Postgraduate Certificate in Nutritional Psychiatry

Neurobiology of Mood and Nutrition

Acetylcholine – neurotransmitter that modulates attention, learning and mood. Related terms: cholinergic system, muscarinic receptors, nicotinic receptors. It is synthesized from choline and acetyl-CoA; dietary choline sources (eggs, soy) influence its levels. Practical application: enhancing choline intake may support cognitive aspects of depression. Challenge: excess acetylcholine can provoke anxiety, and individual variability in cholinergic metabolism complicates dosing.

Acute Stress Response – rapid activation of the hypothalamic-pituitary-adrenal (HPA) axis. Related terms: cortisol surge, sympathetic nervous system, fight-or-flight. Short-term stress can increase glucose availability, but repeated acute episodes may dysregulate mood circuits. Example: a single exam stressor elevates cortisol, temporarily boosting alertness. Application: timing nutrient intake (e.g., complex carbs) to buffer cortisol spikes. Challenge: distinguishing beneficial acute stress from harmful chronic activation.

Adiponectin – adipokine with anti-inflammatory and insulin-sensitizing properties. Related terms: adipose tissue, leptin, metabolic syndrome. Higher adiponectin levels correlate with reduced depressive symptoms. Example: omega-3-rich diets raise adiponectin. Practical use: measuring adiponectin as a biomarker for mood-metabolic health. Challenge: genetic polymorphisms affect adiponectin response to diet.

Amygdala – brain region central to processing fear and emotional salience. Related terms: limbic system, threat detection, affective circuitry. Nutrients that modulate glutamate (e.g., magnesium) can influence amygdala excitability. Example: low-magnesium diets increase amygdala reactivity to negative stimuli. Application: magnesium supplementation as adjunct for anxiety. Challenge: blood-brain barrier transport limits rapid changes.

Anaerobic Glycolysis – metabolic pathway generating ATP without oxygen. Related terms: lactate, glycolytic flux, mitochondrial dysfunction. Elevated lactate in the brain is linked to mood disorders. Example: intense exercise raises lactate, which may act as a signaling molecule for neuroplasticity. Practical use: timing high-intensity workouts to harness lactate-mediated benefits. Challenge: excessive lactate can exacerbate fatigue and depressive rumination.

Anti-Inflammatory Diet – dietary pattern rich in omega-3 fatty acids, polyphenols, fiber, and antioxidants. Related terms: Mediterranean diet, DASH diet, dietary inflammatory index. Evidence shows reduced systemic inflammation and improved mood scores. Example: daily consumption of fatty fish, berries, and leafy greens. Application: prescribing diet plans as part of treatment for major depressive disorder. Challenge: adherence barriers and cultural food preferences.

Apoptosis – programmed cell death essential for neural development. Related terms: caspases, neurotrophins, oxidative stress. Dysregulated apoptosis contributes to neurodegeneration in mood disorders. Example: excess ROS from a high-sugar diet can trigger neuronal apoptosis. Practical approach: antioxidant supplementation (vitamin C, flavonoids) to protect neurons. Challenge: balancing apoptosis

inhibition without promoting oncogenic risk.

Astrocyte – glial cell that regulates neurotransmitter recycling and energy metabolism. Related terms: glutamate–glutamine cycle, blood-brain barrier, lactate shuttle. Astrocytic dysfunction impairs synaptic plasticity. Example: reduced astrocytic glutamate uptake in chronic stress leads to excitotoxicity. Application: targeting astrocyte metabolism with ketogenic diets to improve mood stability. Challenge: limited non-invasive methods to assess astrocyte function in patients.

ATP (Adenosine Triphosphate) – cellular energy currency. Related terms: mitochondrial respiration, oxidative phosphorylation, cellular metabolism. Brain ATP levels influence neuronal firing and mood regulation. Example: low-glycemic meals sustain ATP production, reducing irritability. Practical use: recommending complex carbohydrates for steady energy. Challenge: mitochondrial genetic variations affect ATP efficiency, requiring personalized strategies.

Beta-Oxidation – mitochondrial breakdown of fatty acids for energy. Related terms: fatty acid metabolism, ketogenesis, carnitine shuttle. Efficient beta-oxidation supports brain energy during low-glucose states. Example: fasting or low-carb diets increase reliance on beta-oxidation, often improving depressive symptoms. Application: guided intermittent fasting protocols. Challenge: risk of hypoglycemia in vulnerable populations.

Brain-Derived Neurotrophic Factor (BDNF) – protein that promotes neuronal survival and synaptic plasticity. Related terms: TrkB receptor, neurogenesis, mood-enhancing pathways. Exercise and omega-3 intake up-regulate BDNF. Example: 30 min of moderate aerobic activity raises serum BDNF within weeks. Practical implication: combining physical activity with diet to boost BDNF for antidepressant effect. Challenge: BDNF levels are influenced by genetics (Val66Met) and stress, complicating uniform recommendations.

Blood-Brain Barrier (BBB) – selective barrier protecting the CNS from peripheral fluctuations. Related terms: endothelial tight junctions, transporters, neuroinflammation. Nutrients cross the BBB via specific transporters (e.g., LAT1 for large neutral amino acids). Example: tryptophan competes with other amino acids for BBB entry, affecting serotonin synthesis. Application: dietary manipulation of amino acid ratios to influence mood. Challenge: systemic inflammation can increase BBB permeability, altering drug and nutrient effects.

Calcium Signaling – intracellular cascade influencing neurotransmitter release and gene transcription. Related terms: voltage-gated calcium channels, NMDA receptors, intracellular calcium stores. Dysregulated calcium signaling is implicated in bipolar disorder. Example: lithium stabilizes intracellular calcium fluxes. Practical use: ensuring adequate dietary calcium (dairy, fortified plant milks) while monitoring for hypercalcemia. Challenge: calcium excess can precipitate depressive symptoms in susceptible individuals.

Carbohydrate-Insulin Model – hypothesis linking high-glycemic carbs to insulin spikes, hunger, and mood swings. Related terms: glycemic index, insulin resistance, satiety hormones. High post-prandial insulin may reduce tryptophan transport into the brain, lowering serotonin. Example: sugary breakfast correlates with mid-day irritability. Application: recommending low-glycemic meals to stabilize mood. Challenge: individual insulin sensitivity varies widely.

Carnitine – molecule that transports long-chain fatty acids into mitochondria for beta-oxidation. Related terms: primary carnitine deficiency, acetyl-L-carnitine, energy metabolism. Supplementation can improve depressive symptoms in patients with mitochondrial dysfunction. Example: 2 g/day of acetyl-L-carnitine improves mood in elderly cohorts. Practical use: testing plasma carnitine levels in treatment-resistant depression. Challenge: high doses may cause gastrointestinal upset.

Catecholamines – neurotransmitters dopamine, norepinephrine, and epinephrine that regulate arousal and reward. Related terms: catechol-O-methyltransferase (COMT), monoamine oxidase (MAO), stress response. Diets high in tyrosine (e.g., cheese, soy) can boost catecholamine synthesis. Example: tyrosine supplementation reduces fatigue under acute stress. Application: using tyrosine-rich foods as adjunct in attention-deficit treatments. Challenge: excessive catecholamine activity may provoke anxiety or insomnia.

Cholecystokinin (CCK) – peptide hormone involved in satiety and anxiety modulation. Related terms: vagal afferents, pancreatic enzymes, CCK-B receptors. High-fat meals stimulate CCK release, which can induce anxiety in sensitive individuals. Example: a heavy cheese platter may increase CCK-mediated panic in predisposed patients. Practical implication: moderating dietary fat to manage anxiety spikes. Challenge: individual variability in CCK receptor sensitivity.

Cortisol – glucocorticoid hormone released during stress; influences glucose metabolism and mood. Related terms: HPA axis, diurnal rhythm, glucocorticoid receptors. Chronic elevation depresses hippocampal neurogenesis. Example: night-shift workers often exhibit flattened cortisol curves and depressive symptoms. Application: timing meals (e.g., protein at breakfast) to blunt cortisol spikes. Challenge: cortisol feedback loops are highly individualized, making universal dietary guidelines difficult.

Creatine – compound that buffers cellular ATP via the phosphocreatine system. Related terms: phosphocreatine, brain energetics, neuroprotection. Supplementation can improve depressive symptoms, particularly in females. Example: 5 g/day of creatine monohydrate enhanced mood in a 12-week trial. Practical use: adding creatine to diet for patients with low energy fatigue. Challenge: renal considerations and potential weight gain may limit use.

Cytochrome P450 Enzymes – liver enzymes that metabolize drugs and nutrients. Related terms: CYP1A2, CYP2D6, drug-nutrient interactions. Certain foods (e.g., grapefruit) inhibit CYP3A4, affecting antidepressant levels. Example: grapefruit juice can raise sertraline plasma concentrations. Application: counseling patients on food–drug interactions in psychiatric care. Challenge: polymorphic expression of CYP genes leads to unpredictable interactions.

DNA Methylation – epigenetic modification that can silence gene expression. Related terms: epigenetics, histone acetylation, nutrigenomics. Folate and B12 provide methyl groups influencing methylation patterns linked to mood. Example: low folate status associates with hypermethylation of BDNF promoter, reducing expression. Practical use: measuring methylation biomarkers to tailor supplementation. Challenge: reversibility of methylation changes is limited; long-term dietary patterns are needed.

Dopamine – catecholamine neurotransmitter governing reward, motivation, and motor control. Related terms: mesolimbic pathway, D2 receptors, Parkinson's disease. Tyrosine-rich foods (e.g., turkey, nuts)

support dopamine synthesis. Example: a diet high in fermented soy boosts dopamine turnover in animal models. Application: dietary strategies to alleviate anhedonia. Challenge: excessive dopamine can precipitate psychosis; balance is critical.

Electron Transport Chain (ETC) – series of mitochondrial complexes generating ATP through oxidative phosphorylation. Related terms: Complex I-IV, reactive oxygen species (ROS), mitochondrial DNA. Nutrients such as coenzyme Q10 and B-vitamins support ETC efficiency. Example: CoQ10 supplementation improves mitochondrial respiration in depressive patients. Practical implication: assessing ETC function via lactate/pyruvate ratios. Challenge: ETC deficits are often multifactorial, requiring combined interventions.

Endocannabinoid System – lipid signaling system modulating stress, appetite, and mood. Related terms: anandamide, CB1 receptors, FAAH enzyme. Dietary omega-3 fatty acids increase endocannabinoid tone. Example: fish-oil supplementation elevates anandamide, reducing anxiety. Application: incorporating omega-3-rich foods for mood regulation. Challenge: endocannabinoid levels are also affected by exercise, making isolated dietary effects hard to quantify.

Enteric Nervous System (ENS) – network of neurons governing gastrointestinal function, often called "second brain." Related terms: gut-brain axis, vagus nerve, serotonin (5-HT). Over 90 % of body serotonin is produced in the gut. Example: probiotic strains (Lactobacillus rhamnosus) modulate ENS signaling and reduce depressive behaviors in rodents. Practical use: recommending specific probiotic formulations for mood support. Challenge: strain-specific effects and individual microbiome composition create variability.

Epigenetic Nutrition – dietary influence on gene expression through epigenetic mechanisms. Related terms: methyl donors, histone modification, nutrigenomics. Folate, choline, and betaine serve as methyl donors; polyphenols can inhibit DNA methyltransferases. Example: maternal intake of leafy greens can epigenetically program offspring stress resilience. Application: designing prenatal nutrition plans to reduce future mood disorder risk. Challenge: long latency between dietary exposure and measurable epigenetic outcomes.

Erythropoietin (EPO) – hormone primarily involved in red blood cell production, also neuroprotective. Related terms: hypoxia-inducible factor (HIF), neurogenesis, oxidative stress. Exercise-induced hypoxia raises endogenous EPO, supporting mood. Example: high-altitude training increases brain EPO, correlating with improved depressive scores. Practical implication: using moderate hypoxic training as adjunct therapy. Challenge: excessive EPO may increase thrombosis risk.

Fatty Acid Oxidation Disorders – inherited conditions impairing beta-oxidation. Related terms: medium-chain acyl-CoA dehydrogenase deficiency, carnitine deficiency, metabolic crisis. Even heterozygous carriers may experience mood fluctuations under dietary stress. Example: low-carb diets can precipitate crisis in undiagnosed individuals. Application: screening for fatty-acid oxidation markers before recommending ketogenic diets. Challenge: rare disorders require specialist referral.

Folate (Vitamin B9) – water-soluble vitamin essential for one-carbon metabolism and neurotransmitter synthesis. Related terms: methyl folate, homocysteine, folic acid fortification. Low folate correlates with higher depression prevalence. Example: 400 µg/day of folic acid reduces depressive symptom severity in clinical trials. Practical use: routine folate testing in mood disorder assessments. Challenge: folic acid can

mask B12 deficiency; personalized dosing needed.

Glial Cell Line-Derived Neurotrophic Factor (GDNF) – protein supporting dopaminergic neuron survival. Related terms: RET receptor, Parkinson's disease, neuroprotection. Certain flavonoids (e.g., quercetin) up-regulate GDNF expression. Example: quercetin-rich onions increase GDNF in rodent striatum. Application: incorporating flavonoid-dense foods for dopaminergic health. Challenge: bioavailability of flavonoids varies with gut microbiota.

Glutamate – principal excitatory neurotransmitter; excess can cause excitotoxicity. Related terms: NMDA receptor, astrocytic uptake, glutamine cycle. Magnesium and zinc act as NMDA antagonists, reducing glutamate overactivity. Example: magnesium-deficient diets heighten amygdala glutamate response. Practical use: magnesium supplementation to mitigate hyper-glutamatergic states in anxiety. Challenge: balancing inhibition to avoid cognitive dulling.

Glutathione – major intracellular antioxidant protecting neurons from oxidative damage. Related terms: GSH/GSSG ratio, N-acetylcysteine (NAC), redox homeostasis. NAC supplementation boosts glutathione, showing antidepressant effects. Example: 1200 mg/day NAC improved mood in a double-blind trial. Application: using NAC as adjunct in treatment-resistant depression. Challenge: high doses may interfere with certain chemotherapy agents.

Hippocampus – brain structure critical for memory consolidation and stress regulation. Related terms: neurogenesis, glucocorticoid receptors, atrophy. Chronic stress reduces hippocampal volume; aerobic exercise and omega-3s can reverse atrophy. Example: 12-week treadmill program increased hippocampal gray matter in older adults. Practical implication: prescribing exercise as part of mood disorder management. Challenge: adherence to exercise regimes is often low.

Homeostatic Plasticity – neuronal mechanisms that stabilize firing rates over time. Related terms: synaptic scaling, intrinsic excitability, activity-dependent regulation. Diets high in refined sugars can disrupt homeostatic plasticity, leading to hyperexcitability. Example: sugar-laden diets in mice cause persistent cortical hyperactivity. Application: recommending low-sugar nutrition to preserve neuronal stability. Challenge: measuring homeostatic plasticity in humans remains indirect.

Hormesis – adaptive response where low-dose stressors (e.g., phytochemicals) confer health benefits. Related terms: mitohormesis, oxidative preconditioning, dietary polyphenols. Resveratrol induces mild mitochondrial stress, up-regulating antioxidant defenses. Example: moderate red-wine polyphenol intake improves mood via hormetic pathways. Practical use: integrating hormetic foods (berries, dark chocolate) into diet plans. Challenge: dose-response curves are narrow; excessive intake may be counterproductive.

Insulin Sensitivity – efficiency of cells to respond to insulin. Related terms: HOMA-IR, metabolic syndrome, glucose tolerance. Improved insulin sensitivity via low-glycemic meals correlates with reduced depressive symptoms. Example: 16-week low-carb diet lowered HOMA-IR and improved mood scores. Application: monitoring insulin metrics as part of psychiatric assessment. Challenge: genetic predisposition to insulin resistance limits diet-only interventions.

Ketone Bodies – metabolites (β-hydroxybutyrate, acetoacetate) produced during fat oxidation. Related

terms: ketogenic diet, neuroprotective signaling, epigenetic regulation. β-Hydroxybutyrate acts as a histone deacetylase inhibitor, enhancing BDNF expression. Example: exogenous ketone ester supplementation improves cognition in bipolar patients. Practical use: prescribing short-term ketogenic protocols for mood stabilization. Challenge: adherence, potential dyslipidemia, and contraindications in pregnancy.

Lactate – product of anaerobic glycolysis; also serves as a signaling molecule in the brain. Related terms: astrocyte-neuron lactate shuttle, acid-base balance, mood modulation. Elevated brain lactate is observed in major depression. Example: endurance training reduces resting lactate levels and improves mood. Application: using lactate measurements to gauge metabolic stress in psychiatric patients. Challenge: interpreting lactate without context of exercise or diet can be misleading.

Leptin – hormone from adipose tissue regulating satiety and energy balance. Related terms: leptin resistance, hypothalamic pathways, mood regulation. High leptin levels in obesity can impair reward circuitry, contributing to depressive symptoms. Example: weight-loss interventions lower leptin and improve affect. Practical use: incorporating leptin-sensitive foods (high protein, fiber) to support mood. Challenge: leptin resistance is hard to reverse solely with diet.

Long-Chain Polyunsaturated Fatty Acids (LC-PUFAs) – essential fatty acids, notably EPA and DHA. Related terms: omega-3, membrane fluidity, anti-inflammatory eicosanoids. Clinical trials show EPA ≥ 1 g/day reduces depressive symptoms. Example: daily fish oil capsule improves mood in postpartum depression. Application: recommending LC-PUFA supplementation as adjunct therapy. Challenge: oxidation of fish oil requires proper storage; vegetarian sources (algae) may be less bioavailable.

Microbiome-Gut-Brain Axis – bidirectional communication network linking intestinal microbes with CNS function. Related terms: dysbiosis, short-chain fatty acids (SCFAs), vagus nerve. Certain strains produce GABA, serotonin precursors, and SCFAs that influence mood. Example: kefir consumption increases GABA-producing Lactobacillus and reduces anxiety scores. Practical use: prescribing specific probiotic formulations based on symptom profile. Challenge: inter-individual microbiome diversity limits one-size-fits-all recommendations.

Mitochondrial DNA (mtDNA) – genetic material within mitochondria governing oxidative metabolism. Related terms: heteroplasmy, oxidative stress, maternal inheritance. mtDNA mutations are linked to treatment-resistant depression. Example: carriers of the mtDNA 5178A allele respond better to exercise-based interventions. Application: screening for mtDNA variants in refractory cases. Challenge: testing is costly and interpretation is still emerging.

Monoamine Oxidase (MAO) – enzyme degrading monoamines (serotonin, dopamine, norepinephrine). Related terms: MAO-A, MAO-B, tyramine interaction. Certain foods (aged cheese, fermented soy) contain tyramine, which can precipitate hypertensive crisis when combined with MAO inhibitors. Example: dietary counseling prevents adverse events in patients on phenelzine. Practical implication: providing food lists for MAO-inhibitor users. Challenge: patient adherence to dietary restrictions can be difficult.

Neuroinflammation – inflammatory processes within the CNS affecting neurons and glia. Related terms: cytokines (IL-6, TNF-α), microglia activation, blood-brain barrier dysfunction. High-sugar diets elevate

peripheral cytokines that can cross the BBB. Example: a Western diet raises IL-6, correlating with depressive scores. Application: anti-inflammatory diets to dampen neuroinflammation. Challenge: distinguishing cause from effect; inflammation may be both driver and consequence.

Neuroplasticity – ability of the brain to reorganize synaptic connections. Related terms: long-term potentiation (LTP), synaptogenesis, experience-dependent remodeling. Omega-3s, BDNF, and aerobic exercise synergistically enhance neuroplasticity. Example: combined fish oil and treadmill training improves LTP in rodent models of depression. Practical use: integrating diet and exercise for maximal plastic change. Challenge: measuring neuroplasticity in clinical settings relies on indirect biomarkers.

Neurotransmitter Synthesis – biochemical pathways generating serotonin, dopamine, norepinephrine, GABA, and glutamate. Related terms: precursor amino acids, co-factor vitamins, enzyme activity. Dietary precursors (tryptophan, tyrosine) and cofactors (B6, B12, zinc) are essential. Example: low-protein diets reduce tryptophan availability, lowering serotonin. Application: tailoring macronutrient composition to support specific neurotransmitter pathways. Challenge: competition among amino acids for transport across the BBB can limit efficacy.

Omega-6/Omega-3 Ratio – balance between pro-inflammatory (omega-6) and anti-inflammatory (omega-3) fatty acids. Related terms: linoleic acid, arachidonic acid, eicosapentaenoic acid (EPA). Western diets often have ratios >15:1, associated with higher depression prevalence. Example: reducing seed oil intake while increasing fish reduces ratio to ~4:1, improving mood. Practical implication: counseling on cooking oils and processed foods. Challenge: cultural dietary patterns may impede ratio modification.

Oxidative Stress – imbalance between ROS production and antioxidant defenses. Related terms: lipid peroxidation, DNA damage, antioxidant enzymes (SOD, catalase). Chronic oxidative stress damages neuronal membranes, contributing to mood disorders. Example: high-fructose diets increase ROS, worsening depressive symptoms. Application: antioxidant-rich foods (berries, nuts) as part of treatment plans. Challenge: systemic antioxidant supplementation has mixed clinical outcomes; timing and dosage are critical.

Palmitic Acid – saturated fatty acid prevalent in animal fats and palm oil. Related terms: lipotoxicity, ER stress, inflammation. High intake can induce microglial activation and depressive-like behavior in rodents. Example: diets >20 % energy from palmitic acid raise inflammatory markers. Practical advice: limit saturated fat to Parvalbumin-Positive Interneurons – GABAergic neurons crucial for network synchrony. Related terms: gamma oscillations, schizophrenia, fast-spiking cells. Nutrients that support GABA synthesis (magnesium, zinc) may enhance interneuron function. Example: magnesium deficiency reduces parvalbumin expression, linked to anxiety. Application: assessing mineral status in patients with disrupted gamma rhythms. Challenge: direct measurement of interneuron health in vivo is not currently feasible.

Phytochemicals – plant-derived bioactive compounds, such as flavonoids, carotenoids, and polyphenols. Related terms: antioxidant capacity, hormesis, gut microbiota metabolism. Curcumin, a polyphenol, exhibits antidepressant-like effects via NF-κB inhibition. Example: 500 mg/day curcumin improves mood scores in clinical trials. Practical use: recommending culinary spices as adjuncts. Challenge: low bioavailability; formulations (e.g., phytosome) may be required.

Polyphenol-Rich Foods – foods high in flavonoids, phenolic acids, and tannins. Related terms: anthocyanins, catechins, resveratrol. Consumption correlates with lower depressive symptomatology. Example: daily blueberry intake (≈150 g) improves executive function and mood. Application: integrating fruit smoothies into meal plans. Challenge: sugar content of fruit may counteract benefits in insulin-sensitive patients.

Post-Prandial Glycemia – blood glucose level after a meal. Related terms: glycemic load, insulin response, glucose excursions. Stable post-prandial glycemia supports mood stability. Example: mixed macronutrient meals blunt glucose spikes compared with pure carbohydrate meals. Practical recommendation: pairing carbohydrates with protein/fat to smooth glucose curves. Challenge: patient education on portion sizes and food sequencing.

Probiotic – live microorganisms that confer health benefits when administered in adequate amounts. Related terms: Lactobacillus, Bifidobacterium, microbiota modulation. Certain strains (L. helveticus) reduce cortisol and improve mood. Example: 10^9 CFU/day of L. helveticus for 8 weeks lowered anxiety scores. Application: selecting strain-specific products based on clinical evidence. Challenge: viability through the gastrointestinal tract and product shelf-life.

Psychobiotics – subset of probiotics that influence mental health via the gut–brain axis. Related terms: GABA-producing bacteria, SCFA producers, neuroactive metabolites. Example: Bifidobacterium longum 1714 improves stress resilience in humans. Practical use: incorporating psychobiotic supplements into treatment regimens. Challenge: limited regulatory oversight and strain-specific efficacy data.

Pyruvate – key metabolite linking glycolysis to the Krebs cycle. Related terms: lactate dehydrogenase, mitochondrial respiration, energy substrate. Exogenous sodium pyruvate can support brain energy during hypoglycemia. Example: 500 mg pyruvate supplementation improved mental fatigue in a small trial. Application: short-term use during high-stress periods. Challenge: gastrointestinal side effects at higher doses.

Quercetin – flavonoid with antioxidant and anti-inflammatory properties. Related terms: flavonol, bioavailability, Nrf2 activation. Quercetin up-regulates GDNF and reduces neuroinflammation. Example: 500 mg/day quercetin improved mood in a pilot study. Practical implication: recommending onion or apple skins as natural sources. Challenge: poor absorption; co-administration with bromelain enhances uptake.

Reactive Oxygen Species (ROS) – chemically reactive molecules containing oxygen, produced during metabolism. Related terms: oxidative damage, antioxidant defenses, mitochondrial leakage. Elevated ROS in the brain associate with depressive phenotypes. Example: high-fat diets increase neuronal ROS, impairing synaptic plasticity. Application: antioxidant-rich diet plans to mitigate ROS. Challenge: ROS also serve signaling roles; over-suppression may hinder adaptation.

Receptor Sensitization – increased responsiveness of receptors after repeated stimulation. Related terms: up-regulation, desensitization, neuroadaptation. Chronic low-dose caffeine can sensitize adenosine receptors, enhancing alertness. Example: moderate coffee intake improves mood via adenosine antagonism. Practical advice: timing caffeine to avoid sleep disruption. Challenge: individual tolerance varies widely.

Serotonin (5-HT) – monoamine neurotransmitter regulating mood, appetite, and sleep. Related terms:

tryptophan hydroxylase, SERT transporter, selective serotonin reuptake inhibitors (SSRIs). Dietary tryptophan competes with other large neutral amino acids for transport. Example: high-protein meals increase competition, potentially lowering brain serotonin. Application: balancing protein intake with carbohydrate timing to favor serotonin synthesis. Challenge: peripheral serotonin does not cross the BBB; central effects depend on transport dynamics.

Short-Chain Fatty Acids (SCFAs) – metabolites (acetate, propionate, butyrate) produced by gut microbiota fermentation of fiber. Related terms: colon health, epigenetic modulation, energy source. Butyrate acts as an HDAC inhibitor, increasing BDNF expression. Example: high-fiber diet raises fecal butyrate, correlating with lower depressive scores. Practical use: recommending 25–30 g of soluble fiber daily. Challenge: some patients experience bloating; gradual fiber increase is needed.

Signal Transduction – cascade of intracellular events following receptor activation. Related terms: second messengers, cAMP, MAPK pathway. Nutrients can modulate signaling; for instance, curcumin influences NF-κB pathway. Example: turmeric supplementation reduces inflammatory signaling in mood disorders. Application: integrating anti-inflammatory spices into therapeutic diets. Challenge: complex interactions with medications may alter drug metabolism.

Sirtuins – NAD^+-dependent deacetylases involved in cellular aging and metabolism. Related terms: SIRT1, caloric restriction, mitochondrial biogenesis. Resveratrol activates SIRT1, enhancing neuroprotection. Example: 200 mg/day resveratrol improves depressive symptoms in a small cohort. Practical implication: using SIRT-activating foods (red grapes) as part of mood-supportive diets. Challenge: dose-response unclear; high doses may interfere with anticoagulants.

Synaptic Plasticity – ability of synapses to strengthen or weaken over time. Related terms: LTP, LTD, dendritic spine remodeling. Omega-3 DHA incorporates into neuronal membranes, facilitating plasticity. Example: DHA supplementation improves visual-cognitive performance in depressed patients. Application: recommending fish oil alongside cognitive therapy. Challenge: interindividual variability in DHA incorporation rates.

Thyroid Hormones – hormones (T_3, T_4) that regulate metabolism and neurodevelopment. Related terms: hypothyroidism, deiodinase enzymes, mood lability. Iodine deficiency can lower T_3, leading to depressive symptoms. Example: iodine supplementation (150 µg/day) improves mood in subclinical hypothyroid patients. Practical use: screening thyroid function in mood disorder work-up. Challenge: excess iodine may precipitate autoimmune thyroiditis in susceptible individuals.

Triglyceride-Glucose Index (TyG) – surrogate marker for insulin resistance. Related terms: metabolic health, cardiovascular risk, mood correlation. Higher TyG scores associate with greater depressive severity. Example: lifestyle intervention lowering TyG improves both metabolic and mood outcomes. Application: using TyG as a quick screening tool in psychiatric clinics. Challenge: not all patients with high TyG respond to diet alone; pharmacologic support may be needed.

Trytophan – essential amino acid precursor of serotonin. Related terms: kynurenine pathway, large neutral amino acid competition, dietary sources (turkey, pumpkin seeds). High-protein diets increase competition,

reducing brain tryptophan uptake. Example: carbohydrate-rich meals boost insulin, decreasing competing amino acids and facilitating serotonin synthesis. Practical advice: schedule carbohydrate intake before bedtime to promote sleep-related serotonin. Challenge: individual variations in kynurenine metabolism can divert tryptophan toward neurotoxic metabolites.

Ubiquinone (Coenzyme Q10) – component of the electron transport chain with antioxidant properties. Related terms: mitochondrial function, oxidative phosphorylation, cardiolipin stabilization. Supplementation improves energy production and reduces depressive fatigue. Example: 200 mg/day CoQ10 lowered fatigue scores in bipolar patients. Application: adding CoQ10 in patients with mitochondrial complaints. Challenge: CoQ10 bioavailability is low; lipid-based formulations are recommended.

Vitamin D – secosteroid hormone influencing calcium homeostasis and immune regulation. Related terms: 25-hydroxyvitamin D, sunlight exposure, mood seasonality. Deficiency correlates with higher depression prevalence. Example: 2000 IU/day vitamin D supplementation improves depressive symptoms in winter. Practical recommendation: testing serum 25-OH-D and supplementing to >30 ng/mL. Challenge: genetic VDR polymorphisms affect response; monitoring is essential.

Vitamin B12 (Cobalamin) – co-factor for methylation reactions and myelin synthesis. Related terms: methylmalonic acid, homocysteine, neurological health. Low B12 can elevate homocysteine, a risk factor for depression. Example: 1000 µg methylcobalamin weekly improves mood in vegans. Application: routine B12 screening in psychiatric patients, especially those on plant-based diets. Challenge: absorption issues (pernicious anemia) require parenteral administration.

Vitamin C – water-soluble antioxidant involved in neurotransmitter synthesis. Related terms: ascorbic acid, collagen formation, cortisol reduction. High-dose vitamin C (2 g/day) shows rapid antidepressant effects in pilot studies. Example: intravenous vitamin C improved mood in treatment-resistant patients. Practical use: oral supplementation for mild depressive symptoms. Challenge: renal stone risk at very high intakes; dosing must be individualized.

Vitamin E (α-Tocopherol) – lipid-soluble antioxidant protecting cell membranes. Related terms: oxidative stress, lipid peroxidation, neuroprotection. Supplementation reduces oxidative biomarkers in depression. Example: 400 IU/day vitamin E improved mood in elderly subjects. Application: adding vitamin E to antioxidant regimens. Challenge: high doses may interfere with clotting; monitor anticoagulant therapy.

Vagus Nerve Stimulation (VNS) – therapeutic technique delivering electrical impulses to the vagus nerve. Related terms: parasympathetic activation, neuroplasticity, treatment-resistant depression. Diets rich in omega-3s can enhance vagal tone, complementing VNS. Example: Mediterranean diet improves heart-rate variability, a proxy for vagal activity. Practical implication: lifestyle optimization before invasive VNS. Challenge: patient acceptance and cost of device implantation.

Water-Soluble Vitamins – vitamins that dissolve in water and require regular intake. Related terms: B-complex, vitamin C, renal excretion. Deficiencies can impair neurotransmitter synthesis. Example: B-complex supplementation reduces fatigue in depressive patients. Application: ensuring balanced B-vitamin intake via diet or supplements. Challenge: excess intake is usually harmless, but can mask other

deficiencies.

White Matter Integrity – structural connectivity of myelinated axons. Related terms: diffusion tensor imaging (DTI), myelination, cognitive speed. Chronic inflammation can degrade white matter, affecting mood regulation. Example: omega-3 supplementation preserves DTI metrics in elderly depressed cohorts. Practical use: monitoring white matter health as a biomarker for treatment efficacy. Challenge: imaging cost limits routine use.

Whey Protein – high-quality protein containing all essential amino acids. Related terms: branched-chain amino acids (BCAAs), muscle synthesis, satiety. Whey can increase tryptophan availability when consumed with carbohydrate. Example: post-exercise whey shake improves mood in athletes. Application: recommending whey as part of balanced meals. Challenge: lactose intolerance may require isolate or plant-based alternatives.

Yohimbine – alkaloid that antagonizes α_2-adrenergic receptors, increasing norepinephrine release. Related terms: stimulant, anxiety, dosage timing. Low-dose yohimbine can boost mood in some depressive subtypes. Example: 5 mg oral yohimbine improves alertness without excessive anxiety. Practical consideration: using under medical supervision due to cardiovascular effects. Challenge: narrow therapeutic window and potential for heightened anxiety.

Zinc – trace mineral involved in neurotransmission and immune function. Related terms: metallothionein