

Difference Between Intrinsic and Extrinsic Pathways in Blood Clotting

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Key Difference – Intrinsic vs Extrinsic Pathways in Blood Clotting

Blood clotting is an important process to stop bleeding. It is a complicated process which occurs via series of activation processes collectively called coagulation cascade. Coagulation cascade has two pathways known as intrinsic and extrinsic pathway. The key difference between intrinsic and extrinsic pathways in blood clotting is their initiation factors. **The intrinsic pathway starts when there is a trauma in blood or when blood is exposed to a collagen. The extrinsic pathway starts when there is a vascular tissue trauma or trauma surrounding tissues.**

What is Blood Clotting?

A blood clot consists of fibrin, platelets and blood cells. The formation of a stable blood clot is facilitated by an enzyme called thrombin. Thrombin enzyme catalyzes the polymerization of insoluble fibrin from fibrinogen. Thrombin is formed from prothrombin. The conversion of prothrombin to thrombin is done by prothrombin activator or the factor X. Prothrombin activator is activated by the two blood clotting pathways: intrinsic and extrinsic pathways. Intrinsic and extrinsic pathways in blood clotting initiate and progress towards activating prothrombin activator when there is an injury in the blood vessel. As mentioned above the difference between intrinsic and extrinsic pathways in blood clotting is their initiation factors.

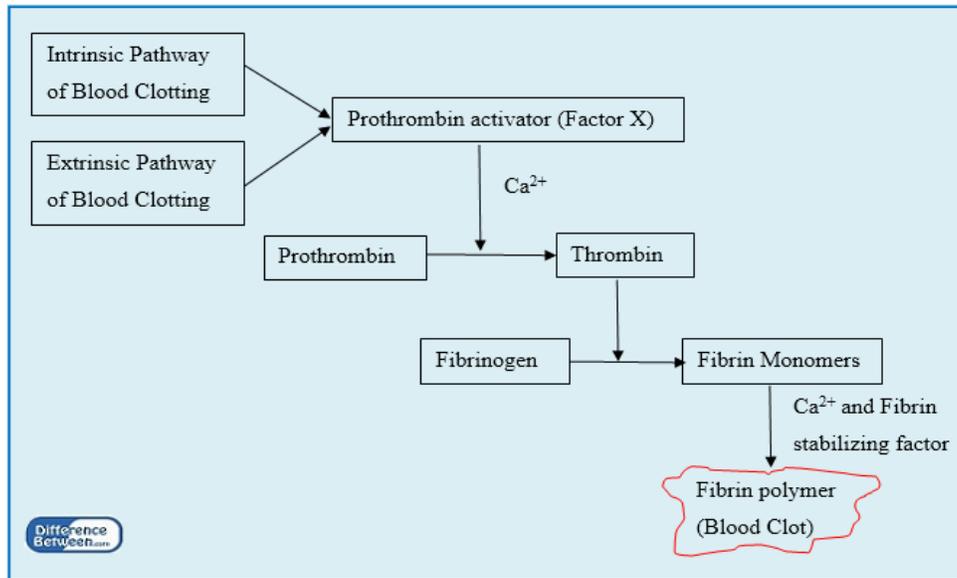


Figure 01: Coagulation cascade

The above figure will help you to understand the process of blood clotting and the two pathways more clearly. The activation of coagulation cascade chemicals is essential for the formation of prothrombin activator. Blood coagulation is usually a result of both intrinsic and extrinsic pathways.

What is Intrinsic Pathway in Blood Clotting?

Intrinsic pathway is a type of blood clotting pathway which is activated by a trauma in blood or when blood is exposed to a subendothelial collagen. Components required for intrinsic pathway are entirely contained within the blood or the vasculature. Hence this process is named as ‘intrinsic pathway.’

Intrinsic pathway begins with the blood trauma and involves factors XII, XI, IX and VIII. When factor XII contacts with the exposed collagen, it activates and catalyzes the activation of factor XI. Activated factor XI then activates the factor IX. Activated factor IX, in turn, activates the factor VIII. Activated factors IX, VIII, and platelet phospholipids collectively activate the factor X or the prothrombin activator. Intrinsic pathway enters into a common pathway of blood coagulation after activating prothrombin activator. When prothrombin activator is activated, it facilitates the conversion of prothrombin into thrombin. Thrombin catalyzes the polymerization of fibrinogen into fibrin, which is the basic component of the blood clot. Intrinsic pathway of blood clotting is a slow process

which completes within several minutes. But it is an important process in organisms.

The three pathways that makeup the classical blood coagulation pathway

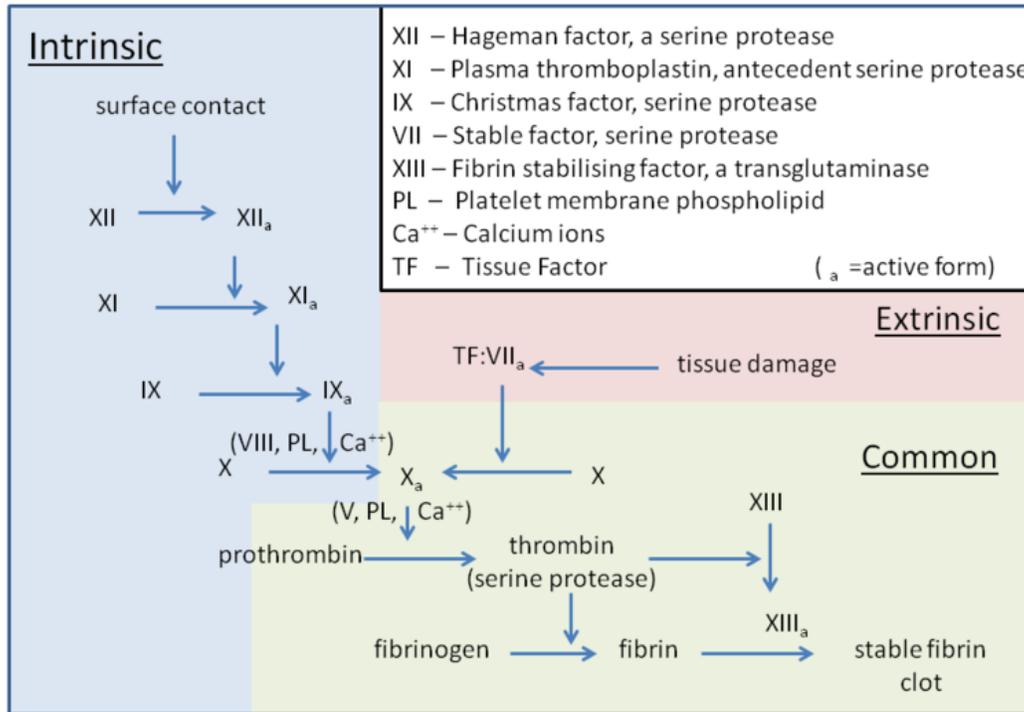


Figure 01: Intrinsic and Extrinsic Pathways of Blood Clotting

What is Extrinsic Pathway in Blood Clotting?

Extrinsic pathway is another way of blood coagulation. This system is activated by vascular tissue trauma or surrounding extra-vascular tissue trauma. These external factors release a complex of several factors which is collectively known as tissue factor or tissue thromboplastin or factor III. Tissue factor is a protein found in many tissues of the body, including brain, lungs, and placenta. Tissue factor is the main component which activates the extrinsic pathway of blood clotting. Under normal conditions, blood is not contacted or exposed to these tissue factors. But when there is an injury, tissue factor exposes to blood and activates factor VII into factor VIIa. Factor VIIa activates factor IX into IXa. Factor IXa activates factor X into factor Xa. Factor Xa is the prothrombin activator which is responsible for the conversion of prothrombin into thrombin. Once prothrombin activator is formed, the common pathway starts and blood coagulation proceeds. Extrinsic pathway is

quicker than intrinsic pathway. Within about 15 seconds, it completes blood coagulation.

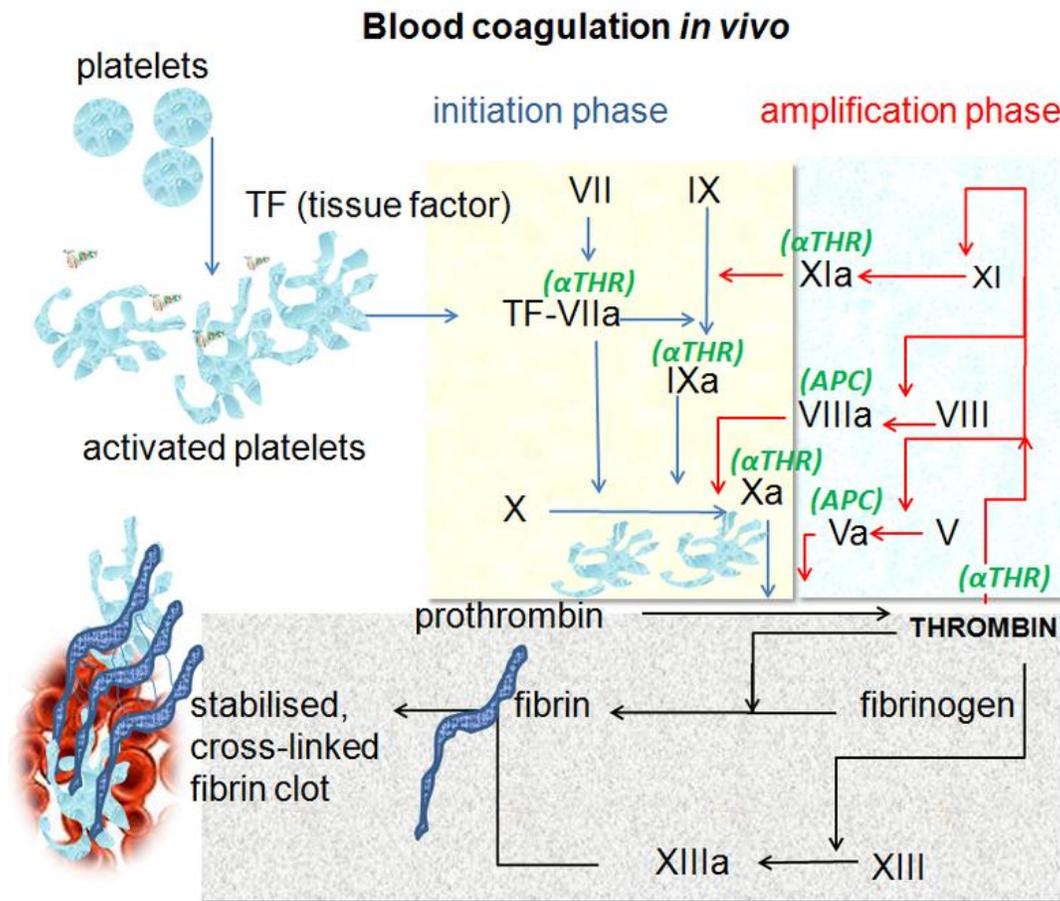


Figure 02: Extrinsic Pathway of Blood Coagulation

What are the similarities between Intrinsic and Extrinsic Pathways in Blood Clotting?

- Intrinsic and extrinsic pathways are two processes of blood coagulation.
- Both pathways proceed towards the formation of prothrombin activator or the factor X.
- Both pathways end up in a common pathway.

What is the difference between Intrinsic and Extrinsic Pathways in Blood Clotting?

| Intrinsic vs Extrinsic Pathways in Blood Clotting | |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Intrinsic pathway is one type of blood coagulation pathway that is activated when there is a blood trauma. | Extrinsic pathway is a type of blood coagulation pathway that is activated when the traumatized vascular wall or the extra-vascular tissues come into contact with the blood. |
| Efficiency | |
| Intrinsic Pathway is slow. | Extrinsic Pathway is explosive. |
| Duration | |
| Intrinsic pathway takes about 1 to 6 minutes to form a clot. | Extrinsic pathway takes about 15 seconds after the tissue factor is released. |
| Initiation | |
| Intrinsic pathway begins with trauma to blood cells or exposure of blood to collagen. | Extrinsic pathway begins with tissue trauma or tissue factor activation. |
| Activation of Initial Factors | |
| When blood is exposed to collagen, it activates the factor XII. | When tissue factor is activated, it activates the factor VII. |
| Origin of the Factors | |
| Intrinsic pathway needs factors to be present in the blood itself. | Extrinsic pathway needs factors from outside the blood. |

Summary – Intrinsic vs Extrinsic Pathways in Blood Clotting

Blood coagulation refers to the process of forming a clot to stop bleeding. A blood clot is mainly formed from fibrin and platelets. Formation of fibrin is catalyzed by the enzyme called thrombin. Thrombin formation is facilitated by prothrombin activator made from two pathways named intrinsic and extrinsic pathways. Both intrinsic and extrinsic pathways activate prothrombin activator to catalyze the conversion of prothrombin into thrombin. The difference between intrinsic and extrinsic pathways in blood clotting depends on their initiation factors; extrinsic pathway is initiated after the release of a tissue factor to the blood due to a trauma to the vascular wall or surrounding tissues while intrinsic pathway is initiated when collagen contacts with the blood due to blood trauma.

Image Courtesy:

1. “Classical blood coagulation pathway” By Dr Graham Beards – Own work ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)
2. “Coagulation in vivo” By Dr Graham Beards – Own work ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)

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How to Cite this Article?

APA: Difference Between Intrinsic and Extrinsic Pathways in Blood Clotting. (2017, July 05). Retrieved (date), from <http://www.differencebetween.com/difference-between-intrinsic-and-vs-extrinsic-pathways-in-blood-clotting/>

MLA: "Difference Between Intrinsic and Extrinsic Pathways in Blood Clotting." *Difference Between.Com*. 05 July 2017. Web.

Chicago: " Difference Between Intrinsic and Extrinsic Pathways in Blood Clotting." *Difference Between.Com*. <http://www.differencebetween.com/difference-between-intrinsic-and-vs-extrinsic-pathways-in-blood-clotting/> (accessed [date]).



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