POLISH ACADEMY OF SCIENCES

MEDICAL RESEARCH CENTRE

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CORRELATION BETWEEN VAGAL AND CENTRAL MECHANISMS IN THE CONTROL OF BREATHING

Department of Neurophysiology
Head: Prof. Witold Karczewski

In the studies on the relationship between vagal and central mechanisms in the control of breathing it was found that inspiratory oscillations depend on the number of active neurones in the brain-stem. The distinction of the information-transforming networks relies among others on the different time constants of the inputs from various receptor fields.

A new method of stochastic analysis of respiratory neuronal discharges was elaborated. It enables the quantitative estimation of the inspiratory oscillations and their frequency characteristics.

The method of simultaneous measurements of Na^+ and Cl^- ions crossover in the biological systems was worked-out. This seems most applicable in the studies on the mechanisms of the epithelia-producing fluids e.g. cerebro-spinal fluid. With the use of this method the high concentration of HCO_3^- anions was demonstrated in freshly-produced cerebrospinal fluid.

The reflex increase of the minute ventilation was found in response to the increased venous return both in men and experimental animals.

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Some new data on participation of the larynx in the regulation of the respiratory phase-duration were described. It has been shown that switching on the larynx to the respiratory system reflexly shortens T_E (expiratory time), while T_I (inspiratory time) is being adjusted mechanically by the laryngeal valvular system.

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See the list of publications:
8, 16, 52, 53, 55, 56, 64, 71, 72, 73, 129, 144, 171

THE ROLE OF BIOLOGICALLY ACTIVE SUBSTANCES IN THE REGULATION OF THE CIRCULATORY SYSTEM

Laboratory of Circulation Physiology
Head: Assoc. prof. Krystyna Herbaczynska-Cedro

Investigations on the release of the prostacyclin-like substance in the experimental cardio-respiratory insufficiency were continued. It was found that release of this substance is connected with disturbances of ventilation and an increased pressure in the pulmonary artery, whereas chemical stimulation (ventilation with hypoxaemic or hypercapnic gas mixtures) or a decrease in the pulmonary blood flow do not play any significant role in this process.

Preliminary identification of this substance indicated that it is more stable than prostacyclin, and its release into blood is not reduced by the prostacyclin synthetase inhibitors.

The effects of inosine on a number of electrophysiological, and metabolic parameters as well as on the ultrastructure of myocardium were studied, applying an experimental model of myocardial infarct.

It was demonstrated that inosine can make satisfactory protection of the ischemic heart, decreasing the ischemic area.

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See the list of publications:
9, 10, 11, 14, 60, 61, 62, 187, 188

http://rcin.org.pl

Physiological basis of working ability
and tolerance of environmental factors:
Role of neurohormonal mechanisms

Department of Applied Physiology
Head: Prof. Stanislaw Kozłowski

NEUROHORMONAL RESPONSES TO PHYSICAL EXERCISE AND THE CONTROL OF ENERGY SUBSTRATE UTILIZATION UNDER DIFFERENT CONDITIONS OF WORK AND ENVIRONMENT

Developing the concept of glucostatic control of hormonal responses to physical exercise it was proved that in men previously depleted of carbohydrate store activation of the sympathetic nervous system and hormonal changes, promoting fuel mobilization, are greater after a meal containing mainly fat and proteins than those found after a carbohydrate-high meal. The observed inhibition of the plasma catecholamine, growth hormone and glucagon responses to exercise as well as an attenuated decrease of blood insulin level after carbohydrate-high meal in comparison with carbohydrate low-meal support the suggestion that glucostatic mechanism takes part in determining the sympathetic and hormonal responses to physical work.

In the studies on exercise metabolism it was demonstrated that prolonged physical exercise may increase the ability of skeletal muscles to remove triglycerides from circulation, by inducing a marked increase in the lipoprotein lipase activity (LPLA) in the working muscles, since the level of LPL activity is considered to be an important determinant of tissues ability to clear plasma TG. The increase in skeletal muscle LPLA is most probably related to the local changes in exercising muscles, since the enzyme activity was not changed in the nonexercising muscle groups.

In further investigations (cooperation with Department of Physiology, Upstate Medical Center, Syracuse, N.Y., USA) it was found that the skeletal muscle LPLA depends on thyroid

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status, being markedly increased in hypothyroid and decreased in hyperthyroid animals in comparison with euthyroid controls. The normal linear relationship between LPLA measured in vitro and triglyceride uptake by different types of muscle fibers - determined in situ is not maintained in hypo- and hyperthyroid rats. It was also demonstrated that physical training, resulting in several alterations of triglyceride metabolism, enhances the skeletal muscle LPLA in euthyroid but not in hypothyroid animals.

Continuing investigations on the physiological effects of enhanced physical activity a reduced response of the plasma cortisol level to ACTH and a diminished adrenal medullary response to glucopenic stimulation were demonstrated after exhausting physical exercise in comparison with resting conditions.

In the complex studies concerning adaptation to physical work in hypertensive patients endocrine changes (catecholamines and their metabolites, aldosterone, cortisol) occurring during graded exercise-tests were compared in normotensive subjects and in hypertensive patients of similar physical fitness. The pattern of urinary excretion of catecholamines and their metabolites in essential hypertension suggests an impaired noradrenaline metabolism during exercise. The physiological response of the renin-angiotensin-aldosterone system to physical exercise is also altered in essential hypertension.

In the investigations carried out at working place in a steel factory energy expenditure, blood pressure, heart rate, and urinary catecholamine excretion were measured in hypertensive and in healthy normotensive workers during their normal 8 hrs shift. Significantly more pronounced activation of the adrenergic system and greater pressor response to work were found in hypertensive workers than in healthy ones, performing identical work, whereas at rest no differences between these 2 groups were noted in the parameters measured, except blood pressure, being higher in the former group. Basing on these data physiological criteria (recommendations) were proposed concerning employment of hypertensive patients in industry.

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Studies carried out with coronary patients revealed that during graded exercise performed at the moderately high altitude (950 m. above sea level) ischemic ECG changes were noted at lower work loads, and the increases in the cardiac output were reduced in comparison with those at sea level. Haemodynamic adaptation to physical exercise was considerably impaired under these conditions. No such altitude-induced changes were noted in healthy subjects. These results indicate that for the post-infarction patients physical effort at high altitude may be hazardous.

Basing on the results of numerous exercise tests the course of the coronary heart disease during 6 years following the myocardial infarct was analysed.

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See the list of publications:
6, 17, 69, 76, 77, 78, 79, 80, 115, 116, 150

NEUROHORMONAL REGULATION OF BODY TEMPERATURE AND WATER ELECTROLYTE BALANCE (INCLUDING KIDNEY FUNCTION) IN DIFFERENT CONDITIONS OF WORK AND ENVIRONMENT

In the studies carried out with healthy men exposed to endogenous (physical exercise) or exogenous (high ambient temperature) heat loads it was found that the sweating rate follows an exponential curve, exhibiting an inertial course. The heat flow model of the human thermoregulatory system was proposed, and an "individual index of thermoregulation efficiency" was elaborated. The latter enables predicting of individual responses to heat loads in human subjects.

In the investigations on the central mechanisms of acclimation to heat a marked decrease in the respiratory response threshold as well as a slight, but significant decrease in the threshold of the circulatory response to the hypothalamic heating were demonstrated in the rabbits previously adapted to high ambient temperature in comparison with unadapted ones.

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The hyperthermic response to intraventricular injection of noradrenaline was found to be diminished in dehydrated rabbits, most probably due to modifications of the respiratory reaction to this transmitter.

Continuing the studies on the physiological effects of hypercapnia it was demonstrated that the marked hyperthermia developing in the rabbits exposed to high ambient temperature ($35^{o}C$) and an increased CO_2 concentration in the inspired gas mixture is due to the inhibition of thermal panting induced by hypercapnia.

The studies on the physiological role of renal innervation have been further developed. It was found that chronically denervated kidney shows a defect of urine concentration, apparently due to a decrease in the osmolality of renal medullary interstitium. On the other hand, kidney denervation did not influence urinary dilution or the response to exogenous antidiuretic hormone.

The investigations on salt and water reabsorption in the proximal tubule provided a better insight in the mechanism of so called denervation natriuresis. It was shown that under conditions of maximal water diuresis or total blockade of distal sodium chloride reabsorption in conscious dogs no major defect of proximal reabsorption can be demonstrated.

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See the list of publications:
12, 13, 51, 57, 58, 59, 104, 105, 106, 151, 152, 153, 154, 169, 170, 206.

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Intracellular mechanisms regulating the metabolism of nerve cells

CORRELATION BETWEEN INTRACELLULAR MECHANISMS REGULATING CARBOHYDRATE-ENERGY METABOLISM AND STRUCTURAL AND FUNCTIONAL STATE OF SUBCELLULAR ELEMENTS WITH REFERENCE TO NEUROTRANSMITTERS

Department of Neurochemistry
Head: assoc. prof. Jerzy Lazarewicz

Studies concerning the effect of hypoxic-ischemic pathology on the composition and metabolism of the lipid component of brain membranes demonstrated the disturbances in incorporation of radioactive label from glucose and acetate into brain lipids and changes in the metabolism of oleyl CoA in synaptosomal membranes.

New data on the mechanism of energy metabolism regulation in the hypoxic brain were obtained. It was shown that stimulation of the glycolytic activity in the hypoxic brain was not caused by the alteration of ATP/ADP ratio, since the concentrations of high-energy compounds remained undisturbed in this model. An importance of the translocation of hexokinase from mitochondria into cytoplasm in this process is also doubtful. It was demonstrated, however, that the hypoxia-induced activation of glycolysis is associated with phosphofructokinase activation.

Studies on the metabolic characteristics of the brain synaptosomes were continued. It was demonstrated that hypoxia leads to a decrease of the protein-linked sialic acid in synaptosomal membranes, which is connected with the observed alterations of amino acid transport in brain synaptosomes. It was shown, that malate participated in the transport of citrate into intrasynaptosomal mitochondria like in perikaryonal mitochondria, however, the maximal accumulation and citrate metabolism were much lower.

The effect of anesthetics on the physico-chemical structure of synaptosomal membranes and the synaptic function was studied.

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Studies involving spin labels, an analysis of kinetic parameters and temperature dependence of membrane-bound enzymes demonstrated that anesthetics increase fluidity of the membrane and alter the lipid-protein interaction, thus affecting activity of the membrane-bound enzymes.

These studies confirmed the lipid hypothesis of anesthesia. It was demonstrated that nembutal anesthesia enables to obtain native synaptosomes with regular metabolic parameters. Moreover, barbiturates in vitro increase calcium binding and inhibit polarization-dependent calcium accumulation by synaptosomes, while in vivo they decrease the synaptosomal calcium content.

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See the list of publications:
5, 18, 19, 28, 29, 30, 74, 94, 95, 127, 133, 134, 135, 136, 137, 138, 145, 146, 147, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 194, 195, 197, 202, 203, 204, 205.

STUDIES ON THE STRUCTURE AND BIOLOGICAL PROPERTIES OF THE NERVOUS TISSUE

Nerve tissue reaction to endogenous and exogenous damaging factors

Department of Neuropathology
Head: Prof. Mirosław J. Mossakowski

ENDOGENOUS ENCEPHALOPATIES CONNECTED WITH IMPAIRMENT OF HEPATIC AND RENAL FUNCTION

The pathomechanism of the central nervous system (CNS) damage in hepatic diseases was studied in chronic poisoning with carbon tetrachloride leading to liver cirrhosis and after shunting of the portal vein and inferior caval vein resulting in portosystemic encephalopathy. In both situations

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there was an increase in the level of glutamine and the activity of glutamine aminotransferase - the enzyme responsible for the synthesis of α-ketoglutaramate. However, the dynamics of changes and the final effect were different in both models suggesting that in the toxic encephalopathy the excess accumulation of α-ketoglutaramate is of pathogenetic significance only in the early period, whereas the later period is characterized by α-ketoglutarate deficiency, depressing the ammonia-detoxicating power of the brain. In neither of the encephalopathy models, any changes in the RNA polymerase activity were found when measured in unfractionated cerebral nuclei. The general negative result does not exclude, however, local or cell type-related disturbances, particularly in the astrocytes nuclei undergoing morphological alterations under the considered conditions.

In investigations on the pathomechanism of CNS damage in renal failure it was established that in uremia, resulting from glomerulonephritis accompanying chronic serum sickness, two encephalopathogenic mechanisms - immunologic and toxic are involved. Deposition of immunological complexes in the cerebral vessel walls leads to deterioration of the barrier mechanisms, penetration of proteins through the vascular bed, induction of inflammatory and demyelinating reactions in the tissue and development of brain edema. Damage to the blood-brain barrier facilitates penetration of the so-called uremic toxins, leading to enhancement of edema and to development of degenerative changes in the nerve cells.

Investigations on the antigenic properties of the nerve tissue grown in culture, performed using the immunofluorescence technique, revealed presence of the brain-specific antigens in both astro- and oligodendroglia. These antigens are most probably produced in the course of the tissue growth in vitro. Identical localization of both the tissue-specific and the organ- and tissue-specific antigens is worth mentioning. The immunofluorescence reaction disclosing both these

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antigens was as a rule more intensive in oligodendrocytes.

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See the list of publications:
1, 63, 85, 192, 193.

STRUCTURAL AND METABOLIC CONSEQUENCES OF THE CENTRAL NERVOUS SYSTEM ISCHEMIA

In the studies on the mechanism of the brain edema development following an increase of the systemic venous pressure, the significance of three factors was emphasized: venous blood volume, blood pressure and the mechanical properties of the nerve tissue. Blood retention in the vascular bed was found to be related to the changes in physical properties of the nervous tissue, and mainly to its decreased elasticity facilitating water filtration through the vessel walls in the preedematous state. The filtration is further favoured by the increase venous blood pressure as well as by metabolic disturbances resulting from hypoxia and tissue acidosis.

Studies on the consequences of complete cerebral ischemia revealed that severe disturbances of circulation considerably reduce the possibility of resuscitation. These disturbances lead to heart failure, pulmonary edema and finally to death. They are characterized by a biphasic course, including both the ischemic and postischemic period, and result from a combination of events related to acute intracranial hypertension, excess fluid accumulation and central nervous system ischemia. Recovery and normalization of the brain bioelectrical activity is possible even after 15 minutes of ischemia.

Administration of γ-butyryl-lactone (GBL) into Mongolian gerbils subjected to bilateral ligation of the common carotid arteries, markedly increases the survival time of these animals. The compound may exert its protective action both on the circulatory system and on the nervous tissue metabolism. The hypotensive effect of GBL in the phase of acute arterial hypertension occurring at the moment of ligation and leading

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to circulation insufficiency seems to be of particular importance. Other relevant effects of GBL include hypothermia and decreased oxygen consumption by the neurons characterized by selective vulnerability to oxygen deficiency.

In histochemical investigations on the functional and structural properties of pial vascular network topographic differences in the activities of dehydrogenases and specific nucleoside phosphatases were demonstrated. A decreased activity of phosphorylases with decreasing caliber of the vessels was also noted. Ischemia caused changes in the histochemical reactions differing with respect to particular enzymes and to different segments of the vascular network. The results indicate that functional differentiation of particular segments is accompanied by distinct metabolic properties.

Studies on the effects of impairment of the vegetative innervation on the pial vasculature demonstrated that lateral removal of the upper cervical ganglion leads to bilateral impoverishment of both the sympathetic and parasympathetic innervation, being more pronounced on the operated side. This is accompanied by changes in the histochemical reactions of the vessels and disturbances of the cerebral cortex vascularization, indicating existence of bilateral, contralateral and ipsilateral vegetative innervation of the vessels. The impairment of parasympathetic innervation, following the excision of a sympathetic ganglion, suggests presence of a parasympathetic component in the upper cervical ganglion.

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See the list of publications:
2, 41, 42, 43, 70, 112, 113, 114, 123, 128, 175, 176, 179, 180, 181, 182, 198

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NERVOUS SYSTEM DAMAGE RELATED TO HYPOXIA
AND TO THE ACTION OF EXOGENOUS CHEMICALS

In the investigations on the metabolic effects of acute hypoglycemia disturbances in the activity of enzymes involved in γ-aminobutyric acid (GABA) metabolism, mainly glutamine and decarboxylase (GAD) as well as GABA aminotransaminase (GABA-AT) - were found. In the early phase of hypoglycemia, activity of both these enzymes increases, suggesting acceleration of GABA metabolism, probably due to the stimulatory effect of insulin on glucose transport. In the later phase, when blood glucose reaches the lowest level an enhanced GABA-AT activity is noted, suggesting an increased GABA catabolism.

In the investigations on the myelinoclastic action of ethylnitroseurea (ENU) in vivo it was established that this methylating agent, administered both directly and transplacentally, beside causing demyelination foci produces also abnormal cells of oligodendroglial origin. They are distinguish from normal cells by exceptional abundance of intermingled cytoplasmic processes forming irregular membranous structures. The abnormal oligodendrocytic processes may be the cause of myelinogenesis disturbances, leading to de- or dysmyelination.

Investigations on the effects of methylnitrosourea (MNU) on cellular elements of the nerve tissue in culture demonstrated that administration of a single dose of carcinogen produces two types of changes - cytotoxic and proliferative, suggesting blastic transformation. On the 3rd day of tissue growth the cytotoxic changes showed a tendency towards recession, while transformation became more pronounced. The latter changes selectively involve astroglia.

In the investigations on the mechanism of vasopressive Cushing reflex, accompanying intracranial hypertension, it was found that this reflex may be abolished by damage to the medial eminence of hypothalamus associated with adrenalectomy.

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This suggests co-participation of nerve and humoral factors in pathomechanism of this phenomenon. In addition, vasopressin was found to cause a transient increase of the cerebral blood flow. A short-term vasodilatatory effect of vasopressin on the cerebral vessels is modulated by β-receptors. The β-receptor blockers markedly decrease the vasodilatatory effect of vasopressin.

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See the list of publications:
83, 84, 86, 87, 88, 89, 90, 91, 92, 132, 139, 140, 141, 142, 143, 191

TOXIC AND ANOXIC DAMAGE TO THE DEVELOPING NERVOUS SYSTEM

Laboratory of Developmental Neuropathology
Head: Prof. Maria Dąmbska

Evaluation of the effect of dichlorvos /DDVP/ on the rabbit brain in the period of myelination altered by the effect of phenobarbital during fetal development.

Previous studies have shown that phenobarbital administered to pregnant rabbits delays development of the central nervous system and causes a decline of acetylcholinesterase activity (AChE) in the brain of newborn rabbits. Dichlorvos (DDVP), a phosphoroorganic pesticide, inhibits AChE activity in the nervous tissue affecting the development and causing the damage of the myelinating structures. The present studies on the effect of DDVP on the rabbit brain were carried out during the period of its development (between the 5th and 16th day of life). The rabbits were previously subjected to transplacental effect of phenobarbital. Two areas of the brain were examined: the cortex and the myelinating white matter in the cerebral hemispheres and in the cerebellar cortex. It was found that administration of phenobarbital during the fetal development increases sensibility of young rabbits to intoxication with DDVP causing prominent metabolic and structural

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changes in the nerve and glial cells and probably a secondary injury to a part of the myelinating fibres. The changes within membrane structures of the cell seem to be connected with an inhibition of AChE activity. Further studies on the same experimental model revealed that the inhibition of AChE activity during fetal developments is compensated after birth, but this compensation may be easily and profoundly abolished by an additional injurious factor (DDVP) causing structural damage to the nerve and glial elements.

AChE activity as well as morphological changes in the neurons of the brain cortex were also studied in the previously healthy rabbits intoxicated with DDVP from the 5th to 16th day after birth. The injuries were more prominent than those found following transplacental intoxication, which may suggest that they depend on the dose of the pesticide acting on the brain tissue during the period of its development.

For more detailed evaluation of the chronic intoxication with DDVP the level of serotonin in the rabbit brain was also examined. Following 10-day intoxication with DDVP a prominent decline of serotonin activity was noted in some structures of the rabbit brain.

The effect of ethrane administration on the developing rabbit brain.

In the newborn rabbit brain subjected to the effect of ethrane - a halogenoted anesthetic - for 60 min an increased accumulation of glycogen in neurons of the mesencephalic nucleus of the trigeminal nerve as well as the lack of glycogen in the pericarion of the glial cells were found. These observations suggest that following ethrane anesthesia reversible injuries of the nerve cells of the brain may occur. This compound may also cause small and probably reversible changes in the synapses of the maturing rabbit cerebral cortex.

Continuous examinations of the autopsy brain material of newborns enabled to indicate morphological features of the intravascular coagulation syndrome (DIC). A comparison of these changes with the injuries to the periventricular areas

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suggests that DIC may play a role in the appearance of focal injuries in the brain of newborns.

The investigations on the content of catecholamines in the newborn rabbit brain under conditions of normobaric hyperoxia and posthemorrhagic shock suggest that an increased content of catecholamines under a combined effect of these two factors is due to their increased synthesis induced by hypoxia and an increased secretion as a result of posthemorrhagic shock.

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See the list of publications:
21, 22, 23, 24, 25, 26, 27, 31, 32, 33, 34, 35, 36, 37, 38, 65, 75, 81, 82, 93,100, 101, 107, 108, 109, 110, 111, 189.

Nervous system ultrastructure

Laboratory of the Ultrastructure of the Nervous System
Head: Prof. Jerzy Borowicz

STUDY ON THE ULTRASTRUCTURE OF NEOPLASMS OF THE NERVOUS SYSTEM IN CHILDREN

Twenty four cases of tumours histopathologically diagnosed as being of neuroblastoma type were examined in the electron microscope. These cases concerned children from early infancy up to 14 years of age. The tumours were mainly localised in the adrenal glands or their vicinity, in the mediastinum and finally in the perispinal region at the lumbar level. The disease involved both boys and girls without any marked preference of sex. In the electron-microscopic pictures of each case pronounced diversity was noted in the degree of maturity and cellular differentiation, with high differentiation prevailing. In the cytoplasm of the tumour cells and their processes a larger or smaller number of catecholamine granules was found in each case. This was noted even in cases when biochemical analyses failed to demonstrate a rise of catecholamine level or their metabolites in the urine.

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Moreover, comparative electron-microscopic examinations of the central nervous system tumours were performed in younger children - age up to 3 years and in elder ones up to 14 years old. A total of 37 cases were studied: 12 of them concerned children below the age of three and 25 cases above this age. In both age groups most frequent were astrocytoma, medulloblastoma and ependymoma. Neoplasms of other types were found only sporadically. No morphological differences in the electron-microscope picture of the structure of the above mentioned tumours were observed between the groups of younger and elder children.

CHANGES IN THE HYPOTHALAMO-HYPOPHYSEO-ADRENAL SYSTEM UNDER UNFAVOURABLE ENVIRONMENTAL CONDITIONS

The supraoptic and periventricular nuclei as well as the nervous lobe of the hypophysis were examined in rats, exposed to an ambient temperature of $-18^{\circ}C$ for 40 min. The electron-microscopic pictures obtained lead to the conclusion that this severe hypothermic stress causes considerable activation and functional synchronization of the supraoptic and periventricular nuclei neurons stimulating at the same time secretion of neurosecretion granules within the nervous lobe of the hypophysis.

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See the list of publications:
44, 45, 46, 47, 48, 96, 97, 98, 99, 124, 125.

EVALUATION OF INTRACRANIAL PRESSURE FOR NEUROSURGERY DIAGNOSIS

Department of Neurosurgery
Prof. Adam Kunicki

The most common methods of evaluating intracranial status used till now, have relied on intracranial pressure (ICP) monitoring. Since disturbances in cerebral venous outflow

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(CVO) may stimulate the development of brain edema their early diagnosis is very important. A very useful method for both an early diagnosis of CVO disturbances and characterizing some physical properties of the intracranial system consists in analysing the spectral density of the recorded ICP signal, using the Fast Fourier Transform (FFT) procedure. Physically FFT represents the distribution of the signal strength, with frequency. A decrease in the random components (i.e. noise) has been achieved with the autocorrelation step. Fouriers transformation of the resulting autocorrelation function gives the relative power spectrum of the recurring components of the original intracranial pressure signal. But the autocorrelation step, needed to yield the power spectrum, can be only applied to ergodic signals and the power spectrum since such nonstationary sources as ICP signal is a function of both frequency and time.

Therefore, in the present approach the finite ICP record length has been divided into subsegments, then these subsegments were taken for the Fourier transformation. Ten or 41 second ICP records, were used for the transformations corresponding to 256 or 1024 ICP samples taken at the 25 Hz frequency. Such type of analysis in the frequency domain, yields quantitative information concerning the contribution of particular frequency components to the ICP signal (e.g. pulse related, respiratory and other oscillations).

It was noted that in patients without intracranial tightness the most prominent components of the PSD_{ICP} diagram are related to cardiac and respiratory functions. Several peaks are usually seen in the PSD_{ICP} plots. The peak at a frequency corresponding to the frequency of cardiac action represents the pulse related pulsations of the ICP signal. The peak at a frequency corresponding to the frequency of the respiration represents the respiratory pulsations of the ICP. The other are harmonics.

However, with a decrease in the intracranial volume compensating capacity a distinct shift of the relationship between individual PSD_{ICP} components has been observed.

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The respiratory component became relatively low, and the subrespiratory components started to dominate the picture. It seems most likely that the changing relationship between the respiratory and the subrespiratory component, constituts one of the early signs of imminent cerebral venous outflow decompensation.

The spectral analysis of the ICP signal - helped to follow these early signs of CVO disturbances, especially, in long-term patient care. This analysis of the signal - recorded in patients monitored in the neurosurgical ICU also proved to be useful in evaluating the effects of the ICP corrective procedures such as furosemide, mannitol or CSF drainage. It should be pointed out that the spectral analysis of the ICP signal can be beneficial clinically if the processed data are being printed out without delay, within the actual ICP measurements. It can be achieved only by using an on-line real-time intensive care computer system.

Another study deals with the effect of vasoprotective drugs and the proteinase inhibitor transylol on the development of experimental cerebral edema after rapid brain decompression. It was found that the first symptoms of blood-brain barrier disturbance normally appeared after about 2 hours of brain compression. After an epidural compression up to six hours the disturbances observed in the blood-brain barrier concern only the compressed hemisphere, and later gradually spread to the whole brain. The intracranial pressure measured from the epidural space starts rising after an average of 2 hours of epidural compression, and reaches the highest values at the end of the experiment. Distinct disturbances of the blood-brain barrier following sudden decompression were observed only if the preceding epidural compression had lasted for at least 2 hours. Two hours after sudden decompression which followed two hours of epidural compression, coloration of the cortex directly under the balloon with perivascular haemorrhages in the white matter and, in some cats, coloration of the basal nuclei, were observed. The

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longer the period of preceding compression the more dangerous are the effects of the subsequent decompression of the brain. Both drugs exhibited a limiting effect on the development of brain edema, although Aescorin was found to be the more effective one. In the experiments with Aescorin there were no haemorrhages and the disturbances in the blood-brain barrier were less pronounced, although their location (in the cortex and basal nuclei) was similar to that observed in the control group.

Next study deals with the changes in intracranial pressure (ICP) systemic arterial pressure and cerebral perfusion pressure immediately after acceleration. Acceleration-induced head injury in the monkey was produced and ICP, SAP and CPP measured. Conclusions are as follows:

1/ Elevation of ICP to as high as 100 mmHg occurs after cerebral concussion.

2/ If subdural hematoma does not occur, then ICP becomes normal by 5-10 minutes after injury.

3/ If subdural hematoma occurs, a secondary rise of ICP occurs and CPP becomes zero.

4/ The magnitude of the initial ICP rise is related to injury severity.

The data best fit the concept that the temporary increase of ICP results from abrupt vasodilatation.

The influence of experimentally induced haemodilution upon intracranial pressure has been also studied. A marked increase in CBF after haemodilution has been observed. A decrease in BBB disturbances usually observed after brain compression were less evident when the haemodilution procedure has been earlier applied.

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See the list of publications:

15, 49, 50, 67, 118, 172, 173, 174, 178.

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EFFECT OF STEREOTAXIC SURGERY OF THE LIMBIC SYSTEM ON MEMORY, EMOTIONAL STATE AND BIOELECTRICAL ACTIVITY OF THE BRAIN

Department of Neurosurgery
Head: Assoc. prof. Eugeniusz Mempel

1) Patients with temporal epilepsy were subjected to the examinations concerning the non-verbal memory. It was found that electrical stimulation of the deep temporal structures and stereotactic procedures, such as selective amygdalar and hippocampal lesions do not increase memory disturbances as compared to the pre-operational period. This regards both dominant and non-dominant cerebral hemisphere.

2) Electrical stimulations of the amygdala and hippocampus were performed during stereoelectro-encephalographic investigations in patients with temporal epilepsy. This study proved that low stimulation (2-3 V, 50 c/s, tms, 5 s) triggers the pattern after-discharges resembling spontaneous patterns of epileptical discharges. In many cases the ways of the discharge spreading could be observed.

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See the list of publications:
20, 39, 68, 102, 103, 117.

DISORDERS OF SPEACH AND OTHER GNOSTIC FUNCTIONS IN FOCAL LESIONS OF THE BRAIN

Department of Neurosurgery
Assoc. prof. Jadwiga Szumska

Patients with focal lesions of frontal, temporal, parietal and occipital regions of the brain were examined, both before and after neurosurgical operations. Basing on these examinations methods were elaborated enabling to reveal symptoms of speach and memory disorders as well as the phenomenon of perseverations lesions.

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The methods consist in exposing the patients to the alteration type tests. Methods of differentiation of speach disorders caused by focal lesions of temporal lobes from those caused by the focal lesions of other regions of the left hemisphere were also presented. The methods consist in revealing disturbances within the phonomatic system.

Besides, it was tried to find out some possibilities of disclosing the so called "space orientation disorders" - characteristic for the parietal and occipital lobe damages.

All the above methods are of particular importance for neurological and neurosurgical clinic.

Some basic research studies on visual perception in human subjects were also performed, involving patients with focal lesions. The data concerning an interaction between letters, and facilitation of letter recognition as a result of the central nervous system activity were presented.

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See the list of publications:
7, 54, 177.

EFFECT OF "pt" MUTATION ON VARIOUS LINKS OF CLOSED NEURONAL CIRCUITS

Department of Comparative Neurology
Head: Assoc. prof. Irmina Zelman

Pathomorphological evaluation of thalamus in pt rabbits revealed striking differences in the intensity of pathological alterations in particular nuclei, depending on clinical stage of the disease. The damage to the thalamus is determined by the primary predilection of pathological process to some thalamic nuclei (nn. lateralis dorsalis and posterior, anterior thalamic nuclei) and by the secondary transneuronal degenerations (n. posterior thalami, zona reticularis) bearing in this respect some resemblance to thalamic lesions in human multiple system degenerations. Acute nerve cell lesions and diffuse

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cellular gliosis, typical early neuropathological feature of pt-syndrome, appear in thalamus in symptomatic stage of the disease and they increase with the development of spastic pareses. On the other hand, in other brain structures (brain stem, pallidum, striatum) tissue abnormalities are present already in presymptomatic period. Neuronal changes are partly reversible and regress gradually during clinical improvement.

In prolonged or chronic course of the disease in neuropathological picture prevail nerve cell outfall and sclerotic changes. Thalamic lesions do not have the defined clinical symptomatology in pt-rabbits although some behavioural abnormalities, aggresion and hyperexcitability may be connected with thalamic dysfunction.

Reverse interdependence between spontaneous rhythmical tremor of the body - the outstanding feature of pt-syndrome - and the intensity and extent of thalamus alteration were found. The decrease or even complete decline of tremor in the period of increasing atrophic changes, especially in the nucleus (ventralis lateralis thalami) could be compared with the effects obtained by neurosurgical destruction of this structure in treatment of human parkinsonian tremor.

The evaluation of basic biochemical parameters in blood serum of pt-rabbits as well as amino acid analysis did not reveal any essential differences as compared with the results obtained in normal healthy rabbits.

In the preliminary cytogenetic study on pt-rabbits results were obtained suggesting chromosomal delation in this mutant.

Pathomorphological analysis of kidneys taken at autopsy from 200 rabbits revealed presence of degenerative-inflammatory process (nephroso-nephritis) in pt flock being independent of the neurological expression of pt-syndrome.

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See the list of publications:
183, 184, 185.

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Studies on transplantation and experimental surgery

Department for Surgical Research and Transplantation
Head: Prof. Waldemar Olszewski

RECIRCULATION OF LYMPHOCYTES AND TRANSPORT OF IMMUNE PROTEINS

1) Natural Killer /NK/ displays limited abilities for migration from the vascular compartment to the tissues and pernodal lymph.

2) Relatively high activities of C1INA and C3bINA were found in human prenodal lymph compared with serum, when expressed as function of protein concentration.

3) Blood mononuclear cells migrate from the spleen predominantly to the bone marrow. The mechanism remains unclear.

4) Postnatally tymectomized rats receiving allogenic skin graft reveal increased lymphocyte cytotoxic activity following treatment with thymosine - fraction 5.

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See the list of publications:
3, 40, 119, 120.

ANTIGEN - SPECIFIC PROLONGATION OF ALLOGRAFT SURVIVAL

1) Treatment of dog kidney recipient with B. Pertussis and ALG does not prolong the graft mean survival time.

2) Combined treatment of rat heart recipient with donor antigen and syngeneic antiserum against donor transplantation antigens prolongs the survival time of that organ but not the skin graft from the same donor.

3) Lymphocytes and spleen cells from recipients of heart or skin allografts reveal cytotoxic activity starting on day 3, with the peak on the day of rejection.

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4) Mouse peritoneal macrophages stored at -196°C and injected i.v. accumulate mostly in the liver.

5) A decrease of peripheral blood killer cells (K) was observed in the first postoperative days in patients undergoing upper abdominal surgery.

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See the list of publications:
4, 121, 155, 190.

NEUROREGULATION OF OXYGEN SUPPLY TO TISSUE WITH REFERENCE TO PARTICIPATION OF ARTERIOVENOUS COMMUNICATION IN MICROCIRCULATION

Laboratory of Experimental Surgery
Head: Prof. Jan Nielubowicz

New data have been obtained suggesting the relationship between development of trophic ulceration and radiologically documented openings of arteriovenous junctions in ilio-lumbal region.

1) Investigations carried out on humans and animals (rabbits) showed that proper choice of parameters for electrostimulation provides any kind of steering of blood flow in arteriovenous junctions in the skin. The changes in blood flow in the capillary loops of the skin have been registered with TV camera.

2) There was shown the efficiency of stimulation of cut peripheral segment of n. ischiadicus in apes with direct current (frequency 70 imp./min., voltage 6) from the heart stimulator. Such stimulation prevented the development of trophic ulceration and caused faster healing of denervated limb.

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OTHER RESEARCH WORKS

BIOLOGICAL, PSYCHOLOGICAL AND SOCIAL CONDITIONS OF DEVELOPMENT OF ABILITIES IN CHILDREN AND ADOLESCENTS

Research Group of School-Psychohygiene
Head: Dr Henryk Osiński, M.D.

The complex investigations were performed on the population of 196 pupils of the Secondary School in Warsaw to evaluate their intelligence, main interests and special abilities. In comparison with general population a great number of pupils with high and very high intelligence index was found at the Secondary School. There were approx. eight times more pupils with the IQ over 130 than in the general population. The predominance of verbal intelligence over unverbal intelligence was found among all the examined pupils except those with average intelligence.

The highest interest tendency index was reached in the science interest-scale, whereas the lowest index was noted in the social-trade and office-administration scales. It was found that very clever pupils reached higher means of interest-index in seven subjects, in comparison with those with average pupils.

Boys achieved better results in the tests checking abilities for form-operating in space and in space imagination whereas girls showed greater verbal abilities and had better results in the tests checking the speed and precision of hand movements.

The results of this study besides their cognitive value, should be of some help for psychologists and teachers.

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See the list of publications:

122.

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FACTORS DETERMINING MENTAL HEALTH OF ADOLESCENTS

Some factors characterizing the group of adolescents avoiding work or/and study

Mental Health Department
Head: Dr Zbigniew Poseł, M.D.

The investigations were carried out on a group of 103 subjects (90 males and 13 females) aged from 17 to 19 years, registered at Łódź Home Department in 1978 as avoiding work or/and study. All the subjects were medically, psychologically and sociologically examined.

Medical examination included assessment of physical, neurological and mental status and informations from medical records prior the investigations. Results of psychological and sociological examination were also considered. Only 14 persons (13.5%) had no evident health defects. In 89 cases (86.4%) of the population examined pathological symptoms were found including: mental disorders - in 75 individuals (72.8%) and somatic diseases - in 14 subjects (13.5%). Among mental disorders: mental retardation, personality disorders and encephalopathies were predominant.

The results of standarized psychological tests were also collected serving as indicators of success and effectiveness of adaptation. These indicators were verified with reference to sociological and medical criteria.

In 43% of the subjects examined low mental ability was demonstrated; among them 12% showed slight mental retardation. Low intellect level depended on both narrow intellectual possibilities and disfavourable environmental factors.

In comparison with the group of secondary school students the examined population demonstrated lower degree of self-estimation, the higher degree of emotional disequilibrium and conflicts, inadequate life goals and aspirations.

Family structure, emotional relations between family members ensuring both the emotional and material needs of the children as well as pedagogical attitudes of parents

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were analyzed. The examined families can be devided into three cathegories: 1) creating possibilities of proper socialization (14.5% of families), 2) creating conditions for disturbed socialization (14.5%), and 3) creating possibilities of abnormal socialization (53.4% of families). On the basis of this analysis it can be concluded that in 70 cases (53.4%) family environment might influence the abnormal acting of the examined group of adolescents.

Frequency and development of delinquency within the group were also analyzed. Twenty five percent of the examined subjects showed delinquent disposition. In great majority of cases delinquent behaviors were noted both in juvenile (till 17 years of age) and in adult periods of life. It contradicts the opinion, that delinquent inclinations play a prevailing role in genesis of avoiding work and/or study. Such dispositions, considering their frequency can be considered as only one of several determinants of the examined sociological phenomenon.

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See the list of publications:
66, 126, 130, 131, 148, 149, 166, 167, 168, 186, 196, 199, 200, 201.

CONSTRUCTIONS OF BIOMEDICAL EQUIPMENT

"Medipan" Laboratories
Head: S. Karalow, Msc. eng.

In 1979 Medipan Laboratory was manufacturing the following types of equipment:

3-channel recorder (5 units)
6-channel recorder (5 units)
Infusion pump type 463-A (30 units)
Infusion pump type 573 (51 units)
Dispenser-diluter (60 units)
Other small equipment.

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	Cantonspital Aarau, Switzerland
Korsak-Sliwka J.	Burdenko Institute of Neurosurgery, Moscow, USSR
Kwiatkowski A.	Burdenko Institute of Neurosurgery, Moscow, USSR
Łuczywek E.	Institute of Clinical and Experimental Neurology Georgian Academy of Sciences, Tbilisi, USSR
Mempel E.	Service de Neurochirurgie Fonctionelle, Marceille, France

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Szewczykowski J.	Central University of Caracas, Venezuela
Śliwka S.	Burdenko Institute of Neurosurgery, Moscow, USSR; University of Leeds, Great Britain

Department of Surgical Research and Transplantation

Łukomska B.	Norwegian Radium Institute, Oslo, Norway
Olszewski W.	Norwegian Radium Institute, Oslo, Norway
Ruka M.	Laboratory of Transplantation of Organs and Tissues, Moscow, USSR
Stępkowski S.	Norwegian Radium Institute, Oslo, Norway

Mental Health Department

Zakrzewski P.	Centre de Recherche et de Formation de l'Education Surveillee, Paris, France

PARTICIPATION IN INTERNATIONAL SCIENTIFIC MEETINGS IN 1979

Symposium Working Group of Neurological Aspects of Breathing; Congress SEPCR, Basel, Switzerland, October 8-14
M. Głogowska, W. Karczewski, J. Romaniuk, B. Szereda-Przestaszewska

III Meeting of the European Neurosciences Association, Rome, Italy, September 10-15
M. Pokorski

XIII Meeting of the European Society for Clinical Investigations, Cambridge, Great Britain, March 20-25
K. Herbaczyńska-Cedro, K. Nazar

International Symposium on Catecholamines and Stress, Bratislava, Czechoslovakia, September 12-16
Z. Brzezińska, S. Kozłowski, K. Nazar

International Symposium on Biochemistry of Exercise-Hormonal Regulation, Brussels, Belgium, June 19-22
S. Kozłowski, K. Nazar

Conference on Cosmic Medicine and Biology - "Intercosmos", Kaluga, USSR, June 4-9
S. Kozłowski

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3rd Colloqium on Kidney Physiology, Stockholm, Sweden,
June 17-20
J. Sadowski

Symposium "Coer et Activities Professionelles", Paris, France,
March 25-27
S. Kozłowski

XV Congress SELP Societe d'Ergonomie de Langue Francaise,
Paris, France, December 6-8
B. Kapitaniak

XI Czechoslovakian Conference on Nephrology, Novi Smokovec,
Czechoslovakia, May 30-June 1
J. Sadowski

VI Conference of the GDR Neuropathologists Association,
Lipsk, GDR, March 20-25
Z. Rap

24 Meeting of the German Society of Neuropathology and
Neuroanatomy, Essen, GFR, September 12-16
M. Dąmbska, S. Krajewski, J. Łazarewicz, K. Renkawek,
H. Weinrauder

International E Reuter Symposium "Brain Edema", Berlin
September 12-15
H. Kroh, M. Mossakowski

Meeting of the International Society of Neuropathology,
Oxford, Great Britain, July 27-29
M. Mossakowski

Polish-Hungarian Symposium on Toxic Encephalopathies and
Neuropathies,Cracow, Poland, September 20-22
S. Krajewski, H. Kroh, G. Szumańska

Bulgarian-Romanian Symposium on Myelination and Demyelination,
Varna, Bulgaria, September 11-14
Z. Kraśnicka

3rd Polish-Soviet Symposium on Cerebral Hypoxia, Warsaw, Poland,
May 21-23
J. Albrecht, K. Domańska-Janik, R. Gadamski, K. Herbaczyńska-
Cedro, M. Mossakowski, M. Ostenda, A. Przybylski, Z. Rap,
K. Renkawek, J. Strosznajder, G. Szumańska, M. Smiałek,
J. Wróblewski, M. Zaleska

VII International Congress for Mathematics Biology, Paris,
France, September 10-12
A. Przybylski

International Narcotic Research Conference /INRC/ North Falmouth,
Mass., USA, June 11-15
J. Wideman

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International Colloqium on Receptors, Neurotransmitters and Peptide Hormones, Capri, Italy, May 13-18
J. Wideman

International Meeting on a Multidisciplinary Approach to Brain Development, Brindisi di Fasano, Italy, April 16-21
J. Strosznajder

VII Meeting of the International Society for Neurochemistry, Jerusalem, Israel, September 2-6
J. Strosznajder

International Symposium on Glycoconjugates, Kiel-Damp, GFR, September 2-8
M. Rossowska

XI International Congress of Biochemistry, Toronto, Canada, July 8-13
Z. Dąbrowiecki, K. Domańska-Janik, J. Strosznajder

63 Annual Meeting American Society of Biological Chemists, Dallas, USA
U. Rafałowska

Symposium of the European Functional Neurosurgery and Stereotaxy Society, Paris, France, July 11-14;
VI Congress of the European Neurosurgeons, Paris, France, July 16-20
E. Mempel

IX Symposium on Cerebral Blood Flow, Tokyo, Japan, May 23-June 4
J. Szewczykowski

Symposium on Intracranial Pressure, Williamsburg, USA, June 9-22
Z. Czernicki, Z. Rap, J. Szewczykowski

Symposium IGP, Aarau, Switzerland, May 21-27
J. Jurkiewicz

XIV Meeting of the European Society for Surgical Research, Rotterdam, Holland, February 10-11
W. Olszewski

Meeting of the Society for University Surgeons, Salt Lake City, USA, February 12-17
W. Olszewski

XVI Congress of the European Dialysis and Transplantation Association, Amsterdam, Holland, June 15-22
W. Rowiński

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XIV Meeting of the European Society for Surgical Research, Barcelone, Spain, May 4-11
J. Kupiec-Węgliński, M. Murawska, W. Olszewski, W. Rowiński, S. Stępkowski, B. Wąsowska

CMEA Members Meeting on Problems of Scientic Research Organization, Praga, Czechoslovakia, March 26-29
W. Rowiński

VII Congress of the International Society for Lymphology, Florence, Italy, October 29-November 3
H. Gałkowska, W. Olszewski, M. Ruka

Congress of the Hungarian Surgeons Society, Szeged, Hungary, November 8-9
W. Olszewski

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