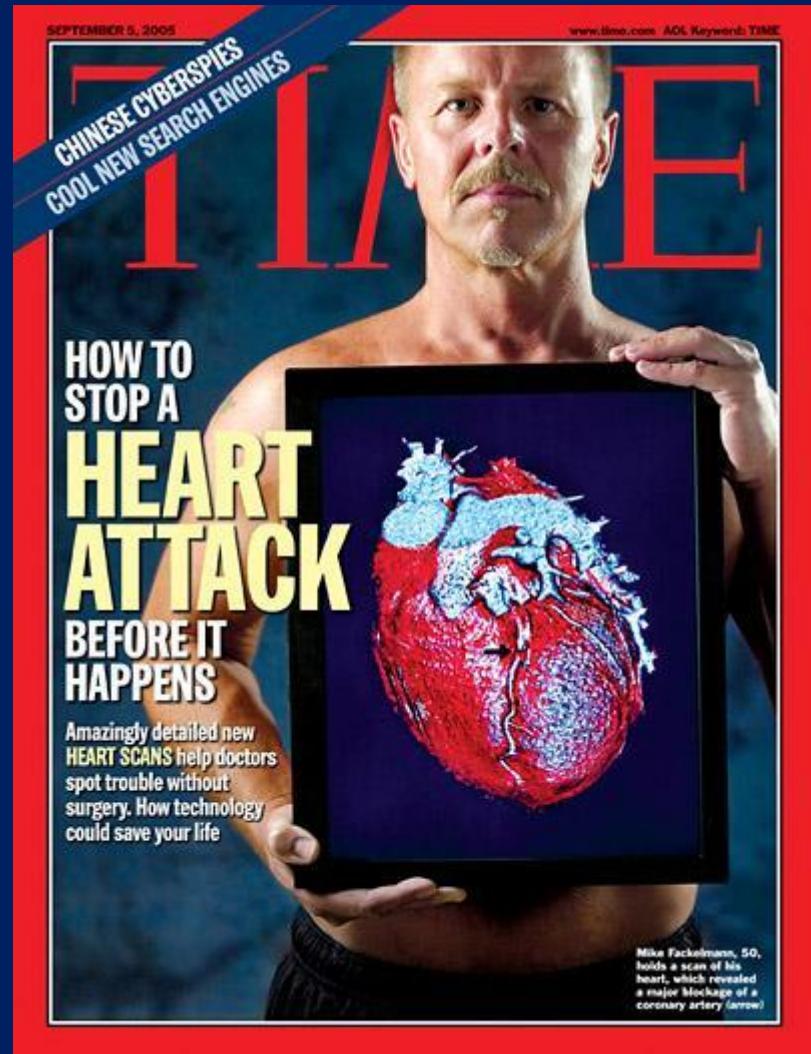
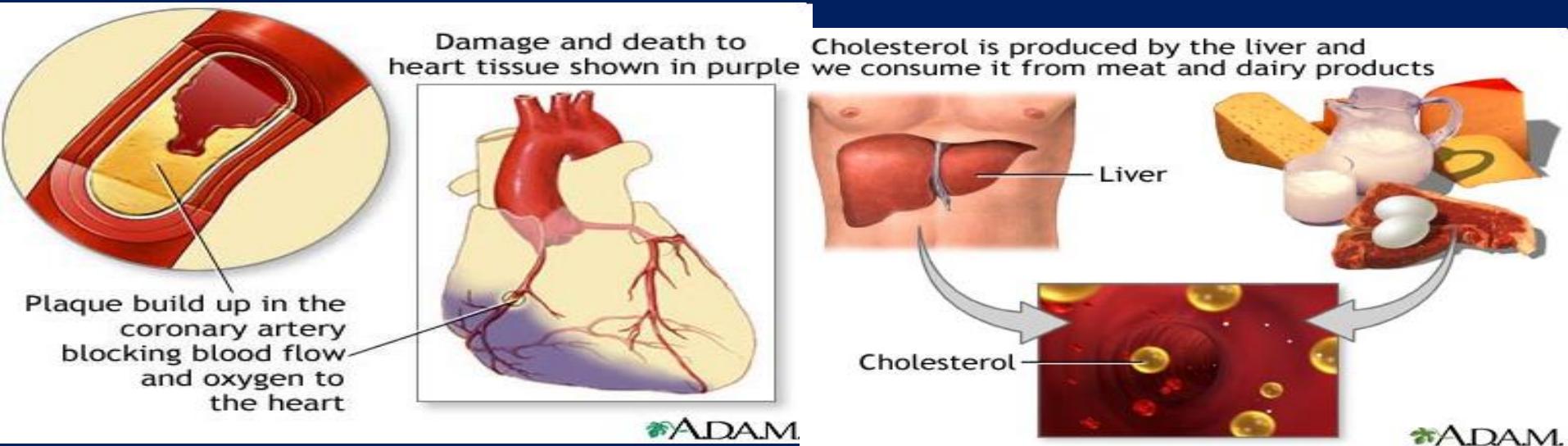
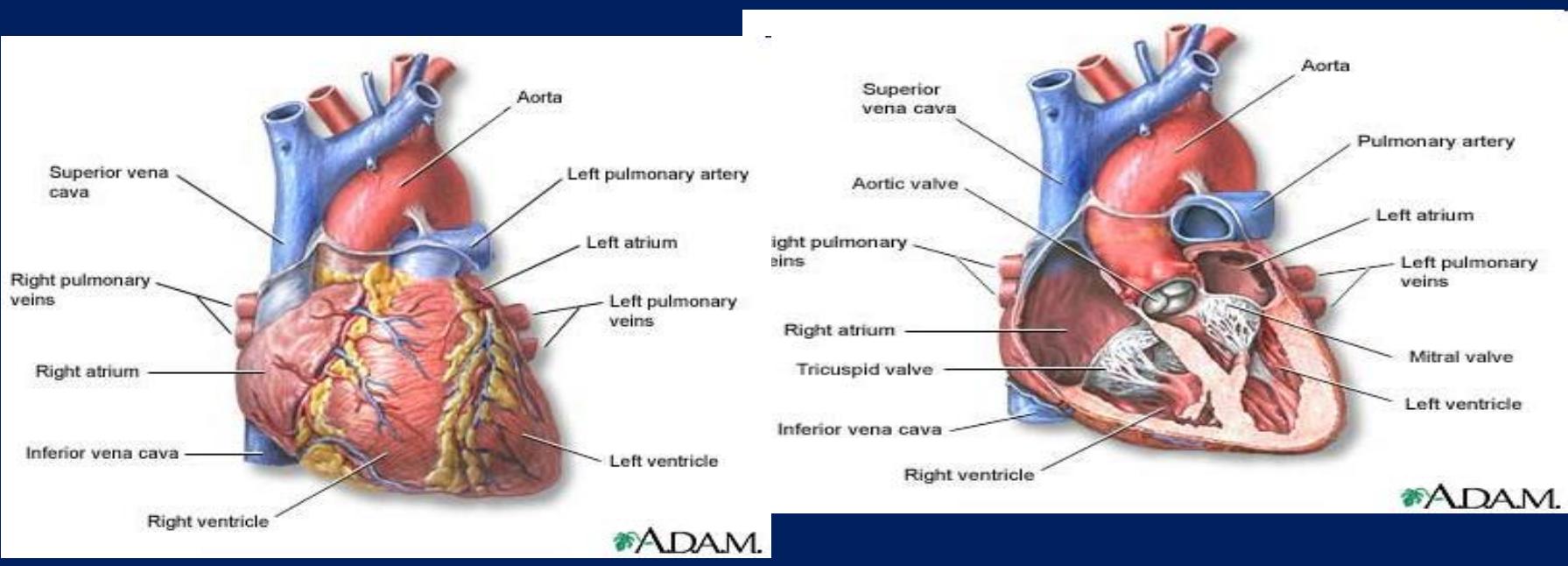


# Arteriosclerosis, Coronary Heart Disease (CHD) and Exercise





# SOME FACTS ABOUT HEART DISEASE

- In 2012, 696,947 people died of heart disease, this being 29% of the deaths in the U.S
- It is the leading death for both men and women in the U.S.
- On average, it is killing a person every 34 seconds in the U.S alone.
- Worldwide, coronary heart disease kills more than 7 million people each year

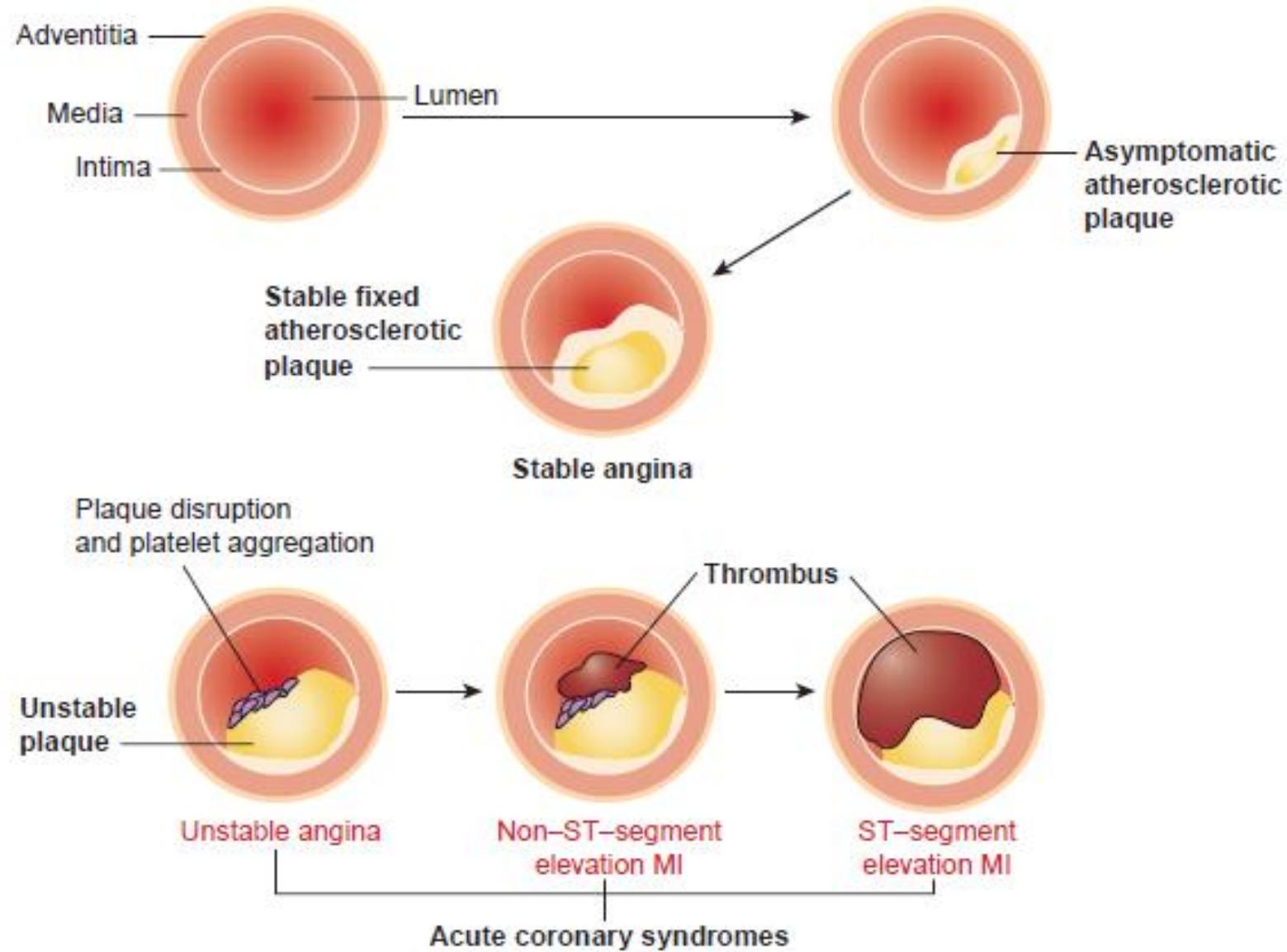
# Arteriosclerosis

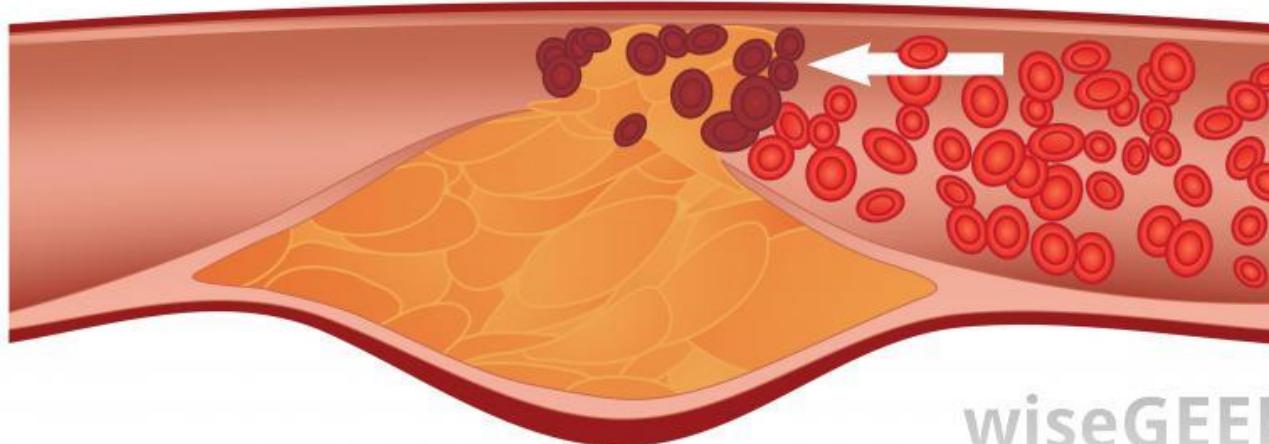
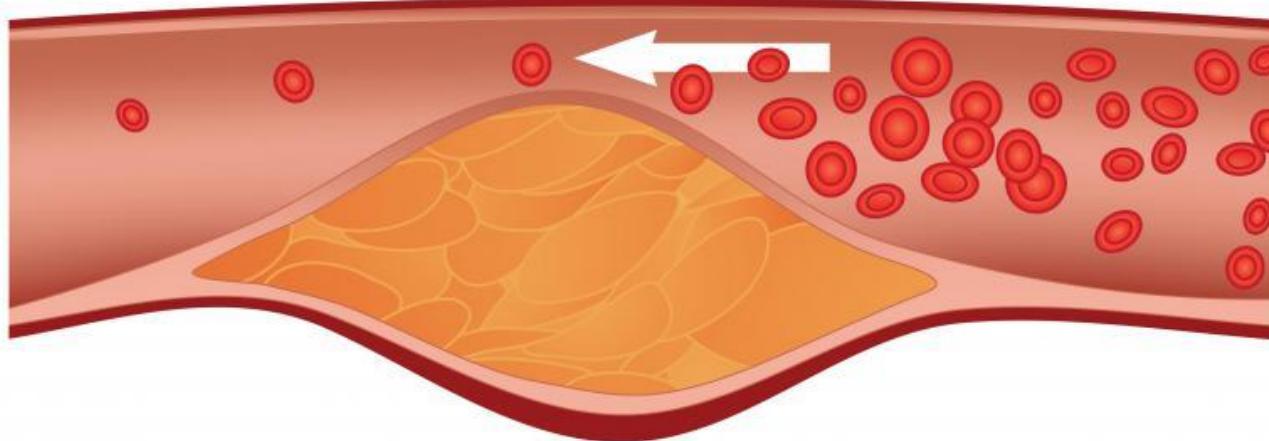
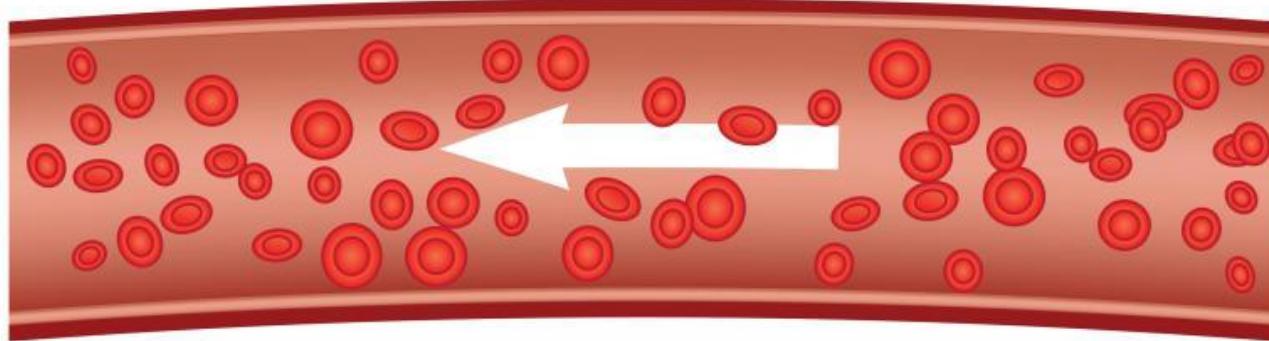
Disease of the arteries characterized by thickening, loss of elasticity and calcification of arterial walls

Resulting in decreased blood supply particularly to the cerebrum and lower extremities

Often develops with:

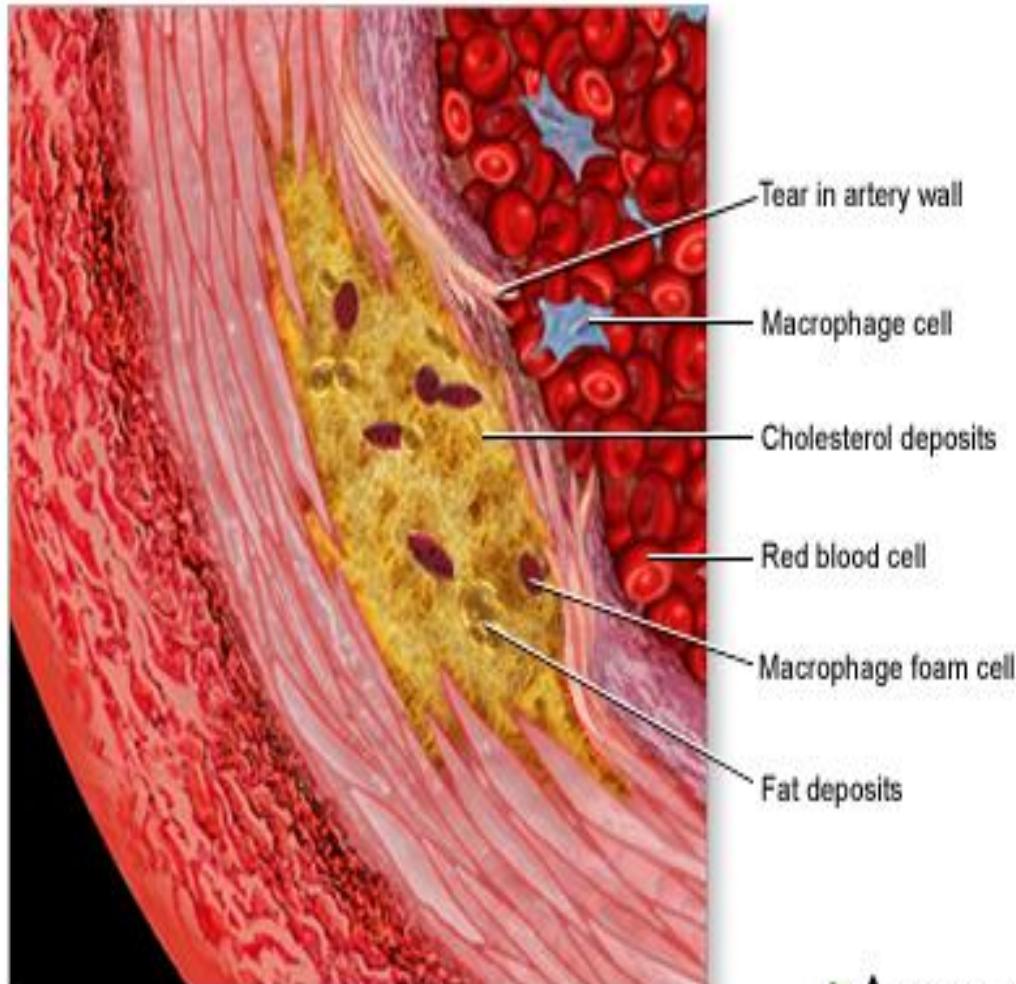
- aging
- hypertension
- diabetes



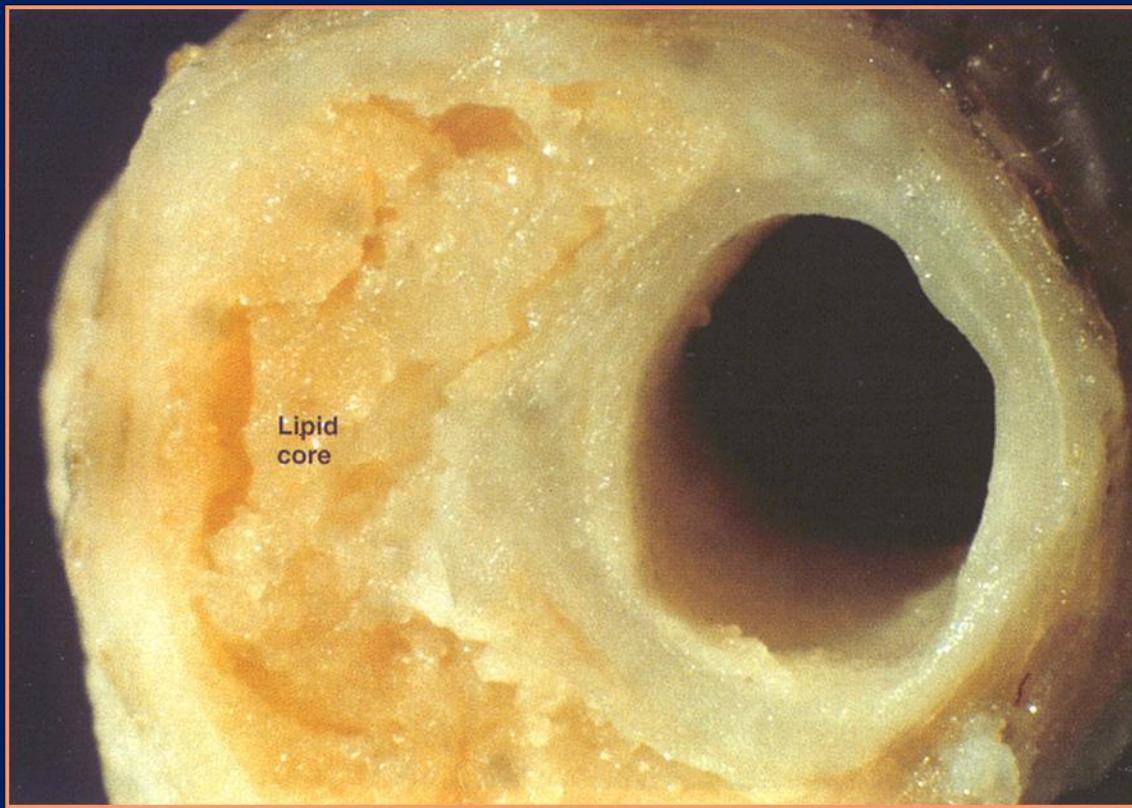


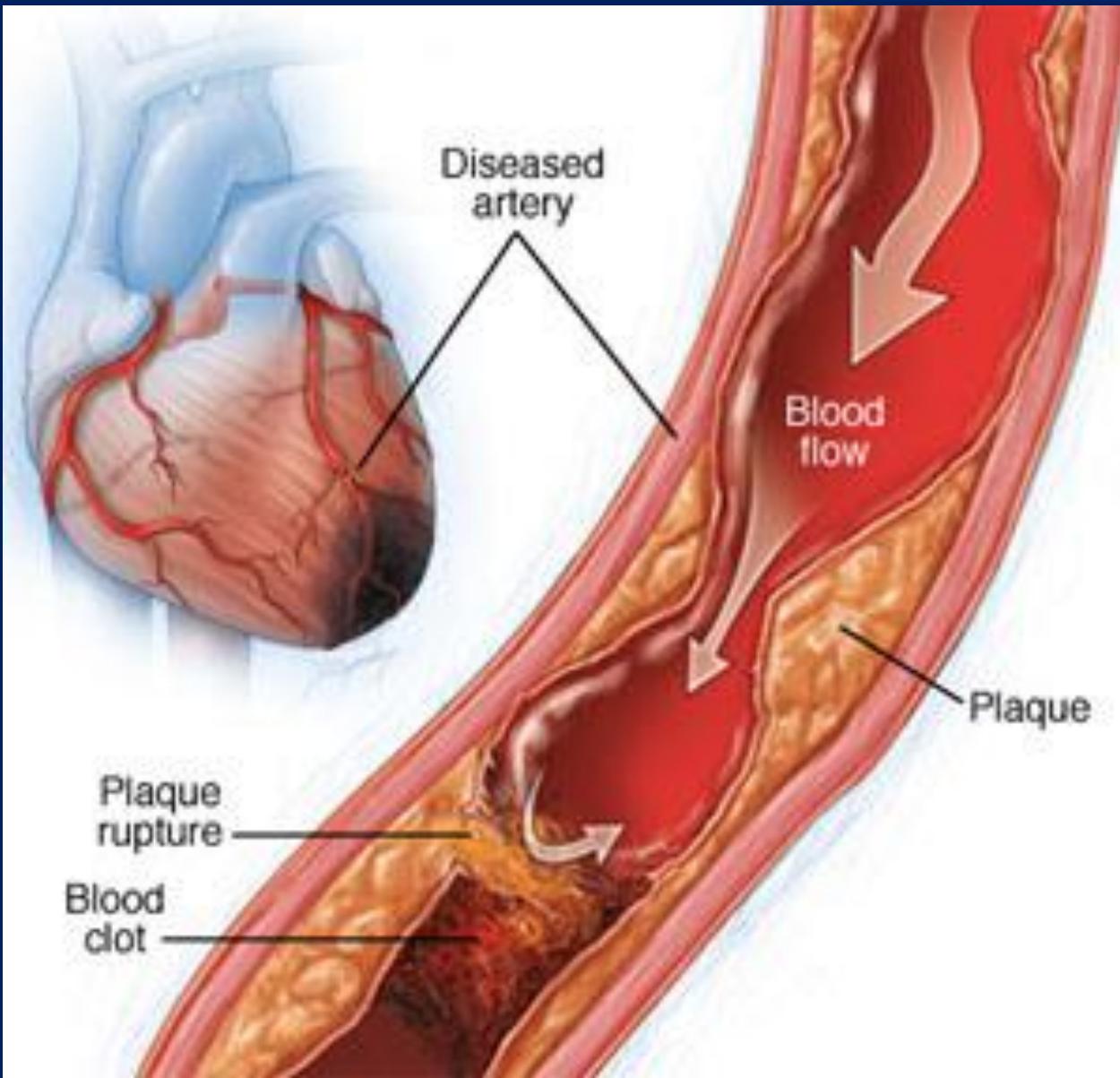
wiseGEEK

## Cut-section of artery







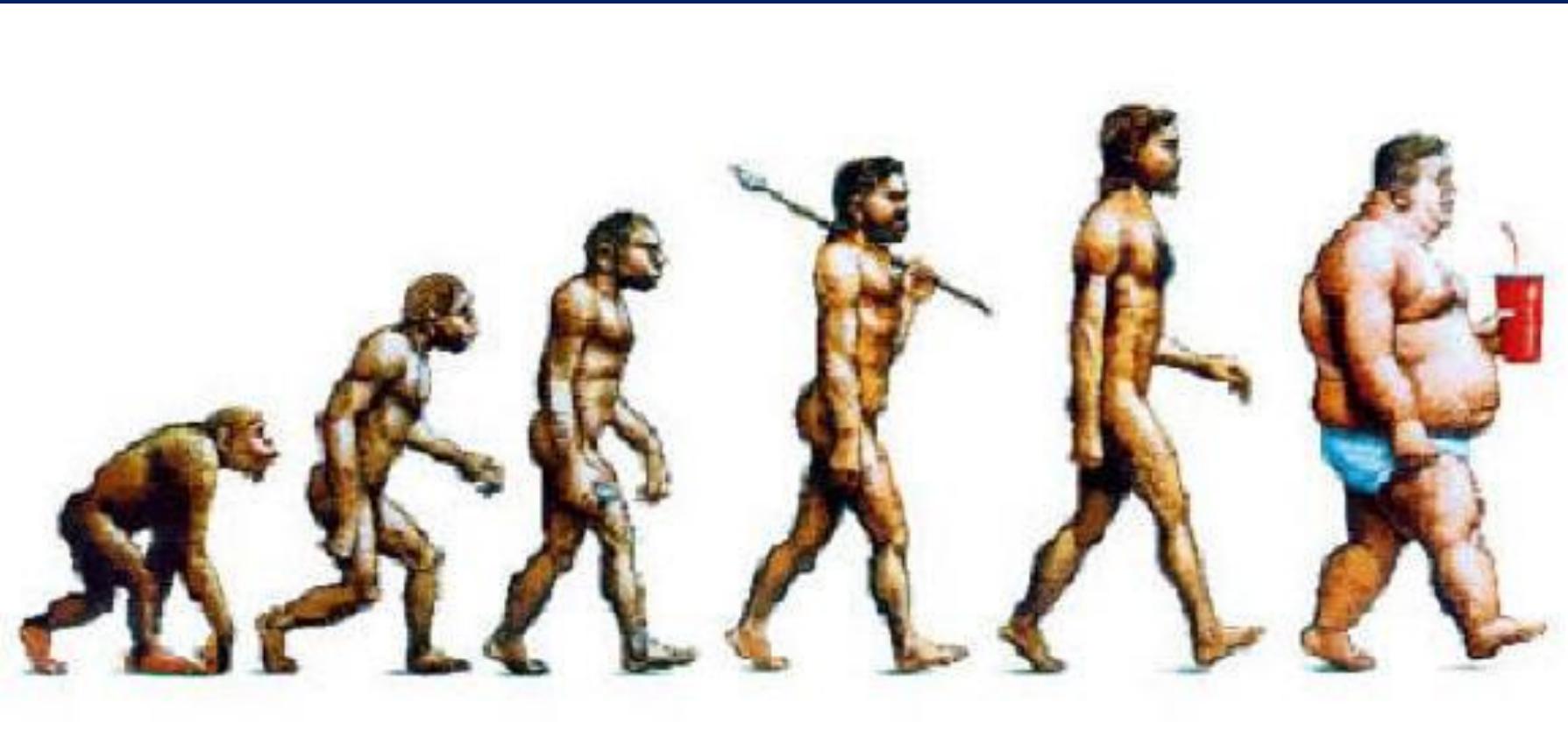


# Risk factors

- High blood pressure (hypertension)
- High blood cholesterol
- Smoking
- Obesity
- Physical inactivity
- Diabetes
- Stress (?)



Controllable



- Τα γονίδια εξελίχθηκαν προς όφελος της φυσικής δραστηριότητας (2.000.000 έτη)
- Οι κοινωνίες εξελίχθηκαν με τρόπο που προάγει την υποκινητικότητα (100 έτη)

# Risk Factors for Physical Inactivity

- Risk Factors:
  - ~ Coronary Heart Disease
  - ~ High blood cholesterol
  - ~ High Blood Pressure
  - ~ Obesity and Diabetes
  - ~ Cardiovascular Disease
  - ~ Stroke
- Facts:
  - ~ Adults ages 18-65 should be getting at least 30 minutes of moderate intensity activity five days of the week - At least 60% of the global population fails to achieve the minimum recommendation
  - ~ Inactivity greatly contributes to medical costs - by an estimated \$75 billion in the USA in 2000 alone.

# Effects of Smoking

- For adult males, smoking has declined from 53 % to 38%
- For women, remains at 30%
- Has increased for younger and teenaged women
- Heavy smoker = 20- 30 cigs/day



# DIET

- Reduce saturated fats
- Increase polyunsaturated fats
- Higher protein to fat ratio
- Count calories



# LIPIDS

- High density lipoproteins seem to have protective effect against development of atherosclerosis
- Women have higher concentrations than men
- Most important of all lipid risk factors
- Below 35 mg/dl----- 8X incidence of CAD compared to those with 65 mg/dl
- Moderate alcohol intake may have + effect
- Exercise has + effect
- Greater weight has a negative effect

# **Diabetes Risk Factors**

**Once a person has type 2 diabetes, they are at risk for problems with other parts of their body too. Some of the problems they can develop are:**

**Heart disease**

**Stroke**

**High blood pressure**

**Eye damage and blindness**

**Kidney damage**

**Foot damage, even amputation**

**Hearing problems**

# Risk Factors

- Gender
- Heredity
- Age



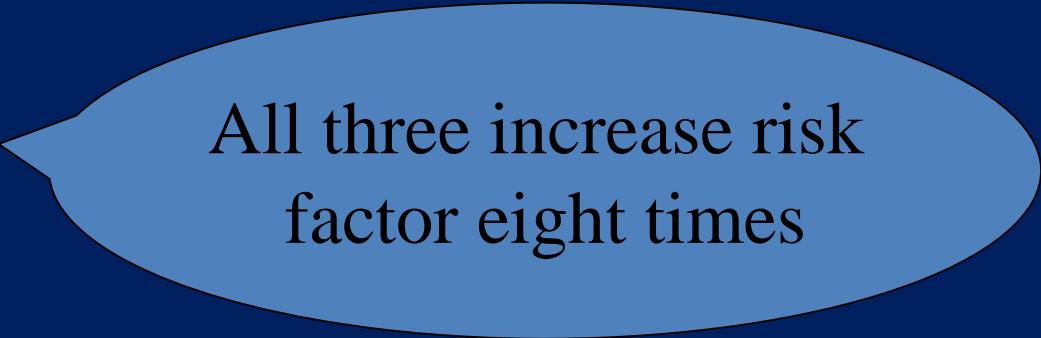
Uncontrollable

# Gender Disparity

- Coronary Artery Disease (CAD) more common in men
- Women have higher mortality rates
  - Older and sicker when first heart attack occurs
  - Less aggressively treated than men
  - Failure to recognize symptoms in timely fashion
- MI in young, healthy women is rare
  - Occurrence greater in those who use OC
  - Age 30-39: 2.7X; 40-44: 5.7X; (complicated by cigarette use)

# Major Risk Factors: The Big Three

- Hypertension
- High cholesterol
- Cigarette smoking



All three increase risk factor eight times

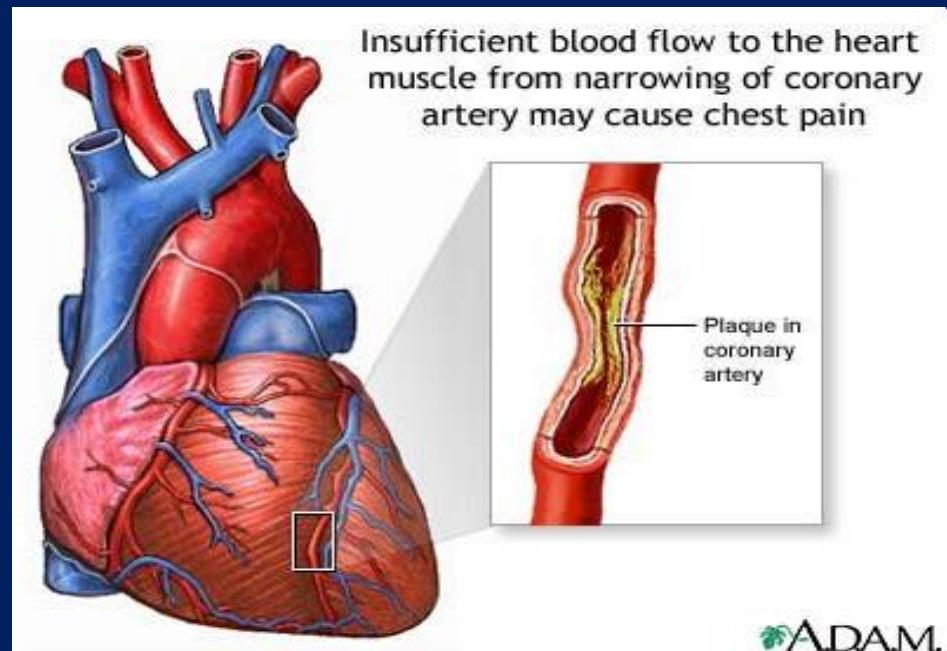
AND.... we should add **LACK OF EXERCISE**

# Symptoms of CHD

- Chest pain (angina)
- Shortness of breath
- Heaviness, tightness, pain, burning, pressure or squeezing
  - behind the breastbone or in the arms, neck, or jaws
- Pain may vary
- Perhaps no pain

# Angina

- Angina is a type of chest discomfort caused by poor blood flow through the blood vessels (coronary vessels) of the heart muscle (myocardium).



ADAM.

# Cause & Consequences of CHD

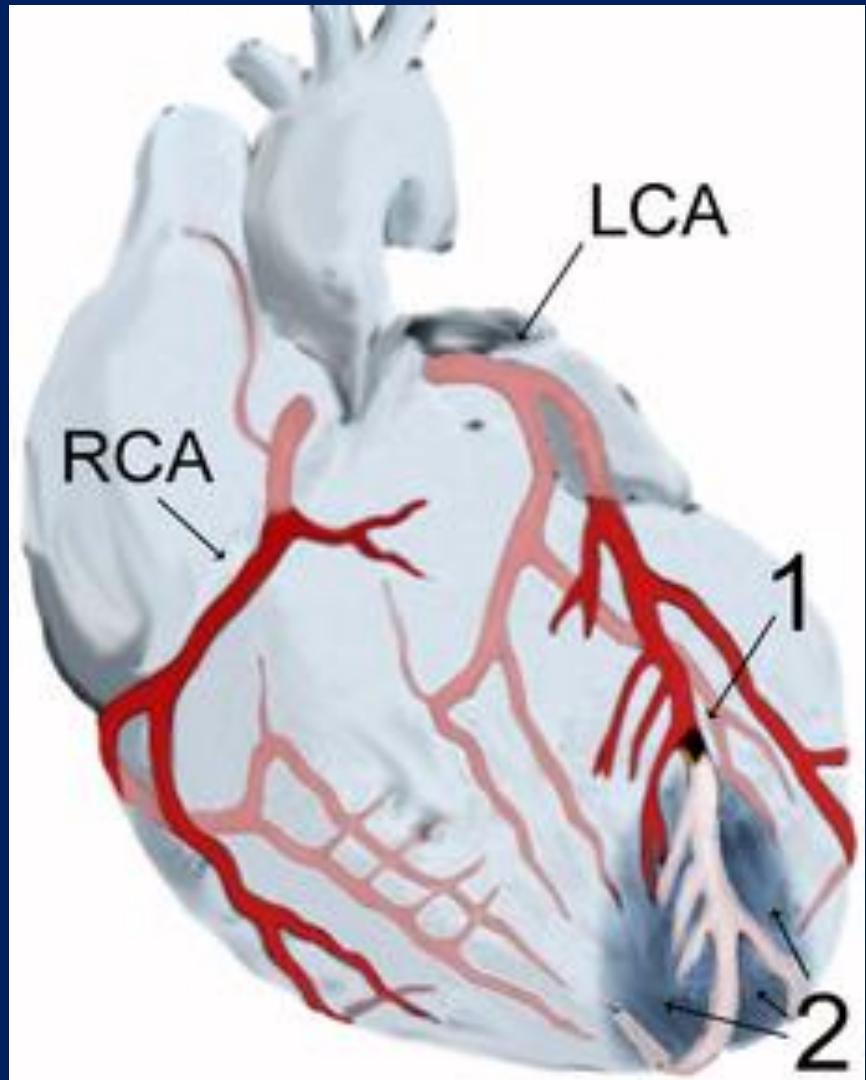
- Lack of oxygen due to ischemia (lack of blood supply)
- Narrowing of coronary arteries
- Heart responds with angina
- Finally, heart attack (myocardial infarction
  - local ischemia usually due to thrombus (clot) or embolus (clot that has moved from another site and lodged in a smaller vessel)
- Possible permanent damage

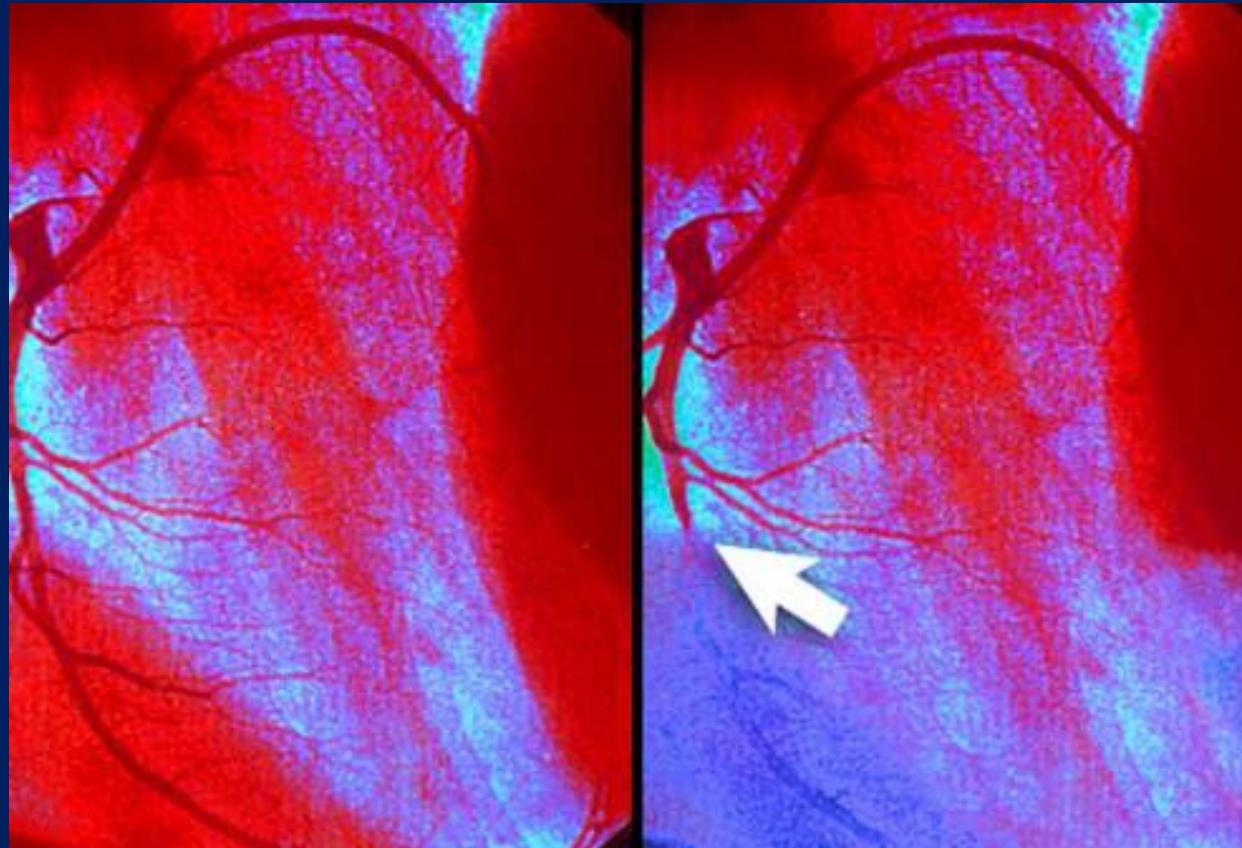
# Myocardial Infarction

- Myocardial infarction is an ischemic necrosis of the myocardium, caused by occlusion of coronary artery and prolonged myocardial ischemia.
- MI is an extreme consequence of acute coronary syndromes – the spectrum of clinical states caused by instability of coronary artery lumen due to plaque instability and (athero)thrombosis

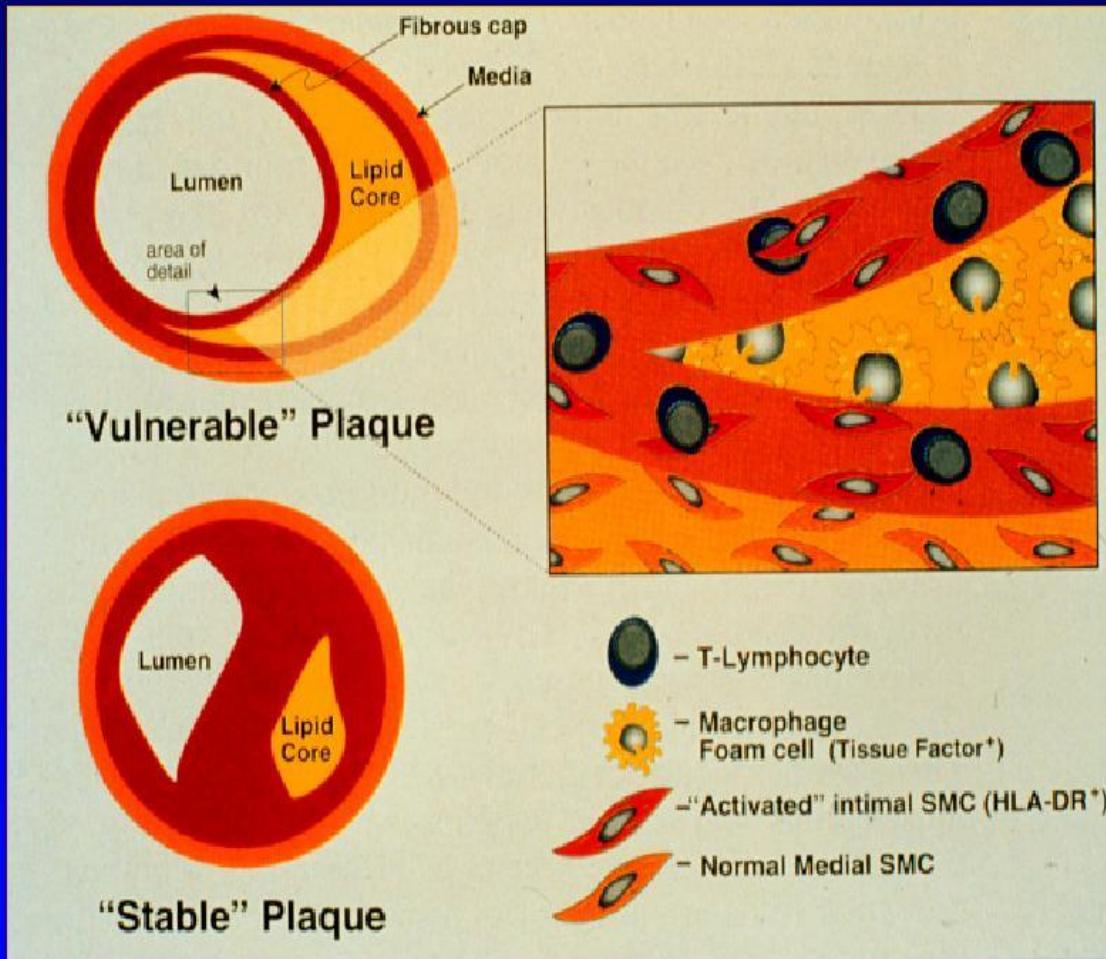
# LOCATION OF THE INFARCTION

- MIs can be located in the anterior, septal, lateral, posterior, or inferior walls of the left ventricle.



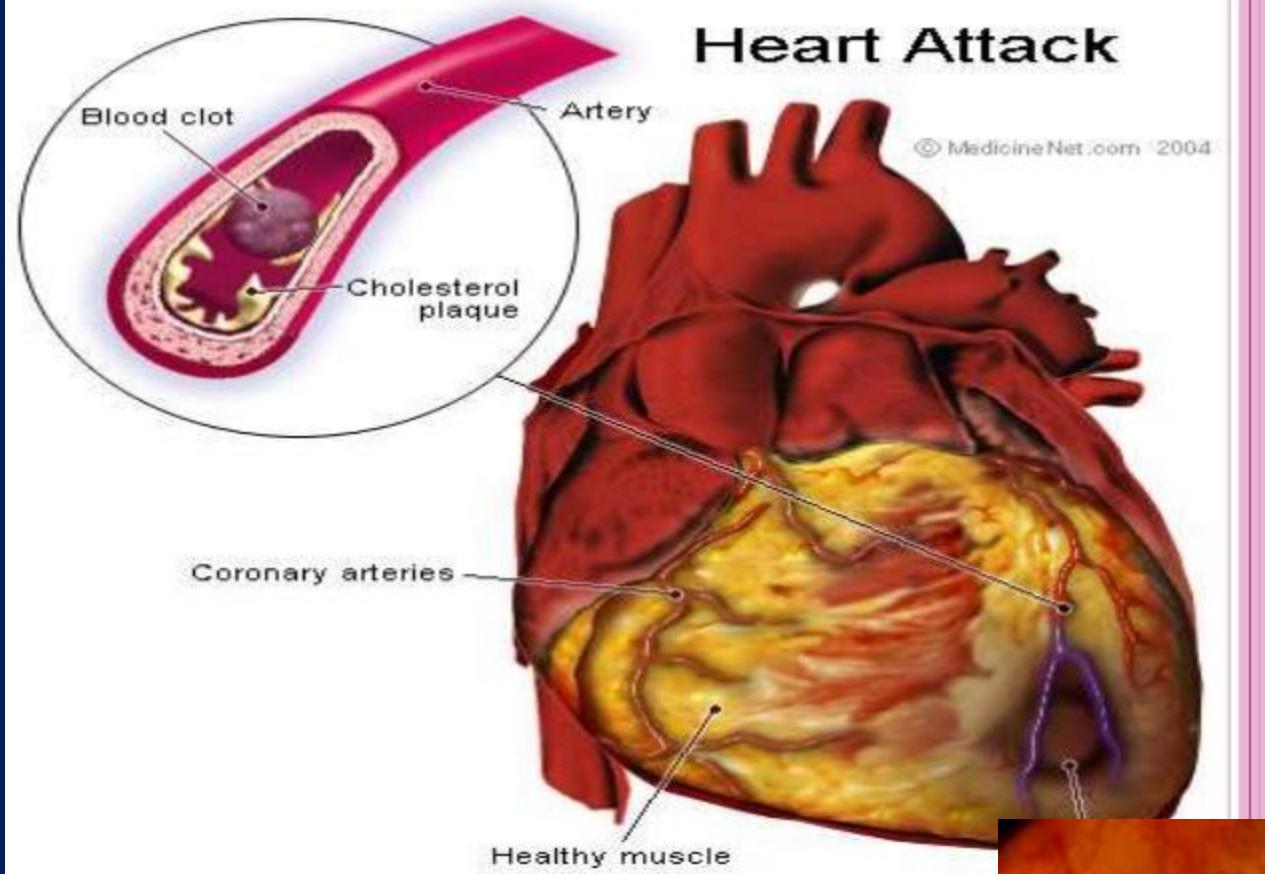


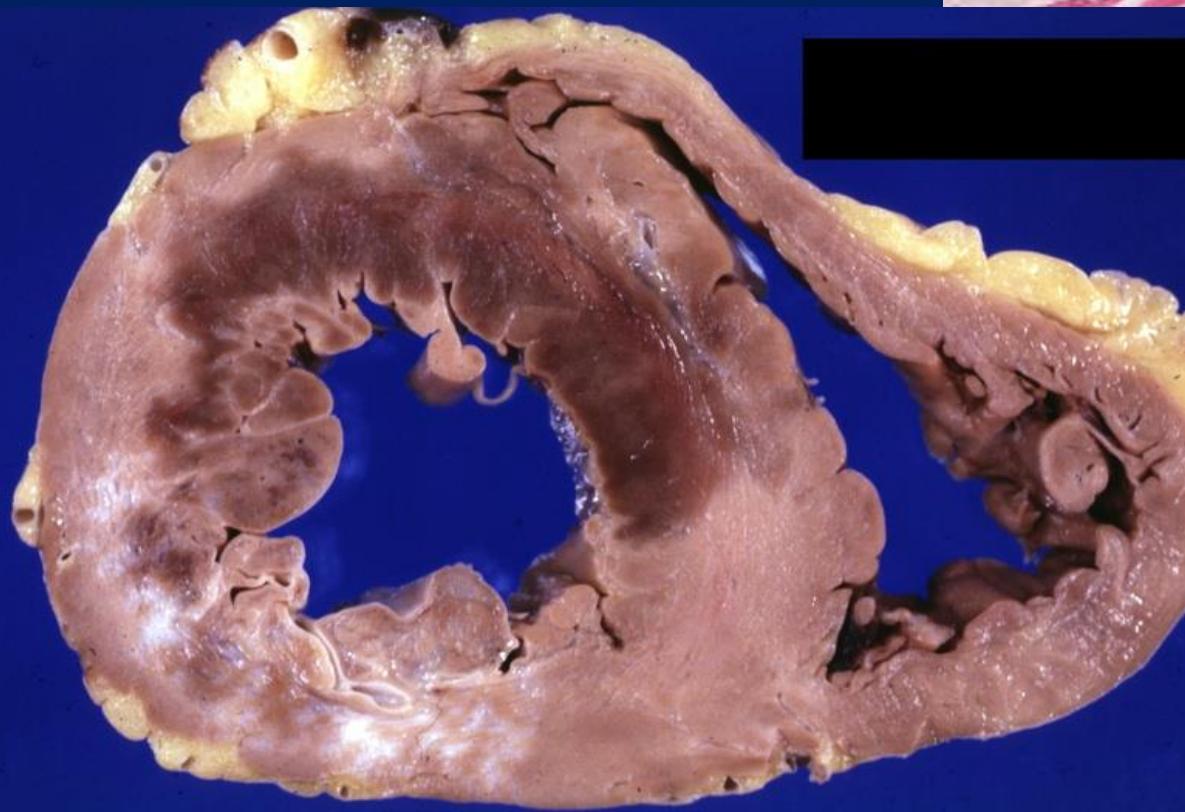
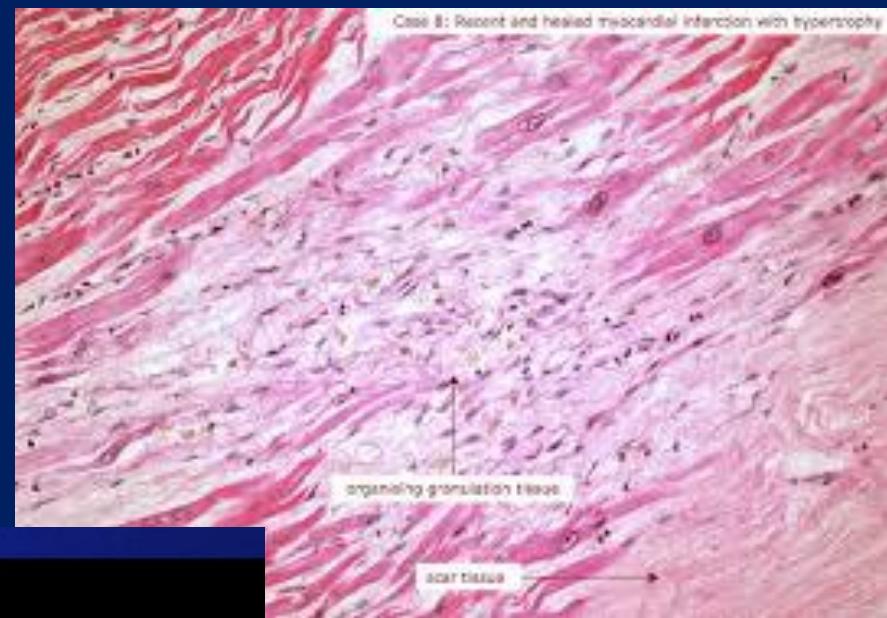
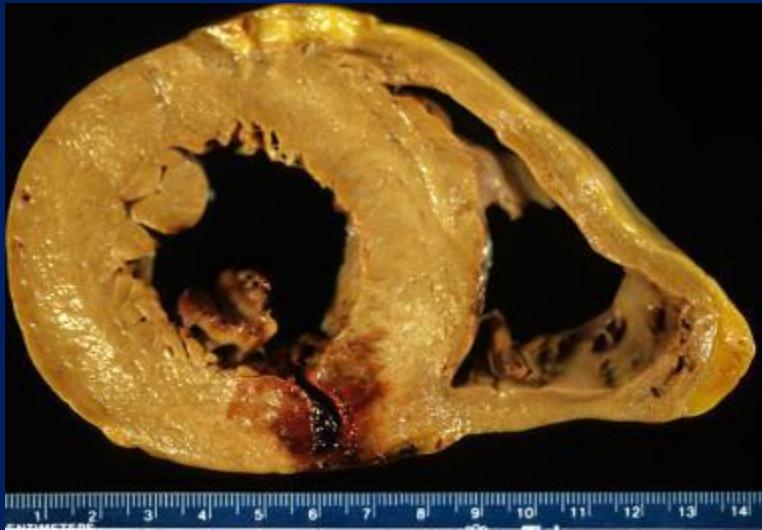
# “Vulnerable” Plaque and “Stable” Plaque



Libby. *Circulation*. 1995;91:2844-2850.

# Heart Attack





# HEART ATTACK WARNING SIGNS



CHEST PAIN



COLD SWEAT



DIZZINESS



UNUSUAL FATIGUE



ARRHYTHMIA



PALE SKIN



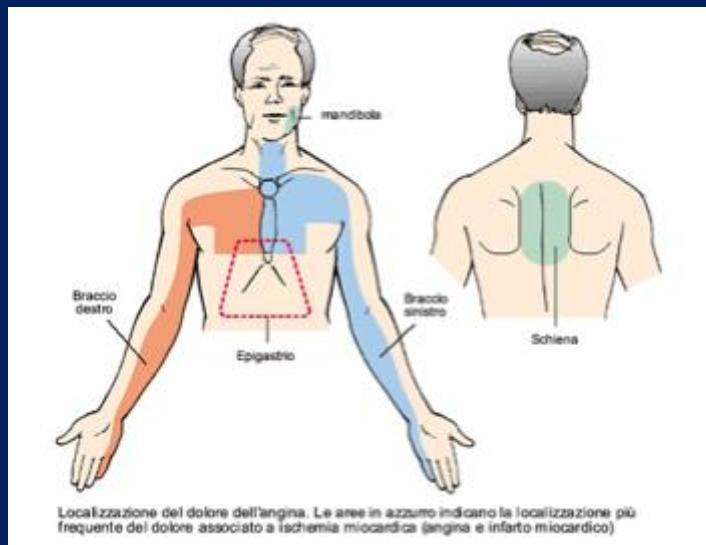
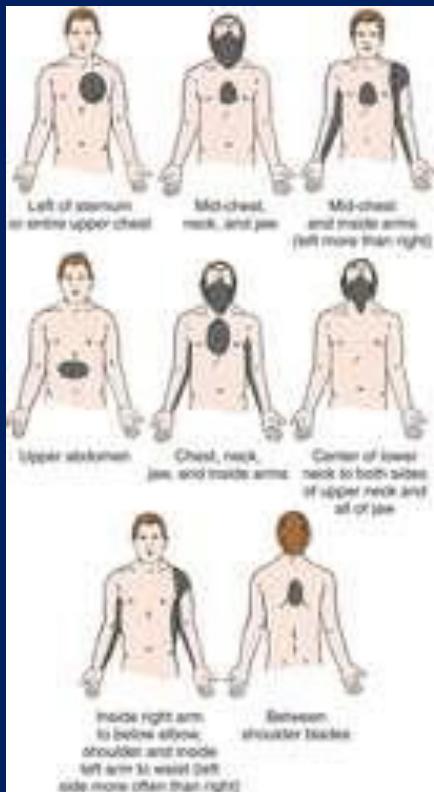
PAIN INTO HAND,  
SHOULDER, BACK



NAUSEA OR  
VOMITING



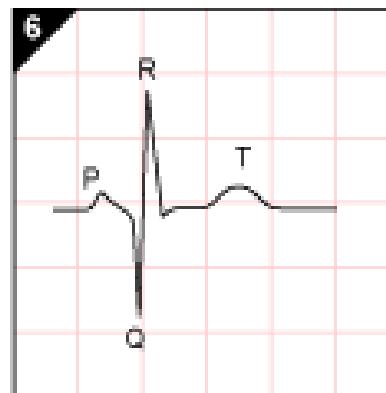
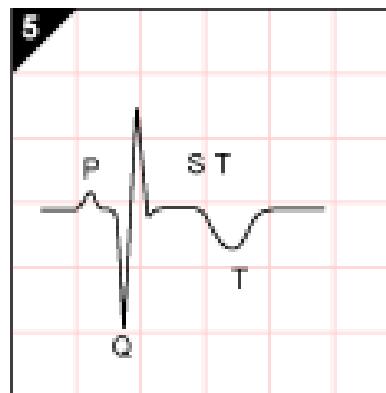
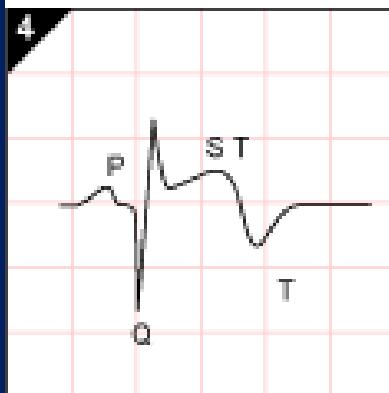
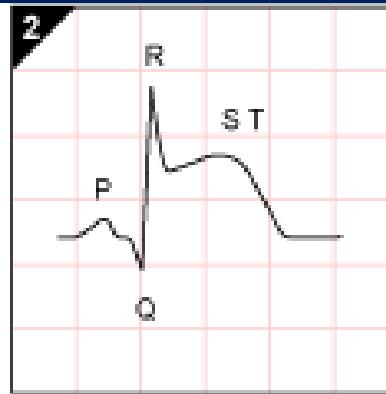
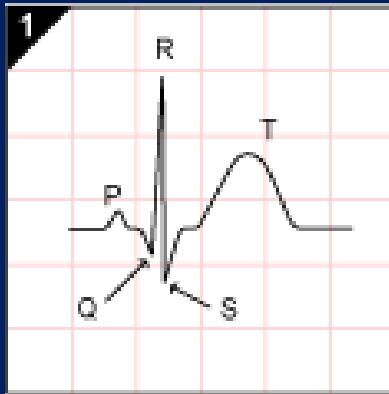
SHORTNESS  
OF BREATH

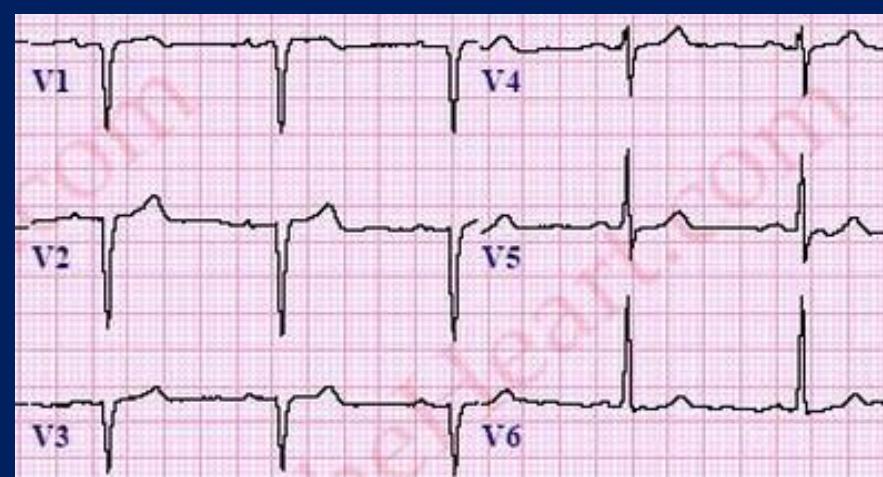
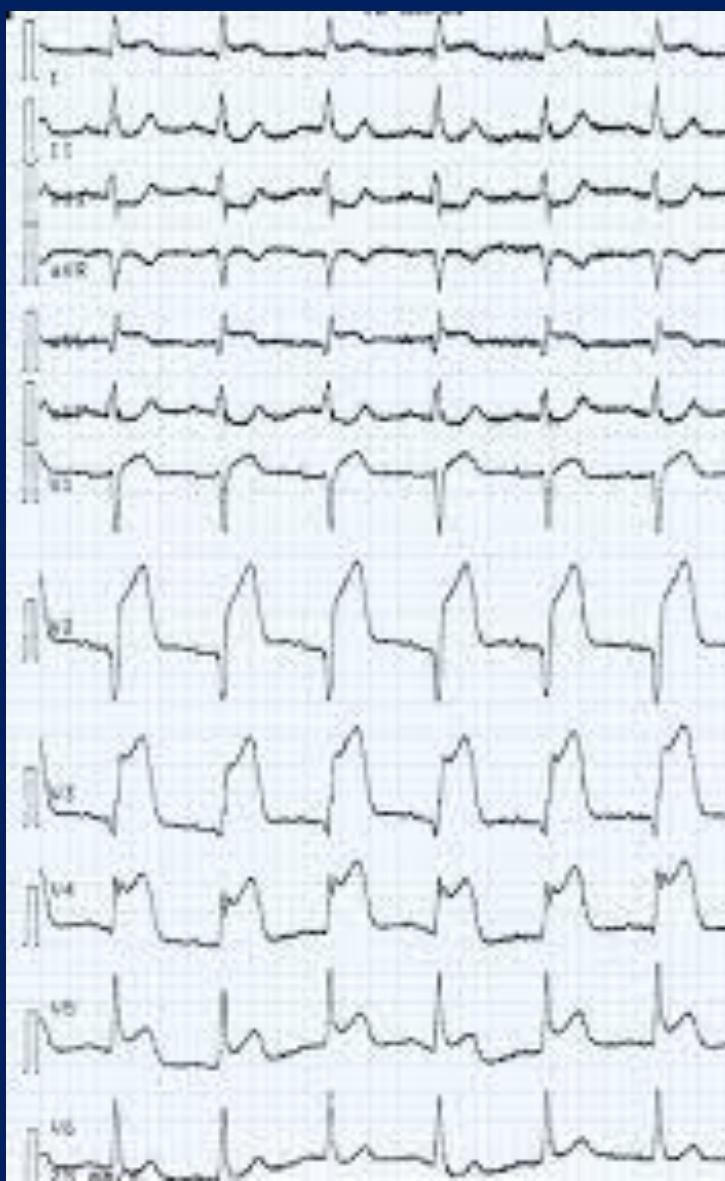


# DIAGNOSTIC TESTS

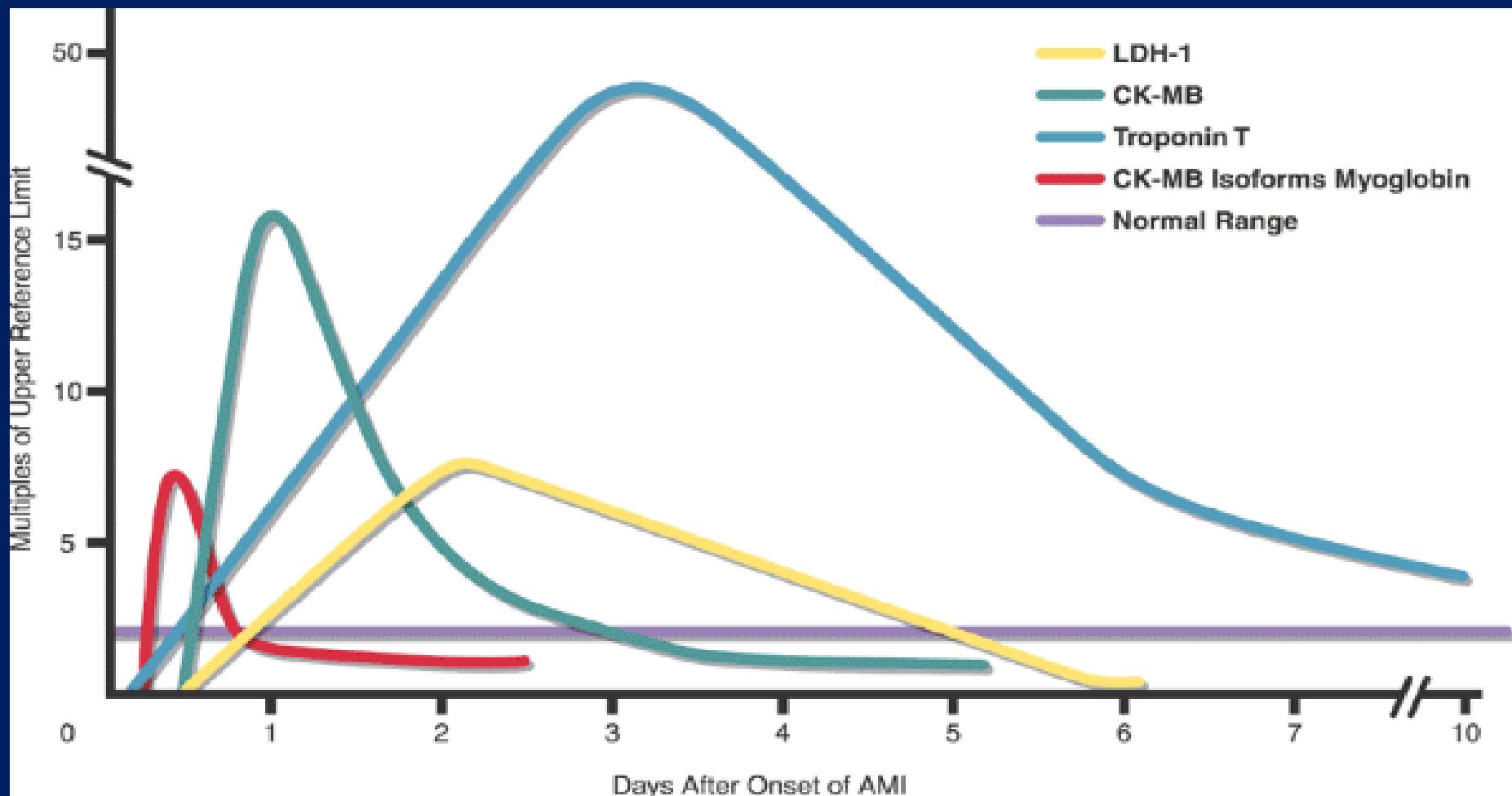
## *The Electrocardiogram*

- An ECG can be used to detect patterns of ischemia, injury, and infarction

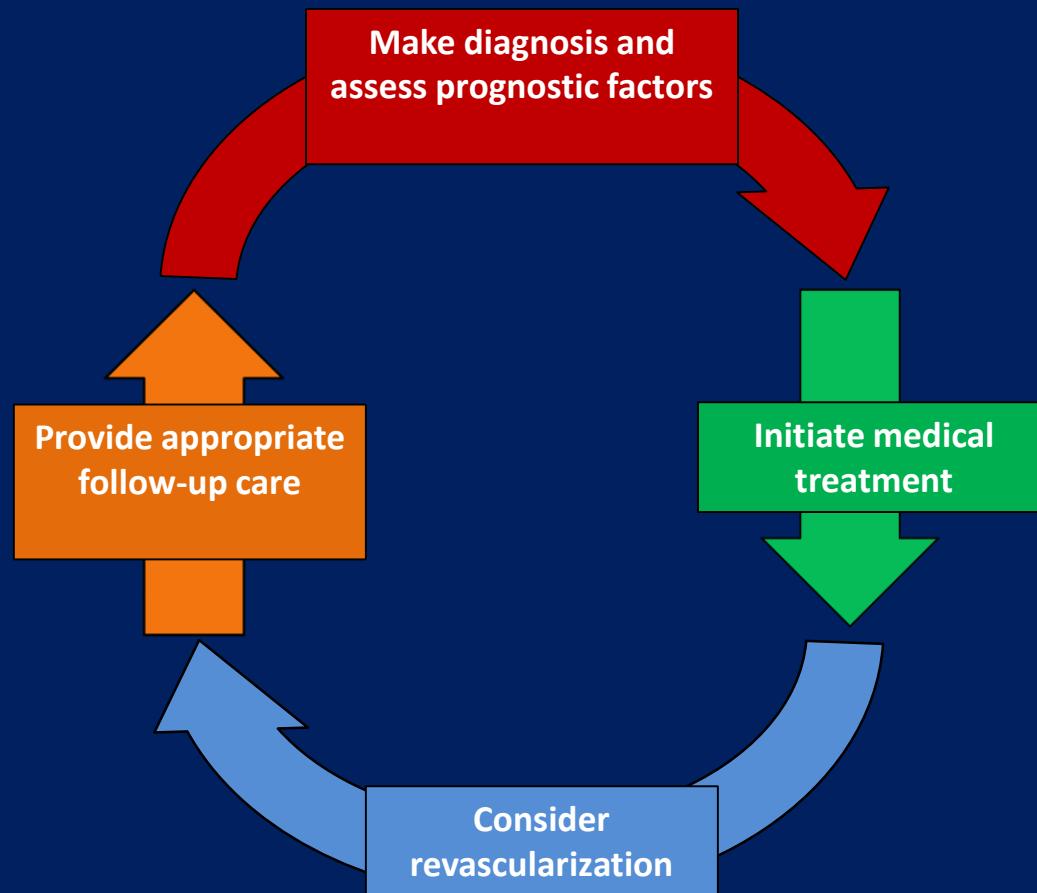




# Release of cardiac markers after acute myocardial infarction (AMI).



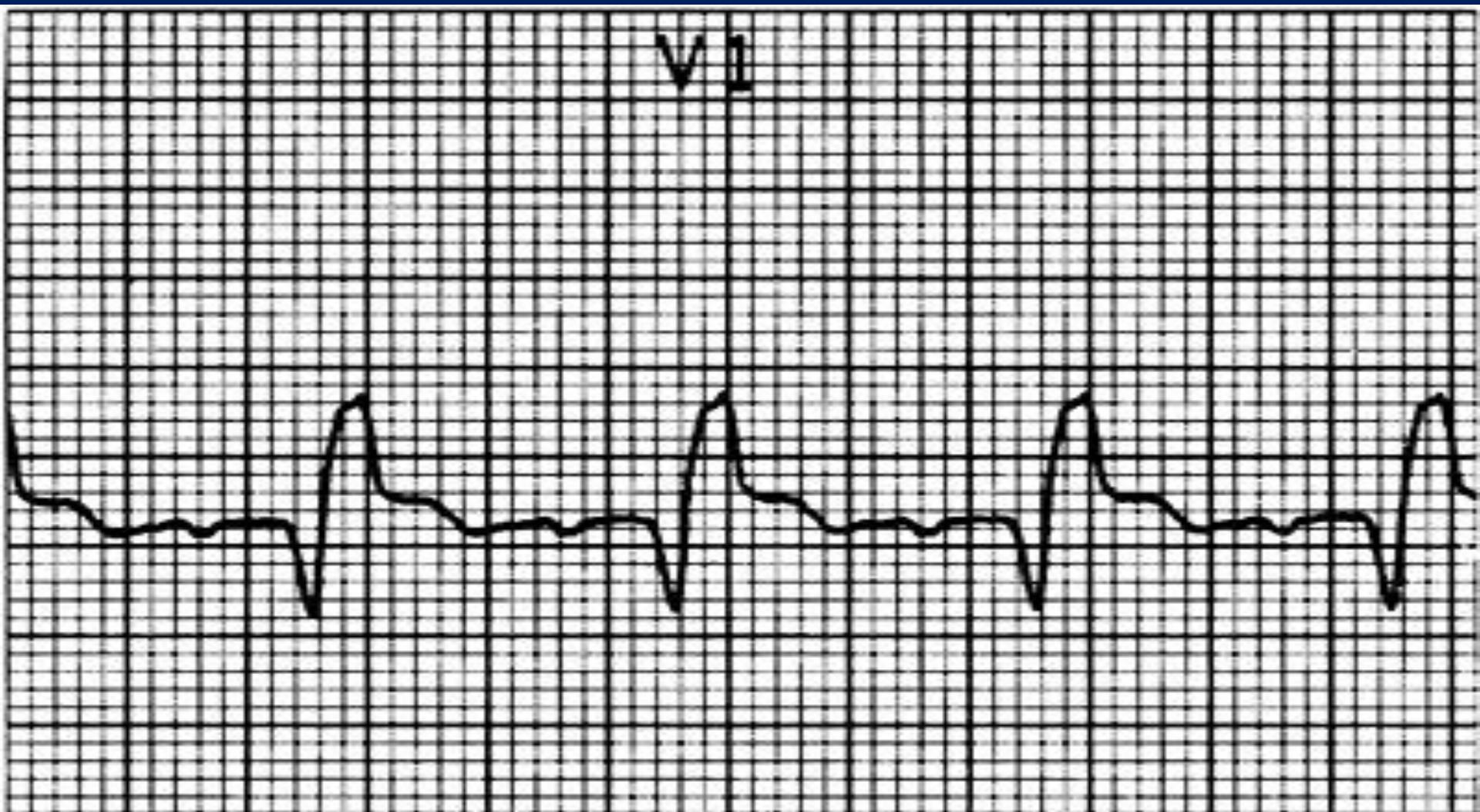
# Diagnosis and management of patients with stable ischemic heart disease



# Diagnosis of CHD

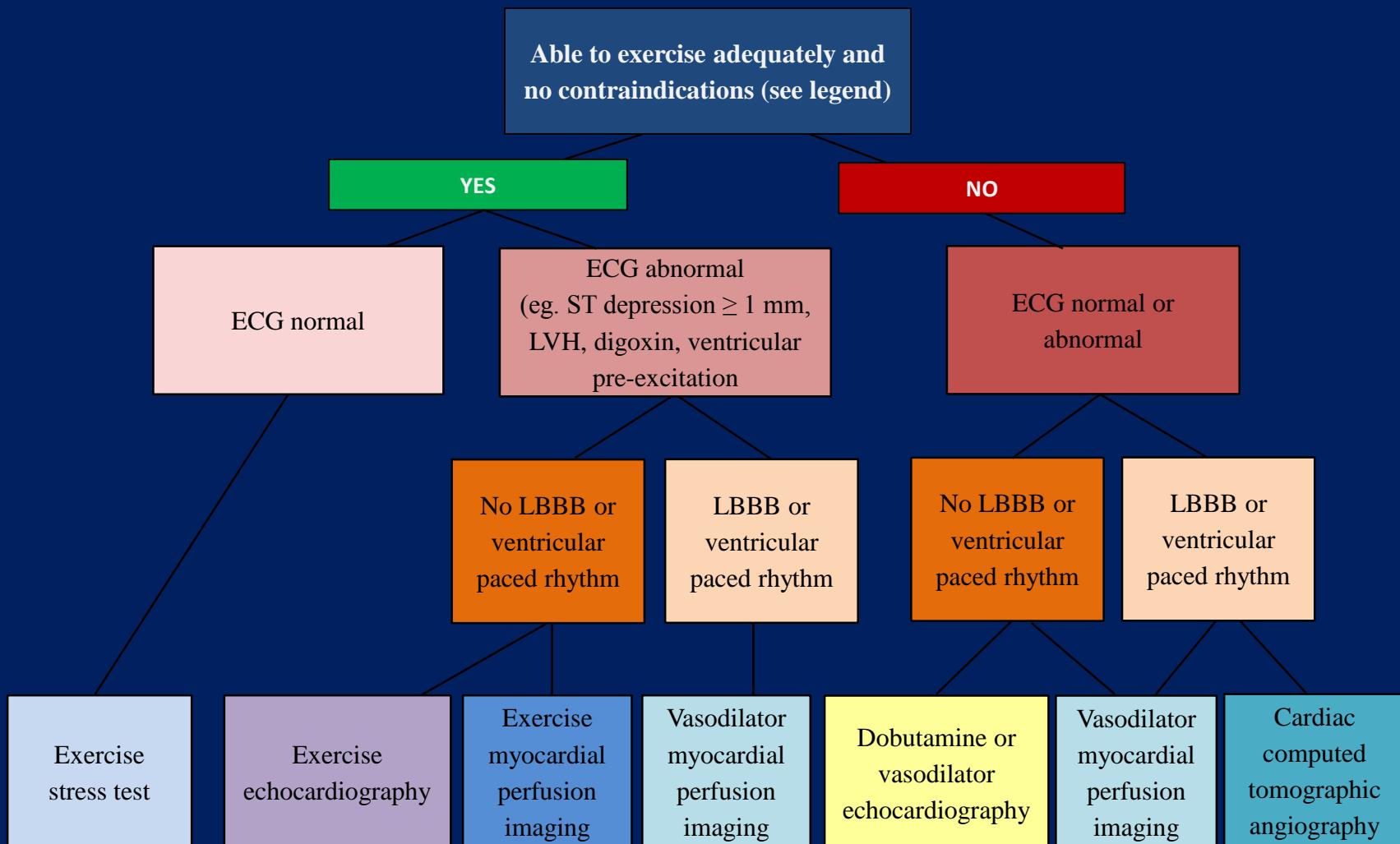
- **Electrocardiogram (EKG)**
- **Stress test**
- **Nuclear scanning**
- **Coronary angiography**

**Q waves indicate tissue necrosis and are permanent. A pathologic Q wave is one that is greater than 3 mm in depth or greater than one-third the height of the R wave.**

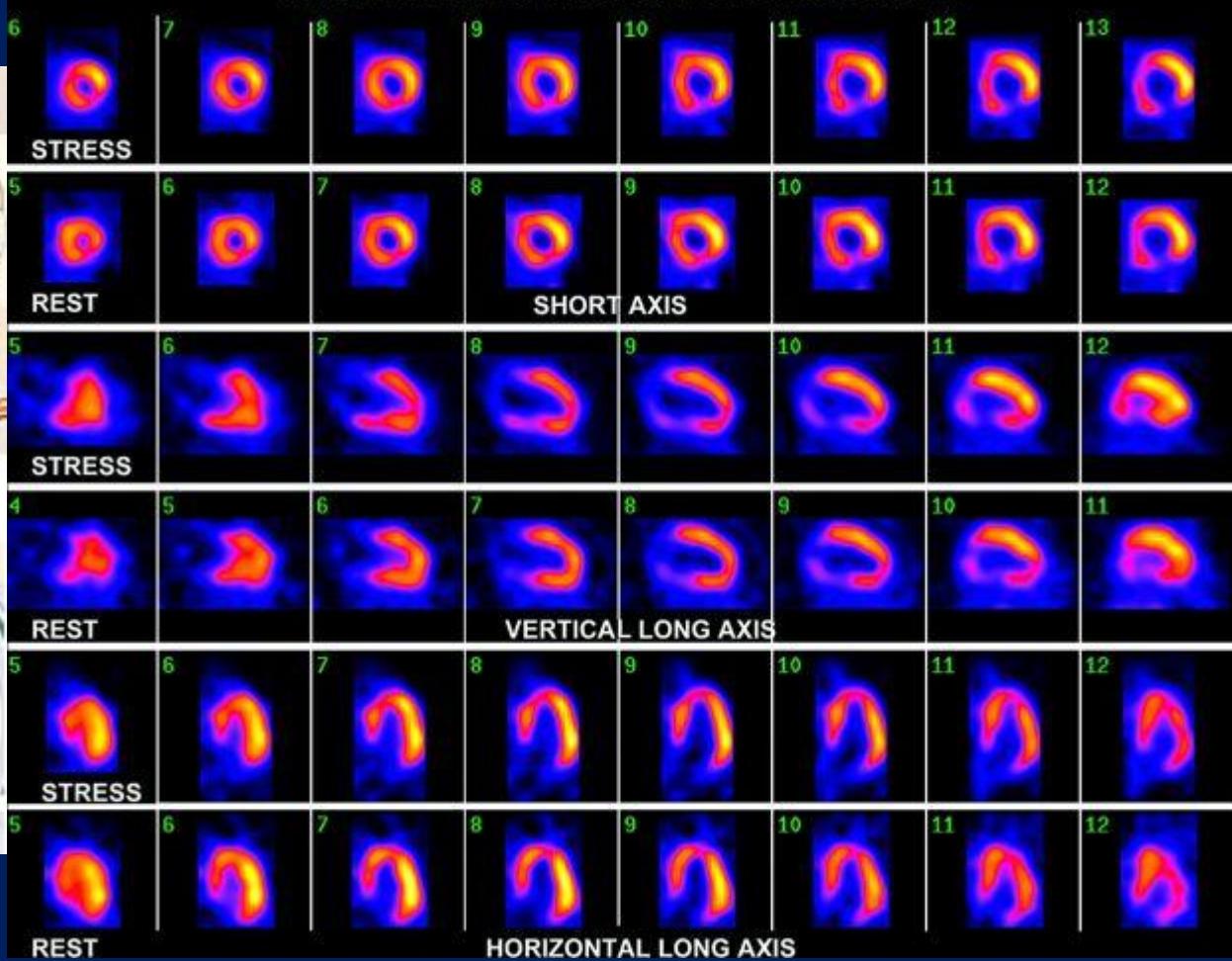
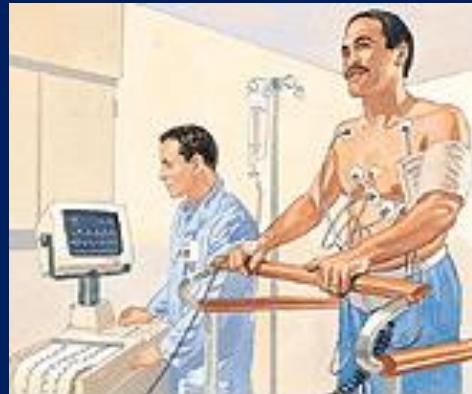


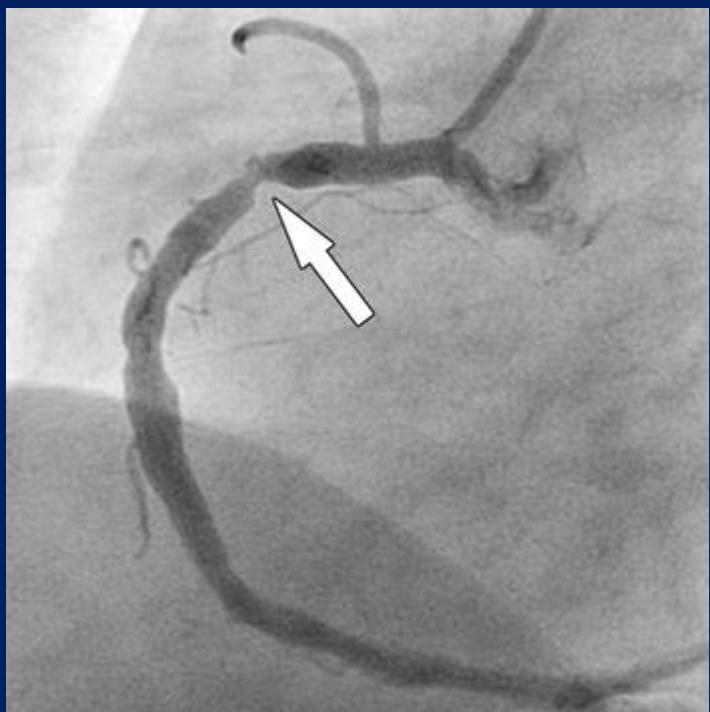
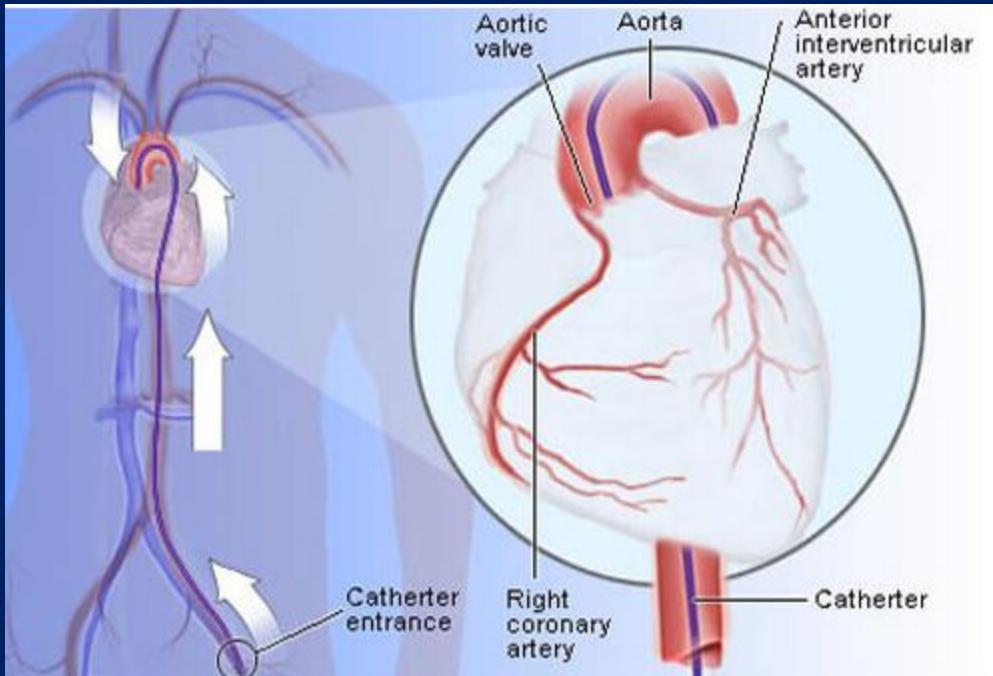


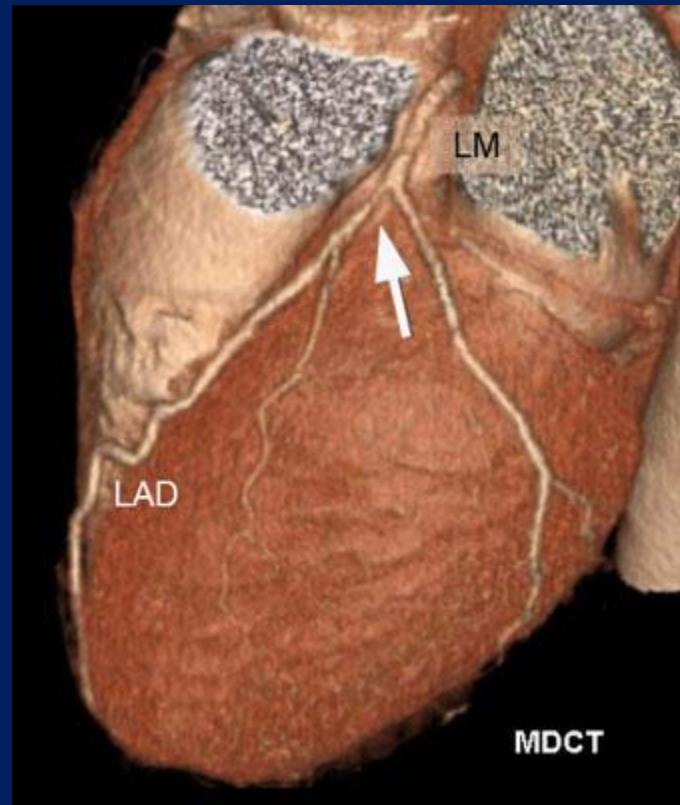
# Guidance for selection of an initial non-invasive test for diagnosing suspected CAD in routine practice settings.

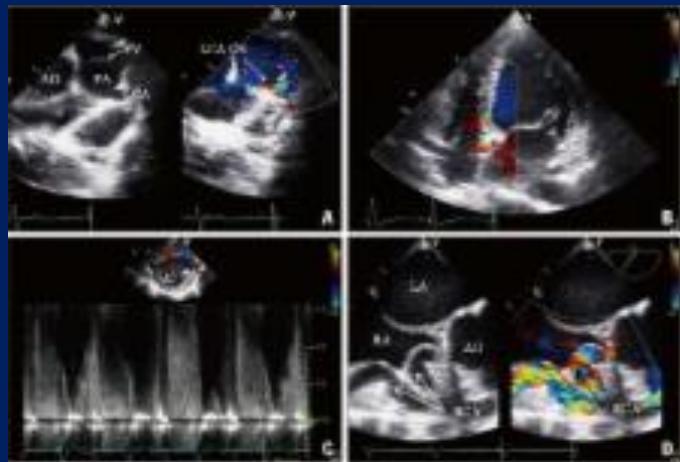
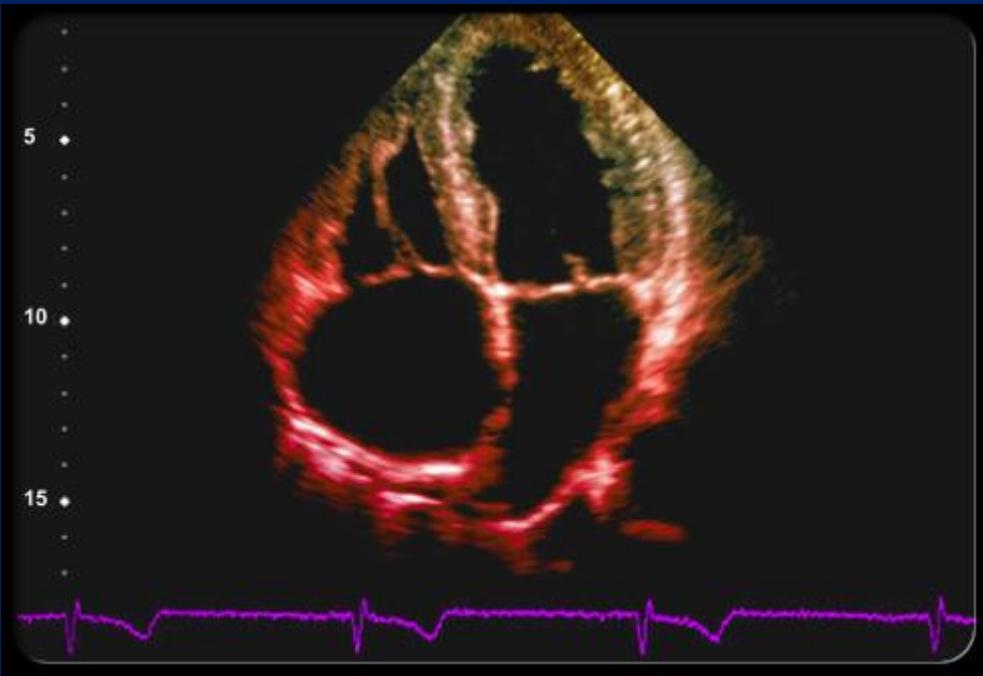


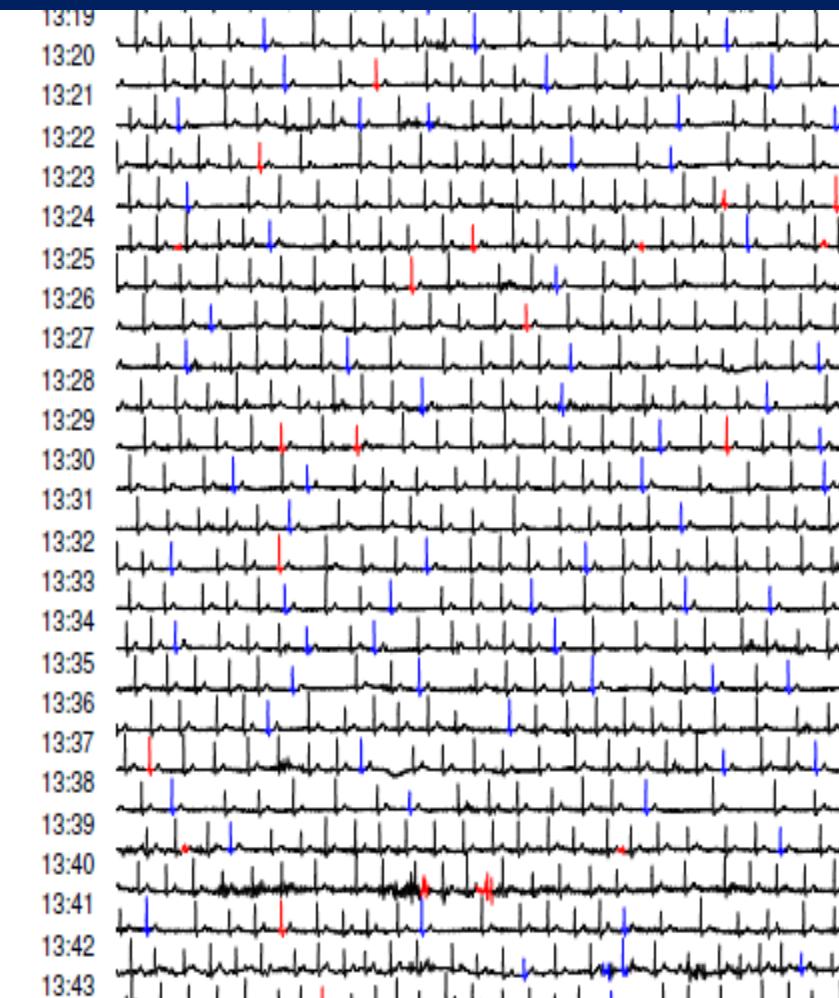
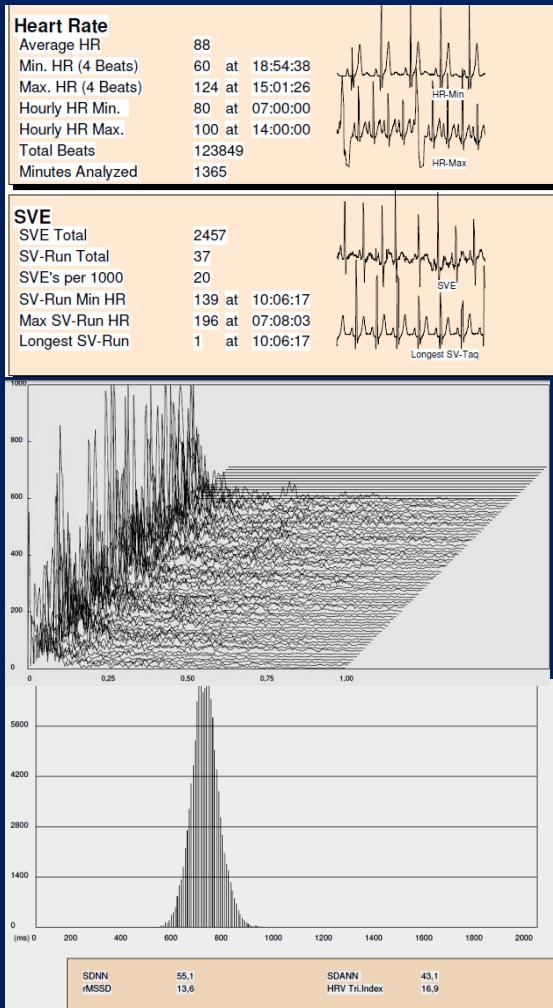
### SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY

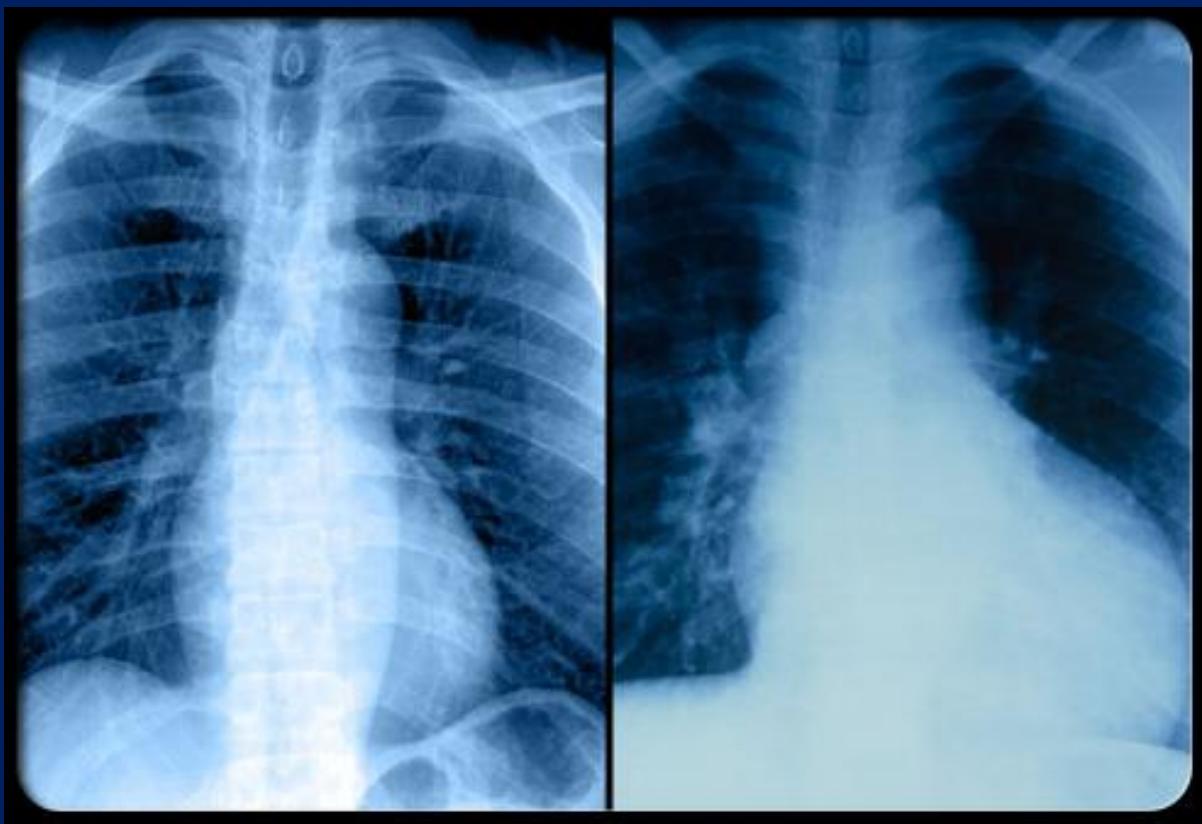












### In The field



### In The Lab



# TIME

## Never Offline.

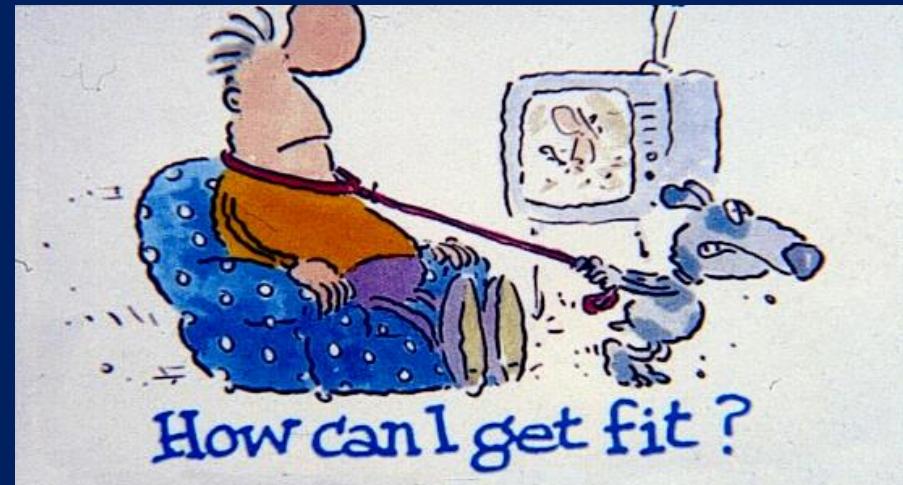
The Apple Watch is just the start.  
How wearable tech will change  
your life—like it or not

BY LEV GROSSMAN  
AND MATT VELLA



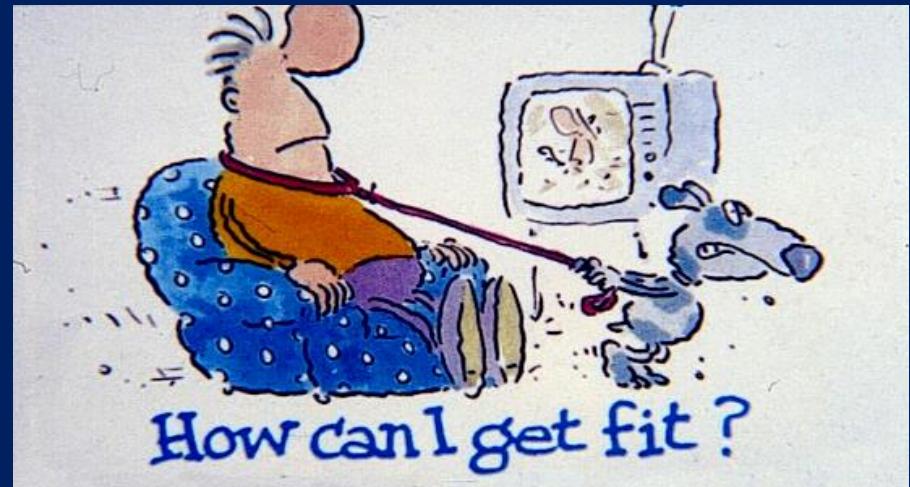
# Treatment for CHD

- Lifestyle changes
- Medication
- Surgery



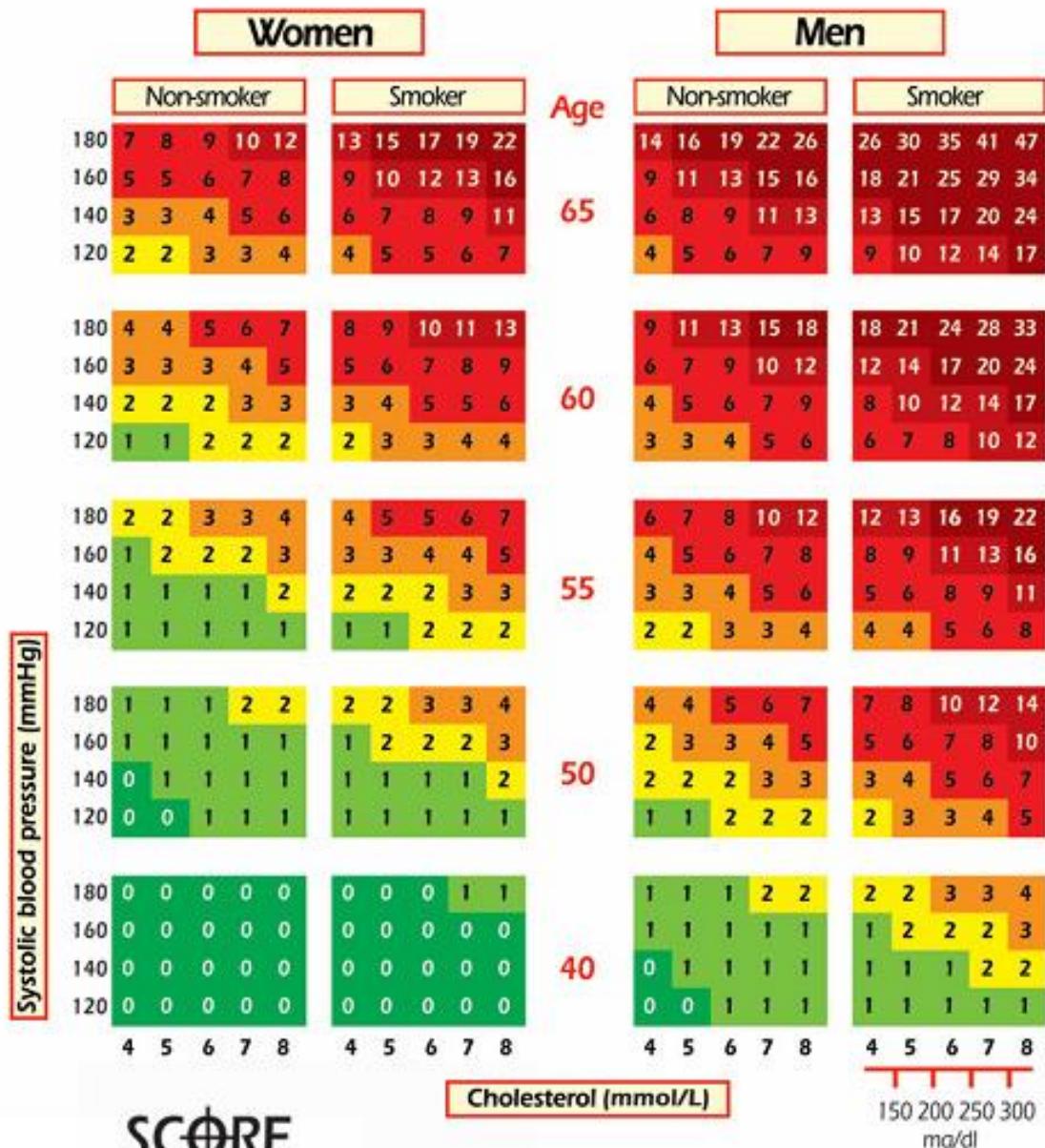
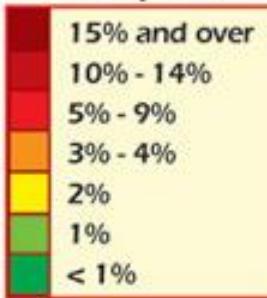
# Lifestyle Changes

- Change of habits
- Low fat diet
- Lower weight
- Increase exercise
- Stop smoking



# 10 year risk of fatal CVD in high risk regions of Europe

SCORE



# Medications to Treat CHD

- Beta blockers
- Nitroglycerine and other nitrates
- Calcium-channel blockers
- Aspirin
- Cholesterol-lowering drugs
  - lovastatin, colestipol, cholestyramine, etc
- Digitalis
- ACE inhibitors
- Diuretics

# Thrombolysis in Myocardial Infarction (TIMI) Score for Unstable Angina Non ST Elevation Myocardial Infarction

[Share](#)

## Select Criteria:

- Age >= 65 (1 point)
- 3 or more CAD risk factors (1 point)
- Known CAD with more than 50% stenosis (1 point)
- Aspirin use in the past 7 days (1 point)
- Severe angina in the preceding 24 hours (1 point)
- Elevated cardiac markers (1 point)
- ST deviation greater than 0.5 mm (1 point)

## Results:

Total Criteria Point Count: **0**

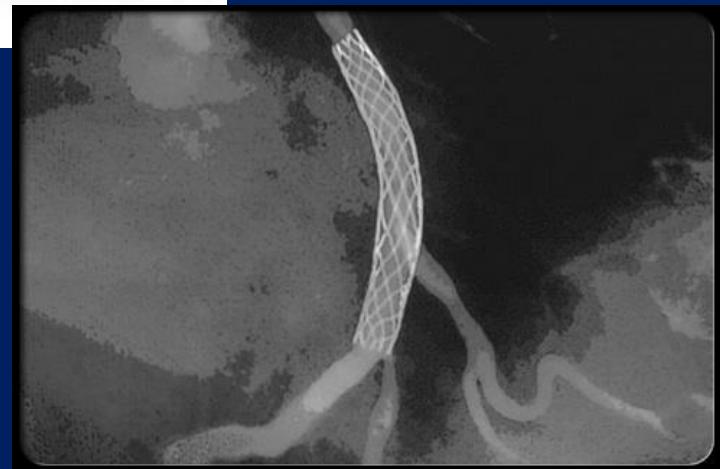
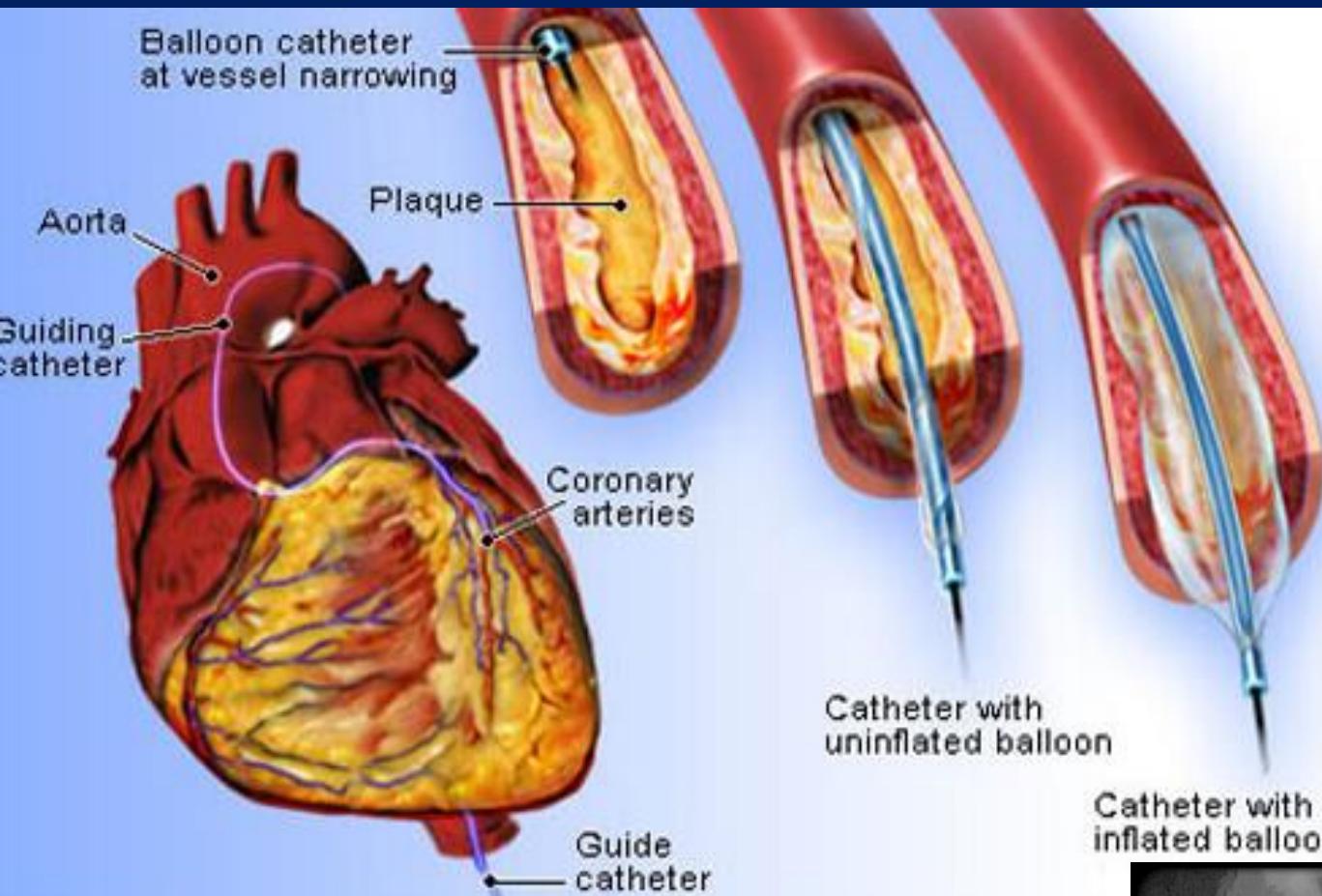
[Reset Form](#)

TIMI Score and 2 week Death / MI Risk \*\*  
Death / MI / Urgent Revasc Risk  
Interpretation

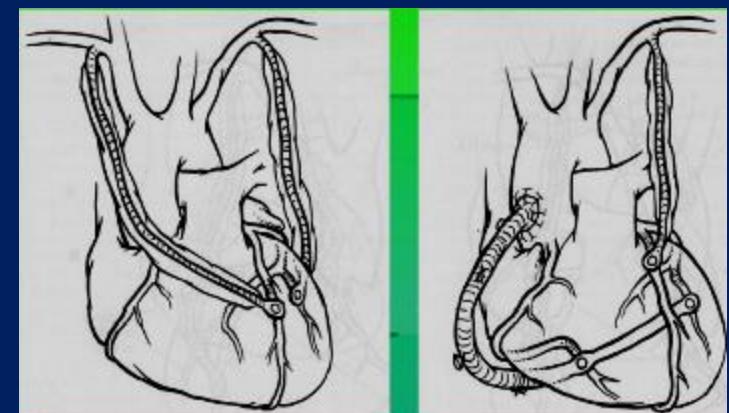
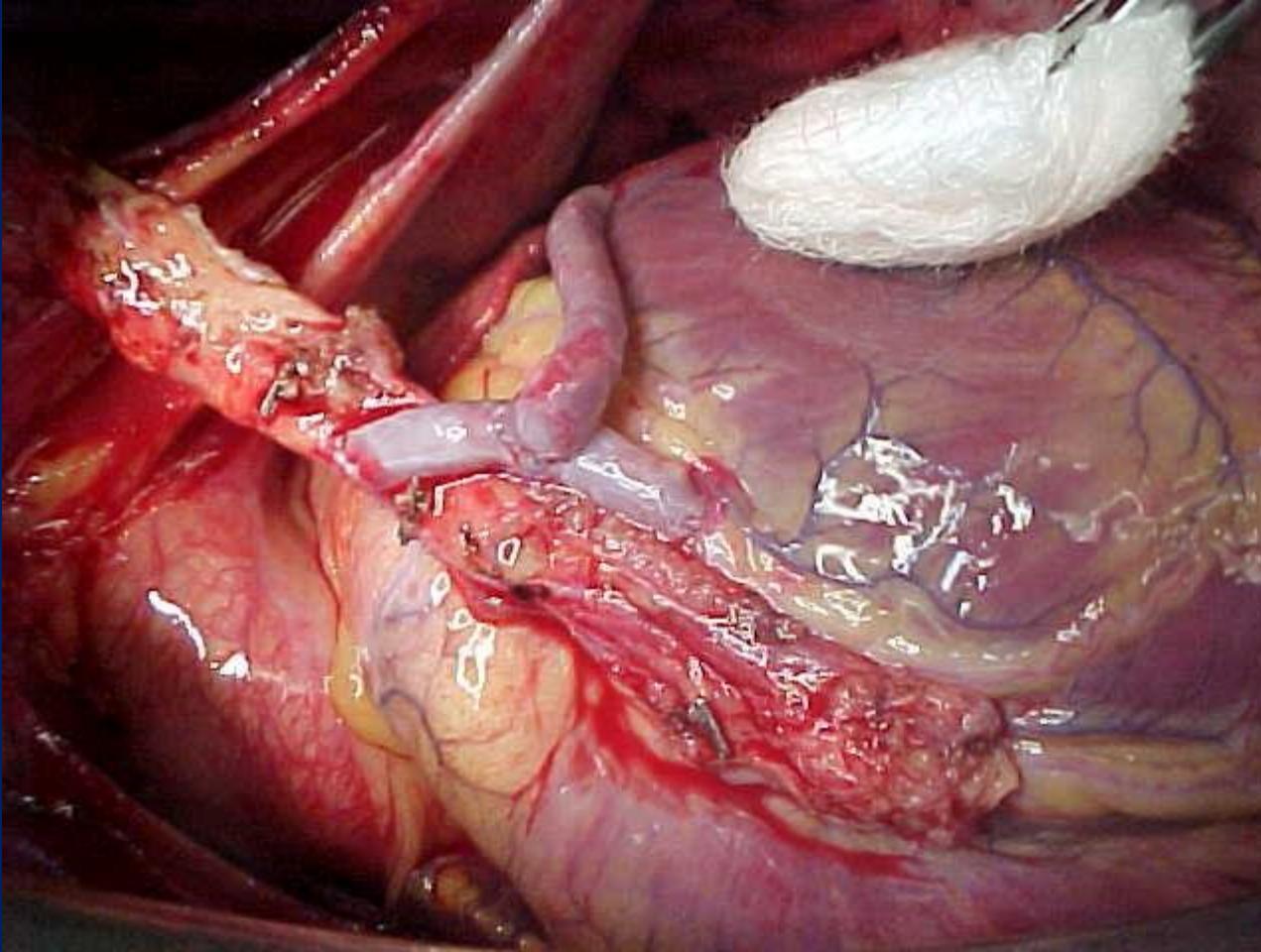
0-1 Points:	3% ** 5%
2 Points:	3% ** 8%
3 Points:	5% ** 13%
4 Points:	7% ** 20%
5 Points:	12% ** 26%
6-7 Points:	19% ** 41%

# Surgery to Treat CHD

- **Balloon angioplasty**
- **Atherectomy**
- **Laser angioplasty**
- **Stent insertion**
- **Coronary artery bypass operation (CABG)**

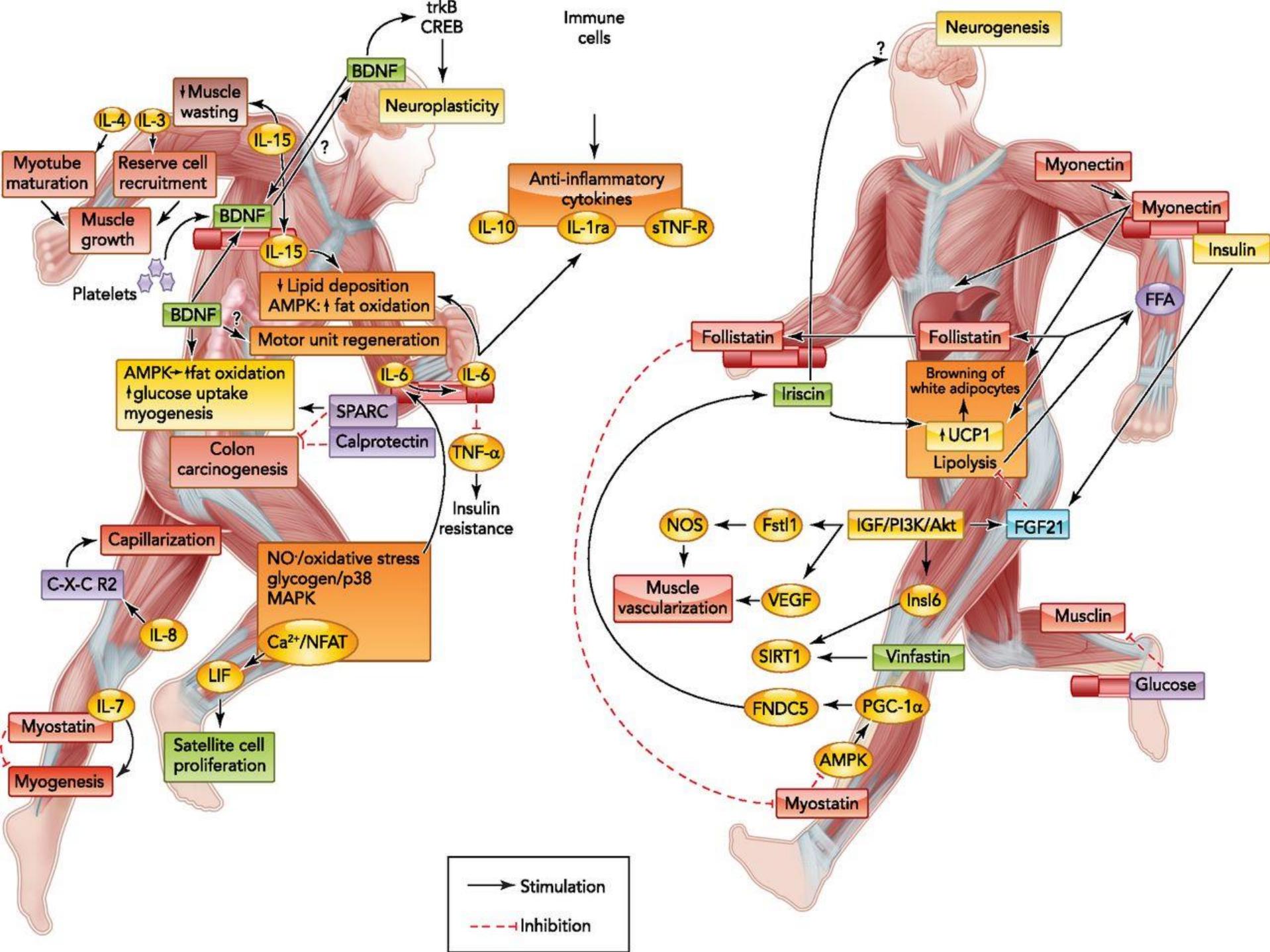


BY PASS



# Effects of Exercise





# EXERCISE

## Systemic Effects

**Skeletal Muscle**  
*Hypertrophy*  
*Hyperplasia*  
*Fiber type switching*

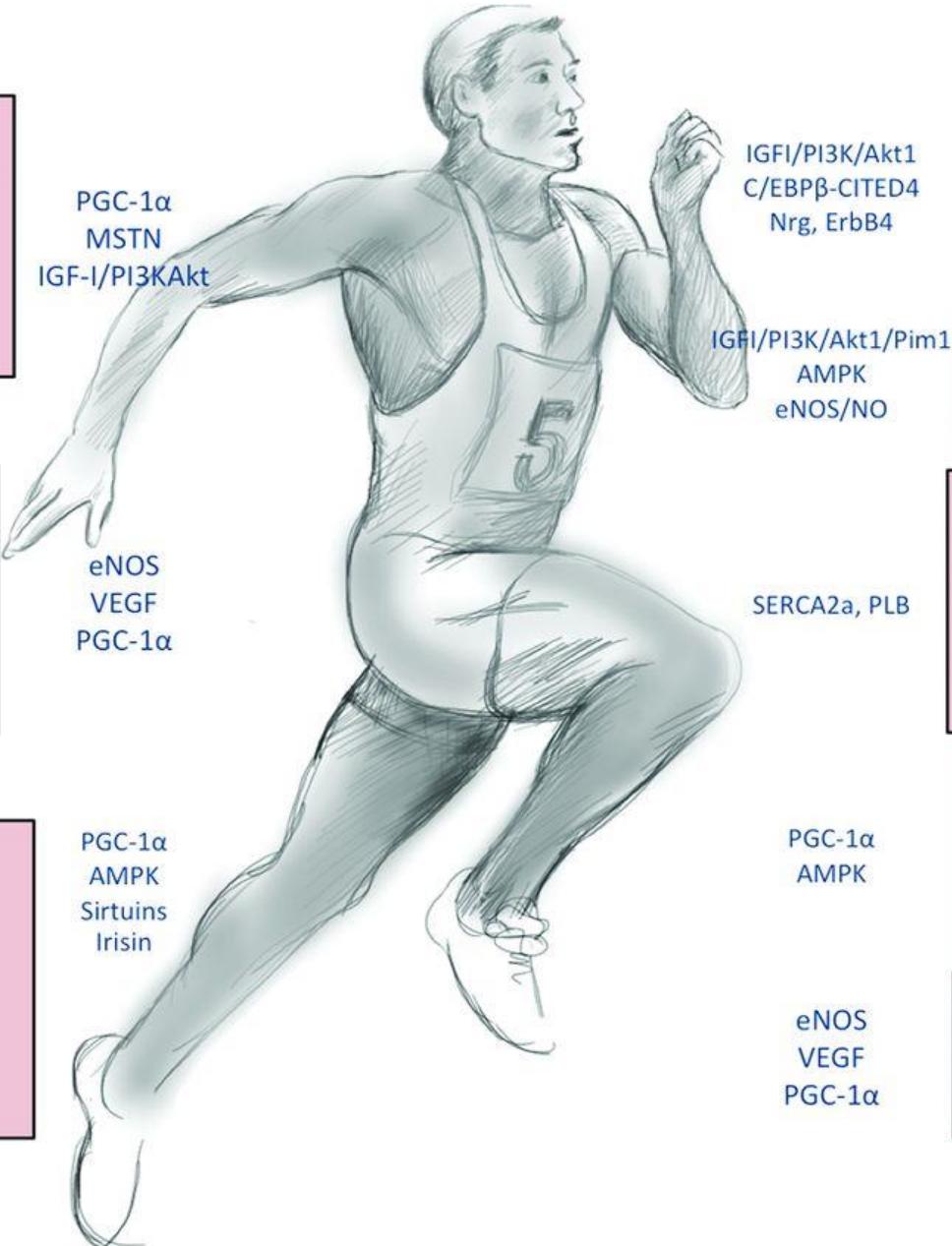
**Vascular**  
 $\uparrow$ Flow,  
 $\uparrow$ Vasoreactivity  
 $\uparrow$ Angiogenesis

**Metabolism**  
 $\uparrow$ Insulin Sensitivity  
 $\uparrow$ Ox. Phosphorylation  
 $\uparrow$ Mito. Biogenesis  
 $\uparrow$ Adipose “browning”

PGC-1 $\alpha$   
MSTN  
IGF-I/PI3KAkt

eNOS  
VEGF  
PGC-1 $\alpha$

PGC-1 $\alpha$   
AMPK  
Sirtuins  
Irisin



## Cardiac Effects

**Cardiac Growth**  
*Hypertrophy*  
 $\text{?Hyperplasia}$

IGF1/PI3K/Akt1  
C/EBP $\beta$ -CITED4  
Nrg, ErbB4

IGF1/PI3K/Akt1/Pim1  
AMPK  
eNOS/NO

SERCA2a, PLB

PGC-1 $\alpha$   
AMPK

eNOS  
VEGF  
PGC-1 $\alpha$

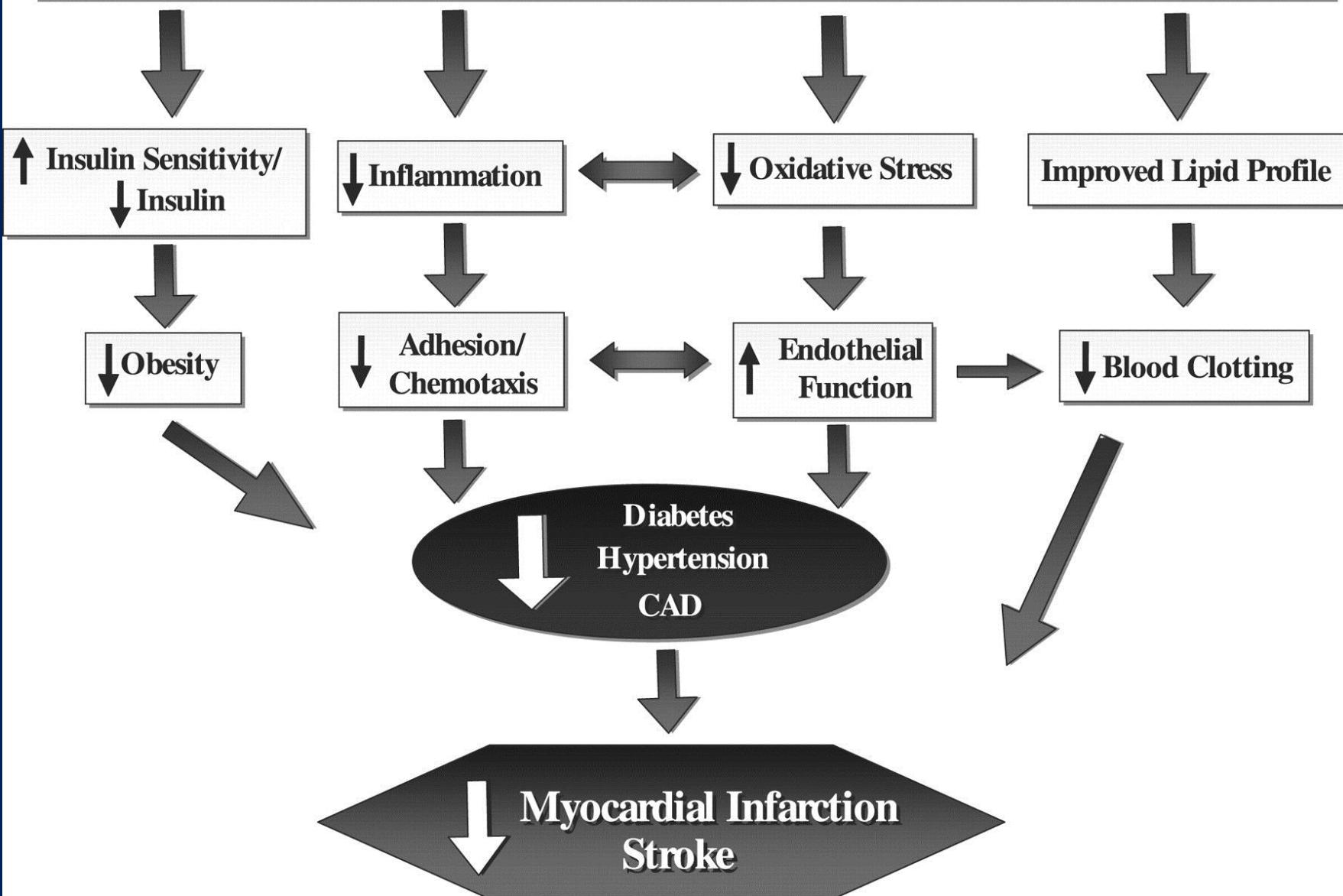
**Cardioprotection**  
 $\downarrow$ Ischemic Injury

**Function**  
 $\uparrow$ Stroke Volume  
 $\uparrow$ Cardiac Output  
Improved Ca $^{2+}$  Handling  
T-Tubule Organization

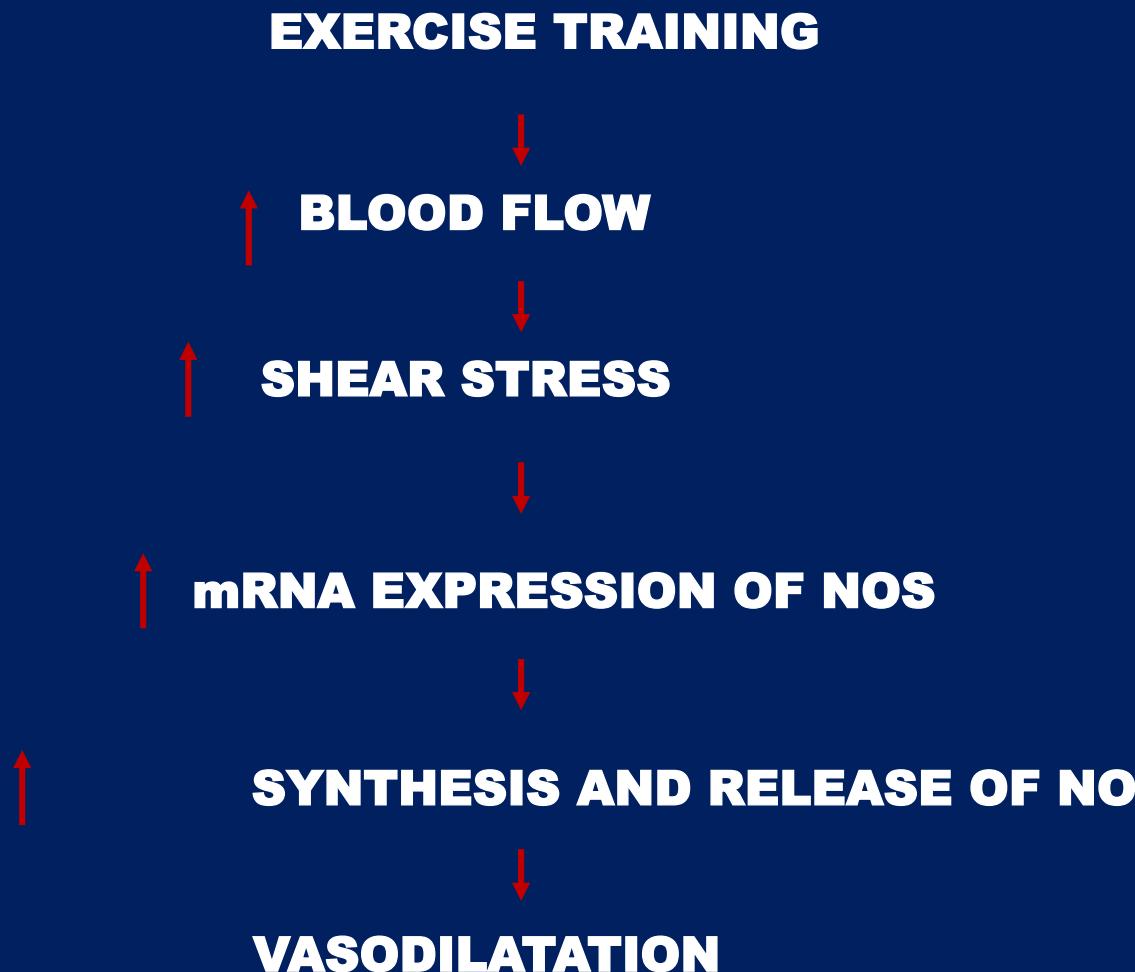
**Metabolism**  
 $\uparrow$ Ox. Phosphorylation  
 $\uparrow$ Mito. Biogenesis

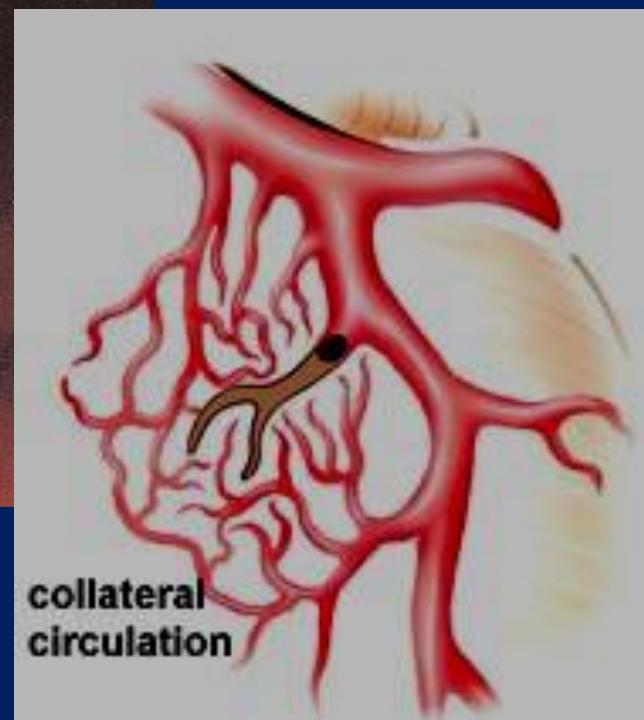
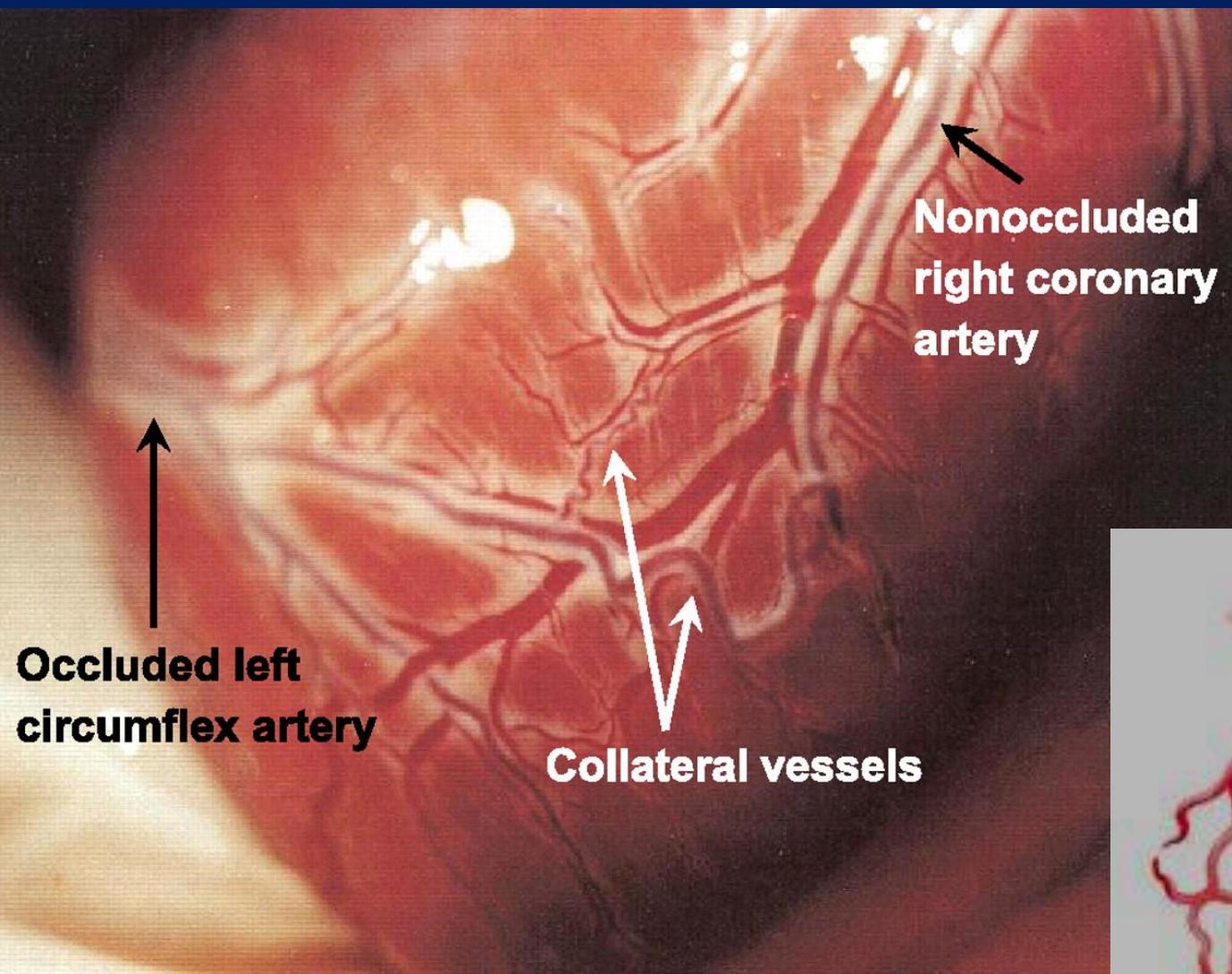
**Vascular**  
 $\uparrow$ Flow, Vasoreactivity  
 $\uparrow$ Angiogenesis

# Physical Activity and Nutrient-Dense, High-Fiber, Low-Fat Diet

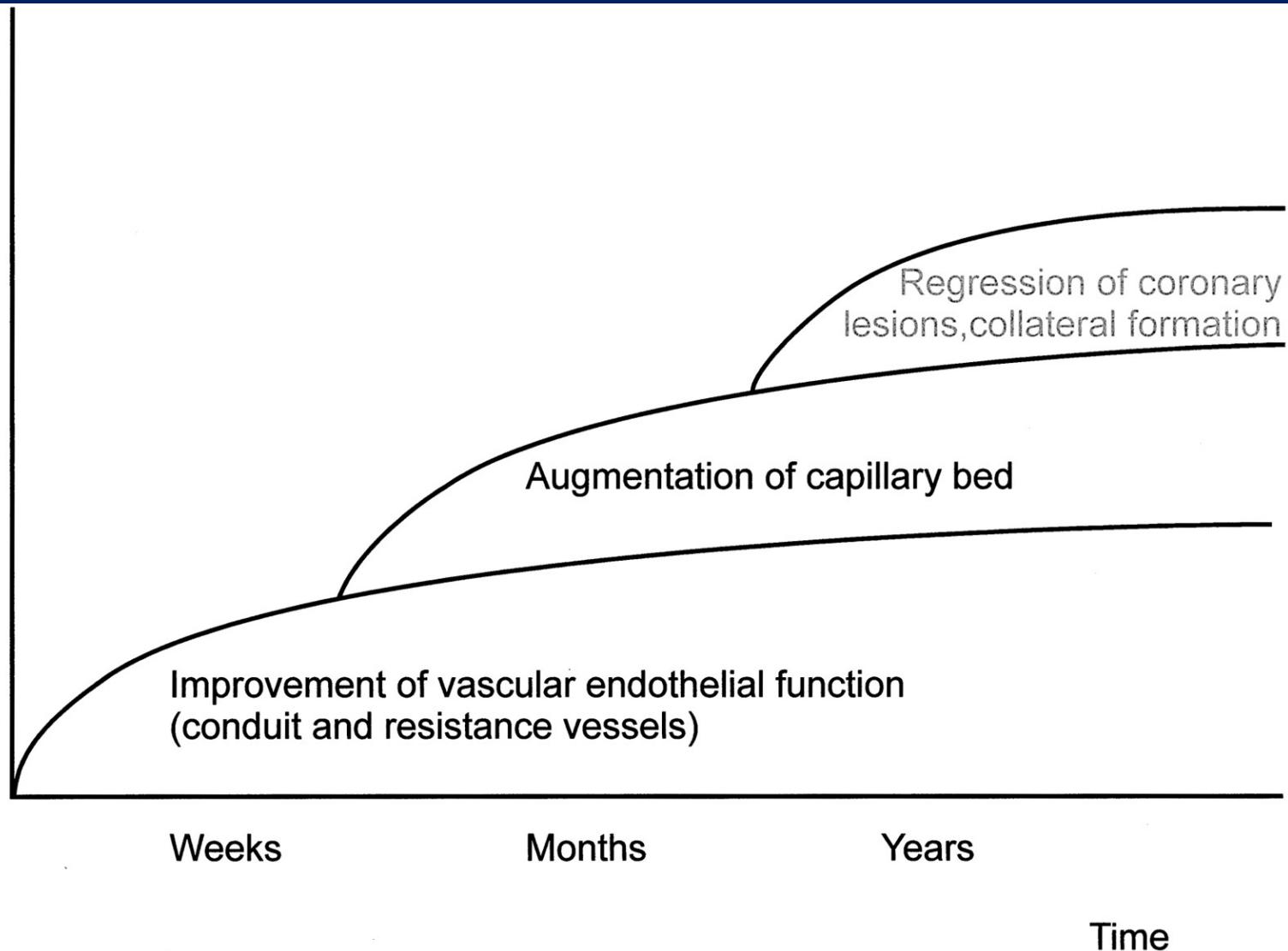


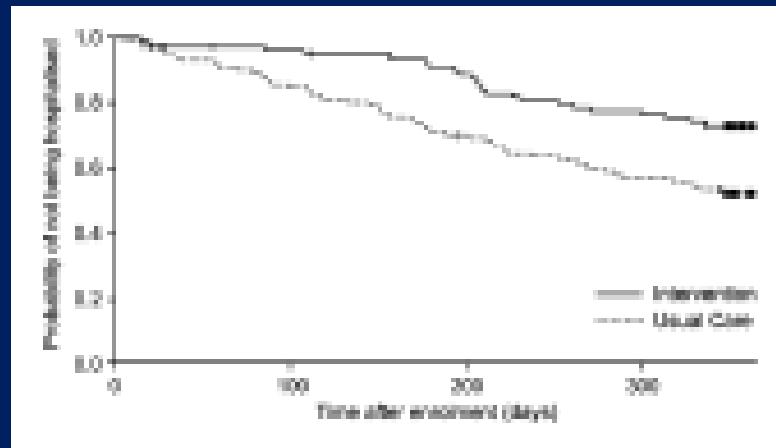
# **EXERCISE TRAINING AND ENDOTHELIAL FUNCTION**





Myocardial  
Perfusion

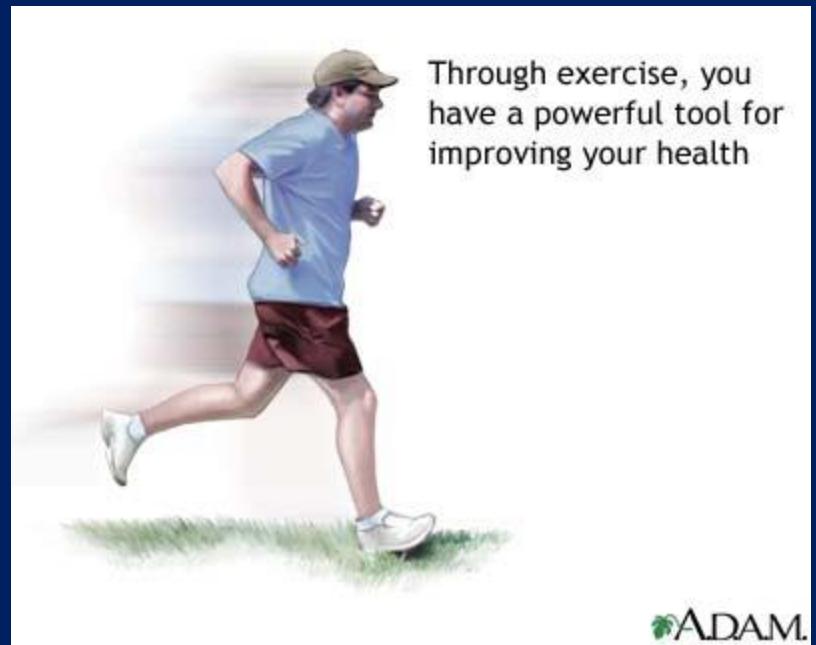




**Studies show that people who have a low fitness level are much more likely to die early than people who have achieved even a moderate level of fitness.**

# QUESTION

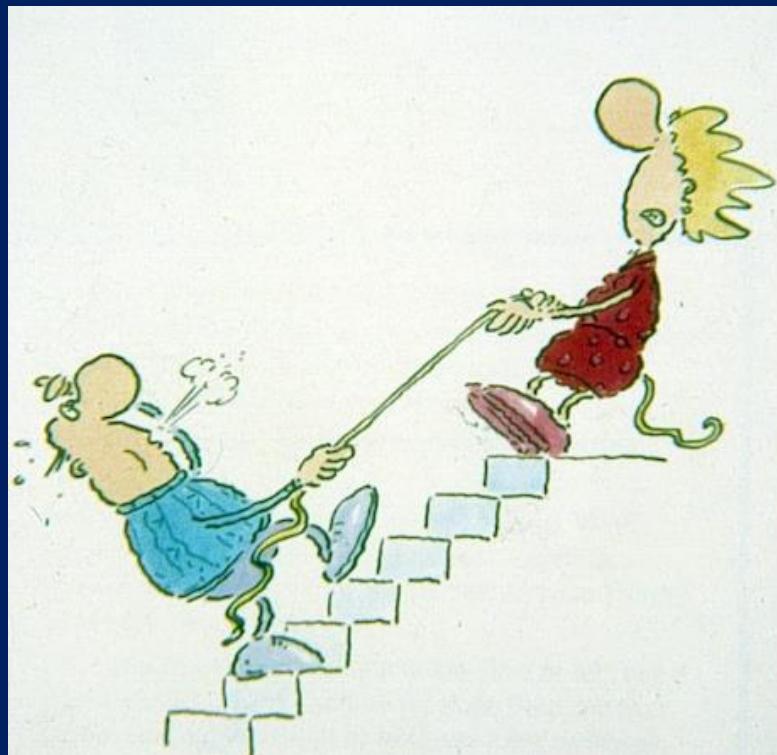
How much physical activity is enough?



Through exercise, you have a powerful tool for improving your health

# ANSWER

**30 to 60 minutes, on most days of the week, at 50-80 percent of your maximum capacity.**



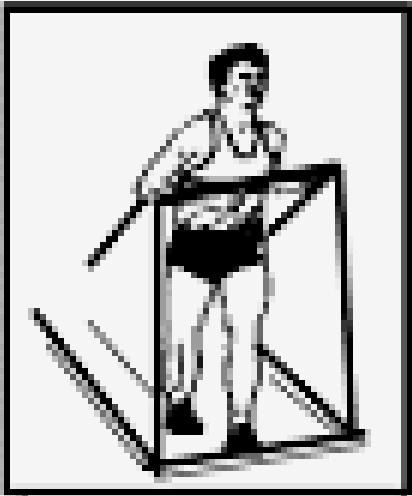
**CELL ACTIVITY CHANGES**



sedentary  
lifestyle



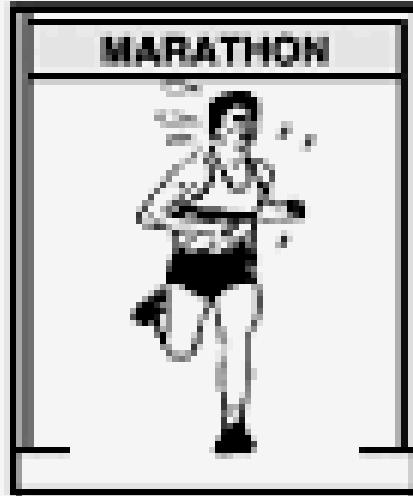
■ NO  
■ Scavengers  
ROS  
Moderate  
oxidative stress



moderate  
exercise



↑ NO  
↑ Scavengers  
↑ ROS  
↓ Oxidative stress



strenuous  
exercise



↑ NO  
↑ Scavengers  
↑↑ ROS  
↑↑ Oxidative stress

**MARATHON**

# CARDIAC REHABILITATION PROGRAM IN LABORATORY OF SPORTS MEDICINE





# Types of Moderate and Vigorous Physical Activity



- Bike riding
- Swimming
- Brisk walking
- Tennis
- Gardening
- Jogging
- Soccer
- Aerobics
- Dancing
- Jumping rope



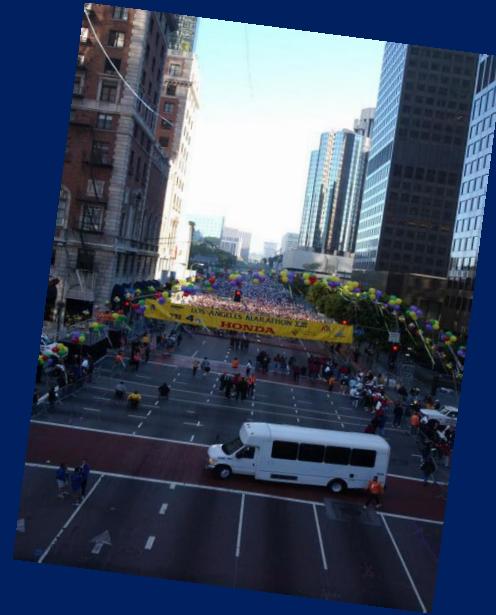


Photo credit: VictahSailer/Photo Run



## HEALTH & FITNESS

# Is Sex Really Exercise?

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Credit: Getty Images

### The average romp is equivalent to a short jog.

You don't need a scientist to tell you that sex can be a full-tilt, sweat-drenched workout. But how many calories does a good romp really burn? [In a recent study](#), researchers at the University of Québec at Montréal measured energy expended during sex versus running, and found that we get our hearts pumping and muscles cranking enough during sex for it to be considered moderate exercise.

The researchers recruited 21 healthy, active, heterosexual couples in their early 20s to jog on treadmills at about 65 percent of their maximum heart rates for 30 minutes. While running, they wore lightweight armband monitors that measure energy expenditure in calories and exercise intensity in METs, or metabolic equivalent of task.