World's first imaging of neonate linguistic cognitive functions using Optical Topography®
- Neonates within 2-5 day of birth able to discriminate language sounds -

Tokyo, September 9, 2003 --- Prof. Jacques MEHLER of the Scuola Internazionale Superiore di Studi Avanzati,[*1] Italy (henceforth "*SISSA*"), the Advanced Research Laboratory (General Manager : Dr. OSAKABE Nobuyuki) of Hitachi, Ltd. (NYSE HIT/ TSE :6501 / henceforth "*Hitachi*"), and the Hitachi Medical Corporation (TSE:6910 / henceforth "*HMC*" / President: Mr. INOMATA Hiroshi) announced today, the first successful measurement of brain activity in new born infants while listening to speech and non-speech matched stimuli using Optical Topography,® with the Istituto di Ricovero e Cura a Carattere Scientifico[*2] Burlo Garofolo (henceforth "*IRCCS*" / Commissioner: Avv. Emilio TERPIN) and Laboratoire de Sciences Cognitives et Psycholinguistique[*3] (henceforth "*LSCP*" / Director: Dr. Emmanuel DUPOUX). This is an important achievement in the attempt to clarify the developmental stages of brain functions accompanying human growth. The results will be reported in the Proceedings of the National Academy of Sciences of the USA.

At the forefront of brain science research, is the attempt to clarify how education and environment affect the developmental process of the human brain. To achieve this, understanding the brain functions of a neonate, a new born infant, is extremely important, as it serves as a starting point. In the past, the research method was to record the behavioral response (looking time, head turning, sucking frequency,[*4] etc.) of infants, however, as a behavioral response is itself the result of an accumulated number of factors, it was difficult to clarify the relationship between individual stimuli and brain activity.

Recent developments in brain function imaging technology, however, are now making it possible to clarify the relationship between individual external stimuli and brain activity.[*5] Optical Topography,®[*6] developed by the Hitachi Group, images regional hemodynamic changes which occur as a result of brain activity by irradiating the scalp with near-infrared light. It is considered ideal for the measurement of neonate brain functions as measurements can be taken by simply fitting a special optical cap and bodily movement is not restricted by the equipment

Using Optical Topography,® research teams at SISSA, Hitachi and HMC undertook to measure neonate brain activity in relation to language. To facilitate measurement under natural settings, a new light and comfortable small optical cap was developed especially for neonate wear, enabling simultaneous measurement of 24 points on the brain (12 points on the temporal lobe of each hemisphere).

The study examined whether neonates were able to distinguish between speech, i.e. linguistic sounds, and non-linguistic sounds. The subjects, newly born Italian infants (2-5 days old; avg. 2.7 days)[*7] were exposed to:

1. normal forward-played Italian speech (linguistic sound)
2. reverse-played Italian speech (non-linguistic sound)
3. no sound (no stimuli),

and the hemodynamic changes in the brain were measured for these three conditions.

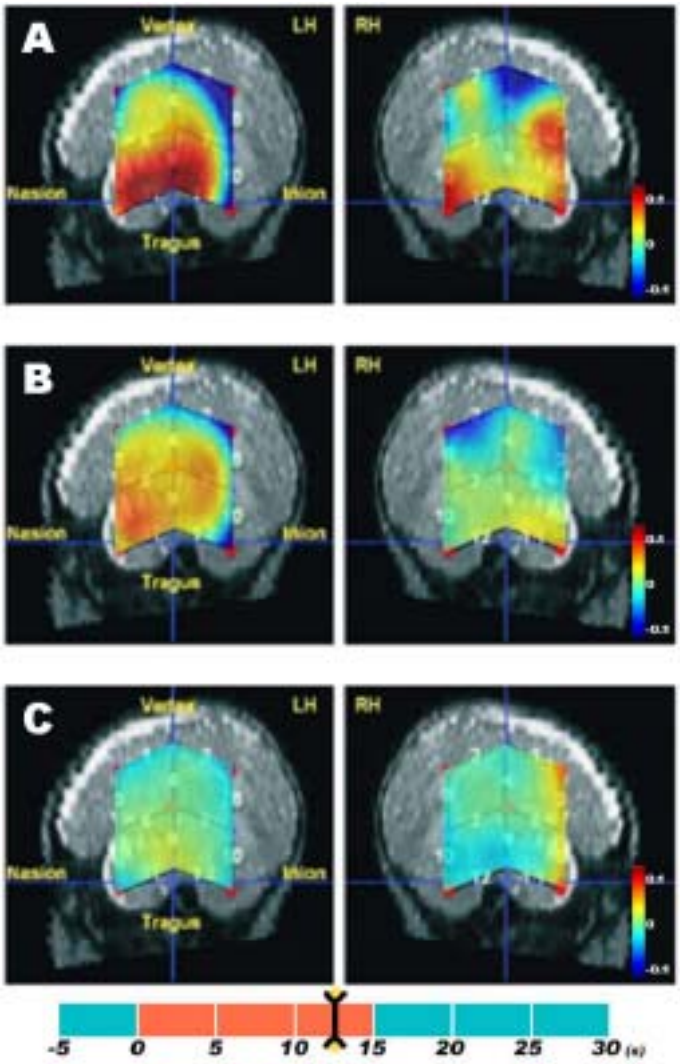

Fig. 1. Neonate brain activity images
(exposed to A: forward speech, B: backward speech, C: no sound)
(These images are drawn by the interpolation of publication data)

When the forward speech was played, a significant response was observed in the left temporal lobe (especially above the ear). The response was statistically analyzed and a significant difference was found between the left and right hemisphere in response to forward speech but not to the backward speech. Whilst it was known that infants had a preference for language stimuli, these results confirm for the first time that a new born infants process language in the left temporal lobe as in adults.

These results open the road to clarifying the developmental stages of brain functions, and in the future, this understanding is expected to contribute to the early diagnosis of brain function disorders, application in child education, and brain damage rehabilitation method.

Notes:

*1) SISSA: Cognitive Neuroscience Sector, Scuola Internazionale Superiore di Studi Avanzati (International School for Advanced Studies (ISAS)), 2-4 via Beirut, 34014 Trieste, Italy
*2) IRCCS Burlo Garofolo: Instituto di Ricovero e Cura a Carattere Scientifico Burlo Garofolo, Via dell'Istria 65/1, 34100, Trieste, Italy.
*3) LSCP: Laboratoire de Sciences Cognitives et Psycholinguistique, Centre National de la Recherche Scientifique (CNRS) & École des Hautes Études en Sciences Sociales (EHESS), 54 boulevard Raspail, 75006 Paris, France
*4) Measurement of sucking frequency: a method of measuring an infant's level of interest from the number of times the infant sucks on an artificial nipple containing a pressure sensor.
*5) Measurement by imaging brain function: The brain has a characteristic of functional localization. By measuring activity in a given area of the brain, it is possible to analyze the relationship between individual stimuli and brain activity.
*6) Optical Topography® equipment: Optical Topography® is a registered trademark of Hitachi, Ltd. The near-infrared light used in Optical Topography® has low irradiation energy, and thus is basically safe; it easily penetrates the human tissue. Thus, when the scalp is irradiated, the light penetrates the scalp; and the light reflected back from the brain can be detected again above the scalp. Brain activity is known to induce a regional increase in blood volume. Near-infrared light is absorbed by hemoglobin, a chromoprotein in the blood. Thus, it is possible to measure hemodynamic changes by measuring the intensity of the reflected near-infrared light, i.e. changes in blood volume, in the brain. By using Optical Topography,® it is possible to simultaneously measure the hemodynamic changes at multiple positions and observe brain activity as images.
*7) Research on new-born infants: Approval was obtained from the bioethics committees for biomedical research in France, as well prior written consent from the parents of the child following an explanation of the measurement procedure.

About Hitachi, Ltd.

Hitachi, Ltd. (NYSE: HIT), headquartered in Tokyo, Japan, is a leading global electronics company, with approximately 340,000 employees worldwide. Fiscal 2002 (ended March 31, 2003) consolidated sales totaled 8,191.7 billion yen ($68.3 billion). The company offers a wide range of systems, products and services in market sectors, including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's Web site at http://www.hitachi.com

About Hitachi Medical Corporation

Hitachi Medical Corporation, headquartered in Tokyo, is a global medical equipment company, with approximately 3,200 worldwide. Fiscal 2002 (ended March 31, 2003) consolidated totaled 121.4 billion yen ($1.0 billion). The company is a medical electronics specialist at the forefront of our industry, offering unique products and services. For more information on Hitachi Medical Corporation, please visit the company's Web site at http://www.hitachi-medical.co.jp

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