BIO-REIGN™

BIOACTIVE MATRIX

Bio-Reign™ Bioactive

MOLDABLE Bone Graft Matrix

ROYAL BIOLOGICS

Our Bioactive Solutions

The evolution of our mineral and collagen composite bone grafts has advanced with the launch of our unique bioactive glass, mineral, and collagen composite bone graft solutions. We have a variety of mineral and collagen composite bone grafts with a wide range of adjustable characteristics. We have expanded even further to offer bioactive moldable bone graft solutions.

Our Composition

Our bioactive composite bone graft matrices are a combination of three components: carbonate apatite anorganic bovine bone mineral, 45S5 bioactive glass, and Type I Collagen. When combined, they provide an optimal scaffold to support the body's natural ability to regenerate new bone.

A Perfect Trio

50%

Carbonate Apatite Anorganic Bone Mineral

20%

Type I Collagen

30%

45S5 Bioactive Glass

Bio-Reign™ Bioactive
MOLDABLE Bone Graft Matrix

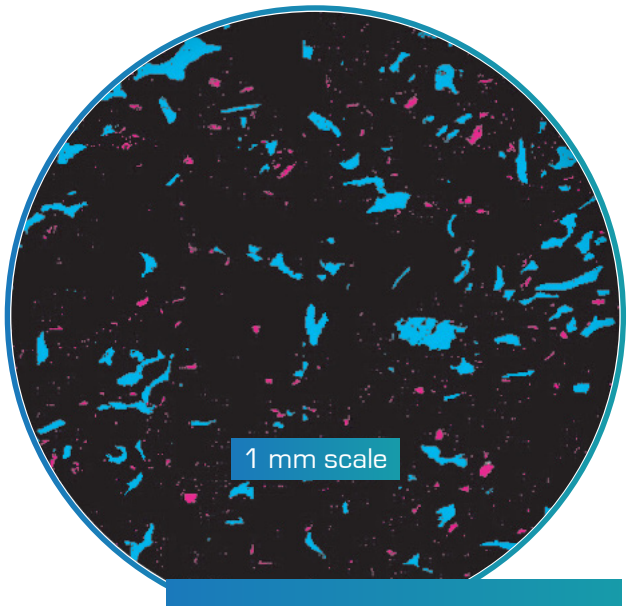
Bio-Reign™ Bioactive Moldable Bone Graft Matrix is composed of carbonate apatite anorganic bone mineral, bioactive glass, and Type I collagen that can be molded to fit the bone defect. It is an osteoconductive, bioactive, porous implant that allows for bony ingrowth across the graft site. The bone graft matrix is slowly resorbed and replaced by new bone tissue during the natural healing process.

Why Bio-Reign™ Bioactive Moldable?

- A Perfect Trio of Components—50% Carbonate Apatite anorganic bone mineral, 30% 45S5 Bioactive Glass, 20% Type I Collagen
- Uniform distribution of bioactive glass and mineral particles throughout the matrix, achieved through our proprietary manufacturing process[1]

Why Bio-Reign™ Bioactive Glass Component

- 30% is Optimal: Less is more. Bioactive glass is incorporated into Bio-Reign™ within a suggested critical range of 5-40% for optimal osteoblast growth and calcium phosphate formation in a composite[2]
- Ideal Particle Range: A narrow particle size distribution limited to 100-300µm to provide a more controlled rate of ion dissolution & surface reactivity, and a more consistent rate of bone bonding & proliferation[3,4]
- Exemplary Particle Size (100-300µm): Larger sized particles may not fully resorb. Smaller particles may resorb away quickly and impede the upregulation of osteoprogenitor cells[4,5]



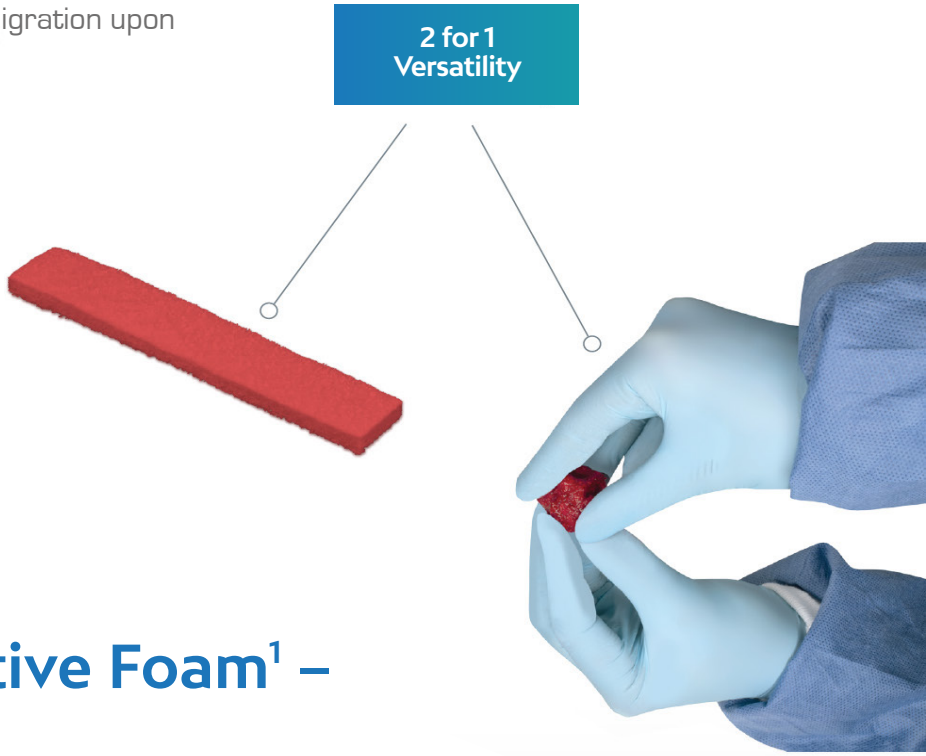
Uniform Particle Distribution

An SEM/EDX Analysis of Bio-Reign™ Bioactive Moldable polished cross sections showing mineral and bioactive glass

- 45S5 BIOACTIVE GLASS PARTICLES
- CARBONATE APATITE ANORGANIC BONE MINERAL
- POROUS TYPE I COLLAGEN MATRIX

Moldable **Advantage**

- 2 for 1 versatility—Upon hydration, the strip conformation can be used in its original shape or optionally molded into alternative shapes to address the unique contours of each defect
- Combined with either autogenous bone marrow or autograft with saline
- Can also be used with autograft as a bone graft extender
- Moldable, flexible, absorbent, resists migration upon irrigation
- A lengthy 40cc size option unlike any other bioactive moldable bone graft



Almost 2x more absorbent than Vitoss® Bioactive Foam[1] –

	Absorbency (ml/g)
Bio-Reign™ Bioactive Moldable	4.59 ± 0.76
Vitoss®Bioactive Foam	2.70 ± 0.35

Why Carbonate Apatite Bone Mineral?

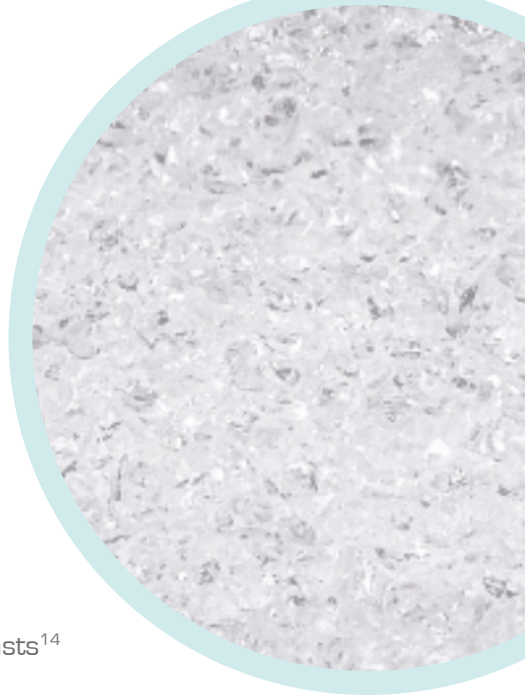
Optimal **Resorption & Remodeling**[6,7]

Natural Mineral Structure
Similar to Human Bone Mineral

More **Calcium Phosphate Deposition** than ß-TCP[8]

Half the crystallinity than HA, **More Soluble**[9]

Independent studies have shown higher **Osteoclastic & Osteoblastic** activity than ß-TCP & HA[10]



Why 45S5 Bioactive Glass?

Over **30 Years** of Presence in **Tissue Engineering**[11,12]

- Favorable Environment for bone regeneration and osteoblast attachment[13]
- Ion Exchange & Release—including soluble tetrahedral silica, which may promote rapid bone formation[2]
- Cell Proliferation & Differentiation—45S5 Bioactive glass has the ability to stimulate the growth & osteogenic differentiation of human primary osteoblasts[14]

Composition of **45S5 Bioactive Glass**

%	Component	
45%	**Silicon Dioxide**	SiO_2
24.5%	**Calcium Oxide**	Ca_2O
24.5%	**Sodium Oxide**	Na_2O
6%	**Phosphorus Pentoxide**	P_2O_5

Why Type I Collagen?

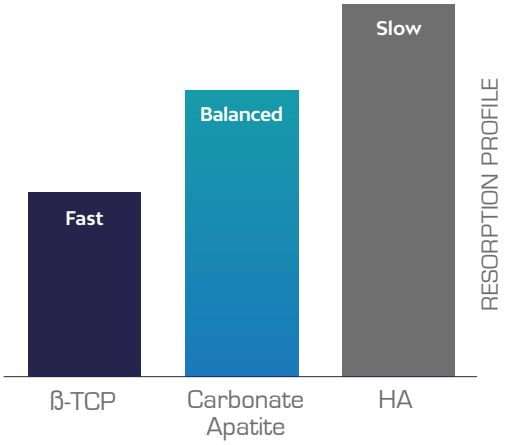
Homologous Molecular Structure
to Human Collagen[15]

- Highly purified for biocompatibility
- 100% resorbable through normal metabolic pathways[16]
- Intrinsic hemostatic properties control minor bleeding[16,17]
- Well-established long clinical history[16]
- Binds proteins and cells and retains biological factors[18]
- Single most abundant protein in the human body[19]

Five Reasons Why Carbonate Apatite is Superior

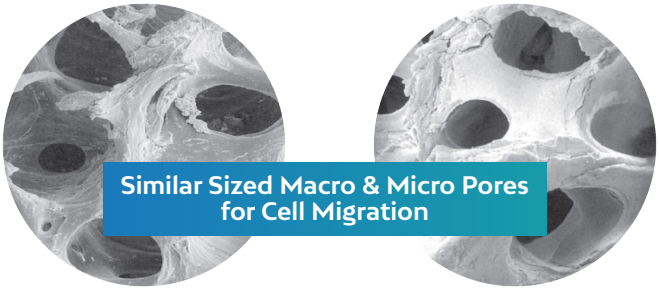
1 Optimal **Resorption & Remodeling**[6,7]

- Not fast like beta-tricalcium phosphate (ß-TCP)
- Not slow like hydroxyapatite (HA)
- Ideally, the rate of the bone graft resorption is balanced to the rate of bone remodeling
- Carbonate apatite resorption and remodeling are similar to human bone[6,7]



2 **Natural Mineral Structure** Similar to Human Bone Mineral

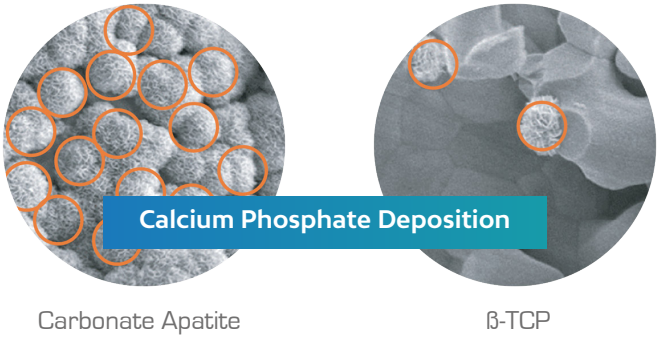
- Pores provide pathways for cell migration and attachment to lay down new bone
- Carbonate apatite is a better osteoconductive material than HA_2O[20]



3 More **Calcium Phosphate Deposition** than ß-TCP[8]

More calcium phosphate is deposited on the carbonate apatite surface as compared to ß-TCP[8]

Osteoblasts prefer attaching to calcium phosphate to lay down new bone



4

Half the Crystallinity than HA. **More Soluble**[9]

Carbonate apatite has half the crystallinity than HA, which enables optimal resorption and remodeling because it more easily resorbs[9]

5

Independent Studies have shown Higher **Osteoclastic & Osteoblastic Activity** than ßTCP & HA[10]

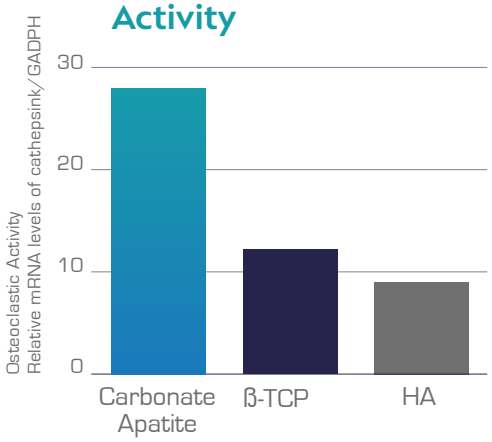
Osteoclasts break down bone

Carbonate apatite shows higher levels of osteoclastic activity than ß-TCP & HA[10]

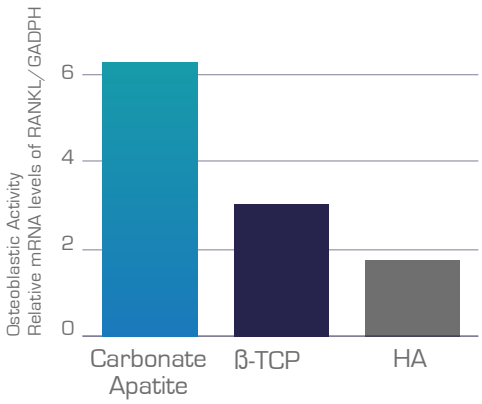
Osteoblasts secrete new bone

Osteoblast proteins are most upregulated with carbonate apatite than ß-TCP & HA[10]

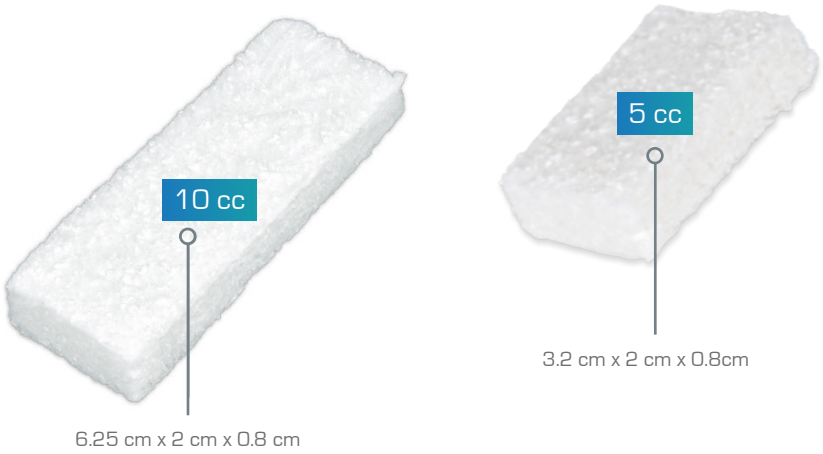
Higher Osteoclastic Activity



Higher Osteoblastic Activity



Ordering Information



Bio-Reign™ Bioactive Moldable Strips

CATALOG No.	LENGTH	WIDTH	THICKNESS	QUANTITY
BR-05	3.2 cm	2 cm	0.8 cm	5 cc, 1 Strip
BR-10	6.25 cm	2 cm	0.8 cm	10 cc, 1 Strip

References

Bio-Reign™ Bioactive Moldable:

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BIOACTIVE MATRIX

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Bio-Reign Bioactive Moldable Bone Graft Matrix is FDA cleared.