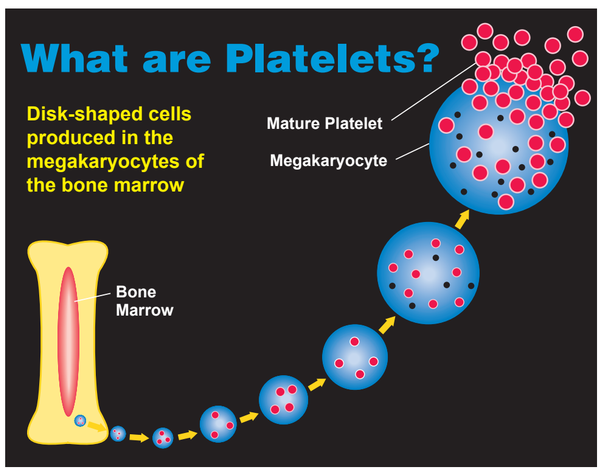
Evaluation of Platelet Function

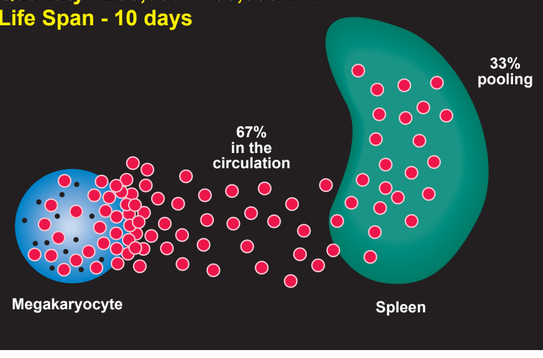
What are Platelets?

Disk-shaped cells produced in the megakaryocytes of the bone marrow

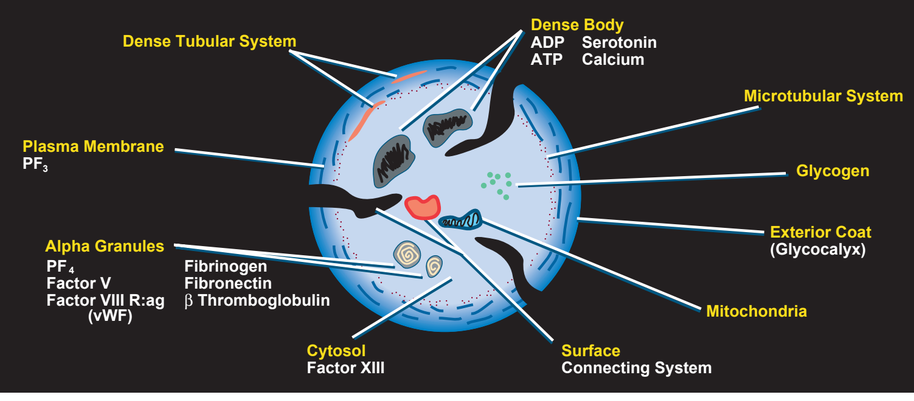


Storage and Circulation

Quantity - 200,000 - 400,000/mm^3
Life Span - 10 days



Anatomy of a Platelet



Dynamics of Hemostasis

Defects of Platelet Function

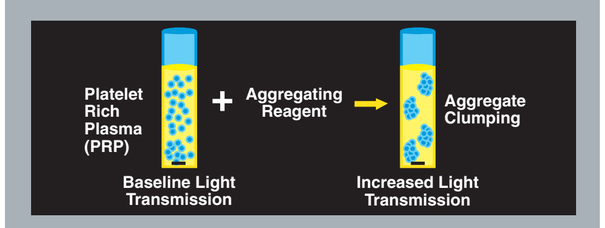
Defect	Aggregation Response							
	ADP		Epinephrine		Arachidonic Acid	Collagen	Thrombin	Ristocetin
	Primary	Secondary	Primary	Secondary				
1. Bernard-Soulier Syndrome	N	N	N	N	N	N	N or ↓	↓
2. von Willebrand's Disease	N	N	N	N	N	N	N	↓* (↑ Type IIb)
3. Glanzmann's Thrombasthenia	↓	↓	↓	↓	↓		↓	±
4. Storage Pool Disorder	↓	↓ or ↓↓	↓	↓	N or ↓	↓	±	±
5. Aspirin-like Disorder or Aspirin Ingestion	↓	↓	↓	↓	↓	↓	±	±

N = Normal
± = Not diagnostic
* = Corrected by cryoprecipitate, factor VIII concentrate or normal plasma; type IIB exhibits increased sensitivity to low concentrations
↓ = Decreased

Platelet Aggregation

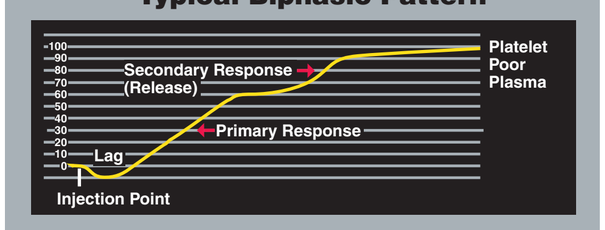
Platelet Aggregation

In vivo, platelets participate in primary hemostasis by first adhering, then aggregating at the site of an injured blood vessel. In vitro, platelet aggregation assays use various platelet activators to identify abnormal platelet function and to monitor antiplatelet drug therapy. ADP, collagen, epinephrine, ristocetin and arachidonic acid are reagents commonly used to induce platelet aggregation.



The platelet aggregation procedure is performed on a turbidimetric aggregometer as first described by Born. Changes in aggregation are recorded as platelet-rich plasma and aggregating reagents are stirred together in a cuvette. The aggregometer serves as a standardized spectrophotometer. As aggregation proceeds, more light passes through the sample.

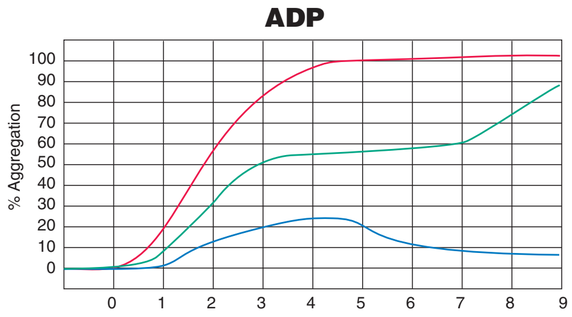
Typical Biphasic Pattern



Primary Response
Is the reversible aggregation of platelets by the aggregating agent. The appearance of a biphasic reaction, showing both primary and secondary response, can occur for some agonists at low concentration.

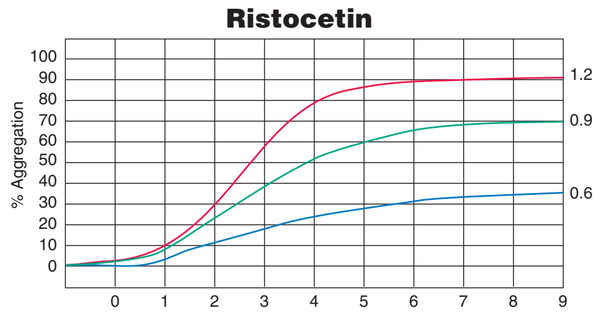
Secondary Response
Is the result of enhancement of the initial aggregation process due to release of endogenous ADP and the formation of Thromboxane A_2. The secondary response is irreversible.

ADP



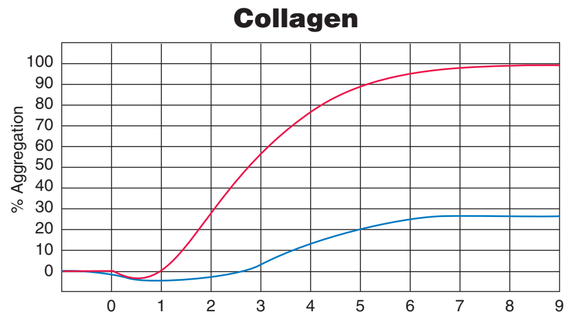
Normal Response to 10 M ADP – Primary and Secondary slopes indistinguishable, aggregation > 60%
Normal Response to 5 M ADP – Primary and Secondary slopes distinctly biphasic
Abnormal Response to 10 M ADP – aggregation < 60%

Ristocetin



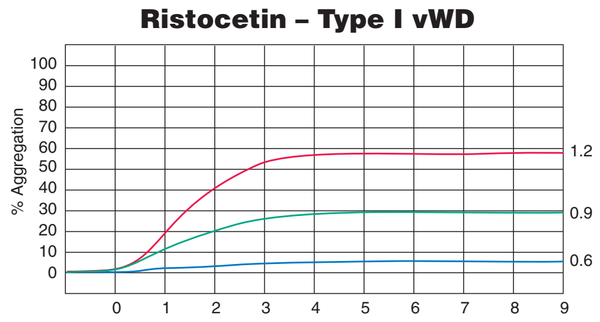
Normal Response – aggregation > 60% with < 1.2 mg/mL ristocetin; response decreases proportionately with 0.9 and 0.6 mg/mL ristocetin

Collagen



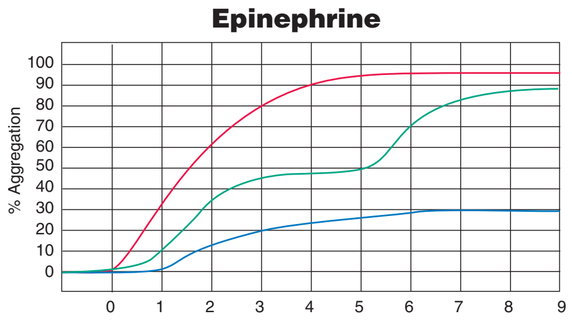
Normal Response to 10 g Collagen – lag phase < 60 seconds
Abnormal Response to 10 g Collagen – prolonged lag phase

Ristocetin – Type I vWD



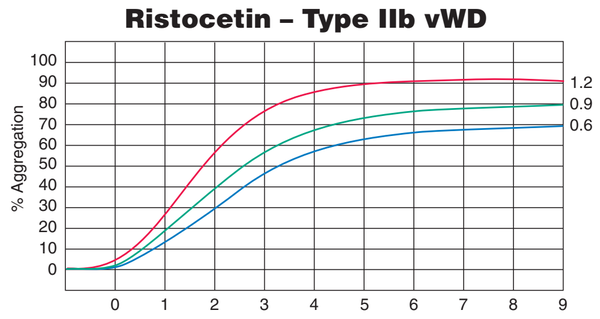
Response of Type I von Willebrand's – aggregation < 60% with 1.2 mg/mL ristocetin; response decreases proportionately with 0.9 and 0.6 mg/mL ristocetin

Epinephrine



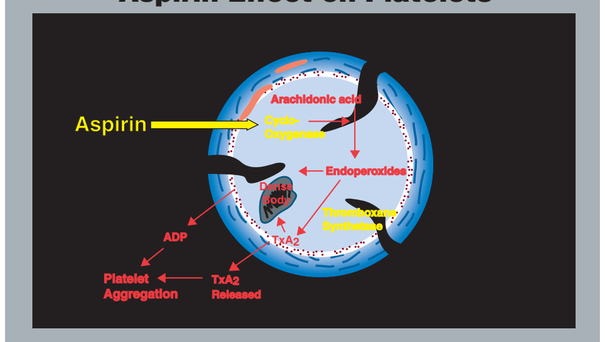
Normal Response to 10 M Epinephrine – Primary and Secondary slopes indistinguishable, aggregation > 60%
Normal Response to 2 M Epinephrine – Primary and Secondary slopes distinctly biphasic; aggregation > 60%
Abnormal Response to 10 M Epinephrine – aggregation < 60%

Ristocetin – Type IIb vWD



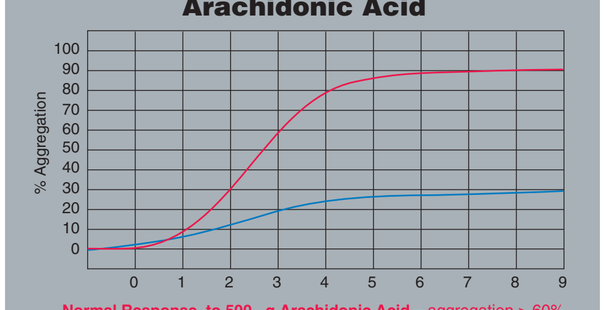
Response of Type IIb von Willebrand's – aggregation > 60% with 1.2 mg/mL ristocetin; increased response to 0.9 and 0.6 mg/mL ristocetin

Aspirin Effect on Platelets



Many drugs can induce platelet function defects, resulting in hemorrhage. The most common mechanisms of interference involve the platelet membrane or membrane receptor sites, and the prostaglandin biosynthetic pathways which are inhibited by aspirin. The arachidonic acid platelet aggregation assay is the only practical way to monitor the effects of aspirin therapy, now widely used to prevent stroke and heart attacks.

Arachidonic Acid

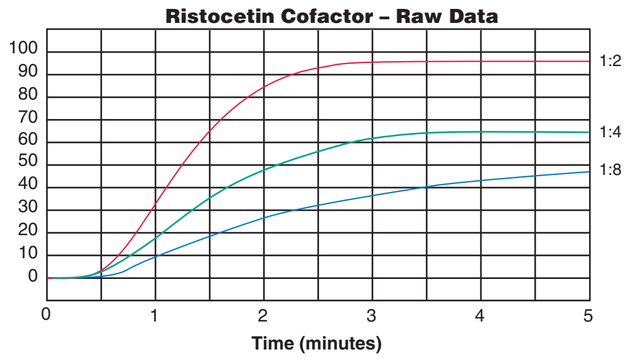


Normal Response to 500 g Arachidonic Acid – aggregation > 60%
Abnormal Response Due to Aspirin

Platelet Agglutination

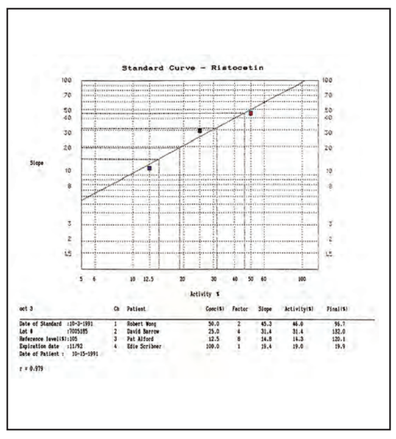
The Ristocetin Cofactor Assay measures the ability of a patient's plasma to agglutinate formalin-fixed platelets in the presence of ristocetin. The rate of ristocetin-induced agglutination is related to the concentration of von Willebrand factor and the percent normal activity can be obtained from the standard curve.

Ristocetin Cofactor – Raw Data



Raw data for Ristocetin Cofactor Standard Curve using 1:2, 1:4, and 1:8 dilutions

Standard Curve



Patient values are determined by comparison to a standard curve, allowing quantitation of % Ristocetin Cofactor Activity.

This wall chart developed in collaboration with
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Helena Laboratories, (UK) Ltd., Newcastle, England
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AggRAM

Plateletworks®

Helena's AggRAM couples 4-channel laser optic modules with a powerful, easy-to-use Microsoft® windows interface to make platelet aggregation and ristocetin cofactor testing easier and more efficient.

- Flexible, modular design
- Quick access to data input screens
- Auto slope & max % aggregation
- Barcode & bi-directional LIS capable
- On-screen prompts for procedures
- Display & print lag phase
- Tri-level password protection
- Integral QC action log

ADP • Epinephrine • Collagen • RIPA • Ristocetin Cofactor

- Platelet Aggregation
- Platelet Inhibition
- Platelet Count

Screen at the point-of-care in just 2 minutes using a standard cell counter

ADP • Collagen • Arachidonic Acid

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