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Anaplastic Oligodendroglioma WHO III Brain Cancer-Patient Recovered Following Operation, Radiation and Chemotherapy Through Coordination Dynamics Therapy, which is also A Covid-19 Treatment without Ventilator

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ABSTRACT

The 72-year old male patient Hans suffered the maligned anaplastic oligodendroglioma WHO III at the Wernicke language cortical area after an undetected hematoma on the other side. Coordination Dynamics Therapy (CDT) was started after the removal of the brain cancer, the radiation and chemotherapy. At the beginning of therapy, the patient was disoriented, could not communicate through speech or writing, could not stay in certain movement patterns, because of low pattern stability and he also had hypertension. With 4 months of CDT, the hypertension was cured, the patient had re-learned walking, running and jumping and he was able again to cycle 14 km to the remote hospital. The aphasia had substantially improved. He had re-learned to write and read a bit. For a few minutes he became able again to communicate by speaking, without mixing words and sentences. No indication for cancer recurrence so far. Such an enormous progress was possible because of exercising integrative coordinated arm and leg movements on a special CDT device in coordination with instructions and self-instructions like '2, 3, 4'. Also, jumping, walking, running and other movements contributed to the repair.

After four months, the intensive treatment of the patient with the Author through interpersonal coordination became impaired through Covid-19 regulations, with the possible consequence of cancer recurrence. The Covid-19 infection around the world is a symptom for the destruction of earth, as well as an out-of-date mainstream medicine by not organizing (and ignoring) basic human medical research, as for example human neurophysiology. Based on human neurophysiology and the development of CDT, a **treatment for Covid-19 infected patients through CDT without using ventilators is introduced**. Furthermore, the immune system naturally activated through CDT will also fight against infections, which were additionally caught at hospital facilities. The first protection shield against viruses and bacteria is the lung epithelia. The corruption in the building system with the consequence of impairments of lung epithelia functions through polluted air with a wrong ionization give Covid-19 or flu viruses a good chance for an attack, supported by insufficient hygiene and missing specific knowledge. CDT can improve the body's defenses, including cardio-vascular performance and improved immune system functions. The behavior of humans on earth is compared with the myth of the 'Tower of Babel'.

Keywords: Oligodendroglioma, Human neurophysiology, Human repair physiology, Coordination dynamics therapy, Movement repair, Speech repair, Cancer growth inhibition, Cure of hypertension, Covid-19 treatment

INTRODUCTION

It has been published that the movement-based learning therapy "coordination dynamics therapy (CDT)" can improve or repair central nervous system (CNS) functioning after stroke [1], traumatic brain injury [2,3], spinal cord injury [4,5,6,7,8], cerebellar injury [8], cerebral palsy [9], hypoxic brain injury [10], in Parkinson's disease [11,12], spina bifida (myelomeningocele) [13] and scoliosis [14]. Speech had been induced and improved in a patient with severe cerebral palsy [15] and in a permanent coma patient [16].

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Urinary bladder functions were restored in patients with spinal cord injury [7,15]. In patients with cancer, especially breast cancer, cancer growth could be inhibited via CDT [17]. A partial repair of the brain could be achieved in a permanent coma patient who lost approximately 50% of the brain. He recovered from coma through 4 to 5 years of CDT with 20 hours therapy per week and relearned to speak following 6 years of CDT [16]. A transient regeneration of the spinal cord could be achieved in a 9.5 years old girl through CDT [18]. Cardio-vascular performance could be repaired in a coma patient (page 460 of [19]). Details of human neurophysiology and movement-based learning theory to repair the neural networks of the human CNS have been published in three books [15,19,20]. A review of CDT has been published recently [21].

If CDT can improve or repair CNS functioning in different diseases, then it should be possible to improve CNS functioning or health in patients with several diseases simultaneously and make the patients live longer with a better quality of life [22]. But the patients have to train at their limits, that means at least 20 hours therapy per week, to use all the repair benefits of CDT.

Especially infiltrating growing brain cancers as astrocytoma and oligodendroglioma are devasting diseases because if too much cancer and brain tissue is removed, then the patient has no quality of life after the operation anymore. If too little tissue is removed, the patient can survive better following the operation, but the cancer recurrence often comes more quickly. Since CDT can repair CNS functioning following brain tissue removal and inhibits cancer growth [17] at the same time, CDT should be ideal for using it in connection with conventional cancer treatment, especially in order to make the patient live longer with a better quality of life, assuming the patient is willing to fight for a longer better life by training at limits [22].

It is reported here about a patient with hypertension and an undetected hematoma, who suffered an anaplastic oligodendroglioma WHO III. Following cancer extirpation, radiation and chemotherapy, CDT was administered to him. The treatment of the maligned brain-cancer was partly impaired by Covid-19 regulations induced by Covid-19 hysteria. This very cooperative 72-year-old male patient was an optimal patient because he was fit and liked physical exercises. It will be shown what tremendous progress could be achieved with him.

When I was post doc with Katz, Huxley and Miledi at the Department of Biophysics, University College London, I learnt the following: 'When you do your research thoroughly, you come across all problems automatically'. Katz and Huxley had tremendous knowledge and they had the ability to very sharp. The Greek philosopher Socrates had a similar strategy, namely to think sharp and logically.

METHODS

Human neurophysiology

Coordination dynamics therapy is a movement-based learning therapy which is based on human neurophysiology and human repair physiology. With the developed single-nerve fiber action potential recording method [23], the impulse traffic between the periphery and the CNS can be analyzed at the single-neuron level under physiologic and pathologic conditions. For identifying the action potentials from which was recorded, a classification scheme for human peripheral nerve fibers was developed [24] **(Figure 1)**. The important finding is that the nepural networks of the human CNS are organizing themselves by phase and frequency coordination [25] among neuron firings. This phase and frequency coordination can be measured rather easily because the motoneurons fire for high activation oscillatory [26] and these oscillatory firing patterns can be used as reference bases for analyzing neural network organizations at the single neuron level under rather natural conditions. Following injury, malformation and degeneration this phase and frequency coordination becomes impaired and has to be repaired through movement-based learning (CDT).

Because of lost nervous tissue during injury, other parts of the brain have to take function over by plasticity, induced efficiently by the re-learning of the automatisms creeping, crawling **(Figure 2A)**, walking running and jumping **(Figure 2B)** and especially the re-learning old-learned movements like riding a bicycle. To repair the neural network oscillators, jumping or similar movements have to be exercised. All movements help for repair. But since neural network repair takes time, those movements have to be trained with the patient, which repair efficiently. The efficiency of repair can easily differ by a factor of 100. This means that if, for example, the time period for a certain efficient repair is 1 year through movement-based learning, an inefficient treatment may need 100 years.

In a real therapy the progress has to be quantified. This can be achieved by measuring the improvement of movements and by measuring the improvement of CNS functioning directly through the "Coordination Dynamics" values. The measuring of the coordination dynamics is based on the "System Theory of Pattern Formation" (see below). To understand the brain repair through neural network learning [20] and learning transfer [27] from movements to speech pattern formation, word finding and communication, also the System Theory of Pattern Formation [28] is used.

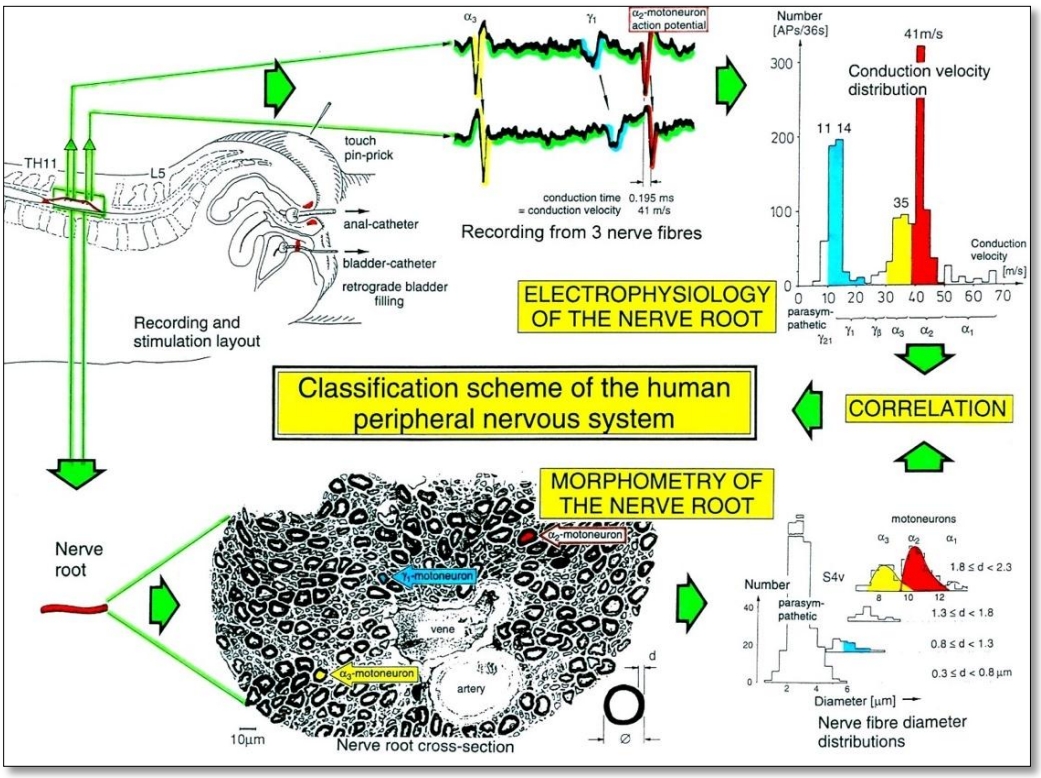

Figure 1. Development of a classification scheme for human peripheral nerve fibers. Conduction velocities (V) and nerve fiber diameters (∅) of afferent and efferent nerve fiber groups in normal humans and in patients with a traumatic spinal cord injury for 0.5 to 6 years.

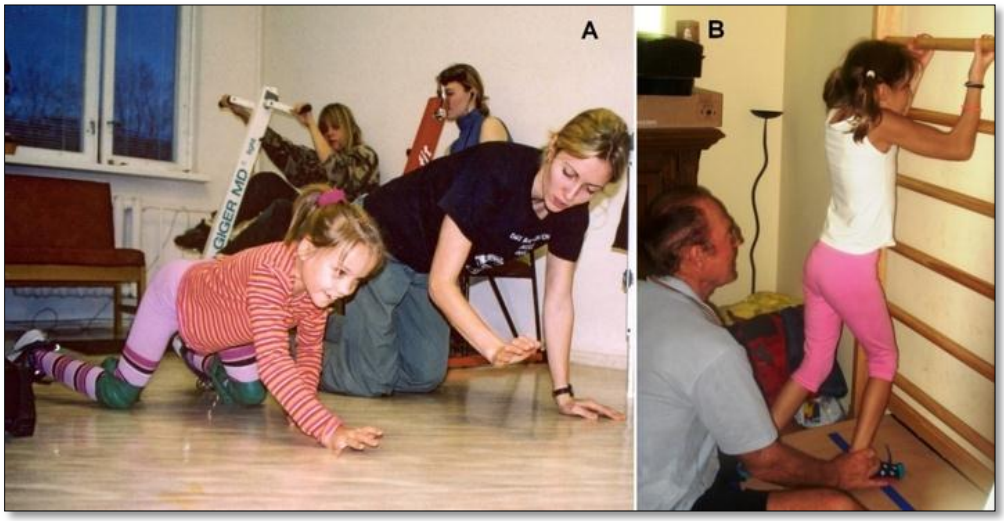

Figure 2. A. Trot gate crawling of a cerebral palsy girl in interpersonal coordination with a therapist. The crawling performance of the therapist is not optimal. The right arm is leading with respect to the left knee. Also, the crawling performance of the patient is not optimal; the knees are too much apart. B. Ten-year-old patient Nefeli with an incomplete spinal cord injury during jumping on springboard, supported by the author. With the right small finger, the author is keeping the foot in a physiologic position to improve the afferent input to the CNS during jumping.

Integrative Physiology: System Theory of Pattern Formation for understanding neuronal network organization, learning and learning transfer

To understand the on-going changes of movement and other patterns in healthy humans and in patients with CNS injury, malformation and degeneration (aging), the System Theory of Pattern Formation is used. In a complex system like the human CNS, patterns are generated by a nervous system which seeks cooperative stability. Stability is what defines collective states. The system has the tendency to slip into the collective states to which it is attracted. When an infant crawl **(Figure 2A)**, its arms and legs are strongly attracted to the 'pace' and 'trot' gait patterns. The attraction is so strong that intermediate crawling patterns seemingly do not exist, as if the patterns are hard-wired. But with the help of a special CDT device the CNS can generate intermediate coordination patterns between pace and trot gait. A patient with a CNS injury often crawls with intermediate arm and leg coordination patterns and has to re-learn the pace and trot gait coordination's for CNS repair and shifts in this way the attractors for crawling to the pace and trot gait coordination's. Attractive states and attractors of CNS organization can be pictured as a ball in a potential well or more generally in an attractor layout. Changes in CNS functioning are characterized as continuous stabilization and destabilization, over time, of preferred attractor states.

To reduce for understanding the complexity of human neural networks of the many billions of neurons, **order parameters** or **collective variables** are introduced for the generation of certain movements. An equation of motion describes the coordination pattern dynamics. However, coordination patterns are not only determined by the task or biological function. Patterns adjust continuously to requirements from the environment (transmitted by impulse patterns from stimulated receptors in the periphery), memory, intention and support given by a therapist. The specific requirements are captured by the concept of behavioral information and are made part of a vector field that attracts toward the required patterns. The coordination pattern dynamics, characterized by equations of motion of collective variables (the vector **X**), takes the general following form [28]:

$$d\mathbf{X}/dt = \mathbf{F}_{intr}(\mathbf{X}) + \sum c_{inf}\mathbf{F}_{inf}(\mathbf{X},t) \qquad (2)$$

where $\mathbf{F}_{intr}$ designates the **intrinsic dynamics** of the nervous system. These intrinsic dynamics capture the anatomical (neuronal network structure), physiological and pathological states of the CNS and its muscular-skeletal elements.

$\sum c_{inf}\mathbf{F}_{inf}(\mathbf{X},t)$ represents the sum of external influences ($\mathbf{F}_{inf}(\mathbf{X},t)$) with their relative strength (c_{inf}) pertaining to each influence. The so-called **behavioral information** $\mathbf{F}_{inf}(\mathbf{X},t)$ includes cognitive states, emotional states, intentions, motivations, instructions, inter-personal coordination [29], movement support etc. During motor learning or while applying therapy to a patient these extrinsic influences become extremely important, because the intrinsic (pattern) dynamics can be changed with these extrinsic influences by altering the equation of motion. By modulating the behavioral information, the intrinsic dynamics of the neuronal networks can be influenced further, that is if CDT is no longer efficient in repairing the injured CNS, requiring the therapy to be updated. With respect to a healthy athlete, the movement performance can be improved by modulating the behavioral information by for example including in the training program the exercising on a special CDT device to improve CNS functioning.

If the behavioral information includes the exercising of extremely coordinated, integrative movements, like exercising on the special CDT device **(Figure 3)**, then the quality of CNS self-organization can be enhanced by improving the exactness of self-organization, namely the precision of phase and frequency coordination among neuron and neural assembly firings. By improving the precision of organization of the intrinsic dynamics, that is the specific variability of the injured networks, certain patterns do eventually re-appear in the case of repairing the injured CNS by movement-based learning.

A **first novel step** in coordination dynamics therapy is the inference derived from the formula 2 of the equation of motion. It suggests that the movement learning does not only improve the performance of that particular movement but does also improve the other non-trainable functions by **transfer of learning** [27]. These functions include vegetative functions like bladder control, breathing, speech and higher mental functions including emotions.

Furthermore, we have means by which the stability of physiological network states can be increased (e.g. movements, continence, continuous concentration in performing certain task, speech etc.) and simultaneously the stability of pathological network states, like spasticity, decreased. The coordination (pattern) dynamics therapy, partly based on the System Theory of Pattern Formation, in combination with human neurophysiology, thus offers us an important theoretical basis and a practical tool to diagnose, quantify and repair/improve the functioning of the human nervous system at the macroscopic level.

The need to improve the stability of phase and frequency coordination to allow specific pattern formation and learning transfer

The self-organization of CNS networks by phase and frequency coordination has to be improved to make learning transfer, for example from movements to speech functions, possible, since in every CNS injury the phase

and frequency coordination became impaired. Large instabilities in phase and frequency coordination will not allow specific pattern formation as a basis for learning and learning transfer. However, the stability of phase and frequency coordination can be improved when the patient is exercising on special coordination dynamics therapy devices.

The **importance of stable phase and frequency coordination, to allow specific pattern formation and in consequence learning transfer to other patterns,** can be understood at the collective variable level (1) and at the neuron level (2).

(1) The behavioural information $\mathbf{F}_{inf}$ of the coordination pattern dynamics, characterized by equations of motion of collective variables, $d\mathbf{X}/dt = \mathbf{F}_{intr}(\mathbf{X}) + \sum c_{inf}\mathbf{F}_{inf}(\mathbf{X},t)$, affect the whole coordination pattern dynamics, including stability, rather than only certain coordination patterns. If the behavioural information includes the exercising of extremely coordinated, integrative movements, like exercising on the special CDT device for turning, then the quality of the CNS self-organization can be enhanced by improving the exactness of self-organization, namely the precision of phase and frequency coordination between neuron and neural assembly firings. By improving the precision of organization of the intrinsic dynamics $\mathbf{F}_{intr}(\mathbf{X})$, that is, the specific variability of the injured networks, certain patterns do then already re-appear spontaneously.

(2) Neurons often serve more than one network pattern at the same time by time sharing of neuron firing and, in this way, give rise to learning transfer among the activated patterns. If sub-networks are improved in the organization of one pattern, the organization of the other pattern will also improve. Neurons involved in the organization of breathing and activating intercostal muscles, for example, are also involved in the organization of trunk stability. By reducing spasticity of the trunk (in patients with spinal cord and/or brain stem injury or patients with Parkinson's disease) breathing will also improve. Similarly, sphincter motoneurons are involved in continence and pelvic floor weight bearing. If the pelvic floor is not trained during pregnancy, incontinence sometimes occurs and continues into the antenatal period.

Quantifying CNS functioning by measuring pattern stability upon pattern change when exercising on a special CDT device

Figure 3. Recording of the coordination dynamics when exercising on a special CDT device of a 72-year-old patient after the removal of an anaplastic oligodendroglioma WHO grade III and radiation therapy. He exercised on a special CDT device to repair the brain due to injury, caused by the operation, to inhibit cancer growth and to improve hypertension simultaneously to live longer with a better quality of life.

Movement pattern stability is tackled here especially because the brain-cancer patient Hans had at the beginning of therapy very poor pattern stability and switched often from one movement pattern to another one. When for example he started to freely jump, then suddenly he walked away involuntary.

Experimentally, the underlying dynamics of coordinated movements can be found in the **temporal stability** of coordination patterns and can be **assessed through pattern change** (**the possibility of measuring CNS functioning through pattern change is the second novel step in CDT**). A change of the coordinated movement patterns is generated, when a subject is exercising on the special CDT and recording device **(Figure 3)**, where the coordination between arms and legs, imposed by the device, changes continuously between pace (P) and trot gait (K) and backwards. The stability of the intrinsic coordination tendencies is measured by the deviations and differential stability during the performance of these rhythmic movements. When the differential stability of the movement pattern is high, the arrhythmicity of exercising is small and when the stability is low the arrhythmicity of exercising in that pattern is high. In the healthy case the arrhythmicity is low for the pace and trot gait coordination's and is high for the intermediate coordination's between pace and trot gate. The pace and trot gait coordination's between arms and leg movements have a high stability and the intermediate coordination pattern have a low stability.

The mean stability per minute can be measured by the arrhythmia of exercising (df/dt:f, f = frequency; or dv/dt, v = angular velocity) when exercising on a special CDT device. Such differential stability value per minute, the so-called coordination dynamics value, quantifies CNS functioning objectively, integrative and non-invasively. The practical assessment of quality of CNS organization through **pattern change by using the special CDT device is the third novel step in CDT.** The measuring of coordination dynamics (CD) values are used here for low and high load. The high-load CD values were especially informative and were obtained by summing up single CD values for increasing and decreasing load, Δ (high-load CD value) = Δ20N + Δ50N + 100N + Δ150N + 200N + Δ150N + Δ100N + Δ100N + Δ50N + Δ20N + Δ20N), and taking the mean of forward and backward exercising.

For CNS functioning quantification, the pattern stability (the arrhythmia during turning) is measured during pattern change, when exercising on the special CDT device and the mean per minute taken.

Equation of motion, potential function and attractor layout for the movement 'jumping'

For the special movement 'jumping' with no behavioral information ($\sum c_{inf}\mathbf{F}_{inf}(\mathbf{X},t) = 0$) the equations of motion (formula 2) take the form:

$$d\varphi/dt = f_{intr}(\varphi)$$

where φ is the relative phase between the two moving legs and is the only collective variable of this special movement.

The mathematical solution of $d\varphi/dt = f_{intr}(\varphi)$ in the Haken-Kelso-Bunz model [29, 30] gives the equation of motion for jumping for the symmetric case:

$$d\varphi/dt = -a(t)\sin\varphi - 2b(t)\sin 2\varphi$$

The so-called potential function is defined by

$$d\varphi/dt = -\partial V(\varphi,t)/\partial\varphi.$$

By integration we obtain the potential function for jumping:

$$V(\varphi,t) = -a(t)\cos\varphi - b(t)\cos 2\varphi$$

The potential function $V(\varphi,t) = -a(t)\cos\varphi - b(t)\cos 2\varphi$ can be plotted for different φ and certain ratios of the parameters a and b and is shown in **Figure 4**.

The potential function shows two attractor states, namely the jumping in in-phase (φ = 0) and the jumping in anti-phase (φ = ± π). Especially for higher frequencies (smaller b/a) the jumping in-phase has a higher stability (the potential well is deeper) than the jumping in anti-phase. Asymmetry (not tackled mathematically here) strongly changes the stabilities of the attractor states (depths of potential wells) **(Figure 4)**.

The human CNS, seeking for cooperative stability, slips into the collective states to which it is attracted. For jumping on springboard these attractive states are the jumping in in-phase and in anti-phase. For crawling (not creeping) the attractive states are the pace (in-phase) and the trot gait coordination's (anti-phase).

Since such a potential function can no longer be derived from more general movements, especially when the CNS is injured, malformed or degenerated, the temporal stability of different movement patterns, for a characterization of CNS functioning, has to be measured. This became partly possible by measuring the so-called coordination (pattern) dynamics (see above).

Including the variability of phase and frequency coordination among neuron firing into the equation of motion of the collective variables

Depending on the relationship between the initial coordination dynamics (so-called intrinsic dynamics, $\mathbf{F}_{intr}(\mathbf{X})$, depending strongly on the severance of the injury) and the patterns to be re-learned (termed behavioral information, $\sum c_{inf}\mathbf{F}_{inf}(\mathbf{X},t)$, which act as attractors of the coordination pattern dynamics toward the required patterns), qualitative changes in the attractor layout occur with learning, accompanied by qualitative evidence for loss (or change) of stability. The nature of change due to learning (e.g., abrupt versus gradual) arises from the cooperative and competitive interplay between the

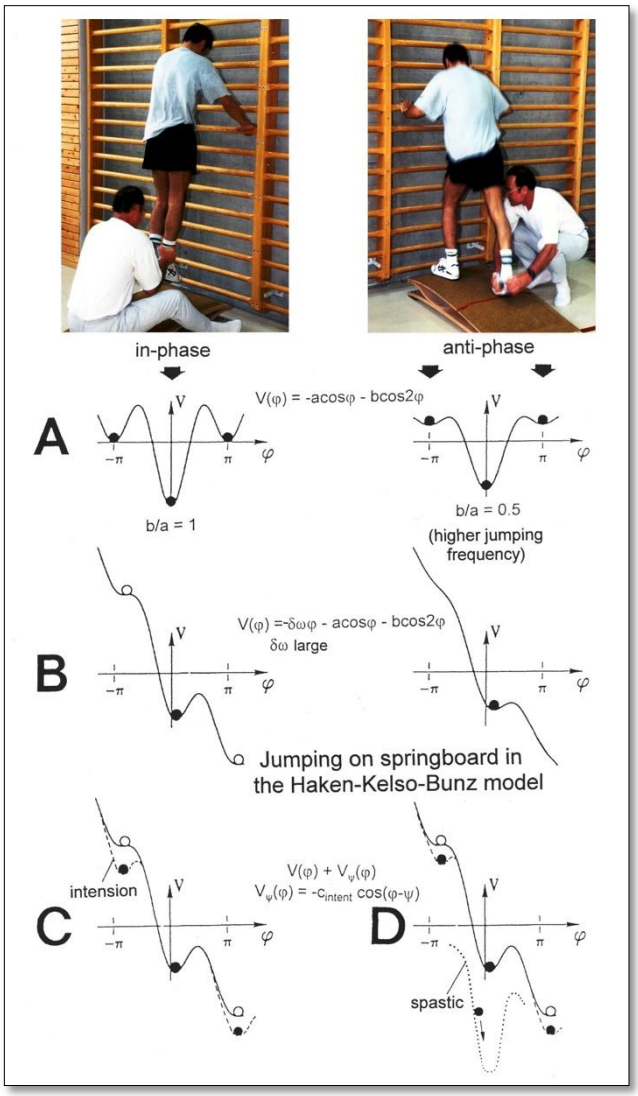

Figure 4. The jumping on springboard in in-phase and in anti-phase, analyzed by the Haken-Kelso-Bunz model in the framework of coordination dynamics. The stability of jumping patterns is represented by the potential wells (derived from the formulas) and a ball moving in the potential landscape. Dark ball = stable state (attractor state), white ball = unstable state. In 'A', the CNS injury is small; in 'B' and 'C' the injury is more severe with impaired symmetries.

behavioral information (supported jumping or walking of the patient) and the intrinsic dynamics.

A completely different, additional nature of necessary learning is needed for a repair of CNS injury. The impaired phase and frequency coordination among neuron firing has to be repaired by re-learning it for proper CNS self-organization. This perturbation of CNS self-organization produces deviations from the attractor states and changes the attractor layout because of altered hard-wiring due to injury. In a first approximation, this tremendously increased variability of phase and frequency coordination can be included into the equations of motion of the collective variables and gives further understanding of pattern change in patients with CNS injury as for example the switch from the jumping pattern to the walking pattern.

In the Haken-Kelso-Bunz model, the jumping **(Figure 4)** can be described in terms of relative phase between the rhythmically moving legs. Without specific behavioral information the dynamical description is defined by a vector field (a differential equation) expressing the rate of change in relative phase, dφ/dt, as a function of the derivative of its potential, V(φ):

$$d\varphi/dt = - dV(\varphi)/d\varphi + (Q\xi_t)^{1/2} \quad (3)$$

where $V(\varphi) = - a\cos(\varphi) - b\cos(2\varphi)$ and $(Q\xi_t)^{1/2}$ is the phase and frequency variability of strength Q (where ξ_t is Gaussian white noise of unit variance). Zanone and Kelso [31] introduced noise in Equation 3 (from a logic point of

view), because all real systems described by low-dimensional dynamics are coupled to many subsystems at a more microscopic level. One may view noise as a continuously applied perturbation that produces deviations from the attractor state. Such fluctuations are conceptionally important in dynamical modeling of phase transition or bifurcation phenomena and are essential in effecting transitions.

The author included noise in Equation 3 (from the experimental point of view) because of the measured increased variability of phase and frequency coordination among the coordinated firing of neurons and neural assemblies in the human CNS. This at the neuron level measured fluctuation of phase and frequency coordination is giving rise to phase transitions or bifurcation phenomena and is essential in causing transitions among attractor states under physiologic and pathologic conditions. In the physiologic case the variability of phase and frequency is small and was measured at the neuron level by a normal small eigenfrequency distribution (**HT5 of Figure 5)**. In the pathologic case (CNS injury) the variability of phase and frequency is large and was measured at the neuron level by the large range of eigenfrequency distribution **(Para 2 in Figure 5)**.

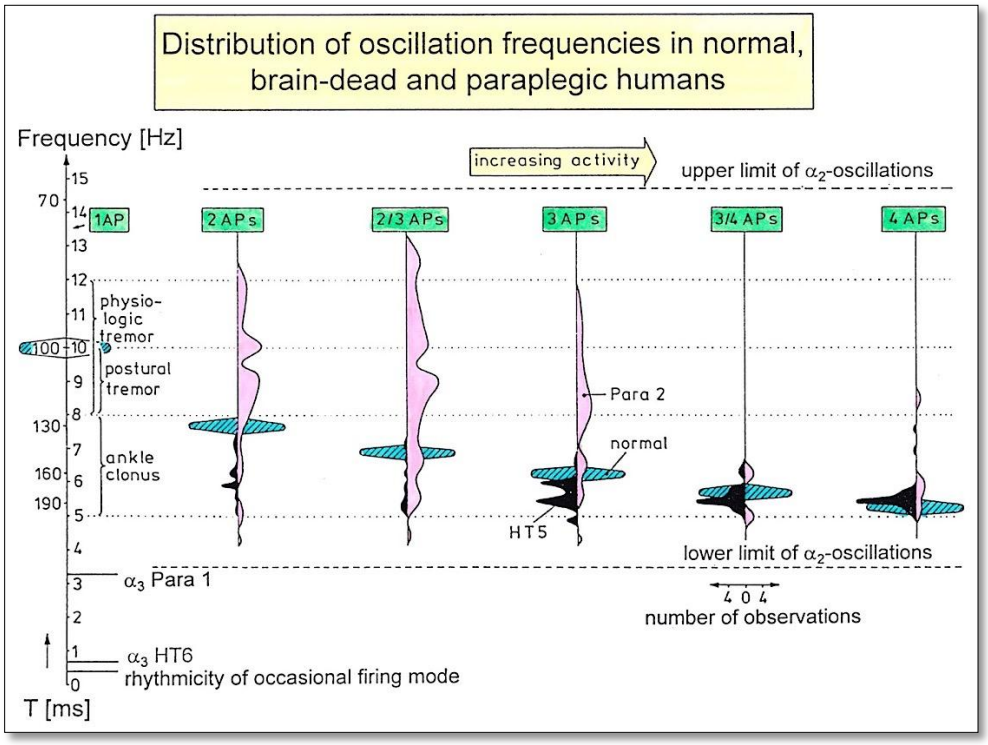

Figure 5. Frequency distributions of oscillation frequencies of continuously oscillatory firing α_2-motoneurons with increasing number of APs per impulse train (increased activity) in paraplegic 2 (open), in brain-dead HT5 (filled), and probably normal human (cross-hatched). Frequencies and rhythmic activity changes in the occasional and oscillatory firing mode are indicated. Ranges of physiologic tremor, postural tremor and ankle clonus are also drawn. Note that frequencies for the brain-dead HT5 are too low, and the oscillation frequencies of the spinal cord, isolated for a long time (Para 2), are too high and too spread as compared to the theoretically predicted frequency ranges (cross-hatched). T = oscillation frequency.

The relative stability of an attractor states is, therefore, reflected by the depth of each potential well (I), the strength Q of the variability of phase and frequency coordination (II) and the attraction of attractor states by the slope at each point of the potential curve.

The behavioral changes when jumping on springboard **(Figure 4)** are represented by the over-damped movement of a rolling ball in the potential landscape for the physiologic (Figure 6A, Q small = little fluctuation of phase and frequency coordination) and the pathologic case **(Figure 6B, C, Q large = large variability)**. The increased fluctuation in the rather stable state, due to increased variability of phase and frequency coordination, will have greater probability of "kicking" the system out of attractor the basin **(Figure 6B, C)**, especially in the asymmetric case.

In the healthy CNS, the phase and frequency variability is small (short arrows) and the jumping in-phase and anti-phase is stable **(Figure 6A)**. Following injury, the

potential landscape is deformed and the fluctuation of the network states, generating jumping, is high **(Figure 6B)**.

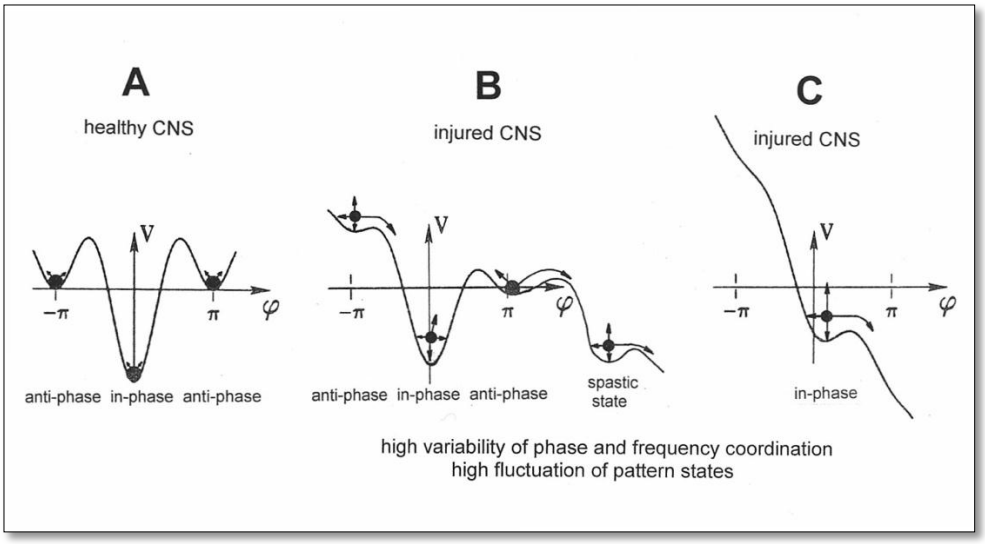

Figure 6. The potential, V(φ), of the coordination dynamics for jumping on springboard of a healthy (A) and injured CNS (B,C). The region around each local minimum acts like a well that weakly traps the system into a coordinated state. Behavioral changes are represented by the over-damped movement of a rolling ball in the potential "landscape". High fluctuations (indicated by long arrows attached to the ball (network state)) in the stable state, due to high variability of phase and frequency coordination (in the injured case), will have a greater probability of "kicking" the system out of the basins of attraction (B, C) than for low fluctuations (short arrows) (A), due to small variability of phase and frequency coordination (in A). In B, only the in-phase jumping is stable, even though the fluctuation is high. In C there is only an attractor basin for the in-phase jumping, but the fluctuation is so high that there is a high probability that the system is kicked out of the basin of attraction. The patient can no longer jump in anti-phase and has difficulty with jumping in-phase; he would need support as in **Figure 4** (upper left). The stability of jumping depends on the motor program (deepness of basin of attraction) and the fluctuation of the pattern state (moving of the ball) caused by the increased variability of phase and frequency coordination due to the injury.

The in-phase jumping is still stable in spite of the increased fluctuation, because the basin of attraction is deep. The jumping anti-phase became unstable because the basin of attraction is shallow and the increased fluctuation in the state has a greater probability of "kicking" the system out of the basin. A switch into a spastic state is also possible. In severe CNS injury or malformation, the patient cannot jump any more in anti-phase because of the missing of attractors for anti-phase jumping **(Figure 6C)**. Support is needed for anti-phase jumping **(Figure 4, upper right)**. The jumping in-phase is still possible but unstable **(Figure 4, upper left)**.

Upon performing very exact coordinated movements, imposed by special CDT devices **(Figure 3)**, the nervous system of the patient learns to reduce the variability of phase and frequency coordination and achieves in this way a small fluctuation of the network states again as shown in Figure 6A. The progress in treatment (learning) is that the in-phase jumping in Figure 6C and the anti-phase jumping in Figure 6B become stable **(Figure 6A)** again. Also, the potential landscape will change due to the reduction of the phase and frequency variability. The important consequence for treatment is that when exercising on special CDT devices and reducing in this way the variability of phase and frequency coordination, the patient can induce the formation of patterns again, without having trained them (learning transfer). Upon improving the coordinated firing of neurons, a permanent coma patient relearned to speak following 6 years of CDT [16].

In conclusion, the impairment of phase and frequency coordination, measured at the neuron level in human, can be included in the coordination dynamics at the collective variable level. The decrease of the variability of phase and frequency coordination (one kind of coordination repair) is an essential part of CNS development and repair by movement-based learning.

Geographical landscape of attractors

The drawback of the equation of motion of the order parameters (formula 2) is that it is normally not possible to find a mathematical solution to it. But by defining a potential function and by picturing the attractive states and attractors by a ball in a potential well or rather by a

ball moving in a geographical landscape of attractors **(Figures 4, 6)**, we form a theoretical basis to understand and measure stability of certain coordinated movement patterns (i.e. the deepness of the potential well of an attractor and the variability of phase and frequency coordination) in patients with CNS injury who receive on-going therapy.

Repair of the stability of the pattern 'running on treadmill'

Because Kelso said in his book that stability of movement patterns is foreign in movement sciences [29] and because the upper theoretical physics theory is a bit difficult, a nice example will be given how a patient with severe brain injury improved the stability of the movement pattern "running on treadmill".

It is not sufficient to re-learn a pattern following CNS injury. Important is that the patient can maintain the pattern as long as desired. Therefore, pattern stability also has to be repaired. When the patient Sotiris with severe brain injury following a car accident re-learned running on a treadmill **(Figure 7)**, also the stability of the pattern 'running' was repaired. The repair of the stability was measured by the time how long the patient could run without losing the pattern. The longest running period per day was used to quantify repair progress. He could manage his balance problems by briefly touching the rail of the treadmill. However, when he lost the pattern, the treadmill had to be stopped and he had to concentrate for some time before starting again.

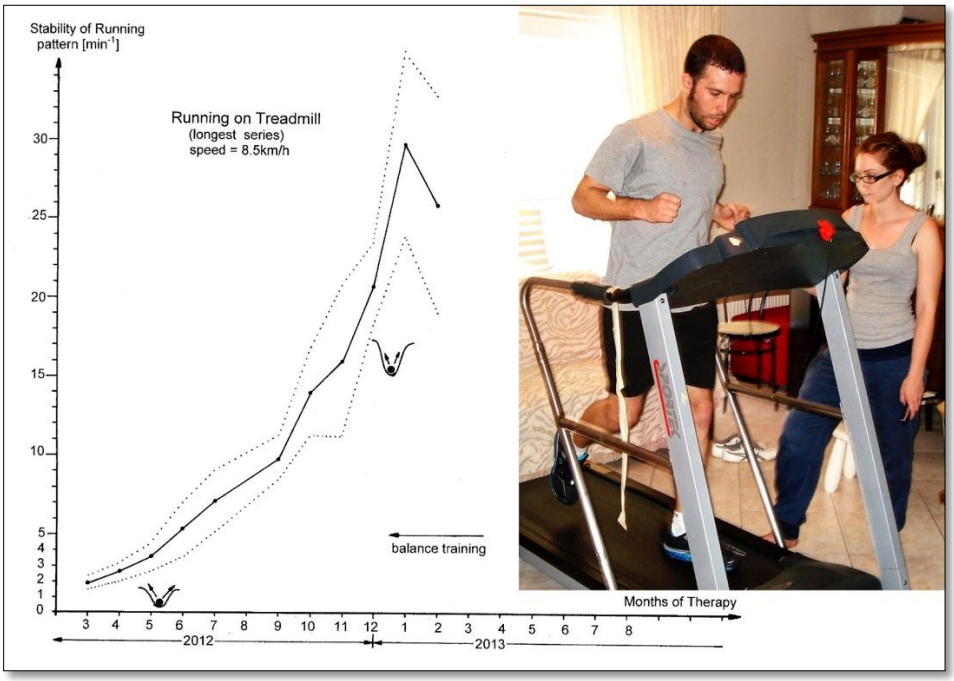

Figure 7. Improvement of the stability of the movement pattern 'running on treadmill' in the forward direction in dependence on therapy time in a patient with severe brain injury following a car accident. The stability of the movement pattern 'running' is quantified by the longest time in minutes the patient could stay in the running pattern with several trials and following a warming-up running. Note that the stability improved strongly. Two insets characterize the increase of the 'pattern stability' with a ball (state of the system) in a potential well. This picturing of stability has its scientific basis in the system theory of pattern formation and human neurophysiology. Within the system theory of pattern formation, the stability of a pattern is pictured by a ball (the state of the system) in an attractor layout (here the potential well). The variability of the pattern running (the 'moving of the ball' in the potential well) is characterized by the lengths of arrows and has its scientific basis in the variability of the phase and frequency coordination of neuron firing (human neurophysiology). Note, with on-going treatment the potential well (the attractor) is getting deeper and the arrows are getting shorter (improvement of phase and frequency coordination).

Figure 7 shows the improvement of running at 8.5km/h on treadmill. At the beginning he could run only 2min before losing the pattern. Eight months later, he could run 30 min. The stability of the running pattern had increased by a factor of 15.

The increase of running pattern stability of the patient is also pictured in **Figure 7** by a ball moving in a potential well. For increased running times the potential well is drawn deeper and the arrows characterizing the variation of phase and frequency coordination are made smaller.

The question is now, what contributed more to the increase of running pattern stability, the deepening of the potential well (according to the system theory of pattern formation) or the reduction of phase and frequency variation (according to human neurophysiology)? The increase of the running stability coincided with a decrease (improvement) of the high-load CD values. The improvement of phase and frequency coordination will have therefore contributed to the improvement of the stability of the running pattern. But the main contribution for stability increase probably came from the deepening of the potential well, that is to say, from a stronger establishment in the networks of the attractor running on treadmill.

The increase of the stability of the pattern running was therefore achieved by both a deepening of the potential well for running and the reduction of the variability of phase and frequency coordination as shown in **Figure 4** for jumping on springboard.

Through a few years of CDT, the patient had no problems any more with the stability of running. He re-learned to run easily 2000m in a sports field without problems.

Healthy humans may tire during running but they do not lose the running pattern, because the stability of the running pattern is very high. It is as if the running pattern is hard-wired in similarity to crawling. This upper patient Sotiris also occasionally lost the crawling pattern, even though the crawling pattern improved strongly during therapy. When a tennis player is serving, one can see that thepattern stability of 'serving with good performance' can vary significantly.

RESULTS

Health state of the cancer patient at the beginning of coordination dynamics therapy (CDT)

The 72-year-old patient Hans **(Figure 3)** was introduced by friends to the Author for a brain repair through CDT. The patient had an older undetected hematoma from two years ago, not caused by an accident (aneurism or another cancer?), which injured his brain. Acutely the patient came for brain repair after brain cancer treatment (removed cancer and radiation therapy). The chemotherapy was applied during CDT. Because of the removed anaplastic oligodendroglioma WHO malignancy grade III and the old removed (and not really by neurotherapy treated) hematoma, the patient had two places of severe brain injury on both hemispheres **(Figure 8)**. Because of the high malignancy, growth of remaining tumor cells has to be expected and inhibited. The side effects of the applied radiotherapy (and chemotherapy) will be perceived most likely only later on. In the Author the side effects of chemo and radiation therapy appeared after one year and lasted for mor than 10 years. Additionally, the patient had hypertension. His medication was Lisinopril.

Anatomy: Visible changes of the brain through follow-up MRI's

Because of the extreme progress the patient achieved through CDT, the case report will be started with the MRI's because, may be, the brain repair can be seen already macroscopically in the future. Figure 8 shows the brain three months before the operation, one day and 6 months after the removal of the oligodendroglioma. Besides the oligodendroglioma on the left side, unhealthy nervous tissue can be seen on the right hemisphere, where the hematoma was removed two years earlier. Both brain-injured places are involved with language generation. The sensory-motor areas and the association fields seem not to be directly injured. After the removal of the cancer tissue, we can expect speech problems but not so much movement problems, even though brain injuries affect the functioning of the whole CNS. The left ventricle seemed to be smaller because of the compression from the cancer.

One day after the removal of the cancer tissue **(Figure 8)**, the left ventricle seemed to be more compressed, probably because of edema caused by the operation. If CDT would have been administered immediately after the operation, such operation-caused edema could have been reduced quickly to avoid further damage caused by the compression from the edema and reduced evacuation of toxic substances. Conventional physiotherapy is inefficient to improve cardio-vascular performance to increase the circulation especially at the injured brain parts to clean the injured brain parts from toxic substances.

When in the author a fibula transplantation was performed in a 9-hours lasting operation one year after cancer removal from the maxilla, he exercised in the morning before the operation and did not get substantial edema in the pharynx and a tracheotomy could be avoided. After a transplantation-operation the Author wanted to exercise on the special CDT device to improve cardio-vascular performance and made the hospital stuff upset. Only the treating male-nurse of the intensive care unit would have liked it, to put the author onto the special CDT device (which the author had taken to the hospital) in spite of the many tubes he was connected to. Because of a quick recovery, the author was transferred one day later to the normal care unit and started to exercise one day after the operation on the special CDT device. The surgeon stated later on stated that the fibula transplantation was 100% successful and realized that the special CDT device was beneficial for the success of that difficult transplantation. With insufficient blood supply for a few hours, the transplant would have been lost and the connection between the nasal cavity and mouth not closed.

Six months after the cancer removal, brain damage and lost tissue can be seen in the MRI sections **(Figure 8)**. A hole in the brain tissue can clearly be seen. The left lateral ventricle became larger again. There is some enlargement of the subarachnoid space above the former cancer place filled with cerebrospinal fluid indicating loss of brain tissue. By comparing the skull above the former cancer area of 6 months to one day after the operation, it seems that the opened skull started to heal. Following brain damage in car accidents, the scull is often not healing easily probably because of poor blood supply.

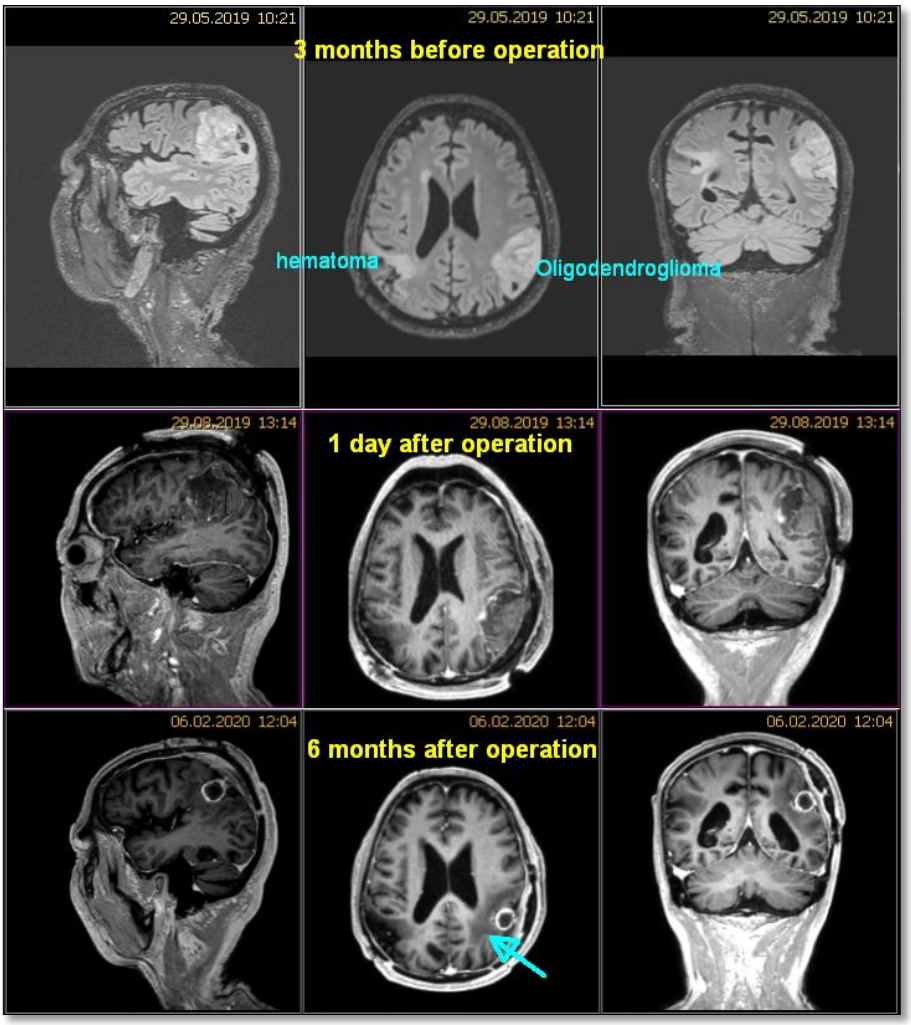

Figure 8. Follow-up MRI's of 3 months before the operation and one day and 6 months following the removal of the anaplastic oligodendroglioma WHO III from a 72-year-old patient, marked with oligodendroglioma (left hemisphere). The site where two years ago an old undetected hematoma was removed is marked with hematoma. 6 months after the operation, loss of nervous tissue can be seen. There is a hole in the brain and loss of tissue adjacent to the former place of the cancer. The arrow marks changed nervous tissue, may be due to brain repair.

By comparing the MRI's after the operation with the one before the operation (the MRI's are taken in the same hospital), it seems that the MRI's taken after the operation are not as sharp as before the operation. One reason for it could be that the circulation of the cerebrospinal fluid was not laminar anymore, but with turbulences, which gave rise to less sharp MRI pictures. A proper circulation of the blood and the cerebrospinal fluid are very important for brain repair and cleaning of the damaged brain from toxins. In extreme severe brain injuries, the not removed toxins will destroy the brain further with the consequence that the brain is further destroyed. The patient may become brain-dead or close to it and is often used then for organ donation [32]. Most interesting in the MRI is the dark area around the hole, 6 months after the operation, marked with an arrow **(Figure 8)**. Obviously, this brain tissue area is not in a normal condition. **Figure 9** shows this area more clearly and is partly marked with color.

It could well be that this marked areas in **Figure 9** shows increased brain repair. Functional brain repair involves

the whole CNS, but substantial brain repair will also take place around the injured brain areas with increased blood supply.

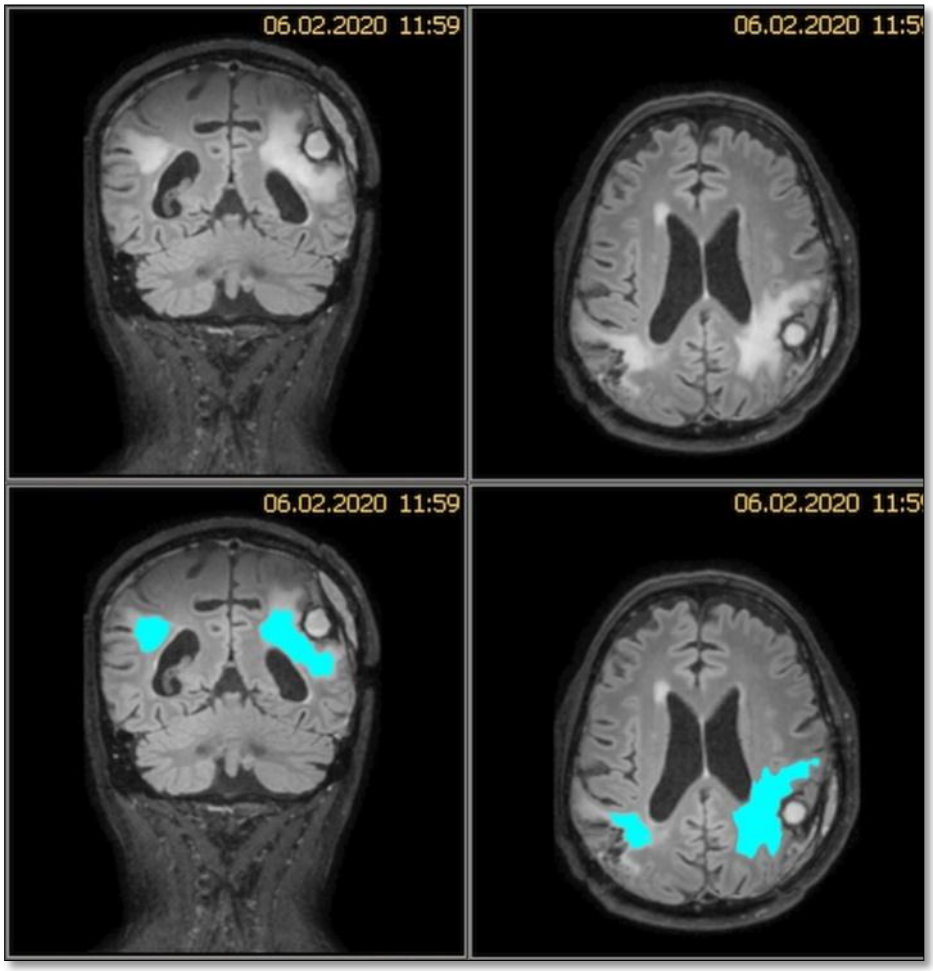

Figure 9. MRI from a 72-year-old male patient after removal of an anaplastic oligodendroglioma WHO III. The white (upper part) or the with color marked area (lower part) may be nervous tissue in the stage of repair and recovery from localized pressure, exerted by the former cancer.

Further, because of rather local brain pressure exerted by the cancer, probably also nerve cells recover from exerted pressure. In the case of hydrocephalus in children, the brain recovers unexpected good following pressure reduction. Such recovery from the pressure probably contributed to the tremendous recovery of the cancer patient through CDT.

Re-learning of walking, running, jumping and cycling

Two months after the removal of the oligodendroglioma, intensive CDT was started with at least 20 hours per week. At the beginning of CDT, the patient was in a closed place for mentally disabled persons. It was not clear whether Hans could manage alone in his nice home. The relations were afraid that he may do some crazy unexpected things. The Author pushed the family to try it, because in a closed place it is not nice to live and the old used surrounding would help to find back into the old way of life. A son of the patient lived in the same house and his partner came often to look for him. It was tried to start with him a new life at home. At the beginning he could walk only with poor performance **(Figure 10A, B)**. A real communication was not possible because he could not find the words and sentences, he wanted to say. The speech was mixed. He could understand only very easy sentences. He got angry about himself that he produced different words and sentences than the one he wanted to say.

Already after three weeks of CDT at home, it was clear that the patient could manage well at home and he understood most of the things he was told, only the communication was very poor. The progress of the repair of movements was tremendous fast. At the beginning he could not really crawl and could not jump. When he tried

to jump, he started to walk with poor performance. He had no pattern stability for jumping.

Figure 10. A, B) The patient with a removed oligodendroglioma at the beginning of therapy. The patient was often walking in in-phase (A, the right arm and right leg are forward) and the arm movements were not coordinated with the legs (B). C, D, E) Nine weeks later, the cancer patient could easily walk in interpersonal coordination with the author (C) and could run even faster than the author D) The cycling was easily possible. Absolutely no problems with climbing the bicycle and the balance.

The potential well for jumping in anti-phase was too shallow like in Figure 4B (right). Figure 10A, B shows his walking with poor performance at the beginning of CDT. Often, he was walking in the in-phase pattern **(Figure 10A)** or the arms were not coordinated with the leg movements **(Figure 10B)**. But already through 9 weeks of CDT, the patient Hans could walk **(Figure 10C)** and run (**Figure 10D)** in a normal way. Unbelievable, he could also cycle without any problems **(Figure 10E)**. He could manage also with the traffic. The patient was a good cyclist before the cancer removal and his old-learned movement cycling seemed not to be lost. With ongoing CDT, he even managed to cycle from his home to the 14km away hospital for speech therapy **(Figure 11)**. His self-confidence improved strongly. The improvement of repair can also be seen in the expression of his face. In Figure 10A his face looks exhausted and depressed, whereas in Figure 10E during cycling he smiled.

At the beginning of therapy, the patient Hans could not jump. He started to walk when he wanted to jump. Then the supported jumping became possible **(Figure 12A).** The stability of jumping was low because often he lost the

jumping pattern. Later on, even the free jumping became possible **(Figure 12B).** This was unexpected by the

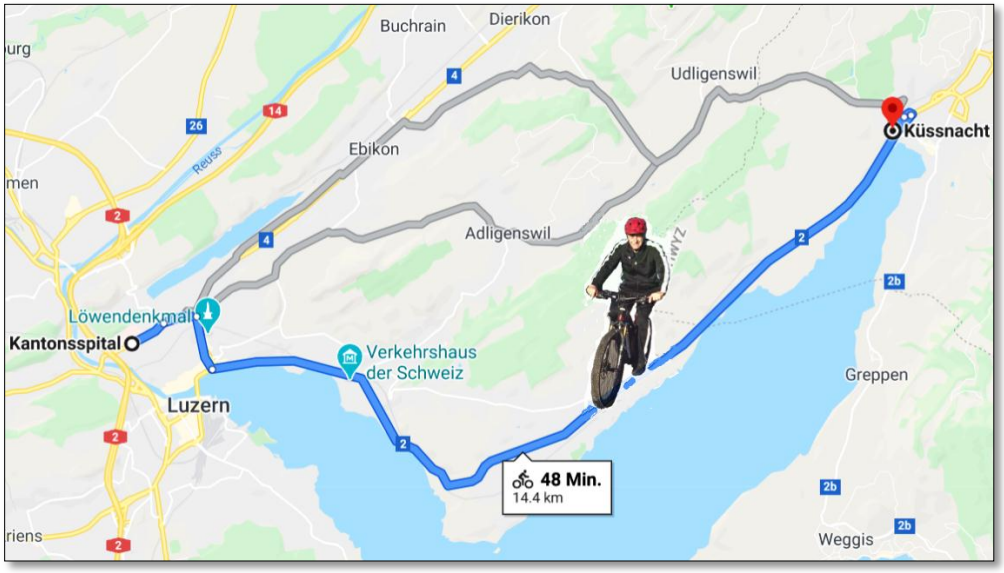

Figure 11. Through 9 weeks of CDT, the 72-year-old patient Hans is able, after removal of the oligodendroglioma, to cycle from his home in Küssnacht to the hospital (Kantonsspital) in Luzern (Switzerland) for speech therapy. Mostly he used the route via Adligenswil.

Author, because the free jumping is a difficult movement pattern. The 34-year-old patient Sotiris of **Figure 7** with a severe brain injury following a car accident, could easily jog 2000m on a sports field, drive a car again and could work a bit as a mechanist through 10 years of CDT, but could not learn so far to freely jump again. But when the patient Hans started the chemotherapy with Temodal, the pattern stability of jumping reduced and he started to jump in in-phase **(Figure 12C)** instead of jumping in anti-phase **(Figure 12B)** (see also below under chemotherapy).

Figure 12. A. Supported jumping of the cancer patient Hans in interpersonal coordination with the Author. B, C. Free jumping of Hans in anti-phase (B) and in-phase (C, left arm and left leg forward).

Figure 13 shows the graph of the improvement of jumping. The supported jumping is much easier to perform and was re-learned first **(Figure 13A)**. Then the difficult free jumping was re-learned **(Figure 13B)**.

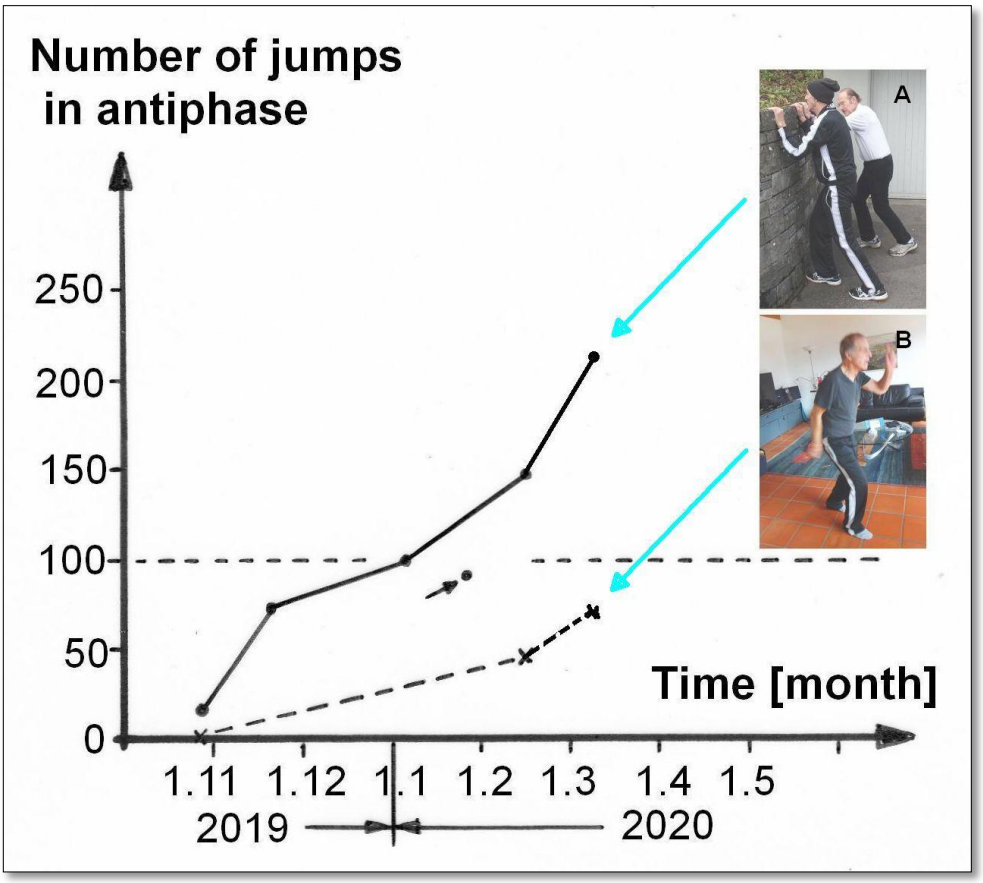

Figure 13. Improvement of jumping of the cancer patient with support (A) in interpersonal coordination with the author and free jumping (B), quantified by the number of continuous jumps per series. The Author was pushing the patient to manage longer series through coordinated instructions '1, 2, 3, 4'. In older times, soldiers could march better when counting ' 2, 3, 4,' in coordination to the march steps.

Also unexpected by the Author, the patient could ski again and could climb the 'Rigi' mountain. The Rigi has a height of 1798m and the village 'Küssnacht', were he started from, is lying 441m over the see level. He became able again to hike up and down over 1000m. Already the poet Goethe liked the view from the Rigi **(Figure 14)**. To one side you see the panorama of the Alps and to the other side you can look deeply into the country. For sure, when becoming able again to cycle long distances **(Figure 11)** and climb mountains **(Figure 14)**, the patient had no problems any more with the cardio-vascular performance and started to enjoy life again.

Figure 14. The Rigi mountain, which the cancer patient was able to climb again through 9 weeks of CDT. Already the poet Goethe enjoyed the view from the Rigi.

Cure of hypertension

The cancer patient had hypertension before and after the cancer removal. To reduce the blood pressure, he was

taking 'Lisinopril Mepha^{R}'. With ongoing CDT, the blood pressure became normal and the family doctor suggested to stop the blood pressure medication.

It was published that the blood pressure can be reduced when exercising on a special CDT device [22]. **Figure 15** shows the blood pressure reduction when the Author exercised on a special CDT device.

At the beginning of CDT, the patient had for example a resting blood pressure of 149/100 before the exercising on the special CDT device and after exercising 121/82, without taking Lisinopril. The reduction of the resting blood pressure through exercising on the special CDT device therefore also worked in him. Later on, when he took no blood pressure reducing drug (Lisinopril) anymore, the blood pressure was at rest around 132/80 (pulse = 66) and once before exercising 118/73 (pulse = 71) and after 109/74 (heart rate = 83). These are very good blood pressure values for an age of 72.

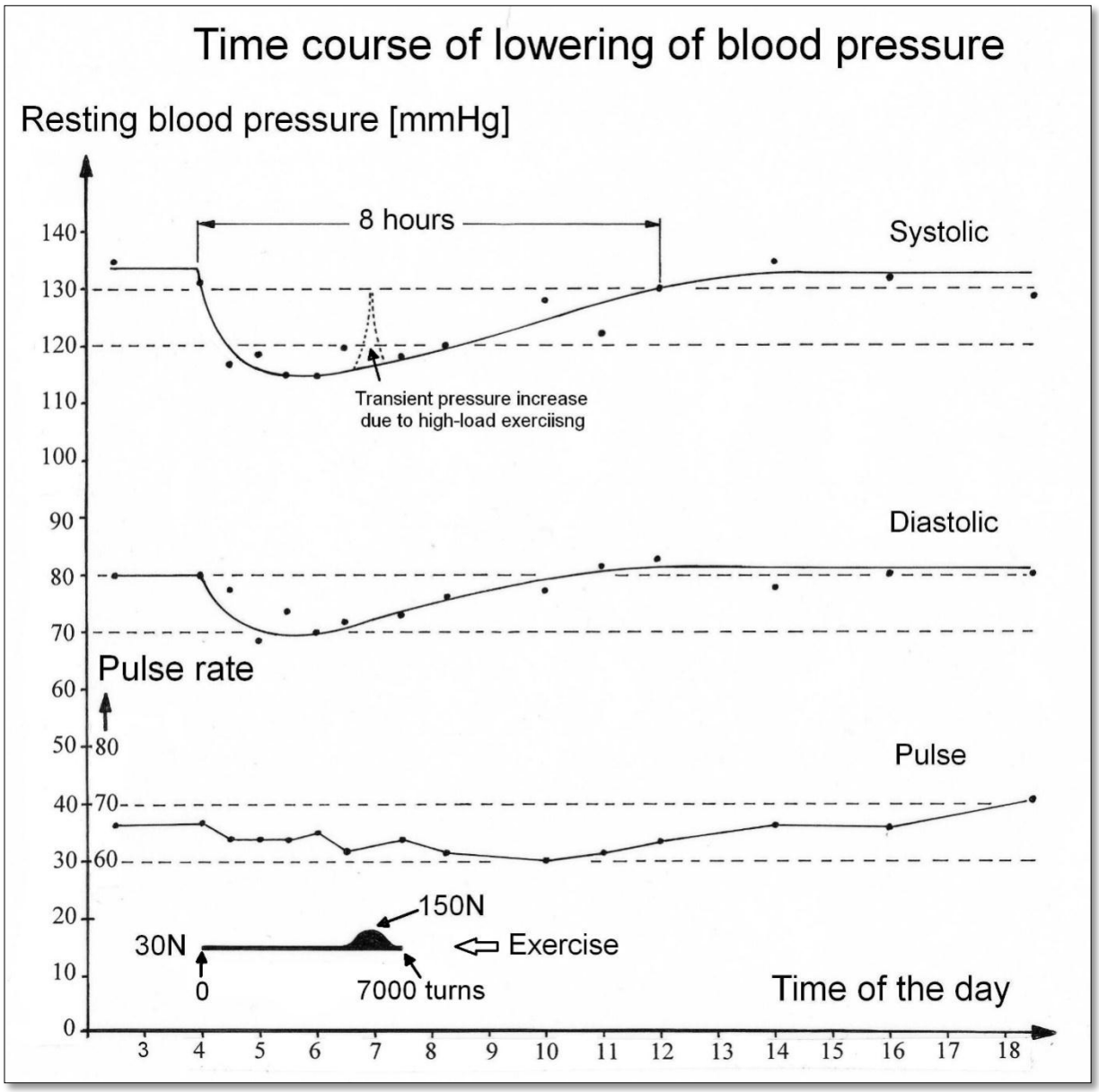

Figure 15. Time course of the lowering of the arterial blood pressure when exercising at 30N (and transiently up to 150N). Note, measured transient pressure increase due to high-load exercising (dashed line) is indicated. The blood pressure lowering was measured in the author.

Improvement of CNS functioning quantified by low-load and high-load coordination dynamics values

Figure 16 shows original recordings of the coordination dynamics when exercising on a special measuring CDT device **(Figure 3)** at the beginning of CDT and after 4 months of therapy at 100N, which is already quite a high load. It can be seen that the arrhythmicity of exercising was high at the beginning of therapy and much lower (better) after 4 months of therapy, namely by a factor of 7.2 (36 reduced to 5). The tremendous reduction (improvement) of the coordination dynamics value is in accordance with the large improvement of the movements following the cancer operation **(Figure 10)**. The frequency of exercising was high, because cyclist normally have a high inner Eigen-frequency of exercising. Still, the value of a healthy comparison (Author) is with 3.7 better. The strong improvement of CNS functioning through CDT, quantified by the high-load-test values, can nicely be seen in **Figure 17**.

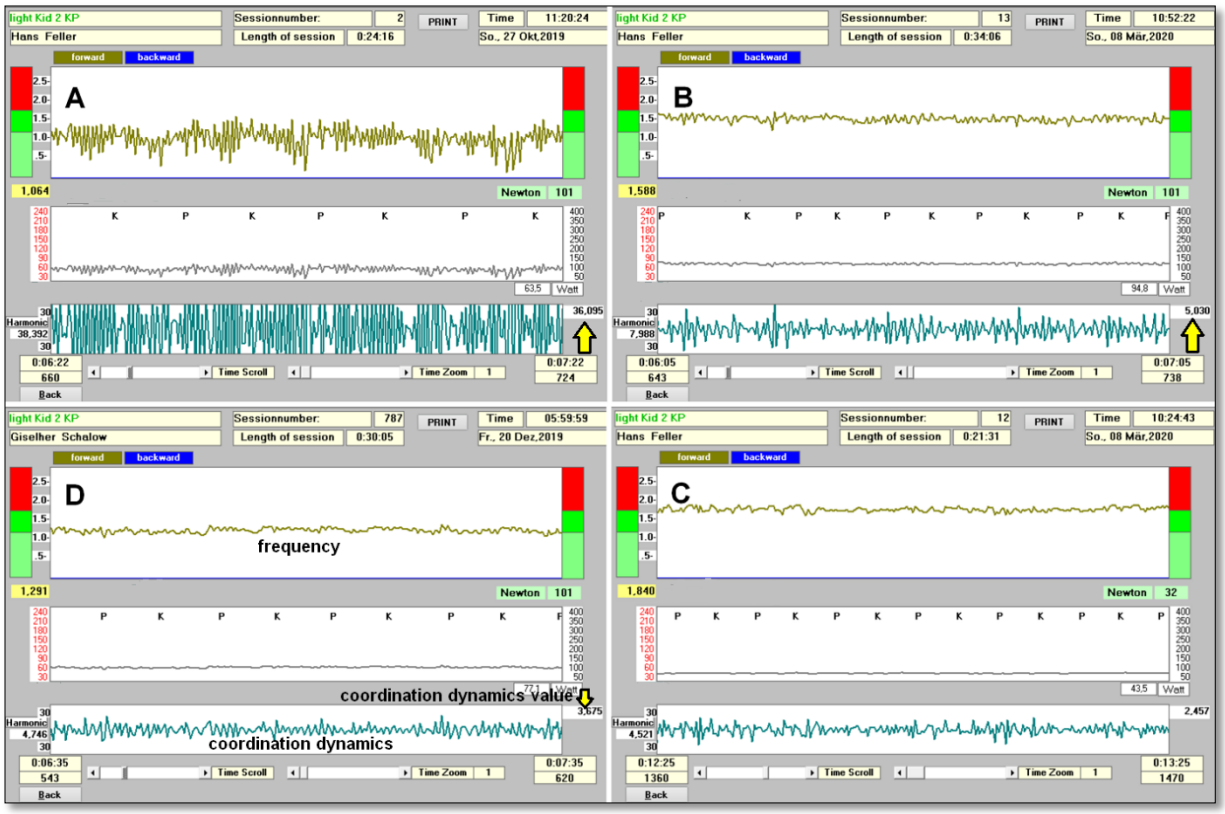

Figure 16. Original coordination dynamics measurements of the cancer patient Hans (A, B, C) and the Author (D). The patient's tremendous improvement by a factor of 7 of the coordination dynamics values at 101N from 36 (A) to 5 (B) is marked by arrows. The value of the healthy Author is still with 3.7 (D) much better.

Figure 17 shows low-load and high-load coordination dynamics (CD) values with ongoing therapy. The fast reduction (improvement) of the high-load values (A, B) supports the quickly re-learning of walking, running, jumping and cycling. A comparison of the high-load values with those of a 16-year-old female athlete shows that the patient Hans improved his high-load values nearly as fast as the young athlete. But the athlete was only exercising on the special CDT device when performing the test, whereas Hans was exercising every day for two to three hours on the special CDT device. Still, in comparison with other brain-injured patients, the patient Hans re-learned very fast. Further, the improvement of CNS functioning of the athlete shows a phase of supercompensation (transient reduction of CDT values), what the patient's values did not show so far. For further details of the improvement of CNS functioning and supercompensation in pupils see Figures 93-98 of [20]. The transient increase (worsening) of low-load and high-load CD values during chemotherapy application may indicate disturbance of CNS functioning through the chemotherapy. More recordings are needed for clarification.

The fast re-learning of walking, running, jumping and cycling was probably, besides being an ideal patient, related to his very good structured CNS with respect to movement patterns. His CNS had a highly specific movement variability and stability. With respect to pattern stability in the system theory of pattern formation **(Figure**

6), the patients potential wells of the movement patternsbecame deep again and the variability of phase and frequency coordination small. The pattern stability with good performance therefore recovered quickly. Further, the previous two months of conventional therapy must have been very inefficient, which means that the patient had no real neuro-therapy before. When learning mathematics and sciences, the brain is structured very much with respect to using logic and facts and not seeing medicine as an art but as a natural science.

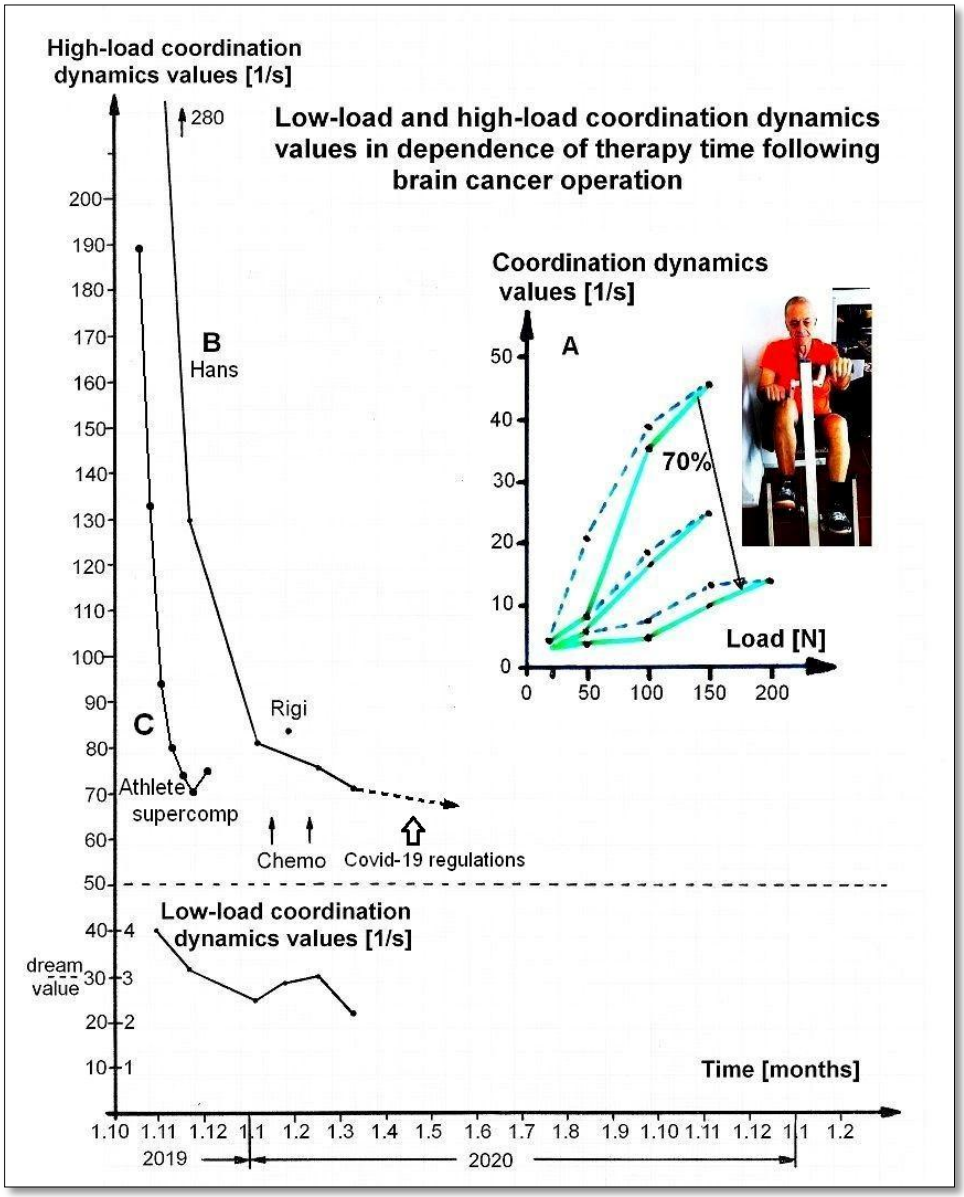

Figure 17. Improvement of CNS functioning quantified by the lowering of high-load and low-load coordination dynamics (CD) values of the cancer patient Hans through CDT. A. CD values for increasing and decreasing (dashed line) load. Improvement (reduction of CD values) by 70% through 6 weeks of CDT. B. Lowering of the summed high-load values from 'A' with ongoing therapy. Chemotherapy (Temodal) and climbing the Rigi mountain one day before the measuring affected (increased) the 'Rigi' value. The patient reached a high-load CD value of 70 so far; the fit Author has an CD value of around 40. Only once in life the Author reached a CD value of 30 (dream value). The dashed line suggests further CD value improvement. C. Improvement of CD values of a 16-year-old athlete for repair-speed comparison. 'supercomp' = phase of supercompensation (transient low (good) value). The low-load CD values of the patient seemed to also show a disturbance of CNS functioning through the two weeks of chemotherapy. According to the Covid-19 regulations (B), the Author could not train with the patient any more in interpersonal coordination. The efficiency of the brain-cancer treatment, including cancer growth inhibition, is most likely reduced in this way.

Strategies of aphasia repair

Due to the location of the cancer and the place of the former hematoma, the speech centers of both hemispheres were injured **(Figure 18A and B)** and a repair with respect to speech and word finding (aphasia) will be very difficult. Very important is a repair through an improvement of the communication of the left and right hemispheres. Both injured speech centers have to work in coordination to generate together speech and word finding. The neural networks have to be repaired by device-imposed involutional learning and device-imposed learning in coordination with instructive and self-instructive training. Four strategies for speech (aphasia) repair were used.

First, when exercising on a special CDT device **(Figure 3)**, the whole CNS will partly be repaired, including the speech centers. Second, by exercising with crossed arms **(Figure 18E)**, the right-left communication via the corpus callosum and other tracts **(Figure 18C, D)** will be improved, so that the speech centers from both sides contribute to speech and word finding. Third, by using a special CDT device where, in addition the coordination changes between arm and leg movements, also the coordination between the left and right arm movements change **(Figure 18F)**, a further repair in the deep complexity of neural network organization by device-imposed learning will be achieved. Fourth, by instructive training through counting the numbers "1-2-3-4-…" in coordination for example with the right moving hand or changing numbers of the display, the speech neural network organization will be trained. Self-instructive training with different words in coordination with the arm movements as for example "right-left-right-left-…" can also be trained.

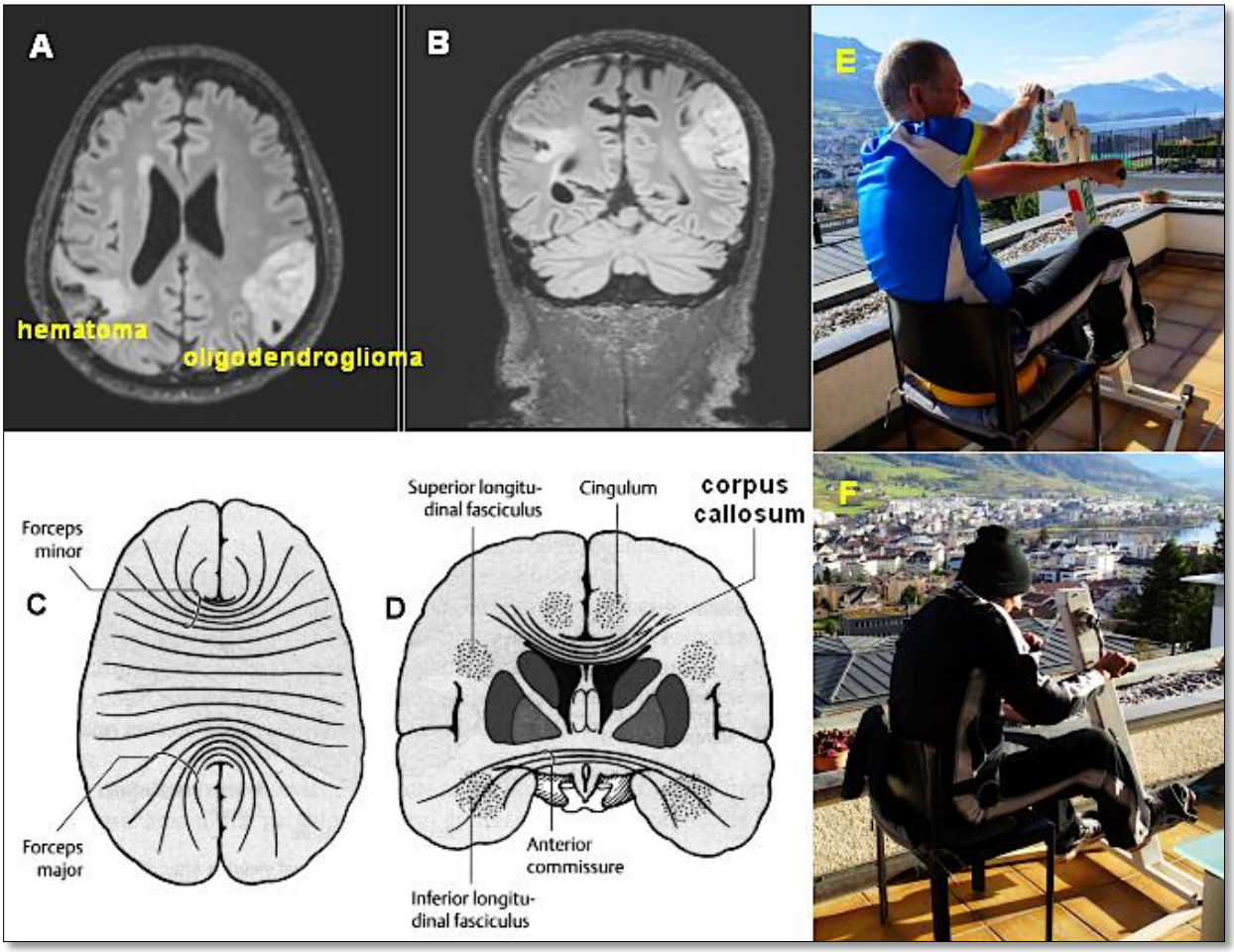

Figure 18. Strategy of speech and word finding repair. A, B) Both speech centers are injured by the oligodendroglioma on the left side and the former hematoma on the right side. C, D) For repair, the communication of the left and right hemisphere has to be improved via the corpus callosum and other right-left communicating tracts. E. When exercising with crossed arms on the special CDT device, the right left communication is trained. F. When training on a special CDT device in which in addition to arm-leg also right-left arm coordination is changed, a deeper repair in the complexity of CNS organization is achieved.

Continuous-Writing-Training for speech and word finding repair

A further strategy for speech therapy and word and sentence finding is the continuous writing training as shown in **Figure 19**. During continuous writing there is an extreme correlation between movement and cognitive functions. This old-learned combined 'movement-cognitive' pattern is used now for the repair of the cognitive functions. Using a key-bord for writing is comparable inefficient for a repair of cognitive functions, because the pushing of buttons is a too simple movement and is not as integrative as the continuous writing. And, the integrative patterns are more efficient for a repair of local injuries because the ratio of functional activated patterns between healthy and injured ones is higher. Since the patient Hans had learned the continuous writing in the childhood at school, he could use this old-learned pattern now for the repair of his cognitive functions.

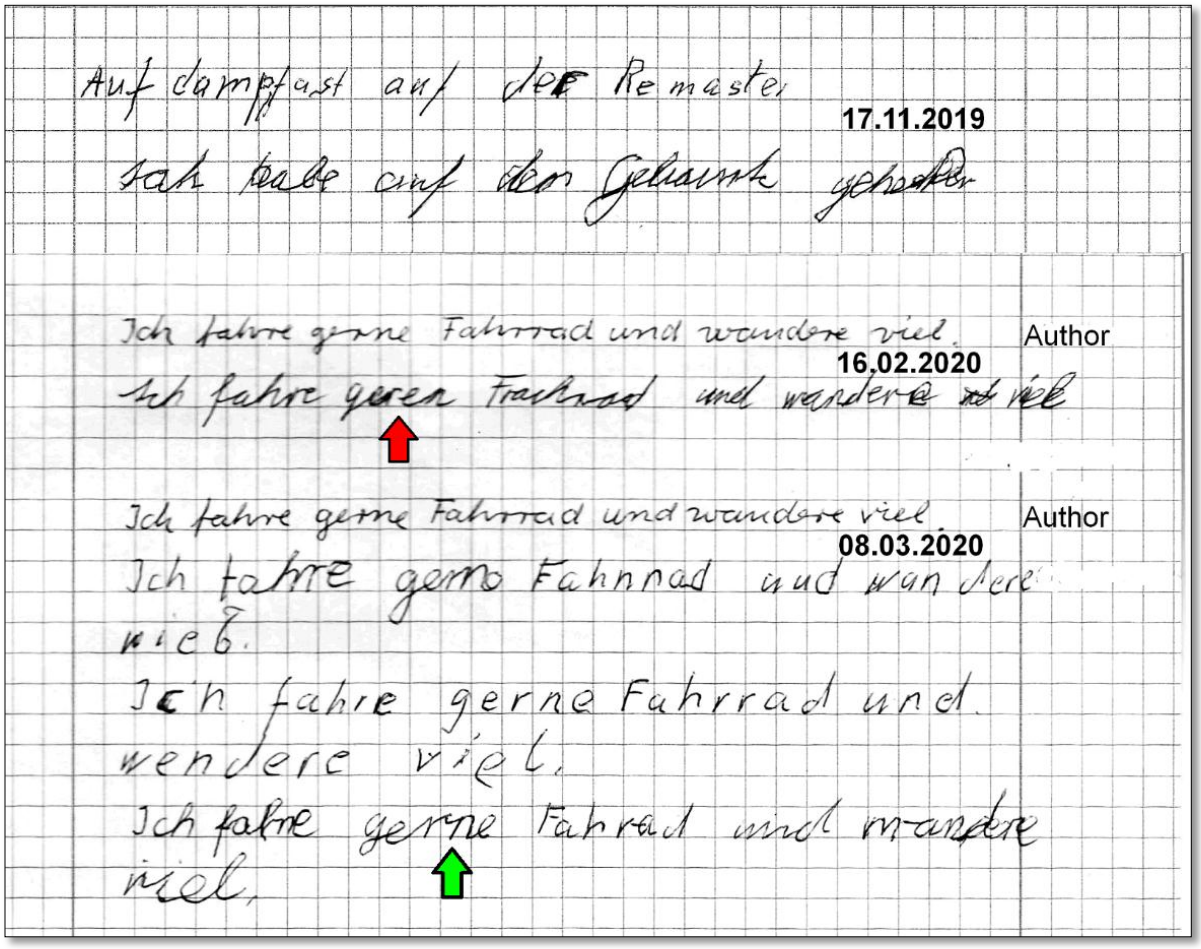

Figure 19. Improvement of writing through CDT. At the beginning of therapy (17.11.2019), the patient mixed the words and it is not clear anymore, what he wanted to write. At the 16.2.2020, he interchanged the letters 'e' and 'n' when the continuous writing interrupted (red arrow). Later on, with therapy (8.3.2020), the 'gerne' word was continuously written and the letters were not interchanged (green arrow) anymore. The movement pattern 'continuous writing' helped to improve his proper writing.

Some repair of writing is shown in Figure 19. At the beginning of therapy (17.11.2019), it was not clear what he tried to write. The patient got angry about himself, because he was writing words which he did not wanted to write (jargon aphasia in writing). At the 16.2.2020, he could write a bit better, but the letters 'e' and 'n'were interchanged, marked by a red arrow in Figure 19. This interchange of letters occurred because of interruption of the continuous writing. Later on during therapy (8.3.2020), the patient wrote 'gerne' continuously and did not interchange the letters 'e' and 'n' any more. The writing improved and the movement pattern 'continuous writing' helped to repair to not interchange letters.

But the improvement of writing may not be continuous, because the chemotherapy was started. It seemed that the chemotherapy disturbed the CNS repair (see below) including speech and word finding (aphasia).

Location of brain damage in relation to language-related areas

The most important repair in the patient with the anaplastic oligodendroglioma WHO III is to inhibit the recurrence of the cancer, following the removal of the cancer and radiation and chemotherapy. The second important function to be repaired is the aphasia because of impaired social communication. In this section it is concentrated on the repair of the aphasia.

The disturbance of language function is called aphasia. In the patient Hans the aphasia affected the writing (dysgraphia), the reading (dyslexia) and the speech, but not the physical act of speaking (dyslexia). The right-handed patient had because of the cancer location on the left side mainly a Wernicke aphasia. **Figure 20** shows in 'A' roughly the location of the language areas and in 'B' and 'C' the location of the cancer before the operation (B) and after the cancer removal (C). The hole in the brain after the operation seems to be just at the Wernicke area. But because of the hematoma (right side) and cancer (left side) operations the brain tissues may have shifted a bit.

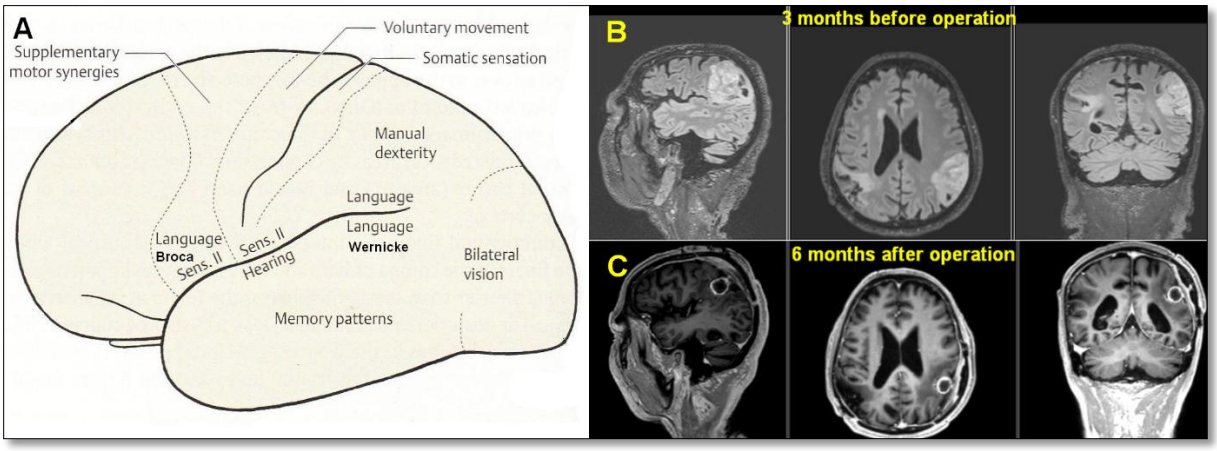

Figure 20. Cerebral cortex with the Wernicke and Broca areas (A) in relation to the places of damageof the former hematoma and the cancer (B). The hole in the brain, 6 months after the operation (C), is close to the Wernicke area (A). The dark area around the hole (marked light blue in **Figure 9)** includes the Wernicke area.

Coordinated Movement-Instructive-Training

Above the importance of the continuous-writing-training for language repair was emphasized. Now, the coordinated movement-self-instructive-training will be illustrated in detail to make understandable why the activation of integrative movement patterns in coordination with the speech are an efficient strategy for brain repair.

In Figure 21B the patient Nefeli [18] with an incomplete spinal cord injury, caused in a cancer removal operation by medical malpractice, is exercising on a special CDT device in the sitting position with crossed arms and counting numbers in vision coordination with hand turning. This is the training position for coordinated movement-self-instructive-training. In such neurotherapy she activates the primary visual cortex (area 17), the primary somatosensory (area 5) and motor (area 4) cortical areas, the sensory language area (Wernicke; area 22) and the motor language area (Broca, area 44). The exercising activates the association areas activated for functional repair. The unimodal association areas of the cortex are located next to the primary cortical areas **(Figure 21A)**.

Unlike the unimodal association areas, the multimodal association areas are not tightly linked to any primary cortical field. They make afferent and efferent connections with many different areas of the brain and process information from multiple somatosensory and special sensory modalities **(Figure 21A** [33]). They are the areas in which linguistic concepts are first drafted and in which neural representations are formed that do not directly depend on sensory input. The largest multimodal association area is the multimodal portion of the frontal lobe. Another important multimodal association area is found in the posterior portion of the parietal lobe. While the anterior of the parietal lobe processes somatosensory information (areas 1, 2, 3 and 5), its posterior portion integrates somatosensory with visual information to enable the performance of complex movements, including those when exercising on special CDT devices.

When exercising with crossed arms on the special CDT device, the patient Nefeli reached via the complex arm and leg movements between pace and trot gate (**Figure 16**) the multimodal association areas and via the crosses arms she reached the multimodal association areas of both hemispheres and connected and integrated them in

coordination via the corpus callosum **(Figure 18C, D)** and other commissural fibers.

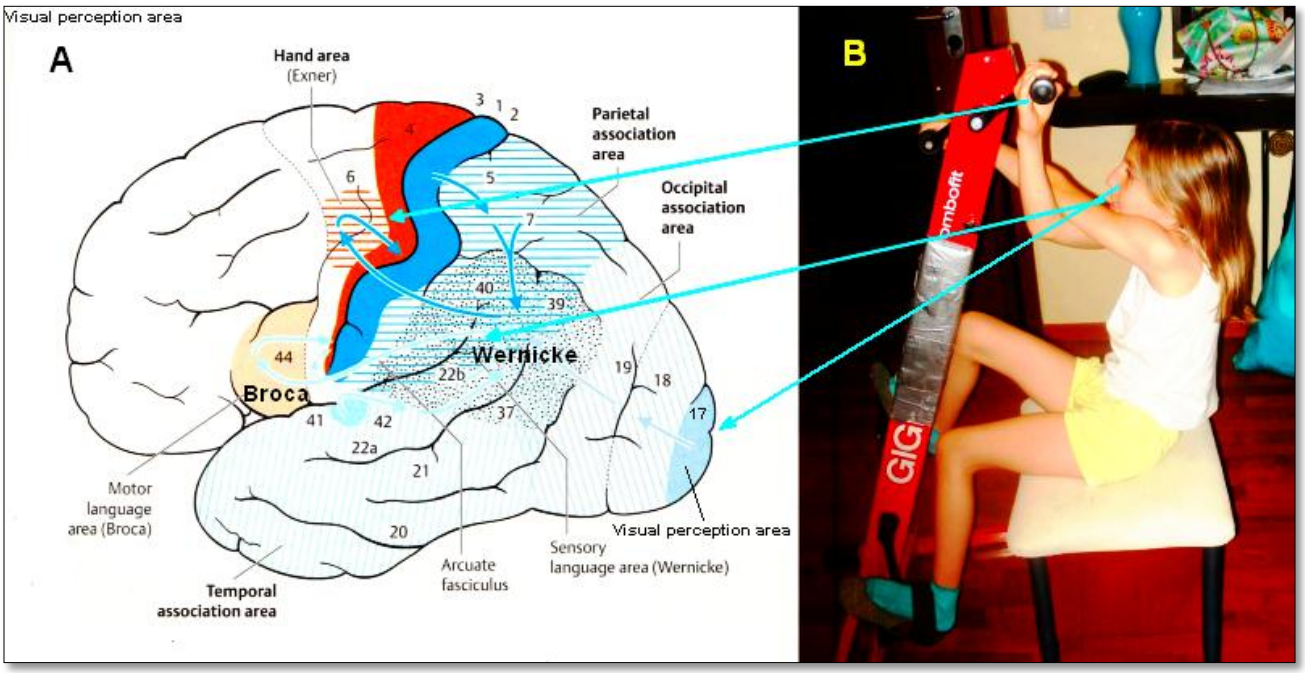

Figure 21. Efficient coordination dynamics therapy through a coordination of vision, speech and coordinated arm and leg movements B) for brain and spinal cord injury repair. Especially the multimodal association areas A) in the deep complexity of CNS organization are activated for repair. This neurotherapy is efficient for a language repair of the Wernicke area of the cancer patient Hans.

Whereas the spinal cord injury patient Nefeli (injury level Th11) used the coordinated movement-instructive-training for rewiring of tract fibers of the spinal cord (see below), the cancer patient Hans, with speech center damage, used it for repairing the language areas. When the patient Hans used a CDT device, where additional to the arm-leg coordination changes **(Figure 18F)** also the right-left coordination changes, additional repair of the multimodal association areas of both hemispheres has to be expected.

To see the difference of brain activation through movement-based learning, coordinated with instructive training, for using only legs or arms to coordinated arm-leg-speech activation, **Figure 22** shows the relative sizes of cortical representations of different parts of the body which are activated when exercising on the special CDT in coordination with instructions.

When using only the legs, like on a fitness bicycle,only a small cortical area is activated **(Figure 22B)**. Whereas using arms, legs and fingers, a much larger cortical area is activated. Through using arm, legs, fingers and speech, nearly the whole human primary somatosensory **(Figure 22A)** and motor cortical fields **(Figure 22B)** are activated. Therefore, when exercising on a special CDT device and counting numbers in visual coordination with the hand movements **(Figure 22C)**, large parts of the brain and spinal cord **(Figure 22)** are activated for brain and spinal cord repair. Also, in speech repair, the efficiency of repair is more efficient, when exercising on a special CDT device during speech therapy, because the brain activation area is larger and not only restricted to the phonation area **(Figure 22B)** and is therefore a more integrative repair.

Integrative CNS activation is most efficient for brain and spinal cord repair

Even though the spinal cord includes only a small part of the nervous tissue in comparison to the brain **(Figure 23)**, an injury of the spinal cord has tremendous consequences for the every-day-live because of a possible dysfunction of the urinary bladder [7,18] and other organs. For a repair, integrative pattern activations are needed **(Figures 21, 22)**.

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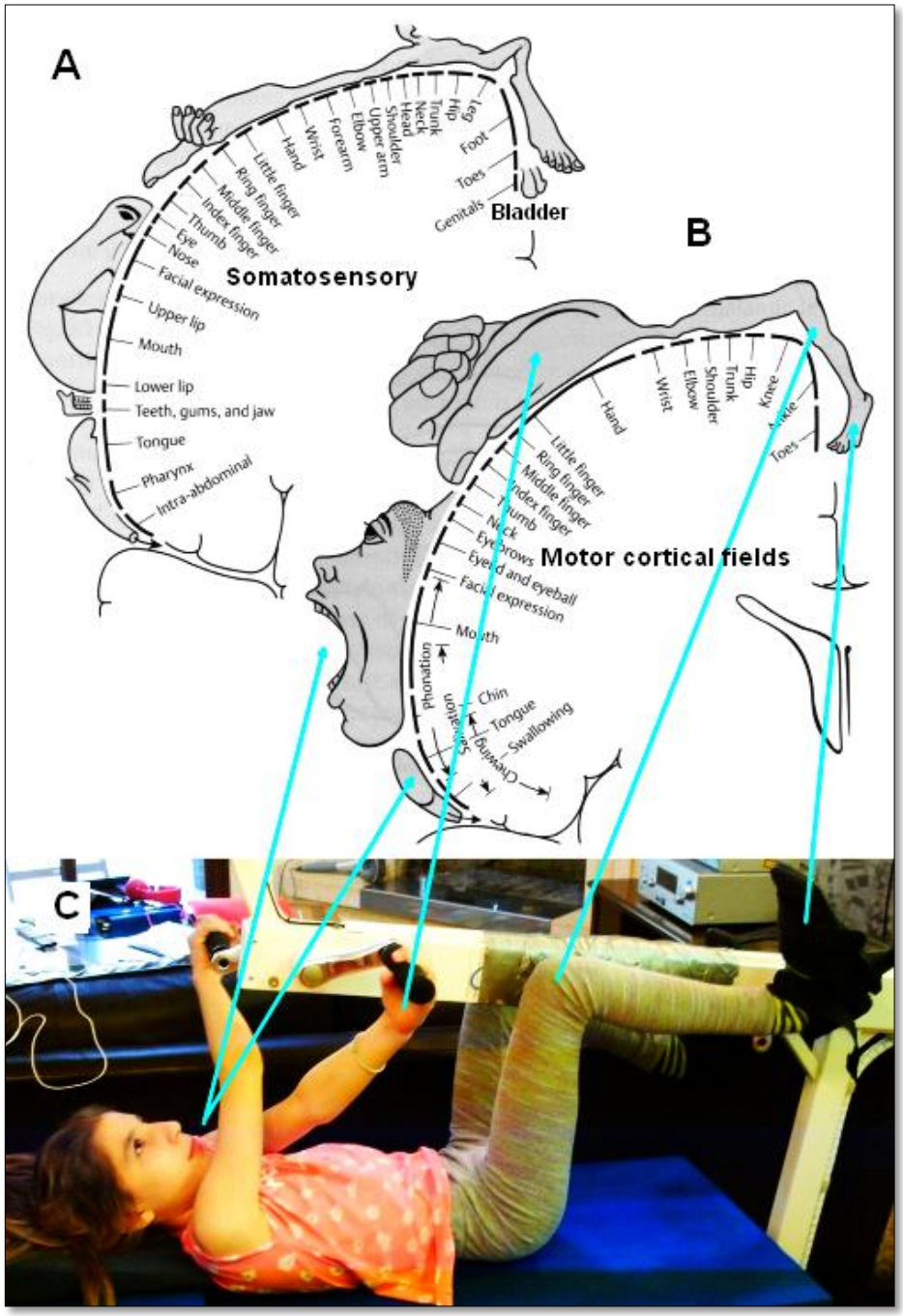

Figure 22. Relative sizes of cortical representations of different parts of the body which are activated when exercising on special CDT devices in coordination with instructions. Nearly the whole somatosensory (A) and motor cortical fields (B) are activated. When moving only the legs, as in case of a fitness bicycle, the activated areas are relatively small. Note, the cortical representation of the urinary bladder is close to the representation of the toes, and during jumping **(Figure 12)**, the toes are activated. The patient Nefeli in 'C' suffered a spinal cord injury during a cancer removal by medical malpractice and had also the urinary bladder to be repaired.

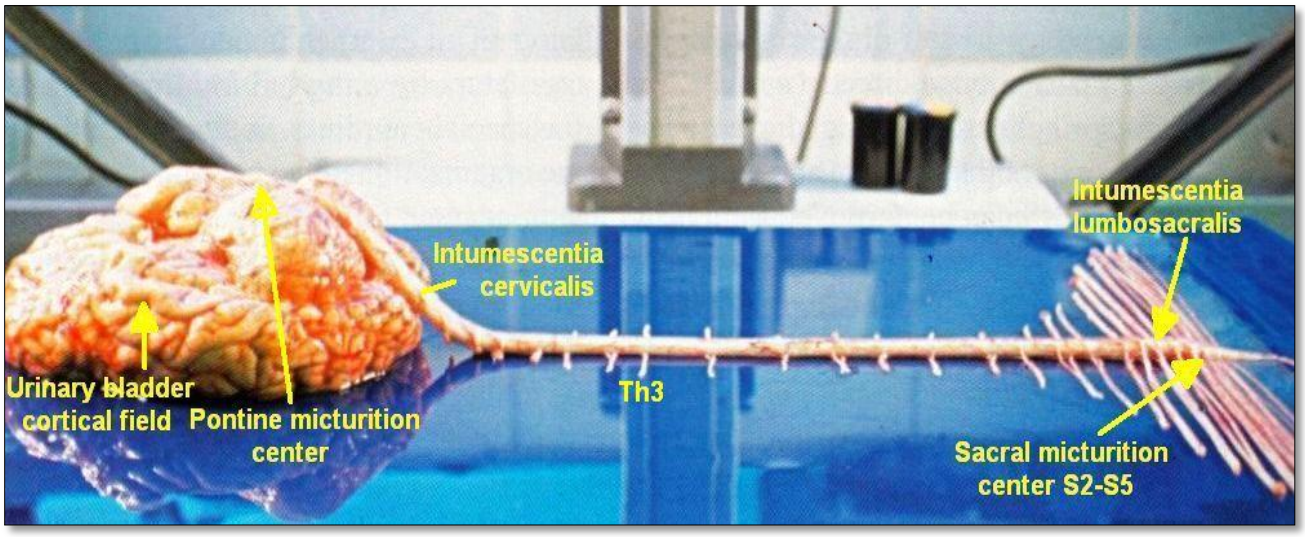

Figure 23. Unfixed human central nervous system dissected by the Author. Lumbosacral and cervical enlargements of the spinal cord (intumescentia lumbosacralis and cervical) are indicated. The S1 root is the last thick nerve root. The urinary bladder cortical field is inside, not to be seen **(see Figure 24).** Such a dissection of the human CNS is not simple. To take the brain out during an autopsy in the Pathology is standard. Following 50 to 100 cadaver dissection, the Author was quite experienced to remove the spinal cord. But to remove the brain in connection with the spinal cord from a cadaver is difficult, if one does not want to damage the outside of the cadaver too much, so that relations of the dead loved person can say in peace goodbye.

Integrative patterns are most powerful in repair if they include the activation of nearly the whole CNS, including the brain, the pons, the medulla oblongata and the intrinsic apparatus of the spinal cord, mainly located in the intumescentia lumbosacralis and cervicalis (lumbosacral and cervical enlargements**, Figures 23, 24**), which are connected via the fasciculus proprius of the spinal cord. Urinary bladder control is generated by the sacral micturition center, the pontine micturition center and the cortical areas for bladder and bowel control **(Figures 23, 24)**. The organization of the CNS and its repair is working in connection with the coordinated input from the periphery via the different kinds of receptors.

Figure 24 shows that practically the whole CNS is activated for repair, if the patient is exercising in the standing position. The integrated movements are most powerful in repair, if they include the activated networks (and tracts) around the injury site. The most important urinary bladder repair is achieved when the patient is exercising on the special CDT device and jumping on springboard **(Figure 2B)**. By with the up and down movements during jumping, the receptors of bladder and rectum are activated and serving via ascending fibers for sensory input to the sensory-motor cortex, thalamus and cerebellum. The jumping on the forefoot does not only repair leg muscle functions and the foot arches, but helps to repair urinary bladder functions, because toes and bladder cortical areas are closely related in the sensory-motor cortex **(Figure 24B)**.

Figure 25 shows schematically the Ascensus of the human spinal cord and its consequences for the segmental innervation of the skin and a spinal cord injury. An original photograph of the human spinal cord is given in **Figure 23.**

At the beginning of CDT,the special CDT devices are very important and often the exercising on them are the first exact, efficient and qualified movement which a patient with an CNS injury can perform. Later on, other integrative movements have to be used so that through plasticity other parts of the brain can take functions over. In **Figure 24A**, the spinal cord injury patient Nefeli is exercising in standing position with deficits in legs and feet. Most important for her is the repair of urinary bladder functions followed by the peristalsis of the bowel [18].

The 72-year-old Hans with the brain cancer has till now no continence problems, probably because he was cycling and hiking before the hematoma and cancer operations very often and he is and was therefore top fit. But the side effects of radiation and chemotherapy are most likely going to come if the patient is living sufficiently long; vision and urinary bladder problems included. Best is to train the whole body through integrative patterns before the side effects are coming, to reduce them.

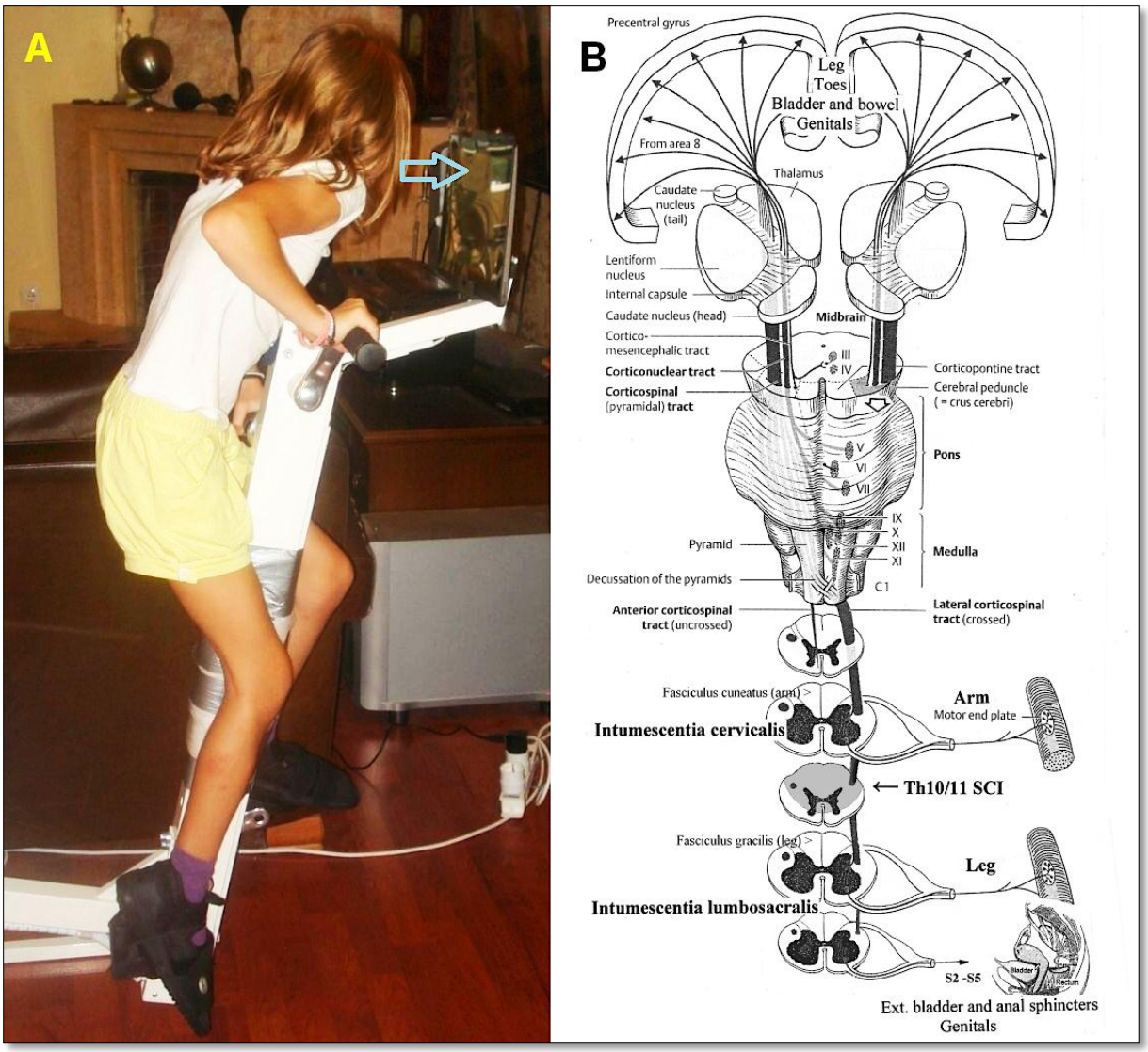

Figure 24. The spinal cord injury patient during exercising in the standing position. The right foot is in a pathologic position. If not taking the photo, the Author would have supported it. If she would count numbers or letters appearing in coordination with the movement on the display in front of her (arrow), then nearly the whole CNS would be activated (B). But the training in the standing position is hard. B. The whole CNS is involved in the repair of the spinal cord (Th10/11) or brain injury. Note, leg, toes, urinary bladder, bowel and sexual functions are closely related in the sensory-motor cortex.

Re-learning of writing an email and telephoning for a few minutes through 4-months CDT

Apart from the brain-cancer recurrence problem, the communication was the main problem of the 72-year-old brain-cancer patient. The sophisticated **(Figures 21, 22 and 24)** and intensive CDT showed after 4-month of CDT a substantial progress in writing and speaking. This communication improvement came just in time, because the covid-19 regulations made the patient staying alone at home.

At the 5th of March 2020, he wrote the first understandable email to the Author and at the 26th of March 2020 the brain-injured patient could telephone clearly with the Author for a few minutes. After a few minutes, his CNS became overloaded and the mixing of words returned. It is known that newly build neural networks get easily exhausted, but they recover after some rest.

This progress was important for him when being isolated at home because of the covid-19 regulations. He could communicate now via emails and speaking via the telephone with relations and friends.

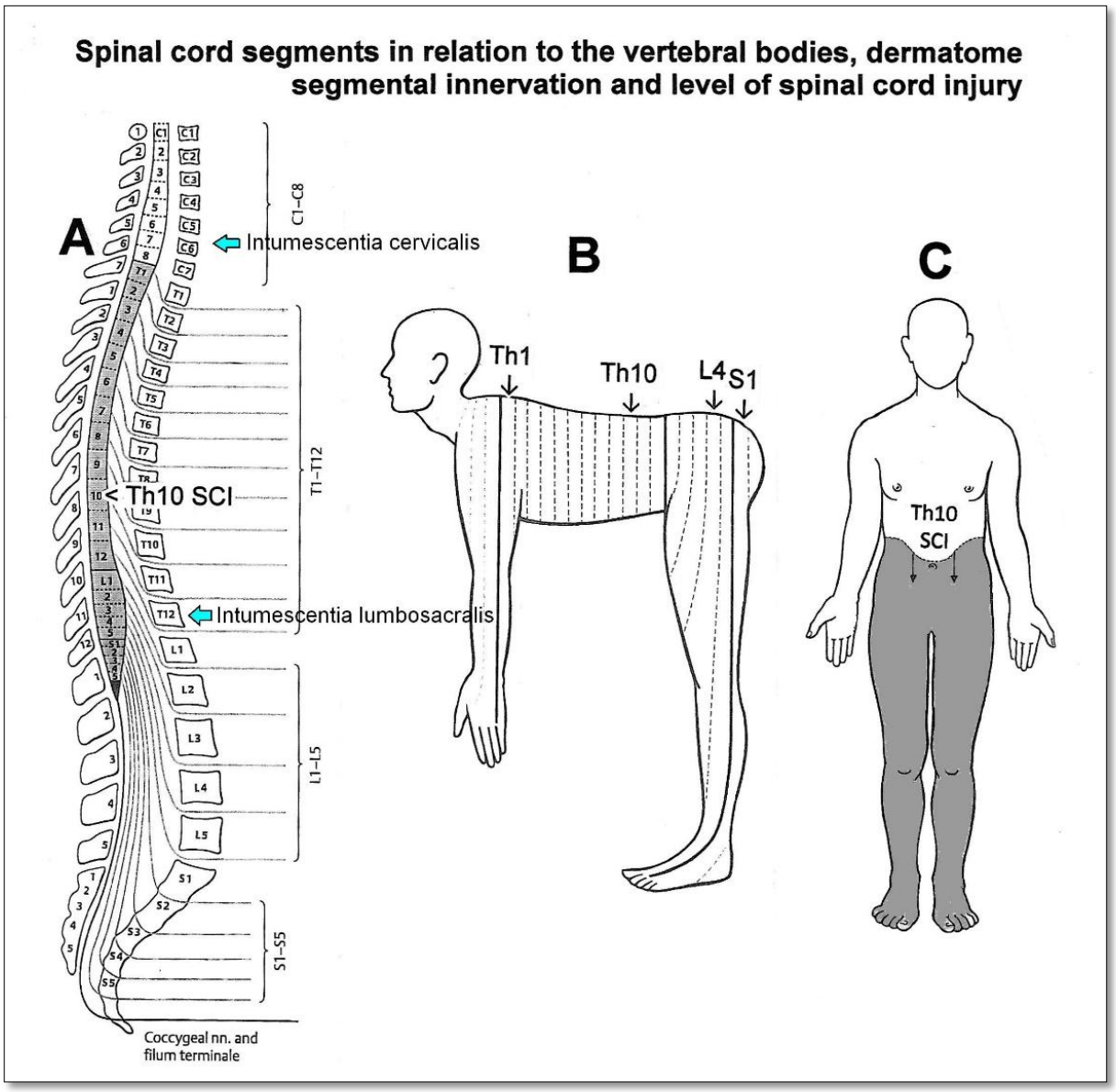

Figure 25. A) Spinal cord segments and their relation to the vertebral bodies. The Ascensus of the spinal cord is giving rise to the long cauda equina nerve roots. B) Approximate segmental innervation of the skin. C) Below the SCI level there is loss of sensitivity and loss of connectivity to muscle and vegetative functions, including urinary bladder and bowel functions.

DISCUSSION

Brain cancer treatment through CDT

The most important property of CDT is that it repairs several functions simultaneously and especially in severe diseases like cancer. In brain cancer with high malignancy, the brain can be repaired, cancer growth inhibited and high blood pressure reduced simultaneously through CDT. The cancer growth inhibition is very important in brain cancer with high malignancy, because the cancer cannot be removed rigorously, since otherwise the patient has no quality of life any more after the operation. In brain cancer patients under 10 years, a more complete cancer removal would be possible because more repair/plasticity is possible through CDT. An important feature of the movement-based learning therapy CDT is that it can be used in connection with other cancer treatments.

Astrocytoma and oligodendroglioma are aggressive tumors with high malignancy. They grow through infiltration and it is impossible to remove too much brain tissue. In a 27-year-old lady an astrocytoma was removed

and CDT administered. First, the lady got better and then she got worse again when the cancer fully re-occurred. Later on, she died. The Author did not directly administered CDT to that lady. But the 72-year-old patient of this report with an anaplastic oligodendroglioma WHO grade III was treated by the Author, and he used all the possible means to make him living longer with a better quality of life. The quality of life of that patient could be improved strongly and quickly through CDT, but the frightened question remains to what extent can the cancer growth inhibited.

The now 14-year-old Nefeli **(Figures 21, 22 and 24)** is an8-year survivor of a neuroblastoma growing from the ganglion Th10, even though probably not the whole cancer and not all metastases were removed during surgery [17]. CDT prevented the recurrence of the cancer and growing of metastases [18]. But this cancer was not very aggressive.

The author himself, now an 11-year cancer survivor, suffered a 'squamous cell carcinoma (epithelioma)' (a malign tumor) in the maxilla. After the cancer removal from the maxilla, he was advised to do radiation and chemotherapy to reduce the probability of cancer recurrence. Because of the severe side effects of radiation and chemotherapy, he complained to the surgeon 10 years later for advising him to administer also radiation and chemotherapy. The surgeon replied that he had only statistical data available for suggestions, but no case reports. Therefore, case reports are also needed to suggest proper treatment to the patient. The side effects of chemo and radiation therapy are underestimated because often the patients do not survive sufficiently long to experience them.

Cancer occurs mostly before 15 and after 50 years of age

The author learned in his medical study that cancer mostly occurs before 15 and after 50 years of age. In the patient Nefeli, the cancer from the ganglionTh10 was diagnosed at an age of 5.5 years in connection with breathing problems. In the patient Hans the brain cancer was found at an age of 71, even though radiologists traced the cancer back to an age of around 67. For the author, the cancer in the maxilla was diagnosed at an age of 67 at a stage of 1.5, but he had the cancer already for a few months. A dentist overlooked the cancer in his mouth. Only when the cancer in the maxilla established metastases in the neck lymph nodes, the Author sweated very much at night and he knew something was wrong. Quite late he had the idea that cancer could be the reason. With diagnostic the cancer was identified. A 55-year-old woman survived breast cancer after the removal of the cancer and the lymph nodes in the axilla. All these cancer occurrences fit the rule that cancer occurs before 15 and after 50. No cancer recurrence occurred because of administration of CDT following the cancer treatment.

But a 34-year-old woman survived breast cancer (including lymph node dissection) and uterus cancer at an early stage. She is now a 7-year cancer survivor.

Two 30-year-old women died 1 to 1.5 years after a partially removed astrocytoma. The low to moderate exercise treatment could not control the cancer. The patient's treatment was not or only partly supervised by the author. A throat cancer could also not be inhibited sufficiently by low-intensity CDT, not administered by the Author.

In conclusion, all cancer patients to whom the Author administered CDT had no disease recurrence so far and cancers may occur also between the ages of 15 and 50.

Impairment of 'interpersonal movement and instructive training coordination' via Covid-19 regulations

Because of covid-19 regulations, the author could not work so well any more with the brain-cancer patient Hans. Most powerful was the interpersonal movement coordination between the author and the patient **(Figures 10C, D and 12A)** in connection with an instructive training. By coordinating the instruction with the movement, the whole CNS was coordinately activated for repair through learning **(Figures 21-24)**. The most integrative and efficient pattern for repair is if the Author is giving the instruction 'A, B, C, …' in coordination with the movement **(Figure 26)** and additionally the patient is giving the self-instructions 'A, B, C, …' in coordination with the movements and the instructions of the author. Such most efficient CNS activation pattern for repair is hard for the patient, but efficient for the repair of the brain neural networks and the inhibition of cancer recurrence. But because of the covid-19 regulations in Switzerland, the cancer patient became afraid to work in interpersonal coordination with the author and most likely the probability of cancer recurrence increased.

It was not only that the covid-19 regulations increased the probability of cancer recurrence in the brain-cancer patient Hans. But also, the regulations impaired qualified cancer research, because Hans was an ideal patient to find out whether it is possible to stop the recurrence of a maligned brain cancer.

For the 72-year-old cancer patient Hans, a covid-19 infection is less dangerous than the recurrence of the anaplastic oligodendroglioma WHO III

A comparison between the risks of cancer recurrence and covid-19 infection in Hans will show that covid-19 regulations are dangerous for brain-cancer patients. The lung epithelia cells of the patient are probably rather healthy, because he lives in a rather healthy surrounding, exercises

Figure 26. Facial expression communication of the author (left) with an 18-year-old female patient who suffered a very severe brain injury after being raped by a refugee from Pakistan, who was trying to kill her afterwards by hitting with a stone on her head. The author is giving instruction by counting or saying "right-left" in coordination with the hand leaver turnings. Note that the patient's facial expression is very similar to that of the author. The author was able to catch the patient's concentration. The patients hands are fixed to the handles for easier exercising.

very much and eats healthy food. The cardio-vascular performance is very good because, through CDT, the patient achieved a resting blood pressure of 118/73 (pulse = 71), which is ideal. It can be expected that his biological age is 10 years smaller than the chronological age [22]. In the case of an infection, he will most likely survive. On the other hand, the anaplastic oligodendroglioma WHO III is very maligned. There is quite a chance of recurrence of the cancer. It is therefore important for the patient to have administered an optimal CDT, to avoid as much as possible cancer recurrence. But this is not possible anymore. Because of the covid-19 regulations, he is not getting an optimal therapy anymore. Most likely therefore, the probability of death is larger because of cancer recurrence than for a possible covid-19 infection.

The author would have trained with the patient and would have taken the risk of infection, but the patient did not. Also, the patient started to listen to persons missing medical knowledge. There are many drawings back in medicine, the research in medicine is not organized, especially in brain research and biologists have taken the medical research over. But without medical knowledge, a treatment of patients with such dangerous diseases is not justified.

Reasons for the pandemic covid-19

Instead of counting in TV only numbers of covid-19 infected patients and how many died, it would be important to ask for the reasons of the pandemic and a comparison to the flu virus. The Author contacted mass media, but they did not want to show a comparison between the covid-19 and the flu virus via curves to see what the real problems are. Till the 31.3.2020, more patients died in Switzerland on the flu (more than 400) than on the covid-19 virus (less than 400). Of course, the rate of infections and deaths are important and may differ. But for the flu vaccines are available! An argument of the mass media was that the population should not be irritated by the complexity of the situation. This is an attack onto democracy: You should vote representative for the parliament without being informed about the reality.

The covid-19 infections are a symptom. Causes are the pollution of the breathing air which impairs lung functions and the out-of-date medicine. Basic human research is not organized and not funded, and biologists have infiltrated medicine. The highly funded stem cell therapy, for example, was a disaster. In more than 50 clinics all over the world, CNS injured patients lost their money with absolutely no progress in their disease. Real problems are the overpopulation on earth and the destruction of the environment, including the pollution of the breathing air. The highest court in Pakistani warned the society because of the increase of the population. Approximately, the population increased in the last 40 years by a factor of three.

Covid-19 protection through breathing clean air with negative ionization

A protection against the covid-19 virus is to not get infected. This is tried around the world though avoiding droplet infection and isolating people by doubtful means. An improvement of hygiene is for sure appropriate. It was published that handles of doors or handrails should be made of metal, best of brass, because these surfaces are not contaminated with viruses and bacteria. On brass bacteria and viruses cannot survive [34]. I have not heard anything in the mass media concerning a criticism that too little effort is taken in general hygiene with respect to handrails.

If infected air is inhaled, the healthy lung has a first protective shield, which will be explained now. **Figure 27** shows the gas exchange between the alveolus and capillaries. The type II pneumocytes secrete pulmonary surfactant to prevent the collapse of the alveolus, to prevent the inner walls from sticking together and to protect against viruses and bacteria. Figure 28A explains this first protection shield in detail. The healthy pulmonary surfactant has a pH-value of 5 (acid), has no damage and is rather liquid to allow easily alveolar macrophages to move about and engulf viruses, bacteria and dirt. Probably, if not too many Covid-19 and other viruses attack the healthy epithelia, this defense system will protect and the person, who inhaled viruses, will not get infected. There is no inflammation, because the viruses could not enter the body.

But in the unhealthy situation, this protection shield is not or not sufficiently working anymore **(Figure 28B)**. If the pH-value of the surfactant is going from 5 in the direction of 6 (less acid), the surfactant is not as liquid anymore and becomes damaged. The macrophages cannot migrate/move so easily about anymore and engulf viruses, bacteria, dust and other particles. The first protective shield against an infection is therefore partly lost.

If the surfactant film got cracks, the viruses can easily infiltrate the blood-air barrier **(Figure 28B)** in similarity to the skin. The healthy skin with their healthy bacteria protects against an infection. Through getting a crack in the skin, the bacteria can cross the skin and cause an inflammation. Also, the private sphere of women is protected by an acid pH, generated by 'good' bacteria. If women bath longer times in saltwater, they have to use sweet water afterwards, because the healthy and clean saltwater increases the pH value, which is dangerous for being infected.

For clarity and summary, for a person with healthy or impaired lung functions, there are several stages for infection and protection:

1. The person breathes clean air with no viruses. No infection.

2. The healthy person breathes clean air with some viruses (airborne infection). The healthy lung epithelia with a pH of 5 kills the viruses by the acid pH and the engulfment of viruses by macrophages. No infection.

3a. The healthy person breathes clean air with many viruses (droplet infection). The healthy epithelia becomes overloaded and viruses can attack the epithelia and reach the blood. Now the immune system starts to work. If the healthy person has a trained immune system, antibodies are quickly built through remembrance cells. Vaccines may not be needed. The infected person may not feel anything because his immune system manages well. There is an infection.

3b. If the person with healthy lung epithelia has an untrained immune system, he will still be managing well, but the infection is stronger.

4. If the person with a healthy lung is inhaling dirty air with many viruses, this first protection shield is getting quicker overloaded and the infection will be further stronger.

5. If the person with a healthy lung is inhaling air with wrong ionization and contaminated, let's say with covid-19 and flu-viruses (hospital stuff), the healthy lung is not protecting well anymore, because the pulmonary surfactant changes its pH in direction of 6, and plenty of viruses succeed to get into the blood-air barrier and into the blood for multiplication. There is even stronger infection, because the immune system has to fight against covid-19 and flu viruses. Hospital and other medical staff must therefore be sufficiently protected.

Since the viruses attack the lung epithelia, the type II pneumocytes cannot secrete sufficient surfactant anymore **(Figure 27)** and the alveolus will collapse and stick together. There is full infection. Pressure ventilation may be needed to open the alveoli again. Exercising would help to activate the breathing system directly through the activation of the nervous system.

Here is an example. The author never had problems with the Herpes virus. But when he got a lung infection (see below), Herpes appeared at the lower lip. When the lung infection was over; the Herpes signs disappeared. This clearly shows that infections in addition to covid-19 will be a bigger load onto the immune system and the whole body. Therefore, care has to be taken of additional infections. Mass media refused to report about additional infections and manipulated the society. Sufficient information would have been to inform, in a first approximation, how many patients died on covid-19, flu, cancer, stroke and heart attack.

6. If the air is polluted, then the dirt particles in connection with moving air are a transport medium for viruses and bacteria. During covid-19 regulations, when persons got something like home prison, the administration did not care about the pollution of the air, even though the Author could see dirty-brown air (smoke), when he was looking out of the window in Switzerland. Only few private cars were going about. Because the trees had no leaves so far to clean the air to a certain extent.

7. In patients with impaired lung functioning, this first protection shield is not working any more. The pH value will be close to 6, macrophages cannot move anymore and engulf particles and microbes and the covid-19 and flu viruses can fully attack the body **(Figure 28B).** Infected smokers have a poor prognosis.

8. Patients with several infection, partly caught in a hospital, and other additional diseases have a very poor prognosis, even when pressure ventilated.

9. Therefore hospitals and family doctors should only be visited in extreme health condition.

Out of these incomplete counted conditions behavioral consequences will follow. Try to avoid droplet infection (2m distance to other persons and in dangerous situations have a protection mask), try to breathe healthy air (with negative ionization, outside), exercise to keep the alveoli open (naturally every 20^{th} inhalation is a deep one) and touch only handles or rails made of metal, when you are outside of your home (or use gloves). Not all covid-19 regulations are senseful. The by far biggest risk is the droplet infection when you are close to another person and talk with one another.

Following these incomplete suggestions for behavior, back to normal discussion. What ruins the lung epithelia? If the patient is a smoker (or passive smoker), the breathing air is mixed with dust, dirt and toxins, which ruin the epithelia. In addition, viruses and bacteria use the dirt particle in the air for transportation into the alveoli. A disco, crowded with people and smokers, is a dangerous unhealthy surrounding. In the case of non-smoker, the inhaled air should not be polluted and have a negative ionization. If you live alone in the mountains with clean air, you are on the safe side. But if you live in a skyscraper, stay longer in a hospital or live in a wrongly heated home you are in danger. The slogan is: In a wrongly heated room you are half-dead'. The climatization systems in hospitals are breading places for bacteria and viruses. The moving air transports the viruses and bacteria to the patients and staff. Additionally, the air ionization changed from negative to positive in the air condition system, which pushes the pH-value from 5 in the direction of 6 in the pulmonary surfactant. The moving air changes the ionization. You can see is in a thunderstorm. Heating (and cooling) has to be achieved through radiation, as the sun is doing it, and not through using the breathing air for heating. The 'Hypokausten-technique' heats rooms through radiation and is not using the breathing air for heating.

The brain-cancer patient Hans exercised mainly outside on the balcony in fresh air, as suggested by the Author **(Figure 18E, F)**. But his heating system was still working through moving air and not through radiation. Also, the Author is living in a wrongly-heated room and by looking out of the window, he is seeing the polluted air. Smoke-alarm is foreign in Switzerland. Big diesel-engines are used for building and many Swiss people move about with tank-limousines (in German: 'Panzer-Limousinen') with broad tires to increase tire abrasion including and to free upthe toxic arsenic.

Treatment of Covid-19 infected patients without ventilation

Instead of having the Covid-19-infected patients ventilated and lying in bed, they should be exercised on a special CDT device in the lying position like the Author performs it with the spinal cord injury patient Nefeli **(Figure 29)**. After ventilation the collapsed alveoli are bound to open through positive pressure. But with additional exercise, the breathing system is activated additionally via the specifically activated nervous system through CDT. When a smoker with lung fibrosis exercised on the special CDT device, his oxygen saturation could be increased (private information).

In easier cases of Covid-19 infections, the patients should be exercised or exercising by themselves in the sitting **(Figures 3, 18E, F)** or lying positions **(Figure 29)**. Ventilation is not needed, as the enhanced breathing through exercising is enough to keep the oxygen saturation sufficiently high. CDT activates the breathing system directly through the nervous system, even before a deeper breathing is necessary due to the lack of oxygen.

When the author exercises on a special CDT device and increases the load, he instantly breathes more deeply before the oxygen saturation goes down.

The cardio-vascular performance is immediately activated as well as the arterioles. The whole microcirculation is improved. When exercising on a special CDT device **(Figure 29)**, the neural networks of the somatic nervous system are activated and improved in its functioning in the short-term memory. Through learning transfer, also the sympathetic and parasympathetic nervous system divisions are activated for better functioning.

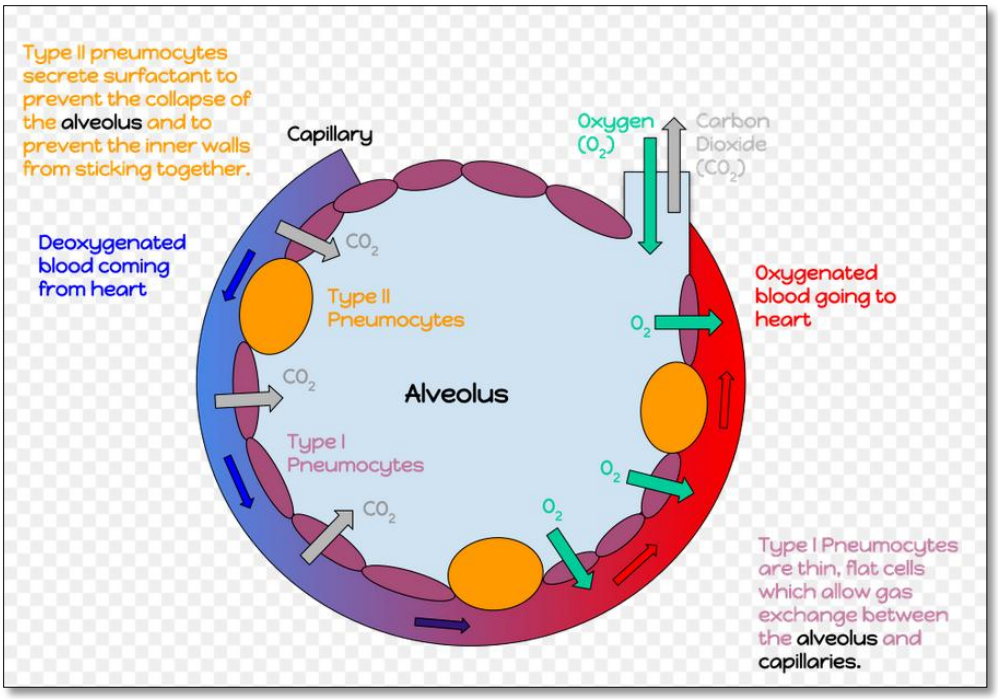

Figure 27. An annotated diagram of the alveolus. Taken from English Wikipedia.

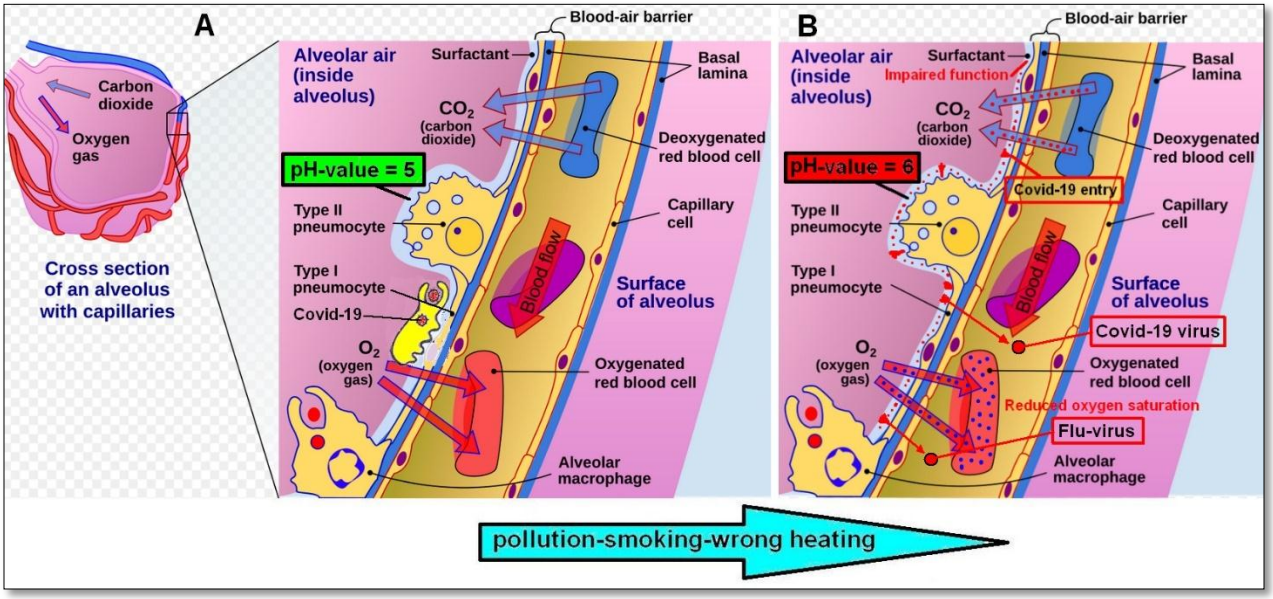

Figure 28. A Cross section of an alveolus with capillaries. Part of the cross section is magnified to show diffusion of oxygen gas and carbon dioxide through type I cells and capillary cells. The alveolar macrophages reside on the internal luminal surfaces of the alveoli, the alveolar ducts, and the bronchioles. They are mobile scavengers that serve to engulf foreign particles in the lungs, such as dust, bacteria, carbon particles, viruses, and blood cells from injuries. Insufficient surfactant in the alveoli is one of the causes that can contribute to atelectasis (collapse of part or all of the lung). Without pulmonary surfactant, atelectasis is a certainty. Parts are taken from English Wikipedia. B. With the damage of the surfactant film (higher pH value, sticky and with cracks), the alveolar macrophages cannot migrate so well any more to engulf particles, bacteria and viruses. With inflammation the gas exchange is reduced. This knowledge was taught at the Technical University of Berlin in 1968; it needs upgrading.

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Figure 29. In the same way the Author exercises with the spinal cord injury patient Nefeli, a Covid-19 patient could be exercised. A ventilator would not hinder the supported training. Only lying in bed all the time is 'half-dead'. In more easy cases of infections, maybe a ventilator is not even needed. In the lying position more infected mucus is transported out of the lung through the cilia.

As can be seen from **Figure 30**, the lung functions improve through the pulmonary nerves.

By exercising on special CDT devices, more patients could be treated, even in the case of lacking ventilators. Through CDT, the activated CNS of the patients also strongly activate the ciliated epithelium of the bronchia and the coughing to transport infected mucus quickly out of the lungs. The ciliated epithelia work more efficient in the lying position. The quality (ionization) of the air breathed in from the ventilators is yet to be explored in the future.

When the author himself suffered a virus lung infection more than a year ago (not Covid-19) from the small brother of Nefeli (who got infected in the kinder garden), he was just exercising on a special CDT device in the sitting position and lying in bed. A terrible amount of infected mucus was coming out of the lung through coughing for a few days. Because the author had no increased temperature, probably the lung epithelia could successfully stop the virus from crossing the blood-air barrier **(Figure 28A)**. To support the ciliated epithelia with the transportation of the infected mucus out of the lungs, he had his pharynx, larynx and trachea directed downwards to use the gravity for additional transportation help. Approximately 10 days later he was healthy again and could continue the supported exercising with Nefeli (**Figure 29)**. The infection was an airborne infection and not a droplet infection, so for it to spread the two children only had to be in the same room. Nefeli and her sister became only mildly infected. But the author (age = 77) was exercising the most and was also breathing the most deeply because of high performance and thus he also inhaled more viruses. The age difference was probably not the main reason.

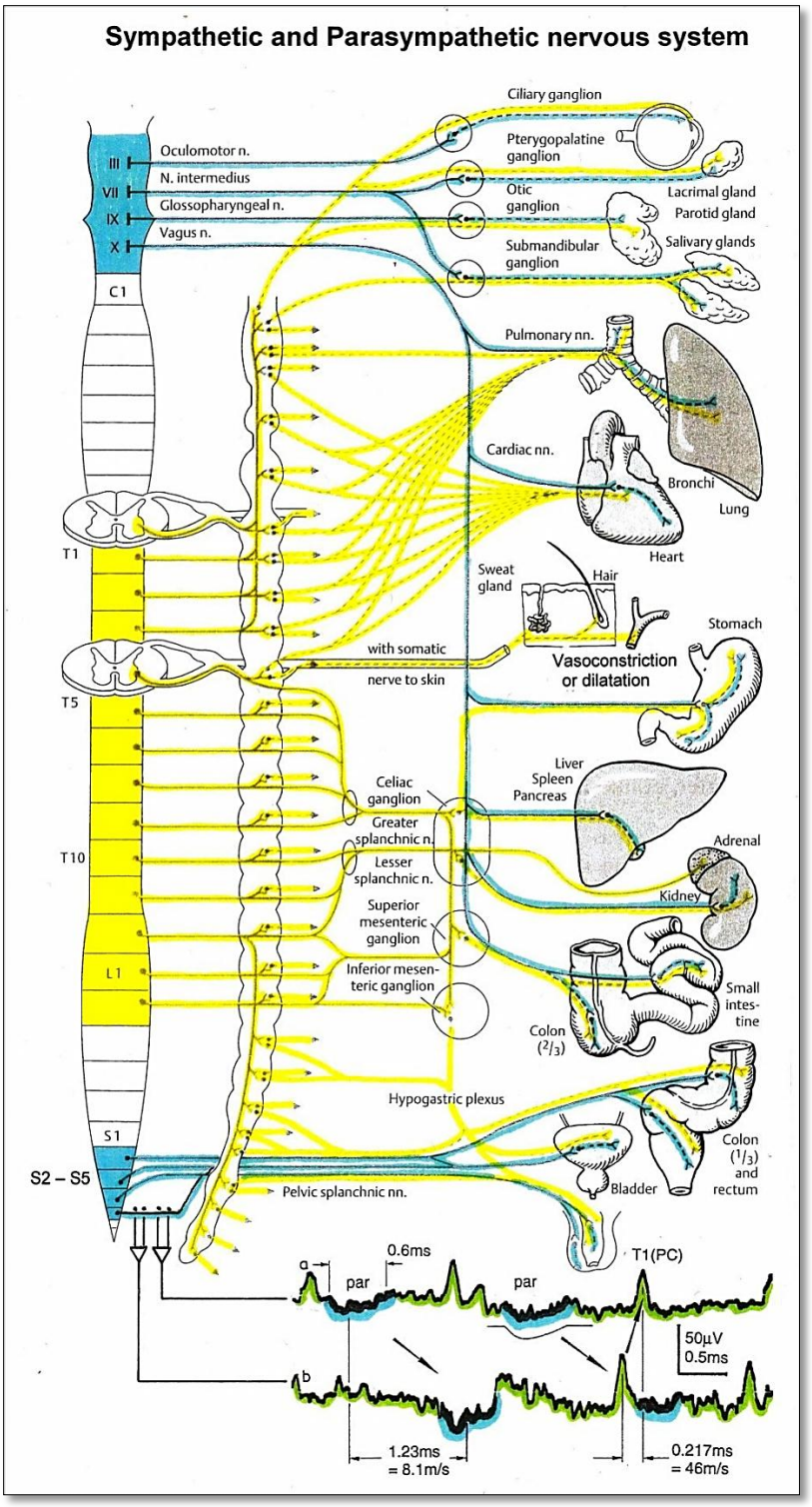

Figure 30. Schematic diagram of the sympathetic and parasympathetic nervous system. Yellow = sympathetic, blue = parasympathetic (it may be that the sacral parasympathetic division is also sympathetic). The recording of single-nerve fiber action potentials from preganglionic neurons (par) and a skin afferent fiber from a S5 sacral root is inserted.

Treatment of Covid-19 infections with CDT without using ventilators through improving the first protection shield and boosting the whole immune system

Through exercising on the special CDT device, "Natural Killer" (NK) cells, a form of white blood cells that are active against cancer [35] and viral infections are built **(Figure 31)**. There is no need of risky intravenous infusion of NK cells, because the exercised body produces them by itself.

Breathing healthy air when exercising on special CDT devices will partly protect against Covid-19 and other virus infections which overcame the first barrier of protection. They are then attacked by the NK cells **(Figure 28A)**. The improvement of cardio-vascular performance through CDT, which also activates arterioles and lymphatic vessels, will transport the NK and other immune cells quickly to the place of inflammation.

Figure 31 shows immune cells in connection with CDT and treated cancers. The own immune system has to be activated and strengthened in similarity to the application of vaccines. For the boosting of the immune system through CDT one does not need to wait a year for vaccines. It can be applied now without all the unnecessary risks of side effects.

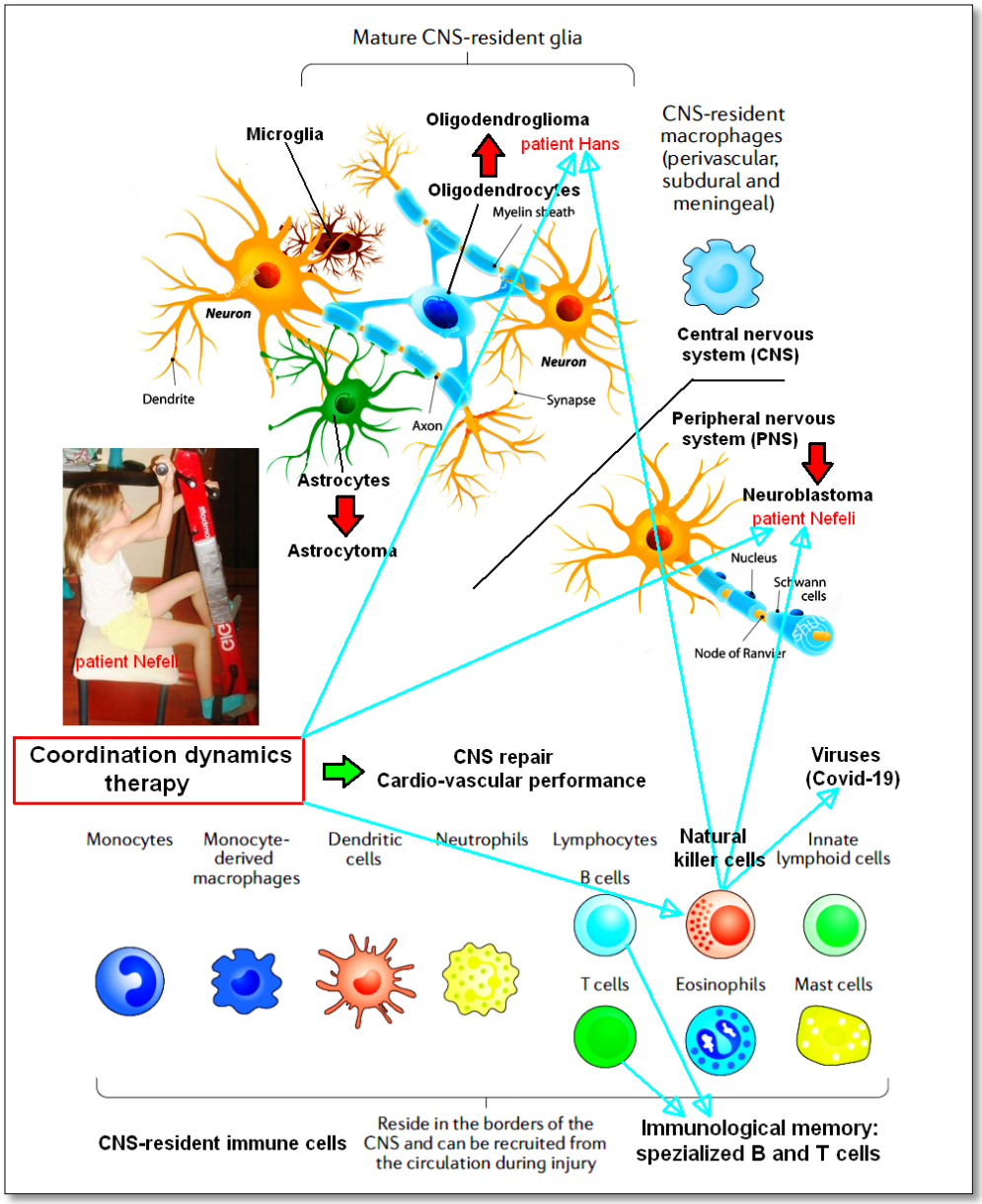

Figure 31. Coordination Dynamics Therapy activates Natural Killer cells to fight against cancer and virus infections, besides repairing the human brain.

Furthermore, the naturally activated immune system will also fight against infections, suffered additionally at hospital.

The world society works on the reduction of infections through isolation and quarantine. The consequences are unsustainable. A terrible amount of money is wasted. Quite a lot of money is also spent for vaccine development. No treatment effort has been done so far in-between these two steps, namely that the inhalation of Covid-19 and flu viruses don't lead to an infection by improving the functions of the pulmonary epithelia. CDT works on the improvement of the lung epithelia and a better fight against infections through improving the immune system naturally through an enhanced generation of NK and other immune cells.

More knowledge is needed about the functions of this first protection shield. Surely, the quality of the air breathed in is an important factor. The air, entering the lungs of active and passive smokers is a good negative example.

Brain-cancer repair includes the modulation of epigenetics through movement-based learning

Through administering CDT to the patient Hans for 4 months with at least 20 h therapy per week, the brain could partly be repaired, the cancer growth hopefully to a certain extent inhibited and the hypertension cured. Still the life-treating problem is the brain-cancer. To what extent can the anaplastic oligodendroglioma WHO III growth be inhibited through the movement-based learning therapy CDT so that the patient can live longer with a better quality of life.

The tremendous progress in repair of the brain-cancer patient can only be understood if CDT is modulating epigenetics **(Figure 32)**. For details of epigenetic regulation for repair by movement-based learning, see [22].

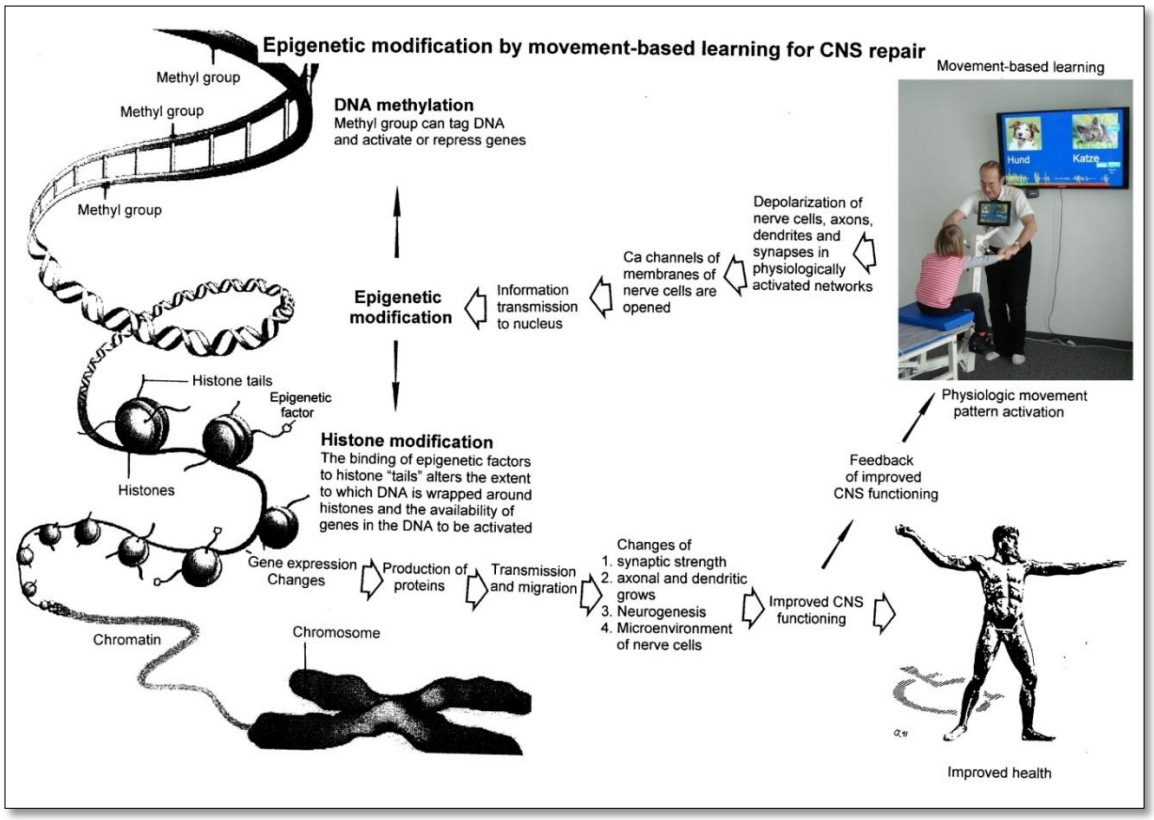

Figure 32. Epigenetic regulation for repair by movement-based learning. CDT-induced stimulation of the pathways that regulate neural network repair is a proven therapeutic and preventive tool. Epigenetic mechanisms, stimulated by physiologic network activation, are likely key players within signaling networks, as DNA methylation, chromatin remodeling and small non-coding RNAs superfamilies' are required for the fine-tuning and coordination of gene expression during neural network repair by learning. Since the nervous system is involved in nearly all body functions, CDT will improve health.

The author studied medicine, theoretical physics and engineering. But he feels overloaded to combine human neurophysiology, movement-based learning, genetics, especially epigenetics, and now also immunology. Interdisciplinary research is needed and has to be organized and funded.

False decision by politicians

The breathing air in Paris is extremely bad and also the hygiene is poor. 10% of the healthy women die of cancer. Inhabitants, who can afford, leave Paris on weekends for recovering the body. Through covid-19 regulations they are forced now by police to stay at home to reduce the infection risk. But the inhabitants breathe now all the time the polluted air, which further ruins the lung epithelia, that was already damaged by the wrong heating system. The psychological problems will increase and via the psycho-somatic functions further impair body functions. With the home-prison, the infection rate will reduce, but the incidence of stroke, heart attack, hypertensions and other diseases will increase. Being not allowed to exercise outside, the positive effects of exercises, even though not optimal, cannot be used. Leaflets of health insurance companies in Switzerland emphasize again and again that regular exercising is necessary to stay healthy. But what to do, if it is not allowed to move outside. Poor people of Paris. In other places of the world, the situation will not be much better.

If CDT would have been supported 30 to 35 years ago, this pandemic may not have occurred or at least at a reduced level. It is the out-of-date system (capitalism, corruption) which is in crisis (see below). Persons advising the society in mass media should have quality. Their educational level should be shown and on what scientific medical research articles their advice is based on. Positions can be obtained by the membership of political parties.

Performed autopsies can distinguish between fact and fiction

In epidemics control it is important to have facts. Pathologists can find out on what a disease a patient died in similarity to forensic medicine. It is therefore important to perform an autopsy on patients who died in connection with a Covid-19 infection. It is important to clarify whether a patient died on the infection or whether he died on another disease and had the Covid-19 infection only as a side disease. Whether the pathologist can distinguish of infection deaths between Covid-19 and flu virus infections is not known for the Author.

Such a clarification is no 'theoretical game' in contradiction to the standpoint of the 'Robert Koch Institute, Germany'. It seems that the 'Virology establishment' tries to avoid control. It may come out that some of the mandatory measures (sanctions) were by far overemphasized. Pathology is a qualified medical discipline. The danger is not so much the virus, it is antidemocratic behavior. More autopsies are needed to get more facts.

Undercut of medical research through biologists and the missing of real qualified medical research apart from statistics

Figure 31 is partly taken from a review on 'Immune cell regulation of glia during CNS injury and disease', published in March 2020 [36] with 234 citations. Papers of the Author on spinal cord injury repair [4-7,18] are not cited. A suggestion how to manage the covid-19 pandemic is missing. The review article had been written before the pandemic. It would have been the duty of the editor to relate the article to the pandemic. Obviously, biologists and animal researcher are getting plenty of financial support, but their qualified research is bypassing the interests of human patients.

When the author submitted two papers to the 'Nature' Journal on human Neurophysiology 20 to 30 years ago, they were rejected by desk decisions. But papers in animal physiology were accepted by the 'Nature' Journal from the author. Also, the Christopher Reeve foundation rejected money support by desk decision. Most likely, Christopher Reeve died though overloading the kidneys (shock) with the administration of too many drugs. His death was not analyzed through forensic medicine as in the case of Michael Jackson.

Politicians in Finland had a good idea. They said, we are a small country with a small research budged and cannot support everything. So, they argued, we will support information technology (Nokia) and we will support medical research. The health care system is run by the state. But they experienced that no medical researcher applied for funding. Therefore, they changed the budget in the way that groups of clinicians and animal researcher could apply for. Groups for funding were found. But since clinicians had too little time for research, the research money for improving medicine went again to animal research. The idea that one first has to organize medical research, was out-of-scope for the politicians.

When I worked for two years in the neuropathology department in Turku (Finland), to clarify the spinal cord anatomy, the chief did research on rats. I said to him at that time: 'It is strange, I am coming here to clarify further human anatomy and you here and have plenty of cadavers, but perform research on rats'. His answer was that only for animal research he could get research money and quite easily. Only 0.3% of the animal research has consequences for human patients.

Seeing this research situation, is there anybody who wonders about the Covid-19 pandemic? And when a vaccine is developed in one years' time, there will be

another virus coming. One problem is the missing organization for qualified basic medical research.

The research of the author was rejected because of being unqualified and ethical not justified in capitalistic countries. But unbelievable, without being involved in politics, the Author was supported by the former 'East Germany'. For the Author, being a subject from West-Berlin, it was in principle impossible to cooperate by politics with the former East-Germany. Still a cooperation was possible. For the University of Greifswald, in the North of Germany, it was very unusual to perform research on brain-dead humans. An ethical committee was founded and luckily, the decision was that the Author's research was ethical justified, including the measurements on brain-dead humans. The measurements on brain-dead humans were the essential step in research to develop CDT. The phase and frequency coordination of human CNS self-organization could be found. For the invention of the single-nerve fiber action potential recording method, he was supposed to get a professorship in Dresden (destroyed by the US Army in the World-war II, even though there were soldiers). A special laboratory should be built for him, because it is not allowed to measure brain-dead humans in a normal operational theater. I am sure, I would have got also a small place for performing neurotherapy to treat patients. The university built all the necessary things around the Author, even though they thought that the Author will not succeed to reach the stage of CNS repair. This became only possible 25 years later. The research in East-Germany was started before the Fall of the Berlin wall and ended after the Fall, when the capitalistic system came.

That a researcher from a capitalistic country (the author) was funded for one year by a socialistic country **(Figure 33)** is a unique research situation.

ERNST-MORITZ-ARNDT-UNIVERSITÄT

DDR 22 GREIFSWALD, DOMSTRASSE 11

AM: 19.05.1987 AZ:

B e s c h e i n i g u n g

Herr Dr. Dr. S c h a l o w, Giselher
ist in der Zeit vom 01.03.1987 bis 01.03.1988
Stipendiat an der Ernst- Moritz- Arndt- Universität Greifswald
und erhält ein monatliches Stipendium in Höhe von
900,-- Mark.

Ernst-Moritz-Arndt-Universität
22 Greifswald
Direktorat für
Internationale Beziehungen

Dr. paed. A Kloß
Direktor f. Internat. Beziehungen

Figure 33. Funding approval of the Ernst-Moritz-Arndt University of Greifswald at times of the former German Democratic Republic (GDR) (Deutsche DemokratischeRepublik) for the author from Berlin-West before the fall of the Berlin wall. Such a funding was for political reasons not possible.

When the author was post doc with Katz and Huxley at the Department of Biophysics, University College London, he did research for two years together with Ian Parker, a very qualified researcher. Ian Parker stayed in animal research, got professor ships in USA and was honored by the United Kingdom. The Author changed from animal research to human research and was therefore thrown out of the research system.

'Hypokausten' technique for healthy breathing air ('wrongly heated is half dead')

The first protection shield in the lung is the pulmonary epithelia. To keep this protection shield in a physiologic condition, one has to breath clean air with negative ionization. The lung is adapted to this negative ionization, because the magnetic field generates such ionization. When using horizontal warmness radiation for indoor climate, the indoor air keeps the natural ionization and the pulmonary surfactant keeps resistant with its negative pH-value **(Figure 28A)**. Such healthy indoor climate can be achieved with the 'Hypokausten' technique. The walls can be heated with resistance-wires or plumbing. With resistance wires one can only heat and through tubes one can lead warm and cold water for heating and cooling. The tubes or wires are placed at the inside of the external walls **(Figure 34B and C)**. The heat storage capacity and the overall heat transfer resistance increase up to a factor of 10. The building and running costs reduce to 50% of the costs for underfloor heating or radiator heating **(Figure 34A)**. Because the external walls are kept dry, the wetness of the ground cannot creep up the walls. To understand practically the importance of dry external walls, here an example. If you feel cold, do you put a wet pullover on or a dry one? But here is not the emphasis to save money for heating, but the healthy climate is of importance to support the pulmonary surfactant.

The 'Misuse of breathing air for heating' has to be avoided, because the moving air transports possibly viruses and bacteria for infecting you **(Figure 34A)**. The Hypokausten-technique dates back to 300 after Christ, when Celts and Germanic peoples were heating the rooms for the freezing Romans. Much later, the 'NichtstaatlichenMuseen von Bayern' in Bavaria ordered building physicists to climate their museums in a way that their figures of Jesus Christ, made of wood, would not tear and bend through the circulating air. In spite of the advantage of heating through radiation from warmed walls, the personal union of the board of management of insulating industry and standards committee stopped the Hypokausten-technique to be included into the building standards (DIN) (corruption). In connection with general isolation technique (for example stone wool), radiators are used to warm up the breathing air through the moving air. The warmer the air, the lower the relative moisture (frankly speaking, the dryer the air). The measured temperature difference between the moving air for heating and heating through radiation is at least 6°C. Further, the moving of the air changes the ionization of the air (electric changes with air movement; think of thunder). The pH-value increases from 5 in the direction of 6 (less acid). Therefore, the breathed air from the circulation, caused by radiators, enters dryer and with a changed ionization the lung **(Figure 34A)**. The epithelia of the lung vesical and bronchi get more dryer, more rigid (and partly brake) and less acid. The immune system has less access to the viruses and bacteria and the epithelia cannot kill the microbes so good anymore because of being less acid (in similarity to the stomach) **(Figure 28B)**.

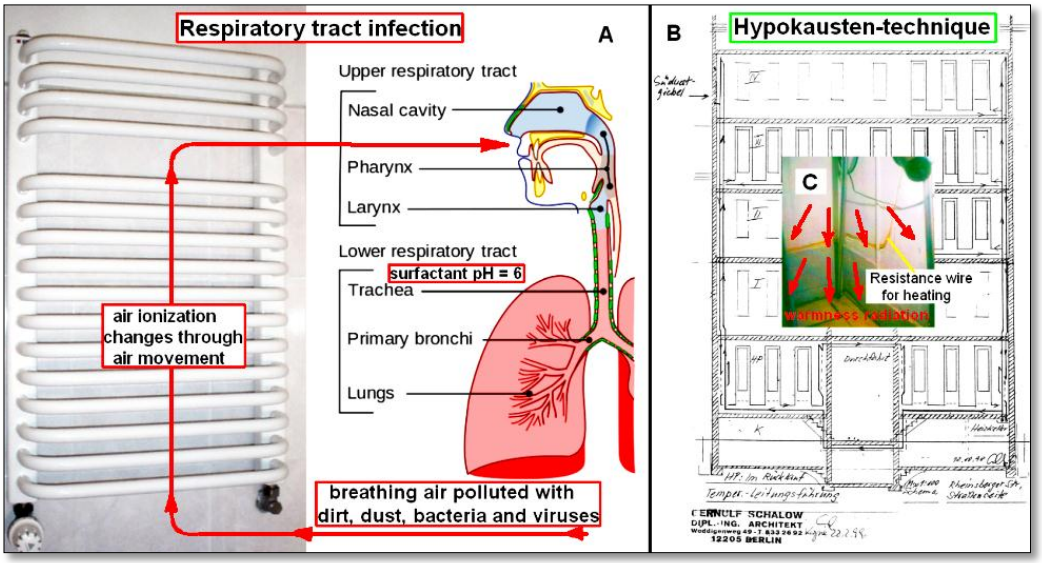

Figure 34. A) Breathing air used for heating. The moving air raises dust, dirt, bacteria and viruses and changes its ionization Such air is breathed by the person. The pH-value of the pulmonary surfactant increases from 5 in the direction of 6. B) 'Hypokausten'- technique for a house with 4 floors. For 'Hypokausten-technique' contact: Gernulf Schalow, Diplom-Ingenieur, Tel: 0049 30 8332692, Weddigenweg 49, D-12205 Berlin. C) In a small apartment in Paris, a resistance-wire is installed for heating to have horizontal warmness radiation without raising dust and dirt and, may be, not to get viruses from other apartments. The resistance wire was so far not covered with stucco.

Further, the ciliated epithelia cannot transport so well any more viruses and bacteria out of the lung because they are less soft. In smokers the ciliated epithelia is destroyed through smoking and toxins and dirt cannot be transported any more out of the lung. One consequence is to develop cancer.

Animal experiments bypass the interest of human patient, because animals repair mechanisms are different

The main difference between human and animals is the complexity of the CNS. Animal regeneration and repair experiments have nearly no consequences for human patients. The rat **(Figure 35)** has a high power of nerve fiber regeneration, but comparable little capacity for learning in comparison to human, because of the probably missing complexity of the CNS. Humans, on the other hand, have little power of nerve fiber growing, but are very good in learning, including movement-based learning, and can use this learning for CNS repair. This is known for 75 years [37-39].

Sperry transposed the nerve supply of flexor and extensor muscles in the rat [37] and in the monkey [38]: the monkey relearned the task, the rat did not. Monkeys also differ from dogs and rats [38] in the physiotherapy they need. In Sperry's experiment on monkeys, their learning to flex or extend the elbow in one situation did not necessarily become generalized to other performances. This indicates that the neural readjustment was not localized solely in the spinal centers but involved reorganization at supraspinal levels. Surprisingly few trials were required for poliomyelitis patients to use transposed tendons successfully. The visualization of the task seemed to be the prime aid to the patients [39]. Intensive neurotherapy gives more useful functions back of the to be re-innervated body parts [39].

A rat would not be able to exercise on a special CDT device of adapted size **(Figure 35A)**. Because of missing CNS complexity, it would not manage the complicated coordination's between pace and trot gait. May be the rat could learn to walk or run on hindlimbs **(Figure 35B)**. In rats therefore the nerve fiber growing strategy is used for repair and in human the learning strategy.

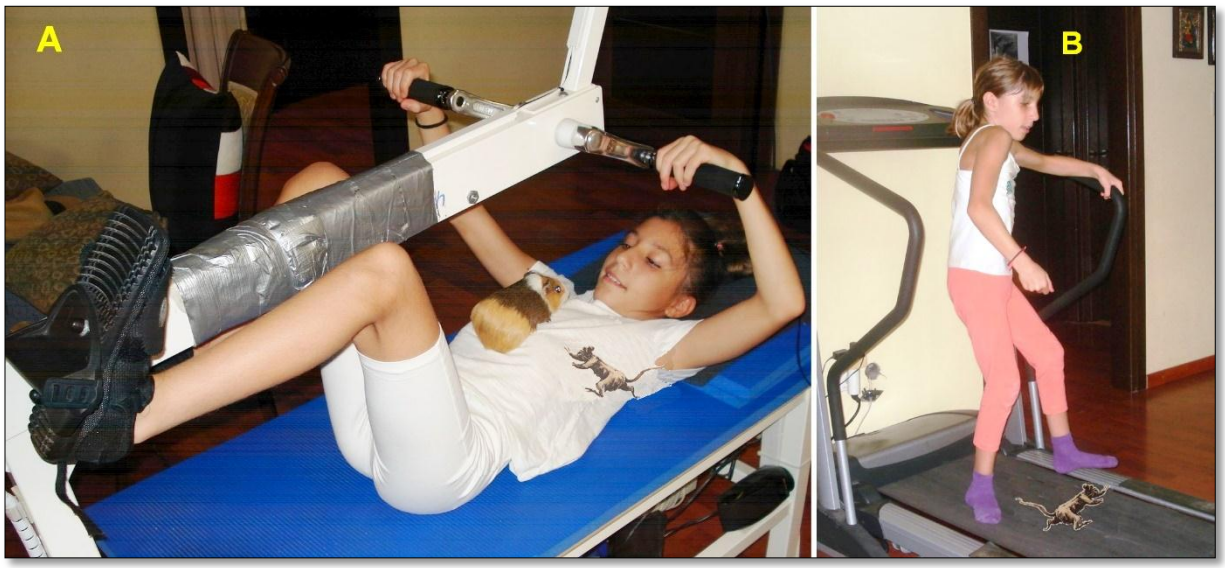

Figure 35. Training comparison of human and rat. The rat may learn to run on two legs (B), but will never be able to exercise on a special CDT device, even if the device would have the appropriate size (A), because its nervous system has not the sufficient complexity to generate the intermediate coordination's between pace and trot gait. A) For motivation the cancer and spinal cord injury patient Nefeli is training with pets. For sure she likes the guinea pig, probably not the rat. B) On treadmill, Nefeli may train together with a rat. She is training backward walking. (the guinea pig is original, the rat not).

The Tower of Babel and skyscrapers

The Covid-19 virus is powerful mainly because of wrong heating systems and air pollution, which ruin the epithelia of the lungs, so that viruses can easily attack the membranes of the injured epithelia cells and multiply there **(Figure 28)**. In a healthy heating system, as the 'Hypokaustentechnick' [34], the air breathed in is not used for heating. The warmed walls are used for isolation and heating through the radiation of heat **(Figure 34B)**. When the architect Gernulf Schalow suggested a better communication system to the town planning institution of New York way back in 1989, the answer was that there was no money for building a 'Kabinenbahn', for example a cable car for having a healthier communication system and better air. In New York, where many people work

close together, the metro system was not a really smart solution.

Being religious, one could compare the building of the Tower of Babel to the building of skyscrapers **(Figure 36)**. With the building of the Tower of Babel to reach the sky or heaven, 'God' punished the peoples by confounding their speech so that they could no longer understand each other and scattered them around the world. One could even say that when building skyscrapers to reach the sky, 'God' punished people by sending the Covid-19 virus so that they have problems with communication and social life through Covid-19 regulations and to think over their style of living.

The '9/11' attack on the World Trade Center skyscrapers had a great effect. Its success may be supported by some disadvantages in the building's construction. The static was probably sufficient for normal temperatures. However, when the temperature started increasing by a few hundred degrees Celsius, the situation changed. Bolts started stretching and the stiction between metal pieces became reduced. It is precisely these bolts that may be more easily sheared off to contribute to the destruction of several levels of floors. Preventive fire protection and escape ways are not any more popular among low-class architects because they may cost a lot of money to carry out and need specialized knowledge as well. The nuclear disaster of Fukushima was the consequence of corruption and using low-class architects and not because nuclear energy could not be used safely.

When Konrad Adenauer built several atomic power stations in Germany, he did not want to use the knowledge of the great scientist Heisenberg. Heisenberg and his team could have built the atomic bomb for Hitler, but they did not want to. Einstein, on the other hand, convinced Roosevelt to build the first atomic bomb for the Americans.

Persons, who contributed substantially to the cause of the pandemic, will present oneself in mass media to be great to solve the pandemic.

Figure 36. The Tower of Babel by Pieter Bruegel the Elder (1563) (left) and the Empire State Building, New York (1931) (right).

Pollution and wrong heating/ climatization systems destroy the lung epithelia which then become good targets for the virus of Covid-19. When a vaccine for Covid-19 is available, there will be another virus coming to attack the damaged lungs. The main problem is pollution, which impairs the natural defense mechanisms of the human lungs/body. Therefore, the main problem is not the Covid-19 virus, but the damaged lungs. Children have mostly no real problem with the Covid-19 infection because their lungs are still not damaged so much, more so if they grew up in a healthy surrounding. Even the strong support of research centers in virology cannot solve the problem, namely the environmental pollution and destruction of the earth. To refuse medical support of the Author some 30 years ago has consequences now similar to the destruction of the earth. The full consequences will not be seen for at least 20 to 30 years' time.

This out-of-date medical approach is used by politicians around the world to stop basic human rights, as for example the right for demonstration. The highest court in

Germany even justified the violation of human rights according to the constitution, as for example the right for demonstration (in German: "Der Schutz der Gesundheit allergehtüber den Schutz persönlicherFreiheiten", "The protection of the majority's health goes beyond the protection of personal freedoms). Such violations of human rights must be limited. Hitler destroyed democracy in Germany through a certain law ('Ermächtigungsgestz'), which allowed him to govern Germany without being controlled by the parliament. There were no legal means any more to stop him. This law ('Ermächtigungsgestz') was one reason for World war II. Furthermore, the decision of the highest court of Germany was not based on up-to-date medical knowledge.

What has all this to do with treating cancer patients? Because of home-confinement, the Author cannot treat his patients in different countries. As a result, according to the 14-year-old patient Nefeli **(Figure 35)** "Because I cannot go to school, I do crazy things at home."

The lying position with trunk rotation is healthy for recovery and treatment of lung functions

In some places in Europe it was through Covid-19 regulations forbidden to lie outside in the grass even when a distance of two meter was kept between two persons. It was also forbidden, to be at the beach. When lying in grass, the air will partly be cleaned by the grass. When lying or jogging at sea water beach, clean air is breathed because the land is heated by the sun and heated air rises and pulls air from the sea in similarity to the urban dust dome generation of **Figure 37C**. It will be shown that these Covid-19 regulations were wrong because lying in the grass or at beach improves your respiratory epithelium which also functions as a barrier to potential pathogens and foreign particles, preventing infection and tissue injury by the secretion of mucus and the action of mucociliary clearance. It will be shown that this mucociliary clearance **(Figure 37A)** is especially successful in the lying position and performing trunk rotation movements **(Figure 37B)**. It will be started with the pollution of air in cities.

Urban dust domes are a meteorological phenomenon in which soot, dust and chemical emissions become trapped in the air above urban spaces. This trapping is a product of local air circulation. Calm surface winds are drawn to urban centers, they then rise above the city and descend slowly on the periphery of the developed core (**Figure 37C)**. This cycle is often a cause of smog through photochemical reactions that occur when strong concentrations of the pollutants in this cycle are exposed to solar radiation. These are one result of urban heat islands: pollutants concentrate in a dust dome because convection lifts pollutants into the air, where they remain because of somewhat stable air masses produced by the urban heat island. In German this meteorological phenomenon is called inversion (Inversionswetterlage).

The urban heat island which causes a city to heat up, caps the dust and other particulates in the atmosphere. If there is not a strong enough wind, then this dome that is created remains intact and causes that heated up air within the urban heat island. Though if the wind does blow strong enough, then this dome is blown downwind causing it to move out of the city. The pollution in New Delhi and many towns of China (including Wuhan) was for a few years very high and will have damaged more or less the pulmonary epithelia of the inhabitants. But even in cities with a lower level of particulates in the air, the inhabitants will have particulates in the lung. Especially big and heavy particles, which got stuck at the foot of the ciliary **(Figure 37A, B**), are reluctant to the action of mucociliary clearance.

When a person is in the lying position, the gravity will help to pull the particles more to the surface of the ciliated epithelia **(Figure 37B).** Through rotating the body, particulates from all parts of the epithelium will pulled through gravity to the service of the epithelia for improved mucociliary clearance. When exercising on a special CDT device in the lying position, the pulmonary mucociliary clearance can be enhanced actively. The movements activate also the vegetative nervous system and via the pulmonary nerves **(Figure 30)** also the ciliated epithelia. The mucociliary clearance is further enhanced. Such stimulation is similar to the stimulation of the peristalsis of the bowel in spinal cord injury. When the cancer and spinal cord injury patient Nefeli had bowel pain because of impaired peristalsis, caused by the damaged vegetative nervous system, she trained for 20 min on the special CDT device and the bowel pain ceased **(Figure 29)**.

In Covid-19 infected patients, the mucociliary clearance will improve if the patient is exercising on the special CDT device with little load by himself or when his movements are supported **(Figure 29)**. Mucus with particles on which also bacteria and viruses are attached to, are transported out of the lung.

A further improvement of lung functions can be achieved when the patient is counting numbers in coordination with the turns **(Figure 22)**. Another possibility to improve the function of the respiratory epithelia is to correlate the breathing rhythm with the turning rhythm. The famous long-distance runner Emil Zatopek was able to win three gold medals at the 1952 Summer Olympics in Helsinki. One reason for his success was that he correlated the breathing rhythm with the running steps. He optimized through this coordination the oxygen consumption. Because breathing-movement coordination, he made certain breathing sounds and was nicknamed the "Czech Locomotive".

In conclusion, the strategy of the breathing-movement coordination is to enhance the self-defense system of the lung/body.

In cervical spinal cord injury, the breathing muscles are not working anymore (paradox breathing). These patients are in danger. The cancer and spinal cord injury patient Nefeli **(Figure 37D)** did not have this problem because her spinal cord injury was at the level of Th10. This means that her rostral intercostal nerves were fully working, and mainly the rostral intercostal muscles contribute to normal breathing.

Back to the healthy persons, who want to lie in grass or at beach. In the lying position and by sometimes turning, they will enhance a bit the mucociliary clearance and get more particles out of the lung, even in polluted air. It is therefore healthy.

Jogging, hiking or exercising at beach **(Figure 37C)** or in the forest **(Figure 37E)** is for sure healthy and improves lung and other functions. A terrible lot of money is spent because of the covid-19 regulation. No money is going to the research for a better treatment of patients and prevention of infections, that means pulmonary protection.

Out of date medicine contributes to deaths of Covid-19 infected patients

Nurses and young physicians are doing a very good job and work hard. Still more infected patients' lives could be saved, if the patients would made moving when lying in bed. Here an example.

My first coma patient Georg died because of lack of professional movements in the hospital.

The 18-year-old Georg was overdriven by a car when cycling and suffered a very severe brain injury and remained in coma even though his parents did a very good job in care and treatment. The car driver was drunk. In spite of coordination dynamics therapy, Georg got several times a lung infection. In the hospital he got drug-therapy and additional respiratory physiotherapy to improve the breathing and he survived the lung infection. With the last lung infection Georg died, because this clever nurse of the hospital was on holidays and the drug therapy alone was insufficient to keep him alive.

With cancer patients, the medical out of date situation is similar. Till shortly it was thought, when you have cancer, you should not move very much so that the body can use all power to fight against the cancer. But now it turned out that when you exercise you live longer with a better quality of life.

In clinics with Covid-19 infected patients, they have an argument to avoid additional movement therapy. When you exercise, you will improve the cardio-vascular performance and distribute the viruses all over the body and make the patient die earlier. For sure, when you exercise, the cardio-vascular performance is improved in the short-term memory. But the immune cells have a better access to viruses and bacteria and additional more immune cells are built, especially the natural killer cells to fight against viruses and bacteria **(Figure 31)**. In hospitals one seems to be afraid of movement therapies. Even though physiotherapy is 30 years out of date, still it is better to administer insufficient movement therapy than no movement therapy at all. Hospitals are full on the side of drug therapy and hi-tech medicine and ignore the support of the natural defense systems of the body.

In conclusion, from the aspect of human brain repair research, humans have to decide what they want. Do they want to live with the nature **(Figure 37E)** or against it **(Figure 37C)**? If they decide to live under urban dust domes, then soon the use of dust mask is insufficient, respiratory masks with filters are needed. The borrowing of a terrible lot of money of most countries is an indication that the world society does not want to change their live style till now and too many people want to live beyond one's means. The author has to live and to do research with approximately 1300 US Dollar per months.

ACKNOWLEDGEMENT

This research project was judged as unqualified and ethically not justified by the DFG, the Swiss national fond and other institutions. Even the support of the German president Richard v. Weizsäcker did not help. No real funding could be obtained for 35 years. When the Author gave a presentation some 20 years ago in the Nobel institution of neuroscience (Prof. Grillner (pattern generators)), he was not allowed to discuss with assistances this human research project. It was intended there to design a rat experiment, what the Author had already performed on human. Most likely, all the reviewers of the negative decisions had less qualifications than the author (Schalow G, Dr.med.habil., Dr.rer.nat., Dipl.Ing.).

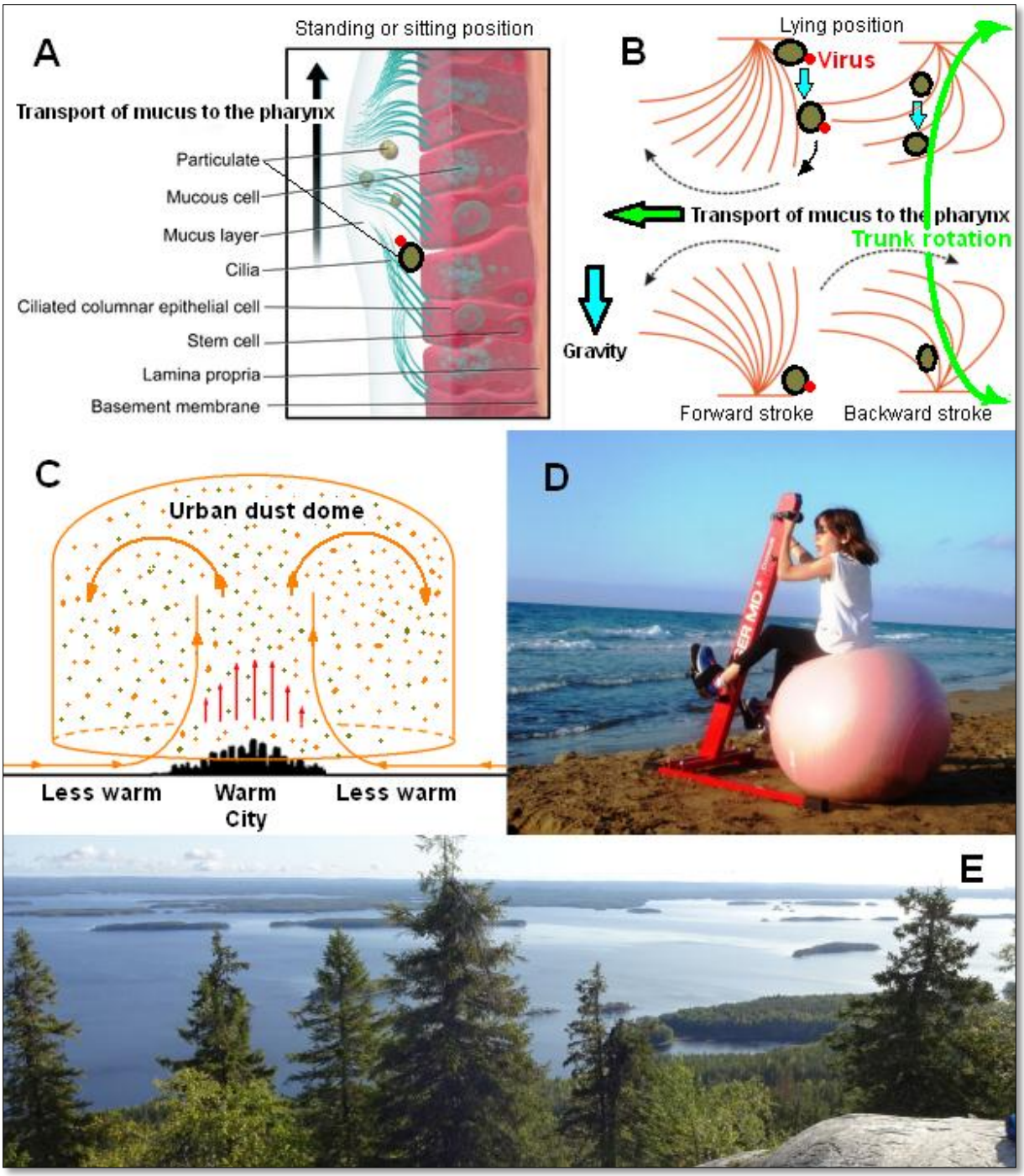

Figure 37. Improvement of mucociliary clearance through exercising and especially in the lying position. A) Respiratory mucociliary clearance when sitting or standing. The clearance is achieved against the gravity. B) Mucociliary clearance in the lying position to transport large and heavy particulates to the pharynx. The gravity supports the loosening of the particulates from the feet of the cilia and to shift them to the top. Through rotating the body, all parts of the respiratory epithelium are reached for gravity unfastening. At the top of the cilia, the mucociliary clearance is more efficient. Bacteria and viruses attached to the particulates transported to the pharynx. C) Generation of an Urban dust dome. Soot, dust and chemical emissions become trapped in the air above a city through inversion and pollutants concentrate in a dust dome. Pollutants are breathed by the inhabitants of the city to contribute to the damage of the respiratory epithelia **(Figure 28**). D. Jogging and exercising at the sea is beneficial for mucociliary clearance to recover impaired lung functions. Forest for repairing the lung. Koli, National park, Finland.

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