Novel Cancer and Viral Infection Treatment via Antisense RNA-Guided Selective Protein Expression

Bomben, Matteo

This research created a novel system capable of targeting cells based only on their mRNA sequences that would, upon recognition of a predetermined, target, mRNA sequence in a particular cell, express any protein of choice. The system is composed a DNA construct that expresses specially designed mRNA strands that contain the antisense sequence to the target sequence, an Internal Ribosome Entry Site (IRES) and the sequence of the protein that is to be expressed in target cells. In cells without the target sequence, the mRNA strand will form a stem-loop causing the IRES to be double stranded and thus inaccessible to the ribosome. This ensures the protein is not translated. In target cells, the antisense portion of the strand binds to the target sequence preventing the formation of the stem-loop. With this, the IRES is single stranded and the protein is translated. During experimentation, it was found that on average, the system expressed the desired protein in 95.9% of target cells, with a mean expression rate of 0.00175% in non-target cells. Cells affected by many diseases including cancer and viral infections can be characterized by the presence of mRNA sequences that are unique to those found in healthy cells. Therefore this system could be used to kill cells affected by not just one but a multitude of disease by directing the delivery of cytotoxic proteins to cells with these unique mRNA sequences. Moreover, since the presence of unique mRNA sequences is a trait of all cancers and viral infections, the system is not limited to any specific type or species. In conclusion, as the system outperformed modern treatments for the aforementioned diseases in terms of both efficiency and selectivity, it is in the unique position of being a novel treatment for numerous diseases.

Awards Won:

Third Award of $1,000