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RELATIONSHIP BETWEEN EEG GENERATORS AND CEREBRAL GLUCOSE METABOLISM IN ALZHEIMER'S DISEASE

T. Dierks[1], V. Jelic[2], P. Judin[2], M. Shigeta[4], S. Valind[3], K. Maurer[1], B. Winblad[2], D. O. Wahlund[2], A. Nordberg[2]. [1]*Department of Psychiatry, University of Frankfurt, Germany,* [2]*Alzheimer's Research Centre, Karolinska Institute, Sweden,* [3]*Uppsala PET-Centre, Sweden, Department of Psychiatry,* [4]*Jikei University, Tokyo, Japan*

Synaptic biochemical processes are the main consumers of cerebral glucose. The synaptic glucose consumption is related to the amount of excitory and inhibitory post-synaptic potentials (EPSP and IPSP). EPSP and IPSP are the main neuronal processes contributing to the scalp recorded EEG which consequently should be coupled to the cerebral glucose metabolism. Results of conventional quantitative EEG analysis in the frequency domain are dependent on the recording reference and do not allow us to draw any conclusion regarding local brain activity of underlying brain structures. The FFT approximation allows the estimation of intracerebral generators of EEG frequency bands. It has been debated if these EEG generators have any physiological meaning or are just descriptive parameters. In 65 patients suffering from Alzheimer's Disease FDG-PET and EEG were performed. The correlation between glucose metabolism in defined cerebral structures and the localisation and amplitude of intracerebral EEG generators was calculated. The anterior posterior relation of glucose metabolism correlated significantly with the localization of alpha- and beta-EEG-generators. Left-right asymmetries of glucose metabolism correlated significantly with EEG localization especially in cortical structures. The amplitude of EEG generators correlated highest with temporo- and parietal glucose metabolism. The results indicate that the localization of intracerebral EEG generators estimated by the FFT approximation reflects local cerebral energy metablism.

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EEG STUDIES OF THE MODE OF ACTION OF NEUROLEPTICS

M. Koukkou, A. Federspiel, M. Merlo. *Department of Psychiatry, University of Berne, 3072 Berne, Switzerland*

Research into the mode of action of psychotropic drugs needs integrative models of the workings of the brain, which link neurophysiology and psychopathology.

Psychotropic drugs induce reversible EEG changes which depend on individual EEG, time and doses and do not appear in all treated subjects. Our studies on the mode of action of neuroleptics are based on a model of the brain functions centred around multifactorially determined brain functional states as manifested in the scalp EEG: the state defines the working memory's contents which are activated and thereby accesible to the information processing operations for behaviour organization. A brain state implies a certain level of organization of neural activity and of neurotransmitter systems. This organization is continuously re-adjusted (update of working memory) by the memory-driven pre-attentive operations underlying allocation of attention (=the elicitation of the adaptive orienting response); and it can be studied as EEG reactivity.

Drug-free first episode schizophrenics show deviant EEG reactivities suggesting access to situation-inadequate memory contents for the organization of behaviour. We report on the characteristics of EEG-reactivity in a group of schizophrenics before and during the treatment with a neuroleptic as well as the differences between responders and non-responders to the treatment as estimated on the basis of syndrome changes. The results suggest that neuroleptics act as modifiers of the level of organization of the brain's functional states, the target organ for treatment which in turn influence the effects of the drug on behaviour.

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QUANTITATIVE EEG IN PSYCHIATRY: FROM RESEARCH TO CLINICAL APLICATIONS

S. Galderisi, A. Mucci and M. Maj *Department of Psychiatry, First Medical School, University of Naples, Largo Madonna delle Grazie, 80138 Naples, Italy*

Objective: The presentation provides a critical review of research and clinical applications of quantitative EEG (QEEG) in psychiatry.
Method: Limitations of QEEG studies based on theoretical models assuming a one-to-one correspondence between function and structure are illustrated, with particular reference to findings in schizophrenic patients. Future research strategies in this field are outlined. Findings which might promote the development of clinical applications of QEEG in psychiatry are presented.
Results: Examples concerning QEEG abnormalities in psychiatric patients interpreted as correlates of localized brain dysfunctions are provided (e.g., the increase of delta activity over the anterior regions interpreted as "hyperfrontality" in schizophrenic patients). Methodological and theoretical pitfalls of this approach are examined and alternative research strategies are outlined. As to the development of clinical applications of QEEG in psychiatry, findings suggesting that QEEG changes induced by a pharmacological challenge enable an accurate prediction of response to neuroleptic treatment are described.
Conclusions: In the study of QEEG in psychiatry, research strategies based on complex, non-linear models of brain functioning should replace those inspired by an isomorphic approach. Clinical applications of QEEG in psychiatry deserve further development.

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SOURCE LOCATIONS OF BRAIN ELECTRIC FIELDS DURING PLEASANT AND UNPLEASANT EMOTIONS

D. Lehmann, I. Kondakor, D. Pizzagalli, K. Kochi, T. Koenig. *The KEY Institute for Brain-Mind Research, University Hospital of Psychiatry, 8029 Zurich, Switzerland*

Emotional states (joy, anger, sadness, fear) were suggested by reading standardized texts to 12 normal volunteers during hypnotic trance. 27 channel brain electric fields (BEF) data ("EEG") were collected continually. The spatial configuration of the BEF was modelled in the frequency domain ("FFT Dipole Approximation"). The model source locations were compared statistically between the four suggested emotional states in the seven conventional EEG frequency bands. ANOVAs were computed for each band for the three location parameters (saginal, vertical, transverse direction). After Bonferroni correction, only the 18.5-21 Hz band source showed significant effects of emotional state across subjects. In post-hoc tests, the joy source (i.e., point of gravity of all active processes) was more left ($p<.014$) than that for any of the three negative emtoions, and more superior ($p<.024$) than the lumped negative emotions. Thus suggested emotions produce brain field model source changes consistent over subjects. The relative left-localization of the point of gravity of brain activity during positive vs. negative emotions corresponds to our findings in two other studies where we used different inductions of emotions (playing music, watching pictures). The brain organization of emotional representations may be relatively independent of the used induction.

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