Project proposal

Project title	Optical fibre probes and design for tissue sensing
First Supervisor	Professor — Barbara Pierscionek
Second Supervisor	Professor Andy Augousti
School	Life Sciences
Other member of supervisory team (no more than three KU supervisors in total)	
Specific requirements beyond 2:1 degree	

Project summary

(max 4,000 characters)

Changes in structural properties of biological tissues alter function and some of these functional alterations which can be physiological or pathological can be detected and measured using optical means. This is particularly pertinent with ocular tissue and for the parameter of refractive power which determines whether an eye is short or long sighted (physiological changes) and whether or not there is an attenuation of light caused by scatter and/or absorption (pathological changes).

This project will continue early work that led to the development of specialised optical fibre systems to detect localised changes in material properties of ocular tissue [1,7]. The work now needs to be extended so that is can be a) applied to newly developed technologies that can measure surface shapes so that the material parameters detected with fibre optics sensing and the shape factors can together provide a more accurate system for determining refractive power and b) to incorporate measures that can detect small changes in scatter and/or absorption and therefore predict pathological changes at an early stage. The work will be combined with computational modelling and optical design using systems such as ZEEMAX and finite element analysis.

1. Pierscionek, B.K.: Surface refractive index of the eye lens determined with an optic fibre sensor. J. Opt. Soc. Am. A 10, 1867-1871(1993).
2. Pierscionek, B.K.: Refractive index of the human lens surface measured with an optic fibre sensor. Ophthalmic Res. 26, 32-36 (1994).
3. Pierscionek, B.K.: Refractive index of decapsulated bovine lens surfaces measured with a reflectometric sensor. Vision Research 34, 1927-1933 (1994).
4. Pierscionek, B.K.: Variations in refractive index and absorbance of 670nm light with age and cataract formation in human lenses. Exp. Eye Res. 60, 407-414 (1995).
5. Pierscionek, B.K.: The refractive index along the optic axis of the bovine lens. Eye 9, 776-782 (1995).
6. Pierscionek, B.K.: Refractive index contours in the human lens. Exp. Eye Res. 64, 887-893 (1997).
7. Pierscionek, B.K. and Green, R.J.: Measurement of corneal surface refractive index. Proceedings of SPIE, vol 5826, 500-511 (2005).