Course Code	HP4271
Course Title	Cognitive Neuroplasticity
Pre-requisites	HP1000 Introduction to Psychology HP1100 Fundamentals of Social Science Research and one of the following: HP2200 Biological Psychology HP2600 Cognitive Psychology HP2700 Abnormal Psychology or BS3001 Neurobiology
No of AUs	4

Course Aims

The process of ageing is associated with cognitive decline and vast changes in the neurophysiology of the brain. These neural changes such as the accumulation of abnormal proteins, cerebral atrophy, and multi-domain cognitive decline are amplified in pathological diseases such as Alzheimer's disease. Cognitive neuroscience research in this area has proposed a number of factors purported to influence the trajectory of cognitive and neural decline such as exercise, cognitive training, socioeconomic status, among others. Students interested in understanding about factors that influence cognitive and neurological changes i.e. cognitive neuroplasticity in the context of ageing and dementia will benefit from taking this course. Through this course, you will learn to appreciate the complexity of cognitive neuroplasticity in ageing individuals.

Intended Learning Outcomes (ILO)

By the end of this course, you should be able to:

1. Describe the neural and cognitive changes seen in Alzheimer's disease and dementia.
2. Critically evaluate the scientific validity of various factors purported to influence cognitive neuroplasticity.
3. Apply your knowledge to determine the relevance and feasibility of implementing ways of delaying and preventing cognitive and neural decline in the context of Singapore.

Course Content

Neuroanatomy; Neurodegeneration; Amyloid cascade; Tau; Cognitive Training; Exercise; Sleep; Diet; Cognitive Training; Meditation; Mindfulness; Loneliness; Depression; Socioeconomic Status

Assessment (includes both continuous and summative assessment)

Component	ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual
1. CA1: Seminar Participation	1, 2, 3	Communication, Creativity & Competence	20%	Individual
2. CA2: Article Commentary	1,2	Creativity & Competence	10%	Individual
3. CA3: Presentation	2,3	Communication, Competence, Civic-mindedness	15%	Team

4. CA4: Mid-term quiz	1,2	Competence	20%	Individual
5. CA5: Final Paper	1,2	Creativity, Competence	35%	Individual
Total			100%	

Formative feedback

You will receive verbal feedback for seminar participation and discussion of article commentaries during class. You will be given summative group feedback on the midterm and presentation. Summative feedback for the final paper will also be given following the conclusion of the module

Learning and Teaching approach

Approach	**How does this approach support you in achieving the learning outcomes?**
Seminar	The class will be conducted in a manner that integrates components of both lecture and seminar. The first part of the class will follow more of a lecture structure and focus primarily on providing you with a historical perspective and core content of the topic for the week. This will be followed by research article discussions to keep you updated on recent advances or to be acquainted with seminal papers in the field. Both the lecture material and article discussions are structured to provide you with a strong foundation in the area that is then built on to help you develop skills to critically evaluate the claims made by existing research.

Reading and References

There is no textbook for this course. Weekly readings will be posted on Blackboard. The reading list will be updated to reflect updated knowledge in the field as needed.

Course Policies and Student Responsibilities

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities.

Absence from class without a valid reason will affect your overall course grade and no makeup/extensions will be given unless there is a valid reason. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a

set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Planned Weekly Schedule

Week	Topic	ILO	Readings/ Activities
Week 1	Introduction to Alzheimer disease	1	No Reading
Week 2	Neuroanatomy and Neuroimaging	1,2	Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2014). Cognitive neuroscience: The biology of the mind (pp 40-57). New York, NY: W.W. Norton.
Week 3	Neurodegeneration	1,2	Henneman, W. J. P., Sluimer, J. D., Barnes, J., van der Flier, W. M., Sluimer, I. C., Fox, N. C., … Barkhof, F. (2009). Hippocampal atrophy rates in Alzheimer disease. Neurology, 72(11), 999–1007. Sabuncu, M. R., Desikan, R. S., Sepulcre, J., Yeo, B. T. T., Liu, H., Schmansky, N. J., … Fischl, B. (2011). The Dynamics of Cortical and Hippocampal Atrophy in Alzheimer Disease. Archives of Neurology, 68(8), 1040–1048.
Week 4	Amyloid & Tau	1,2	Desikan, R. S., McEvoy, L. K., Thompson, W. K., Holland, D., Brewer, J. B., Aisen, P. S., … Dale, A. M. (2012).

			Amyloid-β—Associated clinical decline occurs only in the presence of elevated P-tau. Archives of Neurology, 69(6), 709–713. Aschenbrenner, A. J., Gordon, B. A., Benzinger, T. L. S., Morris, J. C., & Hassenstab, J. J. (2018). Influence of tau PET, amyloid PET, and hippocampal volume on cognition in Alzheimer disease. Neurology, 91(9), e859–e866.
Week 5	Genetics	1,2	Lim, Y. Y., Kalinowski, P., Pietrzak, R. H., Laws, S. M., Burnham, S. C., Ames, D., … Maruff, P. T. (2018). Association of β-Amyloid and Apolipoprotein E ε4 With Memory Decline in Preclinical Alzheimer Disease. JAMA Neurology, 75(4), 488–494. Tan, C. H., Bonham, L. W., Fan, C. C., Mormino, E. C., Sugrue, L. P., Broce, I. J., … Desikan, R. S. (2019). Polygenic hazard score, amyloid deposition and Alzheimer's neurodegeneration. Brain: A Journal of Neurology, 142(2), 460–470.
Week 6	CA4 Midterm Quiz	-	No Reading
Week 7	Exercise	2,3	Colcombe, S. J., Kramer, A. F.,

			Erickson, K. I., Scalf, P., McAuley, E., Cohen, N. J., … Elavsky, S. (2004). Cardiovascular fitness, cortical plasticity, and aging. Proceedings of the National Academy of Sciences of the United States of America, 101(9), 3316–3321. Erickson, K. I., Voss, M. W., Prakash, R. S., Basak, C., Szabo, A., Chaddock, L., … Kramer, A. F. (2011). Exercise training increases size of hippocampus and improves memory. Proceedings of the National Academy of Sciences, 108(7), 3017–3022.
Week 8	Sleep	2,3	Shokri-Kojori, E., Wang, G.-J., Wiers, C. E., Demiral, S. B., Guo, M., Kim, S. W., … Volkow, N. D. (2018). β-Amyloid accumulation in the human brain after one night of sleep deprivation. PNAS, 115(17), 4483–4488 Winer, J. R., Mander, B. A., Helfrich, R. F., Maass, A., Harrison, T. M., Baker, S. L., … Walker, M. P. (2019). Sleep as a Potential Biomarker of Tau and β-Amyloid Burden in the Human Brain. The Journal of Neuroscience: The Official Journal of the

			Society for Neuroscience, 39(32), 6315–6324.
Week 9	Diet	2,3	Berti, V., Walters, M., Sterling, J., Quinn, C. G., Logue, M., Andrews, R., … Mosconi, L. (2018). Mediterranean diet and 3-year Alzheimer brain biomarker changes in middle-aged adults. Neurology, 90(20), e1789–e1798. Pase, M. P., Himali, J. J., Jacques, P. F., DeCarli, C., Satizabal, C. L., Aparicio, H., … Seshadri, S. (2017). Sugary beverage intake and preclinical Alzheimer's disease in the community. Alzheimer's & Dementia: The Journal of the Alzheimer's Association, 13(9), 955–964.
Week 10	Cognitive Training	2,3	Woollett, K., & Maguire, E. A. (2011). Acquiring "the Knowledge" of London's Layout Drives Structural Brain Changes. Current Biology, 21(24–2), 2109–2114. Kable, J. W., Caulfield, M. K., Falcone, M., McConnell, M., Bernardo, L., Parthasarathi, T., … Lerman, C. (2017). No Effect of Commercial Cognitive Training on Brain Activity, Choice Behavior, or Cognitive

			Performance. Journal of Neuroscience, 37(31), 7390–7402.
Week 11	Meditation & Mindfulness	2,3	Quintana-Hernández, D. J., Miró-Barrachina, M. T., Ibáñez-Fernández, I. J., Pino, A. S.-D., Quintana-Montesdeoca, M. P., Rodríguez-de Vera, B., … Bravo-Caraduje, N. (2016). Mindfulness in the Maintenance of Cognitive Capacities in Alzheimer's Disease: A Randomized Clinical Trial. Journal of Alzheimer's Disease: 50(1), 217–232. Hölzel, B. K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S. M., Gard, T., & Lazar, S. W. (2011). Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Research, 191(1), 36–43.
Week 12	Loneliness & Depression	2,3	Gatchel, J. R., Rabin, J. S., Buckley, R. F., Locascio, J. J., Quiroz, Y. T., Yang, H.-S., … Harvard Aging Brain Study. (2019). Longitudinal Association of Depression Symptoms With Cognition and Cortical Amyloid Among Community-Dwelling Older Adults. JAMA Network Open, 2(8), e198964.

			Uquillas, F., Jacobs, H. I. L., Biddle, K. D., Properzi, M., Hanseeuw, B., Schultz, A. P., … Donovan, N. J. (2018). Regional tau pathology and loneliness in cognitively normal older adults. Translational Psychiatry, 8(1), 282.
Week 13	Socioeconomic Status	2,3	Chan, M. Y., Na, J., Agres, P. F., Savalia, N. K., Park, D. C., & Wig, G. S. (2018). Socioeconomic status moderates age-related differences in the brain's functional network organization and anatomy across the adult lifespan. PNAS, 115(22), E5144–E5153. Yaffe, K., Falvey, C., Harris, T. B., Newman, A., Satterfield, S., Koster, A., … Simonsick, E. (2013). Effect of socioeconomic disparities on incidence of dementia among biracial older adults: Prospective study. The BMJ, 347.