<table>
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<tr>
<th>Technology</th>
<th>Gene therapy using modified Cox-2 gene to promote osteointegration</th>
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<tr>
<td>Inventors</td>
<td>William Lau, Jon Wergedal, Charles Rundle VA Loma Linda Healthcare System</td>
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</table>
| Key Features | • Direct local administration of hydrogel scaffold and Cox-2 viral vector  
• Promotes osteointegration  
• Ability to control gene expression easily and efficiently  
• Potential to improve healing time and return to activity |
| Stage of Development | Successful demonstration in a rat bicep tenodesis model |
| Keywords | Osteointegration  
Tenodesis  
Cox-2 gene  
Gene therapy  
Tendon graft / healing |
| Patent Status | Patent application |
| Contact | Lee Sylvers, Ph.D.  
Technology Transfer Program  
Department of Veterans Affairs  
Office of Research & Development  
810 Vermont Avenue, NW  
Washington, DC 20420  
Phone: 202-443-5646  
Fax: 202-495-6153  
E-mail: lee.sylvers@va.gov |

**Cyclooxygenase-2 Based Gene Therapy for Tendon-to-Bone Healing after Tendon Surgeries**  
(VA Reference No. 2-121)

*Unique gene therapy method involving direct local administration of a modified human Cox-2 gene with a biocompatible hydrogel scaffold*

**Technology**

Tendon and ligament injuries are among the most common health problems affecting the adult population. Current treatment options include periods of rest, physical therapy, non-steroidal anti-inflammatories, and corticosteroid injections. If symptoms persist despite adequate conservative therapy, surgical intervention may be indicated. Tenodesis is one of the most common surgical procedures for the treatment of tendon rupture or tear.

The Department of Veterans Affairs (VA) has developed a method using modified human cyclooxygenase-2 (Cox-2) gene in a direct *in vivo* gene transfer strategy to promote osteointegration (tendon to bone) of the tendon graft after biceps tenodesis or related tendon surgeries. The developed method involves the direct local administration of a modified human Cox-2 gene to the tenodesis site with a biocompatible hydrogel scaffold to maintain the viral vector at the tendon/bone interface within the bony tunnel. Once the adenovirus-associated viral vector utilized in the method and the corresponding nucleic acid reach the nucleus of the target cells, the Cox-2 gene can be expressed and the Cox-2 protein acts to promote tendon healing and tendon to bone integration. The gene construct contains a mechanism so that the gene will be expressed while the patient is taking the antibiotic, tetracycline. Once the fracture is healed, the patient will discontinue the tetracycline and the gene will no longer be produced.

**Opportunity**

The aging population, increase in the prevalence of degenerative joint diseases, rise in sports-related injuries, and improvements in orthopedic surgical procedures are contributing to the growth in orthopedic surgical volume. With an increase in orthopedic surgical procedures, the demand for strategies to promote osteointegration is set to increase. The developed method could lead to a commercial product in the tissue engineering market that is expected to grow in the United States from $6.9 billion to almost $32 billion by 2018.

**Competitive Advantage**

The developed method will promote effective tendon to bone healing and can increase the marginal strength of the repaired tendon allowing a quicker return to physical therapy for patients and decreasing the risk of damaging the reconstructed tendon. Incorporation of the hydrogel scaffold design will ensure that the viral vectors are delivered to the target site and ensure that the vectors will stay at the target site to promote osteointegration. In addition, the use of the adenovirus-associated viral vector has been shown to have a high safety profile. The ability to turn on and off gene expression easily and efficiently provides tailored treatment and ensures optimal safety.

**Status**

The Department of Veterans Affairs is looking for a partner for further development and commercialization of this technology through a license and the VA inventors are available to collaborate with interested companies through a Cooperative Research and Development Agreement (CRADA).