



SERVIÇO PÚBLICO FEDERAL

UNIVERSIDADE FEDERAL DE SANTA CATARINA

CENTRO DE DESPORTOS

PROGRAMA DE PÓS-GRADUAÇÃO EM EDUCAÇÃO FÍSICA

CAMPUS REITOR JOÃO DAVID FERREIRA LIMA - TRINDADE - CEP 88040-970 - FLORIANÓPOLIS / SC

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TEACHING PLAN

1. IDENTIFICATION

Course: Advanced Research Methods in Biodynamics of Human Performance

Code: DEF 510003

Number of Credits: 02 Theoretical Credits

Workload: 30 Hours/Class

Level: PhD students in Physical Education

Professors: Juliano Dal Pupo, PhD

Brian R MacIntosh, PhD

2. SYLLABUS

Skeletal muscle fibre-types, power output, performance and energy cost of exercise will be studied from a methodological perspective.

3. OBJECTIVES

To discuss and deepen knowledge related to: the measurement and impact of fibre-type composition on athletic performance and energy cost of exercise. To determine the most appropriate method to assess the energy cost of exercise at high intensities and to discuss the limitations to performance above critical power. To discuss and determine methods for calculating power output during exercise.

4. CONTENT

- i) Skeletal muscle fibre-types and force-velocity relationship
- ii) Studying energetics of skeletal muscle: heat production, oxygen uptake, lactate accumulation
- iii) Skeletal muscle fibre-types, power output, economy and efficiency of exercise
- iv) The critical power, critical speed concepts and related energetics
- v) The slow component of oxygen uptake
- vi) Power output assessment

5. TEACHING STRATEGIES

Expositive-dialogued classes (English), practical class, review of classical literature in each field and critical analysis of recent scientific papers, individual studies and seminars.



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6. ASSESSMENT

Individual studies.

7. SCHEDULE OF CLASSES

DATE	TIME	LOCAL	PROFESSOR
August 25	09h - 12h	Classroom 112 (PPGEF)	Brian R MacIntosh
August 26	09h - 12h	Classroom 112 (PPGEF)	Brian R MacIntosh
August 27	09h - 12h	Classroom 112 (PPGEF)	Brian R MacIntosh
August 28	09h - 12h	Classroom 112 (PPGEF)	Brian R MacIntosh
August 29	09h - 12h	Classroom 112 (PPGEF)	Juliano Dal Pupo

* 15 class/hours will be dedicated to the final work (asynchronous class).

8. MAIN REFERENCES

MacDougall, K.B., Aboodarda, S.J., Wetergard, P.H. and B.R. MacIntosh. Muscle fatigue, pedaling technique and the VO₂ slow component during cycling. Published online in Experimental Physiology, Oct 11, 2024. <https://doi.org/10.1113/EP092116>

MacDougall, K.B., T.M. Falconer and BR MacIntosh. Efficiency of high intensity cycling exercise: quantification, mechanisms, and misunderstandings. Scandinavian Journal of Medicine and Science in Sports and Exercise. 32(6): 951-970 2022. [DOI:10.1111/sms.14149](https://doi.org/10.1111/sms.14149)

Fletcher, J.R. and B.R. MacIntosh. Changes in Achilles tendon stiffness and energy cost following a prolonged run in trained distance runners. PLOSone, published Aug 8, 2018 13(8): (17 pages) e0202026. <https://doi.org/10.1371/journal.pone.0202026>

O'Connell, J.M., J.M. Weir and B.R. MacIntosh. Blood lactate accumulation decreases during the slow component of oxygen uptake without a decrease in muscular efficiency. Pflügers Archiv, 469: 1257-1265, October, 2017. doi:10.1007/s00424-017-1986-y <https://link.springer.com/article/10.1007%2Fs00424-017-1986-y>

Fletcher, J.R. and B.R. MacIntosh. Running economy from a muscle energetics perspective. June 22, Frontiers in Physiology, 2017. Pg 1-15. <https://doi.org/10.3389/fphys.2017.00433>

Fletcher, J.R., T.R. Pfister and B.R. MacIntosh. Energy cost of running and Achilles tendon stiffness in man and woman trained runners. Physiological Reports, 1(7): 1-9, e00178, doi: 10.1002/phy2.178, 2013.



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- MacIntosh, B.R., R.J. Holash and J.-M. Renaud. Skeletal muscle fatigue- regulation of excitation-contraction coupling to avoid metabolic catastrophe. (Invited Commentary) Journal of Cell Science, 125: 2105-2114, 2012.
- Hettinga, F.J., J.J. de Koning, L. Schmidt, N.A.C. Wind, B.R. MacIntosh and C. Foster. Optimal pacing strategy: from theoretical modeling to reality in 1500-m speed skating. British Journal of Sports Medicine, 45:30-35, 2011. Altmetric score = 9
- Fletcher, J. Esau, S.P. and B.R. MacIntosh. Changes in stiffness and running economy in highly trained runners. European Journal of Applied Physiology, 110(5): 1037-1046, 2010.
- Fletcher, J.R., S.P. Esau, and B.R. MacIntosh. Economy of running: beyond the measurement of oxygen uptake. Journal of Applied Physiology, 107: 1918-1922, 2009.
- MacIntosh, B.R. and M.B. MacNaughton. The length-dependence of muscle active force: considerations for parallel elastic properties. Journal of Applied Physiology, 98: 1666-1673, 2005.
- MacIntosh, B.R., M. Kim, and K. Svedahl. Fatigue and optimal conditions for short-term work capacity. European Journal of Applied Physiology, 92:369-375, 2004.
- Svedahl, K. and B.R. MacIntosh. Anaerobic threshold: the concept and methods of measurement. Invited Review. Canadian Journal of Applied Physiology, 28: 299-323, 2003. Was listed as highly cited on journal website; has been cited >500 times, my most cited paper.
- MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023. This text is available in prepublication form. <https://openeducationalberta.ca/otep/>
- MacIntosh, B.R. , M. Tschakovsky and Fletcher, J.R. To help you learn exercise physiology, Chapter 1 in MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.
- MacIntosh, B.R. and R.J. Holash. Skeletal muscle: form for function. Chapter 4 In MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.
- MacIntosh, B.R. Skeletal muscle contraction. Chapter 5 In MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.
- MacIntosh, B.R. Energetics of Exercise. Chapter 6a, In MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.
- MacIntosh, B.R. and Jayne Garland. Potentiation and fatigue: the consequences of repetitive activation of muscle. Chapter 13 in MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.
- MacIntosh, B.R., Esau, S.P. and J.R. Fletcher. Physiological determinants of athletic performance. Chapter 16 in MacIntosh, B.R. (editor) Open Textbook of Exercise Physiology. Pressbooks, Calgary, AB 2023.