Falls are among the most serious problems facing the aging population and have become the largest single cause of accidental death. Moreover, the total direct cost of fall injuries in 1994 among people 65 and older was $20.2 billion. Most falls in the elderly stem from interactions between environmental hazards and increased individual susceptibility to hazards from accumulated effects of age and intrinsic factors. Research on biomechanics of selected physical tasks, which take both environmental and intrinsic factors into account, is needed to quantify impairment magnitudes, to determine what elements are critical to the impairment, and ultimately to design more effective interventions for preventing falls in the elderly. The long-term goals of this proposed project are to advance the understanding of the mechanisms underlying the increased incidence of falls in the elderly, to determine a more effective method of identifying aged persons at risk of falling, and eventually to design more effective exercise/strengthening programs for the prevention of falls in the elderly. Specific aims of this project are to (1) demonstrate that motion of the whole body center of mass (COM) during obstacle crossing could better distinguish fallers from non-fallers when compared to individual segmental motion, (2) examine the relationship between ability to accommodate to environmental hazards during locomotion and muscle weakness, and (3) to identify quantitative, biomechanical indices (muscular demand-to-capacity ratios) that can better indicate the level of mechanical challenge imposed on selected muscles. Motion analysis and muscle strength testing will be performed on 24 elderly non-fallers and 24 elderly fallers (65 years or older). Body segment motion, ground reaction forces, and electromyography will be collected during unobstructed walking and stepping over obstacles of heights corresponding to 2.5% and 10% of each subject’s height. Isometric strength of selected lower extremity muscles will be measured bilaterally. A thirteen-link biomechanical model, with kinematic inputs of each body segment and ground reaction forces, will be used to compute the three-dimensional motion of the whole body COM and three-dimensional joint moments (torques) of the lower limbs. Data analysis will be performed on both mechanical and neuromuscular levels, including the isometric muscle strength, electromyography, motion of the COM, and its interaction with the center of pressure (COP) of the stance foot derived from ground reaction forces and moments. Finally, correlation between muscle strength and dynamic balance control (indicated by the motion of the whole body COM) will be examined. This proposed project is expected to identify/define more sensitive biomechanical measures (both intrinsic and extrinsic) for better quantification of age-related mobility impairment and functional challenges imposed on our musculoskeletal system.