The immune system consists of various organs, tissues, and cells located throughout the body.

**OVERVIEW OF THE IMMUNE SYSTEM**

The immune system is constantly working to protect the body from infection, injury, and disease.

**WHITE BLOOD CELLS (WBCs)**
- The cells of the immune system
- Made inside bone marrow
- WBCs travel through the body inside lymph vessels, which are in close contact with the bloodstream

**THERE ARE SEVERAL TYPES OF WBCs**

- **Neutrophils**: Engulf and destroy
- **Monocytes (Macrophages)**: Engulf and destroy
- **Eosinophils**: Fight parasitic infections
- **Basophils**: Release histamine
- **Lymphocytes**: Attack specific pathogens
- **Plasma Cells**: Produce antibodies

**THE IMMUNE SYSTEM PROVIDES THREE LEVELS OF DEFENSE AGAINST DISEASE-CAUSING ORGANISMS**

1. **Barriers**
   - Prevent entry
   - Skin and mucous membranes
   - Stomach acid and digestive enzymes
   - Beneficial bacteria that live in the colon (the gut microbiota)

2. **Innate Immunity**
   - General defense
   - WBCs called neutrophils and macrophages engulf and destroy foreign invaders and damaged cells

3. **Acquired Immunity**
   - Specific defense
   - WBCs called T lymphocytes (T cells) target and destroy infected or cancerous cells
   - WBCs called B lymphocytes (B cells) and plasma cells produce antibodies that target and destroy infected or cancerous cells
## NUTRIENTS THAT SUPPORT IMMUNE FUNCTION

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>RDA (ADULTS)</th>
<th>GOOD SOURCES</th>
</tr>
</thead>
</table>
| **EPA + DHA**     | No RDA (Advised to consume two servings of oily fish/week) | herring 3 oz, 1.8 g  
|                  |                                                  | salmon 3 oz, 1.5 g  
|                  |                                                  | sardines 3 oz, 1.2 g  |
| **Vitamin A***   | Men: 900 µg/day RAE  
|                  | Women: 700 µg/day RAE                             | egg 1 large, 80 µg RAE  
|                  |                                                  | carrot** ½ cup raw, 534 µg RAE  
|                  |                                                  | sweet potato** ½ cup baked, 961 µg RAE         |
| **Vitamin C***   | Men: 90 mg/day  
|                  | Women: 75 mg/day                                  | sweet red pepper 1 medium, 152 mg  
|                  |                                                  | kiwifruit 1 medium, 91 mg  
|                  |                                                  | strawberries 1 cup whole, 85 mg               |
| **Vitamin D***   | 19-70 years: 600 IU/day  
|                  | 71 years and older: 800 IU/day                   | pink salmon 3 oz, 370 IU  
|                  |                                                  | sardines 3 oz, 164 IU  
|                  |                                                  | fortified milk 1 serving, 120 IU  
|                  |                                                  | sunshine                                       |
| **Vitamin E***   | All adults: 15 mg/day                             | almonds 1 oz, 7 mg  
|                  |                                                  | sunflower oil 1 T, 6 mg  
|                  |                                                  | avocado 1 whole, 2.7 mg                      |
| **Folate**       | All adults: 400 µg/day DFE                       | lentils ½ cup cooked, 179 µg DFE  
|                  |                                                  | spinach ½ cup cooked, 131 µg DFE             |
|                  |                                                  | enriched bread*** 1 slice, 84 µg DFE           |
| **Vitamin B₁₂**  | All adults: 2.4 µg/day                            | clams 3 oz, 84.1 µg  
|                  |                                                  | mackerel 3 oz, 16.1 µg                      |
| **Vitamin B₆**   | 19-50 years: 1.3 mg/day  
|                  | Men 51 years and older: 1.7 mg/day               | salmon 3 oz, 0.5 mg  
|                  | Women 51 years and older: 1.5 mg/day             | turkey 3 oz, 0.7 mg  
|                  |                                                  | potato with skin 1 medium, 0.7 mg         |
| **Zinc**         | Men: 11 mg/day  
|                  | Women: 8 mg/day                                   | oysters 6 medium, 27-50 mg  
|                  |                                                  | beef 3 oz, 4-6 mg                       |
| **Iron***        | Men and women 51 years and older: 8 mg/day       | beef 3 oz, 1.6 mg  
|                  | Women 19-50 years: 18 mg/day                     | tuna 3 oz, 1.3 mg  
|                  |                                                  | lentils ½ cup cooked, 3.3 mg           |
| **Copper**       | All adults: 900 µg/day                            | oysters 6 medium, 2,397 µg  
|                  |                                                  | cashew nuts 1 oz, 622 µg               |
|                  |                                                  | lentils 1 cup cooked, 497 µg                 |
| **Selenium**     | All adults: 55 µg/day                             | tuna 3 oz, 92 µg  
|                  |                                                  | pork 3 oz, 32.5 µg                      |
|                  |                                                  | whole-wheat bread 1 slice, 8.2 µg            |

RDA = Recommended Dietary Allowance  
RAE = retinol activity equivalents  
DFE = dietary folate equivalents  
IU = International Units  
g = grams  
mg = milligrams  
µg = micrograms  
oz = ounce(s)  
T = Tablespoon

*Underconsumed by eating the typical American diet. Iron underconsumed by adolescent females and pregnant women only  
**A source of provitamin A carotenoids  
***A source of folic acid, the synthetic form of folate
FOR SOME NUTRIENTS, GETTING MORE THAN THE RDA MIGHT BE OF FURTHER BENEFIT

VITAMIN C

Routine supplementation with vitamin C (0.25 to 2 g/day) reduces the occurrence of the common cold in individuals undergoing heavy physical stress (marathon runners, skiers, and soldiers in subarctic conditions).

Routine supplementation with vitamin C slightly reduces the duration of the common cold.

The LPI recommends a daily intake of at least 400 mg of vitamin C for generally healthy adults.

VITAMIN D

Low vitamin D status is linked to a higher risk of upper respiratory tract infections and some autoimmune disorders. Supplementation with vitamin D reduces the risk of acute respiratory tract infection.

The LPI recommends 2,000 IU (50 µg) of supplemental vitamin D daily for generally healthy adults.

SOURCES

Micronutrient Information Center

- lpi.oregonstate.edu/mic/health-disease/immunity-in-brief
- lpi.oregonstate.edu/mic/health-disease/immunity