Cell transplants may cure deafness

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(PhysOrg.com) -- When Uppsala researchers found immature stem cells in the inner ear of humans a few years ago, it caused a global sensation. They have also managed to grow hearing nerves from stem cells and human tissue from donated cochleae. Moving images of how nerve cells, like social, swimming beings, seek out each other are now suggesting entirely new and breathtaking perspectives to researchers.

"The film is revolutionary in that it shows how auditory nerves develop: like social beings they explore their surroundings and find a partner. You can see how the nerves, without any direct contact, signal each other and, like ants in an anthill, help each other communicate and form a nerve node, a so-called ganglion," says Helge Rask-Andersen, professor of experimental otology at Uppsala University and a chief physician at Uppsala University Hospital.

Nearly a million Swedes have handicapping hearing impairment. A few years ago researchers at Uppsala University and Uppsala University Hospital managed for the first time in the world to grow a human auditory nerve - a breakthrough that paves the way for new ways to treat both severe hearing impairment and deafness.

"It's our hope that in a few years cell transplants will be a real treatment alternative or complement to cochlear implants."

In 2004 Helge Rask-Andersen and his associates found immature stem cells in the inner ear of adults, a sensational piece of news in the research world. They have also managed to cultivate hearing nerves from stem

cells and human tissue from donated cochleae. With the aid of images taken at three-minute intervals, using a so-called time-lapse microscope, it is possible to follow how the cells, with feeler-like outgrowths, seek contact and sometimes hook together and form ganglia - how the nerve bundle grows into 4 mm long auditory nerves. According to Rask-Andersen, the images are unique in many ways. Brain nerves have been filmed before, but they are tiny and short, whereas auditory nerves are long.

"They've never been seen like this as social beings, since for so long it wasn't possible to film them. You can clearly see that a wandering nerve can ignore a nerve, hook onto another parallel nerve fiber, and then pull it so they coalesce into a bundle."

The next step will be to study how this growth is affected by electric fields. The researchers want to see, on the one hand, whether electric stimulation can get remaining nerve fibers to grow in hearing impaired individuals and, on the other hand, whether nerves can be made to grow out again after having been damaged or exposed to alcohol and other toxins. In a perspective of a few years, Helge Rask-Andersen envisions new means of treatment.

"Cell transplants are a plausible route, with applications in other fields as well, such as treatment for Alzheimer's and ALS. Animal studies in the US have shown that transplanted nerve cells can take root in the cochlea toward the sensory center. Treatment with growth factors that stimulate the body's own capacity to regenerate cells is another path."

The research team is also participating, as one of 23 centers, in the European research project Nano Ear. One of the objectives is to develop new ways to distribute drugs as nanoparticles - tiny little molecules whose surface has been treated with growth factors so they seek out only certain receptors on auditory cells.

Facts: Cochlear implants

In deaf people the hair cells in the inner ear have been destroyed by disease or injury. Cochlear implants function as a hearing aid in three sections: a microphone behind/above the ear, a signal-emitting speech processor with a radio transmitter, and an electrode. The latter receives signals from a receiver inside the skull. Signals are sent from here to an electrode that is placed in the cochlea. Impulses from the electrode are captured by the auditory nerve's branches and goes to the brain's auditory center where they are perceived as sound. Some 1,500 patients in Sweden have had cochlear implants done.

Provided by Uppsala University (news : web)