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EDITORIAL

Hearing Restoration and Stem Cells

The therapy of using genes to grow new auditory hair cells in adult guinea pigs leads to a trail of future discoveries. This could also lead to progress in diagnostic trends for patients who have had a recent disturbance in hearing. Above all this discovery could lead to new treatments for deafness and age-related hearing loss. Gerontology or the science of aging shows that as human being advances with biological age, deafness starts to set in, the main reason behind deafness can be attributed to :

a) Exposure to loud noise will cause irreversible damage to the inner hair cells.
b) Deterioration of the hair cells in the cochlea.
c) Drug medications can damage or destroy the hair cells, resulting in hearing loss.

All said and done the secret of hearing lies in the healthy hair cells which act like miniature amplifiers. Sound waves that enter the inner ear are converted into a series of chemical and electrical signals within the cells. These signals are ultimately transmitted to the brain through the auditory nerve and interpreted as sound.

The persistence of hearing loss is mainly due to the inability of the cochlear sensory epithelium to replace lost mechanoreceptor cells, or hair cells.

At the same time it can be concluded that hearing loss is a common disease of aging while many cases of deafness are congenital or acquired during childhood.

The above mentioned reasons are the focal points where the hearing loss is mainly attributed to. Now as we switch over to remedial measures one arrives at a treatment to counter act the illness which is rampant and many types of patients we come across. Cell based treatments for hearing loss deafness is possible following the generation of inner ear hair cells from embryonic stem cells. Hair cell replacement, either by stimulating regeneration or transplanting progenitor cells, holds promise for reconstructing damaged inner ears.

The Sound Pharmaceuticals Incorporated(SPI) has announced a method for the treatment of diseases or disorders of the inner ear in Europe. A novel strategy to stimulate auditory hair cell regeneration using proprietary cell cycle inhibition technology. Typically, auditory hair cells in mammals are not replaced when injured or lost. This results in permanent and often progressive sensorineural hearing loss, a disease that affects over 100 millions of people, in non mammals like birds, hair cell regeneration occurs through the spontaneous proliferation of the adjacent supporting cells, can go on to become hair cells. However in mammals, auditory supporting cells, do not proliferate or regenerate into hair cells even in the presence of growth factors.

Considerable attention has been drawn in recent past on stem cells but its practical application to cure is still far away. Forgetting the legal or ethical issues on procurement of stem cells from embryo or embryonic stem cells to generate various tissues including hair cells viable in vivo and having normal function needs further research. Stem Cells for clinical use should have ready availability, expandable and

karyotypically stable. Their action must be efficient, predictable, effective and safe too , because tumourigenic effect has been reported. Hence from stem cells proper effective hair cells without any complication is the demand. The stem cells from bone marrow, skin and umbilical cord to generate various types of neurons or tissues have been successful as they are readily available and autologous cells may be having better host immune response than transplanted stem cells.

In the past only birds or reptiles were thought to be capable of generating new hair cells. Now the National Institute on Deafness and other Communication Disorders (NIDCD) scientists have discovered a way to use gene therapy to generate new hair cells in the ears of adult mammals. Scientists used a virus to transfer a gene called Math 1 into the ears of guinea pigs. Math 1 is an expression, which is thought to cause the cells to become hair cells, rather than becoming another cell type within the ear. The virus infects cells of the ear and causes them to produce the Math 1 protein. Early experiments suggest that when the virus infects cells that do not normally express math 1, some of these cells become hair cells. In addition the new hair cells also attract fibers of the auditory nerve, suggesting that the new cells may also be able to establish a link to the part of the brain that interprets sound, the auditory cortex.

The gene expression or implanting stem cells to generate growth factor to potentiate the growth of hair cells from the remaining progenitors in the cochlea leading to self repair and restoration of hearing.

We close this segment on the note that the degree of hair cell regeneration or restoration all depend on what type of hearing loss a person has to begin with. One possibility for regeneration are people who have complete loss of hair cells due to some genetic anomaly, ototoxins, aminoglycosides. In these cases, hearing care professionals may someday have a choice between recommending a cochlear implant versus an approach for growing enough hair cells where hearing aids could be used more effectively and provide much more acoustic information to that patient.

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