

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

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OBJECTIVES:

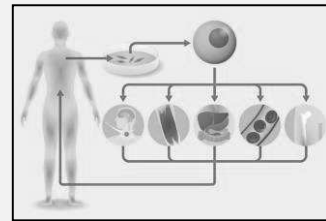
- Discuss the field of regenerative medicine.
- Review the formation of platelets and their structure and functions in the body.
- Discuss platelet-rich plasma as a possible medical treatment.



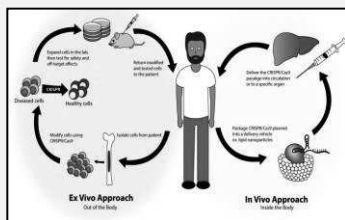
WHAT IS REGENERATIVE MEDICINE?

- 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

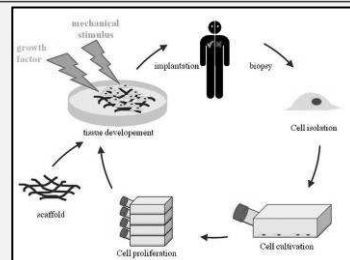
STEM CELL THERAPY



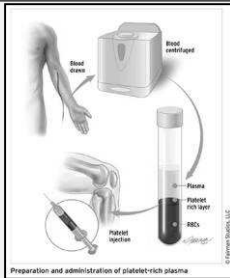
GENE THERAPY



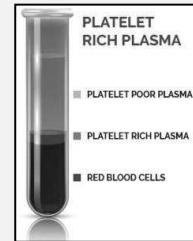
TISSUE ENGINEERING



PLATELET-RICH PLASMA THERAPY



WHAT IS IT?

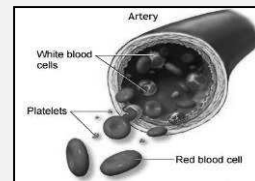


EMERGING POPULARITY OF PRP TREATMENTS



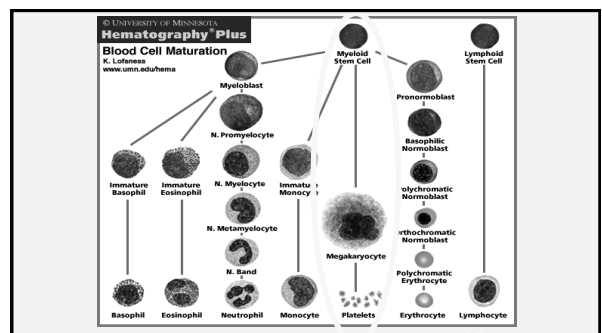
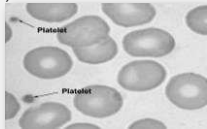
PLATELETS: INTRO

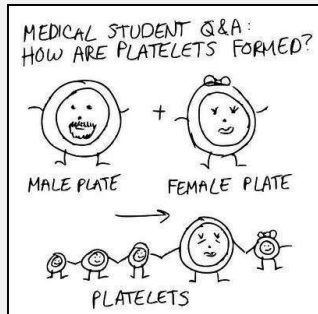
- Reference range: 150,000 - 400,000/ μ L
- Principal function: prevent bleeding



WHAT ARE PLATELETS?

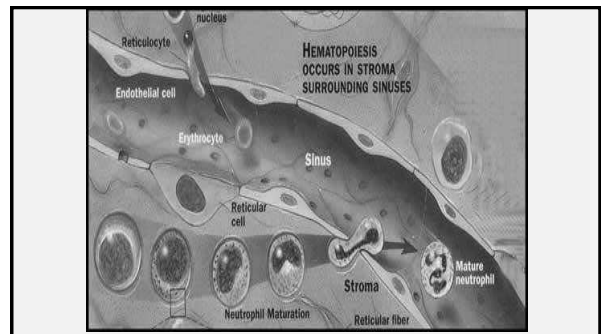
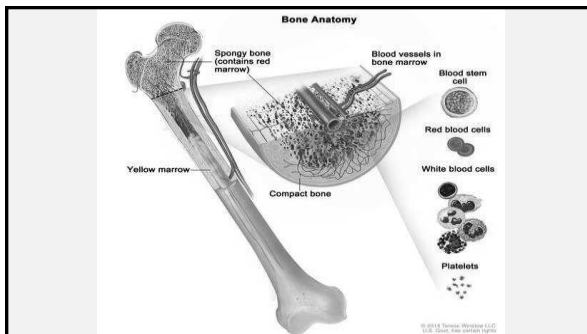
- Small, anuclear 'cells' with azurophilic granules
- Fragments of megakaryocyte (MK) cytoplasm in bone marrow (BM) released to peripheral blood (PB)



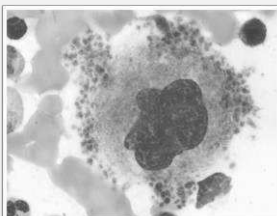


HOW DOES IT REALLY HAPPEN?

- 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

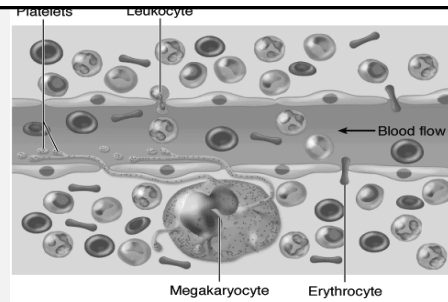
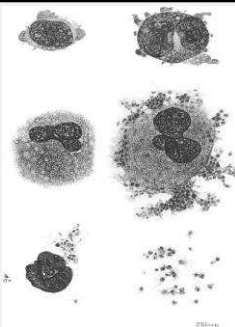
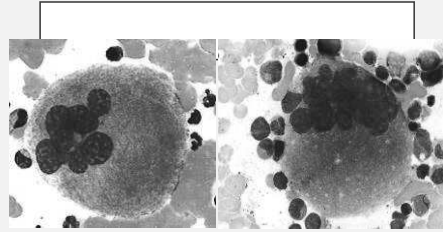
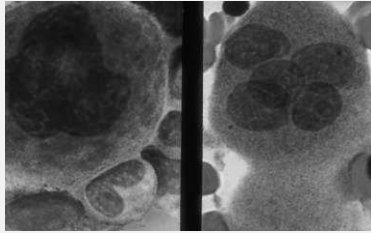


MEGAKARYOCYTE



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



Source: Mescher AL: Junqueira's Basic Histology: Text and Atlas, 12th Edition. <http://www.accessmedicine.com>. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

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

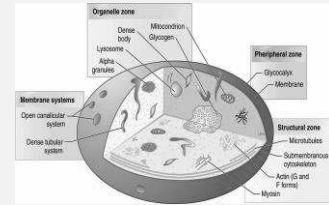


PLATELET STRUCTURE

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

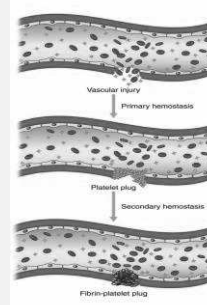


PLATELET STRUCTURE



PLATELETS DO MANY JOBS...

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



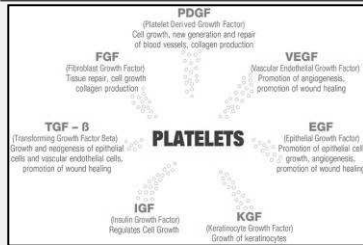
PRIMARY HEMOSTASIS

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

PLATELET GRANULES



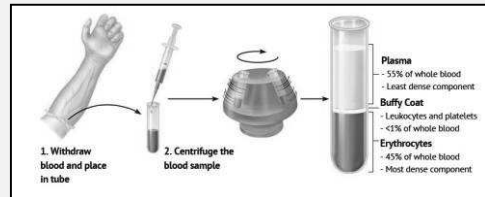
MANY JOBS, CONT.

- 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

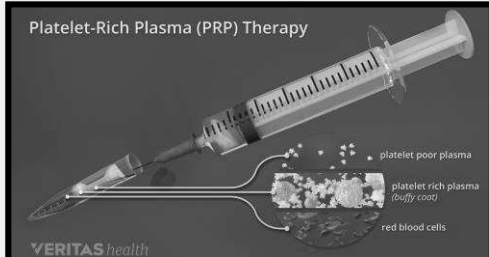
CAN WE USE PLATELETS TO TREAT WHAT AILS US?

- Dental procedures
- Sports medicine
- Orthopedic injuries
 - Tendons
 - Ligaments
 - Joints
 - Pain
- Osteoarthritis
- Wound healing
- Dermatology concerns
- Hair growth
- Sexual dysfunction

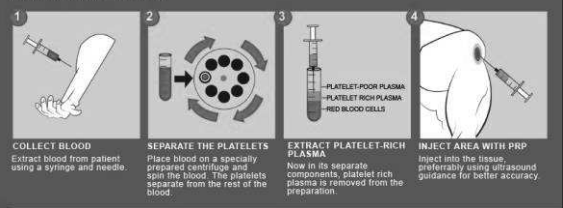
REVIEW: CENTRIFUGING WHOLE BLOOD




Platelet-Rich Plasma (PRP) Therapy



PROCESS OF PRP THERAPY



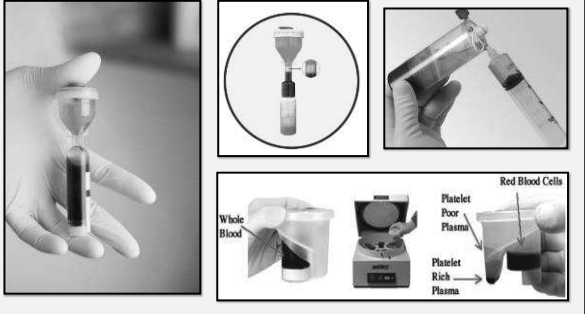
HOW TO MAKE PRP: LET US COUNT THE WAYS!



• <https://binged.it/2lhHe4l>

The diagram illustrates the PRP process in three steps:

- Step 1: Subspin (most investigation)** - 2000 x g, 10 min, 4°C. Result: PRP (platelets) and RBCs (red blood cells).
- Step 2A: Option 1 PRP (most investigation)** - 2000 x g, 10 min, 4°C. Result: PRP (platelets) and RBCs (red blood cells).
- Step 2B: Option 2 PRP (most investigation)** - 2000 x g, 10 min, 4°C. Result: PRP (platelets) and RBCs (red blood cells).



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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?Contact information:

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**THANK YOU!**