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Abstracts of Papers Presented at the 3rd International Society for the Advancement of Respiratory Psychophysiology (ISARP) Congress

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Introduction

Every year the International Society for the Advancement of Respiratory Psychophysiology (ISARP) organizes a symposium—already the fifteenth in succession—in which physicians, psychologists, nurses and paramedical workers report on and discuss the interfaces and interactions between psychological and physiological processes. These reports and discussions concern research on both mechanisms and therapeutic interventions. The congress was attended by 80 scientists from the Netherlands and the other European countries, but also from New Zealand, Australia, Japan and the United States. The organization of the meeting was facilitated by contributions from the Dutch Asthma Foundation.

'Respiration, dyspnoea, sensation of dyspnoea and panic disorder' was the theme of the first day. Initially, A. Nosedá (Brussels, Belgium), introduced a bipolar VAS-score as an instrument to investigate subjectively experienced dyspnoea. This instrument appears to be useful in short-term/acute intervention studies. The instrument discriminates between 'high perceivers' and 'low perceivers'; the first category includes all asthmatic patients and those patients with COPD who still have some degree of reversibility. Patients with COPD without reversibility belong to the category of low perceivers. The FEV₁ is of some value in this respect, but the specific inspiratory airway conductance appears to correlate best with this bipolar

VAS-score. Nosedá wondered if dyspnoea-reducing forms of therapy are always useful: patients feel less, therefore use less medication and delay seeking medical help, so that in some cases it might be counterproductive.

The first part of the day was devoted to free communications. E. Peper (San Francisco, USA), who studies the effect of walking surface on the breathing pattern reported that hard surfaces appear to be able to induce a predominantly thoracic breathing pattern, while walking on a soft surface is associated with a predominantly abdominal respiration. B. Dahme (Hamburg, Germany) reported on the absence of any additional value for autogenous training in asthma as a means to acquire better control of symptoms. The discussion emphasized, however, that, preceding the period of autogenous training, all patients had taken part in a 2-week educational programme, so that the surplus value of autogenous training could not be assessed unequivocally. A. Harver's (Charlotte, USA) contribution was one of the presentations in which education was the central issue. Quality of life was assessed on parameters such as coping, self-image and the way in which disease is experienced, both in children with asthma and in those with diabetes and/or epilepsy. Cognition is a limiting factor. Patients with epilepsy come off worst. They appear to have a lower level of education compared to patients with diabetes and asthma. Asthma, however, scores low, particularly with respect to self-image. The interaction of the perception of the disease by the child and the parent seems to provide an instrument for intervention. H. Kotses (Ohio, USA), who reported on an evaluation of a self-management programme in children suffering from cystic fibrosis, found education clearly useful. In her communication E. Rameckers (Leusden, the Netherlands) explained how an association of patients can facilitate self-management by patients. N. van Veldhoven (Utrecht, the Netherlands) reported that training and physical exercise alone do have a clear effect on coping, though in a wide range. Training in children improves the expectations or self-image with respect to the child's own physical possibilities (although no specific intervention directed at coping was performed). These communications indicate that complementary activities have a better effect than isolated/unidisciplinary interventions.

The afternoon programme was initiated by W. Roth (Los Angeles, USA) with a presentation entitled 'Respiration in anxiety disorders'. In the psycho-bio-physiology model of anxiety, stress leads to a reaction which is known from physiology: a higher heart rate, higher blood pressure and a higher respiratory rate. However, the higher the primary level of stress, the more distinct these reactions will be. Patients suffering from 'panic disorder' have a higher heart rate, but the respiratory rate is also higher at rest. In his model a patient with 'panic disorder' experiences breathlessness sooner, but the experience of breathlessness is of a different nature than in hyperventilation in the narrow sense, within the hyperventilating patient at the other end of the spectrum there are some patients who give a 'catastrophic interpretation' to their sensation of dyspnoea. This results in the feeling of suffocation, which causes a feeling of panic; panic is thus not the primary cause of dyspnoea. The possible role of hyperventilation in the chronic fatigue syndrome was elucidated by E. Bazelmans (Nijmegen, the Netherlands). In 52% of the

patients with the chronic fatigue syndrome hyperventilation was demonstrated on the physiological basis of a lowered $P_a\text{CO}_2$, compared to 22% of a control group. However, no differences were demonstrated between patients with a chronic fatigue syndrome with and without hyperventilation on the scores of fatigue and limitation and on a number of parameters of psychopathology (SCL-90 scale). That physical sensations, however, can evidently influence respiration, was illustrated again by G. Strauss-Blasche (Vienna, Austria), who reported on a study of patients with chronic pain, in which he established that this pain suppresses respiratory sinus arrhythmia.

The first day was concluded with a poster discussion chaired by M. van den Hout and E. Wouters (Maastricht, the Netherlands). Central to the discussion was the problem of relating dyspnoea, the experience of dyspnoea and psychophysiological parameters to the 'hard' criteria of the pulmonary disease, such as the measure of airway obstruction, the measure of bronchial hyperresponsiveness like PC_{20} histamine and the results of allergic skin tests for example. The current limitations of the ambulatory measurement of the end-tidal PCO_2 are also important in this respect. The conclusion of the poster discussion was, therefore, that there is a great need for multidisciplinary study groups, so that the theme of respiratory regulation can be investigated in an appropriate and efficient way.

'Hyperventilation syndrome, complaints and hypocapnia, is there a relationship or is it coincidence?' was the theme of the second day. Preceding the meeting five parallel workshops were held on a variety of subjects, such as specific respiratory muscle training, respiratory regulation by means of biofeedback methods and 'breathing exercises'.

In his presentation K. van de Woestijne (Leuven, Belgium) discussed the possible relations between (abnormal) breathing pattern and subjective complaints. Complaint scores may be positive while the classical hyperventilation-provocation test is negative, a discrepancy noted for some time. An abnormal breathing pattern, particularly an irregular breathing pattern, is a hallmark of both the hyperventilation syndrome in the narrow sense and of panic disorders. The fact that they may coexist suggests a relation, but the irregular breathing pattern in itself does not always seem to be responsible for the complaints.

This presentation set the tone for the two other communications, in particular that by M. van den Hout (Maastricht, The Netherlands) entitled 'Panic and hyperventilation'. His view of the spectrum of respiratory regulation disorders in relation to panic disorders is that patients suffering from panic disorder may experience physical sensations like dyspnoea in such a way that this causes hyperventilation. In her presentation H. Hornsveld (Amsterdam, The Netherlands) demonstrated that many of the symptoms induced during a hyperventilation-provocation test are not specifically related to hypocapnia. W. Gardner (London, England) once again emphasized the physiological definition of hyperventilation, i.e. that respiration exceeds the metabolic need of the body; in other words, more CO_2 is expired than produced. This low PCO_2 is the primary means by which hyperventilation in the narrow sense is diagnosed. Hypocapnia may occur without symptoms. However, a possible cause, which may be physiological, psychological as

well as organic, has to be found. In his opinion hyperventilation on the basis of anxiety alone, i.e. without the presence of other factors, is extremely rare.

The day was concluded with a discussion chaired by W. Roth. The starting point was the definition formulated by the ISARP in Southampton in 1984: 'Hyperventilation is a complex of symptoms, induced by hyperventilation, associated with a lowered P_aCO_2 , and without somatic disease'.

In the past 12 years it has become clear that the complex of symptoms is defined insufficiently, e.g. the extent to which the P_aCO_2 would have to be lowered. This reduces the value of the hyperventilation-provocation test, in which the diagnosis of the 'hyperventilation syndrome' depends upon recognizing complaints. It is clear that there is no absolute relation between complaints and hypocapnia, but the spectrum includes patients who primarily have physiological problems and others who primarily have a panic disorder. Both categories are characterized by an objective dysregulation of respiration. However, complaints can be caused and modulated by a large number of factors other than hypocapnia. From a physiological point of view the etiology of hyperventilation, hypocapnia and complaints of somatic origin can be understood on a number of points, but complaints of psychological origin can still be understood only very incompletely. The situation with respect to complaints and hypocapnia can be described by two tables: hypocapnia is present or absent; complaints are present or absent. Hypocapnia accompanied by complaints is classically called hyperventilation syndrome. Normocapnia and no complaints is by definition a normal situation. Hypocapnia without complaints is by definition hyperventilation (but not necessarily HV-syndrome). Complaints without hypocapnia (at the moment of measurement) is an undefined and unclear situation.

Several proposals were put forward for a new definition of the hyperventilation syndrome. Some psychologists suggested that hyperventilation syndrome be defined as 'having familiar complaints when overbreathing voluntarily' Other psychologists proposed that we abandon the concept of the hyperventilation syndrome altogether. From the physiological side, suggestions were made to regard the hyperventilation syndrome within the larger concept of hyperventilation disorders. The latter include all situations that lead to over breathing and hypocapnia. Psychogenic hypocapnia is part of this hyperventilation disorder. The term 'dysfunctional breathing' was proposed in order to describe uncoordinated and inefficient breathing movement, and use of respiratory muscles. Finally, a proposal was made to define the hyperventilation syndrome:

A dysregulation of ventilation, causing hypocapnia, in the absence of somatic causes for hyperventilation, with symptoms not necessarily linked with the hypocapnia.

The symptoms may be generated or modified by personal history, fear and anxiety, the sympathetic-adrenergic tone, the proprioception from the respiratory muscles, or from other bodily sensations that are perceived in a disproportional

way. In view of the incidence of respiratory regulation problems and attendant patient suffering, further research is clearly necessary,

Glossary of Symbols and Abbreviations in ISARP Abstracts

AT	Autogenous training
CF	Cystic fibrosis
COPD	Chronic obstructive pulmonary disease (chronic bronchitis and emphysema)
CS	Conditioned stimulus
EMG	Electromyogram
\dot{V}_{CO_2}	Ventilatory equivalent for CO ₂ : \dot{V}_E/\dot{V}_{CO_2}
FEV ₁	Forced expiratory volume 1 s
HVPT	Hyperventilation provocation test
HVS	Hyper ventilation syndrome
kPa	kilo Pascal (unit of pressure; 1 kPa = 10 cm H ₂ O = 0.01 Atm)
LTO	Long-term oxygen administration to patients with severe pulmonary disease
LOX	Liquid oxygen
MV	Minute ventilation (l/min breathing)
P _{0.1}	Pressure in airways, during mouth occlusion, at 0.1 s after start of inspiration (expression of ventilatory drive)
PF (PEF, PEFR)	Peak (expiratory) flow (rate)
P _a CO ₂	Partial pressure of CO ₂ in the arterial blood
P _{et} CO ₂	Partial pressure of CO ₂ in the end-expiratory air
P _{tc} CO ₂	Transcutaneous partial CO ₂ pressure
P _i	Inspiratory pressure
P _e	Expiratory pressure
R _{aw}	Airway resistance
RR	Respiratory rate
RSA	Respiratory sinus arrhythmia (alteration in heart frequency synchronously with breathing)
RQ	Respiratory quotient (V_{CO_2}/V_{O_2})
TGV	Thoracic gas volume
TRR	Total respiratory resistance
TTI	Time tension index [(actual/maximal pressure) × (inspiratory time/total time of breathing cycle)]
UCS	Un-conditioned stimulus
\dot{V}_e	Minute ventilation (breathing l/min)
VAS	Visual analog scale
\dot{V}_{CO_2}	CO ₂ -production (of the human body; l/min)
\dot{V}_{O_2}	Oxygen consumption (of the human body; l/min)
VT	Tidal volume (of one breath)

Abstracts

1. 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 (electrodermal response), heart rate, and RSA (respiratory sinus arrhythmia).

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 (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.

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**

** $P < 0.01$.

2. Hyperventilation syndrome (HVS). Depletion of body CO₂ stores as a possible cause of long lasting exercise-induced dyspnea

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Twenty female subjects suffering from HVS (all complaining of usual exercise-induced dyspnea) were investigated during an exhaustive triangular exercise and the immediate following 5 min.

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 included 10 patients whose dyspnea persisted at the end of the recovery period while Group B included 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 W), $\dot{V}O_2$, $\dot{V}CO_2$, VE (± 50 l/min), ventilatory pattern, occlusion pressures ($P_{0.1}$), score of dyspnea (VAS) and heart rate.

However during recovery, whereas mean $\dot{V}O_2$ and \dot{V}_E (as fr, V_t , VT/T_i , T_i/T_{tot}) remained comparable in both groups, mean RQ and $E\dot{V}CO_2$ (for most of the period) as $P_{0.1}$ and $\dot{V}CO_2$ (during the first minute) were found significantly ($P < 0.05$) lower in Group A. So during recovery, Group A had a decreased VCO_2 although VO_2 , ventilation and respiratory pattern remained similar to Group B.

Between the two possible causes for such a discrepancy between ventilation and CO₂ pulmonary excretion, i.e. either an enhanced V_d/V_t ratio or a decreased PCO_2 , we favour the second for theoretical reasons and because observed lower $P_{0.1}$ in group A fit in with lower P_aCO_2 (decreased respiratory drive).

Our results suggest that the CO₂ 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 CO₂ stores. This mechanism could favour low arterial CO₂ levels that are known to elicit, in those patients, dyspnea among many other symptoms.

3. 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 compromise 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 assessment 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 responses. The present paper focuses 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 an 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.

4. 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 in daily 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. A series of experiments will be reviewed to test the validity of this assumption.

Method: All experiments used CO₂ 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.

5. Chronic pain suppresses respiratory sinus arrhythmia

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Forty-eight 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 min 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 five 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 ($r_1 = -0.36$, $r_2 = -0.37$) between pain and RSA was found. An analysis of variance (with respiration rate and age as a covariates) confirmed this result, revealing a 50% lower RSA-amplitude in high-pain subjects compared to low-pain subjects. A detailed analysis showed that joint and limb pain were the pain symptoms most consistently covarying with reduced RSA. Other consistent correlations between respiratory parameters and variables of general well-being were not found.

6. 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% 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 F_{ET}CO₂-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.

7. The need for specialist disciplines in as well as primary care applications of applied psychophysiology in behavioural medicine

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Argument: European practice of medicine runs the risk of becoming less effective and more unscientific depending on the focus on the economy—health care primary care seems to be to keep the cost as low as possible instead of increasing 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 based behavioral medicine. To accomplish this we have to focus on psychophysiological behavioral medicine tools which can be used (together with traditional ones) for treatment of various stress related disorders.

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 psychophysiological educational approach. 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
 - analysis and diagnosis,
 - treatment and training,
 - repeated measurement over time, and
 - 'Kellyian'-like education of patients as well as continuous 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 and knowledge system (KS) analysis. This process will also in it self contribute to increased effectivity in diagnosis and treatment through deductive learning in the KS.

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 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 instead of sickness benefits get salary for taking part in a 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. 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 and he might become the independent variable.

8. 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. Twelve volunteer subjects (nine females and three males, mean age 31.1) participated in this study. Six reported breathless episodes (range 0.8 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 μm in thickness. Each condition consisted of four counter-balanced 60-s 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 ($P < 0.01$) for the concrete image (mean = 14.8) as compared to the meadow image (mean = 13.5) in all positions, significantly higher respiration rate ($P < 0.01$) 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. Dorli Reeves for introducing us to the relationship between walking on hard and soft surfaces and breathing.

9. End-tidal CO_2 as a conditioned response in a Pavlovian conditioning paradigm

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In his seminal 1976 article on 'The syndrome of habitual chronic hyperventilation', Lum 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 CO_2 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 produces a statistically significant drop in end-tidal CO_2 ($P_{\text{et}}\text{CO}_2$)) 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 $P_{et}CO_2$ of 1.82 mmHg, a significant increase in heart rate of 3.77 beats/min, a significant increase in electrodermal conductivity of 4.17 $\mu\Omega$, 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, who used CO_2 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.

10. Detection of hyperventilatory sensations in panic disorder

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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 CO_2 was prevented by addition of CO_2 .

Preliminary results (10 panic patients, 28 controls) indicated that controls were better than panic patients in feeling a difference between the lightest hypocapnia induced and isocapnia. Thus, the hypothesis that panic patients are better detectors of light hypocapnia might be refuted.

11. The impact of compliance on the quality of life in patients with chronic obstructive pulmonary disease under liquid oxygen therapy

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Introduction: The benefits of long-term oxygen therapy (LTO) in patients with chronic obstructive pulmonary disease (COPD) depend on the prolonged and steady application of oxygen (nocturnal oxygen therapy trial group, 1980). However, the compliance to treatment remains a substantial problem with gaseous oxygen as well as with oxygen concentrators. Therefore, liquid oxygen therapy (LOX) was introduced in order to improve patient comfort and compliance because the strawler is easily portable. The purpose of this study was to investigate the effects of two different aspects of compliance with LOX therapy on quality of life and to explore possible pneumonological and psychosocial concomitants.

Patients and methods: The study sample consisted of a consecutive series of 57 patients with COPD and hypoxemia under LOX therapy meeting the NOTT-criteria (Nocturnal oxygen therapy trial group, 1980).

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. Physiological lung function was quantified by the FEV₁, FVC, P_aO₂ and S_aO₂ while the severity of dyspnea was measured using the baseline dyspnea index (BDI). Psychological adjustment was assessed by a self-report questionnaire (FPI-R). The German version of the Sickness Impact Profile (SIP) was employed for the assessment of quality of life.

Results: Seven (12%) patients used LOX less than prescribed 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 discriminant 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 noncompliant (Eigenvalue = 0.71; $r = 0.65$; $\chi^2 = 23.16$; $df = 10$; $P = 0.01$). A further analysis explored the variables discriminating between LOX outdoor users and LOX outdoor use refusers. By means of the degree of emotional lability, social insecurity, life-satisfaction, introversion and the FEV₁, 71.4% of the LOX outdoor users but only 50% of the refusers could be correctly classified (Eigenvalue = 0.27; $r = 0.46$; $\chi^2 = 10.88$; $df = 5$; $P = 0.05$). At follow-up, the data of 25 patients were available. Of these, five refused the LOX outdoor use. Quality of life remained stable in almost all of the SIP subscales in the patients using LOX away from home.

At follow-up, the refusers had worsened significantly in their SIP physical ($P = 0.039$) and SIP total impairment scores ($P = 0.001$). Furthermore, they presented with significantly more impairments in almost all areas of life quality examined, ($P < 0.05$, respectively), except for home-management and free-time activities as compared to the LOX outdoor users.

Conclusions: 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.

12. Development and evaluation of a self-management program for cystic fibrosis

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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, 6-h 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.

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

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Cardiovascular autonomic imbalance has received increasingly attention 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). Medication, exercise training and stress management training may exert their effect by improving autonomic balance.

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 were investigated in 89 myocardial infarction patients.

Relaxation instruction caused a relatively small but consistent decrease in respiration rate after rehabilitation, which remained at three months follow up, whereas respiration remained unchanged in patients who received exercise training only ($P < 0.001$). Resting heart rate decreased after rehabilitation, for all patients ($P < 0.001$). 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.

The outcome supports the idea that breathing and relaxation instruction improves cardiovascular autonomic balance, and that the effect remains stable after the intervention. The effect was partly associated with a slower breathing pattern, and partly independent of respiration. The question is raised whether reduced heart rate and increased RSA reflect an increase in parasympathetic tone, when they are associated with a stable within-individual change in respiration pattern.

14. Functional breathing is '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. Skeletal movement patterns can be reliable tools in the assessment of the functionality of breathing, because the skeleton is a stable, inner reference for the individual neuromuscular control of movement, and because skeletal movement can be tested objectively.

When the spinal column is extended, in upright standing posture and in particular in the supine resting position, respiration involves a minute wave-like motion in the spine. The spinal column connects the ribcage with the head and the pelvis. Its potential for movement facilitates respiration. Inhalation is accompanied with a preference for slight lumbar lordosis and flattening of the cervico-thoracic junction. The opposite preference is present during exhalation. Therefore, small movements, initiated from the legs, arms or head are able to influence respiration indirectly. Also, the change in form of the ribcage during respiration is facilitated by a slight rolling movement of the chest, upwards during inhalation and downwards during exhalation. By contrast, dysfunctional breathing leads to less coordination between spinal column and the ribcage, pelvis and head.

When the spinal column is flexed, for instance in a slightly slump sitting posture, the above-mentioned connections are blocked. This is also the case when the subject lies prone. In that situation, the ribcage can not roll upward and the cervico-thoracic junction can not flatten during inhalation. Instead, the costo-abdominal circumference is expanded more and the lumbar lordosis flattens during inhalation. These two patterns of connecting respiration to the whole body oppose each other. Together, they allow the body to respond flexibly to different postural situations. Therefore, the degree that both patterns can be utilized is an important indicator of functional breathing and serves as a parameter of the success of breathing therapy.

Manual procedures are important in the assessment of whole body involvement of respiration, because the movements are small and consist of preferential directions, rather than actual gross motions. They are clearest when the subject is relaxed and is able to sense his or her body. Thus, their absence may indicate (1) a lack of body awareness, (2) the presence of a high tonus that accompanies a stress situation, (3) a dysfunctional breathing pattern per se.

15. 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, lymph 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.

Complaints, associated with dysfunctional breathing, may originate from inadequate air transport (ventilation, smell, voice), from inefficient movement and from insufficient awareness of the body. For instance, dyspnea, lightheadedness and agoraphobia may result from dysfunctional breathing, and not only from hypocapnia as the term HVS suggests. However, the tendency to hyperventilate may be stimulated by restricted movement in the trunk and spinal column, which the subject is unaware of. Breathing therapy is not limited to the influence on ventilation. It involves the restoration of functional mobility in the trunk and spinal column with respiration, and reeducation of body awareness.

A wider view of respiratory function, beyond ventilation, provides a rational basis for treatment by breathing therapy and extends its indications. There is a need to develop tests for assessment of dysfunctional breathing.

16. 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 8 to 12 years who had been diagnosed with a chronic illness for at least 1 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 36-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 ($M = 73.80$), $F(2,42) = 3.28$, $P < 0.05$. 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.

17. Ambulatory measurements of transcutaneous PCO_2 in panic disorder and hyperventilation syndrome

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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 PCO_2 ($P_{tc}CO_2$) offers the opportunity to directly test the co-occurrence of symptoms and hyperventilation 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).

In the group of PD-patients (Study A) 24 panic attacks were registered that lasted at least 3 min; a decrease of $P_{tc}CO_2$ 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 $P_{tc}CO_2$ 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.

18. Dyspnoea during an incremental ergometer test and respiratory muscle load

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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 P_aCO_2 during exercise.

Methods: Fifty patients with a wide range of obstructive pulmonary diseases (FEV_1 %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 ($P_i + P_e$)_{act} generated at W_{max} was multiplied with the breathing frequency (PFP, indication of the muscle load). $PFP\%$ was calculated from: frequency $\times (P_{i\ act} + P_{e\ act}) / (P_{i\ max} + P_{e\ max})$. Linear regression between V_E and PFP at W_{max} 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 whether this led to a difference in Borg score for dyspnoea between the two groups. Correlations between the changes in TTI_i , TTI_e , PFP, $PFP\%$ and Borg dyspnoea for both groups were calculated.

Results: The slope of V_E/PFP of the non ventilatory limited group was 0.17 l/kPa ($P = 0.007$). The slope of V_E/PFP for the ventilatory limited group was 0.01 L/kPa ($P = 0.7$). The difference between the slopes (0.16) was highly significant (CI(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 TTI_i 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 TTI_e 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.

Table 1. Correlations (r) between Borg dyspnoea (Bd) and TTI_i , TTI_e , PFP and $PFP\%$, none of the correlations were significant

	Bd			
	TTI_i	TTI_e	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. ($N = 28$)	$r = -0.3143$	$r = 0.0619$	$r = 0.1124$	$r = -0.1396$

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.

19. 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 worthwhile 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, six males and 21 females, age 23–54, mean 36.6) with a group of 32 healthy controls (five males and 27 females, age 19–63, mean 37.0). CFS is defined as a severe fatigue, lasting for at least 6 months, for which no somatic explanation can be offered. Patients were diagnosed with CFS if they fulfilled 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 fulfilled three of the following criteria:

1. Low $P_a\text{CO}_2$
2. High breathing frequency, irregular breathing or frequent sighing
3. Decreasing $P_a\text{CO}_2$ in control condition
4. Inverted ventilatory response to CO_2
5. Adding CO_2 results in a regularisation of breathing
6. Provocation test (one of the following criteria):
 - No step-change in $P_a\text{CO}_2$ when stopping voluntary hyperventilation
 - No step change in respiratory frequency when stopping voluntary hyperventilation
 - $P_a\text{CO}_2$ 3 min after the end of the provocation $< 90\%$ of the starting level

As shown in Table 1, significantly more hyperventilation and significantly lower $P_{a}CO_2$ levels were found in CFS compared to healthy controls.

Table 1

	CFS ($N = 27$)	Controls ($N = 32$)	P -value
Hyperventilation, according to physical criteria	59%	22%	<0.005
$P_{a}CO_2 < 4.5$ (kPa)	52%	22%	<0.05

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.

20. 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 (ETCO₂) levels were measured at baseline, during psychological and respiratory stressors, and at the end of recovery periods. As predicted, Type I (respiratory) panickers had significantly lower resting ETCO₂ 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 of normal ETCO₂ in Type I), thus improving treatment success rates.

Table 1. Mean resting ETCO₂ levels (Torr)

	Type I	Type III	Controls
Baseline	35.14 ^a	39.27	39.24
Psychological recovery	34.29 ^b	37.73	39.35
Physiological recovery	35.14 ^c	38.55	39.00

^aType I vs. Type III $P = 0.006$, Type III vs. Controls, NS.

^bType I vs. Type III $P = 0.044$, Type III vs. Controls, NS.

^cType I vs. Type III $P = 0.031$, Type III vs. Controls, NS.

21. 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 attacks.

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 (R_{aw} , 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 R_{aw} , but a small TRR reduction after the training period (-0.04 kPa/l/s), $P < 0.05$). 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.