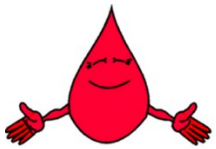
BLOOD

(Haima, Sanquis)

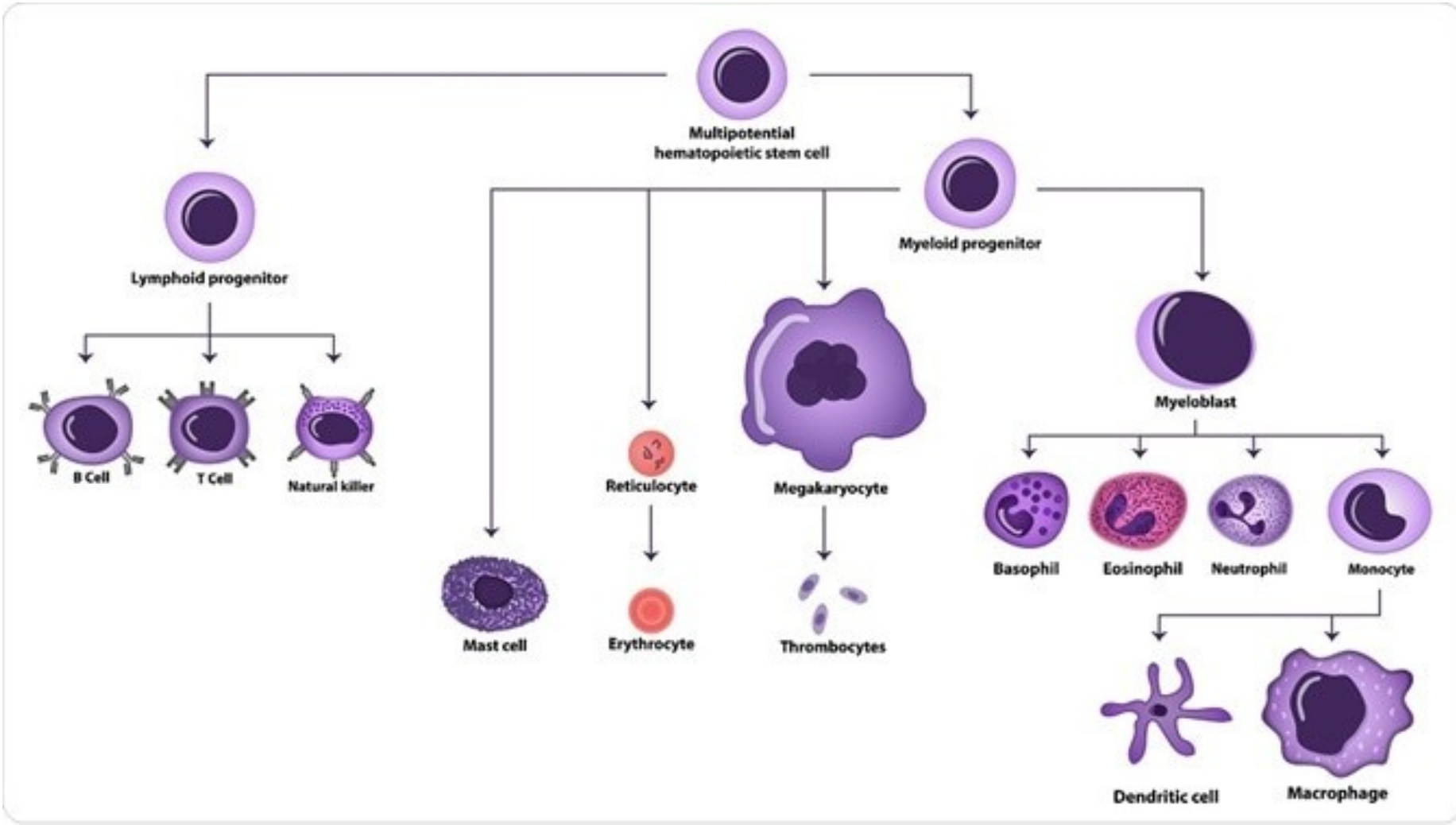
I. Introduction
II. Cell types
III. Glycemia
IV. Blood types

MAIN FUNCTIONS OF BLOOD

1. Exchange of O_2 and CO_2
2. Exchange of nutritions and metabolic waste
3. Transport of hormones, enzymes etc.
4. Thermoregulation
5. Buffering the pH
6. Immune functions
7. Mainteining the blood pressure



HEMATOPOIESIS

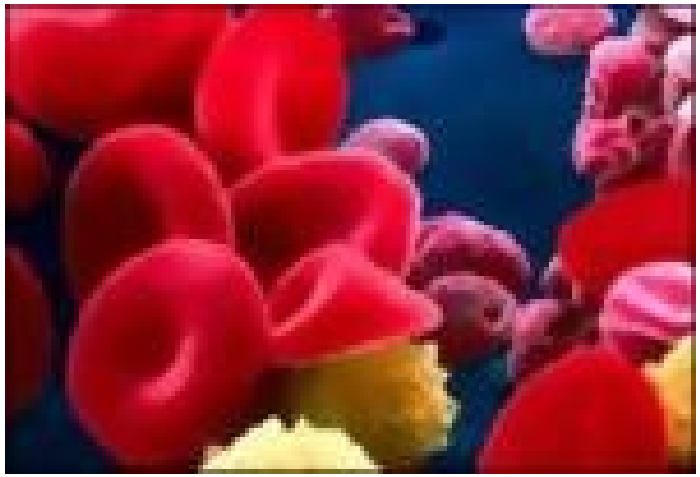


https://www.news-medical.net/life-sciences/What-is-Hematopoiesis.aspx

HEMOGRAM

Number of blood elements

Erythrocytes	Leukocytes	Hemoglobin	Hematocrit
♂ 4,3 - 5,3.10^6/ml	4 - 9.10^3/ml	14 – 18g/100ml	0,39 – 0,49
♀ 3,8 – 4,8.10^6/ml		12 – 16g/100ml	0,35 – 0,43

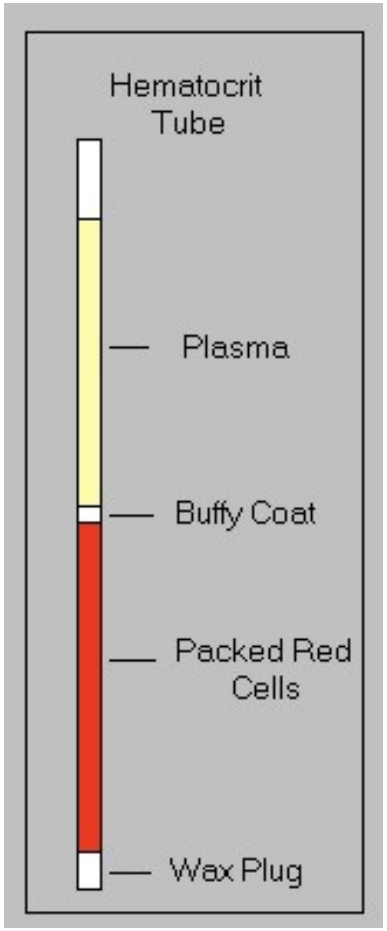


HEMATOCRIT

♂ 0,39 – 0,49

♀ 0,35 – 0,43

Height of the red cell column
in a tube after centrifugation
related to the total volume of blood



DETECTION:
Heparinized tube - plug
Centrifugation
3 min / 12 000 RPM

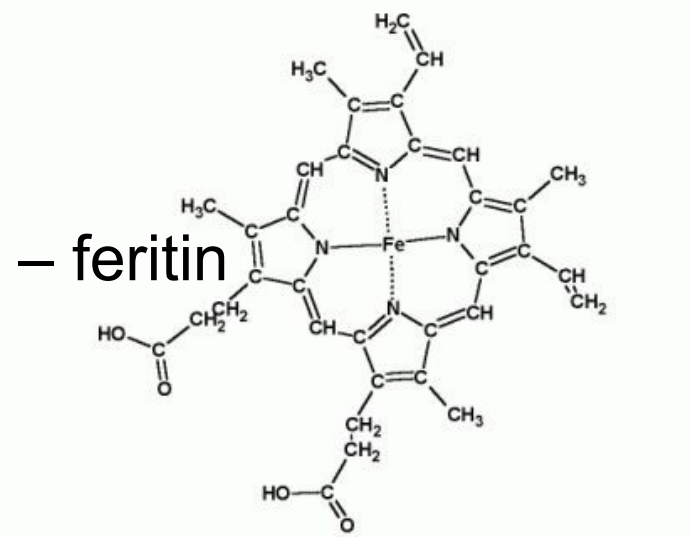
http://www.eclinpath.com/hematology/tests/hematocrit

HEMOGLOBIN

♂ 14 – 18 g/100 ml

♀ 12 – 16 g/100 ml

Transport of O_2 and CO_2
Buffering the blood pH



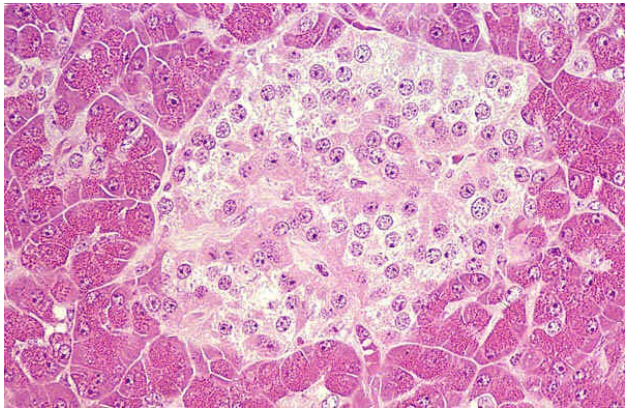
Hemolysis:
Globin – cleaved to the aminoacids
Hem – Fe^{3+} - transferin – hemosiderin – feritin
- biliverdin – bilirubin - bile

DETECTION:
Drop of 0.1 M HCl + 20 ul Blood = acidic (brown) chlorhemin
Dilution with dH_2O in Sahli´s visual hemometer/colormeter

GLYCEMIA

Blood glucose level
Hypoglycemia – hypoglycemic shock (reversible)
Normal level - 3,9 – 5,6 mM (70 – 110 mg/1OO ml)
Hyperglycemia – diabetes mellitus

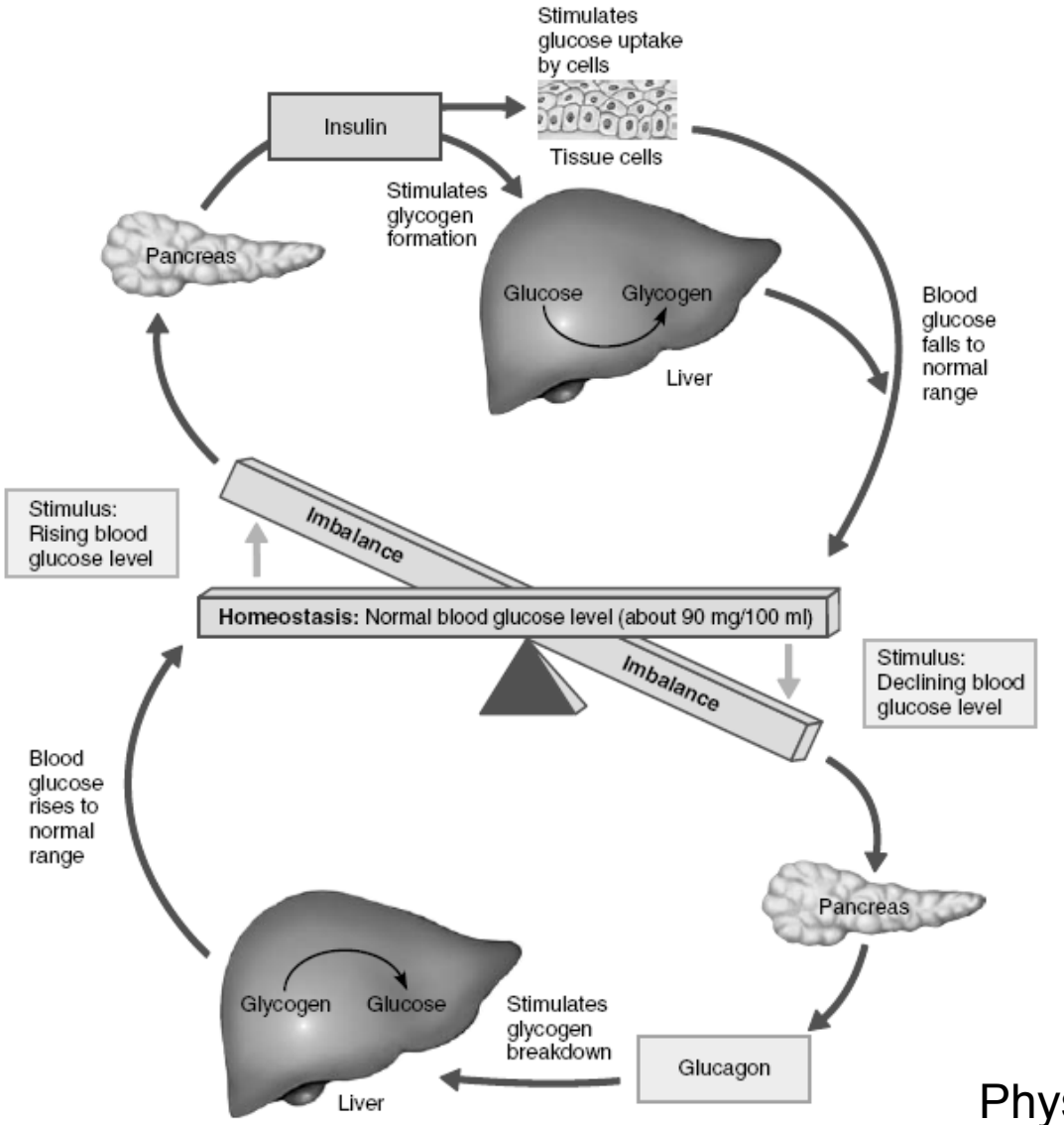
discovery of insulin 1921 – Banting a Best (Nobel price)



Insulin-dependent and -independent cells

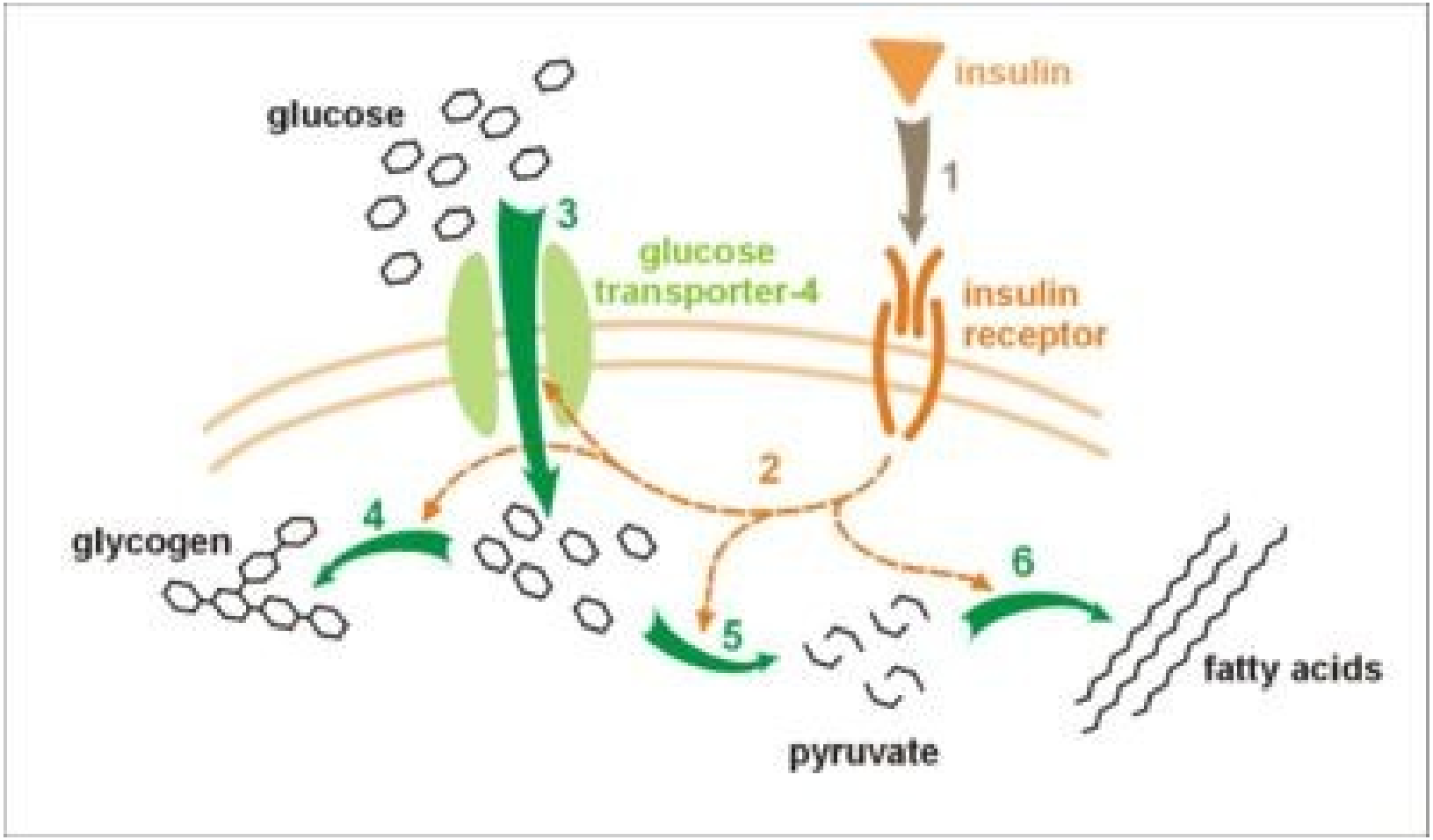
1. Autoregulation
2. Hormonal regulation <u>insulin vs.</u>
   <u>glukagon</u>, adrenalin
   somatotropin (pituitary gland)
   glucocorticoids (e.g. cortisol)
3. CNS regulation

HORMONAL REGULATION OF GLYCEMIA

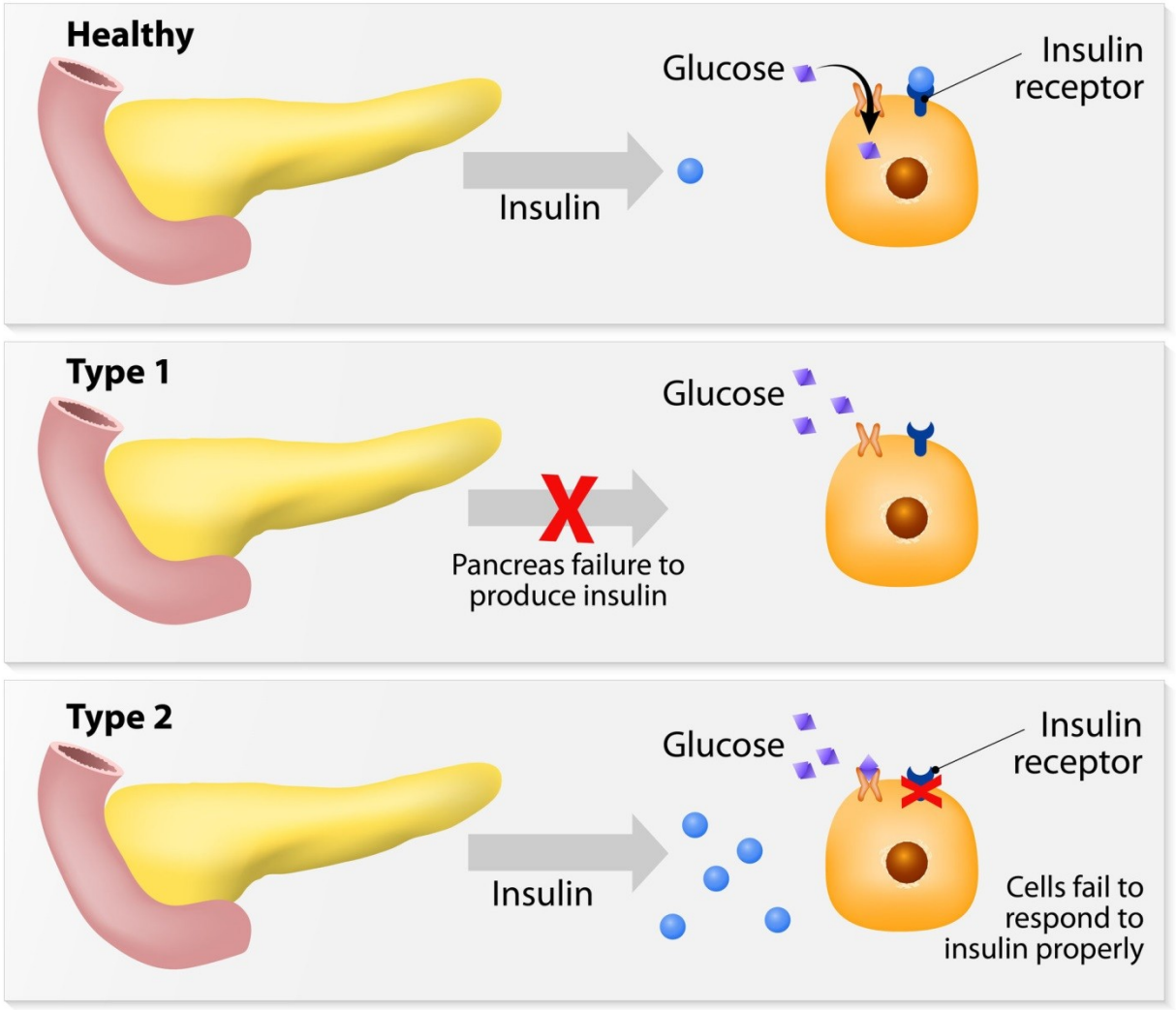


PhysioEx manual

INSULIN FUNCTION



DIABETES MELLITUS



https://www.rudymawer.com/blog/insulin-sensitivity-the-ultimate-guide/

Acute diabetic syndrome DMI (7 %, juvenile)

Ketoacidotic coma

- lack of glucose in insulin-dependent cells – alternative source of energy – overproduction of KETONS (hydroxybutyrate, aceton) – ACIDIC blood Kusmauls breething, excessive urination) – ketons overcome blood-brain barriere – failure of brain centres – COMA

Chronic diabetic syndrome DMII (92 %, senior)

Micro- and macroangiopaties

- imbalanced glycemia – hyperglycemia – glucose binds to hemoglobin = glycated hemoglobin – increased viscosity of blood – plaques – ischemia - first microcapilaries e.g. retina, kidney; later leg veins

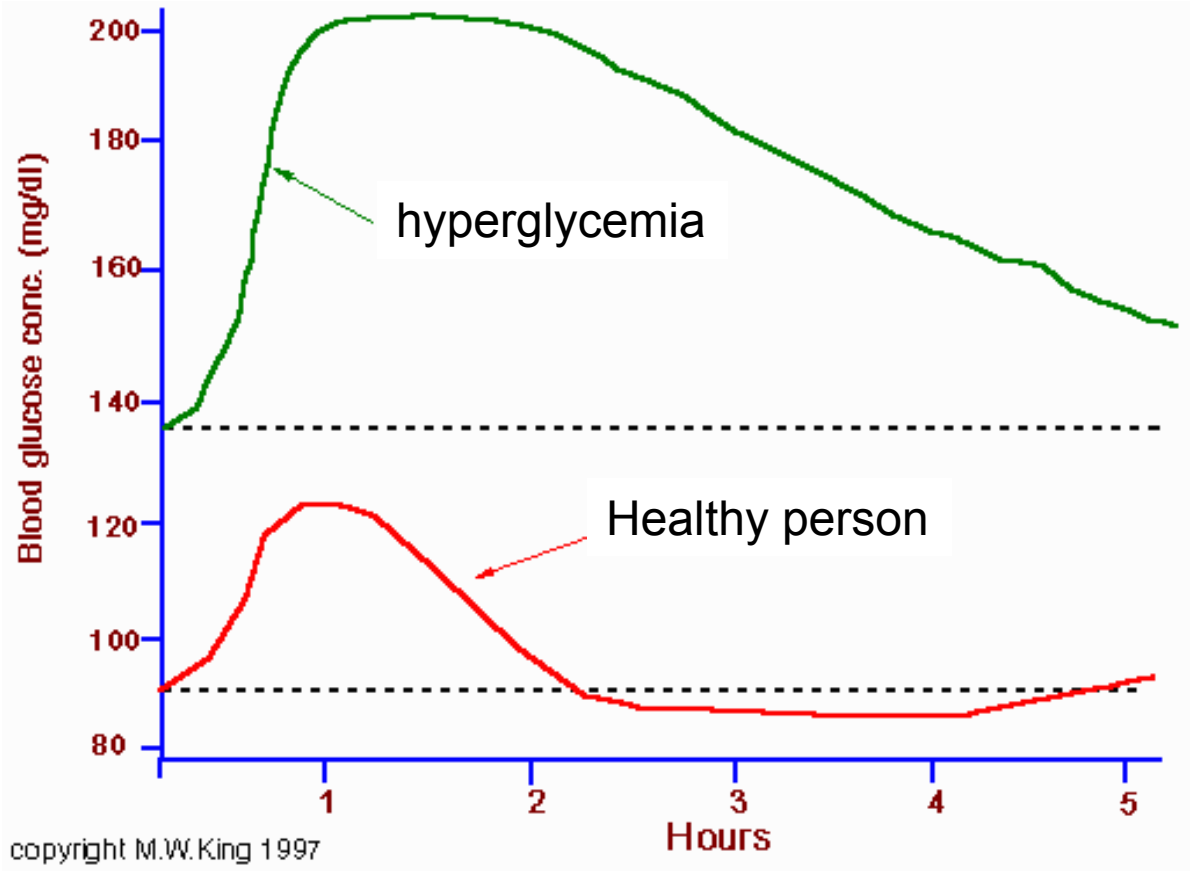
DETECTION

- Indicator on the strip of glucometer (spectrophotometer)
- Glucose and indicator react and the colour of indicator changes
- Intenzity of colour change is in direct proportion to the concentration of glucose

https://www.accu-chek.cz/

OGTT

ORAL GLUCOSE TOLERANCE TEST



- Starving glycemia
- 1g glucose/1kg weight
- 2 hours after glycemia

BLOOD GROUPS

I. AB0
II. Rh
III. MHC/HLA

Blood groups

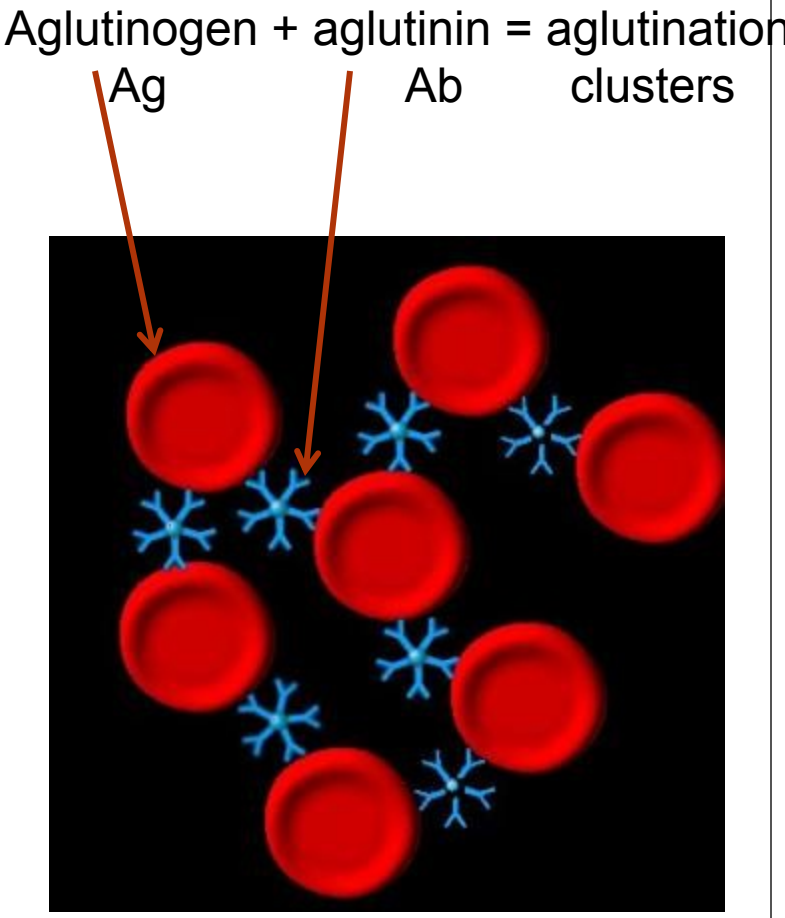
Immunohematology

Antigen = aglutinogen

(protein(glycan) on cellular surface)

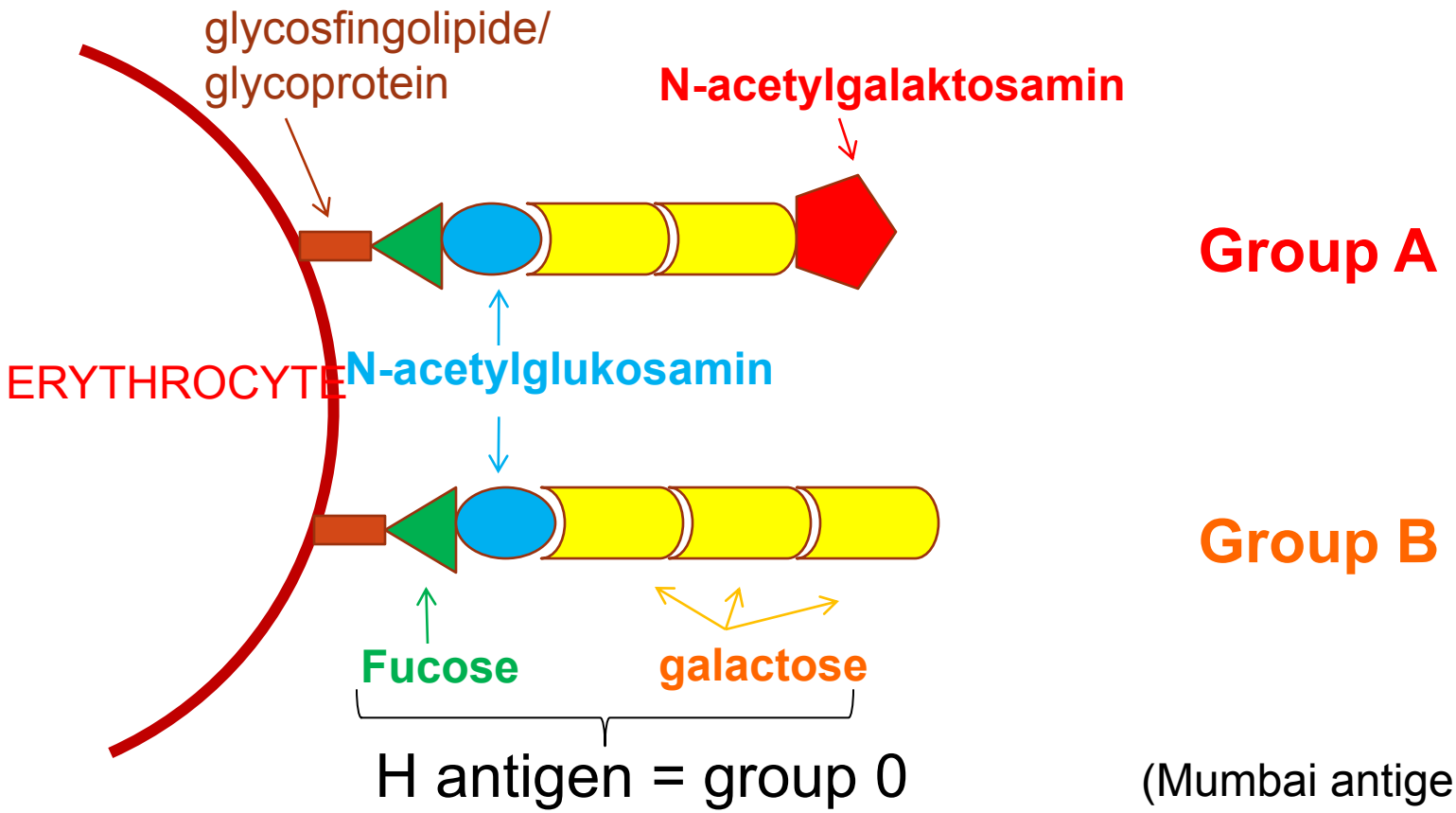
Antibody = aglutinin

(protein produced by B-lymfocytes)

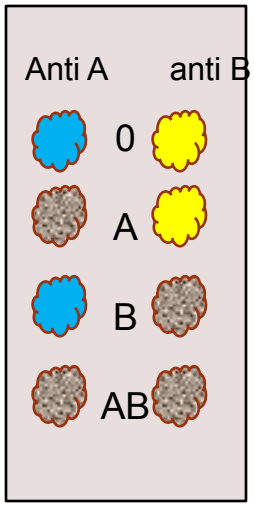


System ABO

1. 1901 Landsteiner (A,B,0)
2. A,B antigens are common in all the microorganisms



Detection of ABO on glass



The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	A agglutinogens only	B agglutinogens only	A and B agglutinogens	No agglutinogens
Plasma Antibodies (phenotype)	b agglutinin only	a agglutinin only	NONE. No agglutinin	a and b agglutinin

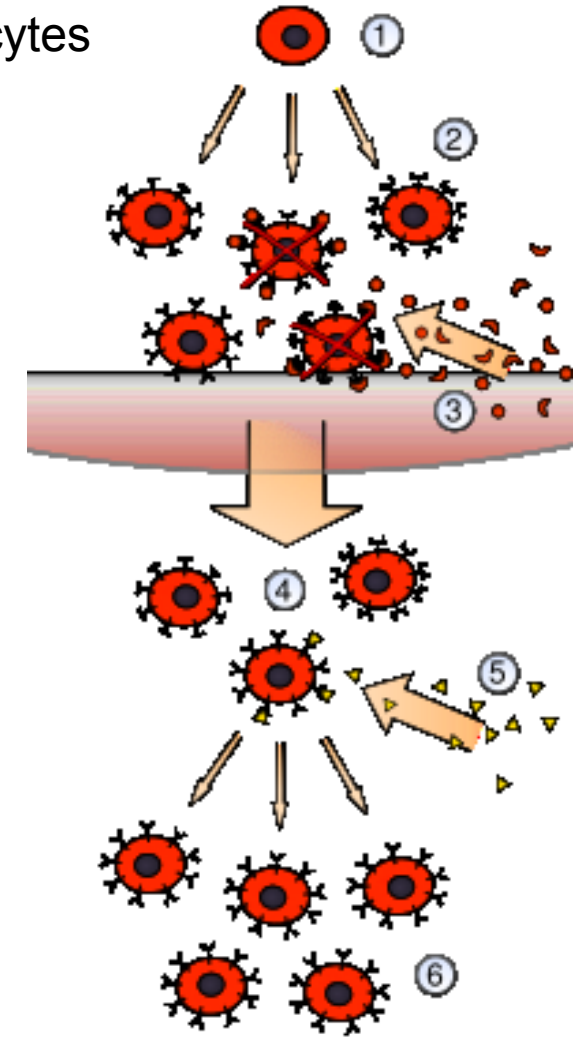
CR	41 %	14 %	7 %	38 %
Most Africans	N Europe	SE Asia	mid Europe	Indians,
World	32 %	22%	5 %	41 %

Clonal selection

Principle of elimination of auto-immune clones of B-lymfocytes

1. Hematopoietic stem cell
2. Imature B lymfocytes with different Ag R
3. Those, who react with body Ag are removed by apoptosis (in bone marrow)
4. Other clones mature and leave marrow
5. React with foreing Ag – activate
6. Proliferate and produce Ab

Those, who have not meet the appropriate Ag yet, are in G0 and circulate



Rh factor (in tube detection)

1940 – Landsteiner

- Immunized the rabbits by the blood of Macacus Rhesus
- Rh incompatibility mother Rh- and child Rh+

	Genotype	Fenotype
CcDdEe	- D	- Rh+ … 85 %
	- d	- Rh- … 15 %

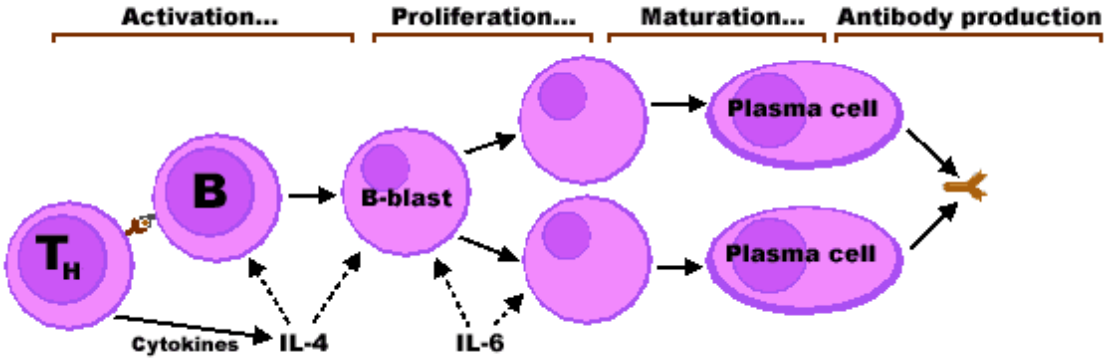
DETECTION: 500 ml of physiolog. solution + 10 ul blood

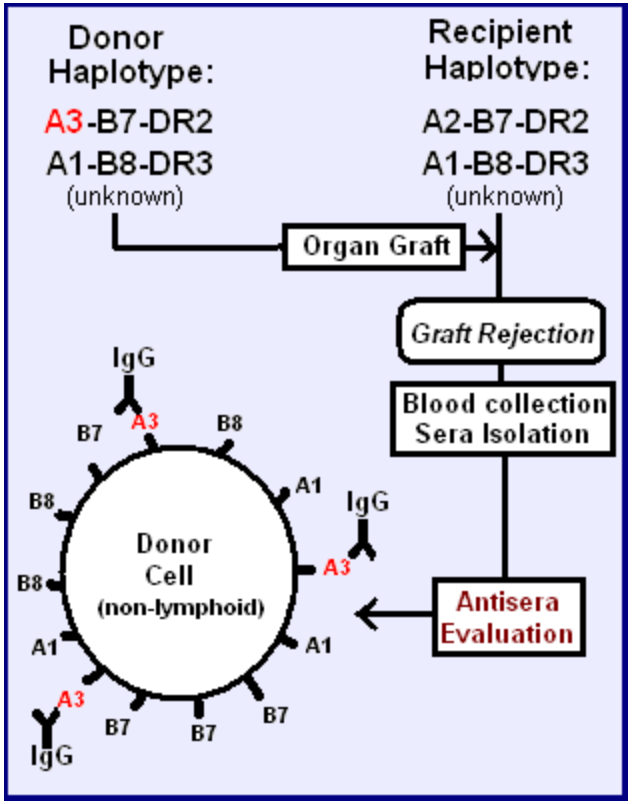
Centrifugation (1OOO RPM/3 min) – add 100 ul of physiol. solution to the pellet)

1 drop of anti-D Ab + 1 drop of erytrocytes, 10´/RT – Centrifugation (1000 RPM/1 min)

Other blood systems

- MN system (Ss), P system, Lewis, Duffy
- HLA/MHC system (leukocytes) – 1960 (10 Ag)





Transplantation – AB0, Rh

heart, liver - 5/10 HLA Ag

kidney – 7/10 HLA Ag

b. marrow – 10/10 HLA Ag

Small test

1. Which hormones increase glycemia?
2. What is the insulin signaling?
3. How proceeds hemolysis (hemoglobin decomposition)?
4. Is there anti-B Ab in the blood of person with blood group O?