

Department of Biotechnology, Guru Nanak Dev University, Amritsar
Global Initiative for Academic Networks (GIAN) @ GNDU
Molecular Gerontology: from homeodynamics to hormesis



Overview

Human lifespan has been increasing worldwide. The increased longevity necessarily brings in the old age, which may or may not be healthy. Whereas a healthy old age can be of great benefits to an individual and the society, unhealthy ageing can be both a personal and a socio-economic challenge. Gerontological research done during the last 50 years has created a large body of knowledge with respect to the biological, psychological and social aspects of ageing. General biological principles of ageing are well understood, and these provide the basis for further research, testing and developing effective methods of intervention for improving health and for extending the health span.

Aim of the course:

To expose the participants to the fascinating field of ageing at the level of molecular biology, and to inspire them to follow this exciting and extremely important subject in detail at higher level. Since this course covers a wide range of biological topics from physiological to cellular and molecular levels in a short period, it is expected that the participants already have the basic biological knowledge of: the structure and function of cells and their components; biochemistry of DNA, RNA and protein synthesis and turnover; the structure and function of the brain, the skin, the skeleton and their components; and the general organization of the immune, the endocrine, the reproductive and the other systems within our bodies.

Expected outcome / achievement:

By the completion of the interactive workshop and course, a participant will be able to:

- explain why evolution has not made immortal organisms
- describe various types of lifespan
- identify and describe maintenance and repair pathways of survival
- distinguish between homeostasis and homeodynamics
- choose and justify various approaches for ageing interventions
- discuss ethical problems associated with ageing research and interventions
- plan new themes and experimental approaches for future ageing research

Course format and schedule:

Up to 3 hours a day, combining intensive interactive workshop/tutorial, and formal lecturing

Reading material:

A short compendium (approx. 80 pages), titled BIOGERONTOLOGY, specially prepared for this course, will be provided to all participants as a pdf or a printed version.

Teaching Faculty with allotment of Lectures and Tutorials: Prof. SIS Rattan: 22 hrs of Lectures and Tutorials/workshops; Prof. Gurcharan Kaur (GK): 6 hrs Lectures/workshops

Course details

Duration: Oct. 8 to 18, 2018 (10 days)

Course plan and schedule:

Monday; Oct 08, 2018; 1 hr lecture, 1 hr workshop/tutorial

- How do we know anything – revealed versus derived knowledge
- Observation and formulating the question – lifespan of an individual is limited
- Making the course and creating a framework
- What is life and what is a living system
- Homeostasis versus homeodynamics

Tuesday; Oct 09, 2018; 1 hr lecture, 2 hr workshop/tutorial

- Lifespan, ageing and age-related diseases
- The nature of the lifespan and its boundaries
- Rapid-, negligible- or progressive senescence
- Survival curves and mortality rates
- Human life expectancies

Wednesday; Oct 10, 2018; 2 hr lecture, 1 hr workshop/tutorial

- Why evolution allows ageing
- Adaptive and non-adaptive reasons for ageing
- Antagonistic pleiotropy
- Disposable soma and immortality of the germ line
- The purpose of life, and the essential lifespan
- Homeodynamic space

Thursday; Oct 11, 2018; 2 hr workshop/tutorial

- Who is an old person
- When does ageing begin
- How to study ageing
- Choice of experimental systems
- Animal models of ageing studies
- Human studies: cross sectional versus longitudinal
- Levels of descriptive changes

Friday; Oct 12, 2018; 2 hr lecture, 2 hr workshop/tutorial

- Cellular ageing
- The Hayflick limit and the phenomenon
- Relevance to ageing *in vivo*
- Phenotype of ageing cells
- The nature of the Hayflick limit

Saturday; Oct 13, 2018; 2 hr lecture, 2 hr workshop/tutorial

- Descriptive aspects of the ageing body
- The skin and the immune system
- The neuro-endocrine system
- The cardiovascular system
- The muscular-skeletal system
- Circadian rhythms

Monday; Oct 15, 2018; 2 hr workshop/tutorial

- Ageing versus disease
- Management, maintenance, prevention, enhancement
- Stress and health
- Hormesis and hormetins

Tuesday; Oct 16, 2018; 2 hr lecture, 2 hr workshop/tutorial

- Understanding health
- Reverting ageing
- Stopping ageing
- Slowing down ageing
- Eliminating death

Wednesday; Oct 17, 2018; 1 hr lecture, 2 hr workshop/tutorial

- Social and psychological aspects of ageing
- Living in old age
- Ethics of ageing interventions
- Your ideal research project

Thursday; Oct 18, 2018; 1 hr lecture, 2 hr workshop/tutorial

- Ideal research projects
- Recapitulation
- Exam and discussion

Date of Examination: October 18, 2018

Who can attend this Course:

- Students at all levels (B.Sc./MSc/PhD) of different subject areas of Life Sciences, Chemistry, Physics etc.
- Faculty from reputed academic institutions
- Researchers /Post-doc/ Research Associate from Universities, Govt and R&D laboratories

Registration Fees:

Participants from abroad: US \$ 200

Participants from Academic Institutions in India:

BSc Students: Rs. 500/-

MSc Students: Rs. 1000/-

PhD Students: Rs. 1500/-

Faculty members: Rs. 2000/-

Detailed CV of Experts

PROF. SURESH RATTAN



Work address

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Department of Molecular Biology and Genetics,
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8000 Aarhus C, Denmark

Phone: +45 8715 5436;

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Aarhus University link: <http://pure.au.dk/portal/en/persons/suresh-rattan%282a4e1855-73fa-4ec6-b498-fadabea36b2a%29.html>

Personal website: <http://sureshrattan.com>

Present nationality: Danish

Teaching Faculty: Prof. SURESH RATTAN is a biogerontologist and heads the Laboratory of Cellular Ageing, at the Department of Molecular Biology and Genetics, Aarhus University, Denmark. His research and teaching expertise is in the area of ageing of normal human cells in culture, regulation of protein synthesis, modifications and turnover during cellular ageing, development of the concept of gerontogenes, discovering the ageing-modulatory effects of cytokinins kinetin and zeatin (presently used in several skin care products), and pioneering the testing and application of the concept of mild stress-induced hormesis and hormetins in ageing research and interventions. He has more than 30 years of experience in teaching of undergraduates and post-graduates in cellular and molecular biology, and he has successfully supervised 10 PhD and more than 40 MSc research projects. He has published more than 240 scientific articles, and has compiled 15 books, including books for children, general public and research scientists. He is the founder and Editor-in-Chief of *Biogerontology* – an international peer reviewed journal published by Springer.

Academic Qualifications

- Dr. Scient. (D.Sc.) 1995, Aarhus University, Denmark.
- Ph.D. 1982, National Institute for Medical Research, Mill Hill, London, UK.
- M.Phil. 1979, Jawaharlal Nehru University, New Delhi, India.
- M.Sc. 1977; Guru Nanak Dev University, Amritsar, India.

Teaching/research guidance experience

- PhD research supervision/co-supervision: 10
- MSc research supervision/co-supervision: 31
- BSc and ERASMUS research supervision: 32

Awards, International recognition and other activities

- Honorary Visiting Professor, Faculty of Biotechnology, University of Rzeszow, Poland (from Jan. 2018 -)
- Honorary Professor, Faculty of Science, Palacky University, Olomouc, Czech Republic (2012-2016)
- Lord Cohen Medal in Gerontology (2011), from the British Society for Research on Ageing (BSRA).
- Honorary Doctorate from the Russian Academy of Medical Sciences (St. Petersburg branch), 2010.

- Founder and Editor-in-Chief, *Biogerontology* (from 2000, an international peer-reviewed journal, Springer Publishers).
- President, Biological Section, International Association of Gerontology and Geriatrics (IAGG)-European Region (2011-2015; and 2015-2019)
- Member, International Dose Response Society, USA (from 2006)
- Member, Danish Natural Science Academy (DNA; from 2004).
- Life Member, the Cell Stress Society, USA (from 1999).
- Life Member, Association of Gerontology, India (from 1983).
- PhD/DSc examiner for universities in Denmark, Sweden, Italy, UK, India.
- Member of various grant evaluation committees in UK, USA, France, Germany, The Netherlands, Switzerland, Austria, Ireland, Singapore, Russia, Georgia, Estonia, Turkey, and the European Research Council (ERC).

Research areas, expertise and commercial developments

- Ageing of normal human cells in culture.
- Development of the concept of ageing genes, gerontogenes.
- Discovering the ageing-modulatory effects of cytokinins: kinetin and zeatin (used in several skin care products)
- Pioneering the testing and application of the concept of mild stress-induced hormesis and hormetins in ageing research and interventions (basis of novel skin-care products by various companies).

Publication metrics from Google Scholar (as per April 2018)

- Number of scientific articles: 230+; h-index: 53; i10-index: 152; #Citations: 9366
- Patents – worldwide patents on the anti-ageing effects of kinetin and zeatin (1994).
- Books – 13 (edited/co-edited) on various aspects of the biology of ageing.
- Popular science and educational books for children- 3; published in English, Danish, Punjabi, Hindi, Polish and Romanian.

Publications: for full details, see personal website for the list of articles, books, patents etc at: <http://sureshrattan.com/category/publications/c35-research-papers/>

Selected publications of most significant work (from a total of 230+)

Rattan, S.I.S. and Hayflick.L. (eds.) Cellular Ageing and Replicative Senescence. Springer Publishers, The Netherlands; 2016

Demirovic, D., Nizard, C. and Rattan, S.I.S. Basal level of autophagy is increased in aging human skin fibroblasts *in vitro*, but not in old skin. *PLoS-One* 10(5): e0126546, 2015.

Nedic, O., Rogowska-Wrzesinska, A. and Rattan, S.I.S. Standardization and quality control in quantifying non-enzymatic protein modifications in relation to ageing and disease: why is it important and why is it hard? *Redox Biology*, 5: 91-100, 2015.

Rattan, S.I.S and Le Bourg, E. (eds.) Hormesis in Health and Disease. CRC Press, USA, 2014.

Jørgensen, P., Milkovic, L., Zarkovic, N., Waeg, G. and Rattan, S.I.S. Lipid peroxidation-derived 4-hydroxynonenal-modified proteins accumulate in human facial skin fibroblasts during ageing *in vitro*. *Biogerontology*, 15: 105-110, 2014.

Rattan, S.I.S. Aging is not a disease: implications for interventions. *Aging and Disease* 5: 196-202, 2014.

Rattan, S.I.S. Healthy ageing, but what is health? *Biogerontology*, 14: 673-677, 2013.

- Nedic, O., Rattan, S.I.S., Grune, T. and Trougakos, I.P. Molecular effects of advanced glycation end products (AGEs) on cell signalling pathways, ageing and pathophysiology. *Free Radical Research*, 47 (suppl. 1) 28-38, 2013.
- Demirovic, D. and Rattan, S.I.S. Establishing cellular stress response profiles as biomarkers of homeodynamics, health and hormesis. *Experimental Gerontology*, 48: 94-98, 2013
- Rattan, S.I.S. Rationale and methods of discovering hormetins as drugs for healthy aging. *Expert Opinion on Drug Discovery*, 7: 439-448, 2012.
- Larsen, S.A., Kassem, M. and Rattan, S.I.S. Glucose metabolite glyoxal induces senescence in telomerase-immortalized human mesenchymal stem cells. *Chemistry Central Journal*, 2012, 6:18.
- Singh, R., Kølvråa, S., Bross, P., Christensen, K., Bathum, L., Gregersen, N., Tan, Q. and Rattan, S.I.S. Anti-inflammatory heat shock protein 70 genes are positively associated with human survival. *Current Pharmaceutical Design*, 6: 796-801, 2010.
- Rattan, S.I.S. and Singh, R. Gene therapy in aging. *Gene Therapy*, 16: 3-9, 2009.
- Sejersen, H. and Rattan, S.I.S. Dicarbonyl-induced accelerated aging in vitro in human skin fibroblasts. *Biogerontology*, 10: 203-211, 2009.
- Rattan, S.I.S., Fernandes, R.A., Demirovic, D., Dymek, B. and Lima, C. F. Heat stress and hormetin-induced hormesis in human cells: effects on aging, wound healing, angiogenesis and differentiation. *Dose Response*, 7: 90-103, 2009.
- Rattan, S.I.S. Theories of biological aging: genes, proteins and free radicals. *Free Radical Research*, 40: 1230-1238, 2006.
- Singh, R., Kølvråa, S., Bross, P., Jensen, U.B., Gregersen, N., Tan, Q., Knudsen, C., and Rattan, S.I.S. Reduced heat shock response in human mononuclear cells during aging and its association with polymorphisms in HSP70 genes. *Cell Stress and Chaperones*, 11: 208-215, 2006.
- Rattan, S.I.S. Anti-ageing strategies: prevention or therapy? *EMBO Reports*, 6: S25-S29, 2005.
- Simonsen, J.L., Rosada, C., Serak, N., Justesen, J., Stenderup, K., Rattan, S.I.S., Jensen, T.G. and Kassem, M. Telomerase expression extends the proliferative life-span and maintains the osteogenic potential of human bone marrow stromal cells. *Nature Biotechnology*, 20, 592-596, 2002
- Stenderup, K., Justesen, J., Eriksen, E.F., Rattan, S.I.S. and Kassem, M. Number and proliferative capacity of osteogenic stem cells are maintained during aging and in patients with osteoporosis. *Journal of Bone and Mineral Research*, 16, 1120-1129, 2001
- Barciszewski, J., Siboska, G., Rattan, S.I.S. and Clark, B.F.C. Occurrence, biosynthesis and properties of kinetin (N6-furfuryladenine). *Plant Growth Regulation*, 32, 257-265, 2000.

CV of Host Faculty:

Work Address:

**Prof. Gurcharan Kaur,
Medical Biotechnology Lab,
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Amritsar-143005**

Tel.: 0183-2258803 Ext. 3176

Email: kgurcharan.neuro@yahoo.com



Specialization: Molecular Neuroscience: Neuroregeneration and Neuroprotection

Educational Qualifications and Teaching/Research experience:

| Degree/Diploma | University/Institution | Year |
|-----------------------|------------------------|------|
| B.Sc. (Honors School) | GN.D.U., Amritsar | 1978 |
| M.Sc. (Honors School) | ---do--- | 1979 |
| Ph.D. | J.N.U., Delhi | 1984 |
| Post Doc | AIIMS | 1985 |

Teaching experience of >32 years and currently teaching Immunology, Animal Cell Culture, Medical Biotechnology

Research experience of >37 years in Neuroscience and Medical Biotechnology

Awards, Honours and Professional recognition:

a. Awards and Honours:

- Fellow, Indian Academy of Neurosciences (2011)
- U.G.C. Young Scientist Career Award (1993)
- Vice President of Indian Academy of Neurosciences (2017-19)
- Member Editorial Board of “Biogerontology” Journal
- Member Editorial Board of “Cellular and Molecular Biochemistry” Journal
- Member Editorial Board of “Annals of Neurosciences” Journal
- Member of DST Expert Committee for Women Scientist Scheme (WOS-A)
- Member of DST ‘INDO-US Fellowship for Women in STEMM
- Member of Translational Neuroscience Task Force of ‘Indian Council of Medical Research’
- Member of Biogerontology Expert Group of ‘Indian Council of Medical Research’
- Member of DBT-Neurobiology Expert Group
- Member, Academic Council, NBRC, Manesar
- Co-Chairperson, Research Advisory Committee, Amritsar Medical College
- Member Task Force, DBT Star College Scheme
- Vice-President, Society for Neurochemistry, India (2008-2011)
- Executive member, Society for Neurochemistry, India (2013-2014)
- Executive member, Indian Academy of Neurosciences (2008-2012)
- Executive Member of Association of Gerontology (India) (2009-2011)
- **Research Grants** worth about 6.0 Crore availed from National and International Funding agencies like DBT, DST, ICMR, CSIR, AICTE, TWAS-Italy, DBT-AIST, Japan, ICMR-BMBF, Germany, CEFIPRA-France
- Referee: Molecular Neurobiology, Nature Scientific Reports, J Neurochemistry, Brain

Research, Biogerontology, Experimental Neurology, Experimental Gerontology, Indian Journal of Experimental Biology, Rejuvenation Research, IJMR, Brain Research Bulletin, PLoS ONE, eCAM, J Ethnopharmacology, Natural Products Research etc.

Role of Host Faculty: Prof. Gurcharan Kaur is the faculty of Medical Biotechnology in the Department of Biotechnology, Guru Nanak Dev University, Amritsar. Prof. Kaur has notable contributions in 'Neurosciences' in the area of Adult Brain Plasticity and Healthy Brain Ageing. She has carried out extensive work on potential Interventions such as (i) Intermittent fasting Dietary Restriction (IF-DR), and (ii) validation of Natural products for neuroregeneration and neuroprotection. Lifelong calorie restriction/DR although in practice for millennia as a powerful tool for healthy aging, but experimental pre-clinical studies in her lab have scientifically validated such imaginative benefits of late onset short term intermittent fasting DR regimen. Her research group has also developed *in vitro* protocols for testing the anti-neuroinflammatory and neuroregenerative potential of natural products. **Host faculty has a well established Medical Biotechnology Research lab and will be responsible for coordinating the course proceedings as well as taking few lectures as listed in the course details.**

Selected Publications of Host Faculty (100+ Research Publications in peer reviewed journals):

Taranjeet Kaur, **Gurcharan Kaur** (2017) *Withania somnifera* as a potential candidate to ameliorate high fat diet-induced anxiety and neuroinflammation. *J. Neuroinflammation*, 14(1), 201 doi: 10.1186/s12974-017-0975-6

Harpal Singh, Taranjeet Kaur, Shaffi Manchanda, **Gurcharan Kaur** (2017) Intermittent fasting combined with supplementation with Ayurvedic herbs reduces anxiety in middle aged female rats by anti-inflammatory pathways. *Biogerontology* 18(4): 601-614.

Muskan Gupta and **Gurcharan Kaur** (2016) Aqueous extract of *Withania somnifera* leaves as potential anti-neuroinflammatory agent: a mechanistic study. *J Neuroinflammation* 22; 13 (1):193. doi: 10.1186/s12974-016-0650-3.

Rachana Mishra, Shaffi Manchanda, Muskan Gupta, Taranjeet Kaur, Vedangana Saini, Anuradha Sharma and **Gurcharan Kaur** (2016) *Tinospora cordifolia* as a potential anxiolytic agent in sleep deprived Wistar rats: a mechanistic perspective. *Scientific Reports* 6:25564. doi: 10.1038/srep25564.

Hardeep Kataria, Sushil Kumar, Harshita Chaudhary and **Gurcharan Kaur** (2016) *Withania somnifera* suppresses tumor growth of intracranial allograft of glioma cells. *Mol Neurobiol.*53(6):4143-58. doi: 10.1007/s12035-015-9320-1.

Rumani Singh*, Shaffi Manchanda*, Taranjeet Kaur*, Sushil Kumar, Dinesh Lakhanpal, Sukhwinder S. Lakhman, and **Gurcharan Kaur** (2015) Middle age onset short-term intermittent fasting dietary restriction prevents brain function impairments in male Wistar rats. *Biogerontology* 16(6):775-88. doi:10.1007/s10522-015-9603-y* equally contributing authors

Rachana Mishra and **Gurcharan Kaur** (2015) *Tinospora cordifolia* induces differentiation and senescence pathways in neuroblastoma cells. *Mol Neurobiol.*52(1):719-33

Navjot Shah, Rumani Singh, Upasana Sarangi, Nishant Saxena, Anupama Chaudhary, **Gurcharan Kaur**, Sunil Kaul and Renu Wadhwa (2015) Combinations of Ashwagandha leaf-extracts protect brain-derived cells against oxidative stress and induce differentiation. *PLoS One* 2015 Mar 19;10(3):e0120554.

Gabriele Loers, Vedangana Saini, Bibhudatta Mishra, Florentia Papastefanaki, David Lutz, Sidhartha Chaudhury, Daniel R. Ripoll, Anders Wallqvist, Sheraz Gul, Melitta Schachner and **Gurcharan Kaur** (2014) Nonyloxytryptamine mimics polysialic acid and modulates neuronal and glial functions in cell culture. **J Neurochem.**128(1): 88-100.

Sushil Kumar and **Gurcharan Kaur** (2013) Intermittent Fasting Dietary Restriction Regimen Negatively Influences Reproduction in Young Rats: A Study of Hypothalamo-Hypophysial-Gonadal Axis. **PLoS One** 8(1):e52416. doi: 10.1371/journal.pone.0052416.

Rachana Mishra and **Gurcharan Kaur** (2013) Aqueous ethanolic extract of *Tinospora cordifolia* as a potential candidate for differentiation based therapy of glioblastomas. **PLoS One** 2013 Oct 24;8(10):e78764

Hardeep Kataria, Sunil C. Kaul, Renu Wadhwa and **Gurcharan Kaur** (2013) Withania somnifera water extract as a potential candidate for differentiation based therapy of human neuroblastoma. **PLoS ONE** 8(1): e55316. doi: 10.1371/journal.pone.0055316.

Rumani Singh, Dinesh Lakhanpal, Sushil Kumar, Sandeep Sharma, Hardeep Kataria, ManpreetKaur, **Gurcharan Kaur**(2012) Late onset intermittent fasting dietary restriction as a potential intervention to retard age associated brain function impairments in male rats. **AGE** 34:917-33.

Course Coordinator and Host Faculty: Prof. Gurcharan Kaur

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REGISTRATION CUM ACCOMODATION REQUEST FORM
(To reach electronically by 24th September, 2018)

Molecular Gerontology: from homeodynamics to hormesis

08-18 Oct. , 2018

**Department of Biotechnology, Guru Nanak Dev University
Amritsar, Punjab**

Name (Block Letters): **M/F:**

Designation/ Professional Title:

Organization:

Address:

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Tel.: **Mobile:**

E- mail:

Accommodation Required (Yes/ No):

The Registration fee of Rupeeshas been paid via Demand Draft No.....in favour of The Registrar, Guru Nanak Dev University, Amritsar Through online/offline banking bearing Transaction No. to Punjab & Sind Bank, Guru Nanak Dev University Campus (RTGS/IFSC code: PSIB0000288) A/Ct No. 02881000020001 of Guru Nanak Dev University. Demand Draft/ Fee Receipt have been enclosed herewith.

Date:

Signatures