

Protocol to Determine Changes to the Torque Velocity Curve above Critical Power while Cycling

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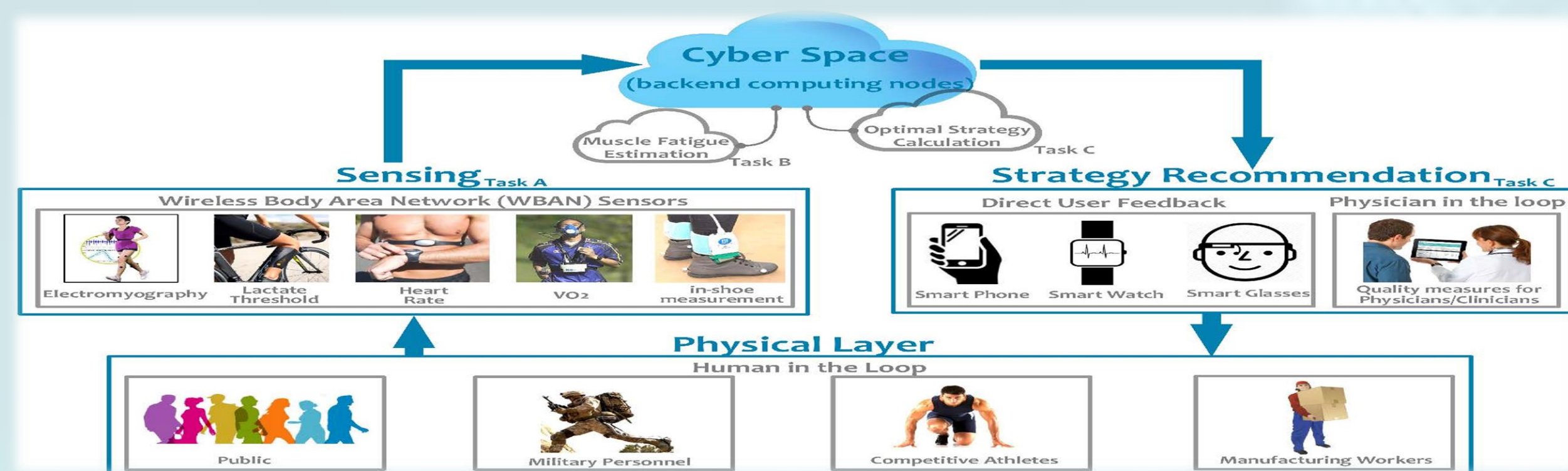
Molnar Human Performance Laboratory



I. BACKGROUND:

- Colon, breast, and prostate **cancer risks** can be reduced by physical activity, but assessment methods are self-reported, crude, and often imprecise.
- Better objective methods are needed to improve the validity and reliability of **non-invasive physical activity measurement devices**.
- Furthermore, **specific activity prescriptions** should be **individualized** and require improvements in assessment protocols.

II. PROPOSED MODEL

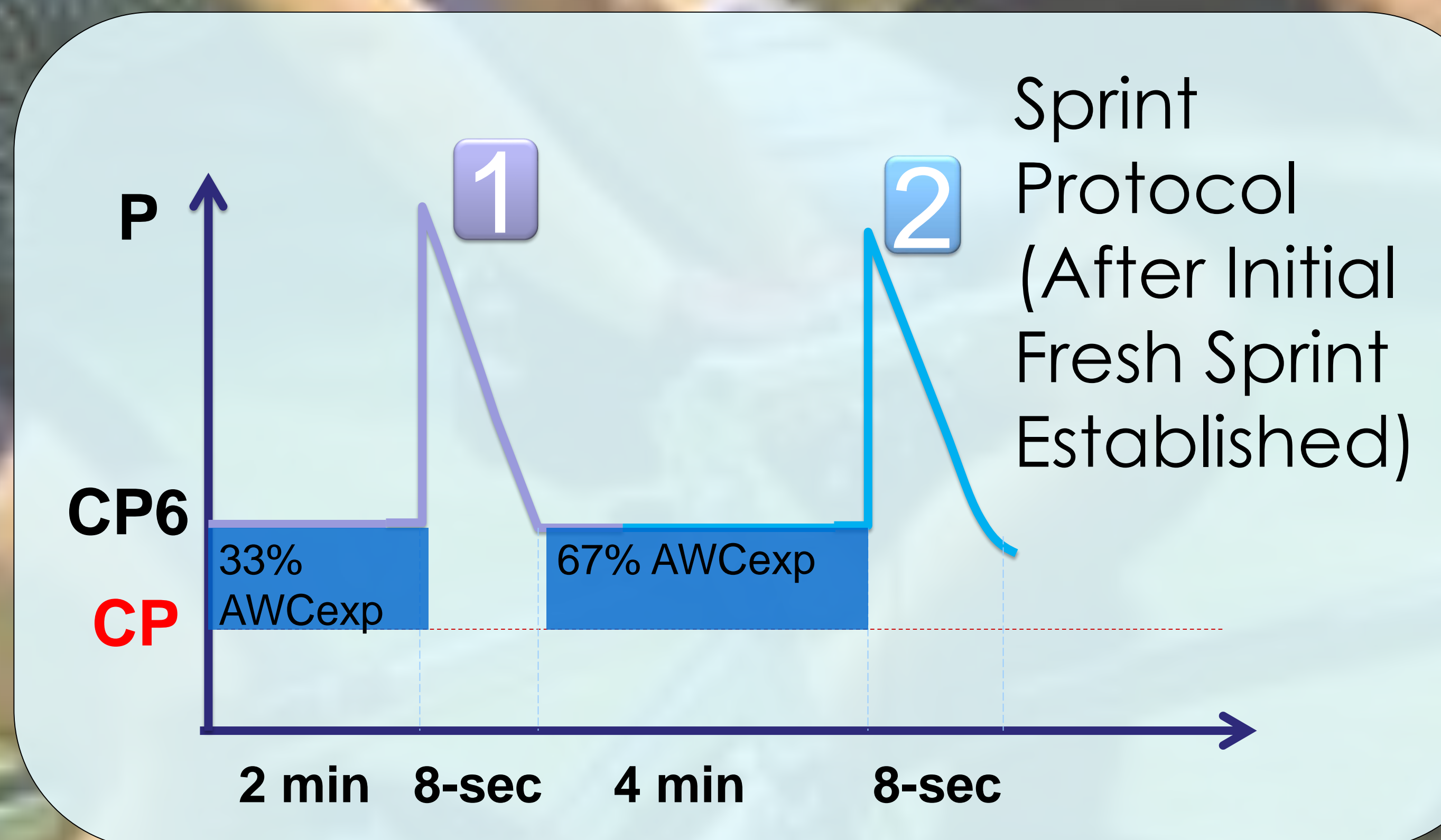
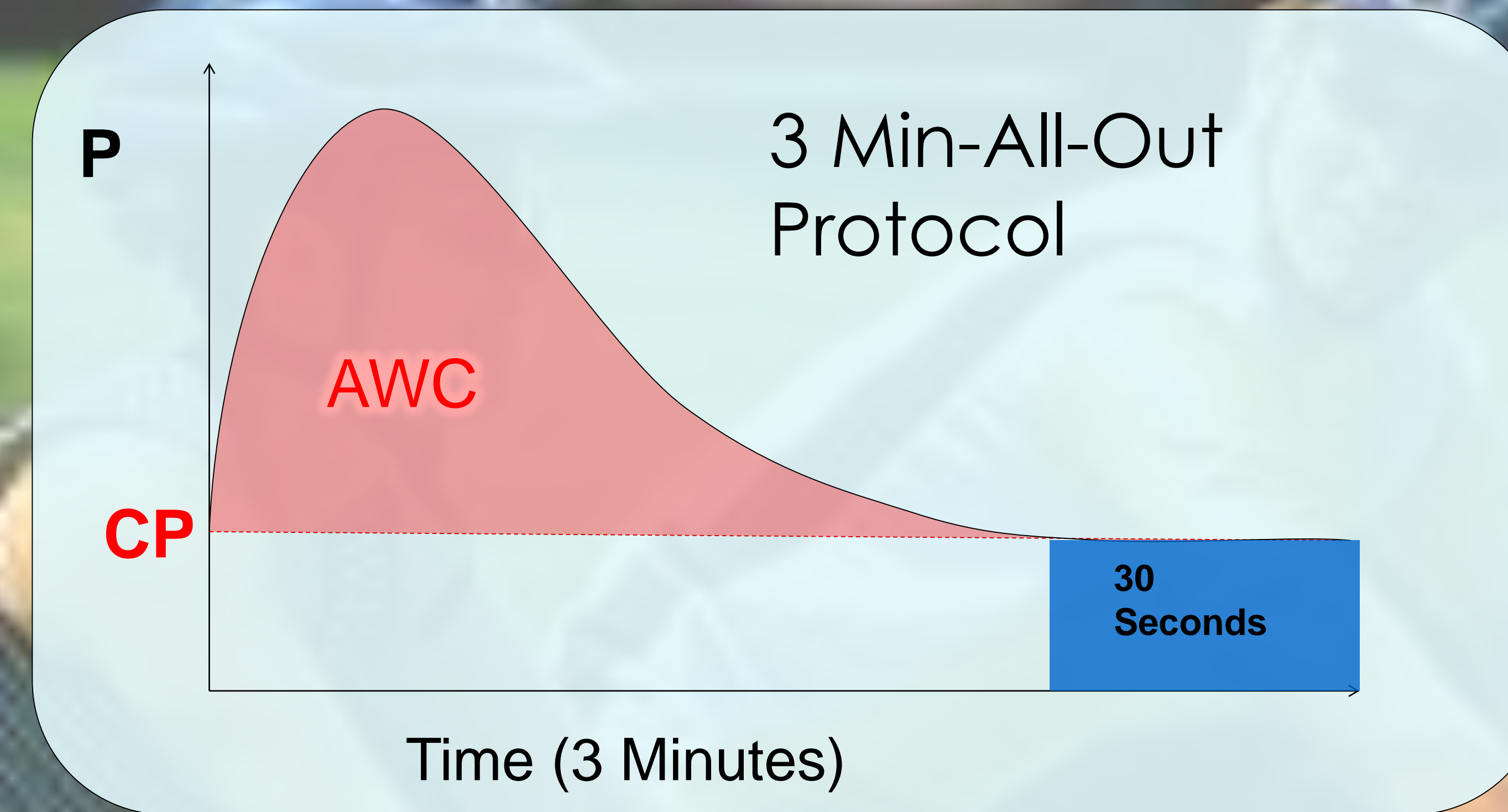


- As part of an overall model, cycling has been proven successful in physical activity assessment, due to its applicability from rehabilitation populations to elite athletes, but individualized determination between moderate and vigorous activity is needed.
- This study demonstrates how a series of three individualized tests can determine an individual's Anaerobic Work Capacity (AWC), the threshold between heavy and severe exercise known as Critical Power (CP), and the correlation between AWC expended (AWCexp) and changes to the torque-velocity curve (T-v).

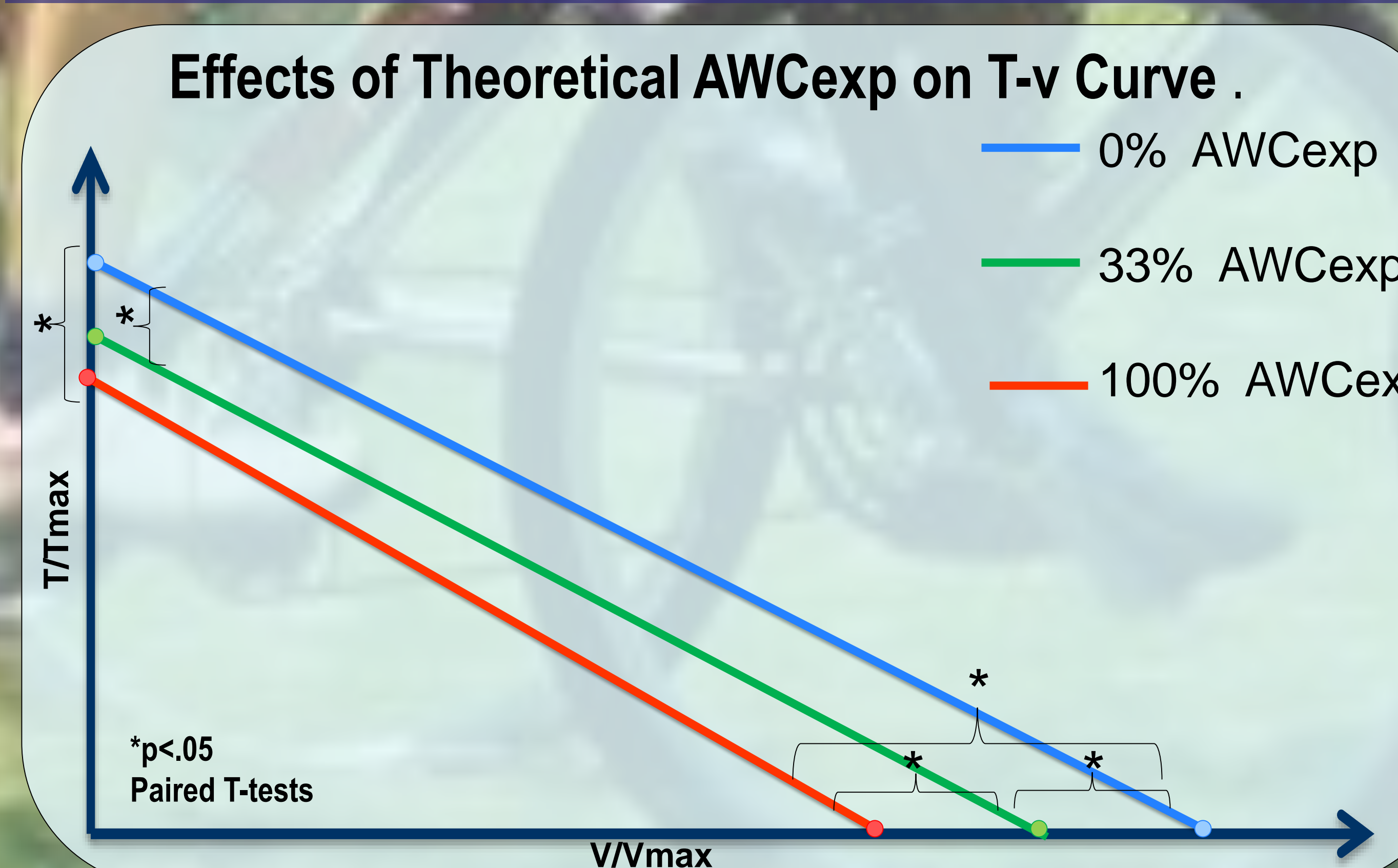
III. METHODS

- Subjects:** Male (n=10) and female (n=2) subjects, regularly trained cyclists or triathletes. Age (37.8 ± 11.6 yrs). Weight (72.7 ± 16.2 kg)
- VO2 Ramp:** Exercise at increasing powers until exhaustion.
- 3 Min All-out:** Exercise for a set time at "all-out" power. CP=last 30 second average, AWC="area under the curve"
- Sprints:** 3 Separate T-v sprints, each at a different AWCexp fatigue levels based on predicted 6-min exhaustive power (CP6).

III. METHODS



IV. RESULTS



V. CONCLUSIONS

- PAST:**
 - Previous work (Butelli, 1996) has looked at changes in the T-v curve versus varying cycling intensities.
 - Our work extends this idea to incorporate CP and AWC for the purposes of modeling a state of fatigue.
- PRESENT:**
 - Our protocols can **individualize exercise prescription** by determining the threshold between moderate and vigorous exercise.
 - Potentially, at any moment in time, a 6-second sprint could determine a subject's state of fatigue.
- FUTURE:**
 - Future work will incorporate these protocols into **real-time monitoring of fatigue** including other non-invasive devices and validated protocols.
 - Protocol will be based on individualized prescription of a threshold between moderate and vigorous exercise.

VI. CONCURRENT & FUTURE STUDIES

- Predicting the Expenditure of AWCexp Based on Changes to the T-v Curve (**Karlee Edwards**)
- Comparison of Threshold Determination between Blood Lactate Samples and Near Infrared Spectroscopy (NIRS) (**Kristine Knowles**)
- Modeling of real-time power output based on wearable, non-invasive NIRS device (**Clemson Univ.**)

VII. REFERENCES

Butelli, O., Vandewalle, H., Jouanin, J. C., Seck, D., & Monod, H. (1997). Effects of aerobic exercise on the torque-velocity relationship in cycling. *European Journal of Applied Physiology and Occupational Physiology*, 75(6), 499-503. ;Butelli, O., Vandewalle, H., & Peres, G. (1996). The relationship between maximal power and maximal torque-velocity using an electronic ergometer. *European Journal of Applied Physiology and Occupational Physiology*, 73(5), 479-483; Jones, A. M., Vanhatalo, A., Burnley, M., Morton, R. H., & Poole, D. C. (2010). Critical power: Implications for determination of V O2max and exercise tolerance. *Medicine and Science in Sports and Exercise*, 42(10), 1876-1890.2004.

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