The "Blood Apple Tree". A simple and straightforward metaphor for teaching blood and bone marrow physiology

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Haematology is a rapidly growing field of medicine. The advent of new molecular biology methods has enhanced our knowledge of blood disorders, but further complicated the study of this important branch of medicine. Although, modern day students tend to have better information technology skills than their predecessors and seem to be very interested in molecular biology methods, the comprehension of some key points in Haematology remains problematic. In our experience, students often experience difficulty understanding how the generation of blood occurs.

We present the "Blood Apple Tree", a simple metaphor between the bone marrow and an apple tree, which has proven to be a helpful teaching tool for medical students approaching the basics of Haematology.

We all know that blood production occurs within the bone marrow, however just for the moment use your fantasy and imagine that the bone marrow is like an orchard of apple trees. Each apple tree has just three branches. Let's imagine these branches are red, yellow and white (Figure 1). The red branch produces red apples (erythrocytes), the yellow branch produces yellow apples (platelets) and the white branch produces white apples (leucocytes). The trunk and the structure of each tree are made of stem cells.

Figure 1 - "The Blood Apple Tree".

Each apple tree has just three branches. The red branch produces red apples (erythrocytes), the yellow branch produces yellow apples (platelets) and the white branch produces white apples (leucocytes). The trunk and the structure of each tree are made of stem cells.
apples (platelets) and the white branch produces white apples (leucocytes). The trunk and structure of each tree are made of cells, so-called "stem cells". These structural cells are capable of self-renewal and if transplanted can easily re-grow apples trees, exactly like seeds. Moreover the presence of a self-renewing compartment ensures that "apple production" will continue even in critical conditions. The maturation occurs on the tree, where you can see blossom, flowers, immature and mature apples. Similarly, in the bone marrow you can see early precursors of each cell lineage. Once the apples are mature, they fall to the ground, and you can collect and count them. Similarly, once the blood cells (erythrocytes, leucocytes and platelets) are mature, they move into the peripheral blood stream, where they can be collected by phlebotomy, counted (blood count) and looked at on a blood film. When a farmer finds immature apples on the ground, he will be surprised and worried! Looking at the tree he might see children playing in the branches, throwing immature fruit onto the ground. These immature apples represent the so-called leuco-erythroblastic picture which is seen when something (metastases, leukaemia, etc.) is growing within the bone marrow, "throwing" immature cells into the blood stream. When ivy grows on the trunk and on the branches of the tree, the ivy will slowly suffocate the tree. This is exactly what happens in myelofibrosis. The ivy branches resemble increased reticulin. The metaphor of the apple tree could also be applied to other blood diseases.

In brief, blood cell maturation occurs in the bone marrow and in normal conditions only mature cells should be seen in the peripheral blood and the bone marrow should always be evaluated when unexplained peripheral blood values are found.

We hope this metaphor will help teachers and students arrive at a better comprehension of blood and bone marrow physiology.

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