

## The 2015 Meeting of the American College of Sports Medicine

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Priority themes at the 62nd annual meeting of the American College of Sports Medicine were clinical sports medicine, sport nutrition, exercise physiology and population physical activity. There were few abstracts with a focus on high-level sport performance. [Featured Presentations](#) included science of resistance training, history of sports nutrition, limits of VO<sub>2</sub>max, pediatric issues, extreme exercise, lactic acid, fraud, fatigue, dehydration, energy balance, concussion, cherry juice, inflammation, and Ball State. [Noteworthy Abstracts](#) focusing on performance and injury prevention are summarized under the following headings... [Acute Effects](#): non-circular chain rings, whole-body vibration, hypoxia pre-conditioning. [Correlates of Performance](#): genes, tests, football-match distance. [Injury](#): core stability, ankle instability, concussion, ACL. [Nutrition and Drugs](#): iron deficiency, high-K meal, paracetamol, betalain, astaxanthin, NAC, cherry juice, caffeine, β-alanine, bicarbonate, chocolate milk, probiotic plus α-lipoic acid, colostrum, beetroot, nitrate, carbohydrate, fish oil. [Talent Development](#): swimming participation, Olympic/worlds participation. [Training](#): overtraining marker, brain training, breath holding, Pilates, hypoxia, blood-flow restriction, barefoot running, dynamic stretching, Thrower's-Ten program. KEYWORDS: anabolic, elite athletes, ergogenic aids, nutrition, performance, tests, training.

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Some 6,400 delegates travelled to San Diego, California for the 62nd Annual Meeting of the American College of Sports Medicine (ACSM) at the San Diego Convention Center, May 26-30. Regular attendees of the ACSM meeting are familiar with sheer size and scale of activities that make selecting sessions a bit of a challenge. This year ACSM also hosted the 6th World Congress on Exercise is Medicine and the World Congress on the Basic Science of Exercise Fatigue. Here we present commentary and analysis of selected sessions: featured presentations of keynotes, symposia and tutorial lectures, which lack abstracts (by David Pyne and Shona Halson) and noteworthy abstracts of the free communications and poster presentations (by Will Hopkins).

### [Featured Presentations](#)

[David Pyne and Shona Halson](#)

The conference program followed the usual format of previous year: several pre-conference programs including nutrition, Exercise is Medi-

cine and research training, followed by three and a half days of the main meeting. A big problem that the ACSM needs to address is the small attendance of delegates on the final Saturday morning. It was embarrassing to see invited symposia and even the President's Lectures so poorly attended. Some posters were being removed at 10:30 am as delegates departed early. One school of thought is to run the main conference from Tuesday to Friday then have the satellite programs on the Saturday – worth a try.

The 3500 abstracts were available online or as a pdf prior to the meeting. The mobile app worked really well and is a great addition – just a pity the free WiFi didn't extend to the meeting rooms. The standard of organisation certainly met the typically high expectations for the ACSM Annual Meeting. There was also a large number of formal meetings (interest groups, journal editorial boards) and informal meetings (alumni reunions, other receptions) conducted

in and around the main program. The trade exhibits had plenty to interest the delegates from instrumentation and equipment, to publications, software and increasing consumer technology and wearables. Our US colleagues certainly know how to run large scale meetings and conferences.

The strongest areas of the conference were athlete care and clinical medicine, exercise and health, physical activity and inactivity, physiology and nutrition. The Basic Science of Exercise Fatigue congress featured several sessions on this important topic, with notable keynote speakers including Michael Joyner (historical aspects), Roger Enoka (fatigue and performance), and Michael Reid (reactive oxygen species). The science was pretty impressive, although the practical applications of muscle research at the level of the cross-bridge (for example) were not always easy to discern.

#### **Bill Kraemer: Science of resistance training**

Bill Kraemer opened the meeting with the J.B. Wolfe Lecture on *Scientific Evolution of Resistance Training*. He outlined a global set of questions addressing the means of building stronger, bigger, powerful bodies underpinning enhanced sports performance. A cluster analysis of relevant publications over the last 50 years highlighted the contributions and lead authors in the areas of applied and clinical work, physiology, metabolic pathways and bone/health benefits. The paucity of good studies on females needs addressing. Kramer contended that research has played important roles in the periodization models of strength and endurance, and that individual variations in response to training are being elucidated by physiological explanations in the areas of satellite cells, mitochondria, hormonal profiles, somatotype and muscle fiber composition.

#### **Ron Maughan: History of sports nutrition**

Ron used his encyclopedic knowledge of sports, sports nutrition and research for the Bruce Dill historical lecture on *Landmarks in the Development of Sports Nutrition*. There is over 100 years of study in some areas of sports nutrition, which prompted Ron to implore interested delegates to be a student of history – we can learn from the acute insights made long ago. In more recent decades advances in macronutrient metabolism, hydration, neurotransmitters, central fatigue and peripheral fatigue are underpinning contemporary practices, but

there is much to learn. Like Bill Kraemer, Ron was generous in acknowledging the contributions of others from well-known scientists to the relatively obscure.

#### **Peter Wagner: What limits VO<sub>2</sub>max?**

Peter Wagner in his usual highly elegant and authoritative style championed a systems approach to this perennial question. He quickly asserted that asking whether VO<sub>2</sub>max was limited by oxygen transport (air to mitochondria), or oxygen utilization by the mitochondria, was not the right question. Peter laid out a persuasive case, based on experimental studies, that both improved O<sub>2</sub> transport and mitochondrial use of O<sub>2</sub> can explain adaptations to submaximal and maximal exercise. This knowledge can inform design of athlete studies examining issues such as energetic profiling in the laboratory, altitude training, and adaptations to endurance training.

#### **Pediatric issues: Kids, sports and injury**

Andrea Straccolini examined the issues of the elite child athlete and risk of injury. The take home messages were that pre-season conditioning can reduce injury rates, warm-up can lower the risk of lower extremity injury, overuse injury is itself a predictor of injury, and injury often initiates unfavorable weight gain. These issues seem to be important for both youth and adult populations. Peak height-velocity assessment can be useful in research settings. Sleep appears to be an injury risk factor (<8 h sleep associated with 1.7-fold higher risk of injury), and early sports specialization was associated with an almost two-fold greater risk of injury.

#### **Extreme exercise: Where do we draw the line**

Cardiac specialist Aaron Baggish detailed studies of cardiac adaptations to exercise and training. Remodeling is a complex process related to genetic, lifestyle and training issues in athletes and sedentary individuals spanning young adults to the elderly. Reference was made to Greg Whyte's research showing, in a small minority of individuals, that fibrosis and cardiac muscle scarring is related to training load. Baggish advised coaches and clinicians to discuss relationships between health and performance, plan for annual periodicity in training loads, employ effective warm-ups and cool-downs, prepare carefully for extreme events, respect a virus (cardiomyopathy), and watch for warning signs.

### **Lactic acid: Friend or foe?**

Bob Fitts and Hakan Westerblad were pitted against each other in a session addressing whether lactic acid is the primary cause of fatigue (Fitts pro, Westerblad anti). Westerblad outlined experimental evidence via single isolated muscle fiber models indicating low pH is not important and that impaired contractility is the primary mechanism of muscular fatigue. He concluded that lactate and  $H^+$  are good markers but not the makers of fatigue. In contrast, Fitts contended that multi-fiber models show that increased  $H^+$  decreases  $Ca^{2+}$  myofibrillar sensitivity,  $Ca^{2+}$  release from the sarcoplasmic reticulum, and ultimately muscle power. So what does this mean for the sports science practitioner? Lactic acid or blood lactate monitoring can be useful, and there is a case for buffering agents, but other factors relating to muscle performance and fatigue need considering.

### **Fraud in Exercise Science**

A panel of exercise scientists including Carl Foster, Steve Blair, John Porcari, David Pyne and Jeffrey Beale explored the issue of fraud in exercise science. Porcari spoke to the need for evidence-based guidelines in the fitness and sporting communities based on research with quality designs, methodology, analysis and interpretation. Beale gave an insightful critique of the predatory practices (spam emails, fake peer review, false claims to legitimacy) of some online open-access journals, and how this is impacting negatively on research and publication standards as some authors are drawn to the convenience of cheap, easy and fast publishing. It was alleged that some databases are now filled largely with junk science. Beale offered education and awareness as two immediate preventative actions.

### **Fatigue: Mechanisms**

Several sessions provided the opportunity for review of basic science studies of the mechanics of fatigue, including muscle glycogen,  $O_2$  transport and utilization, and neural and biochemical sources. The physiologist should have a working knowledge of central and peripheral neural control mechanisms, contractile elements, bioenergetics in the muscle, and how these regulate  $O_2$  delivery for endurance events, and force/power generation for other sports. Roger Enoka proposed a framework of exercise-related fatigue that integrates perceptive elements (subjective) with the various physio-

logical elements (objective). He called for more uniform terminology and explicit language, a systems rather than a reductionist approach for measuring factors that constrain performance, and a focus on primary outcome measures (including exercise and sports performance).

### **Fatigue: Neural Adjustments**

There is increasing interest and evidence regarding the role of the central nervous system in the development of fatigue. Romain Meeusen discussed the use of dopamine and noradrenaline inhibitors during exercise in the heat. These pharmaceuticals can enhance performance and increase core temperature, without a change in perception of effort. Their use can therefore be dangerous. Stimulation of the dopaminergic system can increase motivation and suppress heat-loss mechanisms. He also outlined recent research investigating brain activity (using electroencephalography-EEG) following exercise. A decrease in beta activity was found, which equates to a decrease in information processing and a decrease in fuel use in the brain.

Jacques Descateus outlined the mechanisms of central fatigue, including decreased voluntary drive, decreased afferent feedback, and antagonist muscle activity. He suggested that endurance time on a fatiguing task is constrained mainly at the spinal level.

Janet Taylor described the role of motor neurons during fatigue and described the manner in which motor-unit firing decreases during fatigue. Serotonin from the medulla may influence motor-unit firing.

Finally Markus Annan presented on some of his fascinating work using fentanyl blockade at the spinal level to block III and IV afferents. This work highlights the role of muscle afferents in fatigue.

### **Dehydration**

The notion that controversies are often matters of language and research methodologies underpinned an invited presentation from Sam Chevront on dehydration and fluid replacement. Although there is debate among a few laboratories on thresholds of urine osmolality for determining hydration status, a simple three-factor model for field use with athletes should be effective: monitoring changes in body weight, checking urine composition with color sticks, and accounting for self-reported thirst (all recorded early morning).

### Energy Balance

Simple models of calorie balance between input (diet) and expenditure (exercise) are largely discredited, particularly in elite athlete settings. Dan Bernadot, a sports nutrition researcher and practitioner, provided compelling evidence that simply counting calories on a daily basis doesn't work and should be discarded. He indicated that inappropriate models, belief triumphing over scientific evidence, misattribution of perceived benefits, over-simplification of good and bad foods, and the eternal search for a magic bullet, have all conspired to make nutrition a real challenge for practitioners, coaches and athletes. A more insightful approach that details the timing of the nutrient load with exercise and training sessions is recommended, an approach that has also been championed by John Hawley, Louise Burke and other nutrition experts. In practice, this understanding points to more frequent snacking rather than end-of-the-day bingeing for better training management, performance, body composition and well-being.

### Concussion in sport and war

Concussion in sport is one of the most topical issues in science and medicine. Todd May from the Naval Hospital Camp Pendleton described symptoms that are similar for athletes who have experienced concussion and soldiers who have experienced a blast concussion. These symptoms include headaches, photophobia, anxiety, amnesia, confusion and difficulty sleeping. Sideline tests and appropriate follow-up are needed for determination of return to play.

### Cherry Juice for Recovery and Health

Stella Volpe summarized the studies supporting the role of cherry juice in increasing recovery from exercise, reducing inflammation and oxidative stress, and improving sleep. An 80% increase in slow wave sleep was reported. The effects on improved sleep and recovery are likely related to the anti-oxidants and melatonin in cherries, although questions have been raised about the bioavailability of the melatonin.

### Nutrition for Inflammation and Pain

The role of nutrition in reducing inflammation and pain has gained research attention, particularly in patients with chronic health issues. Erin Danneker described the importance of acute pain from a protective perspective and that expecting or fearing pain can affect motor behavior. Some evidence exists for caffeine, omega-3 fatty acids and polyphenols in reduc-

ing pain. Mary Miles reported evidence for anti-inflammatory effects of strawberries, raspberries, orange juice, tomatoes, red wine, extra virgin olive oil and avocado.

### Inflammation

To address the perennial question of how one can differentiate between adaptive and non-adaptive processes during environmental stress, Pope Moseley presented results of several laboratory-based experiments measuring cytokine and heat-shock protein responses to exercise stress. Which cytokines to measure and when are questions that have challenged many sports scientists. Moseley contended that heat-shock protein is a key modulator of inflammatory processes and performs the role of the master controller switching protein management between damage clearance (tissue breakdown) and rebuilding (tissue repair). The take-home message for researchers of inflammation was to choose cytokine and protein markers carefully to get the right balance of pro-inflammatory, anti-inflammatory and immune-regulatory measures.

### Ball State University 50 years on

A late afternoon session chaired by Mark Hargreaves and Ed Coyle, in the presence of Dave Costill and other Ball State staff and alumni, provided a sentimental view of the long journey. From humble beginnings in the mid-1960's, Ball State has been a powerhouse of physiology and performance research, delivering several generations of students (many of who have gone on to establish their own names), and making connections into the sports community. Mark commented that Dave's greatest legacy was the integration of the underlying physiology with practical applications, and translation of outcomes into lay papers with a wide audience. ACSM also celebrated the life of former president Jack Wilmore, who was a long-time colleague and co-author with Dave Costill.

### Noteworthy Abstracts

#### Will Hopkins

As usual, the focus of my report is athletic performance and injury prevention, topics that were represented by only a small proportion of the presentations. One again I did not attend the meeting, but I have summarized the abstracts of the slide and poster sessions, where all the new research was presented.

The ACSM [conference site](#) provides various

links to information about the meeting, and you can access the conference abstracts via [this link](#). Download all seven PDFs and merge them into one document, then use the advanced search form (Ctrl-Shift-F) in Adobe Acrobat to find abstracts featured in this report via the number in brackets [...]. You will get several hits, but you can quickly home in on the right one. The abstracts are also freely available in the [May supplement](#) of *Medicine and Science in Sports and Exercise*, but searching for individual abstracts via the abstract number with the advanced search form (enter 47 in the Volume field and 5s in the Issue field) can be inefficient.

This year there were fewer fascinating findings to make up for the shortfall in quantity. Here are my picks: predicting injury with [iPod-based measurement of core stability](#); five case studies of [iron non-deficiency](#); the ergogenic effects of [a high-potassium meal](#), [paracetamol](#) and [betalain](#); and a possible [blood marker for overtraining](#).

#### Acute Effects

The title says it all: "**noncircular chain rings** do not improve maximum cycling power and joint-specific power during maximal cycling" in 10 trained **cyclists** [910].

"In cross-country **mountain biking** the start is important due to the importance of a good position when entering the single track where it is difficult to pass other cyclists." So these researchers investigated the effect of **whole-body vibration** combined with body-loaded half squats (mediated theoretically by post-activation potentiation) on 15-s all-out sprint performance 1 min later in a crossover with 11 well-trained cyclists. And they got 4.4% in peak power and 2.7% in mean power, easily substantial in terms of medals. [3299] But how can you do whole-body vibration secretly 1 min before the start on race day?

**Whole-body vibration** added to static stretching impaired split-jump performance in a crossover of 27 young female **gymnasts** [1932].

Should you go **up the mountain** on the morning of the competition or the night before? There was "no difference" in mean power in a crossover when 10 highly trained male athletes (**cyclists**?) performed a 20-km time trial after 2 h or 14 h in hypoxia equivalent to 2500 m. [2581]. But 14 h tended to be better, by a substantial 1.3%, so by then they may have already

started acclimatizing. Two other abstracts on related topics [2580, 2582] were missing from the PDF and were not in the supplement issue of MSSE.

#### Correlates of Performance

There were the usual huge numbers of studies here, but they had to have a good sample size and practical relevance to make the cut.

There was a thematic poster session of associations between **athletic performance** and various **genotypes**, but nothing exciting [1597-1603].

Of all the usual **anthropometric** and **performance-test measures** taken before an **ice-hockey** season, only the beep test and shuttle run contributed to a step-wise multiple correlation with game performance (total points from goals and assists) of 151 male bantam- and midget-level forwards. Together the correlation was only 0.35, so "to augment hockey success in adolescence, an emphasis should be placed on increasing aerobic- and agility-fitness parameters." [3540]. Sure, but don't neglect skill!

My impression from the recent [world football conference](#) was that the losing team covers more ground in **football** matches. So what are we to make of this study of the 611 players in the 32 games of the 2014 World Cup, showing that total **distance traveled** in a game had a positive correlation of 0.41 with points scored? **Passes completed** also had a substantial correlation of 0.33, but in a stepwise analysis this and other performance indicators (goal attempts, recovered balls, tackles, goalkeeper saves, and maximal running speed) did not add anything to distance covered [3545]. I suspect that player position is confounding the relationships: midfield defenders cover less distance and score less goals, so once the authors account for player position, a very different finding may emerge.

#### Injury

An iPod-based application was developed to record a field-based measure of **core stability**: anterior/posterior pelvic tilt during a single-leg raise test. In a prospective study of 347 minor- and major-league **baseball pitchers**, those with poor core stability had 2-3x the risk of at least 30 days of injury, and they had twice as many days injured. "Team staff found the tool easy to use and incorporate into their training programs [43]." Poor core stability was associated with similar risk of injury in collegiate athletes gen-

erally in [last year's ECSS report](#). Core training monitored with this test would be worth implementing.

A custom-made auditory feedback device decreased lateral pressure during treadmill walking in 10 **individuals** with chronic **ankle instability**, but "long-term effects of using this device should be evaluated before providing clinical recommendations [531]."

There were numerous sessions devoted to clinical aspects of **concussion** [A-28, 106-113; E30, 2369-2371; F-16, 2644-2651]. The presentations were outside the scope of this article, with the exception of the following three...

The authors of this study of 223 amateur **boxers** believe they have developed a side-line questionnaire that is "brief, valid, reliable, and discriminating, as well as practical" to identify **concussion** [2371].

A lighter and less expensive **head-impact sensor** did a poor job compared with concurrent measurement with the Head Impact Telemetry System in this study of 17 middle-school (American?) **football** players [118].

When a general **warm-up**, placing emphasis on normalizing movement patterns, vestibular ocular reflex, and ACL injury-prevention exercises, was performed before all practices and games in a season, there were no **concussions** in this grossly underpowered but promising study of 17 Virginian high school female **soccer** players [2370].

**Anterior cruciate ligament** (ACL) injuries also featured in multiple sessions [A-45, 330-363; B-62 972-978; E-14, 2179-2186]. I found these two presentations relevant to this report...

**Oral contraceptive** use had a small protective effect on **ACL** injury in a case-control study of 12,819 cases of ACL reconstruction, but only in **women** in the two youngest age groups (15-19 y and 20-24 y; odds ratios of 0.82 and 0.89, which would be the same as the hazard ratios) [975].

"Biomechanical studies have shown that greater **dynamic knee valgus** is associated with the development of **knee injuries**, especially in women [e.g., 330]." Hence a study of college-age **students** showing that "these data support the use of [knee] bracing for activities and sports that involve significant loading of the knee [337]." But I'd be worried about the brace causing muscle weakness with long-term use, unless specific strengthening exercises were

included.

### Nutrition and Drugs

Five **endurance athletes** (2 men, 3 women) diagnosed as **iron-deficient** on the basis of low serum ferritin showed only a transient increase in serum ferritin and no substantial changes in any other physiological markers or performance following intravenous iron injections over the following 16 months. "This [finding] questions the utility of serum ferritin or the cut-off value to indicate iron deficiency [2932]."

Surprisingly, seven **track athletes** ran 8.8% longer in a short time-to-exhaustion test (~2.5 min) after a **high potassium meal**. That's probably ~2% in a time trial, and it was a clear effect [2060]. Someone please repeat this study!

Try **paracetamol** for endurance. Compared with placebo, acetaminophen (paracetamol) supplementation improved time to exhaustion at VO<sub>2</sub>max speed by 8.2% (equivalent to ~0.5% in a 7-min time-trial) in a double-blind crossover with 12 trained **runners** [1286].

Acute supplementation with **betalain**, an antioxidant in beetroot, improved 5-km running performance by 1.4% and reduced muscle-damage markers, soreness and fatigue in a double-blind crossover with 15 recreational **runners** [2871]. Another study worth repeating.

Three months of supplementation with the antioxidant **astaxanthin** in a double-blind randomized controlled trial with 20+20 male **soccer** players resulted in "improved mucosal immunity in soccer players probably through reducing oxidative stress... and a significant blunting of the minor inflammatory response [3336]."

**N-acetyl cysteine** (NAC) has looked promising as an ergogenic antioxidant for intense exercise, but it had little effect on repeated-sprint performance in this crossover study of 18 recreationally active male **college students** [1284].

Some bad news for **tart cherry juice**: apparently there were no effects of this antioxidant on oxidative stress, inflammation, muscle damage or performance in a placebo controlled trial when 10+10 female collegiate **soccer** players consumed it for 7 d, with a hard training session on Day 5 and performance tests on Day 7 [2062]. No data shown, though.

And is it even bad news for **caffeine**? When it was consumed in pill or gum form, the mean power of the 8 trained **cyclists** in a 16-km time trial was down by 1.2% or 2.3% compared with

placebo pill and gum [3315]. Not significant, though, and the "trained" cyclists managed only ~200 W in the test. Let's call it a Type II error.

But consumption of **caffeine** plus **B-group vitamins** improved several measures of **golf** performance compared with placebo in a double-blind crossover with 12 caffeine-habituated males with a USGA handicap of 3-10 [3316]. Why vitamin B?

A month of  **$\beta$ -alanine** ingestion improved some aspects of performance and a test of cognitive function in a randomized controlled trial of 9+9 **soldiers** in an elite combat unit. P values only [2197].  **$\beta$ -alanine** also increased time to exhaustion in a supra-VO<sub>2</sub>maximal test by 22% (maybe ~2-3% in time-trial mean power) compared with placebo in 11+11 female masters **cyclists** [2200].

Sadly, sodium **bicarbonate** supplementation had a negligible effect on performance in a double-blind randomized crossover study of nine experienced **rock climbers** [709].

**Chocolate milk** before going to sleep resulted in a 2.4% faster 10-km run compared with a "flavor-matched placebo" (composition not stated, presumably a eucaloric sports drink) in eight female **runners** [1839]. So it's likely beneficial, but not if you want to "sleep low" to get more adaptation.

Results of a study of the effects of a **probiotic** supplement and/or  **$\alpha$ -lipoic acid** supplement (an antioxidant) on gut permeability and Ironman triathlon performance were spread over two abstracts. It looks like the probiotic does reduce gut permeability somewhat. Effects on **Ironman** performance are a bit suspect, because the data weren't repeated measurements. Data from a 60-min cycling time trial (which might have been repeated measurements) showed a benefit for  $\alpha$ -lipoic acid but not for the combined supplement [1294, 1296]. More data needed.

**Bovine colostrum** for 8 wk appeared to work better than soy protein for vertical jump (6%) and shuttle run (9%) (but not arm or leg strength) in a randomized controlled trial with 29 **rugby** (union) players [2204]. But whey protein would be a better best-practice control.

In a pre-post crossover, seven trained athletes (5 **cyclists**, 2 **alpine skiers**) experienced a non-significant 2.5% enhancement of sprint power following consumption of nitrate-replete vs nitrate-depleted **beetroot juice**. Analyzed as a

post-only crossover (by me), the effect was a 1.7% impairment. I don't think this underpowered study does anything to resolve the effect of nitrate [718].

This study of **nitrate** supplementation doesn't add much, either. In a crossover with 17 trained **cyclists**, there were no significant differences in performance of a 10-km time trial following a pre-load between 6 d of supplementation, 1 d of supplementation, and placebo. Relative to placebo, the effects of 6 d and 1 d on mean power in the time trial were 1.3% and -0.6% [2199]. So the data are consistent with a small benefit of 6 d, but the cyclists weren't that exceptional. Top cyclists would get no benefit, probably.

A meta-analysis of **carbohydrate mouth-rinse** studies showed that it had a small effect on **endurance** performance [1300]. How much of the effect is attributable to publication bias?

The abbreviations make it almost impenetrable, but it looks tapering did not improve performance in female **runners** who did not maintain **energy availability** [3221].

The results were also impenetrable in a crossover of 16 trained male **cyclists**, but the conclusion was clear: "in order to optimize performance, athletes undertaking repeated high-intensity exercise bouts should ingest **glucose** prior to exercise, but not between exercise bouts [3259]."

Sleeping without replenishing **low carbohydrate stores** (the "sleep low" strategy) had "minimal effects on sleep quality and basic components of immunity" in a randomized controlled trial of 11+10 trained **athletes** [2653], so no side effects with this strategy.

"**Carbohydrate** intake during a **basketball** game may lead to performance improvements in the latter moments of a game [3261]."

**Fish oil** or extra-virgin **olive oil**? I would have thought they might both be good for performance, but in a pre-post crossover with 10 trained male **cyclists**, mean power in a pre-loaded 15-km time trial after supplementing for 4 wk declined, but less on fish oil (-1.2%) than on olive oil (-4.4%). Strangely, distance traveled in the time trial increased on fish oil (1.5%) but declined on olive oil (-2.9%) [3310]. An underpowered study, or a typo?

#### Talent Development

"Nearly half of the top 100 nine-year-old **swimmers** [in the US] continued to excel at an elite level during late adolescence," and there-

fore "**persistent participation** may represent a strategic priority [2562]." I can't see how.

Does prior **Olympic or world championship experience** affect performance at future championships? It's an important question, but it wasn't answered properly in this study of **Team USA athletes** between 2000 and 2013 [2807]. What's needed is a comparison of career performance of athletes with comparable ability who qualified but *did vs didn't* go to the Olympics or world champs first time around.

### Training

It looks like serum **kynurenine** (a precursor of NAD+) could be a useful marker of **over-training syndrome**, to the extent that it was higher in seven sufferers thereof compared with that in recreational athletes ( $3.3 \pm 0.9$  vs  $2.4 \pm 0.4$  nmol/ml). See the abstract [749] for the explanation of the possible role of kynurenine.

As per [last year's ECSS meeting](#), "the results of this study [of 20+20 male **volunteers**] provide initial evidence that the combination of **brain endurance training** [with a mentally-fatiguing task] and standard endurance training is more effective than standard endurance training alone," but of course, "future studies should investigate... elite endurance athletes [754]."

Training with **breath holding** reduced respiratory muscle fatigue in a controlled trial with 25 elite **swimmers**, but "no performance improvements were observed [1335]."

Eight weeks of **Pilates** improved balance in a controlled trial of 10+10 **archers** [2299].

Five days of sprint training in **hypoxia** was apparently enough to improve sprint performance in a randomized controlled trial with 6+6 male college **sprinters** [3055]. If the hypoxia wasn't blinded, it's probably a placebo effect.

Interval training for 7 d in **hypoxia** vs normoxia had little effect on anaerobic running performance of 8 female **runners** in a crossover with a 5-month washout [3058]. An apparent improvement in VO<sub>2</sub>max was reported as a difference in significance, so it's not good evidence of benefit.

The inclusion of ten **blood-flow restriction** sessions during 6 wk of strength training produced significantly larger gains in muscle thickness and cross-sectional area than normal training in a randomized controlled trial of 9+8 national-level **powerlifters**, but "no [significant] differences were observed [or reported] in strength [3088]."

An improvement of 3.1% in 5-km run time followed 10 wk of **barefoot running** in an uncontrolled study of nine previously shod runners [3218].

Six weeks of **dynamic stretching** improved 30-min run distance by 3.4% in 15 **runners**, but the effect in the control static group of 15 was apparently not significant and wasn't reported [3487]. So what about the significance of the difference in the changes? This kind of reporting is really not on.

The **Thrower's Ten Program** is designed to exercise the major muscles necessary for throwing. When 17 elite **underwater hockey** players performed the exercises 3 d/wk for 6 wk, there were various improvements in their flicking performance in this uncontrolled study [3536].

### Reviewers' Comments

Pitre Bourdon

Compliments should once again be given to this year's authors of this report for producing yet another comprehensive ACSM conference summary.

With so many concurrent sessions it is often a difficult task for an attendee to decide on which session to attend. Combine this with the fact that poster sessions are also run simultaneously, and attendees can often find themselves short on time and disappointed at having to miss a session of potential interest. This disappointment can even turn to frustration when poster presenters fail to put their posters up on time, or remove them early. The extra 30-minute time slots which posters are supposed to be displayed before and after the oral sessions are important for time-poor attendees and those authors who chose not to display their research for the full time allocation are potentially missing out on an opportunity for valuable scholarly discussion and perhaps even future collaborations. Maybe the ACSM organizers could consider adopting a take on the ECSS model by making the final versions of all posters available on-line after the conference, rather than just the original submission abstracts.

Finally, as has increasingly been the case at recent ACSM conferences, the number of presentations focusing on sport performance unfortunately appears to be dwindling. In order to address this issue, I recommend that we refer back to Randy Wilber's recommendations in his [comment](#) for [last year's ACSM Conference](#).

### Jeni Pearce

There were numerous papers on bicarbonate supplementation, and probiotics was also popular for poster presentations. In the two sessions I attended on ergogenic aids, which were well covered in this review, only one supplement had been tested to see that it actually contained the ingredients and amounts the manufacturer claimed (green tea) and were certified for use with athletes who could be tested under the WADA code. Two studies using vegetable based (sweet potato) sports drinks with a ratio of glucose: sucrose: fructose (13.5:5.1:5.1 g) reported a benefit compared to control (water). The beverage was reported to be palatable and may become commercially available in the future.

An enlightening session mentioned in the review (Dealing with Fraud in Exercise Science) initially focused on the outrageous claims about food products, weight loss and exercise programs and several devices (including the Power Balance wristband). A nutrition example involved oxygenated water, which was shown to work via a placebo effect (see [this link](#) for a popular summary). David Pyne gave an informed presentation on fraud and its documentation. He presented the AIS fraud policy in detail: areas covered included accounting and equipment theft, unlawful use of property,

wrongful use of intellectual property, deliberate and dishonest use of information, and providing false and misleading information. Signs of fraud include unwillingness to share duties, lifestyle above financial means, and the provision of gifts.

The final presentation in this session focused on journals falsely claiming to be peer reviewed and to meet high scientific standards. Spam emails are used to call for papers, and there is evidence of plagiarism, self-plagiarism, duplicate submissions, and self-referencing in articles to increase citations. Prospective authors are often misled by false impact factors. The focus was on open-access journals, but not all such journals are predatory. Jeffery Beall from the University of Colorado in Denver, who presented this section, has an [interesting blog](#) on this issue. At ACSM he talked about "paper mills", where papers can be arranged to be written by a third party on any topic. There is currently no law enforcement, these companies operate internationally, and with no subscription to cancel they are a challenge to identify.

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