Lab Analysis

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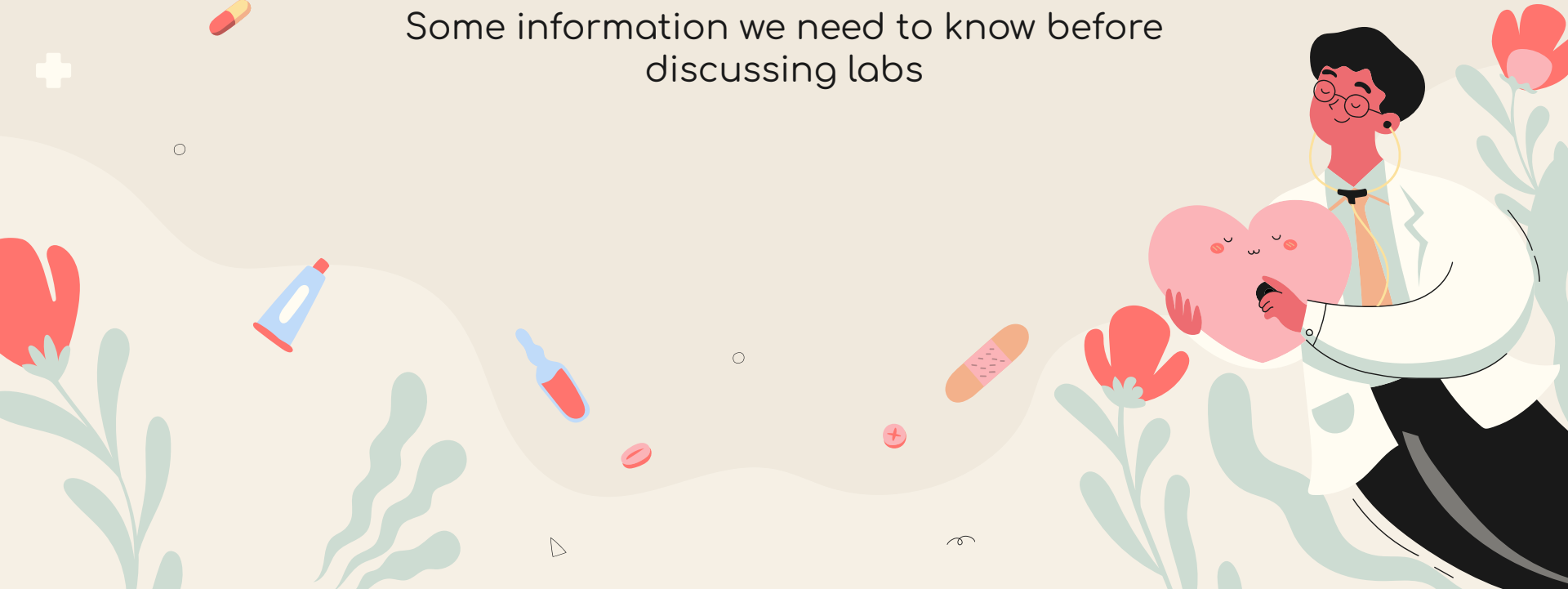
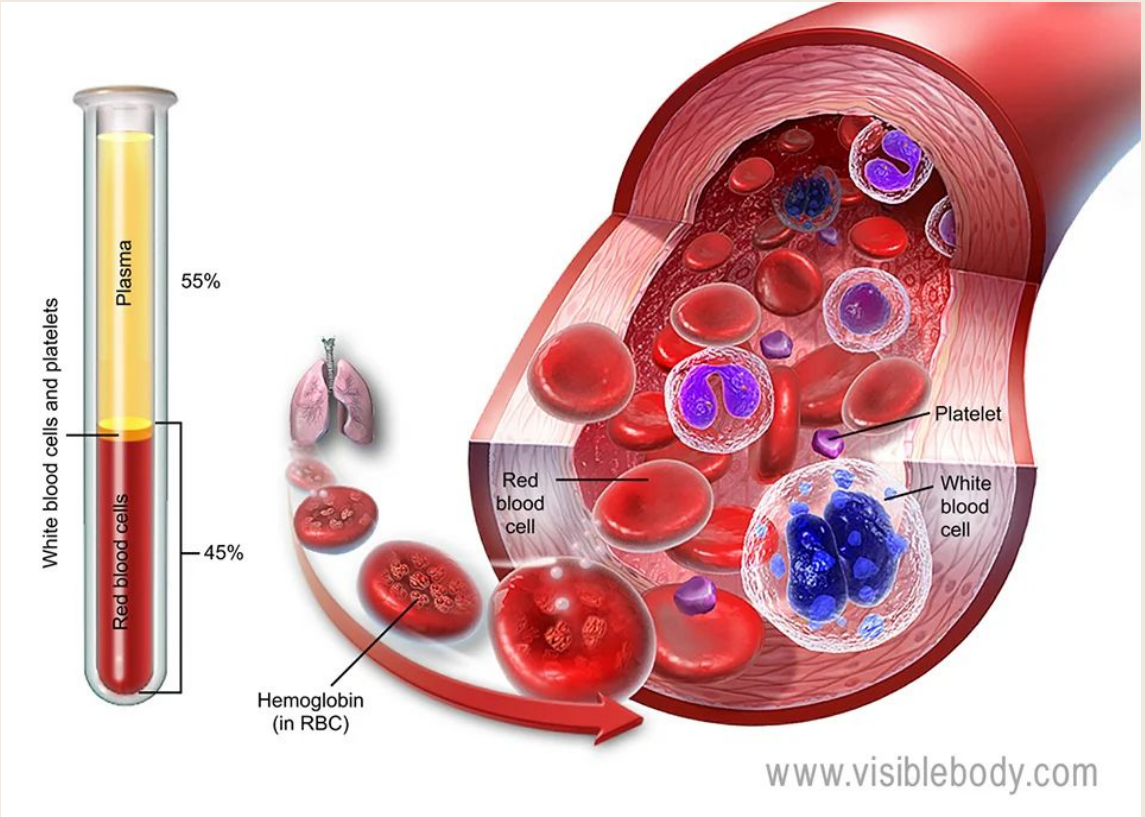
INTRODUCTION

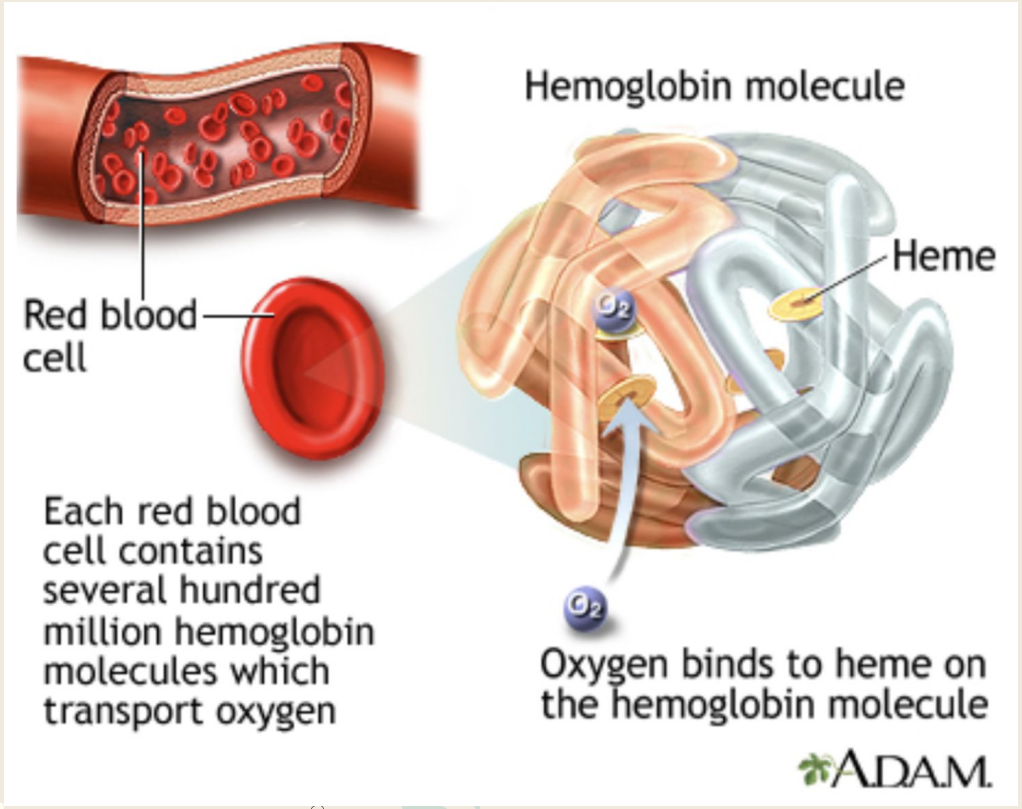
Some information we need to know before discussing labs



What is blood made of?



Red Blood Cells



Source: Mount Sinai

Anemia: Not having enough healthy red blood cells to deliver oxygen

Macrocytic

Large red blood cells that lack nutrients to function normally. Often due to B12 and/or B9 deficiency

Normocytic

When there's fewer red blood cells than normal. Can be due to heavy blood loss, decreased red blood cell production, or increased breakdown of red blood cells

Microcytic

Small red blood cells. Most often due to low iron stores.

01 CBC with Differential/Platelets

OUR CENTER

What is a CBC w/differential/platelets?

- CBC stands for complete blood count
- Gives insight into the components of blood
- “With differential” includes the % of various white blood cells and immature red blood cells
    - White blood cells are the cells of our immune system
- Look at platelets to see how our blood clots

Hemoglobin & Hematocrit

Hb

Hemoglobin

Measures the concentration of a protein that carries oxygen from lungs to rest of body. If low, can indicate anemia

Hct

Hematocrit

Measures average size of red blood cells.

- Too low: Microcytic anemia
- Too high: Macrocytic anemia

	Hemoglobin	Hematocrit
Men	14 - 17.5 gm/dL	40-54%
Women	12.3 - 15.3 gm/dL	36 - 48%

02

Glucose, Hemoglobin, & Insulin

Glucose

- Glucose:
  - How much sugar is in your blood

Result	Fasting Plasma Glucose (FPG)
Normal	less than 100 mg/dL
Prediabetes	100 mg/dl to 125 mg/dL
Diabetes	126 mg/dL or higher

Source: American Diabetes Association

Hemoglobin (HbA1c)

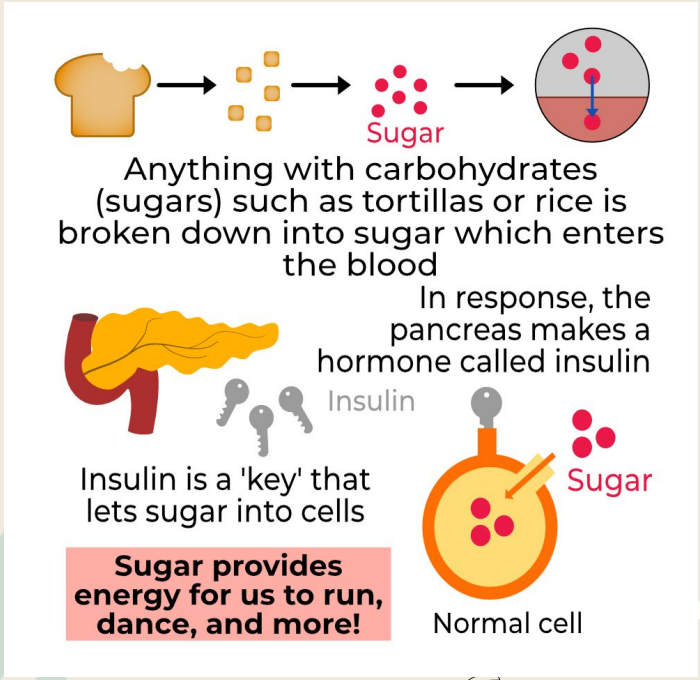
- Hemoglobin A1c:
  - Measures average amount of sugar over the past 3 months
    - More specifically, it provides a % of your red blood cells that have glucose
    - “Past 3 months” because RBCs last about 3 months

Result	A1C
Normal	less than 5.7%
Prediabetes	5.7% to 6.4%
Diabetes	6.5% or higher

Source: American Diabetes Association

Insulin

What happens when we eat?



- High insulin and high blood sugar → insulin resistance
- High insulin and low blood sugar → too much insulin
- Low insulin and low blood sugar → not enough insulin production

03

Kidney Function

Comprehensive Metabolic Panel

Estimated Glomerular Filtration Rate (eGFR)	Glomeruli are tiny filters in kidney that remove toxins; eGFR measures how much blood is cleaned/minute based on body size	Declines as you age but - 20s: 116 mL/min/1.73m2 - 60s: 85 mL/min/1.73m2
BUN (Blood Urea Nitrogen)	Waste produced removed by kidneys; high levels indicate poor kidney function	~7 - 20 mg/dL (varies by age and gender)
Creatinine	Waste product of muscle breakdown removed by kidneys	Varies depending on age, diet, and how active you are
BUN/creatinine ratio	This ratio provides a better picture than BUN and creatinine alone	Should be between 10:1 and 20:1;

Urinalysis

Specific Gravity

Measures the ability of the kidneys to conserve or excrete water

Normal range: 1.005 to 1.030

Glucose

Measures the amount of sugar (glucose) in a urine sample

Normal Range: 0 to 0.8 mmol/l (0 to 15 mg/dL)

pH

Measures the level of acid in urine

Normal range: 4.6 to 8.0

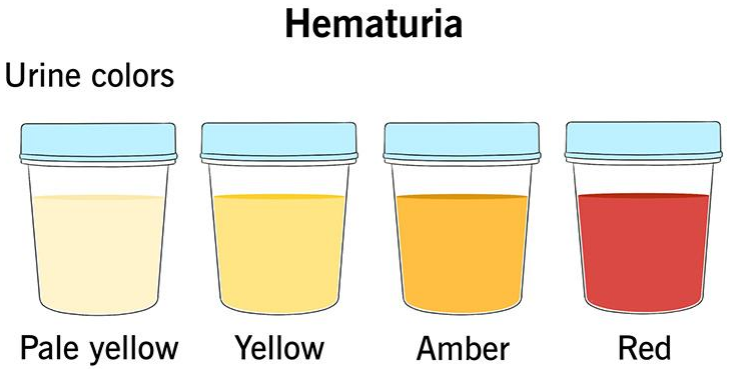
Protein

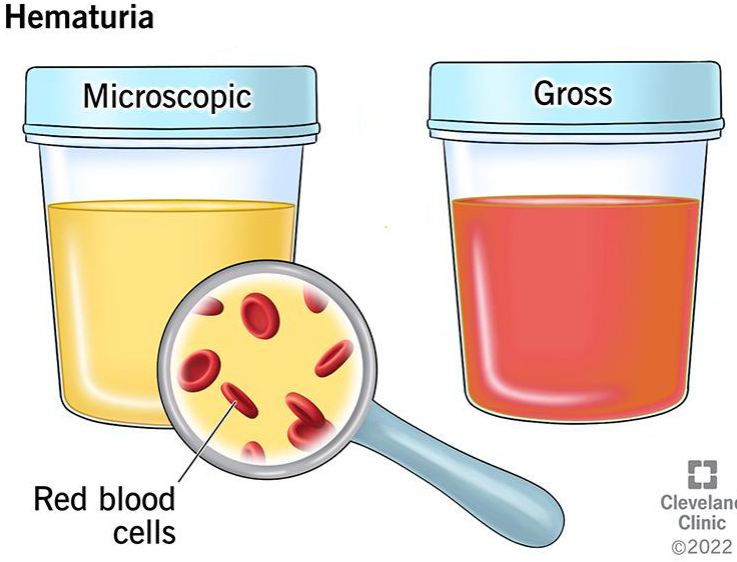
Measures protein in urine

Normal range: <150 mg in a day

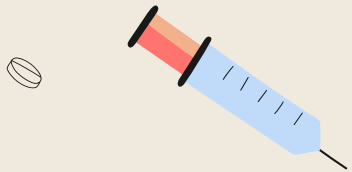
Red Blood Cells in Urine

- Checks for red blood cells in urine
- Not always seen by the eye, may require microscope
- Some causes include:
  - UTI
  - Inflammation of bladder
  - Kidney diseases
  - Bladder cancer





04 Lipid Panel



Lipid Panel

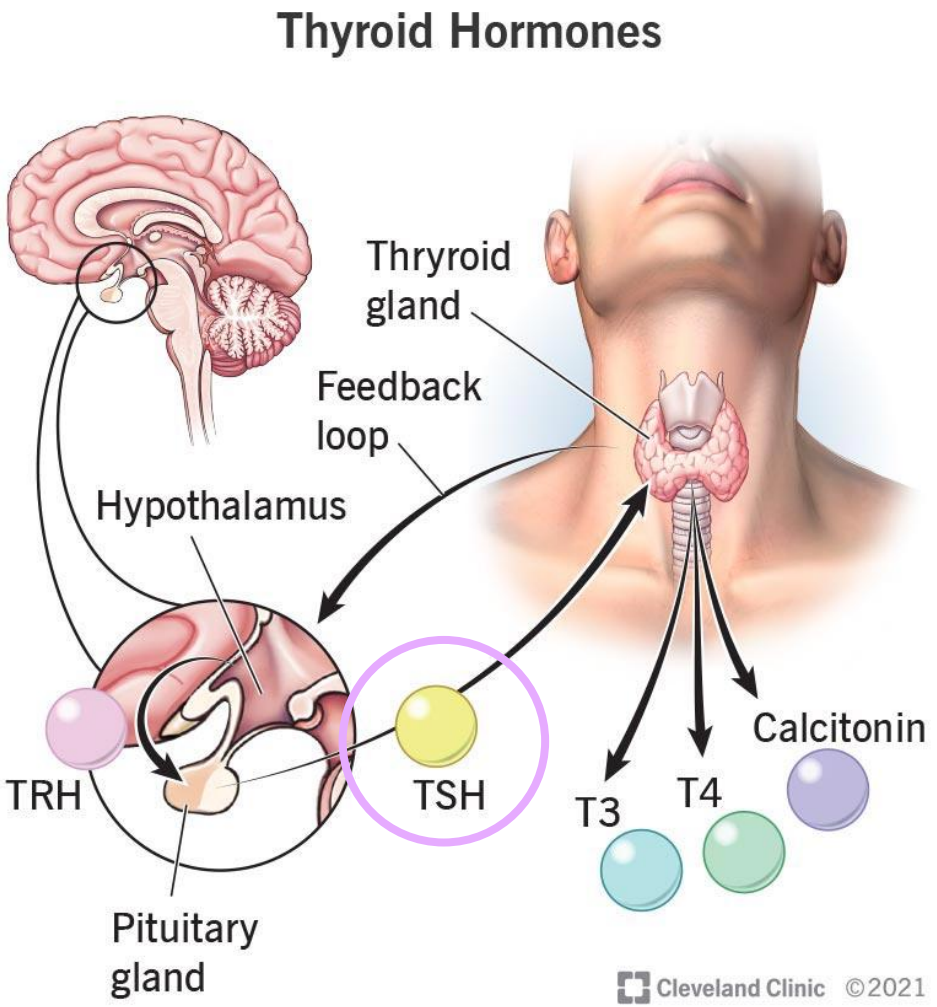
	What is it?	Normal Range
Total Cholesterol	Overall cholesterol level — the combination of LDL-C, VLDL-C and HDL-C	Below 200 mg/dL
Low-density lipoprotein (LDL) cholesterol	"Bad cholesterol" as it can collect in your blood vessels and increase your risk of cardiovascular disease	Above 60 mg/dL
Very low-density lipoprotein (VLDL) cholesterol	Comes from food recently eaten therefore low in fasting samples; can indicate abnormal lipid metabolism	Below 100 mg/dL
High-density lipoprotein (HDL) cholesterol	"Good cholesterol" that helps to remove LDL	~ Above 60 mg/dL (depending on age and gender)
Triglycerides	Type of fat from the food we eat	Below 150 mg/dL

Thyroid Panel

05

Thyroid

- **Location:** Gland on front of neck under voice box
- **Function:** Control metabolism
  - Examples include temperature regulation and heart rate
- **Pathway:**



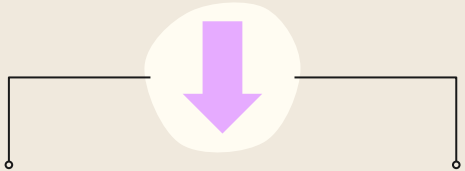
Thyroid Conditions

Hyperthyroidism

Low TSH **High T3/T4**

- Feeling warm all the time
- Nervousness, anxiety, irritability
- Fast heart rate
- Weight loss
- Tremor

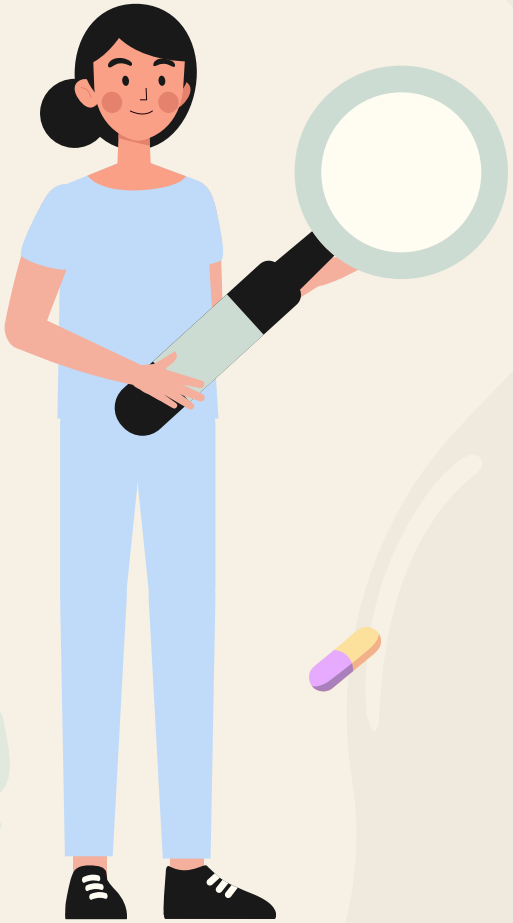
Hypothyroidism



High TSH **Low T3/T4**

- Feeling cold all the time
- Fatigue
- Slowed heart rate
- Weight gain
- Puffy face

A thyroid panel usually tests for TSH, T3, and T4



06

Markers of Inflammation

C-Reactive Protein

- Produced by the liver
- High level indicates inflammation in the body
  - Due to injury, infection, or other disease
- Can tell you if there is inflammation and how much but not why
- Values:
  - Lower risk of heart disease: Less than 2.0 mg/L
  - Higher risk of heart disease: Equal to or greater than 2.0 mg/L

Salivary Cortisol Test

Cortisol:

- Hormone produced by adrenal glands that plays roles in processes such as:
  - Blood pressure regulation
  - Reduce inflammation
  - Control sleep cycle

Uses:

- Marker for stress

THANKS!

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Sources

- Hemoglobin (Mt. Sinai)
- Complete Blood Count (MedlinePlus)
  - Complete Blood Count (Cleveland Clinic)
- Anemias:
  - Macrocytic anemia (Cleveland Clinic)
  - Normocytic anemia (Cleveland Clinic)
  - Microcytic anemia (Cleveland Clinic)
- Hemoglobin A1c (Cleveland Clinic)
- Blood Glucose & Hemoglobin A1c (American Diabetes Association)
- Insulin (MedlinePlus)
- Estimated glomerular filtration rate (Cleveland Clinic)
- RBCs in Urine
- Creatinine (MedlinePlus)
- Urine concentration (MedlinePlus)

Sources

- Glucose in Urine (MedlinePlus)
- Protein in Urine (UptoDate)
- Urine pH (MedlinePlus)
- Lipid Panel (Cleveland Clinic)
- VLDLs (Cleveland Clinic)
- Thyroid (Cleveland Clinic)
    - Hypothyroidism (Mayo Clinic)
    - Hyperthyroidism (Mayo Clinic)
- C-Reactive Protein (Medline Plus)
- Cortisol (Cleveland Clinic)