Cortical auditory evoked potential latencies reflect the accumulated sum of delays in synaptic propagation through the central auditory pathways. P1 has multiple generators; primary auditory cortex is one of those generators.

P1 latencies can be used as an index of the maturation of central auditory pathways.

Cochlear Implant Subjects
- 104 congenitally deaf pediatric cochlear implant users
- Children ranged in age from 2.3 years to 18 years
- Age at implantation ranged from 1.3 years to 17.5 years
- Experience with implant ranged from 6 months to 8 years
Central auditory pathways remain maximally plastic, in the absence of stimulation, for approximately 3.5 years.

After 7 years of deprivation, central auditory pathways have either lost an aspect of plasticity or have been altered in such a manner that stimulation can not shape them into a normal configuration.

How rapidly does the auditory pathway change following the onset of stimulation for early implanted children?
Cortical Activity in Deaf Children Age 5-7

- Wide variability in performance for children 5 to 7 years old
- Performance is related to preoperative hypometabolism of auditory related cortex

Lee et al., Acta Otolaryngol 2003;123:148-153

Is plasticity absent in late implanted children?

Sharma et al. (2002)

Sharma et al. (2004)

Sharma et al. (2005)
There is a critical period in the development of central auditory pathways.

Electrical stimulation can shape a short-term deprived (<3.5 years) auditory pathway into a normal configuration (as measured by P1 latency); electrical stimulation fails to shape a long-term deprived (>7 years) pathway into a normal configuration.

The age cut-offs for normal and abnormal P1 latencies (<3.5 yrs. and >7 yrs) are largely congruent with age-cut offs for better and poorer speech perception and oral language development in children fit with a cochlear implant.

Cortical reorganization during deprivation is likely to be the major factor that limits plasticity once stimulation has been restored to a long-term deprived pathway.

Children who experience a long period of deprivation before the onset of stimulation may experience a ‘disconnection’ syndrome characterized by reduced interactions between primary auditory cortex and higher-order auditory and poly-sensory cortex (Kral et al., 2005).


