ATHEROSCLEROSIS

INTRODUCTION

- **Atherosclerosis** (also known as **Arteriosclerotic Vascular Disease** or **ASVD)**
- Artery wall thickens (build-up of fatty materials such as cholesterol)
- Affecting arterial blood vessels, a chronic inflammatory response in the walls of arteries
  - Due to the accumulation of macrophage
  - Promoted by Low-density lipoproteins
  - Without adequate removal of fats and cholesterol from the macrophages

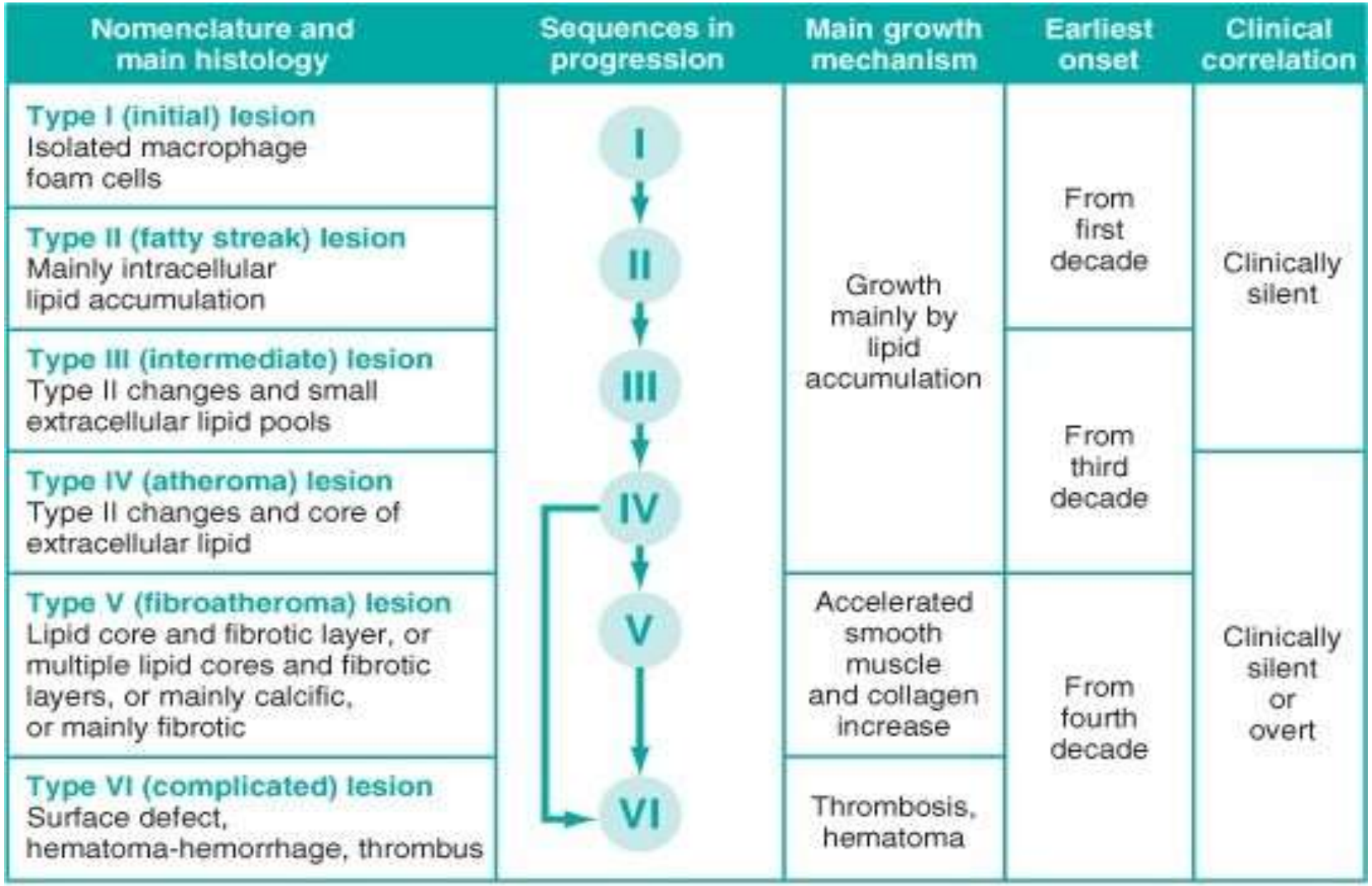
- Hardening or furring of the arteries.
- Formation of multiple plaqueswithin the arteries.
- Restrict blood flow.
- These plaques can also burst, causing a blood clot.
- Often considered a heart problem
- Affect arteries anywhere in your body.
- Atherosclerosis is a preventable and treatable condition.

CAUSES

Atherosclerosis starts with damage or injury to the inner layer of an artery. The damage may be caused by:

- High blood pressure
- High cholesterol
- An irritant, such as nicotine
- Certain diseases, such as diabetes

AHA CLASSIFICATION OF ATHEROSCLEROSIS



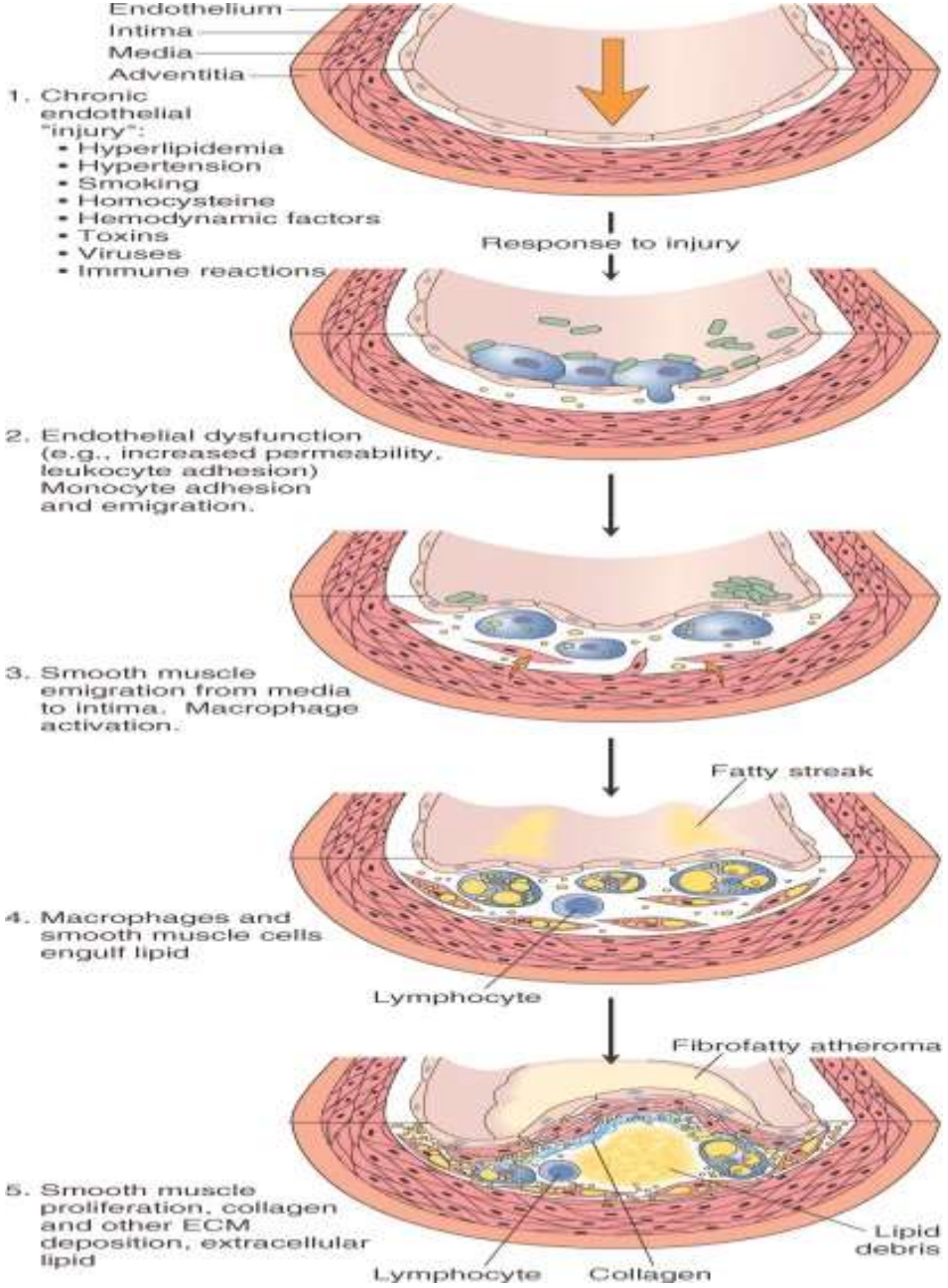
PATHOPHYSIOLOGY

- Atherosclerosis develops as a chronic inflammatory response of the arterial wall to endothelial injury.
- Lesion progression occurs through **interactions of modified lipoproteins, monocyte-derived macrophages, T-lymphocytes**, and the normal cellular constituent of the arterial wall.
- The contemporary view of atherosclerosis is expressed by the **response-to-injury hypothesis**.

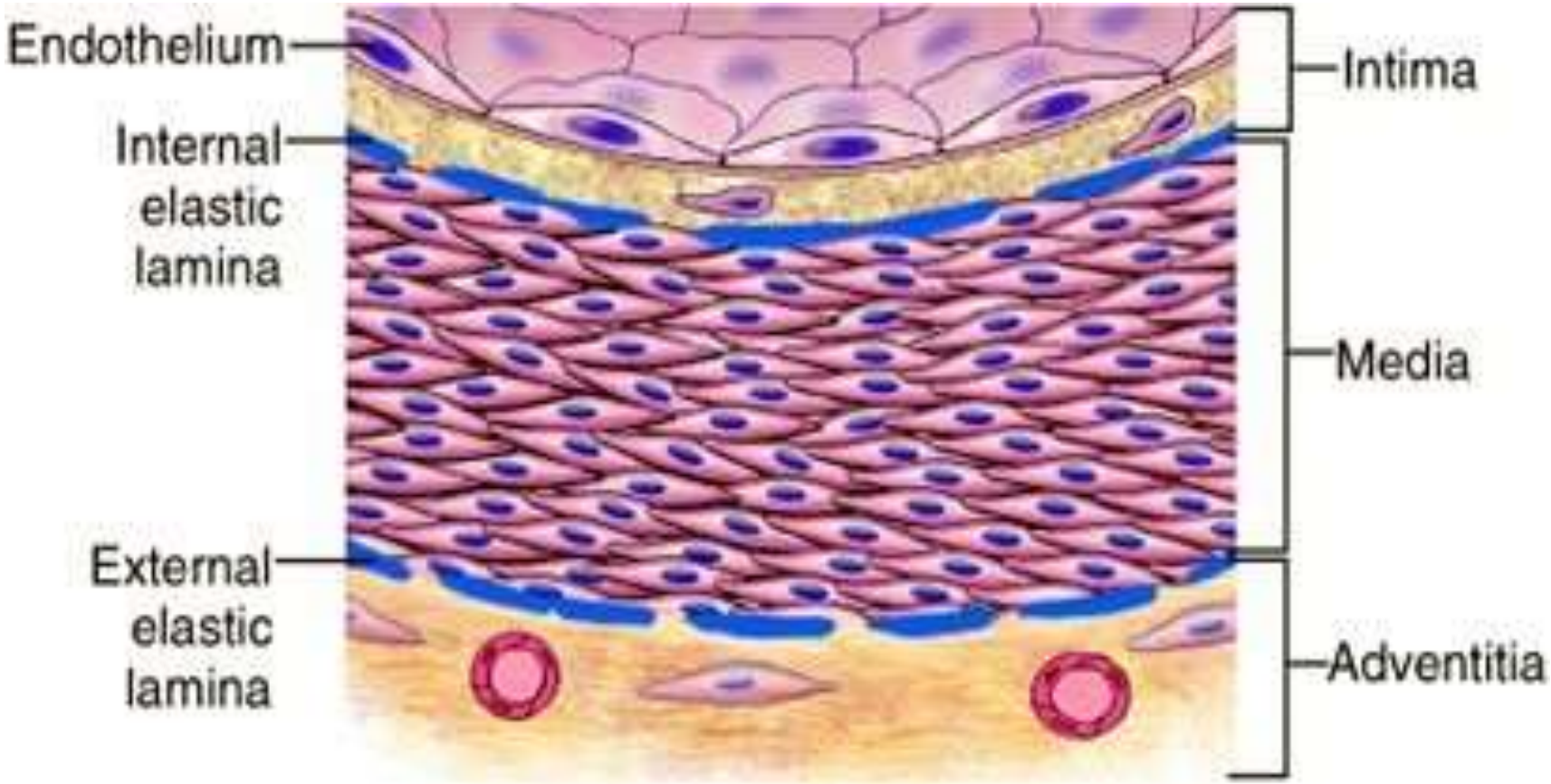
Response-to-injury hypothesis

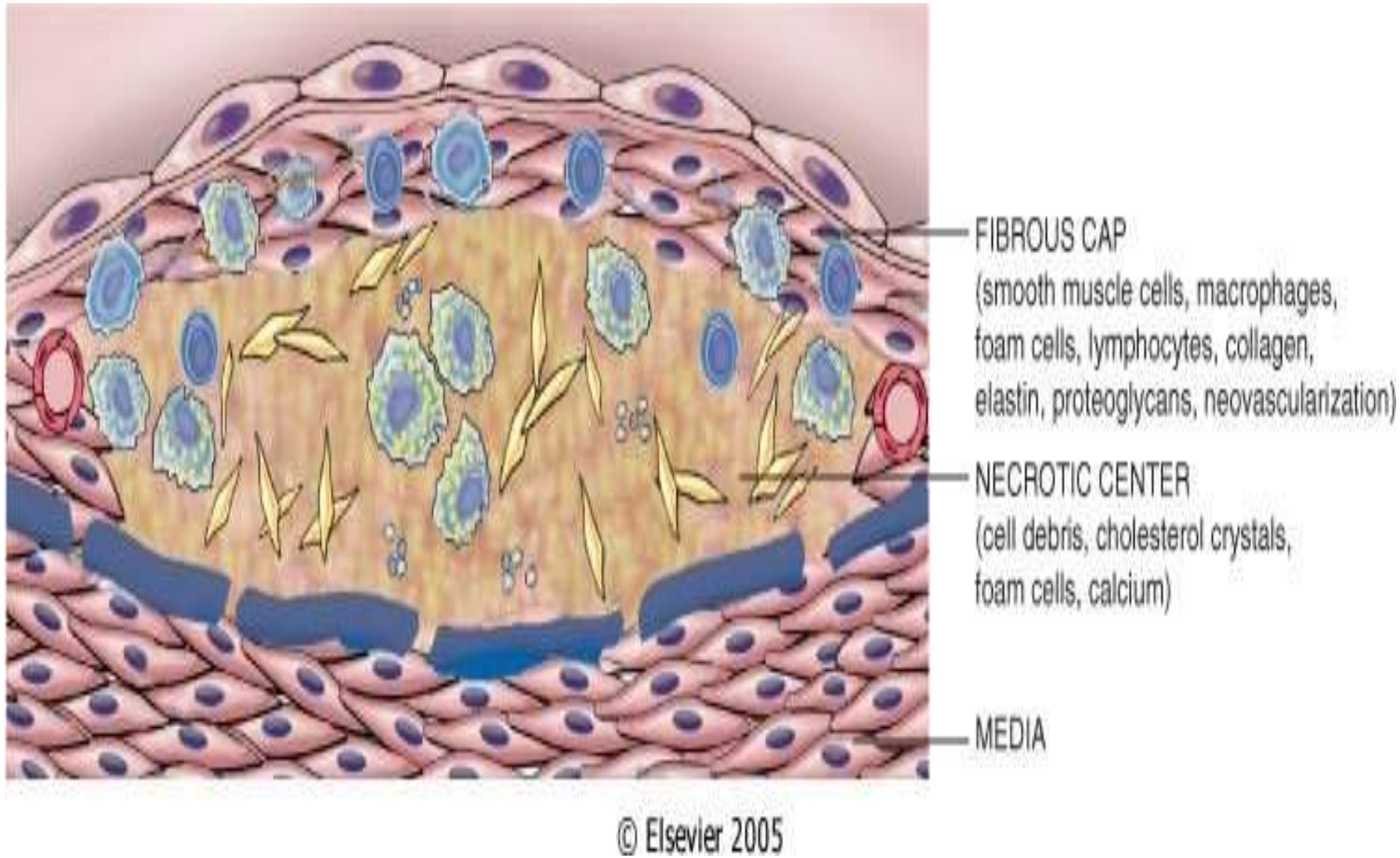
The following are the steps involved in the hypothesis:

1. Chronic endothelial injury
2. Accumulation of lipoproteins
3. Monocyte adhesion to the endothelium
4. SMC proliferations and ECM (extracellular matrix) production
5. Factor release
6. Platelet adhesion

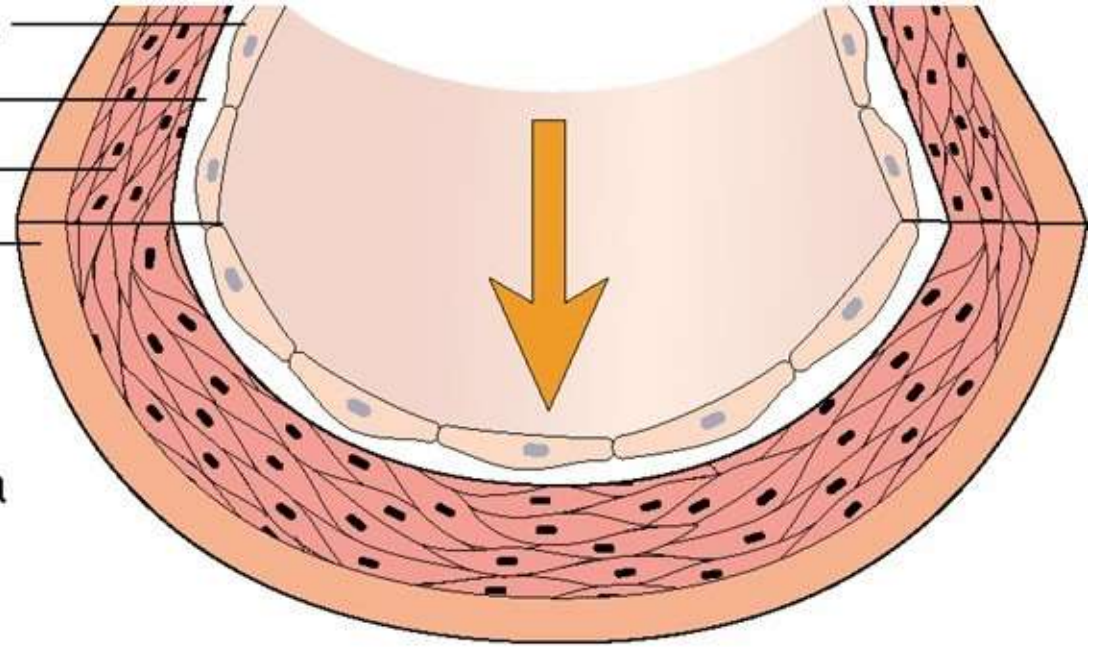


NORMAL ARTERY





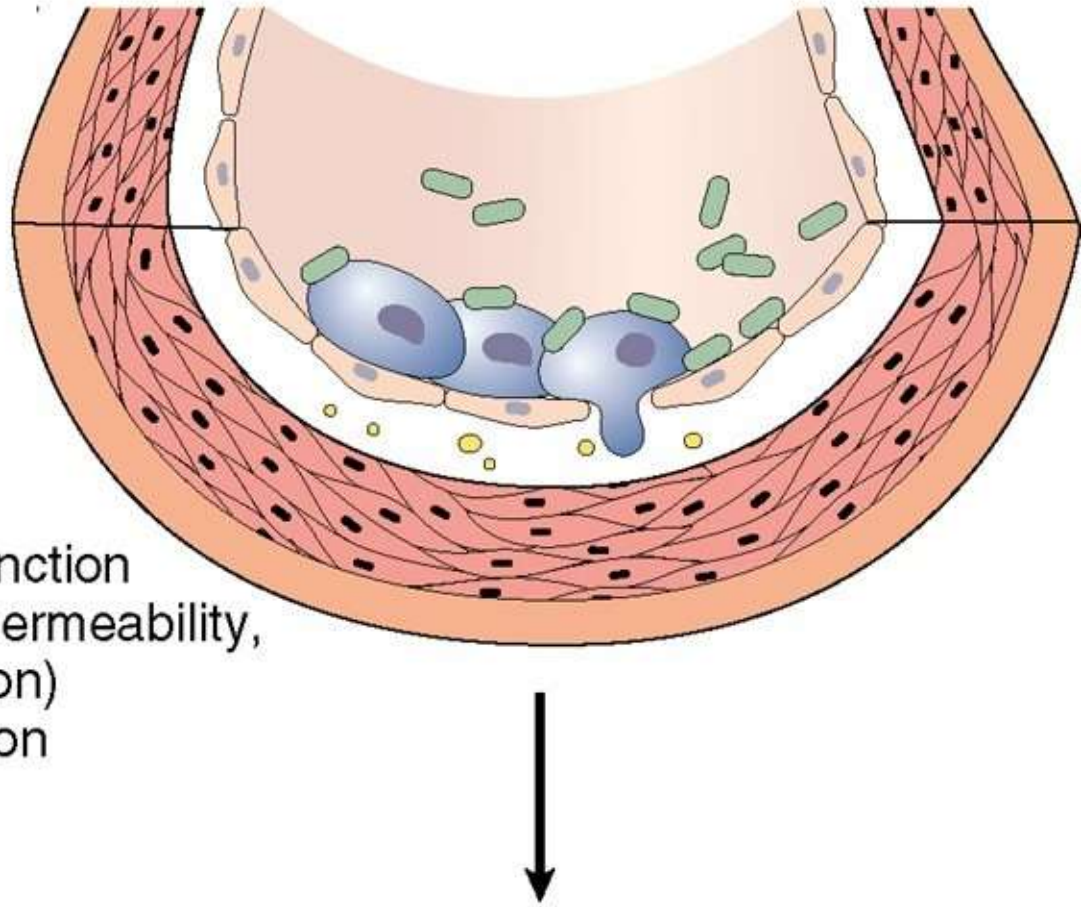
ENDOTHELIAL INJURY



1. Chronic endothelial "injury":
   - Hyperlipidemia
   - Hypertension
   - Smoking
   - Homocysteine
   - Hemodynamic factors
   - Toxins
   - Viruses
   - Immune reactions.

Response to injury

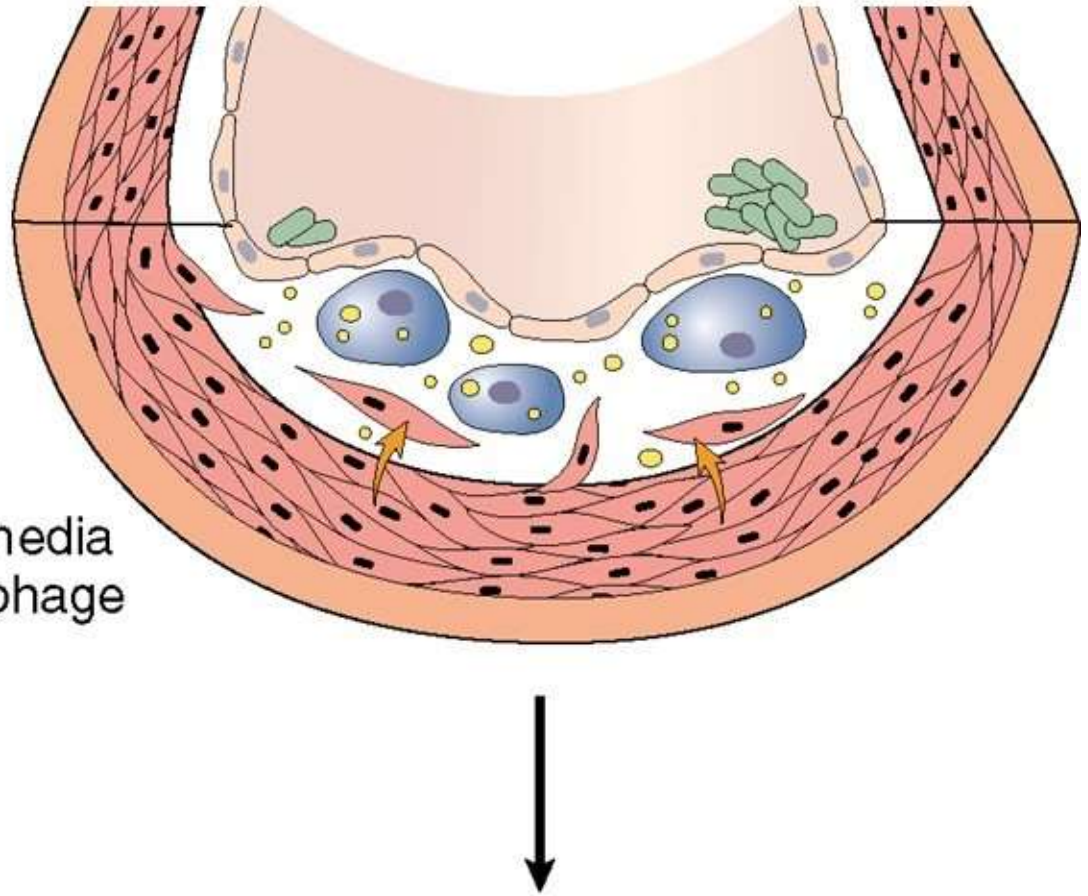
ENDOTHELIAL DYSFUNCTION



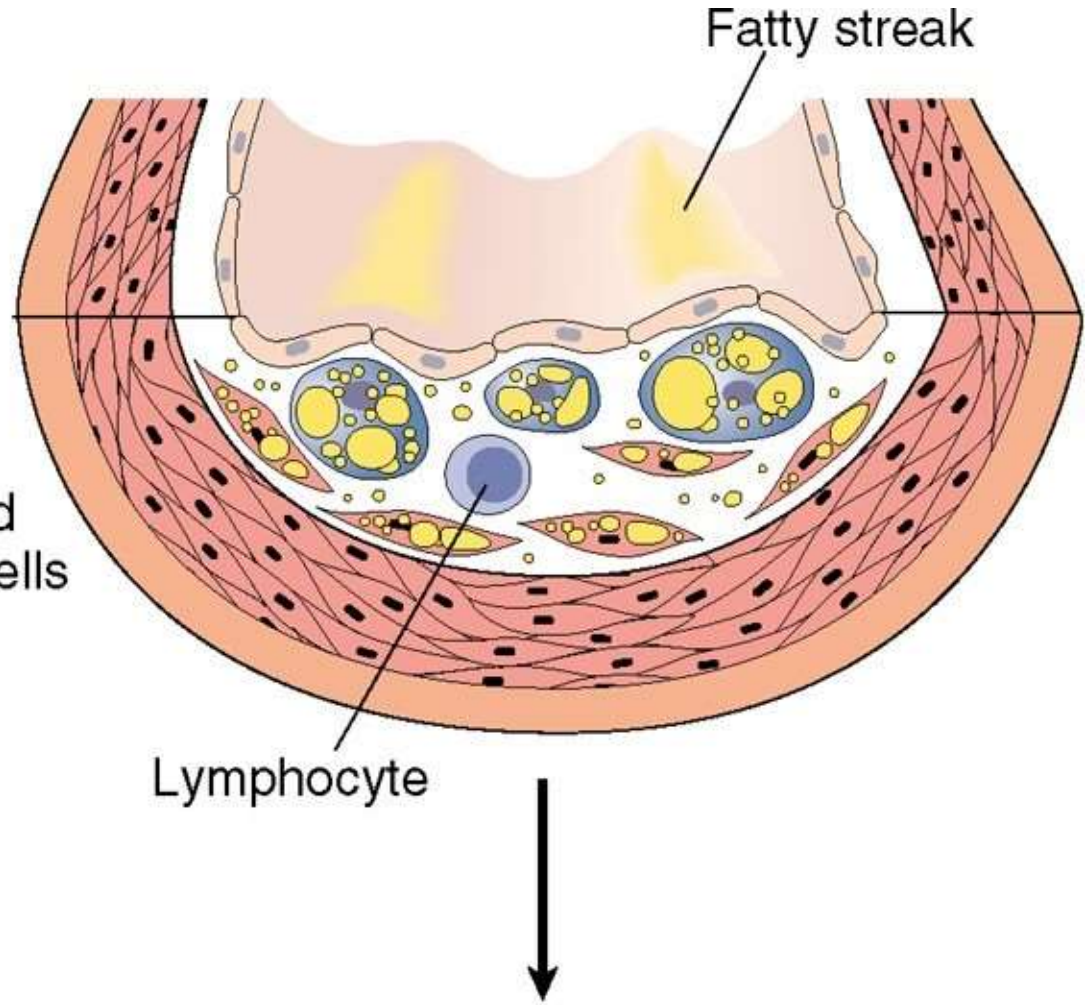
2. Endothelial dysfunction
(e.g., increased permeability,
leukocyte adhesion)
Monocyte adhesion
and emigration.

INITIATION OF FATTY STREAK

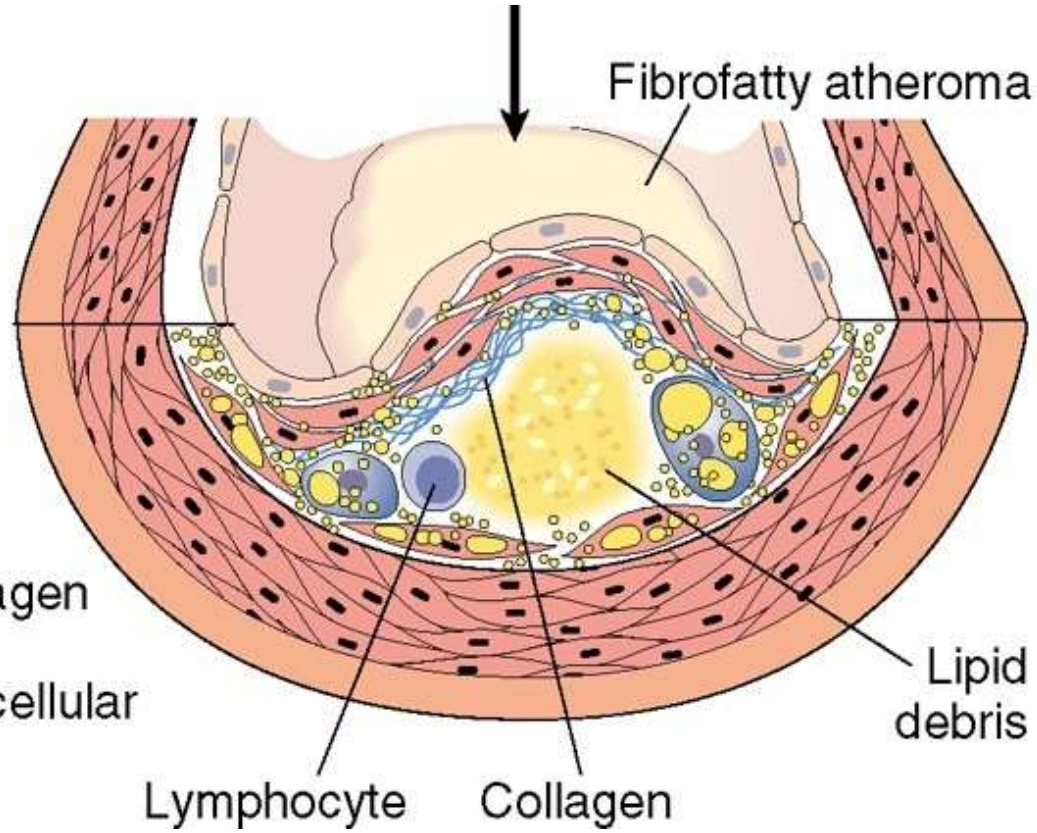
3. Smooth muscle emigration from media to intima. Macrophage activation.



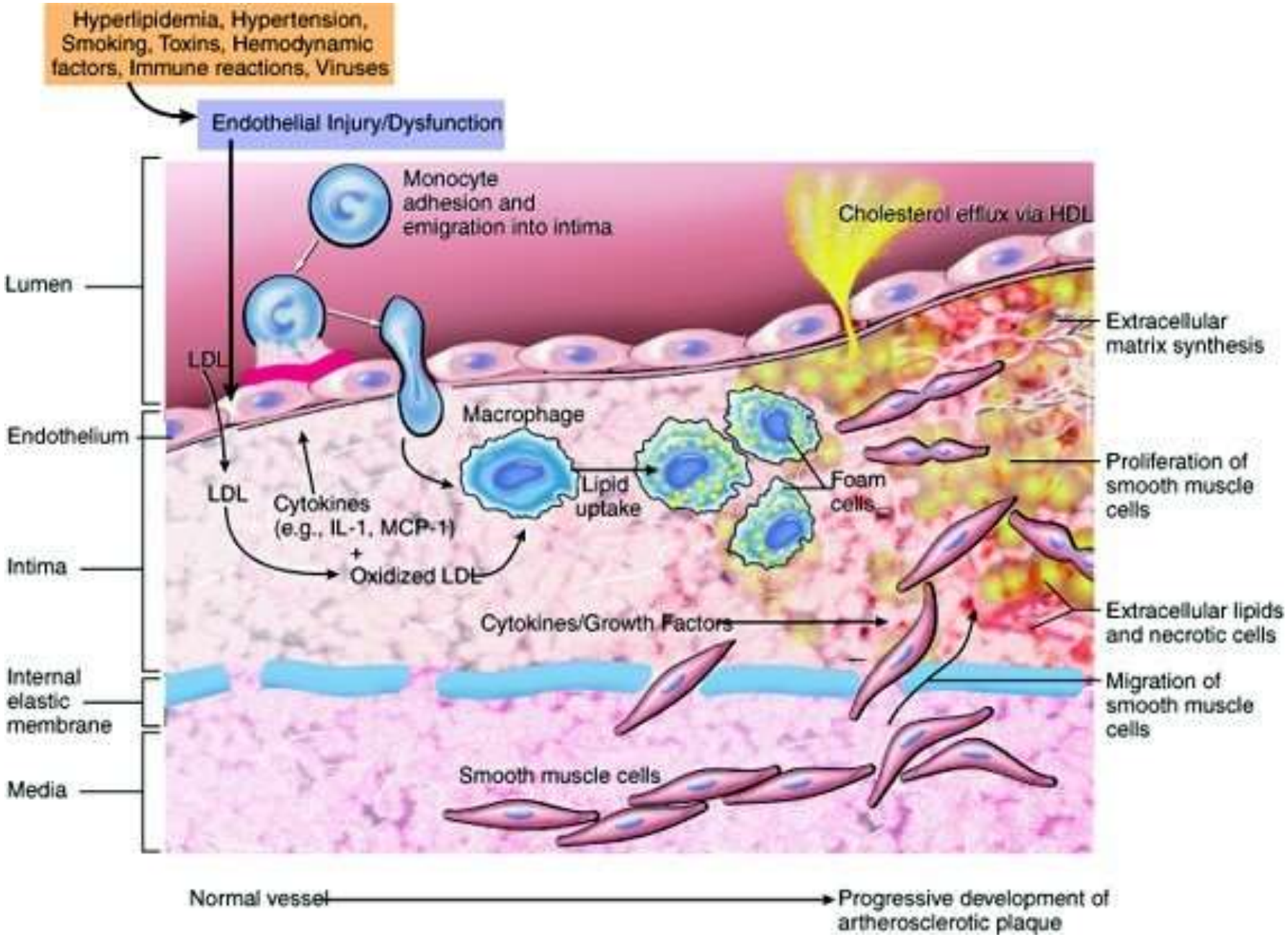
FATTY STREAK



FIBRO-FATTY ATHEROMA

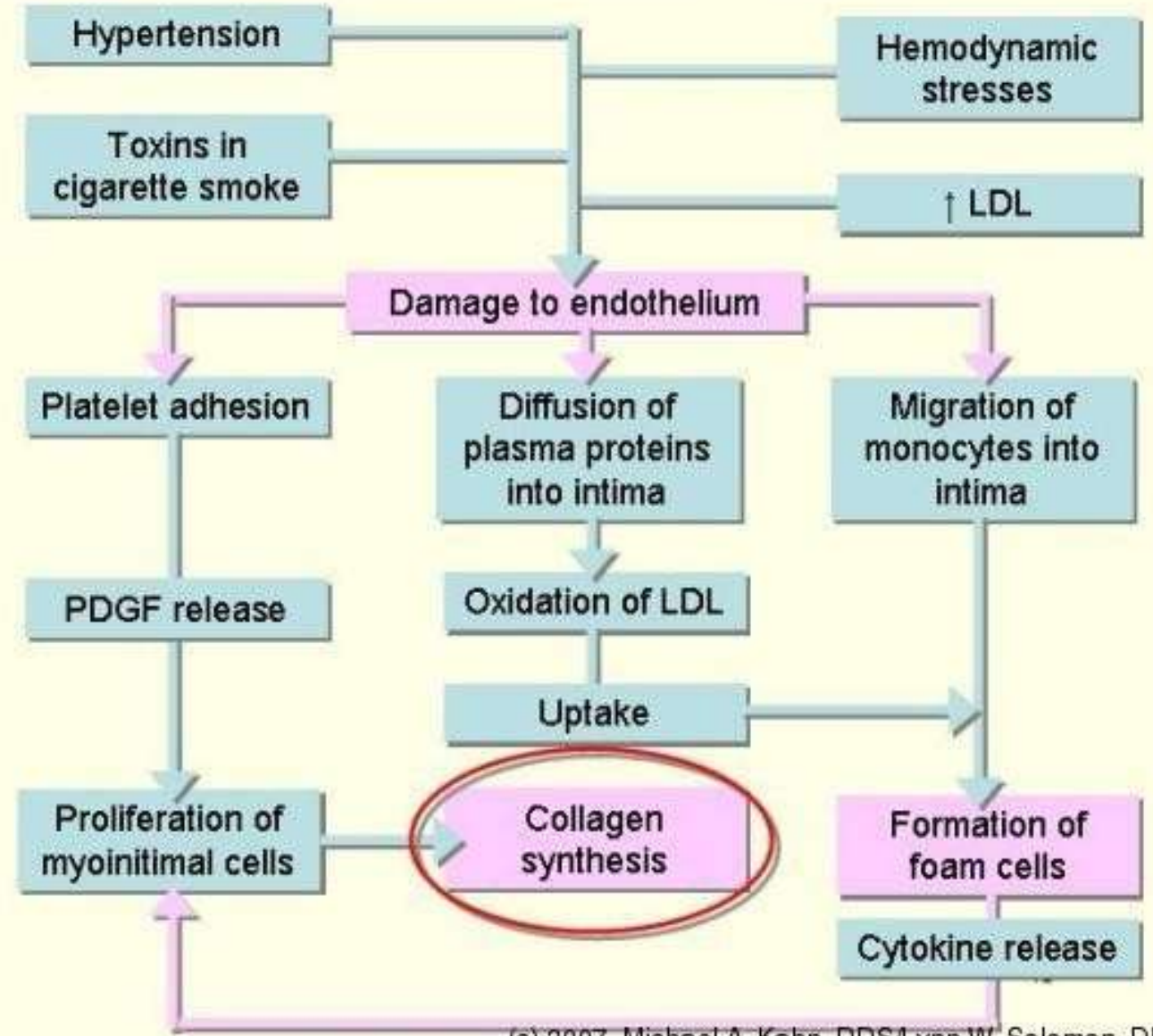


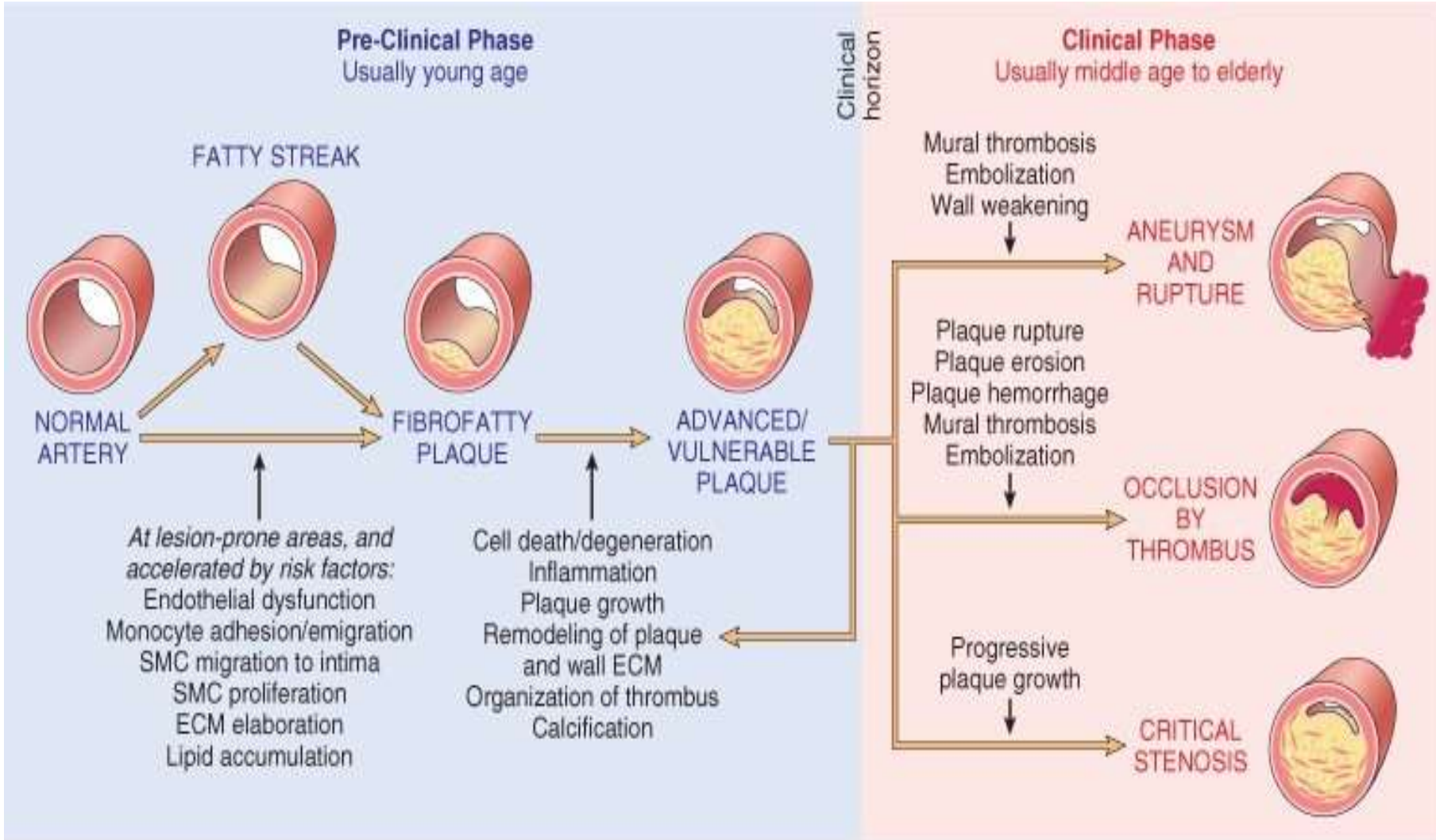
5. Smooth muscle proliferation, collagen and other ECM deposition, extracellular lipid

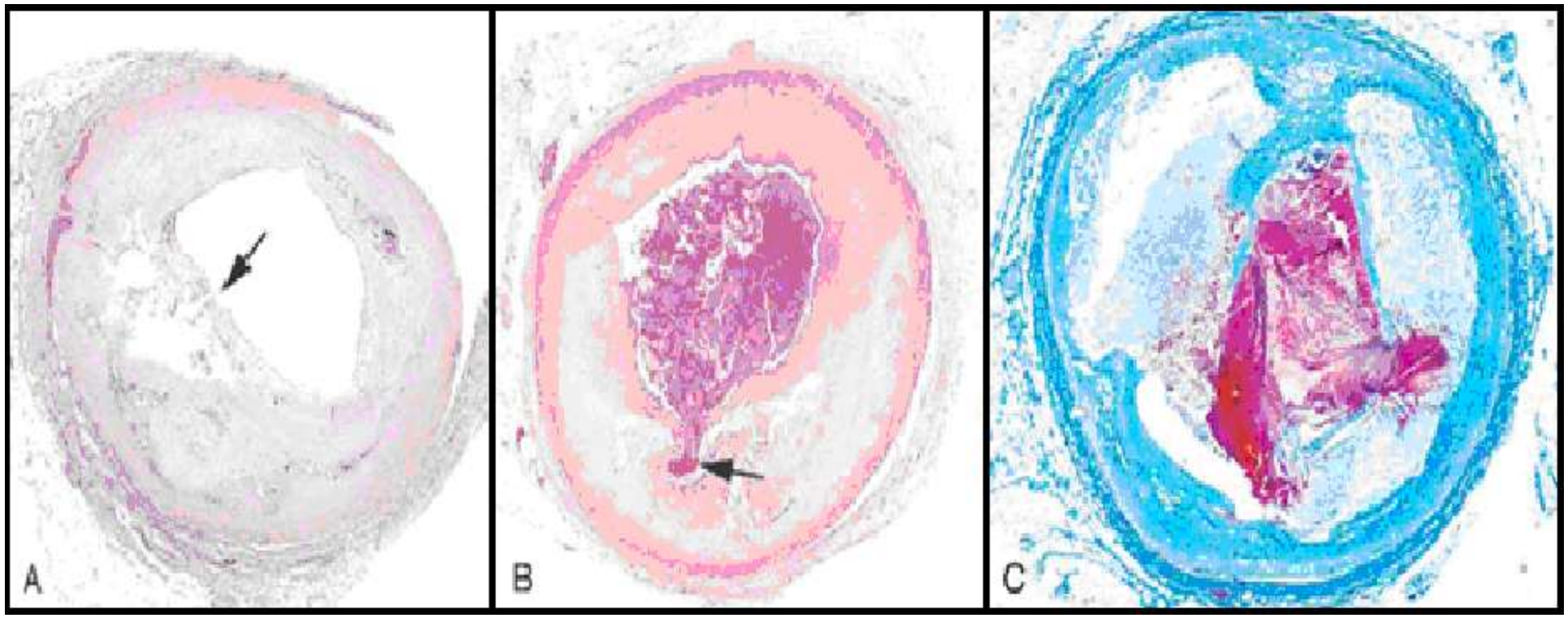

Hyperlipidemia, Hypertension, Smoking, Toxins, Hemodynamic factors, Immune reactions, Viruses
Endothelial Injury/Dysfunction
Monocyte adhesion and emigration into intima
Cholesterol efflux via HDL
Lumen
LDL
Extracellular matrix synthesis
Endothelium
Macrophage
Lipid uptake
Foam cells
Proliferation of smooth muscle cells
LDL
Cytokines (e.g., IL-1, MCP-1)
+
Oxidized LDL
Intima
Cytokines/Growth Factors
Extracellular lipids and necrotic cells
Internal elastic membrane
Migration of smooth muscle cells
Media
Smooth muscle cells
Normal vessel
Progressive development of artherosclerotic plaque

Pathogenesis of Atherosclerosis

Pathogenesis of Atherosclerosis (reaction to injury hypothesis)







Micrograph of an artery that supplies the heart With significant atherosclerosis and marked luminal narrowing

SYMPTOMS

- Atherosclerosis develops gradually, typically begins in early adolescence, and is usually found in most major arteries.
- No atherosclerosis symptoms until an artery is so narrowed or clogged.
- Sometimes a blood clot completely obstructs blood flow, or even breaks apart and causes heart attack or stroke.

Atherosclerosis symptoms depend on which arteries are affected. For example:

- **Atherosclerosis in heart arteries,** have symptoms similar to those of a heart attack, such as chest pain (angina).
- **Atherosclerosis in the arteries leading to brain,** have symptoms such as sudden numbness or weakness in your arms or legs, difficulty speaking or slurred speech, or drooping muscles in your face.
- **Atherosclerosis in the arteries in arms and legs,** produces decreased blood flow is called peripheral artery occlusive disease (PAOD) have symptoms such as leg pain when walking.
- Sometimes atherosclerosis causes **erectile dysfunction** in men.

RISK FACTORS

Various anatomic, physiological & behavioral risk factors for atherosclerosis are known. These can be divided into various categories:, modifiable and non- modifiable.

Modifiable

- Having diabetes or Impaired glucose tolerance (IGT)
- Dyslipoproteinemia (unhealthy patterns of serum proteins carrying fats & cholesterol):
- Tobacco smoking, increases risk by 200% after several pack years
- Having high blood pressure, on its own increasing risk by 60%
- Elevated serum C-reactive protein concentrations

Non modifiable

- Advanced age
- Male sex
- Having close relatives who have had some complication of atherosclerosis (CVD/STROKE)
- Genetic abnormalities, e.g. familial hypercholesterolemia

Lesser or uncertain

- Being obese (in particular central obesity,
- A sedentary lifestyle
- Postmenopausal estrogen deficiency
- High carbohydrate intake
- Elevated serum levels of triglycerides
- Elevated serum lipoprotein concentrations
- Stress or symptoms of clinical depression
- Hyperthyroidism
- Elevated serum insulin levels
- Short sleep duration

COMPLICATIONS

The complications of atherosclerosis depend on the location of the blocked arteries. For example:

- Coronary artery disease.
- Carotid artery disease.
- Peripheral artery disease (Arms and legs)
- Aneurysms (any where in body, formation of bulge in artery)

DIAGNOSIS

Doctors may find signs of narrowed, enlarged or hardened arteries during a physical exam. These include:

- A weak or absent pulse below the narrowed area of the artery
- Decreased blood pressure in an affected limb
- Whooshing sounds (bruits) over the arteries, heard with a stethoscope
- Signs of a pulsating bulge (aneurysm) in the abdomen or behind knee
- Evidence of poor wound healing in the area where blood flow is restricted

TESTS AND DIAGNOSIS

- Blood tests
- Doppler ultrasound
- Ankle-brachial index
- ECG
- Angiogram
- CT

THANK YOU