The Garden of Life Process of "Growing" Nutrients:

Garden of Life is dedicated to empowering vegans with extraordinary health and wellbeing. We offer a full line of vegan friendly nutritional supplements including Vitamin Code vitamins, Perfect Food Raw and Organic Green Super Foods, Raw Meal meal replacement and Raw Protein protein powders, and a host of other products.

In formulating for Vegans, we have embraced the mission of the Vegan Society:

The Vegan Society promotes vegan lifestyles - that is, ways of living that seek to exclude, as far as is possible and practical, all forms of exploitation of animals for food, clothing or any other purpose.[I]

Our goal in creating this document is to inform and educate our vegan customers how we balance the basic tenants of the vegan lifestyle, as described above, while endeavoring to meet vegan's physiological needs for vitamin D.

What is Vitamin D and why do Vegans Need it?

Vitamin D is an essential fat-soluble vitamin which acts like a hormone in the body to help regulate the formation of bone and the absorption of calcium and phosphorus. Its primary role is to control the transport of calcium in the blood, delivering it to the bone for fortification. All people living in northern climates (including most of the Continental US), and particularly Vegans, are at risk for Vitamin D deficiency, particularly during Fall and Winter.[II]

Vegans are especially vulnerable to Vitamin D deficiencies because the primary source of Vitamin D is from fortified foods and supplements. While Vegans can find supplemental sources of vitamin D2 synthesized from Soy, the essential D form that has been the subject of almost all human studies, D3, is only available from two sources. The first and most important source is ultraviolet light from the sun, especially during the hours of 10 AM and 3 PM and during the late Spring and Summer months. The skin must be directly exposed for an adequate period of time in order for the body to convert its native cholesterol into D3. The second source is animal derived.[III]

How we "cracked the code" for "growing" vitamin D:

Hungarian born researcher and pharmacist, Endre Szalay has dedicated the last 50 years of his scientific life to developing an innovative scientific process of growing nutrients inside of yeast. Dr. Szalay worked with Dr. Albert Szent-Györgyi's Nobel Prize winning team on their discovery of Vitamin C, theorized that isolated nutrients could not be fully digested and utilized by the human body. His goal was to find a way to grow them into plant-based foods which the body would recognize, digest and absorb. Because of his ground-breaking work, we are now able to offer Vitamin D3, an essential nutrient for human health, in a plant-based Vegan-friendly form.

Organic fruits and vegetables grown primarily with animal fertilizers are Vegan friendly.

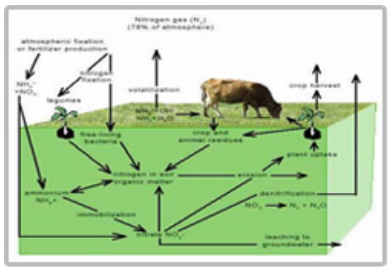

Diagram 1 - Click to Enlarge

To appreciate the process of "growing" nutrients, it's helpful to first look to nature and world-wide best practices for organic agriculture. **Diagram 1**, prepared by the National Sustainable Agriculture Information Service[IV], illustrates how plants up-take essential nutrients (which are later consumed) into their cells.

In the above image we see that organic matter including water, decomposing plants and animals all nourish the soil. The crops – in this case, legumes – use their root systems to absorb the soil's nutrients. Water molecules provide the transportation and specific peptides present in the soil allow for penetration – or bonding – to occur between the plant cells and the soil-based nutrients. The result? A nutrient-dense plant that is valuable for human sustenance.

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It's very significant to note that animal by products are a primary source used for fertilizing the worldwide production of organic crops[V]. The use of fertilizers derived from fish emulsion, fishmeal, blood meal, bone and meat meal are all very common soil-amendments used by the majority of organic farmers, according to the Organic Farming Compliance Handbook[VI] . The use of these materials is specifically addressed, and approved within the USDA's Guidelines for the National Organic Program (NOP)[VII] , subsection "C". ATTRA, the leading non-profit organization dedicated to the creation and conversion of US farmland to organic farming goes further in its embrace of animal by products in organic crop production by teaching that animal manure compost is essential to the proper preparation of organic crops and the University of Vermont, a leading educator of innovative organic farming techniques has adopted their advice, making the handling of raw manure compost an integral part of their organic farming education programs[VIII].

Certainly, the organic crops cultivated by organic farmers who use animal by products are essential food for Vegans, and consumed without question or concern. As the Vegan Society mission explains, "exclude, as far as possible or practical." A vegan who did not consume plant life would die from malnutrition.

We will now explain how the Vitamin Code process for the creation of Vitamin D, which we perform by growing nutrients inside a plant's cell wall, mirrors the above growing of a plant.

Our *Saccharomyces cerevisiae* is a living, growing plant-like yeast.

Growing vitamin D starts with a single-celled plant; in this case *Saccharomyces cerevisiae*, or baker's yeast. *S. cerevisiae* was chosen because is retains the complex cell structure of a plant, but it is also easy to grow. Another important feature of the *S. cerevisiae* is the fact that it produces Vitamin D2 as a normal, non enhanced function, and on a cellular level, there is a specific receptor site for the binding of Vitamin D3.

To begin the process, the plant is mixed with water that has been subject to a multi-stage purification process. This ensures that it is free of any unwanted ingredients that will affect the growing process. Molasses is then added as food for the yeast and the yeast is allowed to begin the growing (budding) process.

At the same time the yeast is growing in its tank, isolated Unites States Pharmacopeia (USP) grade vitamin D3 is put into a much smaller preparation tank. Widely used, the commercially available D3 we purchase has been synthesized from animal cholesterol, primarily lanolin. The starting material is subjected to a lengthy conversion and UV exposure process briefly described below[IX].

Chemists follow a two-step process in order to synthesize vitamin D3 from cholesterol. During the first phase the molecular structure of the cholesterol is converted into crystalline 7-dehydrocholestorol. During the second phase the 7-dehydrocholestorol is exposed to ultraviolet light (similar to the sun's rays). The resulting material is entirely pure D3, free from any chemical residues[X].

All USP grade D3 is manufactured using this process and, as a result, is described as "synthetic" – or synthesized through a chemical process. (Researchers are still studying ways to synthesize D3 from plant derived sources, but have not yet succeeded.) [XI]

In nature, chains of amino acids called peptides are required to make nutrients available to yeast cells.

In the vitamin D tank we add a solution of water and specific peptides which are chains of targeted amino acids and are part of a proprietary process. The peptides have a single mission: to penetrate the cellular wall of the vitamin D through a portal (called a receptor or binding site). This step is necessary if we hope for the plant to eventually up-take, or metabolize the vitamin D.

At the proper time in the growing process, the peptide-bound vitamin D is added to the plant (the growing S. cerevisiae). The peptide allows the nutrients in the vitamin D cells to pass through the plant's cell wall. With the peptide's help, the vitamin D is fully metabolized into the plant and, literally, *becomes a part of it*. Just like in our example above where the legume has metabolized the soil's nutrients and they have become a part of its matrix. The very nature of the vitamin D is converted from synthetic to whole-food. The newly converted vitamin D, now plant-form, contains all of the co-factors you would normally find in any vitamin D-rich food.

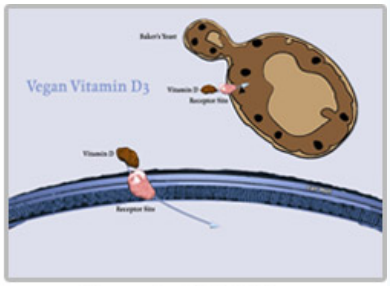

Diagram 2 - Click to Enlarge

Diagram 2 illustrates the Vitamin D specific binding site allowing the vitamin D to penetrate the cell wall of the plant and bind itself to the cell. This process is commonly referred to as metabolism.

What proportion of USP vitamin D is used, as compared to the amount of yeast when "growing" renatured vitamin D?

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After decades of innovation, Dr. Szalay's exact formula and ratio of USP D3 to Yeast are important trade secret but the vitamin D is an exceptionally small component of the formula.

How much vitamin D is in a renatured yeast cell?

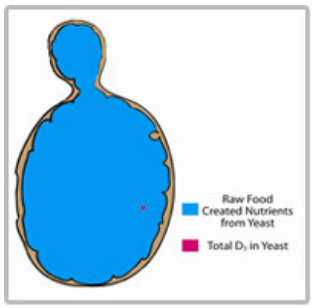

Diagram 3 - Click to Enlarge

When one examines the renatured vitamin D yeast cells on a cellular level, each yeast cell contains so many nutrients and other components that the weight of the vitamin D present, when compared to the entire cell structure of the plant is proportionally very small. This is illustrated by **Diagram 3**, in a drawing of a renatured vitamin D yeast cell:

Could some of the USP vitamin D remain in the batch, without being metabolized by the yeast?

One may question how we know that, at the end of the growing process, none of the USP vitamin D3 is left in its original, non-grown or non-renatured state. There are analytical tests that verify this fact. These tests are performed on every lot of renatured vitamin D we manufacture.

The first analytical test is performed using High Performance Liquid Chromatography (HPLC) equipment. To demonstrate the efficacy of this test, one must first understand that all vitamin D is fat soluble. All vitamins are either fat soluble, meaning they dissolve in fats, or water soluble, indicating that they dissolve only in water. And as we learn in grade school science, fat and water never mix. Therefore, to test for the presence of fat soluble vitamins, the lab must first wash whatever is being tested with alcohol. Alcohol will cause the fat soluble components present to separate from the rest of the medium.

In this case, we wash the high Vitamin D yeast with ethanol. The yeast is then separated and dried. The remaining ethanol is collected for analysis. If the HPLC test reveals any fat soluble substance present within the yeast, then we know that USP vitamin D is present and the yeast has not fully metabolized, and converted all of the vitamin D. That entire batch of yeast would then be discarded. [In the decades we've been growing renatured Vitamin D through our process, we've had to discard very few batches of yeast.]

Our second test is performed once the ethanol wash is complete and we have verified that the only vitamin D remaining is yeast cell. The yeast-bound vitamin D is then subjected to HPLC analysis that actually breaks the cell wall. This time we are looking for the presence of Vitamin D inside of the yeast cell. In order to extract the vitamin D from the inside of the yeast cell we must first break the yeast cell wall during the sample preparation phase. After the cell wall of the yeast is broken we can then perform the analysis for the presence of vitamin D through another ethanol wash. This second analysis confirms that the potency of the vitamin D achieves the specification required for the production of our encapsulated products.

Finally, the most plant-like attribute of the final product are the co-factors present in all plant forms of food but not present in synthetic vitamins. These co-factors include: antioxidants, glycoproteins, lipoproteins, glutathione, CoQ10 and SOD (superoxide dismutase). We never add these co-factors; they are *endogenous to the yeast cells*. Just as plants contain a variety of food components (proteins, carbohydrates and fats) that surround the vitamins in the plant the renatured vitamin D maintains nutrients that mimic the characteristics of plants. With the presence of these co-factors the renatured vitamin D is ready for use in our vegan friendly supplements.

Through this painstaking and careful process we can now make Vitamin D3, a vital nutrient, available in a vegan-friendly format for supplementation.

How much vitamin D, by weight, is used in a typical Garden of Life product?

What may surprise many people is how potent renatured vitamin D remains. The amount of high vitamin D yeast needed to deliver a full dose of vitamin D in one of our Vitamin Code products is proportionally insignificant. Remember, the daily amount of vitamin D recommended for human consumption is measured in International Units (IU's) and generally constitutes mere micrograms of material.

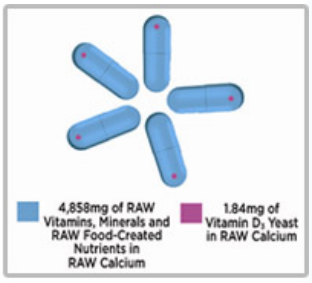

Diagram 4 - Click to Enlarge

Diagram 4 demonstrates the tiny amount of renatured vitamin D yeast – the bulk material contains vitamin D – that is added to our Raw Calcium. In this illustration the formula calls for the potent dose of 1400 IU's per five-capsule serving. There is almost 5000 mg of bulk material in one daily serving of Raw Calcium and of that

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total, less than 2 mg, or .004% is comprised of renatured vitamin D yeast.

Conclusion

The Garden of Life process for growing vitamin D is unique and revolutionary. Unlike chelation or fermentation processes which focus on the decomposition of materials, the growing process mirrors the growth cycle of plant life. And in the case of vitamin D, the plant (yeast) metabolizes vitamin D as it grows. A plant rich in vitamin D is then harvested for inclusion in our formulas.

We are committed to one day find a viable source of USP Vitamin D that originates in plant materials. When we do, that USP vitamin D will be used in our growing process as a further expression of our commitment to the vegan lifestyle. Until that day comes, we believe that the vitamin D we grow provides valuable and necessary supplementation to vegans and can be an important part of the vegan diet. Garden of Life has fully embraced the Vegan Society's mission, to "exclude as far as possible and practical" when creating these vegan supplements and proudly offers them to its vegan customers for their use and benefit.

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†These statements have not been evaluated by the Food and Drug Administration.
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