

Haematology - A short introduction

Haematology is a branch of biology that is focused on the study of blood, the blood-forming organs as well as diseases originating from the defects in the blood forming cells, organs or coagulation systems.

The blood-forming system

The haematological (blood-forming) system is a complex system including red blood cells (erythrocytes) that transport oxygen and white blood cells (leukocytes) that are involved in immune responses. The leukocytes consist of many different cell types with different functions in the innate immune defence (neutrophils, eosinophils, basophils, monocytes and macrophages) and the acquired immune response (B-lymphocytes and T-lymphocytes). Interestingly, all these cell types originate from a common precursor, the haematopoietic stem cell (see figure).

The haematopoietic stem cell (HSC)

The HSC are located in the bone marrow. The cells are rare with 1 out of 10,000 cells being a stem cell. Haematopoietic stem cells are mostly quiescent and only a small fraction participates in active cell cycle. The mechanisms prompting the single HSC cell to dormancy, self-renewal, apoptosis or lineage committed differentiation is not fully understood.

The small population of multipotent HSC has two important functions. The first function is to ensure that there are HSC present throughout life-time of a person, which is possible as the stem cell are able to self-renew and maintain their population. The other function is to differentiate into all the haematopoietic lineages described above.

The differentiation process can be described in a stepwise manner (see figure). First the HSC divides. One of the daughter cells remains a HSC while the other cell starts to differentiate along the lymphoid or myeloid lineages to become a committed myeloid or lymphoid progenitor (CMP and CLP respectively) as shown in the figure. The primitive lymphoid progenitors generate T and B lymphocytes whereas the primitive myeloid progenitor produce all five myeloid lineages including dendritic cells, granulocytes, monocytes (macrophages), megakaryocytes (platelets) and erythrocytes. During the differentiation process, the intermediate cell stages are still able to proliferate, which ensures a large number of specialised cells at the end of the process.

