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REVOLUTION IN SWIMMING:
ULTRA-SHORT TRAINING AT RACE-PACE

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This is an overview for the busy coach, parent, or swimmer, of Brent Rushall's 55-page energy treatise, titled "Swimming Energy Training in the 21st Century: the Justification for Radical Changes" (Swimming Science Bulletin, 39). Dr. Rushall presents a new form of low-volume, high-intensity training, which he designates "ultra-short training at race-pace." By citing research into the specific physiology of swimming, he demonstrates that ultra-short training produces effects more specific to racing than any other method.

More than most coaches realize, pool racing differs from racing in other "cyclic" sports, especially running:

- Swimmers are cooled and suspended by water, whereas runners are at the mercy of heat and gravity.
- Swimmers begin their races with a dive, whereas runners must fight inertia to get up to speed.
- Swimmers have the benefit of turns and underwater skills, which break their races into segments, whereas runners lack any form of in-race active recovery.
- Swimmers enjoy low-energy demands between propulsive movements, whereas runners cannot relax their muscles to the same extent.

The overall intensity of swimming is different from running, thus generating different demands on the supply of energy. The two anaerobic energy systems—the alactacid (ATP-CP) and the lactacid—are prolonged far beyond their usual ~10 second and ~45 second limits, an extension made possible because:

- Low energy demand during arm recoveries allows creatine phosphate (CP) to be replenished for use in the power phases of the propulsive muscles.
- Lesser energy demand from the lower body than the upper allows lactate from the arms and shoulders to be partly cleared by the legs, keeping lactate levels low. Sprint runners, in contrast, work their arms and legs with almost equal intensity.

[These two processes are stymied if swimmers kick too hard or deplete anaerobic energy stores by going out too fast.]

Hence, conventional training methods, which have ossified into dogma based mainly on the physiology of runners, produce maladaptative effects in swimmers. [These effects are compounded by lack of coaching in technique and mental skills.]

Ultra-short Training at Race-pace

[Ultra-short training employs straight sets (of distance and stroke), with 30 to 40 repeats and 20 second rest intervals. Typical repeats are 12.5s at maximum effort, 25s at 100 race-pace, 50s at 200 race-pace, and 100s at 1500 race-pace. Swimmers drop out of a set when they fail to maintain the pace; if they complete the set, they use a faster pace in the next practice.]

Ultra-short training embodies the **Principle of Specificity**, which implies that training must match the energy, technique, and psychological requirements of the target race. In doing so, it resolves apparent contradictions: that race preparation can comprise repeats that are a fraction of the race distance, and that the alactacid, lactacid, and aerobic energy systems can be trained to optimal adaptation without long-rest power sets, debilitating lactate sets, or mind-numbing aerobic sets.

Ultra-short embodies the Principle by combining two fundamental concepts:

1. **The *intensity* of each repeat in a set must equal the even-paced racing velocity of a particular race distance and stroke** because demands on energy, technique and mental skill are specific to intensity. A 200 swim that is broken into repeats of 25, 25, 50, 50, 25, and 25, though it may be intense, is not ultra-short training. It violates the Principle by varying the ratios of work to rest and mixing demands on energy and technique.
2. **The *format* of each set must be that which yields the greatest possible yardage at the specified race-pace.** Energy and technique are inextricable. The more yardage accomplished at a specific intensity, the greater the transfer to races of energy and propelling efficiency. Ultra-short training is the means to maximize race-pace volume. It can be performed daily because its short work and rest intervals avoid anaerobic fatigue and glycogen depletion.

The intensity and format of ultra-short sets stimulate the aerobic energy system to maximum capacity, which cannot be achieved with low intensity swimming or long rest intervals. Oxygen, which is consumed continuously during work and rest intervals, functions: 1) to fuel Type I (slow-twitch) muscle fibers maximally; 2) to stimulate the extended lactacid system to convert a substantial fraction of Type II (fast-twitch) muscle fibers to oxidative Type IIB fibers; and 3) to pay back accumulated oxygen deficit by replenishing creatine phosphate and clearing lactate.

Moreover, the many rest intervals in the ultra-short format permit focused coaching of specific technique and mental skills. In addition, ultra-short training has been shown to be of particular benefit to children, and because its sets are self-limiting, it is not subject to the dangers of overtraining.

[*A note to the reader: If you were inquisitive enough to get this far, I encourage you to read Dr. Rushall's short paper (the one that follows), and then, especially if you are interested in applying his ideas, to delve into the longer treatise. This is swimming's best mind reaching out to the rest of us. Be patient and learn.*]