Evolution of sport performances follows a physiological law

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Geoffroy Berthelot and Stephane Len, both researchers at the IRMES (Institut de Recherche bioMédicale et d'Epidemiologie du Sport at INSEP, Paris, France), have published their findings in *Age*, the official journal of the American Aging Association, describing the evolution of performances in elite athletes and chess grandmasters. This article is congruous with the epidemiological approaches developed by the laboratory, and suggests that changes in individual performance are linked to physiological laws structuring the living world.

Physiological parameters that characterize human capabilities (mobility, reproduction or the capacity to perform tasks) evolve throughout the life cycle. The physical and intellectual abilities follow the same pattern, starting at the moment of conception: The performance of each individual is limited at birth, then increases to a peak before declining until death. With these findings, Geoffroy Berthelot and Stephane Len modeled the careers of more than 2,000 athletes (from a panel of 25 Olympic disciplines) and grandmasters of chess. They demonstrate a simple relation between changes in performance and the age of individuals.

The results of this study validate a model previously published by Moore: The evolution of the performances of an individual throughout his life follows an exponential growth curve to a peak before declining irreversibly, following another negative exponential curve. This peak is reached at the age of 26.1 years for the disciplines studied: athletics (26.0 years), swimming (21.0 years) and chess (31.4 years). For each

data set, the evolution curve is representative of a range of 91.7% of the variance at the individual level and 98.5% of the variance in terms of sport events. Moreover, these cycles are observable in other physiological parameters such as the development of lung function or cognitive skills, but also at the level of cells, organisms and populations, reflecting the fractal properties of such a law.

This study suggests that technical change, energy consumption and development strongly influenced the performance of individuals. These have increased significantly over the last century compared to today's values. Ultimately, the modeling of changes in performance with age can be extended to all individuals and lead to an estimate of life expectancy.

Further research will refine these descriptive models and apply them to other areas of human activity (scientific, economic, ecological ...), and test their viability, which may help to assess the relationships of man to his environment.

More information: Berthelot G and Len S et al (2011). Exponential growth combined with exponential decline explains lifetime performance evolution in individual and human species. *Age*; DOI:10.1007/s11357-011-9274-9

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