



Emilio Bizzi, M.D.
Institute Professor

McGovern Institute for Brain Research – Department of
Brain & Cognitive Sciences
Massachusetts Institute of Technology, Cambridge, MA,
USA

Muscle synergies, concept, principles and potential use in neurorehabilitation

Selecting the appropriate muscle pattern to achieve a given goal is an extremely complex task because of the dimensionality of the search space and because of the nonlinear and dynamical nature of the transformation between muscle activity and movement. The complex task of mapping a goal into a muscle pattern might be simplified by organizing a modular and hierarchical control architecture. To this end, we recorded electro - myographical activity from of the hind limb muscles of intact and freely moving vertebrates in naturalistic conditions. We used multidimensional factorization techniques to extract specific relationships among the amplitude and timing of the muscle activations observed during a variety of different movements. We found that a small number of synergies could explain a large fraction of the variation in the muscle patterns. Most synergies appeared to be preserved across different behaviors and animals, supporting the inference that the structure captured by the synergies reflects a modular and hierarchical organization of the controller.