INDEX OF PAPERS and POSTERS

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CHANGES IN BREATHING PATTERNS BY MEADOW AND CONCRETE IMAGES: IMPLICATIONS FOR HEALTH

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Breathing patterns are effected by imagery and movement. Many people tend to breathe thoracically or hold their breath when they move or walk on hard surfaces. Somatic therapists (e.g. Middendorf) report that respiration shifts towards a thoracic pattern even when their clients imagined or actually walked on hard surfaces and conversely respiration shifted towards a diaphragmatic pattern when they imagined or actually walked on soft surfaces.

The purpose of this study was to explore the effects of different imagery conditions on breathing patterns while walking on hard and soft surfaces. 12 volunteer subjects (9 females and 3 males, mean age 31.1) participated in this study. Six reported breathless episodes (range .8 per day to 4.6 per month). Thoracic and abdominal strain gauges and tibialis anterior electromyography (sEMG) were recorded with Thought Technology Ltd. Flexcomp System.

Subjects were seated with their eyes closed in a comfortable chair. Instructions were presented by a standardized audiotape for the following three sequential conditions: sitting in the chair, walking on the concrete floor, and walking on a soft mat 1" in thickness. Each condition consisted of four counter-balanced 30 second imagery trials: meadow, concrete, meadow and concrete. Following the last imagery sequence, subjects filled out a subjective questionnaire and rated the quality of their imagery.

The results showed a significantly higher respiration rate ($p<01$) for the concrete image (mean=14.8) as compared to the meadow image (mean=13.5) in all positions, significantly higher respiration rate ($p<01$) when standing (mean=15.8) as compared to sitting (means=10.9), a shift to predominant thoracic breathing pattern as shown by the 20.6% decrease in abdominal strain gauge displacement when walking in place as compared to sitting position, an increase in abdominal movement during meadow image, and enhanced subjective feeling of relaxation during the imagery of walking on a soft meadow and an experience of vigilance/arousal during the imagery of walking on a hard concrete surface.

The increase in thoracic breathing and respiration rate during imagery and actual walking was most likely due to conditioned bracing and splinting to avoid jarring and pain when the foot/heel strikes a non resilient surface. Many subjects associated walking on concrete as stressful (e.g. crowded city scenes, pain in back or legs).

We speculate that this increase in breathing rate and thoracic breathing may be covertly evoked by walking on hard surfaces thereby, increasing arousal, hyperventilation, and decreasing regeneration. Implications for relaxation strategies, reversal of arousal, and health assessment of shoes are discussed.

We thank Ms. Dorii Reeves for introducing us to the relationship between walking on hard and soft surfaces and breathing.

Effect of breathing and relaxation instruction on resting heart rate and respiratory sinus arrhythmia in myocardial infarction patients.

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Autonomic imbalance receives increasingly atention as a possible mechanism for cardiac pathology as well as therapy. Low values of respiratory sinus arrhythmia (RSA) and high resting heart rate are factors with prognostic implications after myocardial infarction, and are associated with cardiac pathology (heart failure and arrhythmia). Both exercise training and stress management training may exert their beneficial effect through an influence on autonomic balance.

In previous reports it was shown that the addition of breathing and relaxation instruction to a program of exercise training improves physical and psychological outcome after myocardial infarction, and reduces occurrence of cardiac events.

In this report, the effects on resting heart and respiration rate, and on RSA will be shown. Relaxation instruction caused a relatively small but consistent decrease in respiration rate after rehabilitation, compared to the patients who received exercise training only ($p < 0.001$), which remained at three months follow up. Resting heart rate decreased after rehabilitation, for all patients ($p< 0.001$), but only for the relaxation group it continued to decrease at three months follow-up ($p < 0.05$). This effect was associated with the more quiet respiration pattern.

Respiratory sinus arrhythmia did not change after exercise training only, but increased when relaxation was added ($p < 0.05$). At three months follow-up RSA was still larger ($p = 0.01$), and the difference remained significant when respiration was controlled for.

It is concluded that there are indications of an effect of breathing and relaxation instruction on cardiovascular autonomic balance, which continued after the intervention, and was partly associated with slower breathing, and partly independent of respiration.

Has Autogenous Training specific beneficial effects in the treatment of adult asthmatic patients ?

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Problem: Many physio-, psychotherapists and physicians recommend asthmatic patients to apply relaxation techniques, additionally to drug treatment, for symptom control, mainly to prevent themselves from asthma atttacks.

In this study we examined, if autogenous training (AT) provides specific benefits to voluntary control of airways obstruction.

Methods: All 20 patients involved in this study first participated in a 2 weeks training of asthma management focusing on peak flow measurement, to run a symptom diary, education in drug treatment, management of severe dyspnea etc..

After this common education the group was randomly separated in an experimental and a (waiting for later treatment) control group. The experimental group was instructed in AT in weekly group sessions for a period of 8 weeks. Pre- and post training effects and the follow up outcome 8 weeks later were assessed in physiological (Raw, TGV, TRR; FEV1, PF) and psychological (Asthma Symptom Checklist, Coping inventory etc.)measurements. Additional data of TRR, FEV1 and PF were sampled at several occasions during and following the training.

Results: Neither pre-post nor follow up training effects have been found in Raw but a small TRR reduction after the training period (-0.04 kPa/l/s), $p < .05$). But this latter result is in contrast to the TRR measurements assessed immediately before and after each training session, where no significant between session differences were found. Also no psychological benefits came out. Even the analysis of moderator variables did not show any specific beneficial effects.

Conclusion: Contrary to clinical recommendations we were unable to find any additional physiological or psychological benefits of autogenous training to drug treatment and education in asthma management in adult asthmatic patients.

Children with asthma and physical exercise.

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Account is given of a study on the effects of physical exercise on the working capacity and physical condition, physical competence expectations and coping strategies. The research consisted of 2 experiments (until now).

At first, a pilot study was executed with 7 children with asthma who participated in a special physical exercise program. Secondly, in a follow up program with a pretest- posttest-control group design, 12 children (control group N==6; experimental group N=6) participated .

Analyses suggested that training via this physical exercise program improved endurance performance on the cycle ergometer and the treadmill. Furthermore, this training improved expectations regarding physical competence in sports as measured with a Competence Scale for Children (Veerman, 1989). Coping with asthma as measured with an Asthma Coping Test (Colland, 1993) was also positively affected. As expected, the spirometric variables did not change.

This physical exercise program focuses on the promotion of exercise behavior and familiarity with physical exercise. Therefore, it is important to improve the physical condition of asthmatic children. Moreover, it is necessary to promote the use of adequate coping behaviors in such a way that children will be able to cope with stressing situations within lessons of physical education in school and sport programs outside school.

How can a Patient Association support a COPD Rehabilitation Programme: Patients' role in self management.

Edith M.A.L. Rameckers, MD.

Patients are persons who consult professionals because they want to become healthy again. In chronic disease such as COPD this is not a realistic option and patients are aware of that. So most probably they look for the physician's help to be able to live as normal a life as possible.

This implicates that the prescribed treatment will be weighed against the desire for a normal life. And the patients decisions modify the prescribed treatment.

A literature search on patients' satisfaction with medical care learned us that patients base their opinion on the non-technical rather than the technical aspects of care. The activities traditionally performed by a physician when a symptomatic patient visits him have only a minimal impact on patients' satisfaction; the patient expects the doctor to be skilled.

Patients' satisfaction is directly related to the physician's efforts to deal with the patients need for information, the need for control and the need for support and advice regarding stressful situations. It is related to interventions that generally indicate to patients that their physician respects them as an individual and is concerned about their personal welfare.

Patients' perceptions are important even when their recall of the medical visit is far from perfect. These perceptions ultimately affect patients' behaviour and outcomes.

The Netherlands Asthma Foundation uses this knowledge in their "Patient Empowerment Programme". The aim of this programme is to raise the awareness of the decision-making process both in patients and in physicians. It will enable the patient to take his own responsibility in the management of his disease.

But also in a more direct way a patient association like the Asthma Foundation adds to the benificial effects of rehabilitation programmes for COPD patients, by organising after-care sports in group setting.

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DEVELOPMENT and EVALUATION of a SELF-MANAGEMENT PROGRAM for CYSTIC FIBROS1S

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We developed and evaluated a self-management program for children with cystic fibrosis (CF). The program included both an educational component and a behavior control component.

The educational component consisted of instruction in: the principals of self-management as they relate to CF; the anatomy, physiology, and pathophysiology of CF; CF medications; and the consequences of CF. The behavior control component consisted of training children to respond effectively to CF symptoms they recorded daily in a CF diary.

Twenty children with cystic fibrosis, who ranged in age from 8 to 17 years, participated in the program. They were assigned randomly to one of two conditions: a self-management condition and a control condition.

The children in the self-management condition were taught both program components during two, six-hour training sessions which were scheduled about a week apart. Dependent variables, consisting of knowledge of CF, adherence to medical recommendations, frequency of self-management behavior, weight, peak expiratory flow rate, and quality of well-being, were recorded two weeks prior and eight weeks after the training sessions.

Subsequent to training, the children in the self-management condition showed reliable improvement both in weight and in adherence to medical recommendations, but children in the control condition did not. In addition, self-management group children tended to improve relative to control group children in CF knowledge, frequency of self-management behavior, and peak expiratory flow rate; these changes, however, were not statistically reliable. The children in the two groups did not differ in quality of well-being.

We concluded that self-management programs may play an important role in the control of CF.

Quality of Life and Children with Asthma.

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We compared responses obtained on coping, self-esteem, attitudes toward illness, health, and well-being inventories among children with asthma (n=20), diabetes (n=16), or epilepsy (n=9) to evaluate differential effects of childhood chronic illness on health-related quality of life.

Children ranging in age from eight to twelve years who had been diagnosed with a chronic illness for at least one year, and who were considered "well-managed" by their physician, participated.

Children completed the following five questionnaires, in random order: Kidcope; Piers-Harris Children's Self-Concept Scale; Child Attitude Toward Illness Scale; RAND 3 6-Item Health Survey 1.0; and. Part A of the Child Asthma Questionnaire.

The mean age of children with different illnesses was virtually identical, but reading levels measured by the Woodcock-Johnson Passage Comprehension Test indicated that children with seizures functioned at a significantly lower age and reading level compared to children with either asthma or diabetes.

Overall health as measured by the RAND 36-item Health Survey indicated that children with asthma reported a reduced perception of their general health (M = 66.75) compared to children with either diabetes (M = 81.88) or epilepsy (M = 73.80), E(2,42) = 3.28, n < .05.

Other general scales of quality of life did not discriminate reliably among the three groups, but the RAND general health perception score was correlated significantly with scores obtained on both the Piers-Harris [r(42) = 0.29] and Child Attitude Toward Illness Scale [r(43)=0.33].

Children with well-controlled asthma, diabetes, or epilepsy seem more similar than dissimilar. On the other hand, the reduced perception of general health status reported by children with asthma may reflect more recurrent effects of illness on levels of physical functioning in those patients.

Respiration in anxiety disorders.

T. Roth

Abstract pending.

Dyspnoea during an incremental ergometer test and respiratory muscle load.

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•Department of General Practice and Social medicine, University of Nijmegen; The Netherlands.

Background: In this study the correlation between dyspnoea and load on the ventilatory muscles was assessed. Both inspiratory and expiratory muscle load were of our interest. This was done in patients with obstructive pulmonary diseases during an incremental maximal exercise test. A subdivision was made between patients with or without a ventilatory exercise limitation. The first was defined as an increase in PaC02 during exercise.

Methods: Fifty patients with a wide range of obstructive pulmonary diseases (FEVl%pred.: 66.1% ±28.8) performed an incremental cycle ergometer test. During the test dyspnoea (Borg), oesophageal pressures, mechanical load on the ventilatory muscles (time tension index(TTI)) and minute ventilation were measured.

The amplitude of pleural pressures (Pi + Pe)act generated at Wmax was multiplied with the breathing frequency (=PFP, indication of the muscle load). PFP% was calculated from: frequency*(Pi act, + Pe act)/(Pi max + Pe max). Linear regression between Ve and PFP at Wmax was calculated for both groups. The slopes of these relationships give an impression of the length-tension-inappropriateness. When there was a difference in slope it was assessed wether this led to a difference in Borg score for dyspnoea between the two groups. Correlations between the changes in TTIi, TTIe, PFP, PFP% and Borg dyspnoea for both groups were calculated.

Results: The slope of Ve/PFP of the non ventilatory limited group was 0.17 L/kP (p= 0.007). The slope of Ve/PFP for the ventilatory limited group was 0.01 L/kP (p=0.7. The difference between the slopes (0.16) was highly significant (c.i. (0.159-0.161).

However there was no difference between the Borg score for dyspnoea between those groups (mean Borg vent.lim.: 5.9 ±2.6; mean Borg not vent.lim.; 5.9±2.1; p=0.945). The change in TTIi was 0.04±0.05 for the ventilatory limited group and 0.07 ±0.07 for the non ventilatory limited group, which was not significant. The change in TTIe was 0.08 ± 0.08 and 0.06 ± 0.07 for the ventilatory and the non ventilatory limited group respectively and was also not significant.

Bd with:	TTIi	TTIe	PFP	PFP%
Total (N=50)	r=-0.2272	r=0.0614	r=0.1507	r=-0.0013
Vent.lim. (N=22)	r=-0.1467	r=0.0652	r=0.1922	r=0.1741
Nvent.lim.(N=28)	r=-0.3143	r=0.0619	r=0.1124	r=-0.1396

Table 1. Correlations (r) and p-values between Borg dyspnoea (Bd) and TTIi TTIe PFP and PFP%, none of the correlations were significant.

Conclusions: The sensation of dyspnoea during exercise in patients with obstructive lung disease, did not correlate with parameters of length tension inappropriateness in respiratory muscles. Other parameters of ventilatory muscle load did also not correlate with Borg score for dyspnoea.

The Influence of Compliance, Psychological Adjustment and Lung Function on the Quality of Life in Patients with Chronic Obstructive Pulmonary Disease after Introduction of Liquid Oxygen Therapy.

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Purpose: The purpose of this study was to investigate the effects of two different aspects of compliance with liquid oxygen therapy (LOX) on quality of life and to explore possible pneumonological and psychosocial concomitants.

Patients and methods: The study sample consisted of 57 O2-dependent patients with chronic obstructive pulmonary disease (COPD) under LOX therapy. Compliance was defined as the continuous oxygen use as prescribed and as the readiness of the patients to use LOX also outdoors. The study design encompassed one initial assessment and a follow-up examination 14 months later. The psychosocial variables studied included quality of life and psychological adjustment.

Results: Seven (12%) patients used LOX less than the daily prescribed hours and 13 (23%) refused to use LOX away from home. Those patients who used LOX less than prescribed had a significantly lower life-satisfaction than the compliants ($p=0.02$). A discriminance analysis included several psychosocial variables discriminating between both groups, allowing the correct identification of 85% of the patients who used LOX as prescribed and of 83% of the noncompliants (Eigenvalue =0.71; r=0.65; Chi 2=23.16; df=10; $p=0.01$).

At follow-up, the data of 25 patients were available. Of these, five refused the LOX outdoor use. Their life quality was significantly worse in almost all areas examined, ($p<0.05$, respectively), except for home-management and free-time activities as compared to the LOX outdoor users.

Conclusion: We conclude from our results that compliance is an essential prerequisite for the beneficial effects of LOX on quality of life. Because psychological factors influence the adherence to LOX therapy, depending on the aspect of compliance called for, patients should receive individual psychological counseling and training before their transfer to LOX.

Chronic pain suppresses respiratory sinus arrhythmia.

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48 patients of a spa-clinic and 18 of their relatives (mean age 53, youngest 28 oldest 77; 46 woman, 20 men) participated in a study of possible covariations between respiratory parameters at rest and general well-being.

The aspects of well-being measured were: bodily complaints, emotional well-being and life satisfaction. Respiratory frequency, relation of inspiration to expiration time, relation of abdominal to thoracic respiration amplitude, respiratory sinus arrhythmia and heart rate were

monitored during 8 minutes of rest in the morning and afternoon on the 3rd and 18th day of the 3 weeks stay.

Complaints were measured with the Giessner Beschwerde Bogen , allowing the calculation of 5 scales: heart complaints, intensity of pain at different locations, abdominal complaints, exhaustion and an index of general physical complaints.

A moderate but stable negative correlation (r1=- 36 r2=- 37) between pain and RSA was found. An analysis of variance confirmed this result revealing a 50 percent lower RSA-amplitude in high-pain subjects compared to low- pain subjects. A detailed analysis showed that headache was the pain symptom most consistently covariing with reduced RSA.

Other consistent correlations between respiratory parameters and variables of general well-being were not found

Hyperventilation and the Chronic Fatigue Syndrome (CFS)

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Because hyperventilation can produce substantial fatigue and because fatigue is one of the main complaints in hyperventilation, it seems worthwile to further investigate their relationship. The purpose of this study was twofold:

1- is there any physiological evidence that CFS patients do show hyperventilation more frequently compared to a population of healthy controls?

2- is there any relationship between the complaints in CFS and hyperventilation?

In this study we compared a group of 27 CFS patients, 6 males and 21 females, age 23-54, mean 36.6) with a group of 32 healthy controls (5 males and 27 females, age 19-63, mean 37.0). CFS is defined as a severe fatigue, lasting for at least six months, for which no somatic explanation can be offered.

Patients were diagnosed with CFS if they fullfilled the Sharpe criteria. According to these criteria patients with a current diagnosis of major depression with melancholic or psychotic features, bipolar affective disorder, schizophrenia of any subtype, delusional disorders of any subtype, manic depressive illness, substance abuse, eating disorder or proven organic brain disease (dementias of any subtype), will be excluded Patients and healthy controls were diagnosed as having hyperventilation when they fullfilled three of the following criteria:
- low PaCO2
- high breathing frequency, irregular breathing or frequent sighing
- decreasing PaCO;, in control condition
- inverted ventilatory response to CO2
- adding CO2, results in a regularisation of breathing

- Provocation Test (one of the following criteria):
- no step-change in PaCO2, when stopping voluntary hyperventilation

- no step change in respiratory frequency when stopping voluntary hyperventilation
- PaCO2 3 minutes after the end of the provocation < 90% of the starting level

As shown in Table 1, significantly more hyperventilation and significantly lower PCO2 levels were found in CFS compared to healthy controls.

TABLE 1	CFS (N=27)	CONTROLS (N=32)	p - value
HYPERVENTILATION,	59%	22%	< .005
according to physical criteria			
PaCO; < 4.5 (kPa)	52%	22%	< .05

No differences were found between CFS patients with and CFS patients without hyperventilation on severity of fatigue, impairment, psychopathology or number of complaints (Table 2).

TABLE 2	CFS HV (N= 15)	CFS NON-HV (N=12)	p - value
FATIGUE (CIS-F1)	46.3 (8.1)	48.0 (7.0)	NS
IMPAIRMENT (SIP)	1639 (662)	1892 (697	NS
PSYCHOPATHOLOGY (SCL-90)	153.9 (28.0)	157.8 (37.0)	NS
NUMBER OF COMPLAINTS	8.0 (3.6)	6.5 (3.6)	NS

Although many CFS patients do have hyperventilation, the role of hyperventilation in CFS is still unclear.

Personality, Cognition and Motivational Determinants of Asthma.

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The study to be reported was done in the framework of the cognitive orientation theory (Kreitler S Kreitler) which describes how cognitive contents and processes guide overt behavior and affect 'physiological processes related to disease and health.

The major concepts of this empirically-based theory are meaning attribution to inputs, beliefs of four types (about self, goals, norms and reality), behavioral intent (that summarizes the directionality and intensity of the motivational tendency) and behavioral program (that summarizes the form of the operational means for implementing the motivational tendency). Elements of major importance for physical health are conflicts between cognitive contents specific for each physical disorder.

The purpose of the study to be presented was to identify the themes and conflicts characteristic of patients suffering from asthma as compared to individuals who do not.

In the first stage 10 asthma patients were interviewed according to the procedure generated by the cogniti orientation theory in order to select the relevant themes.

In the second stage the selected themes were used for constructing a questionnaire that was administered to 40 asthma patients (mean age 22.8) an.d 44 controls matched in demographic variables.

The two groups were compared in terms of the four belief types (goals, norms, about self and about reality), the themes and the conflicts, assessed by the questionnaire.

The results showed that the asthma patients scored significantly higher on all belief types and in the majority of themes and conflicts. A stepwise discriminant analysis enabled.a correct identification of the asthma patients in 91% of the cases.

The themes found to be characteristic of asthma patients included not expressing emotions in general and anger in particular, avoiding confrontations with people, loyalty to the family, achievement orientation and rejection of uncertainty.

Major conflicts in the asthma group included striving for independence vs desire for help from an authoritative figure, hard driving vs easing pressure on oneself, etc.

The findings may be used for helping patients control respiratory distress.

Fearful and Neutral Mental Images as Conditioned Stimuli in a Respiratory Learning Paradigm with 5.5% CO2 Enriched Air as Unconditioned Stimulus.

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In a differential respiratory conditioning paradigm with normal subjects (N=28), two fearful imagery scripts describing two typical claustrophobic situations were used as conditioned stimuli (CS+ or CS-).

In a control experiment (N=28) two neutral scripts describing rather relaxing situations were used as conditioned stimuli (CS+ and CS-).

Subjects were instructed to imagine themselves in the situation depicted by the scripts, while either breathing 5.5 °s CO2, enriched air (CS+/US trial) or regular room air (CS- trial) . Three CS+ and three CS- trials were run during acquisition, followed by two CS+ and two CS- only trials (imagining the scripts while breathing air).

Respiratory frequency, tidal volume, minute ventilation, end-tidal fractional concentration of CO2, heart rate and subjective complaints were measured throughout the experiment.

An overall analysis of both experiments showed conditioning effects on complaints and physiological variables when fear scripts were used as CS+'s. The effect on complaints was

not confined to complaints of general arousal, but included respiratory and cardiac complaints as well, but not dummy complaints.

Frequency and minute ventilation increased, while lower FETCO2,-levels were recorded with CS+ compared to CS- imagery.

However, no conditioning effects on complaints were found when neutral scripts were used as CS+'s, while only a small effect on frequency was found.

The findings are discussed as to their relevance for panic and agoraphobic anxiety.

Hyperventilation and dysfunctional breathing.

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The term Hyperventilation syndrome (HVS) refers to complaints which are associated with disturbed respiratory function, without organic pathology Hyperventilating however refers to only one aspect of respiration- gas exchange. It is more realistic to conceive of respiration as a complex psychophysical system with multiple functions.

Thus, the consequences of disturbance in respiratory function, or dysfunctional breathing, should not be limited to complaints associated with inappropriate ventilation. First, transport of air serves gas exchange and lung function, but has also a communicative function in a more behavioral sense: smelling and production of sound and voice. In some mammals it is a means for thermoregulation possibly in humans also to some degree.

A second main respiratory function is musculoskeletal movement. Respiratory movements are volume changes of the trunk which act as pumping force to move gas in and out of the lungs, and also moves body fluids in general (e.g. venous return, lymphe drainage, cerebrospinal fluid). This central pump provides also constant rhythmic motion to the organs and the spinal column. In addition, respiratory movement is involved in stabilizing the trunk for upright posture, walking and weight lifting.

A third main function of respiration is in connecting conscious awareness to the state of the body. Respiratory motion is involved in sensing the three dimensional space/volume of the body and of the environment in which the body exists. Such body awareness in turn stimulates respiration.

A wider view of respiratory function, beyond lung function, has several consequences for the concept of HVS. Complaints, associated with dysfunctional breathing, may originate from inadequate air transport (ventilation, smell, voice), from inefficient movement and from insufficient awareness of the body.

Thus, dyspnoe, lightheadedness and agoraphobia may result from dysfunctional breathing, irrespective of hypocapnia. The tendency to hyperventilate occurs in a subset of patients and is stimulated by restricted movement in the trunk and spinal column, which the subject is unaware of.

Breathing therapy involves the restoration of functional mobility in the trunk and spinal column with respiration, and reeducation of body awareness.

ROLE OF SENSORY COMPONENTS IN RESPONSES OF RESPIRATORY SYSTEM TO A COMBINATION OF FLOW-RESISTIVE LOADS AND INCREASING EXERCISE

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The compensatory responses of respiratory system to a combination of additional resistance and exercise at the humans come true at participation of reactions on the part of sensory sphere in the form of a spectrum of sensations from easy difficulty of breath up to an intolerable breathlessness, limiting work performance.

The goal of the given work was the research of physiological mechanisms, underlying of a respiratory discomfort, arising at the male during a combination of additional resistance and muscular work.

At 13 healthy male subjects performing an increasing work on veloergometer in conditions various on size of respiratory loads, the moments of submission of signals about occurrence of difficulty of breath and about a refusal from continuation of experiment, were recorded.

The analysis of the respiratory parameters, registered in these moment has shown, that the respiratory discomfort occurred at increasing of the alveolar PC02 up to 54-58 mm Hg and the refusal follows at achievement of a certain level of central inspiratory activity (dP/dtI about 2500 mm H20/s).

Subjects considered, that the moment of a refusal coincided with the complete exhaustion of reserves of respiratory system, however their lung ventilation and inspiratory effort did not reach the maximum values, received in special tests.

Apparently, the sensory components of reactions on a combination of muscular work with increased of resistance to breath have protective character and are directed on prevention of exhaustion of functional reserves of respiratory system

The sensory components of reactions are possible to consider as display of the afferent signal system, involving voluntary sphere of the respiratory control in the compensatory responses to intense functional loads.

SPRING UP THE PERCEPTION OF DYSPNEA TO DECREMENTAL EXERCISE DURING LOADED BREATHING

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Investigated sensations during exercise in conditions of breathing against a resistance load.

The experiments were carried out with 8 healthy male in age of 18-46 yr. Additional resistance load was 38 sm H20. Graded cycle ergometer tests were performed.

The testing protocol involved 30 s of loadless pedaling followed by steps at 25 W in 30 s increases in power output until a power output by 100 W was achieved, then those steps a power output was decreased. Rating of perceived dyspnea was evaluated using 3-point scale on every step of power output. The three point of the scale was refusal to continue research because of from an astma.

In experiments without additional resistance load subjects did not perception of dyspnea. On the power output by 100 W heart rate mean ±SE was 102±7 beats/min. End-tidal C02 averaged 93.2±5.0 mm Hg.

In experiments with additional resistance the sensation dyspnea occurred at the first step of decrease in power output of physical work. Heart rate mean ±SE was 106±10 beats/min. In this time end-tidal C02 was 48.4±3.6 mm Hg. Dyspnea was kept up to the third step of decrease in power output and vanished at end-tidal C02 equal 47.8±3.6 mm Hg.

We believe that the sense of dyspnea would reflected a necessity of voluntary correction on respiratory control. This behavior reaction can be displayed or in a refusal to continue experiment, or in amplification respiratory movements.

THE INDIVIDUAL DISPLAYS OF HYPERVENTILATION SYNDROME

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Hyperventilation is one of the wide spreaded reactions to the emotional strain of the people, who work in the extremely conditions (cosmonauts, pilots, divers). Our aim was to study the individual displays of the hyperventilation state in healthy people.

We examined 290 males 18-23 years old at rest, during and after the hyperventilation test (3 minutes of intensive voluntary hyperventilation). The parameters of external respiration and interchange of gases/ PAC02, pneumogram, ECG and EEG were recorded. The feelings of the subjects were taken into account.

According to PAC02, pneumogram, EEG dynamics and the appearance of different feelings all subjects were divided into groups. The mechanisms of various types of reactions to hyperventilation test are discussed.

This experiment allowed to reveal the subjects, highly sensitive to hypocapnia, and subjects, who lose the ability for voluntary control of respiration after the hyperventilation test (so called "nonstop ventilation").

These results are important for the professional selection and for the individual approach to the treatment of hyperventilation syndrome.

THE EFFECTS OF VOLUNTARY HYPERVENTILATION IN CHILDREN AND ADOLESCENTS.

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Hyperventilation syndrome becomes one of the wide spreaded responses of young human organism to the deterioration of ecological conditions and to stress factors. Our aim was to study the age peculiarities of cardio-respiratory and CNS reactions to hyperventilation.

We examined 130 healthy subjects 10-16 years old at rest and during the hyperventilation test (2 minutes of voluntary hyperventilation). The parameters of external respiration and interchange of gases, arterial pressure, ECG, EEG and EMG of the muscles of right forearm were recorded. The reaction time (RT) to light stimulus was measured.

According to minute ventilation (V), heart rate (HR), ECG, EEG and RT dynamics, the nonlinear in the ontogenesis regularity of development of the responses to hyperventilation test was revealed. The most distinct changes of these parameters were found out in 13-14 years old girls and 14-15 years old boys.

We conclude that the subjects of this age possess a high sensitivity to hyperventilation induced neurohumoral alterations in the organism, especially to hypocapnia.

Psychophysiological Response Patterns in Emotionally Triggered Asthma.

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Psychophysiological research on asthmatics has demonstrated various patterns of autonomic activity. Research on asthma has attempted to identify subgroups of asthmatics who respond to emotional stress with bronchoconstriction. The purpose of this study was to objectively identify two sub-groups of asthmatics: those who report emotional as well as allergic triggers (ET) and those whose symptoms are not emotionally triggered (NET).

Forty-two asthmatics completed a questionnaire and participated in a clinical interview to determine whether they reported emotional triggers to their symptoms. Each subject completed a standard psychophysiological stress profile including measures of EMG(frontal), EDR, heart rate, and RSA.

As predicted, two distinct subgroups of asthmatics were differentiated. Psychophysiological data revealed differences in autonomic response to stress between these groups. The two subgroups showed similar values in RSA amplitude at rest. However, in response to stress, the ET asthmatics exhibited significantly larger RSA amplitude (see Table 1). Further, the NET subgroup presented an elevated EDR when compared with ET subjects. This finding was significant at baseline, but non-significant for stress and recovery, although the latter represented trends in the same direction. Among all subjects, a significant negative correlation between frontalis EMG activity and RSA amplitude was discovered(Porges,1995).

A difference in autonomic patterning in response to stress appears to validate the distinction between ET and NET asthmatics. Increases in parasympathetic activity in combination with decreases in sympathetic activation may contribute to the stress induced bronchoconstriction experienced by this subgroup.

Table 1. RSA values for the two asthma sub-groups at baseline, post mental arithmetic, and post stressful image.

	Baseline		Post Mental Arithmetic		Post Stressful Imagery	
	ET	NET	ET	NET	ET	NET
RSA	13.1	10.9	17.7	11.9**	18.3	12.2**

** p<01

PANIC ATTACK SUBTYPES: RESPIRATORY AND PSYCHOPHYSIOLOGICAL DISTINCTIONS

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A comprehensive review of the panic disorder literature strongly suggests the existence of subtypes of panic attacks, including a subtype with primarily respiratory features. Several recent theories incorporate subtyping, but none has been empirically tested.

This study investigated several aspects of Ley's (1992) theory and two diagnostic questionnaires.

Using theory-based subtype groups and a non-panic control, end-tidal carbon dioxide (ETC02) levels were measured at baseline, during psychological and respiratory stresses, and at the end of recovery periods.

As predicted. Type I (respiratory) panickers had significantly lower resting ETC02 compared to Type III (cognitive) and controls. Type III panickers did not differ from controls. Trends suggest the possibility of autonomic involvement in Type I. Neither questionnaire was successful in predicting Type I panickers.

Physiological findings support the existence of respiratory and other subtypes of panic attacks in panic disorder, and suggest that more complex measures of respiration and other physiology are required to adequately elicit the full respiratory subtype profile.

Clinical implications include recognizing the need for differential diagnosis of panic attacks to develop appropriate, effective treatment plans (for example, restoration ofnonnal ETC02 in Type I), thus improving treatment success rates.

Table 1. Mean Resting ETC02 Levels (Torr)

	Type I	Type III	Controls
Baseline	35.14 a	39.37	39.24
Psych Recovery	34.29 b	37.73	39.35
Physio Recovery	35.14 c	38.55	39.00

a Type I vs. Type III p=006, Type III vs. Controls, ns.

b Type I vs. Type III p=044. Type III vs. Controls, ns.

c Type I vs. Type III p=031. Type III vs. Controls, ns.

The conditioning of dyspneic fear in the rat at various CO2 concentrations.

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Previous studies in our laboratory have shown that when a vanilla odor (conditional stimulus: CS) becomes associated with 30 s exposure to 100% C02 (unconditional stimulus: US), which unconditionally elicits dyspnea (unconditional response: UR), the vanilla odor acquires the capacity to independently elicit dyspneic fear (conditional response: CR).

The purpose of the present study was to determine whether manipulating the concentration of C02 (i.e., either 0%, 5%, 35%, or 100%) would influence conditioned responding in rats. The pattern of results indicated that the higher the intensity of CO2, the higher was the level of conditioning as represented by conditioned freezing and conditioned analgesia.

Exposure to 5%, 35%, and 100% C02 produced elevated levels of freezing twenty-four hours following conditioning relative to controls. Moreover, there existed a positive and monotonic relationship between CO2 concentration and resistance to extinction as measured by freezing, ranging from relatively little resistance to extinction at 5% to a great deal of resistance at 100%.

This positive and monotonic relationship between CO2 intensity and level of conditioning to the context was also evident on the analgesia measure. Thirty seconds of exposure to 35% and 100% CO2 resulted in the highest elevation of tail-flick latencies and 0% and 5% resulted in latencies equivalent to baseline.

The findings will be discussed as to their relevance for panic disorder and anxiety.

AMBULATORY MEASUREMENT OF END-TIDAL PC02 AND BREATH TIMING

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Respiratory research in conscious humans relies on measurements via a mouthpiece or other invasive devices which may both modify the breathing being studied, and limit recordings to short periods in a laboratory. There is a need for uninvasive measurements over long periods of time and during a subject's normal activities.

End-tidal measurement of PCO2 is well established and, in awake subjects with normal lungs and in the absence of heavy exercise, is close to arterial PCO2. We have repeatedly demonstrated the feasibility of on-line real-time prolonged recording of end-tidal PCO2 (Pet-CO2) from a fine sampling catheter taped just inside one nostril.

Varley (J Physiol 1993; 467:139P) has developed a portable capnograph linked to a small telemetry transmitter (J Physiol 1994; 479:120P) which can be worn by the patient, sampling via a moisture permeable catheter (Eugstom Aridus) from 3-4 mm up one nostril. The mean rise time from 10-70% maximum response to a step of C02 is 99ms, fast enough for end-tidal sampling up to moderate respiratory rates. The telemetry range is 1-200 yards and the signal is received by a stationary receiver/computer unit which can be located in a central position in a patient's home. The ambulatory unit operates for about 12 hours off a set of 3 small lithium batteries.

In the present study, we wished to compare the signal from the capnograph with that from a VG mass spectrometer. Both signals were measure simultaneously using our computerised on-line data acquisition system. This system is a modification of the system developed by Gardner for on-line measurement of a pneumotachograph signal (JAP 1995;78:1910-1920). PCO2 was sampled continually and simultaneously from the two devices via twinned nostril catheters and was digitised at 100 Hz. Peak reading algorithms detected inspired (PiCO2 peak expired values (Pet CO2), a value 200 ms back from the peak (to determine plateau slope, PslCO2 for both signals, and approximate values for inspiratory (Ti), expiratory (Te) and total cycle (Tt) times.

The telemetry receiver unit for the ambulatory capnograph was either located in the same room about I0 ft from the CO2 sensor head, or was located in an adjacent room. After a period of acclimatisation, every breath was measured over:
(1) about 100 breaths of quiet resting breathing, followed immediately by
(2) breathing to a metronome with 3-5 levels of increasing respiratory frequency.

At least 30 breaths were collected at each frequency. Data was analysed off-line for (1) mean. SD, SE for all variables (2) correlation matrix for all variables (3) Bland and Altman analysis (Lancet 1986; i: 307-310). Difference between PET-CO2 for ambulatory capnograph and mass spectrometer calculated for each breath and confidence range for the difference (±2 SD) was calculated. Breaths were removed if the slope value was less than 2/3 of the end-tidal value, if Ti was less than 0.7 sec, or if Te was less than 70% of Ti.

Five normal subjects have so far been studied. Traces from each machine were almost indistinguishable at all respiratory rates studied and editing algorithms worked satisfactorily. Correlation coefficients between end-tidal values were usually near to 1 and never less than 0.95. The confidence limits (±2 SD) for the difference between the two end-tidal values was app. 2.5 mm Hg. There was up to 2 mm Hg temperature dependent drift of the baseline for the ambulatory capnograph. In more recent machines, this has been automatically corrected in the software by subtracting a running average of the zero of the 10 previous breams from the A-D

reading, and is also reduced by heating the C02 head. The mass spectrometer read consistently 1-2 mm Hg higher than the ambulatory capnograph, possibly due to a small kick-up at the end of the end-tidal plateau for the mass spectrometer. This could not be eliminated.

We will use this system to determine the true lower limit of Pe CO2 in normal subjects during everyday activities outside the laboratory, and to study and characterise the behaviour of Pe CO2 over long periods of time outside the laboratory in patients in whom the symptoms of hyperventilation are clinically significant.

THE NEED FOR SPECIALIST DISCIPLINES IN AS WELL AS PRIMARY CARE APPLICATIONS OF APPLIED PSYCHOPHYSIOLOGY IN BEHAVIOURAL MEDICINE: A plan for Health care in Europe for the next century

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Argument: European practice of medicine run the risk of becoming less effective and more unscientific depending on the focus on the economy - e.g. Health Care primary care seems to be to keep the cost as low as possible in stead of increase the effect and quality in diagnosis and treatment. One possible solution for an effective scientific based Health Care Service at the same time as the cost is lowered might be a paradigm shift toward psychophysiological 3 based behavioral medicine 4.

To accomplish this we have to focus on (ii) psychophysiological behavioral medicine tools which can be used (together with traditional ones) for treatment of various stress related disorders (for a description of some of those disorders see e.g. Association for Applied Psychophysiology and Biofeedback, 1995) including the "man/patient as a scientist" model (Kelly, 1955, von Scheele, 1987, 1995, 1996, von Scheele & von Scheele, 1994).

Patients have thereby to be educated to better take care of their own health. They have to be guided into an active position taking competent part of her/his own health process - we might then view the patient as a resource instead of a problem. Health is not something we can take for granted. Our health is not something outside our responsibility. Health can also be viewed as one's control and hold (a factor of power) over one's life and as a part of one's democratic rights as well as democratic responsibilities.

This can be accomplished through a multidisciplinary psychophysiolgical educational approach (von Scheele, 1996). The Health Care Service, primarily Primary Care, has to change their perspective and recognize the patient in terms of "man as a scientist" and learn how to use the suggested psychophysiological approach.

The consequence of above is that the following organizational model is needed:

1. A specialist discipline level consisting of innovation, clinical and nomothetical research in analysis and treatment of most if not all stress related disorders (probably also some now not recognized as stress related diseases). This level also transfer agreed findings through education to the next level.

2. An applied level primarily concerning the Primary Care centers where the every day work is carried out. That is, out of a cognitive psychophysiological paradigm (i) analysis and

diagnosis, (ii) treatment and training, (iii) repeated measurement over time and (iv) " Kellyian"-like education of patients as well as continues education of their own staff.

There should be a network where different (i) specialist centers easy can cooperate, (ii) National centers might be responsible for educational transfer of knowledge and competence from the specialist centers to (iii) the local Health Care. The clinical results at Primary Care levels will through suggested methodology, computer based Systems Theory analysis (Bertalanffy, 1968) and knowledge system (KS) analysis5 (Sil, n, 1994) be reported back (a feedback loop). This process will also in it self contribute to increased effectivity in diagnosis and treatment through deductive learning in the KS.

The politicians need to get understandable data from a pilot study of the proposed model concerning the cost and benefits as well as its effectivity. The patients need to understand and be motivated to take meaningful, active part of her/his own analysis and treatment giving meaning to her/his own work in the health team. Clinicians and scientists have to develop more effective in cooperation including joint efforts to clearly show their economical needs for doing an effective and integrated satisfactory work.

The proposed model requires:

1. Relevant hardware to generate adequate data including interactions between systems.

2. Effective software for each special domain including knowledge base computer system.

3. Effective methodology in each special domain including how to educate medical staff and the patients.

4. Knowledge and human competence to carry out the above and education of the patients in a "man as a scientist "-like way. The analysis and treatment is centered around the patients where relevant competence is incorporated (also the patient has to be relevant competent according the prerequisites).

To initiate this program requires (i) careful planning at different levels, development of relevant equipment, software, methods and educational plans. As a first step we propose that some interested scientists and clinicians form a project group. If the results from a pilot study are constructive then the project can be expanded, e.g. using this approach while groups of patients in stead of sickness benefits get salary for taking part of a training camp where they are trained to become competent parts of the health team as described above.

Psychophysiological behavioral medicine can be regarded as a key for better understanding, better practical clinical work and feedback for result, both on-line and over time in the treatment of stress related disorders. (Bio)feedback can be used both as the independent and dependent variable depending on where you are positioned - and so is the patient (Kelly, 1955). To joke about something very seriously using an old proverb: Give a man a fish and he will continue to be the dependent variable. Teach him fishing an he might become the independent variable.

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1 Among specialist disciplines needed might be Cardiovascular Psychophysiology, Clinical Psychophysiology, Pain Psychophysiology, Pedagocial Psychophysiology, Preventive Psychophysiology, Primary Care Psychophysiology, Respiratory Psychophysiology, Social Psychophysiology, Work Psychophysiology.

2 Communications should be addressed to: Bo von Scheele, Ph D, The Swedish Association for Applied Psychophysiology & Biofeedback, Lasarettsv,,gen 110, 821 31 Bolln,,s, Phone +46 278/147 05, fax +46 278/140 68, E-mail bo.vonscheele@bollnas.se

4 Behavioral Medicine concerns active health investment through behavioral channels including the quality of food intake, of cognitive functioning, of physiological intervention, e.g. exercise, breathing behaviors and of social interactions as well as behaviors at higher levels, e.g. groups behaviors, national behaviors, universal behaviors which concerns our ecological context.

5 Artificial intelligence is a concept that uses computers as "knowledge" machines. The computer systems that process and apply human knowledge, enabling that knowledge to be used in a manner simulating the human decision-making process are referred to as "knowledge-based" or "expert" systems. The concept of Medical Informatics employs computers as knowledge machines to support and advice physicians. The body of knowledge about the human body and the various diseases it might be subjected to is very complex and only partially known in a scientifically applicable way. No single physician can employ that total body of knowledge because she/he does not have the capability to memorize and understand it all.

Although specializing in a particular field of medicine does not improve the physicians ability to analyze and diagnose specific conditions, the knowledge base is still too large for complete

human understanding, thereby limiting the ability to arrive at the best conclusion in a timely manner.

Through a procedure known as inductive hypothesis generation, computers can through examples acquire the expert's experience and make it visible and available in a knowledge-based system. This system allows the experts themselves to become aware of there own intuitive, somewhat diffuse, set of rules, find the holes in the knowledge and thus increase the accuracy or quality of their decision. Expert systems allow the user to manage their resources in a more effective manner through the use of a rational and optimal decision process.

In the health care sector, this means reduces hospital stay, reduced need for exploratory tests, reduced trial modification, etc. The diagnostic accuracy is increased from 65% to 95% at admittance to the hospital. And the specialist from major hospital can be available at all clinics in the form of the expert system.

It is beyond all doubt that medical informatics can improve the quality and economy of health care (Sil, n, 1996).

DECREASED VAGAL TONE AND INCREASED VAGAL RREACTIVITY: A PSYCHOPHYSIOLOGIC PROFILE OF ASTHMATIC CHILDREN

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Emotional distress is believed to be an asthma trigger. Vagal / cholinergic activation, which may accompany states of emotional distress, is one known pathway which mediates airways constriction in asthma.

The purpose of this research is to:
1) determine mean vagal activation, i.e. vagal tone (VT), in asthmatics vs matched healthy controls;
2) to determine whether transient, laboratory induced emotional stimuli are associates with greater shifts in vagal activation, i.e. vagal reactivity (VR), in asthmatics vs controls.

Method: Twenty-four asthmatic children (20m, 4f, aged 8-17) and 23 healthy children (matched for age and gender) viewed the video movie, "E.T. the Extra Terrestrial", while their heart beat (ECG) was recorded. Specific emotional scenes, pre-selected to evoke sad, and mixed sad/happy feelings were targeted for analysis along with a neutral scene to serve as a baseline. Porges' (1990b) method of computing cardiac band variance provided an index of vagal activation.

Results: Asthmatics have lower VT as compared to controls (6.6 and 7.3, $p<.001$). Asthmatics show increased VR in the sad scene and in the mixed sad/happy scene whereas controls show increased VR only in the mixed sad/happy scene ($p<.05$). Asthmatics also show significantly greater overall VR as compared to healthy controls (.62 and .43, $p<.03$).

Conclusion: These findings suggest a vulnerability in the vagal axis of asthmatic children which may explain, in part, the mechanism by which emotions effect airways reactivity.

THE IMPACT OF SADNESS AND HAPPINESS ON AUTONOMIC AND AIRWAY REACTIVITY IN ASTHMATIC CHILDREN

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Objective: Research suggests the sad/hopeless emotional state evokes autonomic reactivity that predisposes to airways constriction in asthma. A corollary hypothesis (e.g. happy) emotional states evoke opposing effects. This study assesses whether sadness and happiness can be differentiated physiologically and related to asthma-relevant autonomic reactivity aand pulmonary function in asthmatic children.

Methods: Twenty-four children aged 8-17, with moderate to severe asthma, viewed the movie "E.T., the Extraterrestial", while their heart rate (HR) and oxygen saturation (SAO2) were continuously recorded. Specific scenes were pre-selected to evoke sadness, happiness, and a mixture of sadness and happiness. Indices of heart rate (HRSD) and of oxygen saturation (SAO2SD) were used as indices of autonomic and airways reactivity and instability, respectively.

Results: Repeated ANOVA indicated that scene-specific emotions had differential effects on HR ($F=10.68$; df 3, 23; $p<.001$); HRSD ($F=10.18$; df, 3, 23; $p<.001$) and SAO2SD ($F=3.92$; df 3; 23; $p<.01$). Sadness was associated with greater heart rate variability and instability of oxygen saturation as compared to happiness.

Conclusion: Sadness, in contrast to happiness, evoked patterns of autonomic activation that were associated with airways constriction.

Cardiovascular and respiratory responses during simulation of a 135-day space flight: a longitudinal within-subject study.

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In view of the increasing duration of spaceflights, concerns are growing about the potential negative effects of prolonged exposure to the stressors that are implicated in these missions. Sustained high levels of workload, and effects of isolation and confinement may severely compromize operator effectiveness, team functioning, as well as psychological well-being. The goal of the present study, which was performed as part of the HUBES campaign of ESA, was to assess the costs of long-duration spaceflight.

During a 135-day simulation of a spaceflight in the MIR simulator of the IBMP (Moscow), subjective, cardiovascular and respiratory responses were assessed among three cosmonauts. Data were collected three times per week on the same days and at the same time of day. The equipment included a continuous blood pressure monitor (Portapres), Respitrace, and a PC-based data acquisition system. An additional PC was used to administer three demanding cognitive tasks. Physiological responses were measured during a 2 min. pre-task baseline, as well as during performance of the tasks.

Physiological measures included heart rate, blood pressure and various respiratory measures (VT, RR, DC, IF and MV). The analytic plan included assessement of:
(1) temporal effects via linear regression analyses on the rho-corrected successive means of the physiological measures across the mission period,
(2) responses to discrete events during the mission, and
(3) covariation of physiological, performance, and subjective reaponses.

The present paper focusses on the temporal effects. The regression analyses revealed intriguing individual differences in the response patterns across time.

For one cosmonaut, a gradual decrease in cardiac activation was observed across the mission period, but in contrast, ventilation gradually increased. MV increased from a mean of 6.0 l/min in week 1 to a mean of 10.3 l/min in week 19. The MV increase was associated with increases in VT, RR and IF. It seems possible that the MV increase was due to development of a hyperventilatory breathing pattern, which in turn might have been associated with the cumulative effects of mission stress.

The second cosmonaut showed no changes in the physiological measures across time.

For the third cosmonaut, there was a increase in cardiac activity across the mission period, but there were no temporal ventilatory effects. The cardiac increase was probably due to the cumulative effects of fatigue.

The findings are discussed in terms of the value of longitudinal within-subject designs.

Hyperventilation syndrome, breathing abnormalities and subjective complaints.

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In order to investigate the links between breathing pattern and psychosomatic complaints 903 patients suspected of hyperventilation syndrome (HVS) and 170 healthy subjects were studied.

Breathing pattern and end-tidal CO2 concentration (FETCO2) were recorded during breathing through a mouthpiece and pneumotachograph at rest and following a hyperventilation provocation test (HVPT).

Questionnaires concerning complaints in daily life (DL) and following HVPT were completed.

A principal component analysis was performed on the complaints and on the breathing variables. The latter analysis grouped some similar complaints of DL and following HVPT, whereas other complaints of DL were separated from the corresponding complaints following HVPT.

This suggests that HVPT may elicit complaints by its own, unlinked to the corresponding complaints mentioned in DL, and, on the other hand, reinforce existing complaints of DL. Similar findings were observed with respect to the breathing variables measured at rest and following HVPT : breathing through a mouthpiece and HVPT may be regarded as two

different challenges for respiration influencing either similarly or differently some breathing variables

As a challenge evidencing some complaints and the way a steady state of breathing is restored following a temporary disturbance, the HVPT is an interesting tool for diagnosis. The presence of HVS or of anxiety disorders is characterized by a breathing unsteadiness, which is diagnostic only in younger patients, because the same unsteadiness is found in older healthy subjects as in patients.

The links between complaints and breathing pattern are weak, limited to some complaints and to the mean values, not the changes of respiratory variables, mainly of respiratory drive and tidal volume. The correspondence in life time between prevalence of HVS (or panic disorder) and breathing unsteadiness suggests that both are linked, though the unsteadiness by itself is not responsible for the complaints and only a small part of the complaints is linked to breathing.

Classifying the psychosomatic complaints under HVS is misleading because actual hyperventilation with marked lowering of FETCOz is seldom the cause of the complaints, but presents the advantage of drawing the attention of both doctor and patient to the role of a disturbed breathing pattern in the complaints.

End-Tidal C02 as a Conditioned Response in a Pavlovian Conditioning Paradigm.

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In his seminal article on 'The Syndrome of Habitual Chronic Hyperventilation," Lum (1976) outlined his well reasoned and persuasive thesis that a wide range of hyperventilation-related psychosomatic complaints are experienced by "susceptible individuals (who) have acquired a habit of breathing in such a way that the day-to-day level of arterial C02 is low, or that the normal hyperventilatory response to physical or emotional stimuli is exaggerated.... With frequent repetition the response takes on the characteristics of a conditioned reflex."

The purpose of the present study was to determine if hyperventilation (i.e., overbreathing that produced a statistically significant drop in end-tidal C02"PetC02) could be acquired as a conditioned response (CR) in 13 healthy college students following a Pavlovian conditioning paradigm in which a mental stress task served as the unconditioned stimulus (UCS) with a 500-Hz tone at 65 db as the conditioned stimulus (CS).

Continuous capnographic monitoring was accompanied by measures of respiration frequency, heart rate, electrodermal conductivity, and blood pressure (systolic and diastolic). A comparison of responses to the tone prior to conditioning trials with responses to the tone (CS) subsequent to conditioning showed a statistically significant drop in PetC02 of 1.82 mmHg, a significant increase in heart rate of 3.77 b/min, a significant increase in electrodermal conductivity of 4.17 micromhos, but no reliable changes in blood pressure.

These results (a) support Lum's thesis that hyperventilatory breathing "takes on the characteristics of a conditioned response," and (b) are consistent with the findings of van den Bergh, Stegen, and van de Woestijne (1995), and Stegen, van den Bergh, and van de

Woestijne (1995), who used C02 as a UCS in their demonstrations of Pavlovian conditioning of respiratory behavior reported at the Toronto meeting of the International Society for the Advancement of Respiratory Psychophysiology.

The low specificity of the Hyperventilation Provocation Test.

Hellen Hornsveld, Bert Garssen, Mia Fiedeldij Dop, Mea Koomwinder, Paul van Spiegel. Amsterdam, The Netherlands

The Hyperventilation Provocation Test (HVPT) has become a routine procedure in the diagnosis of Hyperventilation Syndrome (HVS). The test is considered positive if the symptoms induced by voluntary hyperventilation are recognized by the patient as similar to those experienced in daily life. Additional physiological criteria in current use are (A) a delayed recovery of PetCO; following hyperventilation, and (B) a resting level of PetCOz < 4 kPa.

The present study tests the specificity of the HVPT, i.e. the assumption that hypocapnia is the primary trigger for symptoms during an HVPT, and the specificity of physiological HVS criteria.

In a randomized double-blind cross-over design, 115 patients suspected of HVS and 40 healthy controls performed an HVPT and a placebo test (PT, isocapnic overbreathing).

The HVPT induced more symptoms than the PT, especially more neuromuscular symptoms, cerebral symptoms, paresthesias, and temperature sensations. However, the absolute difference between the number of symptoms induced by the HVPT and PT was small. In patients, the PT induced 66% of symptoms induced by the HVPT. In the control group this percentage was 60%. Thus, the majority of induced symptoms during an HVPT are not specific for hypocapnia.

Data on symptom recognition (the diagnostic criterion for HVS) similarly pointed at a low specificity of the HVPT; 74% of the patients recognized the induced symptoms during the HVPT but a similar percentage, 67% of the patients, recognized symptoms during the PT. The number of induced and recognized symptoms was highly related to psychological state and trait variables such as anxiety, fear of bodily symptoms, agoraphobia and depression.

Presumed physiological indicators for HVS appeared unspecific as well; equal percentages of patients and healthy controls fulfilled the criteria (A) and (B). We conclude that the HVPT is invalid as a diagnostic test.

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HYPERVENTILATION DISORDERS - THE CHEST PHYSICIANS VIEWPOINT

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Hyperventilation occurs in many medical disciplines from psychology through to all branches of medicine. There is poor consensus about most aspects of definition, diagnosis and management of this condition, and terminology obvious to psychologists is often not comprehensible to physicians.

As a chest physician and a physiologist, I believe that there are a number of fundamental principles which aid in the positive and rational assessment of these patients.(1) The definition of hyperventilation is breathing in excess of metabolic requirements i.e. C02 production and therefore implies arterial hypocapnia. The lower limit of arterial PCO2 (PaCO2) is uncertain but we found that symptoms occurred on average at a value of 20mmHg with a range from 14 - 29.

In clinical practice, hyperventilation is rarely important unless it causes symptoms, most of which are non-specific, due to a combination of neuronal hyperexcitability and vasoconstriction.

Hyperventilation implies excessive drive to breathe and the cause of this drive should always be sought. There is a wide range of physiological, psychological and organic causes which often combine to lower the PaCO2 below the threshold for symptoms.

It is useful to distinguish initiating and sustaining factors which often include the tendency to take large breaths, misattribution and possibly some form of physiological (but not acid based) resetting. We don't believe that the term "hyperventilation syndrome" has any universally agreed meaning, and can be dangerous in the accident and emergency situation but believe that a set of unifying features can be defined for acute/subacute hyperventilation, chronic hyperventilation, air hunger, and disproportionate breathlessness on exertion.

Acute/subacute hyperventilation refers to patients presenting as an emergency with acute hyperventilation due to a range of different causes with subsequent descent into invalidism due to misattribution and misdiagnosis.

Chronic hyperventilation embraces the patients which we reported in the mid-80's and which have previously been described by Lum and others. Air hunger is, we believe, a psychogenic symptom, the causes of which are unclear. It often leads to panic which in turn leads to acute episodes of hyperventilation in some patients. Disproportionate breathlessness on exertion probably best equates with the patients described by Howell some years ago. We have absolutely no explanation for these patients.

Finally, organic conditions such as asthma can occasionally present with predominant symptoms of hyperventilation. In our experience, hyperventilation due to anxiety in the absence of other factors is extremely rare.

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PANIC AND HYPERVENTILATION.

Marcel van den Hout

The most prevalent anxiety disorder in mental health care is "Panic Disorder"; this holds true for the US, the Netherlands and probably other Western countries as well. Panic Disorder is characterised by paroxysmal "panic attacks" during which the patient experiences a wide range of bodily sensations. Interestingly, these symptoms are largely identical to the ones provoked by hyperventilation. This suggests that panic attacks are caused by hyperventilation and that Panic Disorder is essentially a hyperventilation syndrome.

Empirical research will be reviewed. The conclusion will be that, notwithstanding its elegance and plausibility, the hyperventilation theory of panic is untenable. Happily, other approaches to panic appear to more fruitful. These alternatives will be quickly discussed.

The conclusion will be that if hyperventilation plays a role in Panic Disorder, this is not because panic patients are inclined to hyperventilate more than relevant control subjects. Rather, panic patients tend to believe that various innocuous bodily sensations are dangerous.

It is suggested that this "interoceptive fear" may promote a) selectively attention to sensations induced by mild/common hyperventilation, b) perception of even mild drops in CO2 and c) misinterpretation of minor physiological changes as signs of impending doom.

Hyperventilation syndrome (HVS).
Depletion of body C02 stores as a possible cause of long lasting exercise-induced dyspnea.

Willeput R. and Sergysels R.

Twenty female subjects suffering from HVS (all complaining of usual exercise-induced dyspnea) were investigated during an exhaustive triangular exercise and the immediate following five minutes.

Patients were arbitrarily divided in two groups according to the time course of their dyspnea (evaluated with a visual analog scale, VAS) after exercise: group A including 10 patients whose dyspnea persisted at the end of the recovery period while group B including 10 patients whose dyspnea had gained complete resolution at the same time.

Groups A and B were not different in age, weight, height and HVS duration. Both showed comparable response during exercise: similar mean maximum working level (±100 watts), V02, VC02, VE (+ 50 L/min), ventilatory pattern, occlusion pressures (PO.l), score of dyspnea (VAS) and heart rate.

However during recovery, whereas mean V02 and VE (as fr, Vt, VT/Ti, Ti/Ttot) remained comparable in both groups, mean RQ and EVC02 (for most of the period) as PO.l and VC02 (during the first minute) were found significantly ($p<0.05$) lower in group A. So during recovery, group A had a decreased VC02 although V02, ventilation and respiratory pattern remained similar to group B.

Between the two possible causes for such a discrepancy between ventilation and C02 pulmonary excretion, i-e. either an enhanced Vd/Vt ratio or a decreased PC02, we favour the second for theoretical reasons and because observed lower PO.l in group A fit in with lower PaC02 (decreased respiratory drive).

Our results suggest that the C02 metabolic production in HVS patients could not wholly reach the venous reservoir and that a part of it could be used to rebuild previously depleted body C02 stores. This mechanism could favour low arterial C02 levels that are known to elicit, in those patients, dyspnea among many other symptoms.

ATTENTIONAL DISTRACTION, NEGATIVE AFFECT AND SOMATIC COMPLAINTS IN A CO2 INHALATION PARADIGM

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Aim:
Subjects scoring high on negative affect (NA) have been shown to have elevated levels of subjective physical symptoms indaily life. A symptom perception hypothesis about this relationship holds that high NA subjects are hypervigilant and more likely to notice (normal) bodily sensations and minor aches, which they will experience in a negative way, because their scanning is fraught with anxiety (Watson & Pennebaker, 1989). A series of experiments will be reviewed to test the validity of this assumption.

Method:
All experiments used C02 enriched air inhalation trials, which produces low intensity transient somatic complaints. Subjective symptoms and physiological responses were measured.

Conclusions:
1) The link between negative affect and complaints mainly exists in questionnaire studies but tends to disappear in studies using experimental induction of somatic complaints.

2) Manipulations of attentional deployment during the experimental induction of the complaints (e.g. through a RT- task, an odor, or a respiratory challenge) determine the strength of the observed link : NA-related differences only appear in conditions that distract the subject.

3) The findings generally support the symptom perception hypothesis, but suggest to emphasize the distinction between attentional direction to and interpretation of bodily responses. NA related differences are more linked the former than to the latter aspect.

Ambulatory measurements of transcutaneous PCO2 in Panic Disorder and Hyperventilation Syndrome.

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Amsterdam, The Netherlands

Hyperventilation has become popular as an explanation for a wide range of somatic and psychological symptoms. The method of long-term ambulatory measurement of transcutaneous PCO2 (PtcCO2) offers the opportunity to directly test the co-occurrence of symptoms and hyper-ventilation under natural conditions.

We applied this method in 28 outpatients from an Anxiety Disorder Clinic who met DSM- III-r criteria for Panic Disorder (study A) and 30 outpatients from a general hospital with symptoms suggestive of HVS and a positive hyperventilation provocation test (study B).

Results: in the group of PD-patients (study A) 24 panic attacks were registered that lasted at least three minutes; a decrease of PtcCO; was observed during only one of these attacks, and even in this particular attack, the degree of hyperventilation was mild. In the group of HVS suspected patients (study B) 22 symptom episodes were registered; in 5 attacks PtcCO^ decreased.

These decreases were mild and apparently followed the onset of the attack, suggesting that hyperventilation is a consequence rather than a cause of the symptom episode. Hyperventilation seems a negligible factor in both in Panic Disorder and in the so-called Hyperventilation Syndrome. The term HVS can best be avoided.

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Detection of hyperventilatory sensations in panic disorder.

Sabine Kroeze & Marcel van den Hout

For some time hyperventilation has been thought to be a main generator of symptoms in panic disorder. More recently a number of researchers have questioned the validity of the theory and have concluded that, although hyperventilation might in some cases give rise to symptoms, which in turn might lead to a panic attack, it seems unlikely that hyperventilation is a main cause of panic attacks.

As a consequence, focus has shifted to other mechanisms which can account for the sensations reported by panic patients. One of them is the possibility that these patients may be more skilled at detecting actual changes in physiology than others.

Most studies performed in this context concern the perception of heartbeat sensations. In the present study sensations are taken as point of departure that are produced by hyperventilation. The research question was if panic patients can detect periods of light hyperventilation better than controls.

Both panic patients and controls were asked to hyperventilate up to various degrees in order to give panic patients enough chance to display their superiority. The sensations reported during these short periods of hyperventilation were compared with sensations during periods in which subjects were breathing as quick and as deep as in the hyperventilation periods but where the fall of CO2 was prevented by addition of CO2.

Data-collecting and -analysis is still in execution. However, in August we expect to be able to present some preliminary data.

LABORATORY INDUCED EMOTIONS INFLUENCE AUTONOMIC AND AIRWAY REACTIVITY IN ASTHMATIC CHILDREN

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We have developed a laboratory paradigm in which we are able to assess the relationship of specific emotional states to patterns of autonomic reactivity as they relate to airways constriction in asthma. This work shop will describe the theoretical model underlying our work, demonstrate the methods used, and present recent data testing the model. We also will briefly describe a current project in which we will assess the relationship between laboratory induced stressful family interactions and autonomic reactivity and pulmonary function in asthmatic children (7). We will lead an audience discussion of these aspects of our research, focusing on how such models and methods may be applied to other areas of psychophysiologic inquiry.

MODEL: Miller's model of'psychophysiologically vulnerable asthma" (3, 4) posits a condition of autonomic dysregulation and cholinergic bias that is engendered by the negative synergism of cholinergically mediated airways reactivity and increased cholinergic activation in the states of depression/hopelessness/despair.

METHOD: Twenty-four children aged 8-17, with moderate to severe asthma, and 23 healthy matched comparison children, viewed the movie, "E.T., the Extra-Terrestrial", while their heart rate (HR) and oxygen saturation (SA02) were continuously recorded. Specific scenes were pre- selected to evoke sadness, happiness, and a mixture of sadness and happiness. The movie introduction and credits was selected as a relatively emotionally neutral reference scene.

Indices of physiologic response and self report of emotion were analyzed for these targeted scenes. Heart rate (HR) was used as an index of arousal, and within-subject standard deviation of heart rate (HRSD) was used as an index of autonomic reactivity. Oxygen saturation is an indirect measure of airway function. Therefore we used within-subject standard deviation of oxygen saturation (SA02SD) as an index of variability (i.e. instability) of airway function. Porges' (1990) method of computing vagal tone was used to assess vagal activation during the various scenes, and overall vagal tone in the asthmatic versus the comparison children. This method allows for more precise assessment of the nature of the autonomic reactivity as it influences airways constriction in asthma.

RESULTS: Sadness was associated with greater heart rate variability and instability of oxygen saturation as compared to happiness. The mixed sad/happy scene showed less heart

rate variability (HRSD) than the sad scene, but relatively high instability of oxygen saturation (SA02SD). Level of arousal did not predict airway instability. Asthmatics were found to have lower vagal tone and increased vagal reactivity as compared to the healthy children.

DISCUSSION: These results extend Schwartz's (6), Ekman's (1) and Levenson's (2) demonstrations of emotion-specific physiological responses to the realm of stress-related exacerbations of illness. The lack of prediction of airway function by arousal level suggests farther that it is the specific emotions that matter in stress-related illness, rather than arousal, per se.

Our specific findings suggest that some asthmatic children have a vulnerability in the vagal axis, rendering them more vulnerable to emotional influence on their asthma. Furthermore, we found that extreme sadness, in contrast to happiness, evoked patterns of autonomic activation that are associated with airways constriction in asthma. These findings are consistent with Miller's model of'Psychophysiologically Vulnerable Asthma" (3,4,5).

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NEUROFISIOLOGIC ROLE IN REGULATION ON SENSITY AND REACTIVITY OF THE BRONCHI IN PATIENT WITH ASTMA BRONCHIALE

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The aim of inves the relation between the sensity and reactivity of the bronchi and bioelectric activity of the brain. For this purpose the bioelectric activity of the brain by

eleotroencephalograram registration method was examined in 21 patients with asthma bronchiale.

The sensity and reactivity or the bronchi were studied with the help of acetylholin-test. Due to the bioelectric activity the patients were divided in two groups.

In the first group we put the papatients which had normal bioelectric activity. In the second group we put the patient which had not normal bioelectric activity.

We found that in patients with disorder of bioelectric activity of the brain the level of sensity and reactivity of the bronchi were authenticity($p<0,01$) higher then in patients without this kind of disorder. The method of matematition analys showed that the reactivity of the bronchi was in authenticity ($p<0,01$) connection with bioelectric activity of the brain.

PSYCHOPHYSIOLOGICAL METHOD OF TREATMENT FOR RESISTANT ASTHMA.

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The great role of central nervous system in pathogenesis of asthma bronchiale is well known. During the registration of electric activity at the part of the patient with asthma bronchiale fall of the threshold convusive disposition of the brain was found. The treatment by the antiepileptic medicine Dilantin normalised this changes. But this treatment accompanied by toxic effects from kidneies and liver. We tried to normolize the neurophysiological changes without help of medicine.

For this target the special equpment was made,based on principle of biofeedback for EEG. This equipment made it possible to detect "spike-wave" in bioelectric activity, and put the information about it quantity to the patient by changes frequency of lixiviums in ear-tabs.

10 seances for 30 minutes each other helped the patient to reach the significant changes in bioelectric activity of his brain; that helped to treat asthma bronchiale.

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WORKSHOPS

Workshop: Whole Body Breathing

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The involvement of the whole body in respiration can be shown in several ways. One of them is by way of the skeletal structure. The workshop will demonstrate the potential patterns of movement of the spinal column with inhalation and exhalation, in different postural sets.

This is an important basis for providing instructions that induce changes in respiratory pattern, for reducing effort, improving coordination and regulating breath voluntarily, without straining natural respiration too much.

The instructions are characterized as follows:
• coupling body movement and respiratory movement
• uncoupling body movement and respiratory movement
• temporary increase of tidal volume
• regulating timing of respiration
• neutral attitude
• instruct what to do, not what to feel
• alternate active guidance with passive perception of result
• instruction is a proposal, let the result be open
• adapt instruction to the response of the patient

As far as time and situation allows, the practical application of some instructions will be shown

Breathing exercises in patients with COPD.

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Alterations of chest wall motion are common in patients with chronic obstructive pulmonary disease (COPD). Several studies have described an increase in rib cage contribution to chest wall motion and asynchrony between rib cage and abdominal motion in these patients.

The mechanisms underlying these alterations are not fully elucidated, but appear to be related to the degree of airflow obstruction, hyperinflation of the rib cage, changes in diaphragmatic function and increased contribution of accessory inspiratory muscles to chest wall motion.

Increased activity of accessory muscles is believed to enhance dyspnea sensation. Consequently, breathing exercises (Diaphragmatic breathing, Synchronous breathing, Active expiration with abdominal contraction, Pursed lips breathing and Posture) are commonly applied in practice to correct abnormal chest wall motion, decrease the work of breathing and dyspnea, increase the efficiency of breathing and improve ventilation distribution and gas exchange.

In this workshorp these breathing exercises will be critically reviewed and discussed.

WORKSHOP 'INSPIRATORY MUSCLE TRAINING'

A.Harver and H.Folgering

Reports in the literature on effects of inspiratory muscle training (IMT) are somewhat controversial. Some authors claim a succesfull treatment; some reject IMT as useless. Several reasons can be found for this diversity: 1) indications and patient-selection, 2) Supervision of training, 3) apparatus and breathing patterns that are used for IMT, and 4) training intensity and protocol.

This workshop will address the following topics and problems:

Which group of patients is eligible for IMT?
How to assess problems of ventilatory muscle insufficiency?
What type of apparatus should be used for training?
What regimen of training should be used? Intensity, duration, frequency
Should the training be supervised? by whom, how often?
Should the training intensity be adjusted, as the patient improves?
How to evaluate the effects of IMT? Should the training be continued after the initial training period?

We shall exchange experiences among the introducers and participants, and we shall enable you to try out the various forms of IMT.