A GUIDE TO OPTIMAL LAB VALUES FOR BRAIN HEALTH

Laboratory Analysis	Target Values	Comments
	HORMONES	
Progesterone	5-20 ng/mL or 16-63.5 nmol/L	Optimal levels will vary depending on genetics, whether you are male or female, the time of day, and for females the day of their menstrual cycle. Regulates cognition, mood, inflammation, mitochondrial function, neurogenesis and regeneration, myelination and recovery from traumatic brain injury
Testosterone	1000-1500 ng/dL or 34.7-52.05 nmol/L (M)	Optimal levels will vary depending on genetics, whether you are male or female, the time of day, and for females the day of their menstrual cycle. Testosterone plays a key role in spatial cognition tasks and overall mood.
Free Testosterone	7-15 pg/mL (M)	Optimal levels will vary depending on genetics, whether you are male or female, the time of day, and for females the day of their menstrual cycle. More important than Testosterone, the bioavailable Free Testosterone plays a key role in spatial cognition tasks and overall mood.

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Estradiol (E2)	100-250 pg/mL or 367-915 pmol/L (F)	Optimal levels will vary depending on genetics, whether you are male or female, the time of day, and for females the day of their menstrual cycle. Estradiol is involved in functions such as fine motor control, learning, memory, sensitivity to pain and motor coordination, as well protecting against stroke damage and Alzheimer's disease
Pregnenolone	50-100 ng/dL	Pregnenolone is a neurosteroid because it is also made in the brain and carries out several cerebral functions such as neuroprotection, neuroplasticity and neurogenesis. It also regulates mood and memory.
DHEA-S	400-500 (M) 350-400 (F) ug/dL or 10.8-13.5 (M) 9.5-10.8 (F) umol/L	Also a neurosteroid, it increases dopamine (by upregulating tyrosine hydroxylase levels, the enzyme responsible for its production)
Cortisol	12-16 ug/dL or 330-440 nmol/L	High levels of cortisol can wear down the brain's ability to function properly. Stress can kill brain cells and even reduce the size of the brain. Chronic stress has a shrinking effect on the prefrontal cortex, the area of the brain responsible for memory and learning
TSH	1-2.5 mU/L	Thyroid hormones regulate metabolism in every organ of the

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		body, including the brain and when they are imbalanced, this can affect mood, memory span, ability to concentrate, and contributes to the feeling of brain fog
Free-T3	3.2-4.2 pmol/L	See TSH
Free-T4	1.3-1.8 pmol/L	See TSH
Reverse-T3	10-20 ng/dL	See TSH
	NUTRIENTS	
Vitamins B6	75-100 nmol/L	Helps the body make the hormones serotonin (which regulates mood) and norepinephrine (which helps your body cope with stress)
Vitamin B12	1000-1500 ng/mL	Deficiency has been associated with memory loss, especially in older adults. The vitamin may play a role in preventing brain atrophy, which is the loss of neurons in the brain and often associated with memory loss or dementia

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Vitamin B9 (Folate)	20-25 ng/mL	Very active in the brain and central nervous system necessary for making DNA and neurotransmitters, aids in cellular detoxification, and crucial to the proper formation of the nervous system during development
Vitamin C	1.5-2.5 mg/dL	Low levels are implicated in anxiety, stress, depression, fatigue and low mood
Vitamin D (25OHD)	100-150 nmol/L	Aids in the function of neuronal and glial tissue. A deficiency affects a type of brain "scaffolding" that supports the neurons, increases risk of developing dementia, and is linked to depression and the development of autism and schizophrenic-like disorders, hypoxic brain injury, and other mental illnesses.
Vitamin E	15-20 ug/mL	Elevated levels of oxidative stress in the brain has been shown to contribute to Alzheimer's disease. Vitamin E (particularly tocotrienols) protects the brain from oxidation.

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RBC Magnesium	2.0-2.5 mmol/L	Magnesium (especially in the form of Magnesium Threonate) has been shown to improve memory. It plays an essential role in nerve transmission. There is strong data to suggest a role for magnesium in migraine and depression, and emerging data to suggest a protective effect for anxiety and stroke
Calcium	8.5-10.5 mg/dL	Involved in memory, regulates several neuronal functions such as neurotransmitter synthesis, release, and neuronal excitability. An imbalance may trigger Alzheimer’s Disease.
Copper:Zinc	Ratio of 0.8-1.2	An imbalanced ratio has been linked to several neurological disorders including Alzheimer's and Parkinson's. This ratio has also been identified as critical to the enzymes that activate the brain's neurotransmitters in response to stimuli.
Selenium	110-150 ng/mL	Key ingredient for motor performance, coordination, memory and cognition.

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Potassium	4.5-5.5 mEq/L	Although low levels of potassium is rare, it can interrupt electrical signals that drive the brain causing confusion, sluggish thoughts, and brain fog, and is linked to mild cognitive impairment
Coenzyme Q10	0.46-1.72 ug/mL	Important for mitochondrial function. The brain is highly dependent on mitochondria. Optimal levels show benefit in cognitive decline
	SUGAR	
Fasting insulin	<20-40 pmol/L	Affects feeding behavior and body energy stores, the metabolism of glucose and fats in the liver and adipose, and various aspects of memory and cognition. Elevated levels can influence the development or progression of Alzheimer's disease, other forms of dementia, and brain trauma recovery time.
Hemoglobin A1c (HbA1c)	4.0-5.5%	Elevated blood sugar over time and type 2 diabetes are associated with cerebral atrophy,

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		cognitive impairment and dementia.
Fasting Glucose	3.5-6 mmol/L	See HbA1c
	FATS	
LDL-p	700-1000 nmol/L	LDL-P measures the actual number of LDL particles and may be a better predictor of risk than standard LDL-C
Oxidized LDL (Ox-LDL)	<45 U/L	A sensitive biomarker of atherosclerosis, coronary artery disease, and acute myocardial infarction. High Ox-LDL has also been associated with metabolic syndrome, impaired glucose tolerance and insulin resistance, and untreated overt hypothyroidism.
Lp(a)	<30 mg/dL	Elevated “low-density lipoprotein little a” in Alzheimer's disease correlates with brain amyloid beta but also help regulate neurobehavioral function and energy balance.

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Cholesterol	150-200 mg/dL or 5 – 5.2 mmol/L	This is a goldilocks scenario but it is important to note that low blood cholesterol does not cause low brain cholesterol (the brain makes its own). Low total blood cholesterol levels may contribute to depression, violent behavior, and suicidal thoughts. Too much on the other hand, can contribute to thickening of artery walls (if inflammation is also high) and negatively affects blood supply to the brain. This increases the risk of heart disease, stroke and dementia.
Triglycerides	<150 mg/dL or <1.7 mmol/L	As opposed to cholesterol, TGs do cross the blood brain barrier into the brain and central nervous system. Once inside the brain they influence the hypothalamus, the part of the brain that regulates energy expenditure and the “set point” of your weight and metabolism and are negatively correlated with cognitive function
HDL	60-70 mg/dL or 1.55 - 1.80 mmol/L	Anti-oxidant, anti-inflammatory, endothelial health, anti-thrombotic, and modulation of immune function in the brain.

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	INFLAMMATION	
hs-CRP	<0.9 mg/L	As opposed to CRP, hs-CRP is "high sensitivity" and more accurately depicts inflammation in the body
Omega 3 index	>8%	The omega-3 fatty acids EPA and DHA are critical for normal brain function, development, and disease prevention throughout all ages and stages of life. They are abundant in the cell membranes of brain cells, preserving cell membrane health and facilitating communication between brain cells.
*Cytokine IL-6	<=5 pg/mL	Quantitative Multiplex Bead Assay. Precise reference ranges vary greatly depending on age, sex, etc. and need to be interpreted along with other tests that measure inflammation including Hs-CRP
*Cytokine TNF-a	<=22 pg/mL	Quantitative Multiplex Bead Assay. Precise reference ranges vary greatly depending on age, sex, etc. and need to be interpreted along with other tests that measure inflammation including Hs-CRP

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Homocysteine	<7 umol/L	Elevation may indicate damage to arteries and helps determine need for B-vitamins
C4a	< 2830 ng/mL	Inflammatory marker of greatest significance to innate immune responses in those with exposure to mold and water damaged buildings. Traumatic brain injuries, Lyme disease, and mold infections have very similar symptoms.
8-OHdG	<=15 mcg/g Creat (urine)	When elevated, it's important to identify the sources of oxidative stress and test glutathione. Reducing oxidative stress is valuable in optimizing brain health and longevity.
	TOXINS	
Glutathione (whole blood)	>700mmol/L	Essential for the cellular detoxification of reactive oxygen species in brain cells. Low levels are directly associated with the oxidative stress that occurs in neurological diseases

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RBC thiamine pyrophosphate (TPP)	100-150 ng/mL	Maintains glutathione in red blood cells (ability to manage toxins that affect the brain)
Zonulin (pre-Haptoglobin 2	<4 ng/mL	Good indicator of leaky gut and leaky blood-brain barrier
Diamine Oxidase & Histamine	<10 ng/mL & <1 respectively	Good indicator of histamine intolerance which can lead to brain fog and/or depression as well as sinus problems
Mercury	<dL	Mercury should be less than detectable limits (dl). Studies show that there is no safe levels of mercury in the body.
Lead	<1 ug/dL	Can damage the prefrontal cerebral cortex, hippocampus, and cerebellum and can lead to brain damage, behavioral problems, nerve damage, Alzheimer's, Parkinson's, and schizophrenia.
Arsenic	<2.5 ug/dL	Toxic effects on neurotransmitters involved in cell-to-cell signaling within the brain

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Cadmium	<0.5 ug/dL	Elevated levels play a role in neurodegenerative diseases including Parkinson's, Alzheimer's, and Huntington's disease

*https://www.mayocliniclabs.com/test-catalog/Clinical+and+Interpretive/75139