Research says 'evolutionary glitch' could be cause of childhood ear infections

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Researchers at King's College London have uncovered how the human ear is formed, giving clues as to why children are susceptible to infections such as glue ear. The work was funded by the UK Medical Research Council and published today in the journal *Science*.

It is estimated that one in five children around the age of two will be affected by glue ear, a build-up of fluid in the middle ear chamber. This part of the ear contains three tiny bones that carry sound vibrations from the eardrum to the inner ear. When fluid builds up in the chamber, this prevents the three bones from moving freely so they cannot pass sound vibrations to the inner ear, causing temporary hearing loss. Until now, little was known about why some children appear much more prone than others to developing chronic ear problems, with repeated bouts of glue ear.

Carrying out studies in mice, scientists have discovered the cells that line the middle ear cavity originate from two different tissue types – 'endoderm' and 'neural crest' cells. The part of the lining that originates from the endoderm is covered in a lawn of cilia (hairs) that help to clear debris from the ear, but the lining derived from neural crest cells do not have cilia. This makes that part of the middle ear less efficient at cleaning itself, leaving it susceptible to infection.

Interestingly, the process of the middle ear transforming into an air-filled space during development appears to be different in birds and reptiles, which have just one little ear bone. Mammals may have evolved

this new mechanism for creating an air-filled space to house the additional bones. This indicates that the process of two distinct cell types to create the lining of the middle ear cavity may be linked to the evolution of the three tiny sound-conducting bones.

Dr Abigail Tucker from the Department of Craniofacial Development at King's College London's Dental Institute, said: 'Our study has uncovered a new mechanism for how the middle ear develops, identifying a possible reason for why it is prone to infection. The process of neural crest cells making up part of the middle ear appears fundamentally flawed as these cells are not capable of clearing the ear effectively. While this process may have evolved in order to create space in the ear for the three little bones essential for hearing, the same process has left mammals prone to infection – it's an evolutionary glitch.

'These findings are contrary to everything we thought we knew about the development of the ear – in all the textbooks it describes that the lining of the middle ear is made of endodermal cells and formed from an extension of another part of the middle ear – the Eustachian tube. The textbooks will need to be re-written!'

Provided by King's College London

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