

Prof Patrick Prendergast gives Wartenweiler Memorial Lecture at the 22nd Congress of the International Society of Biomechanics

Patrick J Prendergast, Professor of Bioengineering and Vice-Provost/Chief Academic Officer, was invited to give the Wartenweiler Memorial Lecture at the 22nd Congress of the International Society of Biomechanics (ISB) which took place in Cape Town, South Africa from 5th to 9th July 2009. Prof Prendergast's lecture was entitled "Mechanoregulation in the Skeletal Tissues".

The Wartenweiler Memorial Lecture is given to honour Prof. Jürg Wartenweiler (1915-1976), first President of the ISB, who organized the First International Seminar on Biomechanics in Zürich, Switzerland (1967) and it is considered to be an honour to deliver this lecture at such a high-profile, international event in Bioengineering. The International Society of Biomechanics was founded in 1973 to promote the study of all areas of biomechanics at international level, although special emphasis is given to the biomechanics of Human Movement. It currently has over 1,000 members worldwide and its biennial congresses attract a large international audience.

In his lecture, Prof Prendergast opened by stating that the human body can be viewed as a machine; this has been recognised since the time of Borelli. What is not so well recognised is that it is a machine that adapts to its mechanical environment, and these adaptation mechanisms are themselves subject to evolutionary pressures. Prof Prendergast then presented research including the algorithms describing processes of repair and regeneration of skeletal tissues. In particular an algorithm describing the mechanoregulation of the bone remodelling cycle was presented which is used to predict biomechanical basis of bone loss in osteoporosis. Methods for computational simulation of tissue differentiation are more complicated and involve algorithms for simulation cell migration, proliferation, and differentiation. It was shown how these algorithms may be combined to simulate both long bone fracture healing and tissue regeneration in a scaffold for tissue engineering. In the concluding part of the lecture Prof Prendergast returned to the issue of evolution of algorithms for mechanoregulation. It was shown that the evolution of mechanoregulation may not lead to optimal phenotypes; therefore it is unlikely that adaptation can be viewed as a process of optimization – rather we should expect variability of mechanoregulation of tissues in the population. The consequences of this for simulations of clinical relevance was discussed.

Prof Prendergast ended by acknowledging the support of Science Foundation Ireland in funding research.