

A system for evaluating the contractile force of myotubes, and drug discovery applications

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Aging and/or disuse of muscles result in losses of muscle mass and function. Muscle atrophy affects not only an individual's quality of life but also healthy life expectancy with increased risks of various diseases. Recent epidemiological studies revealed a significant correlation between muscle mass and lifespan. The prevention of muscle atrophy and the maintenance of muscle mass based on exercise therapies and with the development of new drugs are thus receiving increased attention. Skeletal muscle cells (myotubes) are frequently used in basic research. Evaluations of myotubes' quality are generally undertaken by measuring the diameter/area and the expression level of contractile proteins such as myosin heavy chain protein, but these indicators do not directly express the cell quality. The contractile force is a better indicator of myotube quality. However, an appropriate method for evaluating cells' contractile force has not been established.

This presentation introduces a system that our group recently developed for measuring the cell contraction force. With this method, myotubes are cultured on a two-layer silicone substrate of differing hardness. When the myotubes are stimulated by an electric pulse, the muscle contraction force is visualized as wrinkles. The length of the wrinkles is correlated with the magnitude of the force, and thus the values of the wrinkles can be used as an indicator of force. This system will contribute to the discoveries of new drugs designed to prevent or improve muscle atrophy.