Becoming Important

By Glenn Webb

The research story

A mathematical model for the production of blood cells in the human body uses cell maturity to track the morphological development of blood cells in the bone marrow. This development begins with the most primitive stem cells, and through successive generations of cell division, cells pass through many increasing stages of maturity. Ultimately, the most mature cells become differentiated to specific cell types and enter the circulating blood. The most primitive blood stem cells, which constitute a very small fraction of the total population of all blood cells, are extremely important in the stabilization of the blood cell population. If there is an insufficient supply of these most primitive cells, the blood cell population may exhibit behavior corresponding to diseases such as aplastic anemia and acute leukemia.

The image

The solutions of the differential equations describing the production of blood cells are numerically simulated in the figure. The most immature stem cells have a very small number at any time. As time advances these cells divide and proliferate to increasingly mature cells, with increasingly large numbers. The gray panels show the maturity distribution of cells at different time points, with the most mature cells at the highest level of maturity values.

References

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