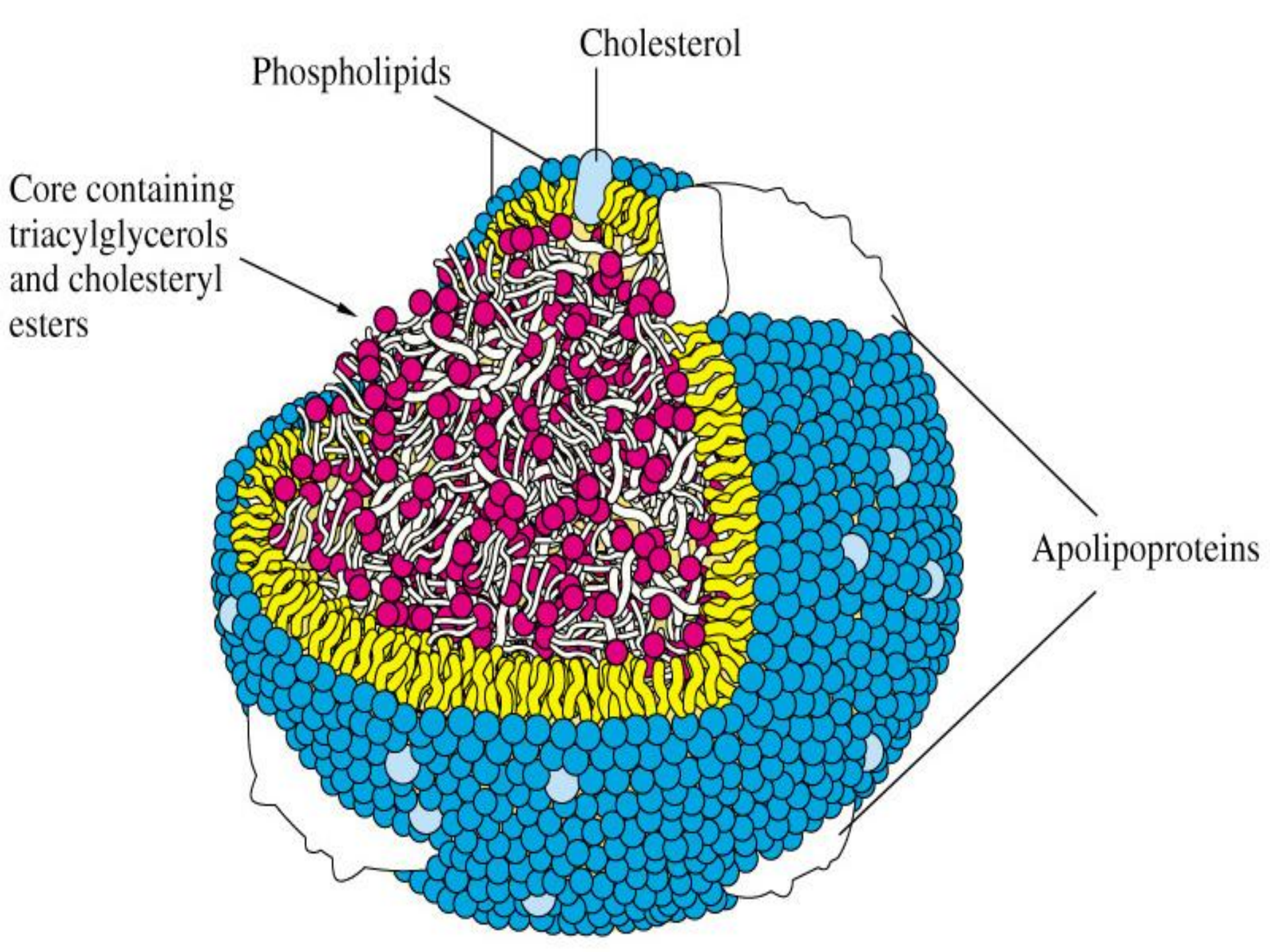# Lipid Profile

MSc. Roza Talaat
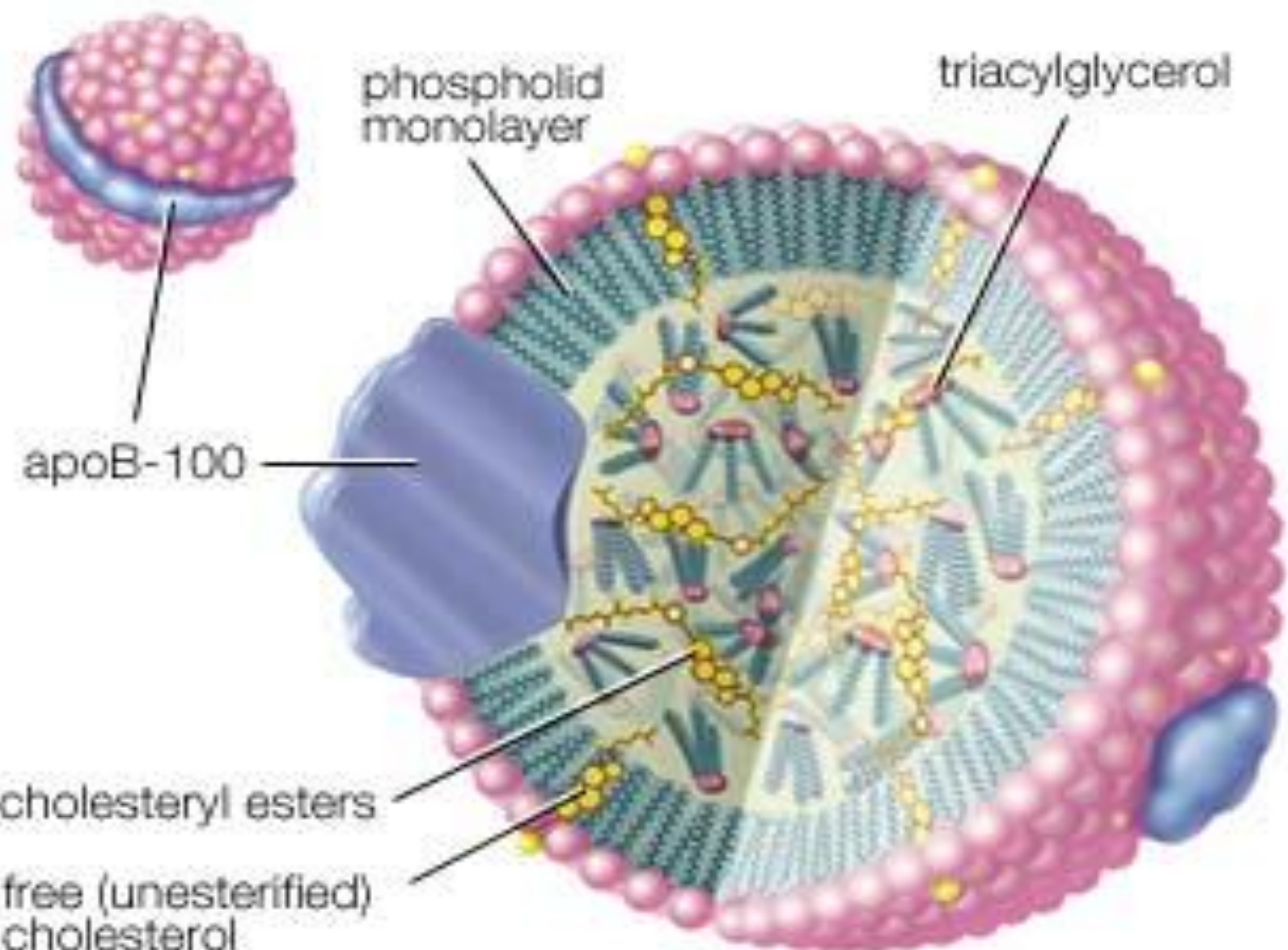**Master in Analytical Chemistry**

Introduction

- The major lipids present in the plasma are fatty acids, Triglycerides, cholesterol and phospholipids.

- Other lipid-soluble substances, present in much smaller amounts (e.g. steroid hormones).

- Elevated plasma concentrations of lipids, particularly cholesterol, are related to the pathogenesis of atherosclerosis.

Lipids transport

- Lipids are carried in the bloodstream by complexes known **as lipoproteins**.

- This is because these lipids are not soluble in the plasma water.

- Thus they travel in **micelle**-like complexes composed of phospholipids, cholesterol and protein on the outside with cholesteryl esters, and triglycerides on the inside.

- The four main types of **lipoproteins** are chylomicrons, VLDL, low-density lipoprotein (LDL or bad cholesterol), and HDL (good cholesterol).

Phospholipids

Cholesterol

Core containing
triacylglycerols
and cholesteryl
esters

Apolipoproteins

phospholid monolayer

triacylglycerol

apoB-100

cholesteryl esters

free (unesterified) cholesterol

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Clinical Significance

- Cholesterol and triglycerides, like many other essential components of the body, attract clinical attention when present in abnormal concentrations.

- Increased or decreased levels usually occur because of abnormalities in the synthesis, degradation, and transport of their associated lipoprotein particles.

- Increased or decreased plasma lipoproteins are named hyperlipoproteinemia & hypolipoproteinemia respectively.

What is Lipid Profile

- The lipid profile is a group of tests that are often ordered together to determine risk of coronary heart disease. It is a good indicators of whether someone is likely to have a heart attack or stroke caused by atherosclerois.

✔ The lipid profile typically includes:
- Total cholesterol
- High density lipoprotein cholesterol (HDL-C) good cholesterol
- Low density lipoprotein cholesterol (LDL-C) bad cholesterol
- Triglyceride
- Very low density lipoprotein cholesterol (VLDL-C)

Classification of Lipoproteins
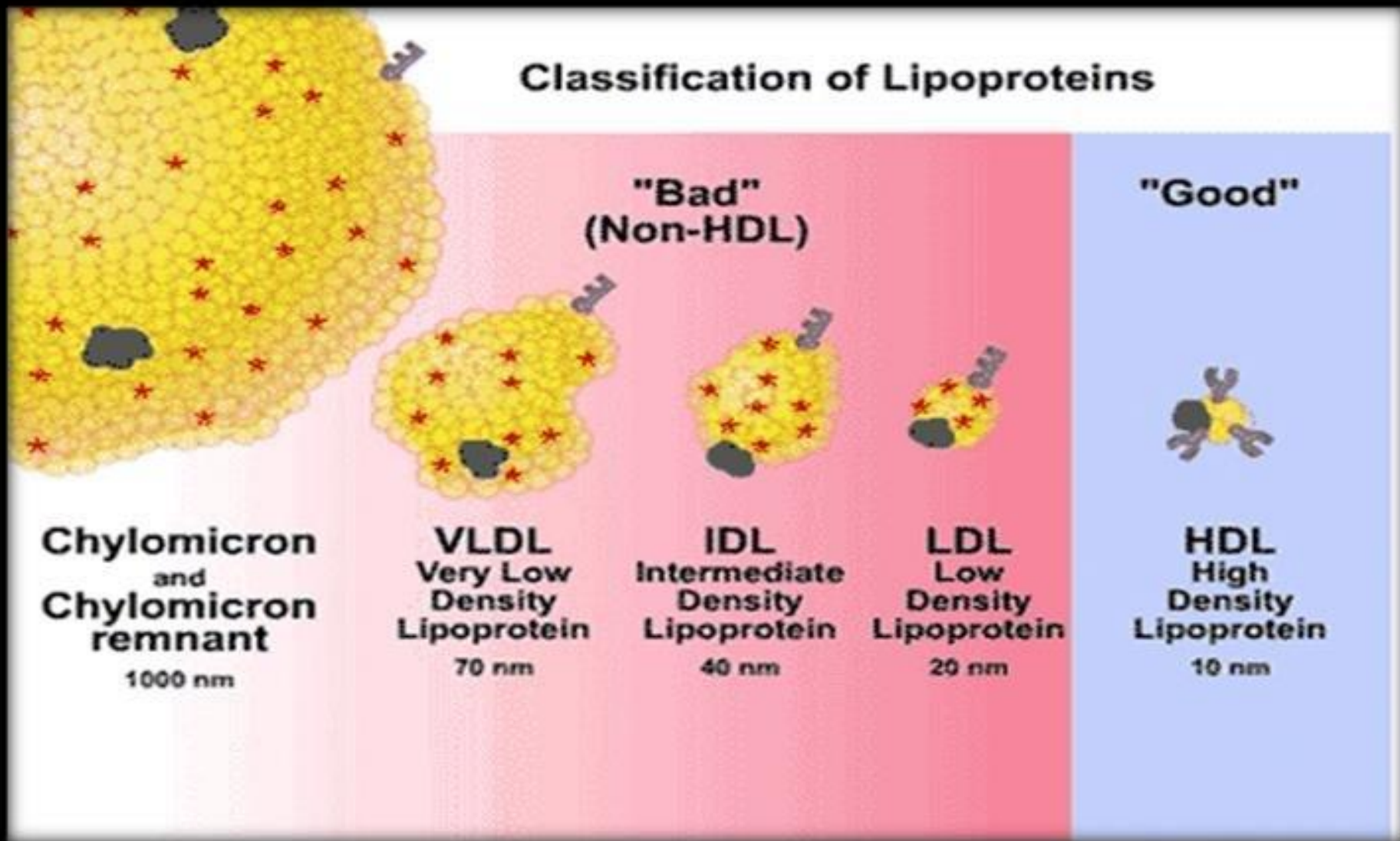
"Bad"
(Non-HDL)

"Good"

Chylomicron
and
**Chylomicron
remnant**
1000 nm

VLDL
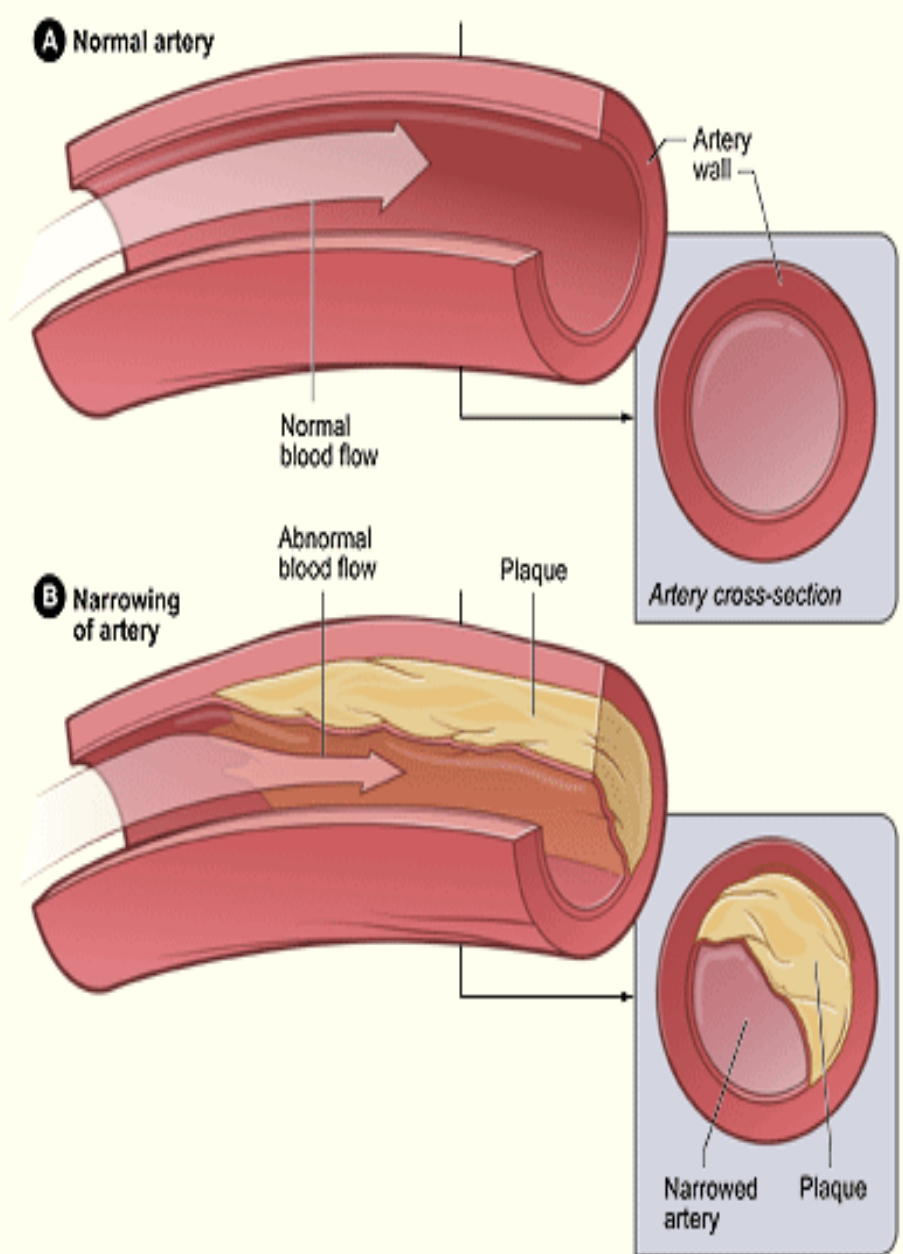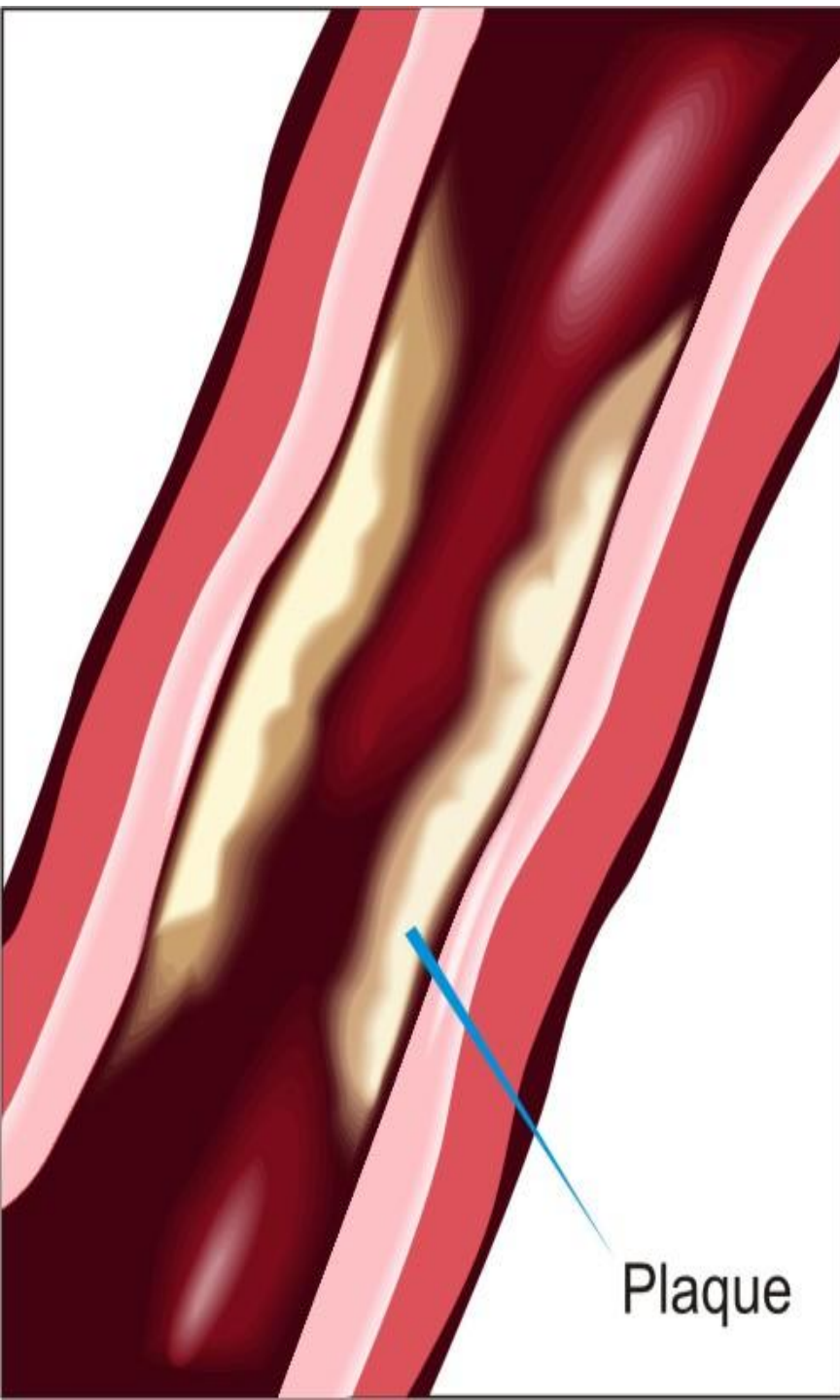Very Low
Density
Lipoprotein
70 nm

IDL
Intermediate
Density
Lipoprotein
40 nm

LDL
Low
Density
Lipoprotein
20 nm

HDL
High
Density
Lipoprotein
10 nm

Risk for coronary heart disease

- Cigarette smoking
- Age (male 45 years or older ,female 55 years or older)
- Low HDL cholesterol (less than 40 mg/dL)
- Hypertension (Blood Pressure of 140/90 or higher)
- Family history of premature heart disease (heart disease in a first degree male relative under age 55 or a first degree female relative under age 65)
- Diabetes.
- Note: High HDL (60 mg/dL or above) is considered a "negative risk factor" and its presence allows the removal of one risk factor from the total

Plaque

A Normal artery

Artery wall

Normal blood flow

Artery cross-section

B Narrowing of artery

Abnormal blood flow

Plaque

Narrowed artery

Plaque

Cholesterol particles

Artery

Buildup of cholesterol
in the lining of artery

Plaque forms
(atherosclerosis)

Normal range

Element	Optimal	Borderline	High risk
LDL C	<100	130–159	160+
HDL C	>60	35–45	<35
Triglycerides	<150	150–199	>200
Total Choles.	<200	200–239	>240

What abnormal result mean?

➢ In general, a total cholesterol value over 200 mg/dL may mean you have a greater risk for heart disease. High total cholesterol levels may be caused by:

- Biliary cirrhosis
- Familial hyperlipidemias
- High-fat diet
- Hypothyroidism
- Uncontrolled diabetes

➢ Low cholesterol levels may be caused by:

- Hyperthyroidism

- Liver disease

- Malabsorption

- Malnutrition

What causes high cholesterol?

- High cholesterol may be the result of an inherited disease or it may result from a diet high in saturated fats.

- For many people, it is caused by a combination of both a diet high in cholesterol, saturated fats, and an inherited tendency towards high cholesterol.

Management

- The first step is changing lifestyle.

- Diets low in cholesterol, saturated fatty acids

- Participating in moderate exercise.

- If low-fat diets and exercise are not adequate to lower LDL cholesterol to the target value, drug therapy would be the next step. LDL will be checked at regular intervals to assure that the drug is working.

Specimen

- Serum, Plasma (EDTA)

- Certain anticoagulants, such as fluoride, citrate, and o xalate, cause large shifts of water from the red blood cells to the plasma, which result in the dilution of plas ma components.

- Fasting sample (from 12 to 16 h) is essential for trigly ceride analysis

- **Storage and stability**

Samples	Temperature		
	20-25 °C	4-8 °C	- 20 °C
Serum/plasma	2 days	7 days	at least 1 year

Cholesterol

- Cholesterol is a sterol compound that is found in all animal tissues

- Serves many important physiological functions including synthesis of bile acids, steroid hormones, and cell membranes.

- Cholesterol also appears to be involved in atherosclerosis; thus cholesterol measurement is one of the most common laboratory tests used today.

Specimen

- Serum, Plasma (EDTA, Heparin)
- Certain anticoagulants, such as fluoride, citrate, and oxalate, cause large shifts of water from the red blood cells to the plasma, which result in the dilution of plasma components.

- **Storage and Stability**
  - ➢ 7 days at 20 – 25 °C
  - ➢7 days at 4 – 8 °C
  - ➢3 months at -20 °C

HDL

- HDL is a fraction of plasma lipoproteins
- It is composed of 50% protein, 25% phospholipid, 20% cholesterol, and 5% triglycerides

- Evidence suggests that high-density lipoprotein (HDL) cholesterol is cardioprotective.

Precipitation Method

- In the plasma, cholesterol is transported by three lipoproteins: high density lipoprotein, low density lipoprotein, and very low density lipoprotein

- HDL lipoproteins are assayed, after precipitation of LDL and VLDL lipoproteins with polyethylene glycol.

- HDL is left in the supernatant solution for cholesterol quantitation.

Any Questions???