



The Hebrew University of Jerusalem

Syllabus

NEURODEGENERATIVE DISEASES (NDS) AND NUTRITION - 71940

Last update 30-10-2024

HU Credits: 2

Degree/Cycle: 2nd degree (Master)

Responsible Department: Biochemistry, Food Science and Nutrition

Academic year: 0

Semester: 2nd Semester

Teaching Languages: English

Campus: Rehovot

Course/Module Coordinator: Dr. Aron Troen

Coordinator Email: aron.troen@mail.huji.ac.il

Coordinator Office Hours: by appointment

Teaching Staff:

Prof. Aron Troen

Course/Module description:

With the extension of lifespan and growing population, Alzheimer's disease and other forms of age-related cognitive dysfunction are increasingly prevalent. At present only symptomatic treatments of limited value and efficacy are available. Epidemiological observations and basic research suggest that nutritional may have a role in the etiology and prevention of the disease, however supportive evidence from clinical trials is limited.

Course/Module aims:

This class will familiarize students with the current views and basic, epidemiological and translational research on the association of nutrition and metabolism in the etiology of, and potential for prevention and treatment of age-related neurodegenerative and cerebrovascular diseases

Learning outcomes - On successful completion of this module, students should be able to:

- *Define the clinical and pathologic criteria for neurodegenerative and cerebrovascular diseases*
- *Explain the theoretical links between several biochemical and metabolic pathways to brain function and neurotransmission*
- *Describe current theories of brain aging and the putative role of nutrition in risk modification*
- *Critically discuss the strengths and limitations of nutritional randomized clinical trials for dementia*
- *Evaluate evidence for nutritional interventions for dementia treatment and prevention*

Attendance requirements(%):

85

Teaching arrangement and method of instruction: Lectures, presentations and analysis of research papers

Course/Module Content:

Introduction and Overview: Age-related cognitive dysfunction: Senescence or Disease?

*Clinical-Cognitive Symptoms,
Biomarkers and Brain Imaging,
Neuropathology*

From men to mice - Nutritional epidemiology of Dementia (including nutrigenomics)

Animal Models of Dementia - What can they teach us?

Epidemiology: Homocysteinemia and Alzheimer's disease - cause or coincidence?

Animal models of hyperhomocysteinemia and brain dysfunction

Homocysteine-lowering for cognition: The FACIT and VITACOG clinical trials

Lipotropes and synapses - part I: enhancing synaptogenesis - Animal studies

Lipotropes and synapses - part II: "Souvenaid" - Clinical trials of a medical food for Alzheimer's Disease

PUFA's and Brain health

(animal models and clinical trials)

Is Alzheimer's disease Type III diabetes? (Epidemiology)

AGE/RAGE and glycemic index

(Animal models)

Cholesterol, Statins and dementia risk reduction

The Oxidative Stress hypothesis: Blueberries are for brain

Cocoa flavonoids for brain vascular health

Required Reading:

מאמרים מדעיים באתר הקורס , מתוך המאמרים הבאים

Terry RD. Alzheimer's disease and the aging brain. *J Geriatr Psychiatry Neurol.* 2006 Sep;19(3):125-8. Review. PubMed PMID: 16880353.

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Webster SJ, Bachstetter AD, Nelson PT, Schmitt FA, Van Eldik LJ. Using mice to model Alzheimer's dementia: an overview of the clinical disease and the preclinical behavioral changes in 10 mouse models. *Front Genet.* 2014 Apr 23;5:88. doi: 10.3389/fgene.2014.00088. eCollection 2014. Review. PubMed PMID: 24795750; PubMed Central PMCID: PMC4005958.

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Gillette-Guyonnet S, et al. Nutrition and neurodegeneration epidemiological evidence and challenges for future research. *Br J Clin Pharmacol.* 2013 Mar;75(3):738-55. doi: 10.1111/bcp.12058. Review. PubMed PMID: 23384081; PubMed Central PMCID: PMC3575940.

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Zhuo JM, et al. Is hyperhomocysteinemia an Alzheimer's disease (AD) risk factor, an AD marker, or neither? *Trends Pharmacol Sci.* 2011 Sep;32(9):562-71. doi: 10.1016/j.tips.2011.05.003. Epub 2011 Jun 20. Review. PubMed PMID: 21684021; PubMed Central PMCID: PMC3159702.

Troen AM. *The central nervous system in animal models of hyperhomocysteinemia. Prog Neuropsychopharmacol Biol Psychiatry.* 2005 Sep;29(7):1140-51. Review. PubMed PMID: 16111797.

Nachum-Biala Y, Troen AM. *B-vitamins for neuroprotection: narrowing the evidence gap. Biofactors.* 2012 Mar-Apr;38(2):145-50. doi: 10.1002/biof.1006. Epub 2012 Mar 15. Review. PubMed PMID: 22419558.

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Craft S, et al. *Insulin and Alzheimer's disease: untangling the web. J Alzheimers Dis.* 2013;33 Suppl 1:S263-75. Review. PubMed PMID : 22936011.

Butterfield DA, et al. *Elevated risk of type 2 diabetes for development of Alzheimer disease: a key role for oxidative stress in brain. Biochim Biophys Acta.* 2014 Sep;1842(9):1693-706. doi: 10.1016/j.bbadis.2014.06.010. Epub 2014 Jun 17. Review. PubMed PMID: 24949886; PubMed Central PMCID: PMC4125611.

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Krautwald M, Münch G. *Advanced glycation end products as biomarkers and gerontotoxins - A basis to explore methylglyoxal-lowering agents for Alzheimer's disease? Exp Gerontol.* 2010 Oct;45(10):744-51. doi: 10.1016/j.exger.2010.03.001. Epub 2010 Mar 6. Review. PubMed PMID: 20211718.

Srikanth V, et al. *Advanced glycation endproducts and their receptor RAGE in Alzheimer's disease. Neurobiol Aging.* 2011 May;32(5):763-77. doi: 10.1016/j.neurobiolaging.2009.04.016. Epub 2009 May 22. Review. PubMed PMID: 19464758.

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Scheltens P, et al. *Efficacy of Souvenaid in mild Alzheimer's disease: results from a randomized, controlled trial. J Alzheimers Dis.* 2012;31(1):225-36. doi: 10.3233/JAD-2012-121189. PubMed PMID: 22766770.

Dyall SC. *Long-chain omega-3 fatty acids and the brain: a review of the independent and shared effects of EPA, DPA and DHA. Front Aging Neurosci.* 2015 Apr 21;7:52. doi: 10.3389/fnagi.2015.00052. eCollection 2015. Review. PubMed PMID: 25954194.

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Wood WG, et al. *Cholesterol as a causative factor in Alzheimer's disease: a debatable hypothesis. J Neurochem.* 2014 May;129(4):559-72. doi: 10.1111/jnc.12637. Epub 2014 Jan 2. Review. PubMed PMID: 24329875; PubMed Central PMCID: PMC3999290.

Richardson K, et al. *Statins and cognitive function: a systematic review. Ann Intern Med.* 2013 Nov 19;159(10):688-97. doi:

10.7326/0003-4819-159-10-201311190-00007. Review. PubMed PMID: 24247674.

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Williams RJ, Spencer JP. Flavonoids, cognition, and dementia: actions, mechanisms, and potential therapeutic utility for Alzheimer disease. *Free Radic Biol Med*. 2012 Jan 1;52(1):35-45. doi: 10.1016/j.freeradbiomed.2011.09.010. Epub 2011 Sep 17. Review. PubMed PMID: 21982844.

Ramassamy C. Emerging role of polyphenolic compounds in the treatment of neurodegenerative diseases: a review of their intracellular targets. *Eur J Pharmacol*. 2006 Sep 1;545(1):51-64. Epub 2006 Jun 17. Review. PubMed PMID: 16904103

Additional Reading Material:

An updated bibliography will be distributed in class

Hugo J, Ganguli M. Dementia and cognitive impairment: epidemiology, diagnosis, and treatment. *Clin Geriatr Med*. 2014 Aug;30(3):421-42. doi: 10.1016/j.cger.2014.04.001. Epub 2014 Jun 12. Review. PubMed PMID: 25037289; PubMed Central PMCID: PMC4104432.

Xekardaki A, et al. Neuropathological changes in aging brain. *Adv Exp Med Biol*. 2015;821:11-7. doi: 10.1007/978-3-319-08939-3_6. Review. PubMed PMID: 25416106.

Fjell AM, McEvoy L, Holland D, Dale AM, Walhovd KB; Alzheimer's Disease Neuroimaging Initiative. What is normal in normal aging? Effects of aging, amyloid and Alzheimer's disease on the cerebral cortex and the hippocampus. *Prog Neurobiol*. 2014 Jun;117:20-40. doi: 10.1016/j.pneurobio.2014.02.004. Epub 2014 Feb 16. Review. PubMed PMID: 24548606; PubMed Central PMCID: PMC4343307.

Castellani RJ, Perry G. The complexities of the pathology-pathogenesis relationship in Alzheimer disease. *Biochem Pharmacol*. 2014 Apr 15;88(4):671-6. doi: 10.1016/j.bcp.2014.01.009. Epub 2014 Jan 18. Review. PubMed PMID: 24447936.

Cooper JK. Nutrition and the brain: what advice should we give? *Neurobiol Aging*. 2014 Sep;35 Suppl 2:S79-83. doi: 10.1016/j.neurobiolaging.2014.02.029. Epub 2014 May 15. Review. PubMed PMID: 24925810.

Swaminathan A, Jicha GA. Nutrition and prevention of Alzheimer's dementia. *Front Aging Neurosci*. 2014 Oct 20;6:282. doi: 10.3389/fnagi.2014.00282. eCollection 2014. Review. PubMed PMID: 25368575; PubMed Central PMCID: PMC4202787.

Barnard ND, et al. Dietary and lifestyle guidelines for the prevention of Alzheimer's disease. *Neurobiol Aging*. 2014 Sep;35 Suppl 2:S74-8. doi: 10.1016/j.neurobiolaging.2014.03.033. Epub 2014 May 14. Review. PubMed PMID: 24913896.

de Jager CA. Critical levels of brain atrophy associated with homocysteine and cognitive decline. *Neurobiol Aging*. 2014 Sep;35 Suppl 2:S35-9. doi: 10.1016/j.neurobiolaging.2014.03.040. Epub 2014 May 15. Review. PubMed PMID: 24927906

Schaffer S, Asseburg H, Kuntz S, Muller WE, Eckert GP. Effects of polyphenols on brain ageing and Alzheimer's disease: focus on mitochondria. *Mol Neurobiol*. 2012 Aug;46(1):161-78. doi: 10.1007/s12035-012-8282-9. Epub 2012 Jun 17. Review. PubMed PMID: 22706880.

Rahmadi A, et al. Advanced glycation endproducts as gerontotoxins and biomarkers for carbonyl-based degenerative processes in Alzheimer's disease. *Clin Chem Lab Med*. 2011 Mar;49(3):385-91. doi: 10.1515/CCLM.2011.079. Epub 2011 Jan 31. Review. PubMed PMID: 21275816.

Grading Scheme:

Essay / Project / Final Assignment / Home Exam / Referat 40 %
Active Participation / Team Assignment 30 %
Presentation / Poster Presentation / Lecture 30 %

Additional information:

The language of instruction is English
The course is limited to 20 students in order to allow discussion

Please note that the course is based on discussion. Although it will be recorded for unavoidable absences, the recordings of class discussions are technically unreliable and do not capture the conversation.