



Training With a Monofin by Peppo Biscarini (1995)

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Peppo Biscarini's swimming career started at the age of 5, at one of the few schools sponsored by the Italian Olympic Committee. He competed in his first national age group championship at the age of 10. Between the years of 1973-76 Biscarini won 3 National age group championships and received a swimming instructors licence (Youngest certified instructor in Northern Italy); started to test fins for fin swimming competition. In May 1976, he won the World Championship Long Distance fin swimming and set a new World Record (83.7km in 24 hours - stood until 1982). Biscarini came to the US in 1980 and in the Fall of 1982 transferred to US San Diego after attending a local community college where he set the highest number of first place finishes in the division (34 out of 37 races). In 1983, Biscarini broke his back while at La Jolla Cove, shattering his dream of participating in the 1984 Olympics. Recovering from his back injury he endorsed monofins from Italy and started to work with top collegiate coaches (UC Berkeley). In 1987 he won 3 golds and 1 silver and set 3 National Records at the first US National Fin swimming

Championship (All American) In 1988 he helped organize the fin swimming events for the first World Corporate Game (over 300 swimmers from 17 countries). At these games he won 2 golds and 1 silver and one more National record. This was the last time he competed. Today Peppo Biscarini is the founder of Hyperfin Inc. and consults as a fin expert for the U.S. Navy Seals, Scripps Institute of Oceanography, Lockheed Co, and various U.S. swimming coaches.

Good afternoon. I don't know how many of you were listening to Nort Thornton's speech earlier. I'm glad I was just listening to the tail end of it, and I'm very glad that he made a big disclaimer at the very end, talking about some hypoxic work that I've done and currently am doing, and I don't want to have any oxygen deprived zombie coming to my house and complaining.

Anyway, my name is Peppo Biscarini from San Diego via Italy, and I've been in the States for about 15 years. I wanted to discuss a few things today, a little bit of my background, and then kind of give you an overview on the history of fin swimming, and then get into some technical aspects of products, as well the training aspect, which is what interests you the most anyway.

As far as my background goes, I was recruited into fin swimming in 1975, being a national butterflyer. I worked with different manufacturers on new designs of monofins. In '76 I obtained my first World Title and World Record, then I endorsed different manufacturers. I came over in the 80s, to the United States and I talked to different coaches about fin swimming. Nobody even knew what fin swimming was. And then Nort Thornton in '86, started to

use monofins for the first time, and then some other people started to follow suit — Harvard, Stanford, USC, Indiana, and so on. I'm the former National Technical Director for fin swimming, and I started coaching age group swimmers back in 1977, and I continue on here in the States, though on a smaller scale. I've done more consulting also for Scripps Institute of Oceanography, the Navy Seals, and the Lockheed Underwater Division.

Now, a little bit about history. So many coaches are wondering where this is coming from. Well, the original detail drawings for fins went way back to Leonardo Da Vinci in the mid 1400s. Then the concept was formalized and patented by a German, by name of Sprotk in 1879. The first idea of monofin came from two German fellows Ristau and Bergann in 1955. And then the first monofin was actually produced by a Russian club, Altai, back in March of '69. So fin swimming is not from Finland, but is from Russia. You want to remember that, because I think there is going to be a quiz question at the end. Now, as far as organized fin swimming goes, CMAS is the world governing body for the sport. They had their first meeting back in '59. They only had spear fishermen at that time. By '67 they incorporated fin swimming into their agenda, and the same year we had the first European Championship in Italy. The first World Distance Championship was also in Italy in 1975, and short distances in Germany in 1976. The US hosted the first international event in 1981 the World Games in Santa Clara. We have received Olympic status, as of 1996, and we're lobbying for the 2000 Olympics in Sydney.

Now, equipment. Let me go through it quickly, so that we can get into training. Originally, the fins were made of very thin laminates of steel, believe it or not. Now, the main problem with this is King Kong might have been able to move it, but ordinary swimmers like me just couldn't do it. The fin would just stay here, your body goes up and down, and you're not going

anywhere. So we decided this doesn't work, let's get into something else. So we go into fiberglass. Again, we started off with fiberglass that was not tapered, it was just one single piece. The problem with that is that you have a lot of water dispersion to the outside, and you are creating more drag than thrust. So finally we got into tapering, actual tapering of the blade. Most of it was done by hand: the Russians, the Greeks, the Germans, the Chinese, are still using that system right now. They're peeling layers, and layers, and layers of fiberglass off the fin to give it a proper taper. Now, there are three companies. There is MatMas of Italy, Sea Wolf of Japan, and Hyperfin here, that are using a progressive taper, in order to have a sealed, bladed fin. So what we do is have the lamination done prior to the curing of the fin. So we have one single envelope, and that would not give you any delamination problem later on. Now, there are no limitations in terms of size to the blade. During competition you can wear whatever you want. And the only problem is obviously, the larger blade will create additional resistance, so you have to have the legs to power it.

Snorkels: the front snorkel has not changed much since its conception which was back in the 70s. CMAS, again the world governing body, regulates the length which is 48 cm, which is roughly 20 inches, and the diameter is 2.3 cm, which is 7/8ths of an inch. Nort showed some of this before. This is basically what it looks like. This is a little bit different, because it's a little bit longer to have additional air drag and air resistance. It has a pivoting mechanism, that we're patenting right now which gives you more adjustments.

Now, the most important part of all of this, is not really what is the equipment, but what it does for you. So, we're all interested in speed, how we can achieve faster speeds in the water. Assuming that the swimmer that you're dealing with already has a satisfactory level of endurance and strength, then I would really focus on minimizing hydrodynamic resistance, and

increasing water flow awareness, range of motion, and oxygen intake. Now, as far as hydrodynamic resistance goes, we've seen skiers, skaters, cyclers, take advantage of artificially created speed through the use of wind tunnel. Also we've seen runners getting benefits from generating further speed, by running downhill.

Now just recently swimmers have caught up with the same system. We're using flumes, we're doing flume analysis with higher speeds, and also using cables to drag the swimmer across the pool at faster speeds than racing speeds. And the idea, the main two objectives, the primary objectives for these are: 1) to expose body movements and posture that is actually unwanted, because of frontal resistance. 2) To create faster neuromuscular responses from the swimmer. So, if we can actually increase the speeds of the swimmer, just a small percentage, he would feel the resistance much more, because water resistance increases at a square function. So, if we can actually generate a 20% to 30% more speed than their normal speed, the swimmer would feel it four to nine times more. The optional one, we can put the swimmer in the flume and just tie him up and just let the water rush, and let him analyze his position in the water. Two, we can drag him across the pool with cables, or three, we can offer him a tool that can dramatically increase his speed. Now, the use of powerful fiberglass fins would be able to do just that. It would be able to give the swimmer enough power, to have much, much higher incremental in speed. If you are comparing the 100 m time in swimming at 48 seconds and the one in fin swimming at 36 seconds, you have a differential of 12 seconds which is basically 25%. So, the swimmer would develop his awareness to water resistance more readily, when he is the one generating that increment of speed. By swimming again much faster, and encountering more resistance, his body will try to find the position that is the most streamlined possible in the water. You're always going to try to minimize those frontal resistances. And that particular feeling of planing, is going to come into effect more, because again the speed is so much greater. So through the use of the monofin, we're also trying to instill certain

neuromuscular responses that the swimmer will be able to feel, once the tool is removed, once the fin is removed from the swimmer.

There are some other things that are beneficial through the use of the snorkels in terms of water awareness or water flow awareness, especially during dives, starts, and flip turns. What's going to happen through the use of the snorkel, you're going to have immediate feedback.

The snorkel, especially at this length which is longer than standard, will fit right into the "V" that you create with your forearms. So the top part of it is going to be lodged right into the "V" of your forearms. Now, if I'm not into the streamlined position, i.e. if my elbows are a bit relaxed, or if my arms are above my head, or below my head, so I have head high or head low, then the top part of the snorkel will vibrate in between my forearms. So you're going to feel that immediately as you are pushing off. So some of the swimmers might be very alert to the streamline position for the first two or three turns in a long set, and all of a sudden they start to lose their position. With this, they're going to have a reminder at every turn. Secondly, you can use this also for starts, and it is the same principles. If on a diving start you are not in a streamlined position, again you are not lodging this right into the "V" of the forearms, you tuck the chin in, the snorkel will pull either to the right or to the left immediately. It's going to just jerk it out of the mouth and it's going to one side or the another. And it's actually hurting. This is a nice one, because you have a mouthpiece on it. The original ones didn't have anything, you just bite into them, so some people knocked their teeth out. You don't want to go to those extremes. So, you get extremely quick feedback and that is beneficial for both starts and turns. Some other benefits I'm going to discuss in a few minutes.

Now, as far as water flow awareness, I think that the more a swimmer can actually feel the water, the better he is going to swim. There is a study that's been done just recently by students at MIT. I don't know if you guys are aware of it. They built an artificial tuna. And they had done a lot of studies on how the water flows around this tuna, and how this tuna is generating thrust. Well, what they have found, is that fish encounter a certain amount of vortices as they are swimming forward, and they have innate capabilities of actually feeling those vortices on their skin. And they're capable of creating some thrust or vortices of their own, to counter-rotate the incoming vortices. So what they're doing is actually timing the flapping of their tail, to build upon the incoming vortices that have been generated already.

In the first study that they had done, they analyzed the speed of different fish and said the best coefficient is such and such, which in this case is called Strouhal coefficient. Now, the Strouhal coefficient says that a fish swims best between .25 and .35. And the way you're getting that coefficient is by multiplying the frequency of the vortices created, times the width of the vortex, divided by the speed that is generated. Now they look at them, and they say, well according to this coefficient, dolphins shouldn't be swimming as fast as they are. They should be one sixth the speed that they're generating. So they did further research, and that's when they started realizing timing is very essential, because dolphins are building upon incoming vortices. You see them many times diving off the bow of a boat, and it seems very, very effortless. So those are studies in a new direction that I think are very important also for us, as fin swimmers definitely because the speeds are higher, but I think the swimming community can draw a lot out of that research as well.

Now, the same concept is typified in a flag. If you're looking at a flag, and there is very low air coming at it, the flag would barely flap. All of a sudden

you are increasing the speeds of the air, and the flag will start moving in a sinusoidal form. It's going to start flapping. That is because of the air resistance that it's encountering. Now, that particular motion is just a result of the air hitting it and moving through. If you were able, though to generate a wave from within the flag, going into the direction of flow, we would be encountering less resistance. So we're kind of applying the same thing with the fin swimmer. If the fin swimmer can actually use his body and assume a timely sinusoid motion, then he would be able to move with less resistance in the direction of flow. Now again, the flow comes mainly from the mid-section of the body, the lower part of your body. We'll get into that in a few seconds. So, the Strouhal number will vary also from swimmer to swimmer. We can do the same analysis. And it's based upon the length of the legs, the power that the swimmer has, and also the joint mobility. Now I've seen in China for instance, the last World Championships in September were the 7th World Championships in Canton, in the Guangdong Province. Some of the Chinese swimmers were taking advantage of adjusting to the wake. Coming into the wall, there's a tremendous amount of wake generated. After the flip turn they would come underwater and literally fly off the wake that they are generating and gaining much more speed doing that. So as a fin swimmer, because of the higher speeds, you're kind of tuning in to frontal resistance a little bit more, it seems like, than a regular swimmer.

One of the drills that I do with my swimmers is repeats of 25's underwater. I want them to focus on the amplitude of their kick. I want them to count the amount of kicks, and obviously I'm going to keep track also of their speed. They need to focus on the upkick as much as the downkick. It's fairly simple to really work on your downstroke, the tendency is to kind of be more relaxed on your upstroke. What we're trying to do is actually to create an even balance between your downkick and your upkick, so they need to draw more from their hip flexors, from their abs, and their lumbar section more evenly. Again, a lot of the power is actually generating from muscle that you

are not using as efficiently in swimming. I think that is something that is being somewhat neglected. I heard Nort Thornton talking about power being generated from the trunk. I agree with him. Those are muscles that are much larger than your lats, your triceps, or your rhomboids, and if you use them properly in a timely fashion, you can generate more speed through it. So the drill basically is to swim, to identify what the frequency is of that kick during that 25, and really focus on the upkick as much as on the downkick. Once we work on that, we truly can have a concept of pushing the body through the water, instead of pulling the body through the water. The way I see it is if I'm moving my arms I'm kind of pulling the rest of my body through the water, where here I'm generating speed from the back part of my body, my legs and my mid section. So I'm pushing the body through, just like an engine on a boat. You're pushing from the back and actually helping first in a flat position, and then you're helping the planing action. Well for those of you that have been to Sea World, you know sometimes those trainers get pushed by Shamu, you know that is kind of a fun thing to do. I don't know if you've seen it, but the idea is to have that power being generated from the lower part, come up on the surface and restarting to plane. So, again, what we want to do is identify the kick amplitude.

A drill that is also good for the swimmer is to swim for 15 meters with the fin first. So I have the guy do a dive start, they go full blast to the 15 m line underwater with the fin. And this is done after we've established already what the kick amplitude is going to be. Then they remove the fin, and they do the same thing with the kicks whether it's fly or backstroke. So they are kicking underwater to the 15 meter mark and I time it. Now, the next set he will be swimming one kick less. We start regressing with the number of kicks, and we start compensating with arm rotation. So the first set is 15 m underwater, completely kicking only, then the second one is minus one kick, so let's say that he went 11 kicks the first time, where the second time he is doing 10 kicks, and come up and do a breakout a little sooner. And then you keep regressing to six kicks or five kicks, and we start establishing, which one

is the fastest breakout. Some of them get into oxygen debt so quickly, they start paying too much at the end. And that's really what you want to focus on, is what kind of a breakout can he actually handle. True, underwater swimming is faster, but if the athlete is not capable of tolerating CO₂ build up, then they're going to be paying dearly at the end. So it might be very quick at the fifty, then all of a sudden coming back, the other 50 is going to die out, because of the oxygen debt accumulation. So those are just little drills that you can use.

These drills generally I do on a 3:00 minute basis. They're very explosive and you don't want to do more than 10, and each one of them is at 95%-97%.

The use of the front snorkel, again, focuses more on stroke mechanics without the distraction of turning of your head. You're able to keep your head in position, it's lodged, you are not breathing, so you can really focus on your body rotation. You can focus on your trajectory of your arms, and also you can focus on your glides per stroke: your head is still, your arms are moving, your body is a little bit higher because you are capable of retaining more oxygen in your lungs, because of the device that you have on, so you are figuring out a way to actually have more distance per stroke.

Now, range of motion. Rich Prichard of Somax, said before that swimming with tight muscles is like swimming with a tight wet suit. And I kind of like to agree with that, because we have seen that all time great swimmers always have a very high level of joint mobility, of flexibility. I have seen that in my training and in my coaching, I have seen tremendous improvement of stroke mechanics because of greater ranges of motions, just as simple as increasing the chest range of motion. Fin swimming can aide in two areas. One is

actually in ankle range of motion, and the other one is chest range of motion. Because of the larger water displacement that we have with the fin, (you are dealing with blades that are roughly about 28 inches in length, by 26 inches in width, so you are displacing quite a lot of water) you have a much higher level of pressure into your ankle area. Now, the studies that have been conducted in Europe, they have done some testing with swimmers and fin swimmers, and they are coming in pretty constant between 20%-35% more foot mobility with the fin swimmers versus the swimmers. And also, because of that, we are finding that the percentage of drag in a kick of a fin swimmer is actually less than the one from a regular swimmer. There is one little problem. The traditional monofins have a tendency of over loading the metatarsus area of your foot. And what is going to happen as a result of that is there is more inflammation of your toe extensors. So in a sampling of 1,470 swimmers, this is again in Europe, 37% of them or 550 of them complained of tendinitis of their foot extensors. So it's important that yes we use swimmer friendly equipment, especially since we're not in the competition mode here in the US, we're more in the training mode. One thing that I've done when I was looking at different designs from the past, was to kind of get away from that. I used to have chronic tendinitis in my legs, I mean in my foot, you even start forming calcium deposits between your tendons, it's pretty ugly. Most of the foot pockets were also single cavity, that means it was just a single hole and it was not tapered or contoured to your foot, so that the loads were mostly on the high part of your foot. So, I sat down and I worked with some engineers from Lockheed and aerospace, and we came up with a design that's a bit different, and actually downloads a lot of the stress area from the metatarsus into the heel portion. This is an old one, it's kind of a museum piece actually, the first manufacturer of commercial monofins, you can see that the heel portion actually stops at mid- foot. So what's going to happen, again, you're displacing a lot of water with the first half part of your foot. So it doesn't really matter how much strength you have in your quads, in your hams, if your foot is not capable of handling those loads, they would never be able to transfer the power into the blade area. So, we came up with this arrangement, this is done purposely to show you how the material actually

goes into the heel, so we have elongated the heel in order to take away some of that load. So as you are downkicking you are pressing down, then you are also receiving pressure directly into your heel. Now your heel can take a lot of abuse because you walk on them all day, so they are built differently and they have more strength. Now, because of this we are changing the fulcrum points, and we are able to transfer more power into the blade. So this is a concept that we have adopted, we have tapered also the foot pocket in order to be more comfortable to the foot, and displacing the load more evenly throughout the foot area. So we are noticing that less and less fin swimmers are actually getting into a traumatic situation where they have inflammation of the tendons and so on.

Now, because of the greater workload that we're encountering by displacing so much more water, typically the swimmer will breathe deeper and more frequently especially when we are combining underwater work doing some more of the hypoxic repetitions. Now, this is also going to stimulate, the swimmer's breathing range of motion. But, nothing works as well as the front snorkel. I keep going back to this, because it's a really great little device. The particular length of the snorkel obviously changes the air intake point. If I'm breathing from my mouth, I'm capable of breathing in a certain amount of air rather quickly. If I extend my air intake point, 22-23 inches away, I have to work much harder at taking in the same amount of air. Not only that, but I'm constricted by the diameter of the snorkel as well. Now, we made some that are a little bit more radical, which are a little more bent to constrict the air intake even more. I've seen coaches in Europe getting to the point of putting corks in here to make it even more difficult. I don't think we need to go to that extreme, but the whole idea again is to overload the muscles that are involved into the inhaling process. So, by doing that, Nort was saying that some of his swimmers were complaining of chest pain because the muscles, the intercostal muscles were getting stimulated, and that's exactly the idea. By increasing the air resistance, what we're going to try and do is develop the lung capacity more, develop the intercostal muscles, so that you

would be able to have much deeper and quicker exchanges of air once you remove the device. So again, we see a lot of benefits not only in the streamline positioning of the snorkel, as well as the capability of increasing the elasticity in your chest. Fin swimmers that are using the snorkel versus regular swimmers have shown a differential of about 15%-20% in lung capacity. These are again studies done in Europe, and if you want data I can provide you with data. So, there is something there that we're not tapping into and I think that there are tremendous benefits to our swimmers. It doesn't require anything more than the price of the snorkel, you don't have to have special lanes. Sometimes with a monofin you're kind of constricted because you don't have enough room. With this you just put it on the swimmers' head and there they go. They can do exactly the same set they were doing before, using this.

Now, we also are incorporating in our training back in Europe a lot of Yoga. I've seen tremendous benefits in specific poses, specific stretches, to increase range of motion. We're trying to lessen the amount of injuries that we're having, and trying to increase the range of motion, so that we have smoother and more efficient stroking. We don't get involved into the metaphysical aspect of it at all, we're just focusing on particular exercises that are going to be much more beneficial to the swimmer.

Now, oxygen intake. Again, to the risk of being redundant, the front snorkel is probably the best tool we have available today. We've discussed the benefits in terms of streamline, and range of motion, but what this also does is increase the amount of CO₂ or dead air that the swimmer will be breathing at every cycle. Why? Because whenever you are exhaling, you are never going to be able to clear water completely out of the snorkel. There is always going to be some dead space, especially if you're going to be having more than this kind of pitch, or this kind of angle, into the snorkel. The more you pitch it, the

more dead air you're going to encounter. The length also is going to determine, how much amount of dead air you are going to be receiving. Now, the configuration of the snorkel allows you to have more of an anaerobic type of workload, even during longer distances.

So even for your long distance swimmers you can have a tremendous benefit by using this. Chris Kirchner from Indiana, had fantastic results with his long distance swimmers, and he started working with us about two years ago. So, again, I can not stress enough the importance of this, and the price is very well within range, it's \$29.95, so I encourage you to look more into this particular tool.

There are other ways that we can actually increase oxygen retention or oxygen transfer. Probably you remember in the old days of the early 70s, with the East Germans, they used to get into blood doping in Lipsia just to have more red cells, more oxygen. There are other ways to do it. We could start taking a drug called epogen, which apparently produces more erythropoietin hormones, which are creating more mitochondria, or we can get into something that is much more safe. I've been exposed to a product because of all the hypoxic training that I've been dealing with. I've seen a product that the USOC, the Olympic Committee has approved, and I've had different clubs try it. Even Stanford university tried it and they got some good results, and it's a product that in essence removes or reduces the production of lactic acid, removes free radicals and it helps in the transport of oxygen at the cellular level. It is called Super Oxy G.

Now, hypoxia. The true definition of hypoxia, I think is kind of a misconception whenever we say that we are doing hypoxic work. Well, true

hypoxia comes when you get to a level of CO₂ saturation about 89%. So in essence, when your body blacks out which is around 88%, 89%, 90%, (it's different person to person) then you would have a true level of hypoxia. So if you're going to do hypoxic training, then you should put your swimmers in the water, make them swim to the point that they dropout, and that's hypoxic training. Nobody wants to do that. So what we are trying to do in essence is actually build the tolerance level to CO₂. And that's exactly the type of training that I've been involved with and Nort has been involved with. We're doing more and more research in that end, because unfortunately the data we have accumulated so far is really inconclusive. We have seen that some of the better swimmers have better CO₂ tolerance, but we don't know if CO₂ tolerance is going to help swimming faster per say. There are some studies that have been done in England and here in the US as well, that are showing that typically there is more of a psychological than a physiological effect. They have tested this on cyclists, some runners with some very good metabolic rates, and if they are put into some situation where CO₂ is greater than normal, most of them have failed tests in comparison to swimmers. So, swimmers in general have a higher tolerance to CO₂ buildup. Some other studies have been done with free divers like Enzo Maiorca. I don't know if you guys have seen the movie the "Big Blue" where there are two nuts going underwater at 400 plus feet. Well, Enzo Maiorca apparently, and his two daughters whom are also diving, have something chemically different than the other athletes. They are trying to see if it's genetic, or if it's something that they have changed overtime because of their training. But apparently, they are able to perform at a higher level with higher levels of CO₂ buildup. So again, it's a little bit of a gray area, we're still stumbling into it, but there are no side effects if it's done properly so it's worthwhile trying it to see if our swimmers can improve their performances because of that.

Here are some of the specific drills and sets we do. What we are trying to do is create a better feel for what the blade can do in the water. A lot of people

don't have the correct feeling, the correct sensation. They kick from the knees, instead of kicking from the hips. They are not using the correct muscle groups. The first drill is called the Roman. You are swimming with the Hyperfin, no snorkel, one arm in front, one arm at your side, and you want to breathe to the opposite side of your outstretched arm (make sure the body stays flat). So if my right arm is outstretched I'll breathe on my left, and what I want to try and do is try and keep it balanced. I don't want my legs and my fins to go all over the place. I want to try and stay in balance as much as possible. You alternate arm positions every 25.

The second one is the Penguin. You kick on your back, you're holding a kickboard flat right above the knees, and you do this drill so that your knees will not touch your kickboard. You want to focus on really using your hips as much as possible. So as you're kicking if your knees start to hit, then you know they are bending way too much. The more you bend, the more you're going to create frontal resistance when you're swimming. So, the idea is to come up and down with almost a stiff knee, and you're trying to eliminate or minimize the amount of pitch of your knee.

The third one, the High Praise, you're on your back, you hold your arms stretched above your shoulders and perpendicular to your body, that means you have your arms stretched out, you have one palm on top of the other, and you're swimming trying to keep your upper body out of the water with minimal shoulder movements. So you're drawing from your hips and your lower body. That is what is propelling you. You're trying to keep your upper body a little bit more still.

Number four, Sub, you kick underwater, put a kick board in front of you, and you tilt it up and down and feel the difference in body plane. This is just a sensation or a feeling drill. As you're kicking at higher speed, as soon as you tilt the kickboard down just barely, you would see that your body would start dipping toward the bottom of the pool. Start tilting up and you would start coming up to the surface very quickly as well.

Five, Train, using the snorkel, you have the Hyperfin, you push another swimmer in front of you. Now the swimmer that is getting pushed in on his back, and the pusher gets a hold of the ankles of the pushee. This is a strength drill.

Six, KC just means kick count. Another thing I want to bring out, whether you start doing drills with a kickboard or without, that is fairly simple. When you start incorporating arm rotation, that's when the stroke varies swimmer to swimmer. Whenever swimmers use arm rotation while finning some will have an interval which is very tight 0:0, so no seconds, and what happens is that the recovery hand comes and meets the other hand before the other hand moves. Or you can have an earlier response where one arm starts as the other arm is at shoulder level. So you have different degrees at first. They have to find the right timing. Most likely when they get a good feel for it, they have two kicks per arm revolution. As they get more into it, they are going to have a more regular rotation with every kick.

There are a couple of groups that I have listed below, and you can choose one set per group. They are different. The first one is more of a lactate type of work, the second one more of a threshold type of work. The first one, 10×50 at 85% underwater on 1:00, you count your kicks and you are descending. You

want to focus on stretching your whole body from fingertip to toe. You want to try and elongate yourself as much as possible. The second one 20×50 at 95% on 0:50; you swim the first 35 underwater then you surface for air, then you go underwater for the last ten, and you really want to accelerate for the last ten. Number three, you have 10×75 on the 1:15 at 80%, 25 underwater, 25 on the surface to recover on your back, then 25 underwater on your back. Again you want to get a different perspective. Because of gravity, the amount of power you put into your kick changes from your back onto your front. So this is going to give you a better feel or even balance in your kick. Number four, 10×75 on the 1:30, you want to build at each 25 and breathe at each turn. Number five is a regressive fifty underwater, so you start your interval at 1:30, and you keep dropping five seconds at a time. And you keep basically swimming until you can not do it any longer, the interval is just too tight. And most of the swimmers that are in pretty good conditioning, can get into forty seconds. So you start at 1:30, then drop to 1:25, then 1:20 and so on.

Now, the second group is more threshold. Find the threshold by starting with a kickboard and have the swimmers kick at 85% of the speed. At every flip turn they take the board underwater for at least ten yards. They want to continue and check the splits at every 100. The moment they start dropping the splits, then you stop them. So let's say that a swimmer holds 1:00 for 500 yds. Then, the second set would be based upon the previous one. So what you would do is add five seconds to the pace and those are the 100 intervals that you're going to use. So in the case of the 1:00, now you have a 1:05 interval and 5×100 on 1:05 at 90% with a kickboard. You want to continue to have at least ten yards underwater at every turn. Number three, 3×200 on 2:30 at 80% with a snorkel, and each turn you increase your underwater kick by one. Starting with four, then at each turn you increase to five, six. So if you are in a short course pool, by the time that you are done, on your last flip turn you are going to have eleven kicks. Number four, 800 straight with the snorkel, descend the second 400, and again you have a minimal of four

underwater kicks per turn. So you still have a little amount of hypoxic work in there. Drills we discussed earlier, and these are just some of the distances you want to incorporate. The goal is to try and do at least 1500 to about 1800 yards or meters per practice. It's really important that you make a commitment. If you want to start using these particular tools, they are really beneficial in as much as you use them on a regular basis. So if you have people that want to try it as a toy and use it once a month, you might as well save the money because the results are going to come over a period of time. The thing that you want to emphasize by using the fin is that the muscle involvement comes from the trunk and the lower part of your body. Make sure that the kickers are not bending their knees too much, because that's not going to be a powerful kick.

Another thing I want to discuss briefly here is CO₂ buildup. There are two ways to do it. One is the way we looked at before, which is more of a dynamic way to build CO₂ tolerance. The second one is more of a static way to build CO₂ tolerance. In the first one I discussed rhythmic breathing, so what you do and you can practice this on your own, you inhale for ten seconds, you are holding your breath for ten seconds, you are exhaling for ten seconds, and then hold your breath again for ten seconds. So you repeat the cycle for at least five minutes. The whole idea here is to have controlled breathing. As you start doing this, your heart rate is going to drop, you are going to relax much more. Once you feel very comfortable with ten seconds, you can increase to fifteen, and you can go up to twenty seconds which is quite a hard interval. I used to do this a lot before racing, because you get into a different state of mind, you are a lot more relaxed, and you don't have a high heart rate. On point number two you have your swimmer hang upside down. Why upside down? Because you have more blood flowing to your brain. You want to be able to keep that going at all times. So you have your legs wrapped on the edge of the pool, you are at a 90 degree angle, and your knees and your body are underwater, so you start with 45 seconds or 1:00, and you augment the time you spend underwater by 30 seconds. So you have 1:00 of recovery

time, then 1:00 underwater, then 1:00 recovery, then 1:30 underwater, and you keep building by 30 seconds the underwater time until you reach 2:30, then you increase the rest to 1:30 on the top. You continue until you can't tolerate it. A lot of people are going to complain or panic. A lot of it is just mental.

I was just training, until two weeks ago, some special group of Navy Seals. They are doing some strange underwater competitions and they are having the World Championships as we speak in Rome. When I first started to do these kind of sets with them, they all panicked and came up at forty seconds. They came up and said we can't do this. And this is the best of the best of the Navy Seals. So we tried it again, we had a little pep talk, and all of them went to 1:30, and two of them went to 2:30. So a lot of it really is psychological. Another thing: I do a lot of spear fishing, I'm not too much involved with swimming because I don't have that much time. But even underwater when you are spear fishing, you get into a funny mode: if the water is dirty and there are no fish, you stay underwater only so much. All of a sudden if a fish comes in, BOOM it's like pulling reserve in your tank. We don't have tanks but mentally you are pulling on something and you can stay underwater for 20, 30, or 40 extra seconds. So we have to draw a line. How much of it is physiological, how much of it is psychological? Well I really don't care. If I can draw more, whether it's one or the other, I'm going to take advantage of that.

So I haven't been able to swim much. I retired in 1988, at the last World Games where I won two Gold medals and a Silver medal. I've had two back surgeries since then because of an accident, but through the use of some of the nutritional products and these drills, I am still capable of holding 4:45 of bottom time in a pool and 2:20 of active underwater time while spear fishing.

When you start adding little components to your training, you don't need to add too much in terms of intensity, but if you add consistency, you would be able to retain some of those results. I hope you've gained a little more information. Thank you.