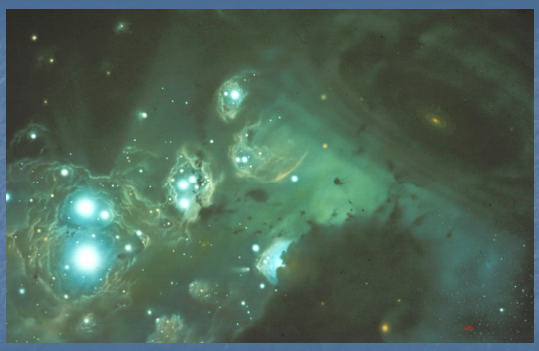
Cardiac Diseases

Pathology of the Heart

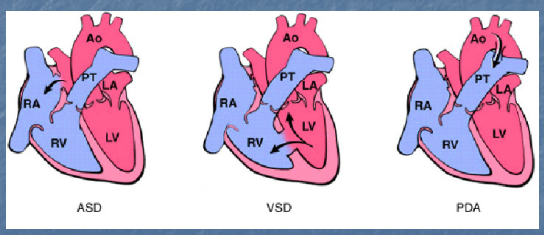
- All problems are eventually expressed as inadequate cardiac output.
  - Leaks in the system
  - Electrical Conduction, irregular rhythm
  - Obstruction to flow
  - Valve problems, obstruction or incompetence
  - Cardiac muscle weakness and failure



Congenital Heart Disease

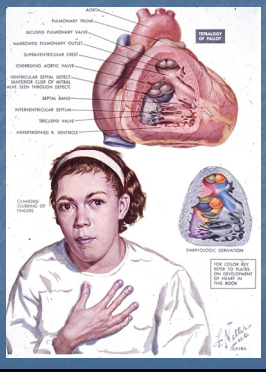
- Clinical symptoms come from mixing blood.
  - Right (unoxygenated) blood is shunted to…
  - Systemic output
  - Cyanosis, either immediate or late
- Present at birth
  - Genetic factors are rare
  - Environmental (developmental) are common
    - Maternal infections
    - Fetal alcohol syndrome

Congenital Heart Disease



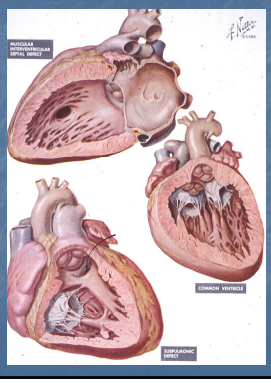
Congenital Heart Disease

- Cyanotic heart disease
  - Child is cyanotic (blue) right from the get go.
  - Right-sided blood is mixing with systemic.
  - Non-oxygenated blood (venous blood) is coming directly out in the aorta.



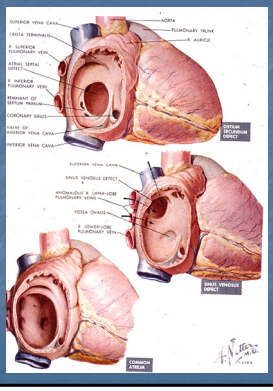
Congenital Heart Disease

- Tardive cyanotic heart disease.
  - Tardive means late, late developing.
  - Comes several years after birth.
  - Underlying problem has been there all along.
  - Left to right shunt.
  - More blood in the pulmonary circulation can handle.
  - In time the shunt reverses.

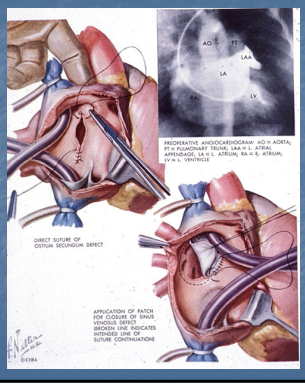


Congenital Heart Disease

- Atrial septal defect
- Common and may cause severe shunting.
- Several varieties.
- Paradoxical embolization.

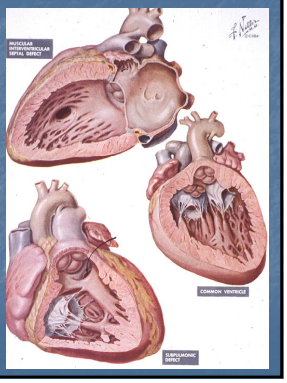


Repair of an Atrial Septal Defect

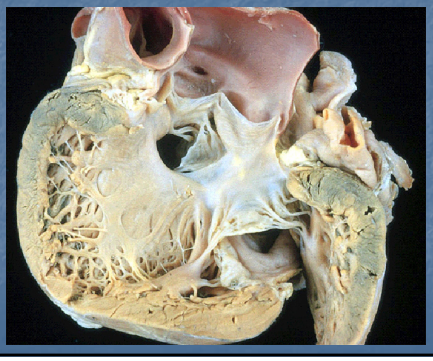


Ventricular Septal Defect

- Left to right shunt
- Depending on size will lead to Eisenminger reaction.
- Later becomes right to left shunt.
- Possible infections.

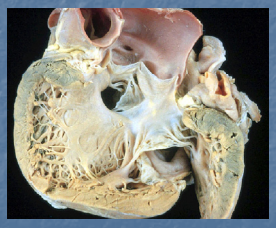


Ventricular Septal Defect



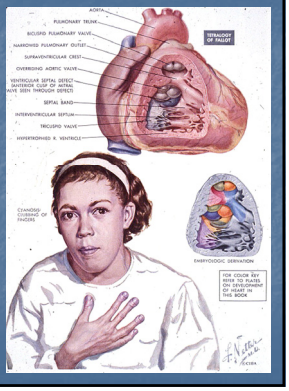
Ventricular Septal Defect

- Colorized Doppler
- Note jet at top of frame.
- Infection on downstream side.
- Eisenminger?

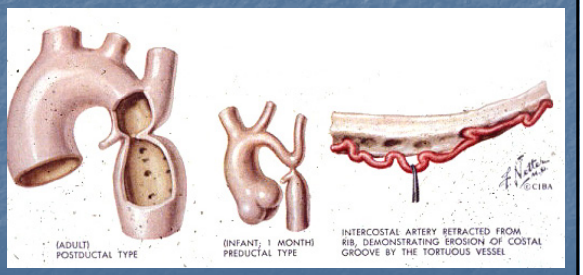


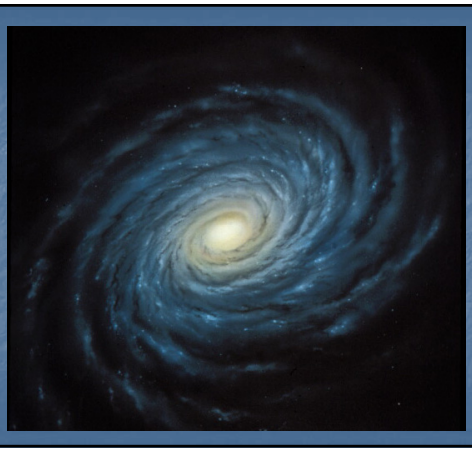
Tetralogy of Fallot

- Four problems
  - 3 defects
  - 1 compensatory
- VSD
- Narrowed pulmonary outflow tract
- Over-riding aorta
- RV hypertrophy



Coarctation of Aorta



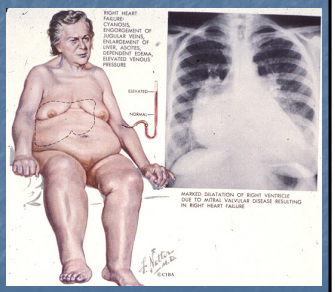


Heart Failure

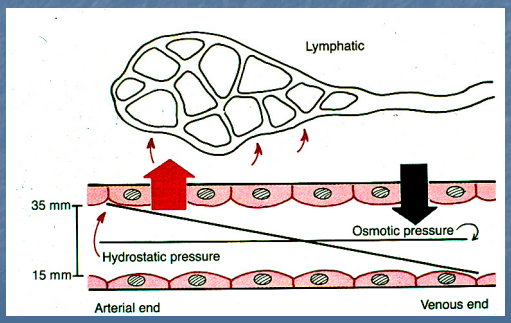
- Diminished out volume of either ventricle.
  - Systolic failure
    - Loss of pumping strength.
    - Backup of blood behind weakened ventricle.
    - Atherosclerosis leading to chronic ischemia.
  - Diastolic failure
    - Reduced ability of ventricle to fill.
    - Constriction of trapping of ventricle

Congestive Heart Failure

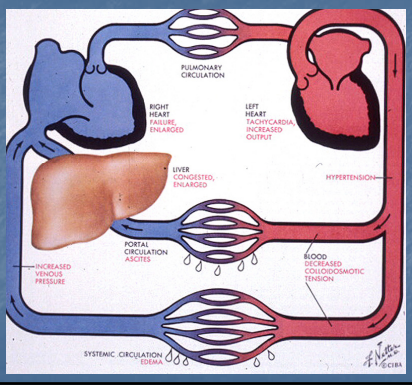
- Diminished of pumping ability of left ventricle.
- Back up of blood in pulmonary vasculature.
- Pulmonary edema
- Peripheral edema



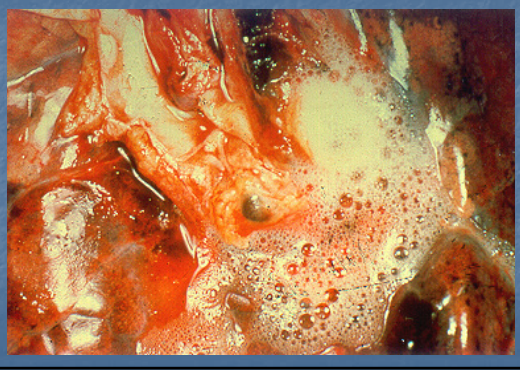
Back Pressure



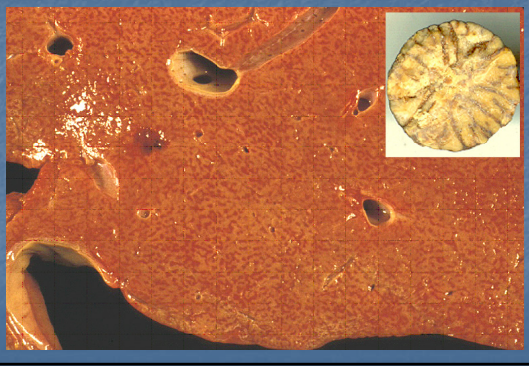
CHF and Edema Formation



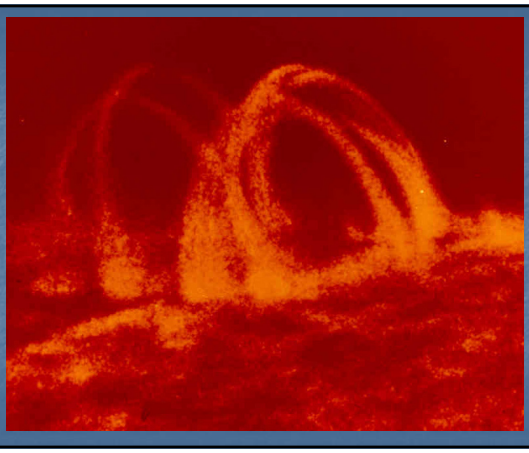
Pulmonary Edema



Liver Chronic Passive Congestion



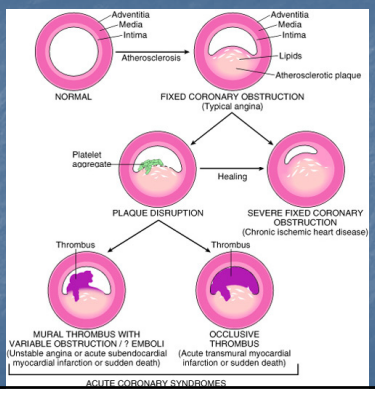
Pitting Edema



Ischemic Heart Disease

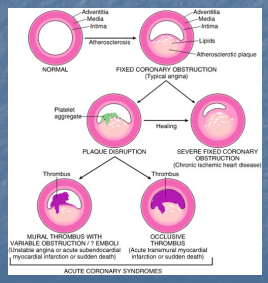
- This is the biggie in the western world.
- Atherosclerosis of coronary arteries.
- Acute vs. chronic ischemia.
- Four basic patterns
  - Angina pectoris
  - Myocardial infarction
  - Chronic ischemia leading to CHF
  - Sudden death from arrhythmia

Coronary Atherosclerosis

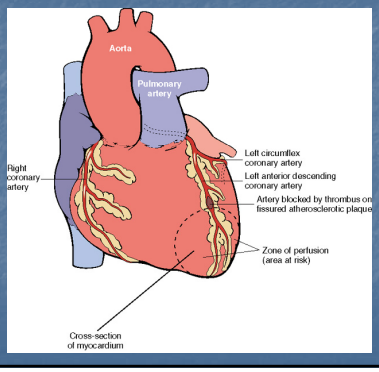


Coronary Atherosclerosis

- Focal narrowing

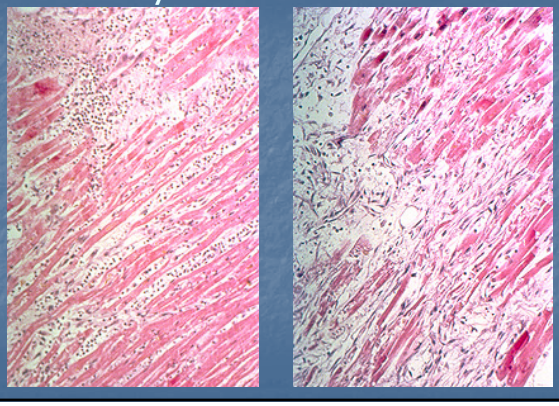


Myocardial Infarction



Myocardial Infarction

Myocardial Infarction

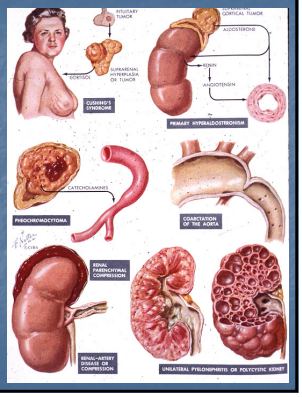


Myocardial Infarction

- Complications of MI
  - Cardiogenic heart failure
    - Sudden loss of pumping strength.
  - Arrhythmias
    - Irritable conduction system.
  - Valvular dysfunction
    - involvement of papillary muscle
  - Rupture and tamponade

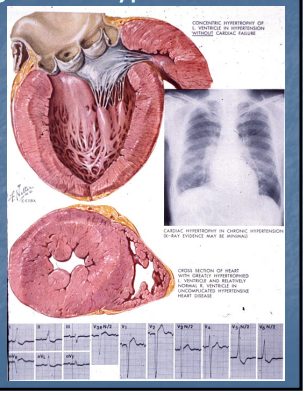
Hypertension

- Many causes
- Essential (majority)
  - No known cause
  - Stress perhaps
- Modifiable causes
  - Endocrine tumors
    - Aldosterone
    - Cushing's Syndrome
  - Vascular related
    - Narrowing of renal a.
  - Primary Renal disease
    - Excess renin production



Cardiovascular Changes with Hypertension

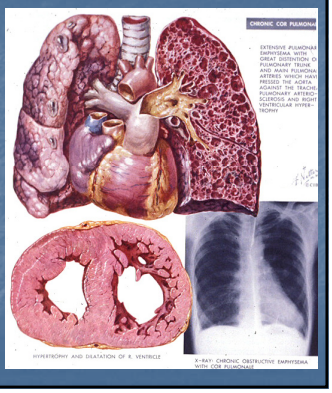
- Left ventricular hypertrophy
  - Abnormal orientation of hypertrophied cells.
- Heart failure in time
- Arrhythmias
- Severe atherosclerosis
- Renal disease
- Stroke
- Aortic wall dissection

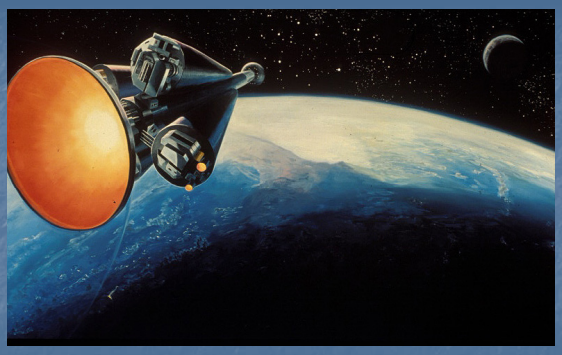


Left Ventricular Hypertrophy

Cor Pulmonale

- Right-sided failure secondary to intrinsic pulmonary disease.
  - Emphysema
  - Scaring conditions of the lung
  - Chronic embolization



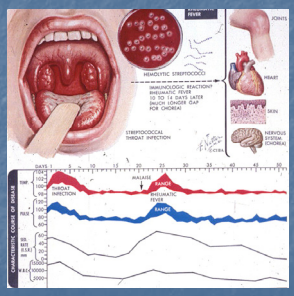


Valvular Disease

- Stenosis (won't open all the way)
- Incompetent (won't close all the way)
- Embolization of junk from a valve

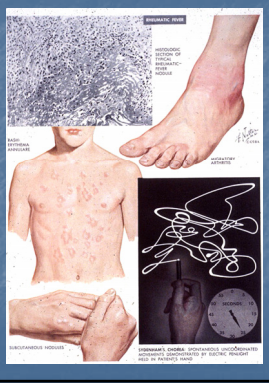
Rheumatic Fever

- Streptococcal infection starts it.
- Antibodies are made against Strep wall.
- Antibodies cross react with connective tissue.
  - Type II hypersensitivity.
- Many systems become involved.



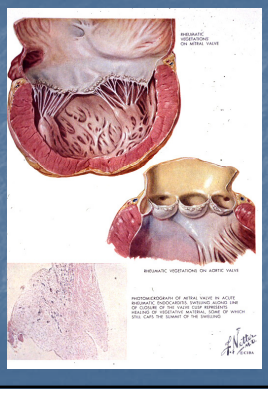
Rheumatic Fever

- Antibodies cross react with connective tissue.
  - Joint symptoms
  - Skin
  - Heart
  - CNS



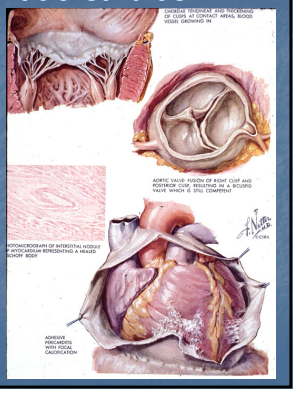
Rheumatic Carditis

- All parts of the heart are involved.
  - Endocardium
  - Valves
  - Myocardium
  - Pericardium
- To the right are sterile vegetations on acutely inflamed valves
  - Can embolize
  - Will lead to scaring



Healed Rheumatic Carditis

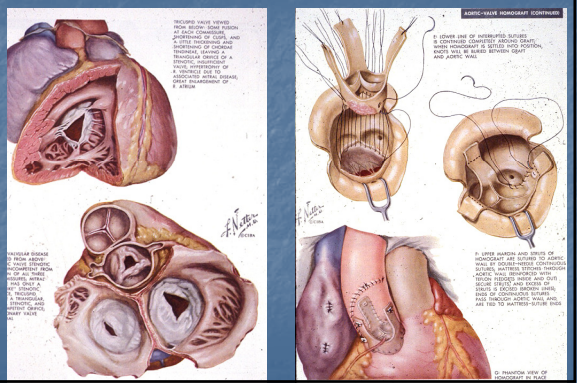
- Scared and stenotic mitral and aortic valves.
- Old sites of inflammation in myocardium
  - Aschoff nodules
- Scars of pericarditis



Healed Rheumatic Mitral Valve

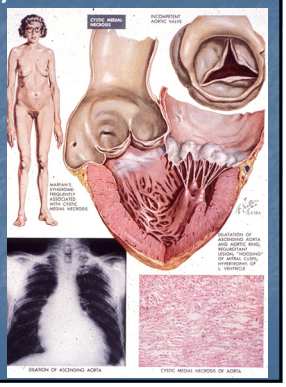
- Scarred valve.
- Both stenotic and incompetent.
- 'Fish mouth'
- This valve is a set up for infections.

Rheumatic Valvular Disease



Marfan's Syndrome

- Inherited disorder of elastic tissue
- Dilated aorta, dissection and rupture.
- Incompetent aortic valve.
- Mitral valve stretches
- Lenses can't accommodate.

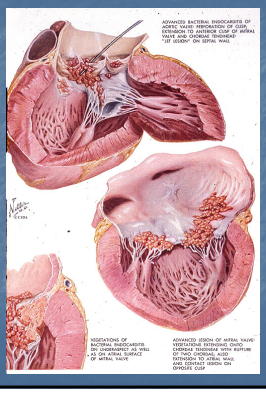


Mitral Valve Prolapse

- Myxoid degeneration of valve matrix.
- Stretches under pressure of left ventricle.
  - Parachute deformity
- The one to the right has a ruptured cordae tendinae

Infective Endocarditis

- Living bacteria on the valves
- Previously damaged valves are at greater risk.
- Destroys valve
- Embolize the junk

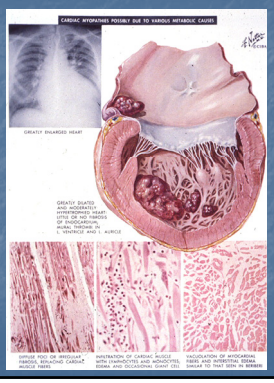


Infective Endocarditis

- Living bacteria on the valves
- Previously damaged valves are at greater risk.
- Destroys valve
- Embolize the junk

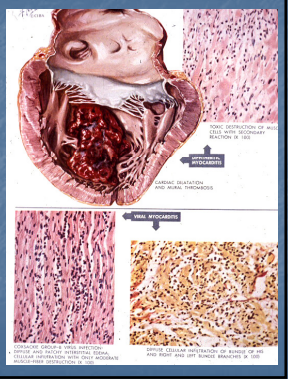
Cardiomyopathy

- Weakened and, paradoxically, hyperplastic myocardium
- 'Primary' means we don't what causes it.
- Secondary to something else.
  - Alcohol
  - Heavy metals
  - Virus?



Myocarditis

- Viruses mostly in US
- Rarely bacteria of TB.
- Parasites
  - Toxoplasmosis gondii
  - Trypanosoma cruzi
- Complications
  - Heart failure
  - Rhythm disturbances
  - Scarring of muscle
  - Mural thrombus and embolization



Pericardial Disease

- Inflammation
  - Viral
  - Lyme disease
  - Renal Failure
  - Cancer
- Effusions
  - CHF
  - Cancer
- Fibrosis leading to restriction of heart motion

Pericarditis

- Inflammation of epicardium and pericardium
- Effusion (fluid) of pericardial space
  - Tamponade
- May lead to serious scarring and restriction of heart motion.

Hemopericardium

- Ruptured or perforated heart
  - MI
  - Penetrating wounds
- Lacerated aortic root
  - Auto accident
  - Rotatory motion unscrews heart from aorta