

# The Cal Apatite® Purity and Bioactivity Profile

## The Key to Healthy Bone Mineralization and Positive Clinical Outcomes\*

### Skeletal Health for a Lifetime\*

The Cal Apatite Purity and Bioactivity Profile is the culmination of an 8-year long, independent study initiated by Metagenics, Inc. Completed in 2007, this exclusive profile describes the integrity and biological activity of our freeze-dried microcrystalline hydroxyapatite concentrate (MCHC), a whole bone extract and key ingredient in Metagenics' Cal Apatite family of products. The profile details the levels of naturally occurring constituents, which research suggests will support healthy bone mineralization.\*<sup>1</sup>

With this exclusive documentation, healthcare practitioners and their patients can be assured of the outstanding quality of Metagenics' proprietary freeze-dried MCHC over other processing methods.

### More than Calcium: Clinical Success is Improved by the Presence of Specific Bone Proteins\*

More than three decades of research demonstrates that whole bone extracts, which contain approximately 25% protein, are more effective in supporting bone mineralization, as compared with ashed hydroxyapatite powder (devoid of intact protein), calcium carbonate, and other forms of calcium. When whole bone is subjected to temperatures exceeding 650° C (referred to as ashing) during processing, the protein constituent is almost or completely destroyed. Although ashed products may have a higher calcium content than whole bone extracts, research has shown that the whole bone extracts have greater efficacy.\*<sup>2-5</sup>

Various clinical trials demonstrating improved bone mineral density in menopausal women used whole bone extracts that contained measurable levels of total protein, collagen type 1 protein, osteocalcin, and delicate bone-derived growth factors – insulin growth factors 1 and 2 (IGF-1, IGF-2) and transforming growth factor beta (TGF-β).<sup>6-13</sup>

While the exact mechanisms of action are still not understood, whole bone extracts with the highest measurable levels of native bone constituents appear to be among the most efficacious materials to support bone mineral density.\*

### Freeze-Dried MCHC – Twice the Levels of Native Bone-Derived Growth Factors

Metagenics' freeze-dried MCHC is manufactured using a specially-developed proprietary, gentle process designed to retain the maximum amount of biologically active components. During manufacture, no solvents or other harsh chemicals or additives are used and the raw material is not subjected to high temperatures. Additionally, freeze-drying

is known to be a premium drying method that is gentle yet preserves as much “native” biological activity as possible in the finished dried material. Correctly used, this method of drying is expected to retain higher levels of growth factors than products dried by other methods.

This proprietary manufacturing process resulted in the critical difference in growth factor levels found in MCHC compared to other commercially available supplements. The preservation of the osteocalcin and the native bone-derived growth factors, particularly, IGF-1 and 2, and TGF-β (shown in Table 1), serve as markers of exquisite raw material quality.<sup>1</sup>

In the following investigation of growth factors in freeze-dried material, Metagenics sought to compare growth factor levels in product manufactured by an alternative vacuum drying method. Results of this testing are reported in Table 1. The levels found in the vacuum dried material, while approximately the same as reported by Stepan<sup>6</sup> and Fernandez<sup>7</sup>, are significantly lower than the results obtained in the freeze-dried product. This supports the theory that the method of manufacturing can impact the retention of sensitive proteins such as growth factors, and that Metagenics' freeze-dried MCHC produces a clearly superior product in terms of growth factor content.

TABLE 1: Comparison of Growth Factor Levels Based on Drying Method<sup>1</sup>

Growth Factors	OHC <sup>6</sup> µg/gram	OHC <sup>7</sup> µg/gram	Vacuum-Dried MCHC <sup>1</sup> µg/gram*	Metagenics Freeze-Dried Hi MCHC <sup>1</sup> µg/gram*
Total Bone-Derived Growth Factors (Insulin Growth Factor-1 [IGF-1], Insulin Growth Factor-2 [IGF-2] and Transforming Growth Factor-β [TGF-β])	0.328	0.329	0.483	1.05
Osteocalcin	7.015	6.99	604	595

### The Purity Guarantee Predicts Safety

All natural ingredients absorb materials from the local environment in which they originate. In bone, heavy metals are a particular concern. To ensure safety, Cal Apatite MCHC is tested for heavy metal contaminants as well as microbial overgrowth. Furthermore, MCHC is produced from New Zealand free-range, pasture-fed cattle. The New Zealand government requires that each batch of product be accompanied by veterinary-signed certificates verifying the safety and disease-free status of the bovine source livestock.

### References

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\* These statements have not been evaluated by the Food and Drug Administration. These products are not intended to diagnose, treat, cure, or prevent any disease.



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## Ingredient

MICROCRYSTALLINE HYDROXYAPATITE CONCENTRATE (MCHC)

## Source

Selected bone from pasture-fed New Zealand Prime Cattle

## Description

Free flowing creamy white powder

**1000 mg of MCHC contains the following:†**

### Mineral Complex

% Calcium (Ca): 250 – 271 mg/g (25 – 27%)

% Phosphorus (P): 114 to 124 mg/g (11.4 – 12.4%)

% Microcrystalline Hydroxyapatite: NMT 70% (max 700 mg/g)

### Proteins

% Protein (N x 6.25): NLT 22

% Type 1 Collagen: 21 – 27%

% Glycosaminoglycan: 0.5-3 (as Chondroitin Sulfate)

Naturally Occurring Growth Factors 596 mcg – 761 mcg

### Additional Naturally Occurring Trace Minerals

Boron 0.9 – 3.1 ppm

Manganese 0.40 – 0.55 ppm

Copper 0.1 – 0.3 ppm

Sulfur 740 – 870 ppm

Magnesium 3800 – 4000 ppm

Zinc 55 – 80 ppm

### Naturally Occuring Heavy Metal Analysis

Lead: < 0.4 ppm

Mercury: < 0.05 ppm

Cadmium: < 0.1 ppm

Arsenic: < 0.2 ppm

### X-ray Diffraction Analysis

Calcium and phosphorous confirmed present

in crystalline hydroxyapatite form

### Crystal Size

(86 – 95) Angstroms

### Microbiological Analysis

Total Aerobic Count (TAC)

(cfu per gram @ 35°C for 48 hours): NMT 1.0 x 10<sup>4</sup>

Total Coliform Count (cfu per g): NMT 100

*Clostridium perfringens* (cfu per g): Not detected

*Staphylococcus aureus* (cfu per g): Not detected

*Escherichia coli* (mpn per g): Not detected

*Salmonella* (per 25 gram): Not detected

Yeast & Mold (cfu per g): NMT 100

ppm = parts per million = micrograms/gram (mcg/g) = milligrams/kilogram (mg/kg)

The raw material for this ingredient was collected to edible standards from New Zealand animals in USDA-approved New Zealand government export licensed establishments. The animals from which collection occurred have passed ante-and post-mortem inspection by a government inspector and were judged free of infectious and contagious diseases. BSE (Bovine Spongiform Encephalopathy) is not known to exist in New Zealand. The incidence of this disease has been under surveillance in countries since 1989. New Zealand is free of all O.I.E. list A diseases. New Zealand government veterinary-signed health certificates accompany each batch of product and verify the safety and disease-free status of the product.

† Typical analysis provided by supplier.

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Metagenics is committed to using only environmentally-friendly papers and inks.

