Stimulan® implant grade calcium sulphate is a synthetic biocompatible bone graft material that completely resorbs, to be replaced by new bone. It has a rate of resorption that corresponds with the rate of new bone growth.

Stimulan® calcium sulphate is produced using a proprietary synthetic process ensuring consistent and reproducible results. The physical and chemical properties are tightly controlled with no traces of potentially toxic impurities, which have been associated with naturally occurring mineral sources of calcium sulphate.

Stimulan® represents a major breakthrough in resorbable bone graft technology. In terms of purity and consistency, it is unrivalled by virtue of its unique and proprietary process, which has been developed by Biocomposites’ biomaterial development team over years of careful, in-depth research.
Bone grafting techniques have been widely used in orthopaedic surgery and bone is the second most frequently transplanted material after blood. Bone grafts are increasingly used to fill bone cavities resulting from disease, trauma or surgery and also to fuse joints and non-unions.

The Case for Synthetic Bone Substitutes

**Autograft**

Autograft availability is limited and its harvesting, usually from the iliac crest, increases surgery time, can prolong hospital stay and very often results in donor site morbidity.

**Allograft**

Galea *et al* stated that the source from bone banks cannot meet the demand for the increasing incidence of revision surgery.

*J Bone Joint Surgery (Br)* Vol. 80-B No. 4, July 1998

Palmer *et al* referred to their findings of pathological lesions present in osteoarthritic femoral heads; unknown to both the patient and the medical staff.

*J Bone Joint Surgery (Br)* Vol. 81-B No. 2, March 1999

“...tissue banks vary in complexity and scope of operation and depend on a variety of techniques in the selection of donors and the exclusion and preparation of bone and tissue allografts...”

“...therefore it behoves orthopaedic surgeons to find out specifically how the allografts they are about to use were excised and prepared...”

“...irradiation clearly alters biomechanical properties of collagen, hence bone structure, and diminishes its osteoinductive potential...”

Extracts taken from *Bone Loss in Revision Surgery: How to Manage the Femoral Side.*
C.A. Engh, Sr., W.C. Head, A.G. Rosenberg, F.H. Sim
Specification of Stimulan®

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>CaSO₄ • 2H₂O</td>
</tr>
<tr>
<td>Physical</td>
<td>Regular pellets or injectable setting paste</td>
</tr>
<tr>
<td>Purity</td>
<td>100%</td>
</tr>
</tbody>
</table>

Comparison Table - Competitor Products

<table>
<thead>
<tr>
<th>Phase analysis</th>
<th>Commercial calcium sulphate</th>
<th>Medical/surgical grade</th>
<th>Stimulan® implant grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaSO₄ • 2H₂O</td>
<td>80-94%&gt;</td>
<td>98%&gt;</td>
<td>100%</td>
</tr>
<tr>
<td>CaCO₃, MgCO₃,*</td>
<td>5.1%</td>
<td>0.5%</td>
<td>Nd</td>
</tr>
<tr>
<td>CaCO₃</td>
<td>1.0%</td>
<td>0.3%</td>
<td>Nd</td>
</tr>
<tr>
<td>Aggregate**</td>
<td>4.5%</td>
<td>0.3%</td>
<td>Nd</td>
</tr>
</tbody>
</table>

Nd: Not detected
* The earth mineral, dolomite
** Aggregate, or “earth impurities,” are present in calcium sulphate sourced from mined gypsum rock. They are non-bioabsorbable and can include such elements as feldspar, clay and crystalline silica (quartz)

Key advantages to the Surgeon

- Controlled phase purity ensures consistent resorption
- Higher chemical purity ensures total biocompatibility
- The resorption rate is consistent with the formation of new bone
- Safe to use even in infected cases

<table>
<thead>
<tr>
<th>Calcium sulphate chemical form</th>
<th>Stimulan® product geometry and form</th>
<th>Presentation to surgical site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemihydrate</td>
<td>Powder and mixing solution</td>
<td>Injectable, mouldable, setting paste</td>
</tr>
<tr>
<td>Di-hydrate</td>
<td>Preformed, uniform pellets</td>
<td>Dispenser for percutaneous, minimally invasive implantation or in jars</td>
</tr>
</tbody>
</table>
**In-Vitro Studies - Stimulan®**

![In-vitro Studies - Scanning electron micrograph showing human osteoblasts growing on surface of Stimulan® at 21 days](image)

**In-Vivo Studies - Stimulan®**

Stimulan® calcium sulphate pellets were implanted into a sheep’s epiphyseal humerus.

Radiographic examination 6 weeks after implantation shows no evidence of the pellets, indicating complete resorption.

Trabecular bone can be clearly seen interspersed with healthy bone marrow (Figure 1) and osteoblast activity is much in evidence (Figure 2).

![Figure 1](image)

**Figure 1**

Trabecular bone interspersed with healthy bone marrow - sheep study

![Figure 2](image)

**Figure 2**

Osteoblasts at 6 weeks in a sheep model

* Full data available on request from Biocomposites
CASE STUDY MAVK090106

53 year old male sustained comminuted distal tibial fracture

Reduction of ankle fracture fragments was achieved using Stimulan® to maintain space and promote ingrowth of new bone

Absorbable pellets for open procedure

Normal physiologic absorption of CaSO₄ occurs with the simultaneous deposition of autogenous cancellous bone


Calcium Sulphate is the material of choice when infection is present or anticipated

Leonard F. Peltier, M.D. Professor of Surgery, University of Kansas Medical Centre, Kansas City, Kansas - The Use of Plaster of Paris to Fill Defects in Bone, Clin Orthop 21-31, 1961

<table>
<thead>
<tr>
<th>Indications</th>
<th>Dia</th>
<th>Pot Size/Dispenser</th>
<th>Catalogue Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal Fusion</td>
<td>3.0mm</td>
<td>5cc/10cc</td>
<td>600-30-005 600-30-010</td>
</tr>
<tr>
<td>Trauma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign Cystic Lesions</td>
<td>4.8mm</td>
<td>10cc/20cc</td>
<td>600-48-010 600-48-020</td>
</tr>
</tbody>
</table>
Calcium Sulphate is an outstanding bone substitute ensuring bone formation and gives results comparable with autogenous bone.


**CASE STUDY MA5K100106**

10 year old male with femoral cyst

Femoral cyst below the lesser trochanter, previous treatment of the cyst involved cortisone injections. However, the hole left by the needle in the cortex caused the femur to fracture.

Fracture was treated with Stimulan® pellets placed percutaneously.

The patient was reviewed at 14 weeks and the X-rays show complete resorption and new bone formation.

Calcium Sulphate is an outstanding bone substitute ensuring bone formation and gives results comparable with autogenous bone.


<table>
<thead>
<tr>
<th>Products</th>
<th>Dia</th>
<th>Pot Size/ Dosage</th>
<th>Dispenser/Cannula</th>
<th>Catalogue Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulan® Dispensers</td>
<td>3.0mm</td>
<td>1.5cc</td>
<td>600-30-s1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.8mm</td>
<td>5cc</td>
<td>600-48-s1</td>
<td></td>
</tr>
<tr>
<td>Stimulan® Instrument Set</td>
<td>3mm</td>
<td></td>
<td>650-C3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.8mm</td>
<td></td>
<td>650-C2</td>
<td></td>
</tr>
<tr>
<td>Sterilisation Tray</td>
<td></td>
<td></td>
<td>650-001</td>
<td></td>
</tr>
</tbody>
</table>
Fully setting injectable paste with individual pelletising kit

CASE STUDY MAVSK170106

80 year old male with spinal stenosis

Fusion of Lumbar vertebral interbodies (L2-L5) was achieved using Stimulan® in combination with autograft

An injectable and mouldable matrix which sets at body temperature and fully resorbs to be remodelled by new bone.

**Stimulan® Preparation Protocol for Syringe Injection**

1. **Step 1** Empty powder into a sterile mixing bowl.
2. **Step 2** Slowly add mixing solution from both bulbs. (If application to pellet mould with spatula is preferred, use contents of large bulb only)
3. **Step 3** Mix thoroughly until a smooth paste is formed (approximately 30 seconds).
4. **Step 4** (i) Backfill the syringe with the paste. Attach the extender tube if required. (ii) The paste can then be injected into the surgical site.
5. **Step 5** Allow digitally packed or injected paste to cure undisturbed for 15 minutes after mixing prior to closure.

**Pack Contents** Disposable
- CaSO₄
- Pre-measured mixing solution bulbs
- Syringe
- 8cm Extension Tube
- Pellet Mould
- Spatula

<table>
<thead>
<tr>
<th>Product</th>
<th>Dia</th>
<th>Pot Size/Dosage</th>
<th>Dispenser/Cannula</th>
<th>Catalogue Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulan® Kit</td>
<td></td>
<td>5cc, 10cc</td>
<td></td>
<td>600-005, 600-010</td>
</tr>
</tbody>
</table>
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