The Second World Congress of Cycling Science

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The venue for this boutique conference was Leeds, which this year hosted the start of the Tour de France. Acute Effects: standing vs sitting, crank length, leg length, mountain-bike wheels, potentiating warm-up, beetroot. Tests and Technology: static vs dynamic bike fit, drafting, TrainingPeaks measures, power-meter calibration; 3-min all-out test, frontal area. Chronic Effects: fish oil, carbohydrate, bicarbonate, interval training, strength training. KEYWORDS: cycle, elite athletes, ergogenic aids, nutrition, performance, tests, training.

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This conference brought together coaches, sports scientists, medical practitioners, students and researchers to share cycling specific knowledge. The host city was Leeds in the UK, to coincide with the Grand Depart for the 2014 edition of the Tour de France. The conference, on July 2-3, was held at Leeds Metropolitan University but organized by sport scientists James Hopker and Louis Passfield from the University of Kent. Attendance was relatively light, almost certainly because of an unfortunate overlap with the annual conference of the European College of Sport Science. However the conference did feature many of the big names involved with cycling science and had the added benefit of the attendance of a number of highly regarded international cycling coaches and professional team directors. The interaction between scientists and practitioners from the sport is something rarely witnessed at conferences and definitely something to be promoted.

The conference included 36 podium and 27 poster presentations of original studies. There was a disappointing dearth of practical applied research, especially given the audience at the conference. Again maybe the overlap with the ECSS conference was the problem. We have focused this review on those studies with some observable outcome in terms of practical use, making it the shortest yet published at Sportscience. Personal impressions of the conference are reported by the author who attended (CDP), while the summaries of the abstracts are the work mainly of the other author (WGH), who opted to go to ECSS. Our pick of the best original research: the two training studies.

The conference abstracts have been published in a special issue of the open-access Journal of Science and Cycling. Download a PDF of the complete book of abstracts, or link directly to each abstract via the first-author's name at the end of each of the summary paragraphs below. With the exception of Iñigo Mujika's presentation on periodization, the symposia do not have abstracts.

Symposia

Parallel sessions combined with big distances between rooms led to some tough decisions on which symposia to attend and rather a lot of rushing about. Highlights were the presentations by Uli Schrober, Iñigo Mujika and David Martin. Uli is the founder and owner of SRM power meters and gave a short history of how he developed the first and now ubiquitous (amongst professionals at least) power meter. Iñigo gave a well prepared presentation (available at this page on his website) on the various forms of periodised training and tapering procedures required to bring elite cyclists to top form for major competition. In addition Iñigo delivered an interesting symposium with Bent Rønnestad and David Martin addressing the often debated merits of resistance training for the endurance cyclist. To close the conference, David gave his usual enthusiastic take on the role sports scientists play in preparing athletes for major events such as the Tour de France, and he introduced the audience to a contempo-

rary ecological concept referred to as a *trophic cascade*. The impact a sport scientist can have on a high performance cycling program was discussed by comparing the embedded sport scientist to an apex predator in an ecological food chain. Unfortunately I missed the end of Dave's presentation to attend presentations by the TDF teams in the Leeds arena next to the conference venue, where there was a massive turnout of ~10,000 enthusiastic attendees. Using Tour de France terminology for recognizing outstanding performances, I would award the yellow jersey to Andrew Philp and his colleagues for their presentation on the role nutritional status in enhancing mitochondrial adaptations, while Carsten Lundby got the polka dot jersey for his enthusiastic questioning of the efficacy of altitude training for performance enhancement (but see Reviewer's Comments).

Acute Effects

The authors claim that you use your oxygen more efficiently, by a massive 4.5% on average, when you climb hills in the **standing vs sitting** position, in the lab anyway. This finding is not consistent with that of an earlier study, in which "gradient or body position appears to have a negligible effect on external efficiency in field-based high-intensity cycling exercise" (Millet et al., 2002). This discrepancy needs to be resolved before you spend more time standing on the pedals. Bouillod

Small changes in **crank length** did not produce significant changes in efficiency of 12 road cyclists. It's hard to tell how definitive this outcome is, or whether there was any evidence of individual differences, because no data were provided in the abstract. Ferrer-Roca

A correlation between leg length and **orientation of the trunk** in the seated position isn't that interesting in itself, but the author pointed out that "riders with a longer leg length gain a performance advantage through being able to rotate further forwards", thereby reducing drag. Crank length might be involved. Brooke

While not the major aim of this study (an investigation of vibration effects in mountain biking), it appears that **bigger wheels** (29" vs 26") are better for mountain-bike performance, supporting a similar study presented at the ECSS conference and the anecdotal observation that most elite MTB riders now opt for bigger wheels in competition. Macdermid

The crossover was performed with only four male and two female international track sprinters, but it looks like finishing a standard **warm-up** with 4× four complete crank rotations against high resistance (a high inertial load) could enhance sprint performance 4 min later. Munro

No data were shown, but **beetroot juice** apparently had little effect on performance of three 30-s sprints in this crossover of eight active males. That makes beetroot juice or the nitrate it contains even less likely to enhance such performance in competitive cyclists. Byrne

Tests and Technology

If you use a **static bike fit**, the usual knee angle of 25-35° should be adjusted to 30-40° to make it consistent with a dynamic fit. Corbett

An expert biomechanist can model the energy expenditure of one cyclist **drafting** in the slipstream of another and thereby predict the best time for the trailing rider to start the final sprint. The model is very theoretical and does not yet take into account any cooperation between two cyclists to stay ahead of the peloton. Dahman

Will **monitoring training** measures of fitness, fatigue and freshness with a power meter and TrainingPeaks software to predict how you will perform in a competition? Not for most road races and time trials, because there were no useful relationships between these measures the day before the competitions and measures of maximum mean power (from 5 s to 20 min) in the competitions in this 6-month study of 20 male and 4 female competitive cyclists. The maximum mean powers were too unreliable, and it may also be important to rethink the validity of the training measures used for longitudinal tracking of form. Ferguson

If you can access a treadmill big enough for a bike, you can **calibrate a power meter** by comparing the difference in power output at two inclinations with the calculated difference based on the inclinations, the speed, and combined mass of rider and bike. Very clever! Maier

From the data provided on the 3-min all-out **critical-power test** for nine well-trained competitive cyclists, we calculated a 3-min all-out test had a prediction error (standard error of the estimate) of 4.5% for mean power in a 10-min time trial. Our conclusion: don't use the critical-power analysis of the 3-min test. Nicolo

Measurement of a cyclist's **frontal area** in

real time with a system of two cameras might be useful for reducing aerodynamic drag. Wheat

Chronic Effects

A week of daily 90-min **high-intensity sessions** consisting of either short intervals (5, 10, 15 s) or long intervals (30, 40, 45 s) produced spectacular gains in 20-km time trial mean power (8.2% and 10.4%) at two weeks post-training compared with control in this randomized controlled trial of 28 male cyclists. Paton

In a controlled trial of 17 young elite cyclists, maximal vs submaximal **strength training** for 9 wk produced gains in maximum mean power over 10 min (7.9% vs 5.6%), 4 min (5.2% vs 4.7%) and 1 min (3.4% vs 2.3%) that did not clearly favor maximal training. However, maximal mean power over 30 s (-6.3% vs 1.4%), 15 s (-0.8% vs 3.5%) and 5 s (0.8% vs 1.9%) showed that submaximal training was superior. Smit

A daily low dose of **fish oil** for 8 wk apparently improved economy in a 5-min time trial, but it didn't significantly change time-trial time (no data shown), and in a preceding set of six 30-s Wingates mean power was down by a non-significant 6.2% in this randomized controlled trial of 26 trained males. More data are needed before you try fish oil for performance. Hingley

Maintaining a high **carbohydrate** intake during periods of **intensified daily training** (9 days) appears to be important in offsetting mood disturbances and reducing performance decrements associated with short-term overreaching with competitive cyclists. Killer

Ingestion of **sodium bicarbonate** vs placebo prior to **high-intensity interval training** sessions for 6 wk led to huge increases in incremental peak power (10.6 vs 8.8%) and modest increases in time to fatigue (75 vs 55%: divide these by 15 to get time-trial effects) in this controlled trial of 19 active men. The differences between groups were "not significant", presumably because of large individual differences in the responses arising from the initial low training status of the subjects, so it's unclear whether it's worth taking baking soda before you train for endurance events. Magnitude-based inference might help here. Hawke

Reviewer's Comments

I am a big fan of sport-specific conferences that attract practitioners, coaches, sport scientists academics and the commercial sector, because they encourage great interaction and an opportunity for myths to be busted. These conferences also provide a unique environment for introducing and discussing contemporary state-of-the-art approaches to improving performance and health. Combining the conference with the start of the Tour de France allowed many unique and busy presenters to fit this event into their calendar. Complements to conference organisers for a very enjoyable couple of days.

It's worth noting that Dr Carsten Lundby's unique views on the altitude-training dose-response relationships are not universally agreed upon. For those interested in an alternative view read the very insightful and comprehensive meta-analysis presented by Prof. Chris Gore and colleagues from the Australian Institute of Sport (Gore et al., 2013). There's nothing like a good debate and a bit of controversy to attract some new PhD students to investigate some of the many interesting questions associated with altitude training for elite cyclists.

Finally, complements to Carl and Will for providing insights into the conference proceedings. Interesting research findings and opinions are emerging at a rapid rate in sport science. These peer-reviewed summaries of conference proceedings provide practitioners with a time-efficient way to keep up to date.

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