Embryology

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Cardiovascular System

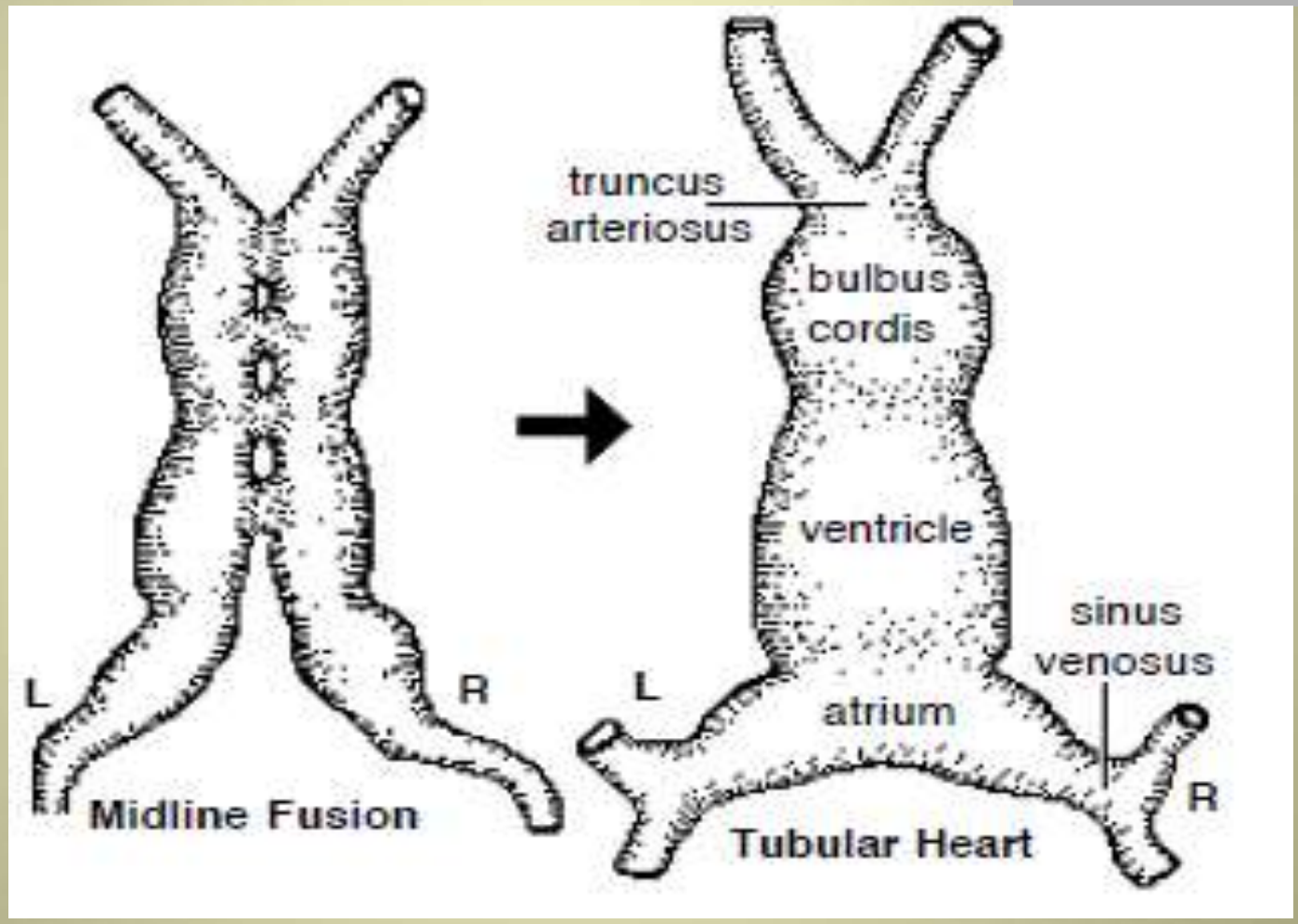
- ***Heart:***
- *From a simple tube, the heart undergoes differential growth into a four chambered structure while it is pumping blood throughout the embryo and into extra-embryonic membranes. Major vessels form and the heart initiates a peristaltic pumping action during the third week in the dog.*

Formation of a Tubular Heart:

- *-The first evidence of heart development is horse-shoe shaped vessel*
- *formation within the cardiogenic plate, which is splanchnic mesoderm situated anterior and lateral to the embryo.*
- *-In mammalian embryo heart arises from paired mesodermal primordial ,situated ventro laterally beneath pharynx .*
- *-The cardiac primordia are paired left and right composed of two layers.*
- *- The inner layer is called the endocardium because its destined to form the internal lining of heart.*
- *- The outer layer is derived from thickened splanchnic mesoderm known as epimyocardium because its will form the myocardium and outer layer epicardium .*
- *- as a result the paired endocardial tubes progressively closer together .Finally fussed into a single tube lying in midline.*
- *-In the same time the epimyocardium are bent toward midline and ventrally to endocardial tubes to become contact with each other .*

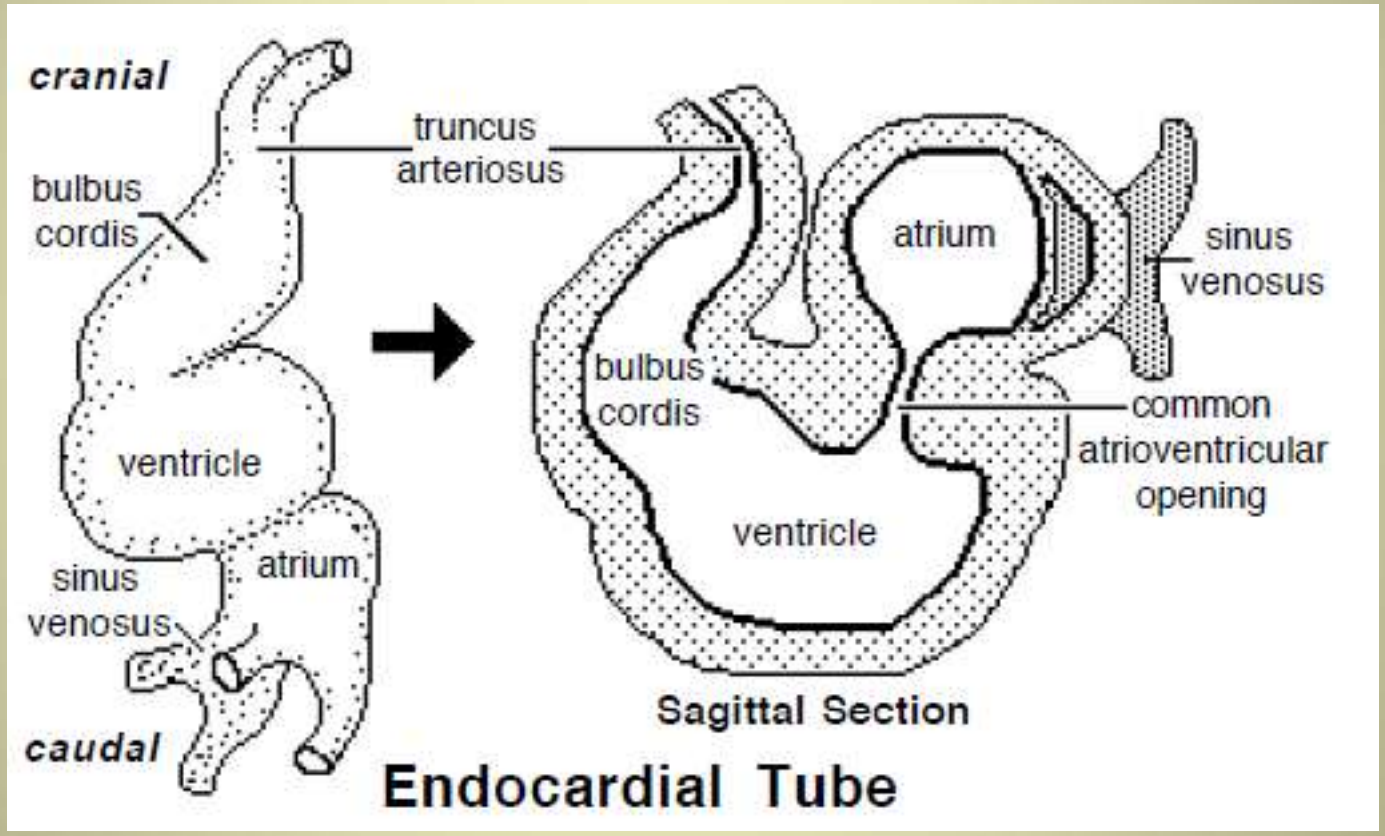
Primitive Heart Regions:

- *Differential growth of the endocardial tube establishes five primitive heart regions:*
- *Truncus arteriosus — the output region of the heart. It will develop into the ascending aorta and pulmonary trunk.*
- *2- Bulbus cordis — a bulb-shaped region destined to become part of the right ventricle (conus arteriosus).*
- *3 - Ventricle — an enlargement destined to become the left ventricle.*
- *4 -Atrium — a region that will expand to become both right and left auricles.*
- *5- Sinus venosus — a paired region into which veins drain. The left sinus venosus becomes the coronary sinus; the right is incorporated into the wall of the right atrium.*

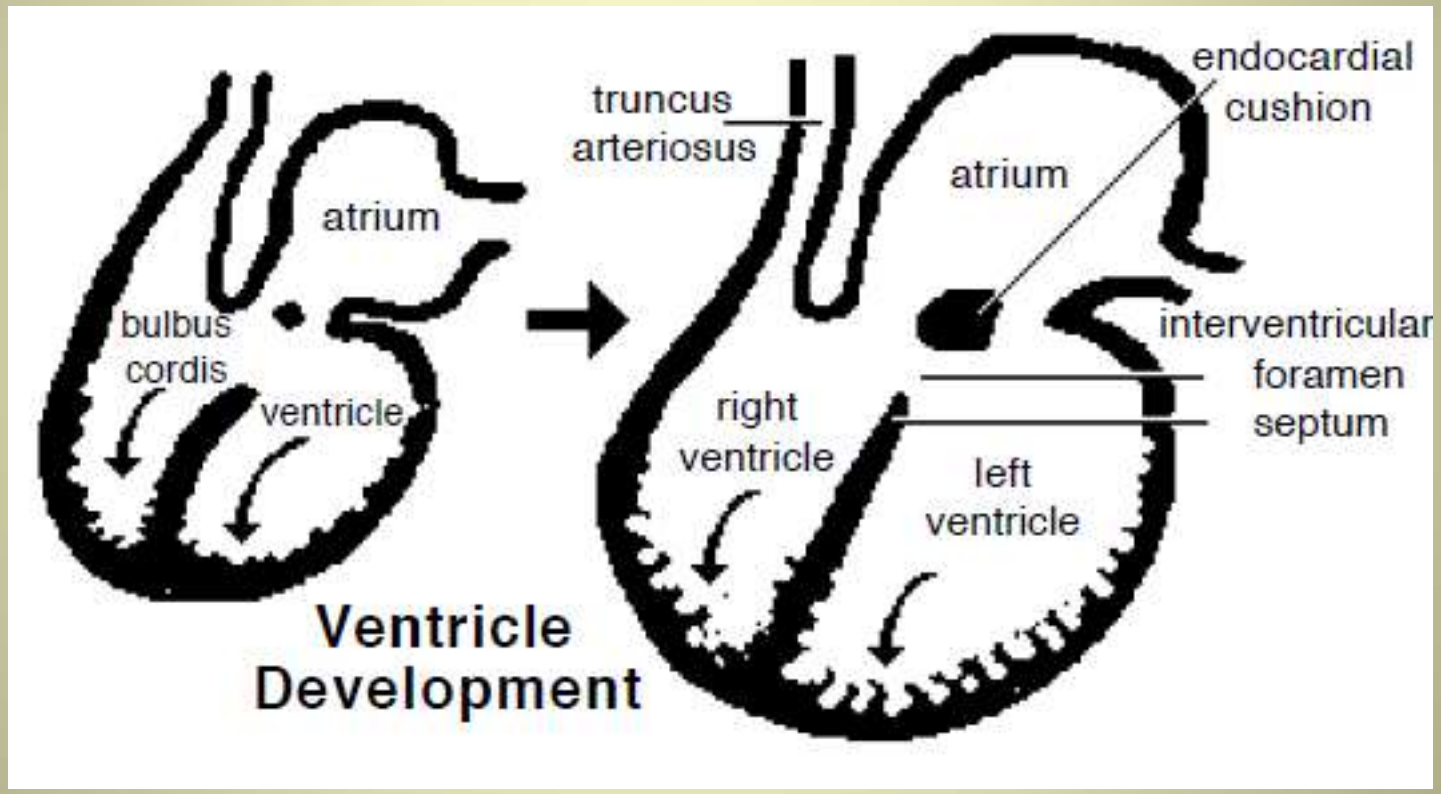

truncus
arteriosus
bulbus
cordis
ventricle
sinus
venosus
atrium
L
R
L
R
Midline Fusion
Tubular Heart

Forming a Four-Chambered Heart:

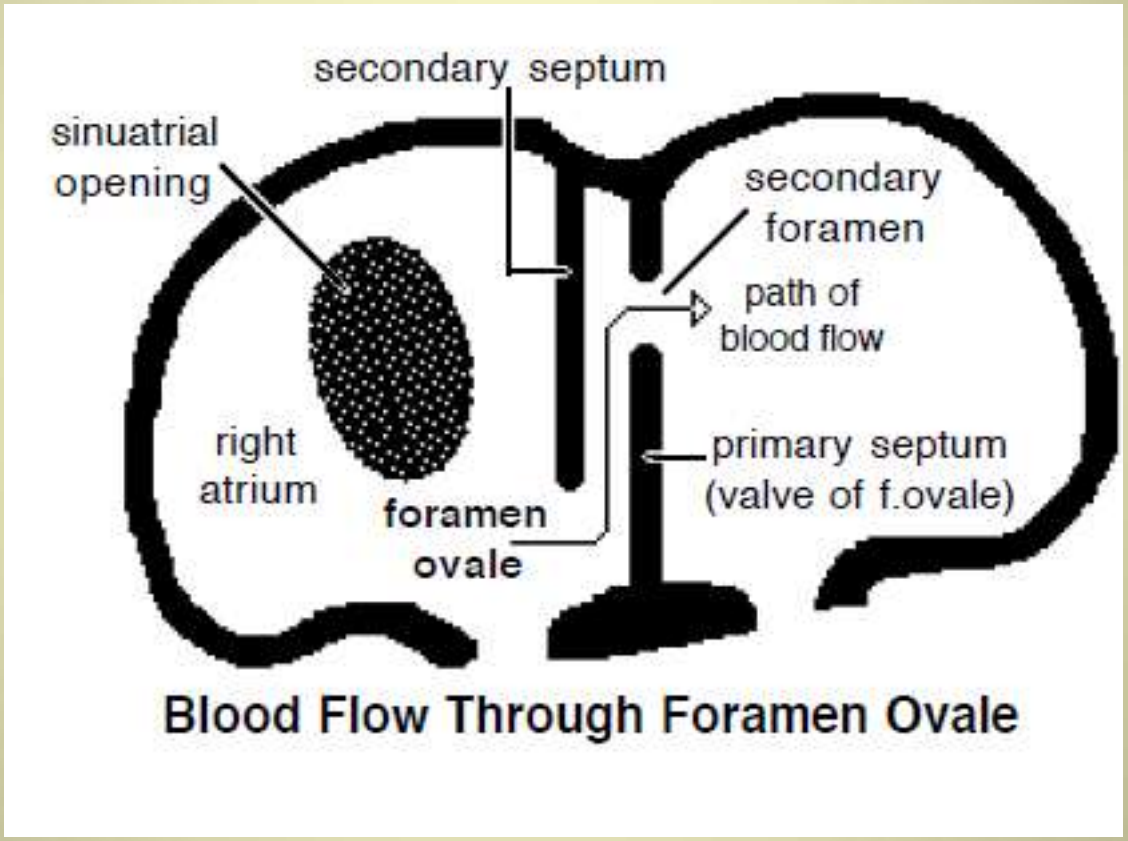
- *A-The endocardial tube lengthens and loops on itself—this puts the bulbus cordis (right ventricle) beside the ventricle (left ventricle) and the atrium dorsal to the ventricle.*
- *B-Venous return is shifted to the right side. The right sinus venosus becomes enlarged and incorporated into the future right atrium.*
- *The smaller, left sinus venosus merges into the future right atrium as the coronary sinus.*
- *The atrium expands and overlies the ventricle chamber. A common atrioventricular opening connects the two chambers. At the level of the atrioventricular opening, a constriction, the future coronary groove, separates atrium and the ventric*


cranial
truncus
arteriosus
bulbus
cordis
ventricle
atrium
sinus
venosus
caudal
atrium
sinus
venosus
bulbus
cordis
common
atrioventricular
opening
ventricle
Sagittal Section
Endocardial Tube

- *C- The common atrio-ventricular opening is partitioned into right and left A-V openings by growth of endocardial “cushions”. Subsequently, ventral growth of the cushions contributes to a septum that closes the interventricular foramen (the original opening between the bulbus cordis &ventricle*
- *D-The right and left ventricles are formed by ventral growth and excavation of the bulbus cordis and ventricle, respectively. An interventricular septum, atrioventricular valves, chordae tendineae, papillary muscles, and irregularities of the internal ventricular wall are all sculptured by selective excavation of ventricular wall tissue.*


truncus
arteriosus
endocardial
cushion
atrium
atrium
bulbus
cordis
ventricle
interventricular
foramen
septum
right
ventricle
left
ventricle
Ventricle
Development

- *E- Right and left atria are established by formation of an interatrial septum. Septum formation is complicated by the need, until birth, for a patent (open) septum that allows blood to flow from the right atrium to the left. The septal opening is called the foramen ovale.*
- *Two septae and three foramina are involved in dividing the atria:*
- *Interatrial Septum 1 grows from the dorsal atrial wall toward the endocardial cushions. The preexisting Foramen 1 is obliterated when Septum 1 meets the endocardial cushion. Foramen 2 develops by fenestration of the dorsocranial region of Septum 1 (before Foramen 1 is obliterated).*
- *Interatrial Septum 2 grows from the cranial wall of the right atrium toward the caudal wall. The septum remains incomplete and its free edge forms the boundary of an opening called the Foramen Ovale*



Blood Flow Through Foramen Ovale