COMPLEX DYNAMICS IN A DELAY DIFFERENTIAL EQUATION MODEL FOR THE HUMAN PUPILLARY LIGHT REFLEX

Rosário Laureano[1]*, Clara Grácio[2], Diana A. Mendes[1] and Fátima Laureano[3]

[1]ISCTE - IUL Lisbon University Institute, Portugal

[2]Department of Mathematics and CIMA, Universidade de Évora,
Rua Romão Ramalho, 59, 7000-585, Evora, Portugal

[3]Instituto de Microcirurgia Ocular, Portugal

maria.laureano@iscte.pt (*corresponding author), deam@iscte.pt,
mgracio@uevora.pt,fatimalaureano@imo.pt

This paper aims to study some of the dynamical characteristics of the pupillary light reflex and to contribute to their clarification based on the nonlinear theory of dynamical systems.

In order to introduce the necessary concepts, terminology, and relevant features of the pupillary light reflex and its associated delay, we start with an overview of the human eye anatomy and physiology with emphasis on the iris, pupil and retina. Also, we present the most regarded models for pupil dynamics found in the actual scientific literature. Then we consider the model developed by Longtin and Milton [1], which models the human pupillary light reflex, defined by a nonlinear differential equation with delay, and present the study carried out on the qualitative and quantitative dynamic behavior of that neurophysiological control system.

References

[1] Longtin, A. and Milton, J. G. (1989). *Modelling autonomous oscilations in the human pupil light reflex using non-linear delay-differential equations*, Bulletin of Math. Bio. 51 (**5**), 605–624.