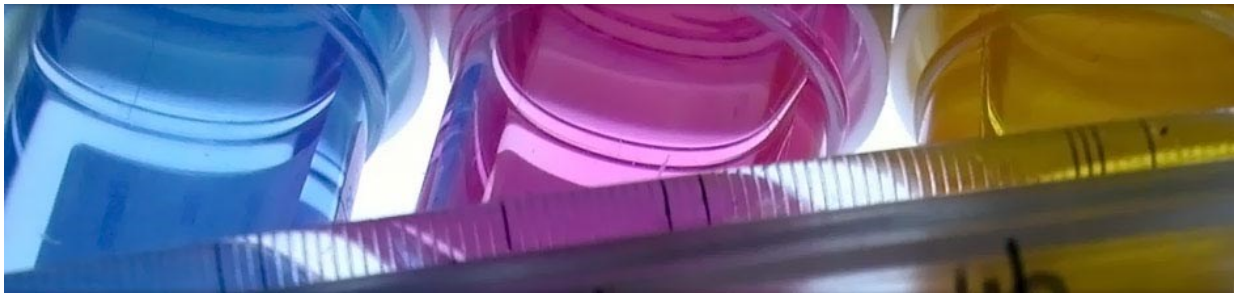
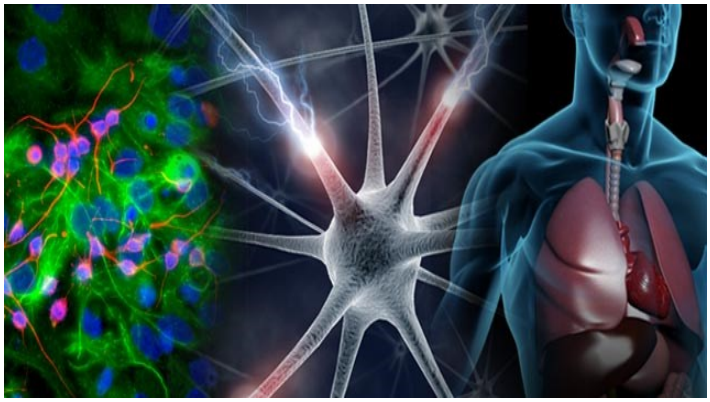
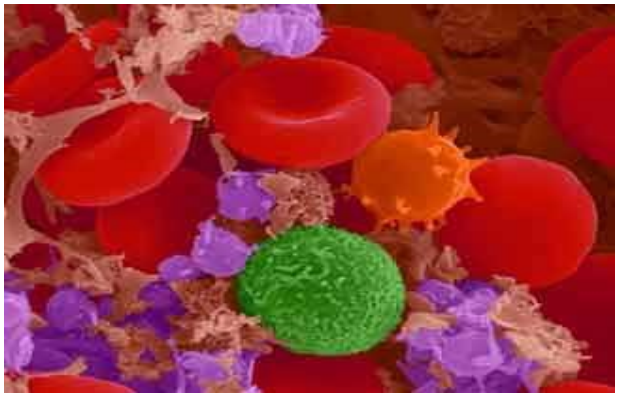


Holistic Blood Chemistry and Urinalysis Reference Manual





Dr. Brandon M. Lundell

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Fourth Edition

About the Author

Dr. Brandon M. Lundell DC, APC, DABCI, IFMCP, Dipl. Ac., NE, CAC
Doctor of Chiropractic
Advanced Practice Chiropractic Physician (New Mexico)
Board Certified in Diagnosis and Internal Disorders (ABCI)
Institute of Functional Medicine - Certified Functional Medicine Practitioner (IFMCP)
Diplomate in Acupuncture and Oriental Medicine (IACA)
Board Certified in Naturopathic Endocrinology (ANMA)
Certified Animal Chiropractor (AVCA)

Dr. Lundell graduated *cum laude* from Parker College of Chiropractic in 2004 with a Doctor of Chiropractic degree. (DC). He received his B.A. from the University of Colorado, Boulder in 1999 with a double major in Political Science and Classical Studies. While in school full-time obtaining his Doctor of Chiropractic degree, Dr. Lundell completed a three year diplomate in acupuncture and oriental medicine. He has also completed a Naturopathic Endocrinology (NE) certification from the National Institute of Endocrine Research in California. He has attained Advanced Practice (AP) certification which allows expanded scope of practice to include IV and injectable nutrients as well as pharmacological training. He is a board-certified Chiropractic Internist through the American Board of Chiropractic Internists (DABCI) which educates and certifies chiropractors in internal disorders, diagnostics, natural medicine and alternative therapies for conditions ranging from heart disease, autoimmune and neurology to pediatrics. He was also among the first practitioners in the country to complete the functional medicine certification program through the Institute of Functional Medicine (IFMCP). Dr. Lundell has developed and teaches several functional medicine courses at the university level and teaches these courses all over the country. Topics of his classes include blood chemistry/pathology, functional endocrinology, inflammatory basis of disease, detoxification, autoimmune, diet, lifestyle, nutrition, methylation, functional genetics and more.

In his 15 years of clinical experience, Dr. Lundell has built a waiting-list only practice. His focus is on integrative primary care, family practice and holistic functional medicine. He believes that functional medicine physicians can provide a much needed service in the current health care environment by filling both a primary care/general practice void as well as offering functional, holistic, science-based treatments which emphasize the correction of the ***Causes*** of illness, ***Prevention*** and ***Wellness*** throughout the lifespan.

His holistic practice includes chiropractic, clinical laboratory testing and analysis (including blood, urine and saliva), functional endocrinology emphasizing *restoration and balance* (rather than just hormone replacement), nutraceuticals, acupuncture, visceral manipulation, homeopathy, detoxification, pre-conception/prenatal planning, functional exercise training, dietary-nutritional education, and more. Dr. Lundell can be reached at his office in Longmont, Colorado: Harmony Healing Center, 303-651-1502, HarmonyHealingCenterPC@comcast.net. Or on the web: www.drbrandonlundell.com

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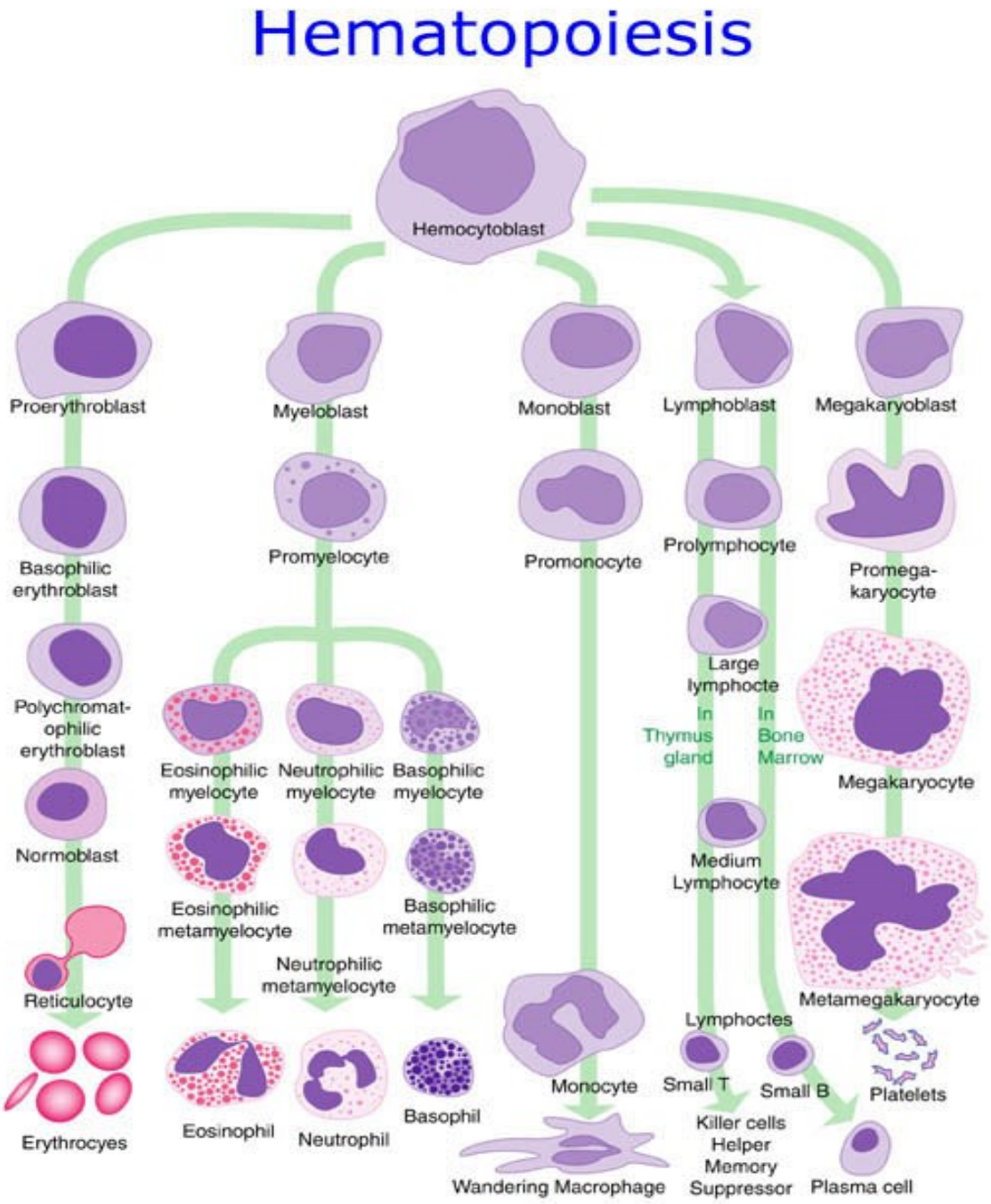
BLOOD CHEMISTRY

Complete Blood Count with Differential



White Blood Cell Count Optimal: 5.5 – 8.5 thous/ml

White blood cells are the first line of defense against microorganisms as well as the mediators of inflammation and tissue repair/destruction. They are grouped into two classes: Granulocytes (Basophils, Eosinophils, and Neutrophils); and Agranulocytes (Monocytes and Lymphocytes). This is both a morphologic as well as functional distinction. These two groups not only look different but have different roles within the complex immune system. The differential is often given in **absolute** numbers (actual count by a lab tech or done by automated cell counters) as well as a **percentage** of total WBC's. The former is usually more accurate and reliable because percentages may be influenced by each other without being necessarily abnormal. The exception to this is neutrophil percentage which is more sensitive to infection than total WBC count.

The role of each WBC will be discussed under their respective differential below. In general the granulocytes are non-specific macrophages which scavenge the body for non-self-organisms, defective cells, and debris. The agranulocytes are part of the humoral immune response and the cell-mediated immune response, which play important roles in cytokine regulation and production. Lymphocytes differentiate into T cells and B cells which produce antibodies.

Leukocytosis is an increase in any or all WBC's. Leukopenia is a decrease in WBC's. A "leukemoid" reaction is a temporary spike in WBC count associated with acute infection. Ranges are influenced by age, sex, ethnicity, environmental, dietary and lifestyle factors.

High (leukocytosis)

- Acute bacterial infection
- Acute viral infection
- Stress (acute)
- Hyperthyroidism
- Pregnancy (late)
- Childhood diseases (measles, mumps, rubella, chicken pox, etc.)
- Leukemia (>15,000/ml)
- Inflammation – leading to insulin resistance, diabetes, cancer and other diseases
- Dehydration
- Leaky gut (intestinal mucosal dysfunction can lead to multiple microorganisms as well as tissue degrading material into the general circulation)
- Malignancy
- Spleenectomy
- Neonates (the first few days of life demonstrate elevated WBC's)
- Steroids (short term)

Low (leukopenia)

- Chronic viral infections
- Chronic bacterial infections
- Immunosenescence (the age-related deterioration of the immune system which is advanced by environmental and lifestyle factors)
- Aplastic anemia (bone marrow failure often due to leukemia)
- Bone marrow suppression / failure / myelofibrosis (hormonal, chemical, autoimmune, congenital and chronic infectious influences)
- Hypothyroid
- Nutrient deficiency – Vit.C, zinc, iron, B12, B6 and folate deficiency affect WBC production.

- Autoimmune (SLE, RA etc.) - anti-neutrophil antibodies will often be present.
- Alcoholism (usually causes nutrient deficiency such as B12, folate etc.)
- Hypersplenism – spleen sequestration of WBC's and RBC's.
- Thymus involution / dysfunction
- Antibiotics – chronic use
- Leaky gut, chronic (over time, leaky gut will deplete the immune system due to inflammation and/or infection as well as cause nutrient malabsorption)
- Chronic illness
- Steroids (long term)
- Drug induced – chemotherapy, immunosuppressant etc.

Functional Considerations

There is a slight diurnal variation of all WBC's, especially the neutrophils, with the peak at 4pm and the nadir at 7am. This is important in interpreting borderline laboratory results. This also explains why symptoms for some immune challenges like the cold/flu may be worse in the evening as the WBC's increase their interleukin and cytokine production, which is actually what produces most of the symptomatology of illness.

Suboptimal WBC counts (high or low) can often be one of the only signs of chronic inflammation. Several studies link slightly elevated WBC counts with increased risk for diabetes, cancer and heart disease. Low WBC can also mean chronic inflammation and increased infections (EBV, CMV etc.).

The immune system is very complex and is influenced by many internal and external factors. It is clear that without supporting the immune system with diet, exercise, meditation (stress reduction), nutrient therapy and careful investigation and specific treatment of chronic microorganism burdens, then the body cannot long experience health and vitality.

Many tests are available to further assess immune function. **One must determine what the etiology behind the apparent abnormal laboratory findings are.** If a microorganism is suspected, then determine what the most likely may be. Treat the immune system as a whole first to see if covering the basics is enough to restore balance. If the patient is chronic or does not respond, then more intensive investigation is required to find underlying causes and how to best support the immune system. Careful not to overlook chronic dental infections such as old root canals that have become re-infected.

Related Tests

CBC w/Diff.: Allows for more complete marrow analysis as well as nutrient factor associated pathology.

Lymphocyte Subset Panel: Helps differentiate T and B cell dysfunction as well as general immune deficiency/dysfunction.

Cytokines: Assesses IL and TNF's associated with immune function. Can give a more in-depth assessment of immune challenges such as causative microorganisms, autoimmune and inflammatory disorders.

Lyme's: Western blot, PCR and antigen subset tests are available to identify past or present B. burgdorferi exposure. At best, these tests have only 70% sensitivity.

Viral Panel: Herpes varieties, EBV, cytomegalovirus, rubella etc.

West Nile: More common than is currently recognized, especially in rural areas.

Food Allergy: Food allergens and sensitivities will both stimulate and weaken the immune system over time.

G.I. Panel: In addition to parasites, functional GI panels will assess microbiota and digestive capabilities. ***Leaky gut is one of the most important factors to address in any immune challenge***.

Autoimmune Markers: ANA complete, RF, Citrillunated peptide, anti-mitochondrial antibodies etc.

Cancer Antigens

Thyroid Panel: Thyroid hormones greatly impact all phases of production, maturation and function of immune cells.
Adrenal Panel: Adrenal hormones, especially cortisol directly impact immune system function.
Spectracell™ Micronutrient Analysis: This test takes WBC's from serum and exposes them to different nutrient rich or nutrient deficient environments, and measures its functional response. Can give specific recommendations on nutrients that may support proper WBC function, as well as total body.
Bone marrow biopsy – most definitive test to determine cause of severe leukopenia

Neutrophils Optimal: 2000 – 6000 cells/mcl; 45 – 65%

Most frequently associated with inflammation as well as infection, neutrophils are sometimes referred to as polymorphonuclear segmented neutrophils (PMN's), or "polys". They are most often associated with bacterial infections whereas viral infections are associated with normal or even low counts of polys (especially percentage). However, about 20% of viral infections may contribute to PMN elevation. *Neutrophils have very short lives - only a few hours in circulation,* so relatively acute disturbances can cause dramatic shifts in PMN levels.

The term "shift to the left" is an older term used to describe an increase in immature PMN's due to rapid mobilization from infection, inflammation or cancer. It was originally used by lab techs who counted the number of immature cells by "stabbing" a punch card on the left side which was used to count the number of different cells in blood.

High

- Bacterial infection (acute)
- Viral (acute or severe)
- Inflammation- acute or chronic (one of the hallmarks of inflammation is recruitment and activation of leukocytes, especially neutrophils)
- Leukemia
- Acute stress (physical or emotional)
- Gout
- Thyroiditis
- Trauma
- Cigarette smoking
- Corticosteroids (can cause rapid elevations, often persisting for 2 – 3 weeks or more after resolution of stressor)

Low

- Blood diseases (aplastic anemia, pernicious anemia, etc.)
- Viral infection
- Chronic stress
- Immunosenescence (the age-related deterioration of the immune system which is advanced by environmental and lifestyle factors)
- Addison's disease
- Hypersplenism
- Vitamin D deficiency (Vit D regulates many aspect of immune cell production and function)
- Radiation
- Adrenal dysfunction (hypoadrenalism can cause neutropenia due to loss of corticosteroid stimulation)