

BLEED WEEK 3

HEMATOLOGY & IMMUNOLOGY

clots (thrombi) [platelets + coagulation cascade]
bleeding disorders

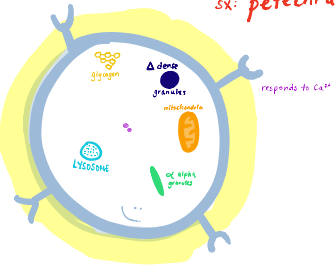
- this Week:**
- TV Platelets
 - AT TV Coag System + Coag Regulation
 - TV Bleeding Disorders I
 - TV Bleeding Disorders II
 - AT Hemophilia
 - AT Transfusion Medicine I
 - AT Transfusion Medicine II
 - TV Thrombosis
 - TV Anticoagulants
 - AT Pathology of Gunshot Wounds

nose bleed
scraped knee
bruising (internal hemorrhage)
gunshot wound

WHAT KEEPS US FROM BLEEDING OUT?

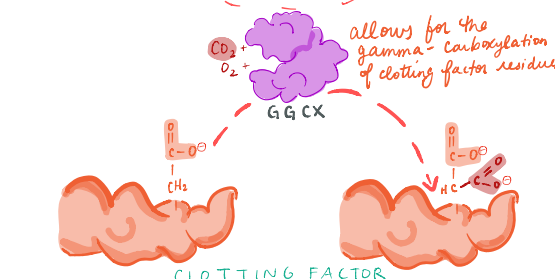
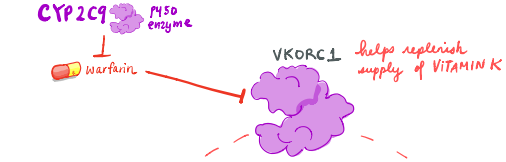
1. PLATELETS

no nuclei, tiny cytoplasmic fragment, sx: petechiae, mucosal bleeding (gums, epistaxis)



II + VII = IX and X
2 + 7 = 9 and 10

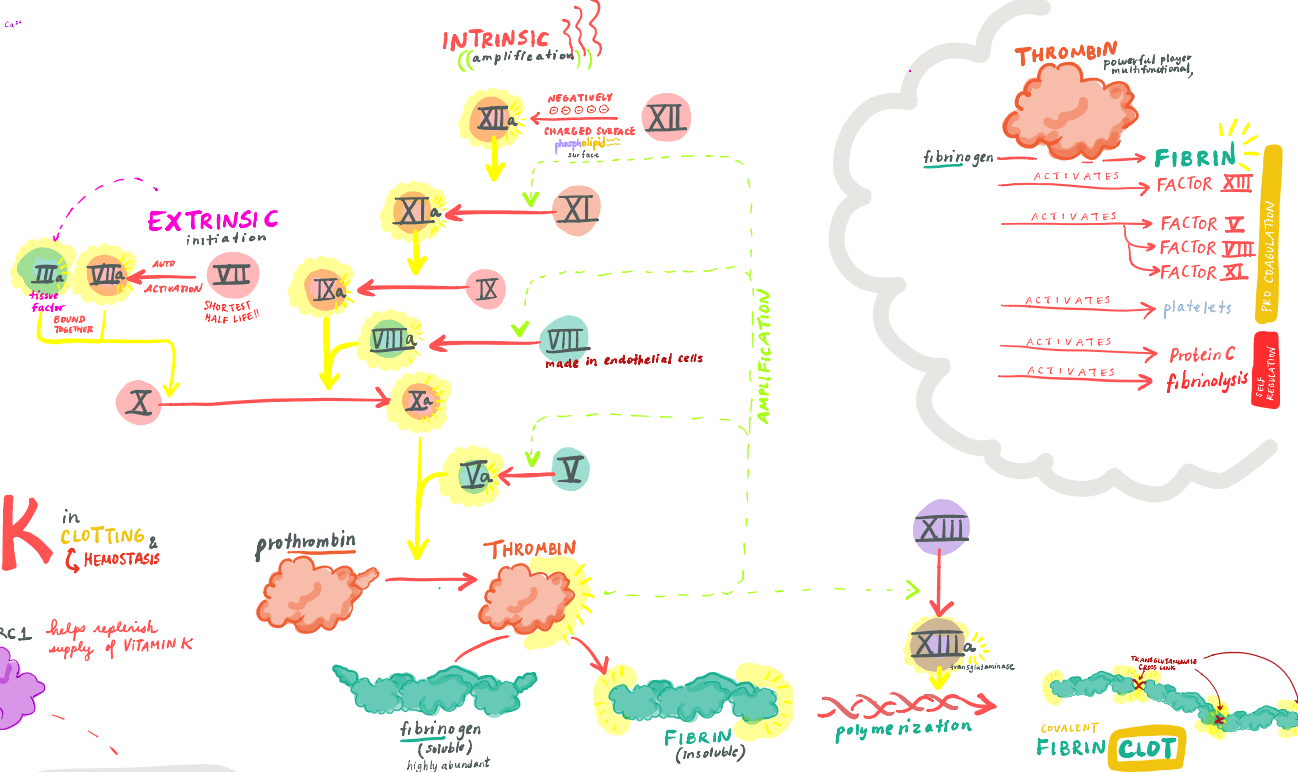
Protein C the essential role of Vitamin K in CLOTTING & HEMOSTASIS



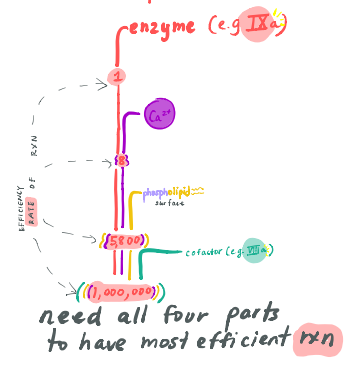
2. COAGULATION

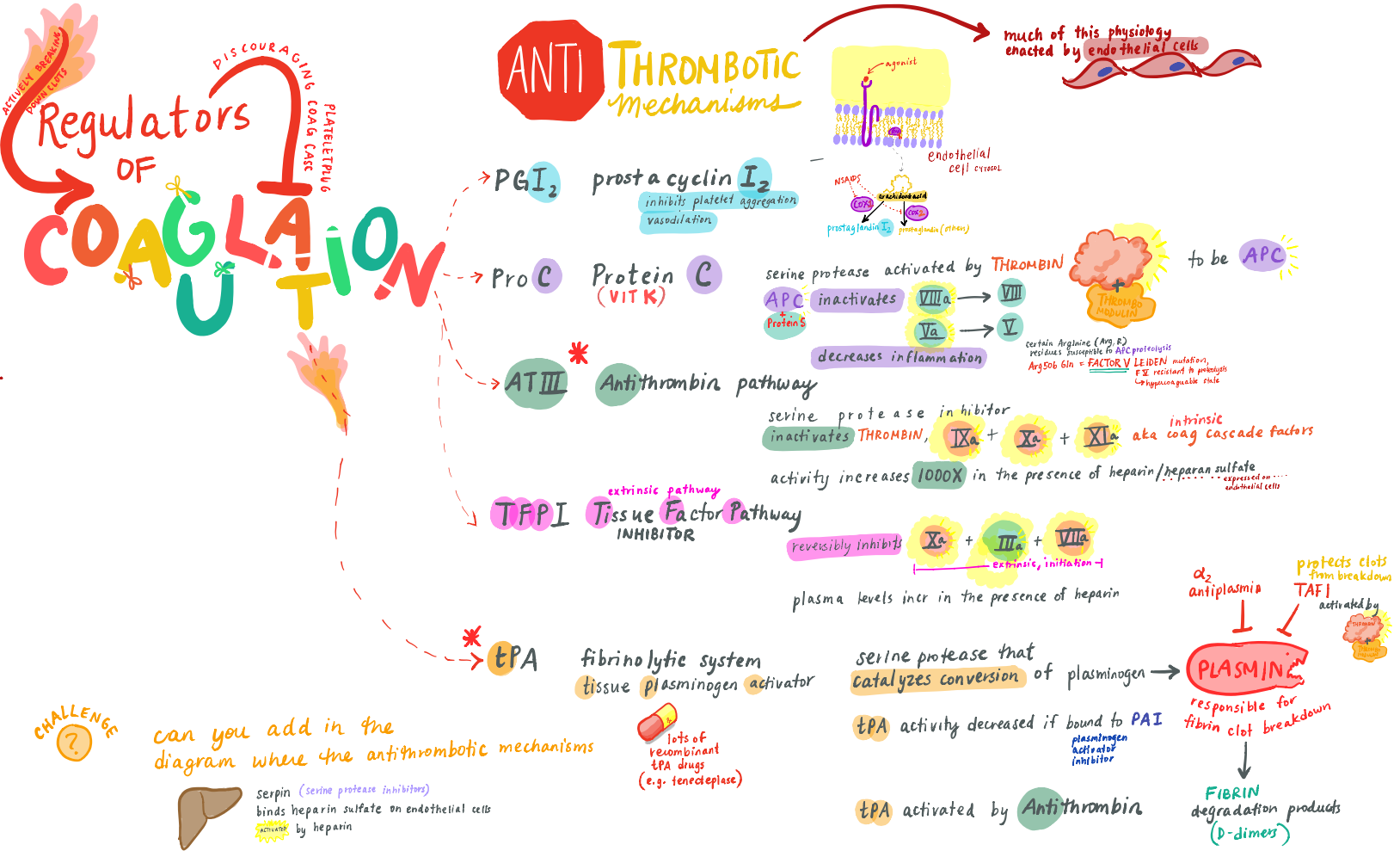
2° HEMOSTASIS
cascading signal of factors (serine proteases/cofactors) that activate the subsequent factor to initiate wound healing, stop bleeding

fibin-based
sx: deep bruising, ecchymoses, bleeding into joints



QUATERNARY complex





hemophilia

X-LINKED RECESSIVE

but can also be acquired (30%)
 cancer pregnancy rheumatologic dz

HOW MUCH FACTOR DO YOU NEED TO GIVE?

- <1%: **SEVERE hemophilia** (GETTING TO ABOVE 1% IS A HUGE DEAL)
- 1-5%: **MODERATE hemophilia** (bleeding w/ trauma w/ surgery rare spontaneous bleeding)
- 6-50%: **MILD hemophilia** (bleeding w/ trauma w/ surgery)

DEFICIENCY OF COAGULATION CASCADE FACTORS

- A hemophilia VIII deficiency**
- B hemophilia IX deficiency**
- C hemophilia XI deficiency** (Ashkenazi Jewish ancestry)

tx: **FACTOR VIII** (t_{1/2} = 12 hours, 1 unit → 2% level incr)
 tx: **FACTOR IX** (t_{1/2} = 18-24 hrs, 1 unit → 1% level incr)
 tx: **FACTOR XI**

desmopressin (ddAVP) why?
 New tx: **emicizumab** (bispecific antibody that binds IX + X which replaces the fxn of VIII)
 15-30% (spontaneous bleeding into joints (hemarthrosis) + musc.)

Lack of soluble fibrin clot formation uncontrolled deep bleeding, severe cases into joints, muscles, long term damage

? what labs would you check?

& what would you expect to see?

? HOW WOULD WE DISTINGUISH absence of factor (VIII) VS presence of factor inhibitor? what lab/test would distinguish? **KEY POINT!!**

Complication: FACTOR INHIBITORS
 ANTIBODIES w/ SPECIFICITY AGAINST **FVIII** OR **FIX** → get destroyed or make giving factor ineffective

! Try drawing out as much of the regulators of coagulation here

TRANSFUSION COMPONENTS

INDICATIONS TYPICAL SEVERE

refrigerated → last 42 days
kept @ RT → last 4 days
slow infusion speed over 2-4 hrs

RBCs

Hct < 21%
OR
Hgb < 7
OR
Acute coronary syndrome
OR
documented symptomatic anemia

1 unit
Hct incr ↑ ~3%

6 units if
Hct < 18

? What is the largest component of plasma? Next largest?



INR > 1.5 prior to major procedure
OR
if bleeding
OR
TTP, low clotting factor levels, DIC

2 units
clotting factors
incr ↑ ~5%

4 units INR = 2 to 2.5
6 units INR > 2.5

use of FFP @ risk of
✓ multiorgan system failure
✓ acute lung injury (TRALI)

fibrinogen (+ FVIII, FXIII, VWF)

"Cryo" precipitate (thaw of FFP)

fibrinogen < 150
AND
PATIENT is bleeding rarely FXIII deficiency

10 units
fibrinogen incr ↑ ~50 mg/dl

20 units
fibrinogen < 50

relative contraindications
→ TTP ? genetic defect associated w/ TTP =

expires 5-7 days
store room temp (20°-24°C)
MUST ROCK GENTLY!
at risk for bacterial growth

Platelets (ADP, TxA2)

< 10 + prophylactic
< 20 + minor procedure
< 50 + major surgery
< 100 Neurosurgery

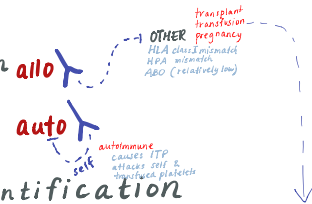
1 unit mL/kg
platelets incr ↑ ~30K/μl

2 units
platelets < 50

& Heparin-induced thrombocytopenia (HIT)
? what form of heparin is less likely to cause HIT

Confirming BLOOD COMPATIBILITY BEFORE we transfuse

1. Type and Screen
2. Antibody Screen
3. Antibody Identification
4. Cross match



Massive TRANSFUSION PROTOCOL

6 : 6 : 1
12 UNITS RBC : 12 UNITS PLASMA : 1 UNIT PLATELET

GIVE IN THIS RATIO TO PREVENT

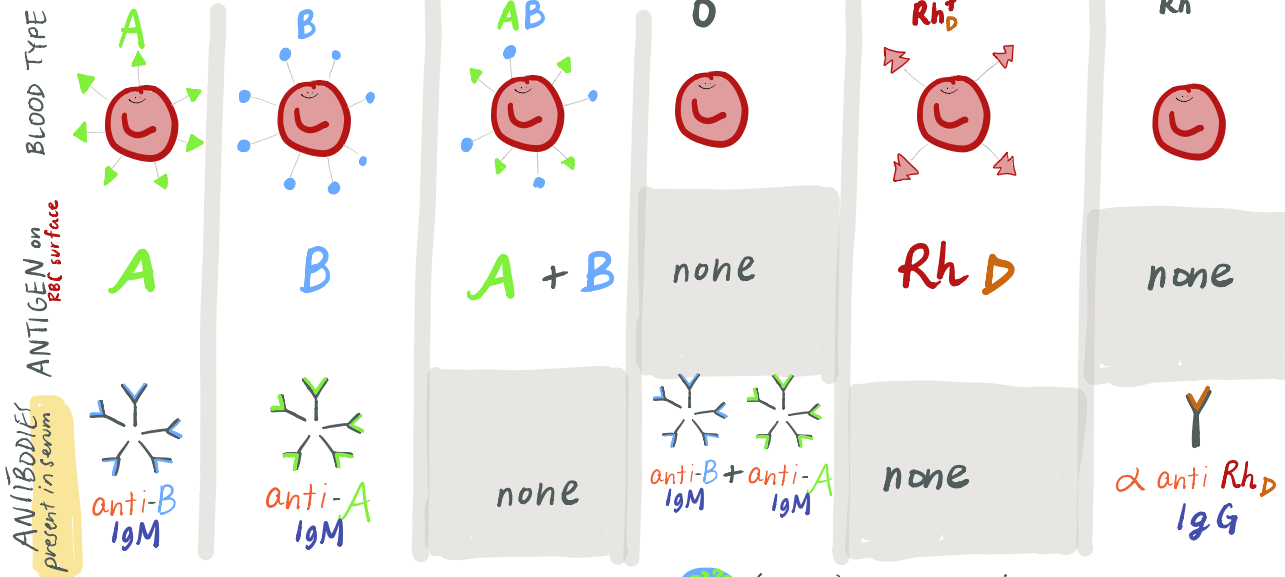
PROTOCOL @ HOSPITAL THAT ENSURES THIS RATIO OF BLOOD PRODUCTS CAN BE DELIVERED < 10 min

hemodilution unequal #s of blood compon

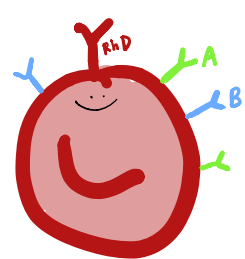
! Be able to understand the result of giving an imbalanced proportion of blood products

A B O SURFACE MARKERS

Rh SURFACE MARKERS



? What constitutes is a Blood Group antigen?
? What are the two most consequential Blood Group Antigens?



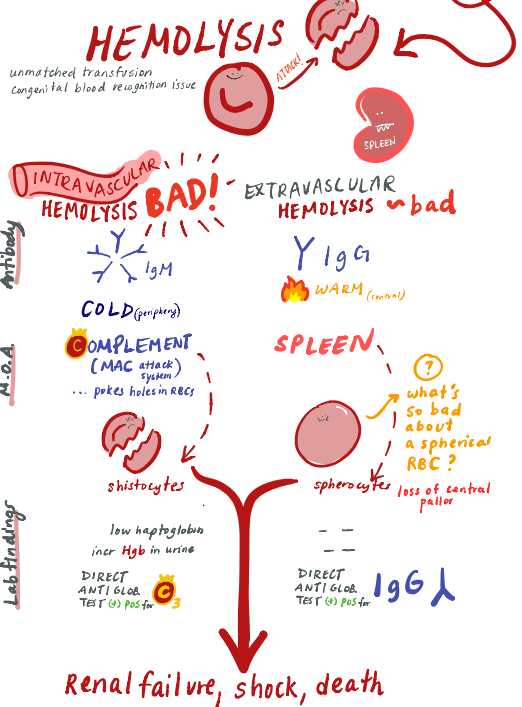
? Name his blood type + what antibodies you would expect in the serum

B or AB transfusion → HEMOLYTIC RXN
A or AB transfusion → HEMOLYTIC RXN

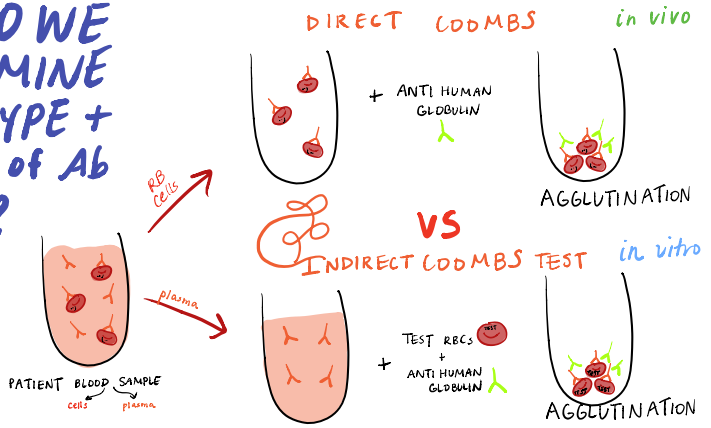
can receive any blood type ABO
universal PLASMA donor
UNIVERSAL RBC DONOR (but can only receive O blood)
can receive any type of plasma

can receive any blood type Rh+ or Rh-

Treat mother w/ anti-D Ig during and after each pregnancy to prevent alpha B IgG formation



HOW DO WE DETERMINE BLOOD TYPE + presence of Ab in blood?



what is CODOMINANCE

how does it compare with other modes of inheritance? NO dominant trait, distinct from autosomal/x-linked recessive, masked by 'dom' allele

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

Genotype Table → Blood Group Phenotype

- Group O
- Group AB
- Group A
- Group B

phenotype

PATHOLOGY of GUNSHOT WOUNDS

fire arm-related injuries = public health epidemic

OREGON SPECIFIC

FROM 2010-2014
2,280 deaths

- 85% male
- majority SUICIDES
- context of intimate partner violence gang violence

1. understand forensic pathology
2. CAUSE vs MANNER of death
3. basic workup/understanding of firearms & associated WOUNDS

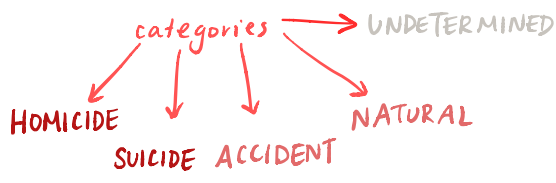
CAUSE of death

the injury or condition that started the fatal chain of events

etiologically specific

- exsanguination
- loss of fxn
- dysrhythmia (heart)
- ischemia
- infxn

MANNER of death



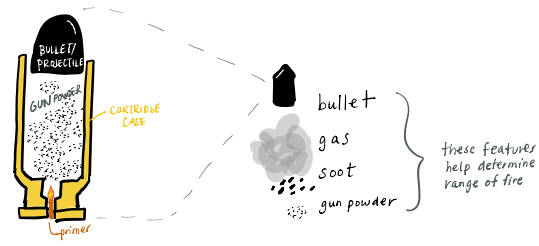
GUNSHOT WOUND

PROJECTILE bullet

fired into body from fire arm leading to serious physical & psycho emotional injury, and very often death.

WHAT info is important?

- 1 entrance → exit
- 2 range of fire
- 3 pathway & direction
- 4 bullet (type?)

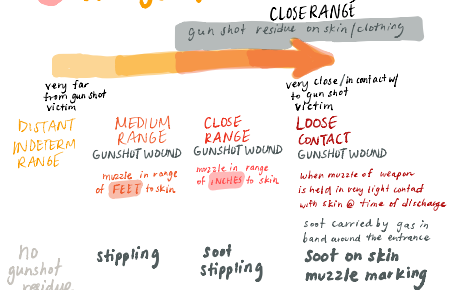


workup of GUNSHOT WOUND

- often by state medical examiner (MD)
1. determine entrance → exit
 2. describe visible residue for range of fire determination
 3. document injury including blood collections
 4. Recover bullets

- 1 entrance WOUNDS vs exit WOUNDS
- ✓ round/oval
 - ✓ "punched out"
 - ✓ present abrasion collar
 - ✓ gunshot residue
 - ✓ stellate
 - ✓ "slit like"
 - lacking abrasion collar

2 Range of Fire



bullet travels in straight line unless deflected (tissue density, elasticity)

GRAZE WOUNDS

looks like abrasion

skin tags determine direction

Contact wounds often stellate

SOLUTIONS?

- ✓ safe storage counseling to patients who own fire arms
- ✓ gun access in home
- ✓ understand as physicians our role in preventing fire arm-related injuries — SHAPE our stories, advocacy

other sx: MULTIPLE INTERSECTING CALVARIAL FRACTURES IN SKULL ORBITAL PLATE FRACTURES → RALDON EYES (peri-orbital hematomas)