What Swimmers Need to Know About Breathing

How to Breathe

Good breathing is:

- **Abdominal**, not from the chest. Take a deep breath. Did your shoulders go up? They should not. Correct breathing is from the diaphragm. Your belly should fill with air before your chest rises.
- **Nasal,** not the mouth. Nasal breathing results in more oxygen uptake (10-20%). Nasal breaths are warmer and humidified, making them easier on the lungs, and they are filtered, reducing the number of germs you take in. Nasal breathing during exercise increases work intensity. Your nose is also where you store nitric oxide (NO), which your body needs to open airways and blood vessels.
- **Quiet** You should not be able to hear yourself breathe when you are at rest.
- **Small. You don't need more oxygen in your lungs.** The air in your arteries is already saturated with oxygen (95% - 98% at rest.) You don't need to take great gulps of air to "get more oxygen". (Why does it feel so good to take a big breath? It's the stretch.)

When to Breathe

- **Learn the difference between <u>wanting</u> to breathe and <u>needing</u> to breathe. NEVER IGNORE THE NEED to breathe.** Practicing holding your breath will not make you faster and it is dangerous!! **Shallow Water Blackout** kills very fit swimmers every year. If you keep ignoring your brain when it tells you that you need to breathe you may wait until it is too late!

  That doesn't mean you should breathe twice into a turn or pop up and breathe as soon as you dive in. You might feel like you want to, but you don't need to. If you work at it, you will learn to tell the difference.

  Your brain does not have an oxygen sensor. When you feel like you need to breathe it is not because your brain is telling you that you do not have enough oxygen. Your brain makes you want to breathe when it senses you have a higher concentration of carbon dioxide (C02) *than you are used to.* **The purpose of breathing harder or more often when you are exercising is mostly to release <u>excess</u> C02**. Part of getting fitter and swimming faster is letting your brain get used to having more C02 around. That means feeling a little breathless is a good thing. And gulping more air when you are a little breathless won't help you get more oxygen where you need it.

The trick is to get the oxygen from your lungs to the tissues of your muscles and organs where it can be put to work. That's where carbon dioxide (C02) comes in. Here's what you need to know about C02

1) **We need C02.** So if CO2 is a waste product we should breathe it all out, right? Well, it is not just a waste product.
   a) **It offloads oxygen from the blood to the cells that need it.** Hemoglobin will not release O2 without the presence of C02. You could have plenty of oxygen in your blood and without enough C02, your muscles could not get to it.

b) **Your lungs have to work harder to get air, and your heart has to work harder to get blood around if you don't have enough CO2.** C02 controls the size of your airways and blood vessels through the dilation of smooth muscle tissue. Too little C02 can constrict the diameter of your blood vessels by up to 50%. Like science? Remember that the volume formula is πr^2 so the diameter of your blood vessels affects the volume of blood flow by a factor of four. That's a lot tighter space to force blood through.

c) **C02 helps to regulate blood pH.** Your body works to tightly control blood pH to about 7.4. At a low pH of 6.8 or a high pH of 7.8 cells begin to die. CO2 is an acid – it lowers your blood pH. If your blood pH drops from C02 build-up – as happens when we exercise – your brain makes you want to breathe more to get the pH back in balance. That is good right after a really hard swim – go ahead and blow out the excess CO2. But if you are only a little breathless and you keep your breathing controlled you will start to get your brain used to that extra CO2, which will help you get faster. (Something to note. You know how your coach is always telling you to eat right? Here's one of the reasons. Processed foods and sodas and other unhealthy foods also make your blood more acidic, so they make it even harder for your body to get balanced.)

2) **We make C02**. So, too much CO2 is bad, and too little CO2 is bad. We need a balance. But where does CO2 come from? You can't get the C02 you need from breathing more. There is not very much C02 in the air. We make it by working, which breaks down fats and carbs, which releases C02. Working out makes more C02, breathing out gets rid of it. The right amount of breathing keeps the balance.

So, Smart Swimmers will:

- **Warm-up hard enough and long enough (at least 30 minutes**) to manufacture lots of C02 to be ready to get oxygen to your tissues. If you don't, at race time you will have an initial burst of energy and then feel tired and sluggish in the water. Start slowly, and concentrate on establishing good breathing. Breathe through your nose If you can. If you need to breathe through your mouth, breathe in a spoonful, not a lungful. Try to relax your chest and establish a good breathing rhythm. As you increase intensity in your warm-up, continue to be aware of your breathing. Sometimes swimmers skip warm-ups because they are tired or have asthma. That is actually when you benefit most from a good warm-up. After a good warm-up, focus on how you feel. Between races, you will need to warm up enough to get that feeling back.
- **Avoid processed foods** which can upset the pH balance in your body, making it harder for your body to balance C02 levels.
- **Cool down enough after a race or workout.** CO2 is not the only acid your body produces when you work out. Byproducts like lactic acid build up, too. Swim steadily and long enough – with good breathing – to help work all of the waste out from your muscles and tissues. Otherwise, you will feel extra tired and sore and may even risk injury.
- **Breathe correctly ALL DAY:** It's not enough to just breathe right at practice. You have to do it all day, every day, to do it right. When you are sitting get in the habit of listening to your breathing. Is it nasal, quiet and slow? When you are on the move practice breath control. Walking, going upstairs or out for a run? Breathe in on one footfall, go several (5-10) footfalls breathing out

slowly through your nose before the next breath. Get out of the habit of mouth-breathing, sighing or yawning a lot during the day.

- **Breathe through your nose during practice** Start breathing through your nose as much as possible during practice. It's harder at first because there is about 50% more air resistance breathing through your nose than your mouth and because you will not be used to the higher CO2 levels right away. Eventually, try to breathe through your nose during all but the very hardest sets and then return to nose breathing as soon as you can after the hard set. If you aren't doing any nose breathing during practice you are not allowing CO2 and Nitric Oxide to keep your airways and blood vessels fully dilated. (Don't try to think about breathing during races. Do it right in practice and warm-ups and let your body do what it wants during competition.)
- **Get control of your breathing between sets.** The fitter the athlete the more work it takes them to get out of breath. Remember, your brain wants you to breathe more when you have more C02 *than you are used* to. What if two swimmers both do the same sets of hard repetitions, and one swimmer controls their breathing between reps and the other blows hard during each break? Which swimmer is training their body to handle the C02 load they will see in races better? Try to keep breathing through the nose, and slow your breathing to normal as soon as you can between repeats and sets– even during hard workouts.
- **Address Breathing Problems.** Consistent difficulty breathing requires a medical diagnosis, ideally from a board-certified allergist. Poor conditioning or bad breathing habits at practice may be the culprit, but you need to know if there is something else going on.

What Coaches Should Know About Breathing

SAFETY FIRST - Shallow Water Blackout kills very fit swimmers every year. Be sure your swimmers, especially your "over-achievers", understand that they will not get faster by practicing extreme breath holding.

- **What is VO2 max?** V02 max, a common measure of a swimmer's fitness, is the amount of oxygen your body can transport and use in 1 minute of exhaustive physical work per kilogram of weight. It relies on many factors, including the amount of hemoglobin, which transports oxygen, in the blood. We know that high altitude training can raise hemoglobin because at high altitude air pressure is lower and has less oxygen. After a period of high-altitude training, the body adapts by increasing the amount of hemoglobin, making oxygen transport to the cells more efficient. Effective, but not very practical here in Annapolis.
- **Can hypoxic training raise VO2 max?** Hypoxic or breath-limiting during training – has no effect on hemoglobin like altitude training does. It builds CO2 concentrations (hypercapnia), which may help swimmers overcome the psychological urge to breathe that sometimes occurs well before the true physical need to breathe. That urge is primal. A swimmer who feels an urgent need to breathe will not be able to focus on technique or much of anything else.

  There is no benefit to extreme hypoxic training – like set after set of no-breathers – that you cannot get more safely doing something else. However, advocates of short sets of hypoxic training - like 3-5-7 freestyle – insist that it helps swimmers build breathing discipline. That is controversial. Some extremely successful coaches have completely gotten away from hypoxic training. They insist that swimmers who are consistently held to a standard of good technique – e.g. bilateral breathing, strong underwater swimming off walls, disciplined breakouts, get plenty of hypoxic training each practice.

- **"Strategies" for good breathing –** I could not find any good studies on the efficacy or safety of some common strategies based on these concepts. Here are a couple of examples. I am happy to research anything you come across and have questions about.
  - Some sprinters will drape a towel over their heads to increase the amount of CO2 in their bloodstream immediately before a short race.
  - Some elite swimmers take sodium bicarbonate (baking soda) during high-intensity training periods or competitions to help buffer their blood pH.

Breathing Problems in Swimmers

- One study suggests that as many as 50% of persistent stroke flaws in competitive swimmers are the result of poor breathing. The primal urge to breathe will cause the swimmer to unconsciously adapt everything from their head or body position to their stroke rate in an effort to maximize the amount of time per stroke they can breathe. If teaching and reinforcing good breathing habits is not working for a particular swimmer, consider a physical reason. Here is what you need to know:
- It is critical that swimmers who complain of breathing issues be seen by a doctor – ideally by a board certified allergist. Doctors can rule out lung or cardiac disorders and treat upper airway problems or anomalies.

- Intermittent breathing problems can occur for any swimmer. Poor conditioning, particularly after a break from swimming or a sudden weight gain can cause breathing issues. Allergy sufferers or swimmers with a virus or bacterial infection may have trouble breathing. Be certain that your swimmers who decide to treat their symptoms with medication are aware of USA Swimming's Anti-Doping Policy. **Urge swimmers and parents to consult the Anti-Doping Hotline (719) 785-2000 before using any medication**. The list of banned substances is subject to frequent change, and even familiar over-the-counter medications are subject to formulation changes.
- Chronic medical issues related to breathing typically suffer from one or more of three primary chronic issues: **Asthma, Vocal Cord Dysfunction, and Gastroesophageal Reflux.** *USA Swimming strongly discourages coaches from advising swimmers and their parents in any way that could be construed as giving medical advice*. However, a coach's observations about the swimmer's symptoms and responses can be very helpful to a medical practitioner who is developing a diagnosis. Also, be aware that **swimmers with chronic breathing problems are often dealing with more than one issue.** It is common for all three conditions to exist simultaneously.
- **Asthma** affects approximately 5%-8% of Americans, but the prevalence may be higher in swimming because asthma sufferers are often drawn to swimming. Clues are a persistent cough (week after week) and difficulty both breathing in and breathing out. It is important that a coach is aware of the severity of a swimmer's asthma and know what steps to take in an emergency. Most exercise-induced asthma attacks occur in the first 10 minutes of physical exercise, often because of an insufficient warm-up, so be certain affected swimmers know to do a gradual and sufficient warm-up before each swim. Also, exercise-induced asthma does not go away when a swimmer gets out of the pool area or stops exercising. It is only more controlled. When supervising a swimmer who has a severe asthma diagnosis be alert to breathing difficulties and aware of emergency protocols for that swimmer at all times. Also, swimmers who use SABA (short-acting beta agonist) inhalers more than two times a week may need to be reevaluated, so it may be helpful to encourage swimmers or parents to record how often a swimmer resorts to an inhaler.
- **Vocal Cord Dysfunction (VCD)** is often initially misdiagnosed as asthma. It is a stress conversion reaction. It does not respond to asthma medications, but swimmers with VCD may achieve relief from inhalers, either because they also have asthma or for psychosomatic reasons. It is usually treated with speech therapy. Common symptoms include more trouble breathing out than in. Swimmers may point to their throats when they are distressed.
- **Gastro Esophageal Reflux (GER)** Like VCD, GER is often overlooked, though as many as 40% of young swimmers may suffer from it. In Masters Swimmers, it is even more prevalent. The symptoms often become acute during swimming, when the swimmer's horizontal body position and inversion during flip turns make reflux more likely. It is exacerbated by protein or caffeine intake before swimming. It is often treated with changes in diet (limiting acid-producers like processed foods, carbonated beverages, chocolate, mint, etc.) and acid-reducing medication, which have side-effects of their own. Common symptoms include heartburn, regurgitation, nausea and vomiting, chest pain, difficulty swallowing or choking, the feeling of a lump of food trapped behind the sternum, chronic sore throat, and hiccoughs.

Ideas for Incorporating Good Breathing in Practice

- Make sure every swimmer knows that when they feel like they "need to breathe" they should. However, discourage poor breathing practices like double-breathing into a turn, or popping up to breathe after a start. At those times swimmers do not have a physical need to breathe – they have a psychological urge to breathe that should not be allowed to become a bad habit.
- Encourage nasal breathing whenever the swimmer's face is out of the water (kickboard sets, vertical kicking, rest between sets, etc.) If you do not feel comfortable using hypoxic (breath-limiting) sets (like 3-5-7 freestyle) but feel your swimmers need breathing work you can try incorporating more of these intense, face-up sets with nasal breathing.
- Encourage swimmers to breathe freely several moments after a difficult swim to release excess C02, and then work to control their breathing – nasal, quiet and slow – as soon as they can. There are some studies about the right amount of forceful exhaling after intense exercise, but nothing compelling for swimmers that I could find.
- Incorporating a snorkel allows a swimmer to focus on good technique without the distraction of breathing while it increases air resistance, building breathing capacity. Swimmers who are being treated for breathing disorders should discuss snorkel use with their physicians. Depending on the condition, they may be helpful. Supervise swimmers who are using snorkels particularly carefully.
- Remind swimmers that breathing right is an important part of warm-ups – and as a coach be particularly diligent about breathing as your swimmers warm-up and cool down.