The Important Role of Biochemical Individuality

John Neustadt, ND, and Steve Pieczenik, MD, PhD

What is biochemical individuality?

Biochemical individuality refers to the unique nutritional needs each person has based on their genetics, lifestyle, and environmental exposure to various stresses.

Biochemistry is a complex web of interactions that controls the way your body uses amino acids, vitamins, minerals, carbohydrates, and fats for all your body functions. Amino acids, for example, are used to produce hormones, skin, and bone. For your biochemistry to function properly, your body requires the right amounts and proportions of nutrients. The amount of a certain nutrient the average person requires may *not* be the optimal amount you need for good health.

How does biochemical individuality relate to disease?

Symptoms of disease can occur in response to problems with biochemical processes. Depression provides a good example. The body requires certain nutrients in order to manufacture mood-regulating hormones (serotonin, dopamine, and epinephrine). For these hormones to be properly manufactured, your body needs the amino acids phenylalanine and tryptophan, vitamins B3 and B6, and the minerals iron and copper. Low levels of these nutrients—the raw materials needed to manufacture the hormones—can produce depression.

People may become deficient in the required nutrients because they don't get enough of the nutrients in their diet, or their unique biochemistry may simply require additional amounts of one or more nutrients for the biochemical pathway to function properly.

What is the role of genetics in biochemical individuality?

A person's genetics influences how much of specific nutrients they need. For example, folic acid is a B-vitamin that is important for cardiovascular and neurological health. One role of folic acid is to decrease the amount of homocysteine that can accumulate as a normal part of metabolism. Homocysteine is an amino acid that may play a role in the development of heart disease, osteoporosis, dementia, and certain cancers (colorectal, cervical, and lung). Folic acid is required to break down homocysteine.

In order for folic acid to do this, however, it must be activated by the enzyme methylenetetrahydrofolate reductase (MTHFR). MTHFR is created by the body and coded for by a specific gene. People can have different variations of the gene, which slightly changes the structure of MTHFR. This structural change can reduce its function by 30–65%, meaning that it cannot activate folic acid as easily. People who have the gene that decreases the MTHFR activity require higher doses of folic acid to effectively "push" the reaction forward and activate enough folic acid to decrease homocysteine. The requirement for folic acid is greater in people with this genetic variation.

If I take the U.S. DRI of a nutrient, should that be enough?

The U.S. Dietary Reference Intake (DRI) was created in collaboration with Canada in 1997 to give more-detailed guidance than the Recommended Dietary Allowance (RDA). The DRI is defined as that amount of a nutrient considered sufficient to prevent a deficiency in nearly all (97–98%) of healthy individuals. For example, the U.S. DRI for vitamin C is 90 mg/day for nonsmoking men and 75 mg/day for nonsmoking, nonpregnant, nonlactating women (smoking increases the requirement). In lactating women the recommendation increases only modestly to 120 mg/day. This is an amount determined to prevent vitamin C deficiency, which can result in the condition scurvy that causes connective tissue problems and bleeding gums. The problem with the U.S. DRI is that it does not define the *optimal* amount of a nutrient for body functions. Even if it did define the optimal amount, some people may require more of a nutrient for optimal function, especially if they are under stress, exposed to environmental pollutants, or genetically predisposed to needing more of a certain nutrient.

How can I find out what my nutrient requirements are?

Nutritional biochemistry testing is the best way to learn about your specific nutrient requirements. The most comprehensive versions of these test panels can evaluate over 400 aspects of biochemical function to provide a complete snapshot of your unique nutritional needs. This test is so comprehensive that it may require up to seven vials of blood and two vials of urine. Testing can help you and your healthcare provider correlate nutrient deficiencies and biochemical pathway abnormalities to any symptoms you may have. Your healthcare provider can then devise a customized treatment plan for you, based on your unique biochemistry.

What are the most important nutritional biochemical tests?

Since biochemistry is a web of interactions, the most useful biochemical tests are ones that report amino acids, minerals, vitamins, and fatty acids. Amino acid testing should report all essential amino acids, which your body cannot produce and that you therefore can get only from diet. Low essential amino acids can be an underlying cause of insomnia, depression, fatigue, and hypoglycemia. Additionally, panels should report some amino acids that the body can manufacture and that are

involved in critical physiological functions. One example is the ammonia detoxification pathway in the liver, which requires the amino acids asparagine, aspartic acid, citrulline, glutamic acid, glutamine, and ornithine.

Mineral tests should evaluate *intracellular* mineral concentrations, such as for magnesium, manganese, copper, chromium, zinc, potassium, and vanadium. Minerals—except calcium—concentrate inside cells, where they participate in biochemical processes. Therefore, reporting intracellular mineral concentrations is the most accurate way to understand your nutritional status and needs. Low chromium and vanadium may explain insulin resistance (pre-diabetes) and sugar cravings, while low magnesium can contribute to fatigue and other health problems. Additionally, toxic metals, such as mercury, arsenic, and lead, can also accumulate inside cells and can be screened for by this method.

Vitamins are best tested using urinary organic acids. These acids are produced as byproducts of biochemical pathways and are excreted in the urine. Since each step in the biochemical pathway has been defined and the exact vitamins and minerals required for those steps are known, urinary organic acids are sensitive and specific markers for functional deficiencies in vitamins (as well as in amino acids). If a marker comes up short, this means that, regardless of the amount of a vitamin you have, it is not enough for your specific biochemistry to function properly. Supplementing with higher amounts of the vitamins in which you're functionally deficient may correct the biochemical dysfunction. Urinary organic acids can also detect intestinal bacterial and fungal infections as well as test liver detoxification pathways. A couple of notable exceptions to testing urinary organic acids as indicators of functional vitamin deficiencies are vitamins D and E. These are most accurately tested directly. Low vitamin D is now understood to put people at elevated risk of breast and colon cancers.

Finally, fatty acids surround all our cells and are required for proper nervous system function. A test panel that includes a fatty acid analysis may provide information about your risk for heart disease and chronic inflammation. It can also point to a possible underlying cause of elevated cholesterol, which may then be correct nutritionally.

John Neustadt, ND, is medical director of Montana Integrative Medicine and president and CEO of Nutritional Biochemistry Incorporated (NBI) and NBI Testing and Consulting Corp, in Bozeman, Mont. Dr Neustadt has published more than 100 research reviews and is coauthor with Jonathan Wright, MD, of the book *Thriving through Dialysis* (Dragon Arts Publishing, Auburn, Wash, 2006).

Steve Pieczenik, MD, PhD, is trained in psychiatry at Harvard, has an MD from Cornell University Medical College, and a PhD in International Relations from MIT. He is a board-certified psychiatrist and was a board examiner in psychiatry and neurology. He is chairman of the board of NBI and NBI Testing and Consulting Corp.