



## **Tissue Engineering for Treatment of Children with HLHS**

Faith's Angels board of directors voted on March 24, 2014 to designate \$15,000 towards the following research;

Despite advances in surgical palliation, there is no cure for hypoplastic heart syndrome and other forms of single ventricle heart disease. Failure of conventional treatment of single ventricle heart disease is usually a result of failure of the only ventricle. This difficult clinical problem motivates the research in our laboratory.

We are developing two solutions for heart failure in single ventricle heart disease. First, we are pursuing a short-term strategy that will extend or enhance the current treatment paradigm by the use of thymus derived stem cells that can improve the pumping function of the single ventricle. The thymus gland is an organ involved in immune function and has an extraordinary ability to grow and regenerate after injury, unlike the heart which has extremely limited ability to regenerate and grow. During open heart surgery in infants, part of the thymus gland is removed and usually discarded to obtain access to the heart. Our lab has unique access to discarded thymus derived stem cells and over the past 5 years we have demonstrated its superiority to bone marrow derived stem cells and its ability to enhance function of laboratory models of heart tissue. Upon completing current animal studies to evaluate the efficacy of thymus derived stem cells to treat heart failure and promoting new blood vessel growth, we will be ready to pursue clinical trials in patients with hypoplastic left heart syndrome.

Our long-term strategy to treat single ventricle heart disease is the fabrication of engineered heart tissue. This strategy incorporates advances in stem cell biology, tissue engineering and surgical science to achieve functional and implantable heart tissue that could augment the hypoplastic ventricle without the problem of rejection, as seen in heart transplantation. A major challenge to this approach is the generation of a blood vessel system in the laboratory engineered heart tissue. To tackle this problem, our laboratory is utilizing an approach that mimics normal blood vessel development in mammalian hearts. With our collaborators in the Department of Aerospace Engineering at the University of Michigan, we are recreating the conditions of normal heart blood vessel development in the laboratory using a custom designed and build bioreactor.

Bold strategies are needed to develop solutions to the difficult clinical problem of treating single ventricle heart disease, and we feel that the multidisciplinary expertise (clinical, basic science, stem cell biology, tissue engineering and materials science) on our team will allow us to develop the above innovative ideas into real treatment modalities.

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Faith's Angels Inc. is a 501c3 nonprofit organization.

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