

Chang '02 receives American Heart Association Fellowship

6/21/05

Carlos Chang '02, who received degrees in both art (BFA) and engineering (BS in materials science), is the recipient of an American Heart Association Fellowship to pursue a Ph.D. in biomaterials at the University of Arizona in Tucson. Chang's research is addressing a fundamental problem with efforts to grow artificial tissues and organs - the difficulty in getting nutrients and oxygen to the new tissues. His project is titled "Patterned 3-D Microvasculatures: An In Vitro System for Tissue-Engineered Microvessel Networks." (More about his research is available at <http://www.u.arizona.edu/...>) "These structures (artificial tissues and organs) contain a complex mixture of materials and cells," explains Chang. "Currently, the tissues are very small, only a few cell layers thick. As the tissues get bigger, many cells die" because they are not adequately supplied with oxygen and nutrients. Additionally, "waste products are not removed, creating a toxic environment." Chang is looking at ways to "create networks of tiny blood vessels; the capillaries, arterioles and venules may be used to circulate blood to and remove wastes from cells within artificial tissues and organs." In his research, Chang is attempting to mold polymers with tiny channels, smaller than a human hair, which potentially can be used as patterns for the blood vessels. If successful, the network will be implanted in mice to learn how the new vessels interact with the animals' circulatory system. Then, it will be back to the laboratory to determine if the mice results can be replicated, providing answers to "fundamental biological questions surrounding vessel development." Chang is hopeful that his research will not only provide new insight into how blood vessels grow and mature, but how they behave in the human body, and eventually, how to develop vessel networks for engineered tissues. It may also lead to a better understanding of how cardiovascular drugs affect blood vessels. Internships at Georgia Tech and Northwestern, and a co-op at Sandia National Laboratories gave Chang a good foundation in biomedically applicable technologies. "While working at both Sandia and Northwestern, I was involved with microfluidic research," said Chang, explaining "Microfluidics relies on surface forces, similar to capillary action, to drive fluids to move through tiny channels. At Northwestern, I concentrated on fabricating silicon molds with surface microchannels to investigate fluid movement for bioengineering applications." But it was a family crisis that prompted Chang to pursue a Ph.D. in biomedical engineering. His grandfather had quadruple bypass surgery, and suffered multiple complications as a result. "After first-hand experience with contemporary medicine's inadequacies, I decided to do something about it," said Chang. He applied several places, and chose the University of Arizona because of its strong vascular research program. So far, he said, he's been able to apply his interest in microfluidics and microfabrication to biomedical engineering. His current interests build upon what he learned at Alfred. "During my five years at Alfred, I gained a strong, fundamental understanding of material behavior. I learned how to modify characteristics through minute changes to nano-, micro- or macro-structure," said Chang. The difference, he said, is that "at Alfred, we had the luxury of working with inanimate substances. If we needed to tweak a material's property, we could just add some polymers or throw in some other ceramic compounds or change the processing conditions a little bit. Biology, as I've discovered in the past year, is a bit more complicated and cleanliness reigns supreme." "My laboratory experience at Alfred and cleanroom experience from internships and co-ops helped with learning sterile technique," said Chang. The techniques he now employs to make media to feed cells, or to culture cells and place them in his molds "are simply variations of basic laboratory skills I gained in Alfred classes." After interacting with students from a variety of large and small universities, I believe Alfred provided superior laboratory opportunity and instruction," said Chang. "Thanks to such a background, I was able to quickly acclimate to my new lab and hit the ground running when I arrived in Tucson. I started working in the lab almost immediately and have already acquired some meaningful laboratory results," and that, in turn, led to the AHA fellowship. Chang hasn't forsaken his art, either. He just had an interactive piece selected for the Arizona Biennial at the Tucson Museum of Art. His one of only 44 pieces selected for inclusion in the exhibition from those submitted by artists from throughout the state. His piece, "microcosm 2005," is on display until the middle of August, and he's working out details with a local gallery to show some digital prints this fall or winter. Images of his work may be found at his website: <http://digitalsculpture.n...>)