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Grouping diverse biomechanics research into several important central themes is a very logical organization strategy. This should aid scientists in aligning their research with important public health problems and with the priorities of funding agencies. One central theme to organize around should be improving healthy life expectancy. This is a highly important public health problem and would include biomechanists working on basic, translational, and clinical research; working from the cellular and molecular level through to the whole body level; and working on a variety of important health problems.

A great amount of current research is designed to improve human life expectancy. However, increased life expectancy should not be the only goal. It is also desirable that we strive to maintain a high quality of life during our later years. In additional to the personal benefits of improving healthy life expectancy, there are also economic benefits. Increasing healthy life expectancy will reduce health care costs and will allow workers to stay in the workforce longer.

Within the central theme of increasing healthy life expectancy, one logical line of research is developing a better understanding of the mechanobiology of bone, muscle and cartilage. It is well known that these tissues respond to mechanical stimuli. Improving the health of muscle, bone, and cartilage has the potential to dramatically increase healthy life expectancy. Problems in these tissues, such as osteoarthritis, directly shorten healthy life expectancy. Additionally, reversing age related loss of bone, muscle, and cartilage would greatly improve functional mobility during activities of daily living and therefore improve quality of life. Increased physical activity would also result in secondary benefits to cardiovascular health.

At the cellular and molecular level biomechanists can contribute by fully elucidating the mechanisms by which bone, muscle, and cartilage cells sense mechanical signals. Additionally, focus should also be placed on understanding how external forces are passed to cells through extracellular matrix, as age related changes in material properties of the extracellular matrix may impair mechanical signaling. Basic science done at this level can produce targets at the cellular and extracellular levels for interventions to improve tissue health. These interventions may be pharmaceutical or they may be mechanical (e.g. exercise or application of vibration).

Another important role biomechanists can play in this line of research is to determine the optimal loading for mechanical interventions designed to improve bone, muscle, or cartilage health. While increasing mechanical loading has the potential to improve tissue health, too much loading could result in injury. Furthermore, determining the optimal loading conditions and duration will enable the simplest interventions to be developed. The possible health benefits from exercise are currently well known. However, adherence to interventions is generally quite low. The development of simple intervention strategies has the potential to increase participation.

Biomechanists are also well suited to evaluate the effects of mechanical or pharmaceutical interventions designed to improve bone, muscle, or cartilage health. This would include directly evaluating the effects of the interventions on the specific tissue’s health. This would also include performing prospective trials to examine the effects of interventions on balance, functional abilities, and ultimately quality of life.