**Discipline MCP5838**
**Advanced Topics of the Role of Exercise in Cardiovascular Pathophysiology**

**Concentration area:** 5131

**Creation:** 09/02/2023

**Activation:** 30/05/2023

**Credits:** 2

**Workload:**

| Theory (weekly) | Practice (weekly) | Study (weekly) | Duration | Total |
|---|---|---|---|---|
| 6 | 5 | 4 | 2 weeks | 30 hours |

**Professors:**

Carlos Eduardo Negrão

Maria Urbana Pinto Brandão Rondon

**Objectives:**

OBJECTIVES: To teach the students the advanced knowledge about the cardiovascular adaptations associated with molecular, cellular and morphologic changes provoked by exercise training. To develop a critical attitude regarding the role of exercise in the cardiovascular diseases. To establish a favorable environment to develop the interest in exercise cardiology.

**Rationale:**

RATIONALE: Accumulated evidence show that exercise provokes remarkable adaptations in the cardiovascular system. More recently, we learned that exercise training is an important strategy in the prevention and treatment of cardiovascular diseases. Therefore, to understand the benefits of the exercise training on the cardiovascular system and, in addition, its therapeutic role is extremely relevant. In this course, the effects of exercise on cardiovascular system in a translational context from cells to patients will be deeply discussed. Emphasis will be given to hypertension, coronary insufficient and heart failure. The effects of exercise on oncologic patients who develop cardiovascular disease due to drug treatment or cancer itself will be equally presented and discussed. Finally, it will be provided laboratory lectures to approximate the theorical teaching to practical experience.

**Content:**

CONTENT: Theorical Physiological hypertrophy provoked by exercise training: molecular basis Physiological limits of hypertrophy in athletes Exercise in the treatment of hypertension: role of microRNAs Autonomic and hemodynamic changes in coronary artery disease: benefits of exercise Exercise in patients with heart failure Exercise in oncologic patients with cardiovascular disease Practical Direct evaluation of the sympathetic nerve activity in humans Noninvasive evaluation of peripheral circulation at rest and during exercise Muscle biopsy in humans

**Type of Assessment:**

EVALUATION: Writing and oral presentation about topics presented in the course

**Notes/Remarks:**

NOTE: Minimum number of students: 5 Maximum number of students: 20

**Bibliography:**

BIBLIOGRAFIA: 1. Albini A, Pennesi G, Donatelli F, et al. Cardiotoxicity of anticancer drugs: The need for cardio- oncology and cardio-oncological prevention. J Natl Cancer Inst 102:14-25, 2010. 2. Alves CR, da Cunha TF, da Paixão NA, et al. Aerobic exercise training as therapy for cardiac and cancer cachexia. Life Sci 15;125C:9-14, 2015. 3. Alves CRR, Das Neves WS, De Almeida NR, et al. Exercise training reverses cancer-induced oxidative stress and decrease in muscle COPS2/TRIP15/ALIEN. Mol Metab. 35:101012, 2020. 4. Alves MJ, Rondon MU, Santos AC, et al. Sympathetic nerve activity restrains reflex vasodilatation in heart failure. Clin Auton Res 17(6):364-369, 2007. 5. Alves MJNN, dos Santos MR, Nobre TS, et al. Mechanisms of blunted muscle vasodilation during peripheral chemoreceptor stimulation in heart failure patients. Hypertension 60(3):669-76, 2012. 6. Antunes LM, Trevizan P, Bacurau AV, et al. Effects of aerobic and inspiratory training on skeletal muscle microRNA-1 and downstream-associated pathways in patients with heart failure. J. Cachex Sarcop Muscle. 11:89-102, 2019. 7. Antunes-Correa LM, Ueno-Pardi LM, Trevizan PF, et al. The influence of aetiology on the benefits of exercise training in patients with heart failure. Eur J Prev Cardiol 1:204748731668353, 2017. 8. Antunes-Correa LM, Nobre TS, Groehs RV, et al. Molecular basis for the improvement in muscle metaboreflex and mechanoreflex control in exercise-trained humans with chronic heart failure. Am J Physiol Heart Circ Physiol 307(11):H1655-66, 2014. 9. Antunes-Correa LM, Kanamura BY, Melo RC, et al. Exercise training improves neurovascular control and functional capacity in heart failure patients regardless of age. Eur J Prev Cardiol 19(4):822-9, 2012. 10. Antunes-Correa LM, Melo RC, Nobre TS, Ueno LM, et al. Impact of gender on benefits of exercise training on sympathetic nerve activity and muscle blood flow in heart failure. Eur J Heart Fail 12(1): 58-65, 2010. 11. Azevedo LF, Perlingeiro PS, Brum PC, et al. Exercise intensity optimization for men with high cardiorespiratory fitness. J Sports Sci 29(6): 555-61, 2011. 12. Azevedo LF, S Perlingeiro P, Hachul DT, et al. Sport Modality Affects Bradycardia Level and Its Mechanisms of Control in Professional Athletes. Int J Sports Med 35(11):954-959, 2014. 13. Bacurau AV, Cunha TF, Souza RW, et al. Aerobic exercise and pharmacological therapies for skeletal myopathy in heart failure: Similarities and difference. Oxid Med Cell Longev 4374671, 2016. 14. Bacurau AV, Jardim MA, Ferreira JC, et al. Sympathetic hyperactivity differentially affects skeletal muscle mass in developing heart failure: role of exercise training. J Appl Physiol. 106(5):1631-1640, 2009. 15. Barretto AC, Santos AC, Munhoz R, et al. Increased muscle sympathetic nerve activity predicts mortality in heart failure patients. Int J Cardiol 135(3):302-307, 2009. 16. Bechara LR, Moreira JB, Jannig PR, et al. NADPH oxidase hyperactivity induces plantaris atrophy in heart failure rats. Int J Cardiol 175(3):499-507, 2014. 17. Blanco-Rivero J, Roque FR, Sastre E, et al. Aerobic exercise training increases neuronal nitric oxide release and bioavailability and decreases noradrenaline release in mesenteric artery from spontaneously hypertensive rats. J Hypertens 31(5):916-26, 2013. 18. Bouchard C, Antunes-Correa LM, Ashley EA, et al. Personalized preventive medicine: genetics and the response to regular exercise in preventive interventions. Prog Cardiovasc Dis 57(4):337- 346, 2015. 19. Bowen TS, Rolim NP, Fischer T, et al. Heart failure with preserved ejection fraction induces molecular, mitochondrial, histological, and functional alterations in rat respiratory and limb skeletal muscle. Eur J Heart Fail 17(3):263-72, 2015. 20. Bozi LH, Maldonado IR, Baldo MP, et al. Exercise training prior to myocardial infarction attenuates cardiac deterioration and cardiomyocyte dysfunction in rats. Clinics 68(4):549-56, 2013. 21. Brandão Rondon MUPB, Alves MJNN, Braga AMFW, et al. Postexercise blood pressure reduction in elderly hypertensive patients. J Am Coll Cardiol 39:676-682, 2002. 22. Brum PC, Bacurau AV, Cunha TF, et al. Skeletal myopathy in heart failure: effects of aerobic exercise training. Exp Physiol 99(4):616-20, 2014. 23. Bueno CR Jr, Ferreira JC, Pereira MG, et al. Aerobic exercise training improves skeletal muscle function and Ca2+ handling-related protein expression in sympathetic hyperactivity-induced heart failure. J Appl Physiol 109(3): 702-9, 2010. 24. Campos JC, Queliconi BB, Dourado PM, et al. Exercise training restores cardiac protein quality control in heart failure. PLoS One 7(12):e52764, 2012. 25. Cardoso JN, Grossi A, Del Carlo CH, et al. Mortality rates are going down in clinical use of inotropics. Temporal trends for prognosis in acute decompensated heart failure (1992/1999- 2005/2006). Int J Cardiol 175(3):584-586, 2014. 26. Costa TSR, Urias U, Negrao MV, et al. Breast cancer

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Post-exercise neurovascular control in chronic heart failure patients. Int J Sports Med 37: 1073-1079, 2016. 83. Paula SM, Couto GK, Fontes MT, et al. Exercise training restores the myogenic response in skeletal muscle resistance arteries and corrects peripheral edema in rats

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**Languages taught:**

Portuguese

**Class type:**

Não-Presencial

**Additional class type information:**

- **A porcentagem da disciplina que ocorrerá no sistema não presencial (1-100%).** 65% da disciplina ocorrerá no formato remoto 35% da disciplina ocorrerá no formato presencial
- **Detalhamento das atividades que serão presenciais e das que serão desenvolvidas via remota, com discriminação do tempo de atividade contínua online.** Atividades presenciais: As aulas práticas previstas no programa da disciplina ocorrerão no formato presencial, no Laboratório de Pesquisa da Unidade de Reabilitação Cardiovascular e Fisiologia do Exercício do Instituto do Coração do HC-FMUSP. Atividades remotas: As aulas teóricas previstas no programa da disciplina

ocorrerão no formato remoto, em blocos de 60 a 90 minutos por tema abordado, perfazendo um total de 4 horas por dia de aula ministrada, com intervalos de 10 a 15 minutos entre as aulas.

- **Especificação se as aulas, quando online, serão síncronas ou assíncronas.** As aulas ministradas online serão síncronas, sempre com a presença de pelo menos um dos responsáveis pela disciplina.
- **Descrição do tipo de material e/ou conteúdo que será disponibilizado para o aluno e a a plataforma que será utilizada.** O cronograma das aulas, artigos referentes às aulas e um resumo dos slides apresentados nas aulas ministradas (PDF) serão disponibilizados para os alunos via Plataforma Moodle – E-disciplinas USP
- **Definição sobre a presença na Universidade e, quando necessária, discriminar quem deverá estar presente (professora/professor; aluna/aluno; ambos):** As atividades presenciais serão desenvolvidas com a presença dos professores responsáveis pela disciplina e dos alunos matriculados
- **Descrição dos tipos e da frequência de interação entre aluna/aluno e professora/professor (somente durante as aulas; fora do período das aulas; horários; por chat/e-mail/fóruns ou outro).** A interação entre aluno e professores se dará durante as aulas teóricas remotas e durante as aulas práticas presenciais. Quando necessário, será disponibilizado o contato via e-mail dos professores ou a realização de conversa via Google Meet, para esclarecimentos de dúvidas.
- **A forma de controle da frequência nas aulas.** A frequência às aulas remotas se dará pela assinatura dos alunos em chat do Google Meet e pelo relatório enviado pelo sistema ao coordenador da aula (docente responsável pela disciplina) constando o horário de entrada e saída no Meet, de cada aluno. Nas aulas presenciais o controle de frequência se dará pela assinatura da lista de frequência disponibilizada pelos professores.
- **Informação sobre a obrigatoriedade ou não de disponibilidade de câmera e áudio (microfone) por parte dos alunos.** Os alunos necessitarão dispor de câmera e microfone para participação nas aulas remotas, através de celular, tablet ou computador.
- **A forma de avaliação da aprendizagem (presencial/remota).** Ao final do curso os alunos idealizarão um projeto de pesquisa, que deverá ser elaborado a partir dos conhecimentos transmitidos nas aulas teóricas e práticas ministradas.