SUPPLEMENT PROTOCOL

Detailed Rationale & Mechanisms

Why each supplement is in the stack, what it does, and how it connects to the whole system

How This Protocol Works

This protocol isn't a random collection of supplements. It's built around four interconnected systems that influence each other: **gut microbiome health** (the ecosystem of bacteria in your intestines that produces essential metabolites), **mitochondrial energy production** (how your cells generate the energy currency ATP), **circadian rhythm** (your body's master clock that controls hormone release, immune function, and cellular repair), and **neurological function** (neurotransmitter balance, focus, mood, and anxiety regulation).

A disrupted gut microbiome leads to inflammation that impairs mitochondrial function. Poor mitochondrial function reduces energy for immune and hormonal systems. Disrupted circadian rhythm impairs gut repair and hormone production overnight. These systems are a web — the protocol addresses all four simultaneously because fixing one without the others produces limited results.

Supplement Rationale

SUPPLEMENT	DOSE	WHY IT'S IN THE STACK
MITOCHONDRIAL / ENERGY		
CoQ10 (ubiquinol)	200-400mg	**The core of the energy stack.** CoQ10 is a molecule embedded in the inner mitochondrial membrane that shuttles electrons in the energy production chain (specifically between Complex II/III and Complex III/IV). Without adequate CoQ10, your mitochondria can't efficiently convert food into ATP — the energy molecule every cell needs. Ubiquinol is the reduced (active) form; your body must convert cheaper ubiquinone into ubiquinol before using it, and this conversion declines with age. CoQ10 also acts as a fat-soluble antioxidant, protecting mitochondrial membranes from the oxidative damage that energy production generates. Must be taken with dietary fat for absorption.
B1 / Benfotiamine	150-300mg	**Upstream fuel for the energy cycle.** Before food can enter the mitochondrial energy chain, it must first be processed through pyruvate dehydrogenase — a gateway enzyme that requires vitamin B1 (thiamine) as a cofactor.

		Without adequate B1, glucose can't be efficiently converted into acetyl-CoA, the fuel that feeds the Krebs cycle inside mitochondria. Benfotiamine is a fat-soluble form with significantly better bioavailability than regular thiamine HCl. Deficiency causes fatigue, brain fog, and poor energy metabolism even when mitochondria themselves are healthy.
Riboflavin (B2)	25mg	**Complex II support.** Riboflavin is converted into FAD (flavin adenine dinucleotide), which is the electron carrier used specifically by Complex II (succinate dehydrogenase) of the mitochondrial electron transport chain. This fills the gap between B1 (upstream) and CoQ10 (downstream) to ensure the full energy production pathway is supported. Also involved in glutathione recycling, complementing NAC.
Creatine monohydrate	5g powder	**Rapid ATP buffer.** While CoQ10 and B vitamins support sustained energy production, creatine handles the rapid recycling system. Phosphocreatine donates a phosphate group to regenerate ATP instantly when demand spikes — during exercise, intense focus, or any burst of cellular activity. The brain is a massive ATP consumer, so creatine has well-demonstrated cognitive benefits for working memory and mental fatigue. It also supports muscle performance and recovery. Monohydrate is the only form with strong evidence; other forms (HCl, buffered, etc.) offer no proven advantage despite higher cost.
L-Carnitine	2g (split)	**Fatty acid shuttle.** Long-chain fatty acids are an important fuel source for mitochondria, but they can't cross the inner mitochondrial membrane on their own. L-carnitine physically transports them across, making them available for beta-oxidation (fat burning for energy). This complements CoQ10 (electron transport) and creatine (ATP recycling) by ensuring the fuel supply is adequate. Split dosing because it's mildly stimulating — morning and early afternoon only.
ANTIOXIDANT / ANTI-INFLAMMATORY		
NAC	1200mg (split)	**Glutathione recycler.** N-acetyl cysteine provides the rate-limiting amino acid (cysteine) for your body's production of glutathione — the master intracellular antioxidant. Every cell uses glutathione to neutralise reactive oxygen species

		generated during normal energy production. Without adequate glutathione, oxidative damage accumulates in mitochondria, DNA, and cell membranes. NAC also has mucolytic properties (breaks down mucus), supports liver detoxification, and modulates glutamate signalling in the brain. Split dosing because of its short half-life (~6 hours). Best absorbed on an empty stomach.
Quercetin	500-1000mg	**Multi-target anti-inflammatory.** Quercetin is a flavonoid that inhibits NF-κB, the master inflammatory transcription factor that activates production of IL-6, TNF-α, and IL-1β. It also stabilises mast cells (relevant if histamine intolerance contributes to gut symptoms), acts as a senolytic (helps clear damaged senescent cells that secrete inflammatory molecules), and strengthens tight junctions in the gut barrier — reducing the translocation of bacterial endotoxins (LPS) into the bloodstream that drives systemic inflammation. Has prebiotic-like effects, increasing Bifidobacterium and Akkermansia. Must be taken with bromelain for absorption; take on an empty stomach for systemic (not digestive) effects. Note: inhibits CYP3A4 liver enzyme, which can increase the bioavailability of other compounds metabolised through this pathway.
Bromelain	500mg	**Quercetin absorption enhancer + mild anti-inflammatory.** A proteolytic enzyme complex from pineapple stem. Its primary role here is pharmacokinetic — quercetin has notoriously poor bioavailability on its own (under 2% absorption in some studies), and bromelain significantly enhances its absorption through the gut wall. Also has independent anti-inflammatory and mild fibrinolytic (clot-dissolving) properties. Look for products measured in GDU (gelatin dissolving units) — 2400+ GDU/g indicates good potency.
MINERALS		
Magnesium glycinate	200-400mg elemental	**Systemic magnesium for energy, cardiac, and hormonal function.** Magnesium is required for over 300 enzymatic reactions. Most relevant here: Mg-ATP is the actual functional form of ATP (magnesium must bind to ATP before enzymes can use it), so magnesium deficiency directly impairs energy production regardless of how well

		your mitochondrial stack is working. Also essential for cardiac rhythm stability, electrolyte balance, muscle relaxation, and hormonal synthesis. Glycinate form has high bioavailability and excellent GI tolerance. The glycine itself is a co-benefit — supports glutathione production (complementing NAC) and has calming properties. Evening dosing supports sleep. Important: check the label for elemental magnesium, not compound weight — '500mg magnesium glycinate' may contain only 70mg actual magnesium.
Magnesium L-threonate	Per label (~48mg Mg)	**Brain-specific magnesium.** This form preferentially crosses the blood-brain barrier, unlike most other magnesium forms. It increases brain magnesium levels more effectively than glycinate or citrate, supporting synaptic plasticity, memory, and sleep quality. However, it delivers very little elemental magnesium per dose (~48mg), so it cannot replace glycinate for systemic needs (cardiac, energy, electrolyte). Think of it as a targeted brain supplement that happens to contain a small amount of magnesium, not as your primary magnesium source. Evening dosing for cognitive and sleep benefits.
Zinc	25-50mg	**Immune and enzymatic cofactor.** Zinc is involved in immune cell function, wound healing, and over 100 enzyme systems. It also modulates hormonal balance by inhibiting aromatase (the enzyme that converts testosterone to oestrogen). Deficiency is common and impairs both immune function and hormonal health. Must be taken with food to prevent nausea, and separated from magnesium by several hours as they compete for the same absorption transporters. Long-term use above 40mg/day can deplete copper, so consider adding a small copper supplement (1-2mg) if using the higher dose range.
Selenium	200mcg	**Glutathione peroxidase and thyroid support.** Selenium is the essential component of glutathione peroxidase (GPx) enzymes — the enzymes that actually use the glutathione your NAC is helping to produce. Without selenium, glutathione can't do its job. Also critical for thyroid function (required for T4-to-T3 conversion) and has been shown to increase beneficial gut bacteria including Lactobacillus, feeding back into the microbiome axis. Selenomethionine is

		the best-absorbed form. Only 200mcg needed — higher doses risk toxicity.
VITAMINS		
Vitamin D3	2000-4000 IU	**Hormonal modulator and immune regulator.** Vitamin D functions more like a hormone than a vitamin. Its receptors (VDR) are found on immune cells, bone cells, muscle cells, and endocrine tissue. Deficiency is extremely common (especially in Australia despite the sunshine, due to indoor lifestyles and sun protection) and is associated with impaired immune function, low mood, poor bone density, and hormonal imbalance. Fat-soluble, so must be taken with dietary fat. Morning dosing is important because vitamin D can suppress melatonin production if taken at night, disrupting sleep. Consider pairing with vitamin K2 (MK-7) if you're not getting adequate dietary K2, as D3 increases calcium absorption and K2 directs it to bones rather than arteries.
B12 Methylcobalamin	1000-2000mcg	**Active methylation support.** B12 is essential for methylation reactions (adding methyl groups to DNA, neurotransmitters, and other molecules), neurological function, red blood cell formation, and energy metabolism. Methylcobalamin is the bioactive form — your body uses it directly. Cyanocobalamin (the cheap form in most mass-market supplements) must be converted first, and some people have impaired conversion. Sublingual delivery bypasses potential gut absorption issues, which is relevant if gut health is compromised. Deficiency causes fatigue, brain fog, nerve damage, and mood disturbance.
AMINO ACIDS / NEUROACTIVE		
Taurine	2-3g (split)	**Multi-system amino acid.** Taurine serves four distinct roles in this protocol: (1) Cardiac — it stabilises cell membranes and has antiarrhythmic properties, supporting electrolyte balance and heart rhythm. (2) Bile acid conjugation — taurine conjugates with bile acids to form taurocholic acid, supporting the bile acid metabolism pathway that the gut microbiome depends on. (3) GABAergic — it enhances GABA signalling in the brain, promoting calm and supporting sleep quality. (4) Antioxidant — it protects cells from oxidative damage. Split

		dosing: afternoon dose for cardiac/bile acid benefits, evening dose for the calming/sleep effect.
L-Theanine	200mg x2	**Caffeine optimiser.** L-theanine is an amino acid from tea that crosses the blood-brain barrier and promotes alpha brain wave activity — the relaxed-but-focused mental state. Paired with caffeine, it takes the edge off jitteriness and anxiety while preserving (actually enhancing) focus and alertness. The mechanism is complementary: caffeine blocks adenosine receptors (stimulating), while theanine boosts GABA and dopamine (calming without sedating). Importantly, it blunts the cortisol spike that caffeine causes, which is relevant because chronically elevated cortisol impairs immune function, gut health, and hormonal balance. Only taken with coffee — no benefit without caffeine.
Inositol (myo-inositol)	2-4g powder	**Insulin and serotonin modulator.** Myo-inositol acts as a second messenger in two important signalling pathways: insulin receptor signalling (improving insulin sensitivity and metabolic health) and serotonin receptor function (modulating 5-HT2A receptor sensitivity). At moderate doses (2-4g), the metabolic benefits are the primary target. At higher doses (12-18g), it has well-demonstrated anxiolytic effects comparable to SSRIs for some anxiety subtypes. It also plays a role in cellular membrane integrity. Powder form dissolves easily in water. Note: it modulates the same serotonin receptors that psychedelics act on, so reduce or skip on microdose days.
CIRCADIAN RHYTHM		
Melatonin	3mg	**Circadian entrainment and mitochondrial antioxidant.** Melatonin's primary role here is as a circadian signal — it tells your body it's nighttime, synchronising the master clock in the suprachiasmatic nucleus with peripheral clocks in every organ. This is important because hormonal release, immune cell cycling, gut repair, and mitochondrial biogenesis all follow circadian patterns. Melatonin also accumulates in mitochondria at high concentrations, acting as a potent local antioxidant. The 3mg dose is deliberately low — higher doses can cause morning grogginess and may have immune-stimulating effects that need to be

		managed carefully.
Morning bright light	10,000 lux / 20 min	**Master clock reset.** Bright light exposure in the morning suppresses residual melatonin, triggers the cortisol awakening response, and resets the suprachiasmatic nucleus — the brain's master clock. This is the single most powerful circadian intervention available, and it's free. It ensures that your body's internal clock is aligned with the external day/night cycle, which in turn ensures that hormone production, immune cycling, gut motility, and cellular repair happen at the right times. Use a 10,000 lux light therapy lamp or direct outdoor sunlight for 20 minutes within the first hour of waking. This replaces early-morning coffee as your alertness driver.
PROBIOTICS		
Miyarisan	3 tablets 2x/day	**Direct butyrate producer.** Contains Clostridium butyricum MIYAIRI 588, a spore-forming bacterium that produces butyrate directly in the colon. Butyrate is the primary energy source for colonocytes (the cells lining your colon), maintains gut barrier integrity, reduces inflammation by inhibiting NF-κB in immune cells, and promotes regulatory T-cell differentiation (immune tolerance). Unlike most probiotics that need to compete for ecological niches, C. butyricum is antibiotic-resistant and establishes readily. The butyrate it produces also cross-feeds other beneficial bacteria, making it an ecosystem enabler.
Florastor	1 capsule/day	**Yeast-based immune modulator.** Contains Saccharomyces boulardii, a beneficial yeast (not a bacterium) that produces polyamines supporting cellular autophagy (the recycling of damaged cell components) and secretes a protease that cleaves Clostridium difficile toxin A, providing protection against antibiotic-associated diarrhoea. It also degrades pro-inflammatory TNF-α receptor binding. Because it's a yeast, it's unaffected by antibacterial antibiotics and occupies a different ecological niche than bacterial probiotics. Strain-specific — do not substitute with other S. boulardii products.
Align	1 capsule/day	**Bifidobacterium restoration.** Contains Bifidobacterium longum 35624, which fills a critical gap in the probiotic stack (Miyarisan is a Clostridium, Florastor is a yeast —

		neither provides Bifidobacterium). Bifidobacteria are foundational colonisers that produce acetate and lactate, which then cross-feed butyrate-producing bacteria like C. butyricum. B. longum 35624 specifically produces indole-3-lactic acid, an aryl hydrocarbon receptor (AhR) ligand that promotes immune tolerance, and has bile salt hydrolase (BSH) activity that supports healthy bile acid metabolism.
L. plantarum 299v	1 capsule/day	**Gut barrier and antimicrobial support.** Found in Jarrow's Ideal Bowel Support. L. plantarum 299v has bile salt hydrolase activity (supporting bile acid conversion), produces plantaricins (natural antimicrobial peptides that suppress pathogenic bacteria), and strengthens gut barrier tight junctions. It occupies yet another ecological niche, complementing the butyrate production (Miyarisan), immune modulation (Florastor), and cross-feeding (Align) roles of the other probiotics. Together, these four probiotics create a diverse, multi-functional microbial ecosystem rather than relying on a single strain.
L. reuteri yoghurt	1/2 cup/day	**High-dose probiotic via fermented food.** Homemade yoghurt fermented from BioGaia Gastrus tablets (L. reuteri ATCC PTA 6475 and DSM 17938) for 36 hours at 37°C. The extended fermentation amplifies colony counts to hundreds of billions of CFUs per serving — far beyond what tablets deliver. L. reuteri 6475 specifically increases oxytocin production (supporting mood, social bonding, and tissue repair), modulates immune function, and reduces systemic inflammation. As a fermented food, it also provides additional microbial diversity. Make fresh batches every 8-10 days using a sous vide for precise temperature control.
GUT BARRIER REPAIR (TEMPORARY 2-3 MONTHS)		
Lactoferrin	200-300mg/day	**Selective antimicrobial and barrier repair.** Lactoferrin is an iron-binding glycoprotein naturally found in breast milk and mucosal secretions. It works by sequestering iron that pathogenic bacteria need to grow, while simultaneously promoting the growth of beneficial Bifidobacterium and Lactobacillus (which have evolved iron-acquisition systems that bypass lactoferrin's binding). This selective pressure reshapes the microbiome toward a healthier composition. It

		also directly repairs intestinal tight junctions, reducing gut permeability ('leaky gut') and the translocation of bacterial endotoxins into the bloodstream. Temporary addition during the ecosystem-building phase; reassess at 12 weeks.
Bovine colostrum	2-5g powder/day	**Immune priming and gut lining repair.** Colostrum is the first milk produced after birth, rich in immunoglobulins (IgG, IgA), growth factors (IGF-1, TGF-β), and naturally occurring lactoferrin. The immunoglobulins bind to pathogens and toxins in the gut lumen, while growth factors stimulate repair of the intestinal epithelium. It creates a more hospitable environment for the probiotic strains to colonise. Look for first-milking colostrum with standardised IgG content (>25-30%). Temporary addition for the gut establishment phase; reassess at 12 weeks.
PREBIOTIC / DIETARY		
Resistant starch	5-15g (ramp up)	**Primary fuel for butyrate-producing bacteria.** Resistant starch is a type of starch that resists digestion in the small intestine and passes intact to the colon, where it's fermented by bacteria into short-chain fatty acids (SCFAs) — primarily butyrate. This is the fuel that powers the entire gut-health axis of the protocol: butyrate feeds colonocytes, maintains gut barrier integrity, suppresses inflammation, and signals immune cells toward tolerance. Source: uncooked potato starch from the supermarket baking aisle, stirred into cold or lukewarm food (heat destroys the resistant structure). Also obtained for free by cooking rice, pasta, or potatoes and then cooling them in the fridge. Start at 5g and increase slowly — too much too fast causes gas and bloating as bacteria adjust.
Dietary fibre diversity	From food	**Ecosystem breadth.** Different fibre types feed different bacterial populations. Resistant starch alone feeds a narrow range of species. Adding diverse fibres — inulin (garlic, onion, leeks), pectin (apples, citrus), beta-glucans (oats, mushrooms), and cellulose (most vegetables) — supports a broader microbial ecosystem. Diversity of fibre is more important than volume of a single type. This is achieved through diet rather than supplements.
Cruciferous	Daily	**Sulforaphane and AhR activation.** Broccoli, cauliflower,

vegetables		cabbage, kale, and Brussels sprouts contain glucosinolates that convert to sulforaphane when chewed or chopped. Sulforaphane activates the Nrf2 pathway (master antioxidant defence), induces Phase II detoxification enzymes in the liver, and provides DIM (diindolylmethane) precursors that support hormonal balance. Cruciferous vegetables also contain indoles that activate the aryl hydrocarbon receptor (AhR) — a transcription factor that promotes immune tolerance and gut barrier integrity.
Omega-3 rich foods	Daily	**Anti-inflammatory and membrane integrity.** Omega-3 fatty acids (EPA and DHA from fatty fish, ALA from walnuts and flaxseed) are incorporated into cell membranes throughout the body, improving membrane fluidity and cell signalling. EPA is a precursor to anti-inflammatory resolvins and protectins. DHA is essential for brain cell membrane structure. Omega-3s also modulate the gut microbiome composition and support overall metabolic health. Dietary sources are preferred over supplements because they come with additional nutrients (selenium from fish, vitamin E from nuts).

How the Systems Connect

The power of this protocol isn't in any individual supplement — it's in how they reinforce each other across systems:

- **Gut → Energy:** Butyrate from gut bacteria (fed by resistant starch, produced by Miyarisan) reduces systemic inflammation. Chronic inflammation damages mitochondria. By reducing inflammation at the source, you protect the organelles that CoQ10, B1, B2, and creatine are trying to optimise.
- **Energy → Gut:** Gut epithelial cells (colonocytes) are among the most metabolically active cells in the body. They need ATP to maintain tight junctions. Magnesium (Mg-ATP), CoQ10, and B vitamins ensure these cells have the energy to maintain the gut barrier that the probiotics and prebiotics are trying to restore.
- **Circadian → Everything:** Deep sleep (supported by magnesium, melatonin, taurine, and morning bright light) is when your body performs hormonal synthesis, immune cell cycling, gut repair, and mitochondrial biogenesis. Disrupted sleep undermines every other intervention in this protocol.
- **Antioxidant protection:** NAC provides glutathione, selenium activates the enzymes that use it (GPx), riboflavin recycles it (via glutathione reductase), and quercetin reduces the inflammatory load that generates oxidative stress in the first place. CoQ10 acts as a local antioxidant inside mitochondria. This layered defence protects all four systems simultaneously.
- **Bile acid axis:** Taurine conjugates bile acids. L. plantarum 299v and Align have bile salt hydrolase activity that converts primary bile acids into secondary bile acids. These secondary bile acids activate immune-modulatory pathways (FXR, TGR5) that reduce inflammation and support metabolic health. Disrupted bile acid metabolism from gut dysbiosis feeds back into both the inflammatory and metabolic dysfunction this protocol targets.

This protocol is based on mechanistic extrapolation from published biomedical research. It is an informed self-experiment, not proven therapy. Consult a healthcare provider before starting, and track your data with baseline and follow-up blood work.