

... And breathe

We do it upwards of 22,000 times a day, but we could still breathe better – and it might just make us better cyclists

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Why do we breathe?

Simply put, we breathe to exchange gases. Oxygen – specifically molecular oxygen, O₂ – is key to the production of adenosine triphosphate (ATP) in cells, the energy-carrying molecule responsible for delivering chemical energy to fuel everything from cell division to nervous system signalling to muscle contraction. ATP is the reason you can grow muscles, command chains of kinetic movement and, ultimately, power a bicycle.

However, ATP production creates a byproduct – carbon dioxide, or CO₂ – which must be expunged, since while CO₂ is not toxic to humans *per se*, it is an asphyxiant, meaning it leaves no room for oxygen molecules. Breathing, and hence our respiratory system, is the key to getting oxygen in and carbon dioxide out.

How does breathing work?

Oxygen enters the body via the lungs, diffuses into the bloodstream via the lung's air sacs, the alveoli, then attaches to red blood cells, or haemoglobin (Hb). This oxygen-rich blood is then transported to cells around the body to produce ATP. The CO₂ produced off the back of this process must then be removed from cells to free up room for more oxygen molecules, so the whole system works in reverse: CO₂ molecules bind to haemoglobin so they can be transported to the alveoli, diffused into the lungs, and exhaled.

Data published in the journal *Breathe* describes how breathing increases from around 15 times per minute at rest to '40–60 times per minute during heavy exercise'. The upshot of all this is a body of thought that breathing can be optimised to increase physical performance.

Can we improve our breathing?

Up until the 1970s, received wisdom was not exactly – the healthy respiratory system was 'overbuilt' for our needs so it didn't need to be optimised. But over the past few decades, science has changed its tune, as summarised by a 2020 study concerning the efficacy of the respiratory system, published in the *Journal Of Applied Physiology*: 'The evidence is clear



'People tend to breathe too shallowly from the upper chest and breathe too much, and mostly breathe through their mouth and not their nose'

that it is the cardiovascular system in general that is the major gatekeeper regulating O₂ transport during exercise.'

In other words, the heart's oxygen-carrying limitations kick in before the lungs' abilities curtail exercise performance. Yet while this is true for most healthy people, 'highly trained subjects' such as cyclists are different. Their respiratory systems' inadequacies can account 'for -15% of the VO₂ max and 15–25% of exercise-induced limb fatigue'. Crucially, the study points out there is a gathering body of evidence to suggest the respiratory system is malleable and can be made to work more efficiently.

What kinds of breathing improvement methods are there – and do they work?

They are myriad, but a few popular ones have

been examined in a collaborative project by scientists in the UK, Canada and USA. Published in the *European Journal Of Applied Physiology* and entitled 'Distinguishing science from pseudoscience in commercial respiratory interventions', the authors examine the plausibility of various common methods.

Among those examined were nasal dilators – those sticky elastic strips that go over the nose bridge and widen the airways, as seen on many a pro cyclist – and canned oxygen that can be inhaled. Neither proved to offer any noticeable benefits for sports performance. However, 'systemised breathing strategies' – learned and practised breathing techniques – showed greater promise, with researchers surmising that 'long-term breathing retraining strategies may improve lung function (mainly

lung volumes and capacities), exercise performance, respiratory symptoms, and quality of life in respiratory patients'.

Can I learn some systemised breathing strategies for myself?

Breathing optimisation coach Emma Farrell has worked with UK Sport to help 'struggling athletes improve their breathing', with one success story being a Team GB cyclist who 'improved her lung function by 10% and moved up an Olympic cycle' over six weeks of training.

Crucially, Farrell says, 'People tend to breathe too shallowly from the upper chest and breathe too much – chronically hyperventilate – and mostly breathe through their mouth and not their nose.' She explains there are dozens of practices out there to help counteract this, as well as to 'increase confidence and tolerate higher levels of CO₂' (coaches such as Farrell are popular among freedivers).

To your right, she shares two daily practices to get you started. ☺

Breathing techniques really can help, with one Team GB cyclist improving her lung function by 10% over a six-week training plan

In, hold, out, hold

Try these exercises from breathing optimisation coach Emma Farrell

PRACTICE 1: Battlement breathing

'I call this exercise "battlement breathing" because it is in the shape of battlements, however you may have come across this exercise before as "box" breathing,' says Farrell.

'Either lie down (legs flat or with your feet on the floor and knees together) or sit so that the spine is comfortably straight. You can sit on the floor, but most people will be more comfortable sitting on the edge of a chair, with the hips higher than the knees. Your hands can rest by your sides or on your body.

'Your breathing during this exercise should be soft, gentle, small and relaxed – you should not become dizzy or lightheaded. Try to ensure your breath is silent. Inhale and exhale through the nose at all times, periodically checking that your facial muscles are completely relaxed, your lower jaw relaxed and your tongue heavy in your mouth.

'Inhale for a count of four, hold your breath for a count of four, exhale for a count of four, then hold your breath for a count of four. Remember this is not a full breath. In terms of the speed of the count, match the count to your heartbeat. Your shoulders and ribs should not move. Once you have a relaxed and comfortable rhythm, try increasing the count to six in, six hold, six out and six hold, but *only* if it is comfortable to do so.

'This exercise should take about five minutes. When you finish, allow yourself a minute or so of soft, gentle abdominal breathing.'

PRACTICE 2: Udiana Bandha

'For safety, this exercise should be done on an empty stomach, bladder and bowel,' says Farrell. 'Take it very gently because it's easy to injure yourself and strain the heart if you do this exercise aggressively.

'Sit on the end of a chair, or cross-legged on the floor, and bend forward slightly, placing your hands on the tops of your thighs for support. You can also stand up, however your legs must be bent and you must lean forward, placing your hands on your thighs.

'Take a deep breath into your belly and then exhale all the air out of your lungs. When there is no air left, hold your breath and pull up your diaphragm to make a space under your ribs. Hold this for a few seconds and then gently release the diaphragm down and breathe deeply and gently to recover.

'To start, do this no more than three times. You can slowly build up the time that you hold the stomach in, up to 30 seconds to begin with.

'The second stage to this exercise is to roll the tummy out after you have pulled it up and repeat until you stop the exercise and breathe in. It is also possible to roll the tummy and make a line with the abdominal muscles that you move from side to side, although the first two stages of this exercise are the most beneficial.'

See breathingoptimisation.com for more information including online classes and free tutorial videos