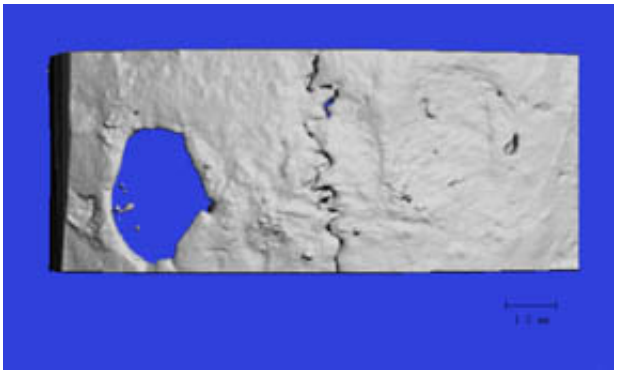
Researchers Discover New Method to Generate Human Bone

April 21 2005



By studying diseases in which the human body generates too much bone, UCLA researchers have discovered and isolated a natural molecule that can be used to heal fractures and generate new bone growth in patients who lack it.

Image: Efficacy of UCB in bone healing 4 weeks post-trauma. Bone defect on right is filled with new bone while the control defect on left still lacked bone.

Bioengineering Professor Ben Wu at UCLA's Henry Samueli School of Engineering and Applied Science, and Thomas R. Bales Professor Kang Ting at UCLA's School of Dentistry are developing a new molecule they've named UCB, or University of California Bone.

The core technology developed by Wu and Ting is potentially the most significant advancement in bone regeneration since the discovery of bone morphogenetic proteins (BMPs) by Dr. Marshall Urist at UCLA in the 1960s.

“For the average person, this new development potentially means faster, more reliable bone healing with fewer side effects at a lower cost,” says Ting. “In more severe cases, such as in children born with congenital anomalies, the new protein may offer an advanced solution to repair cleft palates, which involves bone deficiencies, and also aid in repairing other bone defects such as fractures, spinal fusion and implant integration.”

UCB differs significantly from BMPs, the protein currently used by orthopedic surgeons to aid in bone repair, in that UCB has potentially fewer side effects. With BMPs, bone formation has been observed to occur at locations outside of the intended implant site, and tissue other than bone also has been reported. In contrast, UCB’s main effects appear to be more specific towards bone formation process, giving surgeons increased control over where bone forms. Says Wu, UCB is more specific because it works downstream from the body’s “master switch” for bone formation. Because the two molecules act on different targets, UCB also works synergistically with BMPs to form more bone than is typically possible with BMPs alone.

The key to success for these proteins is designing the right carrier – using the protein alone is not effective. Currently BMPs are delivered with a collagen-sponge into the area where bone growth is needed. The sponge offers little biological benefits for the surgeon, and proteins can migrate away from the sponge. In contrast, the team at UCLA is developing a carrier that is engineered for UCB activities in the biological environment.

“It’s the right combination of carrier and protein that further increases the stability and activity of UCB. For certain clinical applications, we will need to develop injectable options that are minimally invasive. For other clinical applications, we will need moldable carriers that can hold the UCB in place better. By making life easier for the surgeons, they can focus on the surgery. Ultimately, the patient benefits,” says Ting.

Another current option is to use the patient’s own bone grafted from another part of the body.

“Right now we are doing a lot of spinal fusions and these fusions require us to have bone graft material. The problem with taking a patient’s own bone for this procedure is that aside from the pain, which often becomes severe and persistent, there is a high risk of infection. This adds higher risk to the surgery,” says Dr. Jeffrey Wang, Chief of Orthopaedic Spine Service at the UCLA Comprehensive Spine Center. “The discovery of UCB could potentially be a better way to do spinal fusion. Used in conjunction with cartilage growth, this discovery may completely change the way we look at things in the future,” added Wang.

BMPs, found in demineralized bone, were discovered in the 1960s, but until the advent of biotechnology, the arduous process and high cost associated with making BMPs from animal-derived bone was deemed too difficult. To date, only two companies have received FDA approval for BMPs, making the product cost high, and the treatment prohibitive for many.

Ting, who works frequently with children who have congenital anomalies, began his bone research eight years ago. Wu joined him three years ago, and their collaboration resulted in the recent discovery.

“I thought it was important to understand how accelerated bone growth in one situation might be applied to situations where more bone growth

could accelerate healing in those patients who lacked normal or necessary bone formation," says Ting. "This discovery will provide another option for patients. Competition will make treatment options safer, less expensive, and more accessible for those families who really need it."

The team of UCLA researchers, under the business name Bone Biologics, already has begun forming partnerships that may assist in the development of appropriate carriers for UCB. The Musculoskeletal Transplant Foundation (MTF), the nation's largest tissue bank, has signed a collaborative development agreement with Wu and Ting to provide customized tissue forms to support the delivery of UCB.

"We are excited by the initial work of Dr.'s Wu and Ting," stated MTF President and CEO, Bruce Stroever. The development of new protein sources tied to an appropriate carrier that encourage new bone formation and speed healing is work that is synergistic to MTF's mission of advancing the science of bone, ligament, cartilage and skin transplantation. We are pleased to be working with UCLA."

Wu and Ting anticipate FDA approval and first sales of the product in the next seven to nine years. Other collaborators on this technology include Dr. Xinli Zhang and Dr. Chia Soo at UCLA, and Dr. Shunichi Kuroda at Osaka University. The new technology recently has been awarded the prestigious 2005 Hatton Award from the International Association of Dental Research.

Source: University of California - Los Angeles