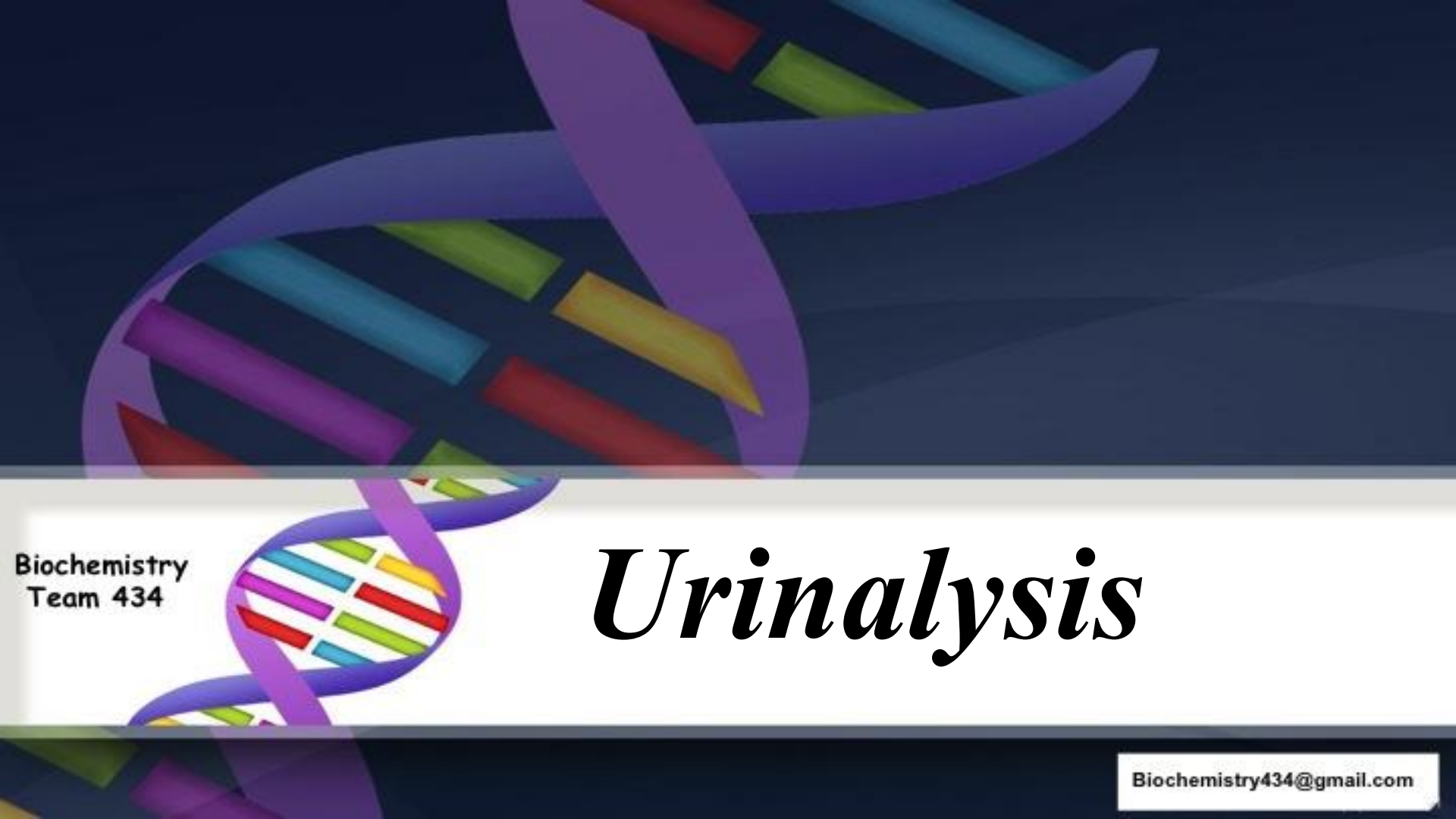


Biochemistry
Team 434

Urinalysis

Biochemistry434@gmail.com

*important to know:

Physical Examination Of Urine:

appearance, color, odor, and deposition, and PH of urine for each case.

Chemical Examination Of Urine:

to know the level of protein, glucose, ketone, bilirubin, nitrite, urobilinogen and blood in the urine.

usually it is a given but just in case memorize the normal values so you can know the abnormal ones.

Urine

Definition..?

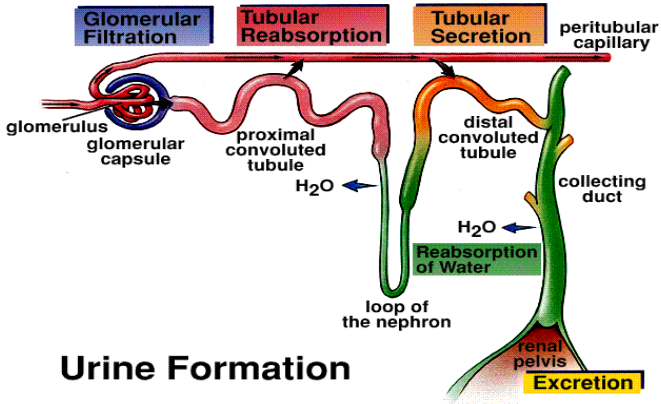
Urine is a fluid excreted by most of mammals including humans.

Formation..?

- It is formed in the kidneys (renal glomeruli).
- The fluid undergoes chemical changes before it is excreted as urine.

Amount..?

Normal urine excretion by a healthy person is about 1.5 L/day.



Physical Properties of urine:

PARAMETER	NORMAL	ABNORMAL	POSSIBLE CAUSES
Volume	0.4-2.0 L/day	Polyuria	Diabetes, chronic renal failure
		Oligouria	Dehydration, Acute renal failure
Appearance	Clear	Cloudy	Presence of pus cells, bacteria, salt or epithelial cells
Colour	Pale Yellow	Colorless	Excessive fluid intake, uncontrolled DM, DI, chronic renal failure
		Orange	Dehydration, carotenoid ingestion
		Yellow-Green	Jaundice
		Red	Blood, drugs etc
		Dark brown-black	Methemoglobin, alkaptonuria, melanoma, black water fever
		smoky	glomerulonephritis
Odor	Urineferous	Fruity	Diabetic ketoacidosis
		Ammoniacal	Contaminated and long standing exposed urine
		Mousy	Phenylketonuria
		Burnt sugar	Maple syrup urine disease
Deposits	None	Crystals, salts or cells	Blood clots, necrotic tissues and urinary stones
Reaction (pH)	4.6 - 7.0	Acidic	ketosis (diabetes mellitus & starvation), severe diarrhea, metabolic and respiratory acidosis, excessive ingestion of meat and certain fruits
		Alkaline	Respiratory and metabolic alkalosis, Urinary tract infection, Vegetarians

*we should know the normal physical properties so we can differentiate them from the abnormal ones.

Chemical Properties of urine:

PARAMETER	NORMAL	ABNORMAL	POSSIBLE CAUSES
Protein	< 200mg/day	Proteinuria	Nephrotic syndrome, glomerulonephritis,, multiple myeloma, lower UTI, tumors or stones
Glucose	None	Glucosuria	Uncontrolled DM, gestational diabetes, Fanconi's syndrome
Ketones	None	Ketonuria	Diabetic ketoacidosis, Glycogen storage disease, starvation, Prolonged vomiting, Unbalanced diet: high fat & Low CHO diet
Nitrite	None	Detected	UTI
Bilirubin	None	Detected	Hepatic and post-hepatic jaundice
Urobilinogen	*Normal Trace (1mg/dl)*	> 2 mg/dl	Jaundice
Blood	None	Hematuria	Acute & chronic glomerulonephritis, *Trauma , cystitis , renal calculi and tumors,* Bleeding disorders *(Hemophilia).*
		Hemoglobinuria	Hemoglobinopathies, Malaria, Transfusion reaction *(Blood Incompatibility)*

*we should know the normal chemical properties so we can differentiate them from the abnormal ones.

Proteins:

Normally less than 200 mg protein is excreted in the urine daily; more than this level leads to condition called **"Proteinuria".**

	Glomerular proteinuria	Tubular proteinuria
Cause..?	Due to ↑ glomerular permeability ⟶ filtration of **Proteins**	As a result of ↓ tubular reabsorption with **NORMAL** glomerular permeability ⟶ excretion of **Proteins**
Size of filtered proteins..?	**High** molecular weight proteins	**Low** molecular weight proteins
Example	Glomerulonephritis	Chronic nephritis

Nephrotic syndrome

- **Large amounts of protein are lost in the urine.**
- **Hypoproteinemia develops.**

Increase protein excretion in urine can be one of the following two types:

Urinalysis
(using the DIPSTICKs):

Principle..?

Are plastic strips impregnated with chemical reagents which react with specific substances in the urine to produce color-coded visual results.

Benefits..?

They provide quick determination of :

- pH,
- Protein
- Blood
- Glucose
- Urobilinogen
- hemoglobin
- Ketones
- Bilirubin
- Specific gravity
- Nitrite

Color codes..?

- The depth of color produced relates to the concentration of the substance in urine.
- Color controls are provided against which the actual color produced by the urine sample can be compared .The reaction times of the impregnated chemicals are standardized.

Procedure

Finally:

- Match the color changes to the color scale provided.
- Give a full report about:

- Physical examination
- Chemical examination

Match the color changes to the color scale provided.

Read the color produced within 30-60 seconds *(Color changes after more than 2 minutes are of no significance).*

Remove the excess urine and keep the strip in a horizontal position.

Dip the strip in the urine sample provided then remove it immediately.

Case I(Urine Sample I)

A 12-year-old girl, a known patient with T1DM, presented to Emergency drowsy with short history of vomiting and abdominal pain. On examination:

- **Tachycardia**
- **Tachypnea with a fruity smell of breath.**
- **BP: 85/50 mmHg (Ref range: 100/66-135/85 mmHg)**
- **Blood sugar: 26.7 mmol/L (Ref range: 3.9-5.6 mmol/L)**
- **HbA1C: 9.9% (Ref range: 5.7-6.4%)**
- **Blood pH: 7.1 (Ref range: 7.35–7.45)**
- **Circulating Ketone bodies: positive**

A mid stream Urine sample was collected for complete urinalysis.

1- Do urinalysis using dipsticks and give a full report regarding:

A- Physical examination.

B- Chemical examination.

2- What is the most likely diagnosis?

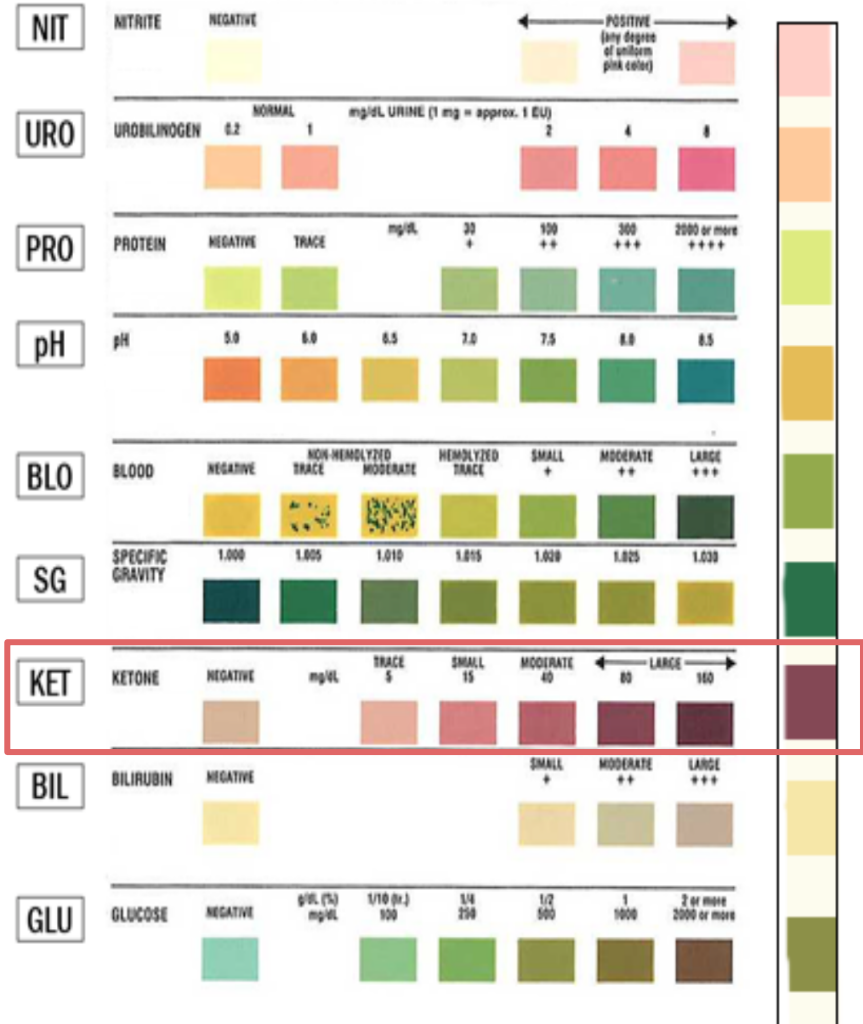
Diabetic with ketonuria
(diabetic ketoacidosis)

Important characteristics:

-What are the Physical Properties of Urine..?
(Polyuria, **Fruity Odor,** Acidic PH, colorless)
(usually the rest is normal)

-What are the Chemical Properties of urine..?
(**Ketonuria ,Glucosuria**)
elevated amount of keton and glucose in urine. (the rest is normal)

Usually under 25 years patient with **type I diabetes** When there is no enough Insulin, the patient can not use the glucose as a fuel so the body breaks down fat instead, lead to acid (ketones) build up.



Case II (Urine Sample II)

- A 49-old woman came to hospital with fever, weakness and dysuria (pain during urination) for the last three days.
- The results of her laboratory tests were as follows:

Test	Result	Reference range
Fasting blood glucose	5.0	3.9-5.8 mmol/L
Creatinine	75	55-120 mmol/L
Urea	3.7	2.5-6.4 mmol/L
Sodium	140	135-145 mmol/L
Potassium	3.9	3.5-5.1 mmol/L

- A mid stream Urine sample was collected for complete urinalysis.
- Microscopic examination of urine showed:-
  - WBCs: over 100/HPF (Ref range: 2-3/HPF)
  - RBCs: 10 /HPF (Ref range: 0-2/HPF)

1- Do urinalysis using dipsticks and give a full report regarding:

A- Physical examination.

B- Chemical examination.

2- What is the most likely diagnosis?

UTI

Important characteristics:

-What are the Physical Properties of Urine..?
(**Alkaline**, cloudy)
(usually the rest is normal)

-What are the Chemical Properties of urine..?
(Proteinuria, Hematuria, **Nitrate detected**)
(usually the rest is normal)

UTI patients usually have:

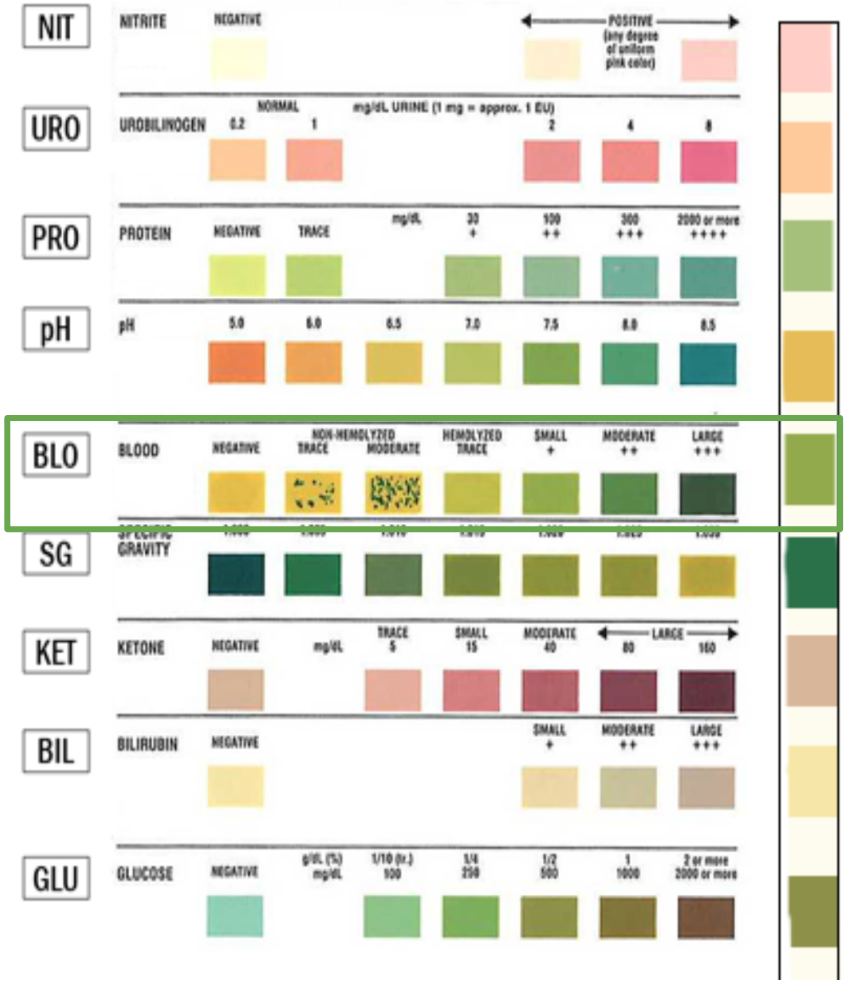
1-Pain or a burning feeling during urination.

2- a feeling of urgency.

3- feeling the need to urinate frequently.

4-an altered appearance of the urine, either bloody (red) or cloudy.

5- pain or pressure in the rectum.



Case III (Urine Sample III)

A 6-year-old boy, developed marked edema over a period of few days.

His mother had noted puffiness around the eyes, characteristically in the morning. She also noted that his urine had become frothy.

His general practitioner ordered the following investigations:

Test	Result	Reference range
Creatinine	58	55-120 mmol/L
Urea	3.4	2.5-6.4 mmol/L
Sodium	136	135-145 mmol/L
Potassium	4.0	3.5-5.1 mmol/L
Total protein	34	60-80 g/L
Albumin	14	35-50 gmL
Cholesterol	11	3.2-5.2 mmol/L
Triglycerides	1.5	0.5-2.27 mmol/L

A mid stream Urine sample was collected for complete urinalysis.

1- Do urinalysis using dipsticks and give a full report regarding:

A- Physical examination.

B- Chemical examination.

2- What is the most likely diagnosis?

nephrotic syndrome

Important characteristics:

-What are the Physical Properties of Urine..?

Frothy urine

(usually the rest is normal)

-What are the Chemical Properties of urine..?

Proteinuria (hyperalbuminemia in the urine)

(usually the rest is normal)

Nephrotic syndrome is a kidney disease with

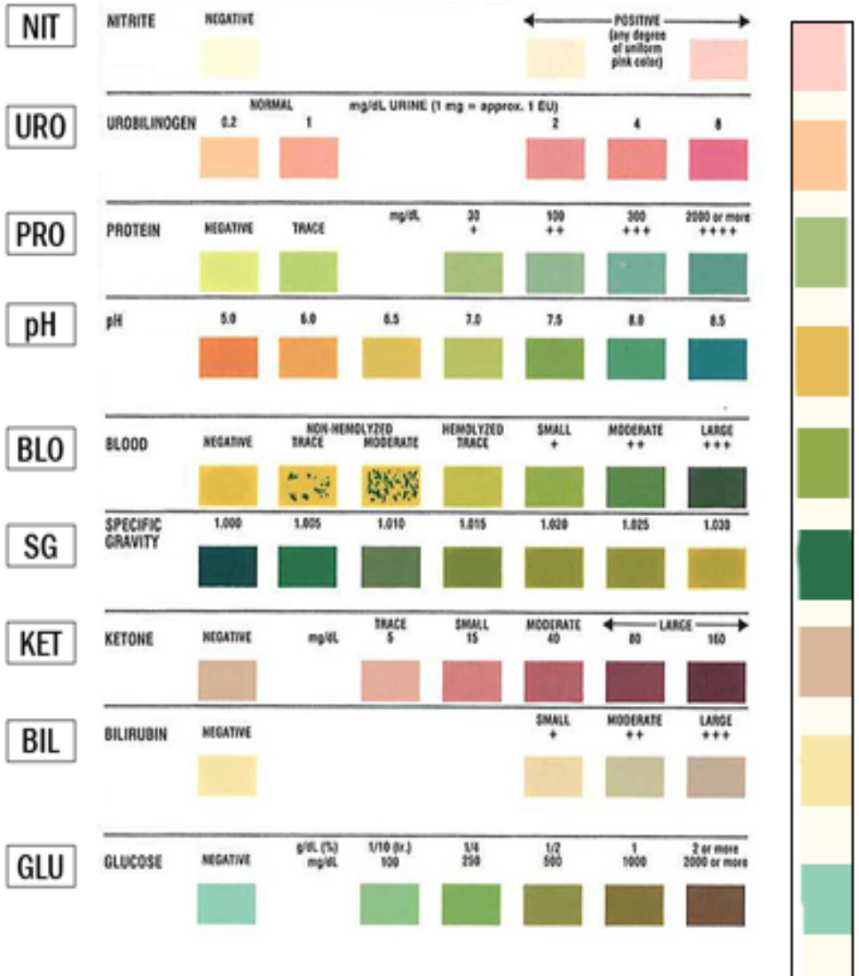
Proteinuria - Hypoalbuminemia - Edema - Hyperlipidemia - Hypercholesterolemia

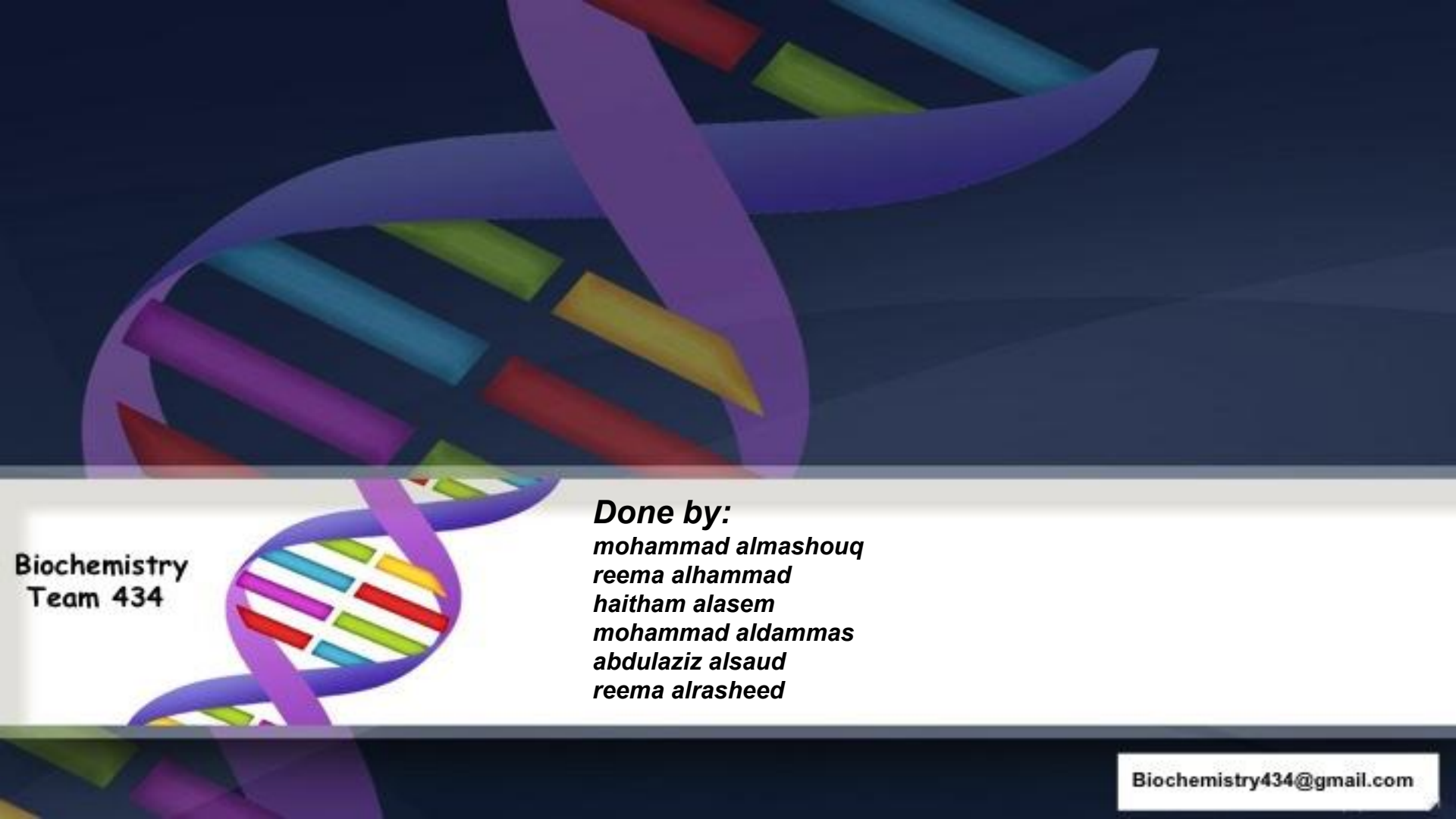
Symptoms

Frothy urine

Puffiness around the eye

Edema





Done by:
mohammad almashouq
reema alhammad
haitham alasem
mohammad aldammas
abdulaziz alsaud
reema alrasheed

Biochemistry434@gmail.com