P3-c16 The response of microglia and astrocytes to the infected cortical neurons induced by a coronavirus

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Following inoculation of a coronavirus (strain 67N) into the rat hind footpad, the time course of the neuronal infection and glial activation were immunohistochemically examined in the primary motor cortex (M1). The activated microglia and astrocytes associated with infected neurons were first detected in the layer 5 of M1 contralaterally to the injection side on day 4 post-inoculation (p.i.), and showed with enlarged cell bodies and thickened processes. Furthermore, activated microglia migrated to and gathered around the infected neurons. On day 5 p.i., activated microglia changed into amoeboid form and tightly ensheathed the infected neurons. Additionally, numerous OX42-immunoreactive cells in round shape appeared on the infected neural tissue. In contrast, astrocytes became more hypertrophic. On day 6 p.i., the OX42- and GFAP-immunoreactive cells dramatically decreased. These results suggest that microglia and astrocytes play a pivotal role in the innate immune response to the CNS viral infection.

P3-c17 Nitric oxide mediates cytokine-induced enhancement of Ca^{2+}-dependent Glu release from astrocytes

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Aim: Cytokines that are released under several pathologic conditions enhance inducible nitric oxide synthesis (iNOS) expression. NO produced by iNOS is involved in several neural functions. To date, there are no studies on the effects of cytokines on Ca^{2+}-dependent Glu release from astrocytes. Therefore, we studied the effects of cytokines and the contribution of NO on Glu release.
Methods: Glu release by the Ca^{2+} influx was determined by HPLC.
Results: Glu release was enhanced by the treatment with cytokines. Inhibition of iNOS canceled the cytokine-induced enhancement of Glu release, and the treatment with a NO donor, even in the absence of cytokines, increased the Glu release.
Conclusion and Discussion: Cytokines enhance Glu release, and this enhancement is mediated by NO. Cytokine-activated astrocytes are known to protect the CNS from injuries. Our results suggest that the increased Glu release through NO by cytokines may participate in the protection from injuries.

P3-c18 Spontaneous calcium activities of astrocytes *in vivo* differ between cortical layer 1 and layer 2/3

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Growing evidence obtained with *in vitro* experiments suggests involvement of astrocytes in neuronal signal processing. For example, increase of intracellular calcium (Ca^{2+}) concentration in an astrocyte propagated to neighboring astrocytes, and induced Ca^{2+} increase in their adjacent neurons; astrocytes release neurotransmitters such as glutamate and ATP upon intracellular Ca^{2+} increases. While detailed research on Ca^{2+} dynamics of astrocytes *in vitro* have been performed, *in vivo* investigation is sparse. We examined Ca^{2+} dynamics of rat cortical astrocytes in layer 1 and layer 2/3 *in vivo* using two photon laser microscopy. Following parameters of astrocyte Ca^{2+} surge were investigated: number, duration, peak, and spatio-temporal correlation. We found that astrocytes in layer 1 had 2–3 times more spontaneous calcium surges than that of layer 2/3, which may reflect the difference in the cytoarchitecture between these layers. Relation between glial Ca^{2+} increase and electrical neuronal activities are under analysis.

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P3-c19 Astrocyte-mediated regulation of synaptic glutamate release in the NTS

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In the nucleus of the solitary tract (NTS), spatially delimited activation of presynaptic P2X receptors with laser-based photoactivation of caged ATP in the brain slices facilitates glutamate release, affecting the excitability of the postysynaptic neurons (Shigetomi and Kato, 2004; Imura et al., 2006). We examined the hypothesis that ATP of astroglial origin could activate these presynaptic P2X receptors and affect synaptic transmission in the NTS. Electron-microscopic analyses revealed that 99% of presynaptic terminals showed partial or full contact with astrocyte-like processes. Two lines of evidence, as confirmed in the rat brainstem slice using patch-clamp recording of synaptic currents, that (1) activation of P2Y1 receptors, that are mostly expressed in astrocytes, increased mEPSC frequency and (2) a treatment with fluoroacetate decreased mEPSC frequency support the notion that these presynaptic P2X receptors might function as an interface between astrocytic ATP signal and synaptic transmission.

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P3-c22 The localization and non-genomic function of the membrane-associated estrogen receptor in oligodendrocytes

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The physiological functions of estrogen involve activation of cytoplasmic signaling mediated by a membrane-associated estrogen receptor (mER). We recently showed that a mER is present within myelin plasma membrane. To understand the physiological function of mER in oligodendrocyte (OL), its cellular localization and involvement in rapid signaling were investigated in OLs. An ERα was expressed along the lacy network of veins in the membrane and in the perikaryon in OLs but not in the nucleus. ERβ was located in the nucleus, and to a lesser extent along the veins. OLs were pulsed with 17α and 17β-estradiol for various times and the total lysates were analysed for phosphorylated kinases. Both estradiols elicited rapid phosphorylation of p42/44MAPK, Akt, and GSK-3β. Here, we show that mER is involved in rapid signaling pathways in OLs, which are activated via both estradiols.

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P3-c25 Distribution of oxytocin receptors in the neonatal brain stem

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It has been proposed that oxytocin is implicated in development and plasticity, and maternal oxytocin may increase the resistance to the stressful delivery associated with high risks to the fetal brain. In order to understand the role of oxytocin at the birth and neonatal period, we examined the distribution of oxytocin receptors (OTRs) in neonatal brain stem of rat by immunohistochemistry. Dense OTR-immunoreactive fibrous structures were observed uniformly in the area postrema, reticular formation and most nuclei in medulla oblongata and pons, however not observed in motor nuclei such as ambiguus, hypoglossal, facial and trigeminal motor nuclei, which were intensely immunoreactive for p75 neurotrophin receptor at postnatal day 1 (P1). These OTR-immunoreactive structures were morphologically considered glial fibers. They decreased at P5 and progressively disappeared by P14 and then OTR immunoreaction became to be observed sporadically in small blood vessel of the brain. These results support that oxytocin may play important roles in the delivery and/or neonatal period of brain development.