

1. Two pathways activate the blood clotting process, the intrinsic pathway and the extrinsic pathway. Ultimately these cascades lead to the conversion of prothrombin (zymogen) to thrombin (active enzyme). Thrombin, in turn, converts fibrinogen (zymogen) to fibrin (mesh former as a result of polymerization).
2. Prothrombin must bind calcium in to be held near the site of the wound to be activated. Binding of calcium by prothrombin allows it to anchor itself to the phospholipid membranes derived from blood platelets after injury. At this site, prothrombin can be readily converted to thrombin because at the site of the injury are other enzyme that can activate prothrombin to thrombin. To enable prothrombin to strongly bind calcium, glutamate residues in it must be carboxylated (addition of a carboxyl group). This reaction is catalyzed by an enzyme that uses Vitamin K as a cofactor. Compounds like coumarin or warfarin that block vitamin K sites on the enzyme act as "blood thinners", reducing the likelihood of blood clotting.
3. Removal of blood clots involves an enzyme called plasmin, which is synthesized as a zymogen called plasminogen. Plasminogen is converted to plasmin by tissue-type plasminogen activator (t-PA). t-PA can be extremely effective in initiating the cascade to dissolve the unwanted blood clot involved in stroke or heart attack.

Highlights of Carbohydrates I Lecture

1. Simple carbohydrates are monosaccharides, also called sugars. These include glucose, galactose, and mannose.
2. The suffix '-ose' is used to designate saccharides. The number-related prefixes 'tri', 'tetr', 'pent', 'hex', 'hept', and 'oct' are used to designate saccharides with 3,4,5,6,7, and 8 carbons, respectively.
3. Monosaccharides with an aldehyde group are called aldoses. Those is a ketone group are called ketoses.
4. Glyceraldehyde and dihydroxyacetone are the simplest saccharides we call carbohydrates.
5. Carbon can have as many as four different molecular groups attached to it. If this happens, the carbon is chiral (or asymmetric) and the groups can be arranged in two different ways. These arrangements are called stereoisomers.
6. The letters 'D' and 'L' are an older nomenclature system used to designate whether a particular stereoisomer rotated polarized light rightwards or leftward, respectively. We use the convention today that the 'D' isomer corresponds to the stereoisomer in which the lowest asymmetric carbon from the top (closest to the bottom) is written on the right side of the molecule.
7. Most biological sugars are in the D configuration.
8. Stereoisomers, such as D-glyceraldehyde and L-glyceraldehyde, are mirror images of each other.
9. When sugars differ in stereoisomeric configuration, they are called diastereomers. When stereoisomers are mirror images of each other, they are called enantiomers. When they differ in configuration of only one carbon, they are called epimers. When they differ only in the configuration

of the anomeric carbon, they are called anomers.

10. Cyclization of monosaccharides leads typically to five member or six member rings. These are called furanoses (five member rings) and pyranoses (six member rings). Cyclization arises from formation of hemiacetals in aldoses and hemiketals in ketoses.

11. Cyclization creates a new asymmetric carbon. This carbon is called the anomeric carbon and it can exist in the alpha (down position) or beta (up position) configurations. If the hydroxyl group on the anomeric carbon is unaltered, the ring and linear forms of the sugar can reversibly form. Thus, a sugar in the beta configuration can, in solution, 'flip' to the alpha form by going to the linear form and then reverting back to the ring structure in the alpha configuration. If the hydroxyl of the anomeric carbon is altered (by methylation, for example), the linear structure cannot form and 'flipping' cannot occur.

12. Altering the hydroxyl group on the anomeric carbon results in creation of a glycoside. Glycosides are commonly created during formation of disaccharides and longer carbohydrates.

13. A given sugar such as beta-D-glucose can have different conformations that have different shapes. These are referred to as 'boat' and 'chair' forms. Chair forms are generally favored over boat forms due to less steric hindrance.