Anatomical and Physiological Basis for cardiac robotic surgery

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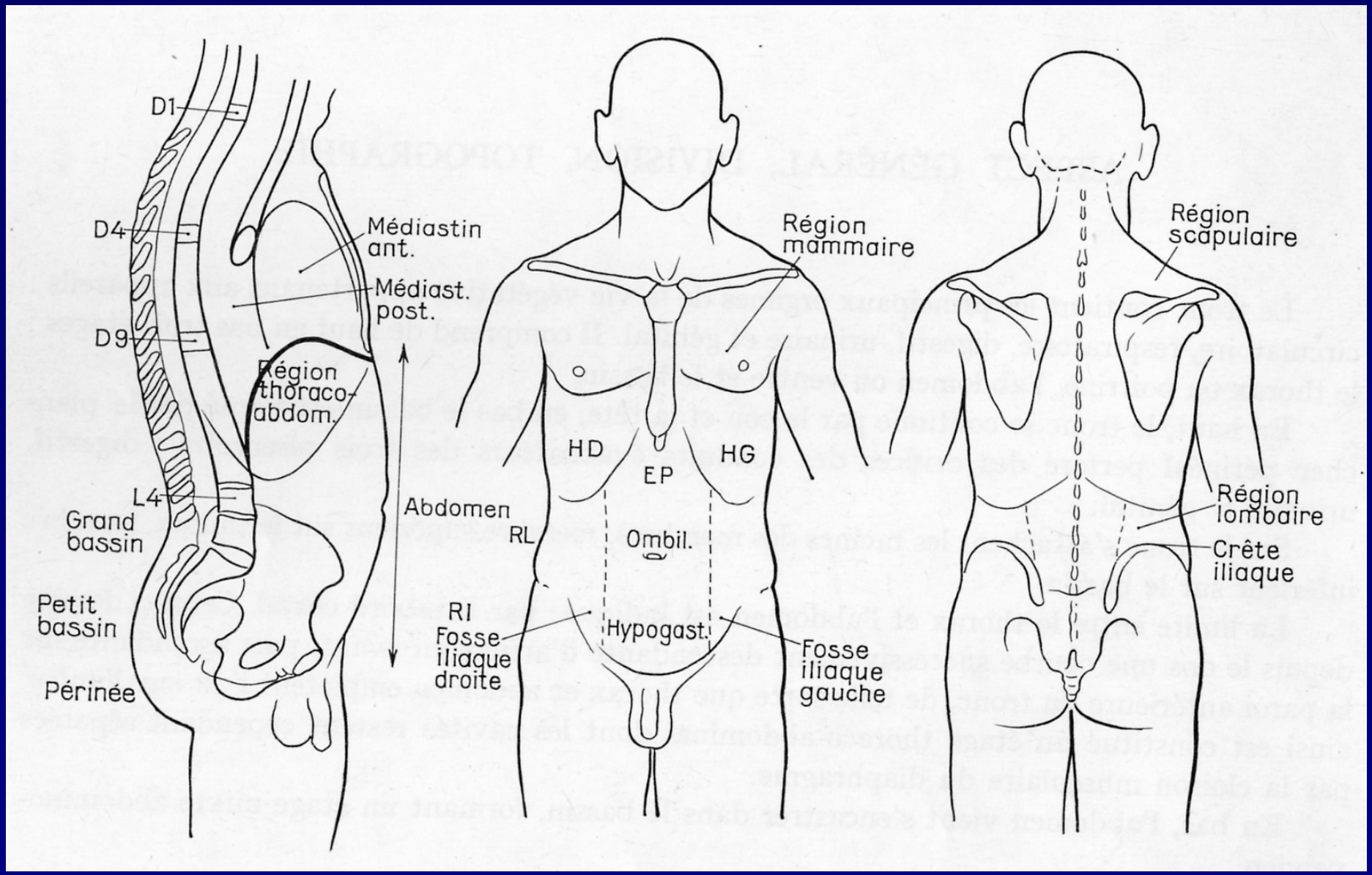
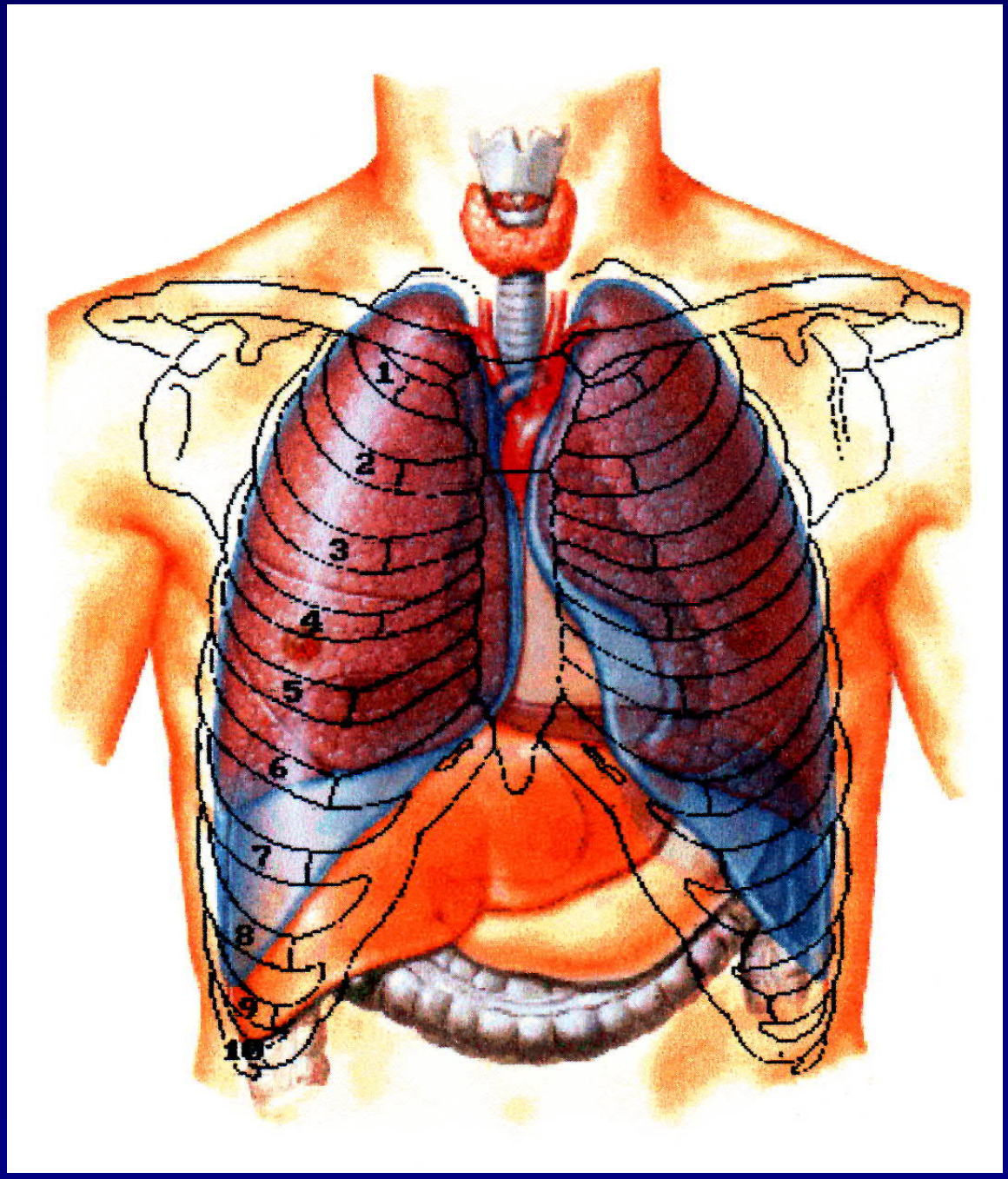
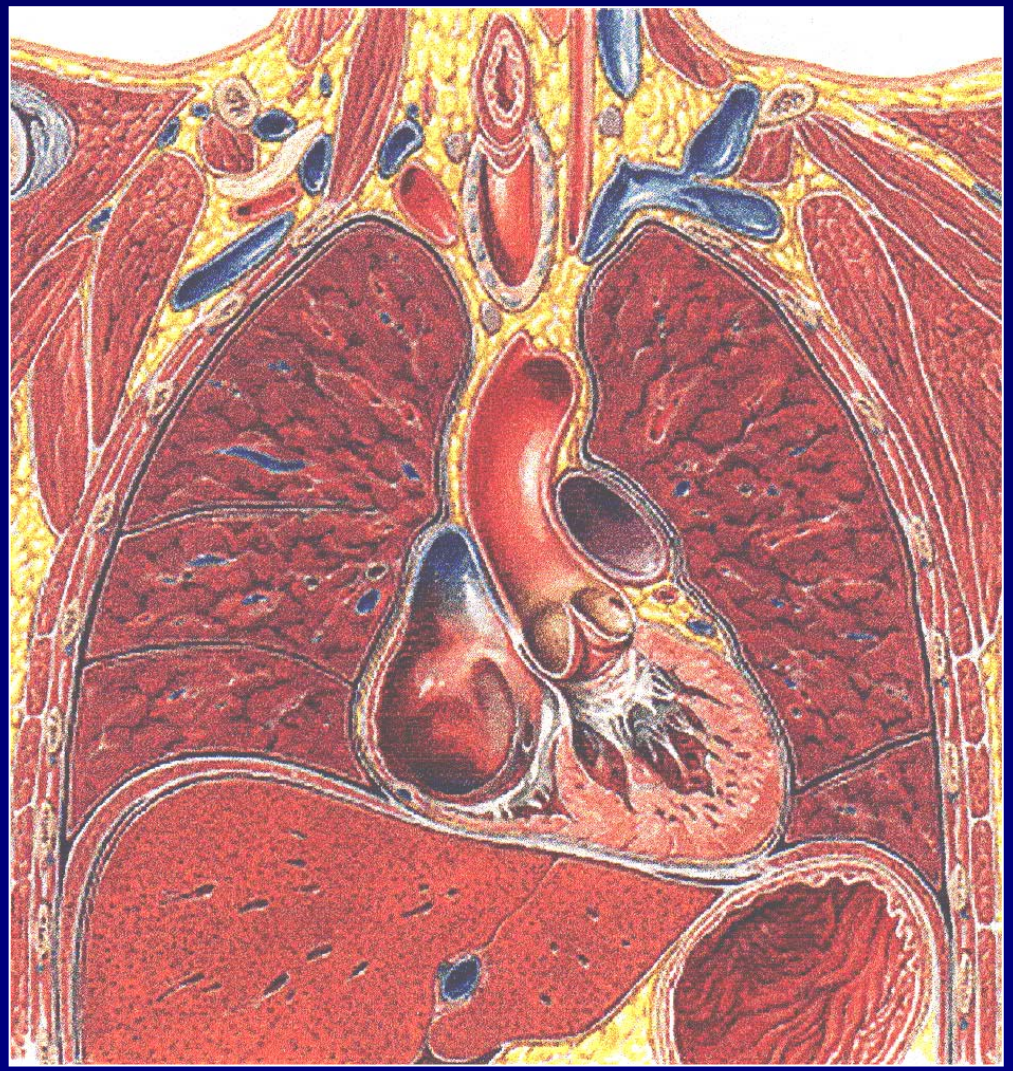
The thorax is the upper part of the trunk

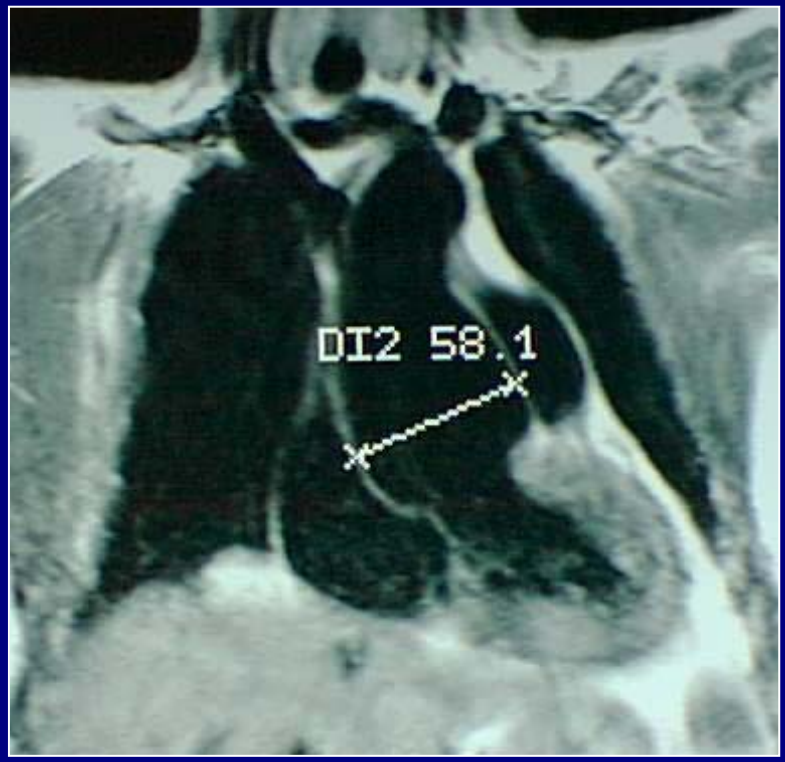




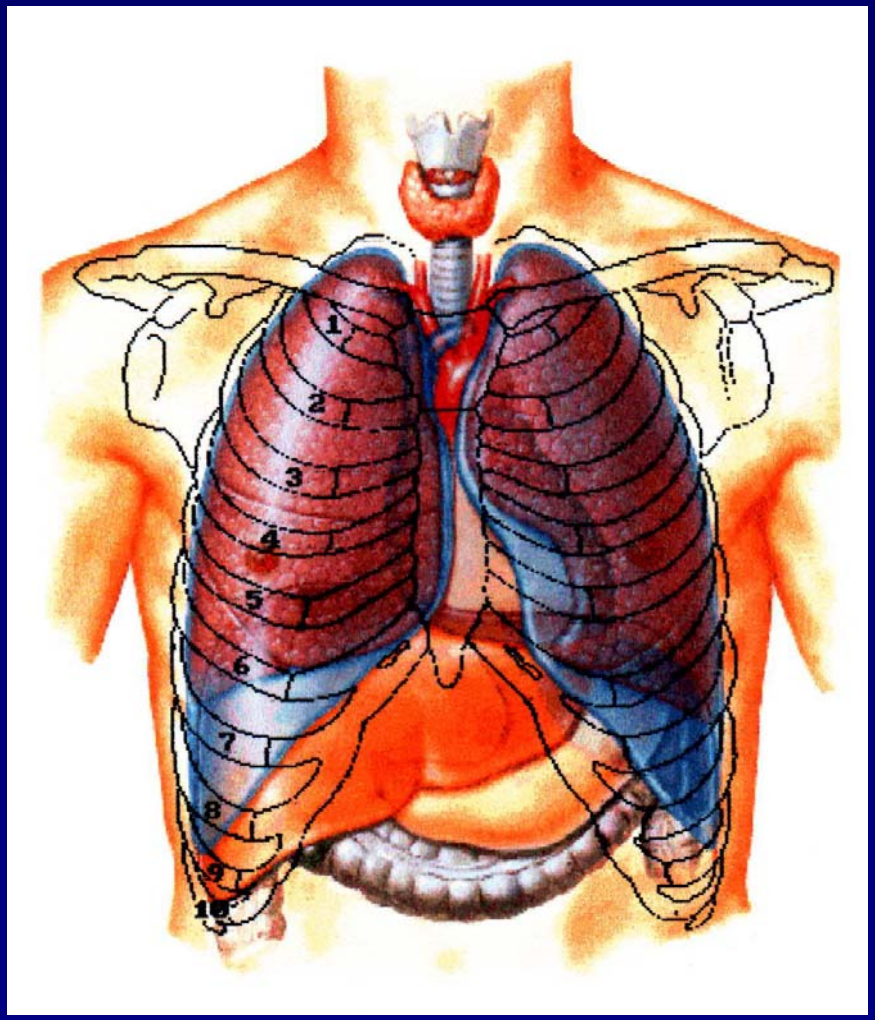
Thorax

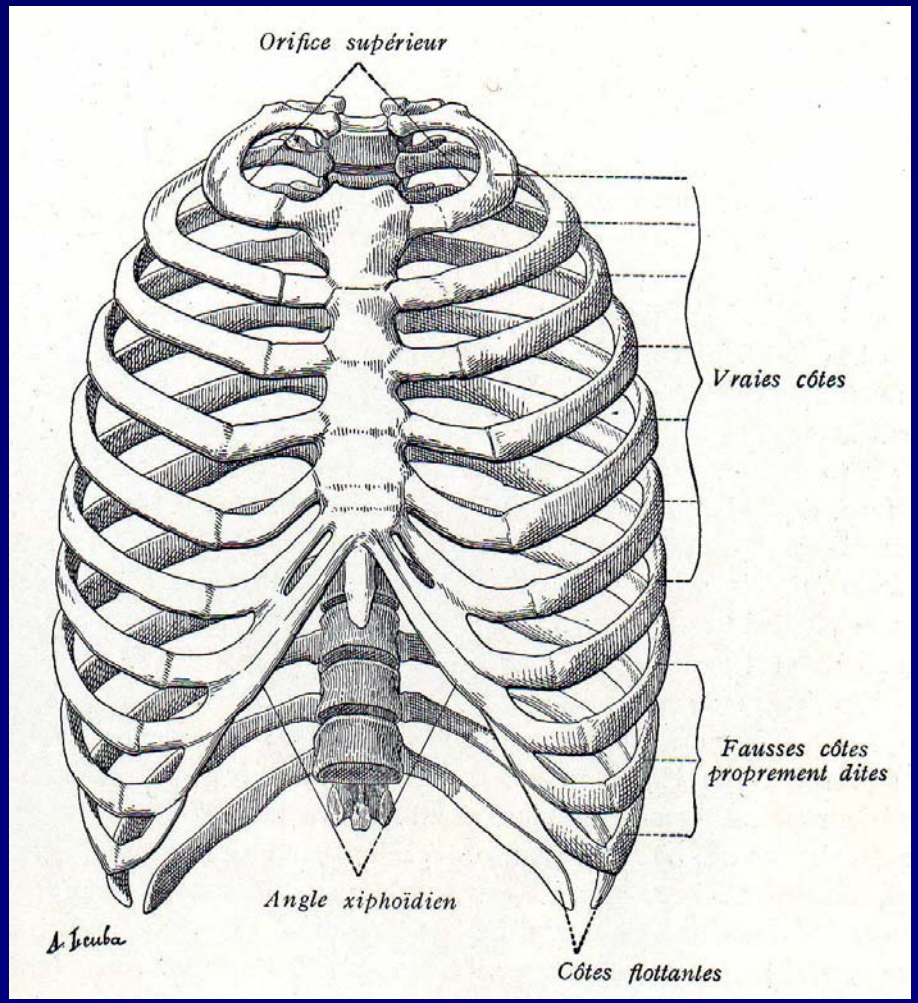
The Thorax…





The heart is in a jail, the thoracic skeletton

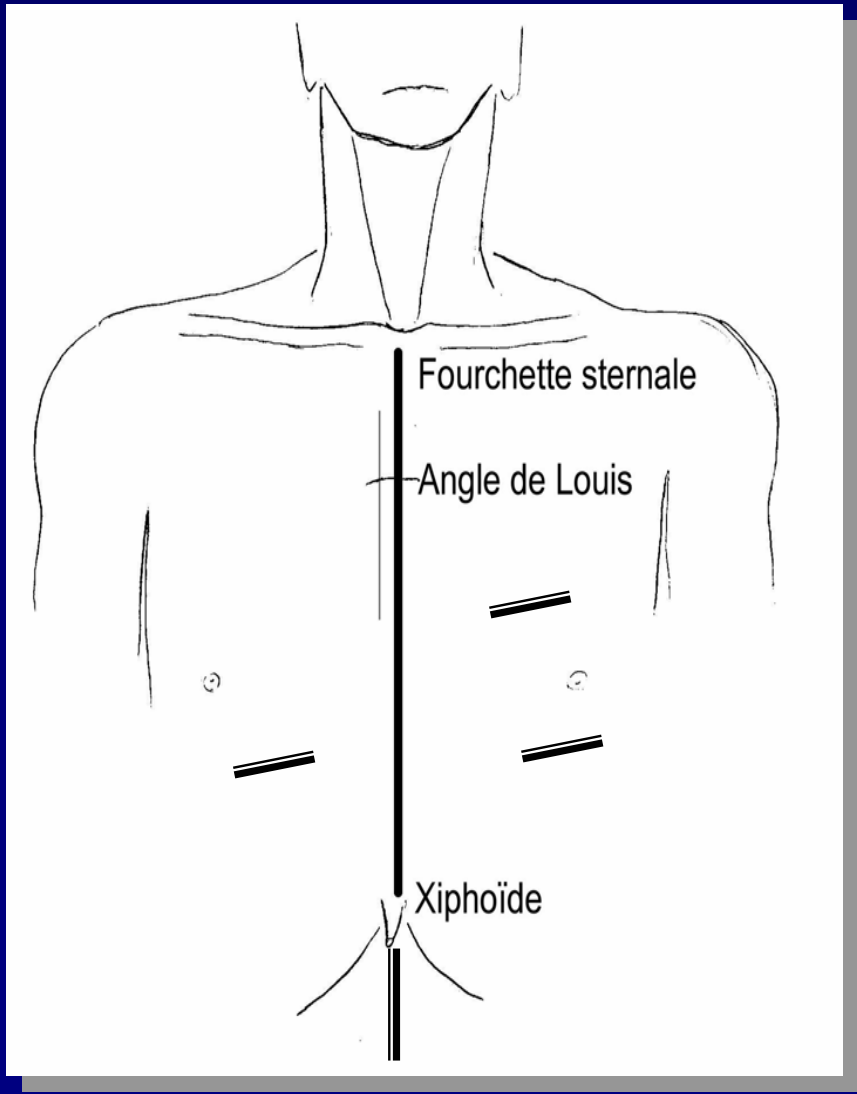




How to work on the heart

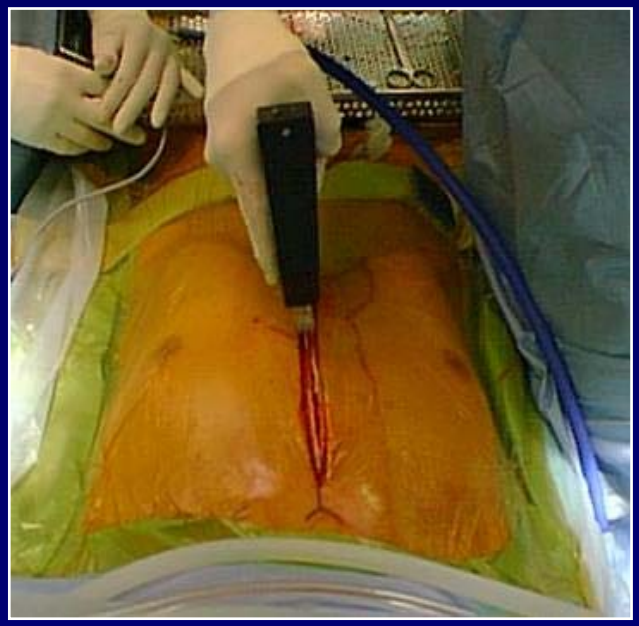
- Go inside
- Reach the target(s)
- Do the cardiac procedure

The procedure is a choice of the best approach regarding the cardiac target, the tools avaliable designed for the procedure and the predictable and unpredictable difficulties.



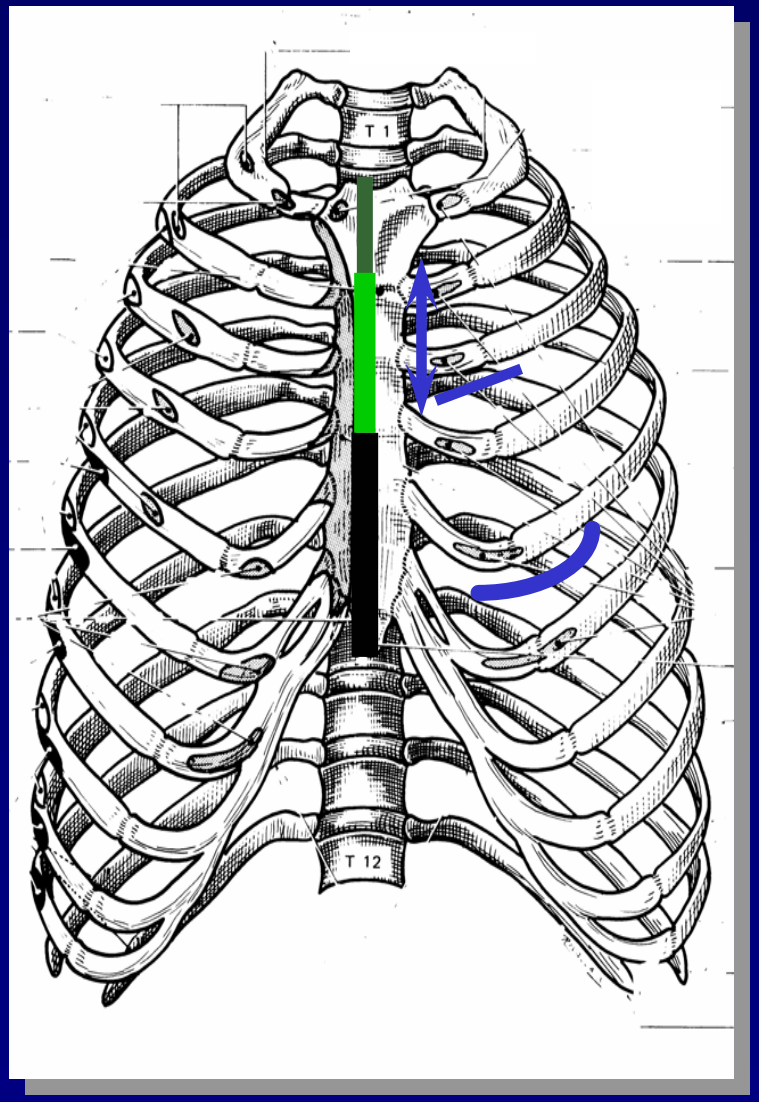
Sternotomy

- Full acces in direct vision
- Redo surgery
- Combined surgery



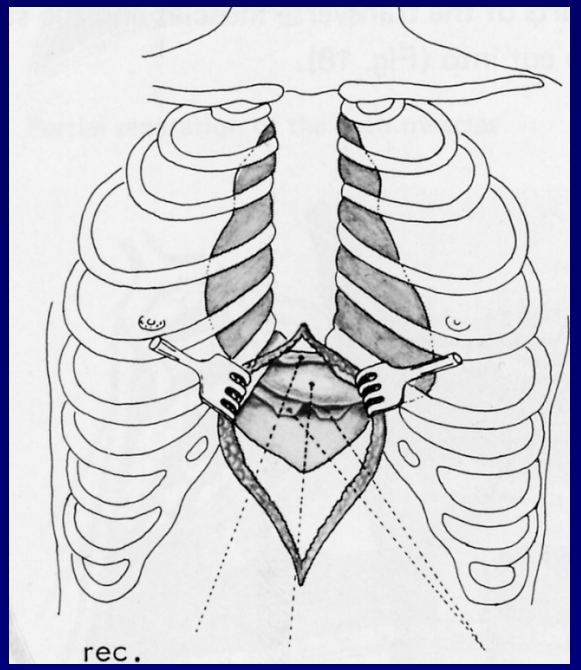
Ministernotomies are sternotomies

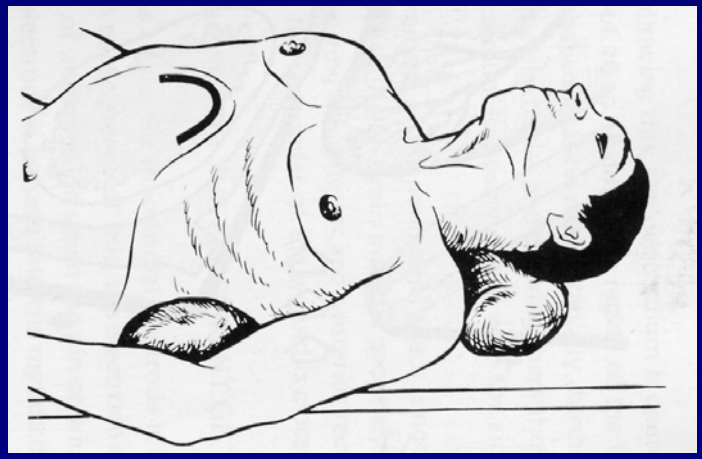
- General anesthesia, surgeon, saw…
- Direct but limited vision to some parts of the heart



Classical subxyphoid –Marfan-

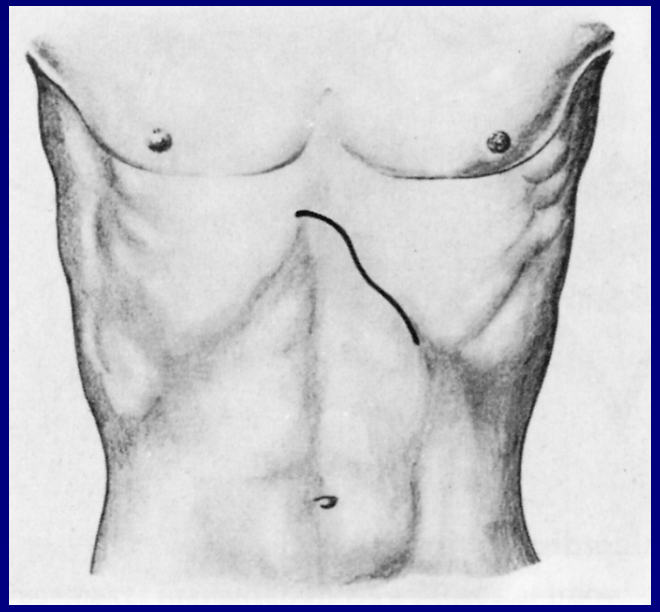
- Easy
- Fast
- Direct vision
  - Pericardium
  - RV
- Improvment of vision with video
- Difficult in obese or redo patients

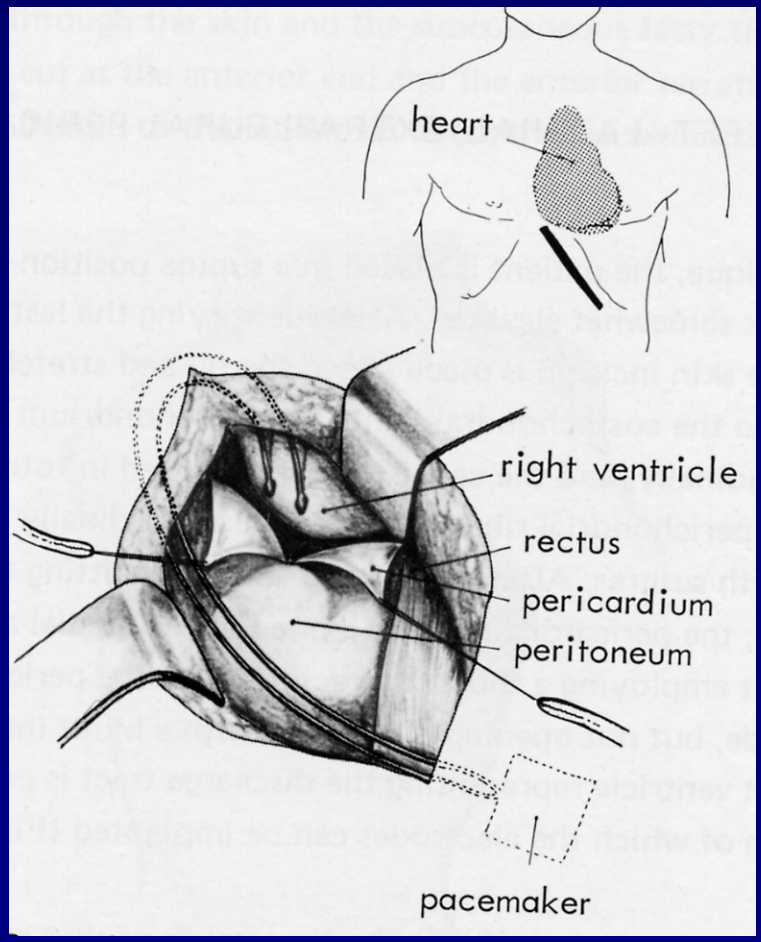




Old incisions
– Larrey Rehn-,- Parsonnet-

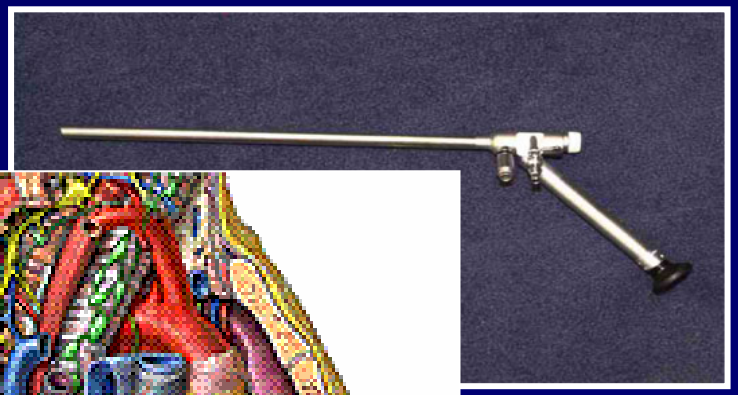
- Real surgery
- Best vision on the RV
- Difficult to close

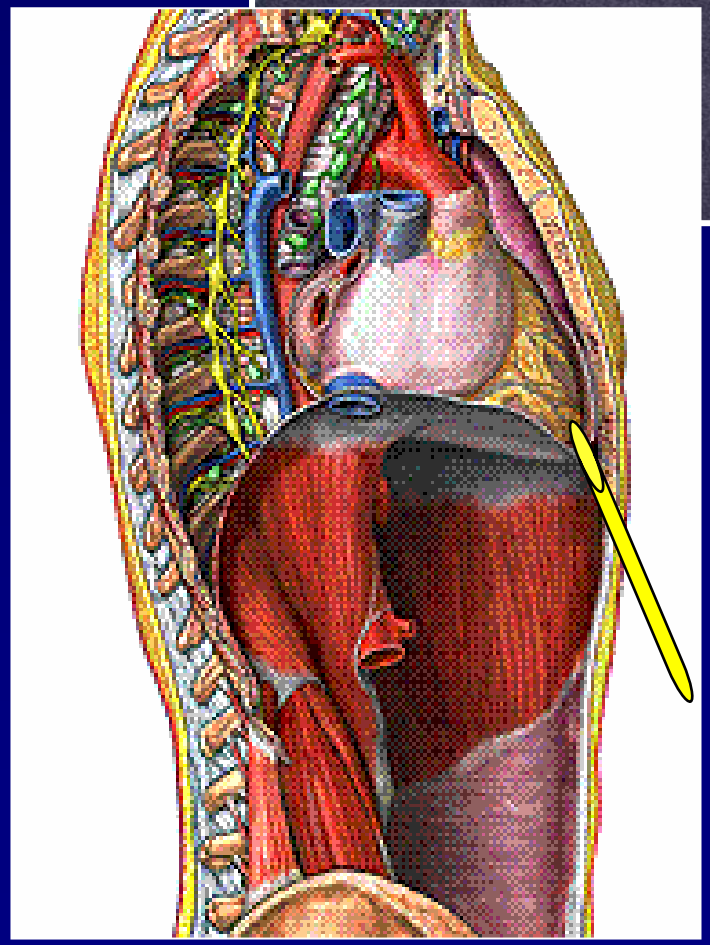




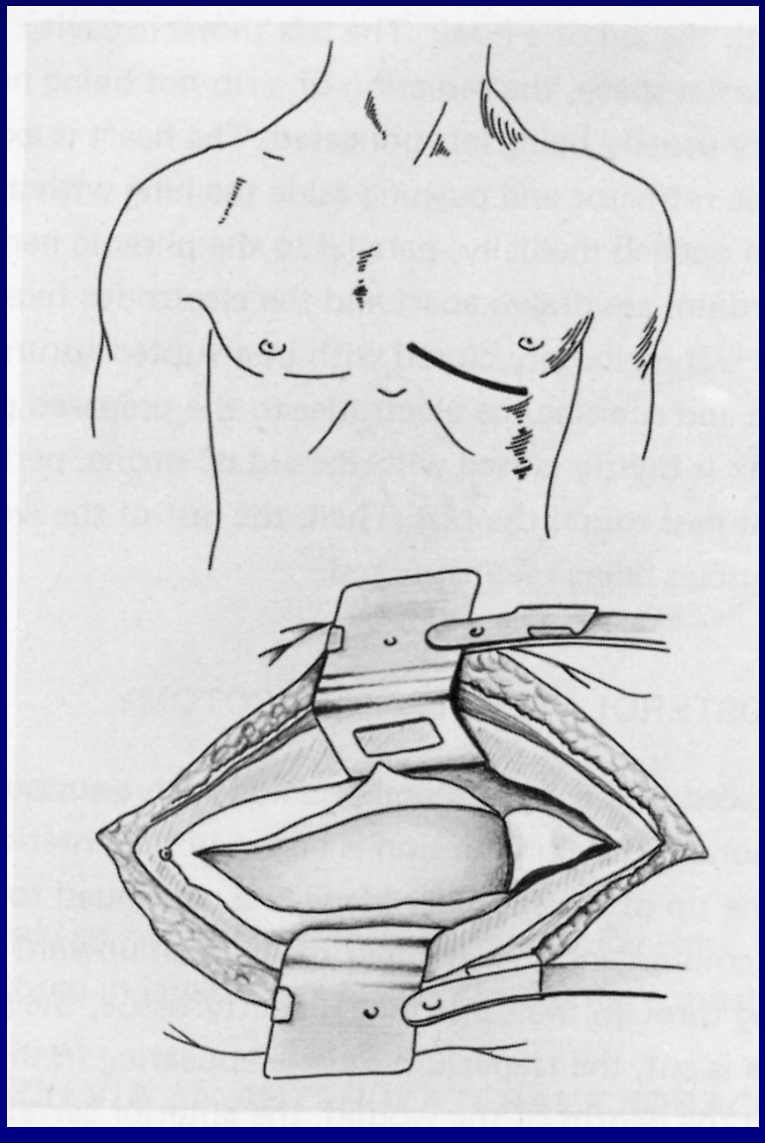
New subxyphoid aproach

- Blind technic: Percutaneous
- Safe technic: Videoscopic approach with a translucent self-cuting trocard -Ethicon™-





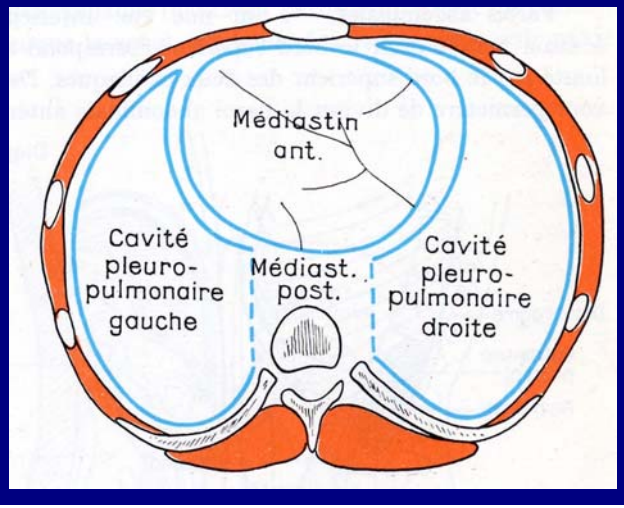
Left minithoracotomy

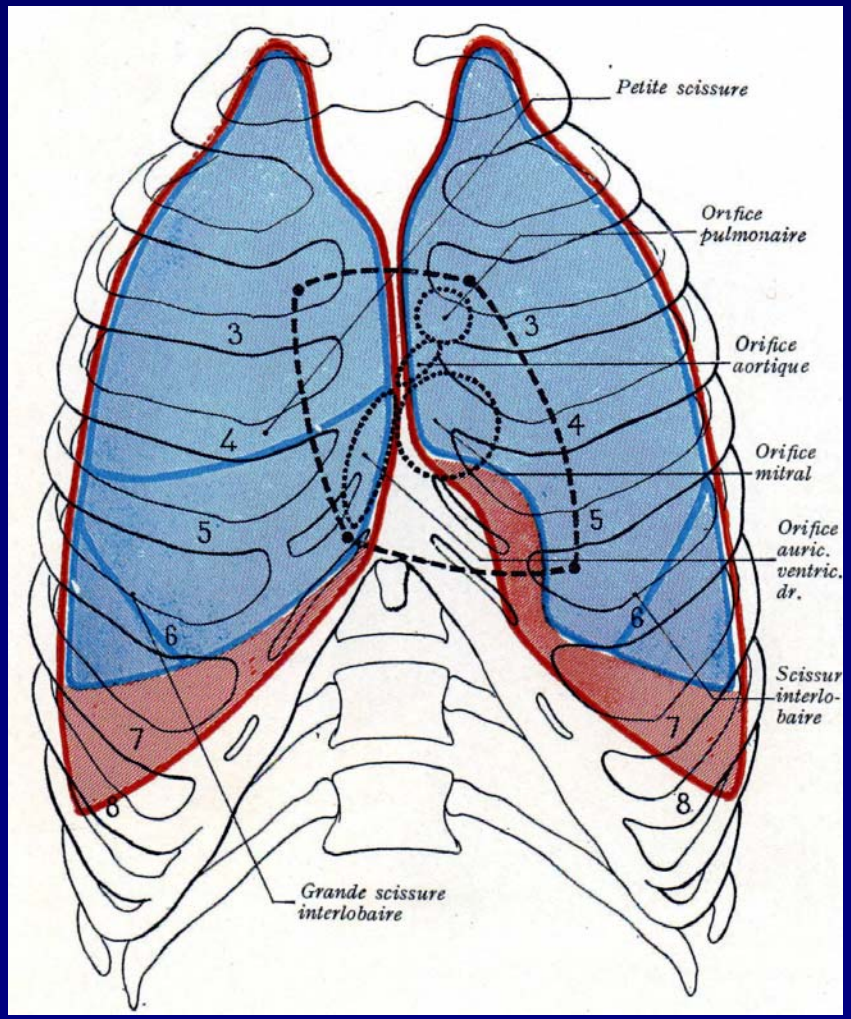


- Easy and Fast
- Direct vision
  - Pericardium
  - LV ± LA
- Improvment of vision with video

Anterior minithoracotomy, pericardium, pleura and lung

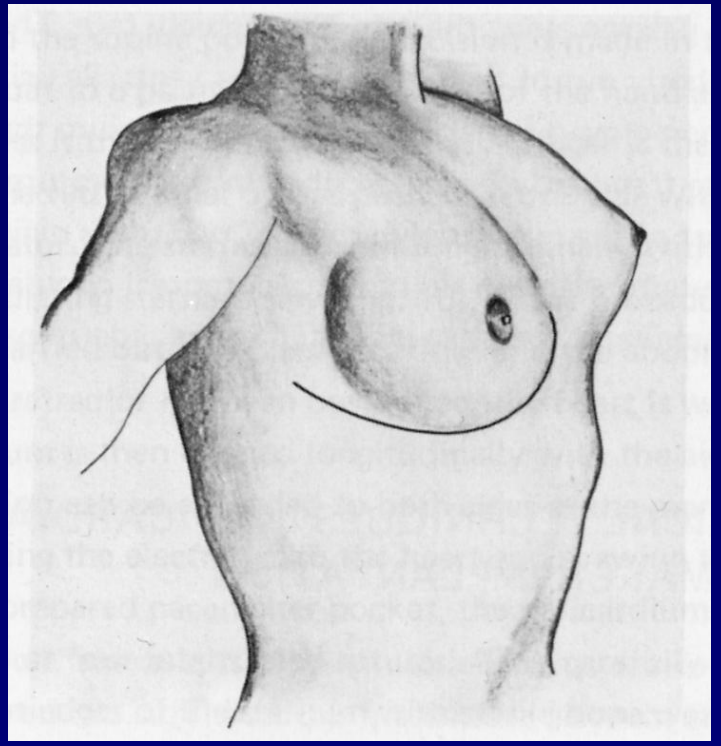
- Pericardium is « under skin »
- Lung is away –no selective intubation-
- Pleura can be avoided
- Take care to the ITA

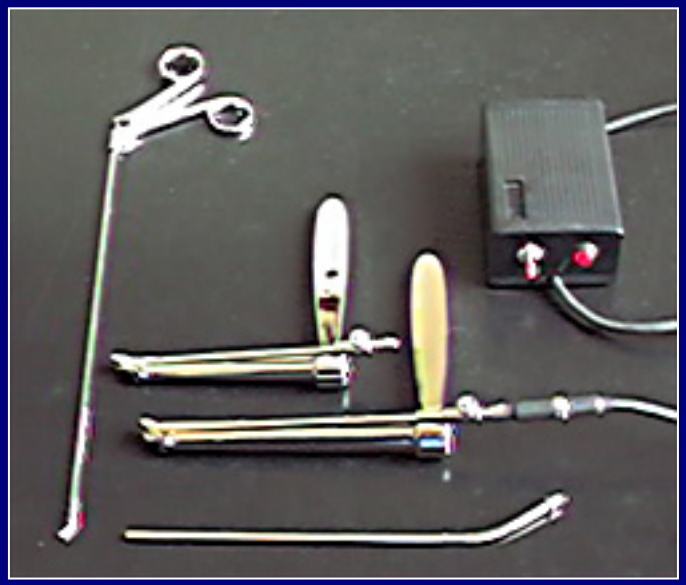




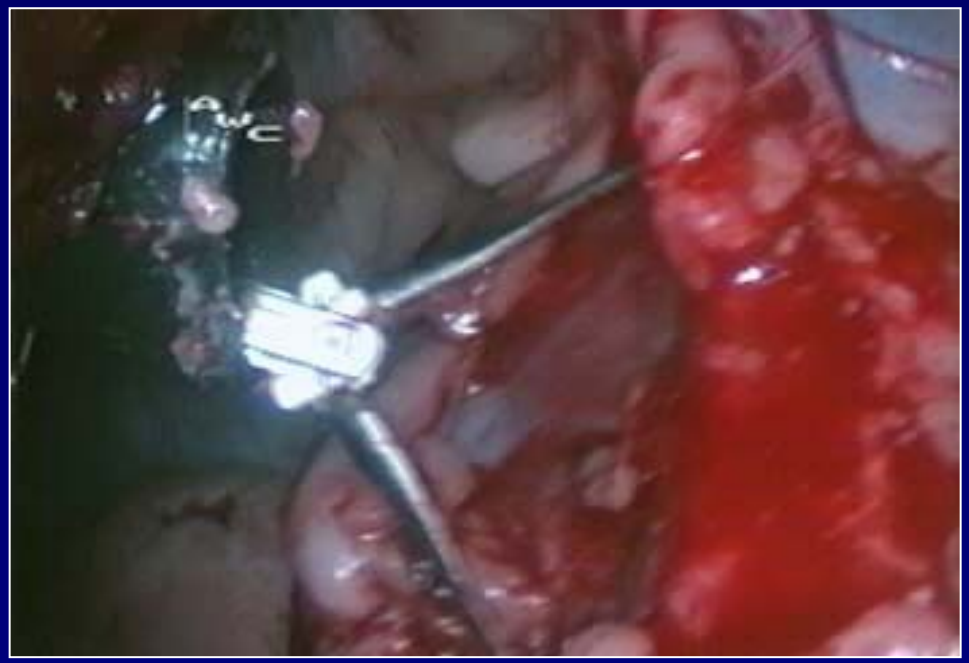
Right minithoracotomy

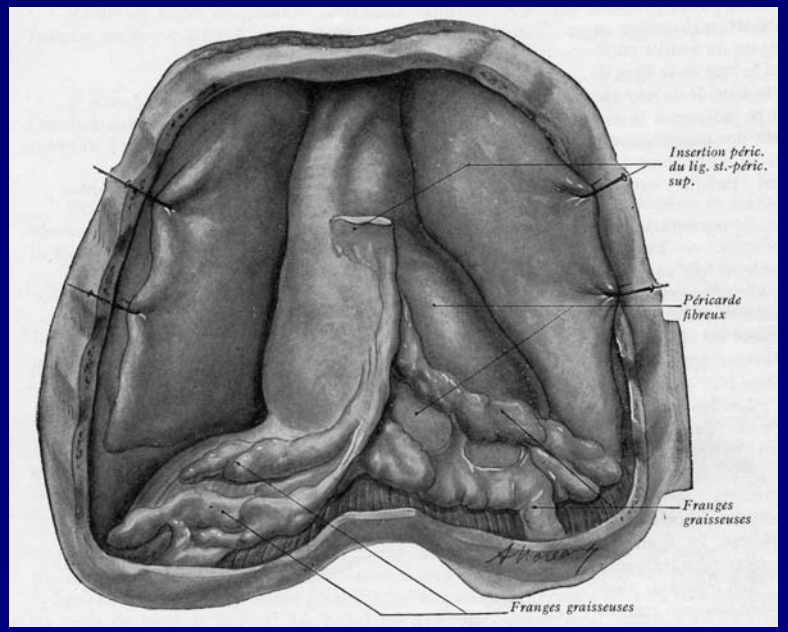
- Easy and Fast
- Direct vision
  - Pericardium
  - RA ± LA
- Improvment +++ of vision with video
- Rescue for endocardial access through RA or LA





Thoracoscopy

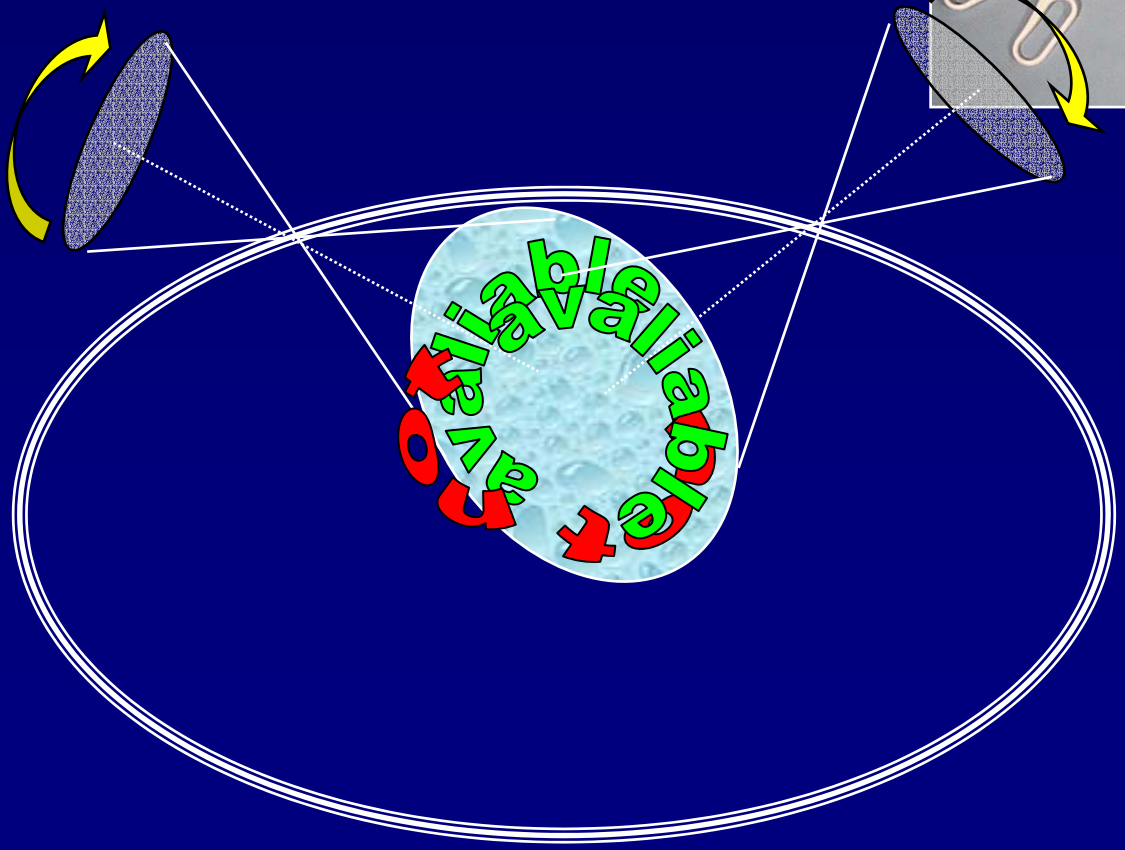




Click on image to start video

Courtesy of Dr. Omar Lattouf

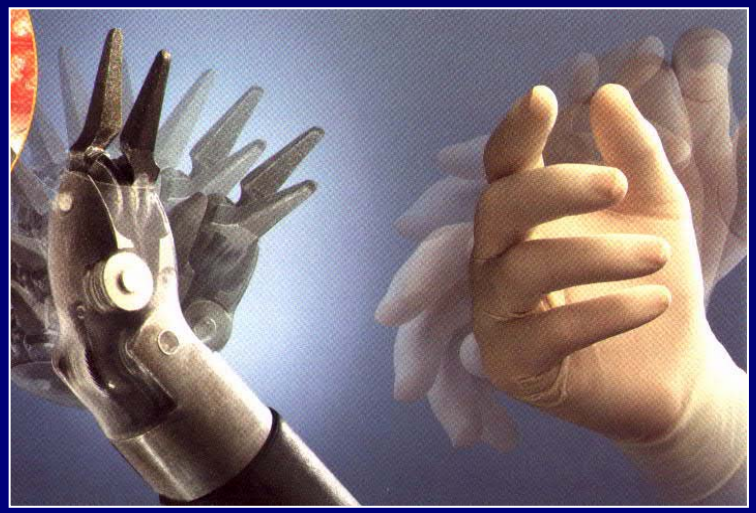
Target and entry point, a geometrical problem

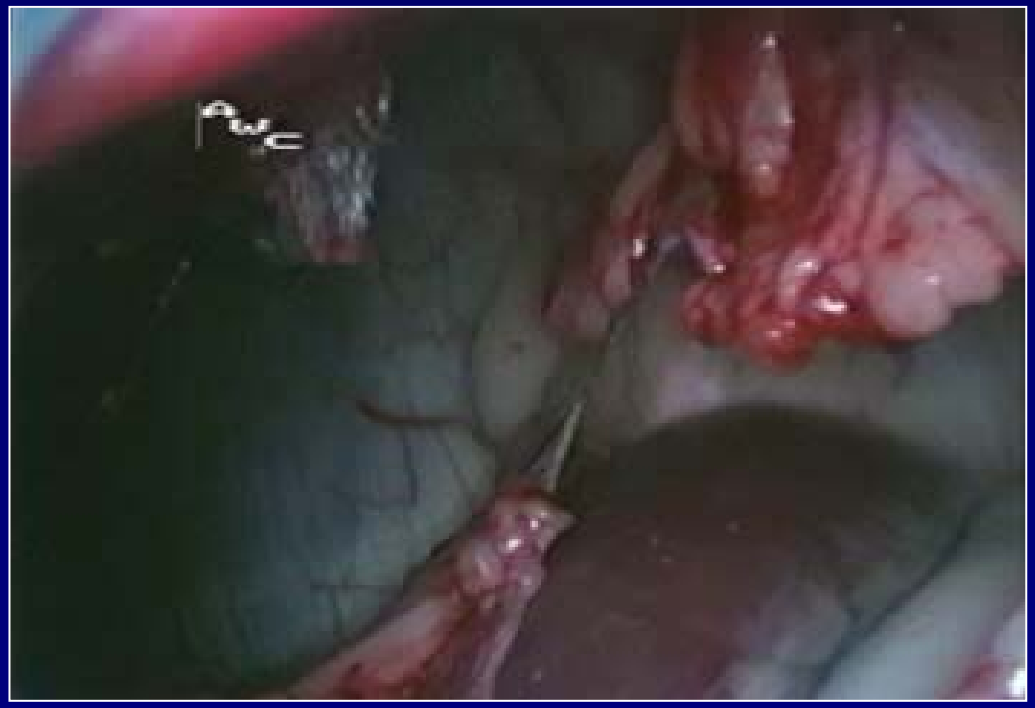


If the tools are rigid,
the pericardial approach depends on the target

More degree of freedom (dof)

new tools and robotic surgery





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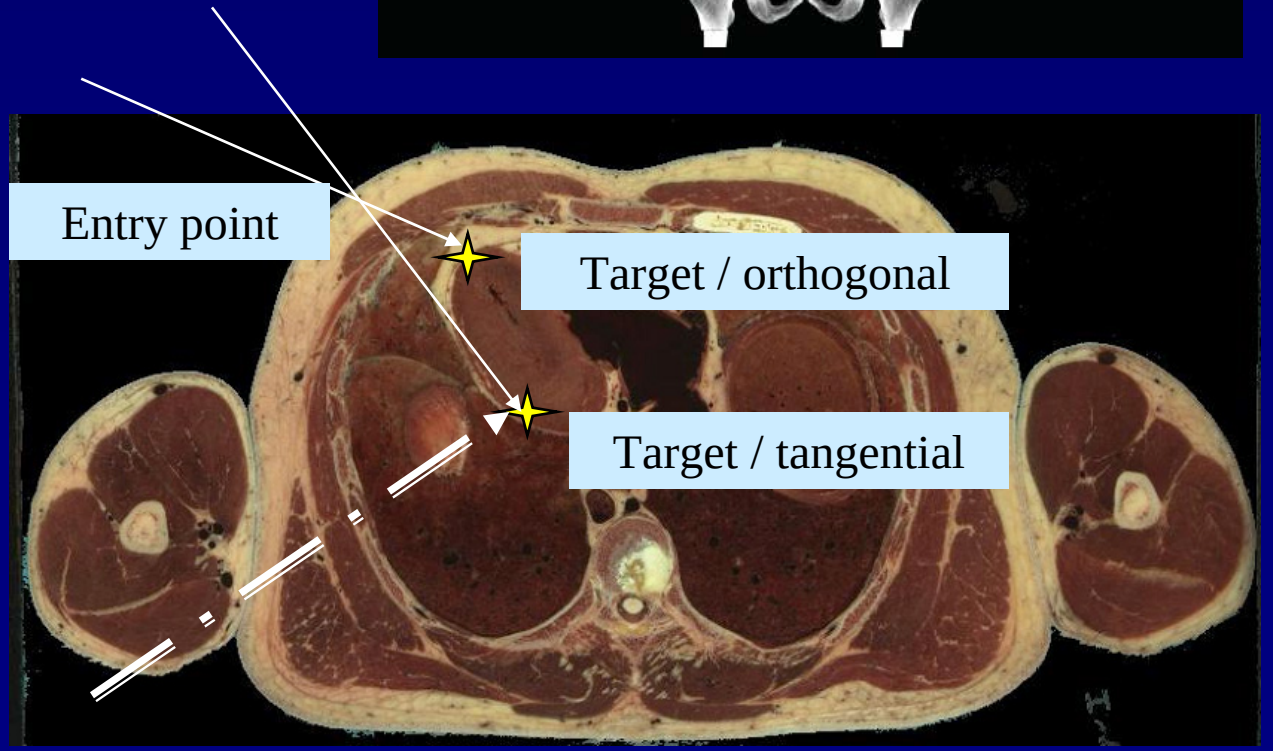
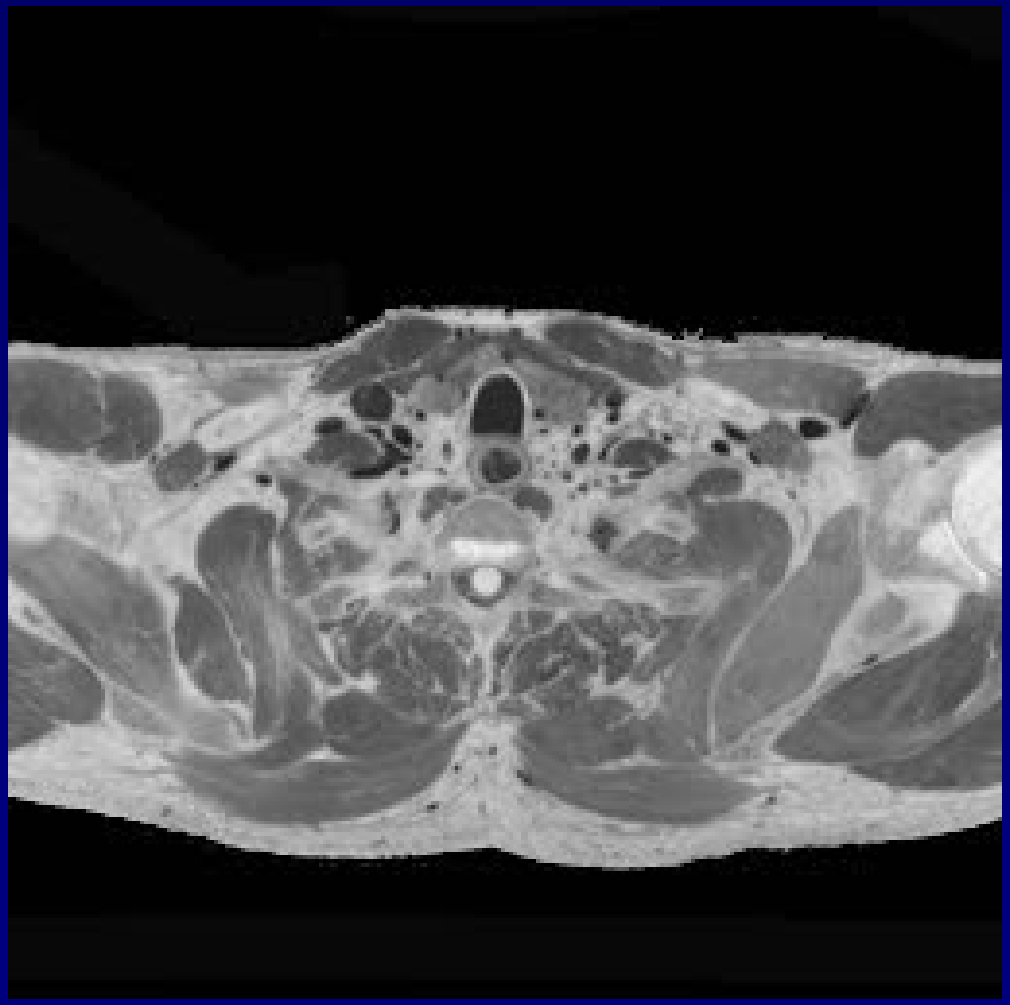
Courtesy of Dr. Omar Lattouf

Surgical approach, a geometrical problem. Inside - Outside



Planification, Virtual Reality



- Preoperative data
- Simulation
- Multimodal vision
- But what about:
  - Motions (heart, ventilation…)
  - Deformations (patient on the right side…)
- To directions
  - Real time reconstructions
  - modelisations

How to see the target(s) and the danger(s)

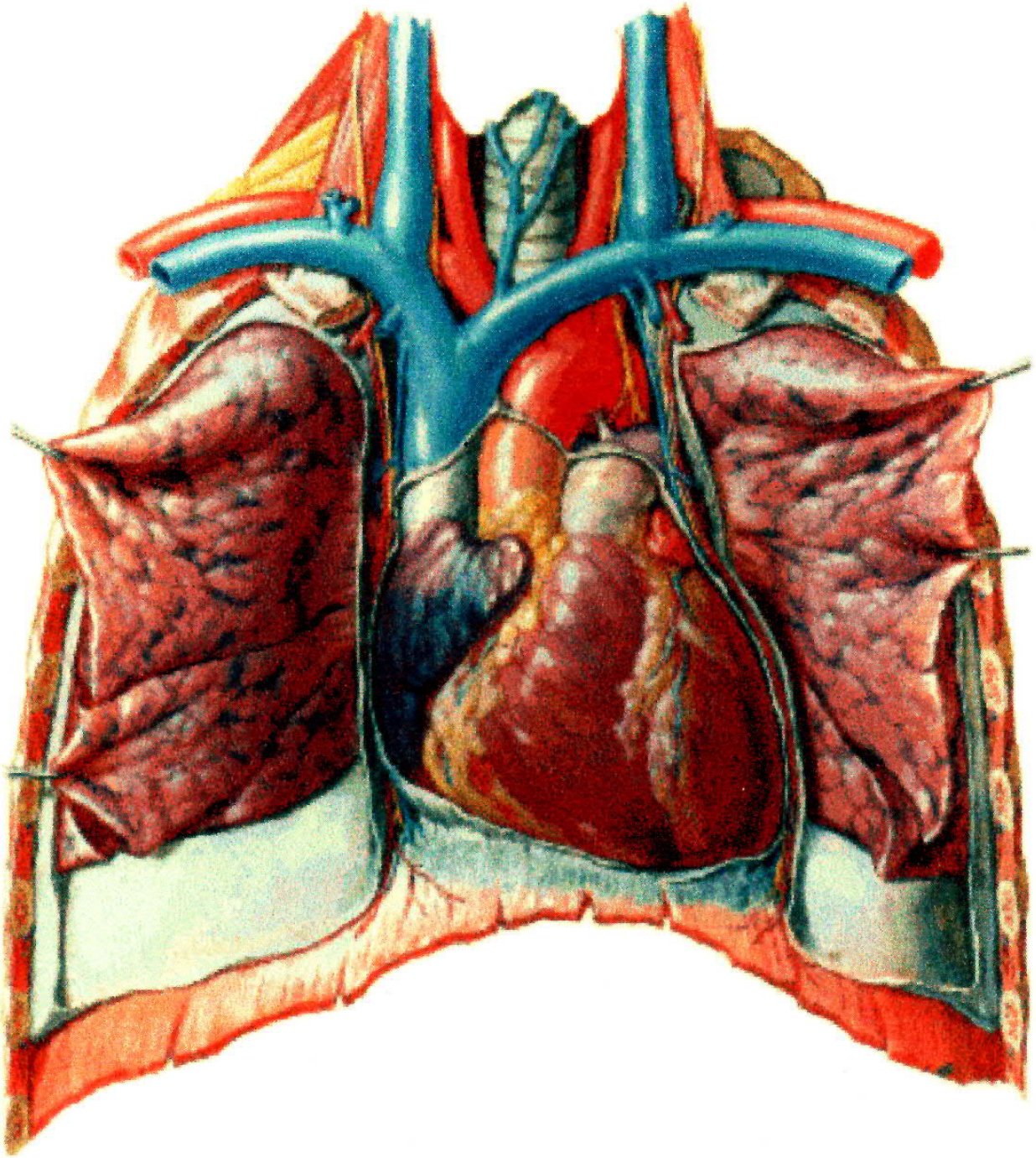
- Direct vision
- Videoscopy
  - Rigid
  - Flexible
- X-ray
- Echo
- EP, magnetic navigation
- NMR…

- In the futur
  - Multimodal vision
  - Enhancement of the reality (recalage)

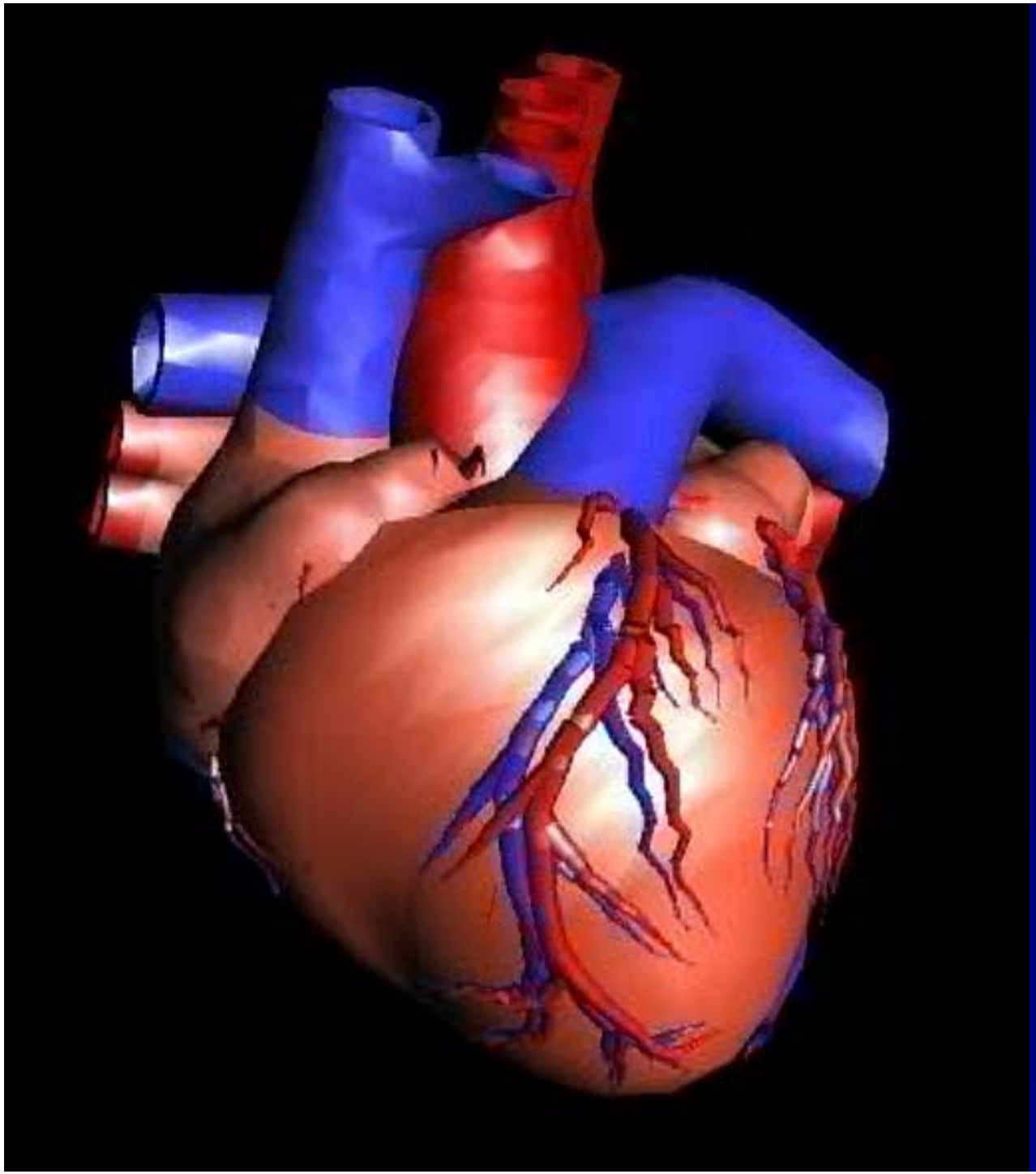
Multimodal operating room and team

Wath is surgery, wath is not?

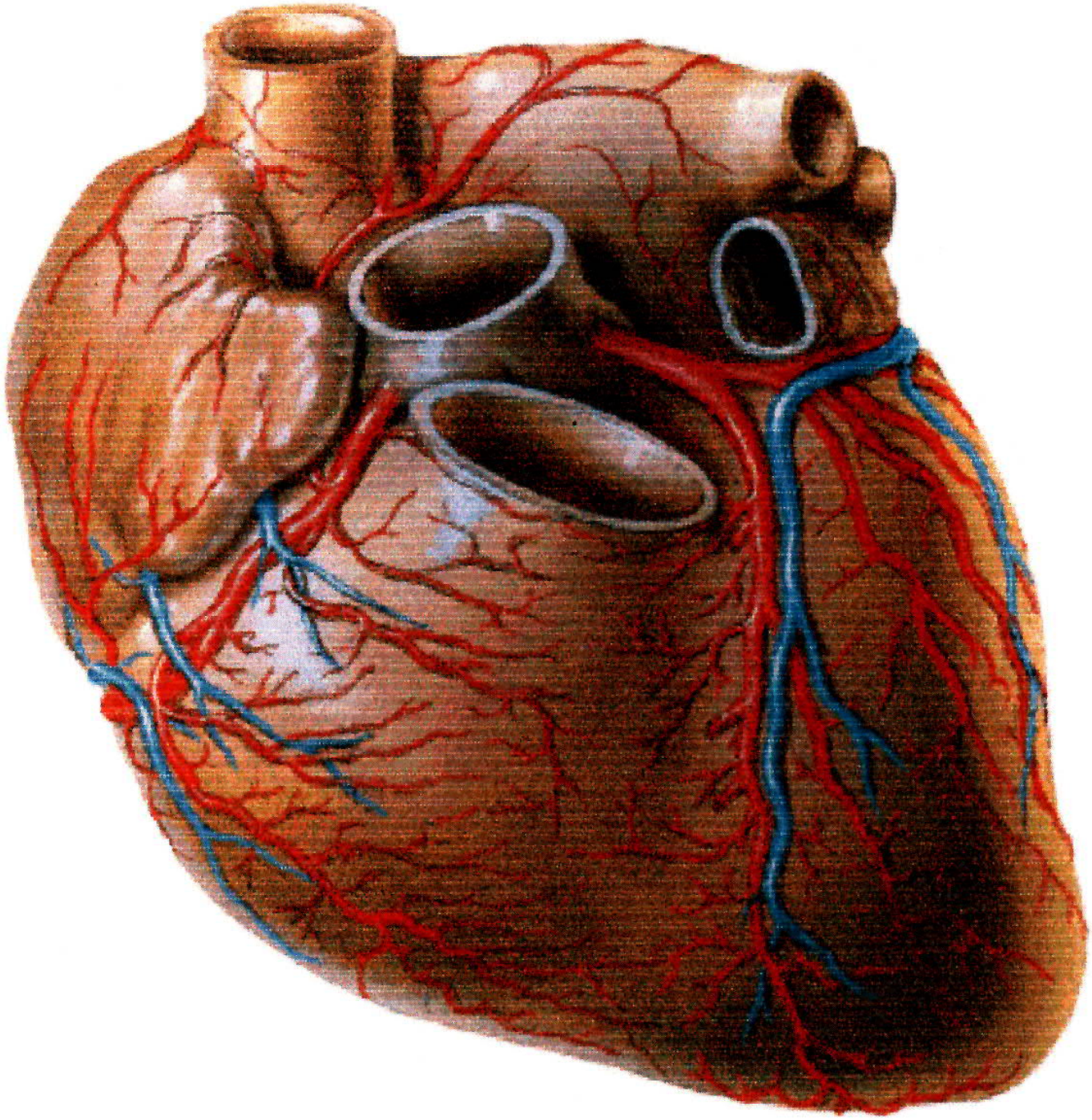
- Surgery
  - General anesthesia
  - Surgeon
  - Operative room
  - Incision
  - Direct vision of the target and the danger
- No surgery
  - Local anesthesia
  - Cardiologist
  - EP lab
  - Percutaneous
  - X-Ray, Ultrasound… no direct vision of the target
- The future
  - Anesthesiologist choice
  - Trained physician
  - Multimodal room
  - The best approach
    - Safe
    - Fast..
  - Multimodal vision



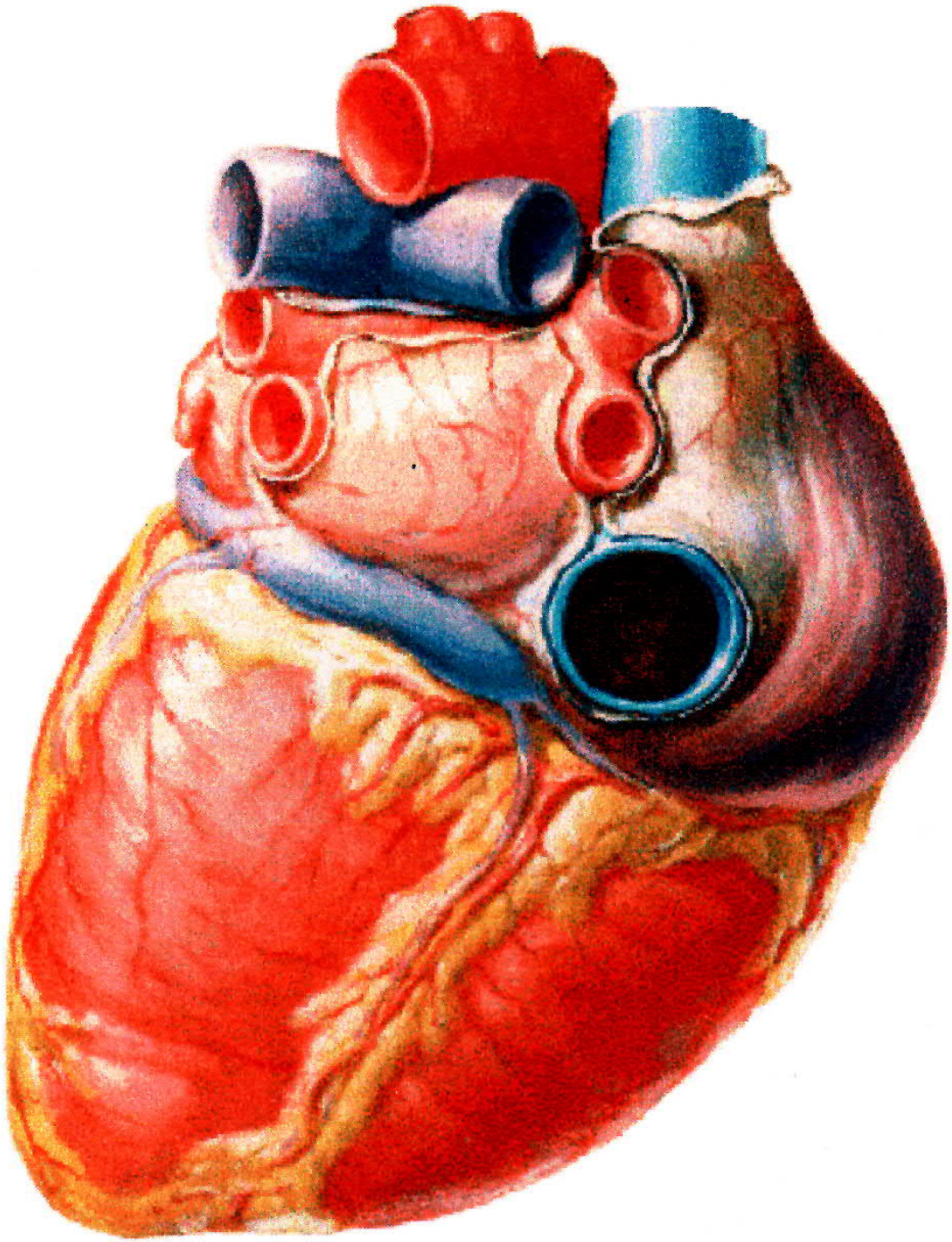
Heart-Lung



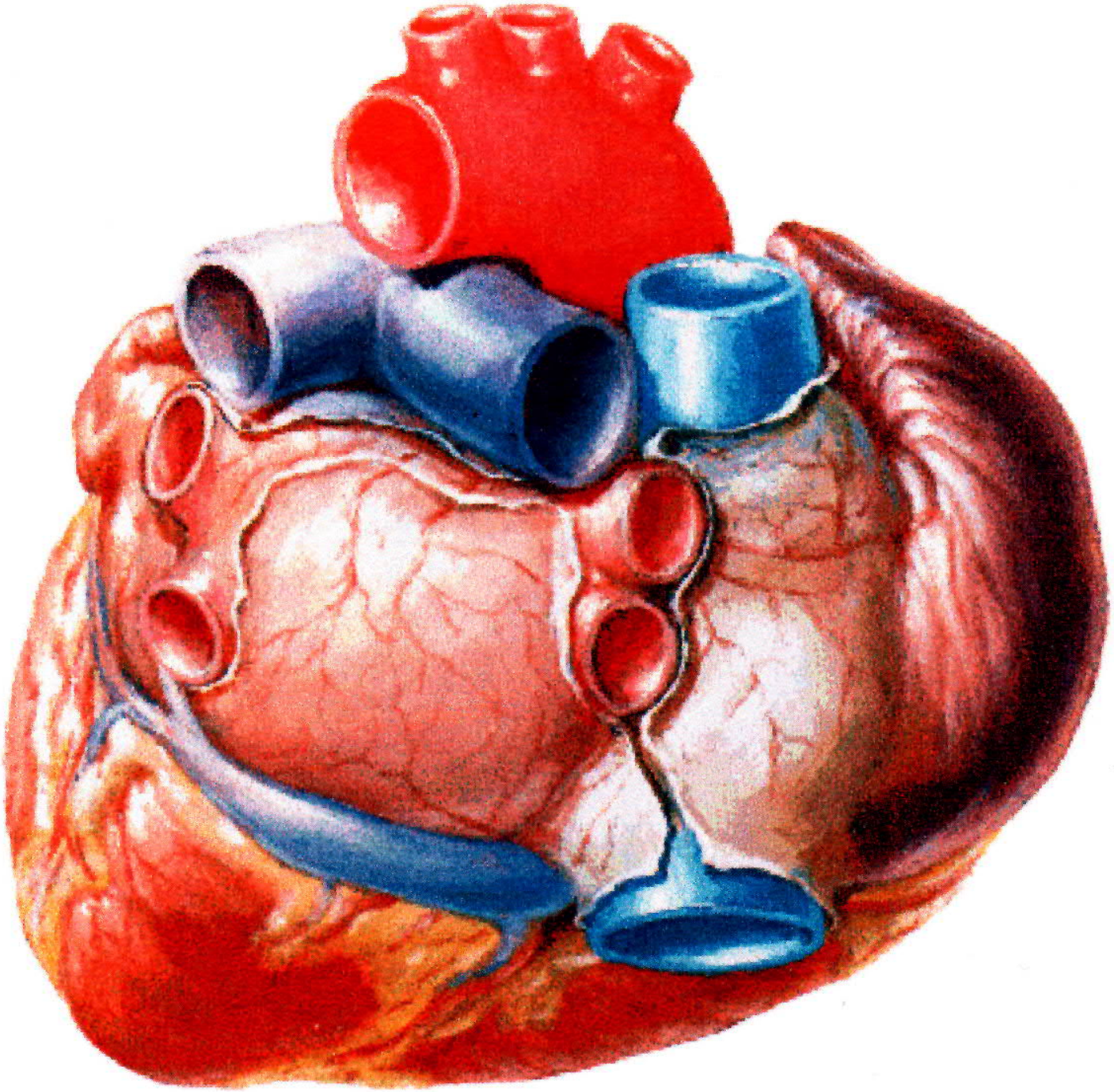
Heart



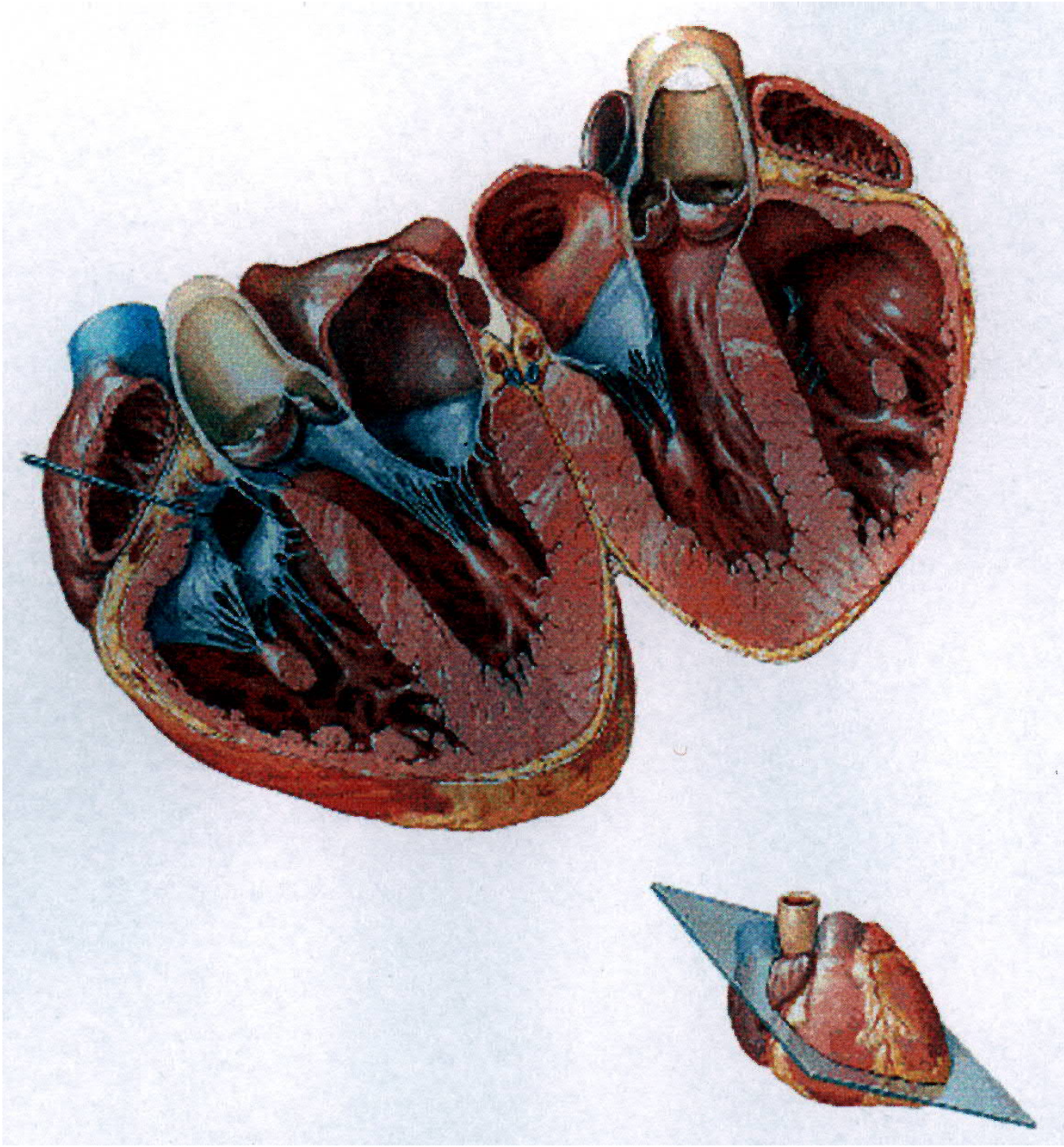
Heart



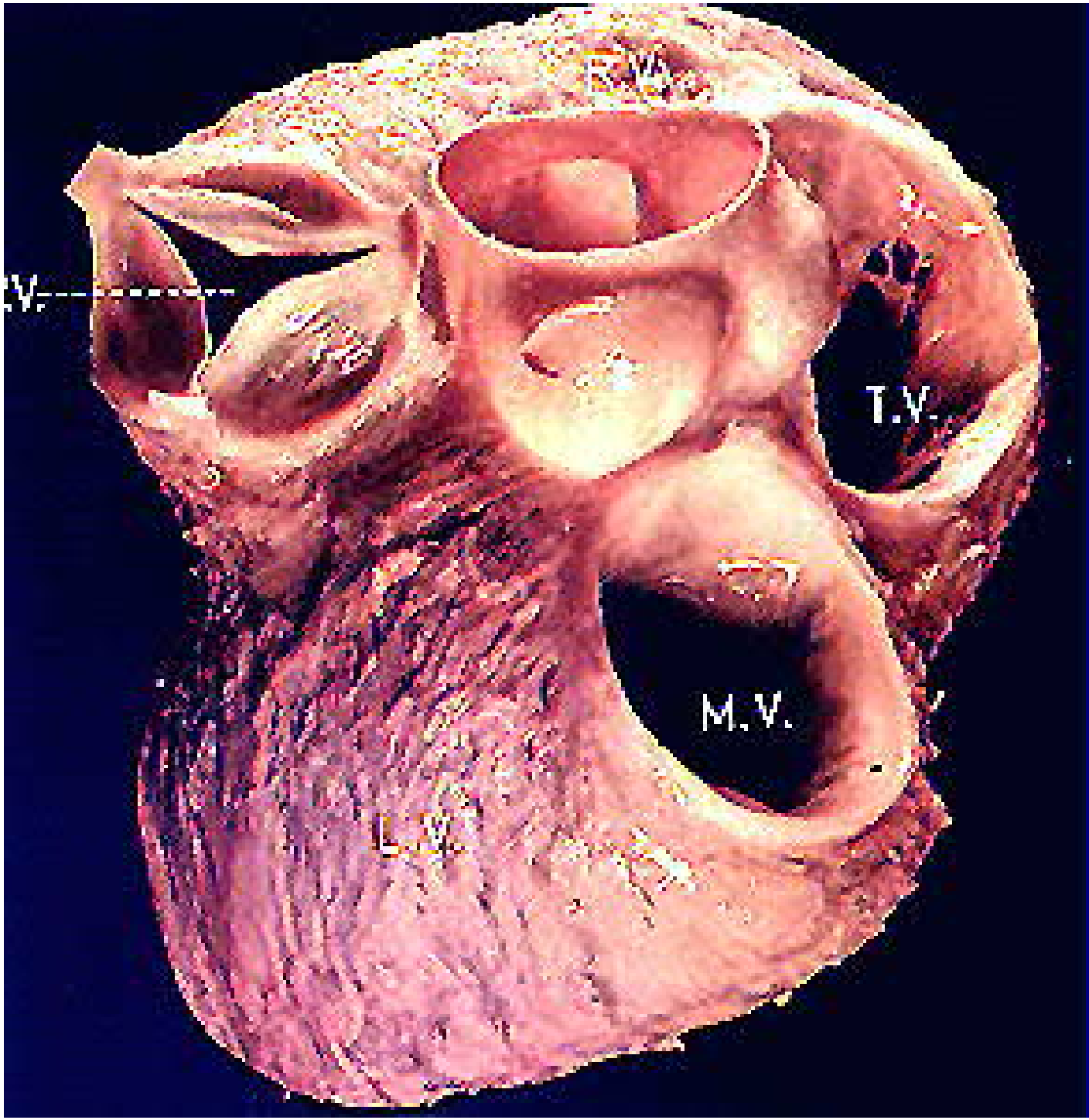
Heart



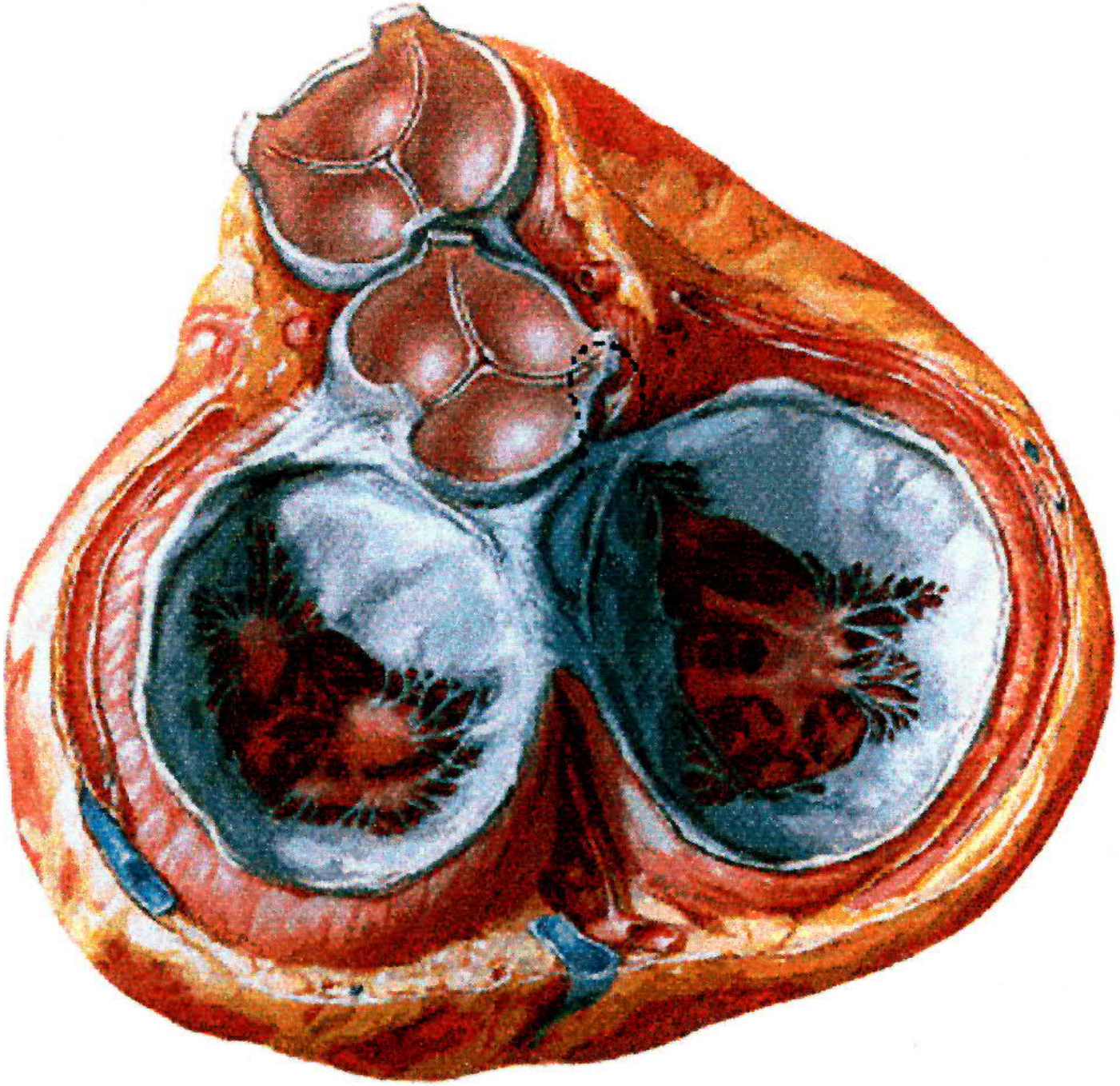
Heart



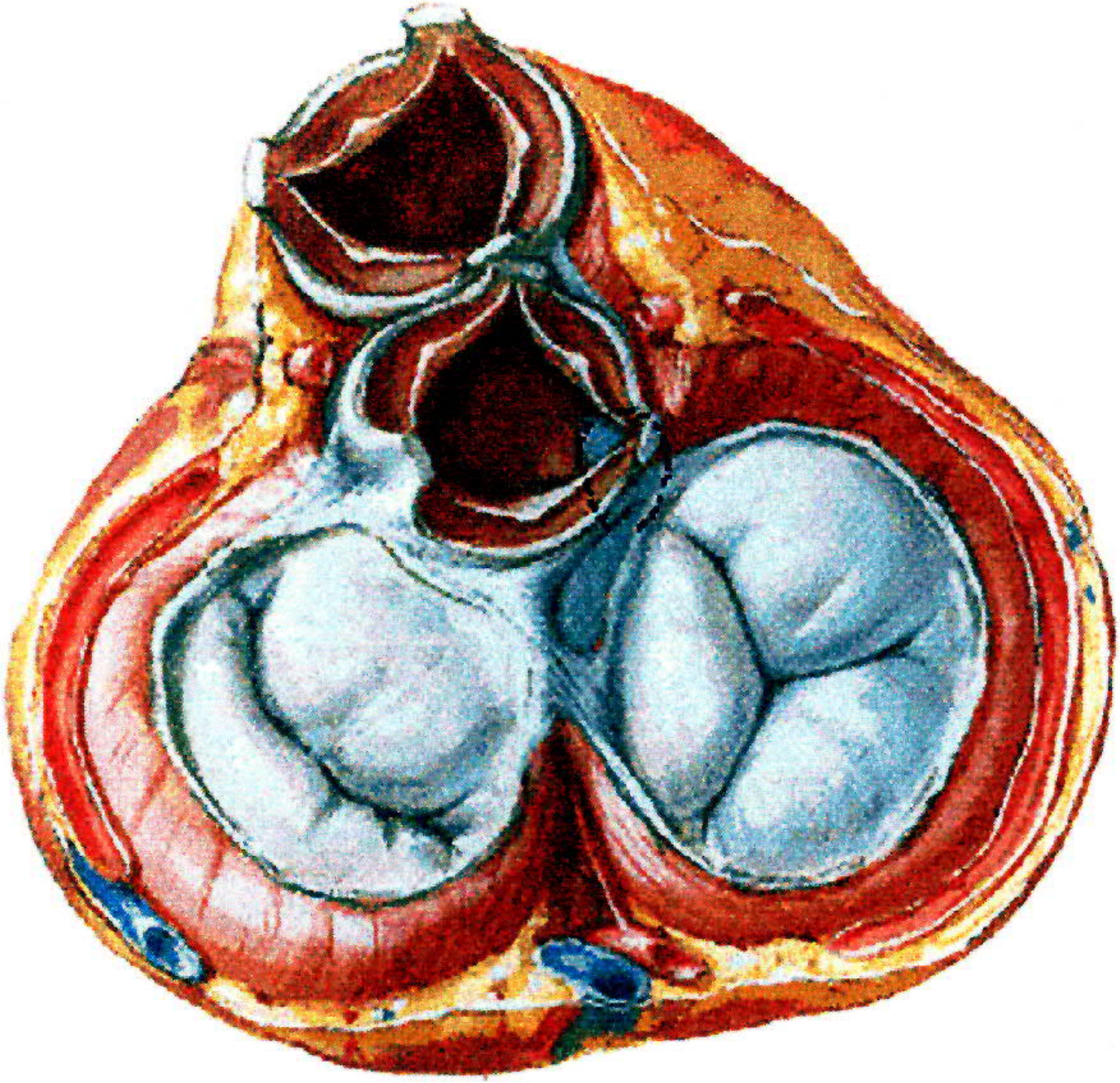
4 Chambers



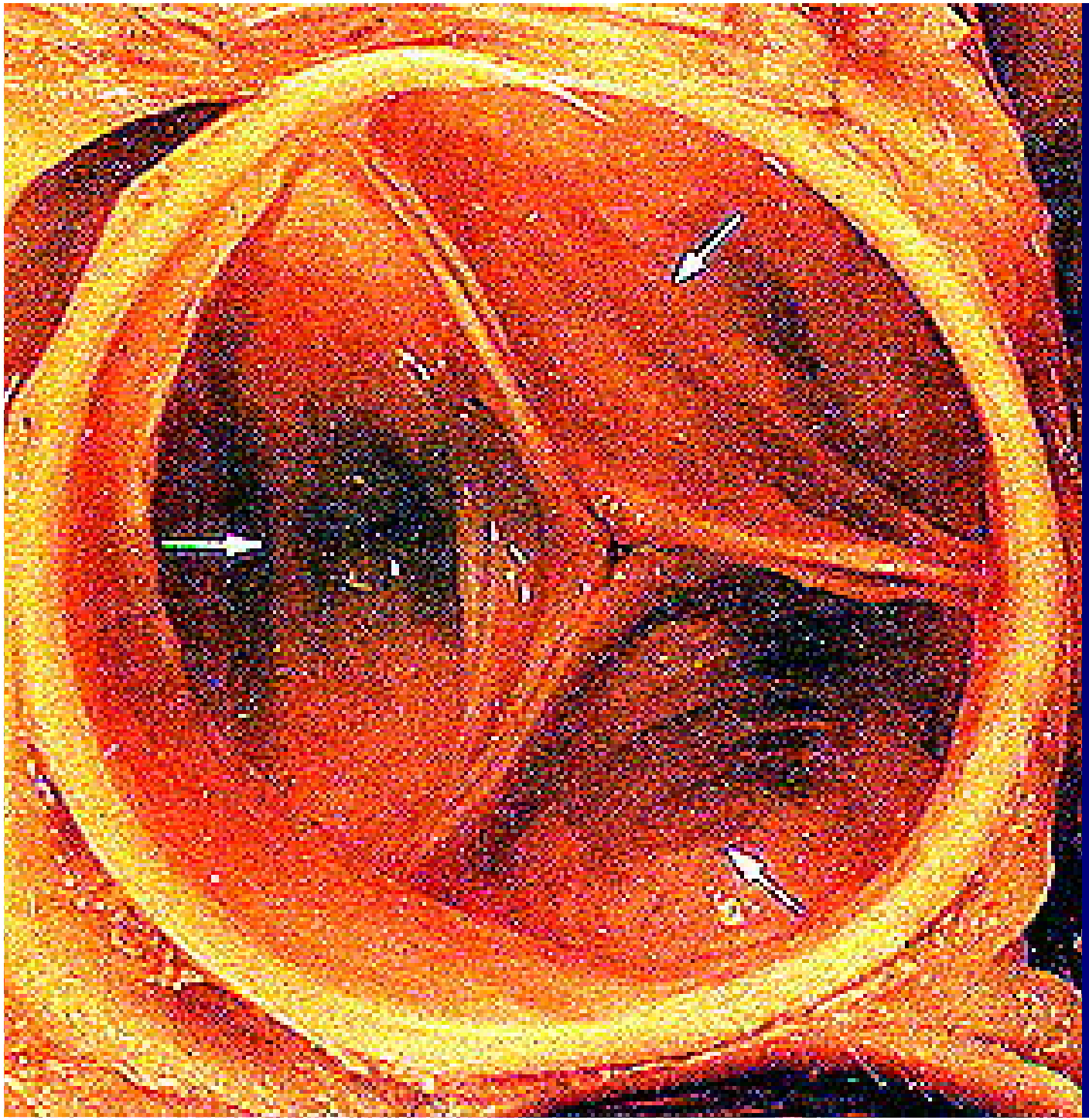
4 valves



Diastole

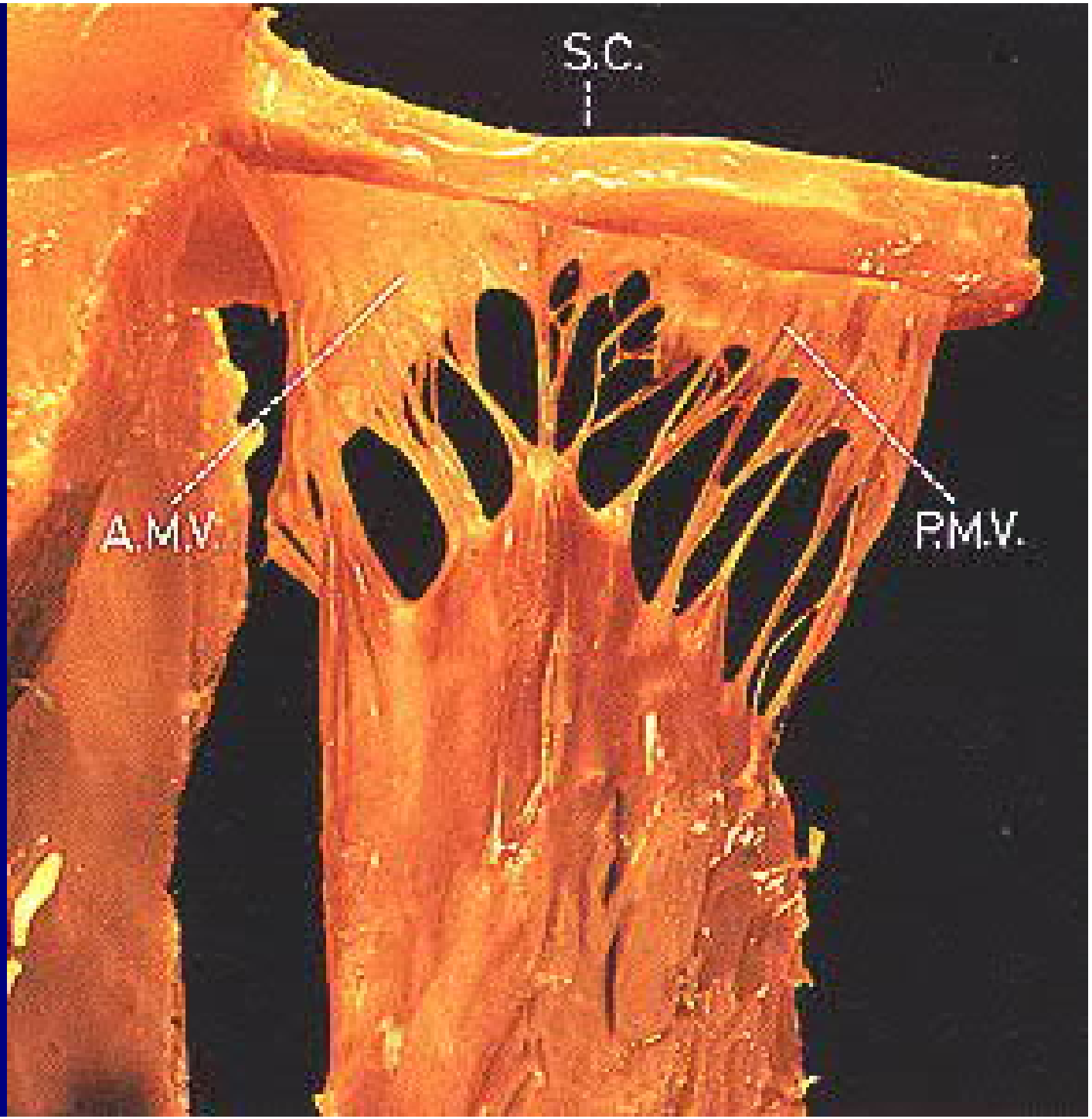


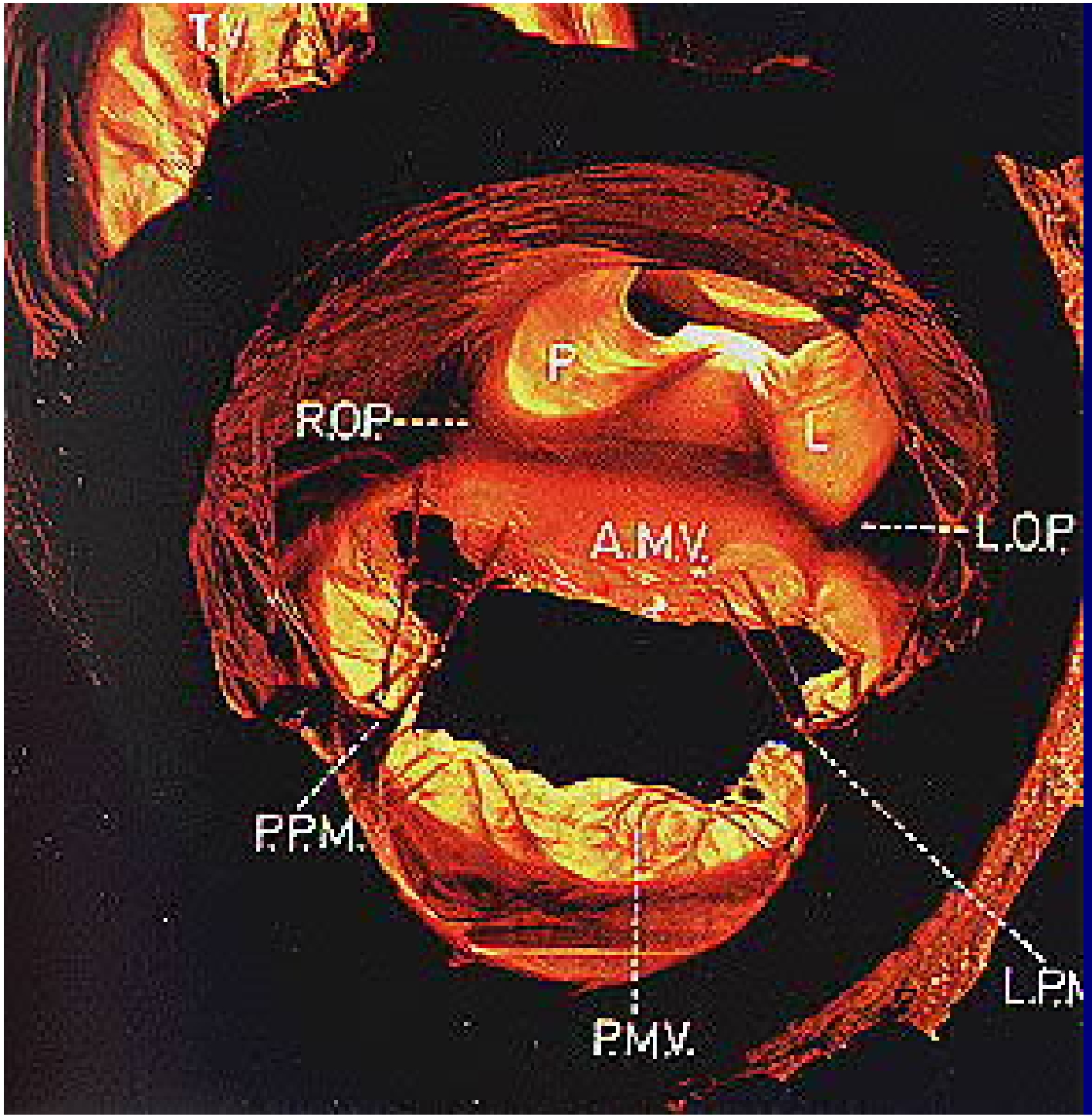
Systole



Aortic Valve

Mitral Valve

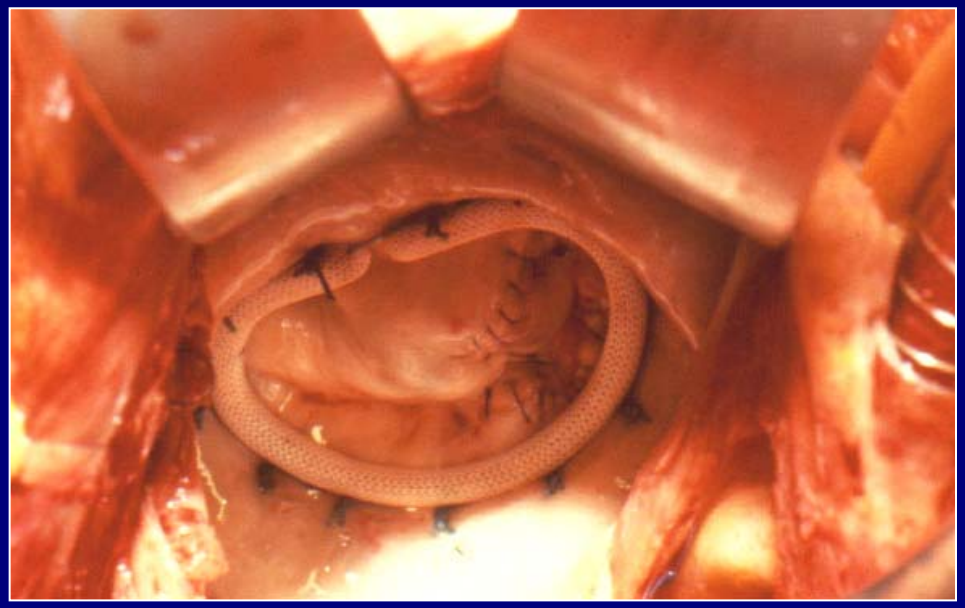




Mitral Valve

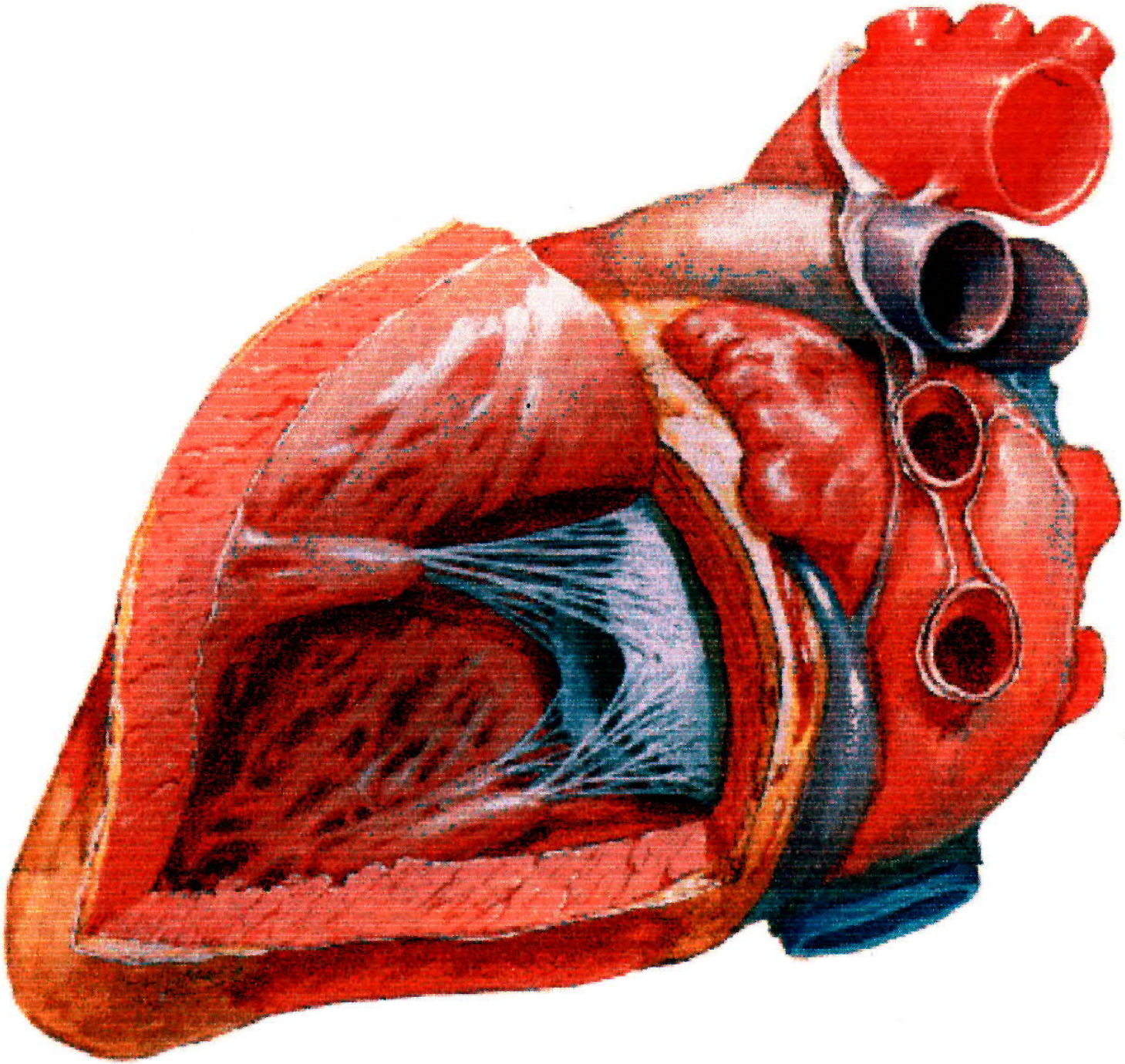
Aortic root

Valvulopathy



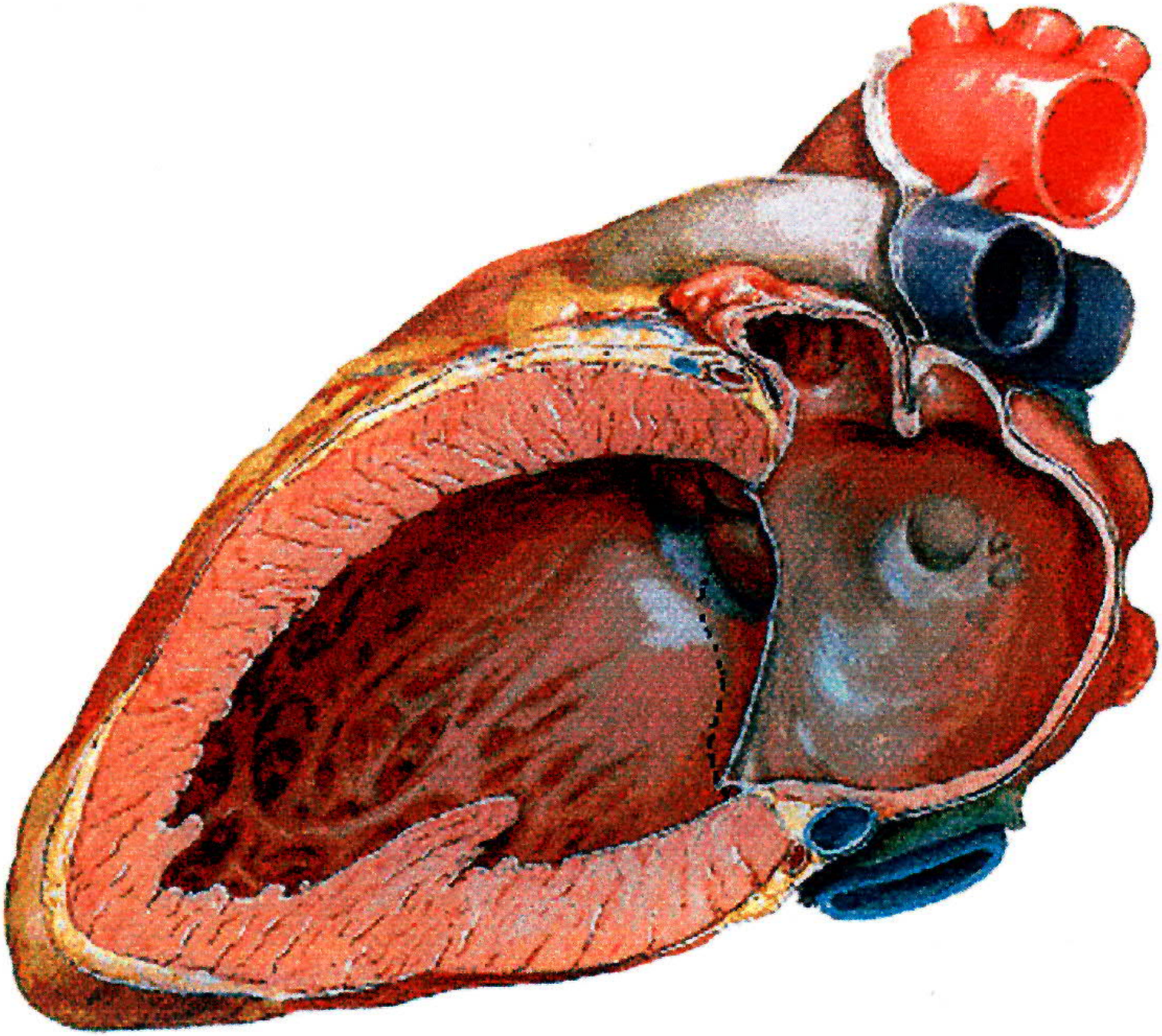
- Stenosis
- Insufficiency

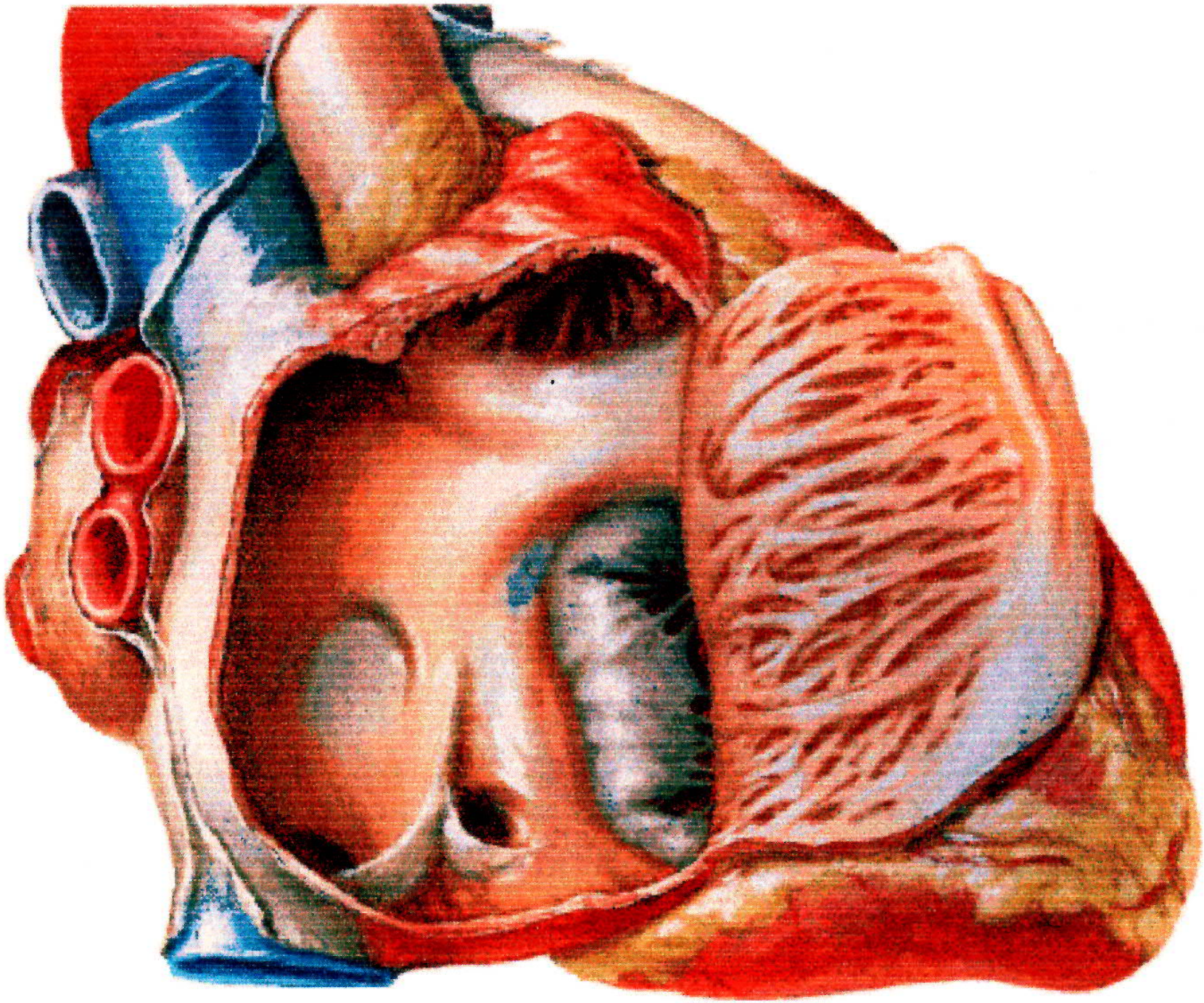
- Valvuloplasty
- Valve Replacement



LV

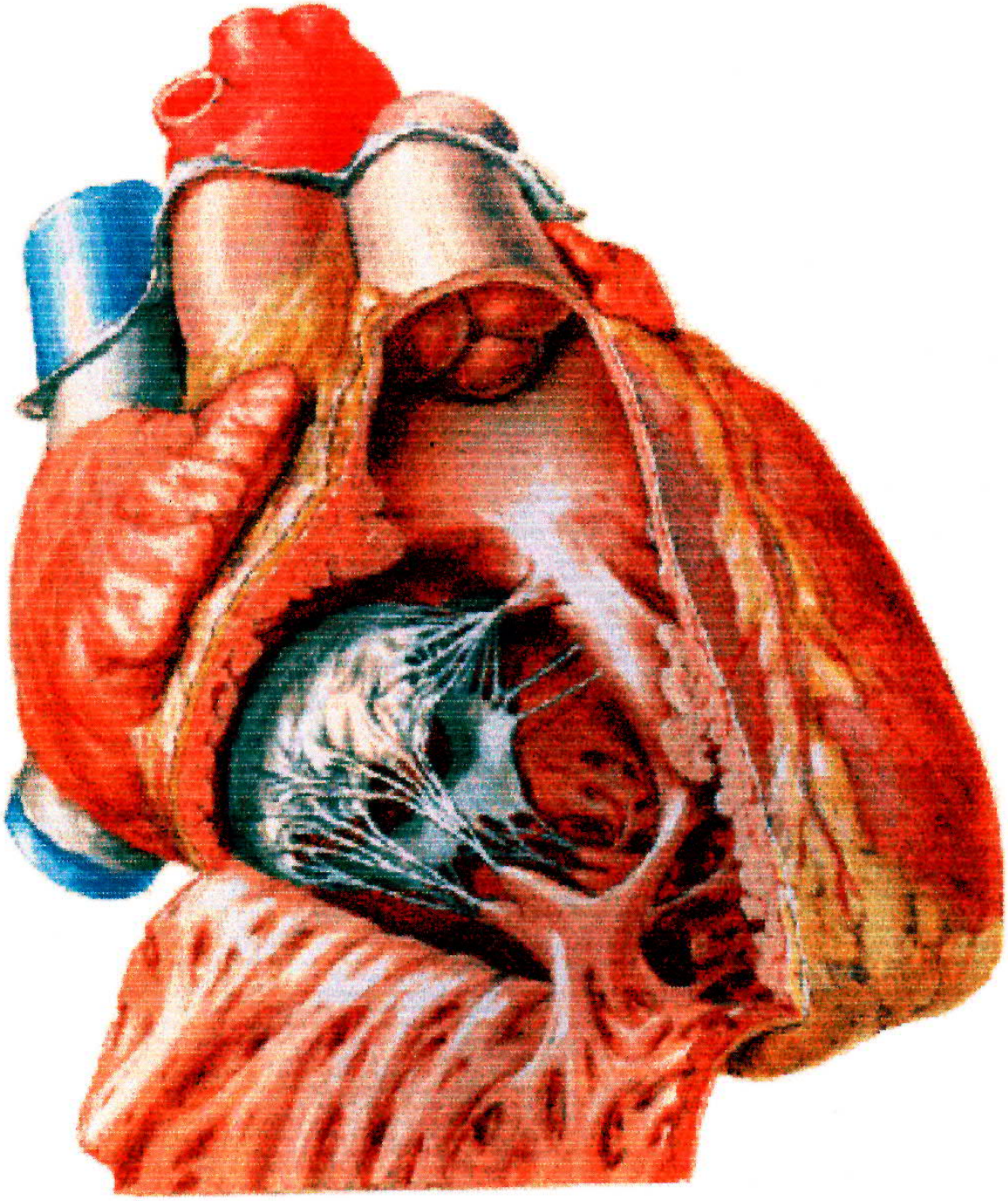
LV



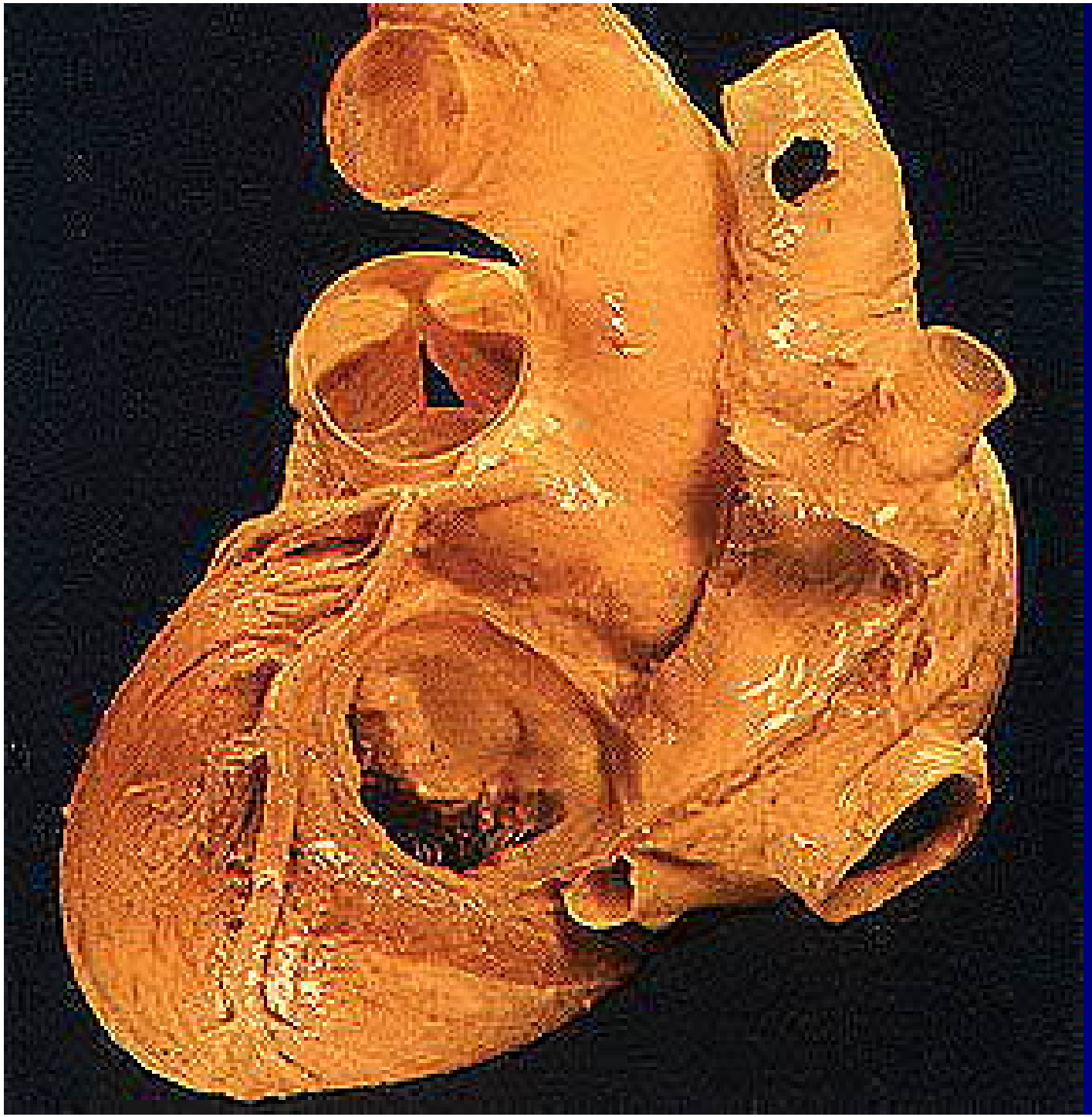


R

A

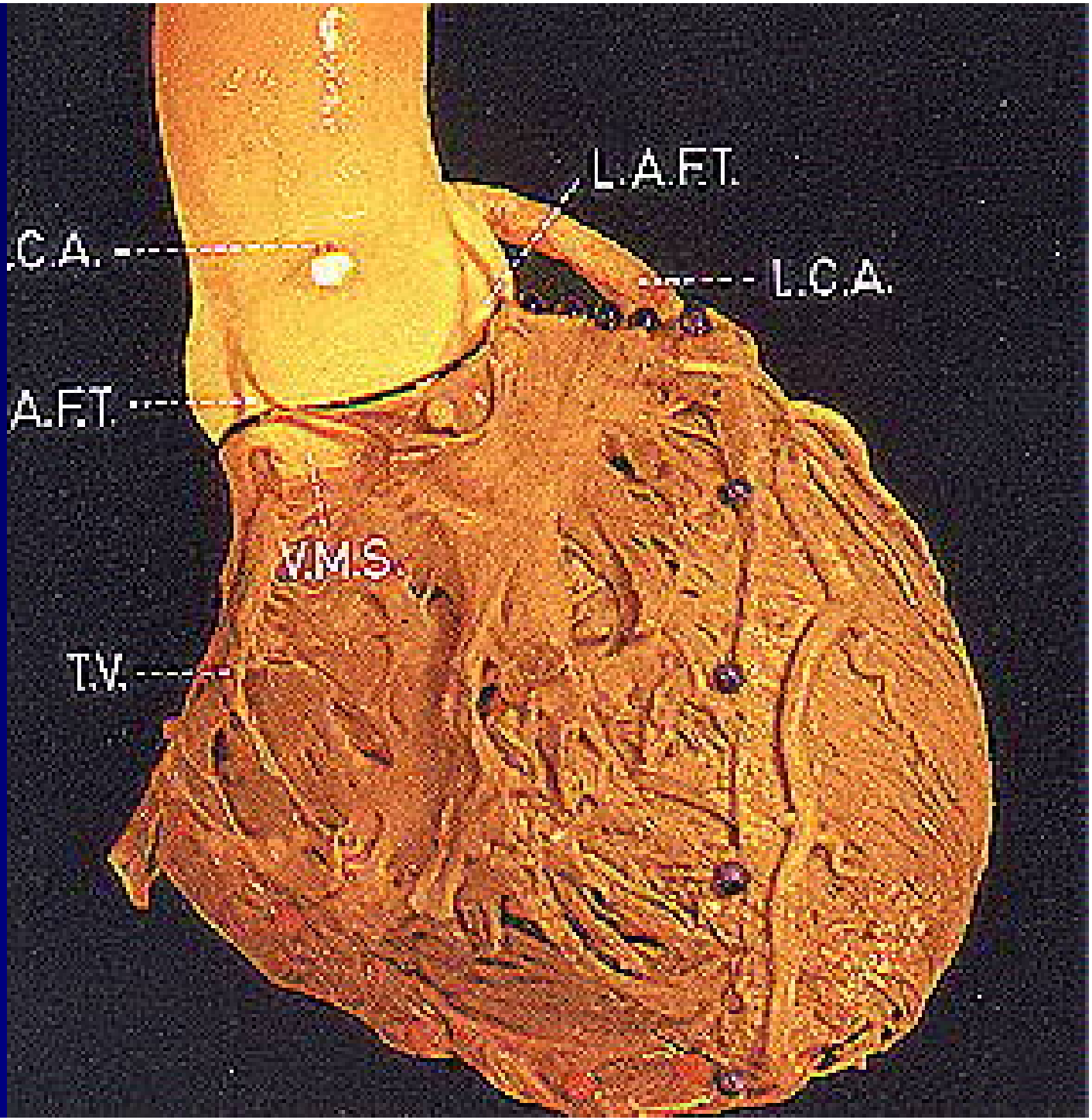


RV Tricuspide Valve

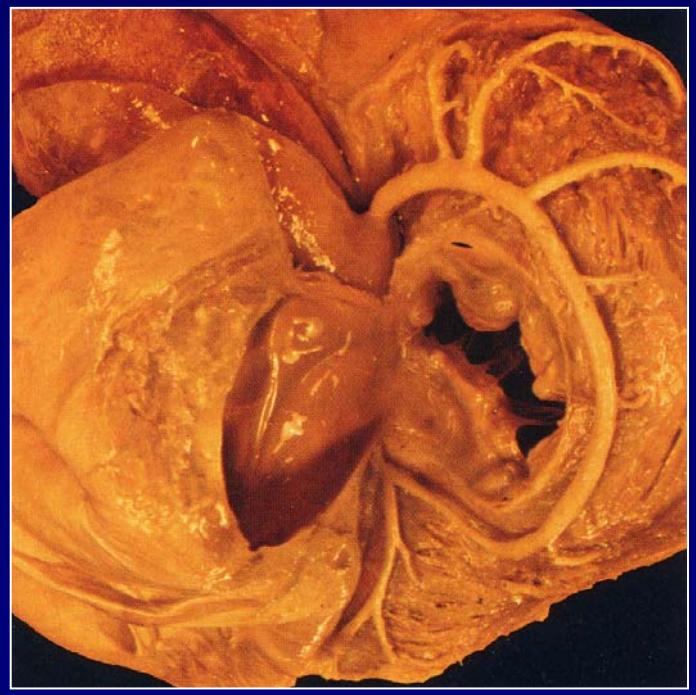


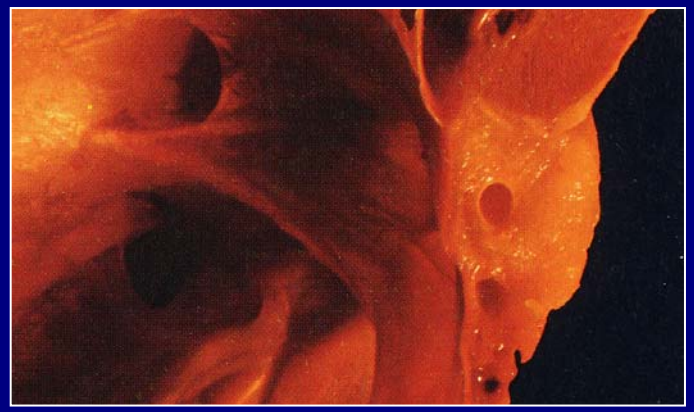
Left main coronary rtery

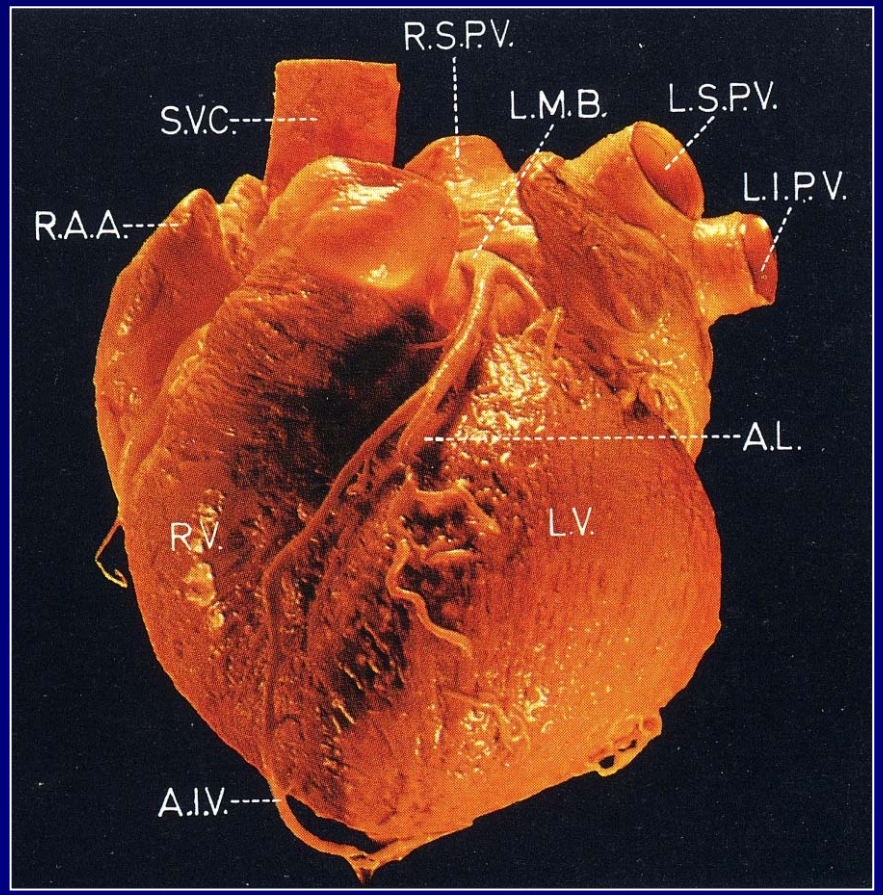
Left Anterior Descending Artery



Fat, grooves and coronary arteries

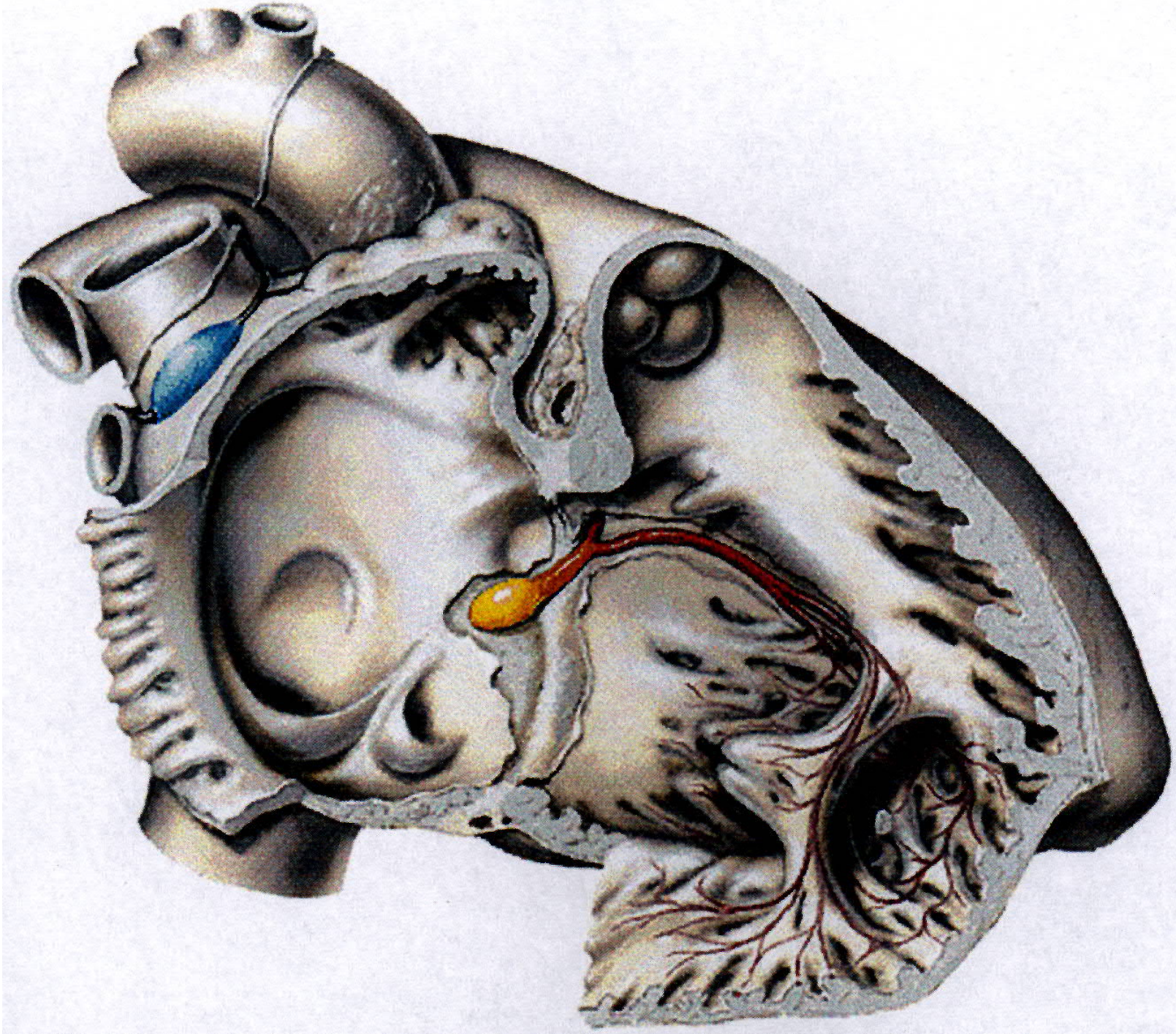






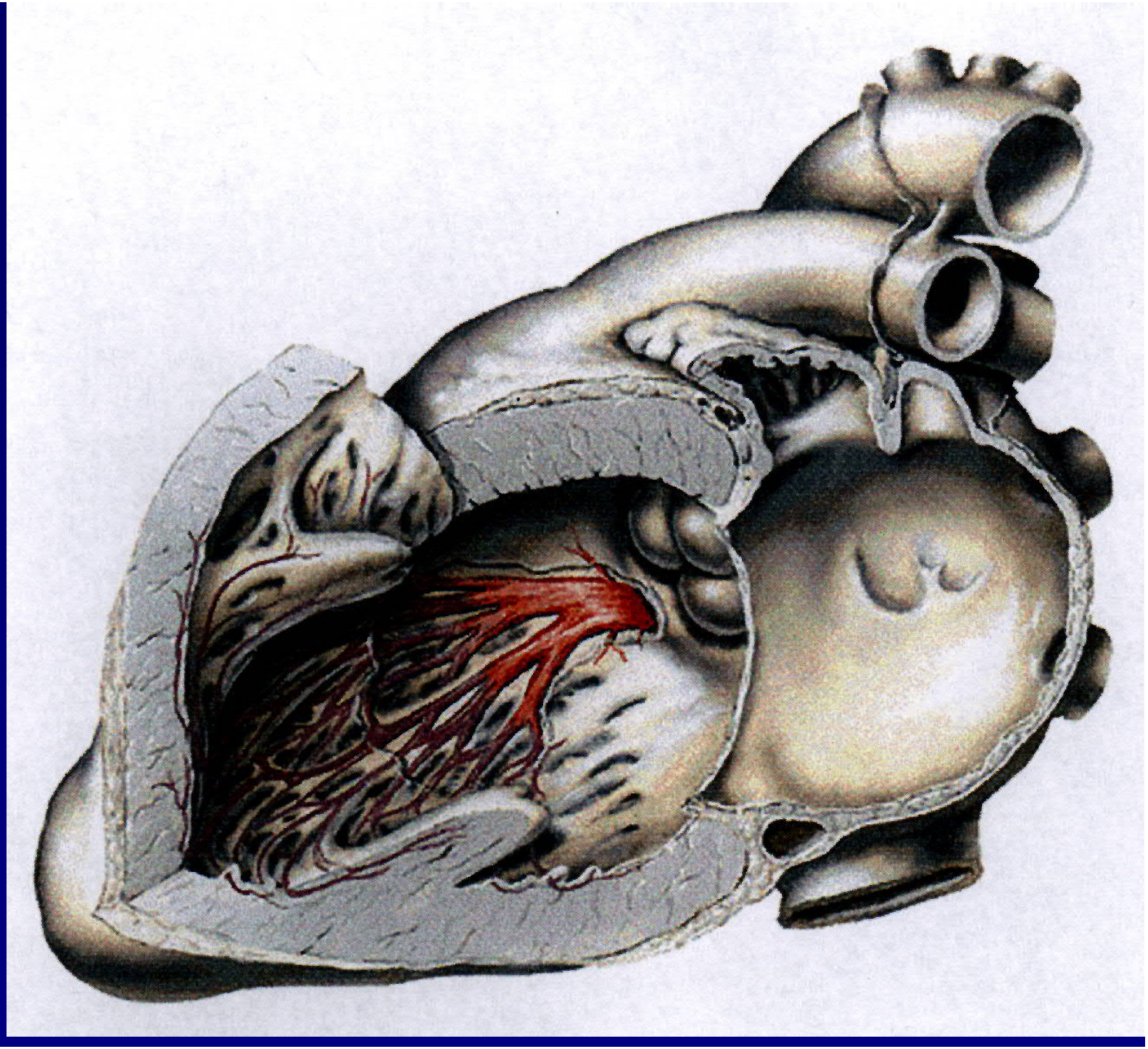
Coronaropathy

- Etiology: atherosclerosis
- Symptoms:
  - Angina pectoris
  - Myocardial Infarction
  - Heart Failure
- Revascularization
  - Percutaneous angioplasty
  - Coronary artery bypass grafting (CABG)

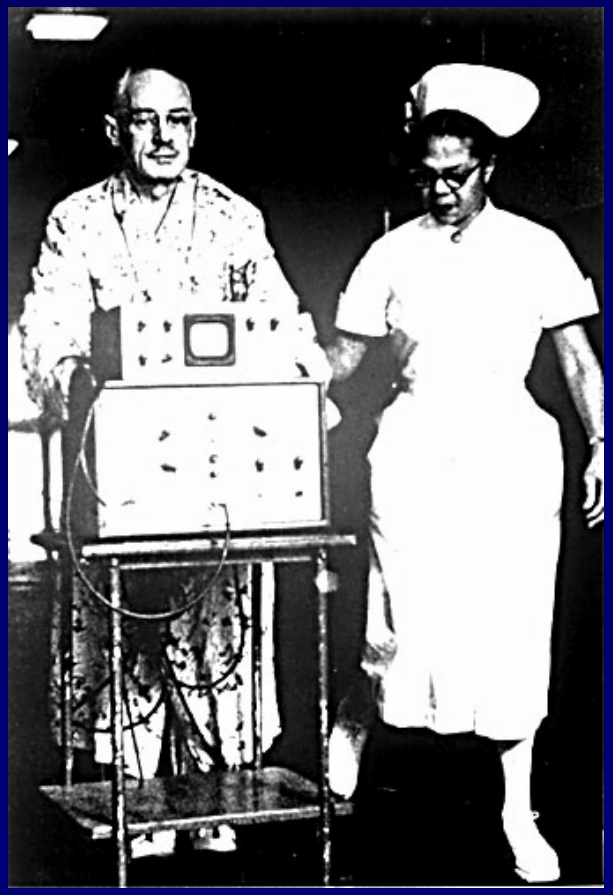


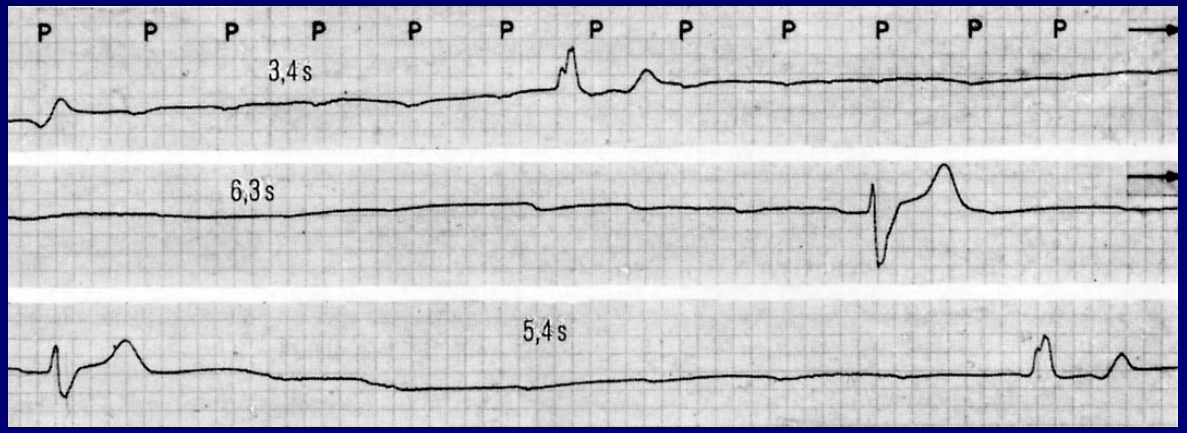
His Bundle

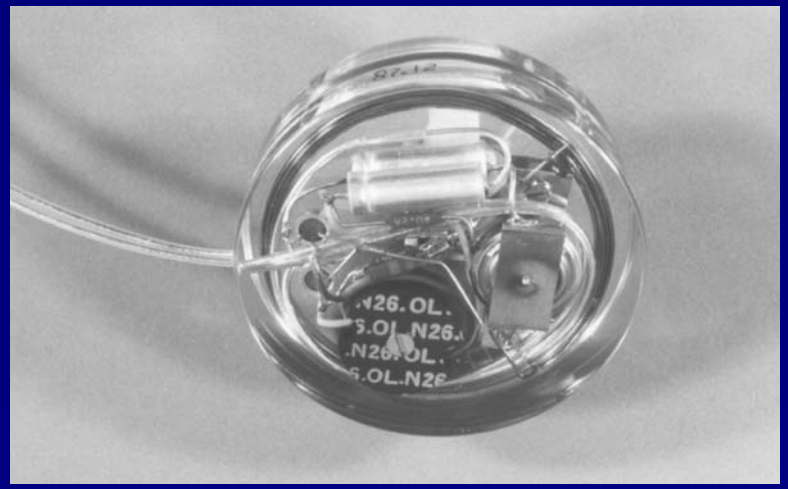
Left Bundle Branch of the His

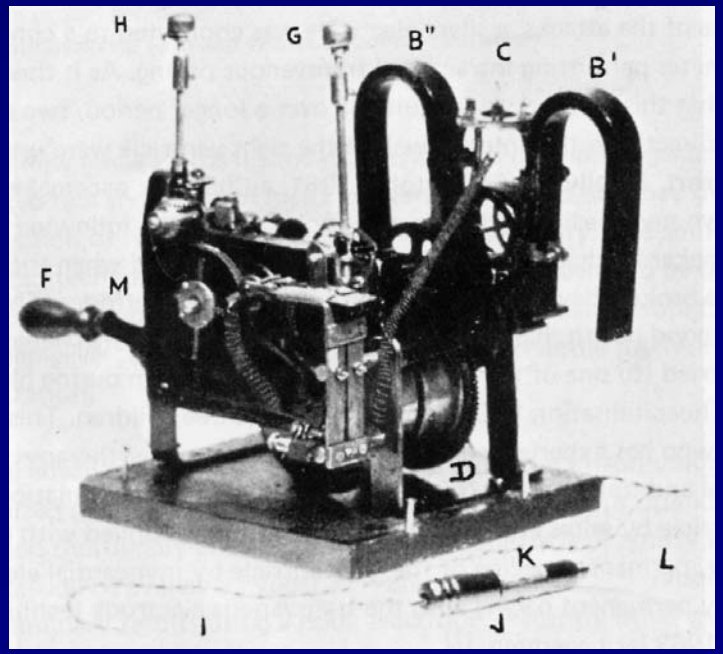


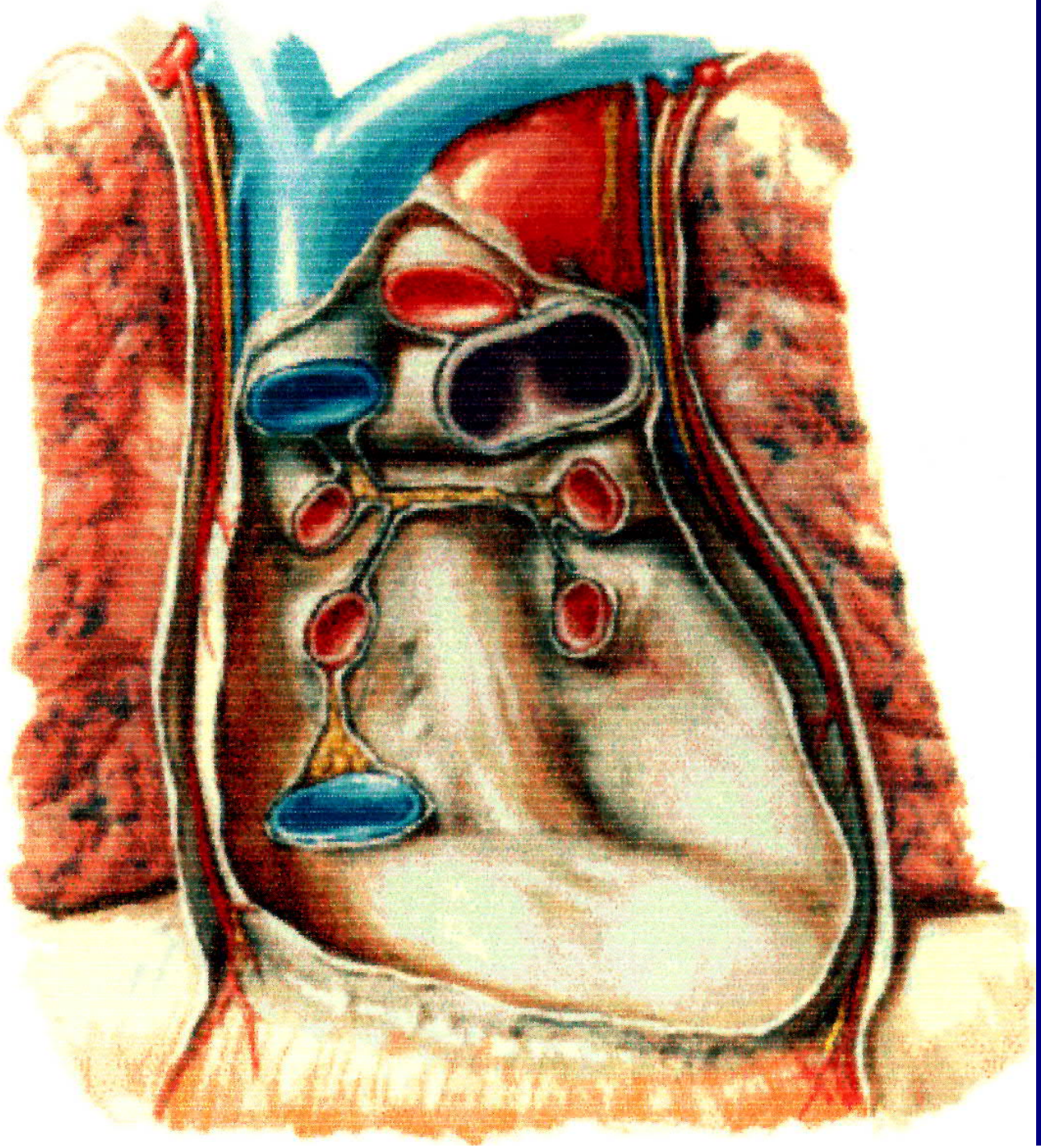
Atrio-Ventricular Block, Cardiac pacing











Pericardium

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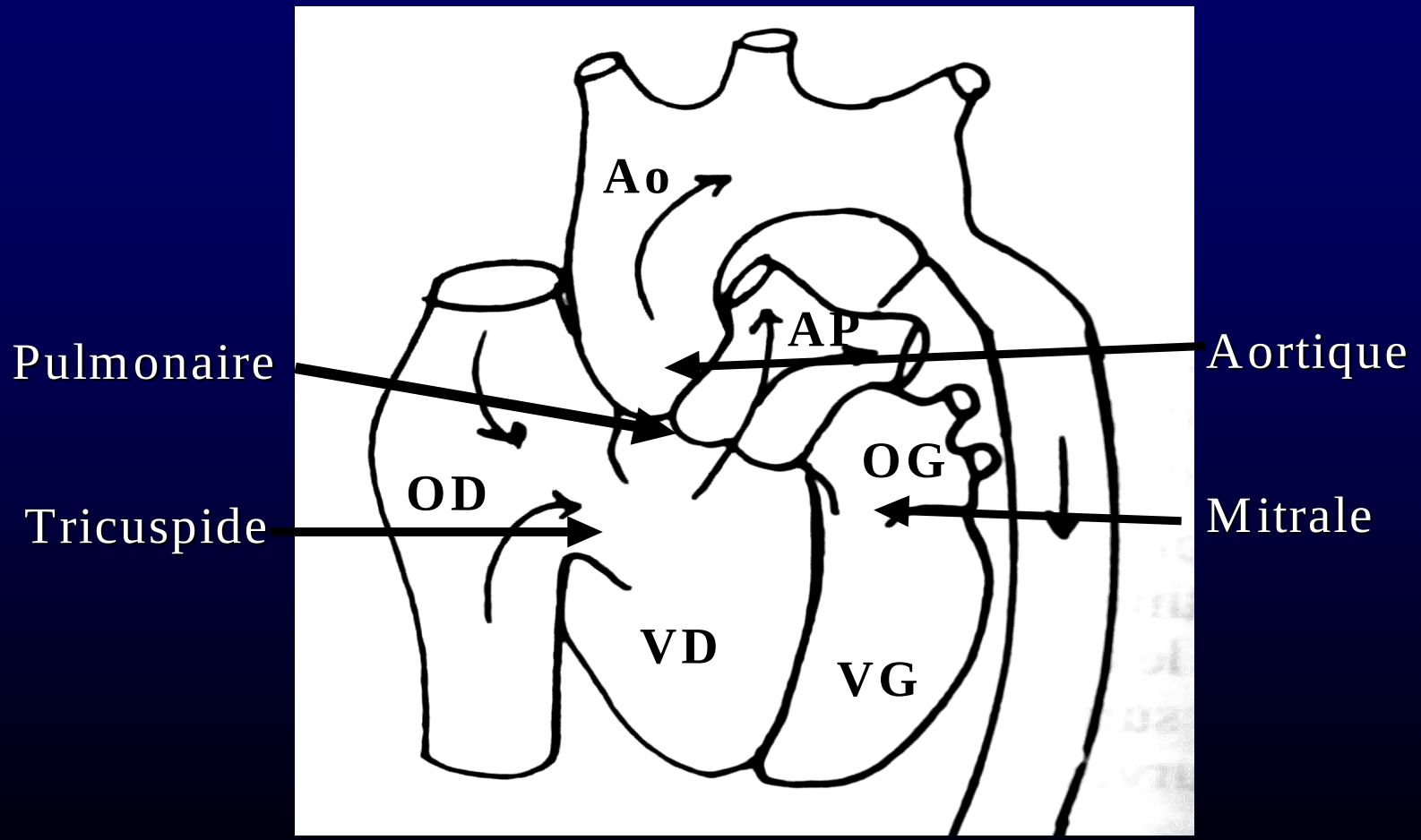

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