Beta-1, 3-Glucan has a long scientific history and a reference list including literally hundreds of papers. Research originated in the 1940's when Louis Pillemer, Ph.D., and his colleagues described a crude yeast cell wall preparation, Zymosan. They reported that this material was able to enhance non-specific immunity. At that time it was unknown which element of this relatively crude composition, containing a mixture of proteins, lipids and polysaccharides, actually activated the immune response. The answer came later in the 60's, when Nicholas DiLuzio, Ph.D. at Tulane University experimented with Beta-1, 3-Glucan. In the late 1980's, Joyce Czop, Ph.D. at Harvard University, described the mode of action of this material in enhancing the immune system: there is a specific receptor for yeast Beta-1, 3-Glucan on the surface of certain cells, called macrophages; that when activated, initiates a cascade of events that turns the body into "an arsenal of defense".

Macrophages play an essential and pivotal role in the initiation and maintenance of the immune response. From an evolutionary point of view, the macrophage is the oldest and most consistently preserved immunologically competent cell known. Not only humans and higher animals, but also primitive invertebrates such as Hydra, which have no other immunological effector cells, have macrophages. In order to function defensively, the macrophages must pass through a state of activation that involves certain morphological changes. Most importantly, a whole sequence of metabolic changes occurs which results in the production of a series of cytokines. They act as internal regulators of the immune system. Activation can be initiated by a variety of different stimuli such as endotoxin, bacteria, viruses or chemicals. However, these activators can be too toxic or pathogenic to be useful. Beta-1, 3-Glucan, on the other hand, is orally effective, completely safe and non-toxic, and may be one of the most potent initiators of the immune response.

There are several different types of Beta Glucan with different levels of activity, the majority of which are inert and used as simple food fillers. The most active type, however, is Beta-1, 3-Glucan from the cell wall of yeast. A three dimensional model of this molecule shows it to be a helix, and research at Harvard University has shown that receptors for several sugar residues exist on the macrophage cell membrane. The fact that such a small number of glucose units can activate these receptors is very remarkable. What is more remarkable still is that there are specific receptors for this sort of polysaccharide chain on the surface of the most ancient cell in the immune cascade. There is now evidence to show that Beta Glucan is, from an evolutionary point of view, the most widely and most commonly observed macrophage activator in nature. The same enhancing mechanisms have been found in all branches of the animal, bird, fish and plant kingdoms.

The activated macrophage is a veritable powerhouse. A macrophage can recognize and kill tumor cells non-specifically, as well as remove foreign debris. It also can produce a number of essential cytokines that are able to stimulate the immune system in general and boost bone marrow production.

Some individuals, because of age, chronic infection or poor nutrition, have a compromised immune defense system. They are susceptible to all of the following

problems: arthritis; reduced wound healing capacity; reduced bone marrow proliferation with resulting lowered white cell counts and anemia; increased incidence of cancers; and increased incidence of viral, fungal, and bacterial infection.

It is well understood that one of the main elements of the aging process is a lowering of the effectiveness of the immune function. All of the problems mentioned above occur with aging. In addition, the immune system is impaired by numerous environmental factors such as UV radiation, food preservatives and antibiotics. Physical and emotional stress and intense physical exercise can also negatively affect the immune system. It is well documented that generally healthy athletes frequently suffer from influenza or pneumonia following heavy periods of intense exercise. The same immunosuppression is observed in people with stress-related diseases, such as coronary disease. Under these influences, the numbers of macrophages available are reduced and unable to participate in the immune cascade, which causes even deeper immunosuppression. Beta-1, 3-Glucan has been shown to both stimulate and activate macrophage cells; which will counter these negative effects.

In the 1970's, after extensive studies in animals, human experiments with Yeast Beta Glucan began. In a study conducted by Peter Mansell, M.D., Yeast Beta Glucan was injected into subcutaneous nodules of malignant melanoma. Subsequent biopsies of the injection sites found no evidence of melanoma, just a collection of obviously activated macrophages.

A subsequent study treated a number of women who experienced recurrent malignant ulcers of the chest wall following mastectomy and radiation for breast cancer. After an application of Yeast Beta Glucan, these normally very indolent ulcers healed completely. The same material was used in the treatment of large pressure ulcers at the New Orleans Charity Hospital with complete resolution of the ulcers, some of which went down to the sacrum. An unexpected benefit was the complete lack of infection and the rapidity of the reappearance of normal skin.

The first human study on Beta-1, 3-Glucan's systemic effect was in the mid-1980's on advanced HIV infection. Even in these deeply immunologically deficient individuals, an increase in serum cytokines IL-1, IL-2 and interferon was measured.

Results of another clinical trial showed a significant mortality decrease from infectious complications in severe trauma patients.

At the time of these studies, a crude preparation containing Beta Glucan was already registered in Eastern Europe for injection to treat the effects of bone marrow suppression from radiation or chemotherapy.

The U.S. Armed Forces Radiobiology Institute undertook one of the most remarkable oral studies with Beta Glucan. In a well-controlled study, rats were given a lethal dose of radiation. Seventy percent of these rats were completely protected from the radiation effects when given a dose of Yeast Beta Glucan by mouth AFTER the radiation.

Myra Patchen, Ph.D., co-author of the above-referenced study, discovered that Beta Glucan is also a free radical scavenger. It is able to protect blood macrophages from free radical attack during and after the radiation, allowing these cells to continue their important functions in the irradiated body and release factors important to the restoration of normal bone marrow production. Free radical scavenging assays were repeated in different models that confirmed the antioxidant effect. In light of what is known about the potential of free radicals to accelerate aging, cause cancer and other diseases, this particular effect of Beta-1, 3-Glucan is especially important.

Recent independent experiments completed at Baylor College of Medicine in the laboratory of Professor Phil Wyde, Ph.D., also indicate the oral effectiveness of Beta-1, 3-Glucan in stimulating non-specific immunity. Peritoneal macrophages doubled their phagocyte activity in mice fed with Beta-1, 3-Glucan. This systemic effect of oral application is comparable to that achieved by injection, which makes this material a unique and very valuable oral immunostimulant.

When Beta-1, 3-Glucan was added to the antibiotic regimen in animals challenged with different bacterial pathogens (Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli and others) and viral pathogens (Herpes virus), a reduced amount of antibiotics or antivirals was needed to cope with the infection. Beta-1, 3-Glucan also has an antifungal effect, shown in experiments with Candida albicans. Such a broad anti-infective spectrum of Beta-1, 3-Glucan can be explained only by the fact that the immunostimulation produced by this unique material is non-specific.

Continuing research on the oral application of Yeast Beta-1, 3-Glucan revealed that it also increases the effectiveness of other oral cholesterol-reducing agents, such as niacin and Lopid®. Interestingly, recent research has also demonstrated the anti-diabetic effect of IL-1 cytokine, which increases insulin production causing the lowering of blood glucose level. Macrophages are the main source of IL-1 in the body and Yeast Beta-1, 3-Glucan supplementation, can boost its production. Mindful of the extremely high rate of atherosclerotic complications and the extraordinary requirement for antioxidants in diabetic patients, Yeast Beta-1, 3-Glucan is an obvious adjuvant for an improved lifestyle in these conditions.

As is repeatedly shown in the multitude of studies concerning the activity of Beta Glucan as an immune stimulator, or perhaps more descriptive, a "biological defense modifier" there are enormous benefits to be obtained by the use of Yeast Beta-1, 3-Glucan as a nutritional supplement.

The aging process has been defined as "the sum total of life's physical embarrassment due to adverse conditions". Yeast Beta-1, 3-Glucan may well be the first and only true anti-aging supplement. It is a defense against negative events such as infection, tumors and radiation damage, and adjunctive to the positive effects of antioxidants, lipid balance enhancer, antibiotics and other therapeutics. The result is improved general health that

means greater enjoyment of life, fewer infirmities, less time and money required for medical needs and potentially dramatic savings in health-related expenditures over time.

To summarize, Yeast Beta-1, 3-Glucan is a safe and very potent nutritional supplement with a systemic effect that can be described as non-specific immune stimulation combined with free-radical scavenging activity. Technically it is a polysaccharide molecule made completely with glucose that is highly purified. Glucose is a simple saccharide that the body transforms to energy as ATP and stores in muscles, liver and other tissues in a form of glycogen. Beta-1, 3-Glucan is different from energy storing glucose containing polysaccharides because the connection between the glucose units is different. More specifically, it is the beta-1, 3-linkage which makes this compound so unique. It is Generally Recognized As Safe (category GRAS according to FDA) and has no known toxicity or side effects.

Some of the biological events illustrating this stimulation are:

Activation of macrophages, expressing increased nonspecific phagocytic activity allowing macrophages to destroy pathogens more efficiently, frequently preventing disease.

Release of important cytokines such as IL-1, IL-2, among others, which initiates an immune cascade and triggers other cell lines, such as T-cells. Release of colony-stimulating factors, boosting bone marrow production.

Cholesterol-reduction through cell activation and anti-oxidant activity

Many of the people who will benefit from Yeast Beta-1, 3-Glucan supplementation are:

1. People with impaired immunity from any cause including, HIV infection; people with high occurrence of infectious diseases, tumors or undergoing chemotherapy and radiotherapy; people over the age of 40 when the natural aging process starts to slow down immune reactivity; geriatric patients, and others with a compromised immune response.

2. People who are affected by extra free-radical production from external sources: such as UV radiation, electromagnetic fields, poor nutritional habits, food preservatives, and people with chronic disease such as diabetes or chronic inflammation.

3. Professional and amateur athletes as well as people who work out intensively. People under physical or emotional stress.

4. People with high risk of atherosclerosis should definitely add Yeast Beta-1, 3-Glucan to their diet in addition to any cholesterol-reducing drugs. Macrophage activation helps draw extra cholesterol from the blood, prevent further plaque formation on the arterial walls and phagocytize existing plaque, which is recognized as a foreign body.