



# A brief and basic competitive swimming stroke clinic handout.

By Robert Boder

*Explaining strokes basics in terms that are easy to understand and remember. Learn and execute what is here to swim faster with less effort. Great swimmers are fast not because they are stronger. They are fast because they move further using less energy. This is the final edition with new material on training plus minor corrections.*

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## Introduction

To swim fast there are two ways to direct body movements in the water.

- Align it to produce the least resistance while moving forward.
- Apply the chest, back and upper leg muscles to provide maximum propulsion.

Body control is muscle power applied to the bones. Power's directional control is through the joints. There are eight important bending and rotating body parts called joints. Joints are where bones meet and they control how the bones can move. They are from top to bottom the neck, shoulder, elbow,

wrist, waist, hip, knee and ankle. Some joints allow bones to bend like a door hinge while others allow rotation. There are joints that work in combination. The shoulder/elbow and hip/knee/ankle combinations allow a wide range to movements that done correctly improve our swimming. The combination of a joint, bone and muscles work like a pair of scissors. The joint is the in the middle. It controls how the cutting blades move. Each blade is like a bone. Fingers are the muscles. They make the blades cut. By using muscles to control body movements through the eight joints, we learn how to make the water help us. To swim fast you must swim smart. So here we go!

Races are mostly on the water surface. Water can help or hold us back. The more we spread the body over the surface the more water will hold us up. The more we push against it in the wrong direction the more it will resist us. In fact, for correct arm position in all strokes we have to bend our elbows when our arms are underwater. Therefore, think of the pool as being only two or three feet deep when you swim. If your arms are straight pointing at the bottom, you will cut your hands on coral and draw sharks!

Have you ever tried to swim through a wave at the beach? This is an example of the body pushing through the water to go forward. We have to move the water out of the way for the arms, head, shoulders, hips, legs and toes. That is a lot of moving unless done correctly. Pushing against water the right way moves us forward. This is the arm pulls and leg kicks. We need to make the water help us and not hold us back. The fastest swimmers move through the water with the least resistance.

The four racing strokes are in two categories. These categories describe how to move the body to breathe and do arm strokes. There are the long axis strokes: freestyle and backstroke, where you do not want any wiggle. The body will be like a pencil going through the water. Any side-to-side movement is with the whole body rolling like a log. Other strokes are short axis strokes: butterfly and breaststroke, where you want a special type of wiggle called undulation. This is what dolphins do. For us it is how to move our chests to breathe. Lie on the floor and lift your head then shoulders up and down. This is undulation.

However, before thinking of swimming like a dolphin, remember we are humans. We run and climb. Hands grab things. In the water, we should understand what works best for the dolphin and apply it to ourselves if we can. Dolphins and fish swim underwater. Rules limit our underwater swimming.

Fluid dynamics tells us that water treats objects moving underwater differently than it does objects moving on the surface. There are three things to know about fluid dynamics.

- To go fast, skim on the top like water-skis or be under the water like a big fast fish.
- When moving on the water surface the way a boat does, you will go faster looking like a speedboat instead of a tugboat. However, you can never go as fast as you could completely out of or underwater.
- Water does not like abrupt changes in the shape of bodies moving through it. This causes extra drag to slow you down. Drag is water resisting your movement through it.

The two fastest ways to move through the water are swimming freestyle and dolphin kicking completely underwater. They are very different ways to move but have some attributes in common.

The key to fast swimming is body streamlining. Streamlining is the easiest part of swimming to learn. We need to disturb the water as little as possible so we make our body look like a pencil. This works on the surface and underwater. We do not want to push the water in the direction we are swimming any more than needed. Pull a kick board through the water with the narrow edge towards you. Next, pull it with the wide flat side towards you. Which is easier? For strokes where you are looking at the pool bottom swim with head, hips and heels in a line on the surface. When on your back it is head, stomach and toes in line. A good way to practice body streamlining is to lie on the floor and pretend to be Superman. Look down instead of ahead because you have a line on the pool bottom to follow. Next roll over, look up at the ceiling stretch the arms out, lock thumbs together and again pretend to fly.

Here are a few more points on how to streamline. Remember, the head position controls body alignment in the water. Head and feet make the two ends of a seesaw. One goes up the other goes

down and causes extra drag. In freestyle, swimmers look at the pool bottom. In backstroke, they look up at the ceiling. Famous coaches and great swimmers often talked about the feeling of swimming “downhill”. This occurs when the body is in perfect balance. Swimming “uphill” means the backside is too low. Just like in running, do you want to run down or up hill? For breaststroke and butterfly, we look forward more than down. In these strokes, swimmers need to move the mouth forward out of the water to breathe. The chest and hips move up and down controlling body position. This is where undulation comes in. We do narrow fast kicks with the feet below the surface. Wide kicks, moving the feet too far apart causes extra drag. The heels (toes in backstroke) are the only foot part that should ever break the water surface. You cannot move through the water by kicking air! Just relax those ankles and get the big leg muscles moving. Do not kick too hard. Kicking is more tiring than arm pulls. Kicks use the body’s biggest muscles. They take a lot of fuel and are not very efficient on the surface.

The kick sets the tempo of your stroke. Tempo is usually thought of how fast your arms can complete a pull cycle. Like it or not, how fast you move your legs determines how fast your arms can go when you are swimming the strokes correctly. The reason is all your body muscles have to work together. We spend much of our early life learning how to do this. Correct kicking is the easiest part of any stroke to learn. To be a very good kicker you have or develop great ankle flexibility. There are many exercises to help you do this. The most important kick to excel at is the dolphin kick. It is used in the starts and turns of all four strokes in addition to being the butterfly kick.

These principles apply to all strokes. There are minor variations to accommodate breathing and arm movements. We are trying not to disturb the water while going fast. Practice streamlining in the water by kicking on the stomach, back and side with arms stretched out in front or at the side. Become comfortable moving like a pencil in all three positions.

All the movements of muscles and bones in the body are connected. For example for your back muscles to move your shoulder, you need correct arm position. To use your legs correctly your hips have to be set up. Front to back all the joints depend on other joints and muscles. Your body is a team.

**Only swim the strokes as far as you can correctly. Try to practice swimming perfectly. Swimming long distances incorrectly reinforces bad habits. Go as far as possible correctly then stop.**

## Stroke specific motions

A great thing about swimming is that each stroke takes special skills. Few swimmers are good at all strokes. Everyone can be good in at least one stroke. Breaststroke takes strength and the ability to do the kick correctly. Backstroke requires strength and the ability to do underwater dolphin kicks. For butterfly, you need coordination along with ankle and shoulder flexibility. Freestyle has fewer physical requirements. Sprinters have fast reflexes and love to race. Distance swimmers enjoy working hard and have a great sense of pace when they swim. By working with your physical skills and attitude towards swimming, you will find a stroke or strokes to enjoy and be successful swimming.

Coaches use *pull*, *push*, *scull* and *kick* to explain arm and leg movements. These are not entirely descriptive of what you are trying to do in the water. Arms and legs are holding or pushing **against** the water to propel your body **forward**. The objective is to press against the water in ways that **you move and the water does not**. We know that the water moves when pushed. This causes waves. We must learn and practice the concept of *holding* or *feeling* the water. This means getting the most forward body movement out of pressing against the water with the least amount of “moving” the water. This is not easy to understand. It takes time to learn. A good way to think of this is to picture being stomach down laying on a skateboard or a sled. Grip the ground or snow with the fingers. Now pull the body forward as the hands remain in place. Ideally, we push against the water with our hands and feet this way. The hands have to move because when the body moves forward adjustments take place in positioning shoulders and elbows. With *pulls* and *sculls*, we want the maximum hand and arm surface area pressing against the water. This requires turning the hand and arm. We use *pulls* to move forward.

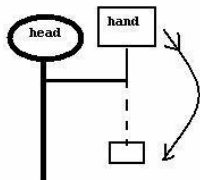
*Sculls* are mostly to change body position in the water. *Sculls* are an important part of breaststroke and butterfly. The best swimmers in the world can *hold* the water. They have gained this knowledge through practice. When reading *pull, push, scull or kick* remember they are terms for arm and legs movements to go forward through the water. It is a good idea to review this concept with your family or a coach. To be successful learn to think this way when swimming. The way to measure our effective *hold* on the water is by counting strokes per pool length. In all strokes, we have a *catch* point. At the *catch*, our arms become an *anchor* and our body moves forward. As we move forward, the arm and hand position changes to maintain the *anchor* until *releasing* it for *recovery* into the next *pull* cycle.

## ***Long axis strokes (freestyle and backstroke)***

We need to move our head to breathe in the freestyle and get our arms out of the water in both strokes. Therefore, we start with body rotation. Coaches describe the motions of the core hips and shoulders as rotation. Rotation makes the arm recovery from when finishing one stroke to starting another easier. The body core begins at our shoulders and goes to our hips. As arms move one at a time we have to get one arm out of the water while the other is in the water. It will also make the arm pull stronger just as it helps baseball players hit homeruns because they apply the back and chest muscles to the process. You have to connect the arm movements to the core muscles for maximum power. This connection is at the catch. The catch requires a special movement of the arm called internal rotation. This is turning your thumb slightly down and moving your elbow slightly up. This causes the connection to the back and shoulder muscles so you can apply maximum pressure to the arms to hold the water for the pull. Face a wall with the right arm on the wall pointing to the ceiling. Now press the armpit into the wall and turn the right hip into the wall. The hand will move up the wall. Next movement is internal rotation of the arm. This is the correct roll and reaching motion for freestyle and backstroke to catch the water and begin the pull. Now do the same motion with the left arm and hip. Go back and forth with these actions and you have mastered long axis body roll. Rolling can be over done especially with the shoulders in freestyle. Excessive rolling in freestyle leads to a wiggle. Rolling the shoulders **before** the hips causes a wiggle. Frequently backstrokers will under roll and freestylers will over roll in the shoulders and not enough in the hips.

When rolling, the whole body core rolls just like a rolling pin. Body rotation starts with rolling a hip up. Chest, shoulders and legs immediately follow. The head does not move except when breathing in the freestyle. The neck turns a little and the top of the head always points to the pool end. In backstroke, never move the head. This is hard and takes practice.

Most young swimmers wiggle when first doing these strokes. This is because they are still learning the strokes' correct body movements. Get rid of a wiggle right away and concentrate on doing things correctly. Our body goes in a straight line from one pool end to the other. The sideways wiggle comes from any or many incorrect body movements. Move the head and neck from side to side and the hips will start to move the same way. Start moving shoulders from side to side and before you know it, the neck and hips do the same thing. Put one foot out to the side and then the other. Guess what, hips will move followed by the shoulders and the head. You are wiggling like a snake. By learning how to get the joint muscles to move arms and legs correctly, we will avoid the wiggle. By not wiggling, we swim straight and fast.



The bending joints are like door hinges. They can be closed or open. Just as with doors there are good and bad times to close or open. For the long axis strokes the shoulder/elbow combination move something like the propeller arms on a whirligig. The hips/knee/ankle kick combination is like scissors cutting paper on the water surface.

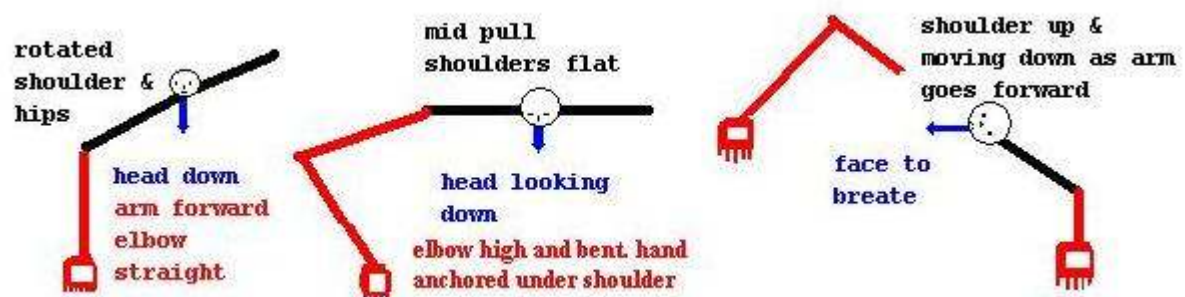
Never above or below the water let your hands cross past your nose over to the other side of the body. Do that on a surfboard and you fall in. Do it when swimming will cause a wiggle. In your mind, draw a line on the bottom to each end of the pool through the shoulder and toes. Hands never cross that line. Pretend it is a wall. The object is to move forward. It is not to move your arms as fast as possible through the water. Moving the arms too fast is like running on ice. You will not move. Count then try to

lower your strokes per pool length. When rolling to the side, the feet roll and kick to the side. Do not move the backside up and down or do a motion such as lifting the head to breathe that we call undulation in the long axis strokes. By pushing the hand, head and/or shoulder down during the pull, the body will wiggle. Push down on the corner of a kickboard. Look what happens to the opposite end's corner. You have a wiggle. When kicking if you start bending the knee like a drum major starting a parade, you will wiggle. Improper breathing often causes the drum major's leg. Air quality does not improve as the mouth goes higher and do not treat every breath as if it is your last! The knees should not bend like a hinge when kicking. A little flex is OK but never a big bend. Relax the ankles so the feet will flip like a whale's tail. Make the big toes touch from time to time when kicking. It keeps the feet close together.

## Freestyle

We start with an arm moving forward to do a pull. The forearm with the elbow as a hinge does not open like a door towards the nose when the arm is moving forward for entry into the water. After the hand enters the water, stretch the arm straight ahead and slightly down. This is to clear entry bubbles from the palm and position the hand for the catch. It should be about a hand's width below the surface. Now start to rotate the forearm so the hand continues moving under the elbow. This is the catch point. You want to catch the water as far in front as possible. Prepare the hand to pull back and hold the water and not push down on it. A common mistake is to leave the hand at the surface and treat that as the catch point. Think of paddling a surfboard to catch a big wave. When you have a correct streamlined body position with the eyes looking at the pool bottom, you will not see the hands until they are at the catch point. After the catch, the fingers should point at the pool bottom. They continue to point to the bottom during the pull. This means moving the wrist joint to adjust the finger position. The fingers form a straight line with the forearm during the recovery. They move down at a slight angle just before entry. The middle fingers enter the water first. Learning to move hands to *hold* the water during the pull is one of the most important parts of swimming fast. Work to establish a proper catch point. Catching too close to the surface will push your body up into a wiggle. Catch too deep and you have a shorter distance to apply the pull. The most important part of the pull is before the waist passes the hand as the body moves through the water. This is the front quadrant of the full arm stroke circle. It is only one fourth of the arm's travel so make the most of it. Following is the freestyle roll sequence starting with hand entry in the water and the shoulder roll down. Hands enter straight in front of the shoulder. They hold the water and move back under the shoulder. Finally, the shoulder leaves the water as the arm starts to recover. Try the movements while lying on a bench.

### A View from the Front



The next sequence of pictures is the stroke from the side. The relative positions of the both arms are close to being correct. The amount of overlap (both hands in the water) varies among swimmers. The variance is greater between successful sprinters and distance swimmers than it is within either group. As the forearm passes pointing at the pool bottom, the release takes place. This is where the hand stops holding on to the water and the recovery begins. It is also the point where your stroke gets an extra push from the core body rolling up to the surface. Some points to remember:

- Hand enters before the elbow. As it moves down the elbow anchors near the surface.
- At the catch point, the hand anchors and the body moves past the hand.
- After your hips pass the anchored hand, the hand releases and prepares to recover.

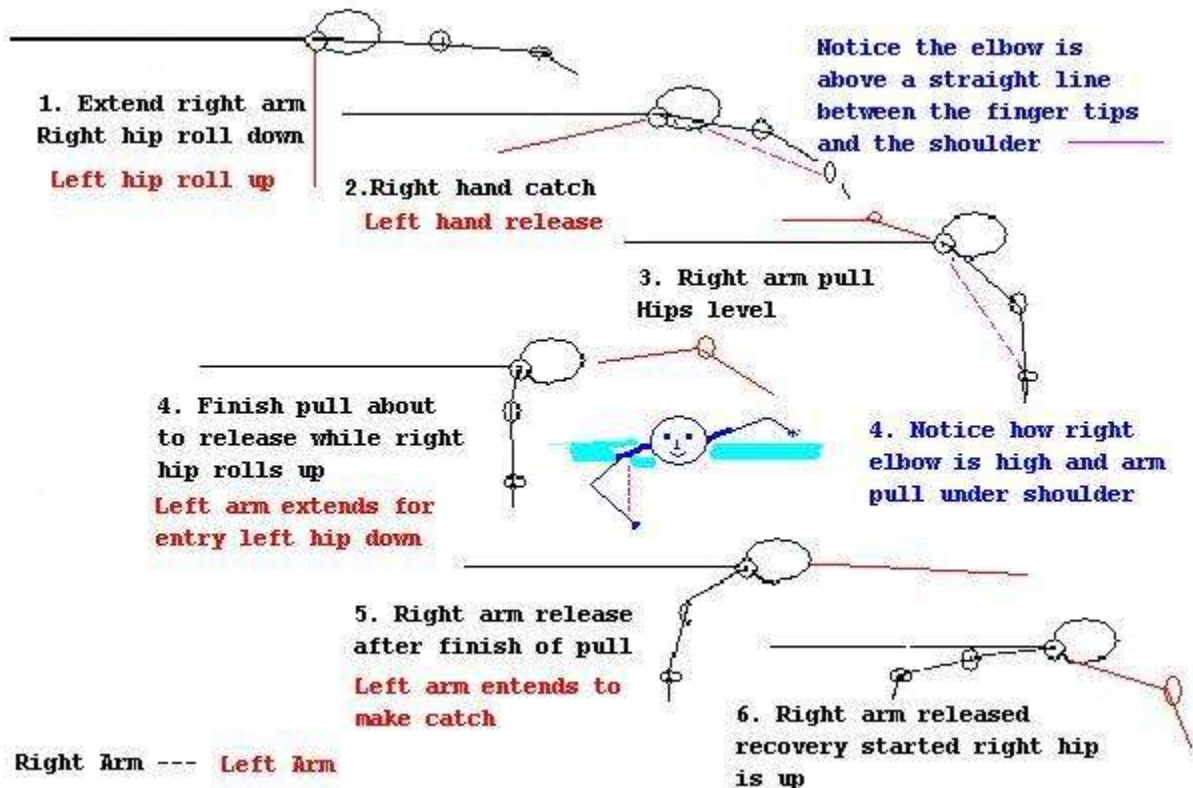


- Fingers point at the bottom from catch to recovery.
- Your legs must roll along with the hips. This means the feet will kick on an angle. They will not point down towards the bottom at the maximum point of the hip roll.

The angle formed by the upper and lower arm at the elbow joint during recovery varies among swimmers. The sharper the angle the more the shoulder may be strained. A wider angle can relieve this. It is important to get this part of the stroke right. Too sharp an angle places extra stress on the rotator cuff. Too wide an angle interferes with hand entry and shoulder extension prior to the catch.

### A View from the Side

Based on diagrams from In Search of the Dreaded Dropped Elbow by Coach Emmett Hines of H2Ouston Swims.



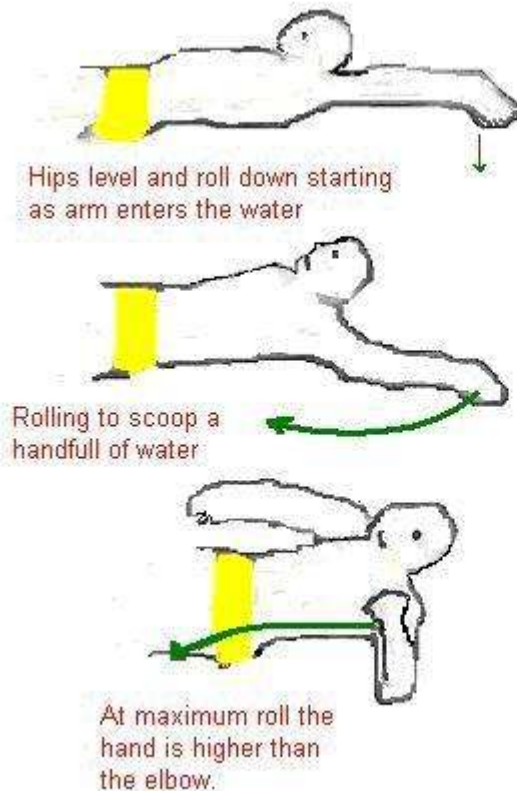
The body roll is in the hips through to the shoulders. The arms before entry thrust straight forward like a sword. They do not chop across as an axe would into a tree. After entry, the hand makes the catch. The catch anchors the hand in the water to pull the body forward. Your right shoulder in the pictures above will roll to level with the surface after the catch and then up in the air for the recovery. As the shoulder lifts the pulling arm moves faster past the hip. The elbow bends, forearm rotates and you begin the recovery motion. The hand skims just above the water surface. The elbow is higher than the hand. Breathe when the hand is in line with the shoulder and make sure the face is down before the hand enters the water. Take small breaths please. Remember to exhale through the mouth and nose when the face is in the water. Be careful of too much body roll. When kicking, if your legs fly apart like a cheerleader's arms and legs the cause is likely to be too much roll.

## Backstroke

Backstroke is a little different. The joints in our arms and legs do not bend in all the ways we would like to swim on our backs. Oh, to be an octopus at times like this. The trick to going fast in the backstroke is we roll on our side to pull. The arm goes straight back just like in the freestyle. The little finger enters the water first. The hand must be perpendicular to the water surface on entry for a correct pull or the hand will slide out of position. Then our shoulder dips down and we scoop a big handful of water. Scoop deep into the water because that is where the best water to pull is. It has no bubbles! As your

body rolls back to where the shoulders are level, the hand moves up towards the surface and throws the scoop of water past your feet. Remember to keep the hand under the water and avoid making bubbles. Then as the hand passes by the hip, rotate the hip up and lift the arm out of the water for a recovery. To keep your head, stomach and toes near the water surface kick hard with your knees straight. Find a breathing pattern you like and stick with it. For young swimmers the best way to learn the correct body position and arm movements is on a bench. As a coach, use your hand to simulate the water as a swimmer moves through the correct pull pattern pushing against your hand. This is a great exercise to have parents do at home with beginning swimmers. It is important that the arms do not enter the water straight above the head. They should enter at an angle. Standup and make the letter **Y** with your arms up and body. This is the correct entry position for the arms. Swim a few lengths doing a double arm pull with the **Y** entry. It is an easy way to learn the correct entry position.

### A Visual Review of Backstroke



This is a view from the side of a backstroke pull. The stroke is not using the arm as an oar. Do not just lie flat on your back, put your arm in the water, keep it straight and pull it back to your leg. To make the best use of the back and chest muscles most of the stroke is while you are on your side. An easy way to think about the arm motion is first the hand slices into the water. It is like a knife with the little finger as the leading edge. After the hand is nicely under the water and free of air bubbles, scoop a handful of water and prepare to throw it at your feet. Just like in baseball, bend your elbow to make a powerful throw.

## ***Short axis strokes (butterfly and breaststroke)***

In butterfly and breaststroke, we breathe with the mouth facing forward. Our shoulders are the pivot or rolling point in these strokes as we breathe and/or do the dolphin kick. This is undulation. It always starts with the head and chest moving a little and ends with the toes moving more. The waist and hips give us a good whipping motion. The arm movements in these strokes include sculling. They are difficult strokes to swim because muscle power is in discrete bursts instead of the continuous power application of the long axis strokes. This process is like comparing a kangaroo hopping to the movement of a cheetah running. A major difference in the long axis and short axis strokes is the motion of the arms. In long axis, it is a linear backwards pull forward recovery movement. In short axis strokes, it is triangular movement. I teach my swimmers to practice the movements in front of a mirror.

### **Butterfly**

Watching inexperienced butterflyers is like watching actors in a silent movie. The actors exaggerate their body movements because they cannot speak. Young swimmers exaggerate the undulation and kick because they lack the strength and timing to do the stroke correctly. Fortunately, physical growth and experience play a big part in correcting these faults.

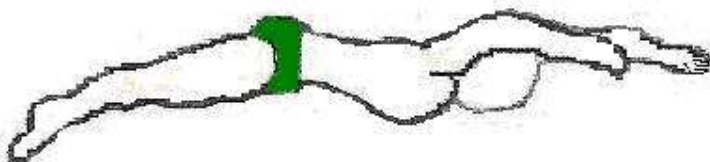
When swimming the butterfly stroke, fingers enter the water as the toes go down finishing the first kick. Arms enter the water in front of the shoulders, not the nose, and the chest presses down as the hips go up. On hand entry, take a small scull with palms pushing towards poolside. As swimmers become stronger, they eliminate the scull and simply move from extend arms into a high elbow catch. Next, turn the palms down. Fingers point towards the bottom. Now the forearms move under the elbows and in towards the belly button. The hands are pushing you forward through the water. As you go forward, they move faster and faster. The speed helps lift the arms out of the water for the recovery. Breathe every second stroke as the forearms start pushing down and back. Thrust the chin forward and take a nice gulp of air. Do not raise the head and shoulders or the body becomes a tugboat with a big bow wave. After breathing, the head goes down. The arms come out of the water with thumbs pointing towards the pool bottom. Head down and thumbs down, why you ask? If the head is up and the hands flat as in freestyle, the shoulders will hurt and you cannot get the arms out of the water. There are two kicks in every stroke cycle. The first is when the hands are about to enter the water. The second is when the hands are exiting the water. These are times when the head is down and the hips are up just like the dolphin. Timing is everything in swimming butterfly.

To experience the chest down hips up motion in the first pictures below try this exercise. Float in the water face down with the arms in the butterfly entry position. Eyes should be just below the surface. The legs and hips are somewhat under the surface. This is the position you would expect to be at this stage of the arm recovery. Now press down with the chest as the arms scull out. The body will look like a capital letter Y at the maximum amount of scull. If doing a complete stroke this is the point that the hands would move down to complete the stroke. As the chest presses down and the arms scull, lift the hips. Move the hands back to the entry position push the hips down and repeat the motion repeatedly. This is the undulation motion of the stroke. Adding some kicking into this exercise is a more advanced option.

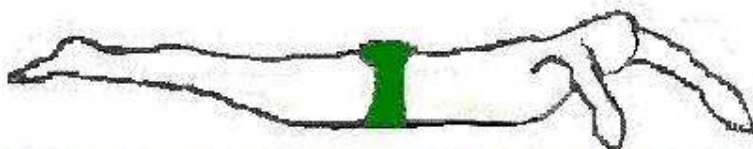
A common mistake inexperienced swimmers make is to try to do the butterfly pull as a double arm freestyle pull. Without the body roll inherent in the freestyle arm recovery, the arms get stuck and cannot clear the water surface. A sure sign of this is seeing a swimmer with both arms fully extended by their legs. They start to sink legs first. Incorrectly doing one arm butterfly drills only reinforces this error. Pay careful attention to proper execution of the underwater pull as described below. Stuck arms are a combination lack of shoulder flexibility and poor technique. There are exercises to improve shoulder range of motion. These will help but cannot completely overcome poor technique.



## A Visual Review of the Butterfly Stroke



This is the hand entry at the start of a stroke. Hips are up as the hands enter the water. The feet finish the kick. The arm stroke starts with a little scull.



The armstroke is similar to abreaststroke scull. Thumbs enter the water first and the hands sweep out towards the side. The hands then turn towards the bottom and breathing begins. The hands are sweeping in towards the hips. The hips are down as the chin juts forward for the breath. As the head is coming down, the arms sweep out after almost touching the hips. Hands turn thumbs down during the recovery. The second kick starts at this time. Hands enter the water directly in front of the shoulders.



The second kick is set up during the arm recovery. The feet go down as the hips go up. As the hands enter the water, do the outward scull motion with the hands. This allows time to finish the kick and get the hips moving up.

The secret of swimming butterfly is timing the different stroke movements. None of the movements is exaggerated. The kicks are small and fast. They start at the shoulders and through the hips. Feet push up as well as down on the water. They are not from the knees. Body undulation is small and just enough to do good kicks and lift the chin out of the water to breathe.

The underwater arm stroke is more like the breaststroke than the front crawl. The sweep out of the arms is very important so the arms will clear the water on the recovery. The thumbs must point towards the water to make the recovery easier. Do not finish the stroke with the hands next to the leg. Remember the eyes are entering the water as the arms sweep forward.

### Do Not!

1. Do a freestyle armstroke
2. Lift your chest out of the water to breathe
3. Have your face out of the water when arms enter the water
4. Bend your knees too much in the kick

To be a good butterfly swimmer you must have an outstanding kick. Butterfly kicking can be practiced three ways. First is on your stomach with arms in either the streamline position or down at the side. Second is by kicking on your back. In this position, swimmers tend to over bend their knees. This also happens when kicking on your stomach completely underwater. Even the best swimmers do this to some degree. Kicking on your back, this way will also help improve your backstroke starts and turns. I encourage my swimmers to go as far as they can underwater on their back on push offs at the start and turns when we do this drill. This develops great backstroke turns. It also lets swimmers learn how to control their depth under the water and keep water from coming up their nose. The third and most valuable kicking drill is vertical kicking. This provides the fast foot action and two-direction pressure on the water needed for a great butterfly kick. Hands out of the water and try to keep waves to a minimum when doing this.

## Breaststroke

In breaststroke, we look to the frog for inspiration. They do the breaststroke perfectly. Their kick is slightly different but the principles are identical. They have those big flippers to push the water. We do that with the bottoms of our feet. Frogs have a short body that cannot bend. When frogs kick all the force goes through the body and moves them forward. We do that when we thrust our arms into the streamline position during the kick. Frogs keep their knees out when they kick. Ours are in. We can run. Frogs cannot so we do it a little differently. Our version of the kick is a whip kick. Get the heels up to your backside. At this point, your legs will look like a **W**. Push back and slightly out with the bottoms of the feet. Then squeeze the legs together as the legs fully extend. The kick finishes when the legs are straight and insteps touch. Keep the head, hips and heels close to the surface. Be in the streamline position as the kick finishes. When bringing your heels up to the backside, do not let the knees point at the pool bottom. Heels will be slightly outside of the knees. They should point back at an angle.

Remember water does not like abrupt changes in body shape. Turn the feet out. Toes point to the side of the pool. Then push the feet bottoms and sides in an egg outline.

The arm pull in breaststroke is a scull. Somewhat like cleaning whipped cream out of a bowl with your hands. Just do a sculling circle without your hands pulling back past the chin. Scull out with palms facing the side of the pool. This is the out sweep. Drop the hands slightly, turn the palms to face each other and scull in. This is like squeezing a pillow. It is the in sweep. The hands move faster and faster as they come close together and finally lunge forward into a glide. The squeeze helps raise the body as the chin moves forward to breathe. This raised position adds to the power generated by the lunge. As the chest moves slightly down and forward, the hips lift. This means the kick pushes forward through the hips. Just like the frog. Go into the streamline positions during the kick. The arms stop when fully extended for the glide. Breaststroke is always done in this order; pull, kick and glide. Elbows and feet cannot break the water surface. During the pull, the hands cannot go past the waist. The pull and kick must be symmetrical.

Breaststroke has a special form of the stroke done on starts and turns. This is the pullout. The pullout consists of a pull where the arms go back to where the hands touch the legs, a dolphin kick while finishing this long pull and finally a proper breaststroke kick into a streamline again. A standard pull follows the pullout kick and the head must break the surface.

Getting the lunge after breathing to enter the glide right is difficult for many swimmers. Usually they push their body too far under the water. A way to correct this is view your body as a wave. Your head and arms are a surfer on a board near the top of the wave. If the board goes deep, you wipe out. Stay too high and you miss the wave. You want to ride down the face of the wave while staying on the surface for maximum forward speed. Lift your hips up to turn the rest of the body into a board. This allows the kick to deliver power through the streamlined body. Try a little body surfing at the beach or a water park. A good way to practice the correct lunge and undulation motion is to do breaststroke arm stroke with a dolphin kick. This highlights the need for a fast and effective arm stroke and the surfing movement of riding the undulation wave. It also improves the ability to lift the hips during the lunge into the glide.

Do not hold your head like the Sphinx when swimming. The breathing method of the sea turtle, extending the neck, is a better example of what to do right. Sea mammals have figured out how to breathe with an undulating motion. We should follow their example and use a similar energy saving motion not an exaggerated lifting of the upper body out of the water.

To swim proper full stroke breaststroke this way you must use the whip kick not the old fashion frog kick. The whip kick power comes from the legs moving back and down. This takes advantage of the leg muscles doing what they do best. The frog kick power is from the legs squeezing together. This has less muscle power and creates far more drag.

If you are not blessed with great ankle flexibility and a natural kick, there are still ways to help performance in the breaststroke leg of the individual medley. First is developing a great pullout. This will cut down on the distance you actually have to swim. Next is working on perfecting a powerful sculling motion. Raw strength plays a major part in how well you will do at this. Finally get the technical details correct.

- Bring the legs together at the end of the kick.
- Keep the elbows outside of the hands on the scull in sweep to exert more pressure.
- Make sure the hands do not stop during the transition from in sweep to glide.
- Chin forward not head up to breathe.
- The arm and leg actions should be fast. Do not bring the legs up slowly for the kick.
- Press the chest down on the glide to lift the hips and maximize the power of the kick.
- Improve ankle flexibility. It will help in all the strokes.

- Many breaststrokers kick too early. Others kick too late. The kick must be when the body is in a streamline position. The pull cannot start until the kick is finished.

Going back to butterfly's silent movie analogy, many breaststrokers swim in slow motion. The arm and leg motions must be fast and powerful. Racing breaststroke is a power stroke requiring great strength and exceptional technique. Recreational breaststroke is one of the best ways to relax and move in the water. Do not confuse the two.

### A Visual Review of Breaststroke



Breaststroke starts with the swimmer in the streamline position. After that the stroke must be done in a specific order of arm and leg movements as follows.



The first is the pull. this is actually two sculling movements. The first is a sweep out with the thumbs down. It is followed by a sweep in.



During the sweep in the hands accelerate as they squeeze the water as if it was a pillow. Elbows should remain slightly away from the side to increase the pressure exerted by the hands.



When the hands come almost together they shoot out to the streamline position. Two other actions take place. First the chin lifts slightly and moves forward to allow breathing. Second the feet move quickly into position for the kick.



The kick takes place as the arms are moving into the streamline position. At this time the swimmer finishes the breathing action and presses the chest down to have the body back into a perfect streamline.



The kick finishes as the body is streamlined. This is called the glide.



In the glide the hands are completely extended. The feet are together and the swimmer receives maximum benefit from the kick. After very short pause the next stroke cycle begins.

There are a number of ways to swim breaststroke. Do not be surprised if your coach teaches parts of the stroke differently than this explanation. There are two approaches to swimming the stroke. The wave style emphasizes undulation to maintain speed in the short glide pause between the pull and the kick. The flat style reduces resistance caused by too much undulation. What is best depends on the physical attributes of the individual swimmer. Like most problems that have two approaches to a solution taking elements of each makes the most sense.

## Basic science as it applies to swimming

We need to understand how the seesaw and the airplane wing work. The seesaw lever explains body alignment and pulling force. The wing explains water's resistance to movement. A seesaw is a special form of a simple lever. So are most of the joint, muscle and bone combinations that make up our moving body parts. In the seesaw, we have a board balanced on a fulcrum in the middle at the board's center of gravity. Put extra weight on an end and the other end goes up. To get the board back in balance you have to either add weight to the up end or place more of the board length on the up end's side of the fulcrum. This is how levers move to lift objectives. Figure 1 is a seesaw with equal force at both ends. It is in a state of equilibrium. Ideally, this is how we would like our body when swimming. The head, hips and heels are in a straight line. We are the board in the lever.



Figure 1

In the water, our body acts like a seesaw. It is rarely in equilibrium. In the long axis strokes, we try to keep it in equilibrium. In the short axis strokes, we try to take advantage of the fact that it is not. Our body with the arms at our side does not make a very good seesaw. We have our lungs filled with air that wants to leave the water and heavy legs that want to sink. In scientific terms, we have a center of buoyancy that is in our chest while the seesaw fulcrum is at our hips in a spot called the center of gravity. In simple terms, the heavy rider is our legs and the light rider is the head. Therefore, without any special actions on our part we would swim like a sea horse. Figure 2 is the forces of nature working on us.

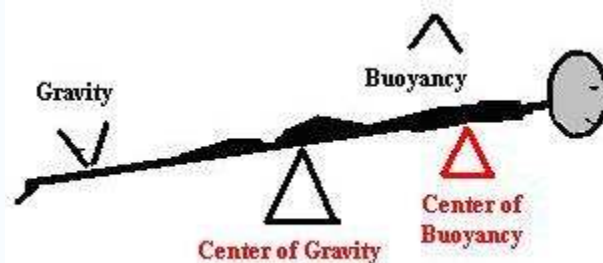


Figure 2

Figure 2 shows the forces, gravity and buoyancy, on our body if we just lie in the water holding our breath with arms at our side. To get our body in balance we must move our center of gravity closer to our center of buoyancy. We cannot move our center of buoyancy but can change its force by the amount of air in our lungs. There are three body parts to help us maintain equilibrium. They are the arms, head and legs. Extending the arms in front extends the board length on the lighter side of the seesaw because it moves the center of gravity closer to the center of buoyancy. We already understand the effect moving the head up and down has. Kicking applies force to raise the legs. These are ways to have the body in balance. They are part of swimming the strokes correctly.

Why is this body position so important? To understand that we need to know how an airplane wing or a hydrofoil works moving through air or water. The easiest way to do that is while riding in a car put your



hand out the window. When the hand is flat, it just goes through the air and you feel very little wind resistance. Tilt the hand up slightly and the hand rises. Tilt down and the hand dives. Tilt the fingers up too high and the hand goes backwards. Your body in the water responds exactly the same way your hand does in the air. In science, there are terms such as lift, drag and angle of attack to explain what is happening. It turns out for hydrofoils, which are just underwater wings; a very small angle of attack produces the most lift. Lift is what keeps the body high in the water operating like a speedboat instead of a tugboat. Drag is a measure of water's resistance to our moving through it. As the angle of attack increases, drag increases. A good example is lifting the chest out of the water in butterfly to breathe.

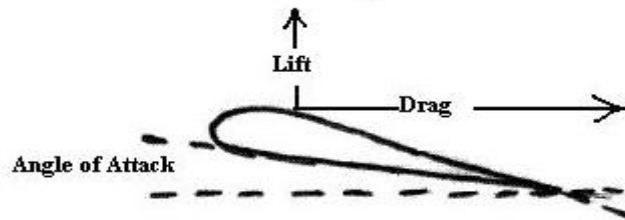


Figure 3

The arms and legs are levers. The hands act as airfoils when moving through the water during pulls and sculls. Most of having a proper “feel” for the water is simply adjusting the hand's angle of attack.

As soon as the hand enters the water, the water acts on the hand and arm movement in the same way air acts on a hand outside of a moving car window. A thumb down entry tends to push the hand and forearm too far out for a proper pull. A flat hand with fingertips up pushes the hand to the surface. A hand behind the head arm entry in backstroke bends the elbow so the pull starts in the wrong direction. You must understand how the water resists as you move forward and forces the arm stroke movements. Hand position on entry must be correct to eliminate unwanted directional movement. This is the “airplanes landing” for freestyle and “little finger first” for backstroke explanations used by coaches to describe hand entry. For freestyle correct breathing to both sides instead of just one side will improve arm movement. Many young swimmers have dramatic stroke improvement when they limit their breathing.

Sometimes using a pull buoy or other floatation device to improve body position will help correct other stroke pull problems. Without good body position, some of the basic stroke movements cannot be done correctly. An example of this is to eliminate freestyle wiggle by making the swimmer use a pull buoy and keep the ankles touching to keep the legs up and force body roll. The swimmer concentrates on proper arm stroke and body roll. The swimmer quickly learns the advantage of this stroke. The next step is to develop a kick that supports the roll and absence of wiggle. Having them touch the big toes while kicking helps keep the legs close.

The movements of our arms and legs are really the combination of simple lever groups in action. They are simple levers with the fulcrum (joint) at the end. To apply the most force to a lever the fulcrum is near the end of the board with the object to move. Force is applied at the other end. With our body especially the complex structure of our shoulder, arms and hands we have many options for apply force to the board. Thinking of the arm as a paddle and the paddle as the lever board is easier to understand. Big muscles can apply the most force. Our biggest upper body muscles are in our chest and back. These are the muscles to use in our arm stroke. Our brains have figured out a long time ago how to apply muscle power. The way you lift your body out of the pool, walk or pick up a heavy object are all examples of how well you understand applying power. All the instruction on how to move the arms and legs correctly are motions you already know. Some people do these motions better than others. They are the “naturals”. The rest of us need to work a little harder at refining these motions. By knowing what the results should be, we can train our muscles to perform them properly.



The objective is to leverage our application of force to get the maximum result. Just like in Figure 4 where five pounds of force lifts 10 pounds of resistance because of the length of the board on the force side is longer than on the resistance side.

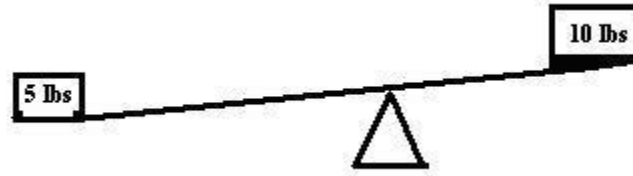


Figure 4

Finally, here are examples of the above shown in pictures of a swimmer. Figure 5 is an example of where the centers of gravity and balance are close together. The swimmer has the right arm extended and preparing for the catch. The elbow will continue to move forward as the hand moves down. The head is looking down while the legs provide propulsion to move the body forward and help keep the hips at the surface. In addition, notice that the left arm is still in the water completing the pull as the right arm prepares to catch. This is the typical stroke pattern for distance freestyle. Sprinters usually have less or no overlap of having both arms in the water.



Figure 5

Figure 6 shows one of the extreme moments in a butterfly stroke where the centers of gravity and buoyancy are far apart. Notice how low the hips are. The lungs are full of air and the breathing process is ending.



Figure 6

The swimmer has to employ undulation to get the body level. The head must come down before the hips move down and the feet rise for the next kick. This is why the butterfly is such a difficult stroke to swim. Timing body movements to keep close to equilibrium takes practice. In this picture, the body because of the large angle of attack is causing considerable drag with very little lift. Far too much energy is expended overcoming this added resistance.

Understanding the complex motions of the arms and legs to provide the most muscle power is a little more difficult to understand. All our lives we have been learning how to use our bodies to perform complex movements. We started with crawling and moved on to break dancing and butterfly. In swimming, the objective is to apply the big core body muscles to apply power. Muscles in the arms and hand are along for the ride. They provide minor adjustments to the arm and hand surface area applied to the water. In the long axis strokes body rotation serves two purposes. First is to reduce resistance to water by having part of the body above the water. Second is to position the shoulder so the chest and back muscles can be applied to holding the water. For example, if you want to pick up a big jug of milk you bend your arm and then lift the jug. You never hold the jug with a perfectly straight arm because you cannot apply much force. The big core muscles cannot apply force with a perfectly straight arm. Bending your elbow and keeping your hand close to the chest produces the same result. In both cases, you are on the wrong side of the lever fulcrum! Below are pictures of the long axis strokes showing rotation and proper arm adjustments needed to apply the core body muscles.



**Figure 7**

The proper arm motion for backstroke is seen in the bubble trail. There is good rotation so the arm is in the proper position to exert maximum force on the water to move the body ahead. The back and chest muscles are moving the shoulder back. They are the rower. The arm is along for a ride. It is the oar.



**Figure 8**

This is an example of the elbow high arm position as the right arm is finishing the “front quadrant” power phase of the pull. Notice the left hand is about to enter the water. The right hip will roll up as the left shoulder extends and the hand moves down. The left hand rotates slightly so the catch is with the elbow higher than the hand.

Figure 9 is a full sequence of the arm stroke. It shows all the elements of body roll, reach and a front quadrant pull. Note how the shoulder moves forward on the entry and then back on the pull. This is the core muscles doing all the work. This is also a good sequence to see the hand “holding” as the body moves forward.

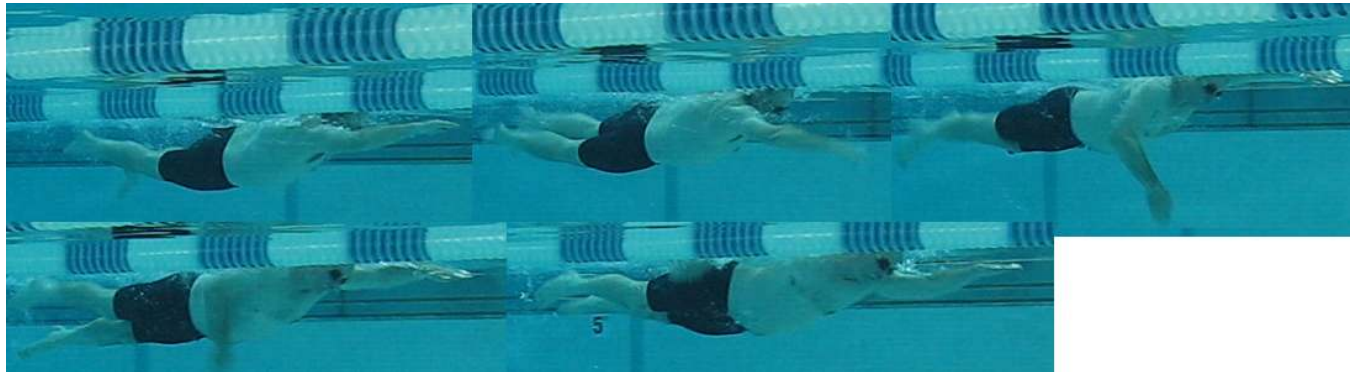


Figure 9

An article “The New Australian Crawl: Easy speed!” published in *Swimming World* and *Junior Swimmer*, January 2000 by Ron Johnson is very important to understanding the basics of an effective freestyle pull. In this article, he places the emphasis on moving the shoulder back and forth. He describes this as “shoulder shift” and points out its importance in all strokes. This is one of the best explanations of how to use the core muscles in the pull. This concept places less emphasis on shoulder roll and more on hip roll. This is the standing in front of a wall drill, where you roll your hip into the wall and stretch the shoulder joint. This motion results in the hand moving up the wall. The object of this action is to increase the distance you move through the water for each stroke. So how does this shoulder shift increase the distance per stroke? I believe there are at least three answers. First, the shoulder shift aids back and chest muscles to power the arm action in holding the water. It also allows the elbow to be held higher in the water to increase the leverage the arm has in this holding action. Underwater pictures of the world’s best freestylers show the high elbow in action. Next, the hip rotation is easier. The whole process of rolling the hip and extending the shoulder is a very natural movement. Finally, the roll is reducing drag because of the profile change from horizontal to somewhat vertical. This also reduces the wetted surface area. A concept anyone who has raced sailboats understands. The sciences of mono-hull sailboat design and stroke efficiency have a number of common solutions and challenges. They both have propulsion systems that generate almost as many problems as they solve and “hulls” that operate on the surface. Finally swimming the stroke this way always leaves an arm in front of the body to move the center of gravity forward. It improves the level body alignment needed to reduce drag. The force generated by the body roll is not turned into power moving the body through the water because there are no gears to transfer the direction of energy. The value of rotation is in how it sets up the core body muscles to work with maximum efficiency in applying power through the shoulders to the arms and reducing drag.



Figure 10

Figure 10 shows the correct time to breathe. Many swimmers breathe too late in the cycle. The head should be down just before or at the catch. Otherwise, the arm opposite the breathing side will loop under the body. This causes a wiggle and an ineffective pull. Notice how the hip rotation is greater than

the shoulder rotation. The next arm motion will have the hand moving under the elbow. The elbow will remain high from the catch throughout the pull.

This example is the butterfly arm pull. This pull has more in common with breaststroke than it does with freestyle. The hands are outside of the shoulders at the start of the pull back and converge at about the navel before splaying out to the side in the recovery. This is the “keyhole” pattern of the arm movement. It is the only stroke where the hands move into the center of the body. In this example, the hands could come even closer together. The shoulders are in perfect position to keep the body close to the surface and reduce drag. The back and chest muscles are providing the power in this burst of movement.



**Figure 11**

Finally is a series of breaststroke pictures. They are not of a very good breaststroke swimmer but do point out three of the most important parts of the stroke in terms of minimizing drag. The sweeps out and in followed by breathing is where the most drag occurs. This is clear even in the murky water of the pictures. The next two pictures show the arm and head movement to get level while finishing the kick. The final picture is the glide with the body level.



The sequence starts with breathing and the legs getting into position to kick. This is where there is maximum drag. The hands have come back just below the shoulders. This may be too far and is adding to the drag.

This is the point in the stroke where hands can not pause and must move forward as fast as possible.



Here the kick is halfway to completion. The body position is much better now. The arms are also fully extended and the head is in a proper position to allow body streamlining.



This is the glide with a pause at the end. The body is again level and streamlined before the breath on the next stroke causes the body to go out of balance.

**Figure 12**

## **Freestyle Front-end Mechanics**

Condensed from “Teaching The Front End Of Freestyle To the Age-Group Swimmer”  
*Teaching Your Kids How To Grab and Hang On to Water* by Dan Thompson

The mechanics of the catch are the specific arm and shoulder movements that give a great front end to the freestyle arm stroke.

*Before you read any further, pull up a chair and sit in front of a table. Place your hands flat on the table with your arms extended straight. Now try at these three movements with your arms.*

- 1. Push straight down with both hands and note which muscles flex and which joints hurt.*
- 2. Turn your thumbs up and push down and note which way your elbow wants to move.*
- 3. Turn your thumbs down slightly and lift your little finger of the table. Again push down and note which way your elbow wants to move.*

*Now think about the results. Which movement caused the most pain? Which movement allowed you to put the most pressure on the table? Remember the answers to these questions and try some other movements to understand how the shoulder and arms interact. This and the following topic are written at an adult level.*

After hand entry, the arm reaches forward under water. This is a true reaching movement. It feels as though you are stretching to reach for something just beyond your grasp. To illustrate, imagine that you are standing on deck and reaching upward to try to touch the ceiling. You are straining upward to gain every last bit of extension, because the ceiling is just beyond your fingertips. Two things will happen initially. First, you will hyperextend your shoulder. That is, you will push the shoulder upward from its resting position on the chest. Next, you will rotate your body forward to the same side. These movements are common, everyday movements that everyone can relate to.

Now comes the tricky part. It involves the swiveling movements of the arm in the socket joint of the shoulder. The movements governed by the muscles of the rotator-cuff tendon. You can swivel an arm to have the thumb point up or down. Thumbs up is termed external rotation. It is an outward rotation. Thumbs down is termed internal rotation. It is an inward rotation. The crucial point is this. When the hand reaches full extension, the upper arm swivels automatically moves in the thumbs up direction. The human shoulder is designed to swivel internally so we can reach overhead to grab solid objects like the branches of trees. In this position, if you reach around to feel where the tip of your elbow is, it is pointing forward. If you were swimming, the elbow would be pointing downward. Bend the elbow just a little, and suddenly you find yourself in the classic dropped elbow position. *Remember what happened when you pushed on the desk with your thumb up?* Our natural inclination is toward the dropped elbow. However, swimmers are not trying to grab solid objects. Swimmers are trying to grab water. It simply cannot be done with a dropped elbow. The reason is that in the dropped-elbow position the arm cannot act on the hand to create leverage against the water. Just watch the great, natural freestylers. As their hands slice into the water and reach toward full extension, they swivel their arms to a thumbs slightly down high-elbow position as in Figure 13. Keep the fingers pointed slightly downward. This drives the arm under the water. If the hand rides up to the surface, moving it downward puts an excessive strain on the shoulder joint just like it did when you sat at the table and pushed down.





Left thumb is turned slightly down to aid in keeping the elbow high. Too much turn causes hand to sweep out!

Figure 13

This is a beautiful, ingenious little maneuver. The effect is to bring the powerful latissimus dorsi muscle into play early in the stroke, even before the elbow begins to flex. Unlike the smaller muscles that work the shoulder, the latissimus is strong enough to lever the hand forcefully against the water. Figure 14 shows the latissimus dorsi muscle and upper arm at the thumbs down catch.

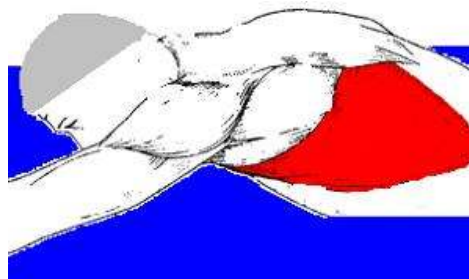


Figure 14

This is the secret of the rubber-shouldered swimmers! This is the technique they use to engage a lot of water at the very front end of the stroke, when the hand is at full extension, just beneath the surface of the water. If performed briskly, it produces an almost solid feel of water pressure against the hand. That sensation can be described as... "Grabbing a handful of water". The movement patterns are what most great, freestylers do naturally that the rest of us do not. Again, the movements are... shoulder hyperextension, body rotation and internal, thumb slightly down, arm rotation to the high-elbow position. This is the catch but the stroke does not end here. Having grabbed water, the swimmer must hang onto it. The swimmer must keep the hand anchored firmly against the pressure of the water until the power phase of the stroke takes over to drive the hand in and back to the hip. Hanging on to water is accomplished by a second part of the freestyle catch mechanism. It is a twofold movement, involving flexion (bending) of the elbow and something called protrusion of the shoulder. Elbow flexion causes the forearm and hand to swing downward, and shoulder protrusion causes the shoulder to roll forward to a position alongside the jaw. Operating together, these two movements create a pivoting mechanism centered at the elbow. It is important to understand the immense distinction between a pivoting movement and a pulling movement. A pulling movement draws the elbow backward. A pivoting movement freezes the position of the elbow. The beauty of a pivoting maneuver is that it can get the hand pitched backward against the water while keeping the elbow fixed in a high, stationary position. This is important because pulling the elbow backward wastes the strong pulling action of the latissimus muscle, the main propulsive muscle in swimming. Watch the great, natural freestylers, and you will see that they use a pivoting movement to anchor their hands in the water. They have the pulling action of the latissimus to be used later, in the power phase of the stroke. It is all a matter of timing, of applying force at the proper point. The average freestyler, unable to pivot, has no choice but to pull the upper arm backward in order to maintain pressure on the water. So, this second, hanging-onto-water part of the freestyle catch mechanism is a latissimus sparing device that anchors the hand and even begins to lever the body forward. It is this technique; the hand's pivoting action against the water that gives the well-known sensation of 'reaching over a barrel.' Another power movement that is often wasted in compensating for a weak catch is something called body re-roll. Body re-roll is the upward body rotation

that reverses the downward rotation motion. As you all know, the underlying rhythm of freestyle is a back and forth rotation of the core body along a central axis. The body rolls down, then re-rolls upward, then rolls and re-rolls again. Because body re-roll pulls the arm and shoulder backward, it gives a big boost to the power of the stroke. Where do the great freestylers use this re-roll power? If you watch them, you will see that they complete the entire catch mechanism during the downward roll of the body. They use the re-roll later, to initiate the power phase of the stroke, to boost the inward sweep of the hand. Why is this? Again, it is a matter of timing. Applying force in the proper sequence and setting up a chain of muscle movement that maximizes the power of the stroke. The great freestylers save re-roll for the same reason they save the pulling action of the upper arm. They conserve the big muscle groups, the latissimus and the core-body rotators, to be used to best advantage in the power phase of the stroke. The average freestyler, lacking a strong, independent catch, is forced to compensate by borrowing power from the re-roll and wasting it at the front end of the stroke. How can you identify that swimmer? The telltale sign is this. The elbow will not go into the high position until re-roll of the shoulder begins. The swimmer uses re-roll to initiate the catch rather than completing the catch and then using re-roll to get the power phase going. However, the big point I am trying to make with all of this is that a poor catch is not just a poor catch. It does not exist in mechanical isolation from the rest of the stroke. In fact, it drains away strength from the most propulsive part of the stroke, squandering the swimmer's most powerful muscular assets.

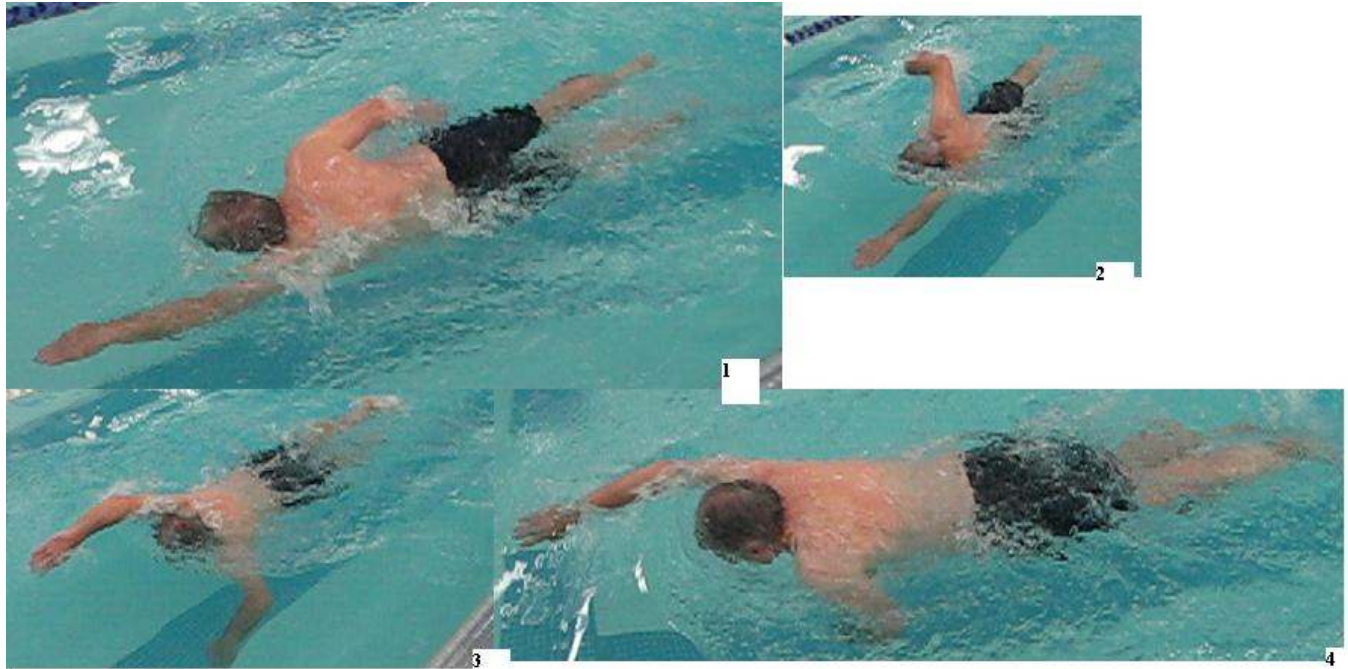
## ***Freestyle Front-end Teaching Tools***

At last, it is time to explore some of the practical methods you can use to teach the front end of freestyle. These are just drills I have come up with. First, keep in mind that rotation of the arm to the high elbow position, especially when the arm is at full extension, does require a degree of laxity in the socket joint of the shoulder. Otherwise, the rotator cuff tendon rubs itself raw against the roof of the joint. In medical parlance, the condition is 'impingement' or 'swimmer's shoulder.' We are trying to teach an unnatural movement for the human shoulder. It is foreign to kids in their land-based activities. The muscles that rotate the arm to the high elbow position are normally small, weak, and tight. Those that resist the high elbow position, i.e. those that rotate the arm to the dropped elbow position, are well developed. So your first order of business is establish a balance between these competing muscle groups by increasing strength and range of motion at the high-elbow position. Our first two teaching tools, the kickboard drill and the overhead-rotator drill, are designed to accomplish just that. The kickboard drill is performed during kick sets. If you will notice, most swimmers hold their kickboards with dropped elbows. Why not zap two birds with one stone by using the kickboard as a tool for training the high elbow position. Ask the swimmers, as they kick, to grip the front edge of the board with their hands together. Then have them rotate their elbows upward and push the board forward to full extension. Their hands will lever the front end of the board down, just under the flow of oncoming water. As a check on technique, they can keep an eye on their hands. If the elbows begin to sag, the kickboard will tilt upward. The hands will break the surface of the water, reminding the swimmer to re-position the elbows. In the overhead rotator drill, the swimmer holds a piece of surgical tubing overhead between the hands and swings the arms back and forth in a pendulum-like motion. As the arms swing behind the head, they are rolled internally to the high-elbow position. As they swing forward, the elbows are allowed to drop. The tubing is adjusted to a length that gives a feeling of stretch, but not pain. You may have to take the swimmer's arm in your own hands, initially, and roll the arm back and forth until the feel of internal rotation becomes familiar. The kids may hesitate at first, because full rotation can feel as though the shoulder is popping out of joint. But, in time your swimmers will become used to the expanded range of motion. By using the overhead rotator and kickboard drills, the kids have learned how to rotate their arms internally and have increased their strength and range-of-motion. Now they need to perform drills using internal rotation to mimic the actual catch mechanism. These are our wall drills, because a wall provides a surface for practicing the drills. The first such drill is wall drill #1. It teaches the swimmer to coordinate the movements of the grabbing-water part of the catch. The swimmer faces a smooth wall and, in a reaching motion, slides one hand up the surface of the wall while rotating the hips forward. As the hand reaches full extension, the swimmer rotates the elbow to the high position, applying forward pressure while keeping the palm flat against the wall. The swimmer

learns shoulder hyperextension, body rotation, and the feel of using internal rotation as a levering mechanism to create pressure on the palm of the hand. Wall drill #2, teaches the hanging-onto-water, pivoting part of the catch mechanism. The swimmers begin at the finish position of wall drill #1. As they perform the pivoting maneuver, they pull down and push away from the wall at the same time. You will have to demonstrate the drill to your swimmers and then guide each swimmer through it patiently. Wall drill #3, combines drills #1 and #2 into a single exercise to simulate the full catch mechanism. The swimmers perform drill #1 and then go directly into drill #2, trying to learn a smooth transition between both parts of the catch. The wall drills develop adequate strength for grabbing water. Below are pictures of the author executing drills #1 and #2. These are followed by above water photos of the same swimmer seen in the previous underwater photos.



Here are drills # 1 and #2. Drill #1 is shown from the front and back. It demonstrates both body roll and extension. Drill #2 is for raising the elbow as the forearm moves under it.



**This is a sequence of a high elbow freestyle by the same swimmer as in the underwater photos. It shows all the elements from entry through catch and power phase. Notice the hip roll from entry to the power phase finish. The left shoulder is extended in photo 1 and has moved back by photo 4. Both arms are in the water showing the typical arm overlap of a middle distance swimmer.**

*Dan Thompson provided the above thoughts and descriptions. This is his work with minor changes and added pictures provided by me for use in this document. The original article is at [www.swimmingcoach.org/articles/teaching.htm](http://www.swimmingcoach.org/articles/teaching.htm).*

### ***Dry land demonstrations of the elbows high freestyle pull.***

There are many outstanding articles and videos on the high elbow freestyle pull. I use this technique in my own swimming and have worked with some very good coaches explaining it at Masters clinics. Unfortunately, I am still having trouble communicating the principles and explaining the arm motions to new age group and triathlon swimmers. I'm sure other coaches have experienced the same frustration, especially those who coach recreational level teams that only swim a few days a week. I have been looking for simpler ways to say and demonstrate what I want to teach. I believe I have hit upon two demonstrations that are fast to show and easy to explain. They seem to work for me. I hope I am reinventing the wheel and other coaches are using these or similar demonstrations. If not they are worth a try. The pictures would be easier to understand with "surface level" camera work. My pool deck is too narrow to allow for that.

The first is bending over beside a wall with a line to represent the water surface. My line is a windowsill. The second is using a bench and a beach ball.

The arm demonstration next to a wall simply allows me to go slowly through the front quadrant stroke motion. By having the surface line, the swimmers can see how deep their hands should be at different points in the cycle. Elbow slightly higher than the hand on entry with fingers pointed slightly down from the forearm. Next is movement of the forearm into the catch while the elbow remains up. Finally is the shoulder being moved back by the chest and back muscles.





This is no different from the motions coaches go through every day to show how to do the strokes. So what is the point? I think having a fixed reference of where the surface is helps the swimmers understand when they need to make the various arm and shoulder motions to do the stroke correctly. A vertical depth ruler on the wall is even more effective. Not shown is the body roll needed. The depth that the elbow should be under the water is too shallow in the second and third picture. Showing body roll would correct this. The second demonstration allows for adding roll to the sequence of movements. This presentation error is not as easy to detect without the surface reference line.

The second demonstration uses a beach ball to represent the pool water our pull will operate on. In this I try to demonstrate the bad effect of the hand pushing down on the water and the good effect of pulling the body forward by pushing back on the water.



This sequence is easy to understand. Clearly pushing down on the big drop of water, represented by the ball, is a waste of effort. The next picture is the most important. It shows positioning the hand/forearm *paddle* behind the water to exert pressure on it. The two following pictures show the chest and back powered paddle moving and imparting maximum energy to the ball. The faster you can move the ball the more energy you are applying to moving forward. The cinder block line on the wall shows the elbow moving back and not down. To emphasize of the importance of applying the core muscles to the process replace the beach ball with a barbell. The paddle is straight with the fingers pointing to the bottom. This is a simple example of the “reach over the barrel” description many coaches use to describe the elbow high catch.

The most important points in the demonstration are:

- Hand entry before the elbow and in front of the shoulder not the nose
- Proper extension of the arm and shoulder at the maximum point of body roll
- Movement of the hand and forearm under the elbow to catch and form a paddle
- Employing the core body muscles to move the shoulder and apply power to the paddle.

By combining pictures of the two demonstrations, the elements of the pull are easy to understand. On the left is the picture of the wall demonstration. The left side has the corresponding bench pictures.





Hand entry should be with the palm flat at a slight downward angle from the forearm. Forearm is lower than the elbow. A thumb first entry often leads to movement towards the side instead of into the catch position. Full extension of the arm and shoulder are at the point of maximum roll. It is not when the shoulders are level. Full extension with level shoulders leads to the hand coming to the surface. This delays the catch.



The catch is when the hand and forearm become a paddle with the elbow as a pivot point. Now the body core muscles can put pressure on the paddle to move the body forward. The body is a canoe. The shoulder is still at maximum extension to allow for a longer period of pull power.



The arm can now apply maximum power to moving the body forward. At a point around the hips the release takes place and the paddle moves rapidly into the recovery position.

This is a very basic overview of the elbows high pull. Any swimmer mastering these arm motions and the principles behind them is well prepared to swim faster and respond to more advanced coaching.

## Starts and Turns

There are many styles of starts and turns. Here is what is common to all. For starts and turn push offs, the streamline is the most important part. We know how to do a streamline. For starts, the entire body goes through one hole in the water. Do not take a breath until after swimming some strokes.

There are two turns. Freestyle and backstroke use the same flip turn except after the push off. For backstroke, you remain on your back. In both cases, do dolphin kicks and pull with one arm to start swimming. For freestyle, take at least one full stroke cycle before breathing.

Work with a coach for backstroke turns, on the timing the roll onto your stomach. The turn onto the stomach and the following arm pull must be a single continuous motion. This is the freestyle turn. It is a summersault. Just like the ones, you do on a floor. Finish on your back and plant the feet on the wall with the face looking up. Feet should be apart for a better push off. Push off, dolphin kick and then if necessary roll on to your stomach for freestyle. In turns just like gymnastics, execution speed is very important. This means do not lift your head. Kick and pull extra hard before flipping.

Both butterfly and breaststroke require a level two hand touch on the wall in an open turn. Swim fast to the wall. Do not grab the wall and pull in. Turn only on your side on the wall to plant the feet. Do not turn completely around and push off! Push and twist when leaving the wall. After streamlining, execute a breaststroke pull out or a series of dolphin kicks followed by a proper butterfly arm pull.

The best way to understand the principle of swimming fast into a turn is to throw a ball against a wall. The faster the ball hits the wall the faster it returns. The majority of the momentum going into the wall

simply changes direction. This is the same as when a wave hits a wall. There are drills that allow swimmers to practice turns at faster than race speed. These are appropriate for advanced swimmers only. Depth of foot placement is also important. Swimmers with good kicks can take advantage of starting deeper in the push off the wall.

You cannot swim faster than the speed of the dive or turn push off so make the most of these or swim long course meters events as I do. Long course events cut turn losses in half. Underwater dolphin kicking on starts and turns is the fastest you can move under the water. Think about it! Good starts and turns win races.

## Starts and surfacing to swim in pictures



These are pictures of Mike Ross, one of the world's best Masters swimmers. First are the two best forms of starts from blocks and a backstroke start. The two feet forward with hands on the front of the block gives the most power off the block. Some times inexperienced swimmers have balance problems when dealing with slanted blocks using this start. The second technique is the track start. With this technique, it is easier to balance on the block. Swimmers should try both and select the one they feel most comfortable using. The



elements of a good start are quick exit, reasonable distance in the air, entry through "one hole" in the water and obtaining a proper depth for underwater kicking or the breaststroke pull out. These principles also apply to backstroke starts. The image of Mike's backstroke shows the importance of clearing the water also show a rule violation. His toes water and the proper depth to dive kicking ability. Do not try to duplicate without having the skill and training entry and use a flutter kick instead of techniques in the freestyle and backstroke events.



prior to reentry. The backstroke starts curl over the gutter edge. Clearing the depends on the swimmers strength and the kicking feats of Olympic swimmers to do so. It is better to make a shallower dolphin kick until you have mastered the



What is important is the streamline you do while underwater.

The next picture shows streamlining after a dive. It is followed by the proper execution of the full arm pull and dolphin kick during the breaststroke pullout. Finally is a picture of coming to the surface to swim backstroke. Mike shows the correct one arm pull that should be the first stroke. Never in freestyle or backstroke use a double arm pull at the start or after a turn.

### Underwater after start



## Flexibility Exercises

There are two body parts where the joints must have good flexibility. These are the ankles and shoulders. This means you need to be able to point your toes or stretch your arms better than most of your friends. The best swimmers in the world have great flexibility. They spend time in dry land exercises keeping or improving their ability to point the toes when kicking and becoming a *perfect* pencil when streamlining. Do dry land exercises in a gym or even on your bedroom floor. They are best done after practice when your muscles are warmed up.

There are many other dry land exercises to do. The ankle and shoulder ones are safe for preteens. These will improve your kicks and the distance you go on dives and turn push offs. Many swim teams do dry land exercises and stretching drills before they go in the water.

- The easiest is to sit on the floor and stretch the legs out in front of you. This is great to do while watching a favorite TV show. Now point the toes down towards the floor as far as they will go. Hold the position and count to five. Try to touch your toes to the floor. Next, relax the ankles and point them back towards your face. Repeat this ten times or more. Do it slowly and feel the ankle stretch **WITHOUT** causing pain.
- Draw circles in the air with your big toes. Ten circles in one direction followed by ten the other way. Draw the biggest circles possible. Again, do this at least ten times.
- To improve the breaststroke kick, point the toes toward the floor and try to have the soles of the feet to come together. This is hard. Do the best you can and hold for a second. Now relax the ankles, pretend you are in a pool and try to point the soles of the feet to the sidewalls. Repeat this ten times.
- Do not have another person apply pressure to your joints during stretching. This will cause damage to the tissue around the joint.

For streamlining, lie on the floor on your back or stand next to a wall. When standing you again may be able to watch television. Get into the superman flying position.

- Hand over hand, palms together and wrist over wrist. Your hands and wrists will look like two twisted ropes.

- Squeeze your arms together so they press against the ears.
- Squeeze the butt and press the small of the back against the wall or floor.
- Do not forget to point the toes!

Now fly and count to five. While flying, hold your breath. You will do this on starts and turns.

Every competitive swimming team should include a dry land exercise program that will improve swimmer's strength, coordination and quickness. A minimum program should have as its goal to improve the overall athleticism of every team member. This is **not** a swimming specific goal. Not all age group swimmers will or even want to become world-class athletes. They all would like to be reasonably successful at all the sports they engage in. The dry land program can improve their overall fitness and ability to execute complex body movements. It is good for all sports. The program my team uses was developed by three local CATZ Sports Center trainers from their experience and information in the *Complete Conditioning for Swimming* book by Dave Salo and Scott Riewald. Two of the developers have swimmers on the team. This made the selection of exercises to include easier. We have three half hour programs. Every week the kids do a half hour program at home on a non-practice day and a second session after our Sunday practice to teach them the exercises. We have very limited space at the pool site to exercise in and use no equipment.

My initial reason for adding this program was to help swimmers who knew what they wanted to do but had not developed the strength or coordination to execute the movements. Coaches of swimmers at every level face this issue. Dry land work speeds improvement.

Finally, there is a limit to the benefits of dry land exercise. It is to address specific needs and can do more harm than good when done in excess. Spend most of your time learning how to do the strokes correctly in the water.

## Swimming Drills

There are special ways of swimming for every stroke called drills. Drills allow you to concentrate on one part of a stroke. Butterfly and the crawl strokes have drills where you swim using only one arm. They help perfect the complex movements needed to do these strokes perfectly. Breaststroke uses a drill where you do two kicks after the arm stroke. This helps improve the kick and glide. All strokes use vertical kicking where you stand up in deep water, do the stroke kick and watch your kick. This allows you to practice the fast quick kicks that are so important. Two drills I use only to teach arm placement for the crawl strokes are: for freestyle overextend the entry glide and body roll and for backstroke do double arm pulls while making sure your body looks like the letter Y at entry. These help speed your muscle memory becoming comfortable with the movements needed for arm positioning. For butterfly, the swimmer should lie face down in the water with the body in arm entry position with the legs fully extended. The swimmer begins to do the outward arm scull while pressing the chest down and raising the hips. Next, lower the hips to raise the feet to complete the next kick cycle. For beginning swimmers this is an effortless way to learn the undulation rhythm of the stroke. Extend this into doing a full stroke cycle. Adding a small floatation device at the waist also helps. The objective is to build muscle memory for undulating and arm/leg movements on the surface. It is not to practice swimming in the seahorse position. Coaches will teach you more drills. Pick favorites and do them when swimming for fun. Most are easy to do.

Another fun activity that is a good drill is sculling with your hands. Sculls are moving the hands in circles to keep the head above the water or move forward or backwards. Sculling improves your *feel* for the water. You know when the hands are holding water and when they are slipping through the water. Change the angle of the hand and wrist to either improve or release the hold on the water. My favorite scull is to lie on my back, legs straight with toes out of the water. Then I scull down the pool feet first with arms extended towards my feet. I make circles with my hands by my waist. Scull this way with a water bottle balanced on your chest.



Do sculling in a crowded pool during playtime. Have sculling races or contests with friends. It is not exactly the same as swim races and you may be surprised at the results. It is also an activity to share in the water with friends not on a swim team.

## **Tired, Sore and Pain**

Tired, sore and pain are three levels of discomfort you may feel during or after a practice. You expect to be tired after a hard workout. With being tired, there will be a degree of soreness. If you do not recover from being tired or the soreness does not go away there may be a problem. Swimmers need to discuss how they feel with coaches and family members. Sports are hard work. If you do age appropriate workouts, the level of tiredness and soreness will lessen. A good way to relieve being tired and sore after a workout is to have a recovery drink. Recovery drinks are an appropriate (5:1) mixture of carbohydrates and protein. They are expensive so tell mom to get low fat chocolate milk for after practice. You will feel better faster after a hard workout.

Pain is very different. Pain comes in many forms from being stuck with a pin to breaking a bone and beyond. It is a misused term. The feeling you experience between swims in a hard set of sprints is often called pain. We should use another term to describe that exhausting gasping for breath body numbing experience. Pain means you may have done damage to your body. It is not easily fixed. Swimmers can experience pain in a number of ways. The most common pain relative to swim strokes is from injuries to joints and muscles. Improper arm and leg movements cause these. For example with the arm extended as far as possible press down on the table. You will feel pain in the elbow. This is the same motion and pain as doing an incorrect arm entry in the freestyle. Do a freestyle recovery without shoulder roll. You will feel pain in the shoulder joint. In this case, you are on the way to rotator cuff problems. Success in sports requires enduring tiredness and some soreness. It is not about enduring the pain that comes from damaging the body's muscles and joints.

To avoid pain and injury you must swim the strokes correctly and report pain to your coach and family. Removing pain may require stroke changes or doing special exercises. The bottom line is pain requires attention by the experts. Swimming is not about injury. "No pain no gain" sounds great as a motivational speech. It is not an appropriate inspiration to do your best. Correct stroke techniques are to take advantage of how our bodies work. Do not hide pain. Find the cause and remove it! As you become a better swimmer, read about physiology and anatomy. It is your body. Learn how it works and take care of it. It has to last a lifetime.

## **Do your brainy best!**

Swimming smart is not easy. It takes more than just plugging away doing laps at practice. You need some reasons to work so hard. Do this by setting goals. Goals are the reasons to practice and compete. Every swimmer needs goals. There are long-term and short-term goals. Long-term goals may take years achieve. Short-term goals are the steps to accomplishing long-term goals. They need to be specific, doable and measurable.

You should make a list of your goals. Do this with the help of your coach and family. As you train and compete, review your goals. Be inspired by your accomplishments. For those you do not accomplish figure out why. Make changes in how you practice or adjust the goal. Either way you have a better understanding of why you swim and what you need to accomplish. Goals help you do your best.

There is a second brainy best technique. This is visualization of future races. Visualization is creating in your mind a "movie" of an upcoming race. This allows you combine all the parts of how you want to swim and what you need to do into a movie. Play it repeatedly to remember all the things you need to do your best. Do this for every race. It will give you confidence in how well you will perform and helps you relax. The ending is doing a personal best!



Do not leave your brain on the starting block! Too many swimmers are excited at the start and forget that they must race smart. Remember the elements of a good start include quick reaction, proper streamline and underwater to surface transition. In your first strokes, get the body position right and a proper stroke pattern. Now you are ready to race. Just remember to go over the elements of a good stroke during the race. The longer you swim the harder it is to keep a good stroke. Finally do not fear running out of gas in the second or third fifty yards of one and two hundred-yard races. If you swim the first fifty too slowly, you will not come up to speed in the rest of the race. Believe in your ability to keep going fast and you will.

In practice, you must develop a good sense of pace. Whether being timed by a coach or swimming by yourself figure out how fast you think you swam then listen to the coach or look at the clock. Your brain clock will quickly become accurate to within a second.

## ***Pennies for Performance***

The penny is a coin that gets no respect. Find one on the floor and you leave it there. You leave it even though you know by collecting enough of them you can buy something you want. Perfect starts, turns and streamlines are the pennies of swimming. Doing them not quite right by being slow off the block, not pushing hard off the turn or just letting those hips sag a little as you swim is just like not picking up a penny on the ground. These and other details of good technique are as easy to ignore as the lowly penny. After all what is a tenth of a second worth? For every 1000 yards of swimming in a 25 yard pool we have 40 cents of turns at a tenth of a second each. If the swim takes 10 minutes, we could have gone 1 minute faster without the extra drag from sinking hips. That is worth \$6.00 of pennies. Soon we are talking real money. Do not ignore the pennies of swimming. They add up very quickly and often are the difference between achieving your goals and leaving them on the floor with the pennies.

## ***Measuring Stroke Efficiency***

There are three basic speed measurements in competitive swimming:

- Time to swim a specific distance
- Arm strokes needed to swim the distance
- Energy expended to swim the distance.

All swimmers keep track of their race times and know their personal best times. Improving personal best times is one of the main measurements in goal setting. After doing a personal best you always think about doing better. Counting strokes and measuring energy expenditure helps you answer the question. Stroke count measures technique. Fewer strokes to cover a specific distance means your stroke movements, body positioning and muscle power application have improved. Energy expenditure is how hard your body organs have to work to supply the energy needed to move you through the water. The goal of these three simple measurements is easy to state. For a given distance, you want to swim it as fast as you can with the fewest strokes possible while using the least amount of energy.

The first goal is simple. All meet races are timed and often there are time trials at practice. Just keep a log of your swims. The other two are more difficult and require you to do some counting and have coaches record the results. For the strokes per distance count, the swimmers count arm strokes and the coach records the time to swim the distance. In the log, add the stroke count and swim time in seconds for a score. This is the “golf game” because it is a measurement of multiple skills and the lowest score wins. The ability to use fewer strokes while going faster. Fewer strokes at a slower speed do not win races. The proper mixture does. Just like in golf, the best mixture of skills produces the lowest score. Finally, measure energy expended by counting heart muscle beats to pump blood throughout your body. This is [pulse rate](#). The harder you work the higher your pulse rate. There are published charts that show average pulse rates by age for doing nothing, easy work and hardest work. Measuring pulse rate is important for two reasons. First is again you want to go as fast as you can while using the least amount of energy you can. Secondly, you can improve your body’s capacity to work hard for longer periods of time. Pulse rate and time to swim measure this development. Energy expenditure comes in two forms of fuel conversion into muscle power energy. [Aerobic](#) is where your

body organs can deliver enough fuel and oxygen to the muscles so they can work for a long period of time without becoming too tired. **Anaerobic** expenditure is when the organs cannot supply enough fuel and oxygen. This is when your muscles start to hurt, you are out of breath and you need to stop or slow down. Next, is a simple explanation of how the body produces and muscles use fuel. Your coach can teach you how to measure your pulse rate and tell you appropriate pulse rates for how fast you are swimming.

Stroke efficiency goals and propulsion power applied per stroke is not the same for all race distances. This in principle is why drag racing cars are not the built same as track racing cars. In swimming terms the shorter the race distance, the more important quickly and correctly applying power becomes. Some “wheel spinning with screeching and smoking tires” is acceptable for maximum power application. The right balance is different for every swimmer. This is why it is important to do a portion of training at or above race pace. Use sets of short swims with longer rest periods so stroke and tempo adjustments can be tried. Some swimming with fins is helpful in becoming accustomed to the accelerated speed of arm movement.

## **A Race Car Driver Explains Aerobic Conditioning**

Your body works much like a car’s engine does. Muscles provide the power. Heart/lungs provide the oxygen for fuel combustion. Body organs store and make the fuel. Unlike a car engine, muscles can work without oxygen for a short time. When this is occurring, the body tells you through acidosis in the muscles to stop so the fuel system can catch up. In a race, you have only one tank full of energy. There are no pit stops. Therefore you need to get the best “miles per gallon” you can by having an efficient stroke and turns. Make a plan to have your fuel tank empty at the race finish not any sooner or later. This is pacing! The best pacing tactic for middle distance and long distance events for all sports is generally considered an even draining of your energy and a relatively consistent speed.

With sufficient oxygen and fuel deliveries to the muscles, you are operating within the **aerobic (energy conversion with oxygen)** zone of your work capacity. This is cruising on a Friday night. You are working well within you body’s abilities. Insufficient oxygen deliveries to the muscles, place you in the **anaerobic (energy conversion without oxygen)** zone of work. This is like red lining the tachometer or having the engine warning light come on. Muscles store a small amount of fuel. This is to do about fifteen seconds of work without bugging the rest of the body to produce fuel. When this internal muscle fuel empties, it takes about forty five seconds for the rest of the system to respond and deliver more fuel and extra oxygen. After the fresh fuel gets to the muscles, the work in an **aerobic** state starts again. Your body can work in an aerobic state for hours. The amount of time depends on how hard you are working. Just as with a car the faster you go the less distance, you can go. The car limit is fuel tank capacity. Your limit is oxygen delivery capacity first and fuel as a secondary limitation. A body’s tachometer is **heart rate** if you consider the speed the car’s drive shaft turning as similar to how fast the heart is beating. Tachometers measure rotations per second (RPM). Heart rate measures pumps (beats) per minute. This is **pulse rate**.

At a **pulse rate** of up to 120, you can cruise for hours at a low speed. For highway speeds, you operate at a pulse rate of 120 to 150 for the slow lane, 140 to 170 for the middle lane, and 160 to 180 for the outside lane. At a pulse rate of over 180 you are speeding. It is just a matter of time before you will stop. These pulse rates are for outstanding swimmers in their prime. Age appropriate rates are available at most gyms or from web sites. A rough approximation of an age appropriate maximum **heart rate** is to subtract your age from 220. This is from the cardiottennis.com web site. Speeding is OK if you are a sprinter. It does not work for distance runners or swimmers. No matter what rate you work at there comes a point where you will go back into the **anaerobic** muscle condition. Continue to work in that condition for too long you become exhausted and stop dead in your tracks.

With training, it is possible to make your body systems work longer and more efficiently to some degree. You can change slightly how fast the fuel delivery process takes place and the amount of oxygen the blood can deliver. This will determine how long you can operate at medium and high speed.

The ability to endure the pain caused by lactic acid is increasable. There is a better way to prepare for athletic greatness. This is to train to complete your event before the **anaerobic** collapse occurs. Great middle distance swimmers to marathon runners do this. They combine efficient movement with increased **aerobic** capacity. Sprint swimmers to middle distance runners learn to deal with continuing to operate in an **anaerobic** state. They also have efficient movement and increased **aerobic** capacity so they can spend minimum the time in **anaerobic** agony. Under a minute in an **anaerobic** state is relatively easy to endure.

To sum this up in swimming terms, go as fast and long as you have to at the lowest possible pulse rate. Stroke training lets you operate efficiently. Interval training increases your **aerobic** capacity. It is important to understand that a given muscle like the bicep is made of many parts. There are **fast and slow twitch** muscle parts. **Fast twitch** is for quick activities like a jump. **Slow twitch** is for prolonged repetitive activities such as swimming the mile. Both muscle types need training. How much training for each is based your event focus. Periods of all-out sprinting improve the ability of **fast twitch** muscles to do quick starts and swim very fast for short distances. It helps the body to delay entry into and tolerate the agony of swimming in an **anaerobic** state. Age group swimmers need this ability for any races over 50 yards. Age group and sprinters need a higher percentage of their practices to be at a sprinting pace. The **fast twitch** muscles do the majority of work in races of 100 yards or less. These muscles need different care and feeding than the **slow twitch** muscles that do most of the work in longer races. The coach has to measure your performance and prepare the correct mixture of practice activities to meet your swimming goals. These are three easy and basic measurements to get you started on the road to faster swimming.

## End of the story

So there you have it. These are the basics of the four competitive strokes. There really is not much to remember. The hard part is getting your body to move correctly. You cannot see most of the movements described here when in the water. You have to feel them with the hands and feet. Practice the movements while lying on a bench, bed or floor. Look into a mirror while practicing the arm movements.

Each swimmer is a little different so they do not swim with exactly the same movements. What they all will have is a good streamlined body position, pulling, and kicking movements to propel their body through the water with a minimum disturbance and maximum effectiveness for them.

No one learned these over a weekend. They take practice, practice and more practice. To improve practice must always be as perfect as possible. ***How well you do is up to you!***

## About the author



**Robert Boder** retired as a ASCA level 3 coach and a Masters Swimmer achieving USA national and New England top ten finishes in multiple strokes. He coached at the Charles River YMCA in Needham Massachusetts, and used this handout for the team and at New England Masters video clinics. Any coach is welcome to use this material by giving credit to the author. Suggested changes are welcome. His email address is "rboder at comcast.net".

## Credits

Thank you to Karlyn Pipes-Neilsen Hall of Fame Masters swimmer, Roy Coates the Northeastern University coach and Paul Bennett the Worcester Polytechnic Institute coach for allowing me to work with and learn from them, also to Ron Johnson and Emmett Hines for their important writings and Mike Ross for his advice and wonderful technique pictures. Finally, to Kipp Dye for explaining his work with Milt Nelms. It made me aware of the importance of how the body works to becoming a successful swimmer. Dan Thompson of South Texas Masters Swimming allowed me to use part of his article on freestyle and encouraged my efforts. Bill Ewan took the underwater pictures of me swimming. He used a high quality digital camera with a large amount of memory in an underwater case. The original pictures are of HDTV quality. My son, Rob, did the surface photos of the dry land exercises.

Finally, I need to thank the swimmers who allow me to coach them and the teenage assistants who help me. The swimmers try anything I ask so my assistants and I have a laboratory to try our ideas and methods. The assistants use their methods to teach these stroke principles and we all share our results. No one is better than a teenager to let you know by words or expression when you are off message or simply doing something that will not fly. Thanks Annie Hooper, Becca Weener, Chris Potterton, Rob Boder and the Charles River YMCA swim team.

## How did they take those pictures?

The photography is mostly the work of Bill Ewan with a high quality Cannon digital camera in an underwater housing. Images are uploaded to a computer and made into movies. I then make stills from the movies. The following explanation is Bill's on how he works his magic.

*The movie clips are in .AVI format (Motion JPEG). Basically the movie is a series of "independent" JPEGs taken at 15 frames/second. So in programs that can click frame-by-frame one can easily get a photograph out of the .AVI file. They will not play on an old fashioned DVD player into a TV. If anyone needs that I can change the files into DVD/TV readable format. It just takes a long time. Also to maintain the quality, the files must become very large. In one system I use, a single swim can fill fully one-third of a DVD to maintain the highest possible picture quality. These are the following programs I use that work fine on a PC to display the .AVI files (in order of my preference). All have similar clarity. **Canon Zoombrowser Ex 6.0** (One can click frame-by-frame through the 15 frames/second movie, or just watch it at normal speed. One can control the click function with a nearly full-frame movie.) This is the program that Canon Digital Cameras also use to download pictures and movies. It is likely that if you have another program for your digital camera.....*

***Handy Avi** (One can click frame-by-frame as in Zoombrowser. It has click control in a  $\frac{3}{4}$  frame. At full frame the click control is currently buried. This program was originally designed for time lapse photography in Astronomy.*

***Intervideo Win DVD 8** (Can quickly click start and stop to move close to frame-by-frame.)*

***Windows Media Player** (Can start and stop motion quickly as in Intervideo Win DVD 8.)(This was used in our wrap up at the end of the clinic.) Hit the print screen key to capture an image and edit with Microsoft Paint. This is the input to this booklet.*

*There are many more programs out there for the PC base, including those based in Linux. Also the Apple Mac computers should have great options, although I do not know Apple Mac.*





Bill's techniques and the products he uses are well within the reach of anyone who likes photography and does not mind dealing with computer programs. Bill does the production work as part of a series of clinics offered by New England Masters. At the clinics, we also use an underwater camera attached to an old TV's built in VCR and a Sony Handicam to produce a DVD surface view of swimmers. All the cameras are used to simultaneously record swims. These are used to analyze swims and in this booklet. These tools are well within the reach of any swim team or family. There are many options and all are worthwhile as a group or individually. The most important point is allowing swimmers to see rather than being told what they are doing right or wrong. Proper technique makes better swimmers and allows their hard work to produce the results they want to achieve! Give them the opportunity to be the best they can be.

# Basic Racing Rules

## All Strokes

- **You cannot do:** Stand on the bottom of the pool during a race.
- Pull yourself along the lane lines or side of the pool.
- Swim more than 15 meters without coming up for a breath.

## Freestyle – you can do anything but the above

## Backstroke

### You can do anything except:

- Swim on your stomach – except for one arm stroke while starting a turn. The turn push off is on the back.

### You must do:

- Finish the race and touch the wall on your back.
- Backstroke starts from in the water with the feet at or below the surface on the pool wall without the toes curling over the gutter.

## Butterfly – you can only do:

- Kick with both legs together – no flutter or breaststroke kicks.
- Swim on your stomach with both arms moving together. The arm stroke recovery must be out of the water. Never take an all underwater breaststroke pull and recovery.
- Touch the wall with both hands on the wall for turns and finishes.

## Breaststroke – you can only do:

- Each stroke cycle stroke including after the start and turns must start with a pull followed by a kick. Your arms must pull together and your elbows remain underwater. Your head must break the water surface during each stroke cycle.
- Except for the first arm pull after the start and turns, your hands must not pull beyond the hips. At the start and turns, the first underwater pull is all the way back to your legs. This is a pullout.
- In a proper breaststroke kick, toes point out to the side. Push water with the foot's side or bottom. Does a dolphin kick during the pullout during the first pull and before the first breaststroke kick.
- Touch the wall with both hands on the turns and finish of a race.
- Elbows and feet cannot come above the water surface.

## Individual Medley

- The order of strokes is butterfly, backstroke, breaststroke and freestyle.
- Each stroke must be swam in accordance with its stroke and finish rules. This means the butterfly to backstroke turn requires a two hand touch and a push off on your back. The backstroke to breaststroke turn must be started on your back and finished on your stomach. The breaststroke to freestyle turn requires a two hand level touch.

## The Medley Relay

- The stroke order is backstroke, breaststroke, butterfly and freestyle.
- Swimmers after the first one must have a part of their body (think feet!) on the starting block when the previous one finishes.
- The backstroke swimmer starts in the water.
- The freestyle swimmer cannot swim backstroke, butterfly or breaststroke.

## All starts. The start sequence is

- A series of short whistles to remove any outer clothing and be ready to swim.
- A long whistle to step up on the block or get in the water for backstroke.
  1. This replaces the old "Step up" means get on the block and remain standing or "Enter the water" is for backstroke.
- "Take your mark" means get into starting position and do not move. If you or any swimmer is moving, the race starter will stop the command sequence and restart it.
- The final command is a loud sound. If the swimmer leaves the block before the start command, it is a false start. The race is restarted. The swimmer may be disqualified.

# Swim Terms for Kids

**Age Group** Swimmer race within divisions by age.

**Anchor** The final swimmer in a relay.

**Blocks** The starting platforms located behind each lane.

**Bull Pen** The staging area where swimmers wait to receive their lane and heat assignments for an event.

**Card** A card the swimmer gives to the timer behind the lane. Cards list name, event number, event description, lane and heat.

**Championship Meet** The meet held at the season's end. Qualification times are usually needed to enter.

**Championship Finals** The top swimmers in Prelims/Finals meets who qualify to swim in the Finals.

**Check-In** The procedure required before a swimmer swims an event.

**Disqualified** A swimmer broke the rules.

**Dual Meet** Type of meet where two teams compete against each other.

**Dropped Time** When a swimmer goes faster than before. They have "dropped their time".

**Dryland** The exercises and various strength programs done out of the water.

**Entry** The Individual and Relay event swimmers event list for a meet.

**Electronic Timing** The timing system has touch pads in the water.

**Event** A specific distance and stroke race. An event equals 1 preliminary with its final, or 1 timed final.

**False Start** When a swimmer leaves the starting block before the start sound. One false start may disqualify a swimmer or a relay team.

**False Start Rope** A recall rope across the width of the racing pool to stop swimmers who were not aware of a false start. The rope is about 1/2 way down the pool.

**Finals** The final race of each event.

**Flags** Are pennants hanging across the pool at 15 feet from the each end. Used for backstroke turns.

**Gun** The blank firing pistol or any loud sound used by the starter to start the races.

**Gun Lap** In a Freestyle race (400 meters or longer) when the swimmer has 2 lengths plus 5 yards to go. The starter fires a gun shot when the lead swimmer is at the backstroke flags.

**Heat** An event with many swimmers is divided into heats. The results posted by swimmer's time swam, after all heats of the event are completed.

**Heat Sheet** The pre-meet printed listings of swimmers heat, lane and seed times in the events at a meet.

**IM** Individual Medley is an event using all 4 strokes. The order is Butterfly, Backstroke, Breaststroke, and Freestyle.

**Interval** A specific elapsed time for swimming or rest used during practice.

**Jump** An illegal start done by the 2nd, 3rd, or 4th member of a relay team. The swimmer on the block leaves the block before the swimmer in the water touches the wall.

**Lane** The place to swim a race, Lane 1 or another. Lane numbers are on the block, pool end or flag.

**Lane Lines** Continuous floating markers on a cable from the starting end to the turning end to separate each lane and quiet the waves. Sometimes call ropes.

**Lap** Means down and back (2 lengths) of the course. A lap finishes at the place of starting.

**Lap Counter** The large numbered cards (or the person turning the cards) used during the Freestyle events. Counting is done at the end opposite the start. Card numbers "odd numbers" only with the final lap being designated by a bright orange card.

**Leg** Each swimmer in a relay swims a leg of the event.

**Long Course** A 50-meter pool. Olympic sized pool.

**NT** Abbreviation for No Time on a heat sheet to showing the swimmer has not swam that event before.

**Officials** The adults who run swim meets.

**Pace Clock** The large clocks positioned at the pool ends or sides so swimmers can read their times during warm-ups or practice.

**Paddles** Colored plastic devices worn on the swimmers hands during swim practice.

**Prelims** Session of a Prelims/Finals meet determines who swims in the finals.

**Pre-seeded** A meet in which a swimmer knows what lane and heat they are in by looking at the Meet heat sheet or posted meet program.

**Prone** The face looking down towards the pool bottom position.

**Psyche Sheet** An entry sheet showing all swimmers entered in each individual event. Also called a "Heat Sheet" or meet program.

**Pull Buoy** A flotation device used for pulling by swimmers in practice.

**Qualifying Times** Published times necessary to enter certain meets.

**Recall Rope** A rope across the width of the racing pool to stop swimmers who were not aware of a false start. The rope is about 1/2 way from the starting end.

**Relays** A swimming event in which 4 swimmers participate as a relay team each swimmer swimming an equal distance of the race. There are two types of relays: 1.) Medley relay order is Backstroke, Breaststroke, Butterfly, and Freestyle, in that order. 2). Freestyle relay where everyone swims Freestyle.

**Scratch** To withdraw from an event after having entered it.

**Seed** Assign the swimmers to heats and lanes according to their submitted or preliminary times.

**Short Course** A 25 yard or 25 meter pool.

**Split** A part of a race, less than the total distance, is timed. The first 50 time in a 100 yard race is the split.

**Start** The beginning of a race.

**Starter** Signals the race start and insures that all swimmers have a fair takeoff.

**Stand-up** Command by the Starter to release the swimmers from their starting position.

**Step-Down** Command by the Starter for swimmers to step off the blocks. It means something is wrong.

**Stroke** There are 4 competitive strokes: Butterfly, Backstroke, Breaststroke, and Freestyle.

**Stroke Judge** Official at the side of the pool, walking the length of the pool as the swimmers race. If the Stroke Judge sees something illegal, the swimmer may be disqualified.

**Submitted Time** Times used to enter swimmers in meets.

**Timed Finals** Competition in which only heats are swum and final placement is determined by time.

**Timer** is behind the starting blocks/finish end of pool, getting watch times on events and activating the backup buttons for the timing system.

**Touch Pad** The removable plate (on the end of pools) connected to an automatic timing system. A swimmer must properly touch the touchpad to register an official time in a race.

**Warm-down** The recovery swimming a swimmer does after a race when pool space is available.

**Warm-up** The practice and "loosing" up session a swimmer does before the meet or their event.

**Whistle** The sound a starter makes to signal for quiet before giving the command to start a race.

**Work Out** The practice sessions a swimmer attends.


**Yardage** The distance a swimmer races or swims in practice.

These are based on the USA Swimming Glossary of Swimming Terms



## Dry Land Training Program

This is the flyer for our dry land training program. It is also offered by CATZ in Needham and is an episode in the *Swimming Rules* series of TV shows on the Needham Channel. The station provides public, educational and governmental programming for cable television subscribers in the town of Needham, Massachusetts. This and other episodes of the *Swimming Rules* series are available to other community cable stations or for purchase from The Needham Channel.



# NEEDHAM SWIMMING PROGRAM

Get in Top Swimming Shape with these CATZ Exercises

**Buckets 1-3 are to be done with a CATZ Instructor**

**Bucket #1 (3 sets of each)**

- Bilateral Anterior Shoulder Swings x 15
- Shoulder Punches x 15 to each side
- OH Split Squats x 15 w/ each leg forward
- Pull Overs x 15
- Sport Squat x 15 to each side

**Bucket #2 (3 sets of each)**

- Single Leg Star Squats x 5
- Bear Crawls x 4 laps
- Broad Jumps x 2 laps
- Downward Dog Push Ups x 20
- Water Buckets x 10 to each side

**Bucket #3 (3 sets of each)**


- Skater Jumps in place x 15
- Partner Push ups x 10 w/each arm
- Burpees x 15
- Shoulder Matrix x 8 each arm
- OH Sumo Walks x 2 laps

**Below Exercises May be Done at Home**

- Plank Holds
- Core Program (see handout)  
(A, B, C, Med Ball or Physioball - pick 2)
- Ankle Dorsi Flexion/Plantar Flexion
- Light DB or Tubing Program (see handout)
- Star Squats (see diagram below)
- Push Ups

**Star Squats**

Squat and reach towards each point of the star



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## Fun Sets, Practice Events and Final Thoughts

Every coach and all swimmers have favorite sets, drills or relay races they like to have in practice. Here are mine. I use these with age group swimmers between the ages of ten to fourteen. I develop entry level swimmers and prepare them to join other teams for higher level competition.

First is a set. We do this to music. You need to create a CD of songs with a good beat and fun lyrics. I like 50s rock and roll. The songs should run about two minutes in length. The swims are 100s where you get to rest until the next song starts. This is even better when the swimmers are doing kicks with a kick board. For younger kids or kicking only just adjust the distance. I frequently use the analogy that swimming is like dancing, especially butterfly. The music is a way to reinforce this concept of timing. I use this set when the kids are distracted by upcoming events such as holidays or tapering before the biggest meet of the season. They will give you good effort and big smiles during the entire execution. Playing air guitar with a lifeguard's rescue tube while pacing up and down the deck is acceptable behavior for coaches especially if it is just before Christmas, snowing outside and nobody wants to be in the pool.

I do relays at the end of most practices. Given the tight pool schedule and limited practice times I operate with, I rarely have time for a limited warm down. Relays at the end of practice are a great way to build competitive spirit and promote team bonding. During the regular season, I use two forms of relay team selection. Mostly I will use random selection by lining swimmers up against a wall and counting off. Vary the way you count or the kids will game the system. Less frequently, I will select captains. To be a captain you have to answer a "school" question in history, geography or science. This allows the kids to rest a bit after a hard series of practice sets and points out the importance school. Do not use captains too often since the slower kids or those with the fewest friends on the team will always be the last ones selected by the captains. Do use it to make all the swimmers learn the names of every other swimmer. The rule is you must select your swimmers by name. Another option if you have the same number of swimmers on a relay team as pool lanes is to make the winning team members become captains and have them select new teams after each race. Do this after every race and soon everyone will meet and swim on a team with everyone else.

I have a group of fun relays that I use frequently. These are as follows.

- Seal relay where each swimmer must push a ball up and down the pool with their head. It is great training for future water polo players. I always point out to my exhausted swimmers after this just how important body position is.
- Reindeer relay where you have a reindeer with a swim noodle harness and a driver holding the harness. Swimmers exchange positions at the turn. They have to sing Jingle Bells while in the water. This is a seasonal event.
- Hat relay where the swimmers keep a noodle knot hat on during their entire leg of the relay.

I am a firm believer in "Always Leave Them Laughing" at the end of practice. This is important to help the kids view swimming practice as fun and not just hard work. You are competing for their time with other sports and activities and often adding humor to your efforts is difficult to achieve and apply in the correct amount. Kids will always talk more about the fun they had than all positive activities you have done to make them better swimmers and helping with their person growth. Parents will recognize your qualities as a coach and appreciate the fact that the kids enjoy their practice time. Most of my swimmers are multisport athletes. They are not at an age to commit to one sport or have no desire to. I have to offer a program that exceeds in terms of training, enjoyment and personal growth what other sports do to keep them swimming. Remember most races are sprints. To fill out relay teams and get second or third place swimmers, a well-conditioned and strong soccer or baseball player will do very nicely. Always be on the lookout for tall former gymnasts.

I make an extra effort to explain the "what and why" of stroke development to parents. Every family gets an email copy of this booklet. From time to time, I bring parents on the pool deck to show what we are trying to do or correct. Finally, I give them tips on what they can do at home to help their swimmer learn faster. My mission is skill development. I do not train national champions. I do prepare my swimmers to select swimming as their primary sport and have the ability to move to a team capable of training them

for a higher level of competition. When USA team, high school and clinic coaches say they look forward to having my swimmers in their programs I have done my job. Parents appreciate this and their understanding leads to far less questioning of what we do in practice. The size of my team has more than doubled in three years mainly on word of mouth parent recommendations because of this approach. You earn your swim team and parents' support by providing a better program that fits **their** athletic goals than any other sport can.



I make extensive use of teenage swim coaches and prefer graduates of my own program. They know my terminology and the team members. My staff above taught many of the team members to swim, swim with the kids on a summer team and baby-sit for their families. When swimming for more advanced teams and/or high school teams they learn training techniques that I do not know or use. This is an opportunity for me to learn from them. The most important part of this is a partnership where I let them run many practices. I give them objectives and they plan the sets and drills to meet those objectives. I help them with their explanations and to develop leadership skills. This allows me to focus on individual swimmers and to correct stroke errors. They have made my program very successful and have learned leadership and teaching skills that will serve them well as adults. I also have college graduates and team parents who were outstanding swimmers help when I can get them. Their participation is an opportunity for me and my team to improve our skills. Helping your swimmers grow up to be happy and successful adults is job one. Swimming success is secondary. I tell my swimmers that winning meets is my job. If I train them properly, set the lineup correctly and they simply do their best, winning will take care of itself.

I am a great believer in demonstrating correct swimming movements on dry land. I do demonstrations while lying on a bench for many of the stroke movements. Sometimes I will use a swimmer to do the demonstration. Often the swimmer is one who needs correction. This allows me to do the correction and demonstration of the correct movement in a positive manner. I encourage swimmers to do these exercises at home in front of a mirror. For the youngest swimmers we do these drills as a "Simon says" game.



Get in the water! As an age group coach, you need to have someone in the water with the kids from time to time. Dan Reilly, the Andover North Andover YMCA coach, has a theory that kids just “catch on” to how to do things correctly. They have to see and feel more than just hear how to swim correctly. Younger kids often do not have the strength and coordination to carry out the motions coaches verbally describe. They need to try by mimicking the movements they see others do. Over time, understanding, strength and coordination come together. You see this form of learning on playgrounds and sports fields everywhere. It also applies to swimming. Children with gymnastic training often seem to “catch on” faster. Adding some coordination training to a dry land program is worth considering.

The “kids” in the pictures above are swimmers at the second New England Masters video clinic. Bill Ewan who provided most of the pictures in this booklet is in the red suit with his underwater camera. He talks as I swim. The workout group coach is on the deck with us. We leave above and below water videos of their swims with the attendees. Two years of feedback on clinic attendee’s success proves instruction with a high level of visual content really helps swimmers catch on.

Finally, never stop learning. Talk with other coaches, join coach associations, watch what the best swimmers do, read books and articles. Do everything you can to learn and share what you know. If parents and athletes feel our sport provides the best coaching and role models for personal growth, we will always get our fair share athletes and our sport will prosper.