person may becomes anxious, depressed, hostile, emotionally labile, and prone to mood swings. Motor changes may occur if the posterior frontal lobes are involved. The individual exhibits rigidity (paratonia) with flexion posturing, propulsion, and retropulsion.

6.11.2.2 Evaluation and treatment

The diagnosis of Alzheimer disease is made by ruling out other causes of a dementing process. A blood-cell membrane aberation is currently being investigaed as a biologic marker of Alzheimer disease. The history, including the mental status examination, and the course of the illness are used to diagnose Alzheimer disease. The course of the disorder is highly variable, usually developing over 5 yrs or more.

The treatment of Alzheimer disease is directed at decreasing the need for the impaired cognitive function by a compensation technique, such a memory aids, maintaining those cognitive functions that are not impaired, and maintaining or improving the general state of hygiene, nutrition, and health. Environmental management, counseling, education, pharmacotherapy, and health promotion measures are the foundation upon which a comprehensive treatment program is built.

6.12 Epilepsy

The term epilepsy includes a group of disorders of the CNS, that are characterized by repeated paroxysmal changes of the nervous function caused by an abnormal electrical activity in the brain. Epilepsy is usually manifested by changes of consciousness of a paroxysmal character, that are usually associated by motor, vegetative, biochemical, and electrophysiological changes.

According to the recent studies about 1 % of the population suffers from reccurent epileptic attacks and it is assumed that about 10 % of people survives some form of an attack at least once in a lifetime. Inheritance is thought to be an important factor in the formation or predisposition to the attacks, not in the occurance of the attack itself.

To understand epilepsy as a nozological unit one basic requirement is not fulfilled being one etiological factor. From the etiological point of view we may devide epilepsy into primary and secondary.

1. **Primary epilepsy**, the cause of which was not possible to determine yet using the recent diagnostic methods. It is a functional disorder of the CNS, that usually has an electrophysiological correlation in the EEG recording. The neuroradiological examinations are negative. It forms about 75 % of cases. Using the modern diagnostic methods the number of cases with primary epilepsy are decreasing and many cases are diagnosed as secondary epilepsy.

2. **Secondary epilepsy**, or symptomatic, which cause is known, occurs in about 25 % of cases.

From the topographical point of view, nowadays we devide epilepsy into:

- focal epilepsy with a defined epileptic focus, most commonly in the cerebral cortex, and

- non focal epilepsy, centrencephalic, in which the epileptic discharge arises from the so called centrencephalic area of the brain and then it is generalized.

6.12.1 The etiopathogenesis of the epileptic attack

The pathophysiological basis of the epileptic attack is **the epileptic discharge**. There will be production of pathological rhythmic excitation in a certain population of neurons. It is synchronized and it spreads in the nervous system form the area of its generation either to a bordered area (**partial attacks**) or to the whole CNS (**generalized attacks**). The basis of the epileptic discharge is a change of the neuronal metabolism, that is associated with a high energy expenditure. As an evidence of this is the increased level of the adenosindiphosphate (ADP) and a decreased level of ATP, a lower level of glucose, glycogen and creatinphosphate, and the drop of pH in the blood and the brain.

Three pathogenetic factors may share the manifestation of the epileptic attack: **the epileptic focus, the readiness (predisposition) for epileptic attacks, and the epileptic stimulus**.

6.12.2 The epileptic focus

The inactive centre of the epileptic focus is surrounded by a transient zone, that consists of a pathologically changed neurons. Their bodies lack some synaptic contacts. The astrocytes will degenerate and fibrocytes will form instead, these are unable to fulfil the normal metabolic function. The dendritic branching is reduced and synapses degenerate. The ratio between the excitatory and inhibitory synapses is disturbed, where the inhibitory synapses are more vulnerable. The extracellular space will expand and such an affected tissue is a source of hyperactivity. What is characteristic for the autonomic activity of the epileptic neuron is the persistant dendritic depolarisation, that forms a potential gradient, that is directed towards the depolarised site. This keeps the neurons in a state of a continuous parital depolarisation. Their excitability threshold is lowered. When the current exceeds this treshold, there will be a high frequency discharge, that will be manifested by the typical electrophysiological changes. The epiletic focus is mainly manifested in cases of focal epilepsy.

The etiology of epiletic discharge is multifactorial. It is believed that the occurence of the epileptic discharge depends on exogenous factors (organic brain damage) as well as on endogenous factors (biochemical lesion of the tissue).

Organic brain damage

- **Perinatal brain injury**. Might be mechanical injury due to head injury, or due to changes of the brain circulation of a local or general character, diffuse hypoxia upon changes of the placental or pulmonary ciculation. The most sensitive area for the perinatal noxi is the hippocampus.
- **Traumatic brain injury** (commotion, contusion, intracranial haemorhage). Repeated microtrauma might be also manifested. Epileptic attacks can occur directly following trauma, or with some latency due to the effect of glial scar.
- **Neuroinfection** (encephalitis and meningitis). Epileptic attacks in the acute stage can result from brain damage by bacterial toxins, and the attacks that appear after the disease might be a result of some traction changes
- **Expansive intracranial processes** (benign and malignant tumors, brain abscesses, chronic and subdural haemotomes). The occurance of epileptic focus is directly caused by the mechanical effect.
- **Post operative conditions** (that follow brain surgery). The epileptic attacks are similar to those cases that follow meningocerebral scars.
- **Cerebrovascular diseases**. These are posthaemorhagic or postischemic attacks, and rarely follow a congenital arterio-venous malformations, and aneurisms of intracerebral vessels.
- **Chronic intoxications** (organophosphates, alcohol, lead, etc.). These are caused by the changes of the brain metabolism. The ethanol-toxic encephalopathy is the most common etiological cause of epilepsy that occurs after the age of 30yrs.
- **Biochemical lesions**. Based on experimental observations we expect that the epiletic firing is caused by biochemical lesions of the neurons, that affect the depolarisation and polarisation phase of action potential:
- **Disturbances of the eletrolyte metabolism**

  We think that a disturbance of the Na^+ and K^+ metabolism is the basic change in the epileptic focus. Samples of human epileptogenic tissues could show $Na^+ - K^+$-pump dysfunction, i.e. an inability to renew the intracellular concetration of the K^+ and remove the Na^+ from the neurons. This means that during the epileptic activity there might be a higher release of K^+ from the cell and an increase of the Na^+ level intracellularly, this will initiate another depolarisation of elements, the degeneration of action potential, and irradiation of the stimulus. The anticonvulsive drugs of the hydantoin type act by stimulating the Na^+ pump.
- **Disturbanes of the oxidative metabolism**

  The occurence of the epileptic attacks is caused by **hypoglycemia**. In the interparoxysmal period it was proven that the activity of oxydase enzymes (cytochrom oxidase) was lower as well as the enzymes for glucose metabolism (hexokinase), and this might lead to a disturbance of oxygen and glucose metabolism. These causes

might be genetically determined or might result from the glial scars. Most of the antiepileptic drugs stimulate the transport of glucose into the tissues.

- **Disturbances of the amino acid metabolism**

  During glucose metabolism there is the formation of free aminoacids and mainly glutamic acid, glutamin and GABA (gammaaminobuteric acid). Glutamic acid is an excitatory transmitter while GABA, glycin, and taurin act as inhibitory transmitter that transmits inhibitory impulses. It was proven that there was a decrease of the free aminoacids in all the epileptic foci. The decarboxylation of the glutamic acid – excitatory factor will result in GABA formation that acts as a mediator in the inhibitory brain synapses. In some epileptic foci there was a disturbance or dysfunction of the decarboxylase enzymes that might lead to **the presence of insufficient amount of GABA** and the formation of a pathological membrane activity. The decarboxylase dysfunction might also lead to the inhibition of the inhibitory effect of taurin, that is used successfully in the treatment of epilepsy.

- **Pyridoxin deficiency**

  Pyridoxin participates in the oxidative metabolism and in the metabolism of aminoacids and mainly on the glutamic acid decarboxylation to form the inhibitory neurotransmitter GABA.

- **Intracellular excess of amoniak**

  This might be a case of overproduction, or a case of disturbed amoniak detoxication, or possibly the combination of both mechanisms. The convulsive effect of amoniak is indirect, and its effect is promoted by the gammaguanidinbuteric acid.

- **Acetylcholine excess on the synaptic area**

  Migh be the result of its overproduction, its over release or the inhibition of cholinesterase.

- **Abnormalities of the neuronal membrane**

  The membrane composition is determined genetically. We know those abnormalities that are due to changes of the phospholipids, changes of Ca^{+} binding to the membrane, all together with a higher permeability and a higher Ca^{2+} entry to the cells.

- **A high membrane permeability for excitatory substances**

  In some epileptic foci we could prove a higher permeability of the blood brain barrier. The dysfunction of this barrier leads to the accumulation of folic acid in the area. Folic acid acts as an effective inhibittor for the back resorbtion of the glutamic acid, and the accumulation of glutamic acid might lead into an epileptic tonic-clonic attack.

- **Disturbances of the metabolism of biogenic amines**

  Monoamines are moderators of the stimulation threshold in the epileptic loci and other structures as well. In some types of epileptic locations we could find less noradrenalin endings than normal. An increased level of brain noradrenalin have a protective effect against spasms, and its insufficiency increases the epileptic activity.

Ischemia of the nerve cells as well as a higher water content and some other metabolic changes stimulate the epileptic firing. All the mentioned metabolic disturbances are interconnected in a pathogenic chains, where it sometimes becomes very difficult to determine which one of them is the primary one.

6.12.2.1 Attack predisposition

For the development of epileptic attack it is important whether the non injured neurons have the liability to be connected into a synchronized activity and wether there are appropriate conditions for its spread in the CNS. The attack predisposition is the liability of a certain population of brain neurones for a synchronized automatic rhythmic activity, that might be caused by a permanent slight depolarisation of the neuronal membrane, the insufficiency of the repolarisation mechanisms, and the inadequate function of the feed back mechanisms. As a result of the attack predisposition some abnormal potentials from the epileptic focus will induce a synchronized activity in the surrounding healthy tissue (hypersynchronization phenomena). The predisposition for the attack is mainly obtained in the nonfocal (centrencephalic) epilepsy. It is partially and constitutionally heriditary conditioned. It is influenced by multiple

factors e.g. level of consciousness, water and ion metabolism, age, and endocrine factors. The predisposition for epilepsy is the greatest in the first years of life due to the brain tissue being immature and after a transient decrease it raises again during the maturance that is related to the endocrine variations. During adulthood it is stable. It is influenced by exogenous factors and different diseases. The predisposition for the attack is affected by the attacks themselves, because repeated epileptic attacks facilitate the generation of new attacks. This fact was proven experimentally by a long lasting stimulation, causes a permanent increase in the excitability after a period of time in an originally healthy neuronal population. This effect finally showed up as spontaneous impulses. This phenomena is called kindling. The mentioned mechanism applies in the formation of secondary mirror image foci, that maintain their independance of stimuli generation even after the removal of the primary epileptic focus. The spread of the epileptic stimuli is related to the so called brain modulating systems. These systems are capable of influencing some special and relatively vast neuronal population and tunning them into a certain type or a certain level of activity. Electrophysiologically they appear as a synchronized activity of wide brain areas and that is why they are called the synchronization systems. They have anatomical basis as well as some functional abilities to enhance or inhibit the spread of epileptic impulses. In conclusion we see that to facilitate or irradiate the stimulation three etiopathogenic factors might take place (Fig. 6.1).

1. **Cortical focal component**, that is a condition for the existance and the activity of the epileptic focus in the neocortex. This etiologic factor is mostly secondary in origin (trauma, vascular disturbances, tumors). The EEG shows a cortical electrographic focus and clinically it is manifested with attacks of symmetrical spasms with cortical aura.

2. **The centrencephalic or thalamocortical component** that's based on the hyperactivity of the modulating thalamocortical circle. The activity is on its maximum during the puberty. It might be as well influenced by a genetic predisposition or a metabiloc disturbance. The EEG shows bilateral changes that are symmetrical in the shape of spike and wave complexes, and clinically it is manifested as forms of abscence seizures or a generalized attack of the grand mal type.

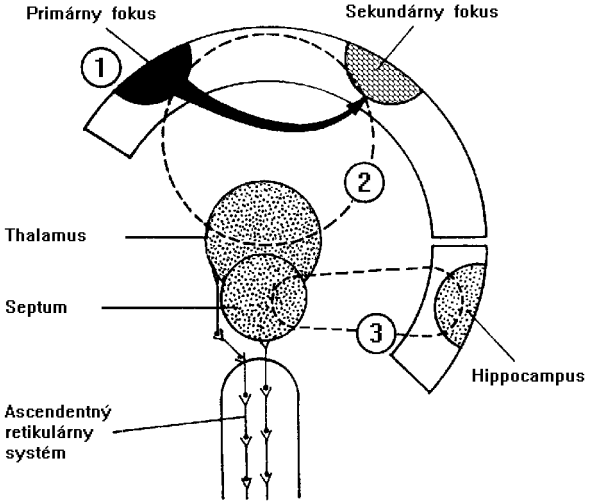

Figure 6.1: The etiopathogenic components of the epileptic proces: 1. cortical, focal, 2. thalamocortical, 3. diencephalotemporal (according to Vasku et al.: 1984)

3. **Diencephalotemporal component**, that is influenced by the hyperactivity in the second main synchronization diencephalotemporal circuit. The cause is usually traumatic, hypoxic, or inflamatory that occured in the early childhood. The EEG reveals some local abnormalities in the shape of theta waves, localized temporally. This condition is clinically manifested as psychomotor seizures.

6.12.2.2 Epileptogenic stimulus

The occurance of epileptic seizure needs apart from the focus and a certain level of attack predisposition the presence of a third factor that is the epileptogenic stimulus. Such a stimulus might be represented by a sudden change in the endogenous or exogenous environment (electric shock, and a visual or auditory stimuli). The epileptogenic stimulus in man is

rarely the determining component of epileptogenesis. This is more frequently seen in animals (audiogenic epilepsy in rodents and photogenic epilepsy in monkeys). Practically in man the most common reaction we meet is reaction to light that is either discontinuous, with a rhythmically changing intensity, possibly an interchanging black and white plains (disco, water surface, the sun between the tree lieves, TV, etc.). A very rare form is the reflex epilepsy where the seizure always occurs following the same stimulus.

6.12.2.3 The neurophysical and the electrophysical substrate of epilepsy

The epileptic focus is a site in the CNS that is characterized by a hyperactivity or hypersynchronization. It represents a neuronal network, that is prominantly excitable and the synchronized generation of spikes (action potentials) of single neurones is one of its characteristics. The cause of these characteristics are changes in the architecture of the neuronal network (the deficiency of the inhibitory neurones) and changes in the function of the focal neurones. The functional injury of the neurones is proven by the results of the scientific researches according to which the increased neuronal metabolism in the focus is not marely the result of hyperreactivity but partially itd's cause. From the electrophysiological point of view the changed physiological state of the focal neurons will cause their characteristic repeated rhythmical hypersynchronized depolarisation.

The expressive synchronized activation is shown on the EEG recording as typical high amplitude spikes and hence spike and wave complexes. Between the attacks the electrical activity of the focus neurons is characterized by a prominant depolarisation of the non stimulated neuron membrane (the so called depolarisation shift), that accompanies the generation of spikes.

After the depolarisation shift, hyperpolarisation will occur and the production of action potential will stop. It seems that apart from the inhibition zone in the vicinity of the focus there is also inhibition in the focus itself, despite the fact that this inhibition is charecterized by a certain latency. If the population of neurons transforms into the state of seizure, the inhibition will be lost and replaced with depolarisation. The shooting of spikes by the neurons will hence last for long. The neurons in the vicinity are activated and by this they become a part of the epileptic seizure and this process is called recruiment.

The intact zone of neurons that surrounds the epileptic focus will form an anextremely inhibited zone that surrounds the focal hyperactivity. This zone of neurons represents an obsticle that prevents the spread of the hyperactivity to the nearby areas, and only if this zone is dispensed the hyperactivity might continue to spread. This theory is supported by the fact that if the focus lies in the cortex these obsticle zones are always the cortico-thalamic junctions, and the generalization of the attacks can occur only when it passes through thalamus.

We assume that the generalization of the pathological hyperactivity from its primary focus demands a certain predisposition of the surrounding neurons to conduct this hyperactivity. Their excitation should be very similar to the spikes generation threshold (this means that the post synaptic potential must be relatively similar to the critical potential), so that further excitation that spreads from the epileptic locus can result in the generation of high frequency spikes.

This neuronal network state of function in the vicinity of epileptic focus i.e. their attack predisposition, can be achieved with a certain type of afferentation. It is well known that, some stimuli can cause an epileptic seizure (e.g. some epileptic foci are unblocked by a blinking light). The end result of this situation is the spread of the hyperactivity to the cortex and the occurence of epileptic seizure. The synchronized activity of the epileptic focus usually lasts for 50 till 100 ms. If they last few seconds or minutes and spread to all the cortical areas, there will be a generation of a partial or a generalized attack. After a certain time of this hyperactivity on a constant level there will be (and due to the feed back mechanism) a lateralized inhibitory junction that leads into neuronal inhibition and the attack (seizure) is ended. Another theory explains the ending of the seizure that it happens because of the exhaustion of the energy supply and reserves of the neurons and their resulting inability to generate action potentials.

Another important neurophysiological aspect of epilepsy is the synaptic conduction that becomes modified by a repeated synaptic activation (the post tetanic potentiation phenomena). The more often the synapse is activated the more conductive it becomes. Upon activating the synapses by a pathological activation there will be some fixation of this

activity. The vicinity of the epileptic focus will then become easily depolarized and tends to become one of the epileptic functional parts. This mechanism explains the occurence of the so called a mirror image loci in the contralateral hemispheres in those areas where synaptic junctions with the primary focus are located.

Theoretically we might think that personality changes of some complicated cases of epilepsy can be apart of other causes, a result of the mentioned pathological changes of the synaptic conduction in the cerebral cortex.

6.12.3 Classification of the epileptic seizures

The symptomatology of the epileptic manifestation is quite variable. The evaluation of the epilepsy development and the appropriate causative therapy largely depends on the accurate classification of the attacks. The recent clinical practice basically depends on the Gastout Classification, that was accepted in 1969 by The international association against epilepsy. It depends on the pathophysiological theories of the occurence and development of epilepsy with some insight into the clinical, electrophysiological and developmental aspects.

6.12.3.1 Focal epilepsy

Focal (parcial) epilepsy is usually secondary in origin. Its causes might be variable: perinatal trauma, head injury, neuroinfection, brain tumors, circulatory disturbances of the brain, etc. The discharge most commonly occurs in the cerebral cortex, most often in the temporal lobe and it is related phylogenic older structures (amygdala, hippocampus). The EEG record shows an evident focal discharge that is composed of either rhythmic or nonrhythmic sharp waves and some localized discharges of spikes and slow waves in the vicinity of the epileptic focus. There might be **a focal simplex seizure** (without loss of consciousness), **a complex seizure** (with loss of consciousess), or **a group of seizures** with a focal character in the beginning that later on transforms to the generalized form (secondary generalized seizures). Every focal attack can transform to a generalized one.

- **Jacksonian epilepsy** is manifested with focal (partial) attacks with a simplex symptomatology. A cortical spread of the discharge might occur, yet it remains sectorally limited. If the discharge comes to affect the precentral gyrus, it will then manifest clinically as a typical **Jacksonian motor epilepsy**. The spasms begin in a small localized area of the body (face, upper, or lower limb) and it gradually spreads to the homolateral half of the body. When the attack finishes, there might be a temporary paresis in the affected areas, so calld Todd paralysis. The localization of the discharge in the postcentral gyrus is manifested as a **Jacksonian sensory epilepsy** with the typical spread of unpleasent dysesthesis. The person remains conscious.

- **Psychomotor attack**. One of the focal (partial) attacks with a complex symptomatology. The epileptic focus is localized in the temporal lobe, in gyrus hippocampus or amygdala. The discharge spreads to the centrecephalic structures and to other parts of the brain, including the limbic system, that is the main morphological substrate for the demonstrated afferentation and the vegetative function of the organs. It is closely related to the phylogenetically younger structures of the cortex, as well as the brain stem. This explains that the motor and sensory symptoms of the attack are accompanied by vegetative, affective, and instictive manifestation. The psychomotor attack has got the widest symptomatology of all forms of epilepsy. It usually begins with a gastric aura, that is described as a hardly defined feeling in the epigastrium. The attack itself is manifested with different mechanical automatism – moving the mouth, licking, smacking, swallowing, undressing, opening the buttons running around, walking around etc. that are accompanied with psychological manifestation (illusion of the seen before, the feeling of depersonalisation, dreamy states, attacks of depression, etc.). The EEG occasionally shows some tonic spikes. The potentials range between 4–7 Hz in frequency, it is the so called theta activity. The psychomotor attack is associated with cloudy consciousness and amnesia.

6.12.3.2 The non-focal epilepsy

In cases of the non focal (centrencephalic) epilepsy the discharge originate in the central brain structures (in the centrencephalic area), from where it generalizes. These are **primary generalized seizures**, and they differ from those secondary generalized attacks in that they are generalized from the very beginning of the attack. The sudden involvement of both hemispheres is shown as loss of consciousness and symetrical mechanical manifestations. Compared with the focal epilepsy the non focal epilepsy is mostly caused by an increased attack predisposition.

- **Grand mal**. Lay people imagine a grand epileptic attack under the term epilepsy, the so called grand mal epilepsy. It seems very dramatic. It starts with a sudden deep loss of consciousness and the patient falls on the floor, this could be accompanied by an abnormal scream due to tonic spasm of the respiratory muscles that pushes the air out of the lung. In **the tonic phase** there will be a generalized spasm of the striated skeletal muscles. The limbs will transform from a short lasting initial flexion into extension, the head will be in **opisthotonic position**. The initial palor will be replaced with cyanosis due to a short stop of breath. The pupils are mydriatic with a negative photoreaction. After about 30 seconds the attack starts its **clonic phase**, that is characterised by symmetrical rhythmic muscular spasms of the whole body. After about 2 minutes the spasms start to relief and become slower till they fade away. Due to the spasm of the muscles of the larynx the patient breaths with difficulty and a frothy sputum flows out of his mouth, it could be bloody if the patient bites his tongue. The patient might urinate. The EEG recording shows generalized rhythmical bilateral synchronized and symmetrical sharp waves of high amplitude, and frequency of 100 Hz. In the post paroxysmal phase the patient is extremely tired, in deep coma, swetting and breaths with difficulty and stridor. The patient does not respond to spoken words nor to painful stimuli. After the patients gain their consciousness they are usually confused , disoriented and often aggressive. They have complete amnesia about the attack.
- **Petit mal**. Small seizures, petit mal, occurs mainly in children. The classical petit mal is manifested in three forms which are absency petit mal, myoclonic petit mal and akinetic petit mal.

Absency petit mal is characterized by a sudden short lasting disturbance of consciousness, that is manifested with a discontinuation of the previous activity. The child suddenly stares infront of him and does not react. There might be some attacks of blinking sometimes with deviation of eye bulbs or possibly some grimase with the mouth. After regaining the consciousness the child returns to his previous activity. The EEG recording shows bilateral synchronized and symmetrical discharges in the form of spikes and waves of a high amplitude and a frequency of 3 Hz. There is complete amnesia after the attack. The number of such attacks might be very high per day.

Myoclonic petic mal (impulsive petit mal) occurs in puberty. It is manifested by a short lasting and relatively strong grimases mainly of the upper limbs, and neck. They occur unilaterally and symmetrically either individually or in clusters. The EEG recording shows complexes of multiple spikes and one slow wave. There is no loss of consciousness.

Akinetic petit mal (Lennox syndrom) affects mainly children in the preschool age. It is manifested with a sudden flexory myoclonic contraction, and loss of postural tonus, so the patient falls down. The loss of consciousness is only temporary.

Infantile spasms (propulsive petit mal) occur in the early childhood before 6 months of age. These are clinically manifested as **a sudden spasms** (a sudden flexion of the head, neck, or the limbs), or as **salaam spasms** (a slow flexion of the head with crossing the upper limbs on the chest) that reminds the oriental greeting. The EEG recording shows some irregular synchronized discharges in the form of spikes as well as, sharp and slow waves.

6.12.3.3 Status epilepticus

Is a serious complication of epilepsy. The epileptic seizures are repeated continuously one after another, during which the patient remains unconscious and does not regain consciousness between the attacks. Attacks of the grand mal type the patient life is threatened. Death might occur due to heart at-

tack or brain edema. Status epilepticus rarely occur in other types of epilepsy (Jacksonian status epilepticus, status psychomotorius, and status petit mal).

6.12.4 Experimental epilepsy

Experimental epilepsy on animals is characterized as a motor reaction that is disproportional to the given situation. In psychological conditions the nervous stimuli that occur upon the stimulation of the nerve endings spread in a precisely defined tracts to subcortical and cortical areas in the CNS. In the place of the analyzor there will be stimulation that is bordered by inhibition. After processing the stimuly are conducted to afferent pathways and the result will be an organic cousative reaction – so called reflex. Any error in the interfunctioning processes of stimulation and inhibition in the brain leads to a non coordinated simultaneous spread of stimuli via many pathways in different directions, as a result of this, there will be an epileptic seizure.

An epileptic attack in animals could be evoked by:

- electric current (electroshock)
- pharmacological and metabolic substances (e.g. setting metabolic alcalosis in rabbits)
- focal brain damage (freezing of brain tissue in dogs, electrocoagulation of brain tissues in monkeys)
- audiogenic and photogenic stimuli (audiogenic epilepsy in rodents and photogenic epilepsy in monkeys).

The model of **audiogenic epilepsy** in rats demonstrates an epileptic seizure and the possibility of pharmacological alternation of the resulting functional state of the nervous system.

It is well known that the organism responds to unexpected or intensive sound by motor reaction. This is a phylogenic old unconditional orientation reaction, that predisposes the organism for flight or fight. A rat that lives in dark environment most of the time has a very developed auditory organs (the rat hears in the region between 22 Hz – 100 KHz). It is extermely sensitive to tones of high frequency and intensity. About 90 % of the infantile rats react to light by a marked motor restlessness, and some of them develop an epileptic attack even without pharmacological interaction upon auditory stimulus. The reason of this audioepileptogenic disposition in rats is yet unknown. It is interresting that upon extripation of the auditory and motor areas from the cerebral cortex, or even a complete decorticalisation can not prevent the occurens of audiogennic attack.

The manifestations of audiogenic epileptic attack in experimental animals are very much similar to the attack in human. Adversive syndrom of head and eye bulbs deviation to one side, with a simultaneous occurence of tonic and clonic spasms might occur in the grand mal type. Akinesis accompanies the petit mal form. This similarity of signs enables us to use animal models not marely for demonstration but also for the study of epileptic attacks.

6.13 Disturbances of the oxygen supply to the brain

An adequate supply of oxygenated blood to all parts of the nervous system is a condition for its normal function. The most sensitive parts of the nervous system to oxygen defficiency are the most specialized ones – especially the cerebral cortex. The blood supply of the brain comes via the common carotid artery and the internal carotid artery as well as the vertebral artery. Both supplied areas are interconnected via the posterior cerebral artery that will complete the circle of Willis. This is how the disturbances of blood supply can be compensated by one of these vessels. Those compensatory mechanisms are favourable mainly in the pathological conditions, they are more efficient in young age.

The cerebral circulation depends on many factors: **the perfusion pressure of the brain, blood viscosity, the characteristics of the cerebral blood field**.

The perfusion pressure is determined by the difference between the mean arterial and the intracranial pressure that represents the venous pressure and the interstitial pressure of the brain tissue. Upon a decrease of the arterial pressure, and hence an increase in the venous pressure (disturbed outflow, stasis) or upon an intracranial hypertension the blood supply is worsening.