The World Swimming Coaches Association
NEWSLETTER

Vol 06 Issue 1

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Congratulations to New WSCA President Michael Ursu of Australia!

The former Executive Director of the Australian Swimming Coaches and Teachers Association, who retired from that position in June of 2005, is now the fifth President of WSCA, following Yutaka Terao of Japan, Peter Daland of the USA, Alan Thompson of Australia and Niels Bouws of Germany.

NEW WSCA CONSTITUTION IN EFFECT AS OF JANUARY 1, 2006.
view file at: www.swimmingcoach.org/wsca

Congratulations to Eddie Reese, Coach of the Quadrennium 2001-2004!
view file at: www.swimmingcoach.org/wsca

Congratulations to new WSCA Board Members:

Germany:	Niels Bouws - (nielsbouws@aol.com)
Argentina:	Osvaldo Arsenio - (aresenioswim@ciudad.com.ar)
Australia:	Ralph Richards - (CEO@ascta.com) *(also Australian office)*
	Rohan Taylor - (rohan.taylor@carey.com.au)
	President Michael Ursu - (wsca.president@sportsignition.com)
Namibia:	Larry Laursen - (laquatic@gala.com.ma)
USA:	Peter Daland - (peter@dalandswim.com) *(also former President)*
	George Block - (Aqua03@NISD.net)
	John Leonard - (Jleonard@swimmingcoach.org) *(also US office)*

And, the European Office: Brian McGuinness - (brianmac@bscta.co.uk)

The Next WSCA Board Meeting will be in Shanghai, China, on the occasion of the World Short Course Championships. 1st meeting will be 8 PM April 3, second meeting to follow on the 5th. Those with agenda items, please send to John Leonard at the email address above.

Brian McGuinness reports interest in hosting the 2009 Gold Medal Clinic in the London area, in part in support of the London 2012 Olympic Games. A report will be forthcoming at the Board Meeting.

THANKS AND CONGRATULATIONS TO MEXICO AND PRESIDENT JAVIER CAREAGA for their wonderful hosting of the Gold Medal Clinic 2005 in Acapulco. They have set a high standard for following GMC's to meet.

WSCA Board Meeting

April 3rd & 5th 2006 - Shanghai, China

Keynote Address

ASCA World Clinic 2005 — *By Eddie Reese*

Introduction by George Block: *I have the incredible good fortune this evening to introduce somebody who needs no introduction. Those introductions are always the best. Eddie Reese is just such a person. Eddie is a native Floridian who has caused incredible trouble in Texas because now our best coach ever isn't a football coach.*

I am going to give you some numbers to think about before we talk about why Eddie is really here. The first number is 25: the number of top 5 NCAA finishes he has had. How about this for yield – 22 Olympians and 21 gold medals; 9 NCAA team titles; 8 times NCAA Coach of the Year and 2 times representing all of us as our Head Olympic Coach. Eddie Reese is probably the hottest coach in American swimming right now, if not in the world. He is a great coach who only gets better with time. When many of us are turning into vinegar as we get older, he is just turning into fine wine -- but that is not really why he is here tonight.

As good as Eddie is in the here and now, he is even better in the future. Eddie Reese has become the prophetic voice of American swimming. Sometimes that gets hidden behind his really crummy jokes, so do not let those jokes fool you. Eddie really tells jokes because he is a very sensitive person, and he uses those jokes to fend off and deflect and protect himself -- because prophets must be sensitive, and they must stay sensitive. Eddie has a unique vantage point, like most prophets have. Some prophets speak from mountain tops; others from deserts. Maybe Eddie speaks from recruiting, or from the summer camp, or from his teams. It is hard to say. I know he might be the hardest working recruiter in the country. A couple of years ago he went to 36 state championships and one of them was in Texas because he had the conference meet that weekend. I know that he has hundreds of campers and has sold out summer camps every year. Obviously, between his own team and being our Olympic head coach, he sees the best swimmers in the world, and so he has perhaps the most unique vantage point in American swimming. But, if I can just tell you three quick stories about Eddie, it might let you know why I view him as a prophetic voice for all of us.

I think it was the 1985 US Open. I think it was the first one that was at U.T. I thought I had a really great idea because U.T. has these lights that go all the way around it. They are all windows, and there are these big underwater windows which, before you could stick the cameras in the water was the way to see, so I was going to sneak down under the pool and watch one of the races but they had security all over that place – because they had the East Germans back then and the Russians. Boy, they had security locked down tight! In order to get to the basement, I had to go all the way up to the top of the U.T. swim center and go down the service stairs to get to the bottom. I was able to get into the basement, but it was completely dark. You guys have heard of staggering around groping. All of a sudden I could see a little light where the light from the pool was coming out from the underwater window. I went down, and all of a sudden I could see a little bit of light in the weight room up to my left, and I started seeing the all these light fixtures in the corridor down below. Then, I saw that next to the underwater window, there was a wooden stand for viewing. Now, I was still groping around, but I could see a little bit better, so I went up on the stand, and there was Eddie – watching the same race that I wanted to see. This reminded me that every time you think you have a great idea, there is somebody a lot greater who had it first, and probably it was Eddie.

About eight years later, maybe in about 1993 -- and maybe Pat or Tommy can help me on this, I am trying to think of what date it was – I was sentenced to a term as general chairman of my LSC. Eddie called, and then he sent a note-- which is incredible if you know Eddie: to send a note – he wanted me to bring something from our LSC to the Age Group Swimming Committee. He wanted to add two races to the 12 and under agenda. He wanted to add a 25 dolphin with a backstroke start and a 25 dolphin with a forward start. So in good legislative form, we brought it to the Age Group Swimming Committee from Eddie Reese and presented it. Those who are here, and I know a few of you in this room were at that meeting, remember what the chair of that committee said: "Eddie Reese – who does he think he is – what does he know about age group swimming?" I think in order for us to learn from those around us, we must first have humility. I sure know that we learned in that one that if we think we know it all, we cut ourselves off from learning anything.

Eddie has always had humility and been willing to learn and he has been willing to share what he has learned. Then just a few years later at the great Juniors debate in 1999 (when should we have a Juniors or should we not – should we grow Nationals – what should we do?), there was one voice who had a different solution. He said: You know, we shouldn't be stopping Juniors. We are arguing about the wrong thing. We don't need to argue about do we or do we not have it, or do we have two, or do we have three… We need to have one Nationals, and then two Juniors for 18 and under men and 16 and under women, and then four other zone meets for 16 and under men and 14 and under women – and, we need to have them all on the same day. It definitely stopped traffic. The room got real quiet, and then everybody came up with all the reasons it was just too hard to do. But where would we be now if we had done that?

Maybe that was the third lesson we got to learn from Eddie – that when we aren't willing to do the hard work that it really takes to implement the best solutions, we end up with something significantly less than the best. But again – we knew that already because that is what we tell our athletes. Maybe as coaches, we have to be willing to do that hard work too, but I will stop – you didn't come to hear me – you came to hear Eddie. Don't get distracted by his jokes, listen for his prophecy, and welcome my friend, Eddie Reese.

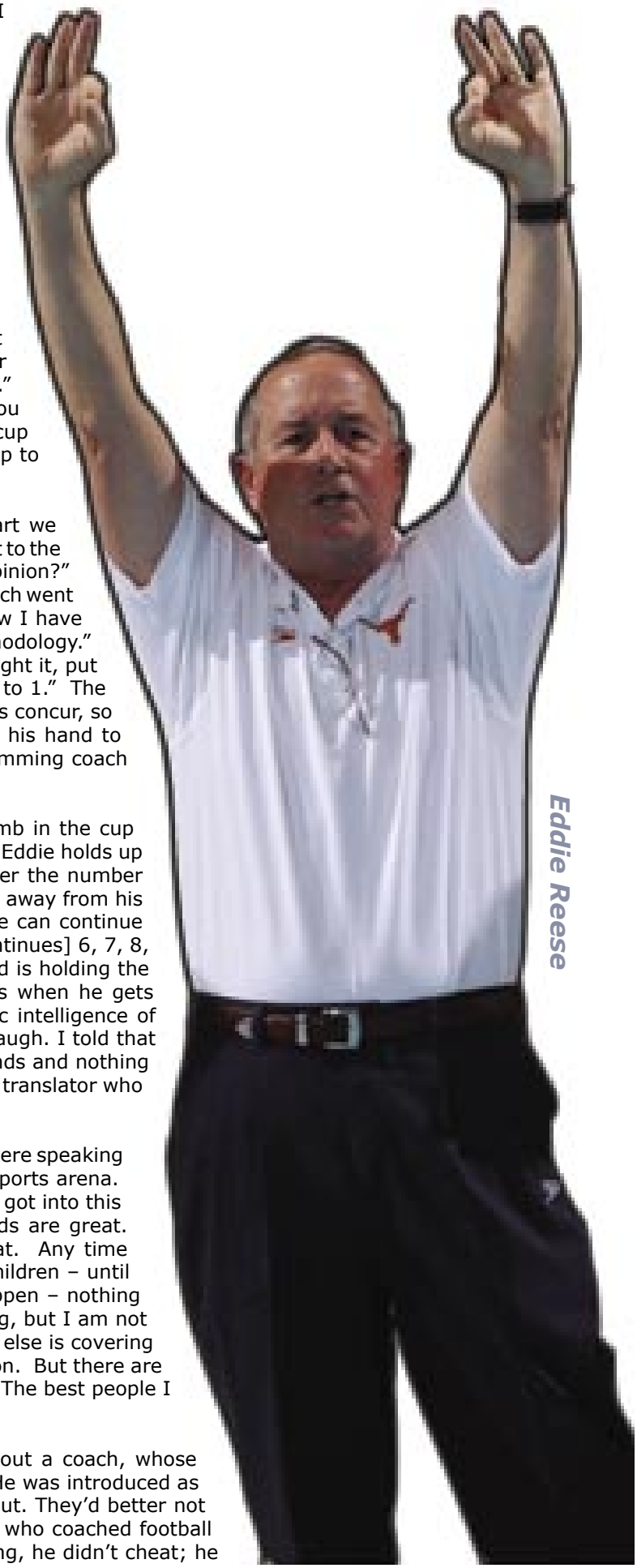
Coach Reese: Thank you very much. I have just changed my talk and I am going to straighten out everything George said about me that was wrong. Luckily, I do not remember any of those things, but I do have a joke. Normally, I am just funny naturally, but I do have a joke that I have told for years. I love it, and my wife didn't come, so I can tell it because she will not let me tell it if she is in the state. It has to do with a swimming coach. He and his wife had had too many children, or had all the children they wanted to have, so the swimming coach went to the doctor said: "Doc, I know my wife and I have had all the children we want to have, what should we do?" The doctor said: "Well, you need to have a vasectomy." So the swimming coach said: "Well how do you do that?" The doctor said: "Well, you take a cup and light a cherry bomb; then, you hold it up to your ear and count to 10."

The swimming coach – you know how smart we are—said: "Well, it doesn't sound like it will get to the problem. So do you mind if I get a second opinion?" The doctor said: "Sure, go ahead." So, the coach went to the next doctor and he said: "Doc, I know I have to have a vasectomy. My question is the methodology." This doctor said: "You take a cherry bomb, light it, put it in a cup, hold it up to your ear, and count to 1." The swimming coach said: "Well, you two doctors concur, so I will do it." [Eddie is now holding a cup in his hand to demonstrate]. So [Eddie continues] the swimming coach lights a cherry bomb, puts it in his cup

[Eddie demonstrates putting the cherry bomb in the cup and holding it up to his ear] "and he counts [Eddie holds up a finger for each number] 1, 2, 3, 4, 5,[after the number 5, Eddie takes the cup with the cherry bomb away from his ear and holds it between his legs so that he can continue counting and holding up fingers, then he continues] 6, 7, 8, [Eddie is counting to ten with his fingers and is holding the cup with the cherry bomb between his legs when he gets to 10] ….. And it is true: I judge the basic intelligence of the audience by how long it takes them to laugh. I told that thing in Finland and I waited about 15 seconds and nothing happened – of course it was going through a translator who said he broke up, and he couldn't say it.

Well, you need to know – it is an honor to be here speaking to you tonight. It is an honor to be in this sports arena. We are very, very lucky – no matter how we got into this -- to be in the sport of swimming. The kids are great. The parents aren't, but you understand that. Any time you deal with somebody's money or their children – until they get educated – nothing is going to happen – nothing good. They are going to question everything, but I am not going to talk about that tonight. Somebody else is covering that, but that is definitely part of our equation. But there are just so many good things about swimming. The best people I know are swimming coaches.

I read most of a book on the way over about a coach, whose book signing I went to last night in Austin. He was introduced as the man who no one says anything bad about. They'd better not either, for that is exactly right. He is a man who coached football for years. When all around him were cheating, he didn't cheat; he



Eddie Reese

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didn't point fingers; he did the best he could the way he wanted to do it with what he had. It is a phenomenal book. It is real simple, just as his technique was real simple. I see swimming as very simple. The only thing difficult about it is the fact that a lot of times the people aren't simple. For example, you might tell a swimmer something, if they have had a bad day, and you may send them out of your practice the way you want them to go home. But they may not be left that way when they get home, because the parents do not have a clue what is happening. And you don't want them to call you either, Right? I didn't mean to bring that up again. That is not my purpose for being here.

Well, George did not use the word that I hate. Sometimes I am introduced as a great coach and that doesn't happen. Even a great coach is not a perfect coach, but great coaches do take care of everybody the right way. They say the right thing every day; they never let their emotions get involved in what's right or the wrong. We have all had people that have swum poorly – for whatever reason – and there are some reasons. I have got them on my team. I have always said that out of 100% of good swimmers in our sport, 80% of them like to win, 20% of them hate to lose, and 95% of the Olympic team comes from the group that hates to lose. So you have got 80% and I have got a lot on my team who … well, they don't have killer instincts, and they are not great racers … What to do about that seems to be one of the two things that I am not very good at. I have read about it. I have talked about it. In fact, I talked at US Nationals about it, trying to get some more insight into – I don't want to say "fixing" that because that is wrong. But how do I change that characteristic, or in my mind, how do I "upgrade" it? Every answer I get from the books and from the people I consult is that this characteristic is genetic. From the books, it says the worst thing you can do is to notice that an athlete is not a great competitor and then push the athlete in that direction. Now, I am not a genetic freak, I am more of an environmentalist. I think that we can change things that we don't know how to change.

The other thing that I have a problem with is "feel for the water." I am luckier than most of you out there in that when I recruit, "feel for the water" is all I look for. I don't ask the dads how the kids swim. I don't even ask the coaches. I ask the moms, how does your son swim, and all I want to hear is "pretty." Distance per stroke, efficiency, that's it … When someone says, why don't you take somebody that is 44.4 for the hundred free and takes 70 strokes or 50 strokes in a hundred yards freestyle and fix their stroke? I say that is all feel for the water. I don't know – I try not to do it. Every once in a while I get a swimmer and I try to change the stroke, but I am not very successful with that. So if you have got any answers to either of those two questions, meet with me later and do not tell any of the other college coaches about it. That would help me a lot.

I love the sport of swimming because it is a microcosm of life. Swimmers learn more about life at an early age than anybody who is not a swimmer will ever come close to learning. There are so many lessons. We know what goal setting is in swimming. Swimmers have been doing it since age 8 – but outside the swimming world, there are courses in graduate schools of business on goal setting, because a lot of people do not know how to set goals. We have got that – we have been doing it forever. In our sport, we are always trying things, and sometimes, we fail. In our society, there are a lot of people who will not try because there are no guarantees on the other side. Swimming is that way. It is not a matter of whether you win medals in the Olympics or whether you make the Olympic team because most people are not going to do that. You can safely say that to almost everybody. But-- there is no one you can tell that they can't get faster. Everyone can get faster.

We have a saying that Mike Walker, women's coach at Texas, started using this summer. It is called: "More Better" – to get better you must do More and you must do it Better. That is exactly right. If you have someone that you take, and no one actually does this, and give exactly the same workouts you gave last year and the swimmer gets better, then that swimmer is <u>really</u> talented -- and you have hurt that swimmer by not stretching him/her and challenging him/her to do more and do it better.

When I go to recruit, I look for two things. I have never been to 38 high school state meets in a year, by the way. I wouldn't have a wedding band on my hand. I would be a goner. I would be out back with the two labs. But whenever I go to a club program or a high school program, I look for two things to see in my mind if those kids are being coached: Are they streamlining off the wall and are they fly kicking off the wall. Now, you don't want that in breaststroke -- except for now, and I don't know where to go with that.

I gave a talk to the officials at the Nationals, and I told them my new abbreviation for FINA. I don't normally talk that way, but I will tell you. No, I won't tell you. It probably would reflect badly on the group and it should reflect badly on me. I am a firm believer in that.

I also know another thing. Have you ever been in a situation where you thought no one else cared? That is not a reason to quit. All that matters is that you care, and you can get something done. That is the name of the game. You have got to care. It doesn't matter if you come to this meeting and you want to talk to anybody about anything – no matter who it is…John Leonard or anybody. If you have an idea, go tell them or e-mail them. They will e-mail you back, especially John. John sends out 80 e-mails a day. The key is that you care. The real key is that you care about your kids and you take care of them every day. I think it is a real simple process. To be a better coach, you have got to forget yourself. You have to forget what you want. You have got to forget what you feel. It is very difficult for younger coaches to do this because of where they are in life.

But, back to what swimming offers. I have been a firm believer for years that nobody in their right mind picks this sport to do. Think about it – you think it could be boring? A lot of you have been swimmers. I am still pretending and it can be boring. We know it is physically demanding. There is nothing that hard in the world. Our basketball coach comes in and he watches practice about once a month. He says he does it "just so I [the basketball coach] can know that there are fools out there doing what you are doing." Now of course, they work with different athletes in different events, so they have got to do different things. Nevertheless, the demands on our swimmers physically, emotionally, and mentally are tremendous.

I always get to comment on how do you get 11 and 12 year olds away from soccer? Dick Jochums wrote probably the neatest letter I have ever read a number of years ago. I think he wrote it to <u>Swimming World</u> and he emphasized

that he has more boys on his team than girls. My brother has got more boys on his team than girls. Why? Dick said that it is all about challenging them. Paul Bergen gave a great talk at the clinic in Acapulco on distinguishing the differences between 11 and 12 year old girls and boys. The difference is tremendous, and it is different. If you are treating them all one way, somebody is being left out. Or, if you are down the middle, both groups are being left out. But, I am a firm believer that it is how you treat people every day.

I get stuck talking – that was the wrong way to say that, wasn't it? I get asked to talk about motivation a lot, and honestly, I don't know how they[the swimmers] do it. I thought that I needed to come in here and motivate you as coaches, and I can't do that. Doc Counsilman wrote about "de-adrenalization" – having great workouts all week, and pressure to do well all week, and swim in a dual meet on the weekend. Doc wrote about how that will just flatten you out. The cure back then was thought to be to have them take a month off at the end of the season and then start over -- because you didn't know you were killing them or de-adrenalinizing them until the end of the year. But, when they just flatten out, there is nowhere for them to go. There is no way that you can rest out of it.

We had a football coach a number of years ago, Fred Akers. When somebody said: "You didn't get them up for that game," he said: "You can't get them up every weekend. You can't get them up for every game. There is no way you can do that emotionally or physically. What you have got to do is to raise their level of their zero level or their average level." It is like the More Better theory for swimmers. It is for us too. The greatest compliment I have gotten this year came from one of my seniors. When he came out of dry land, he said this is the hardest and the best dry land we have ever done. He had been in it three years. He would know, and he is the type who would honestly believe that it would be something that would benefit him. Usually, I am like you. I go by: if they don't like something, then you know it is good for them. That is how you do it – if they bleed from the face, it has got to be good. That is how we got where we were, and where we are: same deal. Remember, I was telling you about why I liked the sport of swimming.

Delayed gratification. We start in September and go to March and hopefully get the taper right. That is 6 months. Most people do not go six months. The saying about our society now is that if you offer somebody $20 today or $100 in two weeks, they will take $20 now because they can't wait. Swimmers have to work and wait, and I think that is a skill that not many people have got. You know swimmers; you have got swimmers on your teams who have just gone through high school. They didn't go to college and swim, so they are out in the world working right now. And 99% of them, you are proud of them. You are glad you got to know them because they are doing a great job. That is what mine are doing too. I really like it.

Swimming teaches people to be on time. Boy, there is a good one! My daughter was working as an accountant at a place in Austin. She was one half of the accounting job, and there was another girl who was another half of the accounting job. Heather would come in on time. She would stay until she got her work done or at least until time to go home. She would come in when she didn't feel well – sounds like a swimming coach doesn't it? And the other girl would call in once a week and say she was not feeling well and would come in at 10 or 11, and eventually not show up at all. That girl got fired, and Heather moved from Austin to Dallas, where the main office was, and they followed her and made a job for her in Dallas. I tell my swimmers every year that working in today's job market is a joke. You have to be on time and try hard. You do not have to have great skills. They will teach you everything you need to know. There is no secret to success nowadays. You don't have to be the best. You don't have to be a genius. It's because when people do a job, if things go against them, they will quit. They won't show up any more and they will quit; or, they won't show up for two weeks and come back. It is a crazy, but easy, world out there in the job market.

Another key for swimming: improvement is self-evident. You don't have to win the Olympic medals. You don't have to get money and, as I have said before, you are not going to probably. But the kid that gets 41st place in the 100 meter freestyle and drops 8 seconds from last year might just as well have won the race. It doesn't matter, and you need to treat them like that. We need to treat them like that. It is easy to get confused by the people who are winning. It is easy to say: "Well, I [referring to Eddie Reese himself] had breaststrokers go 1, 2, at the US Nationals this summer." Neither one of them was Brendan Hansen. They were over four seconds behind Brendan. It doesn't matter. They had never been that fast. The guy that got second is going to be a senior this year. He came out he said: "I really needed that swim." I told him: "No, I really needed that swim." There is a lot more to that.

Faster is where it is at. If not, and you've got them on your team, put them in an easier group or fire them. I have some kids on my team or who used to be on my team, who I should have fired a year or two ago for their own well being. I couldn't do it – I am too easy. I can give them a hard workout and smile and laugh at them, but I couldn't make the right call for them, and one of them is very, very, very, very, very good with a lot of potential. He is going to get out of the sport with a lot of potential-- and as Darrell Royal used to say, that is the worst thing to have. You want to actualize that potential.

I think the most important thing to get is trying and failing. There is nothing like that. I talked about it earlier. We just come back and reset. We had a great Olympic Trials as a group. I mean beyond the first three guys who were beyond whatever I dreamed of for them. And I can write fast times on that sheet of paper too. Mathematically, I am real good with those numbers. But, we were not as good at the Olympics. We had five weeks. I know. I coined this phrase: "five weeks is long enough to get tired, but not long enough time to rest off of it." I had guys going so fast in practice. Brendan Hansen would go ten 50 breaststrokes long course from a push off. He would start at 31.6 and go to 30.5 +/-. I have never ever seen anything like it. Aaron Peirsol went a set of 50 kicks on a minute, plus 100 stroke drill on two minutes plus, and 150 back on 3 minutes – six rounds. This was in that five week period. That is at least two rounds too much. Of course, I didn't know it at the time. My hindsight is as good as yours, but I want to learn from it. I hate to repeat mistakes – I hate to repeat mistakes, but I do [repeat them], I just hate it more. When Aaron would do that set, he started at 1:35 and descended

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to 1:28; and then he did it again and descended to 1:27. Brendan Hansen did the set breaststroke and descended to 1:40 twice. That is 2:15! I have no right to have him doing that. When he got to the Olympics, he was flatter than a pancake.

Peirsol is so good, it doesn't matter. He has had great background. He came out of Dave Salo's program. He has got rhythm; he has got stroke; and he looks for people to race in practice. He will move three lanes over to race them in any stroke they want to do. A couple of years ago, he challenged Brendan to a hundred breaststroke. I was grinning and I am thinking he is doing this to get a little extra rest. Aaron said no, but Brendan needed to wear long shorts and a T-shirt and it was from a push. Brendan did win -- and Aaron could still be there, but we rescued him at the other end. His breaststroke is not for public consumption. You will not see any stroke drill tapes with Aaron breaststroking because we haven't got enough time to talk about the mistakes. He is hoping for the breaststroke where you can't do breaststroke kick, where it is all fly kick. He keeps hoping for that. Aaron is a unique case. I mean, you know he broke the World Record at the World Championship off of 25% workout. And at the World Championship Trials, he broke the World Record in the hundred off of 50% for that period of time, after the World Short Course and all of that. Those are all him. I had nothing to do with that, but after the last time, he wanted to know how he could go that fast. We had this conversation two days ago. How did he go that fast in a 200? Because he knows he wasn't fit.

At Santa Clara he went 58 in the hundred back in the prelims and this is somebody who has been 53.1 named Aaron Peirsol. Even Dave Salo, I got the word, said: "Eddie ought to be worried about Aaron." I said: "I have been worried about him for ten weeks and the first two of those weeks he wasn't swimming." He had gotten his wisdom teeth out, but he had only been using the last half of that word "wisdom." What I told him, and I didn't want to tell him, was that he should be 1:52. But he is better off breaking the world record a tenth of a time. There is a lot of money involved, so if he breaks it a tenth at a time then he will be fine.

We had a case like that years ago – an East German backstroker named Roland Mathes. The world record was 2:05. Roland would come in. He was 6'5" and was a beautiful swimmer. He would come in and he would look at the clock and break it about a half second each time. Backstrokers claim to be the smartest of the four strokes; of course, each group claims that, but Roland may have been the smartest. Aaron was so bad at Santa Clara that before the last person in the heat finished, he had run over to the table and scratched himself out of the final. He was right. He was going to get beat, and he hates to get beat. In fact, he is already back training because he says: "I did not like that feeling – worrying about losing". Usually something bad has to happen to somebody before that occurs – before they learn.

I had talked to our swimmers once before Olympic trials, telling them what was going to happen, telling them how they were going to want all this time off, and time off did not make them good. Time off had nothing to do with them being good. Then, after Olympic trials when they did real well, I talked to them again, and I talked to them again after the Olympics, and I could have been talking right here. Now a couple of them trained pretty hard, and a couple of them didn't, so some did not train well at all. What occurred with Aaron, the reason he was able to go fast at all, was that Santa Clara was five weeks out. Aaron is generally somebody who swims fast all year. He is good all year long. I mean in high school he was 4:22 in the 500, unshaved, un-rested in the meet, and 1:49 in the IM. He was one of those you recruit as a college coach because they are going to make you more famous than you deserve to be. Aaron is definitely one of those.

Aaron has, if you have never heard about it, an over-compensation curve. I talk about it any time I talk about tapering. An over-compensation curve is when the swimmers are training at such a level that they are not recovering on a day to day basis. You depress the body and its ability. Basically, you tell the body it hasn't done a good enough job doing anything – storing glycogen, neuromuscular transmission – just things I don't even know about. After this period of time is when you see the phenomenal swimming – when somebody in your group just goes really fast after doing badly for a long time. It is like when you have a friend coming to town who you used to beat in tennis, and they have been playing and you haven't. You have ten days to get ready, so you go out and you play the first eight of those days. You get worse after about the fourth day, and, when your friend comes to town, he beats you like a drum. Then, you go out a week later, after you haven't played at all, and you play again. All of a sudden, you are really good, not because you haven't played, but because you had played over here too much. That is just where it was. That is the reason Aaron was able to go that fast.

I do want to talk to you a little bit about Ian Crocker, because he learned a lot along the way. He did a great job, coming from Portland, Maine. Can you imagine that? Because you know he didn't swim in the ocean in the summer. It is cold up there. That is a real credit to Sharon, his coach, and Ian because he did it, whatever it was, while they were training. I know Ian, before he came out of high school (I don't recommend this, and I am not saying it is wrong, but I don't recommend it. That is chicken and I am being a chicken on that) but Ian had done 25 X 200 yards of butterfly in a workout. That is a long way, and now it is hard for me to get him to go hundreds. He likes to go hundreds in the prelims fast and then in the finals fast -- so he goes two fast hundreds a day. That is not right. He does just about what he is asked. He has done 100 x 100's on 1:10 in yards. He has done some hard stuff. He was a 16 minute miler. He is a 4:35 five hundred man. But, something put him on the Olympic team.

A strength program, and a swimming program, plus him - put him on an Olympic team. He was 52.4 [100 butterfly, long course] in his senior year in high school. That is good. I thought: "Man, I can hardly wait to get that." The world record was only 51.8. "We will crush that," I thought. He came to school. He spent the first year trying to hang onto his old strength program. You can't blame him. That is what got him there, and he did hang onto it, against my will, and he stayed in the sprint lane. He did that for two years and dropped from 52.4 to 52.2. I am not used to that. I live for improvement. As I tell the swimmers, I am going to make you faster even if it kills you. Luckily, at the end of his junior year – No, the end of his sophomore

year – I'll get it right – let's say the end of his junior year, we – No, it was sophomore year – was the last time he went 52.2. Michael Phelps beat him in Ft. Lauderdale. Ian came back the next year and spent three days a week in the distance lane, and not with the group that goes 150 minutes three days a week. This is with the normal human distance swimmer. He also spent three days a week in the sprint lane -- and he bought 80% of the weight program. After that, in Barcelona, he wins the 100 fly, and breaks a World Record. That is where he goes like this [raising his hands as if to ask what happened?], and I am checking to make sure he is in the right lane because he had never broken 52., I was hoping for 51.98 and so was he -- and he went 50.98!

Ian is one of these guys who is in the 20% group that is not afraid to risk and not afraid to try. The next year, Ian spent six days a week in the distance lane. He went 21 hundred yard freestyles on a minute, holding 55's on all of them, and going 53 on the last 3. No big deal. A lot of distance swimmers can do it, but nobody who can go 43+ for hundred yard fly or 46.2 for a hundred meters freestyle, which is a 41.4 conversion, can do it. None of those guys can do that -- but that is what makes Ian go. He bought the weight room 110%. At Olympic trials, he went 50.7 for the 100 fly, and 49.0 in the hundred free. And -- I take full credit for the Olympics, as far as not going as fast as he should of, would of, could of. Then, this past year, he is one of the two who came in and started workout right after the Short Course World Championships. He started, he did a real nice job on weights. We cut the weights out a little bit, cut a few exercises out, and he went 51.4 for a hundred fly. Now, for a 50.7 guy, that doesn't feel real good.

He was on my back from that point, and he is still on it, because I made a mistake. I told him it didn't matter: "All you had to do was make the team. That was going to be easy." I didn't want to give up training then, since we had already given up September and October because of the Olympics and the Short Course World Championships. He reminded me that it mattered to him. I took that to heart and will soon forget it. But this summer, we did a lot of fast stuff from November until the World Championship Trials [in April] -- and in April, we started again. From April until Ian went 50.4, he may have gone twenty 50's total in that three and one half month period. A fairly fast butterflyer and a fairly fast freestyler. I want to say: "All Out" -- because we don't do much of that – not for 50 meter repeats. I didn't have a clue where he was, but we cut way back on his weights and his strength went up. Ian has a thin chest and he has real long arms. For him to bench press 100 kg., or 220 pounds, in the weight room and do that six times, with his body type, I knew that he was going to be fast.

Nevertheless, I could still see the ups and downs. It doesn't matter who they are. Everybody tells me: "You must have the greatest job." I tell them: "My job is just like your job. It has its ups and downs. It is a little bit how you handle the ups; it is a lot on how you handle the downs." We are all good when things are going right. Everybody is swimming well, and we are happy. When things are going wrong, that is when we have got to be good. That is when we have got to forget ourselves and take care of the swimmers. The best thing to happen to Ian was that Michael Phelps beat him. Without that, I have no doubts we would have had a hard time ever going under 51.

We had been in the water for two days as of this past Friday, and Ian came up to me and said: "when do I move to the distance lane?" I said: "Right now." We are all doing the same thing. We are all kicking 20-25 minutes, and we are doing stroke drills 20-25 minutes, and aerobic swimming 20-25 minutes, with 15 minutes warm-up. We are all doing that. We are doing that – we are running our cycle on that.

I would like to take a shot at my vision for the future. I can't tell you about where FINA is going to take us because they are idiots. Ignorance is not bad unless they don't care, and that is where we stand. Now, I don't know what to do. I know basically the only way you get to them [FINA] is through the newspaper. They do not like to be embarrassed. That is why you are now allowed one fly kick off the wall, because they are not going to go to cameras for officiating. They are not going to make that call, and it is very, very difficult to see from the surface. I mean, we have had teams from our country doing that for years, and it is not the way to do it.

So I am going to take a stab at a vision of where we are going to go physiologically. Where are we are going to go workout-wise? It won't take long. I have been playing with how do we get distance swimmers to go faster? You would wonder. I mean, I don't seem to have distance swimmers. We think we run a great distance program and we don't seem to come up with the guys that go 15:05 or 15:15 [for 1500 meters freestyle]. I will tell you right here now in the next two or three years we will have a couple of guys doing that or more. We have been doing our warm-up (and we haven't been doing this every workout), and we have been swimming our fast stuff first. You know how we normally warm up – full set – kick set – aerobic set – speed – race pace – whatever we want to call it. Warm up, race pace, aerobic is my [current] theory. You need to know that we all have theories, and not all of mine work. I am happy if I get about one to two out of every five. My theory is if you do fast stuff first, then you have more exercise residual (lactic acid) and whatever else shows up in there. You know, they get tired. They have that pain, and so they get to do their aerobic with a different level of lactate in their system. I don't know.

I gave a talk years ago, I think it was in Chicago, and I told the group, that if I had one taper and that is all I had for that season, four weeks out I would give them one week out of the water. Not the distance swimmers. These are normal humans. I would give them one week out of the water, and then I would go back and do my normal taper. But that was back before anybody ever went fast before they started tapering. I had guys try it and say it worked great, but I would hate to try it. I mean, if you have guys who are going to a Conference Meet, and they have to make a cut there, and come back three weeks later, I would not try that.

If you haven't noticed out there, since Sydney, I got a close up look at the value of the flutter kick. The Australians won the 400 freestyle relay in that meet [Olympics], not because they were better than we were, but because we over-swam the first 25 and their kick was about that high on the last 25. Who wins the races at the end of the race? The person whose kick is the best and the highest. Look at Larsen Jensen on the end of the 1500 at the World

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Championships. I am watching it on TV saying: "Larsen – No – Don't let him get ahead of you." Then Larsen beats him by a mile. You know, you cheer: "way to go, Larsen." I am an idiot for thinking that. He must have known he could beat the guy – whatever. But it is the kick that does it. Larsen Jensen in the Olympic training camp at Stanford, at the end of workout, kicked 28.6 for 50 meters flutter kick on a board. For years, all that I have ever heard of is Popov kicking 28.7 for 50 meters flutter kick on a board. Ian Crocker kicked six 100 yard flutter kicks on 1:40 descending, and was 1:05 for a hundred yards on his 5th one, 55.7 on his 6th one. You have got to be able to kick! Aaron Peirsol can break 30 for 50 meters flutter kick. On my brother's team on three days a week all winter long, the first thing they do is a 2,000 set of kicking. Sometimes, half of it is with shoes on -- and they don't kick easy. You must kick strong.

Hey, I never thought kicking was important. We had a plywood boat my dad built. He had a 10 horse Johnson on it. It was great going around corners. Just slide to the bank and bounce off the bank, but I always thought with a 10 horse motor, you could go that fast. If you put a 5 horse on it and turned it on full out, just the resistance would slow it down. I thought that was what kick was. Maybe, kick doesn't propel. Maybe, it just breaks up the drag. I don't know what it does, but you have got to be able to kick -- so you have got to kick. I really believe that. I came back from Sydney and I cut dowels, 8 inch dowels, and we'd freestyle catch up drill, breathing every three, every five, holding 27's or under 30 until it came out our ears.

In flutter kick …you have heard of "capillarization" [increasing the blood vessels in the muscles and in the lungs]. The hardest place to do that is the outer extremities of the arms and legs. You have got to be going a certain speed for that to work. Breaststroke kick is too slow. Maybe fly kick is too, except at a real high rate. You have got to do it for a while, so the only thing you can do is flutter kick. Brendan Hansen has been re-introduced to flutter kick, and he is over there swimming against Aaron Peirsol and a couple of other guys that can flutter kick. At the 100, he is already 30 yards back, so I said: "Brendan, we are going 200's. Make your third 50 breaststroke kick." And, real credit to him, he doesn't do it. He is the work ethic kid. If you had a work ethic poster, Brendan would get it. He just kept flutter kicking and he is better after four days. Of course, when you are minus 3, getting better is not a stretch. So, you know how important kicking is – you gotta do it.

Oh, my other part of kicking … I didn't want to do this because I haven't done it and I don't know if it works, but we did it this summer. We did some sets combining swimming and kicking. We took the middle distance group – No, that is wrong – 100-200 guys, and we did 400 meter freestyle on 5 minutes. That is not that hard. You know, that group was on 4:40. Then, we did two 300 meter kicks on a 1:50 base. That is moderately difficult. Next, we did three 200 freestyles on 2:30, and four 100 meter flutter kicks on 1:50. Nate Dusing, who is a very good workout swimmer, had been interviewed two weeks before that and he had said: "No, there is nothing new that I have done in the water." When he came out with his cheeks red, I said: "Well, is there nothing new for you now?" And he said: "There is something new on the horizon."

Of course, then we would change the intervals and go through it in another stroke and they didn't like it, so you know it's good for them. In fact, today, the set they were doing, after they do the kick and the stroke drills and stuff, they are going 4x50's freestyle on 40 – and all they have to do is hold under 30, breathe in every three, with five fly kicks off every wall. That is everybody, and then after they do those 4x50's, they do 2x50's flutter kick on 45, 2x50's any kick they want on 45. It just needs to be strong. They don't need to kill it, so I am combining swimming and kicking, and I don't know if that is right. I am thinking that this is where I am going this next year. So. if we are less than good at the end of the year, you will know why.

I know – I am known as "Tangent Man" -- and I have done that tonight, but I do love the sport. I have been coaching… This will be my 40th year in college coaching. I started when I was 8, but thanks for getting that joke anyway. It is still exciting, and it is new because what worked last year is not going to work this year for me. I have got to do something else.

I am going to leave you with two thoughts: One: I made the point earlier. If you are the only one who cares, that is enough to get it done. If you want to really read about one person making a difference, get a book about Mother Teresa. She was one person. She started picking up people, because in India, they take their dying to the train station. There is no dignity in their death – at least, that is our way of seeing it. She would go and pick up those people and bring them back to her one room. From there, it has moved to 500 different kinds of houses all over the world.

In the other one – No, I have got three for you – the other one is: you have got a great opportunity here. There are some phenomenal minds in this audience and I have called a number of them. I remember calling a young lady who had a team in a sectional, up around Chicago about three or four years ago or five years ago, and congratulating her on how her kids had swum in the sectionals. I said: "What did you do that you think made the difference this year?" She started laughing, and said: "Why are you asking me?" I said: "Because I do not know and I want to know." There are a lot of people that have a lot of good information. Don't be afraid to ask them. When I was just starting out, I would wait at the back of this room until Don Gambril walked in. I would grab him and steer him to the side, and, in about an hour, I would shoot him about 180 questions. I would do that everyplace I went.

The final one is: you are in a great sport for another reason. I think ultimately, we are here on this earth to help people. There is nothing else for us. There is nothing else worth having than helping somebody else, and you are in a great sport to do that. Doctors are in a great position. Teachers are in a great position. Don't ever lose sight of that fact. You know the old saying that when you die you can't take it with you. They are talking about material things when they say that. I read a long time ago that when you die, what you take with you is what you have given others. We have the opportunity to do that.

Thank you very much. ●

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Sport Science Summit Age Group Coaches Forum

Coaches Quarterly October 2001

By Genadijus Sokolovas, Ph.D., Scott Riewald, Katie Petrok, and Sandra Lombardo

UNDERSTANDING PHYSICAL GROWTH AND PHYSIOLOGICAL DEVELOPMENT OF YOUNG SWIMMERS AND THE IMPACT ON TRAINING AND PERFORMANCE

The third annual Sport Science Summit was organized together with the Age Group Coaches Forum. It was held in Colorado Springs in November 2000. The objective of the summit was to present information about growth and development in athletes and to discuss sensitive periods for the development of physical qualities. The following scientists participated:

- Riggs Klika, Ph.D., Mount Union College
- Joey Eisenman, Ph.D., University of Wyoming
- Tudor Bompa, Ph.D., York University
- Genadijus Sokolovas, Ph.D., USA Swimming
- Scott Trappe, Ph.D., Ball State University
- Randy Hill, M.S., USOC
- Tim Gibbons, M.S., Boulder Center of Sports Medicine

The conclusions drawn from each of the four main areas are presented first, followed by the scientific data and supporting discussion.

Conclusions

1. Growth and Maturation in Athletes
   - Male growth spurt occurs later and is of a larger magnitude
   - Accelerated gains of most parameters occur at or near peak height velocity. (PHV) Normal variation of PHV is aged 11-13 years for girls, aged 13-15 years for boys
   - Early matured swimmers have size advantages that correspond with faster swimming times regardless of stroke mechanics
   - Absolute functional capacities increase during growth and maturation
   - The presence of critical periods for trainability and related physiological mechanisms need further exploration
   - Functional capacities can be used to predict performance but must be kept in the perspective of the performance model
   - There appears to be a transfer of gains from functional capacity to performance
2. Assessment of Biological Maturation
   - There are four ways commonly used to assess biological maturation: skeletal, sexual, secondary sex characteristics and somatic
   - Each of the biological maturation assessment procedures has its benefits and drawbacks.
   - Skeletal assessment involves taking an x-ray of the hand/wrist and comparing this x-ray to standard norms
   - The sexual measurement method is based on breast, pubic hair, and menarche in girls and on genital and pubic hair in boys
   - The method of measuring secondary sexual characteristics is based on arm pit hair, facial hair and voice change
   - The somatic method involves measuring stature, weight, strength, and V02 max and tracking them in long-term training
   - The methods used in evaluating biological maturation are the basis for further understanding growth and maturation. Using and implementing these methods can help coaches to educate their parents and athletes. The coach can explain why some children can and cannot do certain things at specific ages. In the long run, using biological maturation assessments may help coaches to retain their athletes.

3. Sensitive Periods for Development of Physical Qualities

   - Sensitive periods correspond to the time period where we see the fastest rate of increase in a given physical quality of an athlete
   - It is hypothesized that an increase of stress on a physical system during its sensitive period will maximize the potential of that system
   - The order of sensitive periods in long-term career training is as follows: flexibility, balance, agility, aerobic capacity, mixed aerobic-anaerobic capacity, anaerobic capacity, strength, and strength speed
   - The best way to identify when the sensitive periods occur for your athletes is to identify their age of biological maturation or PHV
   - From the order of sensitive periods, a plan for career training can be developed
   - Stressing a system prior to its sensitive period can cause long term harm and limit rather than enhance the athlete's potential.

4. Long Term Planning in Swimming

   - During the adolescent growth spurt many parameters of work capacity show accelerated growth
   - Investigation shows that correlation between strength parameters and swimming performance increases with age. Conversely, this shows that before adolescence, the increase in strength parameters will have a lower influence on swimming performance than after adolescence
   - Through early specialization athletes can achieve quick performance improvement. However, according to scientific investigations, early age results have little to do with adult results.
   - Since the sensitive period of balance and agility occurs before biological maturation, a long term plan should start with basic skills of balance and feel for the water.
   - The sensitive period of aerobic development coincides with the early stages of puberty and PHV. Therefore at this age it is important to increase the aerobic compensation workload. This is a good basis for later development.
   - Strength training should correspond to the sensitive periods. The foundation of strength training is important at age 12-14

- Increased swimming volume decreased the size, force, contractile speed, and power of fast twitch muscle fibers. But there are no changes in slow-twitch muscles fibers during increased swimming volume
- Reducing swimming volume and increasing rest during taper causes fast-twitch fibers to increase in size, contractile speed, and power. These adaptations of the fast-twitch fibers most likely contribute to greater swim performance
- The models of workload progression are based on sensitive periods for physical qualities

Table 1: Averages of Growth During Adolescence

Averages	Girls	Boys
Age at PHV	12	14
Rate of prepobertal growth	5 cm/yr	5 cm/yr
Max rate of growth during adolescent growth spurt	7-9 cm/yr	8-10 cm/yr
Age at onset of adolescent growth spurt	9.5 - 10.3	10.3 - 12.1
Termination of growth	15	17

Supporting Materials

1. Supporting Material for ***Growth and Maturation in Athletes***

Growth is defined as the increase in the size of the body as a whole or as the increase in size of specific body parts. According to various sources of growth data, swimmers usually tend to be average or slightly above the mean.

Maturation refers to the timing and the tempo of progress to the mature state. When do the changes begin and how long do they last? There is a great variability in children, which may affect their performance at younger ages. The maturation phase usually begins somewhere between 10 and 14 years old. It varies between individuals, organ systems, and tissues. Maturation is highly variable. Maturation is related to the adolescent growth spurt.

The most common parameter of the adolescent growth spurt is Peak Height Velocity (PHV). PHV is the maximum rate of growth during the adolescent growth spurt. The growth spurt occurs later in boys and has a larger magnitude than in girls. Average height gain is about 5 cm/ year during the pre-pubertal growth and 7-10 cm/ year during adolescence. The length and rate of the adolescent spurt is genetically programmed. Therefore it is hard to predict these parameters. Normal variation with PHV is 11-13 years for girls, 13-15 years for boys (see table 1). Children are considered "early maturers" when PHV occurs more than 1 yr. before the average (12 years for girls and 14 years for boys). Usually about 16% of all athletes are early maturing. They have size advantages corresponding with faster swimming times regardless of stroke mechanics. Early maturing swimmers are more successful at young ages. After biological maturation they may lose their advantages in size and results. This time is critical for the early maturing athletes. It is important to explain the reasons for early success to the athlete and his parents and try to retain him in the sport after biological maturation.

Children are considered "late maturers" when PHV occurs more than 1 yr. after the average. About 16% of all athletes are late maturers. Often they swim slower both before and during biological maturation. They often catch up in size and begin to swim as fast as the early maturer. Hypothetically, late maturing swimmers may have better mechanics if they stay in the sport longer because they tend to work more on skills and technique. The late maturing swimmer, on average, grows taller and has a more linear physique than the early maturer. They have the physical characteristics usually associated with successful swimmers (UT Austin data).

Maturation is associated with changes in functional capacity (FC). FC is closely related to performances in athletes. It is the ability to perform physical work under various work stimuli. FC in swimming is a basis for performance. The level of FC is related to the swimming event: the longer the distance the athletes swim, the higher aerobic capacity should be. FC depends on the age of the athletes, biological maturation, and body size. Genetic factors and training environment (workload, recovery, training facilities, etc.) also affect FC. Functional capacity involves neuromuscular strength, anaerobic power, maximal oxygen consumption, economy of movement, and anaerobic/lactate threshold. Each of these will be discussed.

Neuromuscular Strength

Neuromuscular strength reflects the ability to exert maximal force. It can be measured as hand grip with an isometric dynamometer, bench press (1 RM), or a similar test. Absolute neuromuscular strength increases with age. There are small and consistent sex differences before adolescence: boys are stronger than girls. An adolescent absolute strength spurt occurs at about age 13 in boys. No clear spurt is evident in girls.

Relative (per unit body mass) neuromuscular strength increases slightly with age in girls. Relative neuromuscular strength increases linearly with age in boys until age 13 and then accelerates. Usually, relative neuromuscular strength begins to accelerate at or 1 year after PHV in boys. There is limited data on girls, which indicates there is no clear spurt in relative neuromuscular strength after biological maturation.

Earlier maturing boys are stronger at all ages in neuromuscular strength. There is a small difference between average- and late-maturing boys. Early maturing girls are slightly stronger during early adolescence, but thereafter there are no consistent differences among maturity groups of girls. The absolute strength advantage in earlier maturing boys is due in part to body size. At many ages, late-maturing boys and girls possess greater relative grip strength. This may be relevant to swimming success.

Anaerobic Power

Anaerobic Power refers to the ability to perform short term (0-90 sec.), high intensity bouts of exercise. It can be measured as vertical jump, standing long jump, and/or a Wingate test (30-second all-out cycling bout). The Wingate test evaluates the peak power output (W) generated during 1st or 2nd 5 sec interval and the mean power output (W) generated during the 30 sec bout.

Absolute and relative anaerobic power increases with age in boys. In girls it increases until puberty and then remains constant. Absolute and relative peak power in boys is closely related to levels of testosterone: the higher the testosterone level, the higher the power.

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The highest increase in power output occurs before or at PHV. Advanced maturers at a given chronological age possess greater anaerobic power. Increases in anaerobic power are closely related to changes in body mass and endocrine status. Neuromuscular maturation and changes in intra-muscular substrate/enzymes are also associated with increased anaerobic metabolism.

Maximal Oxygen Consumption (Aerobic Power)
Maximal oxygen consumption (V02 max) refers to the ability of an organism to take up, deliver, and utilize oxygen to produce energy via aerobic metabolism. V02 max can be measured in the laboratory by a progressive exercise test to exhaustion on a motorized treadmill (flume) or stationary cycle. V02 max is expressed in either absolute (1 min-1) or relative (ml.kg.-1 min.-1) terms. It is advantageous for endurance athletes to possess high values for V02 max. Distance swimmers have higher V02 max than sprinters. Absolute and relative V02 max are related to performances in endurance sports. The highest correlation is between V02 max and long distance events.

The absolute V02 max increases with age. There is a marked sex difference in V02 max. It shows a spurt at PHV (12 years in girls and 14 years in boys). Early maturers have the advantage in V02 max. With age, relative V02 max is stable in boys and slightly declines in girls. Relative V02 max is greater in late-matured athletes and increases during late adolescence in boys.

Economy of Movement
Economy of movement refers to the rate of oxygen consumption or energy expenditure at a given speed of movement. It is advantageous to be more economical (consume less oxygen at a given pace).

Economy of movement increases with age. There is a steady decline of sub-maximal oxygen cost during childhood and adolescence: the older the athletes the less oxygen they use at the same intensity. Some scientists have defined a decrease of movement economy during puberty. This occurs at age 11-12 for girls and 13-14 for boys. This can be related to the highest height gain in athletes and inadequate oxygen delivery to the body during this time.

Anaerobic/Lactate Threshold
Lactate is a by-product of anaerobic metabolism (non-oxidative way of energy recycling). The Anaerobic/Lactate Threshold corresponds to the exercise intensity at which accumulation of lactic acid (lactate) in the blood occurs rapidly. At this point the non-oxidative method exceeds the oxidative method of energy recycling. Anaerobic/lactate threshold is important in the evaluation of training intensity when aerobic metabolism is involved.

Limited data indicates an increase in absolute and relative anaerobic threshold, AT, (relative to V02 max) during growth and maturation. Relative AT increases very slowly and is statistically non-significant. Usually athletes before and during biological maturation can't produce large amount of lactate. Muscle and blood lactate levels in children are lower than in adults. Thus, young athletes are working more aerobically than anaerobically, even at high intensity exercises. Children mobilize the aerobic energy delivery pathway more rapidly than adults.

Trainability in Athletes
Trainability in athletes is related to the responsiveness to a specific training stimulus and to critical periods of development. It is the general opinion that children are more susceptible than adults. Some studies support the existence of windows of opportunity to develop different physical qualities. Trainability in athletes depends on many factors including age, gender, prior experience, and inherited factors. All of these factors affect the sensitivity of athletes to motor skills development, flexibility, strength, and both anaerobic and aerobic training.

At ages 6 to 8, most of the neural structures are formed and children can do different movement patterns. At this age, children can develop basic motor skills, the basis for specific skill development later on. A high variety of basic skills is helpful to developing specific skills. In swimming, basic skills include development of balance and "feel" for the water at age 6 to 8. These basic skills will facilitate development of specific swimming skills as the child matures.

There are limited data on anaerobic power in children. Anaerobic power was mainly investigated as the Wingate cycling test. Limited studies indicate a mean increase of 4-14% in anaerobic power with a 6-9 week training program for 10-13 years athletes. Some studies indicate greater relative gains in anaerobic power by older athletes.

Absolute and relative V02 max are related to aerobic power. The scientific data indicate lower trainability in pre-pubertal athletes than in post-pubertal. This data is controversial because endurance training programs were not always sufficient to develop aerobic power. If athletes have a high fitness level, workload volume for them should be higher. On average, V02 max increases about 14% for post-pubertal athletes when training is of sufficient intensity and duration. For younger children V02 max increases less than 10%.

Economy of movement shows small changes with training. Some scientists didn't indicate any improvement. This could be due to short durations of training programs. Limited studies indicate 6-7% improvement in economy with training. Usually trained athletes show a higher economy than non-athletes.

Transfer of Functional Capacity Gains to Performance
Neuromuscular strength is related to motor performance. Most studies indicate an increase in performance when training is accompanied by strength training. Highest improvement is shown in similar exercises such as vertical jump, sprint running, and sit and reach. Some investigators, however, found that strength training in pre-pubertal athletes was associated with negligible changes in the vertical jump and the sit and reach.

Anaerobic power has a relationship to anaerobic performance. There are strong relationships between lab measures of anaerobic power and field performance; however, some studies with pre-pubertal athletes (10-11 years old) indicated no relationships between parameters of anaerobic power and anaerobic performance. This can be related to the transition of motor skills to performance in young athletes.

Absolute parameters of aerobic power (V02 max) are related to endurance performance: the longer the distance the higher the correlation. But aerobic power relative to weight has a limited relation with performances. Some studies indicate a decrease in relative V02 max with an increase in aerobic performance in pre-pubertal athletes.

2. Supporting Material for Assessment of Biological Maturation:
The skeletal method of assessing biological maturation is the best measurement, however it is not at all practical on a wide scale. Skeletal assessment involves taking an x-ray of the hand/wrist and comparing this x-ray to norms. This, then, determines the skeletal age vs. chronological age.

The next method of evaluation is the sexual measurement method. This method is designed to track the pubic hair/genital growth of children in order to understand what level of puberty they have reached. It is based on breast, pubic hair, and menarche in girls and on genital and pubic hair in boys. This can be done either by self-assessment or in a clinical setting according to Marshall and Tanner (5 stage scale). Although this is another effective way of measuring biological assessment it often draws red flags from parents and the children themselves! However if done professionally the children usually don't have much of a problem with it. The children are asked to look at five sexually specific pictures and rate (what do you look like?) where they fall on the scale. This has proven to be a valid and reliable measure. In addition the girls are usually asked about their age of menarche, this being another good measure of biological maturation.

Measuring secondary sexual characteristics is another method commonly used in assessing biological maturation. When using this method, observation is made of armpit hair, facial hair and voice change. This method is definitely riot as accurate as other methods, however if monitored every three to four months it has been shown to be effective.

Finally, somatic maturation is the measurement of change (longitudinal data) in one or several particular variables. The data usually collected are: stature, weight, strength, and V02 max. The rate of change in a particular variable (i.e. stature, weight, strength) indicates the rate of biological maturation. Longitudinal data are needed to make a reliable and valid assessment of maturity. This method is riot very practical as an immediate assessment of biological maturation. Only after all of the data are collected can it be determined when peak velocities and puberty were reached.

How can you, as a coach use this information on the pool deck? What does it all mean'? As stated previously, knowledge of biological maturation and assessment of where each child lies developmentally are important tools. These assessments can explain some early successes and give a hint toward later successes for the late maturers.

1. Early Maturers - Often experience early success, they are faster in the water because of their size and strength. Their size is an early advantage and they are most often successful at the age group level.

2. Late Maturers - Will eventually catch up and studies have shown that they often grow taller than the early maturers. They eventually swim as fast as the early maturers and if they stay in the sport may end up swimming faster. Late maturers may have spent more time developing better technique rather than relying on size and strength.

3. Supporting Material for Sensitive Periods for Development of Physical Qualities
Sensitive or Critical Period has at least two definitions. One definition is related to augmentation in physical qualities. It is hypothesized that an increase of stress on a physical system during its sensitive period will maximize the potential of that system. The other definition of sensitive period is the period with the fastest rate of development of physical qualities.

There is controversial data about the existence of sensitive periods. Some papers support a hypothesis about "extra" gain from sensitive periods. There is also opposing data stating that there are no sensitive periods where extra gains may occur. The reason why it is hard to prove or deny the existence of sensitive periods is the requirement of long-term longitudinal investigations coupled with a statistically significant number of participants. However, the idea has not been disproved and is worthy of discussion.

There are sensitive periods for different physical qualities and different parameters, both anthropometric and physiological. Sensitive periods correspond to the period in which we see the fastest rate of increase in a given physical quality. Take height as an example. While an athlete may be continually growing taller, the sensitive period for height corresponds to the period of time in which her or she is growing the fastest. Actually, the period of fastest height increase is defined as the peak height velocity (PHV). Many other physical "events" occur at fairly set times relative to the period of PHV. In these sensitive periods it is possible to make gains above and beyond what is seen during normal growth and development. For instance, there is a sensitive period for aerobic development, where the aerobic system is developing faster than it is at any other time in the athlete's life. If increases in aerobic training are introduced to correspond with this period of rapid growth, then it may be possible to see higher increases in aerobic capacity.

An outline of different sensitive periods is shown in Table 1. The ages shown in the table are average values found during normal growth and development. There is variability in the growth of any individual. Probably the best way to identify when the sensitive periods occur for your athletes is to identify their age of biological maturation or PHV (see section on biological maturation) and then estimate when the following windows of opportunity will occur.

Stressing a system prior to its sensitive period can cause long term harm and limit rather than enhance the athlete's potential. This seems to be especially true with strength based and anaerobic based systems. In many respects, this has to do with the maturity of the individual athlete. Prior to puberty, the building blocks are not in place to support strength training and anaerobic development. Trying to develop these systems proves to be futile and may actually cause long-term adverse effects.

Even when growth and development is advanced (early maturer) or delayed (late maturer) the sensitive periods tend to maintain a constant relationship with the age of

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maturity/ puberty and PHV. If the age of puberty/ PHV can be defined, then it should be possible to identify when sensitive periods begin and end.

Probably the most important and controversial topic when dealing with sensitive periods centers on training and energy zones. When should an athlete increase aerobic and anaerobic training to maximize his potential down the road? From the information presented by Dr. Sokolovas, athletes should increase their aerobic training around the ages of 13-14 for males and 11-13 for females. These are the times when the aerobic system is changing at its most rapid pace. Increases in heart size, cardiac output, blood volume and blood pressure correspond to this period in an athlete's life. Similarly, decreases in heart rate and respiratory rate are also typically seen at this time. All of these things are positive adaptations that make the body more receptive to increased aerobic loads. In a sense there may also be somewhat of a feedback loop. While these changes encourage increased aerobic training, increased aerobic training may also help to augment the physiologic changes, thereby setting the body up to handle even greater aerobic training loads.

However, it would not make much sense to attempt to train the anaerobic system at this time, since the building blocks (hormones, etc.) are not in place to fully take advantage of this type of training. It is not until later ages that improvements from anaerobic training can be fully realized. Development of strength and power should occur post-puberty.

These findings go along nicely with the way the physiological systems develop in the body. Data were presented showing that the Aerobic Energy system develops earliest in children, followed by the Aerobic/Anaerobic mixed system, the Anaerobic Glycolytic system, and then the Creatine-Phosphate system. Specific strength does not develop fully until all of these systems have been developed.

4. Supporting Material for Long Term Planning in Swimming

Long-term planning is summarized based on presentations of Tudor Bompa, Genadijus Sokolovas, and Scott Trappe. The same workload volume done at different ages has differing effects on certain physical qualities. When high volumes are prematurely done for the development of specific power, then smaller increases of specific power are noted in younger athletes. Extraordinary stress prior to the sensitive period will suppress response when the sensitive period occurs. This may well limit rather than enhance potential. The same workload volume done after biological maturation will not produce greater increases in specific power.

This statement can be confirmed with an analysis of the relationship between strength parameters and swimming velocity. Investigation shows that correlation between strength parameters and swimming performance is always positive. Thus, increased strength will increase swimming performance too. Correlation between strength and swimming performance increases with age. The older the swimmers, the higher the correlation between strength and swimming performance. This shows that before adolescence, increases in strength parameters will have less influence on swimming performance.

Therefore development of strength and power is especially crucial after adolescence. This conclusion corresponds with analysis of sensitive periods. The period of the highest rate of improvement in strength for boys is 14-16 years. *High volumes of specific strength/ power done prematurely will suppress the response to the same workload after biological maturation.*

Very often age group swimmers are faced with early specialization. Through early specialization athletes can achieve rapid performance improvement. However, according to scientific investigations, early age results have little to do with adult results. After early performances, many young athletes disappear from the rankings. There is increased risk of "burn out" and injury. During childhood, prior to specialization, the emphasis should be on balance, coordination, and basic skills. The sensitive period of balance and agility occurs before biological maturation.

Sensitive period of aerobic development coincides with early stages of puberty and PHV. Therefore at this age it is important to increase the aerobic compensation workload. When swimmers are trained with a less specific and mainly aerobic workload, performance improvement may be slower. However, they have good basis for future improvement. Consistency of performance in competition also depends on the type of workload. An aerobic compensation workload helps speed recovery after training sessions.

Training load steps should follow a regeneration cycle. Regeneration is important, especially for young athletes. They adapt and recover quickly. Two weeks of progressive increase in the workload followed by one week of regeneration appears to work best for young athletes. For late teens and advanced athletes, the cycle can

Table 1: Sensitive period and critical events in an athlete's development

Event or sensitive period	Males - Ages	Females - Ages	Years of PHV
Flexibility	7-13	6-12	-4-6
Balance	9-11	8-10	-3
Agility	10-12	9-11	-2-3
Aerobic Capacity - Vital capacity	13		-1
Cardiovascular Endurance	12-14	11-13	-1-0
Aerobic Capacity - General	13-14		-0.5
Sit and Reach	13-14	11-12	-0.5
Peak Height Velocity (puberty)	13-15	11-13	0
Aerobic Capacity - VO2 Max	14		0
Aerobic Capacity - Oxygen debt	14		0
Peak Weight Velocity	14-15	12-13	0.5
Arm Pull	14-15	12-13	0.5
Vertical Jump	14-15	12-13	0.5
Bent Arm Hang	15	13	1
General Strength	14-16	13-15	1-2
Specific Strength	14-16		1
Strength - in Water	15-16		1.5

be three weeks of progressive increase followed by one week of regeneration. Strength training should correspond to the sensitive periods. At age 12-14 there should not be discomfort in strength training. Developing a foundation of strength training is important at this age. Core and trunk strength is most important. The trunk is a stabilizer of movement. At 12-14 there should be various exercises without specialization, for various groups of muscle.

Swimmers' muscles are comprised of both slow-twitch (endurance) and fast-twitch (sprint) fibers. Slow-twitch muscle fibers (Type I) have considerably less power and higher endurance. Fast-twitch muscle fibers (Type II) have higher power and lower endurance. Resistance training significantly increases the diameter and force in both muscle fibers. Resistance training causes fibers to be larger, stronger, faster, and more powerful.

While maintaining muscle mass is critical, contractile speed is important for power development. In a tested group of collegiate athletes, after 12 weeks of resistance training contractile speed in slow-twitch fibers increased 75%, the increase in fast-twitch fibers was 45%. The increase in size accounted for the increased strength of muscle fibers. Increased swimming volume decreased the size, force, contractile speed, and power of fast-twitch muscle fibers. But there are no changes in slow-twitch muscle fibers during increased swimming volume. Athletes recruit more slow-twitch fibers with high swimming volume. These adaptations of the fast-twitch muscle fibers to swim training most likely contribute to less than optimal swim performances on short distances. Total distance swum per training session gradually reduces during the taper. During taper, slow-twitch muscle fibers didn't increase in size. However, fast-twitch muscle fibers did increase in size. Force improved in fast-twitch muscle fibers, with small improvement in slow-twitch fibers. Single fiber contractile speed increased in both types of fibers. Peak power of the fast-twitch fibers was two-fold greater following taper. Therefore, it can be concluded that reducing swim volume and increasing rest causes fast-twitch fibers to increase in size, contractile speed, and power. These adaptations of the fast-twitch fibers to swim taper most likely contribute to greater swim performance.

People adapt to training irrespective of age. Physiological adaptation occurs when you increase specific workload. Therefore young athletes can adapt to different types of workload, even to specific workloads, and can improve in performance very rapidly. However, early specialization and high performances usually limit athletes' progressions later in career training. Most of the physical qualities have an S-shape of changes during long-term career training: an initial spurt at the beginning of biological maturation, peak velocity and deceleration at the end of biological maturation. Parameters influencing aerobic working capacity ($V0_2$ max, vital capacity and others) develop earlier. Parameters influencing anaerobic-aerobic (mixed) working capacities (0_2 debt, anaerobic threshold and others) develop later. This pattern continues through anaerobic work capacity, power, and strength.

This seems to show that different workload progressions during career training should occur at different times. Therefore during sensitive periods the rate of increasing the workload should be the highest. After the sensitive period the workload should still increase, but the rate of increase should be slower.

The age at the beginning of career training for swimmers is similar for all strokes and either gender. Since the age at peak performance depends on both gender and swimming event, the duration of career training is different. For female distance swimmers, the duration of career training is about 9-10 years, for sprinters it is about 12-13 years. For male distance swimmers duration of career training is about 11-12 years, for sprinters, 14-15 years. Also, the total workload volume at age of peak performance varies by gender and swimming event. Since career training for sprinters is longer and peak workload volume is lower, their workload progression is more gradual than that of distance swimmers. Usually elite level men swimmers have about 15-20% higher workload volume than women. Sprinters have a lower total workload volume but higher intensity. The models of workload progression were created by Genadijus Sokolovas based on analyses of workload volume by swimmers at different ages (table 2 and 3).

Table 2: Workload progression in career training for male sprinters (in yards)

Age	Total	REC-FN1	FN2-3	SP1-2	SP3
10	380,000	351,880	19,000	5,700	3,420
11	446,809	413,854	22,798	6,492	3,665
12	565,798	525,037	28,137	8,370	4,254
13	763,930	694,175	51,358	12,742	5,655
14	1,059,507	950,325	77,073	22,523	0,067
15	1,435,731	1,199,791	177,693	42,582	15,666
16	1,027,902	1,445,050	277,774	77,246	27,912
17	2,160,702	1,511,539	481,950	122,540	44,673
18	2,396,952	1,562,863	609,203	164,174	60,685
19	2,544,339	1,556,091	724,980	191,757	71,510
20	2,628,990	1,572,722	772,739	206,298	77,231
21	2,675,317	1,583,032	799,370	213,050	79,864
22	2,700,000	1,593,000	810,000	216,000	81,000

Table 2: Workload progression in career training for male distance swimmers (in yards)

Age	Total	REC-EN1	EN2-3	SP1-2	SP3
10	380,000	351,880	19,000	5,700	3,420
11	506,924	468,810	26,644	7,512	3,958
12	580,000	533,282	32,658	9,514	4,546
13	1,180,361	1,055,951	92,937	22,983	8,490
14	1,315,760	1,139,067	130,273	34,576	11,844
15	2,432,730	1,967,094	356,755	83,022	25,859
16	2,699,322	2,076,786	474,902	113,116	34,518
17	3,288,872	2,411,622	676,517	154,275	46,458
18	3,431,290	2,473,623	738,471	169,575	50,629
19	3,557,834	2,548,120	779,388	177,166	53,159
20	3,600,000	2,574,000	792,000	180,000	54,000

The presented models of workload progression are based on normal matured athletes. The workload progression in each energy system corresponds to the sensitive periods: aerobic, aerobic anaerobic mix, anaerobic, and strength/power. If athletes are biologically early maturing, workload progression in each energy system should occur earlier. Peak performance occurs earlier. Workload progression for late maturing athletes should occur later, with a later peak performance. ●