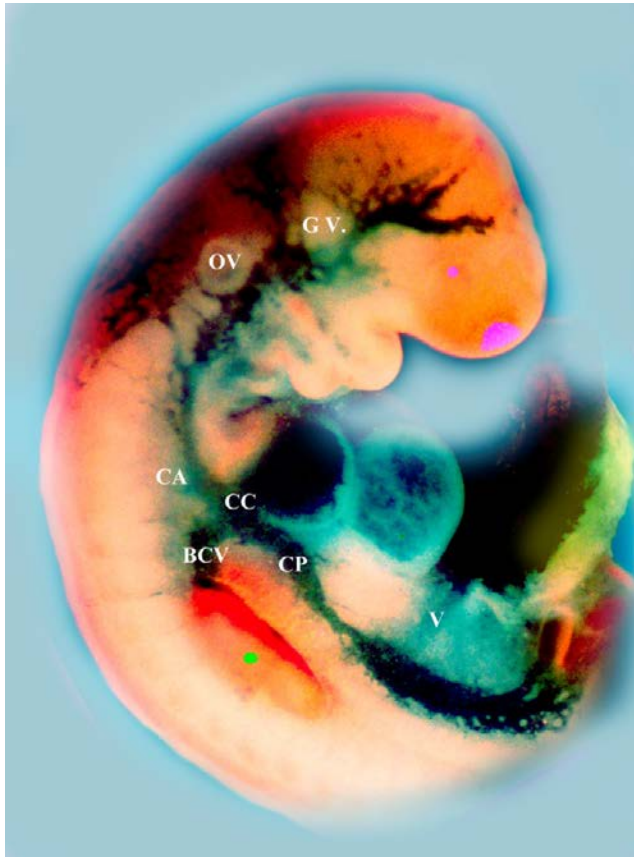


Monochorial biplacental twins

The vascular anastomoses originating from the chorionic net are deep, while anastomoses related to the angiogenesis by umbilical arteries growing from the embryo in the relation to the heart beat are superficial.

In case of placental anastomoses the amount of blood pumped from the donor fetus into the recipient is substantial for the development of **twin to twin transfusion syndrom (TTTS)**.

In case of **acardiac fetuses** there is an early anastomosis between the umbilical artery of the donor to the umbilical vein of the acardiac resulting into the reverse flow of blood within the umbilical cord bringing blood either into the cranial or caudal cardinal vein. The anomalous circulation favors development of the anterior or posterior areas of the trilaminar germ disk (acardius amorphus, acardius acephalus, acardius acorvus, acardius hemiacardus).



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