Yoga and the Heart

Compiled by: Trisha Lamb

Last Revised: April 27, 2006

International Association of Yoga Therapists
P.O. Box 2513 • Prescott • AZ 86302 • Phone: 928-541-0004
E-mail: mail@iayt.org • URL: www.iayt.org

"When most people think about yoga they think hatha yoga, the stretching. To me that's the least interesting aspect of yoga. It's useful, but it's a starting point. What yoga is really about is transformation. It's about transforming your life, rediscovering inner sources of peace and joy and well-being, transcending the sense that we're just separate. On one level you're you and I'm me; on another level, we're part of something larger that connects us. If we can have that double vision, it lends itself to compassion and altruism and service, as opposed to blowing people up and feeling like you're different from them. What we're really trying to do is more than just helping people lose weight or even unclogging their arteries or helping them live longer, as important and desirable as those goals can be. It's really kind of a conspiracy of love, because ultimately that's what we're here for."

—Dean Ornish, M.D.
Developer of the heart disease reversal program that incorporates *yogâsana*, *prânâyâma*, and meditation

Ades, P. A., P. D. Savage, M. E. Cress, M. Brochu, N. M. Lee, and E. T. Poehlman. Resistance training on physical performance in disabled older female cardiac patients. *Medicine & Science in Sports & Exercise*, 23 Aug 2003, 35(8):1265-1270.

Abstract: Purpose: We evaluated the value of resistance training on measures of physical performance in disabled older women with coronary heart disease (CHD). Methods: The study intervention consisted of a 6-month program of resistance training in a randomized controlled trial format. Training intensity was at 80% of the single-repetition maximal lift. Control patients performed light yoga and breathing exercises. Study participants included 42 women with CHD, all >or= 65 yr of age and community dwelling. Subjects were screened by questionnaire to have low self-reported physical function. The primary study measurements related to the performance of 16 household activities of the Continuous Scale Physical Functional Performance test (CSPFP). These ranged from dressing, to kitchen and cleaning activities, to carrying groceries and walking onto a bus with luggage, and a 6-min walk. Activities were measured in time to complete a task, weight carried during a task, or distance walked. Other measures included body composition, measures of aerobic fitness and strength, and questionnaire-based measures of physical function and depression score. Results: Study groups were similar at baseline by age, aerobic capacity, strength, body composition, and in performing the CSPFP. After conditioning, 13 of 16 measured activities were performed more rapidly, or with increased weight carried, compared with the control group (all $P < 0.05$). Maximal power for activities that involved weight-bearing over a distance, increased by 40% ($P < 0.05$). Conclusions: Disabled older women with CHD who participate in an intense resistance-training program improve physical capacity over a wide range of household physical activities. Benefits extend beyond strength-related activities, as endurance, balance, coordination, and flexibility all improved. Strength training should be considered an important component in the rehabilitation of older women with CHD.

Aggarwal, Sheveta. AIIMS [All India Institute of Medical Sciences] cardiologist vouches for yoga as heart cure. ChandigarhNewsline.com, 20 Mar 2005.

"'Yoga can reduce heart diseases by 20 per cent,' said former Professor and Head of Cardiology Department, AIIMS, Dr S.C. Manchanda who was in town for the National Conference on 'Yoga and Naturopathy for Common Man.'

"Highlighting that every tenth Indian suffers from a heart disease and in the next 20 years it is anticipated that this rate will increase by 300 per cent . . .

"'Seeing the growing trend of the disease, the need for practicing yoga has become vital. It should indeed be initiated at [the] school level itself' he said.

"Quoting a research [study] headed by him [at] AIIMS, where a comprehensive lifestyle training programme was used to treat patients who had an angiography done and had multiple blockages (over 70 per cent), it was found that all the risk factors showed a marked improvement. These patients moved towards normalcy by the end of one year. During the research it was also highlighted that the technique of Preksha meditation is beneficial in improving the symptoms and exercise capacity, [and in] lowering weight and serum lipid levels. It also retards the progression of coronary atherosclerosis in patients with severe coronary artery disease and reduces revascularisation . . .

"Dr. Manchanda also highlighted that yoga should be made a part of the lifestyle and should not be restricted to a few hours. 'It controls stress, hypertension, asthma and cures the problems of constipation and anxiety to an extent,' he said. 'Also yoga has no side effect unlike medic[al] drugs, which, according to a study in the US, is the fourth leading cause of deaths there,' he pointed out."

Agrawal, R. C., et al. Effects of shavasana on vascular response to a cold pressor test in hyper-reactors. *Indian Heart Journal*, 1977, 29(4):182-185.

Agrawala, B. L. Heartening news for heart patients. *Yoga and Total Health*, Jun 2000, p. 23. (On establishment of The Caring Heart Project by The Yoga Institute, Santacruz, Bombay, India, which aims to demonstrate that ischaemic heart disease can be treated through Yoga leading to reversal in coronary blockages.)

Anand, B. K., and G. S. Chhina. Investigations on yogis claiming to stop their heartbeats. *Indian Journal of Medical Research*, Jan 1961, 49:90-94.

Appels, A., F. Bar, J. Lasken, et al. The effect of a psychological intervention program on the risk of a new coronary event after angioplasty: A feasibility study. *Journal of Psychological Research*, 1997, 43:209-212.

Found that breathing exercise therapy after percutaneous transluminal angioplasty reduced exhaustion, hostility, and apprehension.

Aruna. Integrated approach of yoga therapy for asthma, migraine, and IHD. Vivekananda Kendra Yoga Research Foundation, 1991.

Ayurveda and Yoga therapy in the treatment of cardio-vascular diseases. First Annual Meeting of the National Ayurvedic Medical Association, 16-19 Oct 2003.

Joelle Babula, Joelle. Martial arts-yoga combo helps heart patients rehab. *The Arizona Republic*, 19 Jun 2004.

"Patients recovering from heart attacks, heart surgery or other cardiovascular problems now can enroll in a novel meditation and recovery program at Chandler Regional Hospital.

"The martial art and yoga-like program incorporates deep breathing with movements, postures and sign language. The movements help lower stress, improve balance and increase circulation to speed up the healing process, said Dr. Anne Borik, an internal medicine specialist and founder of the stress reduction program, called Sign-Chi-Do.

"Borik, a veteran martial artist, created Sign-Chi-Do in an effort to help her elderly patients with balance, stress reduction, depression and fatigue. The exercises stimulate the mind and can help ward off dementia, she said . . ."

Bagga, O. P. , and A. Gandhi. A comparative study of the effect of Transcendental Meditation (T.M.) and Shavasana practice on the cardiovascular system. *Indian Heart Journal*, Jan 1983, 35(1):39-45.

This study was designed "to evaluate the effect of Transcendental Meditation and Shavasana practice on blood pressure, radial and carotid pulse, ECG, EMG and skin resistance."

_____, A. Gandhi, and S. Bagga. A study of the effect of Transcendental Meditation and yoga on blood glucose, lactic acid, cholesterol and total lipids. *Journal of Clinical Chemistry and Clinical Biochemistry*, 1981, 19(8):607-608.

Barnes, Vernon A., Frank A. Treiber, and Harry Davis. Impact of Transcendental Meditation on cardiovascular function at rest and during acute stress in adolescents with high normal blood pressure. *Journal of Psychosomatic Research*, Oct 2001, 51(4):597-60. Author email: vbarnes@mail.mcg.edu. PMID: 11595248.

OBJECTIVE: This study examined the impact of the Transcendental Meditation (TM) program on cardiovascular (CV) reactivity in adolescents with high normal BP. METHOD: Thirty-five adolescents [34 African Americans (AAs), 1 Caucasian American (CA); ages 15-18 years] with resting systolic blood pressure (SBP) between the 85th and 95th percentile for their age and gender on three consecutive occasions, were randomly assigned to either TM (n=17) or health education control (CTL, n=18) groups. The TM group engaged in 15-min meditation twice each day for 2 months including sessions during school lunch break. Primary CV outcome measures were changes in blood

pressure (BP), heart rate (HR), and cardiac output (CO) at rest and in response to two laboratory stressors, a simulated car driving stressor and an interpersonal social stressor interview. RESULTS: The TM group exhibited greater decreases in resting SBP (P<.03) from pre- to postintervention, compared to the CTL group. The TM group exhibited greater decreases from pre- to postintervention in SBP, HR, and CO reactivity (P's<.03) to the simulated car driving stressor, and in SBP reactivity (P<.03) to the social stressor interview. CONCLUSION: The TM program appears to have a beneficial impact upon CV functioning at rest and during acute laboratory stress in adolescents at-risk for hypertension.

Barr, Basil P., and H. Benson. The relaxation response and cardiovascular disorders. *Behavioral Medicine Update,* 1984, 6(4):28-30.

Barrett, Jennifer. Heart to heart. *Yoga Journal*, Dec 2002, pp. 102-109.

"To say that yoga has found its place in the field of cardiology would be a stretch . . . most doctors don't even mention it to their high-risk patients . . . But it might just be a matter of time, given the revolution underway in heart disease care as it applies to women . . ."

_____. Ancient answer to heart health: Research shows that prevention techniques grounded in Vedic medicine help guard against heart disease. *Yoga Journal*, Mar/Apr 2003, p. 33.

Bauhofer, V. Physiological cardiovascular effects of the Transcendental Meditation technique. Was scheduled for inclusion in *Scientific Research on the Transcendental Meditation Program: Collected Papers, Vol. 2*. Rheinweller, Germany: Maharishi European Research University Press, publication date unknown. Doctoral dissertation, Julius-Maximilian University, Wurzburg, Germany, 1978.

Belaia, N. A. Effect of certain asanas used in the system of yoga on the central nervous and cardiovascular system. *Vopr Kurortol Fizioter Fiz Kult*, May-Jun 1976, 0(3):13-18. [In Russian.]

Bell, Baxter, M.D. Yoga 911: How should you handle an in-class medical crisis? *Yoga Journal*, Nov/Dec 2000, pp. 135-137. (When a student has a heart attack during class.)

Benson, H. The relaxation response: Physiologic basis and clinical applicability. In T. Dembroski, T. Schmidt, and G. Blumchen, eds., *Biobehavioral Bases of Coronary Heart Disease*. Basel: Karger, 1983, pp. 439-444.

_____. The relaxation response and cardiovascular diseases. *Chest, Heart, Stroke Journal*, 1976, I:28-31.

_____, J. B. Koch, and K. D. Crassweller. The usefulness of the relaxation response in the treatment of stress-related cardiovascular diseases. *J S C Medical Associates*, 1976, 2:50-56.

Bera, T. K., and M. V. Rajapurkar. Body composition, cardiovascular endurance and anaerobic power of yogic practitioner. *Indian Journal of Physiology & Pharmacology*, 1993, 37(3):225-228.

Bernardi, Luciano, C. Passino, V. Wilmerding, G. M. Dallam, D. L. Parker, R. A. Robergs, and O. Appenzeller. Breathing patterns and cardiovascular autonomic modulation during hypoxia induced by simulated altitude. *Journal of Hypertension*, 2001, 19:947-958.

_____, C. Porta, L. Spicuzza, J. Bellwon, G. Spadacini, A. W. Frey, L. Y. Yeung, J. E. Sanderson, R. Pedretti, and R. Tramarin. Slow breathing increases arterial baroreflex sensitivity in patients with chronic heart failure. *Circulation*, 15 Jan 2002, 105(2):143-145. PMID: 11790690. Author email: lbern1ps@unipv.it.

Abstract: BACKGROUND: It is well established that a depressed baroreflex sensitivity may adversely influence the prognosis in patients with chronic heart failure (CHF) and in those with previous myocardial infarction. METHODS AND RESULTS: We tested whether a slow breathing rate (6 breaths/min) could modify the baroreflex sensitivity in 81 patients with stable (2 weeks) CHF (age, 58+/-1 years; NYHA classes I [6 patients], II [33], III [27], and IV [15]) and in 21 controls. Slow breathing induced highly significant increases in baroreflex sensitivity, both in controls (from 9.4+/-0.7 to 13.8+/-1.0 ms/mm Hg, P<0.0025) and in CHF patients (from 5.0+/-0.3 to 6.1+/-0.5 ms/mm Hg, P<0.0025), which correlated with the value obtained during spontaneous breathing (r=+0.202, P=0.047). In addition, systolic and diastolic blood pressure decreased in CHF patients (systolic, from 117+/-3 to 110+/-4 mm Hg, P=0.009; diastolic, from 62+/-1 to 59+/-1 mm Hg, P=0.02). CONCLUSIONS: These data suggest that in patients with CHF, slow breathing, in addition to improving oxygen saturation and exercise tolerance as has been previously shown, may be beneficial by increasing baroreflex sensitivity.

_____, Peter Sleight, Gabriele Bandinelli, Simone Cencetti, Lamberto Fattorini, Johanna Wdowczyc-Szulc, and Alfonso Lagi. Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study. *British Medical Journal*, 22-29 Dec 2001, 323:1446-1449. Contact: lbernlps@unipv.it. PMID: 11751348.

Abstract: OBJECTIVE: To test whether rhythmic formulas such as the rosary and yoga mantras can synchronise and reinforce inherent cardiovascular rhythms and modify baroreflex sensitivity. DESIGN: Comparison of effects of recitation of the Ave Maria (in Latin) or of a mantra, during spontaneous and metronome controlled breathing, on breathing rate and on spontaneous oscillations in RR interval, and on blood pressure and cerebral circulation. SETTING: Florence and Pavia, Italy. PARTICIPANTS: 23 healthy adults. MAIN OUTCOME MEASURES: Breathing rate, regularity of breathing, baroreflex sensitivity, frequency of cardiovascular oscillations. RESULTS: Both prayer

and mantra caused striking, powerful, and synchronous increases in existing cardiovascular rhythms when recited six times a minute. Baroreflex sensitivity also increased significantly, from 9.5 (SD 4.6) to 11.5 (4.9) ms/mm Hg, P<0.05. CONCLUSION: Rhythm formulas that involve breathing at six breaths per minute induce favourable psychological and possibly physiological effects.

_____, Giammario Spadacini, Jerzy Bellwon, Ramiz Hajric, Helmut Roskamm, and Axel W. Frey. Effect of breathing rate on oxygen saturation and exercise performance in chronic heart failure. *The Lancet*, 2 May 1998, 351(9112):1308-1311.

The training of respiratory muscles decreases respiratory work and at the same time achieves higher levels of blood oxygen. This is of special importance for cardiac patients since the low blood oxygen common in cardiac patients "may impair skeletal muscle and metabolic function, and lead to muscle atrophy and exercise intolerance." Patients in this study who were trained to slow down their breathing via special deep-breathing techniques achieved higher blood oxygen levels and were able to perform better on exercise tests. (The optimum breath rate was found to be 6 breaths per minute, as opposed to the average resting rate of 12-14 breaths per minute.)

Better Heart: Healthy Heart: Better Living. Health Care Guide: Khalsa News Network, 23 Mar 2005.

"The Key Factors Leading to a Healthy Heart

"Most women worry about getting breast cancer far more than they do about heart disease, but heart disease is the number one killer of women as well as men today. The good news is that both modern medicine and ayurveda agree that heart disease can largely be prevented by eating a healthier diet, exercising in moderation and actively managing stress levels.

"'(The) statistics (on heart disease) may sound shocking and indeed have been used to frighten women into taking HRT for prevention, says Nancy Lonsdorf, author of *A Woman's Best Medicine for Menopause*. 'A better use for them is to motivate you to start exercising and eat a healthier diet, because the good news about heart disease is that nearly all of it is preventable, and much of it may be reversible.'

"The Ayurvedic View of the Heart

"According to the ayurvedic perspective, the heart has two equally important aspects that need to be taken into account when discussing heart health-the physical aspect of the organ that pumps blood and the emotional heart that experiences every human emotion from joy to sorrow. 'The heart is the seat of prana, or life-force,' says ayurvedic expert Rama Kant Mishra. 'It is also the repository of the eight essential drops of ojas in the body.' Ayurveda defines ojas as the substance that sustains life and promotes vitality, longevity and bliss. 'Ojas is like a lamp in a doorway, lighting both inside and outside,'

says Dr. Lonsdorf. 'In one stroke, ojas both infuses your mind with bliss and enlivens the healing intelligence of the physical body.' The ayurvedic approach to heart health focuses as much on building up ojas as it does on strengthening and nourishing the physical muscle.

"Ayurvedic healers recognized many millennia ago what modern medicine says today—that eating fatty foods in excess (which do not get completely digested and create toxins (ama) in the system) and too much stress are the prime factors that lead to heart damage. So a healthy diet, exercise and stress management techniques are the cornerstones of the ayurvedic program for heart health.

"Eating for a Healthy Heart

"Eat a stewed apple or pear for breakfast. 'This is the ideal way to begin the day,' says Vaidya Rama Kant Mishra. 'This breakfast helps balance your emotions, enhances natural immunity, supports digestion and elimination, elevates energy levels and helps you build ojas.' 'Include fresh pineapple in your diet,' recommends Dr. Lonsdorf. 'Squeeze a wedge of fresh lemon or lime on your food before serving.'

"Drink lots of warm water through the day to help cleanse the physiology.

"Eat fresh sweet fruit such as pears to balance Sadhaka Pitta, the moderator of emotional health.

"Cook with heart-friendly spices such as small amounts of freshly cracked black pepper and fresh ground cardamom.

"Soak ten almonds in warm water overnight. Peel and eat them in the morning. Ayurveda considers almonds a very saatvic food-one that nourishes the body, mind and spirit. Modern research shows that nuts such as almonds are a valuable source of omega-3 fatty acids.

"Do not skip meals, eat your largest meal at noon, and eat at the same times each day to support your digestion and minimize the build-up of ama in the body.

"Cultivate an Ojas-Enhancing Lifestyle

"Practice the Meditation for 20 minutes twice a day. The Meditation program has been shown in research studies to lower blood pressure, reverse arterial blockage and enhance resistance to heart disease and strokes.

"Manage your mental workload. 'Overuse or misuse of the mind creates day-to-day mental stress,' says Vaidya Rama Kant Mishra.

"Go to bed by 10 p.m. and awake before 6 a.m. Your body needs adequate rest, and working late into the night depletes ojas and increases ama.

"Exercise everyday, in moderation. Walking is a wonderful way to exercise for all body-types. Walk into the rising sun to nourish your mind and spirit. The sun salutation and other yoga exercises are also recommended.

"Practice deep breathing. Deep breathing opens up the shrotas in the body."

Bhajan, Yogi. Heart. In Alice Clagett and Elandra Kirsten Meredith, eds., *Yoga for Health and Healing: From the Teachings of Yogi Bhajan, Ph.D.* Santa Monica, Calif.: Alice B. Clagett, 1994, pp. 70-72, 96.

Bhargava, R., M. G. Gogate, and J. F. Mascarenhas. Autonomic responses to breath holding and its variations following pranayama. *Indian J Physiol Pharmacol*, Oct 1988, 32(4):257-264.

Bhat, Vasanthi. Heart; Blocked arteries. In Vasanthi Bhat, *The Power of Conscious Breathing in Hatha Yoga*. San Jose, Calif.: Vasanthi Bhat, 1997, p. 222.

Bhobe, S. D. Integrated approach of yoga therapy for anxiety neurosis, hypertension, headache, and IHD. Vivekananda Kendra Yoga Research Foundation, 1990.

Bhole, M. V. Pulse control and yoga practices. *Yoga-Mimamsa*, 1972, 15(1):39-49.

_____. Role of yoga in the prevention of heart trouble. *Arogya Sandesh*, 1972, 8(2):16-17. [In Hindi.]

_____, and P. V. Karambelkar. Heart control and yoga practices. *Darshana International*, 1971, 11(2):63-69/*Yoga-Mimamsa*, 1971, 13(4):53-65.

Blanchard, E.B., and L. D. Young. Self-control of cardiac functioning: A promise as yet unfulfilled. *Psychol Bull*, Mar 1973, 79(3):145-63.

Blank, S. E., K. Raman, G. Chock, and J. W. Krieger. Heart rate and oxygen cost responses to power yoga asanas in beginning practitioners. *Medicine & Science in Sports & Exercise*, May 2001, 33(5) Supplement:S107.

Blumenthal, J. A., C. F. Emery, D. J. Madden, L. K. George, R. E. Coleman, M. W. Riddle, D. C. McKee, J. Reasoner, and R. S. Williams. Cardiovascular and behavioral effects of aerobic exercise training in healthy older men and women. *Journal of Gerontology*, Sep 1989, 44(5):M147-157. PMID: 2768768.

Abstract: The cardiovascular and behavioral adaptations associated with a 4-month program of aerobic exercise training were examined in 101 older men and women (mean age = 67 years). Subjects were randomly assigned to an Aerobic Exercise group, a Yoga and Flexibility control group, or a Waiting List control group. Prior to and following the 4-month program, subjects underwent comprehensive physiological and psychological

evaluations. Physiological measures included measurement of blood pressure, lipids, bone density, and cardiorespiratory fitness including direct measurements of peak oxygen consumption (VO2) and anaerobic threshold. Psychological measures included measures of mood, psychiatric symptoms, and neuropsychological functioning. This study demonstrated that 4 months of aerobic exercise training produced an overall 11.6% improvement in peak VO2 and a 13% increase in anaerobic threshold. In contrast, the Yoga and Waiting List control groups experienced no change in cardiorespiratory fitness. Other favorable physiological changes observed among aerobic exercise participants included lower cholesterol levels, diastolic blood pressure levels, and for subjects at risk for bone fracture, a trend toward an increase in bone mineral content. Although few significant psychological changes could be attributed to aerobic exercise training, participants in the two active treatment groups perceived themselves as improving on a number of psychological and behavioral dimensions.

_____, C. F. Emery, D. J. Madden, R. E. Coleman, M. W. Riddle, S. Schniebolk, F. R. Cobb, M. J. Sullivan, and M. B. Higginbotham. Effects of exercise training on cardiorespiratory function in men and women older than 60 years of age. *American Journal of Cardiology*, 15 Mar 1991, 67(7):633-639. (Compares aerobic exercise to Yoga.)

_____, et al. Stress management and exercise training in cardiac patients with myocardial ischemia: Effects on prognosis and evaluation of mechanisms. *Archives of Internal Medicine*, 1997, 157:2213-2223.

From a review by Belleruth Naparstek in *HealthJourneys News*, 16 May 2001:

"[This] placebo controlled, randomized study . . . showed that teaching stress reduction techniques to cardiac patients reduced their risk of having further heart problems by a whopping . . . 75%.

"Of 107 patients, 40 received standard medical care; 34 additionally engaged in vigorous exercise for 35 minutes, 3 times a week for 16 weeks; and 33 were given added weekly group sessions, where they learned relaxation and stress reduction techniques (education, progressive muscle relaxation, biofeedback, thought-stopping, anger management). Results: 30% of the standard care group had subsequent heart problems; 21% in the exercise group; and only 10% in the stress management group . . ."

Bowman, A.J., R. H. Clayton, A. Murray, J. W. Reed, M. M. Subhan, and G. A. Ford. Effects of aerobic exercise training and yoga on the baroreflex in healthy elderly persons. *European Journal of Clinical Investigation*, May 1997, 27(5):443-449.

Abstract: It is unclear whether the age-associated reduction in baroreflex sensitivity is modifiable by exercise training. The effects of aerobic exercise training and yoga, a non-aerobic control intervention, on the baroreflex of elderly persons was determined. Baroreflex sensitivity was quantified by the a-index, at high frequency (HF; 0.15–0.35 Hz, reflecting parasympathetic activity) and mid-frequency (MF; 0.05–0.15 Hz,

reflecting sympathetic activity as well), derived from spectral and cross-spectral analysis of spontaneous fluctuations in heart rate and blood pressure. Twenty-six (10 women) sedentary, healthy, normotensive elderly (mean 68 years, range 62–81 years) subjects were studied. Fourteen (4 women) of the sedentary elderly subjects completed 6 weeks of aerobic training, while the other 12 (6 women) subjects completed 6 weeks of yoga. Heart rate decreased following yoga (69 +- 8 vs. 61 +- 7 min^{-1}, $P<0.05$) but not aerobic training (66 +- 8 vs. 63 +- 9 min^{-1}, $P=0.29$). VO_2 max increased by 11% following yoga ($P<0.01$) and by 24% following aerobic training. Following yoga, a_{HF} (8.0 +- 3.6 vs. 11.5 +- 5.2 ms $mmHG^{-1}$, $P<0.01$) but not a_{MF} (6.5 +- 3.0 vs. 7.6 +- 2.8 ms $mmHG^{-1}$, $P=0.29$) increased. Short-duration aerobic training does not modify the a-index at $a_{MF\ or}$ a_{HF} in healthy normotensive elderly subjects. a_{HF} but not a_{MF} increased following yoga, suggesting that these parameters are measuring distinct aspects of the baroreflex that are separately modifiable.

Brahmakumaris, Prajapati, and Ishwaria Vishwa Vidyala. *Heart Disease and Meditation*. 2d ed. [Publisher unknown.]

British Medical Journal (Clinical Research), 1985, 13:1103-1106. [Title of article and author unknown, but article addresses Yoga and prevention of heart-attack recurrence.]

Bulavin, V. V., V. M. Kliuzhev, L. M. Kliachkin, Lakshmankumar, N. D. Zuikhin, and T. N. Vlasova. Elements of yoga therapy in the combined rehabilitation of myocardial infarct patients in the functional recovery period. *Vopr Kurortol Fizioter Lech Fiz Kult*, Jul 1993, 4:7-9. [In Russian.]

Buselli, E. F., and E. M. Stuart. Influence of psychosocial factors and biopsychosocial interventions on outcomes after myocardial infarction. *J Cardiovasc Nurs*, Apr 1999, 13(3):60-72. (Various interventions including cognitive-behavioral therapies, techniques that elicit the relaxation response, meditation, exercise, and increasing social networks, may play a role in improving health outcomes.)

Caring Heart Project. *Yoga and Total Health*, Oct 2000, pp. 8-10. (A one-year program in which participants with coronary artery blockages confirmed through angioplasties are being given intensive Yoga lifestyle training.)

Carpenter, Jeff. Take a deep breath: Study: Slow breathing of mantras, prayer, improve heart-lung function. 21 Dec 2001. ABC News. Article available online: http://abcnews.go.com/sections/living/DailyNews/Deepbreath011221.html.

"According to a new study in the most recent issue of the *British Medical Journal*, activities like these that promote slow and deep breathing can positively alter many of the body's vital signs.

"'There is a great deal of evidence built up over the last 30 years that breathing exercises are extraordinarily important in health and well being,' said Dr. Herbert Benson, president of the Mind/Body Medical Institute in Boston.

"The 23 test subjects were told to either recite the rosary in Latin or to repeat a typical yoga mantra that they were taught by an instructor unfamiliar with the study. At no time were the subjects told how long they should take to perform the tasks.

"The results of the study found that the slow deep breathing associated with these practices synchronized the subject's cardiovascular rhythms, leading to favorable psychological as well as physiological effects."

Carruthers, Malcolm. Meditation and the heart. *Yoga Today*, Feb 1980, 4(10):18-19.

On Siddha meditation and the heart.

Carson, M. A. The impact of a relaxation technique on the lipid profile. *Nursing Research*, Sep-Oct 1996, 45(5):271-276. PMID: 8831653.

Abstract: The purpose of this research was to test the effect of a relaxation technique on blood lipid levels. Sixty outpatient males with known hyperlipidemia were recruited to the study. All participants were stabilized on an American Heart Association Step I diet for 8 weeks. After stabilization, participants were randomly assigned to relaxation or reading groups and received in-depth follow-up and support over another 8-week period. Monthly follow-up continued for an additional 8 months. Although both groups demonstrated decreased weight, total cholesterol, and triglycerides, no group differences were detected over time. This suggests that relaxation training may not be an effective technique for long-term clinical management of clients with dyslipidemias.

Castillo-Richmond, A., R. H. Schneider, C. N. Alexander, R. Cook, H. Myers, S. Nidich, C. Haney, M. Rainforth, and J. Salerno. Effects of stress reduction on carotid atherosclerosis in hypertensive African Americans. *Stroke*, Mar 2000, 31(3):568-573. Email: amparo@mum.edu. PMID: 0010700487.

BACKGROUND AND PURPOSE: African Americans suffer disproportionately higher cardiovascular disease mortality rates than do whites. Psychosocial stress influences the development atherosclerosis. Carotid intima-media thickness (IMT) is a valid surrogate measure for coronary atherosclerosis, is a predictor of coronary outcomes and stroke, and is associated with psychosocial stress factors. Stress reduction with the Transcendental Meditation (TM) program decreases coronary heart disease risk factors and cardiovascular mortality in African Americans. B-mode ultrasound is useful for the noninvasive evaluation of carotid atherosclerosis. METHODS: This randomized controlled clinical trial evaluated the effects of the TM program on carotid IMT in hypertensive African American men and women, aged >20 years, over a 6- to 9-month period. From the initially enrolled 138 volunteers, 60 subjects completed pretest and posttest carotid IMT data. The assigned interventions were either the TM program or a health education group. By use of B-mode ultrasound, mean maximum IMT from 6 carotid segments was used to determine pretest and posttest IMT values. Regression analysis and ANCOVA were performed. RESULTS: Age and pretest IMT were found to be predictors of posttest IMT values and were used as covariates. The TM group showed a significant decrease of -0.098 mm (95% CI -0. 198 to 0.003 mm) compared with an

increase of 0.054 mm (95% CI -0.05 to 0.158 mm) in the control group (P=0.038, 2-tailed). CONCLUSIONS: Stress reduction with the TM program is associated with reduced carotid atherosclerosis compared with health education in hypertensive African Americans. Further research with this stress-reduction technique is warranted to confirm these preliminary findings.

Chakravarti, Sree. Apana vayu mudra or mrita-sanjibani mudra (for any kind of heart problem). In Sree Chakravarti, *A Healer's Journey*. Portland, Ore.: Rudra Press, 1993, pp. 212-213.

Chandra, F. J. Yoga and the cardiovascular system. *The Journal of The International Association of Yoga Therapists*, 1991, 2(1):29-34.

Chang, Steven T., with Richard C. Miller. Heart exercise; Energizing the heart. In Steven T. Chang with Richard C. Miller, *The Book of Internal Exercises*. San Francisco: Strawberry Hill Press, 1978, pp. 78-82; 82.

Chohan, I. S., H. S. Nayar, P. Thomas, and N. S. Greetha. Influence of yoga on blood coagulation. *J Assoc Phys India*, Sep 1979, 27(9); *Thrombosis & Haemostasis*, 30 Apr 1984, 51(2):196-197.

Christensen, Alice. Heart disease. In Alice Christensen, *The American Yoga Association Wellness Book*. New York: Kensington Books, 1996, pp. 101-109.

_____. Circulatory problems (heart disease/hypertension). In Alice Christensen, *The American Yoga Association's Easy Does It® Yoga*. New York: Simon & Schuster, 1999, pp. 31-32.

_____. Heart function sections. In Alice Christensen, *The American Yoga Association's Easy Does It® Yoga*. New York: Simon & Schuster, 1999, pp. 60, 65-66, 69-70, 83-85, 88-89, 90-91, 97-105, 110-112, 113-115, 116-119, 122-123, 125-126, 128.

_____. *Heart Health: The Complete Program for New Strength and Vigor*. An American Yoga Association Wellness Guide. New York: Kensington Publishing, 2001.

Contents: Introduction, Some facts about heart health, Stress management and our heart, How yoga can improve heart health, Yoga exercise for heart health, Yoga breathing techniques for heart health, Yoga meditation for heart health, Yoga fantasy techniques for heart health, Walking contemplation for heart health, Essential nutrients for a healthy heart, The yoga healthy heart diet plan

Clarke, J. Respiration, heart rate and the autonomic nervous system. *Research Bulletin of the Himalayan International Institute*, 1981, 3:4-6.

Clay, C. C., L. K. Lloyd, J. L. Walker, K. R. Sharp, and R. B. Pankey. The metabolic cost of hatha yoga. *Journal of Strength and Conditioning Research*, Aug 2005, 19(3):604-610.

Abstract: To determine the metabolic and heart rate (HR) responses of hatha yoga, 26 women (19-40 years old) performed a 30-minute hatha yoga routine of supine lying, sitting, and standing asanas (i.e., postures). Subjects followed identical videotaped sequences of hatha yoga asanas. Mean physiological responses were compared to the physiological responses of resting in a chair and walking on a treadmill at 93.86 m.min(-1) [3.5 miles per hour (mph)]. During the 30-minute hatha yoga routine, mean absolute oxygen consumption (Vo(2)), relative Vo(2), percentage maximal oxygen consumption (%Vo(2)R), metabolic equivalents (METs), energy expenditure, HR, and percentage maximal heart rate (%MHR) were 0.45 L.min(-1), 7.59 ml.kg(-1).min(-1), 14.50%, 2.17 METs, 2.23 kcal.min(-1), 105.29 b.min(-1), and 56.89%, respectively. When compared to resting in a chair, hatha yoga required 114% greater O(2) (L.min(-1)), 111% greater O(2)(ml.kg(-1).min(-1)), 4,294% greater %Vo(2)R, 111% greater METs, 108% greater kcal.min(-1), 24% greater HR, and 24% greater %MHR. When compared to walking at 93.86 m.min(-1), hatha yoga required 54% lower O(2)(L.min(-1)), 53% lower O(2)(ml.kg(-1).min(-1)), 68% lower %Vo(2)R, 53% lower METs, 53% lower kcal.min(-1), 21% lower HR, and 21% lower %MHR. The hatha yoga routine in this study required 14.50% Vo(2)R, which can be considered a very light intensity and significantly lighter than 44.8% Vo(2)R for walking at 93.86 m.min(-1) (3.5 mph). The intensity of hatha yoga may be too low to provide a training stimulus for improving cardiovascular fitness. Although previous research suggests that hatha yoga is an acceptable form of physical activity for enhancing muscular fitness and flexibility, these data demonstrate that hatha yoga may have little, if any, cardiovascular benefit.

Cooper, M. J., and M. M. Aygen. A relaxation technique in the management of hypercholesterolemia. *Journal of Human Stress*, 1979, 5(4):24-27.

_____. Effect of meditation on serum cholesterol and blood pressure. *Journal of the Israel Medical Association*, 1978, 95(1):1-2.

Cowley, Geoffrey. Healer of hearts. *Newsweek*, Mar 16, 1998, pp. 50-55. [On the Dr. Dean Ornish program.]

Cunningham, C., S. Brown, and J. C. Kaski. Effects of Transcendental Meditation on symptoms and electrocardiographic changes in patients with cardiac syndrome X. *American Journal of Cardiology*, 1 Mar 2000, 85(5):653-655, A10. PMID: 11078284.

Abstract: Chest pain with normal coronary angiograms is often associated with chronic sympathetic activation, anxiety, and depression, and is resistant to conventional antianginal treatment. The practice of Transcendental Meditation, a standard relaxation method for 3 months twice daily, significantly improved exercise tolerance, angina episodes, and quality of life in 9 women; the positive findings in this study warrant further research.

Cunningham, M. Mala. Cardiac Yoga website, www.cardiacyoga.com.

Curiati, J. A., E. Bocchi, J. O. Freire, A. C. Arantes, M. R. Braga, Y. Garcia, G. Guimaraes, and W. J. Fo. Meditation reduces sympathetic activation and improves the quality of life in elderly patients with optimally treated heart failure: A prospective randomized study. *Journal of Alternative and Complementary Medicine*, Jun 2005, 11(3): 465-472.

Abstract: Objective: We tested whether meditation can reduce sympathetic activation, evaluated by norepinephrine blood levels (NE), and improve quality of life in elderly persons with congestive heart failure (CHF). Design and Setting: This was a prospective, randomized study conducted from April 2000 to October 2001 in an ambulatory care teaching hospital in São Paulo, Brazil. Subjects: We studied 19 patients with CHF, 74.8 +/- 6.7 years old, receiving diuretics, optimal doses of an angiotensin-converting enzyme inhibitor or angiotensin II inhibitor, maximum tolerated carvedilol dose (23.1 +/- 13.6 mg) and spironolactone 25 mg (10 patients). Interventions: After 2 months of optimal treatment with carvedilol, patients were randomized into two groups. The meditation group (M) was provided an audiotape, 30 minutes long, to listen to at home, twice a day, for 12 weeks, plus a weekly meeting. The control group (C) just had weekly meetings. Main Outcome Measures: We determined before and after 14 +/- k1 weeks, NE (in pg/mL); quality of life with the Minnesota Living with Heart Failure Questionnaire (MLWHFQ); VO2 and VE/VCO2 slope by cardiopulmonary exercise testing; left ventricular ejection fraction (LVEF), and left ventricular end-diastolic volume index (LVDDi) measured by echocardiography. Results: Meditation reduced NE (mean +/- SEM) from 677.7 +/- 96.6 to 387.1 +/- 39.1 pg/mL ($p = 0.008$) in M versus 491.4 +/- 35.9 to 470.6 +/- 31.2 ($p = 0.34$) in C; improved MLWHFQ total score (mean +/- SEM) from 33.2 +/- 6.6 to 21.6 +/- 6.8 points ($p = 0.02$) in M versus 18.4 +/- 8.0 to 25.1 +/- 8.9 ($p = 0.41$) in C; and reduced the VE/VCO2 slope (mean +/- SEM) from 31.2 +/- 3.0 to 28.2 +/- 2.6 ($p = 0.04$) in M versus 28.4 +/- 2.7 to 28.8 +/- 2.6 ($p = 0.24$) in C. No changes occurred in LVEF, LVDDi, and VO(2). Conclusions: In elderly patients with optimally treated CHF, meditation reduced NE, improved quality of life, and reduced the VE/VCO(2) slope. Our results support the possible role of meditation as a new hope in the treatment of CHF.

Curtis, William D., And Harold W. Wessberg. A comparison of heart rate, respiration, and galvanic skin response among meditators, relaxers, and controls. *Journal of Altered States of Consciousness*, 1975-1976, 2:319-324.

Cushman, Anne. Yoga with heart. *Yoga Journal*, Sep/Oct 1994, p. 46.

Cuthbert, B., J. Kristeller, and R. Simons, et al. Strategies of arousal control: Biofeedback, meditation and motivation. *Journal of Experimental Psychology General*, 1981, 110(4):518-546.

Damle, P. S., Amrito, M. M. Gore, and S. S. Badade. Effect of meditation on heart rate response to acoustic shocks. *Yoga-Mimamsa*, 1997, 32(1&2):21-26.

Cysarz, Dick, and Arndt Bussing. Cardiorespiratory synchronization during Zen meditation. *European Journal of Applied Physiology*, 7 Jun 2005. Author email: d.cysarz@rhythmen.de.

Abstract: The impact of meditation on cardiorespiratory synchronization with respect to breathing oscillations and the modulations of heart rate induced by respiration (respiratory sinus arrhythmia, RSA) was investigated in this study. Four different exercises (spontaneous breathing, mental task, Zen meditation, and Kinhin meditation) were consecutively performed by nine subjects mainly without any experience in meditation. An electrocardiogram and a respiratory trace were recorded simultaneously. On this basis the degree of cardiorespiratory synchronization was quantified by a technique which has been adopted from the analysis of weakly coupled chaotic oscillators. Both types of meditation showed a high degree of synchronization, whereas heartbeat and respiration were hardly synchronized during spontaneous breathing. During the mental task exercise the extent of synchronization was slightly higher than during spontaneous breathing. These results were largely determined by the breathing frequency because the two types of meditation induce low breathing frequencies which led to a pronounced and in-phase RSA. During the meditation the low breathing frequencies led to a decrease in the high frequency of heart rate variability, whereas the low frequency and the extent of RSA increased. The heart rate primarily reflected the degree of physical effort. The high degree of cardiorespiratory synchronization during meditation in unexperienced meditators suggests that the physiological implications of meditation does not require prior experience in meditation.

Das, N., and H. Gastaut. Variations in the electrical activity of the brain, heart, and skeletal muscles during yogic meditation and trance. *Electroencephalography and Clinical Neurophysiology*, suppl. 6, 1955, pp. 211-219.

Das, Subhamoy. Yoga: Chicken soup for the heart! Article available online: http://hinduism.about.com/library/weekly/aa110700a.htm.

Datar, S. V., and V. A. Kulkarni. Yogic practices and cardiovascular efficiency. *Yoga-Mimamsa*, 1997, 32(1&2):8-13.

Datey, K. K., and S. J. Bhagat. Stress and heart disease and how to control it with biofeedback and shavasana. *Quarterly Journal Surg Sci*, Sep-Dec 1977, 13(3&4).

_____, M. L. Gharote, and Soli Pavri. *Yoga and Your Heart*. Mumbai, India: Jaico Publishing House, 1983.

_____, Swahney, R. C., et al. Coronary Artery Disease (CAD) regression through life style changes: Vegetarianism, moderate exercise, stress management through Rajyoga meditation. Defence Institute of Physiology & Allied Sciences, Lucknow Road, Timarpur, New Delhi, India. URL: http://www.ccryn.org/Index1.html (click on "Abstract of Research Works" in the left menu bar).

Summary: One hundred and nineteen patients of coronary artery disease (CAD) were registered for the study through March 1999. Out of these 119 patients, 70 were angiographically documented cases with superior vena cava (SVC), dicuspid valve defect (DVD) or tricuspid valve defect (TVD), and 49 had tread mill test (TMT) & echocardiographic evidence of CAD. They were selected based on well-defined inclusion and exclusion criteria. All had at least >70% stenosis in one of the major epicardial arteries. None of them was taking any lipid-lowering drug and had left ventricular ejection fraction of more than 30%, without left ventricular failure.

The life style intervention was started with a seven-day stay at Global Hospital & Research Centre (GHRC), Mount Abu. Detailed biochemical, cardiac, physiological, psychological and hormonal investigations were carried out in these patients before starting the intervention program. The noninvasive cardiac investigations included ECG, TMT and echocardiography. The physiological parameters like HR, BP, galvanic skin resistance, EEG and HR variability were monitored using a computerized polygraphic recording system. The psychological assessment included structural interview, anger scale, self-rating anxiety, hostility and depression scale. Anthropometric measurements like hip-to-waist ratio and hip-to-abdomen ratio were also worked out. After basal investigations, subjects were administered an intensive information, education and counseling program about CAD and were explained how the adaptation to right life style can prevent progression of the disease. They received a vegetarian diet of 1600-1800 Kcals./day. Patients were individually asked to exercise (typically brisk walk) according to their baseline TMT level.

Preliminary results from the study have suggested a marked improvement in cardiac function parameters within seven days of the intervention program, which showed further improvement when reinforcement was done after six months of entering the study. The left ventricular ejection fraction and exercise tolerance (TMT) showed a significant improvement in patients whose adherence to the new life style was more than 80%. Both systolic as well as diastolic blood pressure decreased significantly due to a consistent decline in autonomic sympathetic control over the myocardium. Besides causing a 10 to 20% decline in total cholesterol, low density lipoprotein (LDL) and triglycerides levels, the high density lipoprotein (HDL) levels showed a slight but definite increase over the basal values.

The fasting insulin, glycosylated hemoglobin and glucose levels also showed a significant decrease suggesting a better glycemic control.

Morning as well as evening cortisol levels also showed a 15% decline after six months of the life style intervention schedule.

Deliz, Antonio J. Meditation, protein, diet, and megavitamins in treatment of a progressive, iatrogenic cardiac and psychotic condition. *Journal of Orthomolecular Psychiatry*, 1977, 6:44-49.

Delmonte, M. M. Physiological responses during meditation and rest. *Biofeedback and Self-Regulation*, 1984, 9(2):181-200.

Desai, A. N. 13 years. *Yoga and Total Health*, Sep 2000, pp. 17-18. (On The Yoga Institute's heart camps and Yoga therapy.)

_____. Exercise and cardiac patient: An interview. *Yoga and Total Health*, May 2003, pp. 10-11.

Desiraju, T., and B. R. Kanchan. Autonomic changes in meditations. In *Abstr 2nd Ann Symp Indian Academy Yoga*. Madras, India: Indian Inst Technology, Dec-Jan 1982-1983.

Devi, Nischala Joy. Dean Ornish, MD's Lifestyle Program components: Stress management/yoga. An interview with Nischala Joy Devi. WebMD, 21 Jun 2000. Article available online: http://my.webmd.com/content/article/1700.50558.

_____. *The Healing Path of Yoga: Time-Honored Wisdom and Scientifically Proven Methods That Alleviate Stress, Open Your Heart, and Enrich Your Life.* New York: Three Rivers Press, 2000. Reviewed by Phil Catalfo in the Sep/Oct 2000 issue of *Yoga Journal.* (Nischala Joy Devi created the Yoga portion of Dean Ornish's heart-disease reversal program.)

_____. Yoga for cardiac patients. Paper presented at the 10th International Conference on Yoga for Positive Health, University of South Florida, Tampa, 15-17 Dec 2000. Email: nd@abundantwellbeing.com.

_____. Yoga of the Heart: Adapting Yoga for the Heart workshop. 6th Annual Yoga Journal Convention, 27-30 Sep 2001, Estes Park, Colorado.

deVicente, Monjo Pedro. Emotion and heart rhythm as influenced with yoga. *Yoga-Mimamsa*, 1984, 23(2):1-20.

_____. Yogic therapy as a complement in ischaemic heart disease's treatment. *Yoga-Mimamsa*, Oct 1985, 24(3):35-36.

_____, M. L. Gharote, and J. M. Bhagwat. Effect of kapalabhati and uddiyana bandha on cardiac rhythms. *Yoga-Mimamsa*, April 1984, 23(4):41-62.

Dharmaprakash. Integrated approach of yoga therapy of low back pain, diabetes, and IHD. Vivekananda Kendra Yoga Research Foundation, 1990.

DiCarlo, L. J., P. B. Sparling, B. T. Hinson, T. K. Snow, and L. B. Rosskopf. Cardiovascular, metabolic, and perceptual responses to Hatha Yoga standing postures. *Medicine, Exercise, Nutrition and Health*, 1995, 4:107-112.

Abstract: Cardiovascular, metabolic, and perceptual responses during a 32-minute treadmill walk (TW) at 4 mph were compared with those measured during a vigorous, standing-pose, hatha yoga [Iyengar-based] routine (YR). Subjects were six male and four female yoga practitioners age 38-47 years. The 32-minute YR consisted of a series of standing poses [*Utthita Trikonasana, Virabhadrasana 2, Parivrtta Parsvakonasana, Virabhadrasana 1,* and *Parivrtta Ardha Chandrasana*, with *Tadasana* performed between each pose] held for 40 s with 10 s for transitions. Heart rate (HR), blood pressure (BP), oxygen uptake (VO2), and rating of perceived exertion (RPE) were measure at 8, 16, 25, and 32 minutes. All comparisons between YR and TW were significantly different ($p<0.05$) except HR and RPE at 8 min. At 16, 24, and 32 minutes, both HR and RPE were higher during YR than TW (138, 139, 144 vs 117, 118, 120 beats/min; 15.4, 15.3, 15.9 vs 12.5, 12.7, 12.9). Blood pressures were higher during YR at all four time intervals (systolic 153, 148, 147, 147 vs 133, 131, 127, 130 mm Hg; disstolic 85, 93, 86, 89 vs 70, 70, 71, 68 mm Hg). Conversely, VO2 was higher during TW than YR at each time interval. Across the 32-minute session, mean energy expenditure was 34% VO2max for YR and 46% VO2max for TW. The elevated HR, BP, and RPE responses associated with YR vs TW can be attributed in large part to the static exercise components inherent in this type of yoga. Yet, the vigorous YR standing poses resulted in a lower metabolic demand than brisk walking (4.1 vs 5.4 METS). These findings can be used to better understand hatha yoga from the perspective of physiological responses and appropriate exercise prescription.

Dillbeck, M. C., and D. W. Orme-Johnson. Physiological differences between Transcendental Meditation and rest. *American Psychologist*, 1987, 42:879-881.

Dimsdale, J. E., and P. J. Mills. An unanticipated effect of meditation on cardiovascular pharmacology and physiology. *American Journal of Cardiology*, 15 Oct 2002, 90(8):908-909. PMID: 12372589. Author email. jdimsdale@ucsd.edu.

Dostalek, C., and V. Lepicovska. Hathayoga: A method for prevention of cardiovascular diseases. *Activ Nerv Sup*, Suppl. 3, 1982, 24:444-452.

Edy, Carolyn. No side effects: Medical research shows meditation helps treat heart disease, cancer, and more. *Yoga Journal*, Sep/Oct 2000, p. 37.

Elson, B. D., P. Hauri, and D. Cunis. Physiological changes in yoga meditation. *Psychophysiology*, 1977, 14(1):52-57.

Farkas, Jean. Yoga therapy in heart disease. *Spirit of Healing Yoga Therapy Journal*. Article available online: http://www.iytyogatherapy.com.

Fenz, Walter, D., and Jon M. Plapp. Voluntary control of heart rate in a practitioner of yoga: Negative findings. *Perceptual and Motor Skills*, 1970, 30(2):493-494.

Fields, J. Z., K. G. Walton, R. H. Schneider, S. Nidich, R. Pomerantz, P. Suchdev, A. Castillo-Richmond, K. Payne, E. T. Clark, and M. Rainforth. Effect of a

multimodality natural medicine program on carotid atherosclerosis in older subjects: a pilot trial of Maharishi Vedic Medicine. *American Journal of Cardiology*, 15 Apr 2002, 89(8): 952-958. PMID: 11950434.

This study on atherosclerosis is part of a larger study sponsored by the National Institutes of Health, and the program included the following components: Transcendental Meditation, yoga asanas for stress reduction, antioxidant herbal supplements, a low-fat diet high in fruits and vegetables, and walking. For one year, participants meditated twice per day for 20 minutes and walked 30 minutes daily.

Twenty healthy individuals age 65 and older were assigned to the traditional Vedic medicine intervention, 14 to standard care (no added intervention), and 9 to a modern medicine intervention. The latter intervention included walking and exercises for a total of 60 minutes 5 times a week, dietary recommendations, and a standard multivitamin supplement.

After 1 year, those in the traditional medicine group were close to four times as likely to exhibit a decrease in thickness of the carotid intima-media than participants in the other two groups combined. On average, the artery wall thickness in the Vedic medicine group was reduced by 0.318 millimeters (mm), compared with a 0.22 mm increase in the standard care groups and a 0.082 mm decrease in the modern medicine group. Measurement of artery wall thickness was done by B-mode ultrasound and results were most significant for high-risk participants.

Abstract: Although the onset and progression of coronary heart disease (CHD) involve multiple risk factors, few intervention studies have attempted to modify these factors simultaneously. This pilot study tested the effect of a multimodality intervention involving dietary, exercise, herbal food supplement, and stress reduction approaches from a traditional system of natural medicine, Maharishi Vedic Medicine (MVM). The primary outcome measure was carotid intima-media thickness (IMT), a noninvasive measure of peripheral atherosclerosis and surrogate measure of coronary atherosclerosis. Comparison groups included modern medicine (conventional dietary, exercise, and multivitamin approaches) and usual care (no added intervention). Of 57 healthy seniors (mean age 74 years) randomized to the 3 treatment groups, 46 completed IMT post-testing. Carotid IMT was determined by B-mode ultrasound before and after 1 year of treatment. IMT decreased in a larger fraction of MVM subjects (16 of 20) than in the modern (5 of 9) and usual care (7 of 14) groups combined (i.e., 12 of 23; odds ratio 3.7, p = 0.05). For subjects with multiple CHD risk factors ("high-risk" subjects, n = 15), IMT decreased more in the MVM (-0.32 +/- 0.23 mm, mean +/- SD) than in the usual care (+0.022 +/- 0.085; p = 0.009) or modern (-0.082 +/- 0.095, p = 0.10) groups. Within-group reductions in IMT were significant for all MVM subjects (-0.15 +/- 0.21, n = 20, p = 0.004) and for high-risk MVM subjects (n = 6, p = 0.01). These results show that this multimodality traditional approach can attenuate atherosclerosis in older subjects, particularly those with marked CHD risk.

Francina, Suza. Opening the heart with yoga [on heart disease]. *The New Yoga for People Over 50: A Comprehensive Guide for Midlife and Older Beginners*. Deerfield Beach, Fla.: Health Communications, 1997, pp. 185-206.

Frank, J. D. The faith that heals. *Johns Hopkins Med J*, 1975, 137:127-131. [On meditation for heart diseases.]

Frederick, Ambellur N., and Theodore X. Barber. Yoga, hypnosis, and self-control of cardiovascular functions. *Proceedings of the Annual Convention of the American Psychological Association*, 1972, 7(part 2):859-860.

Friedell, A. Automotive attentive breathing in angina pectoris. *Minnesota Medicine*, 1948, 31:875-881.

Friedman, Nicole Lisa. Zen breath meditation awareness improves heart rate variability in patients with coronary artery disease. Ph.D. dissertation. Alliant International University, San Diego, 2002. *Dissertation Abstracts International*, Jun 2002, B 62/12, p. 5948. First 24 pages available online: http://wwwlib.umi.com/dissertations/preview/3037196. UMI #3037196.

Abstract: How patients with coronary artery disease respond to stress can effect their cardiac health. This study examined whether patients with documented coronary artery disease would be able to learn a self-help skill which would reduce cardiac reactivity during mildly stressful and restful activities. Cardiac stress was determined measuring Heart Rate Variability (HRV), an indication of autonomic arousal. HRV has been shown to be a predictor of sudden cardiac death in patients with cardiac disease. 56 patients with documented coronary artery disease were randomized to receive either a cardiac stress management video or a meditation video which guided them through a standard a standard Zen breath awareness meditation. The technique involved becoming attentionally absorbed in the breath, but not manipulating it. Patients' HRV (SDNN) was measured during several conditions including rest, reading, paced breathing, Stroop color word conflict stressor, post stressor rest, post stressor reading, and post stressor paced breathing. Patients who received meditation instruction significantly increased heart rate variability post intervention compared to patients who received a stress management lecture ($p </= .007$). In addition, patients who engaged in meditation practice handled stress better, as indicated by an increase in heart rate variability during the Stroop task ($p </= .042$) and post-intervention pre-stressor paced breathing period ($p </= .006$). Results suggest that engaging in even one brief period of Zen breath meditation awareness can be effective for improving the heart's response to stress for patients with coronary artery disease.

Funderburk, James. Circulatory responses to Hatha Yoga. In James Funderburk, *Science Studies Yoga: A Review of Physiological Data.* Honesdale, Penn.: Himalayan International Institute of Yoga Science & Philosophy of USA, 1977, pp. 15-46.

Gach, Michael Reed, with Carolyn Marco. Heart meridian; Heart meridian balancing exercise; Pericardium meridian; Pericardium meridian balancing exercise; Circulation. In Michael Reed Gach with Carolyn Marco, *Acu-Yoga: The Acupressure Stress Management Book*. Tokyo: Japan Publications, 1981, pp. 107; 108; 113; 114; 135-137.

Gandhi, Sunil. Yoga for heart disease. Article available online: http://www.yforyoga.com/article1001.html.

Ganguly, S. K. Effect of short term yogic training programme on cardio-vascular endurance. *SNIPES Journal*, 1981, 4(2):45-50.

_____. Immediate effect of kapalabhati on cardiovascular endurance. *Yoga-Mimamsa*, 1989, 28(1):1-7.

_____, and M. L. Gharote. Cardiovascular efficiency before and after yogic training. *Yoga-Mimamsa*, 1974, 17(1):89-97.

_____, and M. L. Gharote, and S. R. Jolly. Immediate effect of kapalabhati on the cardiovascular endurance. *Yoga-Mimamsa*, 1988, 27(1&2):8-9.

Garde, R. K. Arterio-sclerosis; Coronary disease. In R. K. Garde, *Principles and Practice of Yoga-Therapy*. Bombay, India: D. B. Taraporevala Sons & Co., 1972, 1984, pp. 52-53; 64-65.

Gash, Arnold, and Joel S. Karliner. No effect of Transcendental Meditation on left ventricular function. *Annals of Internal Medicine*, Feb 1978, 88(2):215-216.

Gayer, M. The position of concentrated relaxation in a training programme for the psycho prevention of myocardial infarction. *Psychia Neuro Med Psychol Leips*, 1975, 27(9):542-549.

Gillespie, Susan. Taking yoga to heart: An interview with Dean Ornish. *Yoga International*, Mar/Apr 1995, pp. 19-25.

Gitananda Giri, Swami. Mitral valve prolapse. In Yogamaharishi Dr. Swami Gitananda Giri Guru Maharaj, *Frankly Speaking*. Tamil Nadu, India: Satya Press, 1997, pp. 204-205.

_____. The role of exercise in heart and kidney failure. *Yoga Life*, Nov 2004, 35(11):3-7.

Gopal, K. S., V. Anantharaman, S. Balachander, and S. D. Nishith. The cardiorespiratory adjustments in Pranayama with and without Bandhas in Vajrasana. *Indian Journal of Medical Sciences*, Sep 1973, 27(9):686-692.

_____, V. Anantharaman, S. D. Nishith, and O. P. Bhatnagar. The effect of yogasanas on muscular tone and cardio-respiratory adjustments. *Indian Journal of Medical Sciences,* Oct 1974, 28(10):438-443.

_____, S. Lakshmanan, and M. Batmanabane. A study of the effect of bandhas in pranayama on pulse rate, heart rate, blood pressures and pulse pressure. *Medicine and Surgery*, 1974, 14(10):5-8.

_____, O. P. Bhatnagar, N. Subramanian, and S.D. Nishith. Effect of yogasanas and pranayamas on blood pressure, pulse rate and some respiratory functions. *Indian J Physiol Pharmacol*, 1973, 17(3):273-276.

Gore, M. M., and M. V. Bhole. Coronary risk factor reduction through biofeedback-aided relaxation and meditation. Heart rate during paschimatana and similar types of isometric and isotonic exercises. *Yoga-Mimamsa*, 1982, 21(1&2):31-34.

_____. Influence of paschimotan and similar type of muscular activity on pulse rate: A preliminary study. *Yoga-Mimamsa*, 1982, 21(1&2):21-30.

Gould, K. Lance, Dean Ornish, et al. Changes in myocardial perfusion abnormalities by positron emission tomography after long-term, intense risk factor modification. *JAMA*, Sep 20, 1995, 274(11):894-901.

_____. Improved stenosis geometry by quantitative coronary arteriography after vigorous risk factor modification. *The American Journal of Cardiology,* Apr 1992, 69(10):845-853

Hammond, Holly. Yoga for the heart. *Yoga Journal,* Nov/Dec 1990, p. 13.

Hanna, Thomas. *Somatic Exercises™ for Full Breathing* audiocassettes. Novato, Calif.: Novato Institute for Somatic Research.

"For those needing to improve respiratory functions and who are concerned with the relation of shallow breathing to coronary health."

Harinath, Kasiganesan, Anand Sawarup Malhotra, Karan Pal, Rajendra Prasad, Rajesh Kumar, Trilok Chand Kain, Lajpat Rai, and Ramesh Chand Sawhney. Effects of Hatha Yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *Journal of Alternative and Complementary Medicine,* Apr 2004, 10(2):261-268.

Abstract: Objective: To evaluate effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. Subjects and methods: Thirty healthy men in the age group of 25-35 years volunteered for the study. They were randomly divided in two groups of 15 each. Group 1 subjects served as controls and performed body flexibility exercises for 40 minutes and slow running for 20

minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group 2 subjects practiced selected yogic asanas (postures) for 45 minutes and pranayama for 15 minutes during the morning, whereas during the evening hours these subjects performed preparatory yogic postures for 15 minutes, pranayama for 15 minutes, and meditation for 30 minutes daily, for 3 months. Orthostatic tolerance, heart rate, blood pressure, respiratory rate, dynamic lung function (such as forced vital capacity, forced expiratory volume in 1 second, forced expiratory volume percentage, peak expiratory flow rate, and maximum voluntary ventilation), and psychologic profile were measured before and after 3 months of yogic practices. Serial blood samples were drawn at various time intervals to study effects of these yogic practices and Omkar meditation on melatonin levels. Results: Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. The plasma melatonin also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial pressure, and orthostatic tolerance did not show any significant correlation with plasma melatonin. However, the maximum night time melatonin levels in yoga group showed a significant correlation ($r = 0.71$, $p < 0.05$) with well-being score. Conclusion: These observations suggest that yogic practices can be used as psychophysiologic stimuli to increase endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.

Harrison, Eric. *How Meditation Heals*. Piatkus Books, 2000. (Discusses circulatory system.)

Hassanagas, Pavlos K. *Yoga: Natural Way to a Healthy Heart*. Yoga Federation of FYR Macedonia, 1993. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

_____. Yoga as a method rehabilitation of cardiovascular diseases. Athens, Greece: International Association of Yoga Science Centres, 1994. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

_____. Application of yoga as a complementary method in rehabilitation of patients after myocardial infarction. Athens, Greece: International Association of Yoga Science Centres, 1995. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

_____. Yoga and cardiovascular diseases. Athens, Greece: International Association of Yoga Science Centres, 1995. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

_____. Application of yoga in rehabilitation of cardiovascular diseases. Athens, Greece: International Association of Yoga Science Centres, 1996. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

_____. Application of yoga as a complementary method of prevention, therapy and rehabilitation of coronary diseases. Athens, Greece: International Association of Yoga Science Centres, 1999. Email: yogscience@otenet.gr, URL: http://www.yoga.org.mk.

Heffernan, Deborah Daw. *Arrow Through the Heart*. New York: The Free Press (Simon & Schuster), 2002. See also the article by Heffernan, "2 Hearts to Heal," in *Body & Soul Holistic Health*, Winter 2002, pp. 58-61,71-75.

Recounts the author's spiritual healing that took place along with her physical healing after suffering a massive heart attack at age 44 during a Yoga class.

Heriza, Nirmala. *Dr. Yoga: A Complete Program for Discovering the Head-to-Toe Health Benefits of Yoga*. New York: Penguin/Tarcher, 2004.

From the publisher: "From the Integral Yoga Cardiac specialist at Cedars-Sinai Medical Center's Preventive and Rehabilitative Cardiac Center and president of the United Yoga Council—a complete program for discovering the specific head-to-toe, health-issue-by-health-issue benefits of yoga.

"Anyone who has experienced the deep mind-body satisfaction that regular yoga practice instills will tell you: Yoga is good for your health. Yet, as Nirmala Heriza reveals in this guide to the health benefits of yoga, the rewards are far more deeply grounded in medical science than has previously been understood.

"Drawing from her work with doctors and cardiac patients at Cedars-Sinai Medical Center, as well as from her extensive experience as a yoga therapist working with people of all ages recovering from a wide array of illnesses, Heriza provides a total program for preventing and treating disease through the practice of yoga. With detailed photos and instructions for all of the major yoga poses, *Dr. Yoga* is an essential health resource for anyone with specific health issues or just the desire to nurture and maintain a balanced, healthy body.

"*Dr. Yoga* includes: two doctor-approved, 30-minute 'Yoga for Health' practice sets, one for prevention and one for rehabilitation; a physician and therapist referral directory; and from the dietitian for Cedars-Sinai Preventive and Rehabilitative Cardiac Center, a cookbook of healthful recipes to support your yoga regime."

Hoenig, J. Medical research on yoga. *Confin Psychiatr,* 1968, 11(2):69-89.

Hoffman, Kevin, and John Clarke, M.D. A comparative study of the cardiac response to bhastrika: A yogic breathing exercise and the exercise tolerance test. *Research Bulletin of the Himalayan International Institute,* 1982, 4(2): 7-16. Reprinted in *The Journal of The International Association of Yoga Therapists*, 1996, no. 7, pp. 35-42.

Holmes, D. S. Meditation and somatic arousal reduction: A review of the experimental evidence. *American Psychologist*, 1984, 39(1):1-10.

_____, S. Solomon, B. M. Cappo, et al. Effects of Transcendental Meditation versus resting on physiological and subjective arousal. *Journal of Personality and Social Psychology*, 1983, 44(6):1245-1252.

Horrigan, Bonnie. Dean Ornish, MD: Healing the heart, reversing the disease [interview]. *Alternative Therapies*, Nov 1995, 1(5):84-92.

Houten, Peter Van, M.D. *Cardiac Physiology and Medical Therapy for Yoga Teachers* video. Nevada City, Calif.: Crystal Clarity, 2002. 3 hours.

From the publishers: You will learn "anatomy and physiology of the heart, and its diseases; how to work with yoga students with cardiac disabilities; how to work with the medical community as a yoga instructor."

Hutchinson, Stephanie, and Edzard Ernst. Yoga therapy for coronary heart disease: A systematic review. *Perfusion*, Feb 2004, 17:44-51.

Abstract: Objective: Yoga is a holistic practice that is said to engage all aspects of our being. The aims of this review are to assess the efficacy of Yoga therapy to normalize cardiovascular risk factors or treat coronary artery disease. Method: Literature searches were performed using the following databases: Medline, Embase, Pubmed, Amed, Cinahl, Ciscom and the Cochrane Library (all from their inception to May 2002). Experts in the field were contacted for identification of hard to find or unpublished trials. Only randomized controlled trials (RCTs) of Yoga in people with known cardiovascular risk factors or coronary heart disease were included. All articles were read by two independent reviewers. Data were extracted in a predefined, standardized fashion. The methodological quality of the trials was evaluated by a modified Jadad score. Results: Six trials met the inclusion/exclusion criteria. Five out of six favored Yoga over control treatment. The evidence for risk factor change is strongest for improving lipid profiles, and decreasing body weight. The evidence for decreasing blood pressure is of poor quality and therefore inconclusive. Good quality evidence exists for Yoga therapy for decreasing angina frequency and severity as well as increasing exercise tolerance. Comprehensive Yoga therapy programs are effective at decreasing coronary stenosis as measure by coronary angiography and can decrease the need for revascularization procedures. Conclusion: The trial data available to date suggest that Yoga practiced as a holistic discipline is beneficial for prevention and supportive of treatment for coronary heart disease.

Hymes, Alan, M.D., and Phil Nuernberger. Breathing patterns found in heart attack patients. *Research Bulletin of the Himalayan International Institute*, 1982, 2(2): 10-12.

Ivanhoe Broadcast News. Transcendental meditation can help heart. Ivanhoe Broadcast News, 6 Nov 2004. For more information, contact: Dave Pedersen, University of Iowa, 5139 Westlawn, Iowa City, Iowa 52242, 319-335-8032.

On Dr. Brian Olshansky, a cardiac electrophysiologist at the University of Iowa who wants to prevent patients from getting to the point of requiring bypass surgery by taking control of their health through proper diet, regular exercise, and meditation. He is studying a group of people with heart disease, and participants in the study practice alternative therapies, including transcendental meditation, Yoga, breathing exercises, herbal preparations, and a mostly vegetarian diet. Olshansky determines patients' results by evaluating their blood pressure levels, cholesterol levels, weight, and mood. The results of the study were not available at the time of this article, but Olshansky is hopeful. He said a larger study will follow if the results are positive.

Iyengar, B. K. S. Coronary thrombosis; Dilation of heart; Heart trouble; Palpitation. In B. K. S. Iyengar, *Light on Yoga*. Rev. ed. New York: Schocken Books, 1979, p. 493-494; 494; 498; 502-503.

_____. Heart & circulation. In B. K. S. Iyengar, *Yoga: The Path to Holistic Health.* London/New York: Dorling Kindersley, 2001, pp. 242-253.

_____. Yoga and the cardiovascular system. *I.Y.T.A (N.Z.) Inc. News,* Autumn 2001, pp. 13-15.

B. K. S. Iyengar answers the questions:

"In what way can yoga strengthen the heart? I ask this in the context of theories of jogging wherein it is contended that a period of extreme rapid breathing is necessary in order to cleanse the internal organs and strengthen the heart."

"How and in what ways does yoga invigorate the cardiovascular system? We heard that recently you had your heart-lung system tested at a conference and it was discovered that you had the heart and lungs of a man of 35."

Javalgekar, R. R. Transcendental Meditation in the management of heart failure. *Journal of Molecular and Cellular Cardiology*, Suppl. 1, Aug 1980, 12:62.

_____, and G. P. Kale. Efficacy of yoga in regulation of cardiac function. Symposium Int Soc Heart Research, Indian Section, 1980.

Jayasinghe, S. R. Yoga in cardiac health (a review). *European Journal of Cardiovascular Prevention and Rehabilitation*, Oct 2004, 11(5):369-75. Author email: superadical@hotmail.com. PMID: 15616408.

Abstract: This review studies the efficacy of Yoga in the primary and secondary prevention of ischaemic heart disease and post-myocardial infarction patient rehabilitation. Yoga is an unconventional form of physical exercise that has been practiced over a long period of time in the Indian sub-continent. It has gained immense popularity as a form of recreational activity all over the world. Its possible contributions to healthy living have been studied and many interesting revelations have been made. Benefits of Yoga in the modification of cardiovascular risk factors and in the

rehabilitation of the post-myocardial infarction patient are areas of significant importance. It is important to assess the practical significance and the suitability of incorporating Yoga into the comprehensive cardiac rehabilitation program. A majority of rehabilitation workers believe that incorporating nonconventional forms of physical exercise such as Yoga definitely would enhance efficacy and add value. This article attempts to study the history and the science of Yoga and evaluate its effects on cardiovascular health.

Jevning, R., A. F. Wilson, W. R. Smith, and M. E. Morton Redistribution of blood flow in acute hypometabolic behavior. *American Journal of Physiology*, Jul 1978, 235(1):R89-92. PMID: 354414.

Abstract: Cardiac output, renal and hepatic blood flows, arterial lactate concentration, and minute volume were measured before, during, and after 40 min of rest induced either by the practice known as "transcendental meditation" (TM) or by an ordinary eyes-closed rest-relaxation period. Two groups of normal young adults were studied: one group consisted of regular practitioners of TM and the other of similar individuals studied prior to learning this technique. Marked declines of renal blood flow were noted in both groups. Decline of hepatic blood flow, increased cardiac output, decreased arterial lactate, and minute volume were also recorded in the TM-induced rest period. These changes imply a considerable increase of nonrenal, nonhepatic blood flow during TM (44%) and, to a lesser extent, during rest (12%). Increased cerebral and/or skin blood flow is hypothesized to account for part of the redistributed blood flow in the practitioner.

Kaivalyadhama. Workshop on Prevention and Care of Heart Ailments through Yoga, 28 May 2000. Kaivalyadhama, Mumbai, India.

This weekend workshop was the first of its kind to be organized at Kaivalyadhama Mumbai. Shri O. P. Tiwariji conducted the practical session on pranayama and meditation techniques giving the practical experience to the participants. Dr.T. K. Bera explained the significance of Yoga in dealing with heart ailments through scientific lines. Shri D. D. Kulkarni explained the interrelationship between stress and heart disease and how to deal with stress. Dr. Sushil Kumbhat, cardiologist from Nanavati Hospital explained the anatomy of the heart and how to take care of it. Dr. M. M. Bhamgara explained the significance of diet and nutrition in heart care.

Karambelkar, P. V., and M. V. Bhole. Heart control and Yoga practices. *Darshana International*, 1971, 20:63-69.

Karambelkar, P. V., S. K. Ganguly, and A. M. Moorthy. Effect of yogic practices on cholesterol level of females. *Yoga Mimamsa*, 1981, 20(1-2):1-8.

Karandikar, Dr. S. V. *A Lifesaver: An Illustrated Manual*. Pune, India: Manava Sansadhan Vikas Ani Sanshodhan Mancha at Kabir-Baug Matha Sanstha, 1997. Available from David McAmmond, 7838 Hunterview Drive, Calgary, Alberta, Canada T2K 4R1.

Dr. Karandikar specializes in the yogic treatment of heart-disease patients, and this handbook "consists of numerous instructional photographs of Yoga postures that have proven effective in the treatment of heart ailments. Postures are deliberately sequenced to achieve the best possible results with each presentation; included is a detailed description of necessary equipment as well as the physical effects and health benefits associated with each pose . . . Yoga therapy offers an alternative means of overcoming the physical breakdown as well as the emotional grief that arises from coronary disorders. A number of the postures included in the handbook can be performed by patients even in the most advanced stages of heart disease." Instructions are provided in Marathi, Hindi, and English.

Karmananda Saraswati, Swami, under the guidance of Swami Satyananda Saraswati. The heart and circulatory system. In Swami Karmananda Saraswati under the guidance of Swami Satyananda Saraswati, *Yogic Management of Common Diseases*. Bihar, India: Bihar School of Yoga, 1983, pp. 27-43.

Kennedy, J. E., R. A. Abbott, and B. S. Rosenberg. Changes in spirituality and well-being in a retreat program for cardiac patients. *Alternative Therapies in Health and Medicine*, Jul-Aug 2002, 8(4):64-66, 68-70, 72-73. PMID: 12126175

CONTEXT: Many epidemiological studies indicate that spirituality or religion are positively correlated with health measures, but research is needed on interventions that change spirituality to verify that it actually affects health and to justify suggestions that changes in spiritual practices or beliefs may have health benefits. However, it is not clear that health interventions can influence spirituality or which techniques are effective. OBJECTIVE: To evaluate whether participation in a retreat program for cardiac patients and their partners resulted in changes in spirituality and whether changes in spirituality were related to changes in well-being meaning in life, anger, and confidence in handling problems. DESIGN: Participants filled out questionnaires before and after participating in the retreat. SETTING: Retreats were sponsored by the Health Promotion and Wellness Program, University of Wisconsin-Stevens Point, and were held in a remote training center. PARTICIPANTS: Notices were sent to cardiac rehabilitation programs and directly to heart patients, resulting in the enrollment of 72 first-time participants. INTERVENTION: The 2.5-day educational retreats included discussion and opportunities to experience healthy lifestyle options. Exercise, nutrition, stress management techniques, communication skills that enhance social support, and spiritual principles of healing were incorporated. Experiential practices included yoga, meditation, visualization, and prayer. RESULTS: Of the participants, 78% reported increased spirituality after the retreat. Changes in spirituality were positively associated with increased well-being, meaning in life, confidence in handling problems, and decreased tendency to become angry. CONCLUSIONS: Programs that explore spirituality in a health context can result in increased spirituality that is associated with increased well-being and related measures. Many patients and their families want to integrate the spiritual and health dimensions of their lives. Further work is needed to develop healthcare settings that can support this integration.

Khanna, S. L. Coronary thrombosis. In S. L. Khanna, *Yogic Health Plan for Human Race*. Delhi, India: B. Jain Publishers, 1995, p. 89.

Khodeskar, A. N. Effects of yogic exercises on the cardiorespiratory endurance and canting ability of the male kabaddi players. Abstract, 2nd International Conference on Yoga Education and Research, Kaivalyadhama (Lonavla), India, 1-4 January 1988. *Yoga-Mimamsa*, 27(1&2):13-14.

King, M. S., T. Carr, and C. D'Cruz. Transcendental meditation, hypertension and heart disease. *Australian Family Physician*, Feb 2002, 31(2):164-168. PMID: 11917830

BACKGROUND: Accumulating evidence that stress contributes to the pathogenesis and expression of coronary heart disease has led to the increasing use of stress reduction techniques in its prevention and treatment. The most widely used and tested technique is transcendental meditation. OBJECT: To describe transcendental meditation and review research on its use in the treatment and prevention of coronary heart disease. DISCUSSION: Transcendental meditation shows promise as a preventive and treatment method for coronary heart disease. Transcendental meditation is associated with decreased hypertension and atherosclerosis, improvements in patients with heart disease, decreased hospitalisation rates and improvements in other risk factors including decreased smoking and cholesterol. These findings cannot be generalised to all meditation and stress reduction techniques as each technique differs in its effects. Further research is needed to delineate the mechanisms involved and to verify preliminary findings concerning atherosclerosis and heart disease and the findings of short term hypertension studies.

Kin-yoga mailing list. 18 Aug 2005.

Julia Payne, a member of the Kripalu Yoga Teachers Association mailing list, posted the following input from a cardiologist regarding cautions for Yoga practitioners following bypass surgery:

"In reference to your student's post CABG status—the issue isn't a heart issue (her heart is theoretically better vascularized now than it has been for years), it's the strength of her sternum. Her sternotomy is held together by wires, and these break not infrequently leading to instability and delayed healing. Even vigorous coughing can snap the wires, so that can be used as a guide. Surgeons recommend something like 'don't lift more than 5 lbs for 8 weeks.' She should avoid exercises that put stress on her sternum for a good 3 months; 6 months for heavy duty work. Exercise that doesn't stress the sternum like walking is okay from day one. I'm sure that over-stretching could be harmful. I wouldn't think that leg stretches or placing her hands over her head (isometric work) would be harmful. Most people are exceedingly fatigued for 4 weeks after surgery, but starting low level exercise immediately is beneficial both physically and emotionally. I would think that gentle twisting of the torso would be okay, but I'd worry about supporting upper

body weight with the elbows [Julia adds here: as in sphinx or any supine backbends] until the sternum is healed (3 - 6 months)."

Kolata, Gina. Scientist at work: Dean Ornish: A promoter of programs to foster heart health. *The New York Times*, 29 Dec 1998, Health & Fitness, Late Edition - Final, Section F, Page 6, Column1.

Konar, D., R. Latha, and J. S. Bhuvaneswaran. Cardiovascular responses to head-down-body-up postural exercise (Sarvangasana). Indian Journal of Physiology and Pharmacology, Oct 2000, 44(4):392-400. PMID: 11214493.

Abstract: Sarvangasana (SVGN) is a head-down-body-up postural exercise in a 'negative g' condition. Though highly recommended as one of the three best of all the asanas it has not yet been studied for its very obvious effects on the cardiovascular (CV) functions. This paper reports the results of the first systematic investigation on SVGN employing echocardiographic analysis in eight healthy male subjects before and after a practice of this asana twice daily for two weeks. The resting heart rate (HR) and left ventricular end-diastolic volume (LVEDV) were significantly reduced ($P < 0.02$, $P < 0.01$ respectively) after practicing this asana. A tendency toward a mild regression of the left ventricular mass was noticed, though it was not statistically significant. The CV responses to acute 45 degrees head-down tilt (HDT) in a tilt table was not altered after practicing this asana. Also there was no orthostatic intolerance during the 3-5 min period of 70 degrees head-up tilt (HUT). These results strongly indicate that further studies of this asana performed for a longer period is most likely to yield very significant observations of applied value.

Kothari, L. K., A. Bordia, and O. P. Gupta. The yogic claim of voluntary control over the heart beat: An unusual demonstration. *American Heart Journal*, Aug 1973, 86(2):282-284.

Kraftsow, Gary. Heart. In Gary Kraftsow, *Yoga for Wellness: Healing with the Timeless Teachings of Viniyoga*. New York: Penguin/Arkana, 1999, pp. 231-233, 273, 306.

Kreitzer, M. J., and M. Snyder. Healing the heart: Integrating complementary therapies and healing practices into the care of cardiovascular patients. *Progress in Cardiovascular Nursing*, Spring 2002, 17(2):73-80. PMID: 11986540.

Complementary therapies and healing practices have been found to reduce stress, anxiety, and lifestyle patterns known to contribute to cardiovascular disease. Promising therapies include imagery and hypnosis, meditation, yoga, tai chi, prayer, music, exercise, diet, and use of dietary supplements. Many of these complementary approaches to healing have been within the domain of nursing for centuries and can readily be integrated into the care of patients with cardiovascular disease. While individual complimentary modalities hold considerable merit, it is critical that the philosophy underlying these therapies—caring, holism, and harmony—also be understood and honored. (c)2002 CHF, Inc.

Kristeller, J. L. Heart rate slowing: Biofeedback vs. meditation. *Res Psychol Med*, 1979, 1:486.

Kubota, Y., W. Sato, M. Toichi, T. Murai, T. Okada, A. Hayashi, and A. Sengoku. Frontal midline theta rhythm is correlated with cardiac autonomic activities during the performance of an attention demanding meditation procedure. *Cognitive Brain Research*, Apr 2001, 11(2):281-287. PMID: 11275489.

Abstract: Frontal midline theta rhythm (Fm theta), recognized as distinct theta activity on EEG in the frontal midline area, reflects mental concentration as well as meditative state or relief from anxiety. Attentional network in anterior frontal lobes including anterior cingulate cortex is suspected to be the generator of this activity, and the regulative function of the frontal neural network over autonomic nervous system (ANS) during cognitive process is suggested. However no studies have examined peripheral autonomic activities during Fm theta induction, and interaction of central and peripheral mechanism associated with Fm theta remains unclear. In the present study, a standard procedure of Zen meditation requiring sustained attention and breath control was employed as the task to provoke Fm theta, and simultaneous EEG and ECG recordings were performed. For the subjects in which Fm theta activities were provoked (six men, six women, 48% of the total subjects), peripheral autonomic activities were evaluated during the appearance of Fm theta as well as during control periods. Successive inter-beat intervals were measured from the ECG, and a recently developed method of analysis by Toichi et al. (*J. Auton. Nerv. Syst.* 62 (1997) 79-84) based on heart rate variability was used to assess cardiac sympathetic and parasympathetic functions separately. Both sympathetic and parasympathetic indices were increased during the appearance of Fm theta compared with control periods. Theta band activities in the frontal area were correlated negatively with sympathetic activation. The results suggest a close relationship between cardiac autonomic function and activity of medial frontal neural circuitry."

Kumar, A. D. Pradeep. Yogic lifestyle can reverse heart disease. *The Financial Express*, 2000. Article available online: http://www.financialexpress.com/fe/daily/20000916/fle10047.html.

La Forge, Ralph. Mind-body fitness: Encouraging prospects for primary and secondary prevention. *Journal of Cardiovascular Nursing*, Apr 1997, 11(3):53-65. PMID: 9095454.

Abstract: In recent years health promotion programs have generated many worthwhile psychologic and physiologic benefits but frequently with less than optimal long-term adherence. Incorporating approaches such as mind-body exercise with existing health promotion and cardiac rehabilitation services can improve self-efficacy and long-term adherence to healthy behaviors as well as improve personal stress management skills. Mind-body exercise couples muscular activity with an internally directed focus so that the participant produces a temporary self-contemplative mental state. This internal focus is in contrast to conventional body-centered aerobic and muscular fitness exercise in which there is little or no mindful component. Research on mind-body exercise programs such as yoga and tai chi reveal they have significant mental and physical value. There

also are numerous primary and secondary preventive indications for cardiovascular disease in which mind-body exercise can play a primary or complementary role. Mind-body exercise programs will be a welcome and necessary addition to evolving disease management models that focus on self-care and decreased health care use.

_____. Mindful exercise in chronic disease management: Focus on hatha yoga and cardiovascular diseases. Article available online: http://newmoms.bodytrends.com/articles/yoga/yogaandcvdrl.htm?AID=50882&PID=282118. Author email: ralphlaforge@msn.com.

Lakshmikanthan, C., R. Alagesan, S. Thanikachalam, B. Ramamurthi, D. Elangovan, T. R. Viswanathan, and S. Kumar. Long term effects of yoga on hypertension and/or coronary artery disease. *Journal Assoc. Phys. India*, 1979, 27(12):1055-1058.

_____. Yoga and the heart. *Indian Journal of Physiology and Pharmacology*, 1978, 22(2):240-241.

Lancet, 1975, II:93-95. [Title of article and author unknown, but article addresses Yoga and prevention of heart-attack recurrence.]

Lasater, Judith. Yoga and your heart: Interview with Dean Ornish, M.D. *Yoga Journal*, Sep/Oct 1989, pp. 13-15.

Laubry, C., and T. Brosse. Documents recueillis aux Indes sur les "Yoguis" par l'enregistrement simltane du pouls, de la respiration et de l' electrocardiogramme [Data gathered in India on a yogi with simultaneous registration of the pulse, respiration, and electrocardiogram]. *Presse Medicale*, 1936, 44:1601-1604. [In French.]

Lee, Cyndi. Heart opening: Your shoulders, arms, neck and ribs can either be a restrictive cage for your heart or an undulating, comforting protector. *Shambhala Sun*, Sep 2000, pp. 85-87.

Lehrer, Paul, Yuji Sasaki, and Yoshihiro Saito. Zazen and cardiac variability. *Psychosomatic Medicine*, Nov/Dec 1999, 61(6):812-821.

Abstract: OBJECTIVE: This study examined the effects of "tanden breathing" by Zen practitioners on cardiac variability. Tanden breathing involves slow breathing into the lower abdomen. METHODS: Eleven Zen practitioners, six Rinzai and five Soto, were each studied during 20 minutes of tanden breathing, preceded and followed by 5-minute periods of quiet sitting. During this time, we measured heart rate and respiration rate. RESULTS: For most subjects, respiration rates fell to within the frequency range of 0.05 to 0.15 Hz during tanden breathing. Heart rate variability significantly increased within this low-frequency range but decreased in the high-frequency range (0.14–0.4 Hz), reflecting a shift of respiratory sinus arrhythmia from high-frequency to slower waves. Rinzai practitioners breathed at a slower rate and showed a higher amplitude of low-

frequency heart rate waves than observed among Soto Zen participants. One Rinzai master breathed approximately once per minute and showed an increase in very-low-frequency waves (<0.05 Hz). Total amplitude of heart rate oscillations (across frequency spectra) also increased. More experienced Zen practitioners had frequent heart rhythm irregularities during and after the nadir of heart rate oscillations (i.e., during inhalation). CONCLUSIONS: These data are consistent with the theory that increased oscillation amplitude during slow breathing is caused by resonance between cardiac variability caused by respiration and that produced by physiological processes underlying slower rhythms. The rhythm irregularities during inhalation may be related to inhibition of vagal modulation during the cardioacceleratory phase. It is not known whether they reflect cardiopathology.

Lepicovská, V., and D. Bárta. Changes in plethysmogram and ECG during "uddiyana" exercise. *Jógová Cvicení*, 1982, pp. 92-96. [In Czech.]

_____, and C. Dostálek. Influence of some hatha yogic exercises upon the cardiovascular system. Int Cong Int Med Praha, August 22-27, 1982.

_____, and C. Dostálek. Effect of nauli upon cardiovascular system. *Yoga-Mimamsa*, 1987-1988, 26(3&4):25-42.

_____, C. Dostálek, and M. Kovarova. Hathayogic exercise jalandharabandha in its effect on cardiovascular response to apnoea. *Act Nerv Super (Praha)*, Jun 1990, 32(2):99-114.

_____, C. Dostálek, and M. Vlcek. Vasomotor changes effected by breathing manoeuvres. *Acta Nerv. Suppl.*, 1983, 25(3):195-196.

Levy, J. K. Standard and alternative adjunctive treatments in cardiac rehabilitation. *Texas Heart Institute Journal*, 1993, 20(3):198-212.

Lewis, Dennis. Diaphragmatic breathing can help your heart. Available online: http://authentic-breathing.com/breathing_tips.htm#heart.

Luskin, F. M. A review of the effect of spiritual and religious factors on mortality and morbidity with a focus on cardiovascular and pulmonary disease. *Journal of Cardiopulmonary Rehabilitation*, Jan-Feb 2000, 20(1):8-16. PMID: 10680093. Author email: fredl@leland.stanford.edu.

_____, K. A. Newell, M. Griffith, M. Holmes, S. Telles, F. F. Marvasti, K. R. Pelletier, and W. L. Haskell. A review of mind-body therapies in the treatment of cardiovascular disease: Part I: Implications for the elderly. *Alternative Therapies in Health and Medicine*, May 1998, 4(3):46-61. PMID: 9581321. Author email: fredl@leland.stanford.edu.

Abstract: BACKGROUND: A review of research on complementary and alternative treatments, specifically mind-body techniques, was conducted at Stanford University. The goals of the review were to establish a comprehensive literature review and to provide a rationale for future research concerning successful aging. METHODS: Computerized searches were conducted using MEDLINE, PsychInfo, Stanford Library, Dissertation Abstracts, Lexus-Nexus, the Internet, and interviews conducted with practitioners. All studies since 1990 that examined mind-body treatments of cardiovascular disorders in the elderly were included. Mind-body practices evaluated were social support, cognitive-behavioral treatment, meditation, the placebo effect, hope, faith, imagery, spiritual healing, music therapy, hypnosis, yoga, t'ai chi, qigong and aikido. Studies conducted after 1990 were a priority, but when more recent literature was scarce, other studies using randomized, controlled trials were included. RESULTS: Mind-body techniques were found to be efficacious primarily as complementary and sometimes as stand-alone alternative treatments for cardiovascular disease-related conditions. Studies provided evidence for treatment efficacy, but the need for further controlled research was evident. CONCLUSIONS: Reviewers found only a handful of randomized, controlled research studies conducted in the United States. As a result, there is a lack of replicated studies with which to determine appropriate treatment dosage and the mechanisms by which many of the practices work. Compelling anecdotal evidence, the presence of some controlled research, overall cost effectiveness, and the lack of side effects resulting from mind-body treatments make further investigation a high priority.

MacInerney, Charles. Hatha yoga & cardiac rehab. Article available online: http://www.yogateacher.com/text/yoga/specialprojects/cardiacrehab.html.

Madanmohan, Ananda Balayogi Bhavanani, and Kaviraja Udupa. Effect of direction of head on heart rate and blood pressure. *Yoga-Mimamsa*, Jul 2002, 34(2):116-122.

Abstract: Indian culture stresses the importance of direction during performance of daily activities. Some yoga teachers prescribe that yogic relaxation and polarity practices must be done while lying with head towards north in order to align oneself with the earth's electromagnetic field. There is some evidence that earth's magnetic field influences physiological functions. Hence, the present study was undertaken to see whether head direction has any effect on heart rate (HR) and blood pressure during supine rest. 43 normal healthy school children were recruited and their recordings were taken after 5 minutes of supine rest. The subjects were randomly assigned to lie with their head towards north, east, south and west directions on four different days. HR and blood pressure were recorded at the end of 5 minutes of supine rest. HR was loweset in north and highest in south, the difference being statistically significant by students' paired "t" test. Systolic pressure was lowest in the north and significantly higher in the west. Lying supine with head towards north had the lowest rate-pressure-product as compared to the west. Our study demonstrates that lying supine with head in different directions has a definite effect on the HR and blood pressure. Further studies in different age groups and in hypertensive patients may help in understanding the mechanisms and implications of this phenomenon.

_____, K. Udupa, A. B. Bhavanani, C. C. Shatapathy, and A. Sahai. Modulation of cardiovascular response to exercise by yoga training. *Indian Journal of Physiology and Pharmacology*, Oct 2004; 48(4):461-465. PMID: 15907055.

Abstract: This study reports the effects of yoga training on cardiovascular response to exercise and the time course of recovery after the exercise. Cardiovascular response to exercise was determined by Harvard step test using a platform of 45 cm height. The subjects were asked to step up and down the platform at a rate of 30/min for a total duration of 5 min or until fatigue, whichever was earlier. Heart rate (HR) and blood pressure response to exercise were measured in supine position before exercise and at 1, 2, 3, 4, 5, 7 and 10 minutes after the exercise. Rate-pressure product [RPP = (HR x SP)/100] and double product (Do P = HR x MP), which are indices of work done by the heart were also calculated. Exercise produced a significant increase in HR, systolic pressure, RPP & DoP and a significant decrease in diastolic pressure. After two months of yoga training, exercise-induced changes in these parameters were significantly reduced. It is concluded that after yoga training a given level of exercise leads to a milder cardiovascular response, suggesting better exercise tolerance.

Mahajan, A. S., K. S. Reddy, and U. Sachdeva. Lipid profile of coronary risk subjects following yogic lifestyle intervention. *Indian Heart J*, Jan-Feb 1999, 51(1):37-40.

Abstract: The effect of yogic lifestyle on the lipid status was studied in angina patients and normal subjects with risk factors of coronary artery disease. The parameters included the body weight, estimation of serum cholesterol, triglycerides, HDL, LDL and the cholesterol - HDL ratio. A baseline evaluation was done and then the angina patients and risk factors subjects were randomly assigned as control (n = 41) and intervention (yoga) group (n = 52). Lifestyle advice was given to both the groups. An integrated course of yoga training was given for four days followed by practice at home. Serial evaluation of both the groups was done at four, 10 and 14 weeks. Dyslipidemia was a constant feature in all cases. An inconsistent pattern of change was observed in the control group of angina (n = 18) and risk factor subjects (n = 23). The subjects practising yoga showed a regular decrease in all lipid parameters except HDL. The effect started from four weeks and lasted for 14 weeks. Thus, the effect of yogic lifestyle on some of the modifiable risk factors could probably explain the preventive and therapeutic beneficial effect observed in coronary artery disease.

Mamtani, Ravinder, and Ronac Mamtani. Ayurveda and yoga in cardiovascular diseases.
Cardiology Review, May 2005, 13(3):155-162.

Abstract: Ayurveda is derived from 2 Sanskrit words, namely, “Ayus” and “Veda,” meaning life and knowledge, respectively. It literally means science of life. Ayurveda, of which yoga is an integral part, is widely practiced in India and is gaining acceptance in many countries around the world. It is a comprehensive and a holistic system, the focus of which is on the body, mind, and consciousness. The Ayurvedic treatment consists of the use herbal preparations, diet, yoga, meditation, and other practices. Based on the

review of available studies, the evidence is not convincing that any Ayurvedic herbal treatment is effective in the treatment of heart disease or hypertension. However, the use of certain spices and herbs such as garlic and turmeric in an overall healthy diet is appropriate. Many herbs used by Ayurvedic practitioners show promise and could be appropriate for larger randomized trials. Yoga, an integral part of Ayurveda, has been shown to be useful to patients with heart disease and hypertension. Yoga reduces anxiety, promotes well-being, and improves quality of life. Its safety profile is excellent. Its use as a complementary therapeutic regimen under medical supervision is appropriate and could be worth considering.

Manchanda, S. C., and R. Narang. Yoga and coronary artery disease. *Indian Heart Journal*, Mar-Apr 1998, 50(2):227-228.

_____, R. Narang, K. S. Reddy, U. Sachdeva, D. Prabhakaran, S. Dharmanand, M. Rajani, and R. Bijlani. Retardation of coronary atherosclerosis with yoga lifestyle intervention. *Journal of the Association of Physicians of India*, Jul 2000, 48(7):687-694.

BACKGROUND: Yoga has potential for benefit for patients with coronary artery disease though objective, angiographic studies are lacking. MATERIAL AND METHODS: We evaluated possible role of lifestyle modification incorporating yoga, on retardation of coronary atherosclerotic disease. In this prospective, randomized, controlled trial, 42 men with angiographically proven coronary artery disease (CAD) were randomized to control (n = 21) and yoga intervention group (n = 21) and were followed for one year. The active group was treated with a user-friendly program consisting of yoga, control of risk factors, diet control and moderate aerobic exercise. The control group was managed by conventional methods i.e. risk factor control and American Heart Association step I diet. RESULTS: At one year, the yoga groups showed significant reduction in number of anginal episodes per week, improved exercise capacity and decrease in body weight. Serum total cholesterol, LDL cholesterol and triglyceride levels also showed greater reductions as compared with control group. Revascularization procedures (coronary angioplasty or bypass surgery) were less frequently required in the yoga group (one versus eight patients; relative risk = 5.45; P = 0.01). Coronary angiography repeated at one year showed that significantly more lesions regressed (20% versus 2%) and less lesions progressed (5% versus 37%) in the yoga group (chi-square = 24.9; P < 0.0001). The compliance to the total program was excellent and no side effects were observed. CONCLUSION: Yoga lifestyle intervention retards progression and increases regression of coronary atherosclerosis in patients with severe coronary artery disease. It also improves symptomatic status, functional class and risk factor profile.

_____, R. Narang, and U. Sachdeva. Coronary atherosclerotic reversal potential of Yoga lifestyle intervention. In H. R. Nagendra, R. Ragarathna, and S. Telles, *Yoga Research & Applications: Proceedings of the 5th International Conference on Frontiers in Yoga Research and Applications*. Bangalore, Vivekananda Kendra Yoga Research Foundation, 2000, pp. 159-161. Contact Dr. S. C. Manchanda, Professor & Head,

Department of Cardiology, All India Institute of Medical Sciences, New Delhi - 110 029, India.

Mandlik, Vishwas Vasant, Jayant Sohoni, and Ramesh Varkhede. Effect of yoga training package on heart patients. Abstract available online: http://www.yogapoint.com/info/newsletter3.htm.

Abstract: Background: Yoga, being the process of normalization, [has been] studied [for] thousands of years. The daily practice of Yoga brings the various unbalanced systems of the body to [a] normal state . . . we [thus] planned to study the effect of [our] Yoga Training Package in heart patients . . . Aim: This paper aims to study the effect of six months of regular practice of a package of selected yogic practices, viz., Asanas, Pranayama, Meditation, Yoga Nidra and Omkar Chanting (one and half hours per day) on heart patients. Subjects: We [have been] teaching Yoga in our institution for the last 22 years, including sick persons. Out of these we have selected 23 heart patients for this experiment. Design: We designed a special course for these heart patients which consisted of simple body movements in yogic style, some stretching Asanas, some types of Pranayamic breathing exercises, and initial types of Meditation. We . . . included the daily practice of Yoga Nidra specially designed for heart patients and Omkar chanting in a particular fashion. The practice was continued daily for six months. The patients were thoroughly checked medically before and after the training and the results were compared. Results and Discussion: [We] observed that . . . blood pressure and blood cholesterol reduced considerably. [We] also observed that the exercise time on [the] stress test increased and [the] number of METS reduced significantly. The patients experienced an overall relief of about 90%.

Manjunath, N. K., and Shirley Telles. Effects of sirsasana (headstand) practice on autonomic and respiratory variables. *Indian Journal of Physiology and Pharmacology*, Jan 2003, 47(1).

Abstract: The present study had two aims: (1) To assess heart rate variability (HRV) along with non-specific autonomic measures (used in earlier studies), before and after two minutes of the headstand. (2) To compare changes in two categories of subjects, i.e., those who practiced the headstand in a traditional way (without any support) and those who used the support of the wall (a present day adaptation). The subjects were forty male volunteers (age range 19 to 36 years), with twenty subjects under each category. The following changes were significant after the practice, compared to values at baseline. (i) Both categories had an increase in the power of the low frequency component (LF) and a decrease in the high frequency component (HF) of the HRV spectrum, increased LF/HF ratio, and decreased heart rate. (ii) Subjects who practiced the headstand with the support of a wall showed reduced finger plethysmogram amplitude suggesting increased sympathetic vasomotor tone. (iii) Practicing the headstand without support was associated with an increase in the skin conductance level, suggestive of increased sympathetic sudomotor tone. Hence, both categories showed similar changes in the HRV components though changes in sympathetic vasomotor and sudomotor activity were different. These changes suggest sympathetic activation, irrespective of the method of practice.

Mart, Krista. Transcendental vessels: Repeating soothing sounds during meditation apparently thinned thickened artery walls. New York: ABCNews.com, 2 Mar 2000. Article available online: http://abcnews.go.com/sections/living/DailyNews/meditation000302.html.

"Relaxing and reducing stress through transcendental meditation may reduce artery blockage and the risk of a heart attack and stroke."

McAmmond, David. Restorative yoga for heart patients. *Reaching Out with Yoga*, no. 6, pp. 3-4.

_____. Yoga for a healthy heart. http://www.yogamat.com/new_page_8.htm

McClure, C. Cardiac arrest through volition. *Calcutta Medicine*, 1959, 90:440-441.

Meastan, J., and M. V. Bhole. Cardiac output in normal, deep and ujjayi pranayamic breathing: A preliminary study. *Yoga-Mimamsa*, 1979, 19(4):11-17.

Mehta, Mira. The lungs and heart; Circulation. In Mira Mehta, *Health through Yoga: Simple Practice Routines and a Guide to the Ancient Teachings*. London: Thorsons, 2002, pp. 122-132; 133-137. (Combines Yoga and Ayurveda.)

Melwani, Lavina. Yoga therapy recognized for treating heart disease. *Hinduism Today*, 93(12). [On Dr. Dean Ornish's program.]

Migdow, Jeff. Yoga's benefits for the heart and blood pressure. *Yoga Bulletin of the Kripalu International Network*, Spring 1997, p. 11.

Mills, P. J. Cardiovascular and adrenergic reactivity and beta-adrenergic receptor sensitivity in practitioners of the Transcendental Meditation program and type A behavior. *Dissertation Abstracts International*, 1987, 58(6-B):1612.

Minvaleev, R. S., et al. Left ventricle filling during head stand and inverted postures. *Fiziol Cheloveka*, Nov 1996, 22(6):27-34. [In Russian.]

Mishra, J. P. N. Coronary heart disease. In J. P. N Mishra, *Preksha Yoga Management for Common Ailments*. New Delhi, India: B. Jain Publishers, 1999, pp. 172-174.

Moffitt, Phillip. The language of the soft heart: The true nature of love is not based on an advantageous response, but on the sheer openness of one heart to another. *Yoga Journal*, Sep/Oct 2000, pp. 64-69.

Mohan, Madan, U. C. Rai, V. Balavittal, D. P. Thombre, and Swami Gitananda. Cardiorespiratory change during Savitri Pranayam and Shavasan. *The Yoga Review*, 1983, 3(1):25-34.

Abstract: The present study was conducted in trained (n=7) and untrained (n=7) volunteers to determine the effect of savitri pranayam and shavasan on O2 consumption, heart rate and blood pressure. In trained subjects we found a consistent and significant ($p<0.01$) reduction in O2 consumption within a few minutes of starting savitri pranayam. During shavasan, there was significant reduction in O2 consumption ($p<0.05$), heart rate ($p<0.001$) and diastolic blood pressure ($p<0.05$). In untrained subjects, the changes in above mentioned parameters were statistically insignificant.

_____, C. Saravanane, S. G. Surange, D. P. Thombre, and A. S. Chakrabarty. Effect of yoga type breathing on heart rate and cardiac axis of normal subjects. *Indian Journal of Physiology and Pharmacology*, Oct-Dec 1986, 30(4):334-40.

Abstract: Effect of inspiratory and expiratory phases of normal quiet breathing, deep breathing and savitri pranayam type breathing on heart rate and mean ventricular QRS axis was investigated in young, healthy untrained subjects. Pranayam type breathing produced significant cardioacceleration and increase in QRS axis during the inspiratory phase as compared to eupnea. On the other hand, expiratory effort during pranayam type breathing did not produce any significant change in heart rate or QRS axis. The changes in heart rate and QRS axis during the inspiratory and expiratory phases of pranayam type breathing were similar to the changes observed during the corresponding phases of deep breathing.

Monro, Dr. Robin, Dr. R. Nagarathna, and Dr. H. R. Nagendra. Circulation; Heart disease. In Dr. Robin Monro, Dr. R. Nagarathna, and Dr. H. R. Nagendra, *Yoga for Common Ailments*. New York/London: Simon & Schuster, 1990, pp. 60; 61.

Moore, Marcia, and Mark Douglas. Heart trouble. In Marcia Moore and Mark Douglas, *Diet, Sex, and Yoga*. York, Me.: Arcane Publications, 1966, 1970, pp. 246-247.

Moorthy, A. M. The effect of selected yogic practices on cardiovascular fitness level of college men and women. *Yoga-Mimamsa*, 1988, 27(1&2):9.

Morrel, A. Perspectives et recherches en cardiologie et yoga. *Les premiers entretiens medicaux du yoga*, Nov 1986.

Morrell, E. Meditation and somatic arousal. *American Psychologist*, 1986, 41(6):712-713.

Morris, Edwin Lee. The relationship of coronoary heart disease and spirituality. Ph.D. dissertation. The Union Institute Graduate College, 1998.

From the abstract: "The first research consisted of giving questionnaires to fourteen participants who had previously been enrolled in the Lifestyle Heart Trial directed by Dean Ornish, M.D. Eight of these participants . . . had practiced meditation and other relaxation techniques and six were in a control group. It was found that there were

statistically different scores between the [two groups] on the spirituality questionnaires. The scores on the . . . questionnaires also statistically significantly correlated with the results of previously obtained cardiac catherization data which showed whether the patients had progression or reversal of their coronary artery obstruction over a four-year time period.

"The second research consisted of giving spirituality questionnaires to six participants who were beginning an educational retreat where they were taught techniques of stress management including deep relaxation, meditation, and visualization. They were again given the questionnaires at the end of four months to see if their sense of spiritual well-being had changed. The two questionnaires used in both studies were the Spiritual Orientation Inventory and the Purpose of Life Test. The scores increased in both tests fro the time they began the relaxation practices, but only the change in the Purpose in Life Test was statistically significant."

_____. The relationship of spirituality to coronary heart disease. *Alternative Therapies in Health and Medicine,* Sep-Oct 2001, 7(5):96-98. MEDLINE® PMID: 11565405. Author email: edmorris2000@yahoo.com.

"Several studies suggest that religious involvement or spiritual well-being may affect health outcomes. This study was designed to investigate whether the scores from a questionnaire measuring spiritual well-being correlated with progression or regression of coronary heart disease as measured with computerized cardiac catheterization data. Participants in Dr. Dean Ornish's Lifestyle Heart Trial were given the 'Spiritual Orientation Inventory.' A significant difference was found in the spirituality scores between a control group and a research group that practiced daily meditation. The spirituality scores were significantly correlated with the degree of progression or regression of coronary artery obstruction over a 4-year time period. The lowest scores of spiritual well-being had the most progression of coronary obstruction and the highest scores had the most regression. This study suggests that the degree of spiritual well-being may be an important factor in the development of coronary artery disease."

Motajova, J., and K. Vicenik. Effect of Hatha Yoga on heart activity in exercising women. *Activitas Nervosa Superior,* 1980, 22(2):125-126.

Motoyama, M. Western and Eastern medical studies of pranayama and heart control. *Research for Religion and Parapsychology,* 1977, 3(1):1-69.

Muralidhara, D. V., and K. V. Ranganthan. Effect of yoga practice on cardiac recovery index. *Indian Journal Physiol Pharmacol*, 1982, 26(4):280-283.

Murphy, Michael, and Steven Donovan. The cardiovascular system. In Michael Murphy and Steven Donovan, *The Physiological and Psychological Effects of Meditation A Review of Contemporary Research with a Comprehensive Bibliography 1931-1996*. 2d ed. Sausalito, Calif.: Institute of Noetic Sciences, 1997, pp. 45-57.

Muskatel, N., R. L. Woolfolk, P. Carrington, P. M. Lehrer, and B. McCann. Effect of meditation training on aspects of coronary-prone behaviour. *Perceptual Motor Skills*, 1984, 58:515-518. PMID: 6377223.

Abstract: 52 undergraduates who had volunteered to receive meditation training were placed into either high or low time-urgency groups based on their scores on Factor S of the Jenkins Activity Survey. Subjects then either received training in Clinically Standardized Meditation followed by 3 1/2-wk. of practice or waited for training during that period. Analyses of scores on a time-estimation task and of self-reported hostility during an enforced waiting task indicated that meditation significantly altered subjects' perceptions of the passage of time and reduced impatience and hostility resulting from enforced waiting.

Myers, Hector. [Transcendental Meditation and coronary artery disease.] *Stroke*, Mar 2000, 31(3).

Preliminary findings from UCLA, Charles Drew Univeristy, and Maharishi Univeristy show that learning to destress via Transcendental Meditation (TM) may reduce the risk of heart attack and stroke. Significantly decreased thickness of the arterial wall was noted by ultrasound in those who practiced TM, as compared to those who did not.

Nagarathna, R., and H. R. Nagendra. Yoga therapy for ischaemic heart diseases: Feasibility studies. Report No. VKYTRC/007/KK1981. Bangalore, India: Vivekananda Kendra Yoga Research Foundation, 1981.

_____. Therapeutic applications of yoga: A report. *Abstr 2nd Ann Symp Indian Academy Yoga*. Madras, India: Indian Inst Technology, Dec-Jan 1982-1983. (Discusses heart diseases.)

Nešpor, K. Jóga a prevence kardiovaskulárních chorob [Yoga and the prevention of cardiovascular diseases]. *Cas Lek Cesk*, Mar 1979, 118(11):333-335. [In Czech.]

Oak, J. P., and M. V. Bhole. Pulse rate during and after bahya kumbhaka with different conditions of abdominal wall. *Yoga-Mimamsa*, 1983-1984, 22(3&4):71-76.

_____. Rehabilitation of patients with acute myocardial infarction and mild hypertension. *Yoga-Mimamsa*, 1987, 26(2):7-15.

Offner, Naomi Judith. *Gentle Yoga with Naomi™ Teacher Training Manual: How to Teach Gentle Yoga to Plus Size, Seniors and Heart Patients.* URL: http://www.gentleyoga.com/yogaTeacherTrainingFlier.html.

Oliver, Jeff. Ornish program life changing. *Valley Independent* (Pittsburgh), 21 Jun 2005. Author contact information: joliver@triweb.com or 724-684-2666. Article available online: http://pittsburghlive.com/x/tribune-review/trib/newssummary/s_346193.html.

The Dr. Dean Ornish Program for Reversing Heart Disease accepts individuals with type 2 diabetes into the program, and the author recounts his extraordinary success. He weighted 370 lbs. when he began and initially had great resistance about participating, but is profoundly grateful that he did.

Omopariola, Tynesia. Graduate assistant to speak on cardio benefits of yoga. *The Vista Online*, 7 Apr 2005.

"The American Heart Association invited yoga instructor Jan Rose to make a presentation at the 'Go Red For Women' luncheon May 5 at the Oklahoma City Country Club to bring awareness for research.

"Rose will talk about heart disease and the benefits yoga has on the heart. The luncheon is a major fundraiser and costs $100 a plate.

"'The practice of yoga is a way to relieve stress [and is] especially good for the heart,' said Rose.

"Rose has taught yoga for 31 years and is a graduate assistant at UCO for the 2004-05 year. She is a graduate of UCO and is obtaining her master's in Wellness Management. She teaches yoga at the Wellness Center and for the Obvious Group in North Park Mall.

"The leading cause of death in the U.S. for women is heart disease. Rose says sitting calmly for a few moments releases stress and increases blood flow, which carries more oxygen to the muscles.

"'That's the biggest thing for the heart,' Rose said.

"Rose said that relieving everyday stress and strain is important in a fast-paced world and it is essential for students particularly when finals are coming up. Keeping the heart healthy, free from disease and keeping physical components vibrant is something that yoga can do for the body . . ."

Ornish, Dean, M.D. *Love & Survival: The Scientific Basis for the Healing Power of Intimacy*. New York: HarperCollins, 1998. [On emotional and spiritual well-being and cardiovascular function.]

_____. Can lifestyle changes reverse coronary atherosclerosis? *Hospital Practice*, 1991, 26(5):123-132. Reprinted in *The Journal of The International Association of Yoga Therapists*, 1996, no. 7, pp. 27-34.

_____. Lifestyle heart trial. *Cardiovascular Risk Factors*, Jul 1992.

_____. The lifestyle heart trial: What have we learned? *Choices in Cardiology*, Jan/Feb 1991, 5(1):24-27.

_____. Can you prevent—and reverse—CAD? *Patient Care*, 16 Oct 1991, pp. 25-33.

_____. Can life-style changes reverse coronary atherosclerosis? *Hospital Practice*, 15 May 1991, pp. 123-132.

_____. Reversing heart disease through diet, exercise, and stress management: An interview with Dean Ornish. *Journal of the American Dietetic Association*, Feb 1991, 91(2):162-165.

_____. Every affection of the mind that is attended with either pain or pleasure, hope or fear, is the cause of an agitation whose influence extends to the heart. *Mind/Heart Interactions: For Better and For Worse*, 1978, 5:266-269.

_____. *The Healthy Heart* video. Buckingham, Va.: Shakticom. 75 minutes.

From the publisher: "In this informal, informative and often humorous presentation recorded live in Yogaville, Virginia, Dean Ornish details the program of vegetarian, low-fat diet, exercise and yoga that he has used to successfully treat heart conditions that traditional medicine maintained could only be healed with surgery."

_____, S. E. Brown, L. W. Scherwitz, et al. Can lifestyle changes reverse coronary heart disease? *The Lancet*, Jul 21, 1990, 336(8708):129-133.

_____, L. Scherwitz, J. H. Billings, L. Gould, T. Merritt, S. Sparler, W. Armstrong, T. Ports, R. Kirkeeide, C. Hogeboo, and R. Brand. Can intensive lifestyle changes reverse coronary heart disease without lipid-lowering drugs? Five year follow-up of the Lifestyle Heart Trial. *Journal of the American Medical Association*, 1998, 280(23)2001-2007.

_____, L. Scherwitz, R. S. Doody, et al. Effects of stress management training and dietary changes in treating ischemic heart disease. *Journal of the American Medical Association*, 7 Jan 1983, 249(1):54-59.

_____, et al. Effects of a vegetarian diet and selected yoga techniques in the treatment of coronary heart-disease. *Clinical Research*, 1979, 27(4):720A.

Oz, Mehmet, with Ron Arias and Lisa Oz. *Healing from the Heart: A Leading Heart Surgeon Explores the Power of Complementary Medicine*. New York: Dutton, 1998.

" . . . explores the . . . [combination] of the best of state-of-the-art Western medicine with complementary methods of self-healing and the all-encompassing holistic approach to healing that comes from the heart. Included are Oz's recommendations for self-healing through hypnosis, reflexology, visual imagery, music, yoga, massage, aromatherapy, and improved diet and vitamins."

Pandey, R. C., V. M. Bhatnagar, and R. K. Kalra. Attenuation of cardiac vulnerability to dysrhythmias by exploitation of cardiovascular reflexogenicity through uddiyan and jalandhar bandhas. Paper read at All India Conference on Yoga and Its Integration in Modern Education, Indian Institute of Technology, Kanpur, 10-13 September, 1981.

Pandya, Dipak P., and Vaidehi H. Vyas. Mind-body therapy in the management and prevention of coronary disease. *Comprehensive Therapy*, May 1999, 25(5):283-93.

"Conventional mind-body therapy has been proven a valuable noninvasive way to manage coronary disease. Yoga practice, especially, has been found to be valuable in preventing adverse outcomes of coronary disease by improving resistance to stress."

Summarizes the physiological changes associated with yoga training, including decreased sympathetic tone, improved control of sympathetic function, decreased peripheral vascular resistance, improved cardiac stroke output, reduction in blood pressure, reduced heart rate, and improved cardiovascular endurance.

Pansare, M.S., A. N. Kulkarni, and U. B. Pendse. Effect of yogic training on serum LDH levels. *Journal of Sports Medicine and Physical Fitness*, 1989, 29:177-178.

Parulkar, V. G., S. L. Prabhavalker, and J. V. Bhall. Observations on some physiological effects of Transcendental Meditation. *Indian Journal of Medical Science*, 1974, 28(3):156-158.

Patel, C., and M. Carruthers. Coronary risk factor reduction through biofeedback-aided relaxation and meditation. *J R Coll Gen Proceedings*, 1977, 27:401-405.

_____, C. H., M. G. Marmot, D. J. Terry, M. Carruthers, B. Hunt, and M. Patel. Trial of relaxation in reducing coronary risk: Four-year follow up. *British Medical Journal*, 1985, 290(6475):1103-1106.

_____, M. Marmot, D. J. Terry, M. Carruthers, and P. Sever. Coronary risk factor reduction through biofeedback-aided relaxation and meditation. *Circulation*, 1979, 60:226.

_____, and M. Carruthers. Coronary risk factor reduction through biofeedback-aided relaxation and meditation. *Journal of the Royal College of General Practitioners*, Jul 1977, 27:401-405.

Payne, Larry, and Richard Usatine. The circulatory system: High blood pressure, heart disease. In Larry Payne and Richard Usatine, *Yoga Rx: A Step-by-Step Program to Promote Health, Wellness, and Healing for Common Ailments*. New York: Broadway Books, 2002, pp. 172-188.

Peng, C. K., J. E. Mietus, Y. Liu, G. Khalsa, P. S. Douglas, H. Benson, and A. L. Goldberger. Exaggerated heart rate oscillations during two meditation techniques. *International Journal of Cardiology*, 31 Jul 1999, 70(2):101-107. PMID: 10454297. (See also Friedman et al. above, a response to Peng et al.)

Abstract: We report extremely prominent heart rate oscillations associated with slow breathing during specific traditional forms of Chinese Chi and Kundalini Yoga meditation techniques in healthy young adults. We applied both spectral analysis and a novel analytic technique based on the Hilbert transform to quantify these heart rate dynamics. The amplitude of these oscillations during meditation was significantly greater than in the pre-meditation control state and also in three non-meditation control groups: i) elite athletes during sleep, ii) healthy young adults during metronomic breathing, and iii) healthy young adults during spontaneous nocturnal breathing. This finding, along with the marked variability of the beat-to-beat heart rate dynamics during such profound meditative states, challenges the notion of meditation as only an autonomically quiescent state.

Pratap, V., W. H. Berrettini, and C. Smith. Arterial blood gases in pranayama practice. Perceptual Motor Skills, Feb1978, 46(1):171-174.

Puente, Antonio E., and Irving Beiman. The effects of behavior therapy, self-relaxation, and Transcendental Meditation on cardiovascular stress response. *Journal of Clinical Psychology*, Jan 1980, 36(1):291-295.

Raghuraj, P., A. G. Ramakrishnan, H. R. Nagendra, and S. Telles. Effect of two selected yogic breathing techniques on heart rate variability. *Indian Journal of Physiology and Pharmacology*, Oct 1998, 42(4):467-472. (Breathing techniques: kapalabhati and alternate nostril breathing.)

Rai, Lajpat. *Yoga Therapy for Diabetes, Hypertension and Cardiovascular Diseases*. Haryana, India: Anubhav Rai Publications. Email: Irai@ndf.vsnl.net.in..

Rajan, Gayatri. Easing stress heals the heart: Beat back heart-attack-causing stress and anger with meditation, breath control and biofeedback training at Dr. Bhat's Cybernetix Institute. *Hinduism Today*, May/Jun 2001, pp. 58-59.

On K. Naras Bhat, M.D., and Kusum Bhat's Cybernetix Medical Institute in Concord, California, where Dr. Bhat has developed a Heart Saver Program that uses a synthesis of ancient Vedic wisdom, metaphysics, Yoga, the Chinese philosophy of yin and yang, and modern biofeedback devices.

Rajesh, M. Yoga therapy for cancer, back pain, arthritis, headache, diabetes, and IHD. Vivekananda Kendra Yoga Research Foundation, 1991.

_____. Integrated approach of yoga therapy for cancer, IHD, back pain, arthritis & diabetes mellitus. Bangalore, India: Vivekananda Yoga Kendra Prakashana, 1992.

Raju, P. S., K. V. Prasad, R. Y. Venkata, K. J. Murthy, and M. V. Reddy. Influence of intensive yoga training on physiological changes in 6 adult women: a case report. *J Altern Complement Med*, Fall 1997, 3(3):291-295.

_____, et al. Effect of yoga on exercise tolerance in normal healthy volunteers. *Indian J Physiol Pharmacol*, Apr-Jun 1986, 30(2):121-132.

Raman, Dr. Krishna. The cardiovascular system; Cardiovascular disorders; Valvular heart disease; [Asanas and pranayama for] the heart and lungs. In Dr. Krishna Raman, *A Matter of Health: Integration of Yoga & Western Medicine for Prevention & Cure*. Chennai (Madras), India: Eastwest Books (Madras), 1998, pp. 223-234; 362-380; 481; 483. [Includes ischaemic heart disease (IHD), cardiomyopathy, and arrhythmias.]

_____, with S. Suresh. *Yoga & Medical Science: FAQ.* Madras, India: EastWest Books, 2003.

Contains ultrasound scans with commentary on the renal artery in parivrtta janu sirsasana, the popliteral artery in standing poses, the central retinal artery in inverted poses, the ophthalmic artery in inverted poses, the ophthalmic vein in inverted poses, the carotid arteries in inverted poses, the cerebral arteries in inverted poses, and the ascending aorta in back bends

Ramanujachar, T. A., M. S. Krishna Murthy, and K. R. Muralidhar. Efficacy of yoga in coronary artery diseases. In H. R. Nagendra, R. Ragarathna, and S. Telles, *Yoga Research & Applications: Proceedings of the 5th International Conference on Frontiers in Yoga Research and Applications*. Bangalore, Vivekananda Kendra Yoga Research Foundation, 2000, pp. 227-229.

Ranade, Dr. Subhash, and Dr. Mrs. Sunanda Ranade. Cardiac problems; Palpitation. In Dr. Subhash Ranade and Dr. Mrs. Sunanda Ranade, *Ayurveda and Yoga Therapy*. Pune, India: Anmol Prakashan,1995, pp. 29-30; 103-104.

Rao, S. Cardiovascular responses to head-stand posture. *J Al Physiol*, 1963, 18:987-990.

Raub, J. A. Psychophysiologic effects of hatha yoga on musculoskeletal and cardiopulmonary function: A literature review. *Journal of Alternative and Complementary Medicine*, Dec 2002, 8(6):797-812. PMID: 12614533.

Abstract: Yoga has become increasingly popular in Western cultures as a means of exercise and fitness training; however, it is still depicted as trendy as evidenced by an April 2001 *Time* magazine cover story on "The Power of Yoga." There is a need to have

yoga better recognized by the health care community as a complement to conventional medical care. Over the last 10 years, a growing number of research studies have shown that the practice of Hatha Yoga can improve strength and flexibility, and may help control such physiological variables as blood pressure, respiration and heart rate, and metabolic rate to improve overall exercise capacity. This review presents a summary of medically substantiated information about the health benefits of yoga for healthy people and for people compromised by musculoskeletal and cardiopulmonary disease.

Ravishankar, N. S. Heart diseases. In N. S. Ravishankar, *Yoga for Health: Curative Powers of Yogasanas*. New Delhi: Pustak Mahal, 2001, p. 153.

Ray, Kali. *Kali Ray TriYoga: Gentle Cardio* DVD. TriYoga, 2004.

Rypins Reuters Health. Deep breathing can improve fitness. 28 May 1998. Available online:
http://www.healthcentral.com/news/newsfulltext.cfm?id=5439&StoryType=ReutersNews

"Simple breathing techniques can lower respiration rates and help cardiac patients to maintain healthy blood oxygen levels and become more physically fit."

_____. Yoga shown to slow heart disease. 13 Jul 2000. Available online at HealthCentral.com:
http://www.healthcentral.com/news/newsfulltext.cfm?id=37890&StoryType=ReutersNews.

Roldan, E., J. Los, and C. Dostalek. The effects of paced breathing at frequencies between 12 and 288 cpm on heart rate in healthy subjects. *Activ Nerv Sup*, 1983, 25:195.

Routt, Thomas J. Low normal heart and respiration rates in individuals practicing the Transcendental Meditation technique. In David W. Orme-Johnson, and John T. Farrow, eds., *Scientific Research on the Transcendental Meditation Program: Collected Papers, Vol. I.* Germany: Maharishi European Research University Press, 1976, pp. 256-260.

Rzesutko, K. M., D. M. Jay, W. J. Picconatto, M. Stuart, and R. E. Nelson. Heart rate and perceived exertion response during power yoga asanas. *Medicine & Science in Sports & Exercise*, May 2002, 34(5) Supplement:S259.

Abstract: Power yoga is a modernized form of Ashtanga Vinyasa yoga [and] has been suggested as a form of aerobic conditioning. Purpose: The purpose of this study was to determine whether participants in a beginning power yoga class could attain a level of intensity to achieve ACSM recommended target heart rate (THR) levels (55-90% HRmax) for aerobic training. Methods: Thirteen active college aged individuals with no prior yoga experience participated in the study. Participants met for three consecutive 45-minute testing sessions with a 48-hour rest interval between sessions. Each session consisted of six segments: 10 min rest, 5 min deep breathing, 5 min warm-up, 20 min work, 10 min deep-breathing, and 5 min final relaxation. Heart rate and rating of

perceived exertion (RPE) was obtained every 5 minutes. Variables of interested included time to achievement of THR level, consistency of heart rates over the initial 3 power yoga sessions, ability to sustain THR levels, and correlation of perceived exertion (Borg 6-20 scale) to heart rate levels. Results: Time to achievement of THR levels varied among participants but there was no significant difference ($p = .05$) within a participant across sessions (power = .145). The amount of time participants were in the target heart rate zone during the 20 minute work segment varied but there was no significant difference ($p = .05$) within a participant across sessions (power = .48). Heart rate and perceived exertion during the work segment showed poor correlation ($r < 0.58$) in each of the three sessions. Conclusion: The results indicate that power yoga does not consistently provide heart rate intensities that meet ACSM recommendations for aerobic training in beginning power yoga participants. In addition the use of perceived exertion during power yoga does not appear to be an accurate correlation with heart rate.

Sadhakas, The. *Yoga Therapy in Asthma, Diabetes and Heart Disease: Principles, Practice, Scientific Results.* Santa Cruz, Bombay, India: The Yoga Institute, 1987.

Sanghvi, Jitendra S. Reversal of heart disease. Available online: http://www.healthlibrary.com/reading/yod/current/reversal.htm

Sarkar, Shrii Prabhat Ranjan. Heart disease. In Shrii Prabhat Ranjan Sarkar, *Yogic Treatments and Natural Remedies*. 3d ed. Calcutta, India: Ananda Marga Publications, 1993, pp. 85-89.

Satyananda Saraswati, Swami. Siddhasana and the heart. *Yoga,* Mar 1981, 19(3):29-32.

_____. *Yoga and Cardiovascular Management*. 2d ed. Munger, Bihar, India: Bihar School of Yoga, 1984.

Contents: Introduction to Heart Disease, Yogic Pathology, Hypertension, Essential Hypertension and Its Complications, Heart Disease, Cardiac Arrhythmias and the Unstable Pacemaker, Stroke, Cerebral Degeneration, Peripheral Vascular Disease of the Lower Extremities, Vasospastic Diseases of the Microcirculation (Raynaud's Disease), Techniques for Arteriosclerotic Degenerative Diseases, Respiratory Diseases, Cancer, Yogic Methods in Cardiopulmonary Diseases: A Lecture from the Congress on Cardiovascular Diseases, Message to the Doctors

_____. [Yoga nidra for] cardiovascular diseases. In Swami Satyananda, *Yoga Nidra*. 6th ed. Munger, Bihar, India: Yoga Publications Trust, 1998, pp. 208-214.
Contents: The coronary personality, Influence upon cholesterol and lipid levels, Influence of the male hormones, Minor and major heart attacks, Coronary vasospasm, Hypertension, Research studies

Sawada, Y., and A. Steptoe. The effects of brief meditation training on cardiovascual stress responses. *Journal of Psychophysiology*, 1988, 24:249-257.

Schaeffer, Rachel. Yoga for a healthy heart. *Natural Health*, Sep 1999, 29(7):104ff.

Shah, A. H., S. V. Joshi, P. P. Mehrotra, N. Potdar, and H. L. Dhar. Effect of Saral meditation on intelligence, performance and cardiopulmonary functions. Indian Journal of Medical Sciences, Nov 2001, 55(11):604-608. PMID: 12508633.

Abstract: Meditation is a mental exercise to improve mental faculty. Present attempt was to evaluate effect of Saral Meditation on development of intelligence, academic performance and cardiopulmonary functions. Results show significant improvement in development of intelligence and academic performance. There was apparent improvement in confidence and they were free from anxiety. There were also considerable changes in psychomotor ability and cardiopulmonary functions, however result was not significant.

Schatz, Mary Pullig, M.D. Yoga, circulation and imagery. *Yoga Journal*, Jan/Feb 1987.

Schell, F.J., B. Allolio, and O. W. Schonecke. Physiological and psychological effects of Hatha-Yoga exercise in healthy women. *Int J Psychosom*, 1994, 41(1-4):46-52.

Scherwitz, Larry, and Dean Ornish. The impact of major lifestyle changes on coronary stenosis, CHD risk factors, and psychological status: Results from the San Francisco lifestyle heart trial. *Homeostasis*, 1994, 35:4-5.

Schmidt, Thomas. Most of the stress we generate ourselves . . . *Bindu*, 2001, no. 14, pp. 4-7.

Professor Thomas Schmidt, medical college of Hanover, interviews Larry Scherwitz, director of the Institute of Preventive Medicine in Sausalito, California, at a seminar at the AHG-clinic, Schweriner See, Germany, on the effects of Yoga asanas, breathing techniques, deep relaxation, meditation, and visualization in the San Francisco Lifestyle Heart Trial.

Larry Scherwitz: "We have shown in study after study that the more [participants] practice the yoga exercises, the lower the cholesterol goes, independent of diet. The hostility diminishes too, and the exercise tolerance increases, even when the exercise level is kept the same, but with more yoga. So there's both psychological and physical benefits from the yoga—plus the opening of the arteries . . . We've never seen a patient get a reversal of disease who didn't do yoga. So our results suggest that it's a critical component to getting reversal . . . If patients just exercise a little, follow a low fat diet and take their medication, they still get a progression of the disease over a five year period. But if they do all of these things, and also do an hour of yoga daily, they can stop the disease from progressing. And if they do more, if they do an hour and a half of yoga, and follow the diet and exercise and come to the [support] groups, they can actually reverse the blockages so that the arteries open up. But the program must be intensive for them to get a reversal of the heart disease."

_____, A. Wijga, A. Von Zur Muhlen, G. Brabant, and T. O. Wagner. Changes in cardiovascular risk factors and hormones during a comprehensive residential three month kriya yoga training and vegetarian nutrition. *Acta Physiologica Scandinavia Suppl*, 1997, 640:158-162.

The following review of this study appears in an article by Ralph La Forge entitled "Spotlight on Yoga" in the May 2001 issue of *IDEA Health and Fitness Source* (http://www.findarticles.com/cf_0/m0BTW/5_19/74886169/p1/article.jhtml?term=yoga):

Study: Researchers at Hannover Medical University in Hannover, Germany, investigated some of the effects of a comprehensive, residential three-month kriya yoga training program on cardiovascular risk factors in 106 healthy adults (58 men and 48 women ages 18-64 years, mean age = 29.6 years). Kriya yoga is an advanced tantric meditation process combining physical and mental techniques; sessions last four hours or longer.

The yoga program, which took place at the Scandinavian Yoga and Meditation School in Ha, Sweden, consisted of three parts: During the first month, subjects practiced traditional yoga (daily hatha yoga exercises, breathing techniques, deep relaxation and meditation). In the second month, they learned kriya yoga. In the final month, they practiced kriya yoga daily, along with other yoga techniques and advanced meditations. Practical work in the school's kitchen, garden, fields and woods constituted an essential part of the training. Throughout the program, participants adhered to a low-fat (23% fat) vegetarian diet with no alcohol or caffeine. Pre- and postlaboratory assessments included blood lipids and lipoproteins, complete blood counts, fibrinogen (a plasma protein that contributes to the formation of blood clots), urinary and serum hormone levels, stress reactivity and blood pressure. The subjects were compared to control groups living their normal lives in Hannover; subjects and controls were matched for age, gender and respective initial risk factor levels.

The subjects lost an average of 5.7 kilograms and reduced their body mass index (BMI) by 1.88. Men experienced significant reductions in total serum cholesterol (from 181 to 166 milligrams per deciliter [mg/dl]), LDL cholesterol (from 117 to 102 mg/dl) and LDL-to-HDL ratio (from 2.7 to 2.2) (p [less than] 0.001 in each category). Reductions in these categories were not significant for women, whose initial levels were lower than the men's. HDL cholesterol did not change significantly in men or women. In the 15 participants whose HDL was initially [less than] 35 mg/dl, however, HDL did increase significantly (from 30 to 40 mg/dl, p [less than] 0.001).

Compared to the matched controls, male and female yoga participants had, after three months, significantly reduced their fibrinogen levels (decreasing the risk of blood clots) (p = 0.04). Blood pressure and heart rate dropped significantly during the course, with blood pressure improvements being more pronounced (decreasing from 150/82 to 123/69) in those with initial systolic blood pressure levels [greater than or equal to] 140 millimeters of mercury (both p [lesser than] 0.000 1). Serum testosterone levels and urinary excretions of adrenaline, noradrenaline, dopamine and aldosterone all fell significantly in the study group compared to the control group. Schmidt and his fellow

researchers concluded that commitment to intensive yoga therapy can significantly reduce cardiovascular risk factors, especially in individuals with increased risk factor levels, such as elevated BMI, cholesterol, blood pressure and fibrinogen.

Comments: The results of this study were not entirely unexpected considering the intensive and residential nature of the intervention. Nonetheless, reductions in total cholesterol, LDL cholesterol and blood pressure were substantial. Such clinical results rival those attained by many drugs prescribed for lowering lipid and blood pressure levels. The challenge for fitness and health promotion professionals as lifestyle-change agents is knowing how to implement effective strategies to foster lifelong behavior change. Finally, it is noteworthy that, as was the case in this program, yoga therapy is often far more comprehensive than mere exercise poses.

Schneider, Robert H., Charles N. Alexander, Frank Staggers, Maxwell Rainforth, John W. Salerno, Arthur Hartz, Stephen Arndt, Vernon A. Barnes, and Sanford I. Nidich. Long-term effects of stress reduction on mortality in persons =55 years of age with systemic hypertension. *The American Journal of Cardiology,* 1 May 2005, 95(9):1060-1064. Address for reprints: Robert H. Schneider, MD, Institute for Natural Medicine and Prevention, Maharishi University of Management, 2100 Mansion Drive, Maharishi Vedic City, Iowa 52556.

Abstract: Psychosocial stress contributes to high blood pressure and subsequent cardiovascular morbidity and mortality. Previous controlled studies have associated decreasing stress with the Transcendental Meditation (TM) program with lower blood pressure. The objective of the present study was to evaluate, over the long term, all-cause and cause-specific mortality in older subjects who had high blood pressure and who participated in randomized controlled trials that included the TM program and other behavioral stress-decreasing interventions. Patient data were pooled from 2 published randomized controlled trials that compared TM, other behavioral interventions, and usual therapy for high blood pressure. There were 202 subjects, including 77 whites (mean age 81 years) and 125 African-American (mean age 66 years) men and women. In these studies, average baseline blood pressure was in the prehypertensive or stage I hypertension range. Follow-up of vital status and cause of death over a maximum of 18.8 years was determined from the National Death Index. Survival analysis was used to compare intervention groups on mortality rates after adjusting for study location. Mean follow-up was 7.6 ± 3.5 years. Compared with combined controls, the TM group showed a 23% decrease in the primary outcome of all-cause mortality after maximum follow-up (relative risk 0.77, $p = 0.039$). Secondary analyses showed a 30% decrease in the rate of cardiovascular mortality (relative risk 0.70, $p = 0.045$) and a 49% decrease in the rate of mortality due to cancer (relative risk 0.49, $p = 0.16$) in the TM group compared with combined controls. These results suggest that a specific stress-decreasing approach used in the prevention and control of high blood pressure, such as the TM program, may contribute to decreased mortality from all causes and cardiovascular disease in older subjects who have systemic hypertension.

Problems with this study as reported by Judy Foreman, "Does meditation offer any health benefits?" *The Boston Globe*, 3 May 2005: "The study, conducted by Dr. Robert H. Schneider, director of the Institute for Natural Medicine and Prevention at the Maharishi University of Management in Fairfield, Iowa, pooled data on 202 mildly hypertensive people from two previous, randomized, controlled studies published in 1989 and 1995. Those studies, said Schneider, showed that Transcendental Meditation, a form of meditation in which a person is given a 'mantra' by a teacher and trained to use the technique to quiet the mind, lowered blood pressure after three to four months if done for 20 minutes twice a day.

"In 2001, Schneider's team looked at death records from the National Center for Health Statistics for the participants in these studies, who were interviewed an average of 7.6 years earlier. The researchers found the participants were more likely to be alive if they had practiced TM in the original studies. But—and it is a huge 'but'—the samples were quite small and researchers had no way of knowing whether the meditators kept meditating after the initial studies."

_____, S. I. Nidich, and J. W. Salerno. The Transcendental Meditation program: Reducing the risk of heart disease and mortality and improving quality of life in African Americans. *Ethnicity and Disease*, Winter 2001, 11(1):159-160. PMID: 11289239.

_____, S. I. Nidich, and J. W. Salerno, H. M. Sharma, C. E. Robinson, R. J. Nidich, and C. N. Alexander. Lower lipid peroxide levels in practitioners of the Transcendental Meditation program. Psychosomatic Medicine, Jan-Feb 1998, 60(1):38-41. Author email: rschneid@mum.edu. PMID: 9492237.

Abstract: OBJECTIVE: Oxidative stress or free radical activity may contribute to the pathophysiology of atherosclerosis and other chronic diseases associated with aging. Because psychosocial stress has been shown to increase oxidative stress, we conducted an exploratory study to investigate the effects of stress reduction with the Transcendental Meditation program on serum lipid peroxide levels in elderly subjects. METHOD: Forty-one normally healthy subjects (aged 56 to 74 years, average 67 years) were recruited from the same Midwest city. Eighteen were long-term practitioners of the TM program (average 16.5 years). Twenty-three controls were not practicing a formal stress management technique. Venous blood samples were analyzed for lipid peroxides by the TBARS assay. A dietary questionnaire was used to assess fat intake, red meat consumption, antioxidant vitamin supplementation, and smoking. Differences between groups and subgroups were analyzed by t test, and correlations. RESULTS: Significantly lower serum levels of lipid peroxides were found in the TM practitioners compared with controls (-15%, $p = .026$). No significant differences were found between groups on smoking, fat intake, or vitamin supplementation. TM practitioners also had lower red meat consumption but matched subgroup analysis and partial correlations did not confirm a relationship between red meat intake and lipid peroxide levels. CONCLUSIONS: These preliminary findings suggest that lower serum lipid peroxide levels may be associated with stress reduction using the Transcendental Meditation technique. Prospective

controlled trials are needed to confirm that this effect is because of TM practice rather than other lifestyle factors, such as diet.

Sengupta, Surajit. The role of yoga in the management of cardiovascular disease. *Twin Cities Wellness*, 11 Feb 1998. Available online: http://www.tcwellness.com/archives/1998wel/february/feb11art.html.

Shah, Dr. J. T. Angina; Cardiac arrhythmias. In Dr. J. T. Shah, *Therapeutic Yoga*. Mumbai, India: Vakils, Feffer and Simons, 1999, pp. xix, 30-31, 94-99; 94-95, 98-99, 102-103.

Shah, V. V. Yoga, mind and body. *Heart Care*, Oct-Dec 1974.

Shannahoff-Khalsa, D.S., and B. Kennedy. The effects of unilateral forced nostril breathing on the heart. *International Journal of Neuroscience*, Nov 1993, 73(1-2):47-60. PMID: 8132418.

Abstract: Three experiments are described that employ impedance cardiography to monitor the effects of unilateral forced nostril breathing (UFNB) on the heart. Experiment 1 includes 7 subjects (4 males, 3 females) with a respiratory rate of 6 breaths/min (BPM). Experiment 2 includes 16 trials using one subject to examine the intraindividual variability, at 6 BPM. Experiment 3 includes 10 trials with the same subject in experiment 2, but with a respiratory rate of 2-3 breaths/s. This rapid rate of respiration is a yogic breathing technique called "b reath of fire" or "kapalabhatti" and employs a very shallow but rapid breath in which the abdominal region acts like a bellows. All 3 experiments demonstrated that right UFNB increases heart rate (HR) compared to left. Experiment 1 gave 7 negative slopes, or lowering in HR with left nostril breathing and 7 positive slopes, or increases in HR with right nostril breathing, $p = .001$. The second and third experiments showed differences in HR means in which right UFNB increases HR more than left, $p = .013$, $p = .001$, respectively. In experiment 2 stroke volume was higher with left UFNB, $p = .045$, compensating for lower HR. Left UFNB increased end diastolic volume as measured in both experiments 1 and 2, $p = .006$, $p = .001$, respectively. These results demonstrate a unique unilateral effect on sympathetic stimulation of the heart that may have therapeutic value.

Sharma, S. K., and Balmukand Singh. Heart disease. In S. K. Sharma and Balmukand Singh, *Yoga: A Guide to Healthy Living*. New York: Barnes & Noble Books, 1998, pp. 72-73.

Shibad, Shaila. Rejuvenating the aged with self program. In H. R. Nagendra, R. Ragarathna, and S. Telles, *Yoga Research & Applications: Proceedings of the 5th International Conference on Frontiers in Yoga Research and Applications.* Bangalore, Vivekananda Kendra Yoga Research Foundation, 2000, pp. 172-174.

Studied “whether addition of a SELF program of yoga to the Dean Ornish Programme for Reversing Heart Disease could give any additional benefit in patients with heart disease.”

Shivananda Saraswati, Srimat Swami. Angina pectoris; Coronary thrombosis; Heart disease. In Srimat Swami Shivananda Saraswati, *Yogic Therapy or Yogic Way to Cure Diseases*. 7th ed. Umachal Series No. 10. Guwahati, Assam/Calcutta, India: Umachal Prakashani, 1994, pp. 72-73; 117-123; 201-209.

Shrikrishna. Comprehensive approach for the treatment of the cardiac patients through yoga. *Yoga-Mimamsa*, 1990, 29(3):33-42.

Shukla, S. B., I. D. Saxena, A. Kumar, and Rajani Shukla. Is pranayama a cardiac exercise as well? *Journal Res Ind Med Yoga and Homeo*, 1979, 14(3-4):146-148.

_____, et al. A study of cardiac response to breath holding in man elaborating the role of thoracic parieties. *Indian Heart Journal*, 1979, 31:73-77.

Simic, Vesela. Sweet forgiveness: Stanford University researcher Fred Luskin's studies on the science of forgiveness show how letting go can free your heart. *Yoga Journal*, Nov 2002, pp. 77-80.

Sinha, B., U. S. Ray, A. Pathak, and W. Selvamurthy. Energy cost and cardiorespiratory changes during the practice of Surya Namaskar. *Indian Journal of Physiology and Pharmacology*, Apr 2004, 48(2):184-190. PMID: 15521557.

Summary: The present study was undertaken to observe the energy cost and different cardiorespiratory changes during the practice of *sûrya-namaskara*. Twenty-one male volunteers from the Indian Army practiced selected yogic exercises six days a week for three months. The practice schedule consisted of Hatha-Yoga *âsanas* (28 min), *prânâyâma* (10.5 min), and meditation (5 min). Subjects first practiced *kapâla-bhâti prânâyâma* for 2 min, then *yoga-mudrâ* for 2 min; after that they rested until oxygen consumption and heart rate (HR) came to resting value. Subjects subsequently performed SN for 3 min 40 sec on average. After three months of training, subjects performed the entire yogic practice schedule in the laboratory, and measurements were taken. Their pulmonary ventilation, carbon dioxide output, oxygen consumption, HR, and other cardiorespiratory parameters were measured during the actual practice of SN. Oxygen consumption was highest in the eighth posture (1.22+/-0.073 1 min(-1)) and lowest in the first posture (0.35+/-0.02 1 min(-1)). Total energy cost throughout the practice of SN was 13.91 kcal and at an average of 3.79 kcal/min. During practice, the highest HR was 101+/-13.5 bpm. As an aerobic exercise SN seems to be ideal, as it involves both static stretching and the slow dynamic component of exercise with optimal stress on the cardiorespiratory system.

Sinha, Phulgenda. Heart ailments and high blood pressure. In Dr. Phulgenda Sinha, *Yogic Cure for Common Diseases*. Rev., enlarged ed. New Delhi, India: Orient Paperbacks, 1980, pp. 180-192.

Sivasankaran, Satish. The effect of a six-week yoga training and meditation program on endothelial function. American Heart Association Scientific Sessions 2004, New Orleans,

7-10 Nov, 2004. With additional input by Gerald F. Fletcher, M.D., Mayo Clinic Jacksonville, Florida.

"Reported by Peggy Peck, WedMD Medical News, in article "Yoga Gets Heart Health: Yoga and Meditation 3 Times a Week Improves Heart Disease Risk," 8 Nov 2004. Article available online: http://my.webmd.com/content/article/96/103877.htm.

"Stretching may do more than make you limber, according to new research from Yale University School of Medicine. Findings show that people who practice yoga and meditation at least three times a week may reduce their blood pressure, pulse and—most importantly—their risk of heart disease.

"Moreover, yoga improves heart health in both healthy individuals and those with diagnosed heart disease, says Satish Sivasankaran, M.D., who conducted the study while training at Yale. He says that volunteers taking a six-week yoga-meditation program improved blood vessel function by 17%. Blood vessel function, also called endothelial function, is the way vessels contract and expand to aid blood flow and is a measure of healthy vessel function. However, study participants who had heart disease had close to a 70% improvement in endothelial function.

"Endothelial function is an important indicator of atherosclerosis because as the disease and plaque build-up progresses, the blood vessels become less supple and less able to constrict and expand.

"'Stress is known to increase the risk of coronary events. Both anxiety and type A behavior have been associated with coronary diseases,' Sivasankaran, who is now a cardiology fellow at the Lahey Clinic in Burlington, Mass., tells WebMD. Yoga and meditation, on the other hand, are often recommended as a way to relieve stress.

"The study, which was presented during the opening day of the American Heart Association's 2004 Scientific Sessions here, is the first to look at the way blood vessels respond to stress.

"'The endothelial function improved in the total cohort of patients and was most dramatic in patients already diagnosed with heart disease,' he explains.

"And, it doesn't take years of lotus positions and meditation to see improvement—the study volunteers had measurable improvement in just six weeks, he says. The yoga and meditation program included 40 minutes of postural yoga, 20 minutes of deep relaxation, 15 minutes of yoga breathing, and 15 minutes of meditation.

"The study enrolled 33 patients, 30% of whom had heart disease. The study required them to practice yoga and meditation for an hour and a half at least three times a week. More than 60% of the volunteers were men and the average age of the study participants was 55.

"The researchers monitored blood pressure, pulse, body mass index (BMI, an indirect measure of body fat used to measure weight), and cholesterol levels at the beginning of the study and again after six weeks.

"The researchers used an ultrasound to measure the blood flow in an artery of the arm, he explains.

Yoga Improves Blood Pressure

"At the beginning of the study the average blood pressure was 130/79 mmHg. The American Heart Association says that a normal blood pressure reading is 120/80 mmHg. After six weeks the average blood pressure reading was 125/74 mmHg, which was a significant decrease with yoga and meditation classes. The volunteers also had a modest reduction in BMI—from 29 to 28, and they 'had an average reduction in pulse rate of nine beats per minute,' he says.

"While people with heart disease had the biggest improvement in blood vessel function, that improvement 'was independent of any improvements in blood pressure,' he says. And after six weeks it was the healthy patients who posted the biggest improvements in blood pressure, pulse rate, and BMI.

"'Even with a small number of patients for a short period of time there was a benefit of yoga and meditation seen in people with heart disease,' he says. He says, however, that the researchers don't know the mechanism involved in that benefit, which means that more study is needed.

"Gerald F. Fletcher, MD, a cardiovascular disease specialist at the Mayo Clinic Florida in Jacksonville, tells WebMD that 'it is probably exercise. There are several studies that suggest that exercise—any kind of exercise—improves oxygen consumption, which improves endothelial function.' Fletcher, who was not involved in the study, is a spokesman for the AHA.

"'I'm not sure that meditation has a specific benefit, but if combining meditation with exercise will get people to exercise, then I'm all for it. But the most important message is that exercise works,' Fletcher says."

Snyder, Bill. The power within. *The Tennessean*, Living Section, June 23, 1998, 12(122). [On Yoga and cardiac rehab.]

Sparrowe, Linda, and Patricia Walden. Strengthening your heart. In Linda Sparrowe and Patricia Walden, *The Woman's Book of Yoga & Health: A Lifelong Guide to Wellness*. Boston: Shambhala Publications, 2002, pp. 342-353.

Srivastava, Niraj. Effect of hypoxia inducing yogic exercises on cardiovascular parameters. Thesis for Doctor of Medicine (Physiology), BRD Medical College, Gorakphur, India, 2003. (On CD.) Author email: niraj1000@rediffmail.com.

Keeping in view the frequency of hypertension-induced cardiovascular incapacitation in a wide range of the population, the present study evaluated some of the beneficial effects of yogic practices on cardiovascular/respiratory parameters, viz., blood pressure, heart rate, electrocardiogram, and various pulmonary functions. Since in some earlier studies yogic practices have been shown to reduce not only blood pressure levels but also mitigate "electrocardiographic heterogenicity," the present study assessed the overall influence of yogic practices on cardiovascular and respiratory parameters in normal human subjects.

Stancák, A., Jr., M. Kuna, P. Novák, M. A. Srinivasan, C. Dostálek, and S. Vishnudevananda. Observations on respiratory and cardiovascular rhythmicities during yogic high-frequency respiration. *Physiol Res.*, 1991, 40(3):345-354.

_____, M. Kuna, Srinivasan, S. Vishnudevananda, and C. Dostalek. Kapalabhati: Yogic cleansing exercise. I. Cardiovascular and respiratory changes. *Homeost Health Dis*, Oct 1991, 33(3):126-34.

STATISTICS. Yoga Biomedical Trust 1983-84 survey of Yoga practitioners: number of heart disease cases: 50, percent claiming benefits from Yoga: 94%.

Mutual of Omaha is reported to have saved $7 million in three years by paying to send 507 policyholders through Dean Ornish's heart disease reversal program. (Source: http://www-camra.ucdavis.edu/books.html)

U.S. Centers for Disease Control and Prevention. Trends in ischemic heart disease deaths—United States, 1990–1994. *Morbidity and Mortality, Weekly Report*, 1997, 46:146-150.

Steinberg, Lois. Basic heart sequence. In Lois Steinberg, *Iyengar Yoga Therapeutics*. Champaign-Urbana, Ill.: BKS Iyengar Yoga Institute of Champaign-Urbana, pp. 25-32.

Stell, Laura. Cardiac Yoga teacher training. *Massachusetts New England Yoga Alliance Newsletter*, Fall 1998, p. 4-5. [Reviews Mala Cunningham's Cardiac Yoga teacher training program.]

Stiles, M. Tom. Yoga therapy for shoulders. *Yoga International*, Aug/Sep 1996, pp. 77-80. [See case study on "George," who is referred for Yoga therapy due to heart disease.]

Stockman, Paula. Strengthening my heart. Article available online: http://www.sunandmoonstudio.com/strengthening.html.

On the heart *cakra*.

Subramanium, A. S. Sensitiveness: The key to a successful yoga therapist. *Yoga Rahasya*, 2002, 9(1):24-27.

Sensitiveness in this article refers to the "controlled increase of intensity" by the Yoga therapist. Clients must be challenged, not appeased, in order to help them recover.

The author is a heart patient who received Yoga therapy from B. K. S. Iyengar.

Sudsuang, R., V. Chentanez, and K. Veluvan. Effect of Buddhist meditation on serum cortisol and total protein levels, blood pressure, pulse rate, lung volume and reaction time. *Physiology and Behavior*, Sep 1991, 50(3):543-548. PMID: 1801007.

Abstract: Serum cortisol and total protein levels, blood pressure, heart rate, lung volume, and reaction time were studied in 52 males 20-25 years of age practicing Dhammakaya Buddhist meditation, and in 30 males of the same age group not practicing meditation. It was found that after meditation, serum cortisol levels were significantly reduced, serum total protein level significantly increased, and systolic pressure, diastolic pressure and pulse rate significantly reduced. Vital capacity, tidal volume and maximal voluntary ventilation were significantly lower after meditation than before. There were also significant decreases in reaction time after meditation practice. The percentage decrease in reaction time during meditation was 22%, while in subjects untrained in meditation, the percentage decrease was only 7%. Results from these studies indicate that practising Dhammakaya Buddhist meditation produces biochemical and physiological changes and reduces the reaction time.

Sukshma Vyayama. Available online: http://www.yogamedicine.com/sukshmavyayama.html.

Swami Vivekananda Yoga Research Foundation. Yoga for Hypertension & Heart Diseases preconference workshop. 10th International Conference on Yoga for Positive Health, Tampa, Florida, 13 Dec 2000.

Tacon, A. M., J. McComb, Y. Caldera, and P. Randolph. Mindfulness meditation, anxiety reduction, and heart disease: a pilot study. *Family Community Health*, Jan-Mar 2003, 26(1):25-33. PMID: 12802125.

Abstract: Heart disease is the leading cause of death among Americans each year, yet the misperception still exists that cardiovascular disease is not a serious health problem for women. Evidence indicates that anxiety contributes to the development of heart disease. The primary purpose of this study was to assess the effectiveness of Kabat-Zinn's mindfulness-based stress reduction program to reduce anxiety in women with heart disease. Anxiety, emotional control, coping styles, and health locus of control were compared in a treatment and control group of women with heart disease. Post-intervention analyses provide initial support for beneficial effects of this program.

Taylor, Louise, and Betty Bryant. The heart meridian; The circulation meridian. In Louise Taylor and Betty Bryant, *Acupressure, Yoga and You*. New York/Tokyo: Japan Publications, 1984, pp. 59-64; 85.

Telles, S., and K. V. Naveen. Yoga for rehabilitation: An overview. *Indian J Med Sci*, Apr 1997, 51(4):123-127.

Telles, S., R. Nagarathna, H. R. Nagendra, and T. Desiraju. Physiological changes in sports teachers following 3 months of training in Yoga. *Indian J Med Sci*, Oct 1993, 47(10):235-238.

Telles, S., and T. Desiraju. Autonomic changes in Brahmakumaris Raja yoga meditation. *Int J Psychophysiol*, Sep 1993, 15(2):147-152.

_____. Heart rate and respiratory changes accompanying yogic conditions of single thought and thoughtless states. *Indian J Physiol Pharmacol*, Oct 1992, 36(4):293-294.

_____. Heart rate alterations in different types of pranayamas. *Indian J Physiol Pharmacol*, Oct 1992, 36(4):287-288.

Thanikacalam, [first name unknown]. Yoga and cardiac health. *The Hindu*.

The 3-month course. Scandinavian Yoga and Meditation School, Haa Course Center, S, 34013 Hamneda, Sweden, voice (from U.S.): 011 46 372 55063. Research conducted since 1985 on the 3-month course (in Kriya Yoga) by Thomas Schmidt, M.D., from The Center of Public Health at the University of Hannover, Germany, has found that the course helps prevent cardiovascular disease, stabilizes blood pressure, decreases the blood content of harmful fats dramatically, and helps students better cope with stress.

Thomas, Andrew P. Yoga and cardiovascular function. *The Journal of The International Association of Yoga Therapists*, 1993, no. 4, pp. 39-41.

Throll, D. A. Transcendental Meditation and progressive relaxation: Their physiological effects. *Journal of Clinical Psychology*, 1982, 38(3):522-530.

Travis, T., C. Kondo, and J. Knott. Heart rate, muscle tension, and alpha production of Transcendental Meditation and relaxation controls. *Biofeedback and Self-Regulation*, 1976, I(4):387-394.

Tulpule, T. H. Cardio-respiratory, metabolic and hormonal changes in middle aged men following yogic exercise. *Maharashtra Med J*, 1978, 25(8):303-308.

_____, and A. T. Tulpule. Yoga: A method of relaxation for rehabilitation after myocardial infarction. *Indian Heart Journal*, 1980, 32(1):1-7.

_____, H. M. Shah, Shantilal J. Shah, and H. K. Haveliwala. Yogic exercises in the management of ischaemic heart disease. *Indian Heart Journal*, Oct 1971, 23(4):259-264.

Udupa, Kaviraja, Madanmohan, Ananda Balayogi Bhavanani, P. Vijyalakshmi, and N. Krishnamurthy. Effect of *pranayam* training on cardiac function in normal young volunteers. *Indian Journal of Physiology and Pharmacology*, Jan 2003, 47 (1):27-33. Article available online: http://www.ijpp.com/vol47_no1_orgn_artcl_1.htm.

Abstract: Systolic tire intervals (STI) are non-invasive and sensitive tests for measuring the ventricular performance. It has been reported that practice of *pranayam* modulates cardiac autonomic status and improves cardio-respiratory functions. Keeping this in view, the present study was designed to determine whether *pranayam* training has any effect on ventricular performance as measured by STI and cardiac autonomic function tests (AFT). Twenty-four school children were randomly divided into two groups of twelve each. Group I (*pranayam* group) subjects were given training in *nadishuddhi, mukh-bhastrika, pranav* and *savitri pranayams* and practised the same for 20 minutes daily for a duration of 3 months. Group II (control group) subjects were not given any *pranayam* training. STI (QS_2, LVET and PEP) and AFT (RRIV and QT/QS_2) were measured in both the groups at the beginning and again at the end of three months study period. *Pranayam* training produced an increase in RRIV and a decrease in QT/QS_2 suggesting an enhanced parasympathetic and blunted sympathetic activity respectively. QS_2, PEP and PEP/LVET increased significantly, whereas LVET was reduced significantly in pranayam group. In contrast, the changes in STI and AFT were much less marked in the control group. Our study shows that three months of *pranayam* training modulates ventricular performance by increasing parasympathetic activity and decreasing sympathetic activity. Further studies on a larger sample size may illustrate the underlying mechanism(s) involved in this alteration.

_____. Stress and the disorders of the heart. In K. N. Udupa, *Stress and Its Management by Yoga*. 2d ed. Delhi, India: Motilal Banarsidass, 1985, pp. 230-242.

_____, R. H. Singh, and R. M. Settiwar. A comparative study of the effect of some individual yogic practices in normal persons. *Indian J Med Res*, 1975, 63:1066-1071.

Van Houten, Peter. *Cardiac Physiology and Medical Therapy for Yoga Teachers, Parts 1 and 2* videotape set. Nevada City, Calif.: Clarity Sound & Light, 2002. 3 hours.

Contents include: anatomy and physiology of the heart and its diseases, how to work with yoga students with cardiac disabilities, and how to work with the medical community as a yoga instructor

Peter Van Houten, M.D., is a family physician and practitioner of yoga and meditation for 24 years and an experienced teacher.

Ventura, Marissa J. Yoga may curb heart disease. *IDEA Health and Fitness Source*, Nov 2000. Available online: http://www.findarticles.com/cf_0/m0BTW/10_18/67050226/p1/article.jhtml?term=yoga.

Viceník, K., and J. Motajová. Continuous observing of the heart rhythm changes during Hatha-Yoga exercises. *Jógová Cvicení*, 1982, pp. 35-39. [In Czechoslovakian.]

_____. Study of the heart rhythm variability during Hatha Yoga exercises. *Activ Nerv Sup*, 1982, 24:175-176.

Vivier, Erika Helen. Effects of a multimodal approach of Maharishi consciousness-based health care on carotid atherosclerosis: A study of coronary artery disease patients. Ph.D. dissertation. Maharishi University of Management, 2004.

Abstract: Cardiovascular disease (CVD) is still the largest contributor to morbidity and mortality in the world. Over the past 30 years, focus on primary and secondary prevention of cardiovascular disease and its related risk factors have yielded three major prevention strategies-drug therapies, lifestyle modification and stress reduction therapies. Despite this effort, up to 50% of patients with documented CVD have recurrent cardiac events. A new angle that supports further prevention of CVD is needed. Maharishi Consciousness-Based Health Care system, a natural, prevention-oriented system of health, includes 40 modalities for enlivening the "inner intelligence of the body," which are responsible for coordinating diverse physiological systems into an integrated whole. This pilot trial compared effects of four Maharishi Consciousness-Based Health Care modalities to those of usual care on carotid intima-media thickness (IMT) in elderly subjects with documented cardiovascular disease and two to six CVD risk factors. The Maharishi Consciousness-Based Health Care modalities included the Transcendental Meditation program, neuro-physiological integration exercises, dietary and herbal supplement approaches. Usual care included the secondary prevention system offered at the University of Iowa Hospitals and Clinics, which are based on practice guidelines promoted by the American Heart Association. Twenty-eight volunteer subjects were matched on age (mean 72 years), gender and severity of documented CVD. Measures were taken for baseline and nine-month posttest. At baseline the experimental group had significantly higher BMI (30 versus 26), triglycerides (177 mg/dl versus 101 mg/dl, and blood pressure (137 versus 120 mm Hg). They were more often single, and had lower income. Covarying for these baseline differences in major CVD risk factors, the experimental group tended to show a greater decrease in mean common carotid IMT after nine months. (Experimental -0.023 mm, Usual Care +0.041 mm, $p = 0.07$). The IMT regression in the experimental subjects was associated with high compliance. There was a strong correlation between compliance and increases in physical, mental and behavioral strength ($r = 0.47$), as assessed by Maharishi Consciousness-Based Health Care procedures. These findings suggest that enlivening "the body's inner intelligence" could be an effective tool to deal with the current epidemic of cardiovascular disease.

Vyas, Rashmi, and Nirupama Dikshit. Effect of meditation on respiratory system, cardiovascular system and lipid profile. *Indian Journal of Physiology and Pharmacology*, Oct 2002, 46(4):487-491.

Abstract: In this study, respiratory functions, cardiovascular parameters and lipid profile of those practicing Raja Yoga meditation (short and long term meditators) were

compared with those of nonmeditators. Vital capacity, tidal volume and breath holding were significantly higher in short and long term meditators than nonmeditators. Long term meditators has significantly higher vital capacity and expiratory pressure than short and long term meditators than nonmeditators. Long term meditators had significantly higher vital capacity and expiratory pressure than short term meditators. Diastolic blood pressure was significantly lower in both short and long term meditators as compared to nonmeditators. Heart rate was significantly lower in long term meditators than in short term meditators and nonmeditators. Lipid profile showed a significant lowering of serum cholesterol in short and long term meditators as compared to nonmeditators. Lipid profile of short and long term meditators was better than the profile of nonmeditators inspite of similar physical activity. This shows the Raja Yoga meditation provides significant improvements in respiratory functions, cardiovascular parameters and lipid profile.

Wachholtz, Amy B., and Kenneth I. Pargament. Is spirituality a critical ingredient of meditation? Comparing the effects of spiritual meditation, secular meditation, and relaxation on spiritual, psychological, cardiac, and pain outcomes. *Journal of Behavioral Medicine,* 2005.

Abstract: This study compared secular and spiritual forms of meditation to assess the benefits of a spiritual intervention. Participants were taught a meditation or relaxation technique to practice for 20 min a day for two weeks. After two weeks, participants returned to the lab, practiced their technique for 20 min, and placed their hand in a cold-water bath of 2 degrees C for as long as they could endure it. The length of time that individuals kept their hand in the water bath was measured. Pain, anxiety, mood, and the spiritual health were assessed following the two week intervention. Significant interactions occurred (time×group); the Spiritual Meditation group had greater decreases in anxiety and more positive mood, spiritual health, and spiritual experiences than the other two groups. They also tolerated pain almost twice as long as the other two groups.

Walker, Robert. Heart savers. *Yoga Journal,* May/Jun 1998, pp. 102-107. [On Dr. S. V. Karandikar's Iyengar-based work with cardiac patients.]

Wallace, R. K. Physiological effects of transcendental meditation. *Science,* Mar 1970, 167(926):1751-1754.

_____, and H. Benson. The physiology of meditation. *Scientific American,* 1972, 226(2):84-90.

Walton, Kenneth G., Jeremy Z. Fields, Debra K. Levitsky, Dwight A. Harris, Nirmal D. Pugh, and Robert H. Schneider. Lowering cortisol and CVD risk in postmenopausal women: A pilot study using the Transcendental Meditation program. *Annals of the New York Academy of Sciences,* Dec 2004, 1032:211–215. Author email: kwalton@mvm.edu.

Abstract: Unlike younger women, the risk of cardiovascular disease in older women matches or exceeds that of men. Excessive cortisol may play a role in this increased risk.

Here we explore the possibility that the Transcendental Meditation (TM) program may reduce the cortisol response to a metabolic stressor as a way of reducing disease risk in older women. Data from 16 women who were long-term practitioners of transcendental meditation (mean = 23 y) were compared with data from 14 control women matched for age (mean = 75 y, range = 65-92 y). Data on demographics, disease symptoms, and psychological variables were collected, and cortisol response to a metabolic stressor (75 g of glucose, orally) was examined in saliva and urine. Pre-glucose levels of salivary cortisol were identical for the two groups. Post-glucose cortisol rose faster in the controls and was significantly higher than that in the TM women ($P < 1\ 3\ 10–4$). Urinary excretion of cortisol during this period was 3 times higher in controls than in the TM women (2.4 ± 0.17 and 0.83 ± 0.10 µg/h, respectively; $P = 2 \times 10–4$). In addition, the number of months practicing transcendental meditation was inversely correlated with CVD risk factors. Lower cortisol response to metabolic challenge may reflect improved endocrine regulation relevant to the disease-preventing effects of transcendental meditation in older women.

Ward, Susan Winter. Healing hearts with yoga. Article available online: http://www.yogaheart.com/articles_healhearts.htm.

Based on Dean Ornish's program for reversing coronary artery disease.

Warrenburg, S., R. R. Pagano, M. Woods, and M. Hlastala. Oxygen consumption, heart rate, EMG and EEG during progressive muscle relaxation (PMR) and Transcendental Meditation. *Biofeedback & Self-Regulation*, 1977, 2:321.

Warshal, Debra, and J. W. Peterson. Change in cardiac output during Transcendental Meditation as measured by noninvasive impedance plethysmography. Was scheduled for inclusion in *Scientific Research on the Transcendental Meditation Program: Collected Papers, Vol. 2*. Rheinweller, Germany: Maharishi European Research University Press, publication date unknown.

Weller, Stella. Angina pectoris; Heart disease. In Stella Weller, *Yoga Therapy*. London: Thorsons, 1995, pp. 89; 32, 109.

Wenger, M. A., and B. K. Bagchi. Studies of autonomic functions in practitioners of yoga in India. *Behavior Science*, 1961, 6:312-323.

_____, and B. K. Anand. Experiments in India on "voluntary" control of heart and pulse. *Circulation*, 1961, 24:1319-1325.

_____. Voluntary heart and pulse control by yoga methods. *International Journal of Parapsychology*, 1963, 5:25-41.

Wenneberg, R. S. The effects of Transcendental Meditation on ambulatory blood pressure, cardiovascular reactivity, anger, hostility, and platelet aggregation. *Dissertation Abstracts International*, 1994, 55(6-B):2120.

When a yogi stills his heart. *Yoga and Life*, no. 6, p. 26.

On stoppage of the heart and burial feats.

Whitworth, Jery, Ann Burkhardt, and Mehmet Oz. Complementary therapy and cardiac surgery (Cardiac surgery, part 2: Recovery). *Journal of Cardiovascular Nursing*, Jul 1998, 12:87ff. [Yoga is one of the complementary modalities employed.]

Woolfolk, Robert L. Psychophysiological correlates of meditation. *Arch Gen Psychiatry*, Oct 1975, 32(10):1326-1333.

Yee, Rodney. The Palace of the Heart workshop. 6th Annual Yoga Journal Convention, 27-30 Sep 2001, Estes Park, Colorado.

Yocardia. Available online: http://www.yogamedicine.com/Yocardia.htm.

Yoga and your heart. *Yoga and Total Health*, Feb 2005, 59(7): entire issue.

Yoga Biomedical Trust. Heart Disease classes. URL: http://freespace.virgin.net/yogabio.med/ (click on "Yoga Therapy & How to Try It," then click on "Index-Alphabetical," then click on "Heart disease").

Yoga beats heart disease. *Focus on Alternative and Complementary Therapies*, Dec 2001, 6(4).

Yoga fears unfounded, instructor says. *Herald-Dispatch*, 5 Jul 2004.

"Many people who enroll in the Dean Ornish program for Reversing Heart Disease have no idea what to expect when they step into their first yoga class.

"Some have seen pictures of yoga artists in rather inhuman positions and worry that they'll be forced into the same pretzel. Others worry about the meditation aspect of it and fear it involves unknown religious practices.

"Not one of those fears is founded, said Charlene Ballard, certified yoga instructor and stress management instructor for the Dean Ornish program at St. Mary's Medical Center.

"'A lot of people think of yoga and think just of the physical postures, but it's so much more than that,' she said. 'There's a period of deep relaxation, breathing and meditation. Meditation is nothing more than giving your mind something to focus on so that it calms down.

"And yoga 'is not a religion,' she said. 'I always clarify that right at the beginning because that is a concern for some people. It's not a belief system.'

"That being said, yoga is a magnificent stress-management tool, said Ballard, who has been practicing it for more than 30 years.

The Yoga Institute. Caring for your heart - the yoga way. Campus of The Yoga Institute, Santacruz (East), India. URL: http://www.yogainstitute.org/index1.htm.

Workshop designed for cardiologists, other medical practitioners, and anyone else interested in an experiential orientation to yogic concepts and techniques helpful in the treatment of persons suffering from cardiac disorders.

_____. *How to Reverse Heart Disease the Yogic Way: Research, Facts and Programme.* The Yoga Institute, 2004.

Brings the results of a major Yoga lifestyle research project on coronary artery disease. Also provides guidelines daily healthy living.

Yoga-like breathing for heart failure. *Health News*, Jun 1998, 4(7):6.

Yoga voluntarily regulated breathing influences heart rate variability. Submitted by Swami Vivekananda Yoga Research Foundation to *Indian Journal of Physiology and Pharmacology*, 1998.

Yoga, wellness formula for the 21st century. *Body, Mind & Spirit: The Newsletter of Integrative Yoga Therapy*, 1996, 1(8): 1. [See section entitled "The human heart."]

Yogendra, Hansa Jayadeva, and Armaiti N. Desai. *Yoga Daily Planner: Heart Care*. Santacruz East, Bombay, India: The Yoga Institute, 1990.

Yogendra J., H. J. Yogendra, S. Ambardekar, R. D. Lele, S. Shetty, M. Dave, and N. Husein. Beneficial effects of yoga lifestyle on reversibility of ischaemic heart disease: caring heart project of International Board of Yoga. *Journal of the Association of Physicians of India*, Apr 2004, 52:283-289. PMID: 15636328

Abstract: OBJECTIVES: Yoga based lifestyle modifications have been earlier shown to be beneficial in coronary artery disease in a small number of patients. We evaluated the role of lifestyle modification based on Yoga techniques, stress management and dietary modifications in retardation of coronary artery disease. METHODS: This prospective, controlled, open trial included angiographically proven coronary artery disease patients (71 patients in study group and 42 patients in control group). They were assessed clinically, by biochemical parameters, stress myocardial perfusion and function studies and coronary angiography and on psychological parameters. The study group patients were given a family based Yoga Programme which included, control of risk factors, dietary modifications and stress management for a period of one year. The patients were assessed at baseline, at frequent intervals and at the end of one year. RESULTS: At the end of one year of yoga training, statistical significant changes ($P<0.05$) were found in serum total cholesterol (reduction by 23.3% in study group patients as compared to 4.4% in controls); serum LDL cholesterol (reduction of 26% in study group patients as

compared to 2.6% in the control group), regression of disease (43.7% of study group patients v/s 31% control group on MPI and 70.4% of study group v/s 28% of control group on angiography) arrest of progression (46.5% study group v/s 33.3% control group on MPI) and progression (9.9% of study group vs 35.7% of controls on MPI, 29.6% of study group v/s 60.0% of controls on angiography). At the end of the study improvement in anxiety scores was concordant with the improvement seen in the MPI. No untoward effects of the therapy were observed. CONCLUSION: Yoga based lifestyle modifications help in regression of coronary lesions and in improving myocardial perfusion. This is translated into clinical benefits and symptomatic improvement.

Young, Jane. Effects of a yoga intervention in cardiac rehabilitation. [Research is complete; data analysis and writeup in progress as of 9/99.] See contact information in practitioner list below.

Zamarra, John W., Italo Besseghini, and Stephen Wittenberg. The effects of the Transcendental Meditation program on the exercise performance of patients with angina pectoris. In David W. Orme-Johnson, and John T. Farrow, eds., *Scientific Research on the Transcendental Meditation Program: Collected Papers, Vol. I.* Germany: Maharishi European Research University Press, 1976, pp. 270-278.

_____, R. H. Schneider, I. Besseghini, D. K. Robinson, and J. W. Salerno. Usefulness of the transcendental meditation program in the treatment of patients with coronary artery disease. *American Journal of Cardiology*, 15 Apr 1996, 77(10):867-870. PMID: 8623742.

Abstract: Twenty-one patients with documented coronary artery disease were tested at baseline by exercise tolerance testing, and assigned to either stress reduction using the Transcendental Meditation (TM) program or to a wait-list control, After 8 months, the TM group had a 14.7% increase in exercise tolerance, an 11.7% increase in maximal workload, an 18% delay in onset of ST-segment depression, and significant reductions in rate-pressure product at 3 and 6 minutes, and at maximal exercise compared with the control group.

Zysk, Kenneth G. Hrddyota (hrdroga) (chest-pain; angina pectoris?). In Kenneth G. Zysk, *Medicine in the Veda: Religious Healing in the Veda with Translations and Annotations of Medical Hymns from Rgveda and the Atharvaveda and Renderings from the Corresponding Ritual Texts.* 2d ed. Delhi, India: Motilal Banarsidass, 1998, pp. 29-31. Available online from Books of India, editor@oscarindia.com.

Of Related Interest

Allan, R., and S. Scheidt, eds. *Heart and Mind: The Practice of Cardiac Psychology*. Washington, D.C.: American Psychological Association, 1996.

Amos, Deborah. Straight from the heart: Controlling the heart's rhythms can benefit the whole body. 7 Feb 2002. Boulder Creek, Calif.: ABC News.

On the HeartMath technique, which claims to work "better than yoga and meditation because it's more long-lasting. In yoga and similar exercises, it takes some time to reach a relaxed state, and it often evaporates quickly. The HeartMath technique, on the other hand, teaches people how to get to their optimum balance point in a few minutes—sometimes people can even do it in less than a minute. It also teaches them how to sustain that point once they reach it."

As heart patients flock to alternative medicine, hazards may lurk . . . University of Michigan Complementary and Alternative Medicine Research Center. Article available online: http://www.med.umich.edu/camrc/recent_news_heart_patients.html.

". . . Other complementary or alternative medicine (CAM) treatment approaches, from prayer, meditation and yoga to chiropractic and acupuncture sessions, do not pose a specific hazard when combined with conventional heart treatments. Many patients find them to be beneficial at reducing stress or increasing body function. They were also included in the U-M study.

"The survey gave some surprising results. 'Of the 145 patients surveyed, 74 percent reported using some sort of CAM therapy,' says Kline-Rogers. 'Sixty percent of the surveyed patients used supplements, vitamins or herbs, while 43 percent used mind-body or body techniques. Many patients used both.' Even when multivitamins and prayer, two widely used and accepted 'alternative' approaches, were subtracted, 60 percent of all the patients used at least one remaining CAM technique. Most said they used CAM to help them heal or to ease their symptoms.

". . . When asked about their greatest concerns about CAM techniques, a majority of CAM users said they were worried their chosen approaches wouldn't work, or were a waste of money. On average, using prices from local stores and practitioners, patients spent about $10 a month on dietary CAM approaches, and $98 a month on body-based or mind-body approaches performed by practitioners such as chiropractors, acupuncturists, Reiki masters and yoga instructors."

From a 9 Apr 2002 Associated Press release: Dr. Sara Warber, co-director of the University of Michigan Complementary and Alternative Medicine Research Center: "It's not surprising when you think about what went on when boomers were growing up. China was opened up so we learned about acupuncture, the Beatles went to India and we learned about meditation and yoga. There was an open-mindedness to new ideas.

"She expects demand will eventually force insurers to cover these types of services and hospitals to include them in their treatment options.

"Boomers have also shown a willingness to pay for items that aren't covered by insurance, ranging from pillows to special chairs that claim to alleviate stress on joints."

Aviles, Jennifer M., Ellen Whelan, Debra Hernke, Brent A. Williams, Kathleen E. Kenny, W. Michael O'Fallon, and Steven L. Kopecky. Intercessory prayer and cardiovascular disease progression in a coronary care unit population: A randomized controlled trial. *Mayo Clinic Proceedings*, Dec 2001, 76(12):1192-1198. Reviewed in *Alternative Medicine Research Report*, Mar 2002, with commentary by Jay Udani, M.D.

OBJECTIVE: To determine the effect of intercessory prayer, a widely practiced complementary therapy, on cardiovascular disease progression after hospital discharge. PATIENTS AND METHODS: In this randomized controlled trial conducted between 1997 and 1999, a total of 799 coronary care unit patients were randomized at hospital discharge to the intercessory prayer group or to the control group. Intercessory prayer, ie, prayer by 1 or more persons on behalf of another, was administered at least once a week for 26 weeks by 5 intercessors per patient. The primary end point after 26 weeks was any of the following: death, cardiac arrest, rehospitalization for cardiovascular disease, coronary revascularization, or an emergency department visit for cardiovascular disease. Patients were divided into a high-risk group based on the presence of any of 5 risk factors (age = or >70 years, diabetes mellitus, prior myocardial infarction, cerebrovascular disease, or peripheral vascular disease) or a low-risk group (absence of risk factors) for subsequent primary events. RESULTS: At 26 weeks, a primary end point had occurred in 25.6% of the intercessory prayer group and 29.3% of the control group (odds ratio [OR], 0.83 [95% confidence interval (CI), 0.60-1.14]; P=.25). Among high-risk patients, 31.0% in the prayer group vs 33.3% in the control group (OR, 0.90 [95% CI, 0.60-1.34]; P=.60) experienced a primary end point. Among low-risk patients, a primary end point occurred in 17.0% in the prayer group vs 24.1% in the control group (OR, 0.65 [95% CI, 0.20-1.36]; P=.12). CONCLUSIONS: As delivered in this study, intercessory prayer had no significant effect on medical outcomes after hospitalization in a coronary care unit.

Bai, J., H. Lu, J. Zhang, and X. Zhou. Simulation study of the interaction between respiration and the cardiovascular system. *Meth. Inf. Med.*, 1997, 36:261-263.

Belardinelli, Romualdo, Ivana Paolini, Giovanni Cianci, Roberto Piva, Demetrios Georgiou, and Augusto Purcaro. Exercise training intervention after coronary angioplasty: the ETICA trial. *Journal of the American College of Cardiology*, 1 Jun 2001, 37(7):1891-1900. Abstract available online: http://www.cardiosource.com/journal/journal/current?sdid=4884. Article about this study available online: http://www.healthcentral.com/news/newsfulltext.cfm?ID=54425&src=n1.

Conclusion: “Moderate ET improves functional capacity and QOL after PTCA or CS. During the follow-up, trained patients had fewer events and a lower hospital readmission rate than controls, despite an unchanged restenosis rate.”

Benson, H., S. Alexander, and C. Feldman. Decreased premature ventricular contractions through use of the relaxation response in patients with stable ischaemic heart-disease. *The Lancet*, 1975, 380-386.

Blanchard, E. B., L. D. Young, and P. G. McLeod. Awareness of heart activity and self-control of heart rate. *Psychophysiology*, 1972, 9:63-68.

Blumenthal, J. A., et al. Stress management and exercise training in cardiac patients with myocardial ischemia: Effects on prognosis and evaluation of mechanisms. *Archives of Internal Medicine*, 1997, 157:2213-2223.

From an article by David S. Sobel, M.D., entitled "Reducing Stress Reduces Heart Disease" (http://healthy.net/asp/templates/column.asp?PageType=Column&id=199): "[This study] found that relaxation, taming hostility, and helping people change the way they look at life's challenges can reduce their risk of having further heart problems by 75% compared to people given only usual medical care and medications. Reducing stress proved even more beneficial than getting exercise.

"In this study, 107 heart patients were randomly divided into three groups. The control group of forty patients received usual medical care. Another 34 engaged in a vigorous exercise program for 35 minutes three times a week for 16 weeks in addition to their usual medical care. And 33 patients along with their usual care from physicians also participated in a stress management program that included: Weekly group sessions, educational information on heart disease and stress, and muscle relaxation practice and biofeedback. Patients were taught skills to monitor automatic irrational thought patterns and to develop alternative interpretations of situations and thought patterns. They were also instructed how to recognize signs of stress and manage moods such as anger and depression.

"The patients' medical records were tracked for the next two to five years for heart attacks, bypass surgery, and angioplasty. In the control group that received standard medical care, 30% had additional heart trouble compared to 21% in the exercise group (not significantly different from usual care). But the stress management group showed a dramatic difference—only 10% had further heart problems. This translates into roughly one-quarter the cardiac risk compared to those not receiving the additional psychological skill training. The stress management training also resulted in lower levels of psychological distress, less hostility, and fewer episodes of ischemic chest pain. If a new drug produced the same 75% reduction in cardiac risk as stress management, it would be headlines and rapidly prescribed by physicians . . ."

Brener, J., and D. Hothersall. Paced respiration and heart rate control. *Psychophysiology*, 1967, 4:1-6.

Castillo-Richmond, A., R. H. Schneider, C. N. Alexander, R. Cook, H. Myers, S. Nidich, C. Haney, M. Rainforth, and J. Salerno. Effects of stress reduction on carotid atherosclerosis in hypertensive African Americans. *Stroke*, Mar 2000, 31(3):568-573.

Channer, K. S., D. Barrow, R. Barrow, M. Osborne, and G. Ives. Changes in haemodynamic parameters following tai chi chuan and aerobic exercise in patients recovering from acute myocardial infarction. *Postgrad Med J,* 1996, 72(848):349-351.

Charvát, J., P. Dell, and B. Folkow. Mental factors and cardiovascular diseases. *Cardiologia*, 1964, 44:142-141.

Cooper, M. J., and M. M. Aygen. A relaxation technique in the management of hypercholesterolemia. *J Hum Stress*, 1979, pp. 24-27.

Dixhoorn, J. van. Physical training and relaxation therapy in cardiac rehabilitation assessed through a composite criterion for training outcome. *American Heart Journal*, 1989, 118:545-552.

Doster, J. A., M. B. Harvey, C. Riley, A. Goven, and R. Moorefield. Spirituality and cardiovascular risk. *Journal of Religion and Health*, 2002, 41(1):69-79.

Engel, B. T., and R. A. Chism. Effect of increases and decreases in breathing rate on heart rate and finger pulse volume. *Psychophysiology*, 1967, 4:83-89.

Friedman, R., P. Myers, S. Krass, and H. Benson. The relaxation response: Use with cardiac patients. In R. Allan and S. Scheidt, eds., *Heart and Mind: The Practice of Cardiac Psychology*. Washington, D.C.: American Psychological Association, 1996, pp. 363-384.

Giardino, Nicholas D., Robb W. Glenny, Soo Borson, and Leighton Chan. Respiratory sinus arrhythmia is associated with efficiency of pulmonary gas exchange in healthy humans. *American Journal of Physiology—Heart and Circulation Physiology*, May 2003, 284(5):H1585-H1591

Abstract: Respiratory sinus arrhythmia (RSA) may be associated with improved efficiency of pulmonary gas exchange by matching ventilation to perfusion within each respiratory cycle. Respiration rate, tidal volume, minute ventilation (E), exhaled carbon dioxide (CO2), oxygen consumption (O2), and heart rate were measured in 10 healthy human volunteers during paced breathing to test the hypothesis that RSA contributes to pulmonary gas exchange efficiency. Cross-spectral analysis of heart rate and respiration was computed to calculate RSA and the coherence and phase between these variables. Pulmonary gas exchange efficiency was measured as the average ventilatory equivalent of CO2 (E/CO2) and O2 (E/O2). Across subjects and paced breathing periods, RSA was significantly associated with CO2 (partial r = 0.53, P = 0.002) and O2 (partial r = 0.49, P = 0.005) exchange efficiency after controlling for the effects of age, respiration rate, tidal volume, and average heart rate. Phase between heart rate and respiration was significantly associated with CO2 exchange efficiency (partial r = 0.40, P = 0.03). These results are consistent with previous studies and further support the theory that RSA may improve the efficiency of pulmonary gas exchange.

Goldner, Diane. Heart matters. *New Age Journal*, May/Jun 2001, pp. 76-81.

"In spiritual traditions, harmony, love and healing are the territory of the heart. Now scientists are finding evidence of these states in our heart rhythms—evidence that suggests this organ may have a profound impact on our health and well-being."

Halámek, Josef, Tomás Kára, Pavel Jurák, Miroslav Soucek, Darrel P. Francis, L. Ceri Davies, Win K. Shen, Andrew J. S. Coats, Miroslav Novák, Zuzana Nováková, Roman Panovský, Jiří Toman, Josef Šumbera, and Virend K. Somers. Variability of phase shift between blood pressure and heart rate fluctuations: A marker of short-term circulation control. *Circulation*, 2003, 108:292. Author email: Josef@isibrno.cz.

Abstract: Background: We postulated that the variability of the phase shift between blood pressure and heart rate fluctuation near the frequency of 0.10 Hz might be useful in assessing autonomic circulatory control. Methods and Results: We tested this hypothesis in 4 groups of subjects: 28 young, healthy individuals; 13 elderly healthy individuals; 25 patients with coronary heart disease; and 19 patients with a planned or implanted cardioverter-defibrillator (ICD recipients). Data from 5 minutes of free breathing and at 2 different, controlled breathing frequencies (0.10 and 0.33 Hz) were used. Clear differences ($P<0.001$) in variability of phase were evident between the ICD recipients and all other groups. Furthermore, at a breathing frequency of 0.10 Hz, differences in baroreflex sensitivity ($P<0.01$) also became evident, even though these differences were not apparent at the 0.33-Hz breathing frequency. Conclusions: The frequency of 0.10 Hz represents a useful and potentially important one for controlled breathing, at which differences in blood pressure-RR interactions become evident. These interactions, whether computed as a variability of phase to define stability of the blood pressure-heart rate interaction or defined as the baroreflex sensitivity to define the gain in heart rate response to blood pressure changes, are significantly different in patients at risk for sudden arrhythmic death. In young versus older healthy individuals, only baroreflex gain is different, with the variability of phase being similar in both groups. These measurements of short-term circulatory control might help in risk stratification for sudden cardiac death.

Harris, W. S., M. Gowda, J. W. Kolb, C. P. Strychacz, J. L. Vacek, P. G. Jones, A. Forker, J. H. O'Keefe, B. D. McCallister. A randomized, controlled trial of the effects of remote, intercessory prayer on outcomes in patients admitted to the coronary care unit. *Archives of Internal Medicine*, 25 Oct 1999, 159(19):2273-2278. Published erratum appears *in Archives of Internal Medicine*, 26 Jun 2000, 160(12):1878. Multiple commentaries on the Harris study also

Haskell, W. L., H. L. Alderman, J. M. Fair, et al. Effects of intensive multiple risk factor reduction on coronary atherosclerosis and clinical cardiac events in men and women with coronary artery disease. The Stanford Coronary Risk Intervention Project (SCRIP). *Circulation*, 1994, 89(3):975-990.

Hattan, Jennifer , Lindy King, and Peter Griffiths. The impact of foot massage and guided relaxation following cardiac surgery: A randomized controlled trial. *Journal of Advanced Nursing*, Jan 2002, 37(2), 199-207.

Abstract: Background: Because of the widely presumed association between heart disease and psychological wellbeing, the use of so-called "complementary" therapies as adjuncts

to conventional treatment modalities have been the subject of considerable debate. The present study arose from an attempt to identify a safe and effective therapeutic intervention to promote wellbeing, which could be practicably delivered by nurses to patients in the postoperative recovery period following coronary artery bypass graft (CABG) surgery. Aim: To investigate the impact of foot massage and guided relaxation on the wellbeing of patients who had undergone CABG surgery. Method: Twenty-five subjects were randomly assigned to either a control or one of two intervention groups. Psychological and physical variables were measured immediately before and after the intervention. A discharge questionnaire was also administered. Results: No significant differences between physiological parameters were found. There was a significant effect of the intervention on the calm scores (ANOVA, P=0.014). Dunnett's multiple comparison showed that this was attributable to increased calm among the massage group. Although not significant the guided relaxation group also reported substantially higher levels of calm than control. There was a clear (nonsignificant) trend across all psychological variables for both foot massage and, to a lesser extent, guided relaxation to improve psychological wellbeing. Both interventions were well received by the subjects. Conclusions: These interventions appear to be effective, noninvasive techniques for promoting psychological wellbeing in this patient group. Further investigation is indicated.

Health World website. Hardening of arteries rampant: All ages showing signs of condition, journal reports. Jul 2001. Article available online: http://healthy.net/asp/templates/news.asp?Id=2730.

"This months issue of *Circulation*, a leading heart journal, published a shocking article looking inside the coronary arteries of more than 200 hearts from healthy donors for heart transplantation. Healthy, that is, before they suffered brain death in auto accidents and other calamities. The findings? You'd better sit down. Of those 13 to 19 years of age, 17 percent had arteriosclerosis, or hardening of their coronary arteries. Of 20- to 29-year-olds, 37 percent had arteriosclerosis. And in those 30 to 39, 60 percent had it. Arteriosclerosis occurred in 71 percent of 40- to 49-year-olds and in 85 percent of people aged 50 and over . . .

"Why do we have this epidemic? Unfortunately, it is largely due to our lifestyle. The causes include tobacco use, obesity, lack of regular physical activity and high-calorie and fat-laden foods. As for exercise, 70 percent of our adult population reported little or no physical activity . . .

To avoid this problem, ". . . stay thin, exercise regularly (such as walking or bike riding), don't use tobacco and eat a low-fat, high- vegetable and high-fruit diet. How many helpings of vegetables and fruit do you need to eat daily? According to a recent study in *The Annals of Internal Medicine*, five to seven helpings per day resulted in a 10 percent decrease in the risk of coronary heart disease. Eight or more helpings per day resulted in more than a 20 percent decrease. Green, leafy vegetables and vitamin C-rich fruits and vegetables were the most helpful . . ."

Humphrey, Reed. Editorial: Tai Chi in cardiac rehabilitation. *Journal of Cardiopulmonary Rehabilitation*, Mar/Apr 2003, 23(2):97-99.

Ivanhoe Broadcast News. Want to stop the rate of your arteries clogging? The answer is simple—exercise. Ivanhoe.com, 8 Jan 2001. (On Finnish study which found that cardiovascular fitness can slow the progression of atherosclerosis in men who already have it.)

_____. Less oxygen during exercise could mean heart problems. Ivanhoe.com, 20 Oct 2003.

"During the first few minutes of exercise, the amount of oxygen per heartbeat increases and continues to rise as the heart carries the oxygen to the blood. A new study shows less oxygen to the body after the first few minutes of exercise could signal heart trouble.

"Researchers from Johns Hopkins studied nearly 100 patients between ages 55 and 75 who had mild hypertension. Researchers measured the patients' heart sizes and performance at rest by using an ultrasound and tissue Doppler imaging. They compared these results with heart performance tests that measured oxygen usage during exercise.

"Results of the study show patients who delivered less oxygen to the body per beat after the first few minutes of exercise had reduced levels of heart function. Researchers say this finding could help doctors follow the progress of patients with problems in the left ventricle. However, they say more research is needed to determine whether oxygen pulse during exercise is a useful screening tool for identifying heart problems."

Jancin, Bruce. Finger-length ratios may predict early MI risk. *Family Practice News*, 15 Jul 15, 31(14).

"A high ratio of the length of the index finger to the length of the ring finger is associated with early acute MI, at least in men. And this trait is present and readily assessable even in early childhood, John Manning, Ph.D., said at WONCA 2001, the congress of the World Organization of Family Doctors . . . There are good data showing that the finger-length ratio is fixed for life in utero, probably by the end of the first trimester. Moreover, the ratio correlates with both in utero and adult testosterone and estrogen levels; the ratio is low—meaning the ring finger is longer than the index finger—when prenatal testosterone is high and estrogen is low. And testosterone, at least in men, is known to protect against MI. Men with a below-average finger-length ratio typically have their first MI at an advanced age, if they have one at all, he explained . . ."

Kreitzer, Mary Jo, and Mariah Snyder. Healing the heart: Integrating complementary therapies and healing practices into the care of cardiovascular patients. *Progress in Cardiovascular Nursing*, Spring 2002, pp. 73-80.

Includes Yoga, meditation, and imagery, among other modalities, and brings a discussion on developing a cardiovascular program that integrates biomedical and complementary approaches.

Lai, J. S., C. Lan, M. K. Wong, and S. H. Teng. Two year trends in cardiorespiratory function among older tai chi chuan practitioners and sedentary subjects. *JAGS*, 1995, 43(11):121-127.

Lan, C., S. Y. Chen, J. S. Lai, and M. K. Wong. The effect of tai chi on cardiorespiratory function in patients with coronary artery bypass surgery. *Med Sci Sports Exerc*, 1999, 31(5): 634-638.

_____, S. Y. Chen, J. S. Lai, and M. K. Wong. Heart rate responses and oxygen consumption during tai chi chuan practice. *American Journal of Chinese Medicine*, 2001, 29(3-4): 403-410.

_____, J. S. Lai, M. K. Wong, and M. L. Yu. Cardiorespiratory function, flexibility and body composition among geriatric tai chi practitioners. *Archive of Physical Medicine and Rehabilitation*, 1996, 77(6):612-616.

Lee, Myeong Soo, Byung Gi Kim, Hwa Jeong Huh, Hoon Ryu, Ho-Sub Lee, and Hun-Taeg Chung. Effect of Qi-training on blood pressure, heart rate and respiration rate. *Clinical Physiology*, May 2000, 20(3):173-6. PMID: 10792409.

Abstract: To examine the physiological effects of Korean traditional Qi-training, we investigated the changes in blood pressure, heart and respiratory rates before, during and after ChunDoSunBup (CDSB) Qi-training. Twelve normal healthy CDSB Qi-trainees (19-37 years old; trained for 1.3 +/- 0.2 years; 9 men and 3 women) volunteered to participate in this study. Heart rate, respiratory rate, systolic blood pressure and rate-pressure product were significantly decreased during Qi-training. From these results, we suggest that CDSB Qi-training has physiological effects that indicate stabilization of cardiovascular system.

Lehrer, Paul M., Evgeny Vaschillo, Bronya Vaschillo, Shou-En Lu, Dwain L. Eckberg, Robert Edelberg, Weichung Joe Shih, Yong Lin, Tom A. Kuusela, Kari U. O. Tahvanainen, and Robert M. Hamer. Heart rate variability biofeedback increases baroreflex gain and peak expiratory flow. *Psychosomatic Medicine*, Sep/Oct 2003, 65:796-805. Author email: Lehrer@umdnj.edu.

OBJECTIVE: We evaluated heart rate variability biofeedback as a method for increasing vagal baroreflex gain and improving pulmonary function among 54 healthy adults.

METHODS: We compared 10 sessions of biofeedback training with an uninstructed control. Cognitive and physiological effects were measured in four of the sessions.

RESULTS: We found acute increases in low-frequency and total spectrum heart rate variability, and in vagal baroreflex gain, correlated with slow breathing during

biofeedback periods. Increased baseline baroreflex gain also occurred *across sessions* in the biofeedback group, *independent* of respiratory changes, and peak expiratory flow increased in this group, independently of cardiovascular changes. Biofeedback was accompanied by fewer adverse relaxation side effects than the control condition.

CONCLUSIONS: Heart rate variability biofeedback had strong long-term influences on resting baroreflex gain and pulmonary function. It should be examined as a method for treating cardiovascular and pulmonary diseases. Also, this study demonstrates neuroplasticity of the baroreflex.

McCraty, Rollin, Mike Atkinson, and William A. Tiller. *Subtle Energies and Energy Medicine Journal*, 1993, 4(3).

Abstract: This work utilizes the measurement of heart rate variability (HRV) as a vehicle to show that continued practice of certain specific techniques involving an intentional shift of focus to the area of the heart, and invoking specific feeling states such as "love" and "appreciation," automatically manifests in increased autonomic nervous system balance. In particular, (1) enhanced balance between the parasympathetic and sympathetic nervous system, (2) a shift of the high frequency and low frequency portions of the HRV power spectra to around 0.1 Hz range, (3) entrainment and frequency portions of the HRV power spectra to around 0.1 Hz frequency, associated with a change in focus of the subject to a different heart feeling state, and (5) the intentional generation of a newly defined internal coherence state (near zero HRV), have all been achieved. These are electrophysiological correlates of certain mental and emotional states occupied by the individual. Three individual subjects plus a group study of twenty subjects are reported on and discussed. From these results, one sees that individuals can intentionally affect their autonomic nervous system balance, and thus, their HRV.

Morris, E. L. The relationship of spirituality to coronary heart disease. *Alternative Therapies in Health and Medicine*, Sep-Oct 2001, 7(5):96-98.Author email: edmorris2000@yahoo.com. PMID: 11565405.

Abstract: Several studies suggest that religious involvement or spiritual well-being may affect health outcomes. This study was designed to investigate whether the scores from a questionnaire measuring spiritual well-being correlated with progression or regression of coronary heart disease as measured with computerized cardiac catheterization data. Participants in Dr. Dean Ornish's Lifestyle Heart Trial were given the "Spiritual Orientation Inventory." A significant difference was found in the spirituality scores between a control group and a research group that practiced daily meditation. The spirituality scores were significantly correlated with the degree of progression or regression of coronary artery obstruction over a 4-year time period. The lowest scores of spiritual well-being had the most progression of coronary obstruction and the highest scores had the most regression. This study suggests that the degree of spiritual well-being may be an important factor in the development of coronary artery disease.

Musselman, Dominique L., and Charles B. Nemeroff. Depression really does hurt your heart: Stress, depression, and cardiovascular disease. In E. A. Mayer and C. B. Saper, eds. *Progress in Brain Research, Vol. 122: The Biological Basis for Mind Body Interactions*. Amsterdam: Elsevier, 2000, pp. 44-59.

Niebauer, J., R. Hambrecht, C. Marburer, et al. Various intensities of leisure time physical activity in patients with coronary artery disease: Effects on cardiorespiratory fitness and progression of coronary atherosclerotic lesions. *Journal of Coll Cardiol*, 1993, 22:468-477.

_____, R. Hambrecht, C. Marburer, et al. Impact of intensive physical exercise and low-fat diet on collateral vessel formation in stable angina pectoris and angiographically confirmed coronary artery disease. *American Journal of Cardiology*, 1995, 76:771-775.

_____, R. Hambrecht, G. Schlierf, et al. Five years of physical exercise and low-fat diet: Effects on progression of coronary artery disease. *Journal of Cardiopulmonary Rehabilitation*, 1995: 15:47-64.

_____, R. Hambrecht, T. Velich, et al. Attenuated progression of coronary artery disease after six years of multifactorial risk intervention: Role of physical exercise. *Circulation*, 1997, 96:2534-2541.

_____, R. Hambrecht, T. Velich, et al. Predictive value of lipid profile for salutary coronary angiographic changes in patients on a low-fat diet and physical exercise program. *American Journal of Cardiology*, 1996, 78:163-167.

Ornish, D. M. *Stress, Diet & Your Heart*. New York: Signet, 1982.

Penninx, Brenda W. J. H., Aartjan T. F. Beekman, Adriaan Honig, Dorly J. H. Deeg, Robert A. Schoevers, Jacques T. M. van Eijk, and Willem van Tilburg. Depression and cardiac mortality. *Archives of General Psychiatry*, Mar 2001, 58(3):221-227.

Powell, K. E., P. D. Thompson, C. J. Caspersen, and J. S. Kendrick. Physical activity and the incidence of coronary heart disease. *Ann Rev Public Health*, 1987, 8:253-287.

***Psychosomatic Medicine*,** Nov/Dec 1999, 61(6), contains several articles on myocardial infarction and psychological state, especially depression and anger. There is an additional article in the Sep/Oct 1999, 61(4), issue on post-myocardial infarction mortality and depression. Additional issues may contain further articles of interest. See the index at the journal website: http://www.psychosomatic.org/index.html.

Reaney, Patricia. Green medicine: Why veggie diet may reduce heart disease, cancer. Reuters, 27 Jun 2001. Article available online: http://more.abcnews.go.com/sections/living/dailynews/vegetables_aspirin010627.html.

"Vegetarians may have a lower risk of heart disease and bowel cancer than meat and fish eaters because of an acid found in fruit and vegetables, Scottish scientists said today.

"Like people taking low-dose aspirin to prevent heart attacks, vegetarians have lots of salicylic acid, aspirin's main anti-inflammatory component, in their blood.
Dr. John Paterson, a chemical pathologist at the Dumfries and Galloway Royal Infirmary in Scotland believes salicylic acid could protect vegetarians from heart disease and cancer just as it protects people taking aspirin . . ."

Reuters Health. Exercise may extend life for chronically ill. 28 May 2001. Available online: http://www.healthcentral.com/news/newsfulltext.cfm?ID=53608&src=n1.

"Adults who suffer from chronic health problems such as high blood pressure or heart disease can lower their short-term risk of death by exercising for at least 30 minutes a week, results of a study suggest."

_____. Exercise training improves angioplasty results. 13 Jun 2001. Article available online:
http://www.healthcentral.com/news/newsfulltext.cfm?ID=54425&src=n1.

_____. CDC expands funding of states' heart programs. Atlanta: Reuters Health, 24 Aug 2001. Article available online:
http://www.healthcentral.com/news/newsfulltext.cfm?ID=57802&src=n1.

"The Centers for Disease Control and Prevention (CDC) announced Wednesday that it will fund heart disease prevention programs in three additional states, increasing the number of states funded to 28.

"An estimated 60 million Americans live with cardiovascular disease, including high blood pressure and high cholesterol. Heart disease is the leading cause of death in the US, and stroke is the third leading cause of death . . ."

Sakakibara, M., and J. Hayano. Effect of slowed respiration on cardiac parasympathetic response to threat. *Psychosomatic Medicine*, 1996, 58:32-37.

Abstract: The present study was designed to examine the effect of voluntarily slowed respiration on the cardiac parasympathetic response to a threat: the anticipation of an electric shock. Thirty healthy college students were randomly assigned to the slow, fast, and nonpaced breathing groups (10 subjects each). Subjects in the slow and fast paced breathing groups regulated their breathing rate to 8 and 30 cpm, respectively, and those in the nonpaced breathing group breathed spontaneously. Immediately after the period of paced or nonpaced breathing for 5 minutes, the subjects were exposed for 2 minutes to the anticipation of an electric shock during breathing paced at 15 cpm. The amplitude of the high frequency (HF) component of the heart rate variability, an index of cardiac parasympathetic tone, significantly decreased during the threat in the fast and nonpaced breathing groups, whereas it was unchanged in the slow paced breathing group. No

significant difference was observed among the three groups in the amplitude of respiration during the threat. Results suggest that a slowed respiration decreases the cardiac parasympathetic withdrawal response to the threat. This study provides a rationale for the therapeutic uses of the slowed respiration maneuver in attenuating the cardiac autonomic responses in patients with anxiety disorder.

_____, S. Takeuchi, and J. Hayano. Effects of relaxation training on cardiac parasympathetic tone. *Psychophysiology*, 1994, 31:223-228. PMID: 8008785.

Abstract: To examine the hypothesis that the relaxation response is associated with an increase in cardiac parasympathetic tone, the frequency components of heart rate variability during relaxation training were investigated in 16 college students. Electrocardiograms and pneumograms were recorded during a 5-min baseline period followed by three successive 5-min sessions of the autogenic training (relaxation) or by the same periods of quiet rest (control), while subjects breathed synchronously with a visual pacemaker (0.25 Hz). Although neither the magnitude nor the frequency of respiration showed a significant difference between relaxation and control, the amplitude of the high-frequency component of heart rate variability increased only during relaxation ($p = .008$). There was no significant difference in the ratio of the low-frequency (0.04-0.15 Hz) to the high-frequency amplitudes. The increased high-frequency amplitude without changes in the respiratory parameters indicates enhanced cardiac parasympathetic tone. Thus, our results support the initial hypothesis of this study. Enhanced cardiac parasympathetic tone may explain an important mechanism underlying the beneficial effect of the relaxation response.

Sane, Rohit M., et al. Case study: An Ayurvedic boon to a failing heart. *Light on Ayurveda*, Summer 2004, 2(4):26-27.

Schneider, D., and R. Leung. Metabolic and cardiorespiratory responses to the performance of wing chun and tai chi chuan exercise. *International Journal of Sports Medicine,* 1991, 12(3):319-323.

Schuler, G., R. Hambrecht, G. Schlierf, et al. Myocardial perfusion and regression of coronary artery disease in patients on a regimen of intensive physical exercise and low fat diet. *Journal Am Coll Cardiol,* 1992, 19:34-42.

_____. Regular physical exercise and low-fat diet: Effects on progression of coronary artery disease. *Circulation*, 1992, 86:1-11.

Sher, L. Type D personality: The heart, stress, and cortisol. QJM Advance Access published online on 8 Apr 2005. Author email: ls2003@columbia.edu.

Abstract: Many studies have demonstrated the role of psychosocial and behavioural risk factors in the aetiology and pathogenesis of cardiovascular disorders. Recently, a new personality construct, the type D or "distressed" personality, has been proposed. Type D behaviour is characterized by the joint tendency to experience negative emotions and to inhibit these emotions while avoiding social contacts with others. The observation that

cardiac patients with type D personality are at increased risk for cardiovascular morbidity and mortality underlines the importance of examining both acute (e.g. major depression) and chronic (e.g. certain personality features) factors in patients at risk for coronary events. Both type D dimensions (negative affectivity and social inhibition) are associated with greater cortisol reactivity to stress. Elevated cortisol may be a mediating factor in the association between type D personality and the increased risk for coronary heart disease and, possibly, other medical disorders. Studies of the effect of age on hypothalamic-pituitary-adrenal (HPA) function in healthy humans have produced inconsistent results. This may relate to a different prevalence of type D individuals in study samples (i.e. some type D individuals may have alterations within the HPA axis that are similar to HPA axis changes in depressed patients). Further studies of the psychological and biological features of type D individuals may help develop treatment approaches to improve the psychological and physical health of individuals with type D personality.

Singh, R. B, D. Pella, K. Otsuka, F. Halberg, and G. Cornelissen. New insights into circadian aspects of health and disease. *Journal of the Association of Physicians of India*, Nov 2002, 50:1416-1425. PMID: 12583475.

Abstract: Early awakening and early to bed as well as good conduct, thought, diet, interpersonal dealings and physical activity have been suggested for healthy life in Ayurveda. Circadian rhythms, coordinated in part by the parietal hypothalamic-pituitary and adrenal mechanisms, have been reported in almost all variables examined thus far, including the circulation. It is possible that all metabolic functions undergo circadian rhythms. It remains to be explored whether these rhythms may be optimized by Ayurvedic practices. The onsets of myocardial ischemia, unstable angina, acute myocardial infarction, sudden cardiac death, and strokes have been reported to exhibit a circadian variation, with increased frequency in the second quarter of the day. An increased physical and mental load caused by an attempt to prepare for the day may be important in triggering acute cardiovascular events. Depending on their timing, meditation (Ayurvedic practice), n-3 fatty acids, coenzyme Q10, beta-blockers and estrogens may have beneficial effects, whereas progestins and mental load may have adverse effects on heart rate and blood pressure variability, which may be expressed by different circadian patterns. Around the clock serial recordings of blood pressure and heart rate during usual activities and lifestyles may be recorded and may be analyzed by computer-implemented curve fitting to assess the about 24-hour (circadian) variation, among other rhythmic, chaotic, and trend components of the time structure (chronome) of these variables. The new disease risk syndrome circadian hyper-amplitude-tension (CHAT), a condition characterized by an excessive circadian amplitude of blood pressure, cannot be ascertained on the basis of single casual blood pressure measurements. The International Chronome Ecological Study of Heart Rate (and blood pressure) Variability in various ethnic groups aims at collecting further evidence regarding the role of blood pressure and heart rate variability in the pathogenesis of cardiovascular events, while also examining any role played by ethnicity and lifestyle-associated factors.

Spina, Robert J., Timothy E. Meyer, Linda R. Peterson, Dennis T. Villareal, Morton R. Rinder, and Ali A. Ehsani. Absence of left ventricular and arterial adaptations to exercise in octogenarians. *Journal of Applied Physiology*, Nov 2004, 97:1654-1659.

Abstract: Recent evidence suggests that octogenarians exhibit attenuated adaptations to training with a small increase in peak O_2 consumption ($\dot{V}_{O2}$) that is mediated by a modest improvement in cardiac output without an increase in arteriovenous O_2 content difference. This study was designed to determine whether diminished increases in peak $\dot{V}_{O2}$ and cardiac output in the octogenarians are associated with absence of left ventricular and arterial adaptations to exercise training. We studied 22 octogenarians (81.9 ± 3.7 yr, mean ± SD) randomly assigned a group that exercised at an intensity of 82.5 ± 5% of peak heart rate for 9 mo and 14 (age 83.1 ± 4.1) assigned to a control group. Peak $\dot{V}_{O2}$ increased 12% in the exercise group but decreased slightly (–7%) in the controls. The exercise group demonstrated significant but small decreases in the heart rate (6%, $P = 0.002$) and the rate-pressure product (9%, $P = 0.004$) during submaximal exercise at an absolute work rate. Training induced no significant changes in the left ventricular size, geometry (wall thickness-to-radius ratio), mass, and function assessed with two-dimensional echocardiography or in arterial stiffness evaluated with applanation tonometry. Data suggest that the absence of cardiac and arterial adaptations may in part account for the limited gain in aerobic capacity in response to training in the octogenarians.

Sroufe, I. A. Effects of depth and rate of breathing on heart rate and heart rate variability. *Psychophysiology*, 1971, 8:648-655.

Taggart, Peter, Peter Sutton, Chris Redfern, Velislav N. Batchvarov, Katerina Hnatkova, Marek Malik, Ursula James, and Avy Joseph. The effect of mental stress on the non-dipolar components of the T wave: Modulation by hypnosis. *Psychosomatic Medicine*, 2005, 67:376-383. Author email: peter.taggart@uclh.org.

Abstract: Objective: Mental or emotional stress-induced ventricular arrhythmias and sudden cardiac death are thought to be mediated by the autonomic nervous system and ischemia. In the absence of ischemia, increased inhomogeneity of repolarization is thought to be important. We tested the hypotheses that in the absence of ischemia, mental stress may modulate repolarization by changing autonomic balance; and mental relaxation induced by hypnosis may offset the potentially adverse effects of stress on the cardiac electrophysiology. Methods: Twelve healthy volunteers (6 male, age 18–35, mean 25 years) experienced a series of different emotions intended to induce a wide range of autonomic response (42 test epochs) on two separate occasions, with and without hypnosis, with continuous electrocardiogram recording. Low- (LF) and HF (high-frequency) heart rate variability was measured and ventricular repolarization was assessed using the relative T-wave residua (proportion of nondipolar components of the T wave) calculated for the T-onset – T peak (TWR-peak T), T peak –T end (TWR-end T), and the whole T wave (TWR). Results: Emotionally induced changes in LF and LF/HF ratio correlated with changes in TWR, e.g., ($R = 0.51$, $p < .001$; $R = 0.59$, $p < .0001$; and $R = 0.59$, $p < .0003$, for LF/HF versus TWR, TWR-Peak T, and TWR-end T,

respectively. Mental relaxation induced by hypnosis increased LF power (1,205 ms2) versus 624 ms2, p < .003 for hypnotized versus nonhypnotized state), HF power (1,619 ms2 versus 572 ms2), p < .0004), and reduced LF/HF ratio (1.0 versus 1.5, p = .052) and was associated with a marked reduction in the changes in repolarization in response to emotion, e.g., 10.7 x 10–6 versus 5.0 x10–6, p < .03 for TWR. Conclusions: a) Mental stress in the absence of ischemia altered repolarization inhomogeneity via change in the autonomic balance. b) Mental relaxation induced by hypnosis greatly reduced the effect of mental stress on repolarization. c) These findings may have implications for arrhythmogenesis.

Tanasescu, M., M. F. Leitzmann, E. B. Rimm, W. C. Willett, M. J. Stampfer, and F. B. Hu. Exercise type and intensity in relation to coronary heart disease in men. *JAMA*, 2002, 288(16):1994-2000.

Taylor-Pilae, R. E. Tai chi as an adjunct to cardiac rehabilitation exercise training. *Journal of Cardiopulmonary Rehabilitation*, Mar/Apr 2003, 23:90-96.

Times News Network. Mantra adds value to cardiac care. 8 Jul 2002. Available online via *The Times of India*: http://timesofindia.indiatimes.com//articleshow.asp?art_id=15303525.

"Dr. Mitchell W. Krucoff, Director, Interventional Device Trials and Ischemia Monitoring Lab, Duke University Medical Center, is in the middle of a project 'MANTRA,' which can change the way cardiologists look at cardiac care.
. . .

"'In 1994, we formed the Monitoring and Actualisation of Noetic Trainings (MANTRA), a project to systematically study the role of spirituality and human interaction in clinical outcomes for patients undergoing cardiac procedures. Noetic therapies include any methods that purport to engage human or divine life force, spirit or energy without the use of a tangible drug,'' he explains.
. . .

"Dr. Krucoff is convinced the power of the spirit and prayer can be leveraged to make medical treatment more efficient. The results of MANTRA are expected in the middle of 2003."

Tuller, David. Stress management may save lives: Study shows increased life expectancy for cardiac patients who learn to unwind. *San Francisco Chronicle*, 22 Jan 2002, p. A2.

Verrier, Richard L., and Murray A. Mittleman. The impact of emotions on the heart. In E. A. Mayer and C. B. Saper, eds. *Progress in Brain Research, Vol. 122: The Biological Basis for Mind Body Interactions*. Amsterdam: Elsevier, 2000, pp. 370-380.

Vogel, John H. K., Steven F. Bolling, Rebecca B. Costello, et al. Integrating complementary medicine into cardiovascular medicine: a report of the American College

of Cardiology Foundation Task Force on Clinical Expert Consensus Documents (Writing Committee to Develop an Expert Consensus Document on Complementary and Integrative Medicine). *Journal of the American College of Cardiology*, 2005, 46(1):184-221.

Westcott, M. R., and J. Huttenloar. Cardiac conditioning: The effects and implications of controlled and uncontrolled respiration. Journal of Experimental Psychology, 1961, 61:353-359.

Wessel, Timothy R., Christopher B. Arant, Marian B. Olson, B. Delia Johnson, Steven E. Reis, Barry L. Sharaf, Leslee J. Shaw, Eileen Handberg, George Sopko, Sheryl F. Kelsey, Carl J. Pepine, and C. Noel Bairey Merz. Relationship of physical fitness vs body mass index with coronary artery disease and cardiovascular events in women. *Journal of the American Medical Association*, 8 Sep 2004, 292(10):1179-1187. Abstract: http://jama.ama-assn.org/cgi/content/abstract/292/10/1179. Full text: http://jama.ama-assn.org/cgi/content/full/292/10/1179.

Conclusions: Among women undergoing coronary angiography for suspected ischemia, higher self-reported physical fitness scores were independently associated with fewer CAD risk factors, less angiographic CAD, and lower risk for adverse CV events. Measures of obesity were not independently associated with these outcomes.

Wulsin, Lawson R., and Bonita M. Singal. Do depressive symptoms increase the risk for the onset of coronary disease? A systematic quantitative review. *Psychosomatic Medicine*, 2003, 65:201-210. Author email: lawson.wulsin@uc.edu.

Abstract: OBJECTIVE: The objectives of this study were to systematically review the recent studies of the contribution of depression to the onset of coronary disease and to estimate the magnitude of the risk posed by depression for onset of coronary disease. METHOD: We searched MEDLINE (1966–2000), PsychInfo (1967–2000), and cross references and conducted informal searches for all community studies of depression symptoms in samples with no clinically apparent heart disease at baseline. From these studies we selected all published cohort studies of 4 years or more follow-up that controlled for other major coronary disease risk factors and reported relative risks (or a comparable measure) of baseline depression for the onset of coronary disease. Following methods for the meta-analysis of epidemiologic studies, we used a random-effects model to estimate the combined overall relative risk. RESULTS: Ten studies met our inclusion criteria. Relative risks ranged from 0.98 to 3.5. Nine studies reported significantly increased risk, including two with mixed results; one study reported no increased risk. The combined overall relative risk of depression for the onset of coronary disease was 1.64 (95% CI = 1.41–1.90). CONCLUSIONS: This quantitative review suggests that depressive symptoms contribute a significant independent risk for the onset of coronary disease, a risk (1.64) that is greater than the risk conferred by passive smoking (1.25) but less than the risk conferred by active smoking (2.5). Future prospective community studies should examine the effect of severity and duration of depressive symptoms and

disorders on the risk for the onset of coronary disease.

Ongoing Research

Amparo Castillo-Richmond, M.D.
Assistant Professor of Maharishi Vedic Medicine and Physiology
Maharishi University of Management
amparo@mum.edu
Tel: 641-472-4600, ext.105
Investigating stress reduction and myocardial ischemia in blacks. Transcendental Meditation based. Funded by NIH (NHLBI).

Dr. Jasmin Diwan and Dr. Chinmay Shah
Department of Physiology
Shree M. P. Shah Medical College
Jamnagar, Gujarat 361008
India
dr_jasmin@rediffmail.com
Planning research on the effect of Yoga on cardiac efficiency. Contacted IAYT 12/19/02.

Medicare Lifestyle Modification Program Demonstration
http://www.hcfa.gov/quality/3q.htm
For more information, contact Debbie Grossblatt (dgrossblatt@hcfa.gov)

From the website: The Health Care Financing Administration (HCFA), Office of Clinical Standards and Quality (OCSQ) is implementing the Medicare Lifestyle Modification Program Demonstration. The demonstration is designed to test the effectiveness of providing payment for cardiovascular lifestyle modification program services to Medicare beneficiaries with moderate to severe coronary artery disease. The treatment outcomes of Medicare beneficiaries who complete the lifestyle modification program will be compared to those of similar patients who receive more traditional services under the Medicare program.

From Debbie Grossblatt: Yoga is part of a package of bundled services that includes a low-fat vegetarian diet, mild aerobic exercise, and group support for those patients volunteering to participate. The package of services is paid for by Medicare under a special payment system and the patient is responsible for a 20% fee unless the participating site has waived the fee for all of the Medicare beneficiaries. There are two providers of care: Lifestyle Advantage (Dr. Dean Ornish's Program for Reversing Heart Disease) and the Mind/Body Medical Institute (Dr. Herbert Benson). We are currently [as of June 2001] in the 21st month of the study with about 30 months remaining Since I had a background in Yoga and knew about the 200-hour approved certification courses, that was included as a requirement to be a teacher. However, there are exceptions. The results of the study will be evaluated by an independent research team to determine the

feasibility and the economic feasibility of both lifestyle programs. The paper is to be ready in 2004.

C. Noel Bairey Merz, M.D.
Cardiology
Cedars-Sinai Medical Center
444 S. San Vicente, #901
Los Angeles, CA 90048
noel.baireymerz@cshs.org
merz@cshs.org
Tel.: 310-423-9660
URL:
http://www.clinicaltrials.gov/ct/gui/c/w2b/show/NCT00010738?order=3&JServSessionIdzone_ct=ixsr67p0u1
Investigating effects of Transcendental Meditation on mechanisms of coronary heart disease. Funded by NIH (NCCAM).

Further details: Recent advances in our understanding of the pathophysiology of acute cardiac events—specifically, identification of the roles that arterial vasomotor dysfunction and autonomic nervous system imbalances play in the pathophysiologic cascade during such acute events—provides a platform for new mechanistic investigation of the interplay of psychosomatic stress and CHD (coronary heart disease). Preliminary evidence further suggests that Complementary and Alternative Medicine (CAM) practices, such as the Transcendental Meditation (TM) technique, can not only reduce stress but also reduce acute cardiac events in patients with CHD. Based on these and related data, we propose a randomized, blinded, controlled study of the effects of one CAM practice, the TM technique, compared to a control group, on the primary outcomes of (1) arterial vasomotor dysfunction (brachial artery reactivity); (2) autonomic nervous system imbalances (heart rate variability); (3) transient myocardial ischemia (ST-segment depression); and (4) the secondary outcomes of psychological stress and quality of life (anger, hostility, anxiety, depression, perceived health, disease-specific symptoms, and life stress/social resources).

Robert H. Schneider
Dean and Chair, College of Maharishi Vedic Medicine
Professor of Maharishi Vedic Medicine and Physiology
Director, Center for Natural Medicine and Prevention
Maharishi University of Management
rschneid@mum.edu
URLs:
http://www.clinicaltrials.gov/ct/gui/c/w2b/show/NCT00010530?order=2&JServSessionIdzone_ct=ixsr67p0u1
http://www.clinicaltrials.gov/ct/gui/c/w2b/show/NCT00010608?order=4&JServSessionIdzone_ct=ixsr67p0u1
Investigating stress reduction and atherosclerotic cardiovascular disease in blacks, stress reduction and cardiovascular disease morbidity and mortality in blacks, stress reduction

and prevention of hypertension in blacks. Transcendental Meditation based. Funded by NIH (NHLM).

Further details 1: Cardiovascular disease (CVD) is the leading cause of death and disability in older African Americans, and accounts for 40% of the disproportionate risk for mortality observed in African Americans compared to white Americans. The majority of CVD patients experience acute cardiac events, many sudden and unexpected, despite conventional treatment of their disease and associated traditional risk factors. The pathophysiologic basis of these cardiac events is not fully established, but substantial evidence indicates that psychosocial stress and the sympathetic nervous system have adverse effects on both vasomotor function and long-term autonomic balance. Recent advances in our understanding of the pathophysiology of acute cardiac events-specifically, the roles that arterial vasomotor dysfunction and sympathetic nervous system imbalance play in the pathophysiology of such acute events-provide a platform for a new mechanistic investigation of the interplay of psychosocial and environmental stress and CVD. Preliminary evidence demonstrating elevated peripheral vasoconstriction due to stress-mediated sympathetic nervous system response in African Americans further suggests that these mechanisms are particularly relevant in this group. We propose to conduct a randomized, blinded, controlled study of the effects of meditation, compared to a control group, on the primary outcomes of (1) arterial vasomotor dysfunction (brachial artery reactivity); (2) autonomic nervous system imbalances (heart rate variability); and (3) the secondary outcomes of transient ambulatory myocardial ischemia (ST segment depression), psychosocial stress, and quality of life in older African Americans with documented CVD. We hypothesize that significant effects on mechanisms associated with practice of meditation will elucidate the known effectiveness of certain CAM techniques as additive/alternative approaches to prevention of acute cardiac events in high risk African American patients. Results of this controlled study will: (a) yield much needed new data regarding the reversal of pathophysiologic mechanisms underlying CVD with CAM meditation and (b) provide mechanism data to complement the Center's ongoing NIH-sponsored trial of this CAM practice on secondary prevention of CVD morbidity and mortality in older high risk African Americans.

Further details 2: Our Center team has previously demonstrated that hypertension can be effectively treated in high risk African Americans with stress reduction using the Transcendental Meditation (TM) program. We have reported clinically significant improvements in CVD risk factors, psychosocial stress, myocardial ischemia, left ventricular mass and mortality rates in this high risk population. Findings from our recently completed, NIH-funded, clinical trial in the prevention of hypertensive heart disease in inner city African Americans indicate that stress reduction significantly regresses atherosclerotic CVD, as assessed by carotid intima-media thickness (IMT), after eight months of intervention in older women as well as in the total sample. These results were comparable to effects of lipid lowering therapies or extensive lifestyle modification. The proposed study will extend these findings by evaluating the effectiveness of CAM meditation in the secondary prevention of atherosclerotic CVD in postmenopausal, older African American women.