Manipulating the Aging Process With Somatic Cell Gene Therapy

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Abstract

Age represents itself as a reduction in the ability of an organism to function and respond to its environment. This loss of function eventually causes the organism to die and cease existence. DNA damage is arguably the most significant cause of aging. This damage to DNA occurs over an organism's lifespan and is due to many factors such as oxygen free radicals which cause damage over time to proteins, membranes, and DNA. In humans this process does not produce a noticeable and negligible effect until after 20 or 30 years. The goal of this document is to theorize a method to replenish this *loss or damage of DNA* through the use of gene therapy. Studies have shown that the bone marrow of humans contain mesenchymal stem cells which are not subject to the same damage of DNA that most other cells in the body are susceptible to as time progresses[2]. In choosing a vector for gene therapy it is important that the body's immune system will not render the vector ineffective. Due to this criteria the lentiviral HIV virus has been chosen as a viable gene therapy vector. By modifying the HIV virus to contain intact stem cell DNA the virus will infect host cells in the body and methodically *repair* the host cell's copies of damaged DNA.

1 Introduction

Before reading this document it should be known that I am not a geneticist, scientist, [insert discipline here], and have no formal education in the field that I am covering. I am simply a person who likes to attain knowledge and to stimulate discussion about certain topics. I hope that after reading this document a person will at least gain a different viewpoint on the aging process and the associated gene therapy.

2 DNA Extraction

Due to the intact nature of the DNA contained in mesenchymal stem cells it is the chosen place to recover DNA for use in gene therapy. Bone marrow can be extracted from various bones throughout the body. A special needle with a syringe is used to collect the bone marrow from inside of the bones. After the bone marrow has been harvested the DNA must be isolated. Normal DNA isolation techniques can be used at this point to recover the DNA.

3 Modified HIV Virus

The lentiviral vector HIV was chosen due to its innate ability to not be detected by the immune system and its efficacy of transferring genetic material into host cells. After DNA has been isolated it is then integrated into the HIV vector. Also, safety modifications should be made to the modified HIV virus so that it does not cause any adverse effects to the host aside from transferring the integrated genetic material. There are many safety methods currently in development such as removing the HIV gene from the packaging plasmid in the virus[1].

4 Gene Therapy

The host should be infected with the modified HIV virus to begin the gene therapy process. The virus should then begin infecting the host's cells and copying genetic information. The hope is that the infected cells will then be similar to their younger, more functional counterparts and when mitosis occurs the newly formed cells will both be of *higher quality* then the original, non-infected cells. The duration until observable effects occur is not known but can be speculated by examining the different cells in the body and their individual life cycles. The effects of the gene therapy would probably not be seen until weeks or months.

5 Expected Result

The end result of the gene therapy should be an increase in the function of all of the host's cells. This would in turn cause the body to respond to its environmental factors wtih more efficiency and ability then it would have previously. The overall effects would be lower risks to age-related health problems and should effectively reset the body to its *prime* state of functioning. Example: A 50 year-old man feels like he is 20 again.

6 Possible Complications

Due to the theoretical nature of this discussion there are many unknowns that may be encountered in attempting this type of gene therapy. If the infection interferes with normal functioning of the host, for example, it could cause eventual death or a further overall reduction in function in the host's systems.

References

[1] R G Amado and I S Chen. Lentiviral vectors–the promise of gene therapy within reach? *Science*, 285(5428):674–676, 1999.

[2] Mandana Mohyeddin Bonab. Aging of mesenchymal stem cell in vitro. *BMC Cell Biology*, 2006.