Superman vs. Doomsday

The Battle of Cancer and its Stem Cells

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Tumors are like the bad guys from a comic, taking over tissue and organs in our bodies, attacking and destroying them. Most tumors are heterogeneous, meaning they consist of multiple cell types. One cell type within a tumor is known as the cancer stem cell (CSC), which can be compared to a super villain from a comic, such as Doomsday. The second type are the normal tumor cells which are similar to the regular bad guys, that can be targeted and destroyed by current chemotherapeutics, much like bad guys getting captured by police officers. Since chemotherapeutics are only effective on rapidly dividing cells, such as normal tumor cells and unfortunately some healthy cells, they do not target CSCs. Similar to comic books, chemotherapeutics cannot defeat the super villain, which leaves Doomsday free to cause all types of mayhem. This is alarming because even when all normal tumor cells are eradicated, CSCs may persist leading to metastasis and recurrence due to their stem cell capabilities, such as self-renewal (Fig.1). Thus, we need to develop a method to target not only the tumor cells, but also the CSCs within the tumor population without affecting the normal, healthy cells. We need a superhero to come save the day.

Scientists are currently working to develop an efficient strategy to target both CSCs and tumor cells through interactions with a type of protein called an integrin. Integrins are like "The Daily Planet" for our cells, a source of communication. The ability of integrins to participate in cell signaling can affect tumor progression and metastasis. Studies of a specific integrin, Alpha v beta 6 ($\alpha_v\beta_6$), have shown that it is a useful target of tumor cells and CSCs because $\alpha_v\beta_6$ is present in high amounts on the surface of cancerous cells whereas very low amounts are found on normal cells [1]. These expression levels allow for delivery of chemotherapeutics to

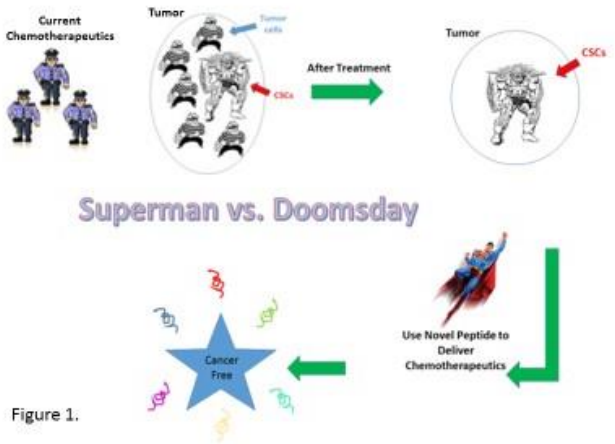

Figure 1.

only the cancerous cells without affecting normal, healthy cells.

In order to target cancer cells overexpressing $\alpha_v\beta_6$ integrins, we need to develop a peptide that can target and bind to $\alpha_v\beta_6$. A previous study identified a peptide that contained two specific amino acid sequences that are important contributors to the binding of $\alpha_v\beta_6$ [2]. Using the two amino acid sequences previously identified, we can synthesize a peptide library using a method called the One-Bead-One-Compound (OBOC) library method. This approach allows for production of millions of different peptides, so we can identify the ideal amino acid sequence that will give us the best targeting ability and act as our Superman, the only one strong enough to defeat Doomsday and keep the innocent bystanders safe.

Not only will this method decrease the current side effects of current chemotherapeutic treatments due to their inability to target only tumor cells, but it will also decrease the possibility of metastasis and recurrence by specifically targeting the CSC population. If we are lucky, our molecular superman will save the day and rid the city of the evil villain, Doomsday.

References

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