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ABSTRACTS

Changes in Cognitive Function with Normal Aging: Underlying Processes, Exceptions, and Contribution of ERPs

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It is almost universally accepted that cognitive function deteriorates with increasing age in healthy individuals. The principal factors underlying almost all of the observed changes are an increase in processing speed, and a deterioration in working memory. Indeed, Salthouse (1996, *Psychological Review*, 103: 403-428) argues that a wide range of cognitive functions decline with age because of the actions of these two processes alone or in combination. However, some aspects of processing speed, e.g. mental operations associated with arithmetic subtraction, do not seem to be influenced by age in the same way as others (Geary et al., 1993, *Psychology and Aging*, 8: 242-256). Exceptions to the general rule that cognitive function deteriorates with age are associated with what might be called mental and physical fitness. Thus, elderly high ability individuals who follow intellectually engaging activities, show a lower rate of decline than those who do not. It is clear, however, that high ability is not enough to ensure slower decline, engagement in intellectually demanding activities is essential to the maintenance of high levels of cognitive function. Physical activity also appears to be beneficial for cognition. Thus, the introduction of a 10-week exercise programme for a group of older adults resulted in a significant improvement in their performance on dual-task processing (Hawkins et al., 1992, *Psychology and Aging*, 7: 643-653). This finding correlates well with a report of a reduction in processing resources with age (Crossley and Hiscock, 1992, *Psychology and Aging*, 7: 499-506). Event-related potential (ERP) studies of normal aging have tended to focus on the investigation of control groups for comparison with demented individuals. There are some exceptions, however, and the early study of the auditory oddball procedure by Goodin et al. (1978, *EEG Journal*, 44: 447-458) established a linear relationship between the latencies of N1, P2, N2, and P3 and age, with the slope of the relationship increasing with the latency of the potential. This observation, replicated many times, is almost certainly related to the increase in processing speed associated with aging. ERPs have the capacity to provide information that is not available from the conventional procedures of cognitive psychology. One important example of this for aging is the study by Cremer et al. (1996, *Journal of Psychophysiology*, 10: 239-251), who investigated the interaction between different types of continuous noise and stimulus quality (intact or degraded) on the performance of young and old subjects. Results indicated that there were no differences between the groups in terms of the increase in reaction times associated with increasing difficulty of processing. However, it was clear from the ERPs that the older subjects were having to allocate a greater increase in mental effort to performance of the task in order to maintain reaction times equivalent to those of the young. This result supports the observations of decreased processing resources with age (Crossley and Hiscock, 1992, see above), and suggests that this effect can be observed with ERPs before it manifests itself in behavioural performance.

Aging and Memory: A Clinical and Instrumental Follow-Up Study of a Birth Cohort

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A group of elderly subjects (all born in 1925), not affected by dementia (MMSE ≥ 24) has been assessed twice (in 1990-1992: cross-sectional study; in 1996-1998: follow-up study) by means of a memory test battery. In both periods they have been labeled with the following test-based categories: N (Normal), MMI (Mild Memory Impairment), MI (Memory Impairment). A subgroup of subjects has been also submitted to an extensive neuropsychological test battery, to a CT-scan, to event-related potentials (oddball paradigm) and to eye movement recordings (saccades, antisaccades and smooth pursuit). Two-hundred and twenty-six of the 412 subjects examined in the cross-sectional study also completed the follow-up, as 21 died, 15 were excluded because of dementia or other illness, 58 moved, and 92 refused. Among those who died, an overrepresentation of memory impaired subjects was found. The percentage of subjects included in the three categories did not vary between the two assessments; in contrast the profile of impairment in the single memory tests changed. CT-scan showed several abnormalities, some of which correlated with the memory category. P300 latency was also weakly associated with the presence of memory impairment. Normal subjects showed a higher percentage of correct antisaccadic movements. A discriminant analysis showed that instrumental parameters, collected in the cross-sectional study significantly contributed to the prediction of the memory category, as assessed during the follow-up.

EEG Spectral Analysis in Dementia

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This abstract summarises data from different studies aimed at evaluating the relationship between EEG spectral parameters and (i) diagnosis of dementia; (ii) dementia severity (MMSE, GDS) and duration; (iii) age at onset. PARTICIPANTS: 52 healthy controls (age range: 40-92 yrs). The following 3 diagnostic groups were studied: Alzheimer disease (AD; n=150); Vascular Dementia (VaD; n=37); non-Alzheimer degenerative dementias (NAD; n=25). METHODS: EEG spectral analysis was based, apart from calculation of routine quantitative parameters, on the following features: (I) classification of power spectral profiles; (ii) use of untraditional 5.5Hz bands in the range 1-28.5 Hz; (iii) calculation of Power Indexes (PI) as the difference in absolute power of the 6.5-12Hz band between two rest conditions: eyes closed (REC) and open (REO). RESULTS: Spectral profiles were classified in:

A: With dominant peak in the band 6.5-12 Hz (controls=94.5%; VaD=97.3%; AD=44-60%; NAD=92%). The peak frequency is significantly lower and the 1-6.5Hz band power is greater in dementia as compared to normal subjects.

B: Without a dominant peak in the band 6.5-12 Hz and an increased 1-6.5Hz band power (controls=0; VaD=2.7%; AD=36-44%; NAD=80%). This type of spectrum tends to be prevalent in presenile AD.

C: Low power profile without a dominant peak (control=5.5-6%; AD=4-12%; NAD=0). As far as the PI values are concerned: (i) global PI (mean 16 derivations) and PI(O1+O2) were significantly lower in AD than in VaD or NAD demonstrating that AD patients have a lower difference in alfa/sub-alfa power between REC and REO; (iv) PI values tended to be positively correlated with age at onset of AD.

Advanced EEG Analysis Techniques in Dementia

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Neurophysiological non invasive methods, such as EEG and Event-Related Potentials, are useful tools in the investigation of brain cognitive function in normal and pathological conditions, providing an excellent time resolution as compared to other functional imaging techniques. Advanced multi-channel techniques also allow a good spatial resolution, which, together with the possibility of integration with anatomical and other functional images, may improve the localization of brain functions. Spectral analysis of the resting EEG has the limitation of a low sensitivity and specificity for the type of cognitive impairment. The sensitivity in the detection of spectral abnormalities is improved by studying centroid modifications. Coherence analysis of the resting EEG, a measure of functional cortico-cortical connections, which has different abnormal patterns in Alzheimer's Disease, cerebro-vascular dementia and dementia associated with multiple sclerosis, thus allowing more specific information. Finally, the study of EEG activity related to particular tasks, such as Event-Related Potentials and Event-Related Desynchronization of the EEG, which allow the study of brain activation during cognitive and motor tasks, may improve the assessment of demented patients.

Programming and Control of Voluntary Skilled Movement with Ageing: Psychophysiological Aspects

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Electropsychophysiological modifications related to ageing have been revealed by some components of Event Related Potentials (ERPs). However, studies of Movement-Related Potentials (MRPs) and ageing, detected by using simple movement paradigms, are not univocal. These paradigms consent, principally, the investigation of premotion activity. Skilled Performance Task (SPT) allows one to systematically analyse not only programming-related activity (Bereitschaftspotential, BP) but also control activity related to performance outcome (Skilled Performance Positivity, SPP). We examined age effects on MRPs in 10 young (range=25-35 years), 10 intermediate (45-55 years) and 10 old (>65 years) normal, right-handed adults, during SPT. Analysis of task performance showed that accuracy level (number of correct trials) diminished significantly with increasing age ($p<0.05$ in young vs intermediate and vs old). BP amplitude did not differ significantly between the three groups. A significantly lower SPP amplitude was observed at parietal sites in old subjects compared to young ($p<0.01$). These preliminary findings suggest that reduced accuracy in older subjects may not be related to the psychophysiological programming phase but, instead, related to modifications in the control strategies of motor execution. Control activity appears more vulnerable to ageing in that it compromises the programming-control relationship necessary for achieving an automatic sequence of skilled action.

A Two Factor Model for the Diurnal Variations in Attention

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Diurnal Variations in Attention have been tested in 12 healthy subjects using 24 hours Poly-Somno- and Poly-Vigilo-graphic recordings as well MSLT and a battery of Psychological tests during the day at 7, 9 and 11 a.m. and 1,3,5,7,9 and 11 p.m.

Multiple Sleep Latency Test (Time to S1 and S2)
Pupil Diameter and Diameter Variability (Using Infrared Equipment)
Choice Reaction Time (Tone/Color; decision and motor reaction time)
Serial Calculation Task
Tracking
CFR
Stanford Sleepiness Scale
VIS tiredness

A structural analysis of the data using Factor Analysis (VARIMAX, Orthogonal Rotation) suggest two factors determining attention variability: Vigilance factor(1): Neuronal Availability (MSLT, Pupillography) Performance factor(2): Neural Performance (Psychological Performance tests and Mood Scales) A z-score transformation of the variables loading in factors 1 and 2 showing the diurnal variations from the day's Median have been plottet as Box Plots. Factor 1 shows a biphasic shape with a maximum in the morning, a down towards late afternoon with an up again in the early evening. Factor 2 shows a slow up from morning over the day with a slight postprandial dip returning down in the evening. A two dimensional plot of the Median z-scores (Abszissa factor 1, Ordinate factor 2) shows highest neuronal availability in the morning and evening (7-9 a.m. and 7-9 p.m.) and best performance during the day (10 a.m. to 6 p.m.) with only a sight postprandial dip. According to our model, tests expressing neuronal availability, are not a good indicator for actual performance. Rehabilitation, according to this model, should be done, when performance is highest, but not when neurophysiological vigilance has its maximum. Individual pattern should be taken into consideration.

Study of the Relationship between Hippocampal Perfusion and Memory Function in Patients with Alzheimer's Disease (AD)*

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Twenty-two patients (mean age: 72.9+7.9) with probable AD (NINCDS-ADRDA criteria) of mild severity (MMSE score >15) and eleven healthy controls (mean age: 64.6+7.5) were studied. Cerebral SPECT was performed with 99mTc-HMPAO by a high-resolution gamma-camera (CERASPECT, Digital Sci., USA). Images were reconstructed with the new method of Conjugate Gradients with Modified Matrix which, unlikely traditional filtered backprojection, takes into account physic and geometric characteristics of gamma-camera. Images were reoriented on the sagittal plane (+30° rotation) to identify hippocampal structures at best. On a 5-mm thick transaxial section two symmetrical Regions Of Interest (ROIs) were drawn around hippocampal structures, and normalisation on thalami was performed. 6-item Buschke-Fuld Selective Reminding Test (SRT) was administered to all subjects; total of words recalled (raw score) was considered for the purpose of this study. Both hippocampal perfusion and raw SRT score were significantly (t-test; $p < 0.001$) lower in patients than in controls. Hippocampal perfusion was significantly (Pearson's r; right hemisphere, RH: $p < 0.05$; left hemisphere, LH: $p < 0.01$) correlated to MMSE score and SRT raw score (RH: $p < 0.05$; LH: $p < 0.02$). Hippocampal perfusion, as yielded by brain-dedicated camera with accurate reconstruction techniques, is strictly related to memory deficit since the milder stage of AD.

Quantitative Regional Cerebral Blood Flow: A Possible Prognostic Index in Alzheimer's Disease

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Sixty-four outpatients (mean age: 68.9±8.7) with probable Alzheimer's disease (AD) (NINCDS-ADRDA criteria) underwent regional Cerebral Blood Flow (rCBF) by planar Xenon-133 clearance method. A mean absolute rCBF value from a posterior temporoparietal region was considered in left (LH) and right (RH) hemisphere. Patients were followed on an ambulatory basis (46 cases) or by a standardised telephonic interview with relatives (18 cases) for a mean time of 40.2±25.5 months. The hypothesis that rCBF values may predict the time of achievement of the loss of Activities of Daily Living (ADL), incontinence, and death was tested by the "lifereg" procedure of the SAS package. 19 patients had already lost the ADL and 3 patients had developed incontinence at the time of rCBF examination, whereas 4 patients died because of pathological conditions other than end-stage AD. 32 patients lost the ADL after 20.6±17.4 months, while 13 maintained them after 25.1±11.1 months. 31 patients developed incontinence after 26.9±19.3 months, while 30 did not after 29.9±20 months. 16 patients died because of end-stage AD after 39.9±25.1 months, while 44 were still alive after 41.2±26.2 months. rCBF of both sides was significantly correlated to the time of achievement of all three end-points: loss of ADL (LH: $p=0.01$, RH: $p=0.02$), incontinence (LH: $p=0.01$, RH: $p=0.02$), and death (LH: $p=0.04$, RH: $p=0.02$). Although both the statistical model and the curves of predicted times should be validated with another sample of AD patients, these data suggest that a quantitative measure of an index that strictly reflect brain metabolism, such as rCBF, may offer clinically useful prognostic information.

Alterations of Flash Visual Evoked Potentials and Indexes of EEG Reactivity as Possible Markers of Reticulo-Cortical Dysfunction in Alzheimer' S Disease

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Different studies show alterations of flash visual evoked potentials (F-PEV) in patients with Alzheimer's disease (AD) and in their relatives, which may be considered a sign of latent neurodegeneration of reticulo-cortical structures. Also EEG reactivity alteration may be related to alteration of the above quoted structures. The aim of this study was to verify if a correlation between indexes of EEG reactivity (PI) and F-PEV exists in AD. We studied 23 patients with Probable AD according to NINCDS-ADRDA and DSM-IV criteria. The F-PEV were obtained using white light administered at a rate of 1 Hz. The EEG spectral analysis was performed using traditional methods. The Power Index (PI) in the occipital leads was used as an indicator of reactivity. This was calculated using the absolute power (PA) in the band 6.5-12 Hz during rest with closed eyes (REC) and open (REO), according to the formula: $[(PAREC-PAREO)/ PAREC]* 100$. We correlated (Spearman's test) the amplitude and latency of F-PEV with PI in occipital derivations and with values of MMSE and GDS. A significant correlation [$r(\text{left}) = -0.47$, $r(\text{right}) = -0.50$] exists between PI and amplitude of III wave: a small PI corresponds to a reduction in the amplitude. A significant correlation also ($r= 0.41$) exists between latency of the III wave and GDS: a greater alteration of cognitive functions and a reduced personal autonomy corresponds to an increased latency of the III wave. So there is a relationship between PI and F-PEV alterations which probably have the same pathophysiological mechanisms. The latency of the III wave, correlating with the GDS, could constitute an objective parameter for evaluation of severity of illness.

Chromatic Subsystem Involvement in Parkinson's Disease.

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Impairment of achromatic vision in Parkinson's Disease (PD) has been clearly demonstrated; colour-opponent pathway involvement is less understood. Aim of this study was to compare VEPs to red-green (R-G) and blue-yellow (B-Y) equiluminant stimuli with those to achromatic black-white (B-W) stimuli in a group of PD patients. Twelve "de novo" PD pts (age range 41-65 yrs) non-undergoing L-Dopa treatment, as well as 28 age-matched controls (age range 19-53 yrs) were included in the study. VEPs were recorded in response to 2 c/deg sinusoidal gratings of both chromatic contrast (equiluminant R-G and B-Y) and achromatic contrast (B-W) presented in full-field (14 deg), Onset (300 ms) - Offset (700 ms) mode, at two contrast (K) levels (90% and 25%) (Porciatti and Sartucci, *Clin. Neurophysiol.*, 1999, 110: 772). In PD pts VEPs mean latencies were more delayed for chromatic than for luminance stimuli, especially for B-Y stimuli of low contrast (K25%: B-W 7.8 ms; R-G 14.8 ms; B-Y 28.8 ms). However, due to the large variability of chromatic-, as compared to achromatic-, VEPs the rate of latency's abnormalities (monocular) was comparable for all kind of stimuli (K90%: R-G 0%, B-Y 29.2%, B-W 25%; K25%: R-G 25%, B-Y 29.2%, B-W 29.2%). Our results indicate that, in addition to achromatic VEPs, chromatic VEPs were also impaired in "de novo" PD pts. The different extent of delay for the different VEP modalities suggests independent vulnerability of visual subsystems in the early stages of the disease; however, the overall yield of chromatic VEPs in detecting early impairment in PD is comparable to that of achromatic VEPs.

Cognitive Performances at 16-24 Weeks from Severe Head Injury: Correlations with P300 Recorded in Acute Phase

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Previous studies have evaluated the use of P300 as a supportive tool to make the prognosis *quoad vitam* in traumatic coma. This study was aimed at investigating the potentiality of the P300 as an early indicator of cognitive outcome in traumatic coma. 24 comatose, brain-injured, right-handed patients (age 15-65 years), without temporal left lesions, were evaluated. P300 was recorded within 15 days of the head trauma using the method reported in Signorino et al., 1995. The survivors were evaluated 16- 24 weeks after the trauma by means of the GOS and a neuropsychological battery (coloured Raven Matrices, Weschler Memory Scale, IPAT-ASQ Scale for anxiety and Beck's for depression, simple and choice reaction times). 18 patients showed the P300 in at least one of the trial blocks of the session (group A); 6 didn't (group B). GOS average was statistically better in group A (t-test: $p= 0.039$). In group A patients latency, amplitude and time of occurrence of P300 during the experimental session were correlated with the neuropsychological data. The predictive role of the P300 was confirmed with regard to the prognosis "*quoad vitam*". Furthermore the P300 correlated with any neuropsychological test effected at a distance of 16-24 weeks from the trauma. In particular short latency was linked to maintenance of the logical deductive abilities evaluated by Raven's test; higher wave amplitude was a good marker of rapidity and discernment of answer (choice reaction times). P300 obtained in only the conditioning phase is related to anxiety risk and worse performance in the choice reaction times and test Raven's test perhaps because of a higher susceptibility to emotional stimuli.

1. Signorino M et al. *Lancet* 1995, 345: 255-256.

Prognosis In Traumatic Coma: Clinical, Electrophysiological And Neuroradiological Parameters

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This study is aimed at investigating the value of clinical, electrophysiological and neuroradiological parameters in traumatic coma as prognostic indicators of both survival and cognitive recovery. 57 patients with traumatic coma (14 F, 43 M) were consecutively enrolled. Severity of trauma was evaluated by the Glasgow Coma Scale in the post-resuscitation phase; EEG reactivity, i.e. changes in the EEG on application of nociceptive stimuli, were classified as: (1) absent, (2) present and synchronised, (3) present and desynchronised. Brain CT was evaluated on the first day of head injury. Outcome was evaluated at 6 months using the Glasgow Outcome Scale (GOS) and cognitive recovery evaluated according to the following tests: Raven's PM47 matrices, Wechsler Memory Scale, simple and choice reaction times. Beck's and IPAT-ASQ for depression and anxiety were also evaluated. EEGs were reactive in 21 cases and non-reactive in 36 cases. There were no differences in age, sex, education, length of coma or post-traumatic amnesia, while the two groups were different in respect to GOS and cognitive recovery, both better in the reactive group. EEG reactivity correctly classified 70%, GCS classified 65% and both measures together classified 76% of the patients into globally good or bad outcome groups. Brain CT does not predict the outcome, reactivity is better than GCS in predicting cognitive recovery.

CNS Function, Cosmic Particles and Microgravity: An Electrophysiological Study

ALTEA project Collaboration (presented by WG Sannita)*

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The ALTEA project participates in the quest for increasing the safety of manned space flights. It addresses the problem of a possible functional damage of the CNS in microgravity and specifically aims at relating it to the peculiar space environment, notably to the particle flux impinging in the head and brain and potentially affecting vision. The project is a large international and multi-disciplinary collaboration. Competences in particle physics, neurophysiology, psychophysiology, electronics, space environment, and data analyses will combine to design and develop the fully integrated electrophysiological systems and particle analyser that form the project core device. An helmet-shaped, advanced multisensor device combined with electrophysiological equipment will measure the functional dynamics of the visual system and the passage of each particle through the brain within a pre-determined energy window. ALTEA is scheduled to fly in the International Space Station on march 2002. An early version of the multisensor silicon telescope is scheduled to be launched in the International Space Station in April 2000 and will serve both as a test for the final device and as a discriminating dosimeter of particle fluences within the Station.

ESES: Encephalopathy Related to Electrical Status Epilepticus during Slow Sleep (Epilepsy with Continuous Spikes and Waves during Slow Wave Sleep)

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Definition: ESES or Encephalopathy related to Electrical Status Epilepticus during Sleep is an age related condition occurring in children characterized (Tassinari et al. 1977-1995):

Clinically a) by a progressive impairment of psychological and motor functions b) by epileptic seizures. On the EEG by the occurrence of a sleep related pattern of continuous diffuse spike and waves (Patry, Lyagoubi and Tassinari, 1971). Classification: The ILAE Commission (1989) refers to ESES as “Epilepsy with continuous Spike and Waves during sleep and places this disorder under “epilepsies and syndromes undetermined as to whether they are focal or generalized. Clinical manifestations

1) Epilepsy: The first seizure is reported to be nocturnal and of unilateral type in almost one half of the cases reported . Absences and epileptic falls herald the appearance of ESES. The seizures are self limited and disappear in the mid-teens.

2) Neuropsychological deterioration. There is a constant and severe deterioration in neuropsychological functions; language capacity is often particularly affected. Patients also may show a profound decrease in intellectual level, poor memory, impaired temporospatial orientation, reduced attention span, hyperkinesia, aggressive behavior, and even psychosis (Jayakar and Seshia 1991).

The mechanism of neuropsychological impairment. Long-lasting persistence of ESES is postulated to be responsible for the neuropsychiatric abnormalities in epilepsy with ESES. Three main arguments are in favour of this hypothesis: there is a close temporal association between ESES and neurological regression (the latter beginning at the time ESES is discovered and improving after ESES disappearance); the duration of ESES is correlated with the final neuropsychological outcome; there is a strict association between the pattern of neuropsychological derangement and the location of the interictal focus (Rousselle and Revol 1995):

- a deterioration of language (acquired aphasia or Landau Kleffner syndrome) is observed in cases showing the predominance of paroxysmal abnormalities over one or both temporal regions (Billard et al 1982);

- a mental deterioration and an autistic behaviour evoking a frontal lobe syndrome has been described in children exhibiting interictal frontal foci (Roulet Perez et al 1995 and also Ballaban Gil et al 1998; Sotero De Menezes et al 1998; Goldberg et al 1998).

3) Motor impairment . Motor impairment, in the form of negative myoclonus, dyspraxia, dystonia, ataxia or unilateral deficit, has been emphasized as one of the outstanding disturbances occurring in this syndrome (Dalla Bernardina et al 1989; Neville et al 1998).

Physiopathology Secondary bilateral synchrony is the mechanism underlying ESES. ESES is a model for prolonged cognitive impairment induced by so called “interictal paroxysmal activity”(Tassinari 1995). “Interictal paroxysmal activity” may interfere with different cognitive processes , as demonstrated by neurophysiological, neuropsychological and biochemical studies (Binnie 1993; Seri 1998; Wasterlain et al 1993).

Differential diagnosis

Lennox-Gastaut syndrome. The distinguishing features include the characteristic EEG pattern, as well as the following: (1) partial motor seizures often occur in epilepsy with continuous spike waves during slow wave sleep but are rare in Lennox-Gastaut syndrome; (2) tonic seizures occur commonly in Lennox-Gastaut syndrome but are absent in ESES and (3) in ESES, seizure frequency declines over the course of the illness, whereas seizures usually remain frequent throughout the evolution of the Lennox –Gastaut syndrome.

Acquired Epileptic Aphasia. ESES and Landau Kleffner syndrome are two facets of a same entity (Tassinari 1995; De Negri 1997; Giovanardi Rossi et al 1999).

enign Epilepsy With Rolandic Spikes. The diagnosis of benign childhood epilepsy is usually made apparent by the characteristic interictal EEG spike morphology and the absence of severe behavioral deterioration.

Evolution and Therapy.

ESES is usually refractory or partially responsive to medical treatment including corticosteroids. The long-term prognosis of seizures is however favourable. In cases of ESES with severe language impairment, a progressive and long lasting improvement of the language function has been obtained

applying the surgical procedure of multiple subpial transections in the region of focal epileptic discharges (Morrell et al 1989). Recovery of neuropsychological function after disappearance of ESES is usually partial.

Specific Cognitive Findings in Epileptic Children

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Epilepsy is a frequent affliction, generally seen as a risk factor for intellectual development, although, cognitive disturbances in epileptic children represents a very complex problem. Difficulties in scholastic insertion, learning and specific cognitive functions are more frequent than I.Q. defects and have an higher indicative value. Particularly, attention and memory deficits are common neuropsychological signs, frequently associated with neurological disorders. As the child's brain is a developing organism, attention disorders have a great influence on the global development of all cognitive functions and learning skills. Attention should not be considered as a single unitary function but has been described as a complex system involving different anatomical structures. From a neuropsychological point of view, theoretical cognitive models describe different interactive levels in the process of attention with clinical expression of a different nature; lesion of each level producing a specific attention disorder. The HAMTEST (Hufty Attention-Memory Test) is a computerized neuropsychological battery designed to assess alertness, selectivity, vigilance and short and long term memory in children aged 6 to 12 yrs and was normalized on a 800 children italian population . We present results of specific testing of attention and memory functions in different population of epileptic normally intelligent children, using the HAMTEST.

Event-Related Potentials in Epilepsy

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Event-related potentials in epilepsy are useful to (1) quantitate cognitive deficits related to epilepsy itself, (2) evaluate cognitive impact of antiepileptic drugs (AED), (3) contribute to pre-surgical evaluation of drug-resistant syndromes. Most of studies are focused on the P300 acoustic component achieved with an odd-ball paradigm; but reported data are often unhomogeneous and contradictory. P300 latency is frequently increased in partial epilepsies (both symptomatic and cryptogenic) versus generalized ones and normal controls, particularly in temporal lobe and bilateral multifocal epilepsies. Also in generalized syndromes a slight increase in P300 latency versus controls is reported. The phenomenon is not related to AED plasma levels or therapeutic outcome. Few reports indicate that P300 is severely altered in children with generalized idiopathic epilepsy, instead. P300 alterations are slightly related to the entity of slow EEG anomalies but not of paroxysmal anomalies (either focal than generalized). P300 has been used to evaluate cognitive impact of AED treatment. Its latency is increased in a significant proportion of patients treated with barbiturates, carbamazepine and phenytoin, but not in those ones treated with valproate. Some late components (N400) recorded directly from hippocampus seem to be useful to predict both postoperative seizure control and verbal memory after left-sided hippocampectomy.

Controlled Study on Subjects with Primary Generalized Epilepsy by the Dissociative Experience Scale

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The aim of this study is to investigate the presence of Dissociation phenomena in consciousness (FDC) in a sample of subjects affected by Primary Generalized Epilepsy (PGE). Moreover the frequency FDC in our sample has been compared to the one of subjects affected by Temporal Lobe Epilepsy, subject of previous study. To this end the instrument used was the Dissociative Experience Scale (DES), a self – assessment scale introduced in 1986 by Bernstein and Putnam and currently being evaluated in Italy. Research results seem to emphasize a greater incidence of Dissociation Phenomena in subjects affected by Temporal Lobe Epilepsy compared to subjects affected by Primary Generalized Epilepsy. This result confirms the hypothesis according to which Temporal Lobe Epilepsy, because of particular localization of the epileptic focus in temporal region (Limbic System), presents a prevalence of dissociative phenomena. Subjects affected by PGE however present an incidence of Dissociative Phenomena greater than what is already known for general population, especially if the illness appeared in the second decade of their life or if we deal with Juvenile Myoclonic Epilepsy.

Multiple Delayed Verbal Reactions in Epileptic Patients

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The study of delayed tasks can be useful to identify cerebral impairments of brain cognitive functions. They are based on the concept that in the time elapsed between the task stimulus and the execution stimulus is associated with a recurrent activity of the neuronal assemblies organized as mnemonic networks of the cerebral cortex. In this study we have investigated 21 epileptic patients applying the methodology of delayed verbal reactions before and during the anti-epileptic therapy. Mean verbal reaction times have been calculated on both electromyographic (from the orbicular oris muscle) and voice recordings. In the patients group, compared to a group of age matched normal controls, we have found in basal conditions a statistically significant increase of the interference index (the ratio between the 100ms foreperiod and the immediate reaction times), while the temporal bridging index (ratio between the reaction times with longer foreperiods [0.5, 1.5 and 4s] and in immediate reaction) was increased only for the 4s foreperiod. In addition during the therapy, we observe an increase of the temporal bridging index for 1.5s foreperiod delayed reactions. These findings can be attributed to alterations of the interference inhibition process and of the selective attention facilitating activity and the neural basis underlying could be the hyperexcitability and the abnormal spread of impulses found in the epileptic brain.

A Case of Morgagni-Stewart-Morel Syndrome with Partial Seizures: Neuropsychophysiological and Neuroradiological Evidences

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The Morgagni-Stewart-Morel syndrome is a clinical entity characterized by hyperostosis frontalis interna, cognitive impairment and various endocrinopathies. A common complaint is frontal headache that could be severe in a few cases. Headache and cognitive impairment could partially be explained by hyperostosis. The presence of seizures was not reported in literature. The aim of this study was the clinical, neuropsychophysiological and neuroradiological assessment in a case with the Morgagni syndrome associated with partial seizures as to evaluate possible cause-effects

between hyperostosis frontalis interna and neurological symptoms. A 47-year old female with hyperostosis frontalis interna, obesity, anxiety, frontal headache complained of behavioral disturbances. To determine of the seizure type a basal EEG and a 24-hours EEG were recorded. The neurophysiological investigation consisted in recording of visual and auditory oddball ERPs and their topographical representation by polychromatic brain mapping. The neuropsychological study assessed executive functions, attention, short- and long term memory. Laboratory data reported endocrinological disorders like hyperglycemia and hyperprolactinaemia. The 24-hours EEG showed focal signs of cerebral irritation in the left fronto-temporal area. P300 were impaired for both visual and auditory modality. The neuropsychological assessment showed impairments for planning and selective attention. A brain MRI revealed bilateral small hyperintense gliotic lesions in the frontal subcortical regions. Clinical, neuroradiological and neuropsychophysiological evidences led us to the diagnosis of Morgagni-Stewart-Morel syndrome associated with complex partial seizures. The association with working memory dysfunctions were described in literature and probably it may be due to the compression of the dorsolateral frontal cortex, an important cerebral area involved in attention, memory and executive functions. Also the seizures could be explained by the compression-phenomenon evidenced by the gliotic lesions in the frontal subcortical regions. The ERPs data confirmed the cognitive impairment and in this way the P300, because of the prefrontal regions involved in its origin, may be a complementary tool to investigate the cognitive status in the Morgagni-Stewart-Morel syndrome.

Visuo-Spatial Attention Test: Correlations with Indexes of EEG Reactivity and Severity of Dementia in Alzheimer's Disease

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The EEG of patients with AD usually shows a reduction of the alpha rhythm, an increase of slow frequencies often associated with a reduction of the alpha blocking when the patient opens eyes during standard recording and in a disappearance of physiological prevalence of power in closed eyes with respect to open eyes condition during EEG recording. Furthermore in this disease there are deficits of attention and poor visuo-spatial performance which can represent the onset symptoms. The aim of this study was investigate correlations between alteration of EEG reactivity and attentive and visuo-spatial performances. We studied 34 patients with Probable AD according to NINCDS-ADRDA and DSM-IV criteria. All subjects underwent MMSE, GDS, Raven's Colored Matrices, Trail Making Test A, Visual Search, Constructive Praxia (copy of designs) tests. We correlated occipital indexes of EEG reactivity (PI) with the values of the tests by Spearman's test. The PI was calculated using the value of absolute power (PA) in the band 6.5-12 Hz during rest in closed (REC) and open (REO) eyes conditions according to the formula: $[(PAREC-PAREO)/PAREC]* 100$. We also correlated PI with GDS and MMSE. A significant correlation was found between reduction of PI and neuropsychological tests (worse test scores in patients with lower PI). PI did not correlate with MMSE and GDS. These results show that attentive and visuo-spatial performances are more compromised when the value of the PI is small (low EEG reactivity), in the absence of significant correlation with the AD severity expressed by GDS and MMSE scores. These data suggest the existence of an pathophysiological correlation between mechanisms involved in visuo-spatial abilities and those involved in the desynchronization of alpha rhythm during execution in specific tasks.

Effects of Anti-Histamine Drugs on Attention

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Many non-psychotropic drugs have a negative effect on attention and vigilance and on psychomotor activity and therefore reduce work performance, concentration and driving capability, even during leisure time as they induce drowsiness and apathy. It is well known that the classic anti-histamines have a sedative effect related to their antagonistic effect at the central level where histamine acts as a neurotransmitter which can maintain alertness and attention. There are at least two important aspects of this sedation. One is objective and based on psychometric tests and the other is the subjective response to drug administration. It is therefore important, in order to identify possible sedative effects, to use tests which are reliable and sensitive to both objective and subjective effects of anti-histamines. For example, the Critical Flicker Fusion Test (CFF), Choice Reaction Time (CRT), Digit Symbol Substitution Test (DSST) and simulated and real driving tests. It may also be appropriate for a complete picture to carry out physiological evaluations using the Multiple Sleep Latency Test (MSLT) and measuring evoked potentials (P300). An arm ring actigraph may also be used to continuously monitor motor behaviour and performance during a whole day so as to avoid the problems associated with evaluations carried out at fixed times during the day. Clinical studies on these tests have shown that II generation anti-histamines generally have less sedative side-effects, especially when taken in the prescribed doses. Fexofenadine, a III generation anti-histamine, has been shown in various clinical studies, even when taken in excessive quantities, not to have sedative effects on driving capacity or alertness or cognitive and psychomotor performances. This summary contains a review of the work carried out by other authors.

1. Fexofenadine was evaluated in a double blind, crossover study involving 24 volunteers who underwent, at various times and with various doses, both psychomotor and driving tests. 60mg BID fexofenadine, 120 mg OD, 120 mg BID, 240 MG OD, 2 mg BID clemastine and a placebo were compared at the same time. In contrast to clemastine, fexofenadine did not affect driving capacity or any of the other parameters measured in any of the doses tested (Vermeeren, O'Hanlon, 1998).
2. Another study in which CFF, CRTR, LARS and the percentage of sleep time (measured by actigraph) were measured confirmed that fexofenadine (80 mg, 120mg and 240 mg a day) had no effect on attention (Hindmarch, Shamsi, Stanley, Fairweather, 1999).
3. The safe use of fexofenadine has also been evaluated by air traffic control organisations such as the Federal Aviation Administration (FAA), which is the American civil aviation authority, and the British Ministry of Defence (DERA). The FAA has approved the use of fexofenadine for its flight staff and the DERA has verified that fexofenadine (at 120 mg, 180 mg and 240 mg) has no influence on the results of multiple tests carried out on military pilots (Silbermann 1997, Nicholson 2000).

Is the Lissauer's Model of Visual Agnosia Still Actual? Report of an Unusual Case

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Visual agnosia is a severe, modality-specific, impairment in the recognition of objects visually presented. Lissauer proposed the dichotomy between apperceptive agnosia, which is the failure to achieve fully specified perception from visual information, from associative agnosia which represents the failure of arousing the attributes that assign it a meaning. Over the last years several clinical reports of visual agnosia are described, many of them with particular features which do not

completely agree with the above model. We describe the case of EM, a 74 years old right handed man, who had two consecutive strokes affecting both parietal and occipital lobes: he developed a failure in perceiving overlapping shapes and degraded gestalt, difficulty in perceiving drawings of single objects as wholes using a description features by features. Furthermore, when he watched television' shows he need of a little binocle for focusing details, allowing him to realize the whole scene. The semantic and structural knowledge of objects that he could not visually identify was intact: he was able to describe and to draw the characteristics of common objects, as he was to performe pantomime. So, EM was affected by an impairment in early stage of perception with a partial integration of stimuli but without semantic defect. This case support the existance of integrative agnosia, as previously proposed by other authors, which do not fill the Lissauer's model. Lissauer H. *Archiv fur Psychiatrie* 21: 222-270 (1890).

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A Topographic Study of Auditory ERPs during General Anesthesia

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Event-Related Potentials (ERPs) were recorded during carotid endoarterectomy (CEA) in order to detect unintentional intraoperative awareness during general anesthesia. The anesthetic agents were propofol (4-7 mg/kg/h i.v.) and fentanyl (50 ucg i.v. bolus), with vecuronium (0.15 mg/kg) providing neuromuscular blocking. Auditory ERPs (oddball paradigm) were obtained the day before surgery and during CEA in 18 consecutive patients (11 males, age range 52-86 yrs), without neurological deficits and no lesions on brain TC/NMR examination. 19-channel ERP spline-voltage maps were computed off-line and compared in the two conditions (before surgery vs during surgery). Normal ERP N1, P2, P3 components were identifiable preoperatively in all the patients. Increased latencies and reduced amplitudes of all ERP components were observed during general anesthesia. A clear N1 component with a frontal-central distribution was detected in 60% of the patients, whereas a later, anterior positive component was observed in response only to the rare tones in 35% of the individuals. The scalp topography and the latency range of this positivity were that of the P3a component. A clear central-parietal P3b was never detected during general anesthesia. Based on these ERP findings, a suggestion is made that under the propofol/fentanyl anesthesia performed in the current study the auditory information processing is not entirely suppressed and that the electrophysiological counterpart of an early alerting/pre-attentive process (represented by N1/P3a ERP components) was maintained.

Auditory Rehabilitation through Cochlear Implantation

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Early cochlear implantation of young children is favoured because of their greater neuronal plasticity, but increases the difficulty of measuring restoration of hearing and auditory perception. Event-related potentials (ERPs) offer objective measures of sound perception. The mismatch negativity (MMN) reflects passive discrimination, while the more robust P300 is potentially useful if active discrimination can be induced. An auditory oddball paradigm was used, with stimuli based on changes in four key dimensions of graded difficulty conveyed in consonant-vowel syllables: (i)

fundamental frequency, (ii) identity of the vowel, (iii) voicing of the consonant and (iv) place or articulation of the consonant. Recordings were made in normal volunteers, and in a good cochlear implant user, under both active and passive conditions. A paradigm using mixed auditory and visual stimuli was also employed. The MMN was not reliably identifiable in all subjects; the P300 was clear in the active condition, amplitude and latency correlating well with perceived difficulty of discrimination, but generally absent for passive recordings. The mixed auditory/visual paradigm elicited a generalised shift in waveform rather than a particular peak. The measures used have applicability in identifying ability to perceive differences in sounds in young children, but their lack of robustness suggests use of a composite measure, rather than a single component, in clinical application.

Alterations Of The Body Schema Following Lesions To The Peripheral Or Central Nervous System And Neuroplasticity

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Background. The term body schema alludes to the complex of sensations, perceptions, memories and ideas about the dynamic representation of one's own body. The persistence of phantom limb perceptions decades after an amputation suggests that the body schema is comparatively static. However, telescoping phenomena (i.e. changes in shape and length of a phantom limb) hint at the dynamic nature of the body schema. Aims. To assess: a) whether chronic perturbations of sensorimotor inputs to an apparently intact central nervous system may modify the perception of the body; b) misperceptions and misrepresentations of the body consequent to brain lesions. Materials and Methods. Patients with idiopathic torticollis and right brain-damaged patients were submitted to questionnaires and clinical tests concerning the body. Tasks assessing personal and extrapersonal space and drawings of extracorporeal objects and human bodies were used. The patients' performance was videorecorded. Results. A patient with chronic torticollis reported a dramatic alteration of the relationships between neck and trunk and a consequent change in the awareness of her body. Brain-damaged patients with lesions centered upon the right-parietal lobe presented with body schema alterations, which ranged from presence of a phantom supernumerary limb to disownership of the contralesional limb. Conclusion. Body schema may change dramatically as a consequence of perturbations of peripheral or central nervous system. Thus, it qualifies as a mental construct largely plastic even in the adult life.

The Correlation between Event Related Potentials and Neuropsychological Findings in the Speech Language Impaired Children

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A large part of the work in psychophysiology and psycholinguistics in recent years has focused on trying to determine the time - course of the processes that result in successful language comprehension. In order to answer questions it is not sufficient only to measure the end results. Techniques that measure comprehension processes as they proceed must also be used so called "on - line" measures. The goal of this special issue of language impairment and Cognitive Processes is to demonstrate how the results of one technique, the recording of event - related potentials highly correlate with Neuropsychological test findings in children with Speech and Language Impairment. ERPs are both on - line and unintrusive on processing, which are very desirable features for a comprehension measure. Also, ERPs can be obtained while children read and listen, so they can be

used as a measure which highly correlates with different Speech Language Impairments in children. Neuropsychological test findings show "developmental immaturity - disharmony of specific intellectual functions, which correlate with ERPs findings.

Event-Related Potentials (ERPs) and Heart Rate (HR) Responses to Emotional Word Stimuli

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The influence of affective information processing on the late positive complex of the ERPs and HR changes was studied using a visual 'oddball' paradigm in which positively and negatively valenced words were used as standard or target stimuli. The hypothesis was tested that the active conscious evaluation of the affective meaning of a word should lead to a more pronounced long lasting positive shift (P3 component of the ERP) in the cases in which the emotional content of a target word (positive or negative) has an opposite emotional valence of a background word. The positive shifts of the ERPs should be also paralleled by emotional-related HR changes. Twenty-one men and 40 women right handed subjects (age range 20-30 years) voluntarily participated in the experiment. Four experimental conditions were obtained by using all the possible combinations of positive and negative words as standard and target stimuli. The ERPs were recorded from F3, F4, T3, T4, P3, P4, O1 and O2 locations. Target and standard emotional words yielded larger P3 peaks (447 + 31 ms) and smaller HR decelerations to target stimuli in women than in men. The most pronounced P3 peak amplitudes were displayed across parietal and occipital locations when a target word had an opposite emotional valence of a standard one. Consistent HR decelerations were also obtained for these conditions. Results suggest that an enhanced inhibitory process was operating in the cases in which the emotional valence of a target word was opposite to that of a background one.

All-Night Spectral Analysis of Sleep EEG: A Study of High-Frequency Bands

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In the past, several studies focused their attention on the relationships between REM sleep and cognitive aspects during development; among the functions attributed to REM sleep, one of the most important is its role in processes of memory consolidation, according to the type of learning and with different time "windows" [Jouvet 1998]. More recently, high-frequency EEG rhythms (~40 Hz) have been indicated as important electrophysiological correlates of cognitive processes taking place during wakefulness; it is also interesting to note that an increase in 40 Hz activity has also been reported during REM sleep, by means of magnetic field recording [Llinás e Ribary 1993]. The time course of the delta EEG band during sleep has already been studied extensively mostly because it shows modifications which are quantitatively very evident, in correlation with the different sleep stages. On the contrary, there are very few studies on the high-frequency EEG bands and on the 40 Hz rhythm, in particular. For these reasons, we carried out a complete spectral EEG analysis during the first 7 hours of sleep in 7 female normal subjects aged 18-20 years; we evaluated not only the classical delta, theta, alpha, sigma, and beta (15-25 Hz) bands, but also two additional ones, gamma1 (25-35 Hz) and gamma2 (35-45 Hz). As expected, the statistical analysis of the delta, theta, alpha and sigma bands showed that they reached their minima during REM sleep. On the contrary, beta and gamma1 bands showed a small increase during this sleep stage; gamma2, again, showed power values during NREM sleep higher than those recorded during REM sleep. All bands, the last three in particular, showed sudden brief and very pronounced increases in correspondence with arousal or body movement periods. In order to enhance the modifications observed in the beta and gamma1 bands, we calculated the ratio between each of these bands and

gamma2 (which we interpreted as being correlated with muscle artefactual activity, low during REM sleep). This allowed us to obtain highly significant results with a clear increase of this ratio during REM sleep, as compared to NREM. Finally, the time relationships between the different bands were analyzed by means of the linear correlation coefficient and the cross-correlation; this analysis, also allowed us to show that high-frequency bands show a very clear and significant negative correlation with the delta band. In conclusion, this study allows us to affirm that while the delta band is characteristically associated with slow-wave sleep and the sigma band is related to the occurrence of sleep stage 2, the bands comprised between 15 and 35 Hz show peaks during REM sleep which are of small amplitude but highly significant from a statistical point of view. Probably, these bands can be considered as the scalp-recorded equivalent of the 40 Hz rhythm observed during REM sleep by means of magnetic recording and, in the future, they might be used as an index of cognitive processes taking place during this sleep stage.

Asymmetric ~15-35 Hz Oscillatory Responses to Pattern Onset-Offset Stimulation and Visual P300 in Volunteers

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Background: "Gamma" oscillatory activity mediates in visual information processing, with a suggested role in neuronal mechanisms subserving cognition. Whether the functional modes are comparable across sensory and cognitive conditions is still unclear. Methods: VEP, P300 and narrow-band ~15-35 Hz oscillatory responses to contrast stimulation were simultaneously recorded from 10 volunteers. Monocular stimuli were onset/offset sinusoidal gratings (central 9° of retina; 70% contrast; 1.3 c/deg), with vertical orientation (frequent stimulus: 80%) or vertical-to-right 15° rotation (rare: 20%). The phase-relationship vs stimulus was computed across frequencies and over time. Results: Increased phase-locked oscillatory activity at ~15-35 Hz anticipates the conventional VEP, with higher phase-locking in response to offset than onset stimuli. Phase-locking in the VEP frequency range (0-15 Hz) was higher for the onset response. The oscillatory activity at central locations increased after completion of, but not during the P300, without temporal correlation with the VEP P100 or phase-locking to the rare stimulus. P300 low frequency components were phase-locked to rare stimulus. Conclusions: Stimulus phase-locked ~15-35 Hz oscillatory activity reflects asymmetrically onset/offset stimulation and anticipates the VEP. The possible role in cognitive processes is not mediated through time-coded relationship with transient stimuli/events.

Olfactory Evoked Potential in Healthy Subjects: Possible Clinical Applications

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Background. Olfaction is recognized among the most complex human sensory system. Aims To develop an electrophysiological method for recordings of cortical potentials evoked by olfactory stimulation (OEPs). To verify the reproducibility of the method. Materials and methods OEPs recordings have been performed by a dedicate device. Every 30 sec, an equal amount of stimulant gas was delivered instead of the constant stream of inert gas (N₂) at 4 lt/min. We performed OEPs recordings in 20 healthy volunteers (12 M, 8 F, mean age 20±5 yrs). No one was affected by ear-

nose-throat diseases and smell function was reported as normal by each of them. The olfactory stimulus was carbon dioxide (CO₂), a prominently trigeminal stimulant, and H₂S, a purely olfactive stimulant. Two sessions were planned: the first without (placebo session) and the second with the stimulant (active session). Eight successive blocks (four in the placebo session) of 4 responses, have been recorded, derived monopolarly from surface electrodes placed on Cz and referred to A2, with Fpz as ground. Results The evoked potential complex N1-P1 showed a mean latency respectively of 302.7 ±24.6 N1 and 406.7±29.9 ms P1, and amplitude peak-to-peak of 13.92 mV (CO₂ stimulus). The reproducibility of the responses was proven. Conclusions OEPs are a non-invasive and reproducible method for assessing olfaction objectively and quantitatively. Interesting applications might be in disorders in which olfaction is suspected to play a pathogenic role, i.e. in neurodegenerative disease.

Emotional Behaviour in Alzheimer Disease: A Study on the Ability to Identify Facial Expressions of Emotions

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The relationship between emotion and cognition in dementia is still poorly understood. In order to investigate emotional behaviour in Alzheimer Disease (AD) we examined the recognition of facial expressions of emotion. Subjects were shown cards containing "chimeric" faces in which the two halves of the face present conflicting information about an emotional state. They were required to recognise the expression of happiness and sadness. Performances were matched with the results of a group of a hundred non-demented individuals (Luzzi et al. Riv. Neurobiologia, 44, (5), 417-423,1998). The study included 52 subjects (29 women and 23 men, age range=55-79 years, education range=3-17 years) with a diagnosis of probable AD. Patients were given a battery of neuropsychological tests exploring verbal and non-verbal abilities, memory, attention skills and executive functions. Results suggest that the ability to identify the facial expressions of basic emotions may be preserved even in subjects with severe impairment of cognitive processing. It seems likely that disorders of emotional behaviour are present only in severe AD. In addition, an impaired test performance seems to be related to defects of visuospatial skills, as might be expected because of the suggested right hemisphere advantage for both perception of visuospatial pattern and judgement of emotion. These findings may be of interest in the management of demented patients and should influence the development of strategies and techniques of rehabilitation.

Longitudinal Study of Cognitive Dysfunction in Multiple Sclerosis: Neuropsychological, Neuroradiological and Neurophysiological Findings

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Background. Cognitive dysfunction in multiple sclerosis (MS) occurs in 13%-65% of cases especially referred to attention, memory, language, conceptual reasoning. A more severe cognitive impairment is present in chronic progressive or secondary progressive form of disease than in relapsing-remitting MS patients. Few longitudinal neuropsychological (NP) and neuroradiological (MRI) studies provide prognostic informations about disease evolution, cognitive dysfunction and MRI involvement during 3 months-4.5 years observation. Aims. 1. Neuropsychological and neuroradiological assessment in clinically definite MS patients followed up for about 8 years to

investigate cognitive dysfunction and MRI evolution. 2. Visual and auditory oddball ERPs (P300) with topographical maps as psychophysiological evaluation of cognitive status at follow-up. Methods. Twelve relapsing-remitting MS patients (10 women and 2 men) underwent the follow-up study. Criteria of inclusion were: EDSS Kurtzke score=4, no clinical relapse, no medication in the previous three months. NP study: assessment of IQ, conceptual reasoning, attention, verbal and visuo-spatial short- and long term memory. RMN study: examination of axial slices to estimate size and presence of lesions, cortical- subcortical atrophy and increased lesion burden at follow-up. ERPs study: visual and auditory oddball paradigm using 30 scalp electrodes to elaborate topographical maps. Neuropsychological, neuroradiological and neurophysiological data were statistically computed to investigate correlation at baseline and follow-up. Results. NP study: attention, visuospatial short- and long-term memory were mildly impaired at baseline and remained unaltered longitudinally. Verbal long-term memory and degree of intellectual deterioration declined significantly at follow-up. RMN study: all patients showed significant increasing of lesion load. ERPs study: 75% of patients reported abnormalities in P300 latency and topography. Visual P300 was more impaired (58.4 % of cases) than auditory wave (41.6 %). Conclusions: This study report mild cognitive impairment in MS patients concerning attention and visuo- spatial memory. Longitudinal investigations revealed an unchanged condition of these dysfunctions and a slight significant worsening of verbal long-term memory and intellectual deterioration. MRI involvement is characterized of increasing in size and numbers of lesions that does not correlate with clinical course of disease and cognitive deficits. Cognitive dysfunction, then, could be related to disease peculiarity and not to the time course. Correlations between P300 and NP and MRI findings provide further informations about the application of ERPs to examine cognitive impairment in MS and probably to investigate their neural generators.

Respiratory-Related Potential Evoked by Negative Expiratory Pressure at the Mouth in Awake Healthy Human

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Cerebral evoked potentials provide a technique for evaluation of central nervous processing of information derived from a variety of sensory modalities. Respiratory-related evoked potentials (RREP) have been elicited by Negative Expiratory Pressure (NEP) at the mouth in 9 healthy non obese, non snoring awake volunteers (age range 30-47 years, 4 males and 5 females). The subjects, wearing a noseclip, were studied in seated position during quiet breathing. Three different pressure levels (1, 5 and 10 cm H₂O) were applied, in a random order, 200 ms after the beginning of expiration. Cortical electrical responses were recorded from scalp electrodes at Fz, Cz, and Pz scalp location (international 10-20 System) referenced to the linked earlobes. Reproducible evoked potentials can be recorded in all subjects. RREP responses, consisted of two negative (N45, N120) and two positive (P85, P195) deflections. There was no significant effect of pressure or electrode on component latencies. With increasing pressure level component amplitude increased significantly (N45 $F(df 16,2) = 12.39, P < 0,02$; P85 $F(df 16,2) = 9.54, P < 0,002$; N120 $F(df 16,2) = 9.32, P < 0,002$; P195 $F(df 16,2) = 15.86, P < 0,0001$). Present results suggest that the upper airway NEP application in humans: 1) elicits sensory information resulting in the activation of the cerebral cortex; 2) appear to be as a promising new method for investigation of the neurobiology of the UA sensation.

Virtual Reality in the Treatment of Anxiety Disorders

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Background: From a cognitive point of view, Virtual Reality (VR) is the result of a manipulation of three variables: space, time and interaction - connected with the experience of reality. The therapeutic use has been suggested for anxiety disorders, eating disorders and, more recently, also for intellectual disabilities. Aim: The aim of the present study is :1) to check if VR is useful for the treatment of anxiety disorders and 2) to locate behavioural and neurophysiological parameters linked with the response to the treatment. Materials and method: The sample is composed by 20 subjects (aged from 18 to 40 years) affected by generalized anxiety or panic attacks. The subjects underwent the following evaluation : 1) a basal psychopathological evaluation, which includes a structural interview based on DSM IV (SCID IV) in order to diagnose anxiety disorders and the Hamilton scale for the evaluation of state anxiety. 2) a basal neurophysiological evaluation, using biofeedback, which includes the measure of surface EMG at hand and forearm bilaterally, heart frequency and cutaneous palmar galvanic resistance. By using VR, subjects plunge into relaxing situations, induced by talking and/or music. These programs aim to increase the consciousness that internal cognitive events are linked to stress and anxiety responses, so that they could learn to control their emotional level. During each session psychophysiological parameters (EMG, GRS, cardiac frequency) are checked because they are strictly correlated with arousal, activation, vigilance and generic emotional conditions. Conclusions: In the end of the treatment, level of anxiety and psychophysiological parameters are evaluated in order to check all variations of state anxiety and of the psychophysiological parameters.

Eeg Event-Related Desynchronization in a Case of Hysteric Paralysis

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Event-Related Desynchronization (ERD) of alpha and beta EEG rhythms is an indicator of cortical activation during motor preparation and execution. Sensorimotor ERD also occur during motor imaging in healthy subjects or subjects with amputations. Beta Synchronization (ERS), occurring after movement, would indicate inhibition of motor areas. We evaluated the pattern of cortical activation by means of ERD/ERS, in a 40 year old woman presenting fluctuating hypostenia/paralysis of the left hand and forearm, in the absence of corresponding abnormalities of tendon reflexes, electro-myography/-neurography, motor and somatosensory evoked potentials, brain and cervical spinal cord magnetic resonance imaging. She was diagnosed with hysteric paralysis. ERD/ERS were evaluated using a reaction time paradigm. After a sound, the patients had to perform or imagine unilateral thumb movement, for both sides. While movement to the right side was correctly performed, for motor commands to the left side no EMG activity was observed. Motor execution and imagery corresponded to contralateral sensorimotor ERD while when the motor tasks had to be performed to the left side, sensorimotor ERS was observed. These results suggest that motor commands to the affected limb corresponded not just to failure in activating the motor cortex, but to active suppression of cortical motor activity, and are in favor of the possible utilization of this technique in cases of functional paralysis.

Middle Latency Somatosensory Evoked Potentials during Hypnotic Suggestion

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We examined 28 healthy subjects , 6 male (aged 26.00 ± 7.29) and 20 female (aged $28,47 \pm 7.57$). They were submitted to MMPI (Minnesota Multiphasic Personality Inventory), Anxiety Scales from STAI-CBA and the Stanford Hypnotic Susceptibility Scale. The aim of hypnotic suggestion was to evoke a reduced left arm sensibility. Somatosensory evoked potentials (SSEP) were obtained stimulating left median nerve at wrist and recording at the scalp (F4-Fpz and P4-Fpz). N20, P40, N60 and P100 amplitudes and latencies were considered in three different conditions: basal, during hypnotic suggestion, after hypnotic suggestion. We noted a different behaviour between high (20) and low (8) susceptibility subjects. In the former group we recorded P40, N60 and P100 longer latencies and reduced amplitudes during hypnotic trance, even if data didn't reach statistical significance. MMPI and Anxiety Scales didn't differ within the groups and showed normal values. The authors will discuss the possibility that hypnotic trance could interfere with sensitive stimulus transmission at the level of different neural generators, in secondary sensitive cortex.

Musictherapy and Biofeedback-Therapy: A Therapeutic Synergy in Regulation of Muscular Tone - A Study on 6 Cases

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The last fifty years have seen the development of a new field of study known as Musictherapy which focuses on the relationship man has with sound and on its therapeutic applications. Many studies have demonstrated the validity of Musictherapy by neurophysiological methods (Cortical Evoked Potentials, Electroencephalographic Mapping, Surface Electromyography, etc.), that have indicated the positive effects of musical hearing on some physical functions as heart rate, respiratory rhythm, electrocortical brain activity, muscular tone, etc.). Therefore we have proposed to six patients with muscular tone disorder (4 hemiparesis, 1 paraparesis and 1 tetraparesis) a treatment by Musictherapy and EMG-Biofeedback-therapy association. The results have demonstrated the efficacy of certain musical pieces in the regulation of muscular tone, with positive effects both on functional independence of patients and on nocturnal muscular spasms.

Computerized EEG (C-EEG) Evaluation of Bioelectrical Changes during Musical Tasks

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Objective. Aim of this work was to evaluate bioelectrical modifications during listening to music. Using a computerized-EEG technology, patterns of information processing were analyzed in normal subjects. These subjects were subdivided in two groups: musicians and non musicians subjects. Method. Fourteen healthy right-hand subjects (seven musicians, range 25-43 years, mean age 34 years, and seven non musicians, range 25-31 years, mean age 28 years), were investigated with computerized EEG (C-EEG). Each subject underwent: 1) hemispheric dominance Oldfield test, 2) psycho-sensorial rest (PSR), 3) listening to instrumental music (IML), 4) listening to rustle of dark (RDL), 5) listening to instrumental and vocal music (IVML). EEG activities recorded with nineteen electrodes (10-20 system) on the scalp were quantified by spectral methods (power and coherence spectra) to investigate power and coherence modifications during different tasks. EEG spectra, concerning delta (0-4 Hz.), theta (4-8 Hz.), alpha (8-12 Hz.), and beta (12-32 Hz.) absolute

frequency bands, were statistically evaluated (T-Test). For each task, spectra of absolute power in both musicians and non musicians groups were analyzed. Results. At the C-EEG, in musicians statistically significant differences in IML and IVML tasks were observed (with respect to non musicians). During IML task, a reduction of theta activity ($p < 0.05$) in bilateral frontal-temporal regions and of alpha activity in bilateral frontal-temporal-parietal regions ($p < 0.01$) was observed. During IVML task, a reduction of theta activity in bilateral temporal regions ($p < 0.05$) and left frontal region ($p < 0.02$) was observed. In the same musical task, a reduction of alpha activity in right frontal region ($p < 0.05$) and in left temporal region ($p < 0.03$) was observed. Conclusions. According to other works (1-2), in normal subjects, listening to musical tasks (IML and IVML), specific bioelectrical activity modifications were observed. Such bioelectrical modifications were more evident in musicians, with respect to non musicians (statistically significant decrease of theta and alpha activity, increase of beta activity in associative regions of both emispheres), showing their analytical and evaluative abilities during musical tasks.

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