

More information on breathing to accompany chapter four of *Mindfulness for Health*¹ by Vidyamala Burch and Danny Penman

*What is the breath?*²

The process we call 'the breath' is one of the many things we take for granted. It flows in and out of the body in about 11,000 cycles a day or 4,000,000 cycles a year, and is perhaps our most basic life-affirming activity. 'Breathing' is a label for all the physical movements that cause air to flow in and out of the body. One way to think of the breath is as 'borrowed air'.

The rhythm of respiration is echoed throughout nature – in the internal respiration of the cells, the ebb and flow of the tides, the waxing and waning of the moon and the pulse of the seasons. Fish, birds and even the most basic cellular life-forms follow the rhythm of respiration: taking in and giving back, moving up and down, in and out. Look at the pulsing movement of a jellyfish that glides through the sea by displacing water. Even plants have respiration that echoes our own. These natural rhythms also change endlessly: no two tides are exactly the same size or duration and likewise our breath is continually varied within its basic rhythm, each breath having a unique quality.

In many cultures breath possesses a sacred significance. The Greeks called it *psyche* 'pneuma', meaning 'breath', 'soul', 'air' or 'spirit'. In Latin '*anima spiritus*' means 'breath' and 'soul', while in Japanese, '*ki*' means air or spirit; and in the ancient Indian language of Sanskrit, '*prana*' is the life force coursing within us that ceases at the moment of death. In Chinese, the character for breath (*hsi*) contains three characters meaning 'of the conscious self or heart', suggesting the breath that enables you to be alive and conscious also brings mental and emotional vitality.³

The breath is like a river running through a dry valley that gives life to everything it touches. It's a profound force for life, a current and a felt presence. By waking up to its beauty and mystery you can learn to live in a painful body with dignity, vitality and health.

¹ *Mindfulness for Health*, by Vidyamala Burch and Danny Penman, Piatkus Books, 2013

² This text is from *Living Well with Pain and Illness* by Vidyamala Burch, Piatkus books 2008, pages 96-100

³ Donna Farhi, *The Breathing Book*, Henry Holt & Company (1996), p. 5

The anatomy of breathing

The prime physical function of breathing is to supply oxygen to the body's cells, where it is used to chemically 'burn' food, releasing energy that's fundamental to life. This creates carbon dioxide, a waste product released back into the atmosphere on the out-breath. Without oxygen, the cells die, which is why breathing is the first and last act of conscious life.

The complex biochemical process through which oxygen from the air feeds the cells starts when the in-breath is triggered by internal systems regulating the rate of respiration to maintain a stable level of oxygen and carbon dioxide in the blood. The big muscle of the central thoracic diaphragm flattens down and the ribs expand, creating a partial vacuum in the chest cavity. As the air pressure in the chest is now lower than that in the atmosphere, air pours in, filling the lungs. It flows into tiny sacs in the lungs, where oxygen passes into the blood to be pumped around the body. When it reaches the cells, it is released into the tissues and transformed into energy. Simultaneously, the waste product – carbon dioxide – is released from the cells into the blood, where it travels back through the circulatory system to the lungs. It is then released from the blood into the air sacs to pour out of the body on the out-breath when the diaphragm relaxes back into the chest, causing the lungs to deflate.

The whole process is initiated by two groups of respiratory muscles: the primary muscles, which are essential for full breathing, and the accessory – or secondary – muscles. In optimal breathing the primary muscles do almost all the work. They're deeper and lower in the body and include the diaphragm, the intercostal muscles, which are between the ribs, and the deep abdominal muscles at the front of the belly. The accessory muscles – including the muscles in the neck, the shoulders and the upper ribs – do about 20 per cent of the work only.

The diaphragm is the most important primary respiratory muscle and it is responsible for most respiratory effort. It is a large, dome-shaped muscle that rests inside the chest like a parachute or an umbrella. A central tendon at the top of the diaphragm sits just beneath the heart, with fibres radiating out like the panels of a parachute. They attach at the front to a little bone at the tip of the breastbone called the xiphoid process, and at the sides they attach to the insides of the lower ribs. At the back two long tendons attach to the first 4 lumbar vertebrae of the spine to act like the handle of an umbrella (Fig. 1). You may think that the breath only affects the front of the body, but these connections mean that the back of the body is also actively involved in the breath.

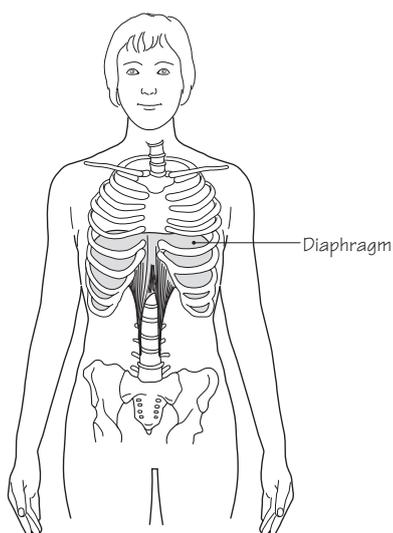
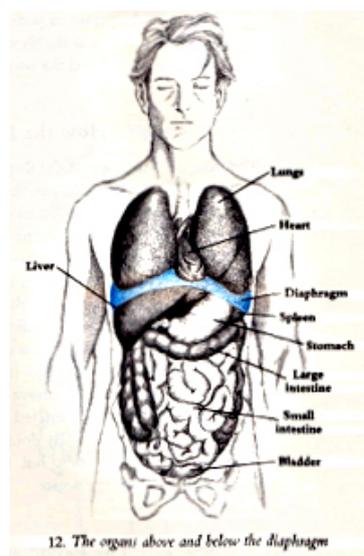


Fig 1



12. The organs above and below the diaphragm

Whenever you breathe in, the diaphragm flattens and broadens; when you breathe out, it relaxes and billows back into the chest, resuming its natural dome shape (Fig. 2). It moves up and down in a regular, tireless rhythm. You can't feel this movement directly because the diaphragm lies so deep in the body, but you can infer it through its effects. Each time the diaphragm flattens on the in-breath it displaces the inner organs, causing the belly to swell outwards and sideways. The organs are continually massaged, squeezed and rolled by this movement, bathing them in new blood, fluids and oxygen and draining waste. For example, the kidneys slide up and down beside the spine up to 3cm (1½in) with each breath cycle.⁴ The whole spine is simultaneously rocked and cradled.

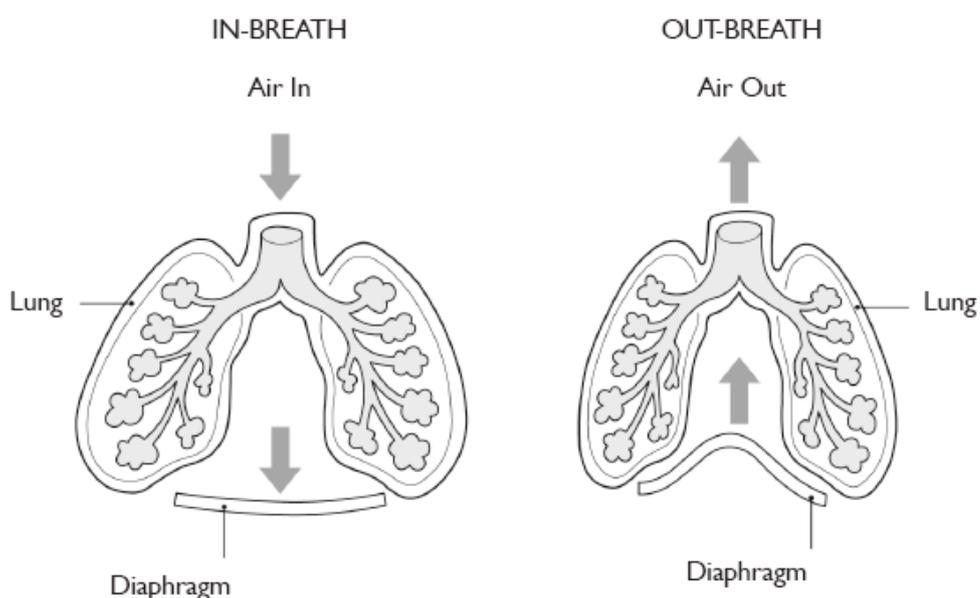


Fig 2

⁴ Gavin Burt, 'It's Your Move', *Talkback Magazine*, Backcare, Autumn 2007, p. 15

This is a description of full-bodied breathing, sometimes called diaphragmatic breathing, which stimulates the whole body and deeply affects our sense of wellbeing. If you have pain, your breathing will probably be inhibited in some way but over time, simply bringing awareness to the inhibition with an understanding of basic anatomy can gently release any patterns of holding. This allows your awareness to drop deep within the body and restores optimal, health-giving breathing patterns.

The Pelvic and Vocal Diaphragm⁵

Traditionally, the diaphragm that separates the thoracic and abdominal cavities is the only one that was considered important for breathing. There are, however, two other diaphragms that play important roles in allowing the most central diaphragm to work effectively. These are the *pelvic diaphragm* and the *vocal diaphragm*. You might imagine the three diaphragms as domes that lie perpendicular to the vertical axis of the body (Fig 3).

The pelvic diaphragm that makes up the pelvic floor is the best known for its function in supporting the weight of the pelvic organs and for its dynamic role in closing the rectum. The vocal diaphragm, located at the top of the trachea, is best known for its role in phonation (making sound). Both are less known for their role in facilitating full body breathing.

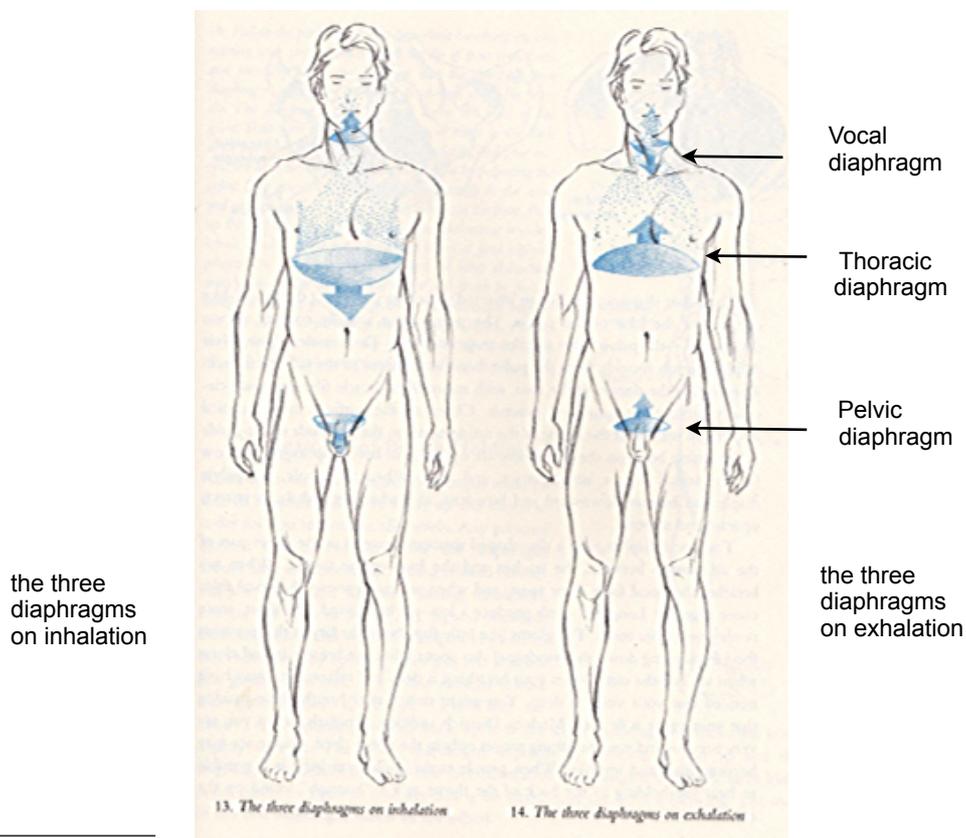


Fig 3

⁵ the text and images from this point are taken from *The Breathing Book* by Donna Farhi. Owl books 1996 pages 53-58

The pelvic diaphragm is like an inverted parachute that lies at the funnel-like opening at the base of the pelvis. The pelvic floor actually consists of two diaphragms – the pelvic layer and the urogenital layer. The muscles of the pelvic diaphragm run roughly from the pubic bone in the front to the tail in the back. This layer is the deeper of the two, with many of its muscle fibers running circularly around the anus and genitals. Closer to the surface, the urogenital diaphragm runs from the inside of the sitting bone on the right side to the inside of the sitting bone on the left. There are openings in both diaphragms to allow for the sexual organs, urinary track, and anus (Fig 4). When we inhale, the pelvic diaphragm billows downward and broadens, and when re exhale, it retracts upward and narrows.

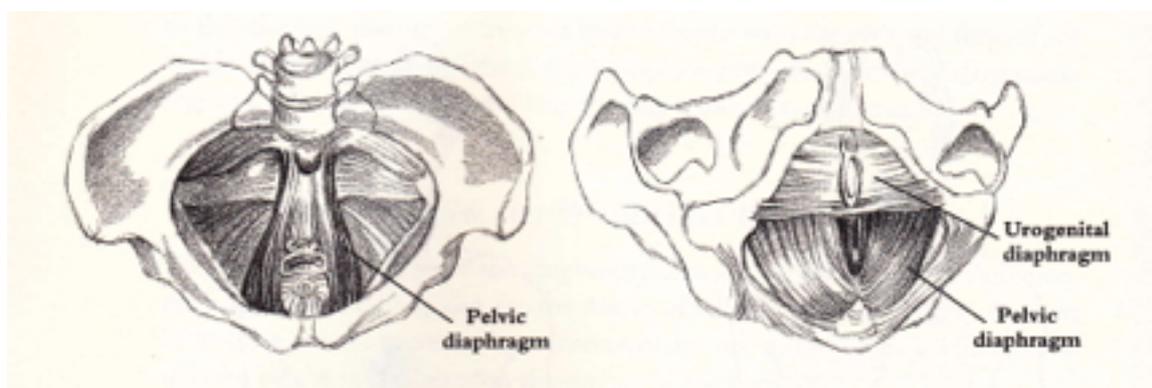


Fig 4

The vocal diaphragm is a disc-shaped structure situated in the upper part of the air passage between the trachea and the base of the tongue. When we breathe, the vocal folds draw apart, and when we make sound the vocal folds come together. Long, lax cords produce a low-pitched sound, and short, tense cords give higher tones. The glottis (the little flap above the larynx that prevents food from going down the windpipe) also opens when we breathe in and closes when we breathe out. When your breathing is deep and relaxed you may have noticed that your voice is deep. Similarly, when you are very nervous and your breathing moves only in the upper chest, your voice may become high and squeaky. When people strain while exercising it is possible to hear the holding in the back of the throat as a “hmmph” sound on the exhalation.

The Anatomy of Breath Holding

Remember that the primary diaphragm must be able to broaden and move freely up and down in order for you to breathe effectively. Any pressure exerted from above or below the diaphragm would limit its movement. During relaxed breathing the diaphragm descends during inhalation, causing the belly to widen and expand outward. Both the pelvic and vocal

diaphragms respond to this movement by opening outwards (vocal cords and glottis open out, and pelvic muscles release and spread). When we exhale, the diaphragm ascends back up into the chest, drawing the abdomen inward and slightly upward. The pelvic diaphragm responds by drawing in and up and the vocal diaphragm by closure of the glottis. Imagine the diaphragms like circular doors that blow open or shut depending on which way the wind is blowing. The movement of any one diaphragm affects all the others.

When the abdomen is chronically tightened and pulled inward and upward, as is so common in Westerners, the pelvic diaphragm is also held in a state of chronic contraction. The anal sphincter muscles become tight and are pulled in and up; the urogenital and perineal muscles contract and move upward. When the pelvic diaphragm is upwardly inverted *all the time* a curious phenomenon takes place. Since the primary diaphragm is unable to complete its downward excursions, the secondary respiratory muscles in the neck, shoulders and upper ribs are required to take over the work of the diaphragm. Using these muscles to breathe deeply is rather like using a fork to dig a hole. It's very tiring and very ineffective. Because the primary diaphragm cannot move freely downward our ability to inhale is radically reduced. When we can't inhale completely we tend to exhale quickly (and thus not completely) in order to grab for another inhalation in the hopes of getting more air. A cycle is set up whereby the harder we try to breathe the less air we get.

Situated as it is at the top of the throat, the vocal diaphragm has a more subtle action upon the thoracic diaphragm. Holding tension in the throat and vocal diaphragm indirectly affects the ability of the central diaphragm to move freely up and down. Imagine now, all three diaphragms hovering over one another. If we close and press downwards with the vocal diaphragm the central diaphragm reacts by reducing its excursions both up and down, and if we pull upward with the pelvic diaphragm the central diaphragm can't descend completely so that we can't breathe in fully.

All these strategies force us to breathe with irrelevant muscles rather than the diaphragm.