

## **PERCEPTION, PLASTICITY AND SOCIAL LIFE: IMPAIRMENT AND RECOVERY OF AUDITORY PROCESSING. A COMPARITIVE ANIMAL/HUMAN PERSPECTIVE**

Sub-themes: Audition, Emotion, Time (duration, period?), Memory

### **Summary**

Research groups in ethology, psychology and medicine shared their expert skills to investigate auditory and social recovery of deaf children who had received cochlear implants. An animal model that a preliminary study revealed to be particularly interesting enhanced this approach. This animal model allowed us to test precise parameters and to approach plasticity at a central level in more detail. This yielded both methodological and scientific leads; for instance a new protocol for the evaluation of linguistic development was elaborated.

We showed that, in both species, the development and auditory recovery required other modalities than the mere auditory channel. We also found that in European starlings 1) social experience was an important factor for the development of sensory areas, and 2) central auditory recovery of adult subjects was possible, although only to a limited extent.

In view of the interest of these first results and the good quality of interdisciplinary exchanges between members, long-term collaborations have developed.

### **Initial project**

The aim of this project was to investigate recovery of auditory processing, especially in young deaf children after cochlear implantation. The well-known fact that these implants give much better results in young children than in adults raised the question of cerebral plasticity and recovery abilities in relation to age.

In order to analyze in detail the effects of auditory and/or social disturbance on the development of sensory areas, we used an animal model: European starlings. The choice of this species was based on several facts:

- Songbirds have proved, for over 30 years, to be excellent models for the study of vocal learning and for increasing our knowledge of the neurological bases of production and perception of sounds.
  - The ethological research group has acquired enough knowledge of starlings to be able to investigate efficiently developmental aspects and sound processing in auditory areas.
- The phylogenetic distance between these two species allowed us to discriminate general from specific tendencies.

The project included three basic parts:

- Development of social skills: impairment related to early auditory and/or social deficits can induce difficulties in communication in young subjects and can lead to their rejection in social situations. The aim of this study was to evaluate individual social skills in relation to early deficits and to follow the development of these skills after restoration of better auditory and/or social conditions.
- Development of information processing systems: the aim was to evaluate the impact of early deficits on the ability to communicate appropriately.
- Cerebral reorganization: the aim was to reveal the nervous mechanisms underlying behavioral and perceptual activities. Impairment related to impoverished early experience was analyzed at the brain level and changes in cerebral activity after recovery of the ability to hear were monitored when the subjects were presented social or auditory stimulations.

The importance of social experience during development in starlings was also investigated, and a similar approach is planned for future studies with children. The question of what would be a "good" social situation to help improve social recovery, vocal production as well as cerebral reorganization is very important, as, after implantation, deaf children can be placed in three types of social situations: at home, in specialized institutions or in ordinary schools with normally hearing children.

## Summary of our results

We obtained very important results both on the methodological and on the experimental levels.

Interdisciplinarity was very successful, as discussions among research groups led to new ideas, induced methodological developments and enhanced a comparative approach. A manuscript including all the current results is in preparation.

Examples of our main results are highlighted below.

- Major methodological developments:

For instance, the evaluation protocol (PEPS) developed by our team has become an important tool for all French speaking research groups concerned. In addition, a new method for mapping areas of the central nervous system as well as for comparing quantitatively auditory characteristics among zones have been developed.

- Major scientific results:

We showed that social experience plays a major role in the development of a central auditory area and that it can override the effects of auditory experience.

Both species require other modalities, especially visual, to stimulate auditory recovery of subjects with early deficits.

These two lines of results converge neatly.

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HENRY, L., LE CARS, K., MATHELIER, M., BRUDERER, C. & HAUSBERGER, M. - Social experience affects European starlings', *Sturnus vulgaris*, reactions to mirror-image. (*soumis*).

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