To whom it may concern,

Re: Lessons for Exercise Physiologists: Lecture about the effect of O_2 measurement errors on estimates of VO_{2max} and RER.

Via this letter I wish to thank Danny Rutar from Redback Biotek for delivering an important and informative lecture to the exercise physiology staff and postgraduate students at Liverpool John Moores University on 31st January 2019. The presented information uncovered flaws in the current technology and measurement routines that most of us use every day.

We all want to make accurate and reproducible estimates of VO_{2max} during incremental exercise until exhaustion (especially in top athletes) and of the respiratory exchange ratio (RER) during prolonged endurance exercise. Danny presented convincing data that this requires highly accurate calibration gas mixtures with 2 decimals for O_2 and CO_2 (eg 16.00% O_2, 3.99% CO_2, Balance N_2). Many users of indirect calorimetry systems in the UK may not be aware that the highest O_2 purity of gas mixtures delivered by BOC is ± 1.0% leading to the need to buy calibration gases from European countries or the USA. In addition highly accurate O_2 analysers are required, which are not present in all the metabolic carts that are currently on the market. In order to calculate VO_2 during exercise with a reasonable accuracy (1.5% error) the O_2 measurement error needs to be ≤ 0.01%.

We also learned that significant issues can arise because of a high humidity of the breath gas that is reaching the O_2 sensor. Users should be aware that Nafion tubing may loose its drying efficiency after prolonged continued use. This theoretically can lead to upto 30% errors in the estimate of the O_2 content. Danny also made it clear to us that using breath by breath systems for research or elite athlete measurements had a number of potential flaws and demonstrated mathematically that mixing chamber systems are a much better solution in most cases.

Yours sincerely,
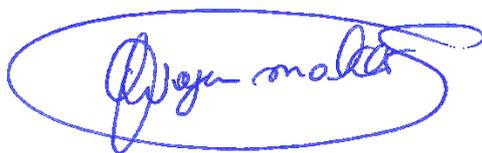
Professor Anton JM Wagenmakers
Lead of the Exercise Metabolism and Adaptation Research Group (EMARG)
Research Institute for Sport and Exercise Sciences
Liverpool John Moores University
e-mail: a.j.wagenmakers@ljmu.ac.uk
website: www.ljmu.ac.uk/about-us/staff-profiles/faculty-of-science/sport-and-exercise-sciences/anton-wagenmakers