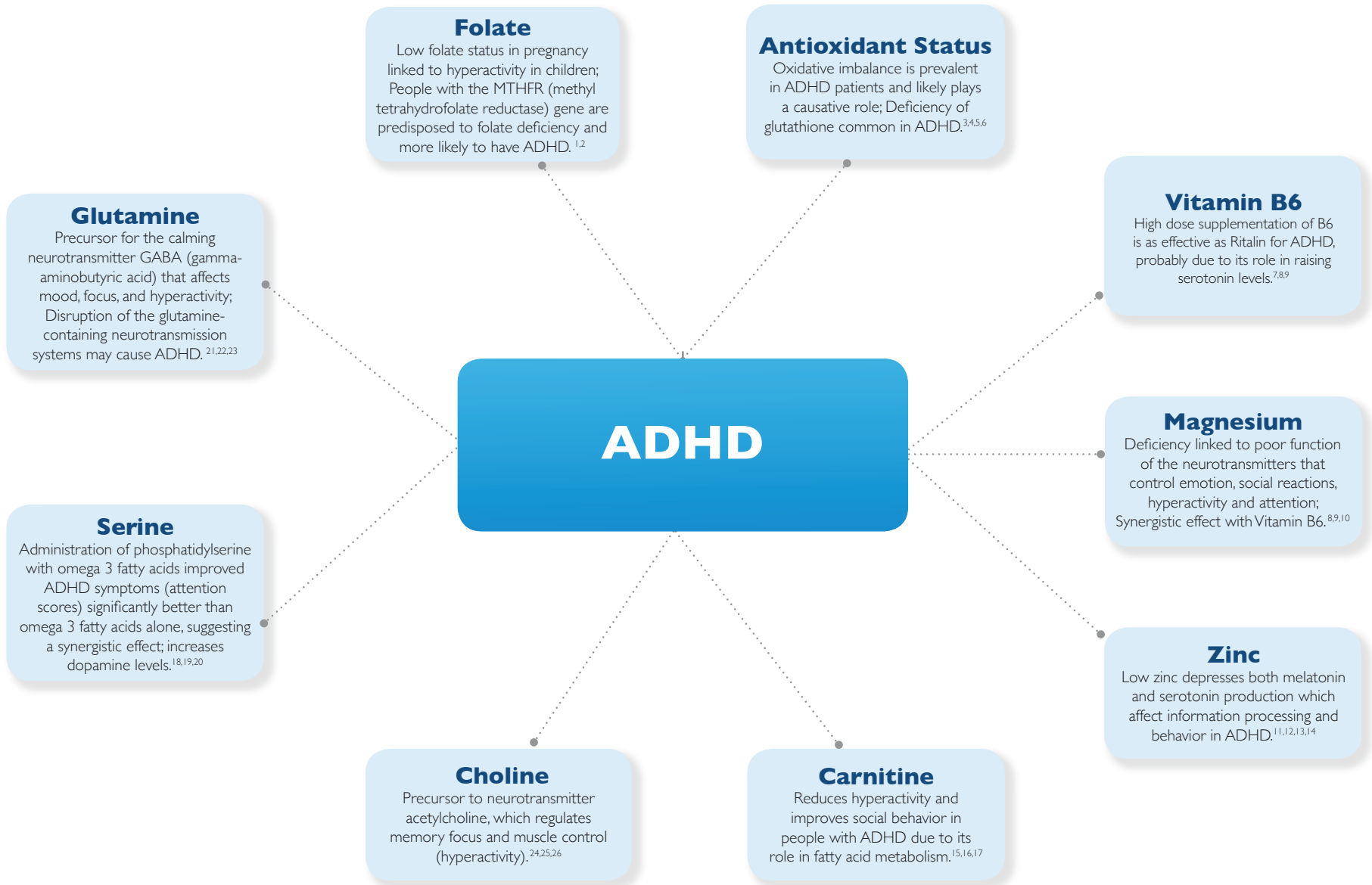




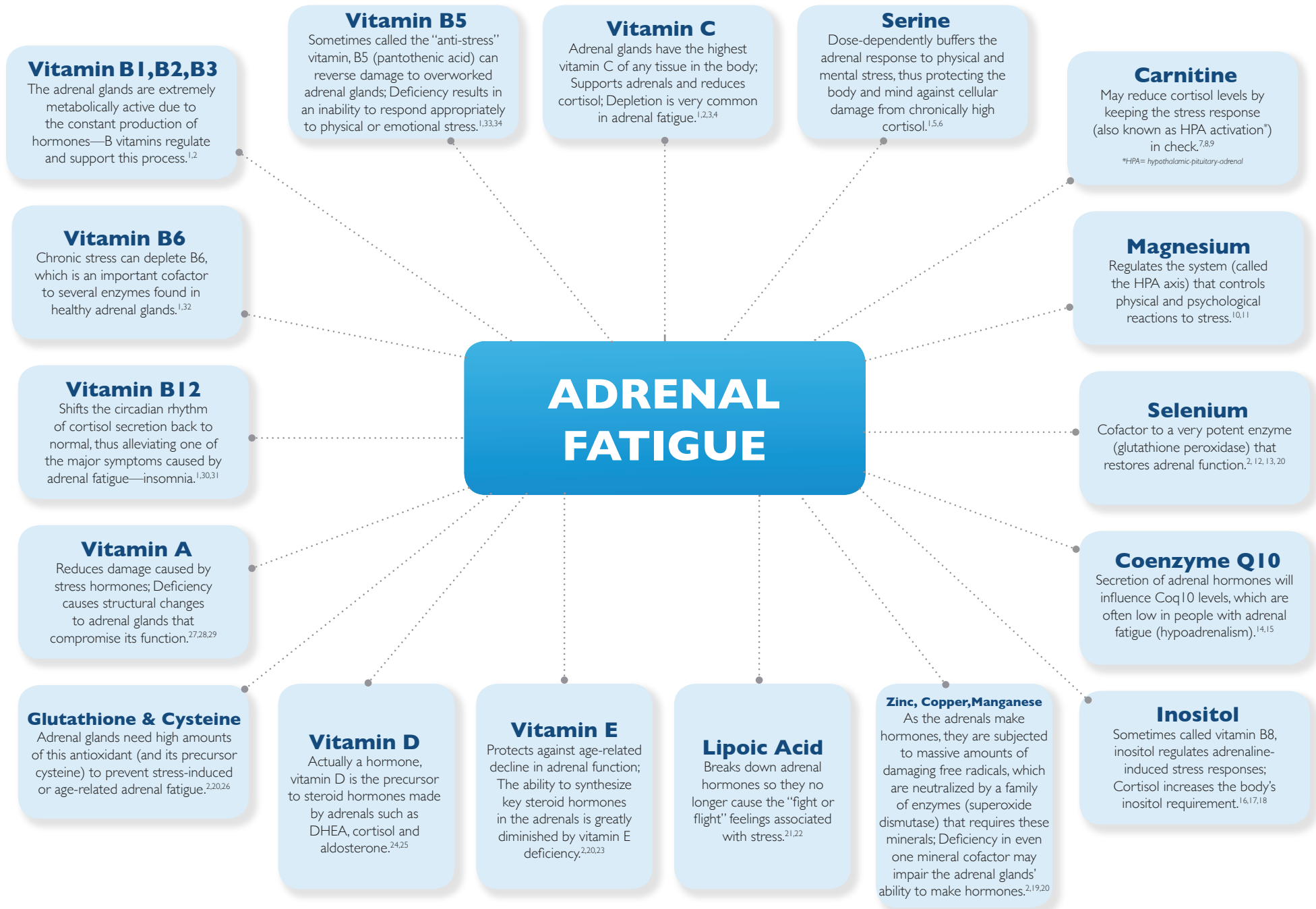
Nutrient Correlations

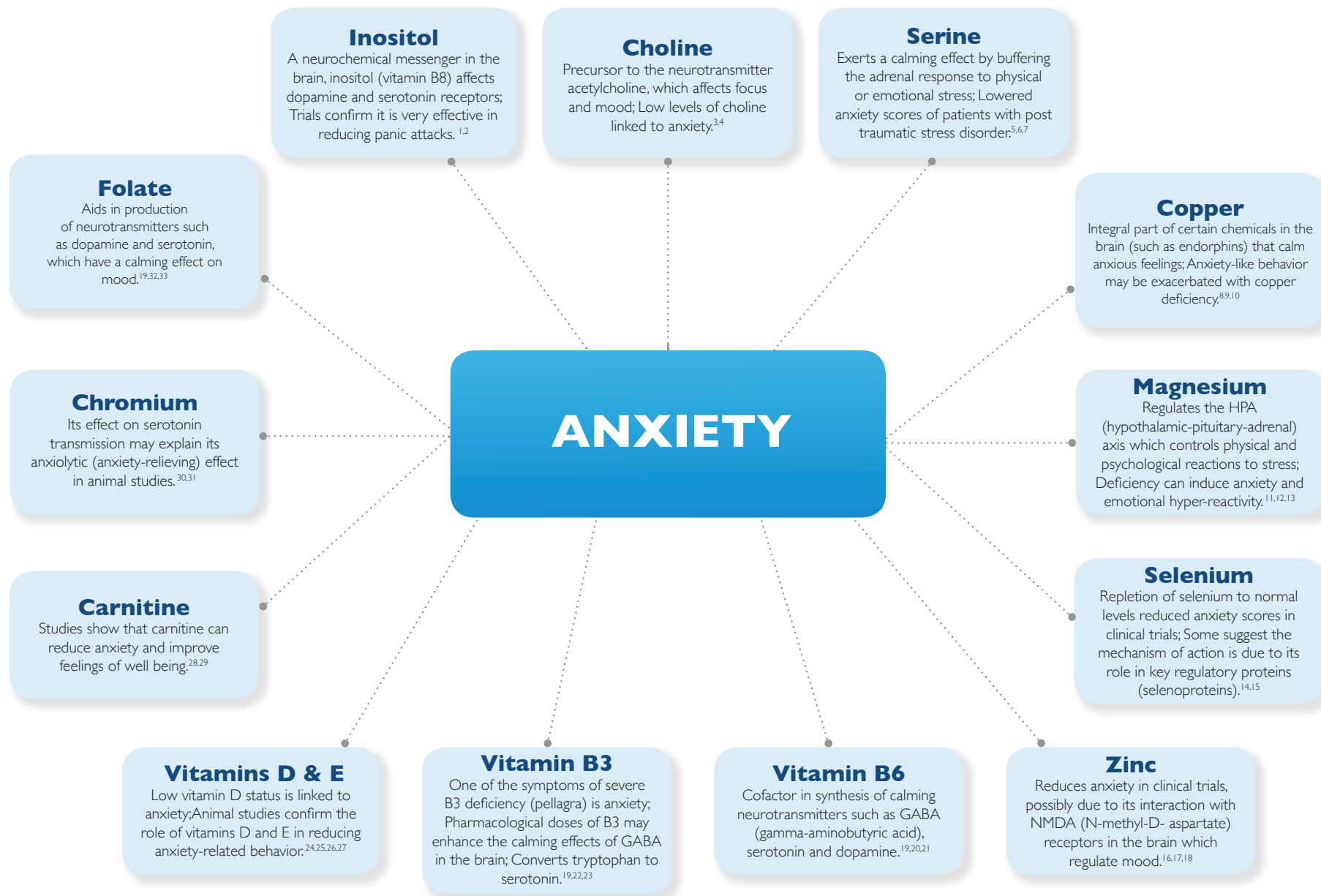
Deficiencies Correlated
with Disease Conditions

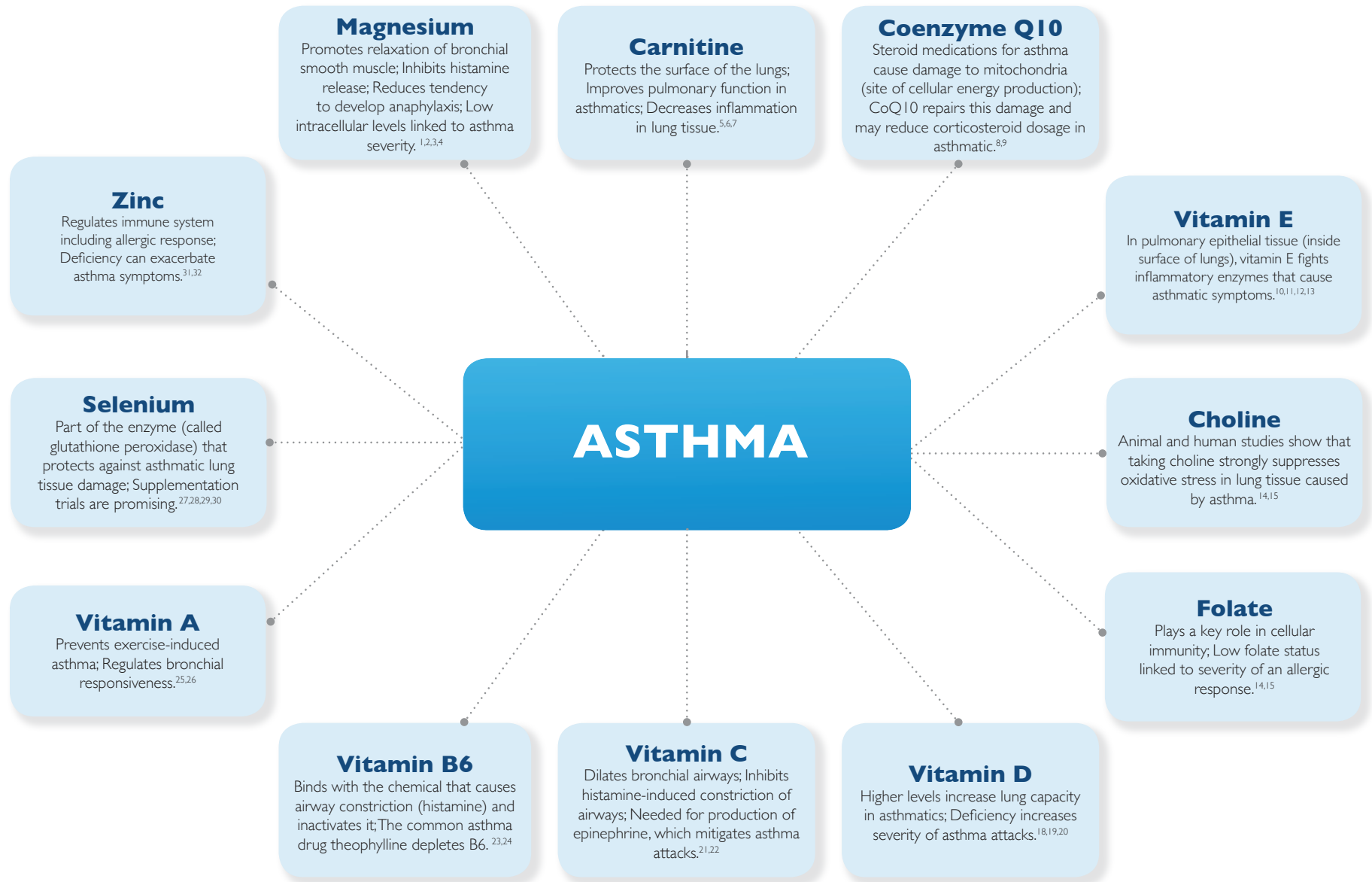




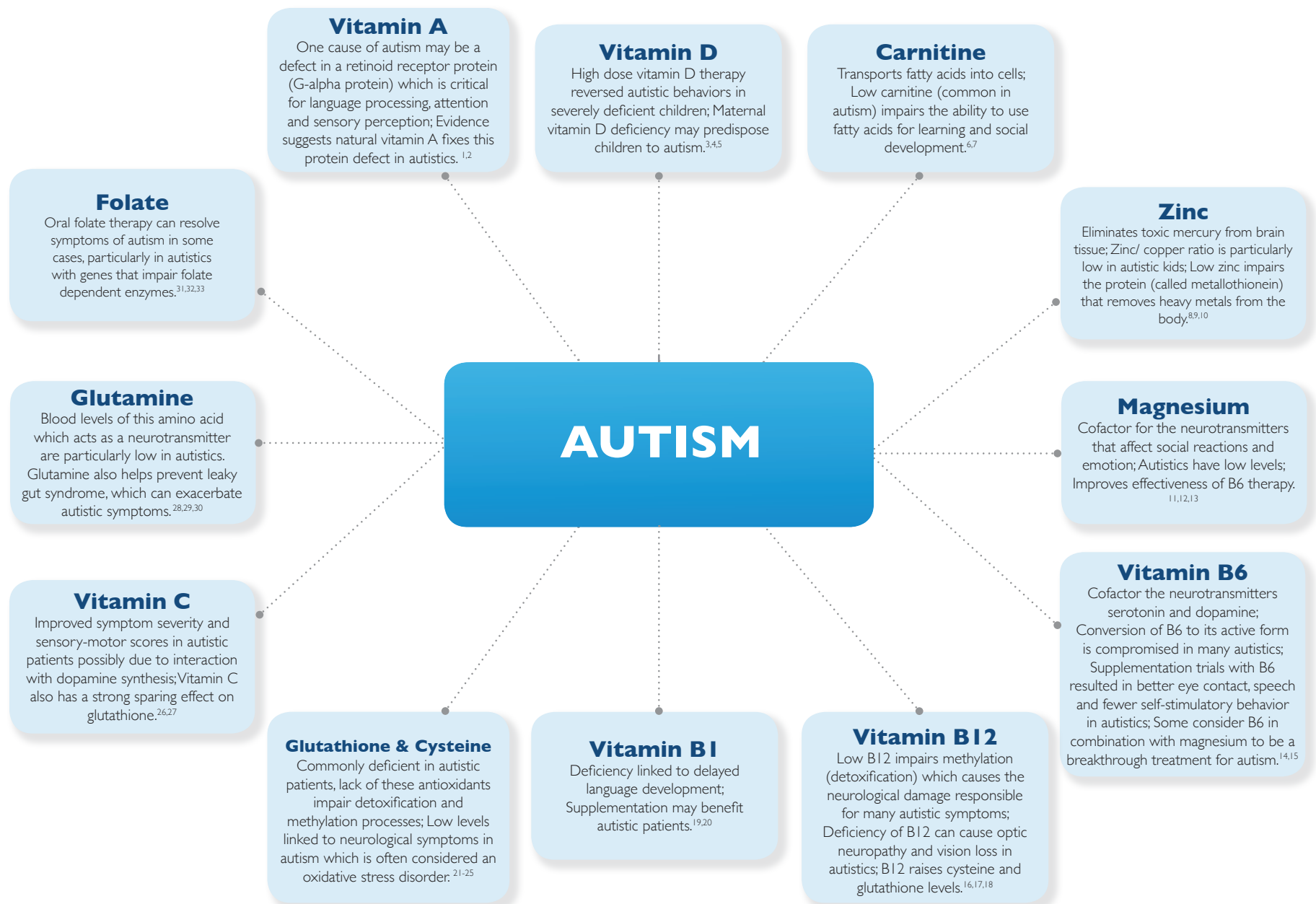
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DEPRESSION

Magnesium

Deficiency damages NMDA (N-methyl-D-aspartate) receptors in the brain, which regulates mood; Well-documented anti-depressant effects.^{1,2,3,4}

Selenium

Integral part of regulatory proteins (selenoproteins) in the brain; Supplementation trials are promising; May alleviate postpartum depression.^{5,6}

Folate

Building block for many "feel-good" neurotransmitters such as serotonin, dopamine and norepinephrine; Low folate causes poor response to antidepressant meds; The lower the folate, the more severe the depression.^{7,8,9,10}

Vitamin B12

Depression may be a manifestation of B12 deficiency; Repletion of B12 to adequate levels can improve treatment response; B12 deficiency common in psychiatric disorders.^{11,12,13}

Chromium

Elevates serotonin (feel-good neurotransmitter) levels in the brain; May be particularly effective on eating symptoms of depression such as carbohydrate craving and increased appetite, due to its effect on blood sugar regulation.^{37,38,39}

Zinc

Improves efficacy of antidepressant drugs; Particularly useful for treatment resistant patients; Regulates neurotransmitters.^{33,34,35,36}

Serine

Regulates brain chemistry; Involved in NMDA receptor function; Acts as a neurotransmitter; Low levels correlate with severity of depression.^{31,32}

Antioxidants

Oxidative stress in the brain alters neurotransmitter function; Antioxidants protect our brain, which is very sensitive to oxidation; Several antioxidants—Vitamins A, C, and E, Lipoic Acid, CoQ10, Glutathione, and Cysteine—play a key role in prevention and treatment of depression.^{28,29,30}

Biotin

Part of the B-vitamin complex, biotin deficiency has induced depression in animal and human studies.^{26,27}

Inositol

Influences signaling pathways in the brain; Particularly effective in SSRI (selective serotonin reuptake inhibitor) sensitive disorders.^{24,25}

Carnitine

Increases serotonin and noradrenaline which lifts mood; In trials, carnitine alleviates depression with few, if any, side effects.^{22,23}

Vitamin B6

Cofactor for serotonin and dopamine production (feel good chemicals); Studies indicate that low levels may predispose people to depression.^{14,15,16}

Vitamin B2

Low B2 has been implicated in depression due to its role in methylation reactions in the brain.^{17,18}

Vitamin D

Clinical trials suggest increasing blood levels of vitamin D, which is actually a hormone precursor, may improve symptoms of depression.^{19,20,21}



DYSLIPIDEMIA

Zinc

Suboptimal zinc raises dangerous lipoproteins that promote vascular inflammation and arterial plaque formation; Cellular zinc controls the gene that makes heart-protective HDL (high density lipoprotein).^{34,25,36}

Manganese

Cofactor to an antioxidant (superoxide dismutase) that repairs damage to blood vessels caused by oxidized LDL (low density lipoprotein).^{1,2}

Magnesium

Deficiency causes proatherogenic (heart-disease causing) changes in lipoprotein metabolism; Protects LDL (low density lipoprotein) from being oxidized.³⁴

Vitamin C

Protects LDL from oxidation, thus making it less "sticky" and prone to atherosclerosis (clogging of arteries); Prevents white blood cells (monocytes) and oxidized LDL from sticking to blood vessel wall; Lowers Lp(a) in some people.^{5,6,7}

Vitamin D

Suppresses foam cell formation thus reducing risk of lipid-related arterial blockages; deficiency linked to dyslipidemia.^{8,9}

Vitamin B3

Niacin (B3) effectively lowers the highly atherogenic Lp(a) by decreasing its rate of synthesis in the liver.^{10,11}

Vitamin B5

Favorably alters low density lipoprotein metabolism and reduces triglycerides; full benefit of lipid lowering effects may not be seen for up to four months.^{12,13}

Carnitine

In supplementation trials, carnitine lowers triglycerides, oxidized LDL and the atherogenic Lp(a); This effect is likely due to its role in transporting fatty acids into cells so they can be used as fuel.^{14,15,16}

Lipoic Acid

Improves lipid profile by reducing small, dense LDL (dangerous type); Protects vascular lining from oxidized cholesterol.^{17,18}

Inositol

Decreases small, dense LDL especially in patients with metabolic syndrome; lowers triglycerides.^{19,20,21}

Choline

Regulates HDL metabolism; Part of the enzyme lecithin- cholesterol acyltransferase that has a major impact on lipoprotein metabolism.^{22,23}

Chromium

Specifically improves the dyslipidemia that accompanies insulin resistance; may increase HDL; Synergistic effect with niacin (B3) for dyslipidemia.^{24,25,26}

Coenzyme Q10

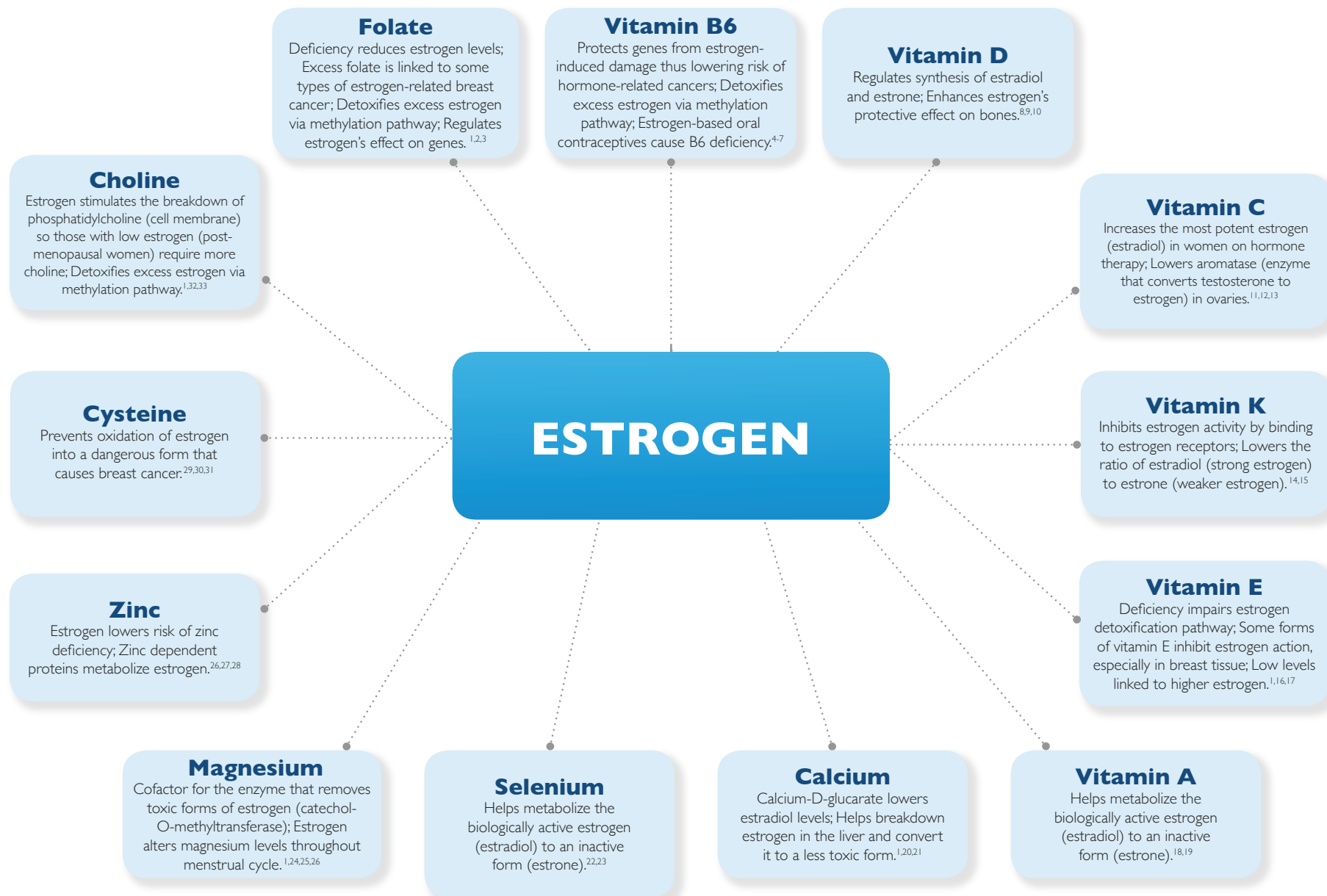
It is well established that statins, often prescribed for dyslipidemia, deplete CoQ10; Lowers Lp(a) and improves efficacy of some dyslipidemia meds.^{27,28}

Copper

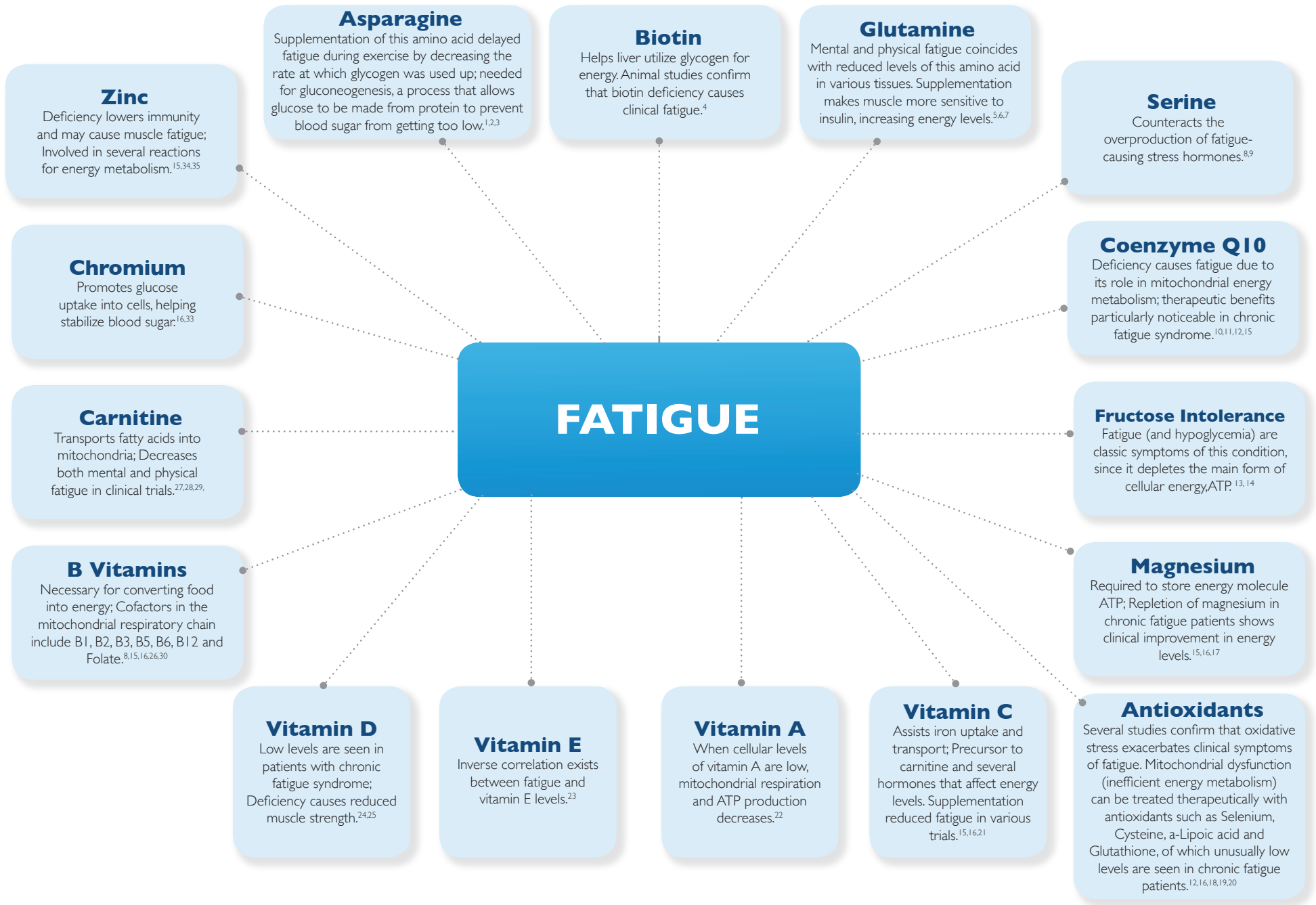
Several copper-dependent enzymes affect lipoprotein metabolism; deficiency contributes to fatty buildup in arteries caused by dyslipidemia.^{29,30,31}

Selenium

Prevents post-prandial (after a meal) changes in lipoproteins that make them susceptible to oxidation and thus harmful.^{32,33}



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 YOC 2013



FEMALE FERTILITY

Folate

Protects genes during rapid cell division which increases likelihood of a healthy embryo (via methylation of DNA); Deficiency raises homocysteine which damages reproductive cells.^{1,2,3,4}

Vitamin B6 & B12

Both are needed to convert toxic homocysteine to a benign form; Low homocysteine levels linked to a better chance of pregnancy.^{5,6,7,8}

Vitamin C

Increases serum progesterone levels; Induces ovulation in some women; Enhances effect of the fertility drug clomiphene.^{9,10,11,12}

Vitamin D

Higher levels linked to better success rates of IVF (in vitro fertilization); Influences production of the sex hormones estradiol and progesterone.^{13,14,15}

Vitamin E

Protects reproductive cells (follicles); May improve endometrial response (ability of fertilized egg to implant into uterine wall properly) during IVF.^{16,17,18,19}

Selenium

Deficiency implicated in miscarriage and infertility; In one trial, 100% of infertile women achieved pregnancy after supplementation.^{20,21}

Glutathione

Protects eggs (fertilized or not) from damage by reactive oxygen species; Protective action of follicle stimulating hormone on embryonic development is due largely to glutathione synthesis.^{22,23,24}

Minerals

Several enzymes needed to protect a woman's reproductive organs (such as superoxide dismutase) are dependent of the trace elements zinc, copper, and magnesium.^{22,30,31,32}

Antioxidant Status

Reproductive cells, including embryos, are very susceptible to damage from oxidative stress due to the rapid rate of growth; Low antioxidant status can cause infertility or miscarriage.^{8,9,10}

Cysteine

N-acetyl cysteine can improve ovulation and pregnancy rates in women with infertility due to PCOS (polycystic ovary syndrome) that do not respond to fertility drugs; Improves viability of endometrial cells in vitro; Precursor to glutathione.^{25,26,27}

FIBROMYALGIA

Coenzyme Q10

Clinical trials consistently show that CoQ10 reduces fibromyalgia symptoms such as pain and fatigue.^{1,2,3,4}

Carnitine

Deficiency causes muscle pain due to inefficient cellular energy metabolism (mitochondrial myopathy) which presents as fibromyalgia.^{4,5}

Selenium

Deficiency is linked to fibromyalgia; In one trial, symptoms improved 95% of patients supplemented with selenium for at least 4 weeks.^{25,26,27}

Choline & Inositol

Altered levels of both nutrients seen in fibromyalgia; Choline & inositol are involved in pain perception.^{6,7,8,9}

Magnesium

Involved in pain perception pathways and muscle contraction; Treatment with magnesium can improve tenderness and pain.^{23,24,25}

Serine

Blood levels of this amino acid are much lower in fibromyalgia patients.^{10,11}

Zinc

Blood levels of zinc are associated with a number of tender points in fibromyalgic patients.²²

Vitamin D

Low levels impair neuromuscular function and cause muscle pain; Deficiency is common in fibromyalgia patients.^{12,13,14,15,16}

Antioxidants

Low antioxidants status increases pain in fibromyalgia, which is often considered an oxidative stress disorder.^{19,20,21}

Vitamin B1

Thiamin (B1) deficiency mimics fibromyalgia symptoms including serotonin depletion (decreased pain threshold), a decrease in repair enzymes (muscle soreness) and poor energy production (muscle fatigue).^{17,18}

GASTROINTESTINAL HEALTH

Lipoic Acid

Suppresses damaging chemicals (cytokines) in GI tract that cause an inflammatory immune response; Preserves glutathione levels and recycles vitamin C.^{35,36}

Glutathione

Counteracts oxidative stress in the intestinal mucosa (gut wall); Recycles antioxidants such as vitamins C & E.^{1,2,3}

Selenium

Cofactor to glutathione peroxidase (GPx), which protects intestinal wall from inflammatory damage; Lower GPx activity due to selenium deficiency is very common in people with gut inflammation.^{3,4,5}

Glutamine

Preferred fuel for enterocytes (small intestine cells), which use the most glutamine in the entire body; Keeps the junctions between intestinal epithelial cells tight so foreign proteins cannot enter bloodstream.^{6,7,8}

Zinc

Decreases intestinal permeability; Maintains integrity of intestinal wall, especially when inflammatory chemicals (TNF α) compromise epithelial lining; Works with vitamin A in regenerating cells that line the gut.^{9,10,11}

Magnesium

Deficiency affects the amount of good bacteria found in the gut; May help prevent stomach ulcers; Insufficient levels are very common in people with irritable bowel; Antacids induce magnesium deficiency.^{32,33,34}

Vitamin A

Regulates growth of epithelial cells, including those that line the gastrointestinal (GI) tract; Reduces inflammatory proteins in the gut.^{12,13}

Choline

Maintains the barrier function of gastric epithelium (helps prevent stomach ulcers) via its role in building cell membranes and acting as a surfactant in the GI tract.^{30,31}

Vitamin C

An inflamed gut uses up the antioxidant vitamin C faster than a healthy gut; Promotes tissue healing in GI tract; Reduces gastrointestinal inflammation.^{14,15}

Folate

Deficiency alters genes in a way that makes colon cells more likely to become cancerous.^{28,29}

Vitamin D

Keeps gut flora healthy by protecting good bacteria; Activates adaptive immunity that originates in GI tract; Promotes gut barrier integrity; Deficiency linked to inflammatory bowel disease flare-ups.^{16,17,18}

Vitamin B6

Deficiency is strongly linked with a higher risk of developing colon cancer.^{26,27}

Carnitine

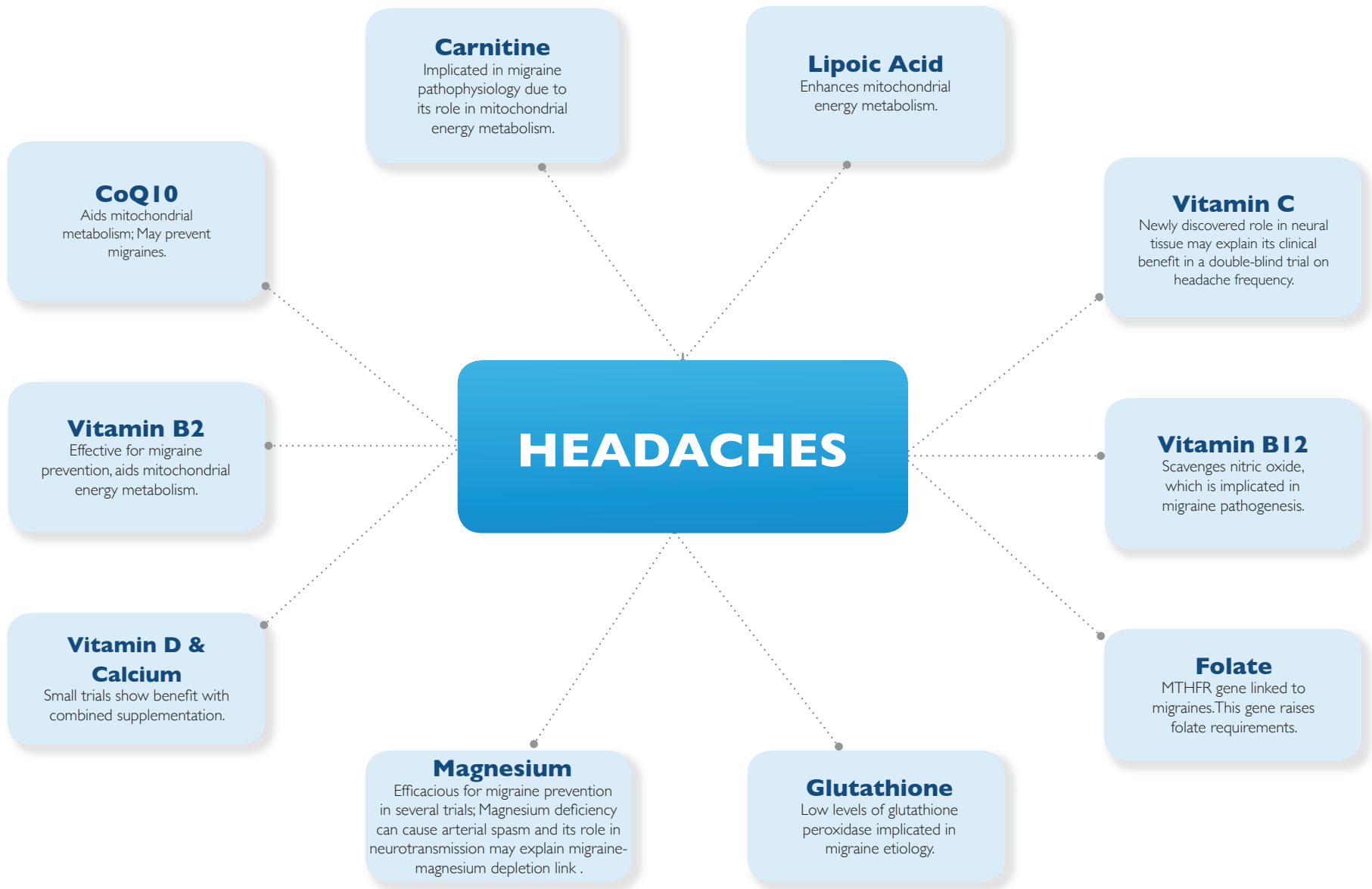
May be therapeutically beneficial in people with colitis (inflammation of colon) due to its role in fatty acid metabolism, which is often impaired in GI disorders.^{23,24,25}

Vitamin B12

Improves gastrointestinal complaints in some patients with dyspepsia (indigestion); Antacids deplete B12.^{21,22}

Vitamin K

Synthesized by intestinal bacteria; Deficiency common in chronic GI disorders; Bone demineralization that occurs with inflammatory bowel diseases (Crohn's, etc) is caused by vitamin K deficiency since it is a required cofactor for bone formation.^{19,20}



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YOC 2012

HYPERTENSION

Copper

Regulates enzymes that keep blood vessels dilating properly; Depletion causes hypertension; Supplementation trials positive.^{34,35,36}

Biotin

Pharmacological doses reduce systolic blood pressure by activating an enzyme (cGMP) that causes smooth muscle to relax.^{1,2}

Vitamin A

Suppresses the growth of vascular smooth muscle, thus keeping blood vessels (lumen) clear and wide.^{3,4}

Vitamin B2

People with a certain gene (called MTHFR type TT) tend to respond well to B2 therapy for lowering blood pressure.^{5,6}

Vitamin B6

Lowers homocysteine, a toxin that makes arteries stiff and raises blood pressure; Low B6 is strongly linked to hypertension.^{6,7,8,9}

Manganese

Cofactor to an antioxidant (superoxide dismutase) that repairs damage to blood vessels caused by oxidized LDL (low density lipoprotein).^{1,2}

Vitamin C

Improves the ability of blood vessels to react appropriately to relaxation signals; Increases nitric oxide, a powerful vasodilator.^{9,10,11}

Magnesium

Promotes dilation of blood vessels; Low intracellular levels are a well-established cause of hypertension.^{31,32,33}

Vitamin D

Low vitamin D is strongly linked to hypertension, possibly due to its role in calcium transport; Augments blood pressure-lowering effect of calcium; Keeps blood vessels smooth and healthy.^{9,12,13}

Calcium

Optimal calcium status reduces vasoconstriction; Particularly effective for salt-sensitive hypertension as it increases sodium excretion.^{9,29,30}

Vitamin E

Increases nitric oxide synthase, an enzyme that causes blood vessels to dilate; Protects blood vessels from damage.^{14,15}

Folate

Lowers blood pressure by improving endothelial function, or the ability of blood vessels to properly dilate.^{27,28}

Carnitine

Lowers blood pressure in the same way as ACE inhibitors, a common hypertension drug which reduces angiotensin, a substance that causes arteries to constrict; its role in fat metabolism explains this effect.^{25,26}

Oleic Acid

The benefits of olive oil for blood pressure is largely due to its high oleic acid content, which protects endothelial cells (inner lining of blood vessels) from inflammation.^{22,23,24}

Cysteine

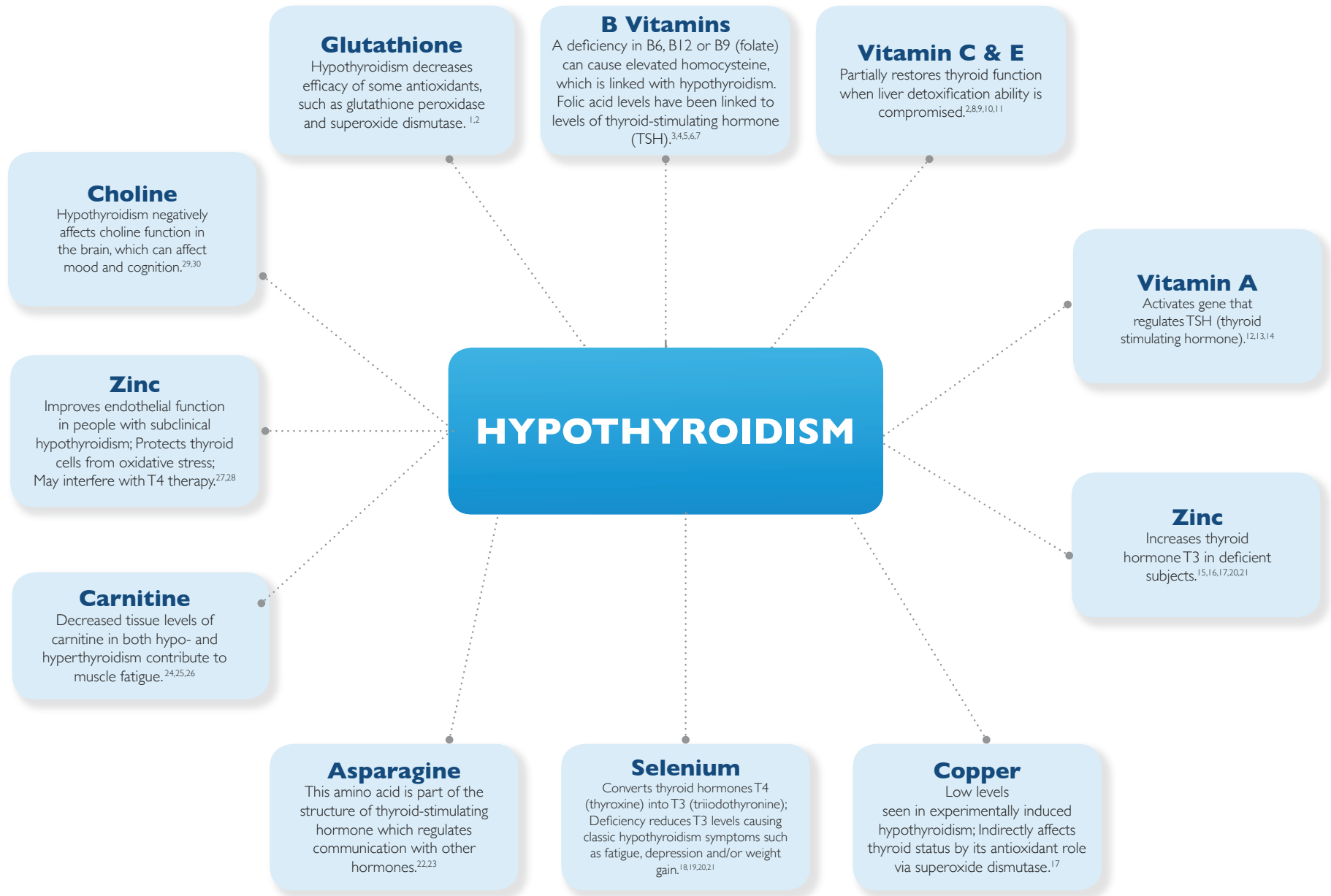
Anti-hypertensive effects stem from its role as a potent antioxidant; Effective vasodilator.^{20,21}

Lipoic Acid

Improves vascular tone; Causes vasodilation; Works like calcium channel blocker meds; Recycles vitamins C, E and Cysteine.^{18,19}

Coenzyme Q10

Improves bioenergetics of blood vessel wall; Deficiency highly correlated to hypertension; Benefits of CoQ10 often not seen for several weeks.^{9,16,17}



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INFLAMMATION

Selenium

Subclinical deficiency negatively alters genes that regulate the inflammatory response; Deficiency promotes vascular inflammation.^{37,38}

Manganese

Cofactor to the powerful antioxidant superoxide dismutase that fights inflammation within cells.^{1,2}

Magnesium

Deficiency activates pro-inflammatory chemicals called cytokines; Deficiency will also kick start a damaging immune response by activating cells called leukocytes and macrophages.^{3,4,5}

Glutathione

Repairs damage to cells caused by inflammation; Regulates the production of pro-inflammatory cytokines; Recycles vitamins C and E.^{6,7}

Cysteine

Protects organs such as blood vessels, brain, and liver from inflammatory damage; Precursor to glutathione production; Supplementation with N-acetyl cysteine raises glutathione.^{8,9}

Copper

Deficiency lowers enzyme activity (such as superoxide dismutase) that fights inflammation; Lowers damaging isoprostanes, a by-product of inflammation.^{34,35,36}

Vitamin C

Low vitamin C linked to inflammation; Inversely related to C-reactive protein (CRP), a marker for systemic inflammation; Increases glutathione.^{10,11,12}

Zinc

Inflammation raises demand for zinc; Pro-inflammatory chemicals (cytokines) dose dependently decrease in response to zinc repletion.^{31,32,33}

Vitamin D

Potent modulator of inflammation; Helps turn off chronic inflammatory responses; Inhibits pro-inflammatory cytokine production.^{2,12,13,20}

Vitamin A

Regulates the cellular immune response to inflammatory signals; Deficiency increases the severity of chronic inflammation; Zinc depletion lowers vitamin A status.^{28,29,30}

Vitamin E

Limits destructive cell behavior caused by inflammatory enzymes gone wild; Reduces damage from tumor necrosis factor-alpha (TNF- α); Deficiency predisposes a person to inflammation-related diseases.^{15,26}

Vitamin B2

Riboflavin (B2) helps minimize pain associated with inflammation; Detoxifies homocysteine, an amino acid that indirectly causes inflammation in various tissues.^{26,27}

Vitamin B6

Low B6 status is linked to high levels of CRP and systemic inflammation.^{1,33,34}

Coenzyme Q10

Decreases several inflammatory markers (CRP and IL-6) in supplementation trials; Affects genes that control response to inflammatory stress.^{21,22,23}

Glutamine

Decreases cytokine production; Invokes an anti-inflammatory response; Precursor to glutathione.^{19,20}

Lipoic Acid

Neutralizes free radicals caused by uncontrolled inflammation in both water and lipoic phases of the cell; Protects endothelial cells from inflammation; Regenerates other antioxidants such as vitamin E, C, and glutathione.^{17,18}

INSOMNIA

Vitamin B1

(Thiamin) In clinical trials, supplementation of healthy individuals that had marginal B1 deficiency improved their sleep.^{1,2,3}

Vitamin B3

(Niacin) Increases REM sleep; Improves both quality and quantity of sleep by converting tryptophan to serotonin.^{4,5}

Folate & Vitamin B6

Both are cofactors for several neurotransmitters in the brain such as serotonin and dopamine, many of which regulate sleep patterns.^{4,6,7,8,9}

Vitamin A

Studies suggest vitamin A deficiency alters brain waves in non-REM sleep causing sleep to be less restorative.^{24,25}

Oleic Acid

This fatty acid is a precursor of oleamide, which regulates our drive for sleep and tends to accumulate in the spinal fluid of sleep-deprived animals. Oleic acid also facilitates the absorption of vitamin A.^{21,22,23}

Vitamin B12

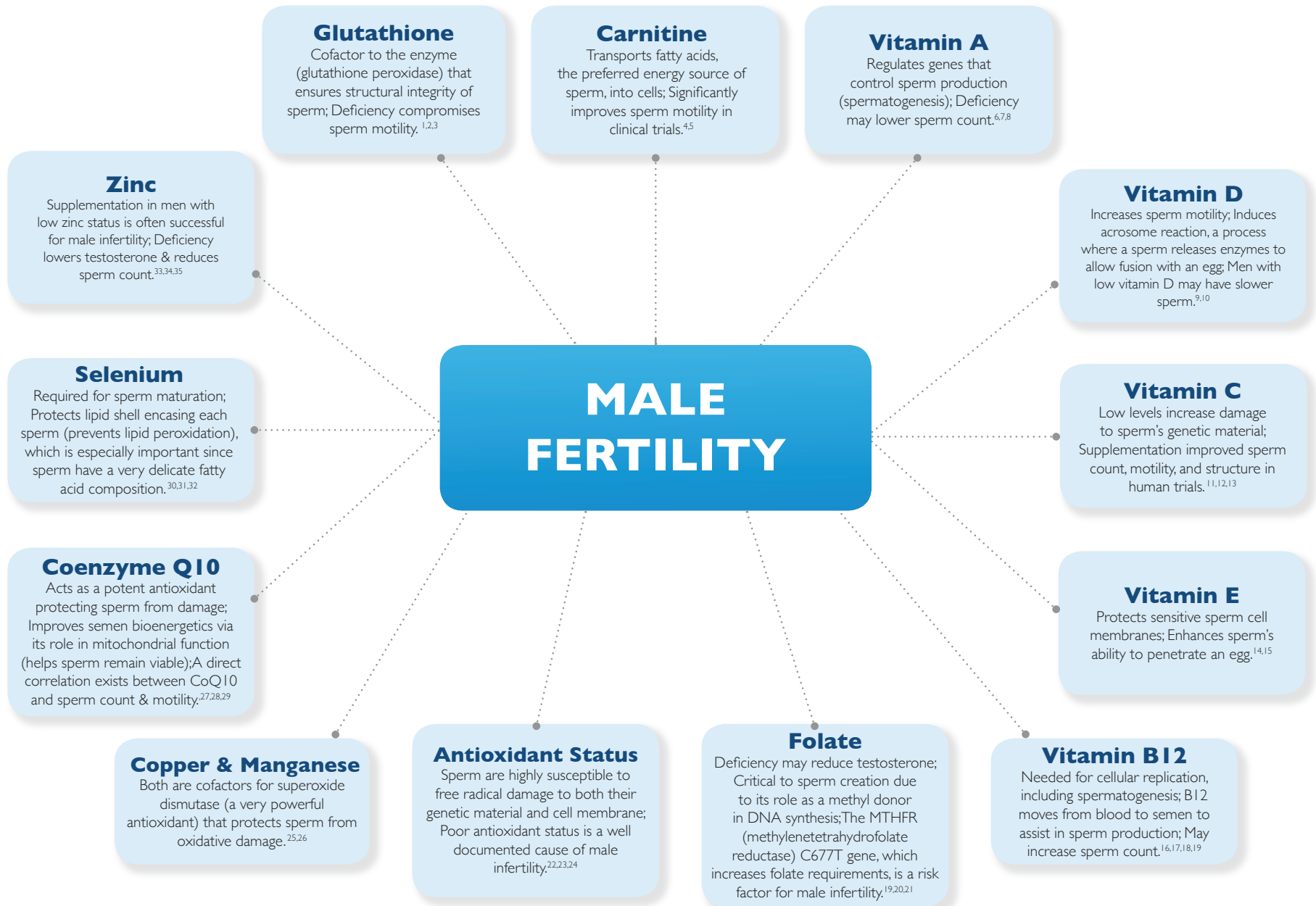
Normalizes circadian rhythms (sleep-wake cycles); Therapeutic benefits of B12 supplementation, both oral and intravenous, seen in studies.^{10,11,12,13}

Zinc & Copper

Both interact with NMDA (N-methyl-D-aspartate) receptors in the brain that regulate sleep; A higher Zn/Cu ratio is linked to longer sleep duration.^{15,19,20}

Magnesium

Improving magnesium status is associated with better quality sleep; Mimics the action of melatonin; Also alleviates insomnia due to restless leg syndrome.^{14,15,16,17,18}



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METHYLATION

Vitamin B2

Helps recycle folate into a usable methyl-donor form; Precursor to FAD (flavin adenine dinucleotide) which assists methylation reactions.^{1,2,3}

Vitamin B3

Maintains proper methylation of genes that suppress tumor formation and growth.^{3,4,5,6}

Vitamin B6

Cofactor for the enzyme (serine hydroxyl methyltransferase) that transfers methyl units.^{7,8}

Zinc

Deficiency can lower the ability to use methyl groups from methyl donors such as SAME, thus causing global hypomethylation of DNA.^{32,33,34}

Vitamin B12

B12 is a key enzyme needed in the synthesis of S-adenosylmethionine (SAME), the body's most important methyl donor. Methionine synthase, an enzyme that catalyzes the methylation cycle is B12 dependent.^{9,10,11}

Selenium

Inhibits a methylating enzyme (DNA methyltransferase) in cancer genes, effectively turning them off; Selenoproteins protect DNA and metabolize methionine.^{30,31}

Folate

Methyl donor for many reactions in the body, including neurotransmitter synthesis and conversion of homocysteine to methionine; Precursor to SAME; Required for proper DNA synthesis.^{12,13,14}

Magnesium

Its role in the methylation of genes that affect glucose metabolism may explain the link between magnesium deficiency and diabetes.^{28,29}

Choline

A major source of methyl groups (methyl donor); Deficiency linked to DNA damage.^{15,16,17}

Copper

Several key enzymes needed for methylation reactions are copper dependent.^{25,26,27}

Vitamin C

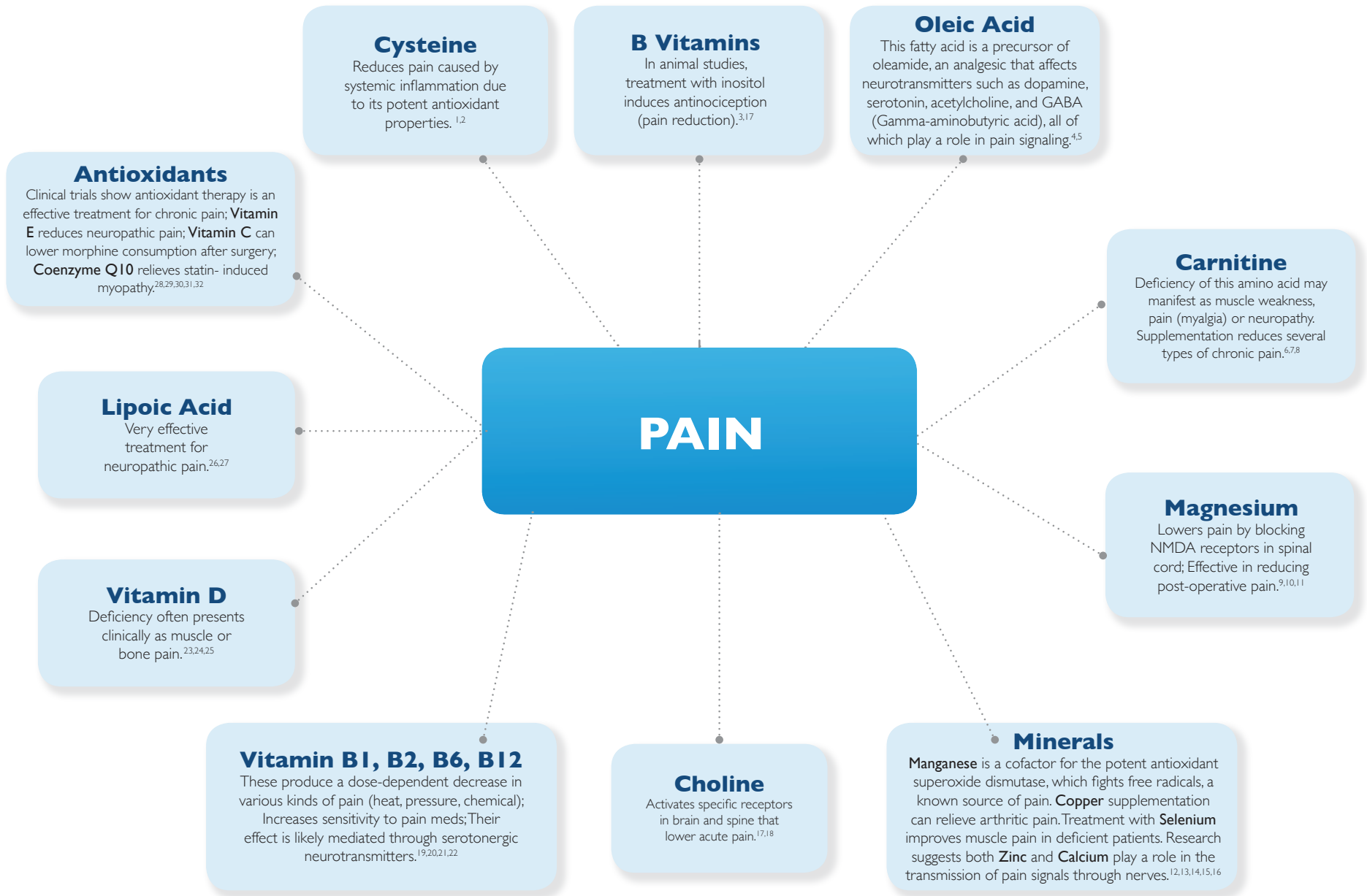
Deficiency alters methylation patterns in cancer cells; Also a cofactor for methylating enzymes.^{23,24}

Glutathione

Deficiency impairs methylation reactions and hinders synthesis of the methyl donor SAME.^{21,22}

Serine

Important methyl donor, especially in the case of folate deficiency.^{18,19,20}



SLEEP APNEA

Cysteine

Oral supplementation with cysteine, the precursor to glutathione, has therapeutic potential for sleep apnea. Snore time and duration were significantly reduced for patients treated with N-acetyl cysteine compared to untreated sleep apnea patients.^{1,2,3,4}

Antioxidant Status

It is well documented that sleep apnea patients have both reduced antioxidant capacity and higher levels of oxidative stress than controls.^{5,6,7,8}

Vitamin C

Improves endothelial function (blood vessel health) in sleep apnea patients to levels seen in people without sleep apnea.^{9,10,11}

Glutathione

Low levels linked to sleep apnea; This powerful antioxidant helps repair liver damage caused by sleep apnea.^{25,26,27}

Vitamin E

Mitigates the oxidative stress seen in sleep apnea patients; Works synergistically with vitamin C.^{5,11,12}

Minerals

The trace minerals zinc, copper, magnesium, manganese and selenium are critical cofactors for the major antioxidant enzymes, which are important in repairing cellular damage caused by hypoxia (lack of oxygen) in sleep apnea.^{23,24}

Vitamin A

Sleep apnea patients have low retinol (vitamin A); Retinol suppresses the growth of vascular smooth muscle, a process that causes blood vessels to clog, linking low vitamin A levels to the cardiovascular complications seen in sleep apnea patients.^{13,14}

Copper

Considered a strong predictor of oxidative stress in sleep apnea patients; Copper's role as a key cofactor in the powerful antioxidant superoxide dismutase (SOD) explains this; SOD is very low in apnea patients.^{21,22}

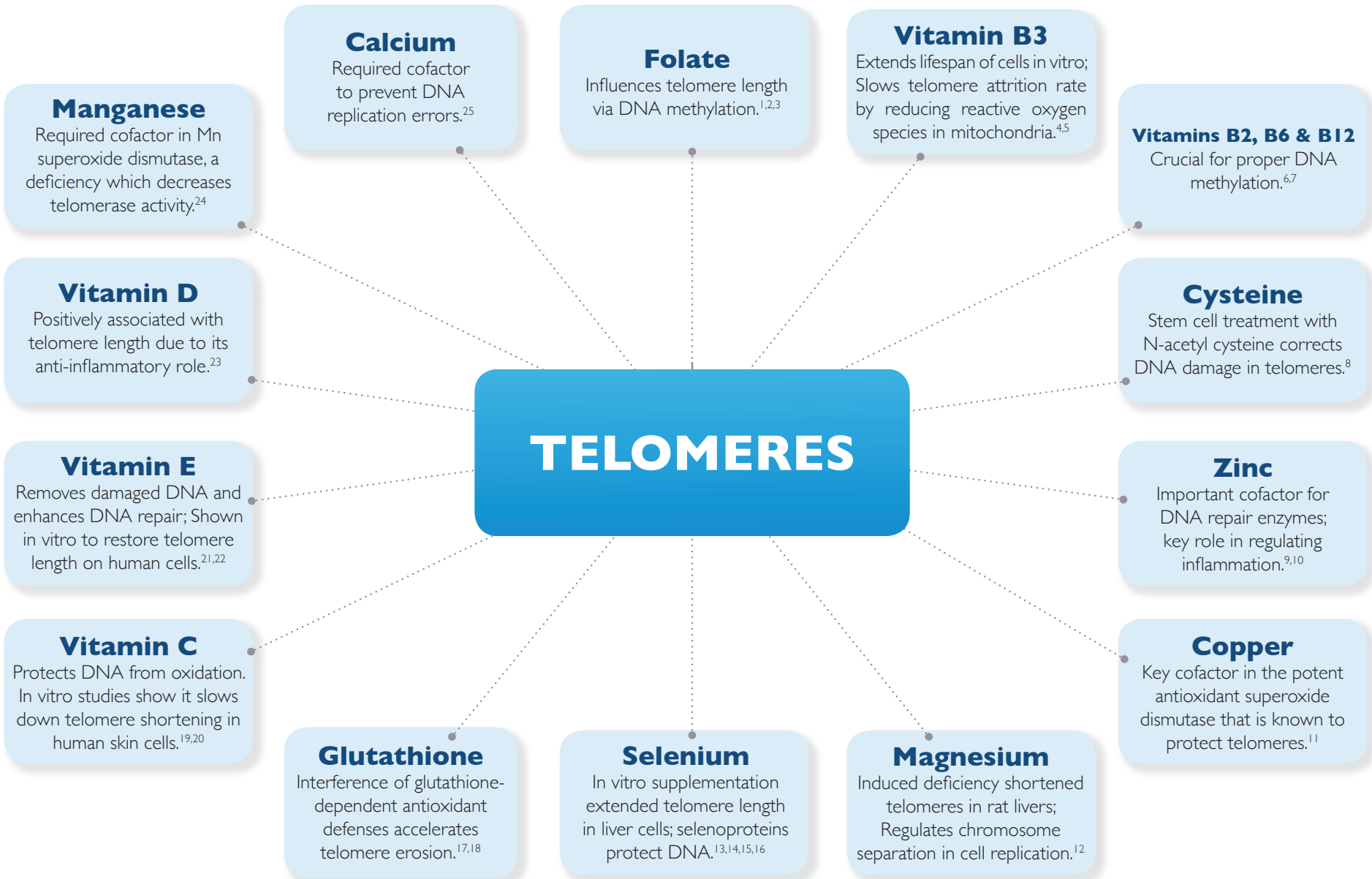
Selenium

In one case report, selenium supplementation completely stopped snoring caused by non-obesity sleep apnea; Selenium's role as a potent antioxidant may reduce the oxidative stress seen in sleep apnea patients.^{18,19,20}

Vitamin D

People with sleep apnea have a high prevalence of vitamin D deficiency; The worse the apnea, the more severe the deficiency; Evidence suggests low vitamin D worsens sleep apnea's negative effect on heart disease risk.^{15,16,17}

TELOMERES



SPORTS NUTRITION

Asparagine

Increases the capacity of muscle to use fatty acids and spare glycogen, thus increasing time to physical exhaustion; Intensive training lowers asparagine levels.^{32,33,34}

Serine

Keeps an athlete's hormone profile healthy by buffering post-workout cortisol levels, which can cause excess muscle breakdown; May increase aerobic capacity.^{29,30,31}

Magnesium

Key to the production of ATP (adenosine triphosphate) which is the body's main storage form of energy; Supplementation may improve aerobic performance and muscle strength and repair.^{27,28}

Zinc

Interacts with hormones to improve body composition and strength; Deficiency impairs peak oxygen uptake during exercise; Low zinc common in distance runners & gymnasts; Supplementation should be accompanied by copper.^{24,25,26}

Carnitine

Allows cells to use fatty acids as an efficient non-glycogen source of fuel; Improves muscle recovery; Offsets the rise in creatine kinase, an indicator of muscle damage.^{35,36}

Glutamine

Its depletion compromises immunity in many athletes after intense physical training; supplementation by marathoners reduced post-race infections.^{1,2,3,4}

Coenzyme Q10

Mitigates muscle damage after high intensity training; Trials indicate CoQ10 benefits both strength and endurance; 300 mg of CoQ10 increased power in Olympic athletes.^{5,6,7}

Lipoic Acid

This powerful antioxidant reduces cellular damage due to intense physical exercise; Recycles other antioxidants such as glutathione.^{8,9}

Glutathione

Powerful antioxidant; Detoxifies cellular by-products after workouts; Reduced blood levels of glutathione are counterproductive to an athlete in training.^{10,11}

Cysteine

Reduces time to fatigue in endurance sports such as cycling; Precursor to glutathione; Supplementation raises glutathione levels.^{12,13,14}

Vitamin C

Decreases post-workout soreness; Required for collagen synthesis and thus protects muscles from injury due to trauma or training; Reduces cortisol induced muscle catabolism.^{15,16,17}

B Vitamins

Cofactors for efficient energy metabolism from food; Synthesizing red blood cells requires B9 (folate) and B12; Deficiencies in various B vitamins may slow healing in sports injuries.^{22,23}

Vitamin D

Improves bone strength, thus reducing potential for sports-related injuries and stress fractures.^{20,21}

Vitamin E

Intense training causes cellular stress; Vitamin E protects the enzymes responsible for repairing this cellular damage.^{18,19}

Additional nutrients affect athletic performance. This list is non-exhaustive.

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TESTOSTERONE

Folate

Deficiency reduces circulating testosterone; Evidence suggests testosterone may regulate folate metabolism.^{1,2,3}

Vitamin B6

Regulates sex hormones; Vitamin B6 reduces prolactin which stimulates hypothalamus to increase testosterone; B6 also a cofactor for dopamine synthesis which influences testosterone levels.^{4,5,6,7}

Vitamin D

Actually a hormone, vitamin D regulates the synthesis of testosterone; Supplementation can significantly increase total, free and bioactive testosterone levels.^{8,9,10,11,12}

Zinc

Deficiency lowers testosterone levels; Inhibits prolactin secretion (testosterone inhibiting hormone); Supplementation increases testosterone depending on baseline levels.^{28,29,30,31}

Vitamin K

Deficiency reduces testosterone production because the rate-limiting enzyme for testosterone synthesis (Cyp11a) is vitamin K dependent.^{13,14,15}

Magnesium

Makes testosterone more biologically active in the body; Raises free and total testosterone levels in men.^{25,26,27}

Vitamin E

Long term administration of some forms of vitamin E may reduce testosterone levels.^{16,17}

Carnitine

Boosts dopamine, which is directly related to testosterone levels; May prevent testosterone decline after intense physical stress.^{21,22,23,24}

Vitamin C

Studies suggest it protects prostate from testosterone induced tumors.^{18,19,20}

WEIGHT MANAGEMENT

Zinc

Deficiency of zinc reduces leptin, a beneficial hormone that regulates appetite, which is reversed by zinc repletion.^{10,37}

Asparagine

This amino acid increases insulin sensitivity which helps the body store energy in muscle instead of storing it as body fat.^{1,2}

Biotin

Boosts metabolism by improving glycemic control (stabilizes blood sugar) and lowering insulin, a hormone that promotes fat formation.^{3,4,5}

Carnitine

Carries fatty acids into the cell so they can be burned for fuel; Helps reduce visceral adiposity (belly fat).^{6,7}

Calcium

Inhibits the formation of fat cells; Also helps oxidize (burn) fat cells.^{8,9,10}

Lipoic Acid

Improves glucose uptake into cells, which helps a person.^{11,12,13}

Chromium

Makes the body more sensitive to insulin, helping to reduce body fat and increase lean muscle.^{14,15,16,27,28,4}

Vitamin B5

Taking B5 lowers body weight by activating lipoprotein lipase, an enzyme that burns fat cells. One study linked B5 supplementation to less hunger when dieting.^{17,18}

Magnesium

Low magnesium in cells impairs a person's ability to use glucose for fuel, instead storing it as fat; Correcting a magnesium deficiency stimulates metabolism by increasing insulin sensitivity. Magnesium may also inhibit fat absorption.^{19,20,21}

Glutamine

Reduces fat mass by improving glucose uptake into muscle.^{22,23}

Cysteine

Supplementation with this antioxidant reduced body fat in obese patients.²⁴

Inositol

Supplementation may increase adiponectin levels.²⁵

Vitamin B3 (Niacin)

Treatment with B3 increases adiponectin, a weight-loss hormone secreted by fat cells; Niacin-bound chromium supplements helped reduced body weight in clinical trials.^{26,27,28}

Vitamin A

Enhances expression of genes that reduce a person's tendency to store food as fat; Reduces the size of fat cells.^{10,29,30}

Vitamin E

Inhibits pre-fat cells from changing into mature fat cells, thus reducing body fat.^{10,31,32}

Vitamin D

Deficiency strongly linked to poor metabolism of carbohydrates; Genes that are regulated by vitamin D may alter the way fat cells form in some people.^{1,30,31}

Vitamin K

Poor vitamin K status linked to excess fat tissue; Vitamin K helps metabolize sugars.^{35,36}

