Melatonin a hormone produced by the human pineal gland during the night provides a signal that inhibits the metabolism and growth of a variety of human cancers in the experimental setting. In a first of its kind study funded by the National Leiomyosarcoma Foundation the hypothesis was tested that melatonin can directly inhibit the growth and metabolic activity of human leiomyosarcomas grown in rats over the short-term as well as cause the regression of these tumors over the long-run. Our results demonstrated that melatonin directly and almost completely suppressed the metabolic and growth activity of human leiomyosarcomas. Furthermore, melatonin was able to cause a substantial regression in the size of these aggressively growing tumors. These findings are the first to demonstrate a potent anticancer effect of melatonin on human leiomyosarcoma growth in rats by suppressing the metabolic activity of these cancers. The next step in this research process is to test the effects of melatonin on the growth activity of leiomyosarcomas (growing in rats) directly perfused with donor blood collected from human subjects following their intake of an oral melatonin supplements. These promising initial results indicate that melatonin may be a unique and effective potential new strategy for the treatment of leiomysarcoma in future human clinical trials in leiomyosarcoma patients.