

LETTERS TO THE EDITOR

$\dot{V}O_2$ slow component and performance in endurance sports

EDITOR,—I read with interest the leader by Veronique Billat entitled " $\dot{V}O_2$ slow component and performance in endurance sports".¹ Oxygen uptake kinetics in general, and the aetiology of the $\dot{V}O_2$ slow component phenomenon in particular, are certainly topics of great conceptual and practical importance. However, there were several points of contention within Dr Billat's article that should be brought to the attention of readers so that an informed and balanced debate can take place.

Dr Billat states that "A high range of work (rates) can be identified at which there is a sustained increase in blood lactate . . . with time. These responses decline back towards a baseline value." These two sentences, which are applied to a description of the physiological responses to moderate intensity exercise, are clearly inconsistent. It is also stated that during moderate exercise "oxygen uptake stabilises at about 80% in high level marathon runners". This suggests that $\dot{V}O_2$ will reach a steady state close to 80% $\dot{V}O_{2MAX}$ irrespective of the absolute work rate within the moderate exercise intensity domain. However, it should be remembered that moderate intensity exercise is, by definition, any exercise that is performed below the lactate threshold. Therefore constant load moderate exercise can lead to the attainment of a steady state $\dot{V}O_2$ of between ~10% and ~80% $\dot{V}O_{2MAX}$ depending on the absolute work rate and fitness of the individual subject.

In her article, Dr Billat appears to support the widely held view that the maximal lactate steady state velocity and the critical velocity (which, by the way, corresponds to the horizontal and not the vertical asymptote of the hyperbolic relation between velocity and time to exhaustion) represent the same physiological transition point. However, it is difficult to reconcile this viewpoint with Dr Billat's statements that when "the rate of appearance of blood lactate exceeds the rate of disappearance . . . $\dot{V}O_2$ reaches a steady state that is higher than the $\dot{V}O_2$ requirement" and "(time to exhaustion at) critical velocity is reduced to less than 30 minutes". If Dr Billat believes that critical velocity occurs at a higher intensity than the maximal lactate steady state, then she should support this position with references. I am unaware of any studies that have compared the directly determined critical velocity and maximal lactate steady state in runners, and the more thorough studies in cycling suggest that the two may be viewed synonymously.² Dr Billat also states that time to exhaustion is limited above the critical velocity "because of rapid glycogen depletion". To my knowledge, there is no evidence to support this assertion, and it would be safe to say that fatigue at these exercise intensities may result from a number of different mechanisms.

On the mechanism for the $\dot{V}O_2$ slow component, Dr Billat states that this ". . . is mainly due to the recruitment of fast fibre type II fibres (sic) with fatigue". This is something of an oversimplification. Although it is true that the relative amplitude of the

slow component is well correlated with the proportion of type II fibres in the vastus lateralis,³ a great deal of additional work must be carried out before the recruitment of type II fibres during heavy exercise can be unequivocally accepted as the mechanism for the slow component phenomenon. Dr Billat also states that the reduction in the slow component observed at the same absolute exercise intensity after endurance training occurs ". . . because of an increase in the distribution of type I fibres". Again, to my knowledge, there is no evidence that changes in the proportion of type I muscle fibres will occur as the result of a short term training programme. It is also difficult to understand Dr Billat's assertion that ". . . the amplitude of the slow component is not linked to endurance at all". It seems implausible that a phenomenon that is causing $\dot{V}O_2$ to rise inexorably towards its maximum, and that is generally associated with a profound and increasing metabolic acidosis, is not related to endurance exercise performance. Indeed, in her own article, Dr Billat reports that, after a training programme that reduced the slow component, the time to exhaustion at the high intensity training pace was doubled.

Of greatest concern to me is Dr Billat's statement that ". . . fit endurance athletes . . . have no $\dot{V}O_2$ slow component". In several years of work in this field, I have yet to observe a single person (elite, well trained, recreationally active, or sedentary) in whom a $\dot{V}O_2$ slow component has not been shown during high intensity treadmill running. Dr Billat's reports of minimal slow components in highly trained runners can be explained by methodological problems in her studies.⁴ The subjects in these studies were not exposed to "square wave" exercise functions as is conventional in the serious study of $\dot{V}O_2$ kinetics but, rather, the treadmill belt velocity was increased gradually until the subjects reached the required velocity (which was not appreciably greater than the critical velocity) before timing was started. The $\dot{V}O_2$ slow component was then defined simply as the difference in $\dot{V}O_2$ between the value at three minutes and the value at the end of exercise. Given the faster $\dot{V}O_2$ on-kinetics in fit subjects, the reduced slow component in subjects who are aerobically fit or who have a high proportion of type I muscle fibres,³ and the fact that the slow component typically emerges at two minutes into heavy treadmill exercise,⁵ it is possible that Dr Billat's methods lacked the sensitivity to detect the slow component.

Dr Billat's work in identifying the type of training session that maximises the time spent at $\dot{V}O_{2MAX}$ may well be of some conceptual value. However, I feel that it should be acknowledged that there is no evidence that this type of training is more effective than other types in improving $\dot{V}O_{2MAX}$ or any other physiological correlate of endurance performance.

In conclusion, Dr Billat's observations and ideas are interesting and deserving of further study but I feel strongly that they should not be presented as fact (as they were in her article) until they can be confirmed by other groups. An over-reliance on unpublished observations, unreferenced material, and uncorroborated studies in review articles is unscientific and potentially misleading.

ANDREW JONES
Manchester Metropolitan University

1 Billat VL. $\dot{V}O_2$ slow component and performance in endurance sports. *Br J Sports Med* 2000;34:83-85.

- 2 Poole DC, Ward SA, Gardner GW, *et al.* Metabolic and respiratory profile of the upper limit for prolonged exercise in man. *Ergonomics* 1988;31:1265-79.
- 3 Barstow TJ, Jones AM, Nguyen P, *et al.* Influence of muscle fiber type and pedal frequency on oxygen uptake kinetics of heavy exercise. *J Appl Physiol* 1996;81:1642-50.
- 4 Billat V, Binnsse V, Petit B, *et al.* High level runners are able to maintain a $\dot{V}O_2$ steady state below $\dot{V}O_{2MAX}$ in an all-out run over their critical velocity. *Arch Physiol Biochem* 1998;107:1-8.
- 5 Carter H, Jones AM. Mathematical modelling of oxygen uptake kinetics during treadmill running. *J Physiol (Lond)* 1999;518:98P.

Impact of professionalism on injuries in rugby

EDITOR,—Garraway and colleagues have recently written an important follow up study¹ to their 1995 survey on rugby injuries in senior rugby clubs in the Scottish Borders.² This comprehensive review of rugby injuries and their implications set standards in injury definition and information gathering. They have now studied the same model and population to assess the changes over the last four years and to define increased injury rates, which have caused some concern. The authors conclude that this increase in injuries has resulted from the introduction of professionalism, which has been the major change in the game during the period between the initial study and the follow up. The emergence of paid players and the marketing of the sport has undoubtedly accelerated changes in the game. However, it is important to look at what professionalism means. A professional player is financially rewarded for what he does, which introduces the imperatives of pay, the pressure of his employers, the opportunity for increased fitness and strength, and the desire to return to sport too soon after injury. All of these factors are understandable and were to be expected.

However, hand in hand with the payment of top players has come a much broader professionalism. There are changing attitudes throughout rugby, and indeed throughout sport in general. The growth in sports science, which has led to a wider array of available information concerning nutrition, fitness, strength, and training techniques, has fuelled the desire for sportsmen and women, professional or amateur, to be better and more competitive. This professional approach to sport, and the increasing emphasis on winning, is further driven by the general commercialisation of sport as a pastime.

Rugby union is an evolving game. Changes to the Laws and style of play have been introduced to make the game faster and more attractive, and must continue to be closely monitored to define the emergence of new injury patterns. The dramatic increase in injury shown in this study should not only focus attention on the tackle and so called protective equipment, as the authors rightly suggest, but also on the increasing intensity and frequency of training and playing.

N J HENDERSON
Consultant Orthopaedic Surgeon,
Dept of Orthopaedics and Trauma,
Stoke Mandeville Hospital NHS Trust,
Mandeville Road, Aylesbury,
Buckinghamshire HP21 8AL, UK

- 1 Garraway WM, Lee AJ, Hutton SJ, *et al.* Impact of professionalism on injuries in rugby union. *British Journal of Sports Medicine* 2000;34:348-51.
- 2 Garraway WM, MacLeod D. Epidemiology of rugby football injuries. *Lancet* 1995;345:1485-7.

Hormones, offspring sex ratios, and weekly training distances of male runners: implications for overtraining

EDITOR.—Mackelvie *et al*¹ report that, within a group of male runners, free testosterone levels correlate negatively and highly significantly with the weekly training distance ($p < 0.005$). Crawford *et al*² reported that the offspring sex ratio (proportion male) of a sample of male runners varied significantly by their weekly training distance (table 1). Inspection of these data suggests that the regression of sex ratio on training mileage is U shaped ($\chi^2 = 16.7$, df 4, $p < 0.005$).

Table 1 Numbers of sons and daughters sired by male runners, by their weekly training mileage around the time of conception (data of Crawford *et al*²)

Weekly training mileage	Sons	Daughters
Nil	112	69
0–30	50	30
30–50	46	70
50–70	35	25
70+	19	17

There is now abundant evidence that the sex ratio of offspring of mammalian (including human) parents is partially dependent on the hormone levels of both parents around the time of conception.³

The relevant hormones almost certainly comprise testosterone, oestrogen, and the gonadotrophins, and probably progesterone. However, others—for example, growth hormone and thyroid hormones—may be implicated.

These data on sex ratios need confirmation, but, if confirmed, they would suggest endocrine involvement in overtraining. While the right arm of the U of the regression does not imply pathology, it is certainly suggestive of a process that is associated with pathology. So I suggest that hormone assays should be performed on male runners, particularly those who run more than 50 miles a week. One may wonder whether their established testosterone deficit is accompanied by an even more extreme gonadotrophin deficit.

WILLIAM H JAMES

The Galton Laboratory, University College London,
Wolfson House, 4 Stephenson Way,
London NW1 2HE, UK

- Mackelvie KJ, Taunton JE, McKay HA, *et al*. Bone mineral density and serum testosterone in chronically trained high mileage 40–55 year old male runners. *Br J Sports Med* 2000;**34**:273–8.
- Crawford E, Gilmore D, James WH. Running in the family. *Nature* 1992;**357**:272.
- James WH. Evidence that mammalian sex ratios at birth are partially controlled by parental hormone levels at the time of conception. *J Theor Biol* 1996;**180**:271–86.

What is a sports medicine specialist?

EDITOR.—I feel that I must respond to the recent article on sports medicine specialists.¹ After an editorial and several papers on the recognition of sports medicine as a specialty, this paper listed the 18 attributes considered necessary to be a sports medicine specialist. Of these only four (items 5, 10, 12, and 16) seem to me to be specialist. The others items are either attributes of all doctors (items 3, 4, 8, 9, and 11, possibly 12, 13, 14, 17, and 18) or firstaiders (items 1, 2, 6, and 7). Surely sports doctors and specialists should be more than that? They should be able to discuss the pros and cons of exercise, should have

detailed knowledge of the risks and benefits of different sports, and should be promoting the concepts of wellness and injury prevention. I think it would be useful to know the original background of the selected group of sports specialists who drew up this list although I suspect it will be they will be part of the orthopaedics specialty or that of accident and emergency. If any doctor can do what they suggest is “special”, and that you get free at point of contact in the NHS, I would question the validity of the concept of sports medicine as a specialty.

As an aside, if stabilisation of the cervical spine is the second most important attribute of a sports medicine specialist, how many sports specialists attending aquatic events know how to effect that in water and recover the casualty?

P SCHUR

Wiggo Cottage,
135 Main Road,
Wybunbury, Nantwich
Cheshire CW5 7LR, UK

- Thompson B, McNally O, Neill SO, *et al*. What is a sports medicine specialist? A pilot study. *Br J Sports Med* 2000;**34**:243–4.

Authors' reply

We welcome Dr Schur's letter and are glad that this small pilot study has stimulated his response. Indeed, his thoughts on the matter really bring one back to the title of the article—“What is a sports medicine specialist?”

The choice of Delphi methodology was specifically to allow a wide range of input to reach an initial consensus. We attempted to maximise the breadth of the study by offering both examples of similar studies and inviting as many responses as possible. Those involved in the pilot study had all shown their commitment and expertise in sports medicine by holding the Diploma in Sports Medicine. Their backgrounds were varied: nine are general practitioners, two are sports physicians, one is an orthopaedic surgeon, and one an accident and emergency specialist. Seven of the GPs also run sports medicine clinics. The sporting backgrounds of those contributing to the study were also diverse, covering many major and minor sports.

Every person involved in sports medicine will have their own viewpoint based on personal experience, qualifications, sporting background, age, and outlook and a full study involving a much larger sample size will hopefully expose this. We look forward to the full study involving many of the cross section of members of BASEM (British Association of Sport and Exercise Medicine) in a greater number of rounds to get a more specific consensus.

By completing studies such as this, it should be possible to convince the sceptics that sports medicine is indeed a speciality which requires recognition rather than something which any doctor or firstaider can provide competently.

B THOMPSON

Sports Medicine Clinic, Craigavon Area Hospital,
Portadown, Northern Ireland BT63 5QQ

OMCNALLY
S O NEILL
D MACAULEY

Institute of Postgraduate Medical and Health Sciences,
University of Ulster, Ulster BT37 0QB,
Northern Ireland

BOOK REVIEWS

Physical activity. A guide for community action. US Department of Health and Human Services. (Pp 386; soft cover £26.50.) Leeds: Human Kinetics, 1999. ISBN 0-7360-0152-2.

As a general practitioner working in sports medicine and on a PCG board, I found this an interesting and stimulating book. Its main drawback is that it is written for an American audience, but it is a welcome resource and it would be good to have in a library or PCG/PCT office.

It is split into four main sections: the scientific background; strategies for planning action; approaches for intervention, including partnership working with social services, workplace, and schools; a large appendix including national reports and handbooks. I particularly liked the emphasis on the cycle of change, with many ideas on how to influence people at different stages of commitment to physical activity, which is a welcome evolution and synthesis of current health promotion ideas. As an HImP lead, I found ideas on the wider picture in the community and partnership working extremely helpful. Many general practitioners yearn for health promotion to be effective, and there is a lot here to encourage this to happen. At the end of each chapter is an extensive list of references, further reading, literature review, and information on related organisations, many of which have web and email addresses encouraging further research.

I have two recommendations: firstly, it could do with an appendix of UK organisations; secondly, all the resource information could come on an accompanying floppy disc or CD-ROM, which would make copying and further use very enticing. This would make a good book into something quite exceptional.

Analysis

Presentation	20/20
Comprehensiveness	20/20
Readability	20/20
Relevance	12/20
Evidence basis	20/20
Total	92/100

A LANGTON

GP/Sports Physician, Monks Park Surgery, Bristol
Doctor to Bristol Rovers FC and
England FA Youth Team

The GP quiz book 2. Further detection and management of physical disease. Alick Munro. (Pp 191; soft cover £17.95.) Abingdon, Oxon: Radcliffe Medical Press Ltd, 2000. ISBN 1- 85775-383-6.

This well presented paperback contains true/false and short answer questions based on recent articles from the *British Medical Journal* and the *British Journal of General Practice*. Chapters cover specialties, diseases, or treatment areas. Sports medicine is pitifully represented by only five questions (one less than the HIV section!); however, at least the GP reader is reminded therein of the implications of prescribing for sportsmen.

Never one to plough through weighty texts when studying, I preferred to use books of this kind to test areas of strength or highlight deficiencies. Somehow MCQs in exams were always worded slightly differently from those seen previously in a quiz book making them difficult to revise verbatim. The author admits that this book is not intended as a definitive text, and the subjects discussed are open ended with the aim of stimulating further reading. I would dispute the author's claim that the book can be used as an aide memoire in the consulting room; although it contains many facts and figures, it would be difficult to extract them quickly in view of the lack of a subject index.

The book was enjoyable and it highlighted one's tendency to study disproportionately on subjects in which one is already knowledgeable. However, the evidence base is very restricted and the *British Journal of General Practice* has recently received criticism from the profession for lacking flair and relevance to mainstream general practice.

This book could persuade GPs to begin their personal development plans, thereby avoiding accusations from postgraduate tutors of becoming overspecialised in certain areas (in my case sports medicine) while neglecting others of less personal interest but no less importance to everyday practice.

Analysis

Presentation	16/20
Comprehensiveness	10/20
Readability	14/20
Relevance	15/20
Evidence basis	8/20
Total	63/100

STEVE McNALLY

General Practitioner, Southport,
and Medical Officer, Liverpool FC Academy

NOTES AND NEWS

Sport and Exercise Working Group of the Royal College of General Practitioners

The Sport and Exercise Medicine Working Group of the Royal College of General Practitioners have elected a new chairman, Dr Paul Jackson, medical officer for English Rugby, who has a particular interest in medical education. This group has been very active in recent years and have organised a number of meetings, including the successful joint meeting with the BMA on the benefits and hazards of exercise. Sport and exercise medicine will also feature on the main programme of the 2001 spring meeting of the Royal College of General Practitioners.

Olympic success for Great Britain

Many members of BASEM were involved in the preparation of the Great British team for the 2000 Olympics. This was the most successful games in recent memory, with British athletes winning medals in many sports and many other remarkable performances outside the medals. The success of this team was greatly assisted by medical and scientific support. Lottery funding aided athletes in training but was also important in

financing medical and scientific support. The UK Sports Institute will play an important part in the continuing success of British sport and the development of sport and exercise medicine.

A journey through sports medicine, ethics, and the law

The Institute of Sports Medicine held a very successful meeting in association with the Section of Sports Medicine of the Royal Society of Medicine in November. It was entitled "A journey through Sports Medicine, Ethics and the Law" and it addressed some very difficult topics. Sport and medicine have a complex relationship and, while medicine can help athletes recover from injury and return to top level, medicine also has the potential to aid performance through illegal and unethical means. The participation of high profile members of the legal profession and media in this meeting reflects the major changes in sport and has implication for all those involved with high level sport.

Sports medicine and the Royal Society of Medicine

Dr John Lloyd Parry is President of the Section of Sports Medicine, of the Royal Society of Medicine, which was founded in 1994 with Sir Roger Bannister as its first President. Dr Parry has put together a very exciting programme for 2001 which, in addition to the academic programme, includes away days to Burghley Horse Trials, Wimbledon All England Tennis and Croquet Club, and a golf tournament at The Belfry. Further details are available from the RSM (tel: 020 7290 2987; email: Sports@Roysocmed.ac.uk).

2003 conference on sports medicine

The 2003 conference on sports medicine will be a joint venture between BASEM and BASES. It will take place in Sheffield and will be hosted by the Sports Science Research Institute. The theme of the conference is reflected in the title "The total athlete", a particularly apt title reflecting the partnership organisation and the content. The conference officers include Professor Roger Bartlett, who is chairman of the committee including Dr Simon Till as Treasurer, Professor Ian Maynard, BASES coordinator, and Dr Bryan English, BASEM coordinator.

Current concepts

The "Current Concepts" series, designed to provide an advanced update in key areas of sports and exercise medicine, has its next meeting on 8 December at Churchill College, Cambridge. These meetings offer continuing medical education for sports medicine and musculoskeletal medicine specialists and are particularly suitable for those at post diploma level and those who have completed an MSC.

Appointment of new editor

Dr Paul McCrory has been appointed editor of the *British Journal of Sports Medicine*. He is a neurologist in Melbourne, Australia, and has a long and distinguished career in sport and exercise medicine research and publishing. We wish him every success in his new role.

CALENDAR OF EVENTS

Diploma in Sport and Exercise Medicine, Great Britain and Ireland

This two part diploma examination will be held twice a year. Part 1 of the examination, consisting of a multiple choice question and short essay paper will be held in April and September in London, Glasgow, or Dublin. Successful candidates will proceed to part 2 of the examination in either June or November. This consists of an oral and a clinical, based on two OSCEs, and will be held at a single centre which will rotate every six months.

Further details: Examinations Department, Royal College of Surgeons in Edinburgh, Nicolson Street, Edinburgh EH8 9DW. Website: www.rcsed.ac.uk

20th national congress of the Société Française de Médecine de Sport: Physical activity, sport and health

6–8 December 2000; Paris, France

Topics include:

- Physical activity and fertility
- Sport and aging
- Rehabilitation

Further details: Pranacom, 40 rue des Blancs Manteaux, 75004 Paris, France. Email: pranacom@ifrance.com
Website: www.sfms.asso.fr

NSMI/BASEM Current concepts meeting on tendinopathies

8–9 December 2000; Cambridge, UK

Subjects covered include:

- Tendon science
- Achilles tendon
- Rotator cuff

Further details: Barry Hill, NSMI Medical Education, Medical College of St Bartholomew's Hospital, Charterhouse Square, London EC1M 6BQ. Tel: 020 7251 0583 x237; fax: 020 7251 0774; email: barry.hill@nsmi.org.uk
Website: www.nsmi.org.uk

UK Radiological Congress

21–23 May 2001; London, UK

Further details: UKRC Secretariat, PO Box 2895, London W1A 5RS, UK. Tel: 020 7307 1410/1420; fax: 020 7307 1414; email: ukrc@dial.pipex.com
Website: www.ukrc.org.uk

True or false?—answers

(T = true; F = false)

p 415: Standaert CJ, Herring SA. Spondylolysis: a critical review

(1) F; (2) F; (3) T.

Multiple choice—answers

p 415: Standaert CJ, Herring SA. Spondylolysis: a critical review

1 (d); 2 (b).