



Don't Take Too Much For Granted (Ask Better Questions) by Nort Thornton (1995)

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I did really want to have the opportunity to talk to you folks because I enjoy doing that. I think I have a couple ideas that may stimulate a little thinking. Hopefully I can touch on a couple things — not a lot of things — but just enough to get you thinking and maybe you could take a note or two. I'll be happy to talk to you about them, at least my ideas about them.

I think I would like to start off by saying, welcome to the information age. With all the explosion of knowledge that has taken place today, we are solidly into the information age. With that being the case, I think knowledge is power. I think we have to try to find some way to get more knowledge — more practical knowledge so we can use it in our training sessions. I think the fact that you're attending the ASCA clinic is a good step, although I've sat in a few of the sessions and I've come away with a few more questions than I went in with. In some cases, because people are saying, "Well, I'm not sure

about this.” And that’s kind of the way I felt before I got here. So I think you have to try to figure out what’s going to work for you.

I went to a place called San Jose State College which is a great teacher training school. It has a good base in physiology, anatomy, psychology. It had a lot of technique in teaching, and coaching in practically every sport known to the human race and I came out of San Jose State thinking “Boy, I’m ready to coach. Just give me any group of swimmers and I’m going to be successful.” Well, I got that turned around right away in my first year at Los Altos High School. I think we won one meet, the last meet of the year and I thought, “Boy this stuff is not working very well.” And I thought maybe, just maybe it’s me and I worked a little harder.

About that time a young man named Steve Clark came and enrolled in Los Altos High School. Steve was, as you probably already know, was a tremendous athlete and a tremendous young man. He pretty much convinced me that I could coach after I’d lost a lot of confidence the first year or so. When he goes 46+ in a high school dual meet and I figured well maybe something is working right. I didn’t realize at the time it was just Steve. I thought everybody was going to be one Steve after another. It didn’t work that way. Anyway, it did make me realize that everything that you hear, everything that you read is not necessarily going to work for you.

I think you have to analyze a little more in your own particular program or how your own situation is because everybody has a little different situation and things that work one place might not work at another. Particularly if you have less or more talented athletes that you are trying to work with. In my first year at San Jose State (I was an art major) I quickly found out that

everything I thought was good, the teacher that I had (who was my advisor) didn't like; and everything that she thought was good, I didn't like. I figured, boy I better get out of here, I'll never make a living doing this if she knows what she is talking about. She was the person that was supposed to be the authority. So I figured well, let's get into something more practical.

I switched over into the coaching major. But, I did learn one thing from that year as an art major. I think I developed a critical eye. I think that has served me probably better than all the rest of the information that I got at San Jose State. When I look at situations, when I look at swimmers, I try to ask myself "What are they doing that is making them successful or what are they doing that isn't making them successful?" I think you have to look and you have to look real hard. You have to ask a lot of questions either of them or of yourself. You have to try. Sometimes, I'll go for years and I won't get an answer and all of a sudden something will hit me and I'll say "Oh, that's what it was." Hopefully it doesn't take years but sometimes you can figure things out if you think just about them enough and look hard enough at what is going on.

I would like to think that I've learned a few things from the various swimmers that I've had the opportunity to work with because I've been very blessed by having some great athletes come through our programs. If I didn't learn anything from them then it probably was a total waste of time. When I look back at what I started with at San Jose State, my beliefs early on in my career, I think probably most of those truths have been disproved either scientifically or in my own mind. I'm still scrambling around looking for answers. And that's ok. I think sometimes when we have a point of view, when we have a stake in being right, sometimes you spend all your time defending that point-of-view. We really don't take the time to look for better ways to do things. If you don't have to defend a point of view I think you are more free to look for better ways to do things. I think that is what it is all about.

There is always, not always but I'd say most of the time there is usually a better way to do things. You just haven't found it yet and you just need to keep looking and asking. I think there is nothing wrong with that. I really admire my son, Richard, because when he goes to a National Championship or any swimming meet, he'll work the deck. He'll go around and he'll get all his questions answered by the time the meet is over. He'll hit you one day or another. He just comes around the deck and apologizes if you're trying to warm up a swimmer and you try to take stroke counts or splits and he's there trying to ask questions of you. But he is just that intense about learning. I think that is a really good quality and I'm really proud of him in that sense and I think he has really developed the right idea about how to find out what works and what doesn't work.

I think that whether you are an individual, whether you're a team or whether you are a nation, if you stop searching for a better way to do things, I think you are in big trouble. Sooner or later other people are going to catch you and pass you. I think you can't be too smug about this is the way we used to do it or this is the way we do it. I think that happens. That is kind of history. People get to a certain point of proficiency then they stand on that and they don't keep going forward. We need to keep going forward and that is why I say I don't think we should take too much for granted, I think we should keep asking better questions.

A lot of times scientists will tell that this is the way things are and it may or not be the way they are. It may be that you need to look and see what was their sample. If this test was run on a series of six masters swimmers that have not trained for three years at a certain University and they did a certain amount of work and this is what they came up with. That may or not be

usable for you. It may be great for six unconditioned master swimmers. It might not be good for you. I think that if you write a test on a plaster-cast hand and water can't slide between the fingers, and the fingers can't move and there is no movement, I'm not sure we get the right statistics and information that we would if we're working with a regular hand. I'm sorry but I just don't think it is the same thing. Not that it is not good information but I'm not worried about going fast with a plastered hand. That's where I'm coming from. I think it depends on the sample, on the researcher's premise, and maybe even more importantly than that, who is paying for the research. You can always prove points by having research back it up. Just get what you want out of the research. There are people that will give you the research you want if you have enough money to get it. And, I don't think that is what I'm interested in either.

I get the best feel working with what is going by working with my own swimmers, trying different things and watching what happens. I'm not afraid to try different things and if it doesn't work I'll go away from it. If it does work, I'll just keep trying different things. It does frustrate some athletes. They want to have a precise way to do things and when they find out that you don't know what the hell you're talking about it kind of shakes them up. I try not to put that out too much. The only thing I try not to do is make the same mistake more than once. I think if we do that we are heading in the right direction. I think you need to base your own opinion on what your swimmers are doing on a day-to-day basis. Do not take the chance on accepting someone else's premise and base your whole year of success on operating your training program around that whole premise. For me, if I'm going to fail, I want to fail because it was my mistake. I don't want to fail because somebody else made a mistake. That is the way I look at it.

I want to tell a little story that sort of sums this up. There is kind of a gruff old-timer that goes to the doctor for a physical checkup. He goes in and the doctor runs a few tests and comes out and calls him into the office and says, "Well you're in great shape for sixty years old." The old guy says, "Who said I'm sixty, I'm fifty!" And the doctor says, "Oh, gee I'm sorry. I thought it said sixty on the chart." And the old-guy says, "No, I'm fifty years old I'm not sixty." The doctor says, "Well, I'm really sorry, I thought it said that. But you are still in pretty good shape for a fifty year old." And the old guy said, "Well, I'm fifty." He was pretty upset about it. The doctor says, "Probably even at fifty years old in your condition you can expect pretty good longevity, you'll probably live for quite a few more years. You can if you take care of yourself. By the way, what age did your father die." And the guy said, "Who said he died? He's alive, he's 75 years old and he's alive. He's in good health." The doctor says, "Oh gees, that's great. I didn't realize. Well then, why are you so concerned about your condition." The guy says, "'Cause I want to take a trip to New York and attend my grandfathers wedding. He's 101, and he's getting married next week. I want to drive back there and save a little money. I don't want to take the plane. I want to know if I'm in good enough shape to drive to New York." The doctor says "Boy that's amazing. Your grandfather is getting married at 101 years old. Why would he want to get married at 101?" The guy says, "Who said he wanted to get married."

So, don't take too much for granted, really. I think you just have to find out for yourself what is going on and I think you need to ask better questions. With this in mind, I kind of want to ramble a little bit about some things and kind of give you a few of my paradigms. I'm not saying that they are factual. They are factual in my mind but that doesn't mean anything. I make a lot of mistakes and I admit it. But, I think we learn by trying and asking.

I think everything we do in the water produces a given result. Each piece of equipment we use really produces the same thing, given results. For example, if you use a kickboard I think you get a flat body position with a kicking style that probably has more knee bend than he needs that probably doesn't have a lot to do with actual swimming. I've seen great swimmers who can't kick on a board who are great kickers and strokers and vice-versa.

We've got, I think, a great example right on our team. We have a young German sprinter who is quite talented. He came from Germany. Germans are noted for being a little hard headed. He has a great kick on a board and he loves to kick. The first year he was at Cal he used to lead the 100 at every dual meet at about 75 yards. He would come off the last wall and look around, see he was out in front and he'd always die and one or two people would go by him. I'd say, "Marcus what is going on?" He said, "Well, I just get so tired." I said, "Well, did you see when you came off the last turn that you were in front?" He said "Yeah." I said, "Well, what did you think?" He said, "Well, I wanted to win." I said, "Yeah, but what did you think?" He said, "Well, I wanted to win so I went to my strength." I said "What is your strength?" He said, "My legs." I said, "Well how did you go to those strengths?" He said, "I started to kick hard." And I said, "Well, how did you kick hard?" He said, "You know just like on a board. I just got flat and kicked just as hard as I could." Basically why he went away from his body rotation, he started just swimming flat, kicked like crazy, got real tired and everybody went by him.

And, so now I keep hiding his kickboard. He keeps finding it. He was going push 23 pluses before he left to go to back to German Nationals. He went back a couple weeks early to get a look at the guys he'll be racing at German Nationals. He got back, the German coaches said "Oh, those Americans just ruined your stroke. "Get the board and let's get going. We can do something three weeks out." So they kicked him like crazy for three weeks and got him

ready to go. He went slower then he did from a push off at our place and didn't make the team, got real discouraged and came back. The next year we got him all better then the same thing happens. He goes home a couple of weeks early, the coach says "get kicking." He gets kicking and went slower again. I said, "Marcus, don't you see a pattern developing here? Can't you see what's going on? If you're going to use your technique, use your power around your body rotation, get rid of that damn kickboard." But, he's still kicking. I keep hiding it and he keeps finding it. I think I've got to burn it or do something.

What I'm saying is that kickboard gives you a certain type of effect. I think pull buoys do the same thing. If you want your rear end to stick up high when you swim and not rotate very much use a pull-buoy all the time. Because that's what it does. It elevates your hips, and I think makes it harder to rotate, locks you into a position where you can't rotate. Sorry, but I think there is some problems with that. Also, with paddles — every paddle, I think, creates a different way of swimming. Our swimmers have seven different pairs of paddles in their equipment bag. We use, sometimes, three or four in the same practice. Most swimmers have one set of paddles that they like to use. They say well, this feels good. Usually it feels good because they can control it and doesn't allow them to do anything. Or, it lets them swim the way they like to swim which maybe not be in their best interest.

What I think is, paddles or equipment are a lot like medication. If you go to the doctor when you're sick and you have something wrong the doctor is going to prescribe the medication that is probably going to best affect your illness and bring you back to health. I think we have to look at equipment the same way. Give your swimmers the equipment that is going to help improve their technique in the area that it is deficient. If you have a paddle that doesn't allow them to pull out short and they are pulling out short, put that

paddle on and let them struggle with it until they get the idea. But, don't let them swim with the same pair of paddles all season or all you get is one type of stroke and it may not be what you want. It might be creating what you don't want. Different paddles have different effects. Just like every medication works better on different illnesses.

So, I think that is one point I wanted to make. I think we have to look at the equipment we are using. Just because someone wants to make a little money selling the stuff doesn't mean we have to buy it and use it. I think we need to figure out what we need and then get equipment that will work for that.

The second point I wanted to make, I don't want to spend a lot of time on it because it is kind of old news. This relates to the long-axis rotation strokes, crawl and backstroke. I think in Matt Biondi's case, I got a chance to watch him quite a bit so I was able to, hopefully, learn a few things from him. I think the hip and trunk rotation that Matt showed us became an international buzzword. I think everybody believes, at least everybody kind of says they believe, that's the way you should swim crawl stroke. I think, it certainly got me thinking about it — and he convinced me that that is the way to go. But, I think the problems we have is that we don't quite understand how he did it. I'm not sure that Matt understood, because Matt was very gifted and he just did it. I think if he had to describe how he did it, I think he would have a little bit of a problem. That happens very often with gifted athletes. If you ask somebody how they really do something they show you but they can't verbalize it. It came so easy to them they never had to really stop and think about it. Sometimes, I think that is what coaching is all about. Us that couldn't do it, had to think about it and we're still so frustrated that we're still trying to find a way to get it done. And, at least in my case that probably applies pretty well.

Some other things that I think I learned from Matt are related to Pruet's Law. Pruet's law is a ship building law that was developed in England years ago. It says that the length of the vessel determines the speed potential of the vessel. In other words, the longer you can stay from fingertips to toes (the longer the length of the body), the more speed potential you have. So if you have a short stroke and you're chopping it up, you're hurting your speed potential. If you watch most good swimmers they stay elongated the majority of their stroke. They don't shorten up very much. They keep their stroke balanced.

Another point was that the more ways that we can find to let water pass over our body the less frontal resistance we're going to get. I think that explains very nicely why when you are underwater dolphin kicking you can go faster than somebody on the surface swimming. Theoretically in my mind that didn't make sense. But if you can drop down underwater and allow water to go over both sides and around your body evenly you can eliminate up to as much as 50 percent of the drag or frontal resistance that you're getting through the water. If you can find a way to breath under there then we would have it made but the problem is obviously that you have to pay the price in some areas. The point I'm trying to make is that Matt found a way to let more water pass over his body, by getting on his side.

So far this ties two things together. The length of stroke and getting on your side. He was doing two things at the same time. I'm going to try to show you how he did a few more things too. Also, the other thing I learned was that the more distance per stroke that you can create and maintain when you race increases the more speed you can generate. So, by getting on his side, by allowing more water to float pass over both sides of his body he's maintaining longer distance per stroke.

There is a third thing that he's incorporated into this. The other thing that I think I learned and I'll just make a couple brief editorial comments after this. But, I think the hand anchors on a spot in the water, it catches the water and I think our body rotates past our hand. I'm sorry but I just don't think that it is as difficult as some of the things I'm hearing. I sat in the back of the room this morning and I watched the guys doing the patterns. Guys are scratching their heads and I don't think it really works that way. I think it is a lot easier. Maybe I'm way out in left field, I don't know, may be. But what I think, what Matt did, is he anchored his hand. He is on his side and he anchors his hand and he rotates his body past that point. His hand is not moving in relationship to that spot in the water — or very little.

We talk about, in relationship to the center of our sternum, and we talk about where the hand goes in relationship to that point. There is a big difference in the hand going out here and coming back in here. With the hand sitting here and the body moving in and out. Your hand is going farther and closer to the sternum but it is not moving in the water around it. I think that is where people get confused. We are speaking different languages. Somebody tried to say in relationship to the bottom of the pool or surrounding water around the hand. Other people are talking in relationship to the body position. It is like one person speaking French, another person speaking English. We don't really understand what that other person is saying.

I really don't think that we need to talk about what the hands and feet are doing. I believe that the hands and feet are a reaction to what the trunk is doing. But the most obvious thing to see is what the hands and feet are doing. They're doing the most movement. But if the hand and the feet are going properly, that means the trunk is moving properly, I believe. If the trunk

is not moving properly, your hands and your feet are going to do something different. If you hold a towel up there and you don't move it the other end doesn't move. If you rotate the towel a slight bit, by the time the momentum gets to the other end it is moving pretty well. Maybe I'm being over simplistic and I'm sure I am, but I just don't think it has to be difficult.

I have trouble understanding all the scientific jargon. I have some background in it and I tried really hard but I think it is more confusion than anything else. I watch what the swimmers are doing and I don't think that it has to be that difficult. So I think the hand pretty much anchors, occasionally you have stroke defaults that causes it to slip but those are things you can work with.

I think we need to look at where it all initiates. I believe it initiates in the power source which is the trunk or the hip girdle. The last point that I think Matt pretty much taught me is that power translates into speed. The power comes from this power source, I call it the power plant. I know that Vern Gambetta calls it the hip engine or something of that nature, but I think it's all the same thing. I call it the power plant because we are talking about generating power and I think the power plant is where it comes from. The power plant is your trunk. I believe that what we need to do, is we talk about stroke rate. We don't need to time arm strokes, we need to count timed hip rotations. We don't need to talk about shoulder rotations, we need to talk about trunk rotations. That's where it is starting. If you talk about any place outside of that you're short serving it and confusing your athlete, I believe. At least it confuses me.

I think you need to show them how it comes out of that energy. Talk about baseball for example. One of the best examples I can think of is the Dodger pitcher Nomo, the Japanese pitcher. If you see the stretch he gets in before he delivers his fast ball. I don't think he could throw a fast ball that fast without that stretch. He comes clear around and gets a little extra torque and comes around with that body and really delivers tremendous speed. I think it comes from the rotation of the hips. I don't understand why baseball players pitch from a stretch. Due to the roll of their arm and shoulder. I don't think it is nearly as powerful. I understand why they do it but I'm not sure it's that good of a reason. There is just a lot of things that I think are important about that.

I think the one thing that happens is that people don't really understand the timing of it. They say timing is everything. I believe it is true here as well. I think the main point is that you need to understand about hip rotation is that you can't just twist your hips without some anchoring point. We did a research project while I was at school. We used to drop guys out of the rafters into the pool. The guy would yell twist or wouldn't yell anything. The guy had to start from midair and throw a twist. Well if the guy tried to twist one direction he would go the other direction because he was trying to make his hips rotate. You have to have something to initiate. It is not like being on land. You can push off your feet on land. I think when you twist in the water it is a different ball game. I think the anchor point is the catch. I think when you get out in front, and you wrap the water up and you catch it here I think that is what initiates the hip rotation right there. If you don't get that catch or if your hand starts to move or starts doing the sculling where your body gets too far past your hand, I think you're in big trouble. So, I think the timing is important.

I think that the way I talk about it is important. I call it skating. We try to imagine that there is an ice skater or roller blade on each hip and when your right hand is out in front and your are on your right side, you've got to get on to that left skate and work past that and slide on the left skate past your hand. When the left hand is out there you have to slide it. Have you ever watched an ice skater go — he pushes off and slides on that foot. You're pushing off by catching and sliding on that opposite foot. It is that sliding motion that you are looking for. If you watch good swimmers swim that is what they look like they are doing. They are sliding on that opposite hip. I think that's the key. At least that is the key to the timing.

I see a lot of swimmers that get a body rotation, because they know that's good but they either pull their hand back or they've moved all the way past and it is like throwing a ball and then rotating through after the ball is going. It doesn't do you any good. When Matt's hand is out in front he is rotating over to the side so he can get over to the other side quicker to cut down on the frontal resistance, stay longer, and be able to have a longer stroke in back. Because as you rotate and go past this hand you can finish up. If you are flat and you get to here you can't do anything but pull your hand out. You can get around your body. So I think it is critical.

Now, an interesting discussion I had two summers ago at Santa Clara with Alexander Popov and his coach in Barcelona indicated to me that they had taken Biondi tapes and copied pretty much everything that Matt did. They did a great job of it, obviously. But they did one thing a little bit better and that one thing that I see is they keep a lower head position. Matt used to try to raise, keep his head up because that is what we thought he needed to do at that time. Popov figured out that if he laid his head down and kept it on the spine line and didn't try to hold it up that he could rotate better, he could generate a little more power and keep a little longer stroke. That makes a hell

of a lot of sense when you stop and think about it. People in this country always say “You got to get your head up so you get good high body position.” Popov’s answer to that was “Well, I’ve seen speed boats plane out on a lake but I’ve never seen a speed boat planning when it is tied to the dock.”

Your body position is determined by the water that is sliding under your body and speed by which it slides under. If you are going flat you don’t hinge the bow of the speed boat up to get up on top of the water. You keep it straight but you generate more power. As you generate more power, the water slides under your body faster and the resistance is to push you up on the surface. So, basically, what Popov is telling me is that he keeps his head in line with his spine, he doesn’t unhinge it by lifting it up.

What happens, when you lift your head up your feet go down? When your feet go down you have to work harder to keep your feet up. What Popov is doing is what he told me they are trying to do. He wants to be able to maintain perfect balance in his stroke. He could lay in that position for hours, you know just lay there. Then when he lifts his head his feet start to sink. He doesn’t want to have to keep his feet up. He doesn’t want to use any power for anything other than moving straight ahead – forward propulsion. So if he can keep his body in line, he is going to be able to rotate better. Have you ever seen a bent object rotate? You’ve got something that looks like this. When it rotates it swings a bigger arc. If it is straight it is going to go quicker and basically that is what you are trying to do, rotate quicker.

Now I didn’t want to spend a lot of time on that but I felt it was important to touch on those things because I think they are fairly important. Last year at the NCAA’s I did get a chance to watch two very fine athletes perform. I made

a little video of it because I wanted to see exactly why they were so much better than some of the other people. I was kind of surprised by what I found. I was searching to see what they were doing that I could learn from.

I think this is the 200 back, if I'm not mistaken. He trains a more traditional style which is probably a little more effective in long course swimming. But I think it is very interesting to see its consistency. I have something on here that will show that in just a second. I think I've got a little bit of the 1650 and then a little 400 IM for you.

I've been through these and broken down and analyzed them. Brian Retterer: on a fifty back he did about five stroke cycles on each 25 and he had about a 70 cycle per minute rate on the 50 back. On the 100 back he was about five as well with about 56 and a half cycles per minute. The 200 back was at about six cycles per 25 and about 53 cycles per minute rate. Actually on about Tom Dolan it is probably more interesting to me. On the 500 if you'll notice on every long-axis stroke, with his free style or back stroke he was 7 cycles per 25 through the whole meet. Whether it was 200, whether it was 500, whether it was 1650 whether it was part of the 400 IM. He was in the 500 and he was having 42 « cycles per minute and in the 1650 he started at 42. When he dropped off to about 39 « that's when Carvin made his move. He got it back up to 42-44 in the very last 25. But very consistent. In the fly you can see that he is nine and nine on breaststroke so his short-axis rotation strokes are nine strokes per lap. His back and free is all seven per lap. It is consistent, it is amazing to me to figure that out.

They both pretty much took totally separate paths. In my mind, I'm looking at this saying "what, there has to be something that they are doing that might

be similar.” In other words it looked like on the surface they are so separate and I’m thinking I finally struck on the idea that both athletes trained a great deal without oxygen. Brian Retterer because he willed himself to stay underwater worked on that part of his race. And Tom Dolan because of his asthmatic condition. For both of them, that is probably the one thing that they did that was similar.

I’m thinking to myself, well maybe if they train with less oxygen and get to use it in a race they are better able to assimilate it, maybe that is part of the secret. I thought to myself, over the years you got Rick Demont who was an asthmatic with an Olympic medalist. You have Paul Hartloff, someone you may remember, who swam with for Jack Simon outside of Santa Barbara, was a 1500 meter swimmer that swam I think at Montreal. He used to train breathing every three, every five, every seven, nine, eleven, clear up to the twenties sometimes. He did all his pulling hypoxic and a lot of his swimming that way. And he seldom breathed less than five or seven when he was in the pool, seldom. And so he was used to that. I think of Martin Zubero, the backstroker out of Bolles Prep School in Florida representing Spain. He taught me a great lesson about this. He came off the wall farther on a 200 backstroke on every turn and he started off the race by popping up at mid-pool and he was about maybe fourth or fifth in the field of eight. By the time he got to the last turn he was down most of the lap and he was just tearing people apart underwater. So he trained for that.

Another guy that trained very much for that was Mike Barrowman. I know that because Roque Santos has told me exactly what they did. That was probably 50% of their training under water. I think John Urbanchek alluded to that yesterday in his talk. They were doing things like four up, four down, four up, four down, flipping the turns. They used to do repeat 200’s that way and go under 2 minutes in practice. I mean they were so used to it that they

condition to being under water. And, I'm sure that there are many others that I'm just not aware of. My reasoning is that maybe there is something here we need to look at.

So what I'm doing is I'm going around talking to every research physiologist I can, bugging them. They are all telling me the same thing. There is absolutely no scientific evidence to show that there is anything true about this oxygen thing. But, I finally got to Rick Sharp. By the way, if you don't know Rick Sharp you should get to know him. He is a tremendous addition to the ICAR program and a fine scientist. He has a lot of swimming background. I think Rick is going to be very invaluable. He has certainly been helpful to me in the short time he has been up here. Rick says "I think maybe something else is going on." He said, "Maybe there are effects of CO₂ rather than oxygen." What Rick did was put me onto a study. He told me about a study about some dogs, where they put dogs in a room, pumped CO₂ into the room. Initially the dogs started to pant with the build up of CO₂. Eventually the dogs went back to a pretty normal lifestyle. They sacrificed a couple of them and did some muscle biopsy tests on them and found out that the dogs had actually learned to buffer the CO₂ imbalance in their blood stream and went back to a normal thing. I think that must be what is happening with our athletes. The people that spend more time underwater training or have asthmatic problems learned to live with a lot less oxygen and more CO₂ because of that and what's happening is we learn to buffer that like we learn to buffer lactate and I think maybe that is something we should be building into our programs as a training device.

So Rick basically got me off the oxygen path and got me onto the CO₂ path. Now, I think you need to control the CO₂ levels during the training and have our swimmers learn to buffer that. If they learn to buffer that they can get out with less breaths on the first lap and have less stress

and at the end of the race be able to come back and be able to go the last 25 without any breaths, without any real gasping response because they are conditioned to that and it doesn't really bother them. I know from talking to John Urbanchek and watching Tom Dolan train, that he goes into this condition quite occasionally. I think he said in Hawaii last Christmas he turned blue, lost feeling in his fingers, hand, and legs and they had to call 911 and revive him. He went over the safe limit. But here's a guy that in training, when we trained with him the guy is amazing at the end of sets. And, sometimes he just can't breath and sometimes when everybody else is getting fatigued he is just fantastic on the end of some sets. I think it has something to do — I don't know I'm just guessing. After my conversation with Rick Sharp at ICAR and other coaches that have used this hypoxic type of training I think that we basically need to spend some time looking at this and possibly developing it.

I've come up with a plan for a team and I'll share that with you because I think there are some things we can do. There are three different techniques basically. I'll show you what I'm doing. We've gone to a mono fin snorkel. There is a front mouth snorkel and basically what Rick Sharp says is this is increasing the dead space in the breathing. When you exhale all the air doesn't go out, the air that stays in the snorkel shaft is more CO₂ than oxygen. When you breathe back in the initial part of your breath is more CO₂. Therefore, I think we are getting a higher CO₂ level in our system while we are training and while we are swimming. At first our people had a lot of problems with it.

Another thing I noticed is that on our team when we did a little underwater work, the best people on our team had less trouble with it. Now whether it is hereditary, I'm sure some of it is, or whether it is condition to tolerate higher CO₂ levels I think we can do something about it. I think we should be

thinking about doing something about it. So, by using the snorkel for swimming, pulling, kicking sets, whatever you want, I think it is critical. I talked to Peppo Biscarini who is actually in this room next with the monofins. He says maybe when they get a little bit better we can put a little bit longer shaft on this thing to make the dead space a little bit greater so he could continue the training effect. Peppo tells me that if you get another bend in them that you could actually make it a little more difficult to breathe, so to speak and increase the dead space.

When Matt Biondi was training for Seoul, we took these things, turned them upside down and cut them off and he used to run stadium stairs and hills with these in his mouth. He said what happened to him, and our kids say the same thing. Initially they get sore muscles in their rib cage. It builds up the intercostal muscles. It allows you to expel the air more vigorously. That is what is going to allow you to get more dead air out and more oxygen in per breath. I think the breathing technique is critical and I don't think we spend enough time thinking and talking about that. I think this may be the key to increased performance and in our program we plan to do a little better job in that area.

What Rick Sharp says is that the high concentration of CO₂ goes into the arterial blood stream and forces your body to accept the higher level of CO₂ concentration. It is similar to breath holding but is a more gentle way of doing it. The other thing that Rick said was that the higher tolerance is going to allow you to have a little better technique. The snorkel will allow you to have a little better technique because it will balance off your stroke if you don't have to worry about the breathing.

Most people's stroke comes unglued when they breathe. You can watch the snorkle like a metronome. If the guy has a balanced stroke his snorkle will be steady. If he has an unbalanced stroke the snorkle will be all over the place. So it is a nice tool to measure stroke balance as well as build up that CO2 tolerance which I think is the key.

Along with the he snorkel training we do things like regular hypoxic training. We do a lot of breath control swimming. Hypoxic training was coined by Doc Counsilman years ago. I'm not sure that it is totally descriptive of what we are doing, it is more like breath holding and breath control training and Doc will say that he got a lot of flack from the scientists for using that term, but it is a catchy term and it is easy to use. So hypoxic training where you breathe three, five, and on up. Paul Hartloff, Jack Simon's 1976 1500 Olympian used to breathe up in the twenties. Every 20 strokes, breathe once every 20 strokes. This is amazing to me but it is surprising what you can condition your body to do.

The other thing we do is something that a lot of people probably do is "Shooters." Shooters are 25's or 50's underwater dolphin kicking with fins or without or with mono fins. And without air. You go under and do maybe 10, 20 in a set and maybe go on 20, or 25 or 30 seconds per twenty five and you would be amazed at people who have trouble with that. You can condition quite well your better swimmers with do a much better job of that. And whether it is because they get a better buffering affect for CO2 tolerance or whether they were just more talented and gifted it is hard to say. But I think it is a little of each. If it is a little of each then I want trade for everything.

And the last thing. I called around because I thought there are a lot of free divers that go down for three or four minute dives. And I thought, they must know something about breath holding and breath control so I talked to Peppo Biscarini who does a lot of free diving. There is a movie out called "Dark Blue Hunter" I think. The guy that was featured is an oral surgeon out at Ventura. I got him on the phone and talked to him. I said "How do you train for this?" and they said, "Well we just dive primarily." I said, "Don't you ever train in a pool." "Well sometimes if we can't get in the ocean we go to a pool. I said, "How do you train? " He said, "We just swim underwater for 25 and then back on the top and underwater." Yeah, intervals?" I asked. He said, "No we just swim." And I asked, "How long do you swim?" He said they swim 20 to 30 minutes at a time holding their breath every 25 and then they get to the point where they are relaxed doing this. I think that's the key.

Here is a breathing exercise Peppo does: he goes down about 1:15 and up a minute. Then down about 1:45 and up a minute. Then down about 2:00 and up a minute. Then down about 2:15 and then he added a 30 second rest. You keep taking that up as long as you can. And the experience I had was our guys they couldn't make forty-five seconds. It was terrible. I can't do it, this is ridiculous. So I called Peppo back and said, "What is going on? Do I have a bunch of wimps or what?" He said that is normal. "You've got to concentrate on slowing down the heart rate and relaxing." So I go back and said, "Ok this time I'll just tell them to go forty-five seconds to see if you could think about your heart rate. Find your heart rate and try to slow it down mentally. It is just like yoga just relax it." And what happens is the first couple times their heart rate elevated and they could barely make 45 seconds. Then after learning the technique at 1:15 they found that the heart rate dropped down. It got much easier to be 1:15. Then at 1:45 the heart rates stuck down to almost resting and below — the lowest possible heart rates I think I've ever really seen.

Now we use that in our loosen up period everyday. We swim a few laps easy then we hook our feet over the edge with our heads in the water and I just go over tap on the ladder at 45 seconds so they know when to come up. It seems to work extremely well. They go out of there with a real low heart rate. It teaches them to relax when they swim. It teaches them to control their body and I think that's critical. Now I want to push a disclaimer on this. No one wants to get a phone call, "I was following your article of July 23 about the breath control work and it didn't work and the guy died and I'm going to sue you." So there is not going to be too much in print about this. But what they're telling you is it does work and I'm telling you the same thing. I think you have to be extremely well conditioned and extremely supervised. I think it is the same thing that Barrowman and Santos were doing in their underwater swims.

I think when you are in shape and when you learn how to control your breath control you can do it. We've got guys on our team now in a couple weeks that have gotten up over 2 minutes and as much as 3 minutes. It is like a game, they love it. This is not that hard but it does teach you to control what they are doing. I guess what I'm trying to share with you is that I think maybe there are other ways we can be faster. I think breath control is one way. A lot of us do it in maybe unscheduled, unstructured ways. I think maybe we need to structure it. I think maybe there are things we can get from it that maybe we are getting now but maybe we can do it better. And I think there are other ways to do it.

This is my simplistic approach to the way of getting it done.

Now there are probably a lot of other ways, obviously. Hypoxic breathing, I'm sure you all do that from time to time. These underwater shooters, I know people do that. Retterer does 100's of them, and he's willed himself into that shape. That's why he can stay down longer than anyone else, he has learned how to stay there, how to relax and how to control his breath. Now I would like to make one last comment and that is: I think in the 200 fly Melvin Stewart went to underwater work. When Melvin Stewart was underwater he was ahead of everybody else. Melvin Stewart died at the end of his races. And I heard him talking about whether he should give it up because it is too hard, he just can't do it. My thinking about that is for Melvin, if he hasn't done it long enough, he hasn't really conditioned himself. My thinking is he is faster and if he can beat people underwater then all he has to do is get in shape to do it the whole damn race. If he is dying on the end it is because he is not conditioned to it. And I think if Melvin Stewart, if he can beat everybody else under the water, he better stay there and keep working on it. I watched a video tape of Denis Pankratov setting his world records in the 200 fly. He was under 25 meters on the beginning. He was under maybe 7 or 8 meters off of every wall. He is not having trouble dealing with it. I'm not imagining that the better athletes like the Zubero's, or Barrowman's have trouble staying down. Barrowman never had any problem staying down on his last pull down off his last wall in breast stroke) where other people might have. He had an advantage right there because he spent more time training without oxygen.

Basically without oxygen it's anaerobic. This is a subtler more gentle way to train anaerobically and maybe you don't beat your swimmers up so much that way. You just have to be sure you don't leave them on the bottom of the pool.

So basically that is all I have to share with you today, I hope it is of some help.

Summary of three different techniques. They are:

1) To use a snorkel (a monofin front mounted variety). A snorkel increases the respiratory dead space. This means that when they inhale, the first bit of air that reaches the lungs is the air left over from the last exhalation. This left over air (dead space) has a high concentration Of CO₂. The arterial blood is forced to accept a higher than normal CO₂ concentration. This is similar to what happens when you hold your breath: CO₂ accumulates in arterial blood until it reaches an intolerable level, forcing you to start breathing again. One person can hold their breath longer than another because they have a higher tolerance to CO₂. This higher tolerance can be inherited and can also be increased by frequent exposure to higher than normal levels Of CO₂. If a swimmer has better CO₂ tolerance, then when they're asked in a race to breathe only twice on the first 50 and 4 times on the second 50, they can do it without undue discomfort. In addition to the improved CO₂ tolerance, the higher than normal blood CO₂ causes blood and muscle PH to drop much the same way that lactic acid accumulation causes PH to drop, and causes an improved buffer capacity in the muscle. Perhaps snorkel training is a gentler type or "Lactate Tolerance" training with similar adaptations being made.

Rick Sharp also points out that another possibility is that snorkel training may encourage a more streamlined stroke by allowing greater body rotation on both sides with better symmetry. This creates better reach/stroke length, roll and duplication on both sides. Being more streamlined, the swimmers could

hold the same or faster pace with less physical effort. Less physical effort translates into lower heart rates, longer distance per stroke, and ultimately, improved performances.

2) Regular Hypoxic Training. Breathing every 3, 5, 7, 9, 11, 13 or even 15 and above, can condition a swimmer to better buffer higher CO₂ levels in the body. This style also allows swimmers to balance their strokes and to concentrate on proper technique.

3) Passive breath holding technique – something used by free divers to train in swimming pools for ocean dives. We use this at the end of sessions as part of our loosen-up/cool down. The technique is to hook your lower legs up on the deck with a 90° bend at the waist and the knees. Your upper body is submerged in a relaxed position under water on your back facing upward. The routine we use is breath holding for 45 sec., then recover with normal breathing for a minute. Then 1 x 1 min. 15 sec. sub surface, then one minute recovery. Next is 1 min. 45 sec. sub surface, followed by one minute recovery and finally 2 min. subsurface. Our plan is to continue to take these breath holding periods up by 30 seconds on each extension of time. 30 more seconds will also be added to the rest periods above 2 minutes. The mental focus is on relaxation and slowing down the heart rate. We find that on the first sub surface bout of 45 seconds often the heart rate goes up and it is difficult to complete the 45 seconds, but often on the second bout of 1 min. 15 sec. the heart rate drops down quite low and things become easier.

4) Another active training technique use by most coaches is called “Shooters”. These are 25’s or 50’s sub surface dolphin kicks often with fins or zoomers on send offs of 20-25 or 30 seconds. (for each 25). It is not uncommon to do up to 20 or 30 of these in a set.

I would like to finish with a disclaimer. This type of training is dangerous if not conditioned for and supervised properly, and should not be attempted unless proper preparation and supervision has been arranged for. I am not recommending it's use for everyone.