



Shriners Hospitals for Children®
Boston, Massachusetts

ORGAN REENGINEERING

There are over 123,000 patients on the organ transplant waiting list in the United States. That number increases by 5 percent every year. Tens of thousands of people die waiting for organs, while even more are not even placed on the waiting list. One possible solution to the donor organ crisis is developing tissue-engineered grafts in the lab.

Our group at Shriners Hospitals for Children — Boston was the first to establish the whole liver engineering approach to creating grafts that are transplantable and may potentially serve as alternatives to donor livers. Researchers use donor livers that are not deemed suitable for transplantation because of poor quality or excessive damage during storage. After removal of the dead cells by a process called perfusion decellularization, the resulting extracellular matrix scaffolding is used to recreate the native liver architecture using fresh and healthy liver cells. Having established the technology in a small animal model, our current efforts focus on scaling up to human livers, regenerating liver tissue from human induced pluripotent cells and improving the blood compatibility of the grafts.

Recent Publications

1. Uygun BE, Yarmush ML (2013) Engineered liver for transplantation. *Curr Op Biotechnol* 24:893–899. doi: 10.1016/j.copbio.2013.05.008
2. Uygun BE, Yarmush ML, Uygun K (2012) Application of whole-organ tissue engineering in hepatology. *Nat Rev Gastroenterol Hepatol* 9:738–744. doi: 10.1038/nrgastro.2012.140
3. Uygun BE, Price G, Saedi N, et al. (2011) Decellularization and recellularization of whole livers. *JoVE*. doi: 10.3791/2394
4. Uygun BE, Soto-Gutierrez A, Yagi H, et al. (2010) Organ reengineering through development of a transplantable recellularized liver graft using decellularized liver matrix. *Nat Med* 16:814–820. doi: 10.1038/nm.2170
5. Parashurama N, Nahmias Y, Cho CH, et al. (2008) Activin alters the kinetics of endoderm induction in embryonic stem cells cultured on collagen gels. *Stem Cells* 26:474–484. doi: 10.1634/stemcells.2007-0303
6. Cho CH, Parashurama N, Park EYH, et al. (2007) Homogeneous differentiation of hepatocyte-like cells from embryonic stem cells: applications for the treatment of liver failure. *FASEB J* 22:898–909. doi: 10.1096/fj.06-7764com

Figure captions

Fig 1. Rat liver during decellularization.

Fig 2. Network of blood vessels in the liver is preserved upon decellularization; venous (blue) and portal (red).

Fig 3. Human hepatocytes derived from human embryonic stem cells.

Images provided by Basak Uygun, Ph.D.

Figure 1

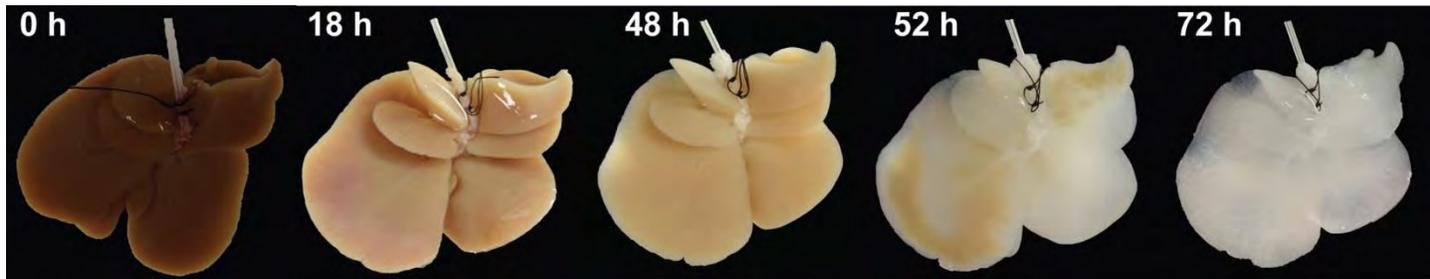


Figure 2

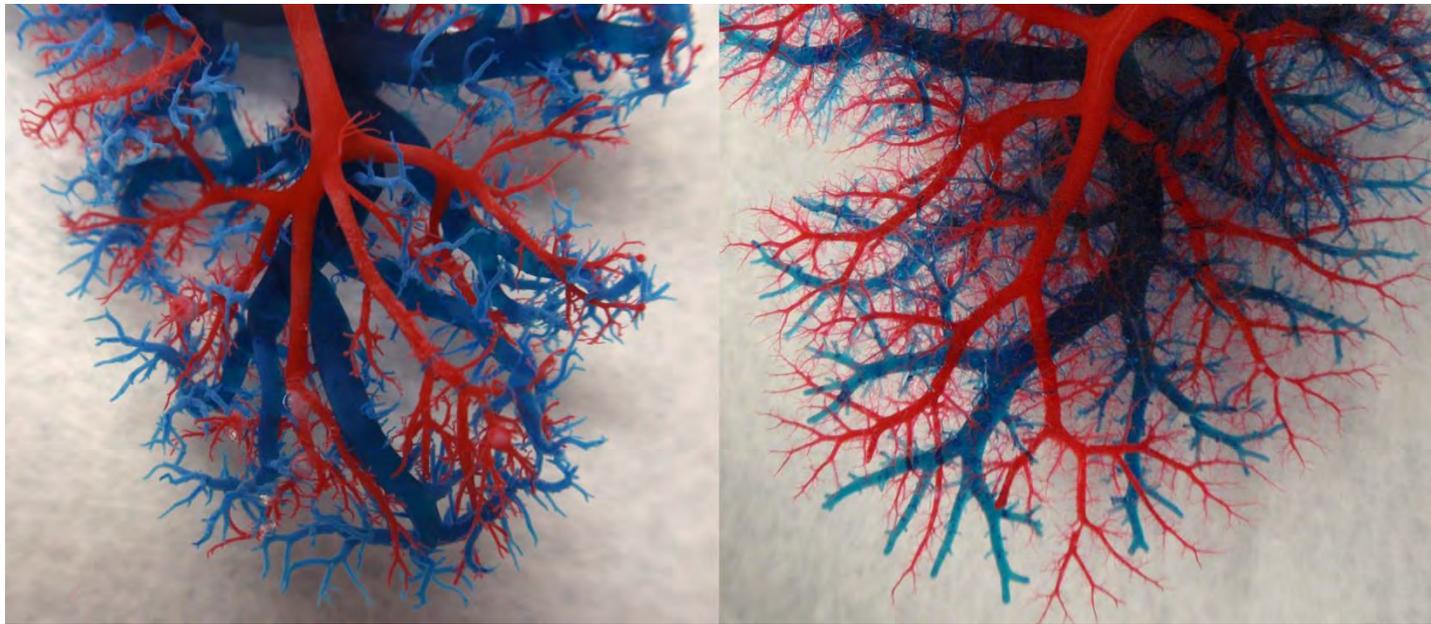


Figure 3

