

THE CEREBELLAR CORTEX AS AN ARRAY OF INDIVIDUALLY TUNED PURKINJE CELLS
 PROVIDING AN OVERALL "DYNAMIC CUSHIONING" OF JERKY MOTOR COMMANDS :
 DEMONSTRATION OF A NEW CONCEPT

András Pellionisz

First Department of Anatomy, Semmelweis University Medical School
 Tüzoltó u. 58. Budapest 1450, HUNGARY

Theories, speculating on the basic question of what the cerebellum does and how it works, concentrate to the issue if there is an interaction between climbing fiber response (CFR) and parallel fiber response (PF) on a Purkinje cell (PC). According to the "time-sharing" concept (Llinás) there is no such interaction. The "read out" (Eccles) and "redistribution" theory (Boylls) assumes a standard, passive action of CFR on PF. Hitherto the only concept proposing an alteration of PC by CFR is the theory of heterosynaptic facilitation (Marr) meaning that the "wiring" of PF-PC synapses is modified. That concept, however, seems deadlocked. Hereby a proposal* is discussed which abandons pursuing the belief that a CFR-induced modification of PC is morphological. Rather, it holds that the modification of PC by CFR is *physiological* i.e. the *spike producing mechanism* of active membrane of PC itself is altered by CFR: the massive depolarization of PC by CFR alters the phasic-tonic dynamic character of spike train generator mechanism. By virtue of this experience-based "tuning" of PCs by CFR into spike generators with highly individualized dynamisms the cerebellar cortex serves as an array providing a multi-faceted dynamism-additive which mixes into the raw, jerky skeleton of motor commands downgoing from motor cortex. This "dynamic cushioning" translates them into smooth, elaborate execution of movements which is also fitted to the external disturbances on executors.

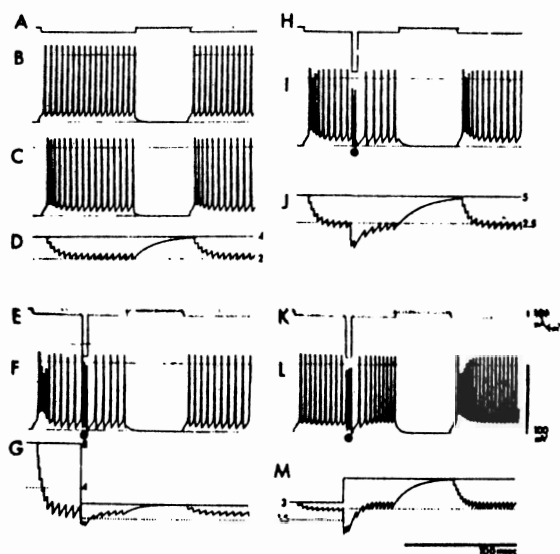


Fig.1. Demonstration of the concept of shaping the dynamism of spike producing mechanism of PC by CFR. Applying double current injection (AEHK), numerical integration of unchanged HH - equations yields trains shown on B. But, if exponent of n is changed to a *function* of activities (DGJM) then trains show accommodation (C). If a CFR (large dot) now modifies the asymptote of this floating value depending on its deviation from a reference (dotted) then the dynamism at the *next* occurrence of the same input may be unchanged (HIJ), lessened (EFG) or shaped into a very phasic one (KLM).

*Pellionisz (1974) CB Control Theory,
 Pellionisz (1976) Proposal for Shaping
 the Dynamism of PCs by CFR.
 Brain Theory Newsletter, Oct. (in press)