Neutropenia Treatment using Modified Receptors

The most abundant type of white blood cells in the human body is neutrophils. These are an important part of the immune system. Neutrophils, alongside other immune cells, can be compared to microscopic soldiers, fighting off infections every day from foreign invaders, such as bacteria and fungi, preventing you from becoming ill. If the neutrophil numbers decrease drastically however – a condition named neutropenia, their ability to fend off invaders is desperately hampered. In this critical state, even the most common infection can lead to serious consequences and death.

Cancer treatment using anti-cancer drugs is one contributing factor for developing neutropenia, extending the hospital stay for patients with over a week on average, for treating this ensuing disease. The current neutropenia therapy uses a drug abbreviated GCSF. GCSF acts as a key for a protein, a large cellular molecule, present on the surface of a cell that can develop into neutrophils. The protein is a receptor and is acting as a lock. Once the key and lock interact, a process is initiated inside the progenitor cell, leading to its development into neutrophils. The cell differentiates. The cost for this treatment alone is approximated to $25,000 per patient in 2012 in the US, which is why this study examined alternative treatment options using cheaper drugs.

Just like any (good) lock requires a specific key to be opened, when a different key is to be used, the lock must be exchanged. This was done to the receptor to enable the usage of cheaper drugs, leading to three receptor variants. One piercing through the cell surface, one anchored to it, and the last floating freely inside the cell.

The new drugs were administered to cells containing these modified constructs, and the subsequent cell behaviors compared to cells given the original drug, GCSF. Neutrophils were believed to form when triggering each of the modified receptors. The efficiency of the anchored type receptor for promoting differentiation was particularly high, even rivaling the performance of the original receptor. In addition to this, cell proliferation was observed when using this anchored receptor type. This means that not only were neutrophils developed, but the total number of generated neutrophils were much higher than the number of initial cells exposed to the drug.

From these discoveries, it is not just likely that a cost-efficient alternative therapy might be available for treating neutropenia in the future, but also an even more efficient method than the current approach. This would give more people access to available treatments, especially in combination with chemotherapies, for example low-income households or people without medical insurance.