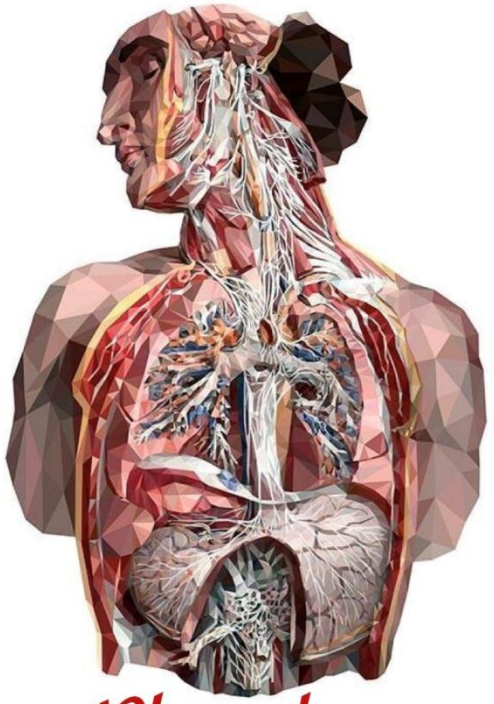
LAST LECTURE

BLOOD GROUPS & TRANSFUSION



Physiology

Team 438

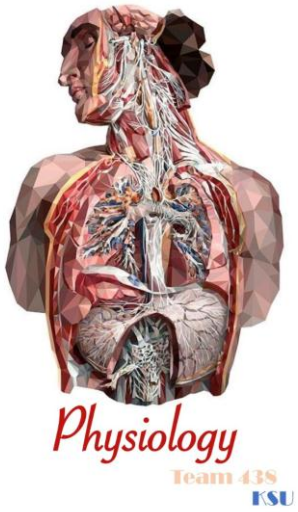
KSU

- Red : important
- Black : in male / female slides
- Pink : in girls slides only
- Blue : in male slides only
- Green : notes, Extra

Reviewed by Razan AlRabah & Khalid Alkhani

OBJECTIVES

- Describe:
  - the ABO and Rhesus blood groups
  - Grouping
  - Crossmatching
  - Anti-sera
  - Transfusion
- Recognize Agglutinins
- Define hemolytic disease



Blood typing

Blood groups are determined by the antigens (glycoproteins) on the surface RBCs .
The chief and most clinically important systems are:

i. ABO system
ii. Rhesus (Rh) system (+ or -)

i. ABO (IgM) long arm of chromosome 9

- Anti-A & B agglutinins start forming from birth and peak at ~8 yr old and would gradually decline thereafter
- O is a universal donor while AB is a universal acceptor

Genotype(s)	Blood Type	%	Agglutinogens	Agglutinins
OO	O	47%	Null	Anti-A & B
AA / AO	A	41%	A	Anti- B
BB / BO	B	9%	B	Anti- A
AB	AB	3%	A & B	Null

Type A & Type B genes are co-dominant

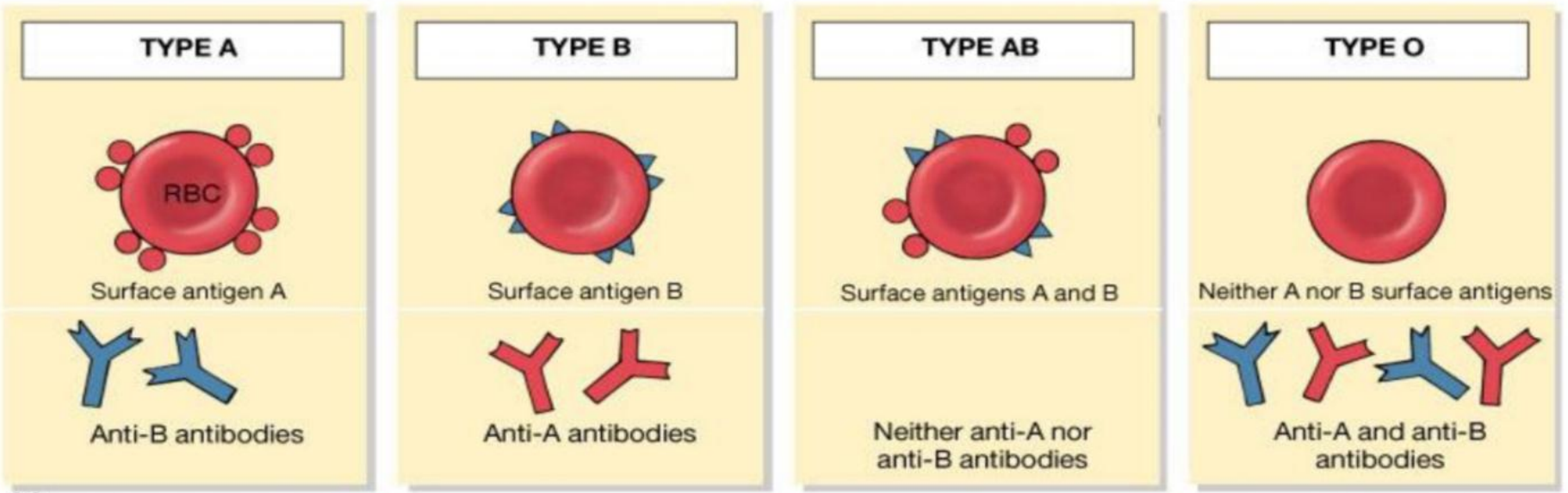
- Depends on whether the red cells contain one, both or neither of the two blood antigens: A and B.
- Four main ABO groups: A, B, AB, O

A & B antigens: are genetically determined and appear in the early fetal life and remained unchanged throughout life.

Anti-A & Anti-B: •They are naturally occurring antibodies not present at birth, appear 2-8/12 Triggered by A & B antigens in food and bacteria

•Agglutinogens: Blood group antigens on RBC membrane (A and B)
• Agglutinin: The respective antibody to the antigen
•Agglutination: Reaction between agglutinogen on RBC and the respective Ab.

Blood Typing and Agglutination



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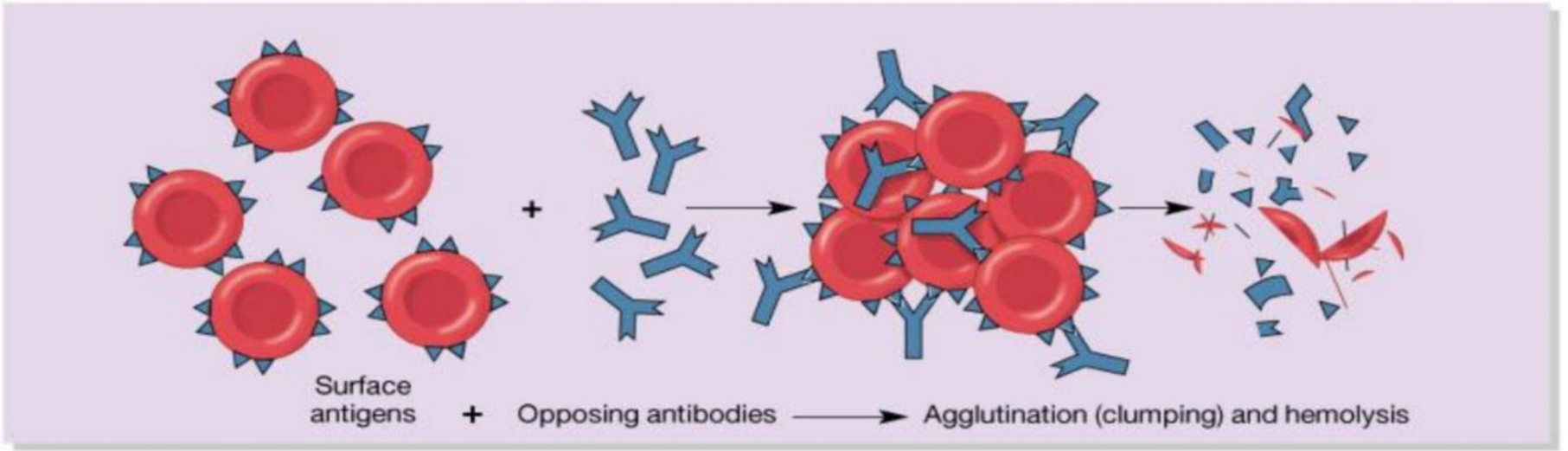


(b)

INHERITANCE OF BLOOD GROUPS

THIS SLIDE WAS FOUND IN THE FEMALES SLIDES ONLY

Blood group	Genotypes
A	AA, AO
B	BB, BO
O	OO
AB	AB

Uses of genotypes:

- Sorting disputes in paternal dispute
- Frequency of ABO has ethnic variation

The Question of paternity?

- Blood types can't be used to prove paternity
- Blood types can disprove paternity

Q1 :Nora blood (type A) and Ahmad blood (type B) Have a baby (blood type O) Can Ahmad be the father?

Phenotype	Possible genotype
Nora: A	AA or AO
Ahmad:B	BB or BO
Baby: O	OO

Parent Allele	A	B	O
A	AA	AB	AO
B	AB	BB	BO
O	AO	BO	OO

II. RHESUS SYSTEM (IGG) CHROMOSOME 1

- Determined by: • Presence or absence of the Rhesus antigen (D) on the surface of RBC.
- Rh antigens are of many types (Cc, Dd, Ee…), Clinically most important is D
  - RBC with D Rh+
  - RBC without D Rh-
- Plasma has free flowing antibodies (agglutinins) in IgM form
- these are of 3 types:
  a. Anti-A reacting with antigen A
  b. Anti-B reacting with antigen B
  c. Anti-Rh reacting with Rh

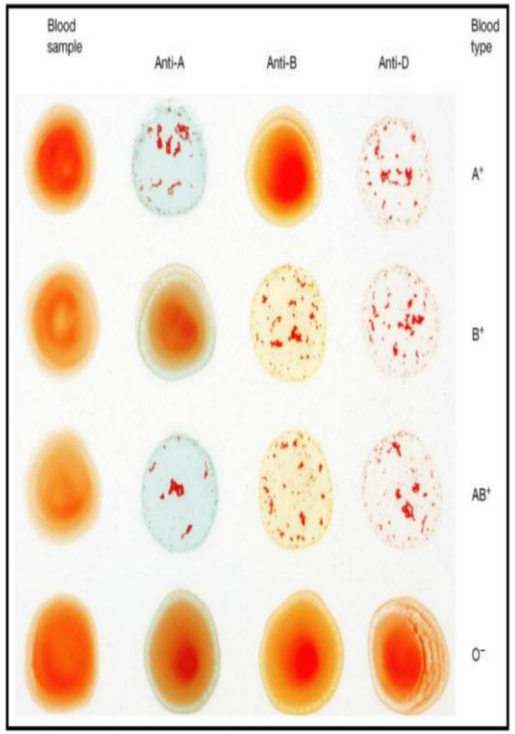
Anti-D antibody (agglutinin): -
Is not naturally occurring (develop once exposed to Rh+ antigens "not present at birth")
Can be acquired by:
i-Transfusion of Rh-ve individual with Rh+ve blood.
ii-Rh-ve pregnancy with Rh+ve faetus.
*Rh –ve person becomes sensitized

There are 8 possible blood groups:

A Rh+	B Rh+	AB Rh+	O Rh+
A Rh-	B Rh-	AB Rh-	O Rh-

ABO Blood Grouping (Typing) in Laboratory Using Anti-sera

Group	Anti-A	Anti-B
A	Agglutination	Nil
B	Nil	Agglutination
AB	Agglutination	Agglutination
O	Nil	Nil



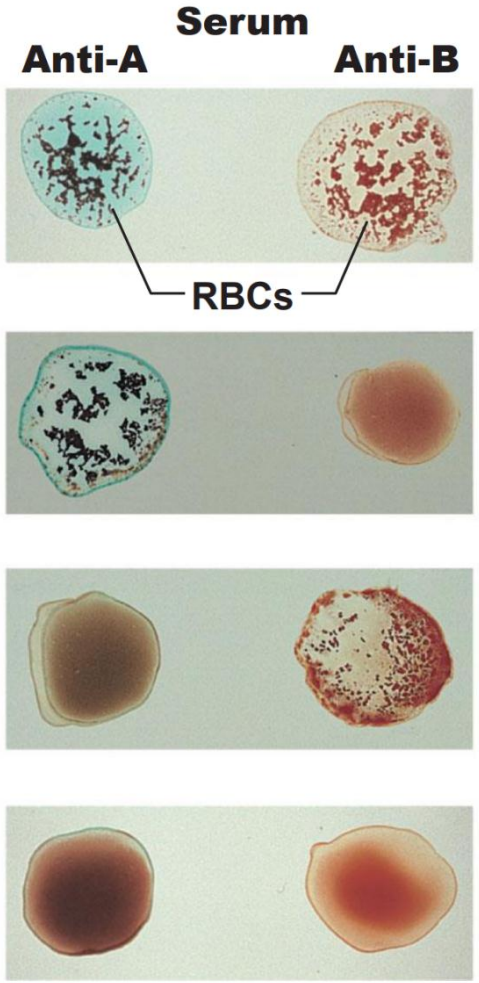
Blood being tested

Type AB (contains agglutinogens A and B; agglutinates with both sera)

Type A (contains agglutinogen A; agglutinates with anti-A)

Type B (contains agglutinogen B; agglutinates with anti-B)

Type O (contains no agglutinogens; does not agglutinate with either serum)



Importance of blood groups:

Blood transfusion →

Indications:

- Severe hemorrhage
- Severe anemia
- Erythroblastosis fetalis?
- To supply elements

  (RBC, platelets, …)

Hemolytic disease (next slide)

Paternity cases
(Only to disprove paternity)

Medico-legal cases

Disease susceptibility

- O- Duodenal cancer
- A- Stomach/Pancreas/Salivary gland carcinoma

Requirements for transfusion:

- Grouping of recipient:

  determining blood types
- Cross matching:

  donor cell + recipient serum

  if incompatible → Agglutination
- Antibody screening:
  - Hep B & C
  - HIV antigens & antibodies
  - Syphilis

Transfusion reactions: Incompatible blood transfusion

(Agglutination in transfusion reaction)

- RBCs rupture, then release Hb to bloodstream.
- Causes Kidney damage

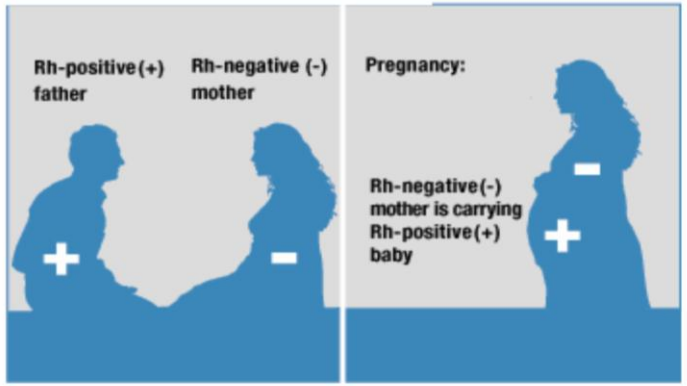
Symptoms & signs:

- Pain
- Nausea
- Hypotension
- Shock
- Chills
- Oliguria/ Anuria

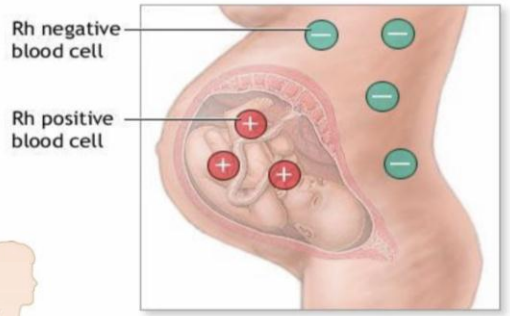
	Donor	
Recipient	Blood transfusion	Plasma transfusion
O	O	O,A,B,AB
A	O, A	O,A
B	O, B	O,B
AB	O, A, B, AB	AB

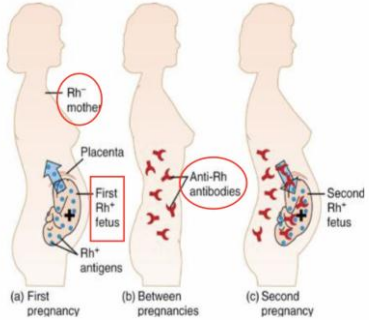
In Plasma transfusion, Antibodies are transferred to recipient. Reaction is opposite to blood transfusions.

HEMOLYTIC DISEASE OF NEWBORNS



- During birth, the Baby's blood would leak into the mother's circulation
- If the Baby is Rh+ and the Mother is Rh- she will develop Rh-antibodies (IgG)
- The mother is given Anti-D (anti-Rh antibodies) removing these antibodies from the mother's circulation before getting sensitized.
- Anti-D could attack subsequent baby's in later pregnancies causing Hemolysis in the baby





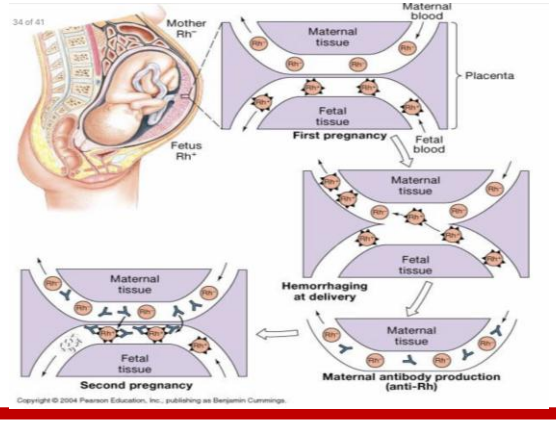
- Hemolytic Anemia: treated with blood transfusion / Rh- blood/ several times
- Hydrops fetalis (death)
- Kernicterus (Jaundice causing brain damage)

- The 1st born 0%
- The 2nd born 3%
- The 3rd born 10%

Note: Rh antigens (IgG) are able to cross the placenta because they are small. ABO antigens (IgM) are larger, thus can't cross the placenta

RH INCOMPATIBILITY BETWEEN MOTHER AND FETUS

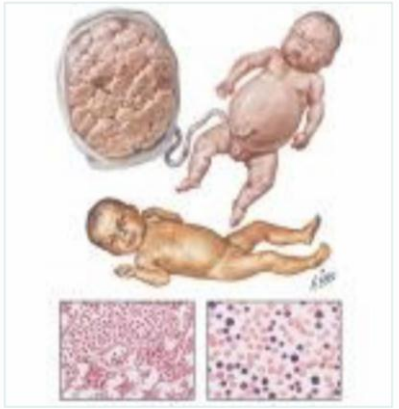
- **Mother Rh-ve first Rh+ve baby:**
- • At delivery – Fetal Rh+ RBC cross to maternal blood
- • The mother will develop Anti-D after delivery.
- • **First child** escapes & is safe
- (If the mother is transfused with Rh+ve blood before, first child will be affected)
- **Second fetus –**
- If Rh+ve – Anti-D crosses placenta and destroys fetal Rh+ RBC. Causing Hemolytic Disease of the newborn.



Prevention of hemolytic Disease of the newborn

• Injecting the mother with anti-D immediately after 1st childbirth.

• Antenatal (during pregnancy) prophylaxis.

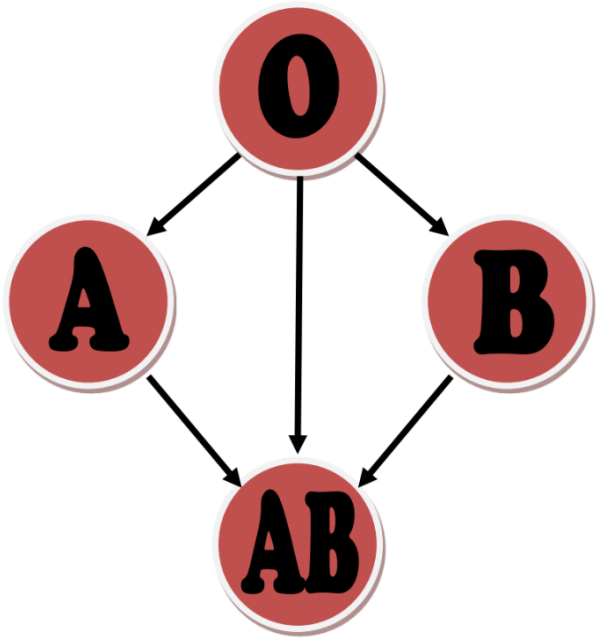


Hydrops fetalis

WHO CAN GIVE YOU BLOOD?

- People with TYPE O blood are called Universal Donors, because they can give blood to any blood type.
- People with TYPE AB blood are called Universal Recipients, because they can receive any blood type.
- Rh + Can receive + or –
- Rh - Can only receive -

Blood Group	Antigens	Antibodies	Can give blood to	Can receive blood from
AB	A and B	None	AB	AB, A, B, O
A	A	B	A and AB	A and O
B	B	A	B and AB	B and O
O	None	A and B	AB, A, B, O	O



Complications of blood transfusion:

1- Immune reaction: Incompatible blood transfusion leading to immediate or delayed reaction, fever, haemolysis, allergic reaction.

2. Transmission of diseases (e.g.mlaria, syphilis, viral hepatitis, AIDS virus).

3. Acute kidney failure (reaction to mismatched transfusions).

4. Iron overload due to multi-transfusion in case of sickle cell anemia and thalassemia.

QUIZ

Q.1 Where are ABO antigens found?			
Long arm of chromosome 6	Long arm of chromosome 3	Short arm of chromosome 3	Long arm of chromosome 9
Q.2 A child has an O+ blood type, which of the following can be his parents?			
AB+ / O-	AB+ / O+	A+ / O-	B- / O-
Q.3 Which of the following patients would be considered the universal donor?			
O	A	B	AB
Q.4 Where would you rather spend a vacation?			
USA	Dubai	Europe	Wadi Aldawasir
Saq : 1- How can we prevent hemolytic Disease of the newborn?			
2- What are the most important blood group systems ?			

Key answers:

MCQ

1) Long arm of chromosome 9
2) A+/O-
3) O
4) If you get a vacation

SAQ

Saq-1:After birth, the mother is given anti-D in order to remove any fetal blood before activating the mother's immune response.

Saq-2:There are many systems that can be used for blood groups, but the ABO and Rh systems are clinically important , since they are associated with transfusion reactions.

THANK YOU

Click for helpful video

Contact us

Editing file

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	• مي بابعير
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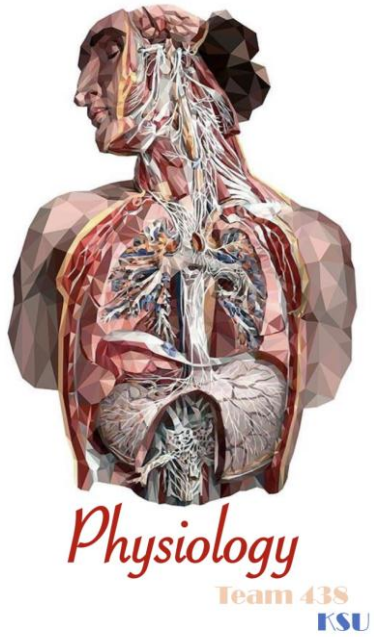

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Special thanks to Omar Alghadir