“Mind, Prana, sex-energy (Virya), and the subtle desires of the subconscious (Vasanas) are interdependent. Control of any one of these leads to the control of all others. In other words, when one has attained mastery of Prana, one automatically acquires control of mind, sex energy, and subtle desires.

“Pranayama is the control of the vital force through the regulation of breath. It therefore leads to Vasanalaya. In other words, control of the vital force leads to the control of the subtle desires of the subconscious. When the subconscious mind is freed from worldly Vasanas or complexes, one attains the immense powers of the Spirit.”

—Swami Jyotirmayananda

“The peptide-respiratory link is well documented: Virtually any peptide found anywhere else can be found in the respiratory center. This peptide substrate may provide the scientific rationale for the powerful healing effects of consciously controlled breath patterns. Mind doesn’t dominate body; it becomes body. Body and mind are one . . . At this molecular level there really [is] no distinction between the mind and the body.”

—Candace Pert, Molecules of Emotion

Normal respiration rates for an adult person at rest range from 12 to 20 breaths per minute, and on average 6 to 8 liters of air are inhaled per minute. The respiratory rate for children decreases steadily from 25 breaths in the 2nd year to 18 breaths per minute by the 15th year.

NOTE: See also the “Nose” bibliography.


“Easy-to-follow directions in mastering _agni sara_, diaphragmatic breathing, and _asanas_ for relaxation and energy.”


_____________. Your Breath as a Bridge to Penetrate Asana workshop. _Iyengar Yoga Institute of San Francisco_.


“Vanita Panapalia (32), who was admitted to Masina Hospital, Byculla, with 75 per cent burns and a very small chance of survival, has finally recovered after almost 100 days of treatment.

“Her hands still bandaged, she is now able to walk and eat on her own. With a radiant smile, this resident of Akola, praises the doctors and nurses who helped her recover.

“But apart from the treatment at the hospital, Vanita has an unusual do-it-yourself cure up her sleeve. ‘I would perform Pranayama as often as I could manage. It helped me build my willpower.’

“Vinod Panapalia, her husband says, ‘When we had rushed her to hospital after using blankets to douse the flames on her, the doctors had said Vanita had 75 per cent burns and no chance of survival.’

“But Vanita did not lose hope. ‘I have faith in yoga. Though I could not move to perform the asanas, I would feel strong every time I did Pranayama. Never for a moment did I think that I would not survive,’ she said.

“Zubin Zarthoshtimanesh, an Iyengar Yoga teacher, believes that yoga could have been an important tool in her recovery.

“‘Pranayama is the harnessing of energy through the breath. It has a direct impact on your mind, psyche and your will power,’ he says.

“Doctors say that survival is difficult for someone with 50 per cent and above burns. ‘Only athletes and people with a good constitution can survive such burns,’ says Dr Milind Ghare from Wockhardt Hospital, Mulund.

“Vanita was admitted to Masani Hospital after she sustained burns when her synthetic sari caught fire on December 31.”


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


ASTHMA. See “Asthma” bibliography.

At last! An end to the ballooning belly? *Yoga and Life*, late 1970s, no. 7. (A review of Andre van Lysebeth’s *Pranayama*.)


Abstract: Asymmetrical shoulder, thoracic and buttock pressure affect ipsilateral nasal resistance, autonomic tone, and hemisphericity. This factor must be taken into consideration when conducting psychological experimentation, and, in fact, may have confounded much prior research.


“The classic breathing practice of Nadi Shodhanam (alternate nostril breathing) inducing calmness and raising your energy level.”


Contents: Introduction, Traditional views on Swara Yoga (rhythmicity of the swara, activities prescribed in various swaras, interesting observations on Swara Yoga), Mechanism of nasal cycle, Effects of nasal cycle and forced uninostril breathing


Topics addressed: Pranayama in the Indian spiritual texts; Views on Pranayama by eminent Yoga masters; Why Pranayama is vital to the Yoga sadhak; Conclusion


Abstract: Reaction time (RT) is an index of the processing ability of [the] central nervous system and a simple means of determining sensory-motor performance. It has been reported that yoga training improves human performance including central neural processing. Earlier studies from our laboratories have shown that yoga training produces a significant decrease in visual reaction time (VRT) and auditory reaction time (ART). The present work was planned to determine if *mukh bhastrika* (a yogic technique in which breath is actively blasted out in “whooshes” following a deep inspiration) has any effect on central neural processing by studying its effect on RT. 22 healthy schoolboys who were practicing yoga for the past three months were recruited for the present study. VRT and ART were recorded before and after nine rounds of *much bhastrika*. *Mukh bhastrika* produced a significant (P<0.01) decrease in VRT as well as ART. A decrease in RT indicates an improved sensory-motor performance and enhanced processing ability of central nervous system. This may be due to greater arousal, faster rate of information processing, improved concentration and/or an ability to ignore extraneous stimuli. This is of applied value in situations requiring faster reactivity such as sports, machine operation, race driving and specialized surgery. It may also be of value to train mentally retarded children and older sports persons who have prolonged RT.


__________,. Fusing body, mind and spirit: A scientist explains why working with the breath is crucial for anyone determined to follow the path of yoga. *Yoga International*, Jan/Feb 1992, 32-36.
Bell, Harold J., and James Duffin. The respiratory response to passive limb movement is suppressed by a cognitive task. *Journal of Applied Physiology*, 23 Jul 2004. Author email: j.duffin@utoronto.ca.

Abstract: Feedback from muscles stimulates ventilation at the onset of passive movement. We hypothesized that central neural activity via a cognitive task source would interact with afferent feedback, and we tested this hypothesis by examining the fast changes in ventilation at the transition from rest to passive leg movement, under two conditions: (A) no task, and (B) solving a computer-based puzzle. Resting breathing was greater in condition (B) than in condition (A); evidenced by an increase in mean ± SEM breathing frequency (18.2 ± 1.1 br·min⁻¹ versus 15.0 ± 1.2 br·min⁻¹, p = 0.004) and ventilation (10.93 ± 1.16 l·min⁻¹ versus 9.11 ± 1.17 l·min⁻¹ p < 0.001). In condition (A) the onset of passive movement produced a fast increase in mean ± SEM breathing frequency (. = 2.9 ± 0.4 br·min⁻¹, p < 0.001), tidal volume (. = 233 ± 95 ml, p < 0.001) and ventilation (. = 6.00 ± 1.76, p < 0.001). However, in condition (B) the onset of passive movement only produced a fast increase in mean ± SEM breathing frequency (. = 1.3 ± 0.4 br·min⁻¹, p = 0.045), significantly smaller than in condition (A) (p = 0.007). These findings provide evidence for an interaction between central neural cognitive activity and the afferent feedback mechanism, and we conclude that the performance of a cognitive task suppresses the respiratory response to passive movement.

Benagh, Barbara. How healthy is your breathing? Poor breathing habits are easy to spot. Here are a number of self-administered tests to help determine if you can benefit from breath-retraining exercises.*Yoga Journal*, Jul/Aug 2000. Article available online: http://www.yogajournal.com/practice/218_1.cfm.


Abstract: Autonomic responses to breath holding were studied in twenty healthy young men. Breath was held at different phases of respiration and parameters recorded were Breath holding time, heart rate systolic and diastolic blood pressure and galvanic skin resistance (GSR). After taking initial recordings all the subjects practised Nadi-Shodhana Pranayama for a period of 4 weeks. At the end of 4 weeks same parameters were again recorded and the results compared. Baseline heart rate and blood pressure (systolic and diastolic) showed a tendency to decrease and both these autonomic parameters were significantly decreased at breaking point after pranayamic breathing. Although the GSR was recorded in all subjects the observations made were not conclusive. Thus pranayama
breathing exercises appear to alter autonomic responses to breath holding probably by increasing vagal tone and decreasing sympathetic discharges.


“Bellows (bhashrika) breathing for warmth and energy; kapalabhati to clear the nasal passages and invigorate the brain.”


Abstract: Relative nostril efficiency (nasal cycle) is related to hemispheric EEG differences and performance on cognitive tasks. We investigated how unilateral forced nostril breathing influences spatial and verbal performance. Right-handed males and females performed both tasks under either left-nostril, right-nostril, or free-breathing conditions. Unilateral breathing affects performance differently in males and females. It influences male performance ipsilaterally on both tasks: Their spatial performance is better during right-nostril breathing, and their verbal performance is better during left-nostril breathing. Unilateral breathing influences female performance contralaterally, but only on the spatial task: Their spatial performance is better during left-nostril breathing. These differences within and between sexes may exist because unilateral nostril breathing differentially activates the two hemispheres and thereby facilitates performance, or because attempts of the brain to control the nasal cycle unilaterally interfere with performance.


Subjects were randomized to an aerobic exercise condition (cycle ergometry), nonaerobic yoga, or a nonexercise control group for 4 months.


In comeditation, mutual breathing in rhythm is used to help ease the psychic suffering of the terminally ill.

Breath debate (Dialogue section). Yoga International, Apr/May 2000. (On diaphragmatic vs. chest breathing.)


Exhale and hold: Richard Rosen on the breath in yoga.
From mindfulness to awareness: Larry Rosenberg on the breath in Theravada.
Be kind to your breath: Edward Espe Brown on the breath in Zen.
Prana and the path: Gaylon Ferguson on the breath in Tibetan Buddhism.
Adventures in breathing: Edward Espe Brown.


“Includes instructions in calming, quieting breathing practices, including: 2:1 breathing, Bhramari, Ujjayi. Plus—how to relieve anxiety with breathing.”


The breath of life . . . and the life of breath. Yoga and Life, no. 5, pp. 8-10.

Provides “a comprehensive approach to the fundamentals of yoga breathing.”


Discusses the Buteyko Technique and its relation to pranayama and asthma.


Exhale and hold: Richard Rosen on the breath in yoga.
From mindfulness to awareness: Larry Rosenberg on the breath in Theravada.
Be kind to your breath: Edward Espe Brown on the breath in Zen.
Prana and the path: Gaylon Ferguson on the breath in Tibetan Buddhism.
Adventures in breathing: Edward Espe Brown.


“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.”


From the Winter 2001 *Kripalu Yoga Teachers Association Yoga Bulletin*: “. . . 43 minutes of guided *ujjayi, dirgha, kapalabhati, bhasrika, parvatasana, nadi shodhana* and *anuloma viloma* pranayama. Bhasrika pranayama is explored in depth in an additional instructional track; the CD ends with a 22-minute guided posture flow emphasizing yogic breathing. The insert includes written instructions for each pranayama.”

Cascolan, Dinah, and Aura Fechter. The Anatomy and Physiology of Breathing and Its Application to Yoga workshop. URL: http://www.radyoga.com, email: tfechter@radyoga.com.


Topics addressed: Pranayama, prolonged expiration, abdominal/diaphragmatic breathing, increased resistance, alternate nostril breathing, nasal passages and nasal cycles, abdominal pressures


Contents: What is meditation?, Meditation and health, Meditation theory and philosophy, Preparing for meditation, How to meditate


**Complete breath.** *Yoga Today,* no. 1., pp. 30-32.

**COPD.** See the “COPD and Emphysema” bibliography.


Contents: Controlling the breath; Oxygen and carbon dioxide; The chemoreceptors; High altitude and the bellows breath; Bhandrika, the bellows exercise

Coulter-Parker, Nancy. Breathe to win: Top athletes say that without breath awareness, all of the strength and flexibility in the world won’t get them to the finish line first. *Yoga Journal*, Nov 2002, pp. 67-69.

“. . . as Ian Jackson crossed the finish line in a respectable 45th place at the 1982 Ironman in Hawaii, a *Time/Life* reporter noticed he didn’t look as beaten up as the others. ‘I just completed 140 miles of breath meditation,’ Jackson told the reporter. ‘The last few miles of the run were like the champagne bubbles of bliss,’ . . . and ever since Jackson has preached the wonders and importance of breathing to athletes.”

“Jackson encourages athletes to push air out actively on the exhalation and to let it passively in on the exhalation.”

For information on Jackson’s *BreathPlay* CDs, see http://www.breathplay.com.

Cummins, Claudia. Prescriptions for pranayama: Most teachers agree that the breath is a powerful tool for expanding awareness—but the consensus stops there. Claudia Cummins profiles the pranayama practices of six yoga traditions and finds differences ranging from the subtle to the profound. *Yoga Journal*, Mar/Apr 2002, pp. 108-113, 187-188. Article available online: http://www.yogajournal.com/practice/673_1.cfm.

Examines Integral, Kripalu, Ashtanga, Iyengar, Viniyoga, and Kundalini Yoga.


On the correct way to breathe while doing asanas.


“You know from your own practice that pranayama—breath control—has profound benefits for your body and mind. But when and how should you teach it to your students? Learn how six yogic traditions understand this powerful practice.”


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.


**Dana Laboratory.** Initial research project—the breath. *Research Bulletin*, Eleanor M. Dana Laboratory, Himalayan International Institute, 1979.

**Dandy, Bill.** Letter to the editor on the negative aspects of breath-holding from a conventional point of view. *Yoga Today*, Feb 1981, 5(10):31. See the follow-up letters to the editor by Philip Jones, Peter Longcroft, and Jo Hodby Holman in the Apr 1981 issue, pp. 11 and 47, and by David Burnett in the May 1981 issue, p. 47, bringing the yogic point of view.


**Davidson, Teresa.** The neurophysiology of the control of breathing. *Yoga Rahasya*, 1999, 6(3):37-43.


Breathing skills may improve performance in darts, running, public speaking, chiropractic work, test taking, and childbirth.


“Part healing technique, part performance enhancer, breathwork has been used throughout the world to help victims of trauma, torture and disaster, as well as addicts and athletes. Now, fueled by the popularity of Eastern traditions such as yoga and tai chi, breath awareness is gaining acceptance in the West as a tool for maintaining good health.

“Conscious breathing breaks up the habit patterns coded in the body and emotions,’ said Shakta Kaur, a Kundalini yoga teacher in Chicago who leads ‘breathwalk’ classes, which synchronize breathing and walking. ‘You end up transforming yourself, actually changing your body chemistry.’

“Increasingly, science offers support for her claims. Still, although breathing is so basic and essential that it happens whether we’re knocked unconscious or fall asleep, most people do it incorrectly.

“Less than 10 percent of the population breathes efficiently, according to chronic-pain specialist Ingrid Bacci . . .”


Abstract: The present study conducted on twelve normal healthy male subjects showed decrease in blood urea, increase in creatinine and tyrosine after one minute of Kapalabhati, a fast-breathing technique of Hatha Yoga (120 respiratory strokes (min.). From biochemical point of view the practice of Kapalabhati seems to promote decarboxylation and oxidation mechanisms due to which quieting of respiratory centres is achieved, which is also the prerequisite for the practice of Pranayama, another important technique of Yoga.


Studied the effects of a six-week Yoga training program on selected physiological parameters such as heart rate, respiratory rate, tidal volume, vital capacity, breath holding, PWC130, PWC170, and flexibility.


EMPHYSEMA. See the “COPD and Emphysema” bibliography.


“...explores over 20 Hatha Yoga postures, 20 Qi Gong techniques, and 12 Pranayama exercise programs... with a special section that recommends breathing techniques to alleviate a variety of health problems from asthma to insomnia...”
“A practitioner of Patanjali’s Astanga Yoga, George Ellis has studied the Yoga classics as well as the works of Sri Aurobindo, Ramakrishna, Vivekananda, Krishnamurti, and Swami Ramdass for over 20 years.”

E-Sutra mailing list breathing flow and breath mechanisms thread. Sep 2001 - Jan 2002. (The e-Sutra mailing list is moderated by Leslie Kaminoff. For more information, see http://www.breathingproject.org/esutra.shtml.)


Contents: What is the essential breath?, The breath connection, Untying the breath, Developing breath perception, Preparing for the inquiries, Checking in with your breath, Alternative relaxation positions for the inquiries, Characteristics of free breathing, Going inside the body, Primary and secondary respiratory muscles, The diaphragm, How the diaphragm moves, The pelvic and vocal diaphragm, The anatomy of breath holding, Breathing and the heart, The nose, Your lungs and your rib cage, Common breath holding patterns, Breathing deeper: It’s not what you think, Dismantling breath holding patterns, Bringing back your breath, Using the techniques in your everyday life, Getting started, Preliminaries: BodyBreath synchrony, When should I breathe in and out?, Waking up the breath, Opening the center, Opening the lower channels, Opening the upper channels, Deep relaxation, Strengthening diaphragmatic breathing, Lengthening the exhalation, Stimulating the breath, Stimulating your breath through exercise, Balancing the breath, Fostering intimacy: Touching from the inner body, The movement of love, Cultivating mindfulness, Myths that take our breath away, The history of your breath, Merging with the breath, General “feel good” programs, Guides for dealing with specific breath holding patterns, Guides for health conditions and specific interests

___________. Holding your breath: In a high-tech, hot-wired world, we’ve almost forgotten how to do it. Here are some tips for liberating the most important energy source we’ve got—our own breath. Yoga Journal, Mar/Apr 1996, pp. 75-81,140-144.


Abstract: We observed, over four independent experiments, 565 criterion-meeting episodes of breath suspension in 40 subjects practicing the Transcendental Meditation technique (TM), a simple mental technique involving no breath control procedures. The
frequency and length of these breath suspension episodes were substantially and significantly greater for TM subjects than for control subjects relaxing with eyes closed. Voluntary control of respiration was most probably eliminated as an explanation of this phenomenon by the experimental design and by the use of a variety of nonintrusive respiration transducers, including a two-channel magnetometer, an indirect but accurate means of monitoring respiration. Many TM subjects report experience of a completely quiescent mental state characterized by maintained awareness in the absence of thought. Eleven TM subjects were instructed to press an event mark button after each episode of this pure consciousness experience. The temporal distribution of button presses was significantly related (p less than 10(-10)) to the distribution of breath suspension episodes, indicating that breath suspension is a physiological correlate of some, but not all, episodes of the pure consciousness experience. In an extensive study of a single advanced meditator, pure consciousness experiences were also associated with reduced heart rate; high basal skin resistance; stable phasic skin resistance; markedly reduced mean respiration rate, mean minute ventilation and mean metabolic rate; and statistically consistent changes in EEG power and EEG coherence (an indicator of long-range spatial order in the nervous system).


Freeman, Richard. Yoga: Breathing & Relaxation video. 75 minutes.

Abstract: The effects of spontaneous high-frequency breathing (HFB) on lung function were evaluated in three subjects highly trained in the practice of yoga. Transpulmonary pressure was measured by an esophageal balloon catheter and gas flow by pneumotachography. The abdominal and rib cage contributions to tidal breathing were measured separately by respiratory inductive plethysmography. Gas exchange was studied by the conventional technique and by multiple inert gas elimination. During HFB, respiratory rate increased to 232 cycles/min with a tidal volume of 0.35 liter. This resulted in a more than 10-fold increase in expired minute ventilation to approximately 90 l/min. The transpulmonary pressure varied by 20 cmH2O, with the calculated elastic, resistive, and accelerative components varying by 2, 20, and 8 cmH2O, respectively. Respiratory work increased more than 200-fold in comparison with resting ventilation. A phase shift between thoracic and abdominal breathing was observed and was interpreted as a volume displacement of approximately 30 l/min between the two parts of the respiratory system. Arterial oxygen and carbon dioxide tension remained normal. Bohr dead space increased, while acetone dead space remained unaltered. A bimodal distribution of ventilation-perfusion ratios (VA/Q) was observed, with one mode in normal and another in “high” VA/Q regions.


The “Kumbhaka Paddhati is the only text which deals exhaustively [with] the topic of prânâyâma. It is extensively quoted by Sunderadeva, another writer on hatha-yoga in his Hatha-Sanketa-Candrikâ and Hatha-Tatva-Kaumudi. The text describes more than 50 kumbhakas, many of which are not commonly known. Despite the description of various kumbhakas, the author is loud in [his] praise for meru-kumbhaka, [for] which he describes 47 stages . . . These are not found described in any available text . . . [this] is the unique feature of Kumbhaka Paddhati.”

Gilmore, Ruth. Answers the following questions: “Am I right in assuming the concentration of carbon dioxide in the brain’s blood vessels has nothing to do with good breathing, as you say ‘carbon dioxide’ is a waste product of cell metabolism? Or is it
connected to the breath?” “When the blood vessels of the brain expand or contract to cope with varying levels of carbon dioxide, can we feel it, i.e., does this cause headaches, migraines, etc.?” “Is it possible, desirable or necessary to have voluntary control of carbon dioxide levels in the brain?” “If carbon dioxide controls acid/alkaline balance in the body, does its imbalance cause indigestion and stomach disorders?” *Yoga & Health*, Jul 1998, p. 31.

__________. Answers the question “Do you think yoga will help?” from someone who hyperventilates and has been told by her physician that she should start attending Yoga classes. *Yoga & Health*, Jun 2002, p. 34.


Includes *bhasrika*, *ujjayi*, *surya bhedana*, *sitkari*, *sheetali*, *bhramari*, *murch’cha*, *plavini*, and *kapalabhati*.


Includes: Sitkari, seethali, kaki, matangi, bhujangi, kavi, and mukha bhasrika pranayamas.


“In the first group of Prana Mudras where the pranic energy is directed in to specific lung areas, the hands are used to touch the appropriate part of the body, indicating the area into which the breath and Prana should be moved by inflation and deflation of the lungs. This group of Mudras is termed ‘Sparsha Mudras,’ literally, the ‘Touching Gestures.’”


**Grill, Heinz.** *Harmony in Breathing*. Heinrich Hugendubl Verlag.

__________. Breathing room: Yoga allows you to pay attention to the breath—and brings greater awareness to the parts of the body that allow us to exhale and inhale fully. *Yoga Journal*, Mar/Apr 2002, pp. 157-159. Article available online: http://www.yogajournal.com/practice/656_1.cfm.


Mary Guerrera, M.D., writes: “I wonder whether the teaching community’s precept could be “Every breath a lesson.”’ When I recently rediscovered this intriguing quote by the respected medical educator, Neal Whitman, Ed.D., an entirely new meaning emerged. In the chapter on this subject, he writes: ‘In the presence of medical students and residents, medical teachers are never not teaching. This notion will not ring true for you if you equate teaching to giving information. But, if you view teaching as any interpersonal communicative event that occurs because of your desire to help learners, then every breath is indeed a lesson.’

“For office-based teachers of family medicine, teaching time is not limited to the discussions we have with learners about the patients they have seen. Students and residents also learn from us during many other moments of the day as we navigate the complex and ever-changing sea of clinical practice and teaching roles. They watch our every move and even our every breath, observing how we reason a differential diagnosis, converse with a worried patient, and communicate with colleagues. They notice not only our solutions to the various challenges that arise during the day but also how professionally we conduct ourselves in dealing with these issues. Indeed, every breath, word, and action that learners observe are learning potential by role modeling and demonstrating how to address the various issues and challenges of daily practice . . .”


Contents: Physiology of breathing; Yoga—the basis of pranayama; Prana—the essence of breath is the fundamental source of pranayama; Basic preparations prior to pranayama practices; Variations of pranayama and how they are performed; Kundalini: The dormant cosmic energy in [the] human being; Training charts for pranayama performances


Based on the British Wheel of Yoga’s Teacher Diploma regulations.


Hillsman, D., and V. Sharma. Yoga and pneumothorax. Chest, May 2005, 127(5):1863. Author email: deane.hillsman@ieee.org. This is a response to Johnson, Tierney, and Sadighi, which is cited in this bibliography.


__________. Nostril dominance: Experiencing subtle energy. *Yoga International*, Jul/Aug 1993, pp. 61-65..


**HYPERVENTILATION.** See “Hyperventilation” bibliography.

**The importance of breath.** *Reaching Out with Yoga Magazine*, no. 7. Theme of the entire issue.

**International Centre for Yoga Education and Research.** *Pranayama for Health and Well-Being* DVD. Available from Super Audio (Madras) Pvt. Ltd, www.musicandchants.com, or Dr. Ananda Balayogi Bhavanani at ananda@icyer.com.

Contents: INTRODUCTION TO PRANAYAMA: Yogacharya Dr. Ananda Balayogi Bhavanani (director of ICYER with Yogacharini Meenakshi Devi Bhavanani); SECTION 1: SITTING POSTURES FOR PRANAYAMA: Vajra Asana, Sukha Asana and Padma Asana; SECTION 2: VIBHAGA PRANAYAMA (SECTIONAL BREATHING): Sectional or lobular breathing is the “A, B, C” of pranayama and is the beginning of good breath control. Here we learn to breathe into the low, mid, and upper sections of the lungs in a proper manner. Vibhaga Pranayama is the conglomeration of lower chest breathing (Adham Pranayama), mid chest breathing (Madhyam Pranayama), upper chest breathing (Adyam Pranayama), and complete unified breathing (Mahat Yoga Pranayama); SECTION 3: MUDRAS FOR PRANAYAMA: Chin Mudra, Chinmaya Mudra, Adhi Mudra, Brahma Mudra, Nasarga Mudra, Vishnu Mudra, Shanthaki Mudra or Yoni Mudra, Kaki Mudra, Kakachandra Mudra and Jihva Mudra; SECTION 4: HATHENAS: ASANAS TO HELP BREATHE BETTER: Hathenas are forcing techniques used to help the respective sections of the lungs to be enlarged, expanded, reconditioned and rejuvenated. Ushtra Asana, Matsya Asana, Bala Asana, and Chatus Pada Asana with Vyagraha Pranayama; SECTION 5: CLEANSING BREATHS: Mukha Bhaistrika, Anunasika Pranayama, and Kukkriya Pranayama; SECTION 6: PRANAYAMAS FOR ACTIVATION: Surya Pranayama and Kapalabhati; SECTION 7: COOLING DOWN: Sheetal Pranayama and Sitkari Pranayama; SECTION 8: CONTEMPLATION AND MEDITATION: Pranava Pranayama, Bhramari Pranayama and the Savitri Pranayama with Surya Prana Mudra; SECTION 9: STRESS RELIEF AND RELAXATION: Nasarga Mukha Bhaistrika, Chandra Pranayama, Bhujangini Mudra, Aloma Viloma Pranayama and Savitri Pranayama in Shavasana; CLASSIFICATION AND BENEFITS OF PRANAYAMA: Interview with Yogacharini Dr. Nalini Devi (a medical doctor and well-trained Yoga teacher, who is director of the Gitananda Yoga Centre in Ibiza, Spain); SPIRITUAL VALUE OF PRANAYAMA: Interview with Yogacharini Meenakshi Devi Bhavanani (director of ICYER with Yogacharya Dr. Ananda Balayogi Bhavanani).

**Introduction to pranayama.** *Yoga Rahasya*, 1994, 1(2).

**Introduction to pranayama and yogic breathing.** Article available online: http://www.yogasite.com/pranayama.htm.

From the publisher: “With this book we see a philosopher well steeped in the Western tradition thinking through ancient Eastern disciplines, meditating on what it means to learn to breathe, and urging us all at the dawn of a new century to rediscover indigenous Asian cultures. Yogic tradition, according to Irigaray, can provide an invaluable means for restoring the vital link between the present and eternity—and for re-envisioning the patriarchal traditions of the West.

“Western, logocentric rationality tends to abstract the teachings of yoga from its everyday practice—most importantly, from the cultivation of breath. Lacking actual, personal experience with yoga or other Eastern spiritual practices, the Western philosophers who have tried to address Hindu and Buddhist teachings—particularly Schopenhauer—have frequently gone astray. Not so, Luce Irigaray. Incorporating her personal experience with yoga into her provocative philosophical thinking on sexual difference, Irigaray proposes a new way of understanding individuation and community in the contemporary world. She looks toward the indigenous, pre-Aryan cultures of India—which, she argues, have maintained an essentially creative ethic of sexual difference predicated on a respect for life, nature, and the feminine.

“Irigaray’s focus on breath in this book is a natural outgrowth of the attention that she has given in previous books to the elements—air, water, and fire. By returning to fundamental human experiences—breathing and the fact of sexual difference—she finds a way out of the endless sociologizing abstractions of much contemporary thought to rethink questions of race, ethnicity, and globalization.”

The author thinks that there should be separate yogas for men and women and that there is no universalized transcendence through yoga, no such thing as “beyond gender,” which is the teaching of all self-transcending traditions.


On Isaac Friend’s Tai Chi Yoga Bag, which assists in practicing deep breathing.


Contents: The Theory of Pranayama: What is yoga?, Stages of yoga, Prana and pranayama, Pranayama and the respiratory system, Nadis and chakras, Guru and sisya, Food, Obstacles and aids, The effects of pranayama; The Art of Pranayama: Hints and cautions, The art of sitting in pranayama, The art of preparing the mind for pranayama, Mudras and bandhas, The art of inhalation (puraka) and exhalation (rechaka), The art of retention (kumbhaka), Grades of sadhaka in pranayama, Bija pranayama, Vrtti pranayama; The Techniques of Pranayama: Ujjayi pranayama, Viloma pranayama, Bhramari, murchha and plavini pranayama, Digital pranayama and the art of placing the fingers on the nose, Bhasrika and kapalabhati pranayama, Sitali and sitakari pranayama, Anuloma pranayama, Pratiloma pranayama, Surya bhedana and chandra bhedana pranayama, Nadi sodhana pranayama; Freedom and Beatitude: Dhyana (meditation), Savasana (the art of relaxation), Appendix: Pranayama courses


Iyengar, Prashant. *Prânâyâma* audiocassette. 60 minutes.

Provides “instructions for the basics of *prânâyâma* while lying down in *Savâsana*. The instructions start with observing normal breath before attempting any regulation of the breath or pranayamic breathing. One side of the cassette deals with *Ujjâyi* exhalations while the other with *Ujjâyi* inhalations. The instructions are . . . clear, precise and explicit with reference to the different techniques of regulating the exhalations and then the inhalations . . . The practitioner is then guided through the experience and sensations in different parts of the body following the implementation of the techniques described.”

Pranayama Classes (5 days) audiotapes or CDs. Contact info@postures.com.

Specific breathing tools and techniques for athletes. “Jackson encourages athletes to push air out actively on the exhalation and to let it passively in on the exhalation.”

From the website: “BreathPlay . . . also . . . elevates breathing beyond mere air supply, using it to activate the spine and to integrate body and mind, breathing and movement.”


Abstract: This study describes the effects of 30 minutes of unilateral forced nostril breathing on cognitive performance in 51 right-handed undergraduate psychology students (25 males and 26 females). A verbal analogies task modeled after the Miller Analogies and SAT Tests was used as a test of left-hemispheric performance and mental rotation tasks based on the Vandenburg and Kuse adaptation of Shepard and Metzler's tests were used as spatial tasks for testing right-hemispheric performance. Spatial task performance was significantly enhanced during left nostril breathing in both males and females, p = .028. Verbal task performance was greater during right nostril breathing, but not significantly p = .14. These results are discussed in comparison to other cognitive and physiological studies using unilateral forced nostril breathing. This yogic breathing technique may have useful application in treating psychophysiological disorders with hemispheric imbalances and disorders with autonomic abnormalities.


Abstract: Spontaneous pneumothorax is the most common cause of pneumothorax. We report a case of a 29-year-old healthy woman who presented to the emergency department...
with a spontaneous pneumothorax caused by a yoga breathing technique called Kapalabhati pranayama, or breath of fire. Yoga breathing exercises are commonly practiced, and a limited number of studies have shown various physiologic benefits of yoga breathing. This is the only known report of spontaneous pneumothorax caused by pranayama, but some other rare causes are noted. This case should illustrate that adverse side effects can occur when one pushes the body to physiologic extremes.


Jones, Terrie Lynne. “Spiritwise”: The role of prana and breath in healing the body, mind, and spirit. Master’s thesis. Sonoma State University, Santa Rosa, California, 1998.


Contents: Respiration and breathing, Meaning of yogic breathing, Initial steps, Techniques and procedure, Evaluation of yogic breathing, Psychophysiological aspects


Contents: What is pranayama?, Misconceptions about pranayama removed, Before making a beginning, How to practice pranayama, Varieties of pranayama, Pranayama: A key to good health, Pranayama for the cure of disorders, Cure of disorders


Abstract: Thirty three normal male and forty two normal female subjects, of average age of 18.5 years, underwent six weeks course in “Pranayam” and their ventilatory lung functions were studied before and after this practice. They had improved ventilatory functions in the form of lowered respiratory rate (RR), and increases in the forced vital capacity (FVC), forced expiratory volume at the end of 1st second (FEV1%), maximum voluntary ventilation (MVV), peak expiratory flow rate (PEFR-lit/sec), and prolongation of breath holding time.


Kaminoff, Leslie. The Breathing Prescription. Author email: leslie@breathingproject.org.

The Breathing Project’s 100 Hour Advanced Course for Yoga Professionals. The Breathing Project, Inc., 5 East 22nd Street, #15C, New York, NY 10010, Tel. and fax: (212) 979-9642, e-mail: BreathingProject@aol.com.

The Breathing Project is taught by Leslie Kaminoff and consists of 70 classroom hours and 30 workshop hours over the course of nine months. Enrollment in this course is by application and will be limited to twelve participants.

Course material will focus on the essential details of spinal and respiratory anatomy and their relation to the practice and teaching of yoga. Some of the topics that will be covered in-depth are: the evolution, structure, and function of the spinal column; the evolution and function of breathing, and its relation to spinal movements; the anatomy and kinesiology of the diaphragm and respiratory mechanism; the Shape/Change® method of breath education and yoga teaching methodology; breath as the integrating principle of posture, movement, and yoga practice.

The bulk of the classroom hours will be focused on providing participants with a clear understanding of the anatomical and theoretical components of the course. Five weekend workshops will allow for extended practice sessions in which the course material can be experientially applied to the practice and teaching of yoga.

Applications for The Breathing Project’s 100-hour course are accepted from any yoga teacher with a minimum of one year’s teaching experience and an understanding of basic anatomy. The application process will include testing of anatomical knowledge. The course will include reading assignments and homework, which will be submitted weekly via e-mail.

Leslie Kaminoff, originator and teacher of the course, is a Yoga educator, bodyworker, and breathing therapist inspired by the Viniyoga tradition of T. K. V. Desikachar. He is an internationally recognized specialist in breath anatomy who has led workshops for many of the leading Yoga associations and schools in America. He currently practices bodywork, Yoga, and breathing therapy in New York City and Great Barrington, Massachusetts. Leslie’s first book, The Breath Prescription, is based on the material in this course.


Thirty healthy volunteers performed yogic breathing exercises 30 minutes every day for 10 weeks. Pulmonary function tests were done initially and at the end of the 10-week exercise period. Levels of malonaldehyde (an indicator of free radical activity) and
superoxide dismutase (an indicator of antioxidant activity) were also collected. Following the exercise period, volunteers showed significant improvement in pulmonary function. Malonaldehyde levels also decreased significantly (9.54 +/- 0.56 nm/mL before exercises to 8.21 +/- 0.76 nm/mL after exercises). Superoxide dismutase levels increased, but not significantly (11.60 +/- 3.14 units/mg to 13.04 +/- 2.66). Researchers concluded that the practice of yoga not only improves pulmonary lung function in healthy adults, but may also be helpful in reducing the prevalence of bronchial asthma, chronic obstructive pulmonary disease, and lung cancer.


From the publisher: “For those who have been doing breathing practices for awhile this is an excellent talk with examples for deepening your practice. Recorded during the 1999 Yoga Teachers Reunion in Yogaville.”


From the publisher: “In yoga, the system of breathing practices, or pranayama as it is known, is a key element in physical and emotional health. In this inspirational talk, one of Integral Yoga’s main teachers and Yogaville’s resident expert on pranayama explains its many benefits and details the connection between the breath and the mind.”


An Introduction, Pranayama in the Anusara Style of Yoga, Explorations of the Breath, Natural breath, Diaphragmatic Breath, Three Diaphragms, Pranayama, Full Yogic Breath, An Initial Practice of Ujjayi Breathing, Viloma Pranayama, Sitting Poses for Pranayama, Mudra, Bandhas and the Loops of Anusara Yoga, Prana and Apana, The Bandhas, A Round of Seated Ujjayi Pranayama, Breathing Through the Loops and Bandhas, The Significance of Aligning with Loops, Maha Mudra, Clearing Techniques, Stoking the Fire of the Prana, Cooling and Soothing, Regulating the Breath through the Nostrils, The Nadis, Technique for Regulating the Nostrils, Breathing Techniques through Both Nostrils, Anuloma Pranayama, Pratiiloma Pranayama, Alternate Nostril Techniques,
Surya Bhedana, Chandra Bhedana, Nadi Shodhana, Practicing Pranayama with the Bandhas, Breath Ratios, The Yoga of Sound—Mantra, Bibliography

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Breathing and the bandhas in Anusara Yoga. Article available online: http://www.doyoga.com/a_yogapurpose.html. (Excerpted from Anusara Yoga.)

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Diaphragmatic breath. Article available online: http://www.doyoga.com/bk_diaphragmatic.html. (Excerpted from Refining the Breath.)

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An initial practice of ujjayi breathing. Article available online:

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Pranayama in the Anusara style of yoga. Article available online: http://www.doyoga.com/bk_pranstyle.html. (Excerpted from Refining the Breath.)

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Yoga and the breath. Article available online: http://www.doyoga.com/bk_ujjayi.html. (Excerpted from Refining the Breath.)


From the publisher: “Breathing and walking comprise two of our simplest activities, yet they are also two of our most powerful actions. By bringing them together in a systematic and meditative way, we can enhance our physical, emotional, and spiritual fitness. We can tap our vitality to fully enjoy and excel in our lives.

“With a series of easy to follow, transformational exercises that combine breathing and walking in very specific ways for specific benefits, Breathwalk teaches us: how to alleviate exhaustion, anxiety, sadness, and other problems; to heal physical, mental, and spiritual conflict in our lives; to enter a zone of total fitness within our own bodies and minds . . .”


“Since ancient times, prana has been used in the recovery of illness, because yogic breathing directly affects the glands, nerves, and magnetic field of the body, benefiting health outcomes. Learn the science and soul behind breathing for healing effects, including techniques for moving prana through the psyche and physical body.”
**KIN-Yoga mailing list pranayama and children thread.** 21 Jul - 27 Jul 2001. (The KIN-Yoga mailing list is run by the Kripalu Yoga Teachers Association.)


**Krishna, Gopi.** *The Wonder of the Brain*. Institute for Consciousness Research.

From the publisher: “The current state of confusion about the real nature of spiritual experience is due to a lack of understanding of how the brain functions as a channel for the expression of consciousness. In this book, Gopi Krishna challenges scientists and psychiatrists alike to stop ignoring the important part the physical brain plays in our development. He asserts that an understanding of prana, the super-intelligent cosmic energy behind all forms of life, is the key to understanding how higher forms of reality and other planes of creation, currently inaccessible to us, will become available for exploration.”


__________. Answers the question: “My yoga practice used to include asanas, pranayama . . . and meditation; but when I began experiencing a tightness and soreness in my throat, I stopped the pranayama. I would like to resume pranayama, but even a couple of rounds aggravates my throat. How can I get around this obstacle? *YogaChicago*, Mar-Apr 1999.


Contents: Respiration, Asanas appropriate to pranayama, Pranayama in general, Ujjayi, Kapalabhati, Bhashrika, Suryabhedana, Sitkari, Sitali, Bhramari, Murcha, Plavini, Physiological and spiritual values of pranayama, A full course in yogic physical culture, A short course in yogic physical culture, An easy course in yogic physical culture, Glossary


“*Pranayama* delivered me from the exhaustive Lamaze-style huffing and puffing that did me no good in labor with my first son. Knowing how to effectively breathe during asana was as critical to my prenatal yoga practice as knowing when to stop once I reached my limit.”


Lee, Cyndi. Path without a goal: “Using the rhythm of the breath, we can join movements together into a flowing sequence that has no peak experience and no non-peak experience.” Shambhala Sun, Jul 2000, pp. 85-87.

__________. Breathing room: “Freeing the breath from both mental and physical constraints is like opening a tight belt after Thanksgiving dinner.” Shambhala Sun, Jan 2003, pp. 77-78.

__________. Answers the question: “I want to add pranayama and meditation to my daily home yoga practice. What is the best sequence for these activities? Yoga Journal. Article available online: http://www.yogajournal.com/practice/709_1.cfm.


Abstract: Jalandharabandha (JB) is the important constituent of apnoea (kumbhaka) in hathayogic breathing exercises. It is performed by pressing the chin into the jugular notch and creating thus the positive pressure on the neck region. The influence of JB on the heart rate and vasomotor response was studied in relationship to different lung volumes. The course of R-R intervals is highly significantly different according to the type of apnoea. JB leads to the diminution of bradycardia, but does not change the position of the maximum and minimum in comparison to the apnoea without JB. Application of JB increases the number of vasodilatations and shortens the latencies of vasodilatations, duration and amplitude of reactions. JB during breath holding decreases the vagal reflex changes and may thus work as a stabilizing component in yogic breathing exercises.

Lewis, Dennis. Relaxing your face muscles for deeper breathing and more energy. Available online: http://authentic-breathing.com/breathing_tips.htm#eyes.

“Those of us whose work requires extreme visual concentration (and the list is a long one, especially in this age of computer technology) can improve our work and increase our energy by making sure that our face muscles are relaxed and by looking away frequently from the work we are doing . . .”


Lindsay, Jamie. The energetic effects of pranayama. My Yoga Mentor, Nov 2004, no. 12. Article available online: http://www.yogajournal.com/teacher/1411_1.cfm?email=mail@iayt.org&ctsrc=nlt12.

“You may have noticed that changing the sequencing of your class changes your students’ energetic experience. But there’s another way to create different energetic effects—the careful use of breath control.”


Lundeen, Sudha Carolyn. Answers the question: “When I exhale during a pranayama breath or just in natural breathing, which is preferred, the mouth or the nose?” Yoga Journal. Article available online: http://www.yogajournal.com/practice/561_1.cfm?ctsrc=nlv109.


On the Art of Living Foundation’s Sudarshan Kriya Yoga breathing techniques.
Machander, A. R. Comments on the increase of intrathoracic pressure in the practice of pranayama. Jógová Cvicení, 1982, pp. 65-70. [In Czechoslovakian.]

Summary: “Both intrathoracic and intraabdominal pressure can be increased during yogic practice. Abhyantara kumbhaka . . . during pranayama can increase intrathoracic pressure in different degree[s], according to the technique used. The increase of thoracic pressure elevates venous pressure with consequent venous blockade and the increase of pressure both in cerebrovascular fluid and intracranially. If the breath-holding with increased intrathoracic pressure lasts 45 seconds, it causes stagnant hypoxia of the brain with metabolic changes . . . Thanks to limited venous return, minute heart volume is decreased to one-half with consequent disturbance of cardiac rhythm. Therefore the breath-holding with increased thoracic pressure is not without danger (cerebral stroke, collapse, paroxysm of epilepsy, coronary infarction).

“Pronounced increase of thoracic pressure can be caused by [the] following conditions: 1) if tension of expiratory thoracic muscles is increased after glottis is closed, 2) if uddiyana bandha is practiced incorrectly, causing abdominal press[ure], 3) if there is relaxation of diaphragm during breath-holding and increased abdominal pressure expands over it to thoracic cavity. Increased intraabdominal pressure can have negative effect also during asanas, if they are practice with longer breath-holding and with activation of expiratory muscles (e.g., mayurasana, backward bending).

“As a consequence we can state that incorrect practicing of certain yogic exercises can endanger especially disposed persons and regular incorrect practice could negatively influence even healthy people.”


Abstract: There is evidence that the practice of yoga improves physical and mental performance. The present investigation was undertaken to study the effect of yoga training on visual and auditory reaction times (RTs), maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), 40 mmHg test, breath holding time after
expiration (BHTexp), breath holding time after inspiration (BHTinsp), and hand grip strength (HGS). Twenty seven student volunteers were given yoga training for 12 weeks. There was a significant (P < 0.001) decrease in visual RT (from 270.0 +/- 6.20 (SE) to 224.81 +/- 5.76 ms) as well as auditory RT (from 194.18 +/- 6.00 to 157.33 +/- 4.85 ms). MEP increased from 92.61 +/- 9.04 to 126.46 +/- 10.75 mmHg, while MIP increased from 72.23 +/- 6.45 to 90.92 +/- 6.03 mmHg, both these changes being statistically significant (P < 0.05). 40 mmHg test and HGS increased significantly (P < 0.001) from 36.57 +/- 2.04 to 53.36 +/- 3.95 s and 13.78 +/- 0.58 to 16.67 +/- 0.49 kg respectively. BHTexp increased from 32.15 +/- 1.41 to 44.53 +/- 3.78s (P < 0.01) and BHTinsp increased from 63.69 +/- 5.38 to 89.07 +/- 9.61 s (P < 0.05). Our results show that yoga practice for 12 weeks results in significant reduction in visual and auditory RTs and significant increase in respiratory pressures, breath holding times and HGS.


Abstract: Twentyfive normal male volunteers undergoing a ten weeks course in the practice of yoga have been studied by some parameters of ventilatory functions tests. The observations recorded at the end of ten weeks of the course have shown improved ventilatory functions in the form of lowered respiratory rate, increased forced vital capacity, FEV1, maximum breathing capacity and breath holding time, while tidal volume and %FEV1, did not reveal any significant change. Thus, a combined practice of yoga seems to be beneficial on respiratory efficiency.

**Mandlik, Vishwas V.** *Pranayama* CD. Information available online: http://www.yogapoint.com/ASPScripts/YogaStore/Courses/ShortCourses/PranayamaCourses.asp.


Abstract: This study compared the psychological effects of Progressive Muscle Relaxation (PMR) and breathing exercises. Forty-two students were divided randomly into two groups and taught PMR or breathing exercises. Both groups practiced for five weeks and were given the Smith Relaxation States Inventory before and after each session. As hypothesized, PMR practitioners displayed greater increments in relaxation states (R-States) Physical Relaxation and Disengagement, while breathing practitioners displayed higher levels of R-State Strength and Awareness. Slight differences emerged at Weeks 1 and 2; major differences emerged at Weeks 4 and 5. A delayed and potentially reinforcing aftereffect emerged for PMR only after five weeks of training—increased levels of Mental Quiet and Joy. Clinical and theoretical implications are discussed. Copyright 2001 John Wiley & Sons, Inc.

_________. The politics of breathing: Still liberating women, after all these years? Article available online: www.bodybreathmind.com.


Miller, Richard C. *The Psychophysiology of Respiration: Eastern and Western Perspectives*. Sebastopol, Calif.: Anahata Press. (Booklet.)


_________. The breath of life. Sebastopol, Calif. No date.

Miller, Olivia H. A sharing of breaths: Performed for centuries by Tibetan physicians, comeditation is now being used in the West to ease the psychic suffering of the terminally ill. *Yoga Journal*, Mar/Apr 1993, pp. 136, 124.


Abstract: The ventilatory response to hypercapnia and arterial blood gases during ujjai respiration of once per minute for an hour were determined in a professional hatha yogi.
The results suggest that lower chemosensitivity to hypercapnia in yoga practitioners may be due to an adaptation to low arterial pH and high PaCO(2) for long periods.

**Mohan, Madan, U. C. Rai, V. Balavittal, D. P. Thombre, and Swami Gitananda.**

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.


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.


**Morgan, Lata.** The Anatomy and Yoga of Breathing workshop. For information call Lata Morgan 415-837-1765 or email lataji@mindspring.

“What is the shape of your diaphragm? How does it move when you breath? Does the way you breathe impact your alignment, movement, and consciousness?

“These are a few questions we will explore in this thirty hour course focusing on the elements of respiration. Throughout the five days we are going to look at how the function of breathing organizes the skeletal, muscular, organ and fluid systems of the torso.

“Embody the lobes of your lungs to increase your breathing capacity; learn about the spiral architecture and movement of your ribs; build your core support by engaging your pelvic floor, kidneys, and psoas in breathing; understand how balanced muscular action of the spine allows for efficient and easy breathing.

“This course blends experiential anatomy, breathing exercises, guided movement, yoga and vocalization to help you clarify your breathing options, mobilize your rib cage and spine, and enliven your belly and chest.”

“Principles from Body-Mind Centering®, the Feldenkrais Method®, Functional Anatomy, Traditional Chinese Medicine, and Yoga will be applied as we examine the relationships between function and structure, mobility and stability, breath and movement.”


Mounamurti Saraswati, Swami. Nitric oxide (NO) and some of the added benefits of nostril breathing. Article available online: http://satyamyoga.virtualave.net.

Muktibodhananda, Swami. Swara Yoga. Article available online: http://www.yogapoint.com/info/newsletter3.htm#.

From the website: ‘Swara is [a] Sanskrit word, meaning sound or note. It is also a continuous flow of air through one nostril. Yoga means union, so Swara Yoga is a science which is [the] realization of cosmic consciousness through control and manipulation of breath.

“Swara Yoga is [a] science which is a complete study, observations, control and manipulation of breath or Swara. Pranayama is only related to control of breath in various ways. In Swara Yoga, you will find association of breath in relation to activities of sun, moon, various seasons, physical and mental conditions of individuals, etc. So Swara Yoga is more comprehensive in theory and practices related to breath.”


Abstract: Uninostril breathing facilitates the performance on spatial and verbal cognitive tasks, said to be right and left brain functions, respectively. Since hemispheric memory functions are also known to be lateralized, the present study assessed the effects of uninostril breathing on the performance in verbal and spatial memory tests. School children (N = 108 whose ages ranged from 10 to 17 years) were randomly assigned to four groups. Each group practiced a specific yoga breathing technique: (i) right nostril breathing, (ii) left nostril breathing, (iii) alternate nostril breathing, or (iv) breath awareness without manipulation of nostrils. These techniques were practiced for 10 days. Verbal and spatial memory was assessed initially and after 10 days. An age-matched control group of 27 were similarly assessed. All 4 trained groups showed a significant increase in spatial test scores at retest, but the control group showed no change. Average increase in spatial memory scores for the trained groups was 84%. It appears yoga breathing increases spatial rather than verbal scores, without a lateralized effect.

**The neurophysiology of the control of breathing.** *Yoga Rahasya*, 1999, 6(3).


Provides “detailed instructions and black-and-white illustrations of techniques and visualizations, and all the practices dealing with awakening and harmonization of the vital force. The last section of the book describes the various stages of *Prana Vidya* and other forms of psychic healing.”

**Nostril to nostril: Setting the stage for meditation.** *Yoga International*, Jun/Jul 2001, pp. 14-16.


**Our respiratory system.** *Yoga Rahasya*, 1994, 1(2).


“Sometimes the stresses of our society make us feel like peace is a million miles away. But yoga shows us that it’s right in our reach. As teachers, we must heal our students’ nervous systems by giving them concrete tools to cultivate peace on the mat . . .”
In addition to positive uses of pranayama, the article also cautions: “... as teachers, we must be very careful with certain pranayama practices. Bhastrika pranayama (often known as ‘Breath of Fire’) can damage or even destroy the nervous system. I’ll never forget a woman who came to me for legal advice when I was practicing law. She was extremely agitated, constantly distracted, and couldn’t finish a thought or a sentence. I learned that her nervous system was burnt out from years of practicing pranayama improperly, specifically bhastrika and kapalabhati (Skull shining breath). When an excess of pranic energy floods the nervous system, it is like a balloon that’s filled with more air than it has the strength to contain. The nervous system is shattered and severe mental trauma can result. The body must be properly prepared with years of asana (especially backbends) to safely receive and contain the power of prana.

“And there are other ways to harm our students with the practice. For instance, the nervous system is agitated by jerky movements. This includes trembling during a pose by working too hard. Remind your students that there is no virtue in holding poses too long, for the benefits quickly unravel and turn into detriments. I have heard some teachers say to their students, ‘Shake it out!’ and encourage their students to shake themselves after intense poses to release tension. This misses the point. It is far better to be still and melt the tension with awareness.”


Pasek, Tadeusz, Henryk Gaertner, and Mike J. Plyley. Voluntary control of breathing according to Yoga, personal experiences and physiological research. Paper given at the 9th European Symposium on Somatotherapy/2nd European Symposium of Psychosomatic Education, 24-26 October 1999, Krakow, Poland.


“New study findings presented at the American Society of Hypertension's annual meeting say it may be a good idea to take some deep breaths next time you're feeling stressed.
The recent research, conducted at the Kaleida Health-Millard Fillmore Hospital in Buffalo, New York, reinforces previous findings that suggest pranayama may help lower blood pressure.

Researchers took 12 people between the ages of 22 and 55 with normal blood pressure and subjected them to mental stress for five minutes by asking them to perform a frustrating mathematical task. Then they compared the use of controlled breathing—inhaling and exhaling at a rhythmic pace—with listening to classical music, nature sounds, or no intervention, to measure how long it takes for blood pressure levels to return to normal.

Results showed that classical music made systolic blood pressure (SBP)—the top number that reflects blood pressure when the heart contracts—drop to pre-stressed levels after an average time of 2.9 minutes, nature sounds worked in 3.0 minutes, and doing nothing normalized SBP after 3.7 minutes, whereas deep breathing returned SBP to normal after just 2.7 minutes.

Diastolic blood pressure (DBP) was slower to return to normal, but after four minutes, readings had dropped by 11.2 percent with yogic breathing, compared to 2.7 percent for the group doing nothing. This suggests that DBP would return to normal levels more quickly with yogic breathing.

Lead researcher B. H. Sung, an associate professor of medicine at the State University of New York at Buffalo, believes that even hypertensive patients would have similar results, although the higher the blood pressure, the more time it would take for the pressure to come down.

B. H. Sung and her coresearchers speculate yogic breathing may work by relaxing muscles that constrict blood vessels and changing the signals sent to the brain that announce stress to the body. Sung believes the technique may prove an effective complementary form of therapy to medication and lifestyle changes for hypertensives . . .


**Pranayama.** Available online: http://www.yogamedicine.com/pranayama.htm.

**Pranayama in water.** Article available online: http://www.yoga.com.ua/lappa/date/lessprac/2engl.html.

**Pranic energization technique.** Available online: http://www.yogamedicine.com/astralhealing.htm.

Abstract: Pranayama is a Yogic breathing practice which is known experientially to produce a profound calming effect on the mind. In an experiment designed to determine whether the mental effects of this practice were accompanied by changes in the arterial blood gases, arterial blood was drawn from 10 trained individuals prior to and immediately after Pranayama practice. No significance changes in arterial blood gases were noted after Pranayama. A neural mechanism for the mental effects of this practice is proposed.


Abstract: A previous report described selective electrical activity of the cerebral hemispheres with uninostril breathing. In the present study, middle latency auditory evoked potentials (MLAEPs) were recorded from symmetrical scalp sites during the practice of uninostril Yoga breathing. There were two sessions (40 min each) of right nostril Yoga breathing (RNB) and of breath awareness (BAW), with (i) “before,” (ii) test (either RNB or BAW), and (iii) “after” periods. The participants were 14 male volunteers aged between 18 and 33 years, and the setting was a Yoga center. MLAEPs were recorded from symmetrical scalp sites (C4 and C3). During RNB, the peak amplitudes of two negative components (i.e., Na wave and Nb wave) were significantly increased on the right side. Increased peak amplitudes of Na and Nb waves suggested that RNB increased the number of neurons recruited on the right side, suggesting a possible application of RNB in certain psychiatric disorders with cerebral hemispheric imbalance.


Abstract: The present study was conducted to determine whether breathing through a particular nostril has a lateralized effect on hand grip strength. 130 right hand dominant, school children between 11 and 18 yrs of age were randomly assigned to 5 groups. Each group had a specific yoga practice in addition to the regular program for a 10 day yoga camp. The practices were: (1) right-, (2) left-, (3) alternate- nostril breathing (4), breath awareness and (5) practice of mudras. Hand grip strength of both hands was assessed initially and at the end of 10 days for all 5 groups. The right-, left- and alternate-nostril breathing groups had a significant increase in grip strength of both hands, ranging from 4.1% to 6.5%, at the end of the camp though without any lateralization effect. The breath awareness and mudra groups showed no change. Hence the present results suggest that
yoga breathing through a particular nostril, or through alternate nostrils increases hand grip strength of both hands without lateralization.


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: Heart rate variability (HRV) is a functional measure of the proficiency of the parasympathetic nervous system. Greater variability is associated with relaxation and quiescence and a lower risk of major cardiovascular events, such as heart attack.

To measure HRV, two spectral components of an electrocardiogram are usually recorded: a high-frequency (0.15-0.50 hertz [Hz]) component, attributable to parasympathetic activity, and a low-frequency component (0.05-0.15 Hz), attributable to sympathetic activity.

Researchers at the Vivekananda Kendra Yoga Research Foundation in Bangalore, India, studied HRV during two yoga practices that had previously been found to have opposite effects: sympathetic stimulation (kapalabhati, or breathing at high frequency, i.e., 2 breaths per second for several seconds) and reduced sympathetic activity (nadi shodana, or alternate-nostril breathing). All 12 male volunteers (age range = 21-33 years) were assessed before and after each practice on separate days.

Following kapalabhati, low-frequency power and the ratio of low to high frequency increased significantly, whereas high-frequency power fell significantly. There were no significant changes following nadi shodana. According to Raghuraj and colleagues, these results suggest that (1) kapalabhati modifies cardiac autonomic control (nervous system regulation of heart function) by increasing sympathetic activity and reducing vagal (primary parasympathetic nerve) activity and (2) HRV is a more useful psychophysiological measure than heart rate alone.

Comments: HRV is an up-and-coming measure of cardiovascular function in clinical cardiology. HRV cannot be discerned by heart rate palpation or wrist-worn cardiотachometers; it must be measured using very expensive electrocardiographic spectral analysis equipment, such as that found in university-based cardiovascular research institutions.

Abstract: Some reports have described the effects of forced uninostril breathing on autonomic activity as sex-specific, while other reports have described selective effects of breathing through a specific nostril on the two divisions of the autonomic nervous system, irrespective of sex. There are also yoga breathing techniques which involve voluntary uninostril breathing. These techniques also influence the autonomic activity based on the patent nostril rather than sex. These descriptions were in line with experiential observations of the ancient sages described in classical yoga texts. This paper summarizes these perspectives on uninostril breathing.


Abstract: Energy expenditure and ventilatory responses to yogic standing posture of Virasana were studied on 10 healthy men (25-37 years of age). The results of various responses respectively to the horizontal supine, Chair-sitting and Virasana were: Minute Ventilation (VE) 7.64, 8.61 and 18.67 L/min; Respiratory Frequency (FR) 15.71, 15.70 and 21.45 Breath/min; Tidal Volume (VT) 0.496, 0.544 and 0.827 L/min; Oxygen consumption (VO2) 0.127, 0.234 and 0.573 L/min; Carbondioxide Elimination (VCO2) 0.127, 0.134 and 0.420 L/min; Respiratory Exchange Ratio (RER) 0.58, 0.57 and 0.69; Heart Frequency (FH) 65.2, 74.5 and 104.4 beats/min; Oxygen Pulse (O2P) 3.32, 3.17 and 5.45 ml/beat; Ventilatory Equivalent (VE-EQ) 36.78, 37.12 and 33.85; Multiple of Resting VO2 (METS) 0.96, 1.05 and 2.53 and Metabolic Cost (MC) 1.04, 1.13 and 2.76 Cal/min. Virasana posture was characterised by higher VE, FR, VT, VO2, VCO2, FH and O2P with lesser VE-EQ. The observations suggest that Virasana induces temporarily a hypermetabolic state characterised by enhanced sympathetic nervous system activity which gets inhibited during the adoption of resting supine shavasana posture.


Abstract: Thirumular says in his Thirumanthiram the body is a sacred instrument to contain the soul and therefore must be nurtured well to safeguard the life. Thirumular is reported to have lived a long span of three thousand years according to tradition. The art of longevity and the attempts of immortalising the corporeal human body were the ultimate aims of Siddhars as understood from their numerous treatises on the art of rejuvenation—Thirumular Karpam - 300, Bohar Karpam - 300, Thiruvalluvur Karpam - 300, Yugimuni Karpam - 300, etc., which form some of the excellent works in this regard. One of the means to rejuvenate the body was achieved through the art of breathing (Pranayama) which has a direct bearing on the basal metabolic rate and the span of longevity. In this paper an attempt has been made to throw some light on the scientific basis of the various Kaya Kalpa methods adopted by Siddhars.


Abstract: Twelve normal healthy volunteers (6 males and 6 females) undergoing yoga training for 90 days were studied for the effect of yoga on exercise tolerance. Their ages ranged from 18 to 28 years. The volunteers were taught only Pranayama for the first 20 days and later on yogic asanas were added. Sub-maximal exercise tolerance test was done on a motorized treadmill by using Balke's modified protocol, initially, after 20 days (Phase-I) and after 90 days of yoga training (Phase-II). Pyruvate and lactate in venous blood and blood gases in capillary blood were estimated immediately before and after the exercise. Minute ventilation and oxygen consumption were estimated before and during the test. Post exercise blood lactate was elevated significantly during initial and Phase-I, but not in Phase-II. There was significant reduction of minute ventilation and oxygen consumption only in males in Phase-I and II at the time when the volunteers reached their 80% of the predicted heart rate. Female volunteers were able to go to higher loads of exercise in Phase-I and II.


Abstract: The effect of pranayama a controlled breathing practice, on exercise tests was studied in athletes in two phases; sub-maximal and maximal exercise tests. At the end of phase I (one year) both the groups (control and experimental) achieved significantly higher work rate and reduction in oxygen consumption per unit work. There was a significant reduction in blood lactate and an increase in P/L ratio in the experimental group, at rest. At the end of phase II (two years), the oxygen consumption per unit work was found to be significantly reduced and the work rate significantly increased in the
experimental group. Blood lactate decreased significantly at rest in the experimental group only. Pyruvate and pyruvate-lactate ratio increased significantly in both the groups after exercise and at rest in the experimental group. The results in both phases showed that the subjects who practised pranayama could achieve higher work rates with reduced oxygen consumption per unit work and without increase in blood lactate levels. The blood lactate levels were significantly low at rest.


“Research has shown that air flow in the turbinates in the nose triggers neuronal responses that set up reflexes throughout the body.”


Rao, Shankar. Oxygen consumption during yoga-type breathing at altitudes of 520 m. and 3,800 m. Indian Journal of Medical Research, 1968, 56(5):701-705.


**Ridges, Anita.** [Natural breathing vs. the yoga complete breath]. In “Stress and energy flow.” *Yoga Today*, Jan 1981, 5(9):18-20. See also the author’s letter to the editor regarding her ideas on this topic in the Nov 1981 issue, p. 19, and subsequent letters both critical of and agreeing with the author in the Jan 1982 issue, p. 9.


“People with anxiety and panic will often breathe mainly with the upper chest. Those with depression will often use deep abdominal breathing with little chest involvement . . .”


**Rodenbeck, Joachim.** Bhramari—the bumble bee. *Bindu*, no. 10, pp. 4-5.

Contents: Practice, A more harmonious pregnancy with Bhramari, Musicality and Nada Yoga


**Rossi, Ernest Lawrence.** The new yoga of the West: Natural rhythms of mind-body healing. *Psychological Perspectives*, issue date unknown.
On ultradian and circadian rhythms, such as the nasal cycle. “These quotations suggest that we are in an exciting period of convergence in which the traditional practices of yoga, meditation, and psychotherapy are intersecting current research at the molecular-genetic level. We . . . end this survey with some suggestions about the practical application of this new ‘Yoga of the West.’”


Satyananda Saraswati, Swami. Answers the questions: What is Pranayama? And what is its purpose? What are the different varieties of Pranayamas? What are their techniques for the practice and what are the benefits of those Pranayamas? Please enumerate some of the important instructions in connection with the practice of Pranayama. In Ma Yogabhakti, ed., Yoga Discussed in Relation to Other Thoughts & A Dialogue on Practical Yoga. Bihar, India: The Bihar School of Yoga, 1968, pp. 75-82.

Abstract: Santhi Kriya is a mixture of combined yogic practices of breathing and relaxation. Preliminary attempts were made to determine the effect of Santhi Kriya on certain psychophysiological parameters. Eight healthy male volunteers of the age group 25.9 +/- 3 (SD) years were subjected to Santhi Kriya practice daily for 50 minutes for 30 days. The volunteer's body weight, blood pressure, oral temperature, pulse rate, respiration, ECG and EEG were recorded before and after the practice on the 1st day and subsequently on 10th, 20th and 30th day of their practice. They were also given a perceptual acuity test to know their cognitive level on the 1st day and also at the end of the study i.e., on the 30th day. Results indicate a gradual and significant decrease in the body weight from 1st to 30th day (P less than 0.001) and an increase in alpha activity of the brain (P less than 0.001) during the course of 30 days of Santhi Kriya practice. Increase of alpha activity both in occipital and pre-frontal areas of both the hemispheres of the brain denotes an increase of calmness. This study also revealed that Santhi Kriya practice increases oral temperature by 3 degrees F and decreases respiratory rate significantly (P less than 0.05) on all practice days. Other parameters were not found to be altered significantly. It is concluded that the Santhi Kriya practice for 30 days reduces body weight and increases calmness.


“The performance of music and yoga are originally closely related, as the musical sense and ability to perceive tone are associated with Nada Yoga (sound yoga), and are prepared for it through the use of breathing exercises.”

Instructions for Kapalbhati and Bhranmari pranayama are given and Nada Yoga is discussed.


Overview: “One of the authors (VVA) recently traveled to India and had the opportunity to interview several well-known yogic masters regarding their use of yogic breathing for selected emotional disorders. The goal of this paper is to discuss the psychologic changes
associated with respiration controlled by the Yogic method. Two case examples will be presented with discussion.”


**Sequeira, H.** Pranayama as I see it, part I. *Yoga and Total Health*, Aug 2000, pp. 11-12.

__________. About prana and pranayama from my studies, part II. *Yoga and Total Health*, Sep 2000, pp. 20-22.

Contents: The tenfold prana [as described by Yajnavalkya], Channels of life force—nadis, Prana and pranayama in the Upanisads, Pranayama in Puranas, Prana and pranayama in the Yoga-Sutra, Study of prana and pranayama at The Yoga Institute, Pranayama IX (anuloma-viloma)


Abstract: This article reviews the published basic science and clinical studies on unilateral forced nostril breathing (UFNB), a subset of yogic breathing (pranayam) techniques that were discovered/devised more than 5000 years ago. The relationship of UFNB to the ultradian physiological phenomenon called the nasal cycle, a marker of mind-body states is also reviewed. Basic science studies show how UFNB can effect the autonomic nervous system, central nervous system (including cognition), and general metabolic activities. Clinical trials on the application to angina pectoris and obsessive compulsive disorder are described. In addition, three selected advanced UFNB techniques are described; one for stimulating the immune system; one for developing a comprehensive, comparative, and intuitive mind; and a third for developing an enlightened-transcendent mind. These three techniques are part of the ancient science of Kundalini Yoga as taught by Yogi Bhajan.


Abstract: Ultradian rhythms of alternating cerebral dominance have been demonstrated in humans and other mammals during waking and sleep. Human studies have used the methods of psychological testing and electroencephalography (EEG) as measurements to identify the phase of this natural endogenous rhythm. The periodicity of this rhythm approximates 1.5 – 3 hours in awake humans. This cerebral rhythm is tightly coupled to another ultradian rhythm known as the nasal cycle, which is regulated by the autonomic nervous system, and is exhibited by greater airflow in one nostril, later switching to the other side. This paper correlates uninostril airflow with varying ratios of verbal/spatial
performance in 23 right-handed males. Relatively greater cognitive ability in one hemisphere corresponds to unilateral forced nostril breathing in the contralateral nostril. Cognitive performance ratios can be influenced by forcibly altering the breathing pattern.


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 "breath of fire" or "kapalabhati" 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.


“Simple instructions on breath awareness, diaphragmatic breathing, the walking breath.”


Summary: The present study was undertaken to observe the energy cost and different cardiorespiratory changes during the practice of *sūrya-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 āsanas (28 min), prānāyāma (10.5 min), and meditation (5 min). Subjects first practiced kapāla-bhāti prānāyāma for 2 min, then yoga-mudrā 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 l min(−1)) and lowest in the first posture (0.35+/−0.02 l 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.


Contents: Prana and pranayama, What is prana?, Seat of prana, Sub-pranas and their functions, The colour of pranas, The length of the air-currents, The centering of the prana, The lungs, Ida and pingala, Sushumna, Kundalini, Shat-chakras, Nadis, Purification of the nadis, Shat-karmas (the six purificatory processes), Dhautis, Basti, Neti, Trataka (gazing), Nauli, Kapalabhati, [Chapter 2 brings dietary, meditative, etc., preparation for pranayama], What is pranayama, Pranayama (according the Gita), Pranayama (according to Sri Sankaracharya), Pranayama (according to Yogi Bhusunda), Control of breath, Varieties of pranayama, Three types of pranayama, The Vedantic kumbhaka, Pranayama for nadi-suddhi, Mantra during pranayama, Exercises 1-4, Deep breathing exercise, Kapalabhati, The external kumbhaka (bahya), Easy comfortable pranayama (sukha purvaka), Pranayama for awakening kundalini, Pranayama during meditation, Pranayama while walking, Pranayama in savasana, Rhythmical breathing, Surya bhed, Ujjayi, Sitkari, Sitali, Bhastrika, Bhramari, Murchha, Plavini, Kevala kumbhaka, Pranic healing, Distant healing, Relaxation, Relaxation of mind, Importance and benefits of pranayama, Special instructions, Concentration on solar plexus, Pancha dharana, Prithvi dharana, Ambhasi dharana, Agneyi dharana, Vayavya dharana, Akasa dharana, Story of Yogi Bhusunda, The inner factory, Yogic diet, Sivananda’s pranayama, Kundalini pranayama, Questions and answers

Contents: Exercise no. 1, Exercise no. 2, Kapalabhati, Suryabheda, Ujjayi, Sitkari, Sitali, Bhastrika, Bhramari, Murcha, Plavini, Kevala Kumbhaka, Benefits of pranayama, Hints on pranayama

**Smith, Gordon.** From breath to light: Simple guidelines to yogic breathing. *Yoga & Health,* Mar 2000, p. 12.


On the effects of three different positions of the abdominal wall on *kumbhaka.*

**Somerville, Rebecca.** Relationship of yama, niyama and breath. In the article, “Patanjali’s divine gift – part two: Sadhana Pada.” *Australian Yoga Life,* 2003, no. 6, p. 61.


Side 1 provides a 13-minutes systematic reclining relaxation in the corpse pose, and side 2 provides a 9-minute deeply relaxing breathing practice in the crocodile pose.

___________. Breathing through emotions. *Yoga International,* Feb/Mar 2000, pp. 61-64.


Abstract: We tested whether chemoreflex sensitivity could be affected by the practice of yoga, and whether this is specifically because of a slow breathing rate obtained during yoga or as a general consequence of yoga. We found that slow breathing rate per se substantially reduced chemoreflex sensitivity, but long-term yoga practice was responsible for a generalised reduction in chemoreflex.


Yogic high-frequency respiration—kapalabhati (KB)—was studied in 24 subjects from a point of rhythmicity. Respiratory movements, blood pressure and R-R intervals of ECG were recorded in parallel and evaluated by spectral analysis of time series. Respiratory signals during KB were modulated by 0.1 Hz rhythm in 82% of experiments. This component was also present in R-R intervals and blood pressure during KB. Frequency (0.2-0.3 Hz) was observed in 67% of respiratory records. The presence of the component 0.2-0.3 Hz in respiration was dependent on resting respiratory frequency. This frequency component was reduced in R-R intervals but increased in blood pressure during kapalabhati as compared to that at rest. The occurrence of both frequency components in respiration during KB supports the hypothesis about the integrative role of cardiovascular and respiratory rhythms in physiological states characterized by altered respiratory frequency.


Abstract: Topography of brain electrical activity was studied in 11 advanced yoga practitioners during yogic high-frequency breathing kapalabhati (KB). Alpha activity was increased during the initial five min of KB. Theta activity mostly in the occipital region was increased during later stages of 15 min KB compared to the pre-exercise period. Beta 1 activity increased during the first 10 min of KB in occipital and to a lesser degree in parietal regions. Alpha and beta 1 activity decreased and theta activity was maintained on the level of the initial resting period after KB. The score of General Deactivation factor from Activation Deactivation Adjective Checklist was higher after KB exercise than before the exercise. The results suggest a relative increase of slower EEG frequencies and relaxation on a subjective level as the after effect of KB exercise.

Abstract: We studied cardiovascular and respiratory changes during yogenic breathing exercise kapalabhati (KB) in 17 advanced yoga practitioners. The exercise consisted in fast shallow abdominal respiratory movements at about 2 Hz frequency. Blood pressure, ECG and respiration were recorded continuously during three 5 min periods of KB and during pre- and post-KB resting periods. The beat-to-beat series of systolic blood pressure (SBP) and diastolic blood pressure (DBP), R-R intervals and respiration were analysed by spectral analysis of time series. The mean absolute power was calculated in three frequency bands--band of spontaneous respiration, band of 0.1 Hz rhythm and the low-frequency band greater than 15 s in all spectra. The mean modulus calculated between SBP and R-R intervals was used as a parameter of baroreceptor-cardiac reflex sensitivity (BRS). Heart rate increased by 9 beats per min during KB. SBP and DBP increased during KB by 15 and 6 mmHg respectively. All frequency bands of R-R interval variability were reduced in KB. Also the BRS parameter was reduced in KB. The amplitude of the high-frequency oscillations in SBP and DBP increased during KB. The low-frequency blood pressure oscillations were increased after KB. The results point to decreased cardiac vagal tone during KB which was due to changes in respiratory pattern and due to decreased sensitivity of arterial baroreflex. Decreased respiratory rate and increased SBP and low-frequency blood pressure oscillations after KB suggest a differentiated pattern of vegetative activation and inhibition associated with KB exercise.


Abstract: We studied eight Belgian subjects well advanced in the practice of hatha-yoga and compared them with eight sex-, age-, and height-matched control subjects. Practice of yoga (range 4-12 yr) involves control of posture and manipulation of breathing, including slow near-vital capacity maneuvers accompanied by apnea at end inspiration and end expiration. Average values for the yoga and the control group (in parentheses) are as follows: ventilation (VE) 5.53 1 X min-1 (7.07); tidal volume (VT), 1.03 liters (0.56); rate of breathing, 5.5 min-1 (13.4); end-tidal PCO2, 39.0 Torr (35.3). All differences are significant (P less than 0.05). Ventilatory response to CO2 (rebreathing technique) was significantly lower in the yoga group (P less than 0.01). The regression relating VE to VT during rebreathing of CO2 was VE = 8.1 (VT - 0.23) for the yoga group and VE = 15.8 (VT - 0.16) for the control group (P less than 0.005). We attribute these changes to chronic manipulation of respiration.


“When breath control is correct, mind control is possible,’ says Sri K. Pattabhi Jois. Recognize and develop the subtle qualities of one’s practice necessary for breath control. Proper positioning (alignment), sound (ujjayi), and rhythm (length) will be used to understand the transformative power of proper breathing.”


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.


Abstract: According to ancient Indian and Chinese texts the subtle energy (prana or chi) flows through several thousand anatomically indistinguishable channels or meridians (nadis). Three channels are especially important (ida, pingala, and sushumna). The ida and pingala channels correlate with left and right uninostril breathing, respectively. Like yin and yang, they are considered to represent the masculine and feminine principles present in all creation irrespective of sex. From this perspective these principles are
assumed to be present simultaneously in persons of both sexes. This suggests that any sex-specific effects of uninostril breathing may be associated with sex-based physiological differences, not with ‘masculine’ and ‘feminine’ attributes of the channels (and the corresponding nostrils).


Abstract: To determine whether the yogic Ujjayi pranayamic type of breathing that involves sensory awareness and consciously controlled, extremely slow-rate breathing including at least a period of end-inspiration breath holding in each respiratory cycle would alter oxygen consumption or not, ten males with long standing experience in pranayama, and volunteering to participate in the laboratory study were assessed. These subjects aged 28-59 yr, had normal health appropriate to their age. Since kumbhak (timed breath holding) is considered as an important phase of the respiratory cycle in the pranayama, they were categorised into two groups of five each, one group practising the short kumbhak varieties of pranayama, and the other the long kumbhak varieties of pranayama. The duration of kumbhak phase was on an average 22.2 percent of the respiratory cycle in the short kumbhak group, and 50.4 per cent in the long kumbhak group. The oxygen consumption was measured in test sessions using the closed circuit method of breathing oxygen through the Benedict-Roth spirometer. Each subject was tested in several repeat sessions. Values of oxygen consumption of the period of pranayamic breathing, and of post-pranayamic breathing period, were compared to control value of oxygen consumption of the prepranayamic breathing period of each test session. The results revealed that the short kumbhak pranayamic breathing caused a statistically significant increase (52%) in the oxygen consumption (and metabolic rate) compared to the pre-pranayamic base-line period of breathing. In contrast to the above, the long kumbhak pranayamic breathing caused a statistically significant lowering (19% of the oxygen consumption (and metabolic rate).


Abstract: Middle latency auditory-evoked potentials (AEP-MLRs) of 10 healthy male subjects in the age range of 21-33 years, were assessed to determine whether yogic pranayamic practice would cause changes in them. The pranayama type assessed here is an exercise of consciously-controlled rhythmic breathing involving timed breath-holding in each cycle of breathing, while the subject holds utmost attention and experiences the touch of inhaled air in the nasal passage [Ujjayi and Bhastrika type of pranayama]. The results revealed that the Na-wave amplitude increased and latency decreased during the
period of pranayamic practice, whereas the Pa-wave was not significantly altered. The change is interpreted as an indication of a generalized alteration cause in information processing at the primary thalamo-cortical level during the concentrated mental exercise of inducing modifications in neural mechanisms regulating a different functional system (respiratory). Further research is required to understand the operational significances of such changes.


Abstract: There is increasing interest in the fact that breathing exclusively through one nostril may alter the autonomic functions. The present study aimed at checking whether such changes actually do occur, and whether breathing is consciously regulated. 48 male subjects, with ages ranging from 25 to 48 years were randomly assigned to different groups. Each group was asked to practice one out of three pranayamas (viz. right nostril breathing, left nostril breathing or alternate nostril breathing). These practices were carried out as 27 respiratory cycles, repeated 4 times a day for one month. Parameters were assessed at the beginning and end of the month, but not during the practice. The “right nostril pranayama” group showed a significant increase, of 37% in baseline oxygen consumption. The “alternate nostril” pranayama group showed an 18% increase, and the left nostril pranayama group also showed an increase, of 24%. This increase in metabolism could be due to increased sympathetic discharge to the adrenal medulla. The “left nostril Pranayama” group showed an increase in volar galvanic skin resistance, interpreted as a reduction in sympathetic nervous system activity supplying the sweat glands. These results suggest that breathing selectively through either nostril could have a marked activating effect or a relaxing effect on the sympathetic nervous system. The therapeutic implications of being able to alter metabolism by changing the breathing pattern have been mentioned.


Abstract: This study was conducted to assess the physiological effects of a yoga breathing practice that involves breathing exclusively through the right nostril. This practice is called surya anuloma viloma pranayama (SAV). Twelve volunteers (average age 27.2 years +/- 3.3 years, four males) were assessed before and after test sessions conducted on two consecutive days. On one day the test session involved practicing SAV pranayama for 45 minutes (SAV session). During the test period of the other day, subjects were asked to breathe normally for 45 minutes (NB session). For half the patients (randomly chosen) the SAV session was on the first day and the NB session on the next day. For the remaining six patients, the order of the two sessions was reversed. After the SAV session (but not after the NB) there was a significant (P < .05, paired t test) increase in oxygen consumption (17%) and in systolic blood pressure (mean increase 9.4 mm Hg) and a significant decrease in digit pulse volume (45.7%). The latter
two changes are interpreted to be the result of increased cutaneous vasoconstriction. After both SAV and NB sessions, there was a significant decrease in skin resistance (two factor ANOVA, Tukey test). These findings show that SAV has a sympathetic stimulating effect. This technique and other variations of unilateral forced nostril breathing deserve further study regarding therapeutic merits in a wide range of disorders.

__________, S. Narendran, P. Raghuraj, R. Nagarathna, and H. R. Nagendra. 


Abstract: The present study was conducted to evaluate a statement in ancient yoga texts that suggests that a combination of both “calming” and “stimulating” measures may be especially helpful in reaching a state of mental equilibrium. Two yoga practices, one combining “calming and stimulating” measures (cyclic meditation) and the other, a “calming” technique (shavasan), were compared. The oxygen consumption, breath rate, and breath volume of 40 male volunteers (group mean +/- SD, 27.0 +/- 5.7 years) were assessed before and after sessions of cyclic meditation (CM) and before and after sessions of shavasan (SH). The 2 sessions (CM, SH) were 1 day apart. Cyclic meditation includes the practice of yoga postures interspersed with periods of supine relaxation. During SH the subject lies in a supine position throughout the practice. There was a significant decrease in the amount of oxygen consumed and in breath rate and an increase in breath volume after both types of sessions (2-factor ANOVA, paired t test). However, the magnitude of change on all 3 measures was greater after CM: (1) Oxygen consumption decreased 32.1% after CM compared with 10.1% after SH; (2) breath rate decreased 18.0% after CM and 15.2% after SH; and (3) breath volume increased 28.8% after CM and 15.9% after SH. These results support the idea that a combination of yoga postures interspersed with relaxation reduces arousal more than relaxation alone does.

Tigunait, Pandit Rajmani. Understanding the pranic sheath. Yoga International, [date unknown].

__________. Waking the energy of breath. Living Joyfully (Himalayan Institute), Spring 2004, pp. 8-12.

“The majority of diseases today, both physical and psychosomatic, are related to the lower half of the torso . . .

“Agni sara loosens the knots caused by fear, insecurity, sense cravings, anger, hatred, loneliness, and sense of unworthiness.”

Answers the questions: “How do I prepare myself to practice pranayama? What must I do (or not do) for a safe and successful practice?” “This doesn’t make sense. Pranayama seems to be less vigorous and demanding than the asanas, especially the full range of 84 classical poses. How can something as advanced as asana be a prerequisite to something as simple as pranayama?” Yoga International, Jun/Jul 2005, pp. 28-30.


Abstract: Ten healthy, untrained volunteers (nine females and one male), ranging in age from 18-27 years, were studied to determine the effects of hatha yoga practice on the health-related aspects of physical fitness, including muscular strength and endurance, flexibility, cardiorespiratory fitness, body composition, and pulmonary function. Subjects were required to attend a minimum of two yoga classes per week for a total of 8 weeks. Each yoga session consisted of 10 minutes of pranayamas (breath-control exercises), 15 minutes of dynamic warm-up exercises, 50 minutes of asanas (yoga postures), and 10 minutes of supine relaxation in savasana (corpse pose). The subjects were evaluated before and after the 8-week training program. Isokinetic muscular strength for elbow extension, elbow flexion, and knee extension increased by 31%, 19%, and 28% (p<0.05), respectively, whereas isometric muscular endurance for knee flexion increased 57% (p<0.01). Ankle flexibility, shoulder elevation, trunk extension, and trunk flexion increased by 13% (p<0.01), 155% (p<0.001), 188% (p<0.001), and 14% (p<0.05), respectively. Absolute and relative maximal oxygen uptake increased by 7% and 6%, respectively (p<0.01). These findings indicate that regular hatha yoga practice can elicit improvements in the health-related aspects of physical fitness. Copyright © 2001 CHF, Inc.


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-bhashrika, 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 (QS2, LVET and PEP) and AFT (RRIV and QT/QS2) 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 suggesting an enhanced parasympathetic and blunted sympathetic activity respectively. QS, 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.


Abstract: This study tested the effectiveness of Ian Jackson’s “BreathPlay” method of respiration. BreathPlay uses a pattern of forceful expirations and less forceful inspirations in varying ratios. The experimental (E) and control (C) subjects (N = 15 and 10) were volunteers from local USCF clubs. All subjects participated in a maximal OXT (I) on their own bicycles mounted on a wind-load trainer. Following I, E worked 12 hrs. with Jackson over three days learning BreathPlay. Both groups were retested in the following 10 days (II). Percent changes from I to II by E versus C include time to exhaustion, 7.2 vs 0%, (p<.05). Decrease in submaximal ER and RPE, 4.7 vs 2.8% and 9.6 vs 4.6% (p<.01, p<.02). Peak %CO2 occurred 26.8 later vs 14.8% earlier for C (p<.001. Time of RQ = 1.0 was extended 2.0 minutes for E vs .85 minutes for C (p<.20). Anaerobic threshold (AT) was delayed for 2.0 minutes for E in II. Submaximal VCO2 and %CO2 was decreased for E vs C, 9.8 vs 0.8% (p<.05). For racing cyclists BreathPlay increases endurance and delays onset of AT.

Discussion: It is a commonly held belief that there is little or no enhanced athletic performance with voluntary breath patterning by healthy subjects for activities other than swimming. The purpose of the present investigation was to determine if an experimental basis exists for anecdotal reports for the effectiveness of the BreathPlay technique of voluntary ventilatory patterning (VVP) for racing cyclists.

The results of the present study suggest that endurance cycling performance may be enhanced by voluntary breath patterning in which cyclists exaggerate the force and duration of exhalation. Cyclists using this technique demonstrated a significant increase in time to exhaustion. The improved endurance performance was accompanied by significantly lower submaximal VO2 HR and RPE in those cyclists using VVF. The lower VO2’s may have been the result of increased ventilatory efficiency. If ventilatory
efficiency increases with VVP then a lower value for the oxygen cost of breathing (OCB) may be expected. Since the OCB can rise to 10% of VO2 during exercise a reduction could significantly reduce total body oxygen consumption. It has also been hypothesized that distraction from the sensation of effort can reduce the HR and RPE response to exercise. The concentration required to perform VVP may therefore be in part responsible for the lower values observed in the cyclists using the experimental technique.

A second explanation for the lower HRs may be that a reduction in intrathoracic pressure may occur during the prolonged exhalation. A reduced intrathoracic pressure would reduce impedance to venous return that would in turn facilitate an increased stroke volume and decreased HR while maintaining the required cardiac output.

It is interesting to note that the increase in endurance times observed in the experimental group was not accompanied by an increase in VO2 peak under the same condition. The improve endurance performance would therefore seem to be related to the lower submaximal VO2 and the observed delay in inset of the anaerobic threshold.

Much additional research regarding the potential of VVP remains to be performed before it may be recommended as an ergogenic aid. At present the results appear promising and suggest a role for VVP to enhance the endurance performance of racing cyclists.

The use of breath as a natural tranquilizer. L’yx, Special Issue 2000 in English, pp, 7-8.


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 in spite of similar physical activity. This shows the Raja Yoga meditation provides significant improvements in respiratory functions, cardiovascular parameters and lipid profile.


Weller, Stella. Breath & the mind: Because the relationship between breath and mind is reciprocal, we can create a change in our emotional state by consciously altering our pattern of breathing. *Yoga & Health*, Jun 1999, pp. 5-7.


Abstract: Alternating dominance of cerebral hemispheric activity was demonstrated in humans by use of the electroencephalogram (EEG). Relative changes of electrocortical activity have a direct correlation with changes in the relative nostril dominance, the so-called nasal cycle. The nasal cycle is a phenomenon where efficiency of breathing alternates predominantly through right or left nostril with a periodicity ranging from 25 to greater than 200 minutes. Relatively greater integrated EEG value in one hemisphere correlates with predominant airflow in the contralateral nostril, defining a new interrelationship between cerebral dominance and peripheral autonomic nervous function.


Abstract: We have previously demonstrated by the integration of EEG amplitudes, that an ultradian rhythm of alternating cerebral dominance exists in humans. This rhythm is tightly coupled with the nasal cycle, since its lateralization correlates with shifts in airflow through the left and right nostrils, where relatively greater integrated amplitudes in one hemisphere correspond to predominant airflow in the contralateral nostril. The nasal cycle is known to be regulated by the sympathetic and parasympathetic branches of the autonomic nervous system. This dynamic lateralization of alternating activity in the autonomic nervous system exists in other peripheral structures and is also likely to be the mode of regulation of the cortical rhythm. This paper shows that forced nostril breathing
in one nostril produces a relative increase in the EEG amplitude in the contralateral hemisphere. This phenomena was demonstrated in 5 out of 5 untrained subjects. These results suggest the possibility of a non-invasive approach in the treatment of states of psychopathology where lateralized cerebral dysfunction have been shown to occur.

**Where is your diaphragm?** *Yoga Today*, no. 1., pp. 28-29.


Abstract: The effects of three different procedures, relaxation, visualization and yogic breathing (pranayama) and stretch on perceptions of physical and mental energy and on positive and negative mood states have been assessed in a group of normal volunteers (N = 71, age range 21-76). Pranayama produced a significantly greater increase in perceptions of mental and physical energy and feelings of alertness and enthusiasm than the other two procedures (P < 0.5). Relaxation made subjects significantly more sleepy and sluggish immediately after the session than pranayama (P < 0.05). Visualization made them more sluggish but less content than pranayama (P < 0.05) and more upset than relaxation after the second session (P < 0.05). Thus, a 30 min programme of yogic stretch and breathing exercises which is simple to learn and which can be practised even by the elderly had a markedly “invigorating” effect on perceptions of both mental and physical energy and increased high positive mood. A more extensive investigation is planned to establish whether such a programme can readily be incorporated into everyday life, and with what long-term results.


__________. Pranayama Teacher Training and Foundation Course. London and Sheffield, England. Email: pax_yoga@yahoo.com; URL: www.yogaquests.co.uk.


Abstract: During recent years, a lot of research work has been done to show the beneficial effects of yoga training. The present study was undertaken to assess the effects of yogic practice on some pulmonary functions. Sixty healthy young female subjects (age group
17-28 yrs.) were selected. They had to do the yogic practices daily for about one hour. The observations were recorded by MEDSPIROR, in the form of FVC, FEV-1 and PEFR on day-1, after 6 weeks and 12 weeks of their yogic practice. There was significant increase in FVC, FEV-1 and PEFR at the end of 12 weeks.

**Yee, Rodney.** *The Art of Breath and Relaxation* audiocassettes. Venice, Calif.: Living Arts. 90 minutes.


**Yoga Biomedical Trust.** Hyperventilation classes. URL: http://freespace.virgin.net/yogabio.med/ (click on “Yoga Therapy & How to Try It,” then click on “Index-Alphabetical,” then click on “Hyperventilation”).


Chapters include: Genesis of prana; Order of succession of prana [in the causal body]; Origination of prana from the tanmatra of touch in the realm of ahankar; Origination and essential nature of prana in the realm of gross elements; In the realm of gross elements perception of thirty types of pranas in the gross body and self-realisation by samadhi; In the realm of subtle elements or five tanmatras perception of thirty types of pranas and self-realisation by the tanmatra of touch; In the realm of mahat, perception of three types of more subtle pranas in the causal body and self-realisation; Realisation of Brahma and the most subtle causal pran in the quiescent state of prakriti

**Of Related Interest**


Abstract: Life begins and ends with breath. Slight bodily changes are brought about by alteration in the mechanisms of breath. In addition, mental changes are also influenced by breath. Our general condition of well-being is dependent upon the rhythmic cycles of breathing within us. Similarly, emotions change the rhythm of breath and when we become overexcited, then we lose control over the breath. By gaining control of the breath then we gain mastery of mind and body. Not only that, we also establish a connection with the world around us, of which we are part, through the breath.

Two specific healing initiatives based upon breath are used as illustration of breath both as a subtle organizing property and as a material manifestation. The first example is the use of breath through singing to intentionally organize the physiological abilities of another person as they recover from coma. Singing is literally the intentional use of
breath to heal realized through a particular therapeutic form, which is improvised music therapy. A fundamental property of breathing is that it has rhythm. In musical terms, rhythm has to have the property of intention otherwise it would be simply cyclic repetition or pulse. The second healing initiative is that of Qigong Yangsheng for the treatment of asthma. Breathing is used here also as an intentional activity, this time by the patient to improve his or her own breathing abilities and to heal what is essentially a breathing problem, the material manifestation of air-flow. In this latter example, the healer acts as a teacher and guide for the sufferer to influence her own breathing.

**Aust, G., and K. Fischer.** [Changes in body equilibrium response caused by breathing. A posturographic study with visual feedback.] *Laryngorhinootologie*, Oct 1997, 76(10):577-582. [In German.]

Abstract: . . . deals with the psychophysical breath work by Middendorf and examines whether it has an effect on reactions of the body’s equilibrium system . . . Group 1 and 2 show significantly better results in the posturographic test with visual feedback than subjects without experience in breath work (Group 3). Furthermore, posturographic results immediately after one hour of breath work reveal clear improvements in the body equilibrium.


**Bell, Harold J., and James Duffin.** The respiratory response to passive limb movement is suppressed by a cognitive task. *Journal of Applied Physiology*, 2004. Author email: j.duffin@utoronto.ca.

Abstract: Feedback from muscles stimulates ventilation at the onset of passive movement. We hypothesized that central neural activity via a cognitive task source would interact with afferent feedback, and we tested this hypothesis by examining the fast changes in ventilation at the transition from rest to passive leg movement, under two conditions: (A) no task, and (B) solving a computer-based puzzle. Resting breathing was greater in condition (B) than in condition (A); evidenced by an increase in mean ± SEM breathing frequency (18.2 ± 1.1 br min⁻¹ versus 15.0 ± 1.2 br min⁻¹, p = 0.004) and ventilation (10.93 ± 1.16 l min⁻¹ versus 9.11 ± 1.17 l min⁻¹ p < 0.001). In condition (A) the onset of passive movement produced a fast increase in mean ± SEM breathing frequency (= 2.9 ± 0.4 br min⁻¹, p < 0.001), tidal volume (= 233 ± 95 ml, p < 0.001) and ventilation (= 6.00 ± 1.76 l min⁻¹, p < 0.001). However, in condition (B) the onset of passive movement only produced a fast increase in mean ± SEM breathing frequency (= 1.3 ± 0.4 br min⁻¹, p = 0.045), significantly smaller than in condition (A) (p = 0.007). These findings provide evidence for an interaction between central neural cognitive activity and the afferent feedback mechanism, and we conclude that the performance of a cognitive task suppresses the respiratory response to passive movement.


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.


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.)


Abstract: The term “transformational breath work” commonly refers to techniques which use the breath for inducing altered states of consciousness to promote healing on any level. This paper describes common elements of transformational breath work and rationale for its use in medical illness. It then describes the use of one form, Evocative Breath Therapy (EBT), TM within a group mind/body medicine program. The technique employs an hour-long, four-stage process of focused awareness on the breath accompanied by guided imagery and evocative music. It is designed to induce an altered state of consciousness that promotes expanded self-awareness, self-acceptance, self-compassion, a sense of inner peace, and release of emotional and physical tension. A pilot study was conducted to determine the impact of EBT TM on one indicator of immune function, salivary immunoglobulin A (S-IgA). A heterogeneous sample of forty-five adults (21 cancer patients, 22 healthy others, 2 with other illnesses) contributed saliva samples before and immediately after the experience. A 46.3% increase in S-IgA was found ($p = 0.0123$, paired-differences t-test). There were no significant differences between cancer patients and others. Effect strength was moderate, .278. Leave-one-out analysis found the effect strength to decrease only marginally, suggesting the results are likely generalizable to independent random samples. Issues in the use of transformational breath work in clinical programs and implications for further research are discussed.

**Control of human ventilation.** Article available online: http://homepages.culver.edu/faculty/jcoelho/biol309/ventlate.htm

A brief overview of the physiology of human respiration.

Abstract: The objective of this study was to investigate the synchronization between low-frequency breathing patterns and respiratory sinus arrhythmia (RSA) of heart rate during guided recitation of poetry, i.e., recitation of hexameter verse from ancient Greek literature performed in a therapeutic setting. Twenty healthy volunteers performed three different types of exercises with respect to a cross-sectional comparison: 1) recitation of hexameter verse, 2) controlled breathing, and 3) spontaneous breathing. Each exercise was divided into three successive measurements: a 15-min baseline measurement (S1), 20 min of exercise, and a 15-min effect measurement (S2). Breathing patterns and RSA were derived from respiratory traces and electrocardiograms, respectively, which were recorded simultaneously using an ambulatory device. The synchronization was then quantified by the index $\gamma$, which has been adopted from the analysis of weakly coupled chaotic oscillators. During recitation of hexameter verse, $\gamma$ was high, indicating prominent cardiorespiratory synchronization. The controlled breathing exercise showed cardiorespiratory synchronization to a lesser extent and all resting periods (S1 and S2) had even fewer cardiorespiratory synchronization. During spontaneous breathing, cardiorespiratory synchronization was minimal and hardly observable. The results were largely determined by the extent of a low-frequency component in the breathing oscillations that emerged from the design of hexameter recitation. In conclusion, recitation of hexameter verse exerts a strong influence on RSA by a prominent low-frequency component in the breathing pattern, generating a strong cardiorespiratory synchronization.


Abstract: The object of this article is to present a novel physiological classification of Limbic-Autonomic (LA) arousal on the basis of human physiological data, specifically the oro-nasal breathing patterns in man. It is proposed that the multidimensional LA arousal can be classified into five grades: Grade I: Non-nasal (NN) or oral breathing with bilateral nasal congestion, and nonactive behavior, Grade II: Left Nasal (LN) breathing and quiet behavior, Grade III: Right Nasal (RN) breathing and active behavior, Grade IV: Bilateral Nasal (BN) breathing and very active behavior, and Grade V: Oral and Bilateral Nasal (ON) breathing with maximal behavioral activation. The data from polygraphic electroencephalographic recordings from five healthy volunteers, before, during and after exercise are presented in support of this physiological classification of LA arousal. On the basis of Limbic-Autonomic asymmetry a novel concept of ‘Visceral Dominance’ is also proposed.


Abstract: Breathing is a vital behavior that is particularly amenable to experimental investigation. We review recent progress on three problems of broad interest. (i) Where and how is respiratory rhythm generated? The preBötzinger Complex is a critical site, whereas pacemaker neurons may not be essential. The possibility that coupled oscillators are involved is considered. (ii) What are the mechanisms that underlie the plasticity necessary for adaptive changes in breathing? Serotonin-dependent long-term facilitation following intermittent hypoxia is an important example of such plasticity, and a model that can account for this adaptive behavior is discussed. (iii) Where and how are the regulated variables CO₂ and pH sensed? These sensors are essential if breathing is to be appropriate for metabolism. Neurons with appropriate chemosensitivity are spread throughout the brainstem; their individual properties and collective role are just beginning to be understood.


“This straightforward . . . guide shows readers how to take advantage of several easy breathing techniques and exercises to effectively reduce stress—the most common health complaint in North America—as well as a range of other health problems, including asthma, migraines, hypertension, hyperventilation, and psychosomatic disorders. The author presents simple breathing exercises anyone can do, any time . . .”

Giardino, Nicholas D., Robb W. Glenny, Soo Borson, and Leighton Chan.

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.


Abstract: We hypothesize that routinely applied short sessions of slow and regular breathing can lower blood pressure (BP). Using a new technology BIM (Breathe with Interactive Music), hypertensive patients were guided towards slow and regular breathing. The present study evaluates the efficacy of the BIM in lowering BP. We studied 33 patients (23M/10F), aged 25-75 years, with uncontrolled BP. Patients were randomized into either active treatment with the BIM (n = 18) or a control treatment with a Walkman (n = 15). Treatment at home included either musically-guided breathing exercises with the BIM or listening to quiet music played by a Walkman for 10 min daily for 8 weeks. BP and heart rate were measured both at the clinic and at home with an Omron IC BP monitor. Clinic BP levels were measured at baseline, and after 4 and 8 weeks of treatment. Home BP measurements were taken daily, morning and evening, throughout the study. The two groups were matched by initial BP, age, gender, body mass index and medication status. The BP change at the clinic was -7.5/-4.0 mm Hg in the active treatment group, vs -2.9/-1.5 mm Hg in the control group (P = 0.001 for
systolic BP). Analysis of home-measured data showed an average BP change of -5.0/-2.7 mm Hg in the active treatment group and -1.2/+0.9 mm Hg in the control group. Ten out of 18 (56%) were defined as responders in the active treatment group but only two out of 14 (14%) in the control group (P = 0.02). Thus, breathing exercise guided by the BIM device for 10 min daily is an effective non-pharmacological modality to reduce BP.


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, eventhough 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.


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


“Reverses stooped, imbalanced posture that begins in middle years; also relieves depressed breathing.”


**International Society for the Advancement of Respiratory Psychophysiology.** See website: http://cscwww.cats.ohiou.edu/isarp/.


Abstract: Guolin Qigong is a combination of meditation, controlled breathing and physical movement designed to control the vital energy (qi) of the body and consequently to improve spiritual, physical, and mental health. Practice of Qigong has been reported to alter immunological function, but there have been few studies of its effects on cytokines, the key regulators of immunity. Numbers of peripheral blood cytokine-secreting cells were determined by ELISPOT in 19 healthy volunteers aged 27-55 before they were taught the practice of Qigong and after 3, 7 and 14 weeks of daily practice. The effect of Qigong on blood cortisol was also examined. Numbers of IL4- and IL12-secreting cells remained stable. IL6 increased at 7 weeks and TNF; increased in unstimulated cultures and 3 and 7 weeks but decreased at these times in LPF and SAC-stimulated cultures. Of particular interest, IFN-secreting cells increased and IL10-secreting cells decreased in PHA-stimulated cultures, resulting in significant increases in the IFN:IL10 ratio. Cortisol, a known inhibitor of type 1 cytokine production, was reduced by practicing Qigong.

Self-evaluation of respiratory deterioration was significantly predictive of death from all causes.


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.


Abstract: Objective: This review article aims to explore current opinions on Qigong-induced mental disorders, an entity which is unfamiliar to Western psychiatrists. Method: Relevant literature published in Chinese and English is reviewed. Results: The review is divided into three sections: first, there is brief consideration of the historical development of Qigong in traditional Chinese medicine and its role in psychiatry; second, there is a review of the literature published on Qigong deviations and Qigong-induced mental disorders; and third, there is a discussion on the aetiological role of Qigong in these conditions. Conclusions: Qigong remained veiled in secrecy and available only to the elite until the early 1980s. Despite the widespread use of Qigong, there is a conspicuous lack of controlled data regarding its effects on mental health. Qigong, when practised inappropriately, may induce abnormal psychosomatic responses and even mental disorders. However, the ties between Qigong and mental disorders are manifold, and a causal relationship is difficult to establish. Many so-called “Qigong-induced psychoses” may be more appropriately labelled “Qigong-precipitated psychoses,” where the practice of Qigong acts as a stressor in vulnerable individuals.


“After many years in Korea, I’m just beginning to break the Korean shell and experience its rich spiritual culture. Korea has much more to offer the world than kimchi and ‘the red devils.’ I’d like to introduce the world to the Korean form of meditation called ‘Seon-do’ Practice. It’s more than 5,000 years old and precedes Buddhism, Taoism, Confucianism and others. The focus is on the ‘living’ breath, which can only be found by focusing on the ‘Dan-jeon’ spot. Dan-jeon is known as ‘tan-tien’ in Chinese and ‘hara’ in Japanese. Yoga uses a chakra to describe the location but doesn’t use methods to store energy there: which is the main point of using the Dan-jeon, located five inches below the navel.

“The essence of Seon-do practice is in concentrating on the breathing point, after having controlled your emotions, practiced muscles exercises, and lowered your consciousness. You’ll find that this is not mindfulness—but mindlessness. Masters throughout Asia have searched for correct Dan-jeon breathing, understanding that it’s the origin of all breathing techniques, but many have not had the patience or the correct teacher to learn it. Even now, we receive phone calls from monks from time to time asking how to do the breathing method!

“Meditation in the ‘lotus position’ is not emphasized until your breathing point has been found, and it takes six months of lying down breathing just to find the location . . .”


Abstract: Maximum nasal flow rate in the right and left nostrils was simultaneously determined during expiration with the help of two flowmeters in 10 healthy subjects in different postures and in two patients, one with Horner’s syndrome and the other with facial palsy. It was found that pressure on the hemithorax from any surface (i.e., lateral, anterior, posterior, or superior) leads to reduced patency of the ipsilateral nostril but increased patency of the nostril on the opposite site. In the patient with Horner’s syndrome, the nostril on the affected side remained blocked even on compression of the opposite hemithorax, and in the one with facial nerve palsy, the nostril on the affected side remained patent despite compression of the hemithorax on that side. The findings suggest that compression of hemithorax leads to changes in the congestion of the nasal
mucosa that may be mediated through autonomic nerves.


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

**Stein, Emily, and Leah Brzuszkiewicz.** The relationship between nostril dominance and preferred handedness. Poster presentation at St. Lawrence University Festival of Science, Canton, New York, Apr 2001.

Abstract: The classic nasal cycle is a pattern where congestion on one side of the nose is accompanied by decongestion of the other side. Past studies have investigated various aspects of this biological occurrence, and great variability was found. Flanagan and Eccles (1997) and Fisher, Liu, and Lund (1994) reported that a nasal cycle was exhibited in approximately 80% of the population. However, others, such as Gilbert (1989) and Winkler, Combs, and Daley (1994) reported that only 20% of the population displayed these cyclic changes. In addition, different studies have reported huge differences (from 48 minutes to 7.3 hours) in the average length of the nasal cycle. A goal of the present study was to account for some of this large variability in nasal cycling behavior by considering a person’s preferred handedness. Since some studies have reported evidence that odorant sensitivity differs between the left and right nostril, and that this difference varied if a person was right-handed or left-handed (Hummel, Mohammadian & Kobal, 1998; Youngentob, Kurtz, Leopold, Mozell, Hornung (1982, but cf., Zatorre & Jones-Gotman, 1990), we hypothesized a relationship between handedness and nostril dominance.

We tested 20 healthy males, 11 right-handed subjects (RH) and 9 left-handed subjects (LH). Nasal airflow was measured once every 15 minutes for a 6 hour period. The participants were confined to three separate rooms, and monitored to ensure participation in only stationary activities. A nasal flowmeter was constructed to measure the relative airflow of the two nostrils. Hot wire anemometers were secured in place on the apparatus and connected to a Mac Lab recording system. In order to obtain a reading, with their mouths closed, the participants exhaled through their noses onto the anemometers. The probes measured various aspects of nasal airflow such as maximum slope, maximum peak, mean flow, and volume. Since all four of these measurements identified the same nostril as being dominant, maximum peak was chosen as the representative measure of airflow. Following each nasal flowmeter measurement, participants were asked to provide a self-report concerning which nostril they thought was the one with the dominant airflow.

Although LH were found to have more nasal cycle shifts than RH, based on both maximum peak and self-report, these differences were not significant. For LH, the left nostril was significantly more likely dominant, while the opposite was true for RH, for both maximum peak and self-report. Self-report was not a very reliable measure when
compared with physiological measures of airflow. This study demonstrates for the first time a relationship between nostril dominance and handedness.


Weil, Andrew. *Breathing: The Master Key to Self Healing* audiocassettes. 100 minutes. Available from P.O. Box 792, Mt. Morris, IL 61054, 888-3DR-WEIL.


Abstract: Alternating dominance of cerebral hemispheric activity was demonstrated in humans by use of the electroencephalogram (EEG). Relative changes of electrocortical activity have a direct correlation with changes in the relative nostril dominance, the so-called nasal cycle. The nasal cycle is a phenomenon where efficiency of breathing alternates predominantly through right or left nostril with a periodicity ranging from 25 to greater than 200 minutes. Relatively greater integrated EEG value in one hemisphere correlates with predominant airflow in the contralateral nostril, defining a new interrelationship between cerebral dominance and peripheral autonomic nervous function.


Abstract: We have previously demonstrated by the integration of EEG amplitudes, that an ultradian rhythm of alternating cerebral dominance exists in humans. This rhythm is tightly coupled with the nasal cycle, since its lateralization correlates with shifts in airflow through the left and right nostrils, where relatively greater integrated amplitudes in one hemisphere correspond to predominant airflow in the contralateral nostril. The nasal cycle is known to be regulated by the sympathetic and parasympathetic branches of the autonomic nervous system. This dynamic lateralization of alternating activity in the
autonomic nervous system exists in other peripheral structures and is also likely to be the mode of regulation of the cortical rhythm. This paper shows that forced nostril breathing in one nostril produces a relative increase in the EEG amplitude in the contralateral hemisphere. This phenomena was demonstrated in 5 out of 5 untrained subjects. These results suggest the possibility of a non-invasive approach in the treatment of states of psychopathology where lateralized cerebral dysfunction have been shown to occur.


**White, Michael Grant.** Emotions and breathing. Article available online: http://www.breathing.com/articles/emotionsandbreathing.htm.


**Ongoing Research**

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Seeking funding from NCAMS for research on Yoga and dyspnea. Contacted IAYT 8/19/02.

**Lee Lieske**
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Studying the relationship between Chinese Qigong exercises and Indian Yoga *asanas*. Is trying to find exercises that are most commonly used to affect each of the zang and fu organs and exercise routines that exercise them in the correct manner. Contacted IAYT 06/01.

**Philip Stevens, BSc (Psych, Physiol), BSc (hons) (Physiol)**
Ph.D. candidate in collaboration with the department of Complementary Medicine in the School of Health Sciences and the School of Electrical and Computer Engineering
RMIT University
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Conducting the following research project:

**Electrophysiological Correlates of Yoga Breathing Techniques**

Various styles of breathing are promoted as beneficial. Inhalation and exhalation methods often differ widely, however, with various combinations of abdominal &/or thoracic dominance being favored. Different rhythms of breathing, from hyperventilation to very-slow-rate, are used, often with various esoteric and/or medical claims. Validation studies are few, particularly comparative studies of more than one technique. While certain, specific breathing practices have been studied so far that show differential effects on brain laterality and cardiac autonomic variations, no study to-date has described and cross-correlated the effects of all the main, breathing techniques commonly promoted in yoga classes today.

This project seeks to:

1. catalogue and describe the various breathing techniques available today using standard, anatomical, physiological, psychological and medical-terminologies.
2. explore the relationship between certain breathing techniques by measuring abdominal and thoracic inputs and their concomitant-effects on the brain, heart and autonomic-nervous-system using electrophysiological recordings (EEG and ECG) on human subjects over time.
3. uncover functional brain and cardiac autonomic-nervous-system interactions using conscious, controlled, yoga-based, breathing techniques that may have relevance in preventing and/or dealing with certain cardiac problems prevalent today.

As certain types of breathing can profoundly impact on human physiology and psychology, this study will help better understand the neurophysiological implications underpinning various yoga, meditation and relaxation techniques. It may even have relevance in non-pharmacological management of stress, hypertension, depression, stroke, cardiac problems, sleep disordered breathing and asthma.

Equipment required to complete this study will include:

EEG to give measures of localised, hemispherical brain-activity, which can be correlated with other ancillary measures of autonomic nervous activity such as lateralised nasal-airflow and lateral peripheral-temperature.

ECG to provide relative changes in heart rate variability. Cardiac parasympathetic and sympathetic activity can then be assessed using respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP). The cardiac system allows both parasympathetic and sympathetic activity to be reliably and concurrently estimated, with strong consensus in the literature identifying RSA and PEP as the most validated, non-invasive measures of cardiac parasympathetic and sympathetic activity, respectively.

Your participation would initially involve completing an online yoga and health-questionnaire that takes around 15 minutes. Various volunteers in certain locations
around Australia will be required for the experimental trials that involve simple breathing practices for about 1-hour while measurements are taken and recorded on a laptop.

The experimental part of the project involves 15 minutes preparation time to attach medical recording equipment to your abdomen, chest and scalp and then approximately $\frac{1}{2}$ -1 hour to complete the breathing tests. These will measure breathing muscle movements, heart-rate and brain-wave activity in conjunction with your breathing. Your total time commitment should only take 1½ - 2 hours.

Data collection will involve standard, non-invasive medical-recording equipment to test normal breathing using specific respiratory muscles. All electrical equipment is full shielded from the electricity grid as it runs on batteries and all equipment is medically approved for clinical and human research use in Universities, Hospitals and Clinics around Australia and overseas. All information collected will be coded so you will not be personally identifiable and kept secure at RMIT University for academic research purposes only. Non-identifying results will be reported in a manner that protects your anonymity.

If you have any queries regarding this project, want more information, or wish to be considered for the experimental trials, please contact me on 0419 806 066 or research@yogalinks.net