Nottingham Trent University

School of Science & Technology

PhD Studentship: Nanotechnologies for the eye and potential treatments for cataract

The eye lens grows throughout life and retains within it all cells synthesised. The proteins within these cells, called crystallins, have a particular organisation that maintains transparency. This organisation alters with age and can lead to aggregate formation that causes light scatter and eventually cataract. Cataracts block light reaching the back of the eye causing a deterioration of sight. This is a common condition in older people and is also found with diabetes and other chronic diseases. As people are living longer and chronic diseases are increasing there is an expectation that cataracts will rise in number. The only current treatment for cataract is surgical removal of the biological lens and replacement with an intraocular lens. Development of a drug treatment is needed, as demand for cataract surgery continues to be high driven by an ageing population in developed countries, as well as a rise in chronic diseases. New lines of discovery, based on nanotechnologies [1-3] and novel compounds [4,5] promise effective drug treatments for cataract. The actions of these compounds on lens proteins and lens function: how they improve solubility of crystallins and how this translates to breakdown of aggregates within the lens are not understood. Doses deemed safe at the DNA and protein levels have not been determined. Preliminary studies testing doses and exposure durations of antioxidant nanoparticles on lens cells, DNA [1,2] and proteins [3] have been described for a single nanoparticle type and though promising require further analysis. This project will involve determining how a range of different nanoparticles affect DNA and proteins from cell cultures and whole lenses and will require cell culture and a range of tests of DNA integrity [6] as well as protein characterisation after exposure to nanoparticles. The nanoparticles will be provided from the University of Texas, Arlington and a number of advanced measurements will be made at the National Physical Laboratories in Teddington.

References

1. Pierscionek BK et al. Nanoceria have no genotoxic effect on human lens epithelial cells. Nanotechnology 21, 035102 (2010)
2. Pierscionek, B.K., Li,Y., Schachar, R. and Chen, W. The effect of high concentration and exposure duration of nanoceria on human lens epithelial cells. Nanomedicine: Nanotechnology, Biology and Medicine 10.1016/j.nano.2011.06.016 (2011)
3. Pierscionek BK et al. CeO_2 nanoparticles have no detrimental effect on eye lens proteins. Current Analytical Chemistry 6,172 (2010)
4. Zhao L et al. Lanosterol reverses protein aggregation in cataracts. Nature 523, 607 (2015)
5. Makley LN et al. Pharmacological chaperone for α-crystallin partially restores transparency in cataract models. Science 350, 674 (2015)

6. Marthandan S et al. SENIEUR status of the originating cell donor negates certain 'anti-immunosenescence' effects of Ebselen and N-acetyl cysteine in human T cell clone cultures, Ageing and Immunity, 11: 17-26 (2014)

Entry requirement and programme of work
A first class or upper second class UK B.Sc. (Hons) in biology or biomedical sciences.

Eligibility
Applications can be accepted from UK/EU and also International students. The minimum English language proficiency requirement for candidates who have not undertaken a higher degree at a UK HE institution is IELTS 6.5 (with a minimum of 6.0 in all skills).

Award
The studentship will pay UK/EU fees and provide a maintenance stipend linked to the RCUK rate for up to three years. Applications from non-EU students are welcome, but a successful candidate would be responsible for paying the difference between non-EU and UK/EU fees. (Fees for 2017/18 are £12,900 for non-EU students and £4,195 for UK/EU students and are subject to annual increase.

Start date: 1st October 2017

For informal enquiries, please contact:

Professor Barbara Pierscionek:
E-mail : barbara.pierscionek@ntu.ac.uk, Tel : 44 (0)115 848 3738

Application packs can be obtained from
http://www4.ntu.ac.uk/research/ntu_doctoral_school/studentships/index.html

The closing date for applications is 5pm (UK time) on 18th May 2017

Applications by CV only will not be accepted