# Vitamin C Mechanism and Deficiency

Vitamin C, also called ascorbic acid, is a water-soluble vitamin which is mostly essential for collagen synthesis and its antioxidant properties. The vitamin catalyzes several enzymes in the synthesis of collagen as well as catecholamine synthesis. When the vitamin is deficient, the most notable effect is the onset of Scurvy, a disease characterized by poor wound healing and perifollicular hemorrhage. Additionally, patients deficient in the vitamin can have anemia due to poor antioxidant ability as well as iron absorption problems.




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## Mechanism

**Ascorbic acid**
A-sword with Acidic-lemon
Vitamin C is also known as ascorbic acid. This is derived from the medieval Latin “scorbutus”, or scurvy, coupled with the English term “a-”, or without. This name was coined in the 1930's as further experimentation and discovery indicated that the vitamin C present in the limes, lemons, oranges and sauerkraut that exploring ship captains would give their crew during their long voyages was because, in some circumstances, the majority of the crew would expire from scurvy before arriving at their destination. Unknowingly, this “without scurvy” vitamin would then become the focus of the first controlled experiment in history, in which a British Navy surgeon named James Lind gave two oranges and a lemon to some ship crew members and not to others. The results clearly demonstrated the role of citrus fruits in preventing scurvy.

**Antioxidant**
Anteater-shield Eating Oxygen-molecules
Vitamin C has antioxidant properties due to its capacity as a reducing agent and functions to minimize the body of free radicals.

**Protects Against Free Radicals**
Protecting against Free Radicals
Ascorbic acid acts a reducing agent, contributing electrons in a variety of enzymatic and non-enzymatic biochemical reactions. It displays significant antioxidant properties that play a major role in protecting the body from free radicals.

**Keeps Iron in Reduced State**
Down-arrow Red Iron
Vitamin C, an exceptional reducing agent, assists in keeping iron in its reduced ferrous state (Fe2+) which improves intestinal absorption. Patients with iron deficiency, or those prone to iron deficiency, which is the most common anemia in the world, should take vitamin C concurrently with iron to assist gut absorption.

**Hydroxylation of Proline and Lysine**
Hydra-lace and addition of OH's to Pro-lion and L-icing
Hydroxylation of proline and lysine are essential steps in the complicated synthesis of collagen, which utilizes vitamin C as a cofactor.

**Necessary for Dopamine B Hydroxylase**
Doberman (B) Bee Hydra-lace
Vitamin C is a cofactor for dopamine B hydroxylase, which is an enzyme in the catecholamine synthesis pathway, specifically for norepinephrine and dopamine.

## Deficiency Signs and Symptoms

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**Scurvy**

Scooby-scurvy

Scurvy results from deficient vitamin C intake and subsequent poor collagen synthesis. This disease consists of poor wound healing, bleeding and swollen gums, perifollicular hemorrhages, and easy bruising.

**Swollen Gums**

Swollen Gums

One of the common symptoms of scurvy is gingival overgrowth, represented by swollen gums, which can be described as spongy, bulging, or protruding.

**Bruising**

Bruising

Bruising is another presentation of scurvy, and patients may complain of bruising very easily or the presence of petechiae. This is thought to result from inadequacy of connective tissue in the capillary wall as opposed to platelet or clotting factors.

**Poor Wound Healing**

Bandages

Vitamin C plays a major role in the formation and maintenance of connective tissue in the body, particularly collagen synthesis. As such, patients with ascorbic acid deficiency may present with poor wound healing.

**Hemarthrosis**

Hammer-King-Arthur

Hemarthrosis, or bleeding into joints, should be an important indicator in the mind of the clinician that a potential vitamin or dietary deficiency should be included in the differential diagnosis. Important to note that in severe cases this can lead to blatant hemorrhage and hemopericardium.

**Perifollicular Hemorrhages**

Pear-with-hair-follices and Hammer

Perifollicular hemorrhages refer to microbleeds around the hair follicles of patients with scurvy. Realize that not only is there bleeding, thought to be due to connective tissue failures in the blood vessel walls around hair follicles of these individuals, but the hair in question is also commonly described as corkscrew in appearance.

**Anemia**

Anemone

Vitamin C deficiency can result in anemia for a variety or combination of factors. This can occur due to poor iron intake and absorption, extensive oxidative damage to red blood cells, as well as hemorrhage from connective tissue inadequacies in blood vessel walls.

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