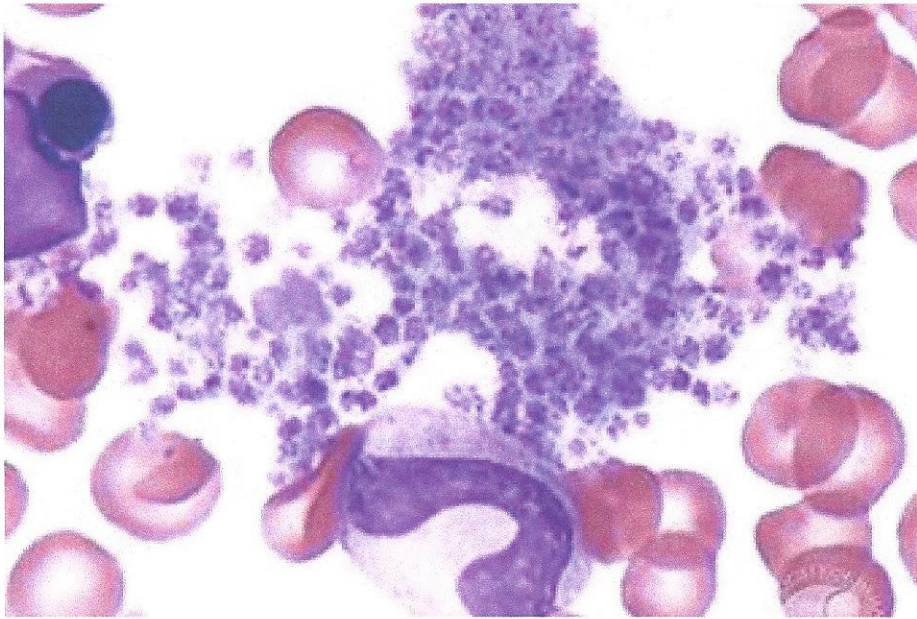


WHAT IS PRP?



- Platelets
- Plasma
- Proteins
- Growth Factors
- Cytokines
- Lysosomes
- Exosomes
- And MORE!

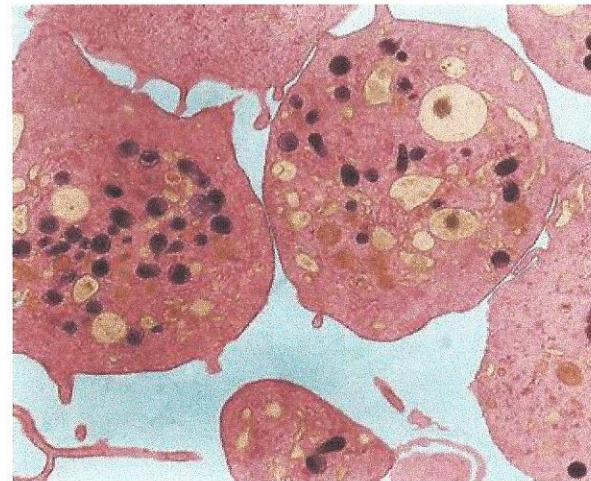
AN IDEAL SYSTEM WOULD...

- Harvest High Quantity of Platelets
- Physically Separate RBCs
- Enable User-Driven Selective Retention of WBCs

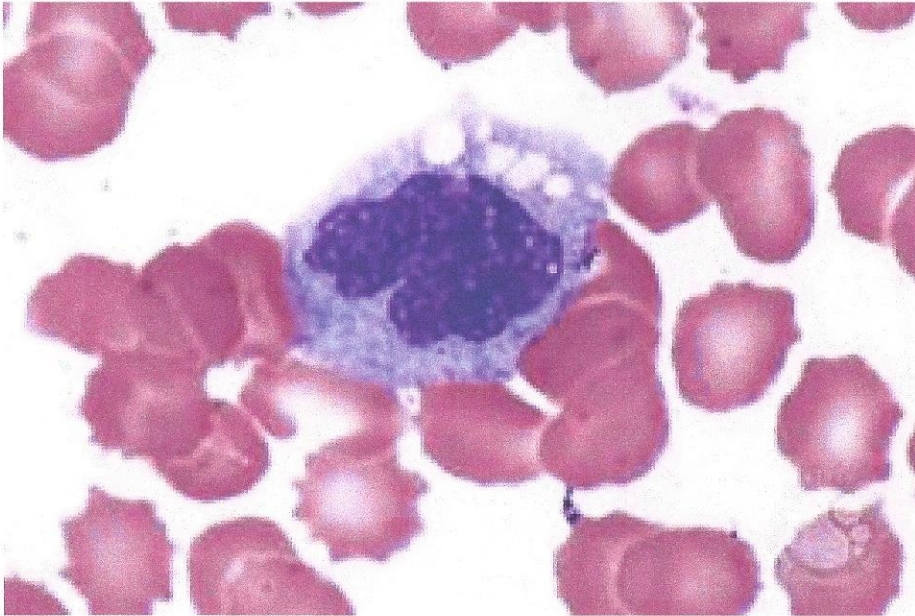


WHAT IS A PLATELET?

- A cytoplasmic anucleated fragment derived from a megakaryocyte
- “An injection of concentrated platelets at sites of injury may initiate tissue repair via the release of many biologically active factors (growth factors, cytokines, lysosomes) and adhesion proteins that are responsible for initiating the hemostatic cascade, synthesis of new connective tissue, and revascularization.” – Dr Everts et al



WHAT IS A MONOCYTE?



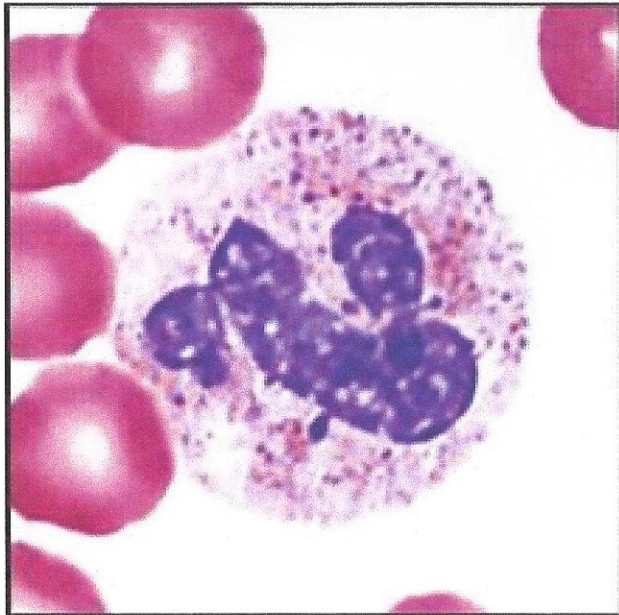
- Size: **15-30 μ m**
- Volume: 3-8% WBC
- Function: Immunomodulatory & Tissue Repair
- More: phagocytosis & T-cell communication; produces anti-inflammatory cytokines (TNF, IL-1 & IL-12)
- Evolution: morph into macrophages!
- Healing Stage: Proliferative-Differentiative
- FunFact: largest type of WBC

WHAT ARE LYMPHOCYTES?

- Size: **7-15 μ m**
- Volume: 20-25%
- B Cells – make antibodies, block invasion & enhance pathogen destruction
- Helper T Cells (CD4+) – make cytokines & coordinate immune response
- Cytotoxic T Cells (CD8+) – binds virus-infected or tumor cells and kills them
- Natural Killer Cells – attacks viral / cancerous cells



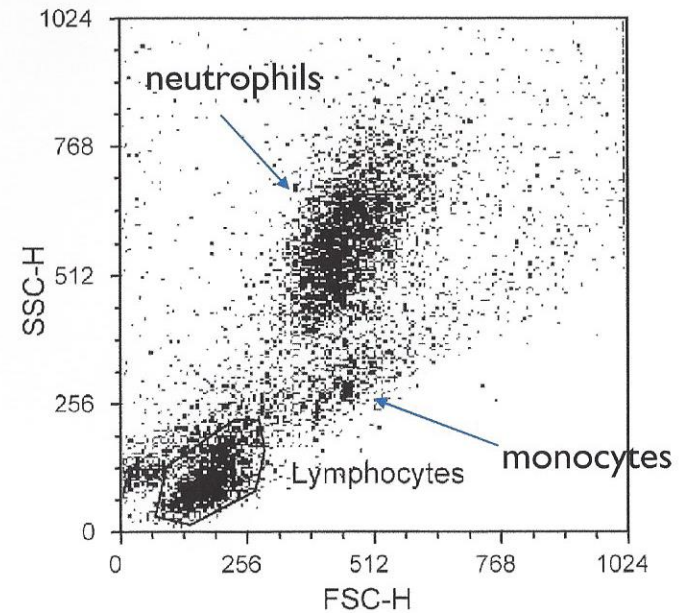
WHAT IS A NEUTROPHIL?



- Size: **10-12 μ m**
- Volume: Most abundant WBC (60-70%)
- Function: defend against bacterial or fungal infection
- Healing Cascade: Inflammation
- FunFact: they create pus when they activate and die
- High Concentrations May Cause Necrosis
- **No Known Clinical Value**

BUT WHERE ARE THEY?

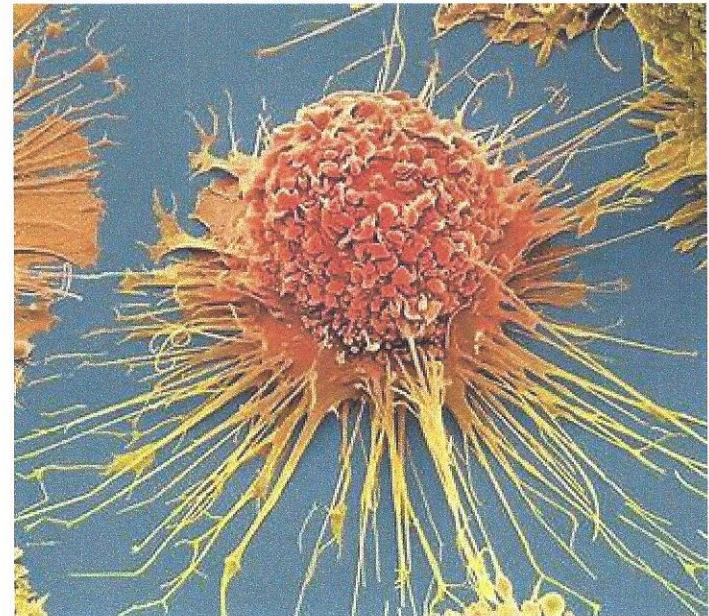
- Biological Science is Never Perfect!
 - “Average Range”
 - “Gaussian Distribution”
- Buffy Coat – based on density (not size)
 - Upper Fraction – Monocytes & Lymphocytes
 - Lower Fraction – Everything Else



FROM MONOCYTES TO MACROPHAGES

What do Macrophages do?

- Removes dead cell debris (M1 / M2);
- Secretes bone morphogenic proteins, IL-1 β , TGF- β , PDGF & IGF);
- Promotes recruitment and proliferation of osteoblasts, stem cells & progenitor cells



BUFFY COAT

Cellular Diversity, Sorted by Gravity

- 7-11% Platelets
- ~>99% White Blood Cells
- <1% RBC

Nothing is perfect! Including Separation!

The Thin White Line



PLATELET MATH -- DOSAGE


- X = ml blood drawn, Y = % platelets recovered in sample, V = Volume of Injectate,
- C = Concentration, D = Dosage
- $X/V = C$
- $X * Y = D$...only when entire volume of recovered plasma is injected!
- Remember: Gaussian Distribution of Average Ranges!

| CAREprp Blood Draw | 23.0 |
|---------------------------|-------------|
| 2x | 11.5 |
| 3x | 7.7 |
| 4x | 5.8 |
| 5x | 4.6 |
| 6x | 3.8 |
| 7x | 3.3 |
| 8x | 2.9 |
| 9x | 2.6 |
| 10x | 2.3 |
| 16x | 1.4 |

CONCENTRATION

It's just Math (expressed in CCs)!

RECOVERY RATES (N=12)

| <i>Company</i> | Platelet | RBC | WBC |
|---|--------------|-------------|---------------|
| A | 60.7% | 0.2% | 6.3% |
| B | 61.1% | 1.2% | 9.2% |
| C | 79.8% | 6.9% | 10.8% |
| D | 78.5% | 5.0% | 5.0% |
| CARE PRP  | 91.0% | 0.2% | CUSTOM |

PLUNGER / MECHANICAL

Pros

- High Potential Platelet Recovery Rate
- More Customizable PRP (LR vs LP; Concentration)



Cons

- High RBC Retention Rate
- High Cost
- Manual Error-Prone
- Long Time to Prepare

DR ANNA PETROPOULOS, PLASTIC SURGEON



- *PRP Injections for Facial Collagen Rejuvenation: Mechanisms of Action & Lessons in Learning*
- Regenerative aesthetic medicine seeks to reverse the ravages of time using the body's own mechanisms of action.
- Aging reduces melanocytes, fibroblasts, and collagen synthesis; DNA damage accumulates & causes harm to cellular function, protein maturation.
- Over 1100 proteins in a single platelet (fibronectin & vitronectin); platelet alpha granule release stimulates fibroblast proliferation, migration, collagen synthesis, elastin synthesis and differentiation into myofibroblasts

AMSSM POSITION STATEMENT ON REGENERATIVE MEDICINE, '21



- “Treatments that are the least invasive, safest, most cost-effective treatment with the highest level of evidence are implemented first.”
- “Treatments options, such as PRP, are relatively inexpensive, less invasive, and have more evidence in the treatment of specific musculoskeletal conditions.”
- “PRP injections are more effective in reducing pain and improving function than steroid or hyaluronic acid injections for knee OA.”