3E1534 心拍における「自律的制御メカニズム」の役割の解明：単一心筋細胞における自動振動特性の解析

**Unraveling the role of autonomous regulation in heartbeat:
Analysis of self-oscillatory properties of rat neonatal cardiomyocytes**

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Cardiac myofibrils show spontaneous rhythmic oscillations, i.e., oscillations of sarcomere length (SL) characterized by saw-tooth waveform, under partial activation conditions. The period of Ca-SPOC in skinned myocardium correlates with that of resting heart rate in various animal species (Sasaki, D. et al., 2005 & 2006). In the present study, we found and analyzed the sarcomere oscillations under constant Ca^{2+} concentrations in rat neonatal cardiomyocytes after treatment with ionomycin. Despite intracellular environment, the oscillations occurred and the properties resembled Ca-SPOC. The oscillation properties were measured by expressing AcGFP in the Z-lines. We found that the oscillations occurred at $\text{pCa} \sim 6.0$ with a frequency of 1-4.5 Hz. At low frequency, SL oscillations showed a saw-tooth waveform, consisting of quick lengthening and slow shortening phases. Whereas at high frequency, the SL oscillations showed triangular wave. We also found that in untreated neonatal cardiomyocytes in 2 mM Ca^{2+} Tyrode's solution, an increase in the frequency of electrical stimulation to the physiological level caused the elevation of a base Ca^{2+} level, resulting in the waveform being indistinguishable from that observed during the sarcomere oscillations under constant Ca^{2+} concentrations in cardiomyocytes. Therefore, these results suggest that the self-oscillatory properties of the contractile system of cardiac muscle may be involved in the regulation of cardiac beat.

9:00~12:00 F 会場 / Room F

神経・感覚、神経回路・脳の情報処理、行動

Neuroscience & Sensory systems, Neuronal Circuit & Information processing, Behavior

3F0912 文学作品におけるタイプのな動詞とトークンのな動詞それぞれによる登場人物の図地関係の変化

The transition of figuer-ground relationship of characters of literatuers: about "type" verbs and "token" verbs

Tetsuya Matsui, Yukio Gunji, Yujin Kitamura (University of Kobe)

A type token relationship is popular notion in philosophy and cognitive science. In these domains "type" is definition of notion of things and "token" is things belongs to the notion. If we apply type token relationships to verbs in literatuers we may define verbs actually did are "type" verbs and verbs mentioned in speech of characters are "token" verbs. A notion of figuer and ground is popular tool to reserch conversions in human mind. Literatuers request human to change characters noticed in story to read. So we can guess there are transitions having some rules about figuer and ground in text of literatuer. In this reserch we defined verbs did actually in text as "type" verbs and verbs mentioned in speeches as "token" verbs. And we use lattice diversed rough set theory to express figuer ground relationships of characters. We make lattices showed evolutions of figuer and ground relationships. As a result in short stories two currents of lattices have obvious differences from openings to endings. But in long stories differences of two currents of lattices tend to become smaller and smaller according to progress of stories and finally have same characteristics near endings. So we can conclude that characters involved in "type" verbs and "token" verbs are essentially different in literatuers but if the texts are sufficiently long relationships between characters and two verbs become the same.

3F0924 オスは脳海馬で合成する女性ホルモンにより記憶力を高める

Esradiol induced the long term potentiation (LTP) of the male hippocampal neurons under sub-threshold stimulation

Yoshitaka Hasegawa, Suguru Kawato (University of Tokyo)

Estradiol (E2;female hormone) in male brain is a neuro-modulator. The male hippocampus has more E2 than the female hippocampus (Mukai H. et al., 2010). It is known that E2 modulates hippocampal synaptic plasticity such as long term depression (LTD) (Hojo et al., 2009). In the current study, we demonstrated that

E2 induced the long term potentiation (LTP) of the male hippocampal neurons under sub-threshold stimulation (weak-TBS (Theta Burst Stimulation), 15 pulses). Without E2, LTP was not induced by weak-TBS. On the other hand, 10 nM E2 perfusion induced full-LTP was induced even by weak-TBS. This full-LTP was approximately the same as that induced by full-TBS (50 pulses). The neurotrophic E2 enhances weak-LTP to become full-LTP.

3F0936 記憶・学習中枢海馬に性差はあるか？その3

Is there sex difference in the hippocampus, the center of learning and memory? Part3

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Sex difference in the brain is a very attractive problem. For example, the hypothalamus, the brain region responsible for reproductive behavior, exhibits a clear sex difference in the size of nerve nucleus. In contrast, the hippocampus, a center for learning and memory, does not have sex differences at the anatomical level. Nevertheless, the significant sex difference in the performance of hippocampus-dependent task such as spatial learning and memory is demonstrated. For example, studies in rodents show that males tend to outperform females on spatial learning and memory using Morris water maze or radial arm maze task. What is the cause of sex difference in the performance of memory and learning depending on hippocampus? So far, sex difference in the hippocampus had been attributed to the level of sex hormones in the blood. However, we revealed that the hippocampal level of sex hormones is much higher than the blood level. Surprisingly, hippocampal estradiol (E2), the most potent female hormone, in the male is 7-fold higher than female whereas female E2 in the blood is much higher than male. This clear sex difference in hippocampal E2 means that E2 plays a different role in the brain compared with the body, that is, controlling the neural networks via modulation of transmission, and neuroprotection from oxidative stress, in a sex different manner.

3F0948 線虫の定量的神経モデルと化学走性回路への応用

Quantitative neural model of C. elegans and its application to a neural circuit for chemotaxis

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We present a quantitative neuron model for the nematode C. elegans. Because the synaptic connectivity is completely determined, C. elegans is a useful model organism to make a progress in mathematical neurobiology. A voltage-gated Na^{+} channel is not found in C. elegans. Therefore the intracellular Ca^{2+} concentration is particularly important in neural signaling and a key dynamical variable in our model together with the membrane potential. In C. elegans, the neural activity is visualized by calcium imaging in vivo. We consider a dynamical variable corresponding to "fluorescence intensity" of calcium imaging. In our model, the intracellular concentrations of Ca^{2+} , Ca^{2+} -buffering protein, fluorescent protein and Ca^{2+} -binding proteins are determined by chemical reaction equations. The fluorescence intensity is calculated from the concentration of Ca^{2+} -binding fluorescent protein.

C. elegans shows the attractive response to NaCl. We apply the neuron model to a neural circuit for NaCl chemotaxis. In C. elegans, neurons which are mainly associated with NaCl chemotaxis are identified. The neural responses of the membrane potential, the Ca^{2+} concentration and the fluorescence intensity to "NaCl stimulus" are simulated. Our results are compared with experimental data. We find that the threshold dynamics of Ca^{2+} current causes the quantitative difference between the change in the membrane potential and the change in the fluorescence intensity.

3F1012 β -ケトアジピン酸走性に関与する *Burkholderia* sp. NK8 株の外膜ポリン遺伝子

An outer-membrane porin gene of *Burkholderia* sp. NK8 involved in the taxis toward β -keto adipate

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Burkholderia sp. NK8 (degrading 3-chlorobenzoate as a sole carbon source) shows chemotaxis toward various aromatic compounds including chlorinated benzoates. The (chloro) benzoate dioxygenase of strain NK8 converts 3-chlorobenzoate to 3- and 4-chlorocatechols, then the resulting chlorocatechols may be decomposed into β -keto adipate by the products of chlorocatechol