I. Introduction and Overview

This report outlines theoretical background, methods and results of Capnometry-Assisted Breathing, a novel behavioral intervention to treat panic disorder. The studies presented in this doctoral thesis were conducted from 1999 until 2003 at the Laboratory of Clinical Psychopharmacology and Psychophysiology, Palo Alto Veterans Administration Health Care System in association with the Stanford University Department of Psychiatry and Behavioral Sciences under the supervision of Prof. Walton T. Roth.

Breathing training has been discussed for some time as an intervention to reduce hyperventilation-produced symptoms in panic disorder. Although the theoretical implications with respect to the regulation of breathing and the role of hypocapnea in triggering anxiety are straightforward, clinical research has suffered from conceptual and methodological weaknesses. Voluntary hyperventilation has been employed in various ways in panic disorder treatment, but its theoretical and practical implications for therapy, as well as its actual effect on patients has rarely been reflected.

In this doctoral project, a method for altering pCO_2-levels was developed using feedback from a small hand-held capnometry device. In a 4-week therapy that comprised 5 sessions of education and training as well as twice-daily home-based breathing exercises panic patients systematically increased their pCO_2-levels by breathing slow and shallow using pacing tones as guidance. Panic frequency and severity, global impairment, agoraphobic avoidance, anxiety sensitivity, depression, and response to voluntary hyperventilation were measured before and after training, as well as 3 and 12 months following training. Compared to a waiting control group, panic patients of the intervention group showed increases in pCO_2-levels and marked reductions in panic symptoms and anxiety. They also managed to return faster to normal pCO_2 levels following voluntary hyperventilation. These improvements were sustained at 3- and 12- months follow-up. In addition to the results from the clinical trail, an individual case is reported that illustrates the therapeutic techniques and the course of the treatment. In conclusion, pCO_2- biofeedback assisted breathing training is a theoretically well-funded and clinically effective behavioral treatment for panic disorder.