

Intracisternal injection of 5,7-dihydroxytryptamine: different effects on serotonin transporter sites on rats lesioned in early and adult period of life

Kostowski W.^{1,3}, Bidziński A.², Krząścik P.³, Szyndler J.³, Wisłowska W.², Zienowicz M.², Kołomańska P.³, Rok P.^{1,3}, Płaźnik A.^{2,3}

¹Department of Pharmacology and Physiology of the Nervous System; ²Department of Pharmacology Neurochemistry, Institute of Psychiatry and Neurology, Warsaw, Poland; ³Department of Clinical and Experimental Pharmacology, Medical University of Warsaw, Poland

In the present study we examined the [³H]citalopram binding sites using quantitative autoradiography, following intracisternal injection of the serotonin (5-HT) neurotoxin, 5,7-dihydroxytryptamine (5,7-DHT) in neonatal and adult male Wistar rats. One group of rats was injected with neurotoxin at 3 days after birth while the second group received neurotoxin at 3 months after birth. Control groups were injected with saline. Afterwards, all rats were studied at the end of 4th month of age, to determine the distribution and density of [³H]citalopram binding sites in the brain using quantitative autoradiography. Rats lesioned in their adult period of life showed dramatic reduction of 5-HT transporter in all brain structure investigated i.e., the prefrontal cortex, hippocampus (CA1, CA3, dentate gyrus), nucleus accumbens, ventral tegmental area and entorhinal cortex. Surprisingly, administration of 5,7-DHT to newborn rats failed to reduce 5-HT transporter sites in the ventral tegmental area and produced only slight reduction in the nucleus accumbens. Thus, it appears that the mesolimbic ventral tegmental area – nucleus accumbens system is resistant to 5,7-DHT neurotoxicity in the early postnatal period.

Depressive-like behavior in rats with neonatal 5-hydroxytryptamine depletion

Kostowski W.^{1,2}, Krząścik P.²

¹Department of Pharmacology and Physiology of the Nervous System, Institute of Psychiatry and Neurology, Warsaw, Poland; ²Department of Clinical and Experimental Pharmacology, Medical University of Warsaw, Poland

Little information exists about the subsequent behavioral induced when developing neonatal rats are depleted with serotonin (5-HT). It is known, that neonatal 5,7-dihydroxytryptamine (5,7-DHT) treatment produces a marked 5-HT denervation in different brain areas. The present study was performed to investigate the effect of treatment of newly born rats with 5,7-DHT on their subsequent behavior in forced swim test. When rats of 3 days of age were injected intracisternally with neurotoxin, a marked depletion of brain 5-HT (but not noradrenaline and dopamine) was observed when animals were killed 4 months after treatment. The behavioral consequence of 5,7-DHT administration to developing rats was the significant reduction of activity of adult animals in the forced swimming test. Desipramine markedly increased activity of rats in both 5,7-DHT and control groups while fluoxetine produced anti-immobility effect only in rats pretreated neonatally with 5,7-DHT. We propose, that the neonatal lesion of 5-HT neurons might be considered as an animal model of depression and a tool for looking into neuronal mechanism that may underlie the etiology of depression.

The expression of NF-kappa B transcription factor in mixed neuronal-glia cultures of rat hippocampal dentate gyrus treated with glutamate or trimethyltin

Figiel I., Dzwonek K.

Nencki Institute of Experimental Biology, Warsaw, Poland

The mechanisms of the neuronal-glia interactions during brain injury are not well understood. There is evidence that glia produce various immunoregulatory molecules including pro-inflammatory cytokines, which can have both neuroprotective and neurodegenerative effects. This is probably due to the complexity of the cytokine signaling system in the brain, which often involves signaling loops between one or more types of glia and neurons. To address question about molecular mechanisms of interactions between neurons and glial cells in pathogenic conditions, we used a new *in vitro* model of mixed neuronal-glia cultures of rat hippocampal dentate gyrus treated with glutamate or trimethyltin. We previously reported that these substances induced granule neuron apoptosis and glial cell activation accompanied by an increased expression of TNF-alpha mRNA. It is well known that NF-kappa B transcription factor plays an important role in molecular mechanisms of TNF-alpha action. Therefore, using the Western blot technique, we have studied the expression of an active form of NF-kappa B in our *in vitro* models of neurodegeneration. The obtained results indicate the different role of NF-kappa B transcription factor in granule neuron apoptosis evoked by glutamate or trimethyltin. In the first case neuronal cell death was accompanied by increased activation of transcription factor, however in the second the complete fall in the NF-kappa B expression was observed.

Endotoxin-induced central activatory pattern (*c-fos* study)

Januszewski R., Kamieniecka A., Myślińska D., Tokarski J.

Department of Animal Physiology, University of Gdansk, Gdansk, Poland

The aim of the study was to evaluate the influence of intravenous administration of lipopolysaccharide (LPS) from *E. coli* on *c-fos* expression in selected brain structures. Immunohistochemically detected Fos is a well-established marker of neural activation. Additionally natural killer cells activity (ACNK), leucocytes number and plasma corticosterone level were measured. Immunization with LPS causes significant enhancement of neuronal activity and reduction of peripheral blood ACNK concomitant with lymphopenia and an increase in plasma corticosterone level. The highest *c-fos* expression was found in the anterior hypothalamic (the paraventricular and supraoptic nuclei) and limbic forebrain structures (the septal nuclei and BNST), and also in the nonspecific thalamic nuclei, the piriform and motor cortices. A decrease in ACNK (from $34.62 \pm 5.57\%$ to $21.41 \pm 4.63\%$ in LPS group, $P \leq 0.001$); and $30.86 \pm 4.64\%$ in saline control, $P \leq 0.01$) comparing to LPS rats) was probably caused by the increase in corticosterone level (36.95 ± 3.71 ng/ml; 109.86 ± 9.63 ng/ml, $P \leq 0.001$); 43.03 ± 5.95 ng/ml, $P \leq 0.01$), respectively). Our study suggests that immunization with LPS caused an increase in neuronal activity in the structures involved in the activation of the hypothalamo-pituitary-adrenal (HPA) axis.

Correlation between locomotor response to novelty and the number of central dopaminergic neurons

Jerzemowska G., Plucińska K., Klejbor I., Trojnar W.
Department of Animal Physiology, University of Gdańsk,
Gdańsk, Poland

Individual differences in the intensity of a locomotor response to a new environment (exploratory reaction) are used as a model to study individual vulnerability to stress and drug addiction. In the present work we studied the number and morphology of the cells expressing tyrosine hydroxylase (immunohistochemical staining of dopaminergic neurons) in male Wistar rats divided into high (HR) and low (LR) responders on the basis of their locomotor activity to a new environment (Columbus activity meter). The following results we obtained: the HRs had a significantly higher total number of TH+ cells in comparison to the LRs ($r = 0.86$, correlation between the number of TH+ cells and locomotor activity score). HRs\LRs differences were most pronounced in the hypothalamic arcuate nucleus (A12 group), the midbrain substantia nigra (A9 group) and the ventral tegmental area (A10 group). At the midbrain level there were regional differences between HRs and LRs with more numerous TH+ cell in the rostral part of A9 and A10 group in HRs and in the caudal parts in LRs. The results obtained indicate that morphological differences in the central dopaminergic systems correlate with individual reactivity to environmental loads.

Photoreception *Stegobium paniceum* L. as the biological strategy of pest control

Korpała M., Tyczyński M.
Department of Animal Physiology, N. Copernicus University,
Toruń, Poland

Photoreception plays a great role in the life of insects and usually their reaction is a phototactic orientation of the body to the light. Insects are known to have the ability to distinguish colour lights and to have preferences of one colour over another. This insect eye ability depends on transformation of the spectral lights of different wavelengths in photopigment cells in their eyes. The light of a specific wavelength is absorbed in the rhodopsin that gives spectral sensitivity to the eye. Phototactic responses can vary in various insect species and may depend on the light intensity. For many insect species the most attractive is the UV, white or blue-green light. In the present study we tested the behavioural reaction of the beetles *Stegobium paniceum* L. which is one of the common pests of books, ethnographic objects, and also cereal food store products. The test were done in the special photometer consisting of 1-metre-long tunnels with different colour lights at their ends. Beetles could choose the most attractive colour and approach it. These tests showed that beside the UV light, *S. paniceum* is attracted by the bright blue and white light. Moreover, there were differences between reactions of males and females. Knowledge of the specific light colour preferences for *S. paniceum* may be helpful for developing non-chemical strategy of their control. It is possible to use some colour lights to attract pests to traps and therefore, to keep some products and objects from damage.

Is an antigen a stressor?

Myślińska D., Cecot T., Prabucka I, Tokarski J.
Department of Animal Physiology, University of Gdańsk,
Poland

Immunization was evoked by intravenous administration of YAC-1 lymphoma cells. Brain *c-fos* expression – a marker of neural activation, natural killer cells activity and plasma corticosterone were measured. The results obtained indicate that intravenous administration of YAC-1 lymphoma cells causes significant enhancement of neuronal activity mainly in the structures involved in the activation of the hypothalamo-pituitary-adrenal axis. The highest density of Fos⁺ neurons was found in the anterior hypothalamic: paraventricular and supraoptic nuclei and in the limbic forebrain structures: lateral, dorsal, central, medial and septohippocampal septal nuclei and medial, lateral and ventral parts of the bed nucleus of stria terminalis. The evident *c-fos* expression was also observed in the nonspecific thalamic nuclei (especially in centromedial, paracentral, paraventricular and rhomboid), the piriform and motor cortices. Decline of NK cytotoxic activity, lymphopenia and the increase in plasma corticosterone level observed two hours after YAC-1 immunization also could be connected with the induction of stress reaction.

Development of the telencephalon impar in staged human embryos

Woźniak W., Rapalska K., Szwabe M.
Department of Anatomy, Karol Marcinkowski University of
Medical Sciences, Poznań, Poland

Studies were made in 50 serially sectioned human embryos, aged 32 to 56 days (developmental stages 13-23). All embryos were from the Collection of the Department of Anatomy University Medical School in Poznań. Sections were made in three planes, viz., frontal, horizontal, and sagittal. Sections were stained with routine histological methods and/or impregnated with silver nitrate. In some embryos graphic reconstructions were made. In embryos at stage 13th the terminal plate and commissural plate may be distinguished. Growth of telencephalon and differentiation of the cerebral hemispheres during stage 14th result in appearance of middle structures between hemispheres. During 6th week (developmental stages 16 and 17) the longitudinal fissure separating two hemispheres deepens and the telencephalon impar is more evident. The commissural and chiasmatic plates are separated through lamina terminalis. The interventricular foramen narrows and the telencephalon impar are separated from diencephalon. The interventricular foramina become constricted during 7th postovulatory week and the septum pellucidum is evident. The anterior commissure begins in embryos of stage 23.