OCA & PDST Joint Educational Lecture

Title: ***Becoming a High Performance Swimmer***

Speaker: Dr. Dan G. Tripps

Dan G. Tripps, Ph.D:

- Previously served as Director of the Center for the Study of Sport & Exercise at Seattle University where his research and teaching focused on biomechanics, physiology, and psychology of performance.
- Coach for world-class swimmers and triathletes
- President and Executive Director of the 1984 Olympic Scientific Congress held in conjunction with the Los Angeles Olympic Games
- Co-editor for ten books on the subject of human performance
- Authored two books, The Heart of Success: Conversations with Notable Achievers (BainBridgeBooks, 2001) and In Search of Greatness: Attributes of Achievement and Lessons for Life (Town Books, 2002)
- Ph.D in Human Performance from University of Oregon; MA in Education from Stanford University

Becoming a High-Performance Swimmer

Dan G. Tripps, Ph.D.

Myth vs. Reality

- **Myth: Training should be grueling day after day in order to achieve the highest level of performance.**
- **Realities:**
  - **Indiscriminate training across time leads to over-training and burnout.**
  - **Failure to develop mechanical efficiencies across time leads to injury and reduced performance.**
  - **Training across time should be scientifically designed and engaged with precision.**

Swimming World Records

Event	Women	Men	Difference (D)	D/100
50 Free	23.67	20.91	2.76	5.5200
100	51.71	46.91	4.80	4.8000
200	1.52.98	1.42.00	10.98	5.4900
400	3.56.46	3.40.07	16.39	4.0975
800	8.04.79	7.32.12	32.67	4.0838
1500	15.20.48	14:31.2	49.28	3.2853
50 Back	26.98	23.80	3.38	6.7600
100	57.57	51.85	5.72	5.7200
200	2.03.35	1.51.92	11.43	5.7150
50 Breast	29.30	25.95	3.25	6.5000
100	1.04.13	56.88	7.25	7.2500
200	2.19.11	206.12	12.99	6.4950
50 Fly	24.43	22.27	2.16	4.3200
100	55.48	49.50	5.98	5.9800
200	2.01.81	150.73	11.08	5.5400
200 IM	2.06.12	1.54.00	12.12	6.0600
400	4.26.36	4.03.84	22.42	5.6050
				5.4836

World Records for Swimming vs Track

Swim	Record (F)	Track	Record (F)	Ratio
50	23.67	200	21.34	1.1091
100	51.71	400	47.60	1.0863
200	112.98	800	113.28	0.9973
400	236.46	1500	230.07	1.0277
Swim	**Record (M)**	**Track**	**Record (M)**	**Ratio**
50	20.91	200	19.19	1.0896
100	46.91	400	43.03	1.0901
200	102.00	800	100.91	1.0108
400	220.07	1600	206.00	1.0683
				1.0599

Scientific Elements of Human Performance

Physics

Biomechanics = Mechanics of Movement Proficiency

↓

Chemistry

Nutrition = Energy Production

+

Cardiovascular Physiology = Energy Mobilization

+

Muscular Physiology = Energy Utilization

↓

Psychology

Performance Psychology = Attributes of Achieving

Summary of Energy Systems

- AEL – baseline aerobic fitness
- AEG1 – aerobic endurance
- AEG2 – aerobic speed
- LAC – aerobic power
- ANG1 – anaerobic endurance
- ANG2 – anaerobic speed
- ATPCP – anaerobic power

Energy System Use by Percentage

- Anaerobic/Aerobic energy systems work simultaneously.
- They contribute differently across performance intensity.

Time	Swim Event	Percent AEL-AEG1	Percent AEG2-LAC	Percent ANG1-ANG2	Percent ATP-CP
0:00:10	25y free			50.0	50.0
0:00:20	50y free		10.0	65.0	25.0
0:00:45	100y free		27.5	60.0	12.5
0:01:45	200y free		45.0	50.0	5.0
0:03:30	400y free		75.0	25.0	
0:15:00	1650 free		87.5	12.5	
0:30:00	Open water		97.5	2.5	

Sample Energy System Utilization

- Using men's and women's 800-meter times as a model, energy is produced by the following systems:

Gender	Record	AEL-AEG1	AEG2-LAC	ANG1-ANG2	ATP-CP
Men	7:32.12	0.000	0.783	0.217	0.000
Women	8:04.79	0.000	0.793	0.207	0.000

- For all practical purposes, this event is 80% aerobic (AEG2-LAC) and 20% anaerobic (ANG1-ANG2).

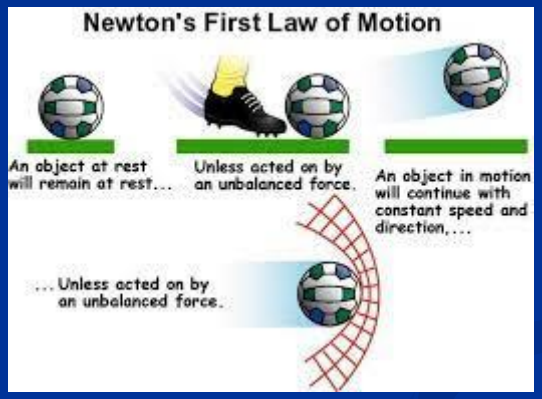
- To swim any event well, you need to train substantially in the energy systems utilized.

Sir Issac Newton (1642-1726)

- In 2005, Britain's Royal Society deemed Newton to have made a greater contribution to science than Albert Einstein.
- In 1999, a poll of 100 physicists identified Newton as the greatest physicist of all time.
- Einstein kept a picture of Newton on his study wall.

Newton's First Law
The Law of Inertia

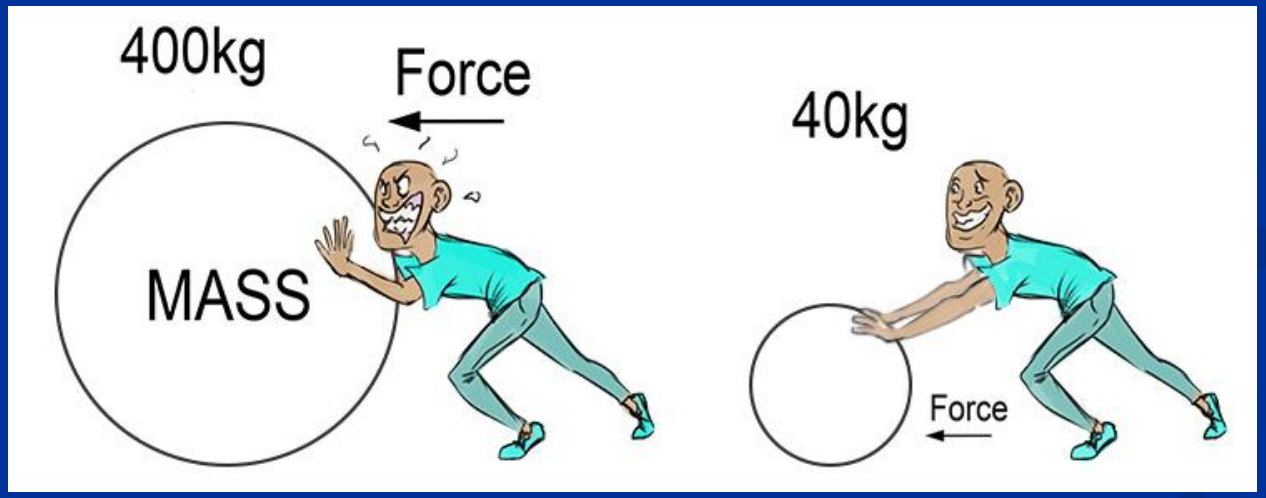
- An object continues at rest or in uniform motion unless acted upon by another force.



- In swimming, a force must be applied by the hands and arms to overcome the effect of body weight and to maintain horizontal speed.

Newton's First Law
Law of Acceleration

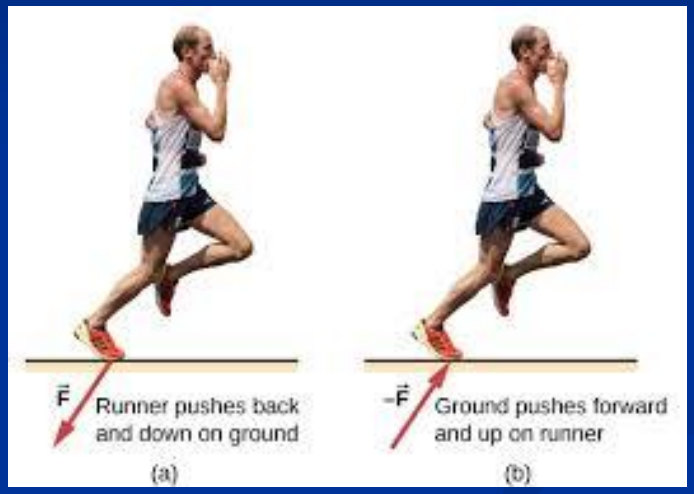
- The acceleration of an object is directly proportional and in the same direction as the force causing it and inversely proportional to the mass of the object.



- In swimming, the hands must press and pull with increasing speed along a line parallel to desired path.

Newton's Third Law
Law of Reaction

- For every action there is an equal and opposite reaction.



- In swimming, the action of the hands and arms must be accompanied by complementary rotation of the hips and spine to stabilize the body and minimize wasted lateral and vertical motion.

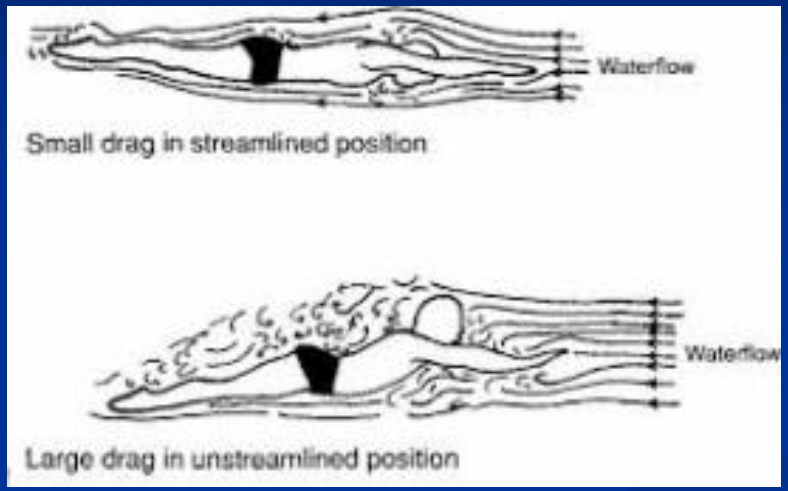
Train Smarter, Not Harder

- To swim faster, you can use power – faster strokes, bigger kick – and see how long your energy will last.
- Or us can use your brain….
  - Reduce drag you create in the water with streamlined mechanics.
  - Generate greater propulsion with efficient mechanics.

Understanding Drag

- Drag is the resistance that water exerts on your body as you move through it.
- There are three types of drag that slow swimmers.
  - Pressure (form) drag is the resistance created from your body position.
  - Surface (wave) drag is the resistance derived by the turbulence you create in the water.
  - Friction is the resistance caused by the contact of water against your skin and suit.

Illustration of Drag in Swimming



Impact of Drag on a Swimmer

- Because water is 800x “thicker” than air, drag in the water increases by the square of your swim speed.
- If you swim 100 yards freestyle in 1:00 and you want to improve your time to 0:50 (20% increase in speed), you must increase your power by 145% to overcome the increased drag.
- Or you can use the same amount of power by reducing the drag…..Your choice.

Reducing Drag:
Improving Your Balance

Form Drag

- One of the best ways to decrease form drag is to improve balance by staying as horizontal as possible while moving through the water.

- By doing so, you disturb the least number of water molecules resulting in reduced form drag.

Poor Breathing Mechanics

- Lifting your head forward before turning to breathe,
  - You become unbalanced forcing your hips and legs to sink creating more drag.
  - You must kick harder to provide more power which wastes energy.

Poor Mechanics

Good Mechanics

Special Note

- **Breaststroke and butterfly are a bit different.**
  - **These strokes rotate around an imaginary axis that runs through your hips.**
  - **You do not remain horizontal over the entire stroke cycle.**

Reducing Drag: Swimming Taller

Wave Drag

- Make yourself as tall as possible in the water because a long, tapered body moving through the water creates less wave drag than a short, wide one.

- To swim taller in freestyle, make sure you fully extend your recovering arm forward underwater before starting the downsweep and catch.

Reducing Drag:
Compact and Efficient Kick

Friction

- Freestyle kick contributes only 10% to propulsion so it is more of a stabilizer than a propellor.
- An efficient flutter kick
  - is fast and compact
  - breaks the water surface only slightly
  - does not drop below your body line
- An inefficient flutter kick generates undesirable friction drag, slowing you down.

Improving Propulsion

- Once you have reduced drag, you can work on improving your propulsion.

- VERY IMPORTANT….improving propulsion is best achieved by improving the mechanics of your stroke, not by building larger, stronger muscles or using arms and legs more quickly.

Improving Propulsion
Swim with a Slight Roll

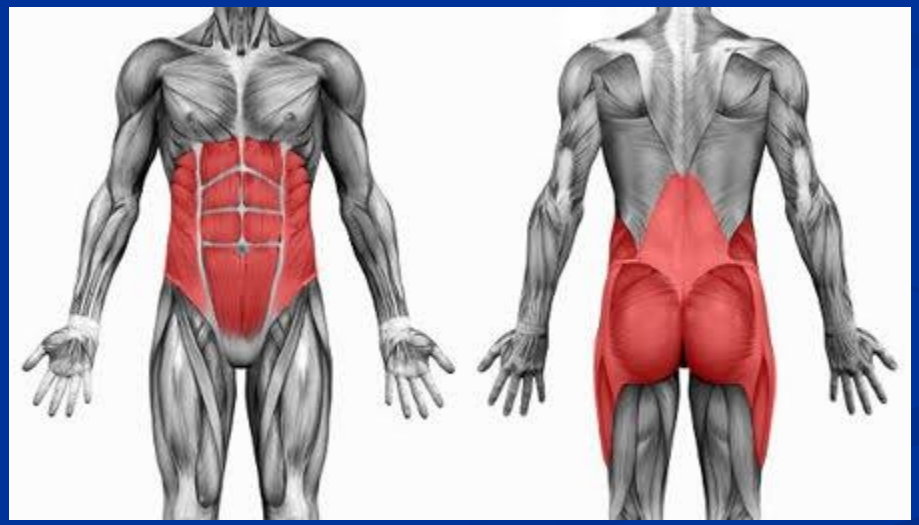
Rolling

- Improve your propulsion by rolling slightly from side to side while pulling with your arms.
- Your body is then in a better position to use chest, shoulder, and back muscles.
- Rolling in this manner can feel a bit odd in the beginning and requires practice and patience.

Improving Propulsion
Swim with Your Core Muscles

Core Muscles

- After learning how to effectively roll, develop better use of your core muscles.
- The most critical core muscles are in the lower back, hips, pelvis, butt, and abdomen.



Reduced Fatigue

- Using core muscles allows you to put power in your arm stroke without tiring your shoulders too quickly.
- Incorporate dryland exercises for strengthening core muscles and engage core muscles with every stroke by concentrating on relaxing upper back and shoulder muscles in your long, tapered swimming position.
- Once you have integrated your core, you will be able to swim longer and faster and tire less quickly.

Improving Propulsion
Swim by Anchoring Your Arms

Timing

- Before pulling your arm backward in the water, you need to wait until your forearm and hand are in line and pointing downward, with the inside of your forearm and palm facing backward.
- At this moment, the elbow is high in the water and located above the hand (called a “high-elbow catch”).
- Once your arm is in this position, you can move it backward as a single unit, like a large paddle, and create a lot of propulsion.

Shape

- Physicists using 3D-printed plastic hand and arm models found that fingers spread 10° boosted swimming speed by 2.5% compared with fingers pressed together.

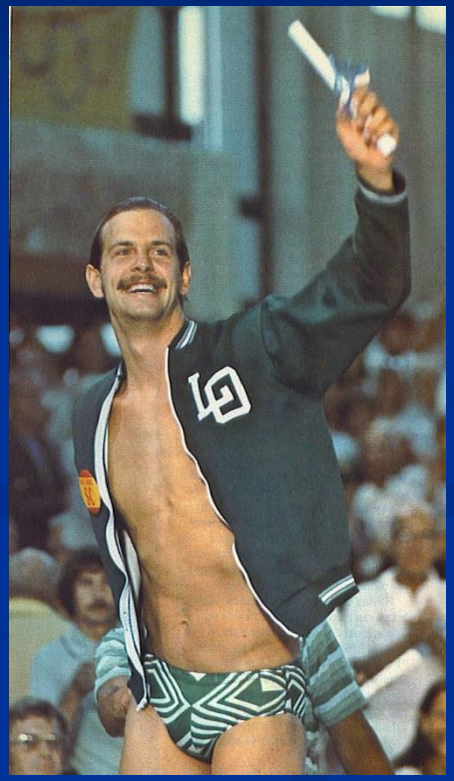
- That translates into several tenths of a second in a 50m freestyle race, an enormous margin considering that 50m freestyle races are often won by hundredths of seconds.

Path

- To obtain a fast swim time, you need to keep your path as straight as possible.
- Rotations and undulations are good but don't bend sideways which forces you to swim in a crisscross pattern that decreases the distance you travel with each stroke.
- Reducing your distance per stroke by 1" for 18 strokes each length adds 72" or 2 yards in the 100-yard freestyle. Why swim farther than your competitors?

Swimmers

- Fundamental Principles
  - Commitment
  - Discipline
- Short-Term Demands
  - Hard Work
  - Responsibility
- Long-Term Requirements
  - Determination
  - Perseverance



Parents

- Be a role model.
- Support the coach.
- Respect officials.
- Encourage your child.
- Let your child choose.
- Love watching your child.
- Cheer for everyone.
- Enjoy the process.

Coaches

- Communicate coaching & program philosophy.
- Communicate updates on program rules and logistics.
- Use data to make decisions and assess swimmer progress.
- Provide time to address parent concerns.
- Set appropriate boundaries for parent communication.
- Encourage parents to take ownership but never blame.

Don’t Just Do It…
Do It Smart, Do It Right

- **“In football as in watchmaking, talent and elegance mean nothing without rigor and precision….”**

Lionel Messi

Paris St. Germaine F.C. * Argentina National Team

Ranked #1 player in the world