The Immune System

The two arms of the immune system, humoral and cell-mediated immunity, work together as an integrated defensive system. Normally, antibodies are produced in response to a foreign material (acquired immunity). Immune complexes form between antibodies and antigens and are scavenged from the circulation or mucosal surfaces. Cell-mediated immunity relies on T and B lymphocytes, mast cells, macrophages and others. T-cells regulate other defensive cells, including macrophages and killer cells. Cells of the immune system turn over rapidly, hence, their nutrient requirements are high.

In addition, phagocytic cells generate free radicals and other reactive species to attack invaders. These oxidants contribute to the oxidative burden of organs which, if unchecked by the body’s antioxidant defenses, can damage membrane lipids, diminish T- cell function and injure mucosal cells. Membranes damaged by lipid peroxidation may offer less resistance to infection. The production of radicals from endogenous and exogenous sources consumes antioxidants. Consequently, a variety of nutrients and factors support immune function.

Vitamins

**Vitamin A** has long been known to support mucosal cell surfaces and the immune system. Vitamin A helps maintain the integrity of lymphatic tissues, antibody levels (especially sIgA), and responses of cellular immunity to challenge by exogenous stimuli. However, the effects are selective. Possibly a metabolite of retinol regulates lymphocytes. In vitamin A deficient rates, phagocytic stimulatory substances. However, the effects are of cellular immunity to challenge by exogenous antibody levels (especially sIgA), and responses helps maintain the integrity of lymphatic tissues, dark, green, leafy vegetables. Vitamin A requirements are susceptible to disease. Vitamin A requirements appear to be only partially met by the consumption of dark, green, leafy vegetables.

**Vitamin C** scavenges free radicals and is essential for the function of many systems, including the immune system. Vitamin C is required for eicosanoids that regulate inflammation and it combats the effects of oxidative stress. Vitamin C is a major antioxidant in the blood and it works together with vitamin E. For example, supplemental vitamin C and vitamin E decreased the production of reactive oxygen species and of lipid peroxidation in patients with myocardial infarction. During periods of stress, urinary excretion of vitamin C increased. Vitamin C supplemented volunteers exhibited increased natural killer cell activity. Vitamin B6 deficiency is characterized by reduced phagocytic activity. Vitamin B2, B6 and pantothenic acid have specifically shown an ability to enhance antibody production. Lack of vitamin B1 reduces the spleen’s ability to produce antigens. Vitamin B2 is necessary for proper thymic function.

**Vitamin B6** as pyridoxal phosphate, the coenzyme form of the vitamin, is required by transaminases and amino acid decarboxylases in the breakdown of amino acids. As such, vitamin B6 plays a critical role in all rapidly dividing cell types. Human studies, as well as animal experiments, link vitamin B6 deficiency to reduced lymphocyte differentiation, reduced delayed hypersensitivity responses and impaired antibody production. Other research suggests that suboptimal vitamin B6 intake may play a role in a defective immune response in hemodialysis patients.

Pantothenate deficiencies are associated with infections of the upper respiratory tract and pharyngitis. Pantothenic acid is necessary for immunoglobulin production. Proper adrenal function requires pantothenic acid, ascorbic acid and zinc. These water soluble nutrients are necessary during stress.

Co-Factors

Mixed natural carotenoids, isolated from plants, include alpha and beta carotenes and oxy-carote- 


denos, such as zeaxanthin, lutein and cryptoxanthin. Carotenoids complement vitamin E as lipid-soluble antioxidants. The natural mixed carotenoids are better absorbed and are more effective antioxidants than synthetic beta carotene in vivo. By acting as antioxidants, carotenoids can limit lipid peroxidation. As example, beta carotene supplementation reduced lipid peroxidation in smokers \(^{14}\) beta carotene has long been known to have a protective impact on the immune system. Healthy male nonsmokers supplemented with beta carotene revealed increased CD4-CD5 ratio after 9 months compared to controls who had taken a placebo. After supplementation with beta carotene, there were significant increases in monocytes expressing major histocompatibility complex molecules, adhesion molecules and TNF secretion in a similar group of subjects. Coenzyme-Q10 functions both as an essential mitochondrial electron carrier for energy production and as a lipid-soluble antioxidant, and dietary coenzyme-Q10 can decrease plasma production of lipoperoxides. Although coenzyme-Q10 can be synthesized by the body, the levels in membranes of mitochondrial and other structures may be lower than needed for optimal function. Thymic coenzyme-Q10 levels declined in mice with increasing age. Coenzyme-Q10 together with vitamin B6 supported the production of T4-lymphocytes and immunoglobulins.

Minerals

**Selenium** is a trace mineral that is converted to selenocysteine, which plays a catalytic role in glutathione peroxidase production. In this sense, selenium can be considered an antioxidant. Selenium has a major impact on the immune system. Selenium deficiency can lead to depressed immunity and reduced T-cells. Glutathione peroxidase activity was significantly higher in younger people than in elderly subjects.

**Copper, Manganese and Zinc:** Superoxide dismutase (SOD) is the only family of enzymes that specifically inactivate free radicals, namely, the superoxide radical. Excessive superoxide production, as well as excessive amounts of other oxidants, is linked to chronic, oxidative stress.

Mitochondrial SOD requires manganese as an essential cofactor, while the cytoplasmic form of SOD requires both copper and zinc. Manganese SOD and copper-zinc SOD activities in lymphocytes and neutrophils were not inducible by cytokines in elderly subjects, although these activities were readily inducible in nonaged subjects. These results suggested an age related alteration in the regulation of these defensive enzymes. Erythrocyte copper-zinc SOD activity tends to reflect copper status, and this has been used in laboratory assessment. In addition, supplementation with superoxide dismutase of Biotics Research Corporation’s vegetable culture may increase erythrocyte superoxide dismutase activity in vivo.

Zinc plays an important role in maintaining the health of the immune system. It is a required cofactor for DNA polymerase and RNA polymerase, essential for cell proliferation. Rapidly dividing cells, including mucosal cells and immune cells, require...
Bio-Immunozyme Forte™ contains bovine neonatal thymus, spleen, liver, pancreas, in addition to bovine parotid gland, lymphatic and placental tissues. These glandular preparations are processed to maintain nutrients, enzymes and associated factors. Biotics Research uses bovine neonatal tissues where possible. The newborn animal has not been subjected to environmental factors to which the adult animal is subjected. The thymus is most active within a few days after birth, when it populates lymph nodes and the spleen. The effects of prepara-
tions of thymic factors after oral administration have been studied. Thymus extract supported thymic function during environmentally-induced physical stress. Spleen extracts can specifically modulate phagocytic activity in vitro. Healthy endocrine pancreatic glands are also important. They secrete glucagon, insulin and somatostatin. Somatosta-
tin regulates growth hormone secretion. Healthy adrenal glands support normal immune function. They produce hormones that adapt the body to stress, including epinephrine and glucocorticoids. Cortisol stabilizes mast cells to inhibit inflamm-
ation. It also decreased capillary permeability to improve lymph node function. Therefore, the DDS-1 strain developed at the University of Nebraska, has proven to be a superior species used in Biotics Research supplements.

References
3. de Pee S et al. Lack of improvement in vitamin A status with increased consumption of dark green leafy vegetables. Lancet. 1985; 346: 205-208
23. Intraona M, Moss J, Ronziò RA. The effect of oral supplemen-
30. Biotics Research Canada
32. Biotics Research Southeast
33. Biotics Research Northwest
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For more information, contact our Client Services Department or one of our Technical Consultants

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Supplement Facts

<table>
<thead>
<tr>
<th>Serving Size: 2 Tablets</th>
<th>Each Container: 45</th>
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<tbody>
<tr>
<td>Vitamin A (as palmitate and natural mixed carotenoids)</td>
<td>6,667 I.E.</td>
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<tr>
<td>Vitamin C (as calcium and magnesium ascorbates)</td>
<td>200 mg</td>
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<td>Vitamin E (as d-alpha tocopheryl acetate)</td>
<td>30 I.E.</td>
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<td>Vitamin B1 (as thiamin mononitrate)</td>
<td>10 mg</td>
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<tr>
<td>Vitamin B2 (as riboflavin-5-phosphate)</td>
<td>15 mg</td>
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<tr>
<td>Vitamin B6 (as pyridoxal-5-phosphate)</td>
<td>15 mg</td>
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<tr>
<td>Pancreatic Acid (as calcium pantethenate)</td>
<td>25 mg</td>
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<td>Zinc (as zinc glucosinate)</td>
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<tr>
<td>Selenium (from vegetable culture) and Selenomethionine</td>
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<tr>
<td>Copper (as copper gluconate)</td>
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<tr>
<td>Manganese (as manganese gluconate)</td>
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<tr>
<td>Neuronal Adrenal Complex (bovine)</td>
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<tr>
<td>Neuronal Thymus (bovine)</td>
<td>60 mg</td>
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<tr>
<td>Neuronal Spleen (bovine)</td>
<td>60 mg</td>
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<tr>
<td>Neuronal Liver (bovine)</td>
<td>60 mg</td>
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<tr>
<td>Neuronal Pancreas (bovine)</td>
<td>60 mg</td>
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Daily Value Not established

Proprietary Blend
110 mg
- Echinacea (Echinacea angustifolia) (root) 20 mg
- Ginger (Zingiber officinale) (root) 20 mg
- Oregano (Origanum vulgare) (leaf) 20 mg
- garlic powder (Allium sativum) 20 mg
- Lactobacillus acidophilus (DS11) 20 mg

*Daily Value not established

Other ingredients: Gelatine, citric acid, vegetable wax, magnesium stearate (vegetable source), methyl cellulose gum and gel food.

*If typically given, for example: active vector culture containing Physiologically Nutrient Bound Trace Elements™ and natural associated phytochemicals including phytochemical compounds with 50% and cellulose, dried at low temperature for temperature associated enzyme toxins.

RECOMMENDATION: Two (2) tablets each day as a dietary supplement or as otherwise directed by a healthcare professional.

Caution: Not recommended for pregnant or lactating women.

KEEP OUT OF REACH OF CHILDREN

Keep container tightly sealed and stored in a cool, dry area away from direct sunlight.
Sealed with an imprinted safety seal for your protection.

NDC: 85146-0309 Rev. 3/09

Product Information

Bio-Immunozyme Forte™ is available in bottles of 90 and 180 tablets.

Product Adjuncts: IAG™

These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.