PLEASE FILL OUT OUR SURVEY IF YOU ARE ATTENDING 6+ TALKS

https://ubc.ca1.qualtrics.com/jfe/form/SV_bQS3qcdSRtNZPeu

MINI MED SCHOOL

Talk 1: What do your test results mean?

JULIA DE PIERI, BSCHK, UBC MD CLASS OF 2024

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Medicine

University of Victoria

let's talk science

TERRITORIAL ACKNOWLEDGEMENT

I would like to begin by acknowledging that I am joining you from the unceded territory of the Coast Salish Peoples, including the territories of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), Stó:lō and Səlílwətaʔ/Selilwitulh (Tsleil- Waututh) Nations.

I would also like to acknowledge the Lekwungen peoples on whose traditional territory the University of Victoria stands and the Songhees, Esquimalt and Wsanec peoples whose historical relationships with the land continue to this day.

DISCLOSURE

I am a medical student. These talks do not constitute or substitute for medical advice.

Many of the tests I will mention can be ordered for a multitude of reasons. I will try to mention the ones that are most common and relevant.

Please consult with your healthcare provider if you have questions about your specific health situation.

FUTURE TALKS

- Sunday Nov 28: The role of genetic testing
- Sunday Dec 5: Diabetes

- Sunday Jan 16: Common medications and how they work
- Sunday Jan 23: Popular diets
- Sunday Jan 30: The biology of stress

- Sunday Feb 6: Stress management
- Sunday Feb 13: How to avoid a drug interaction
- Sunday Feb 20: Supplements

We hope to see you there!

TOPICS

- Complete Blood Count (CBC)
- Electrolytes
- Lipids
- Glucose
- Kidneys

- Heart
- Liver
- Hormones
- Coagulation

Which of the following tests assess kidney function? Select all that apply.

A. Fasting Plasma Glucose
B. Creatinine
C. Complete Blood Count
D. Glomerular Filtration Rate (GFR)

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Which electrolyte imbalance can lead to a life-threatening emergency?

A. Sodium
B. Potassium
C. Chloride
D. Bicarbonate

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If you walk into the ER and say you have chest pain, which of the following tests will be ordered to rule out a heart attack?

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B. Albumin
C. Troponin
D. Thyroid-stimulating hormone (TSH)

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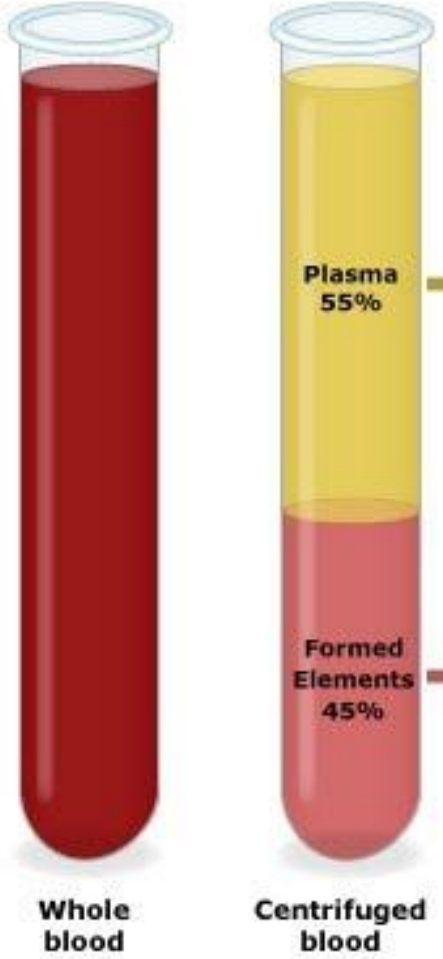
COMPLETE BLOOD COUNT (CBC)

- Red blood cells (RBC)
- Hematocrit
- Hemoglobin
- White blood cells (WBC)
- Platelets

Composition of Blood



Water 91%

Proteins 7%

Albumins | Globulins | Fibrinogen

Other solutes 2%

Electrolytes | Nutrients | Gases | Wastes

Vitamins | Regulatory substances

Red Blood Cells (millions)

Platelets (hundreds of thousands)

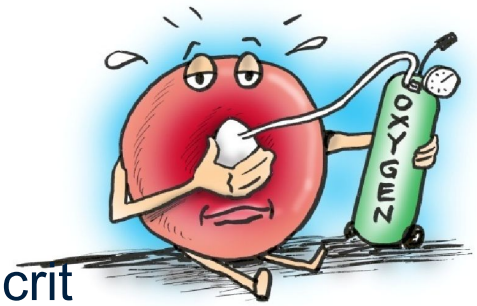
White Blood Cells (thousands)

Neutrophils 70%
Lymphocytes 20%
Monocytes 5%

Eosinophils 4%
Basophils 1%

Component	Your Value	Standard Range	Units	Flag
White Blood Cell Count	5.4	4.0 - 11.0	K/uL	
Red Blood Cell Count	5.20	4.40 - 6.00	M/uL	
Hemoglobin	16.0	13.5 - 18.0	g/dL	
Hematocrit	47.2	40.0 - 52.0	%	
MCV	91	80 - 100	fL	
MCH	30.8	27.0 - 33.0	pg	
MCHC	33.9	31.0 - 36.0	g/dL	
RDW	12.7	<16.4 -	%	
Platelet Count	149	150 - 400	K/uL	L
Differential Type	Automated			
Abs. Neutrophil	3.1	2.0 - 8.0	K/uL	
Abs. Lymphocyte	1.2	1.0 - 5.1	K/uL	
Abs. Monocyte	0.7	0.0 - 0.8	K/uL	
Abs. Eosinophil	0.4	0.0 - 0.5	K/uL	
Abs. Basophil	0.0	0.0 - 0.2	K/uL	

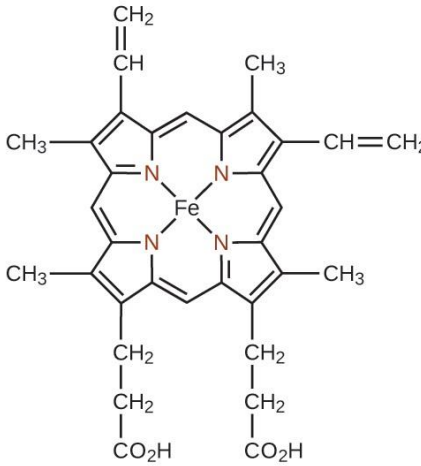
RED BLOOD CELLS (RBC)



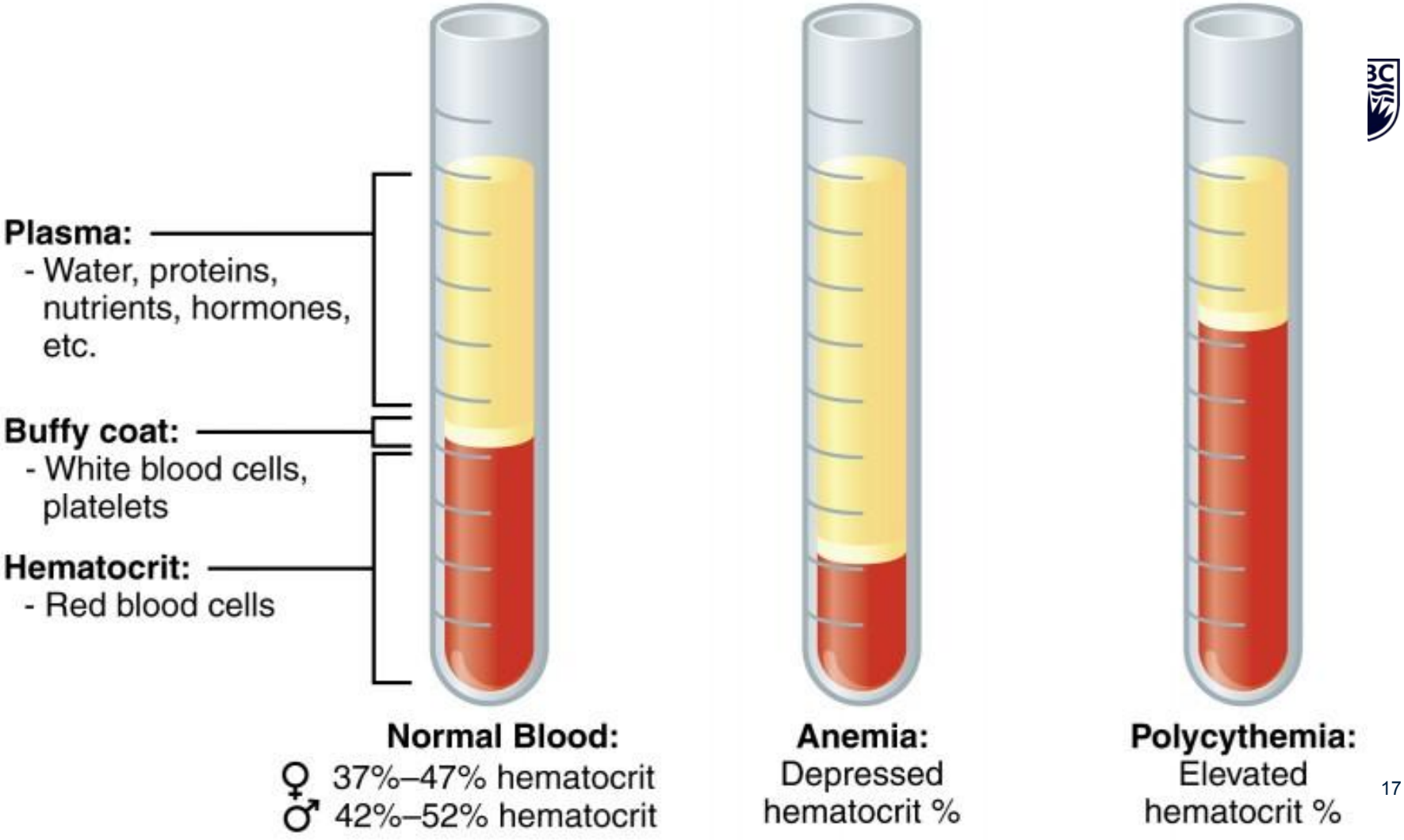
- **Function:** Carry oxygen via hemoglobin
- CBC measures number, hemoglobin and hematocrit
  - Hematocrit = proportion of RBCs to other components

- Too few RBCs or not enough hemoglobin ANEMIA
  - Use mean corpuscular volume (MCV) to distinguish cause

- Too many RBCs POLYCYTHEMIA



Hemoglobin

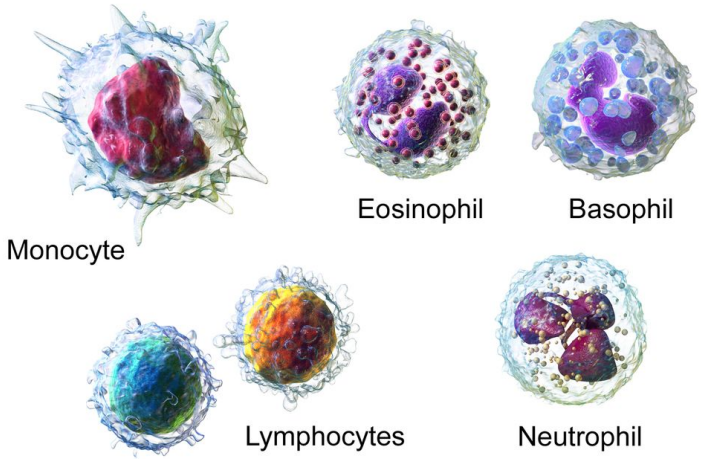

Plasma:
- Water, proteins, nutrients, hormones, etc.
Buffy coat:
- White blood cells, platelets
Hematocrit:
- Red blood cells
Normal Blood:
♀ 37%–47% hematocrit
♂ 42%–52% hematocrit
Anemia:
Depressed hematocrit %
Polycythemia:
Elevated hematocrit %

WHITE BLOOD CELLS (WBC)

- **Function:** Fight infection and disease
- Measures overall number, and potentially the breakdown of each type of WBC (differential)

- Too low infection, autoimmune, malignancy, medication etc.

- Too high infection, inflammation, malignancy



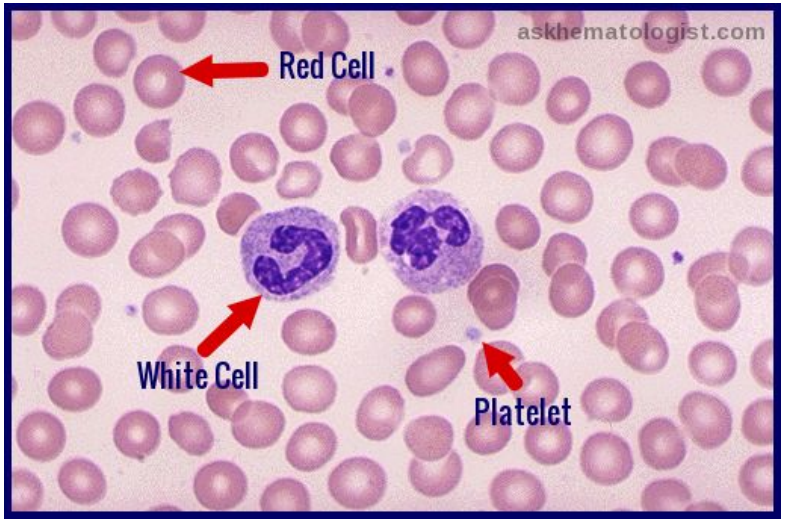
White Blood Cells

PLATELETS

- **Function:** Blood clotting
- Measures overall number

- Too low (thrombocytopenia) bleeding disorder, malignancy, medications

- Too high (thrombocytosis) acute bleeding, anemia, infection, inflammation, malignancy??



ELECTROLYTES

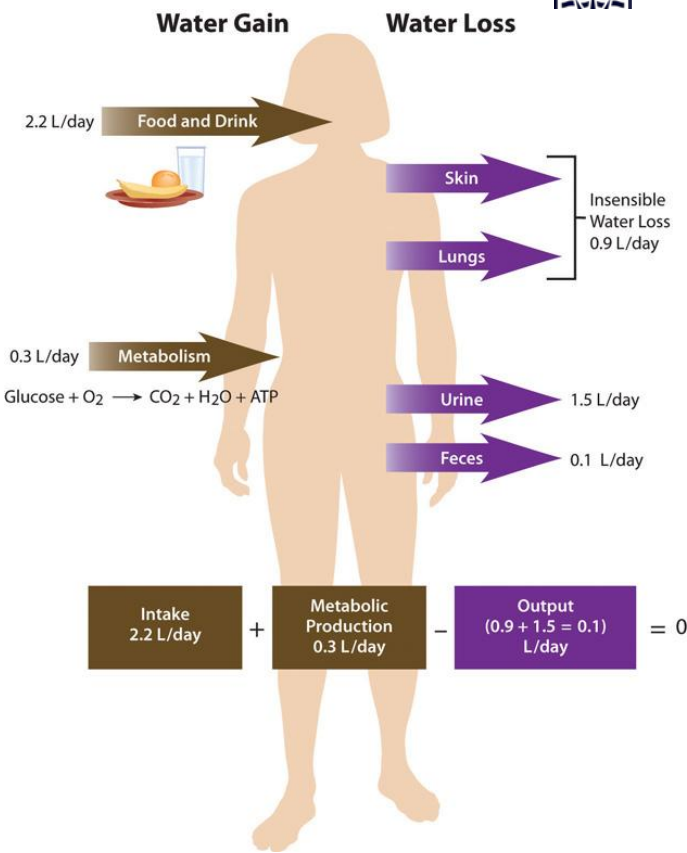
- Sodium (Na+)
- Potassium (K+)
- Chloride (Cl-)
- Bicarbonate (HCO3 -)

SODIUM (NA+)

- Measures concentration of sodium ions
- Normal range: 135-145 mEq/L

- Too low (hyponatremia) medications, fluid accumulation, severe vomiting/diarrhea, overhydration

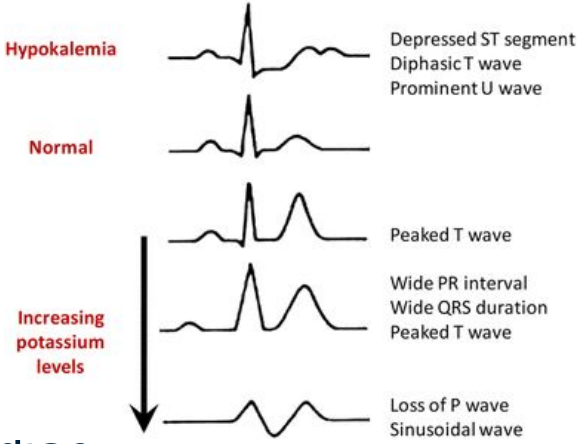
- Too high (hypernatremia) dehydration, severe diarrhea/vomiting, burns, kidney issues, diabetes insipidus



POTASSIUM (K+)

- Measures concentration of potassium ions
- Normal range: 3.5-5.0 mEq/L

- Too low (hypokalemia) □ vomiting/diarrhea, medications, hyperaldosteronism



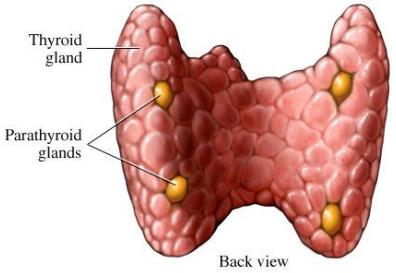
- Too high (hyperkalemia) □ kidney disorders, medications,
  - Severe consequences: arrhythmias and cardiac arrest

CALCIUM (CA 2+)

- Measures concentration of calcium ions in blood

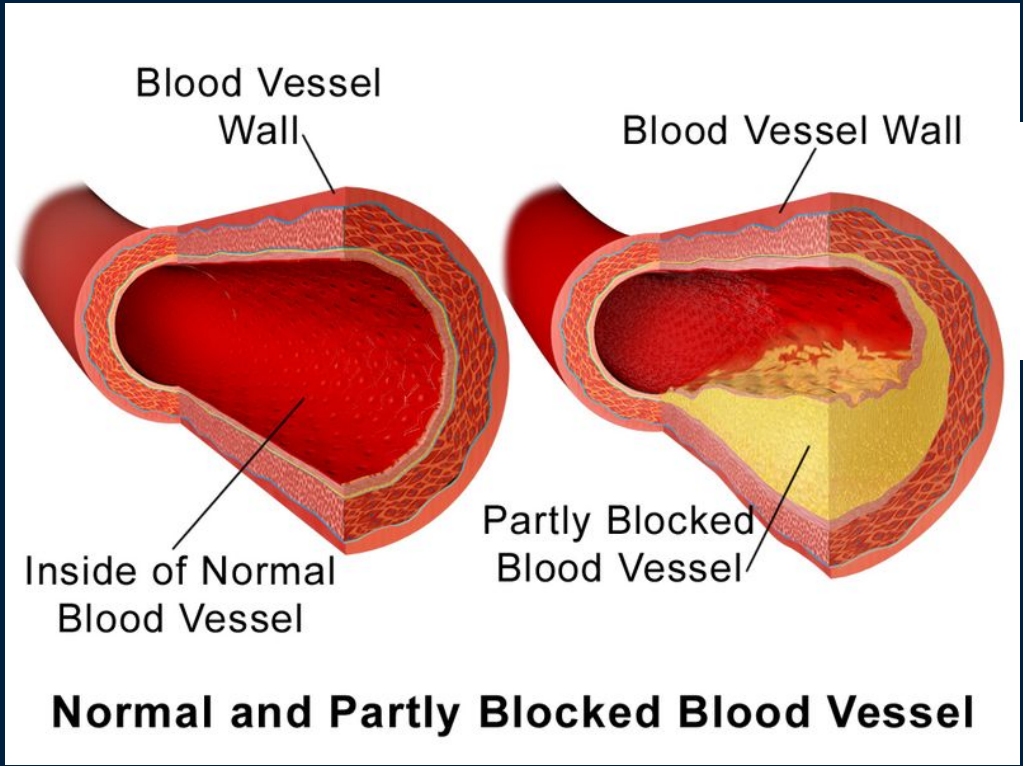
- Too low (hypocalcemia) liver disease, malnutrition, vitamin D deficiency, renal failure, medications etc.
    - Consequences: weakened bones, muscle cramps, seizures

- Too high (hypercalcemia) hyperparathyroidism, malignancy, medications, overuse of calcium supplements!
    - Consequences: kidney stones, pancreatitis



LIPIDS

- Triglycerides
- Total Cholesterol
- LDL cholesterol
- HDL cholesterol



Looking for: Cardiovascular disease risk

TRIGLYCERIDES

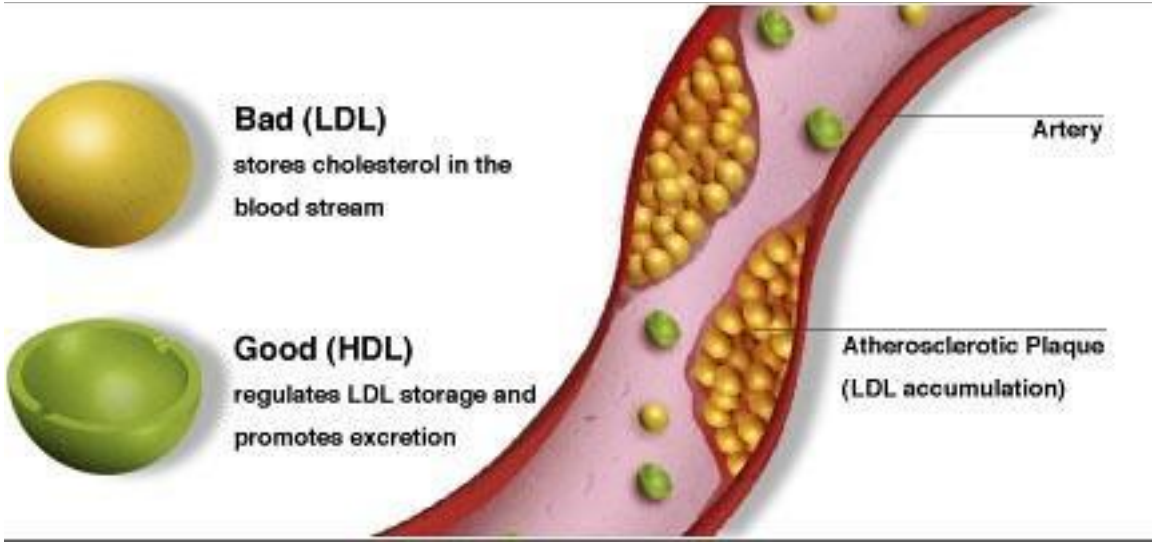
- Measures amount of triglycerides in your blood

- If too high increased risk of heart attack and stroke, pancreatitis

- Possible ways to lower triglycerides: exercise, diet changes, weight loss, medications

CHOLESTEROL

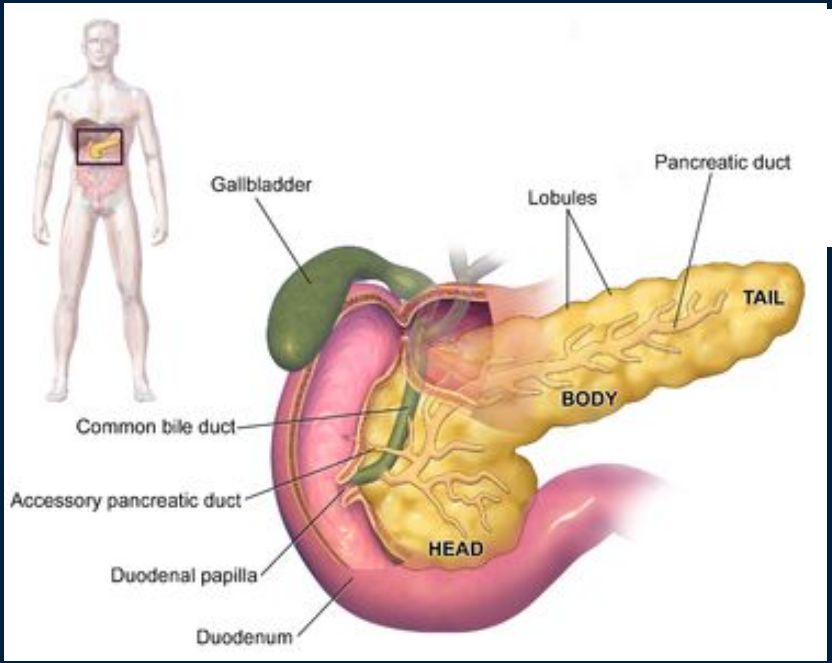
- Measures concentration of total cholesterol, LDL-C and HDL-C
  - LDL-C = bad cholesterol
  - HDL-C = good cholesterol

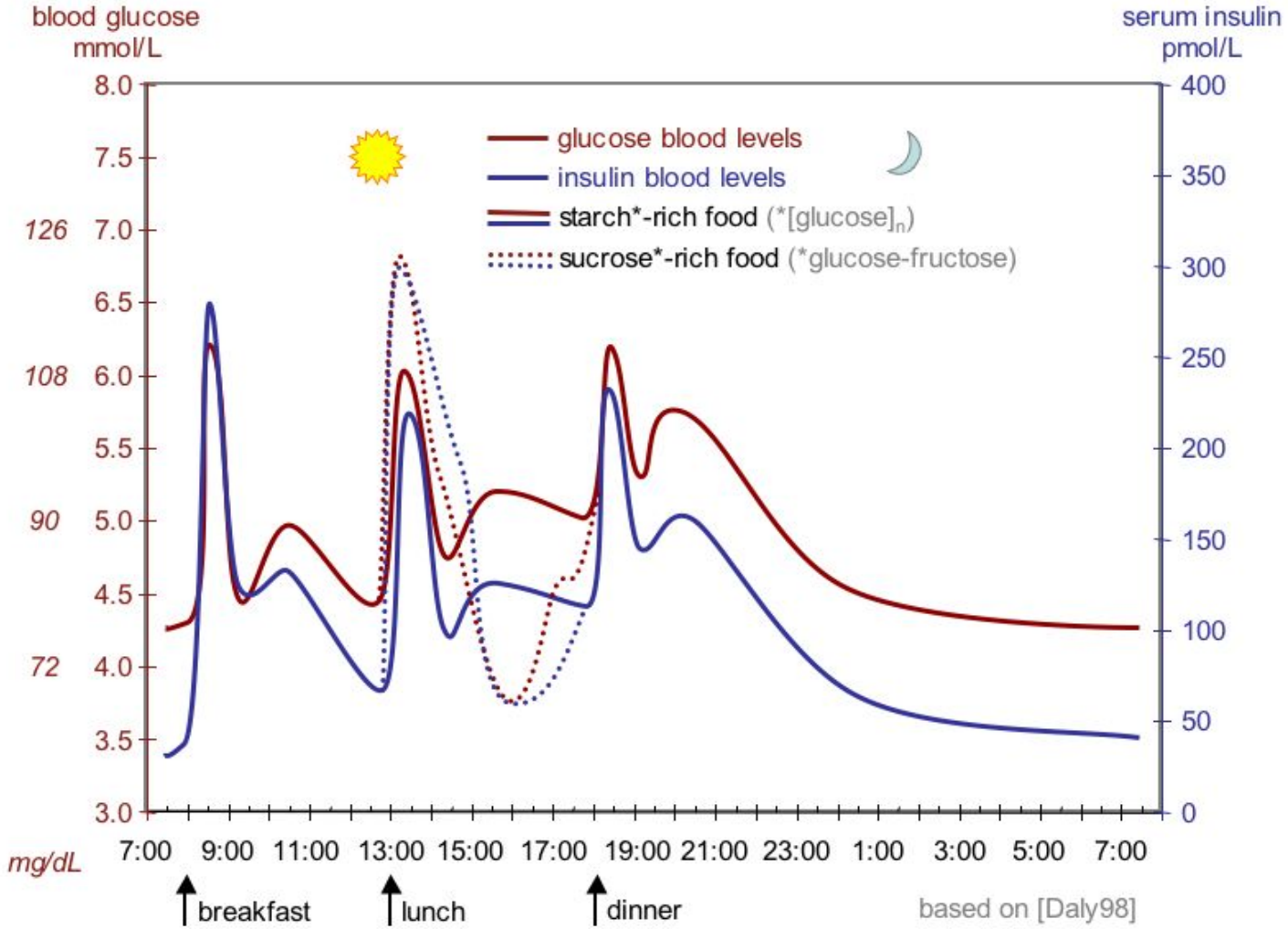


GLUCOSE

- Fasting Plasma Glucose
- Hemoglobin A1C

Looking for: Diabetes Mellitus




blood glucose
mmol/L
serum insulin
pmol/L
8.0
7.5
126
7.0
6.5
108
6.0
5.5
90
5.0
4.5
72
4.0
3.5
3.0
400
350
300
250
200
150
100
50
0
glucose blood levels
insulin blood levels
starch*-rich food (*[glucose]n)
sucrose*-rich food (*glucose-fructose)
mg/dL
7:00
9:00
11:00
13:00
15:00
17:00
19:00
21:00
23:00
1:00
3:00
5:00
7:00
breakfast
lunch
dinner
based on [Daly98]

FASTING PLASMA GLUCOSE

- Measures concentration of glucose in the blood at least eight hours after a meal.

- Recommended every three years if >40 years OR every 6-12 months if at high risk (family history, ethnicity etc.)

Normal	**<5.6 mmol/L**
At risk	5.6-6.0 mmol/L
Prediabietes	6.1-6.9 mmol/L
Diabetes	>7 mmol/L

HEMOGLOBIN A1C

- Indicates average blood sugar control over the past three months

- Recommended every three years if >40 years OR every 6-12 months if at high risk

Normal	**<5.5%**
At risk	5.5-5.9%
Prediabietes	6.0-6.4%
Diabetes	>6.5%

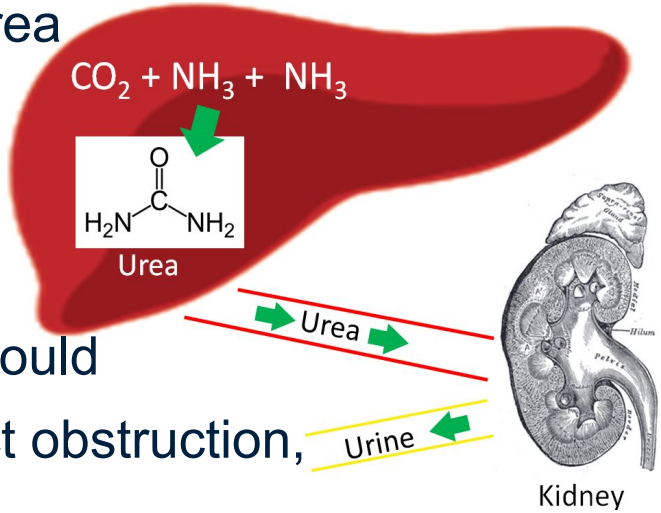
KIDNEYS

- Blood Urea Nitrogen (BUN)
- Creatinine
- Glomerular Filtration Rate (GFR)

Assess: Kidney Function

BLOOD UREA NITROGEN (BUN)

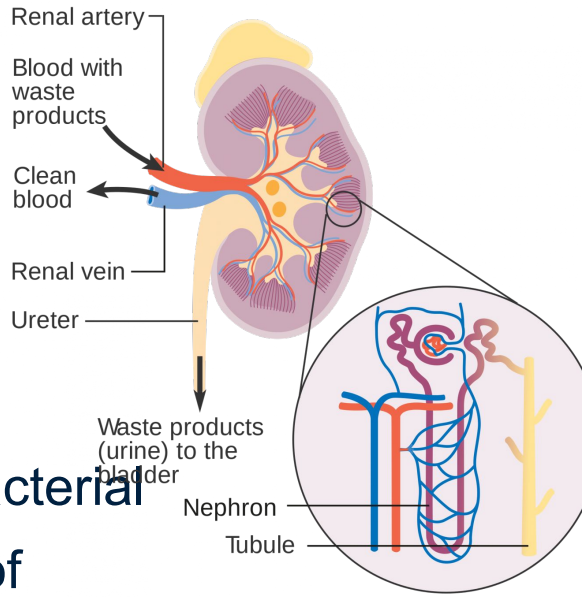
- Measures amount of urea nitrogen in your blood.
  - Proteins are broken down in the liver produce nitrogen
  - Nitrogen combines with other elements urea
  - Kidneys filter and remove urea via urine.



- Too high kidneys aren't removing what they should
  - ie. Kidney disease, dehydration, urinary tract obstruction, heart failure/attack, certain medications
- Too low liver disease, low protein diet, overhydration

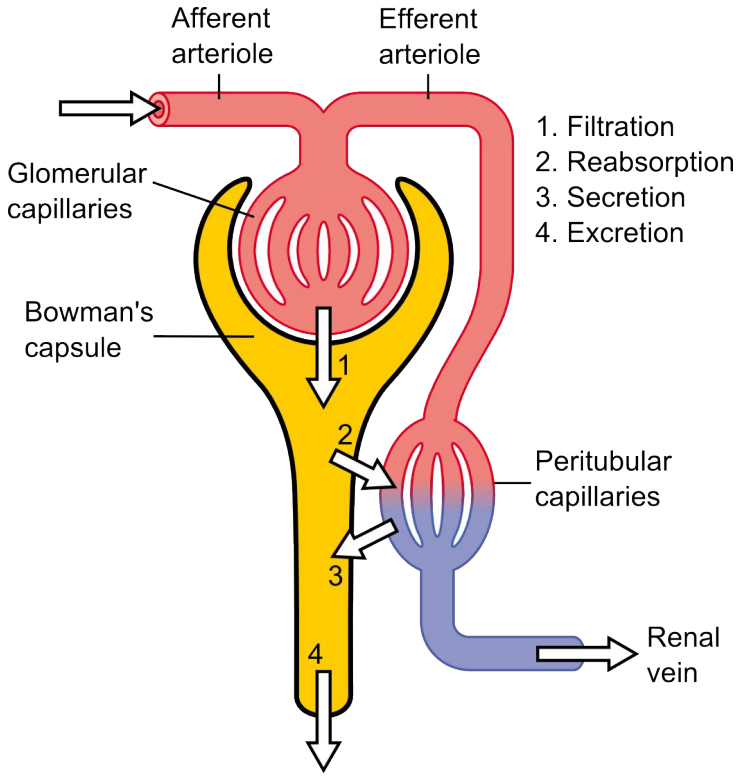
CREATININE

- Measures concentration of creatinine in the blood (or urine).
  - Helpful for estimating glomerular filtration rate
- It is a waste product produced by skeletal muscle
  - Varies with age, sex, muscle mass
- Too high **kidney disease**, autoimmune causes, bacterial infection of the kidneys, heart failure, complications of diabetes (diabetic nephropathy)



GLOMERULAR FILTRATION RATE (GFR)

- Estimate of the filtration rate through the kidneys
  - VERY IMPORTANT FOR KIDNEY FUNCTION!
- Blood arrives at the glomerulus and is filtered □ waste products go into the tubules to be reabsorbed or excreted □ “cleaned” blood goes back to body
  - If body can’t do this □ dialysis



Excretion = Filtration – Reabsorption + Secretion

BREAK TIME FOR 10 MIN!

FILL OUT OUR RESEARCH SURVEY IF YOU HAVEN'T ALREADY!

HTTPS://UBC.CA1.QUALTRICS.COM/JFE/FORM/SV_BQS3QCDSRTNZPEU

TOPICS

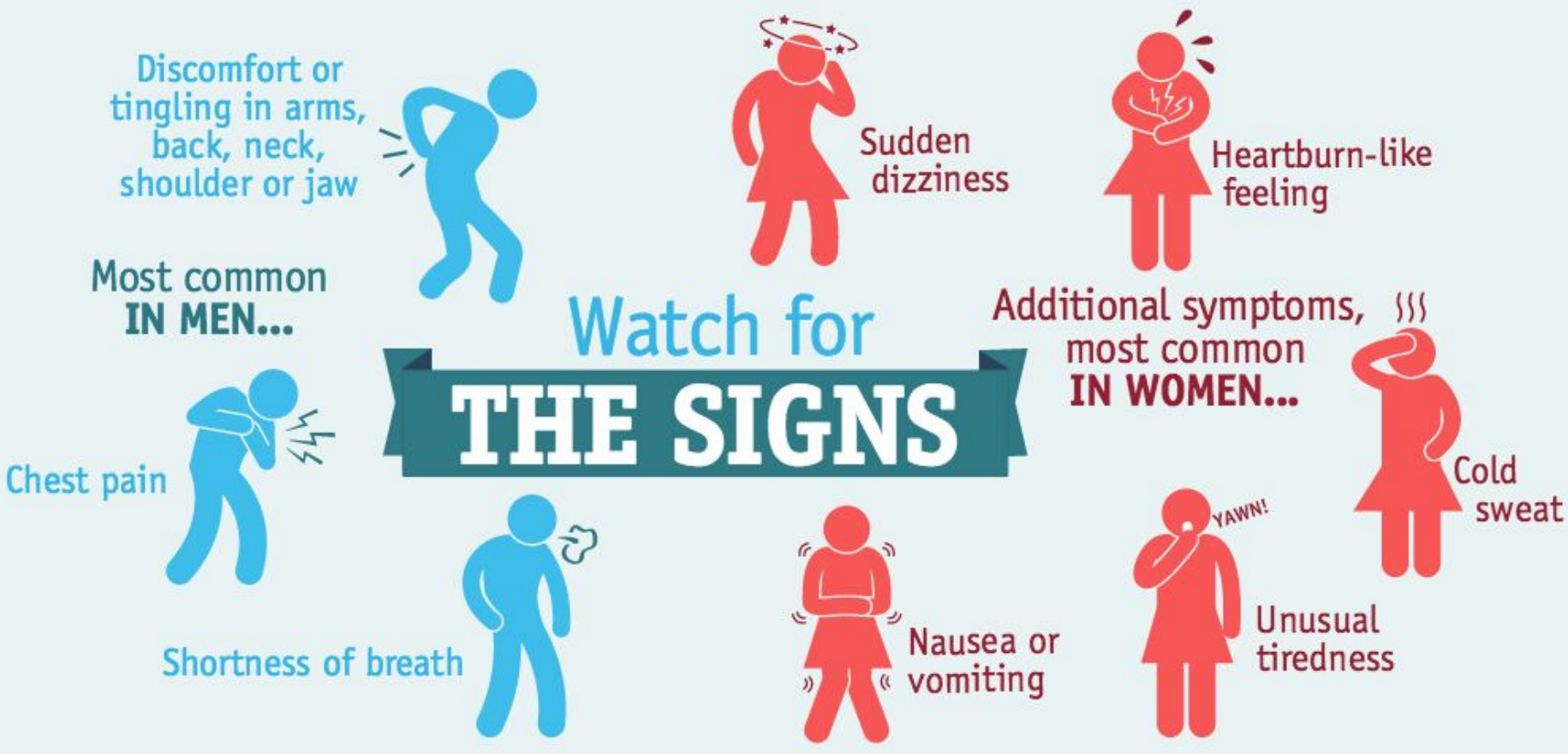
- ~~Complete Blood Count (CBC)~~
- ~~Electrolytes~~
- ~~Lipids~~
- ~~Glucose~~
- ~~Kidneys~~

- Heart
- Liver
- Hormones
- Coagulation

HEART

- Troponin
- D-Dimer

Looking for: Heart Damage


Watch for
THE SIGNS
Most common
IN MEN...
Discomfort or tingling in arms, back, neck, shoulder or jaw
Chest pain
Shortness of breath
Sudden dizziness
Heartburn-like feeling
Additional symptoms, most common
IN WOMEN...
Cold sweat
YAWN!
Unusual tiredness
Nausea or vomiting

TROPONIN

- Measures the levels of troponin in the blood
  - Type of protein found in heart muscle □ usu
    not present in the blood

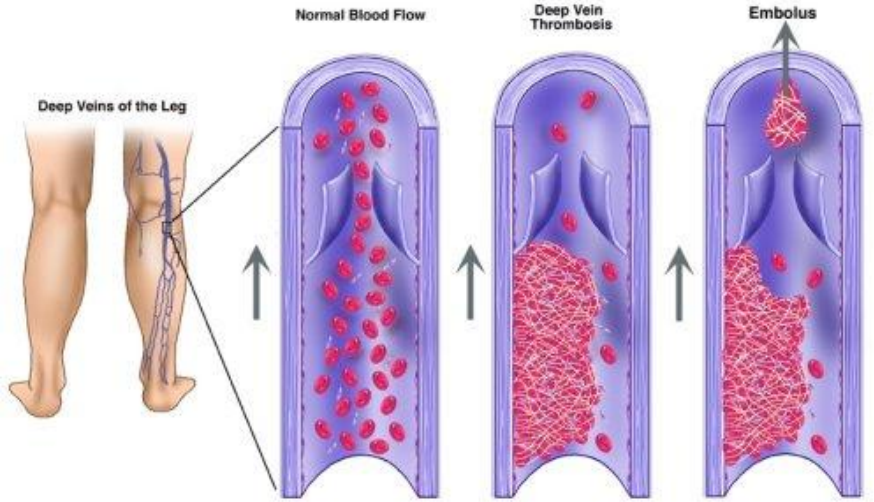
- Potential causes: **heart attack,** angina, heart failure, kidney disease, blood clot in the lungs (pulmonary embolism)

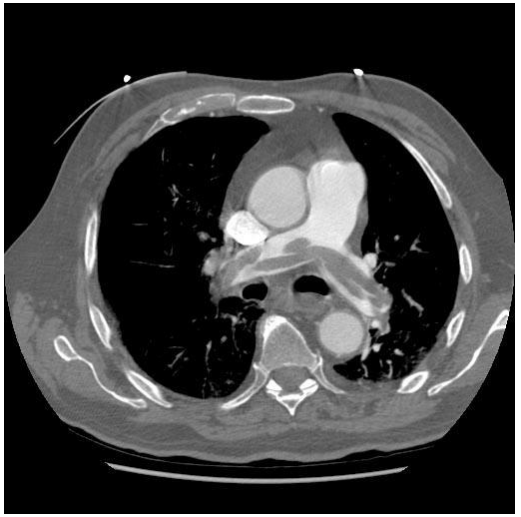
- Typically measured multiple times in one visit

D-DIMER

- Measures the levels D-Dimer in the blood
  - D-Dimer is produced when a blood clot starts to dissolve evidence of clotting activity

- <u>Potential causes</u>: deep vein thrombosis (DVT), pulmonary embolism (PE), stroke

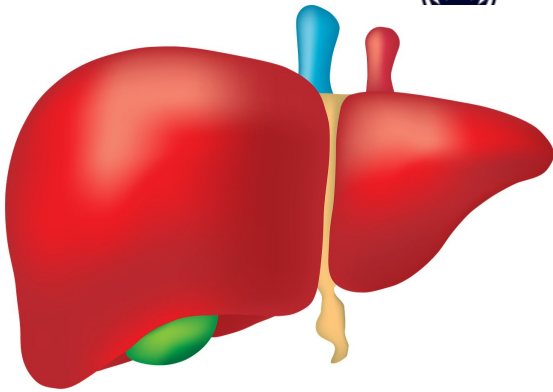




LIVER

- Albumin
- Bilirubin
- Liver enzymes (ALP, ALT/AST, GTT
- Ferritin

ALBUMIN



- Measures the levels of albumin – a plasma protein
  - Function: carrier in the blood, fluid retention
  - Produced by the liver

- Too low (hypoalbuminemia) chronic liver disorders (cirrhosis, hepatocellular carcinoma), systemic inflammation, kidney disease, malnutrition

- Too high dehydration

BILIRUBIN

- Measures the levels of bilirubin in the blood
    - Produced by liver as result of red blood cell breakdown

- This is what turns you yellow (jaundice)
- Too high: liver disease (hepatitis), blood disorders that increase red blood cell breakdown, blockage of bile duct

LIVER ENZYMES

- Aspartate aminotransferase (AST)
- Alanine aminotransferase (ALT)
- Alkaline Phosphatase (ALP)
- Gamma-glutamyl transferase (GGT)
- Lactate Dehydrogenase (LD)

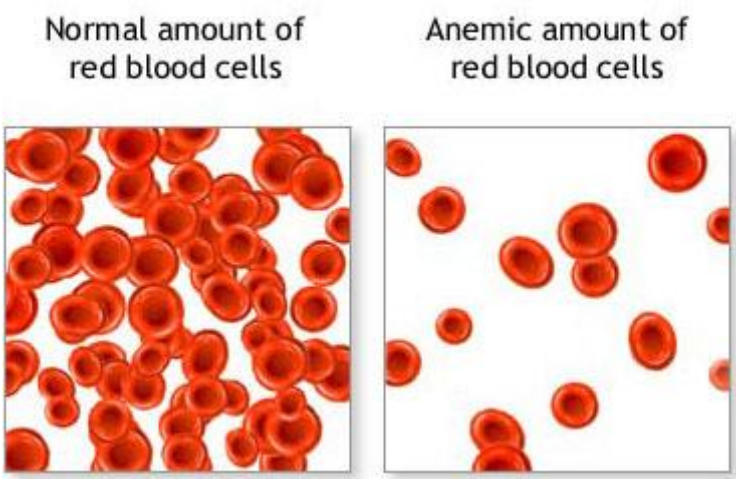
- Relative levels of each inform the cause important to interpret them as a group

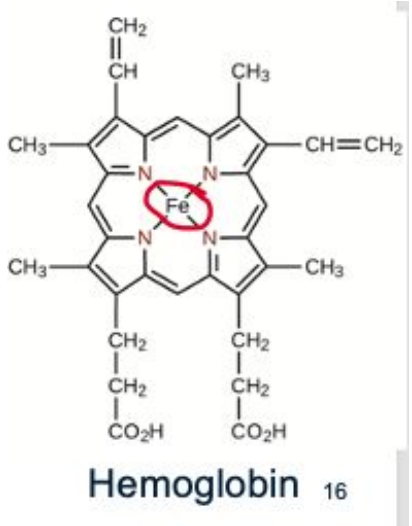
FERRITIN

- Measures the levels of ferritin in the blood
  - Function: binds/stores iron needed for red blood cell formation

- Too low **anemia (**bleeding, iron deficiency)

- Too high alcohol abuse, infection, liver disease

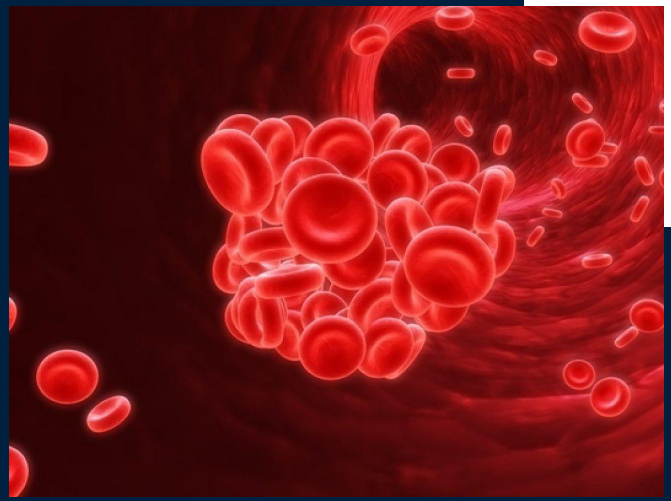




Hemoglobin 16

COAGULATION

- Prothrombin Time (PT/INR)
- Partial Thromboplastin Time (PTT)



PROTHROMBIN TIME (PT/INR)

- Measures the extrinsic and common clotting pathway

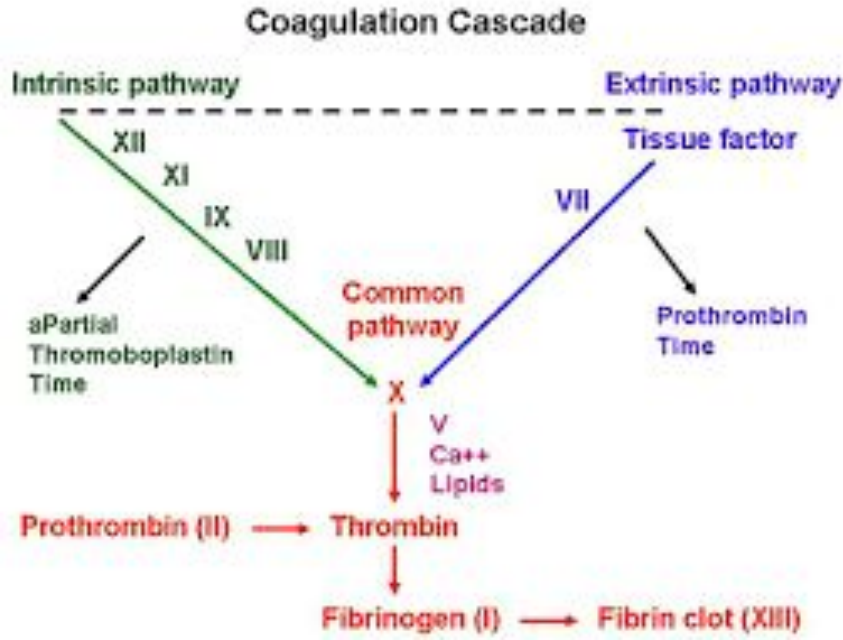
- INR (international normalized ratio) used for monitoring warfarin (blood thinner)

- Too high bleeding disorder, vit K deficiency, cirrhosis, warfarin (expected)

PARTIAL THROMBOPLASTIN TIME (PTT)

- Measures the intrinsic and common clotting pathway

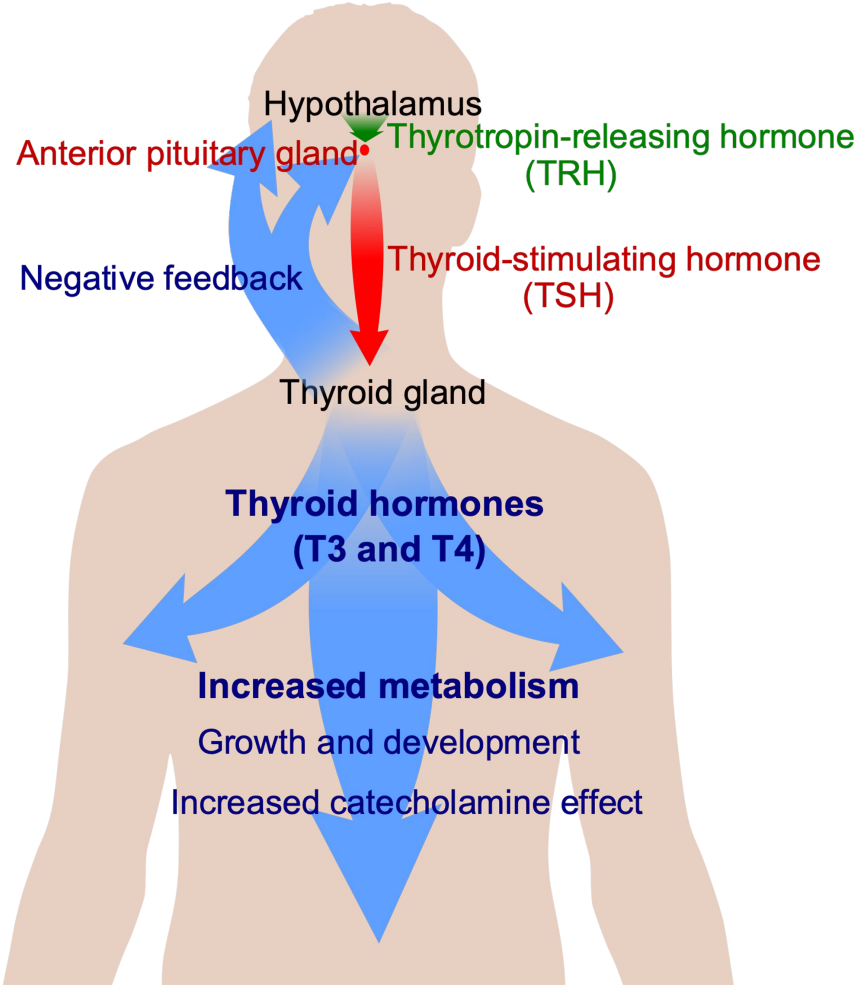
- Too high bleeding disorders (hemophilia, von Willebrand disease), vitamin K deficiency, lupus



HORMONES

- Thyroid (TSH, T3/T4)
- Prostate Specific Antigen (PSA)

Thyroid system



THYROID STIMULATING HORMONE (TSH)

- Measures concentration of thyroid stimulating hormone

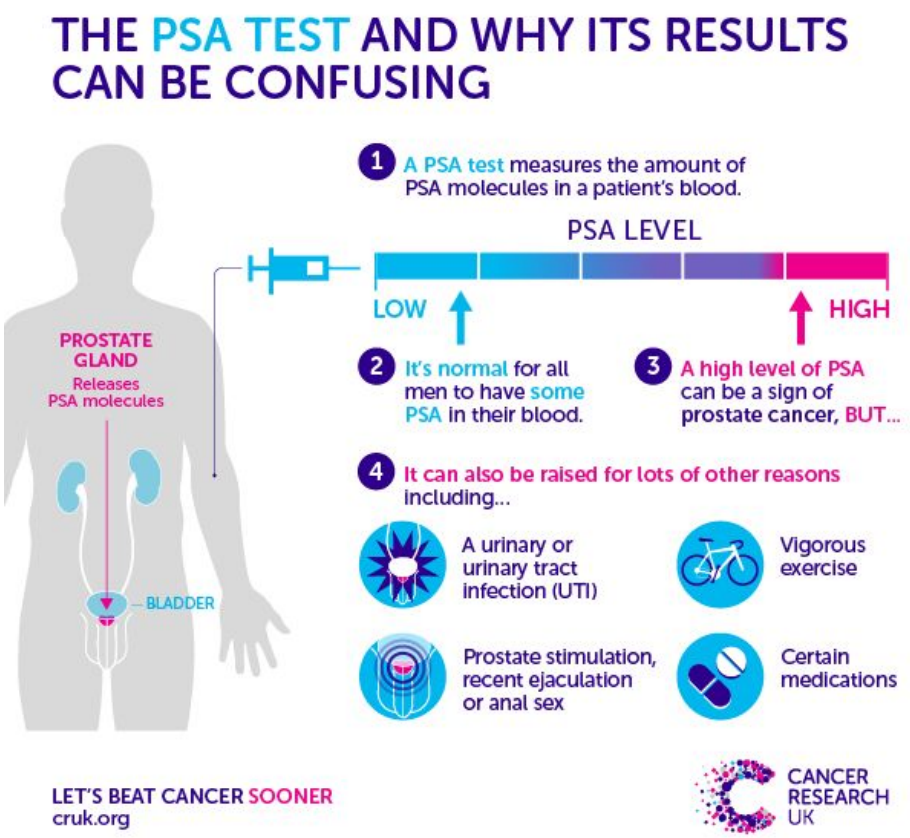
- Low TSH hyperthyroid
  - Ie. Grave's disease, thyroid nodule, thyroiditis

- High TSH hypothyroid
  - Ie. Hashimoto's, thyroid surgery, medications

- Need T3/4 to confirm, even if TSH is normal

PROSTATE SPECIFIC ANTIGEN (PSA)

- Measures levels of prostate specific antigen (PSA)
- Elevated levels may indicate prostate cancer (or may not!)



HELPFUL RESOURCES

- Your healthcare provider or pharmacist!

- Health Link BC or 811
- Health Gateway

- Lifelabs results are available online at MyCareCompass!

- MedScape
- WebMD, Mayo Clinic, Cleveland Clinic etc.

FUTURE TALKS

- Sunday Nov 28: The role of genetic testing
- Sunday Dec 5: Diabetes

- Sunday Jan 16: Common medications and how they work
- Sunday Jan 23: Popular diets
- Sunday Jan 30: The biology of stress

- Sunday Feb 6: Stress management
- Sunday Feb 13: How to avoid a drug interaction
- Sunday Feb 20: Supplements

We hope to see you there!

THE UNIVERSITY OF BRITISH COLUMBIA

Thank you!

Any questions?