

THE HARTWELL FOUNDATION

2007 Individual Biomedical Research Award

Daniel H. Teitelbaum, MD

**Professor
Department of Surgery**

University of Michigan



Development of an Internally Implanted Device for the Growth of the Gastrointestinal Tract

Problems during the growth of the fetus may lead to an abnormally short small bowel caused variously, by failure of a portion of the intestine to develop, infectious inflammatory disease, damage of the bowel induced by a twist that impaired blood supply, and gastroschisis. Babies with insufficient length of small bowel develop malabsorption, malnutrition, diarrhea, and electrolyte abnormalities, and require parenteral nutrition and fluids to sustain life. The morbidity associated with this disorder can be devastating and is associated with mortality rates in excess of 30%. Approximately 10,000-20,000 patients are currently receiving home-delivered total parenteral nutrition for short-bowel syndrome in the US, with estimated societal healthcare costs of \$2-4 billion each year. Various approaches to treat short bowel syndrome include surgical attempts at elongation, growth factors, and intestinal transplantation; all of which are very costly, have not provided desired relief, and have been associated with a high rate of complications and death. By contrast, Dr. Teitelbaum has pioneered the application of physical devices to lengthen the intestine by application of longitudinal distractive force. He has shown feasibility to lengthen significantly pig small intestine and has demonstrated that the lengthening was not merely a stretching of the intestine, but true growth with preservation of intestinal function. His innovative proposal is to develop an implantable device suitable to fit within the abdominal cavity of infants and children, which will apply a continuous and controlled distractive force on the intestine to lengthen it by mechanotransduction — the translation of mechanical signals to biochemical signals that can affect both cellular function and activation of growth mechanisms responsible for lengthening the intestine. Effectively, the strategy would be directed to grow an infant's own intestine to a length sufficient to reduce their risk for long-term related health problems. Teitelbaum and his collaborators intend to explore the potential use of cutting-edge technology to achieve their goal, including deployment of shape memory alloys in the design of a self-ratcheting device to lengthen the intestine. Successful implementation would provide dramatic relief for those families affected by short bowel syndrome.