1P222 光駆動と視覚認知におけるノイズの効果
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1pD08 Effects of visual noise on photic driving and visual perception
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Phase dynamics and synchronization of human electroencephalogram (EEG) under an application of weak signal is presented. It is known that a periodic modulation of visible light that is illuminated toward human closed eyes leads to an increase of power spectrum component at the frequency of modulation or its higher harmonics (photic driving response, or PDR). Recently, it has been reported that an additional noise may useful when the amplitude of modulation is below threshold, e.g. the optical noise may induce the stochastic resonance phenomenon to the visual perception processes. On the current study, the authors investigate how the optical noise modifies fundamental dynamics of EEG rhythms with and without the periodic modulation. The experimental results show that the application of noise modifies the distribution of power spectrum density depending on the cortical positions. Especially the gamma-band oscillation (30-100 Hz) is relatively sensitive to the noise intensity. In addition, the sensitivity of the PDR is also affected to the noise. At the same time, the cortical area that shows PDR is expanded. Due to the above observations, the applied noise may modify the inter-cortical connectivity, and therefore the perceptual sensitivity may be improved.

1P224 顔認知における下側頭葉のスバイク同期の神経機構
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Neural Mechanism for spike synchronicity of inferotemporal cortex in face perception
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Understanding the neural mechanism underlying object recognition is one of the fundamental challenges of visual neuroscience. Neurophysiological experiments have provided evidence for a "simple-to-complex" processing model based on a hierarchy of increasing complex image features. However, little is known about how the information about object parts and a whole object are represented in inferiortemporal (IT) cortex. To address this issue, we focus on the neural mechanism of face recognition, because face is a whole image that consists of its parts such as eyes, nose, and mouth. Recent experiment has been demonstrated that the IT neurons exhibit different responses in spike synchronicity for face and non-face images. To investigate the neural mechanism for the difference in the spike synchronicity, we made a model of visual system in ventral pathway from retina to IT cortex. The model has two kinds of resolution maps in early visual areas, i. e. broad and fine resolution maps. The broad map encodes the information of a whole face image, and is used to determine quickly whether the presented image is face or not. On the other hand, the fine map encodes the information about fine structure of the parts, and is used for fine discrimination of face images. We show using the computational model that the synchronicity of neuronal spiking for face images is generated by binding of the information of face parts under the feedback from downstream neurons detecting a whole face image.

1P223 ノイズとシグナルの相互作用を考慮した計算論的視覚モデル
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1pD09 The computational model of mutual interaction between noise and signal in the visual system
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The fact that ongoing activity (without extrinsic stimulus) in the early visual cortex is "oriented" has been one of the hottest topics in the last decade. Then, the question arises: what is the relation between ongoing activities and those induced by oriented stimulus? If the former is highly patterned, is there any mutual interaction between the latter? At the last annual meeting, we reported Diagonal Mesh Pattern (DMP), a novel visual phenomenon which actually can be explained as a result of such interaction between them. The illusion emerges when a spatiotemporal white noise and high contrast gratings are viewed dichoptically. During binocular rivalry, intermittently the noise can be perceived exclusively, but at the same time it is organized by the gratings given to the other eye in a certain rigorous way, although the gratings are perceptual suppressed. Interestingly, the illusion emerges almost irrespective of noise kinds. Not only extrinsically given visual noise, but also "intrinsic" visual noise - the visual noise with one eye closed- can be adopted to evoke DMP. We suggest that the illusion is the result of mutual interaction between stimulus-driven activity and ongoing activity, and implement a computational model of early visual process which derives DMP as an equilibrium solution of such interaction. The model is based on conventional notions. Only the combination of the notion and the pair of the stimulus is novel. The behavior and implications of the model to other scientific fields will be discussed in the meeting.

1P225 TE 野神経細胞に見られる複数の発火状態と状態遷移の細胞間同期－発火系列を記述するモデルの拡張－
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Inter-neuronal synchrony of transition between activity states revealed by extension of a model for spike trains in area TE
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Area TE, a ventral part of the inferior temporal cortex, is the final purely visual area of the ventral pathway and is considered to play an important role in visual perception and object recognition. An object image activates widely distributed multiple neuronal clusters (inter-cluster distance > 500 μ m) in area TE. Thus, understanding neuronal representation in area TE requires investigations of interaction between activities of distant TE neurons. In a previous study, we found distant TE neuron pairs (synchronous pairs) that had synchrony in spontaneous spike activities. In the study, we showed that the synchrony reflects synchronous fluctuations of firing rates and the fluctuations were described by a model of synchronized two-state (up and down states) Markov processes without time difference. In the model, neurons fire only at the up state. However, the model explained the fluctuations only for a small portion of the synchronous pairs. In the present study, to test other synchronous pairs for the synchrony of state transition, we extended the model by introducing time difference between Markov processes, two states at the up state, and firing at the down state. The extension revealed that most of the synchronous pairs could have the inter-neuronal synchrony of the up- and down-state transition, meaning that this synchrony is not exceptional but common property of the synchronous pairs.