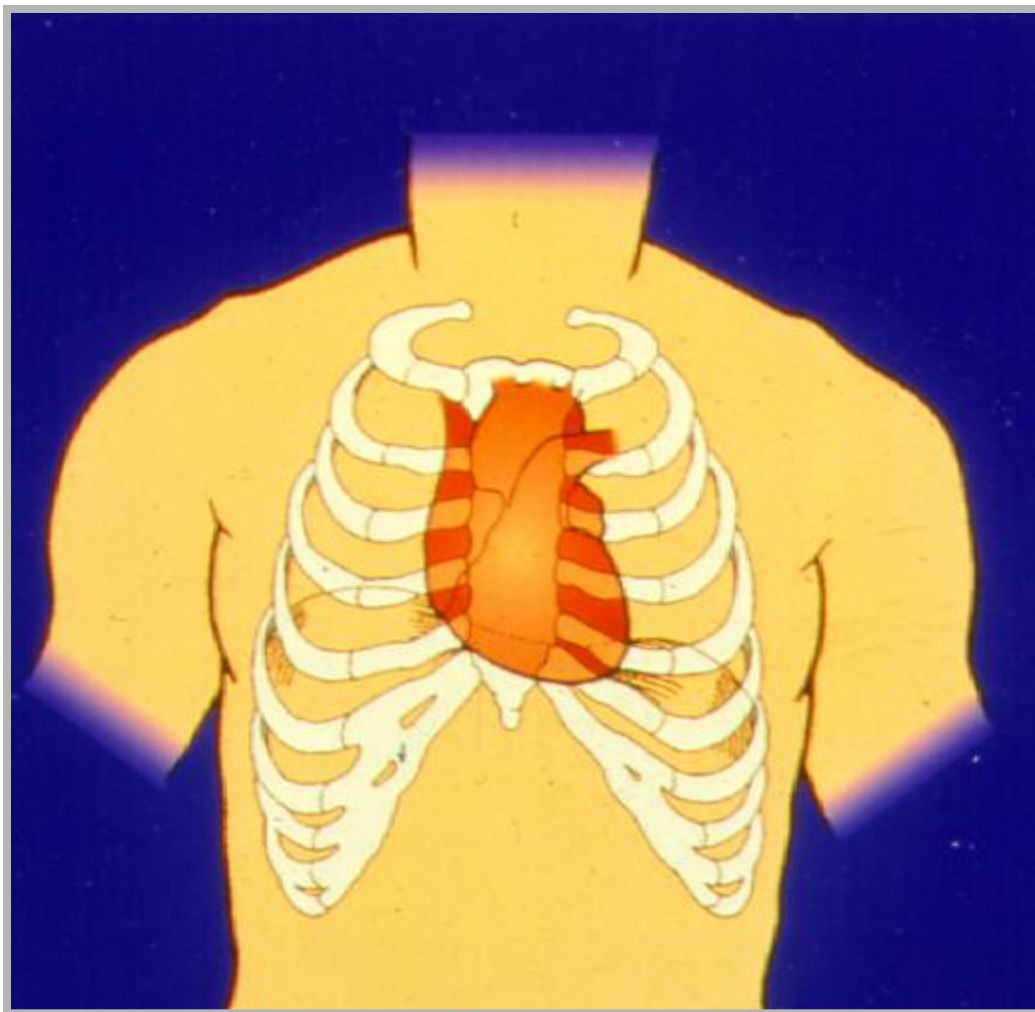
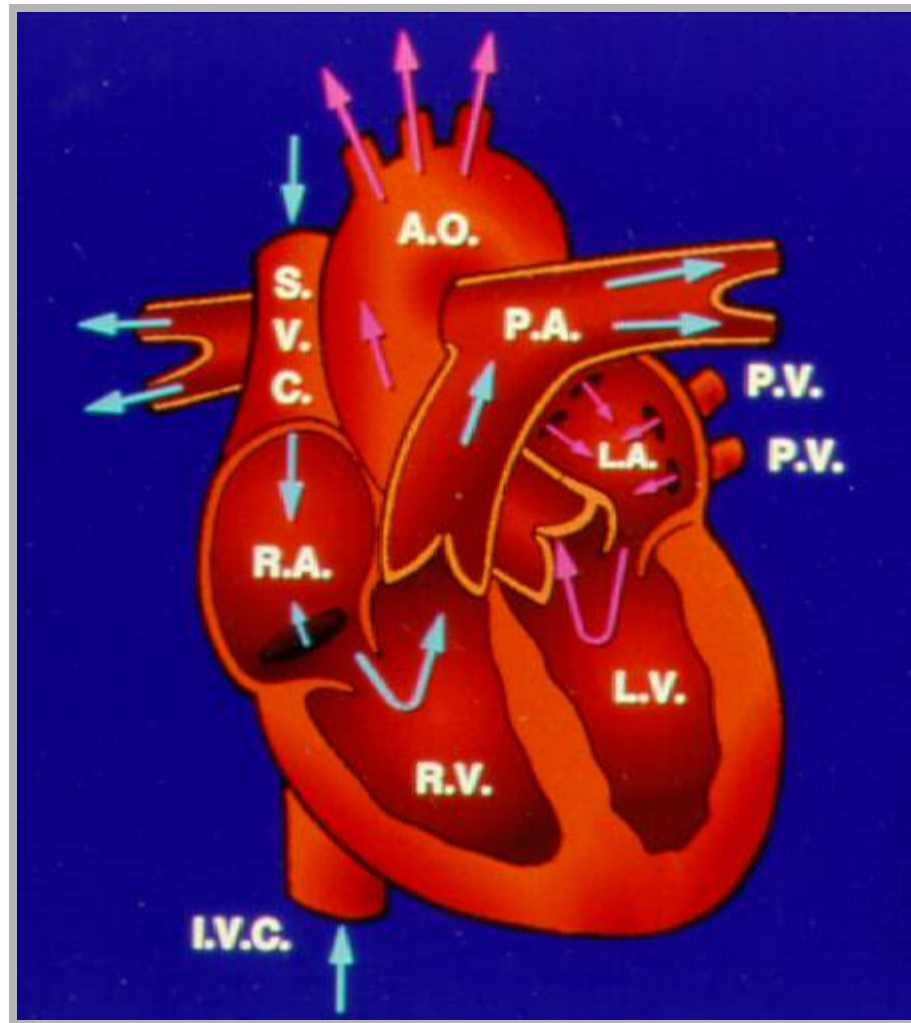
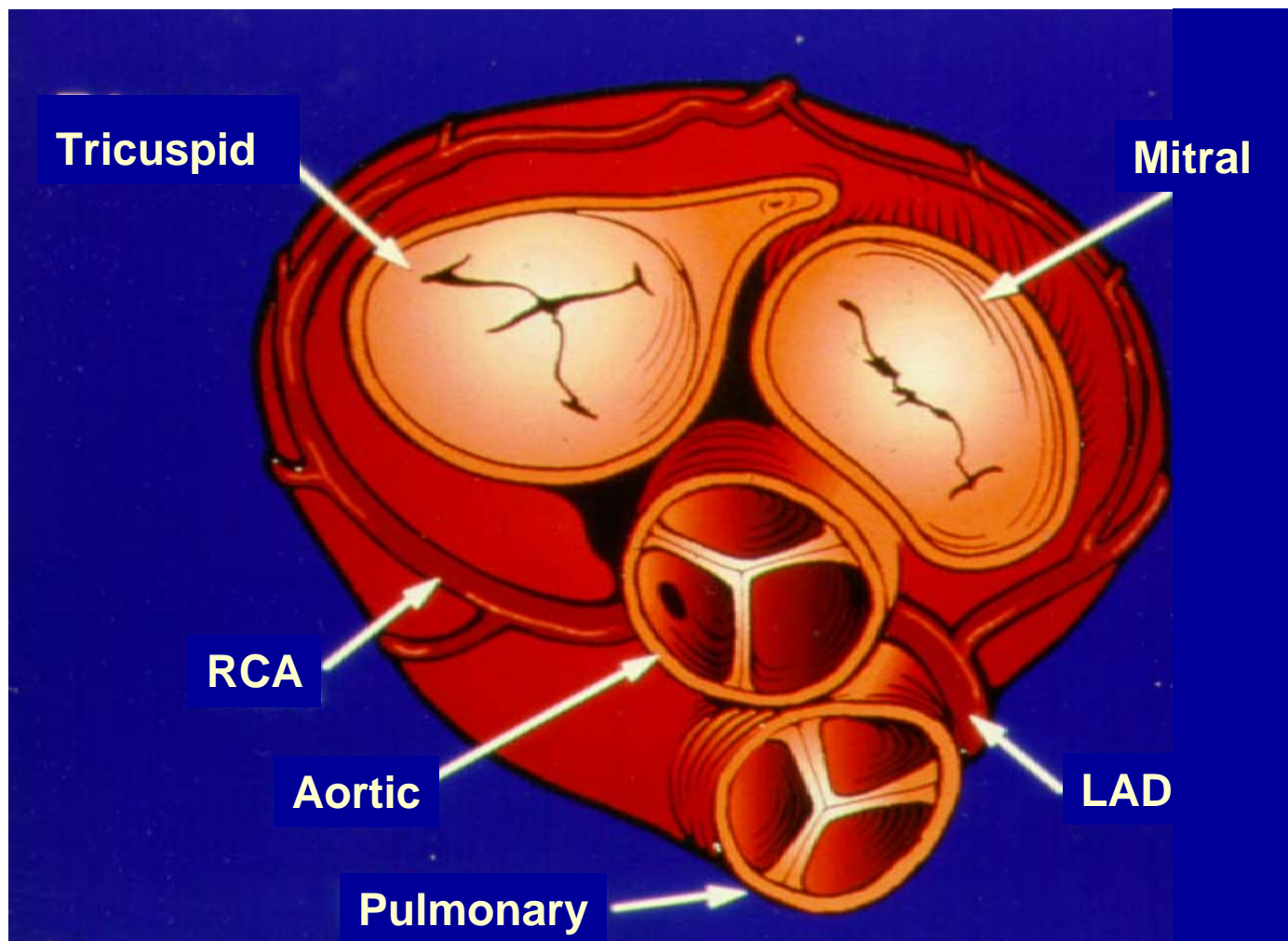




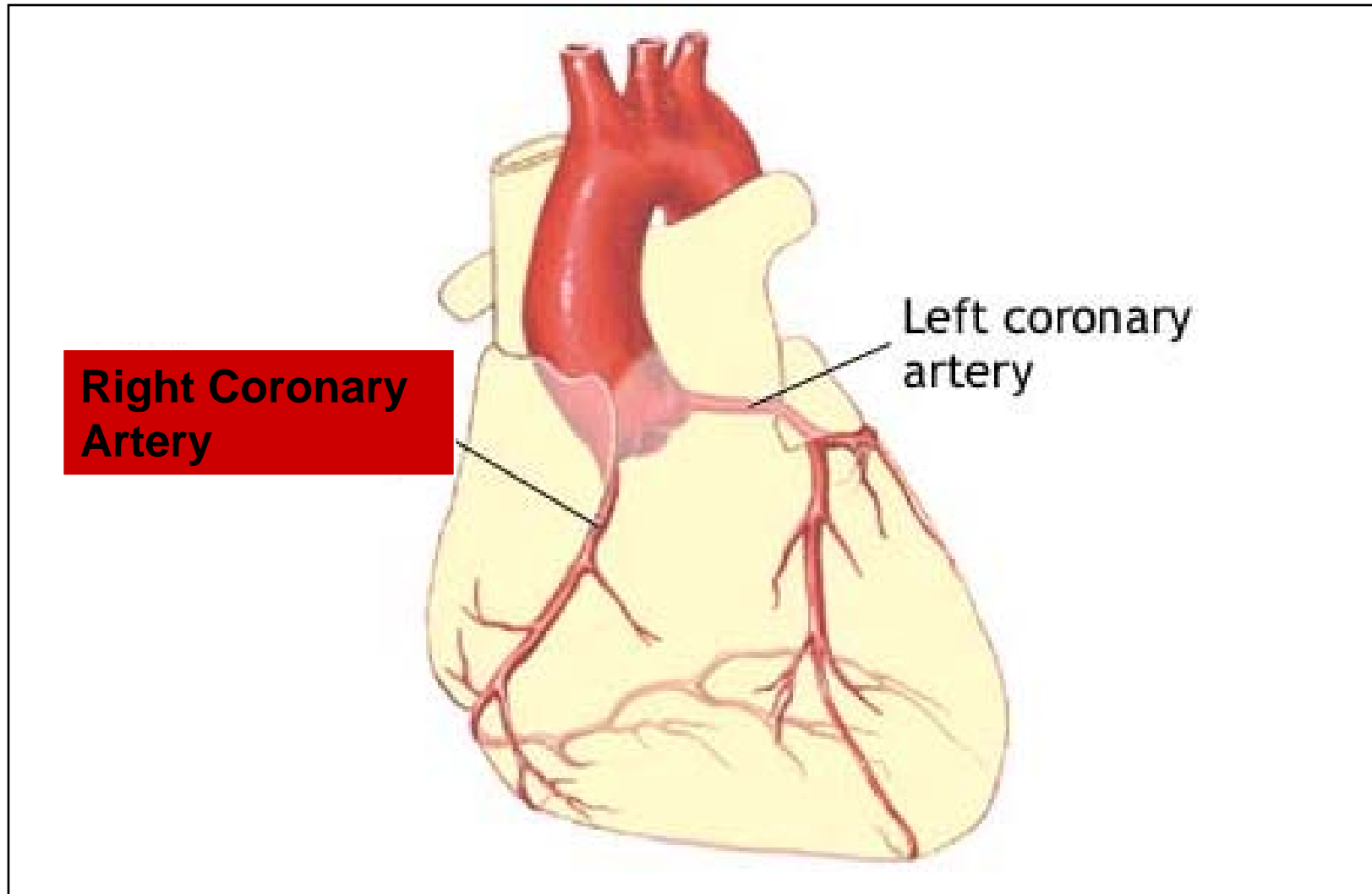
Coronary Anatomy



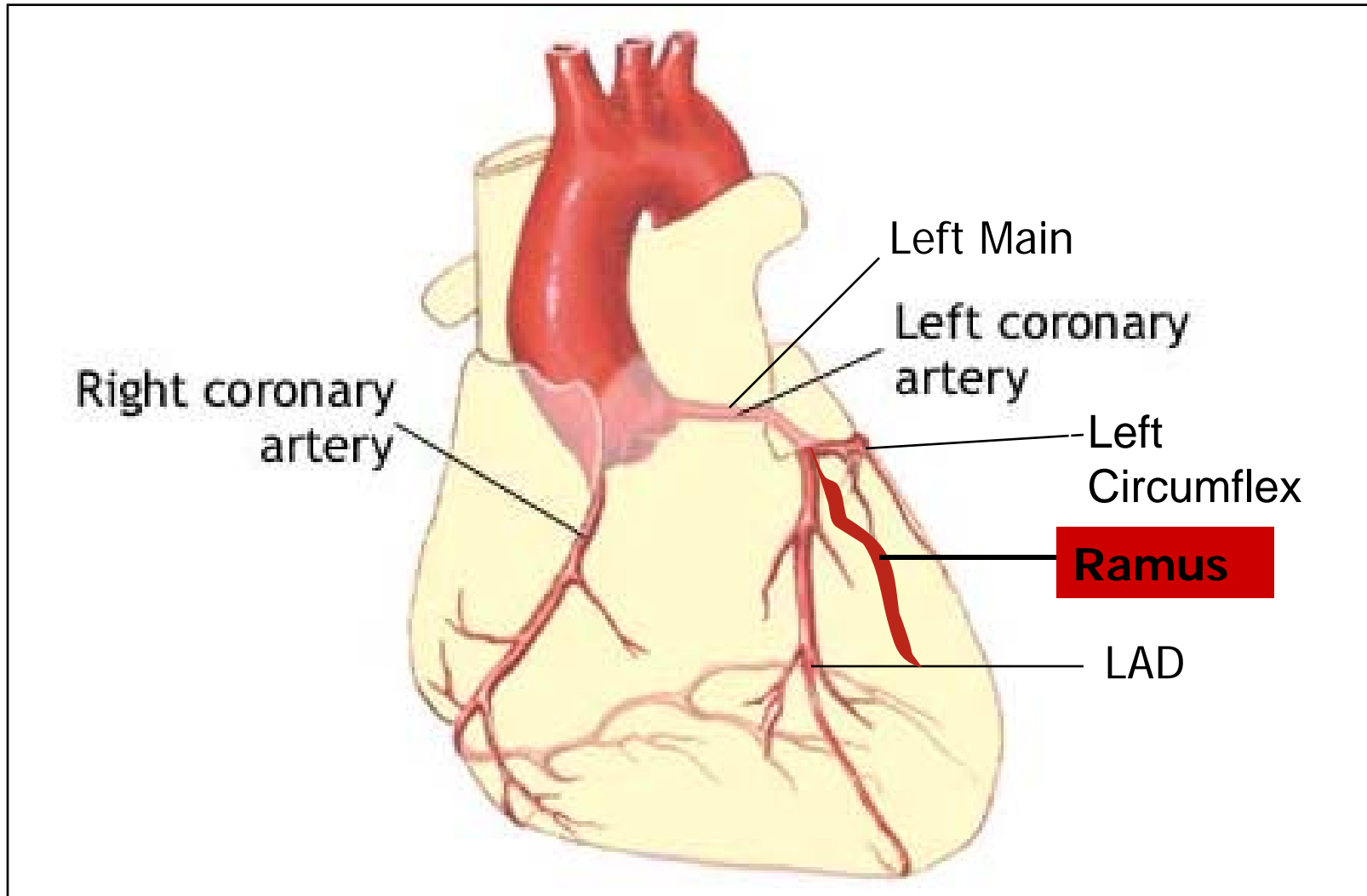




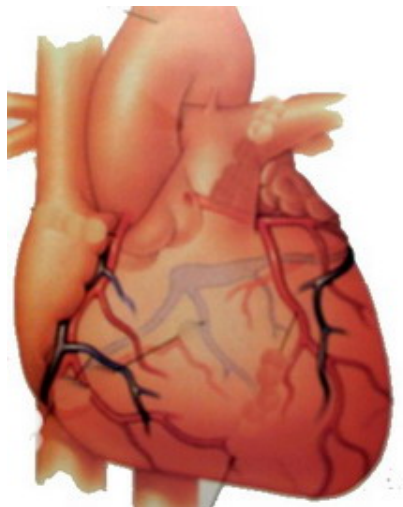
Coronary Circulation



Coronary Circulation



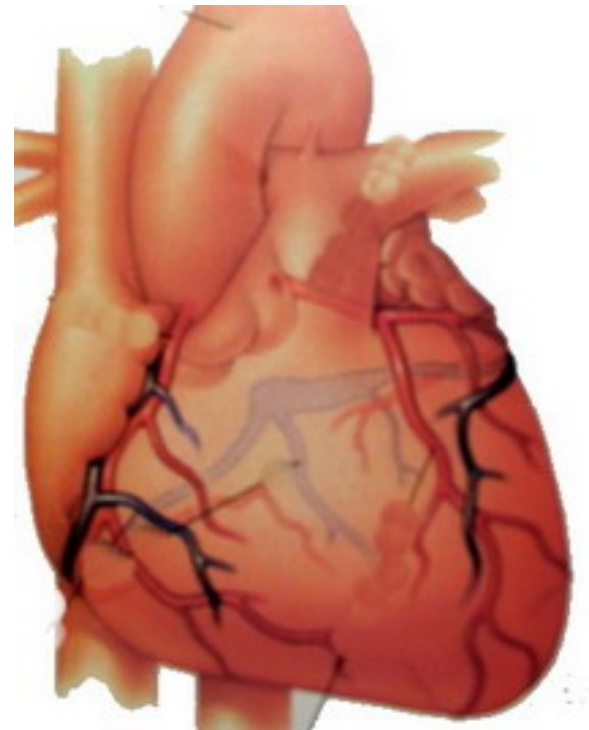
Left Coronary Artery



- Left Main
- Left Anterior Descending (LAD)
 - Diagonals (D1, D2)
 - Septals
- Left Circumflex (LCx)
 - Obtuse Marginals (OM 1, OM 2, etc)
 - Posterior Descending (PDA)

Right Coronary Artery

- Conus/SA Branches
- Acute Marginals (RV)
- Posterior Descending Artery (PDA)
- Posteriolateral Artery (PLA)
- Posterior Ventricular (PV)



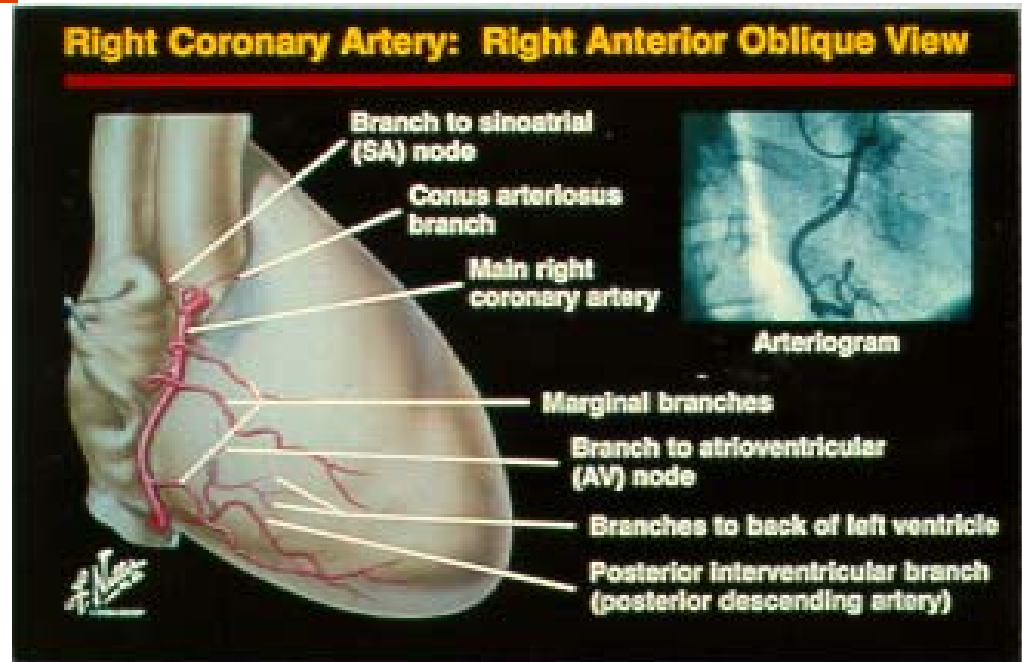
Right Coronary Artery (RCA)

Supplies blood to the right side of heart:

Right Atrium

Right Ventricle

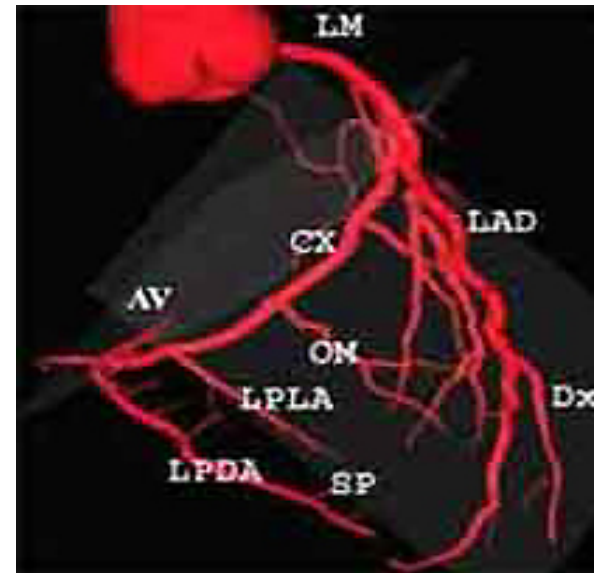
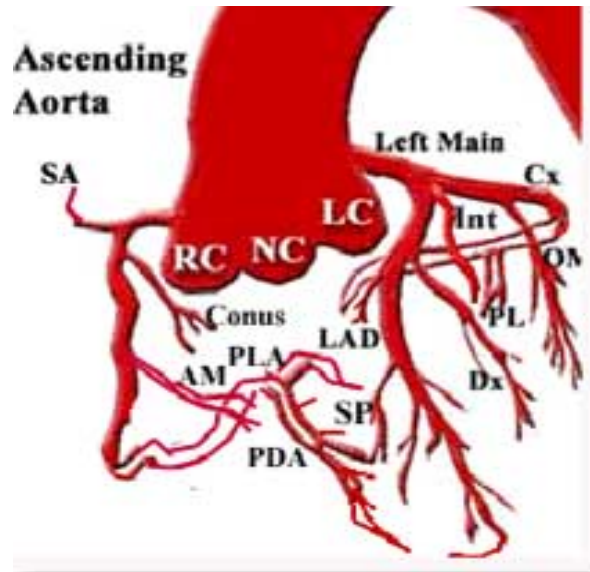
*Posterior & Inferior walls of Left Ventricle
(if dominant system)*



Coronary Artery Dominance

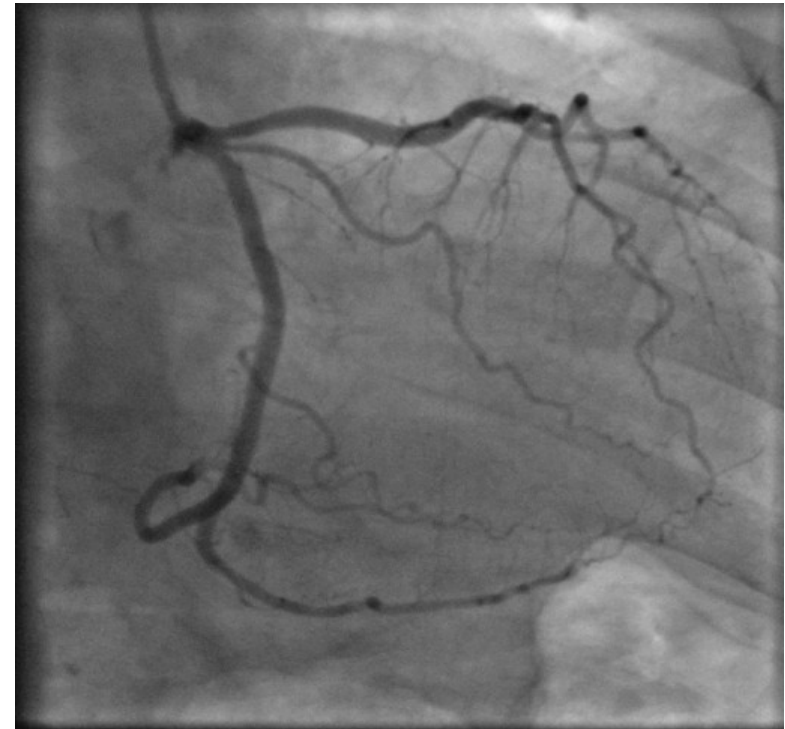
Definition: Dominance refers to the blood supply source to posterior and inferior wall of left ventricle

Determined by the posterior descending (PDA) and posterolateral (PL) branches



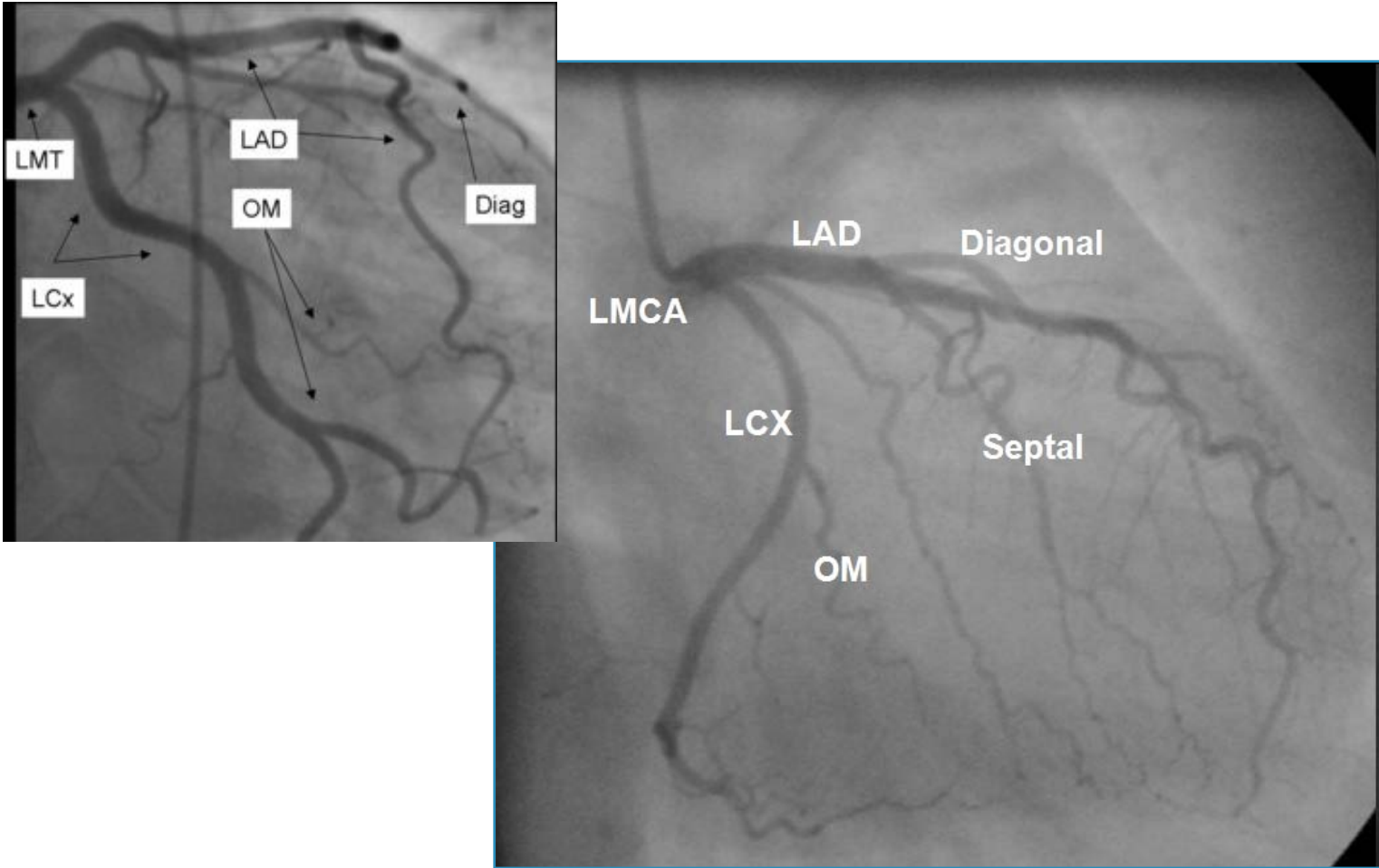
Source:
www.cardiologysite.com

Coronary Artery Dominance



Right - 85% **Left - 8%** **Balanced - 7%**

Angiographic Imaging



Collateral Circulation

Definition:

Small capillary-like branches of the artery that form over time in response to narrowed coronary arteries

Did you know:

Everyone has collateral vessels, at least in microscopic form

Collateral vessels help to supply enough oxygen-rich blood to the heart muscle.

At times of increased exertion collateral vessels may not deliver enough blood.

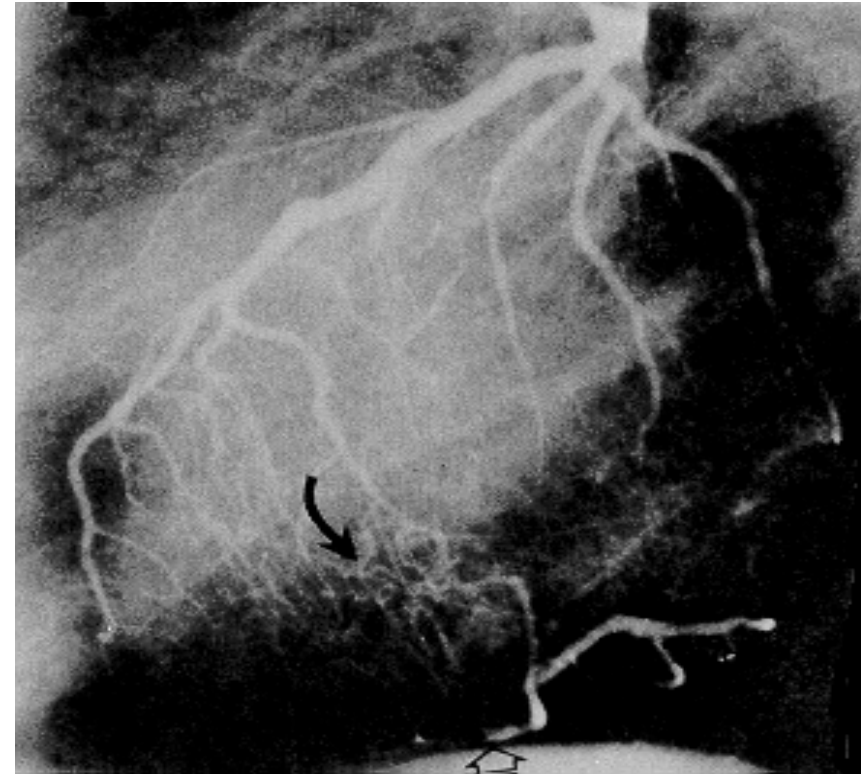


Collateral Circulation

Description to collateral circulation:

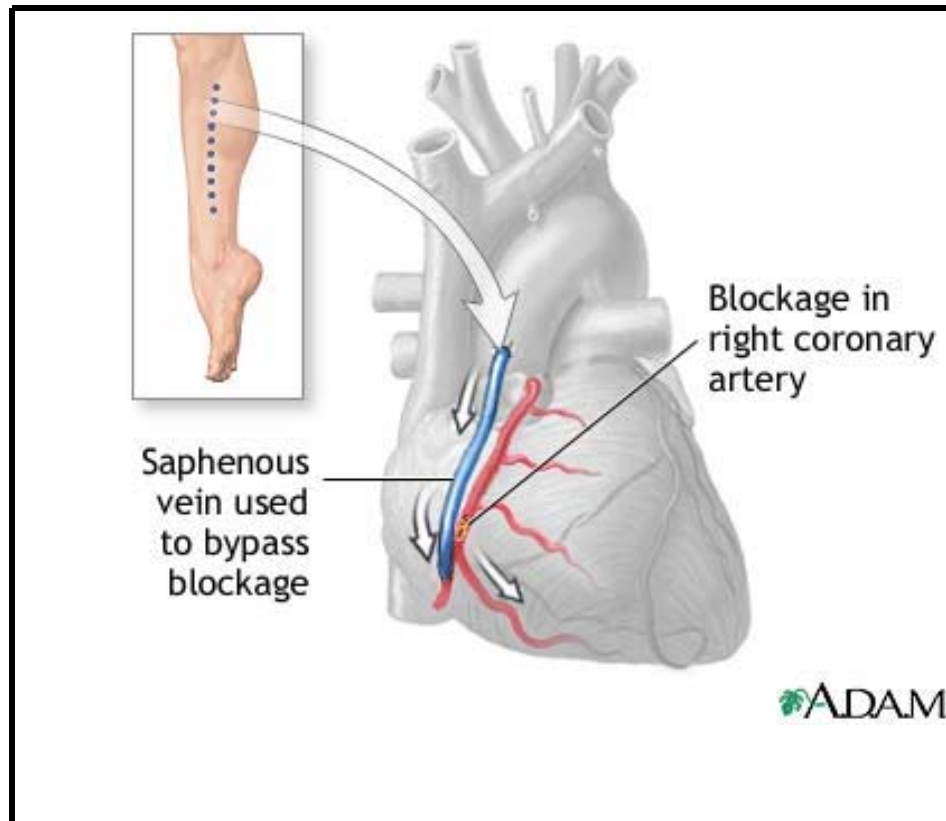
Same side - left-to-left
right-to-right

Opposite side - right-to-left
left-to-right

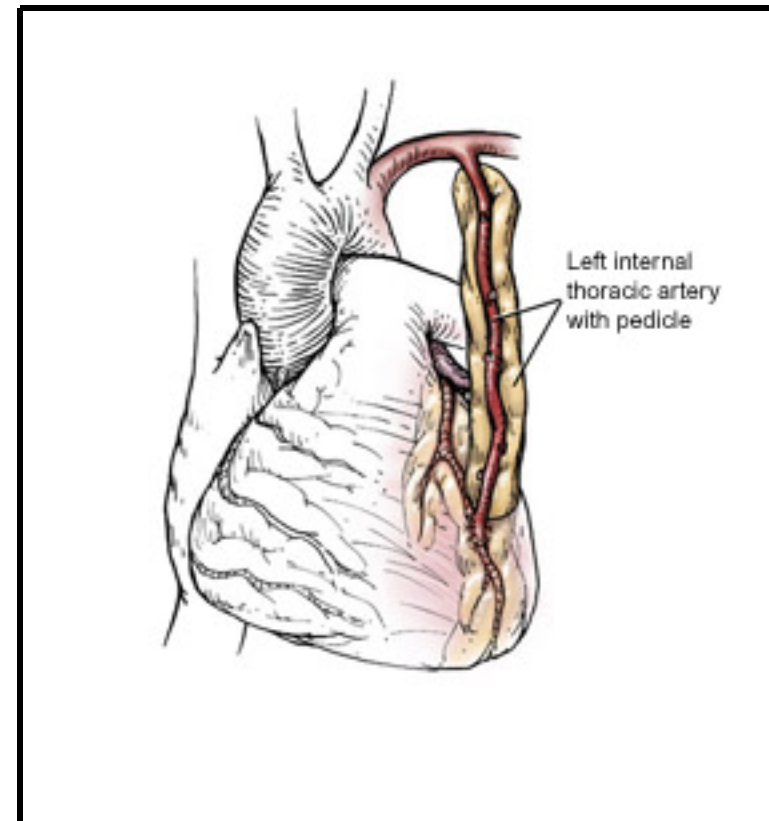


Coronary Artery Bypass Surgery

Saphenous Vein Graft



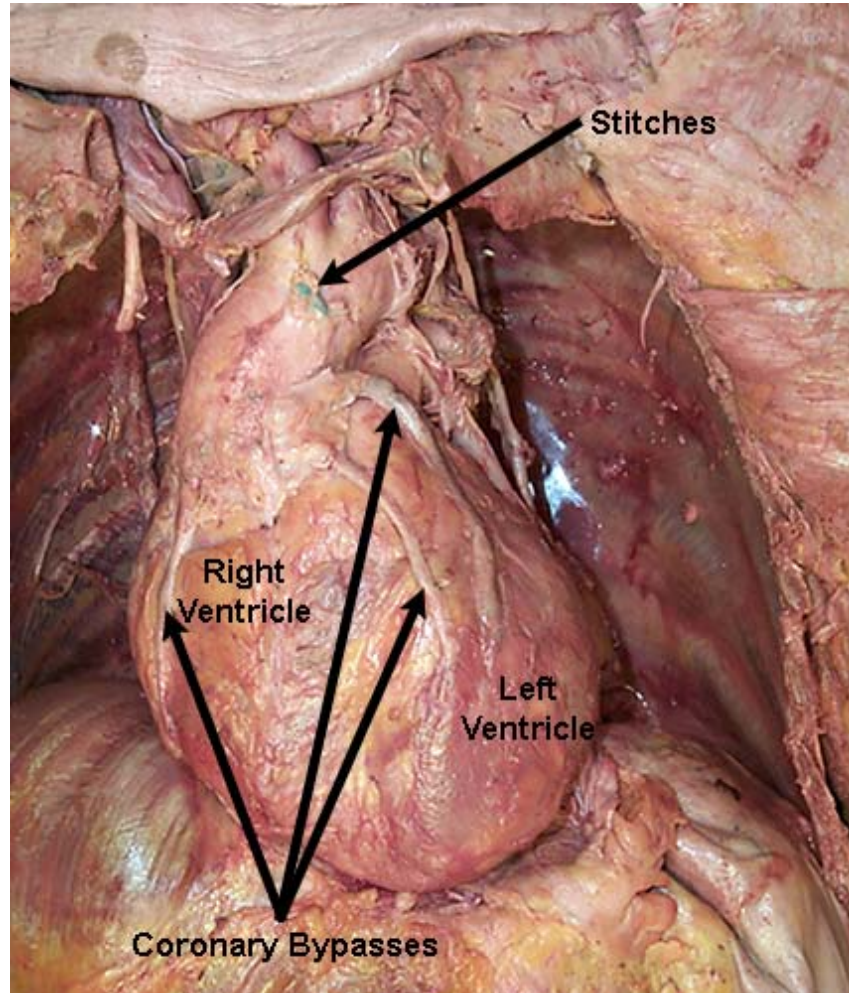
LIMA-LAD



Internal Mammary Artery (IMA) Grafts

- IMA's Will Generally Connect to the Same Side (RIMA to RCA, LIMA to Lad/Diag)
- They Seldom Cross the Midline
- Very Rarely Go to CX.
- “Free” IMA/Radial grafts act like a Venous Conduit but has arterial wall integrity

Coronary Artery Bypass Surgery



<http://www.upstate.edu/cdb/grossanat/thoraxpath5.shtml>

Ventriculography

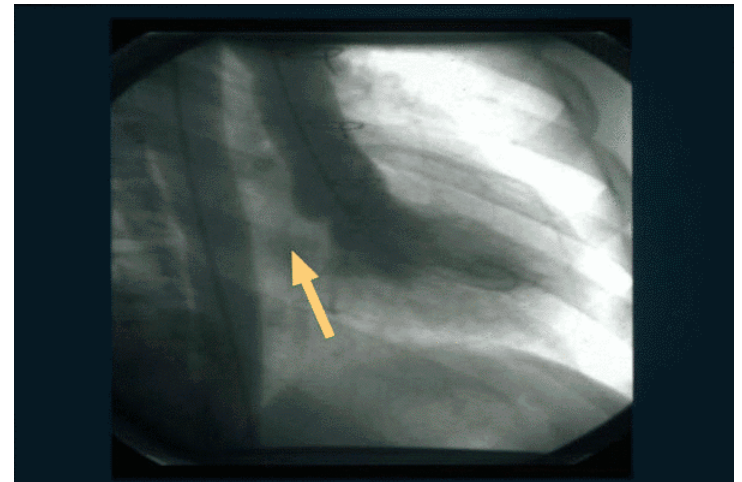
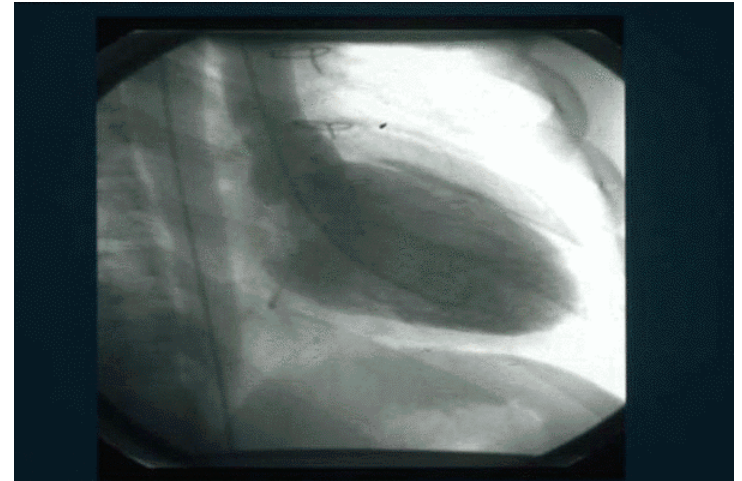
Purpose is to **evaluate left ventricular function**

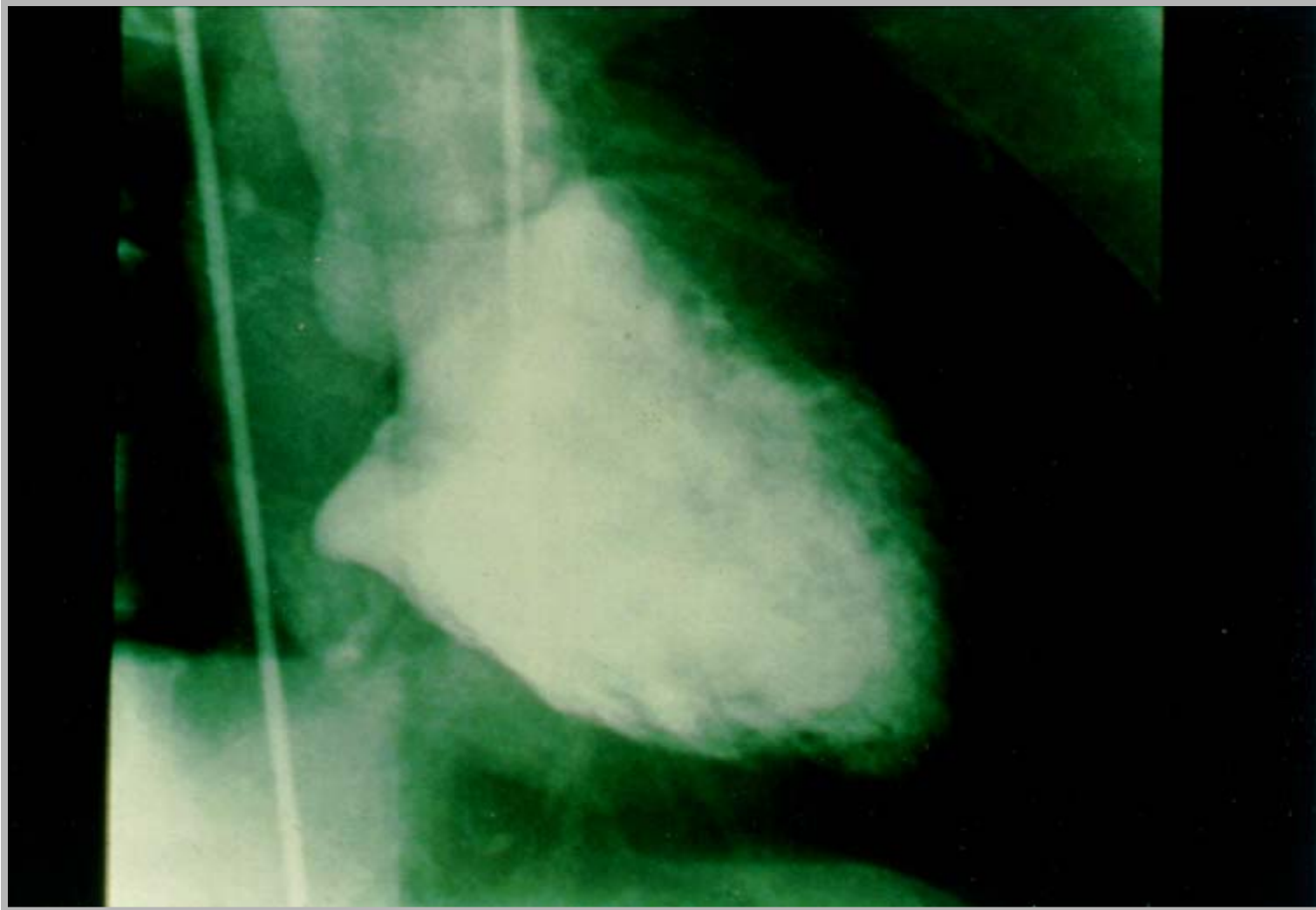
Evaluation meaning **contractility, size, wall thickness, quality of valve function**

We measure by **Ejection Fraction**

Volume of blood ejected by the left ventricle during a contraction

Normal: >65% The EF is a good predictor of survival after an MI

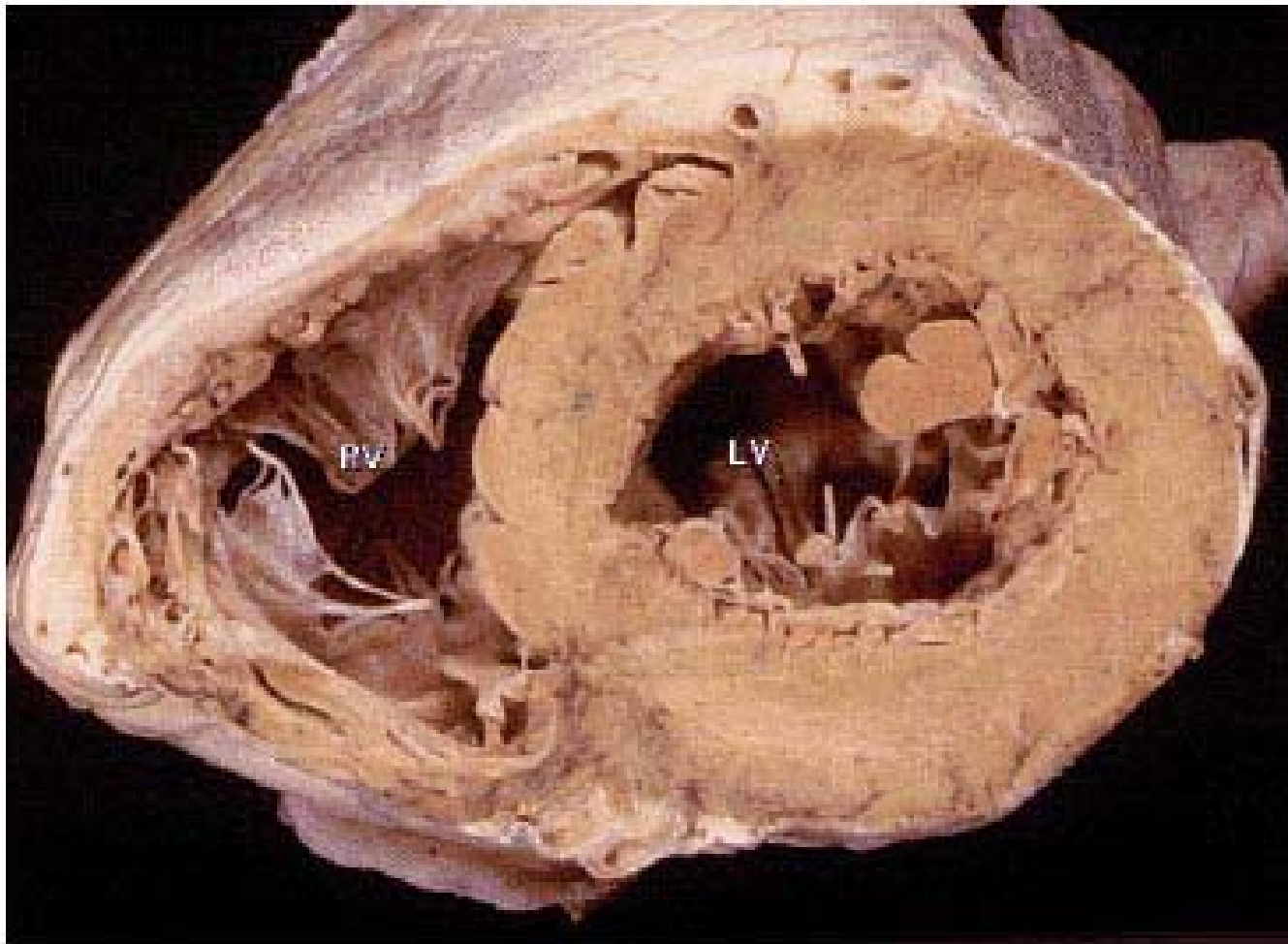




Left Ventricular Ejection Fraction (LVEF)

- Compares internal dimension: end systolic volume (ESV) to end diastolic volume (EDV).
- Normal is approximately 60-70%.

Ventricular Walls



Allworth, A., www.zoey.med.howard.edu, 2003.

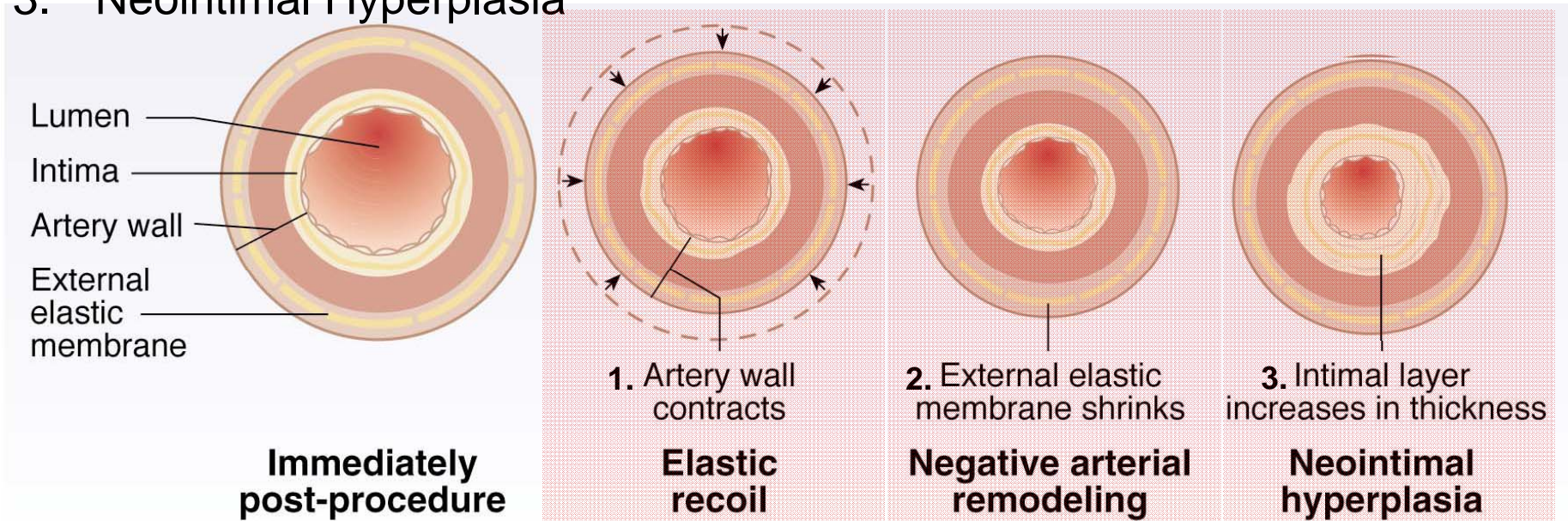
Three Mechanisms Cause Restenosis

Post Balloon Angioplasty

Three mechanisms leading to restenosis

1. Elastic Recoil
2. Negative Arterial Remodeling
3. Neointimal Hyperplasia

POBA Restenosis ~40–50%



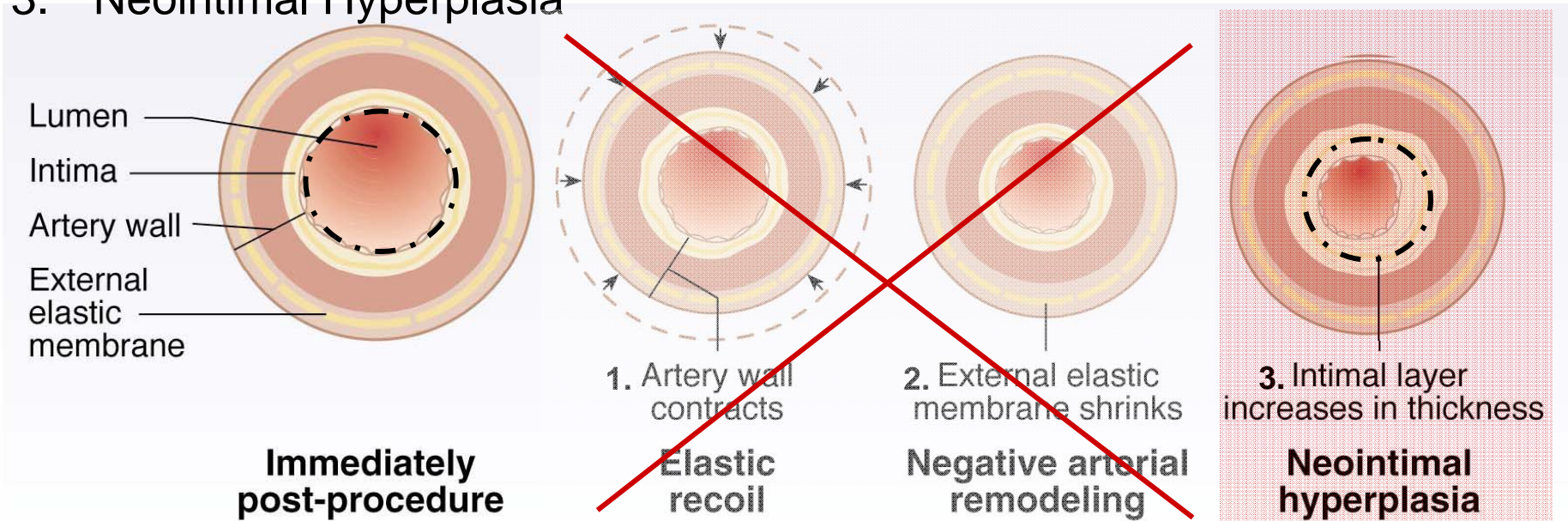
J. Zidar, Restenosis & Metal Stents: The Hard Data, TCTMD.com

Restenosis Post-Stent: Neointimal Growth

Three mechanisms leading to restenosis

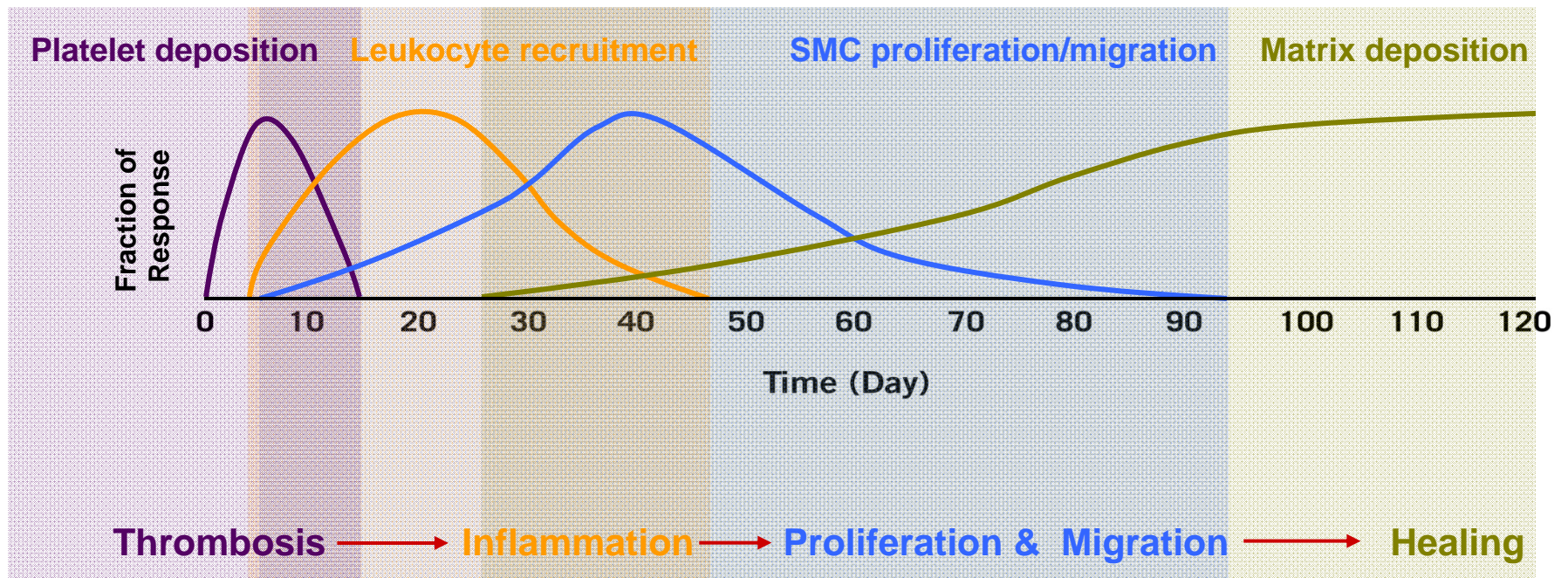
1. Elastic Recoil: Mitigated by stenting
2. Vascular Remodeling: Mitigated by stenting
3. Neointimal Hyperplasia

In-Stent Restenosis ~15–25%



J. Zidar, Restenosis & Metal Stents: The Hard Data, TCTMD.com

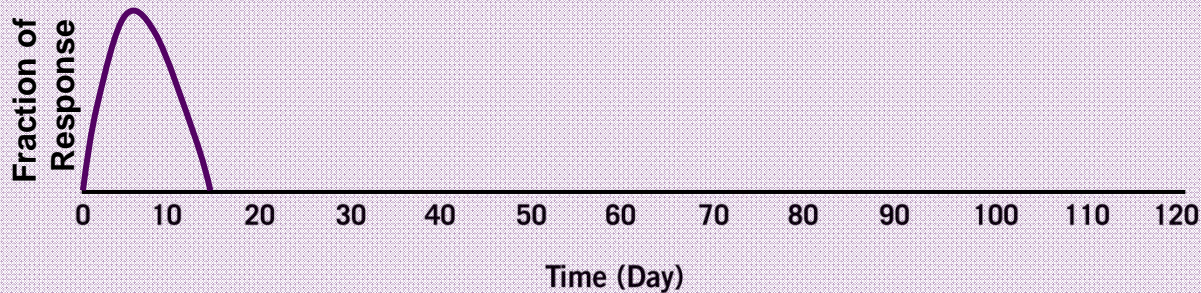
Timeline: In-Stent Restenosis Cascade



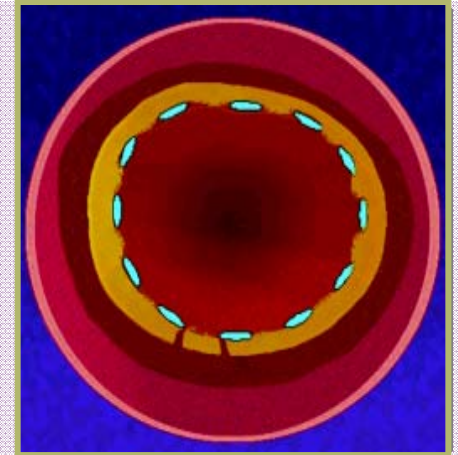
Source: Source: Forrester et al. J Am Coll Cardiol. 17:758-769, 1991. Welt et al. Atheroscler Thromb Vasc Biol. 22:1769-1776, 2002.

Simon, "Inflammation: The Key Element in the Biology of Restenosis." Inflammation Summit. TCT 2003.

Timeline: The Initial Short-Term Reaction

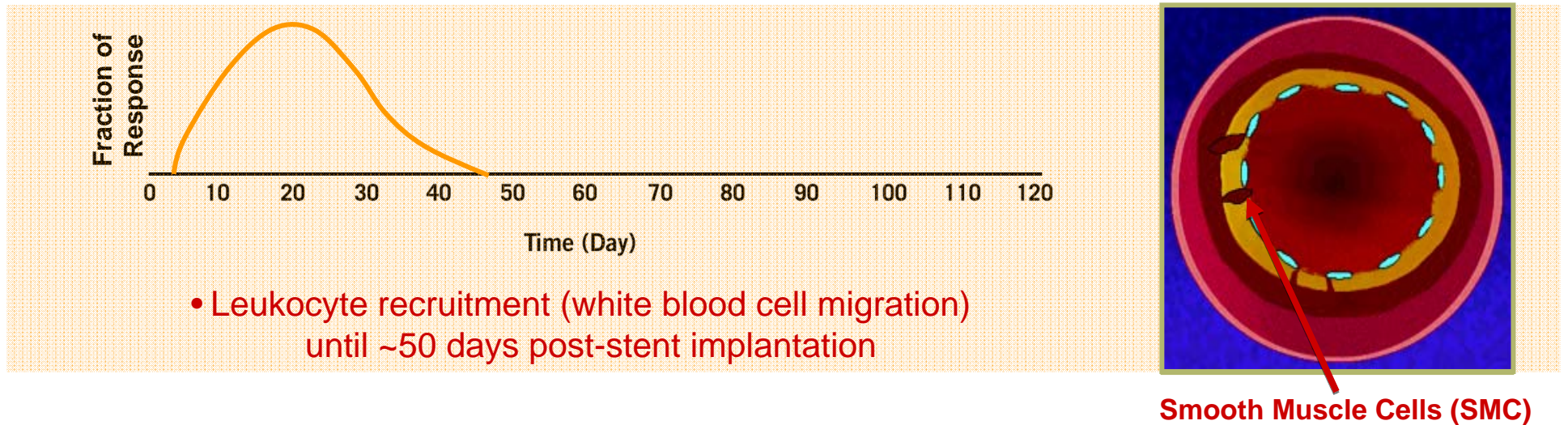


- Platelet deposition occurs until ~15 days post-stent implantation



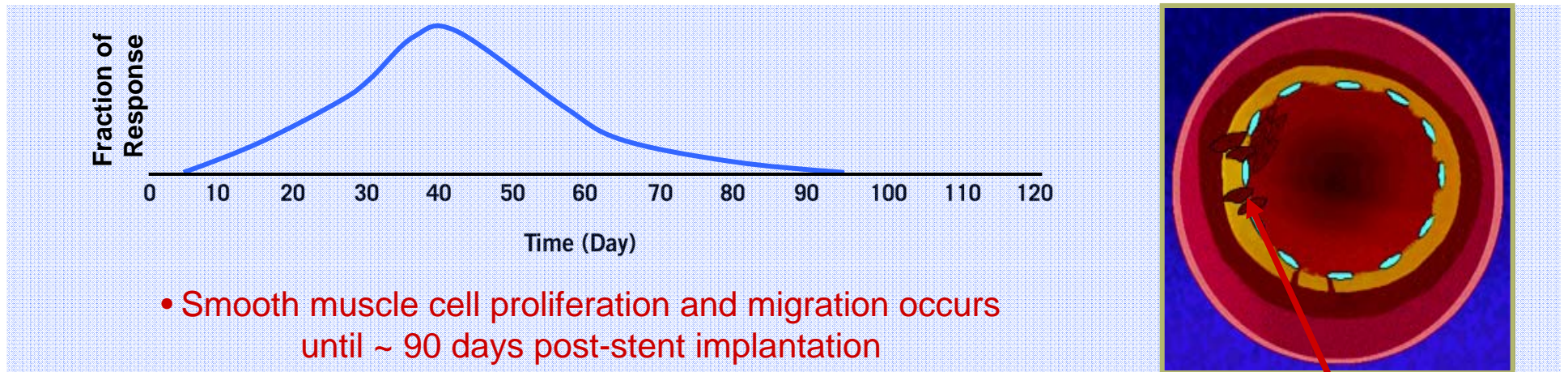
- Stent deployment causes a mechanical injury to arterial wall, impacting the endothelial lining of the artery
- The short term reaction is to activate platelets resulting in platelet adhesion and aggregation / thrombus formation

Timeline: Local Inflammation



- Recruitment and activation of white blood cells is induced by the injured arterial intima, the platelets, and the stent
- The presence of a stent increases the length of inflammation period
- The inflammation level is a predictor of restenosis

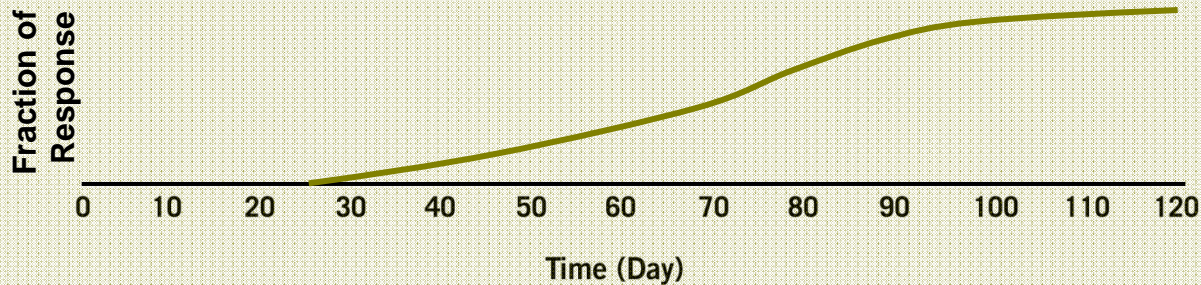
Timeline: Smooth Muscle Cell Proliferation and Migration



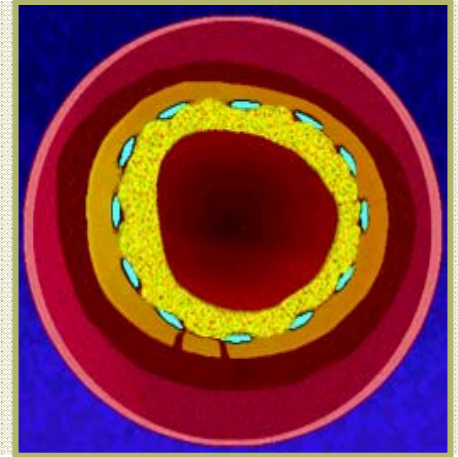
Smooth Muscle Cells (SMC)

- SMC proliferation occurs within the arterial media and neointima
- Degradation of the extracellular matrix (the protein structure between cells that increases integrity)
- SMC migrate across the Internal Elastic Lamina (IEL) to the luminal surface

Timeline: SMC Proliferation Leads to Neointimal Thickening



- Matrix deposition occurs >120 days after stent implantation

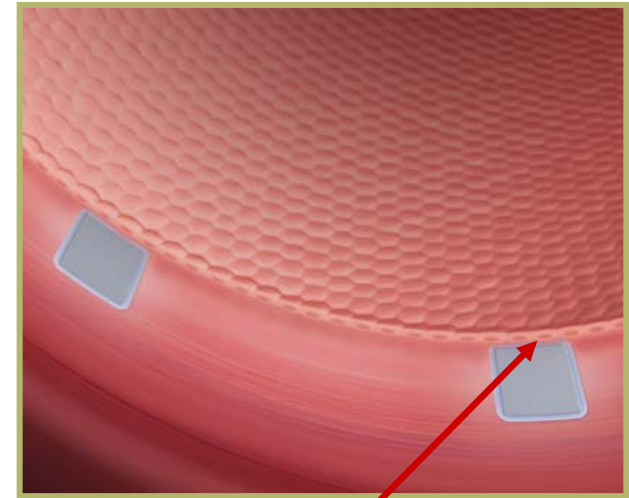


- Normal process leading to general healing
 - Matrix deposition
 - Re-endothelialization

Source: Fourth Annual Symposium on Radiotherapy to Reduce Restenosis, Scripps Clinic, Jan 13-15, 2000, Abstract #56

The Ideal End Result: Healing With a Limited Loss of Lumen Space

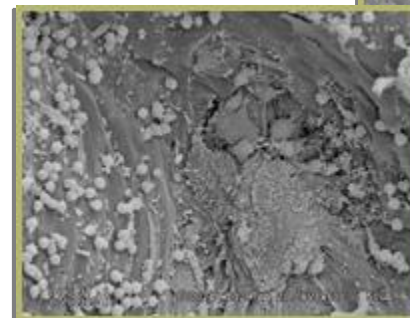
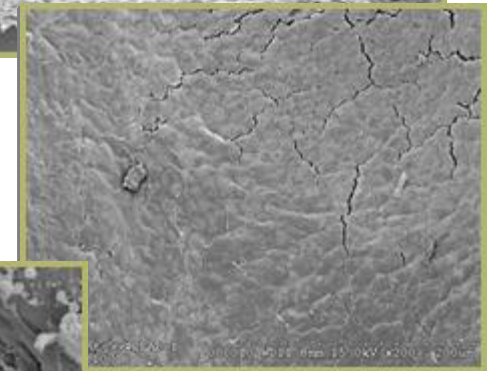
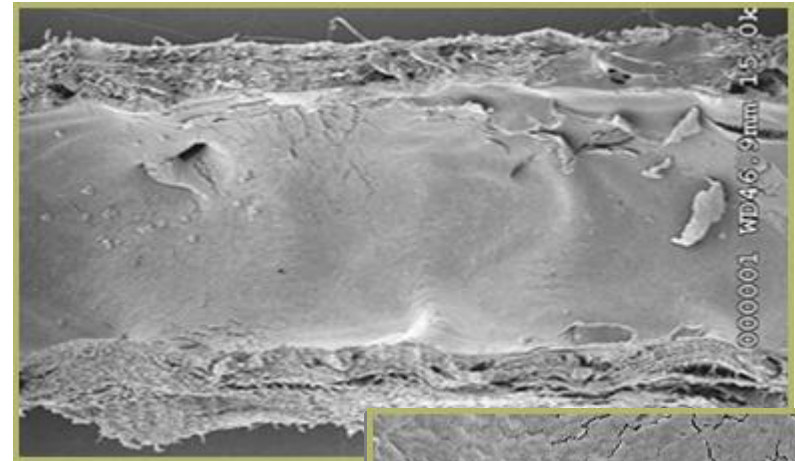
- Healing is characterized by re-endothelialization, a single cell layer of endothelial cells covering the vessel wall
- Endothelial layer needs to be both complete **and** functioning
 - Minimal inflammation in the neointima
 - Intact endothelium acts as a barrier to vessel wall injury and SMC proliferation
- **A complete functioning endothelium creates a smooth, non-thrombogenic surface**



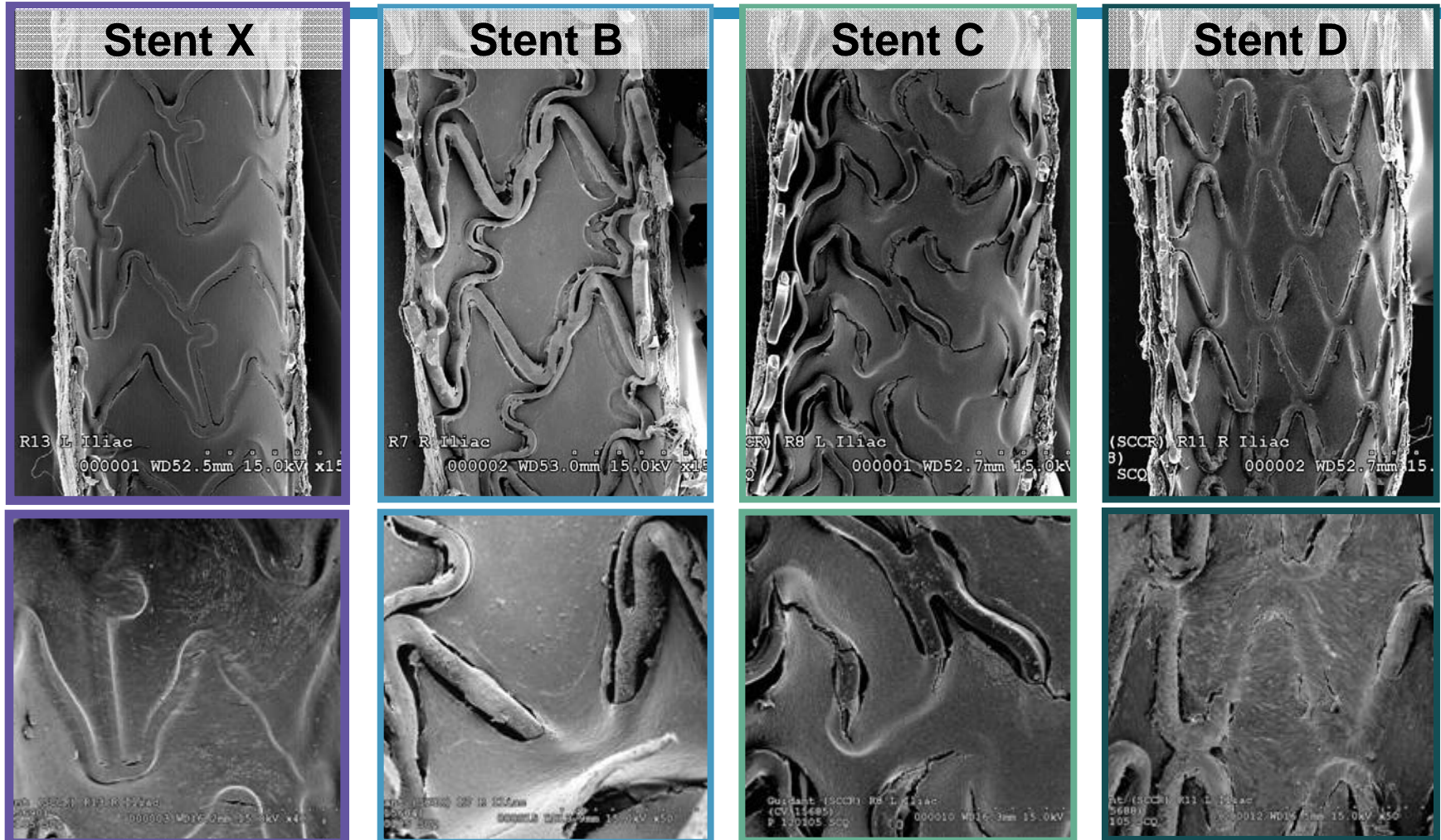
Endothelial cells
covering stent struts

Re-Endothelialization

- A complete and functional endothelium is *required to have a 'healed' vessel*
- The endothelial layer is comprised of a single layer of endothelial cells which form a barrier between the blood and tissue
- *An incomplete layer* or a break in the endothelial layer results in platelet, *fibrin*, and WBC accumulation on the luminal surface which can trigger a thrombus

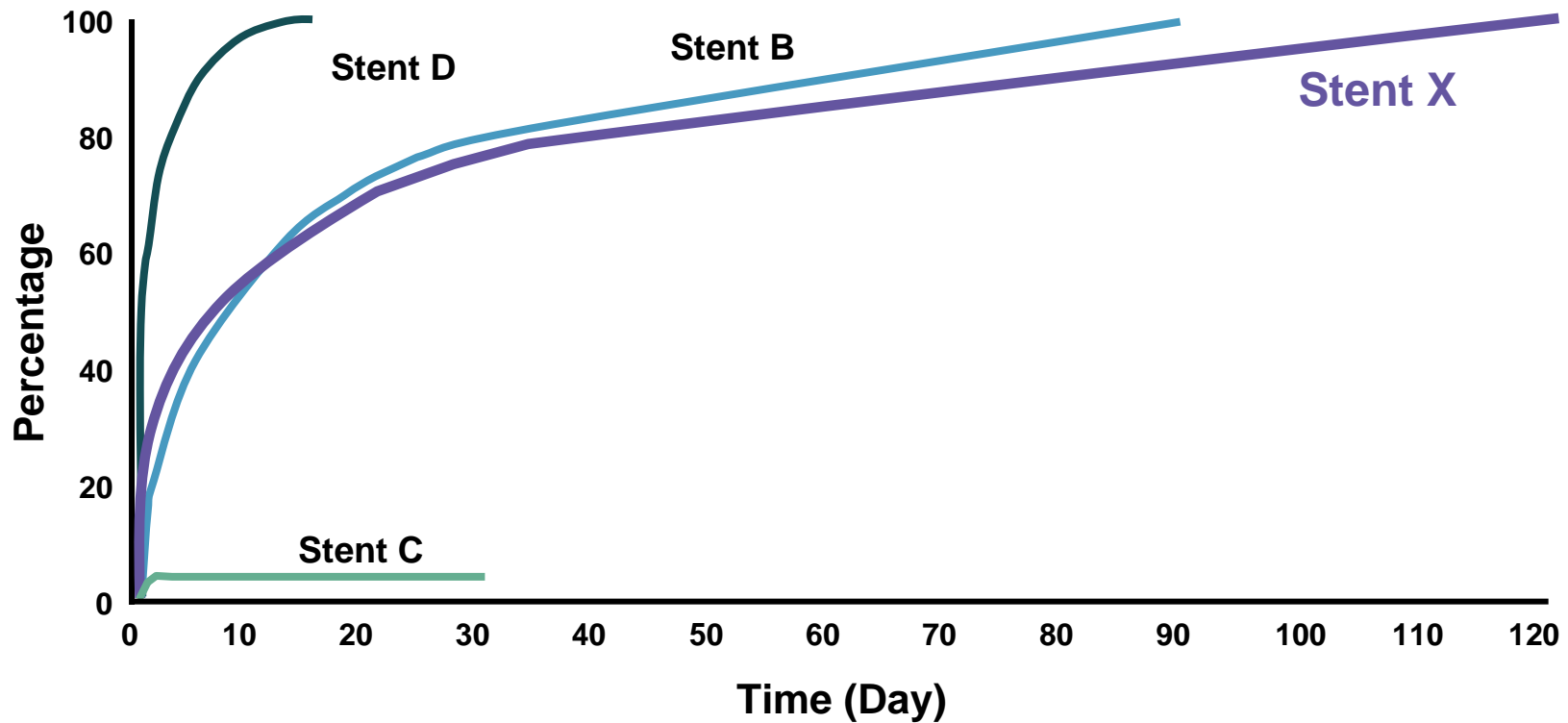


Rapid Re-endothelialization 14-Day Rabbit Iliac Study



Photos on file at Abbott Vascular

DES Drug Release Profiles



Medtronic Vascular Data Presentation, TCTMD; TAXUS IV SR Presentation, TCTMD; Cypher Presentation, TCTMD; Data on file at Abbott Vascular.

