

PLATELET-RICH PLASMA AS A TREATMENT: VALUABLE OR JUST PLAIN EXPENSIVE?

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OBJECTIVES:

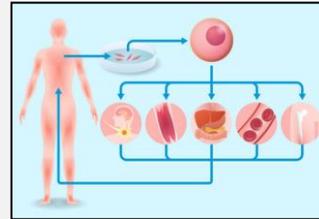
- Discuss the field of regenerative medicine.
- Review the formation of platelets and their structure and functions in the body.
- Discuss platelet-rich plasma as a possible medical treatment.



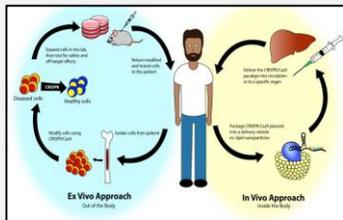
WHAT IS REGENERATIVE MEDICINE?

- Regenerative medicine (RM) involves using cells, tissues, or genetic material to treat and manage diseases.
- Emerging field that aims to repair, replace or regenerate human cells, tissues, or organs to restore or establish normal function
 - Stem cell therapy
 - Gene therapy
 - Tissue engineering
 - **Platelet-rich plasma (PRP) therapy**
- BIG business: 5000+ clinical trials worldwide

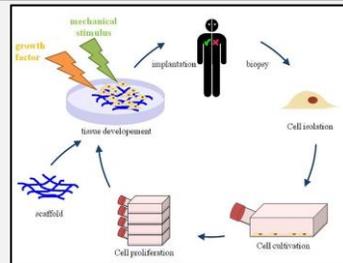
STEM CELL THERAPY

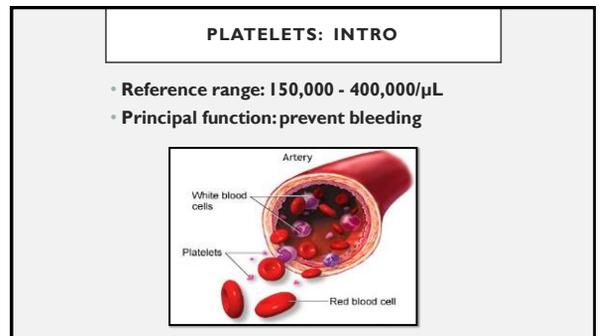
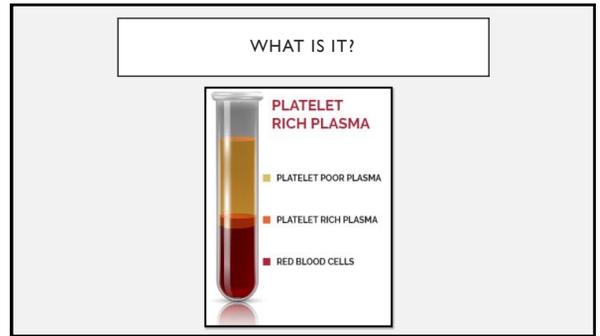
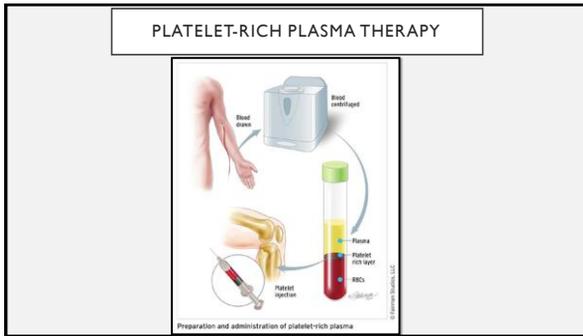


GENE THERAPY



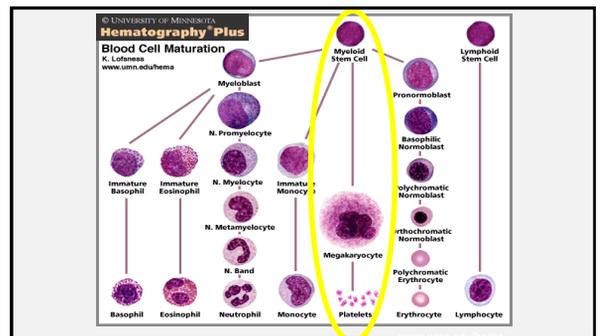
TISSUE ENGINEERING

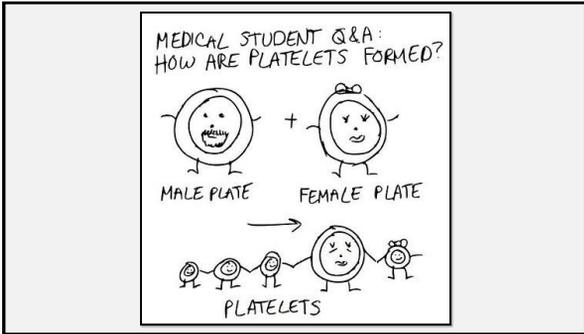




WHAT ARE PLATELETS?

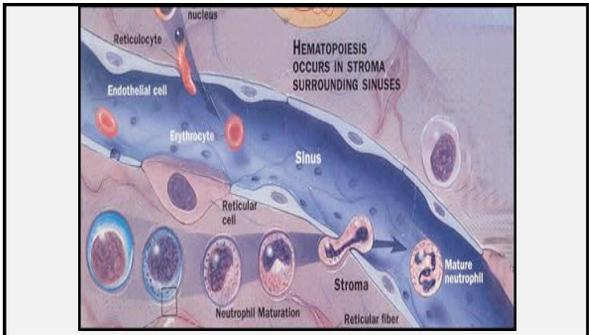
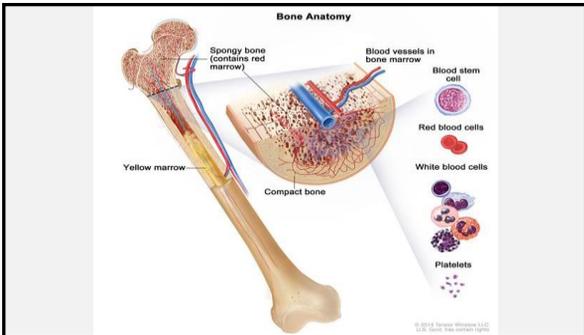
- Small, anuclear 'cells' with azurophilic granules
- Fragments of megakaryocyte (MK) cytoplasm in bone marrow (BM) released to peripheral blood (PB)





HOW DOES IT REALLY HAPPEN?

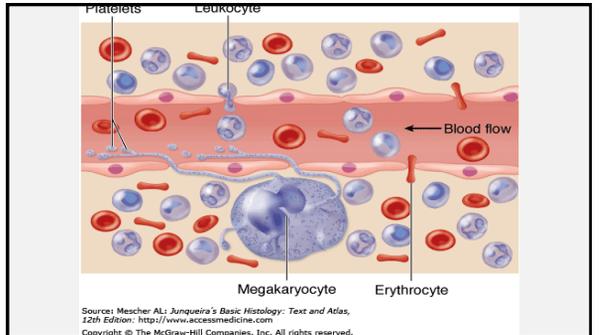
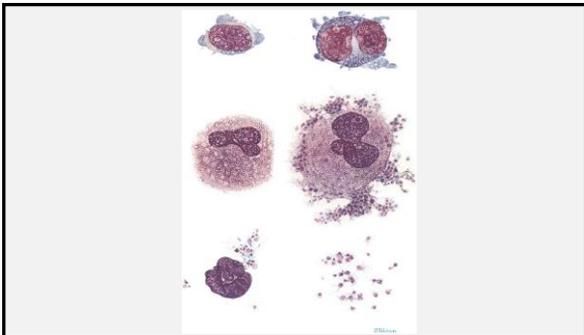
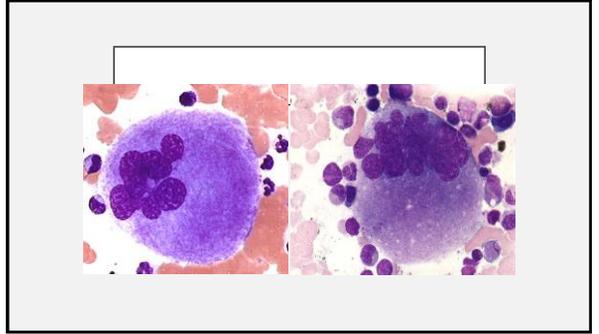
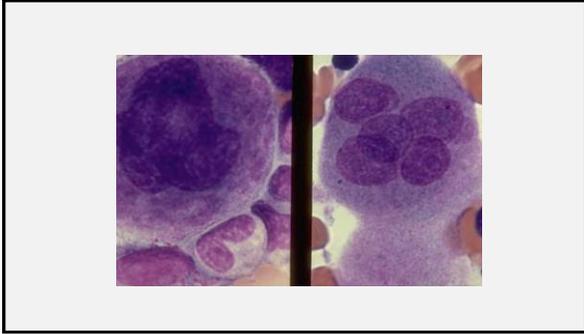
- Hematopoiesis is responsible for replacement of peripheral blood cells.
- In healthy adults, occurs primarily in the bone marrow.
- Like any other organ, blood vessels supply nutrients and gases to the marrow
 - Nutrient artery
 - Central vein
- Blood cells pass through gaps in intravascular lining to enter circulation



MEGAKARYOCYTE

MEGAKARYOPOIESIS

- Occurs in bone marrow
 - Morphologic alterations in the megakaryocyte:
 - Vast increase in cell size with maturation
 - Nucleus goes from round to bi-lobed to multi-lobed
 - Diffusely **granulated** cytoplasm
 - Mitosis, followed by endomitosis
 - **Endomitosis**: Doubling of DNA content without nuclear division or cell division



MEGAKARYOCYTE WITH PROPLATELETS



PLATELETS

- Survival: 7-10 days
- Non-viable or aged platelets removed by spleen & liver
- Platelets released from the BM (no reserve in BM)
 - 2/3 of platelets circulate in the PB
 - 1/3 are sequestered in the spleen

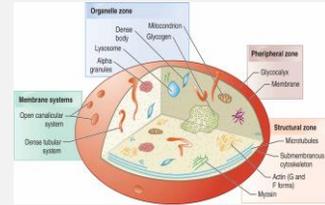


PLATELET STRUCTURE

- PLT surface has membranous channels that extend deep into PLT.
- PLT ultrastructure:
 - Peripheral zone
 - Structural/Sol-Gel zone
 - Organelle zone
 - Membrane systems

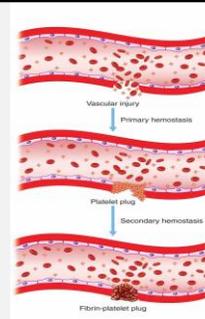


PLATELET STRUCTURE



PLATELETS DO MANY JOBS...

- Interact with injured vessel
- Interact with other platelets
- Interact with coagulation factors/proteins

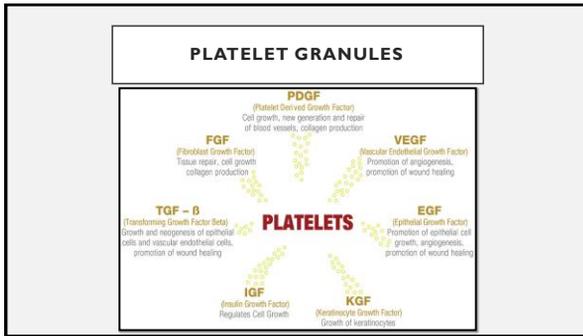


PRIMARY HEMOSTASIS

1. Adhesion → PLT attach to injured vessel
2. Activation → PLT function & shape change
3. Secretion → Release of **PLT granules**
4. Aggregation → PLT attach to each other

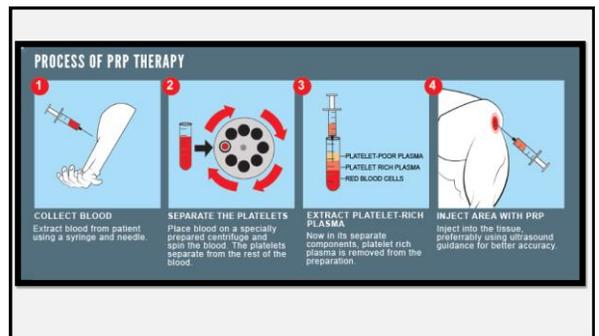
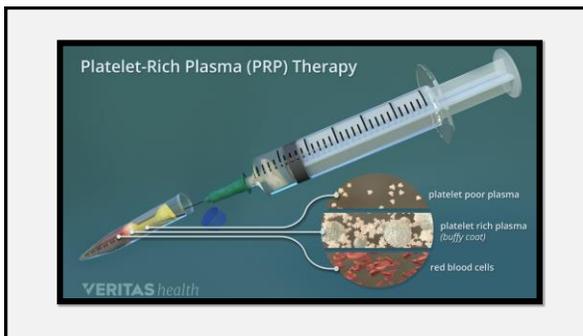
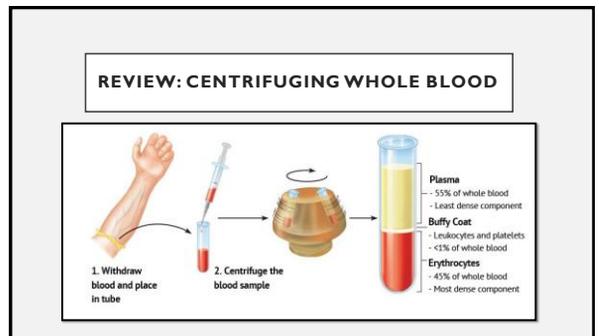
OTHER PLATELET ROLES

1. Surveillance of blood vessel integrity
2. Platelet-endothelium interactions
3. Platelet-platelet interactions
4. Platelet-coagulation proteins interactions
5. Aid in healing of injured tissue



- ### MANY JOBS, CONT.
- **Maintain integrity of blood vessels**
 - Passive surveillance of vessel endothelial cell lining for gaps
 - Releases platelet-derived growth factor (**PDGF**)
 - A decrease in platelets results in blood leaking into tissues
 - **Aid in healing injured vessels and tissue**
 - Contain proangiogenic cytokines and growth factors

- ### CAN WE USE PLATELETS TO TREAT WHAT AILS US?
- Dental procedures
 - Sports medicine
 - Orthopedic injuries
 - Tendons
 - Ligaments
 - Joints
 - Pain
 - Osteoarthritis
 - Wound healing
 - Dermatologic concerns
 - Hair growth
 - Sexual dysfunction



HOW TO MAKE PRP: LET US COUNT THE WAYS!

• <https://binged.it/2lhHe4l>

The diagram illustrates the three-step process for PRP preparation:

- Step 1: Subspin over centrifugation** (1200 x g for 10 min): This step separates the blood into three layers: PRP (top, yellow), buffy coat (middle, thin white layer), and RBCs (bottom, red).
- Step 2: Spin PRP** (1200 x g for 10 min): The PRP layer is further processed to concentrate platelets.
- Step 3: Subspin over centrifugation** (1200 x g for 10 min): The final PRP is separated from the plasma.

The images show the manual process of PRP preparation, from drawing blood into a syringe to centrifugation and the resulting components: Platelet Rich Plasma (PRP) and Platelet Poor Plasma (PPP). Labels include 'Whole Blood', 'Platelet Rich Plasma', 'Platelet Poor Plasma', and 'Red Blood Cells'.

COST

- \$300-\$2000/injection
- Multiple injections often recommended
- Most insurance does not cover

SAFETY?

- FDA oversight?
 - "off-label use"
- Autologous = "natural" = safe?
- Platelet "dosage" – is more always better?
- Adverse reactions
- Cross-contamination from equipment?
 - Two HIV cases

RESEARCH?

- Most studies are far from rigorous
 - Very small sample size – anecdotal evidence?
 - Lack of standardization of PRP prep or of injection procedure
 - Few randomized, controlled trials – funding shortage for non-drug treatments
- PRP vs. whole blood?
- Several high quality studies show no significant benefit
- Placebo effect?

RESEARCH, CONT.

- This just in...
 - Bacterial cystitis in women
 - Androgenetic alopecia in men
 - MRSA treatment in canine wounds
- Nearly all studies acknowledge a need for more research.

THOUGHTS, QUESTIONS OR EXPERIENCES?

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THANK YOU!

