INTRODUCTION TO HUMAN HEART DEVELOPMENT

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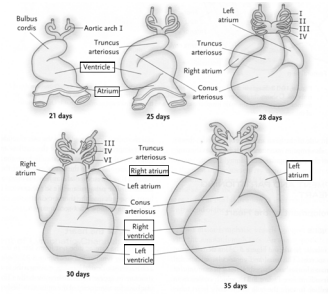
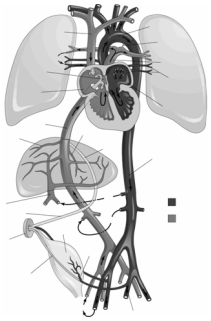
HUMAN HEART DEVELOPMENT



POSTNATAL CIRCULATION

PULMONARY CIRCULATION
RIGHT CHAMBERS

SYSTEMIC CIRCULATION
LEFT CHAMBERS



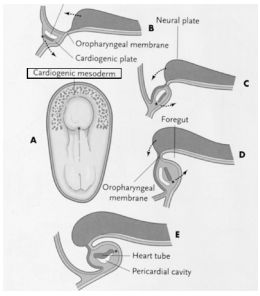
HUMAN HEART DEVELOPMENT

- **HEART TUBE FORMATION**
- **CARDIAC LOOPING**
- **CHAMBER SEPTATION**
- **VALVE AND OUTFLOW FORMATION**

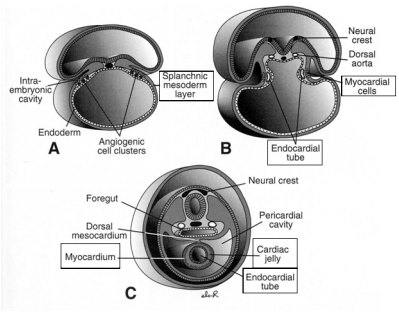
CONGENITAL HEART DISEASE

- **RELATIVELY COMMON**
- **GENERALLY INITIATED BY EARLY DEVELOPMENTAL ERRORS**
- **CAN BE CAUSED BY EXPOSURE TO TERATOGENS**
- **CAN ORIGINATE WITH GENETIC DEFECTS**

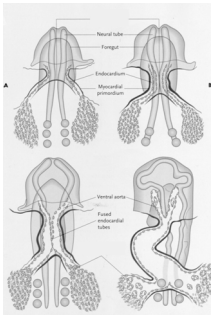
LONGITUDINAL FOLDING POSITIONS CARDIAC CELLS



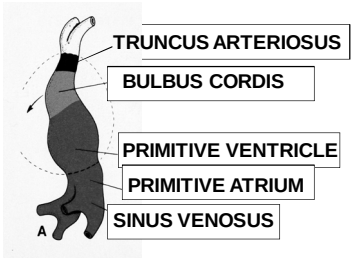
LATERAL FOLDING FACILITATES TUBE FORMATION



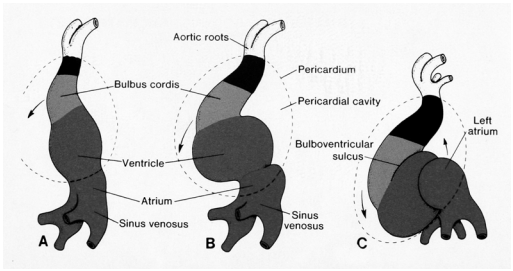
TUBE FORMATION BEGINS ROSTRALLY



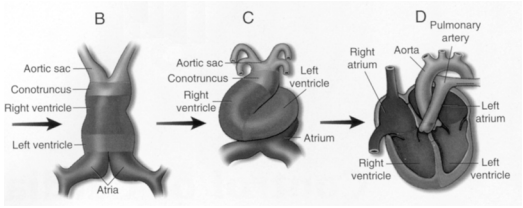
PRIMITIVE HEART TUBE



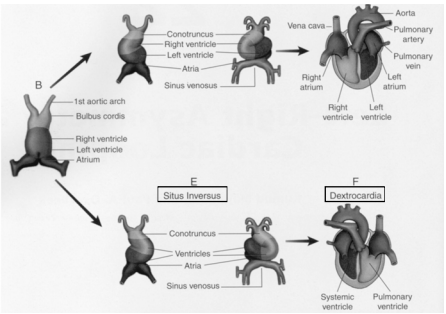
CARDIAC LOOPING



CARDIAC LOOPING



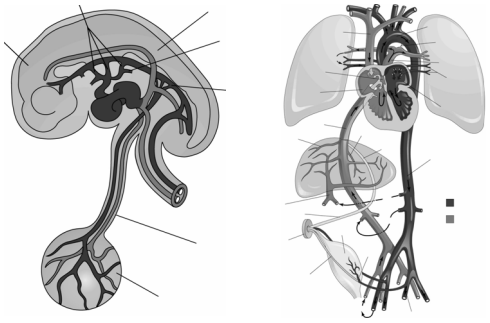
DEXTROCARDIA AND SITUS INVERSUS



GENETIC BASIS FOR HETEROTAXY

- NODAL FAMILY OF GROWTH FACTORS REQUIRED FOR ESTABLISHMENT OF LEFT-RIGHT AXIS
- *CFC1* GENE ENCODES A COMPONENT OF THE RECEPTOR FOR NODAL FACTORS
- MUTATIONS IN *CFC1* CAUSE HETEROTAXY

FROM FETAL TO POSTNATAL CIRCULATION

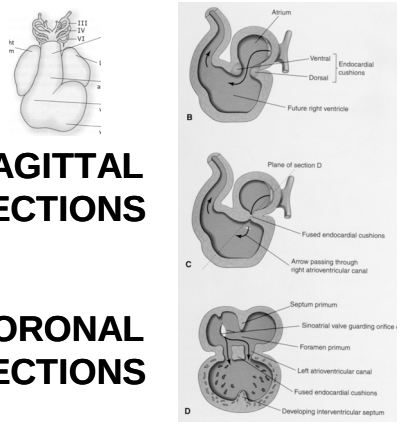


PARTITIONING THE HEART

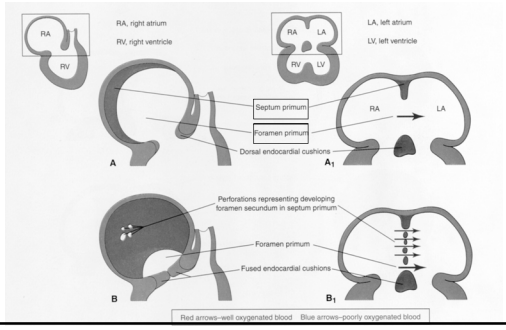
- ATRIAL SEPTATION
- VENTRICULAR SEPTATION
- ATRIOVENTRICULAR VALVE FORMATION
- DIVISION OF THE OUTFLOW TRACT

SAGITTAL SECTIONS

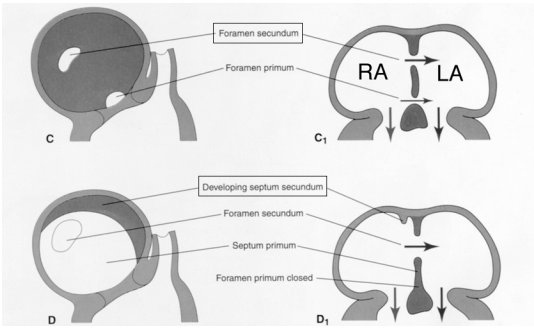
CORONAL SECTIONS



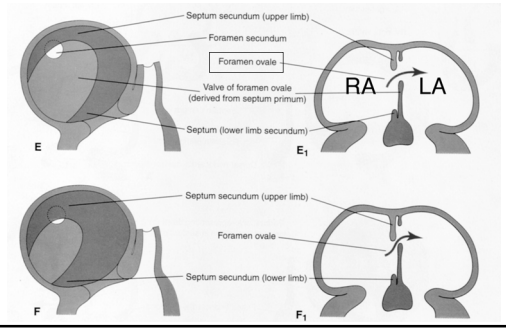
ATRIAL SEPTATION I: SEPTUM PRIMUM



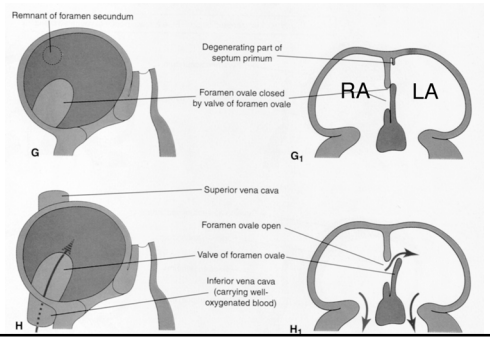
ATRIAL SEPTATION II: FORAMEN SECUNDUM



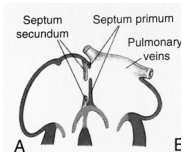
ATRIAL SEPTATION III: SEPTUM SECUNDUM



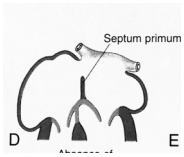
ATRIAL SEPTATION IV: COMPLETION



ATRIAL SEPTAL DEFECTS



NORMAL



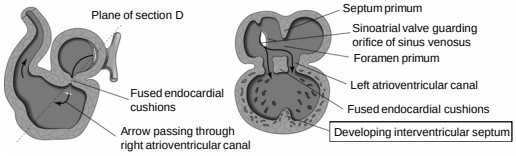
OSTIUM SECUNDUM (HIGH) ASD

GENETIC CAUSES OF ASD

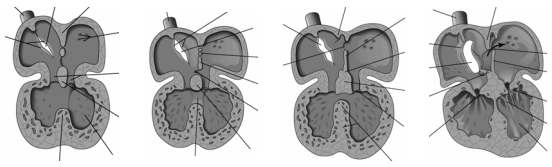
HETEROZYGOSITY OF MUTATIONS IN GENES LIKE:

- ***Nkx2-5*, ENCODING A HOMEODOMAIN TRANSCRIPTION FACTOR**
- ***TBX5*, ENCODING A T-BOX TRANSCRIPTION FACTOR (HOLT-ORAM SYNDROME)**

BEGINNING OF VENTRICULAR SEPTATION



PROGRESSION OF VENTRICULAR SEPTATION



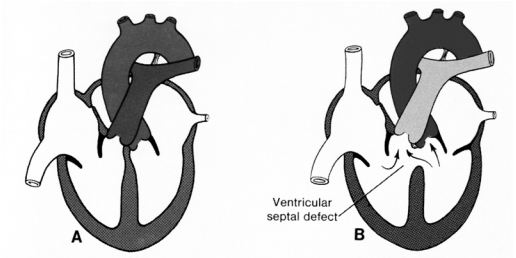
COMPLETION OF VENTRICULAR SEPTATION

MUSCULAR SEPTUM

MEMBRANOUS SEPTUM

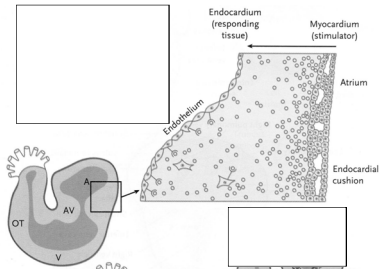
CONOTRUNCAL SEPTUM

MEMBRANOUS VSD

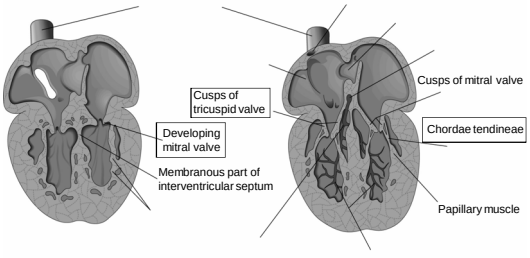


NORMAL **VSD**

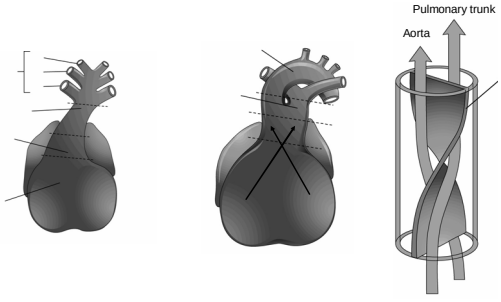
ENDOCARDIAL CUSHION FORMATION



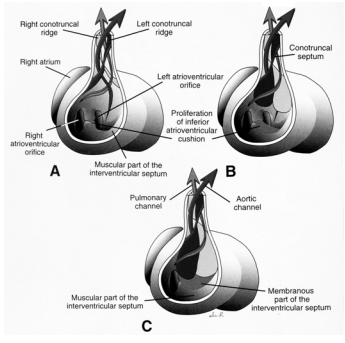
VALVE FORMATION



OUTFLOW SEPTATION

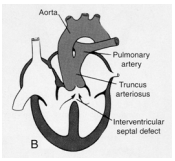


OUTFLOW SEPTATION

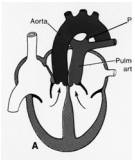


DEFECTS IN OUTFLOW SEPTATION

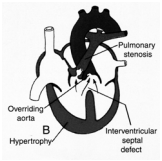
NORMAL



NO SEPTUM: PERSISTENT TRUNCUS ARTERIOSUS

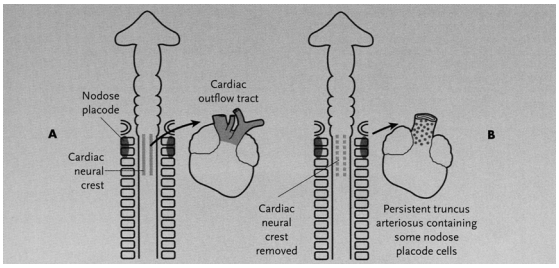


STRAIGHT SEPTUM: TRANSPOSITION OF GREAT VESSELS



ASYMMETRIC SEPTUM: PULMONARY STENOSIS; TETRALOGY OF FALLOT

NEURAL CREST AND OUTFLOW TRACT SEPTATION



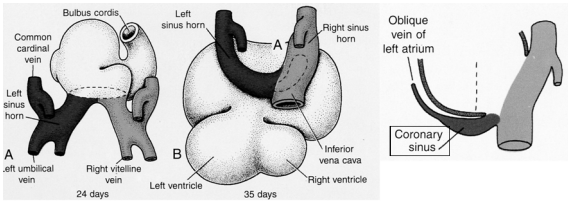
GENETIC BASIS FOR OUTFLOW DEFECTS

- *TBX1* ENCODES A TRANSCRIPTION FACTOR EXPRESSED NEAR MIGRATING NEURAL CREST CELLS
- *TBX1* MUTATION IN MICE CAUSES DEFECTS RESEMBLING DIGEORGE SYNDROME
- DELETION OF *TBX1* FOUND IN MANY DIGEORGE SYNDROME PATIENTS

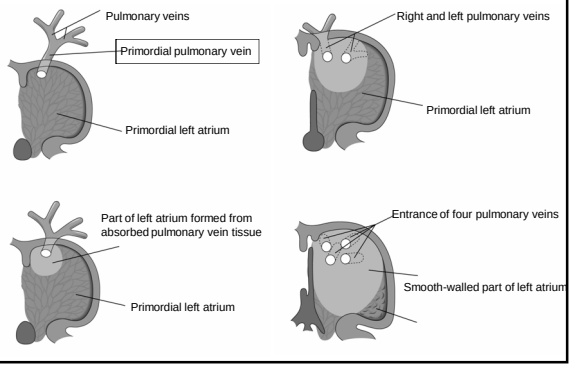
HUMAN HEART DEVELOPMENT

- HEART TUBE FORMATION
- CARDIAC LOOPING
- CHAMBER SEPTATION
- VALVE AND OUTFLOW FORMATION

SINUS VENOSUS AND RIGHT ATRIUM



PULMONARY VEINS AND LA



ATRIAL SEPTAL DEFECTS

- **OSTIUM PRIMUM (LOW) ASD**
- **OSTIUM SECUNDUM (HIGH) ASD**
- **SINUS VENOSUS ASD**