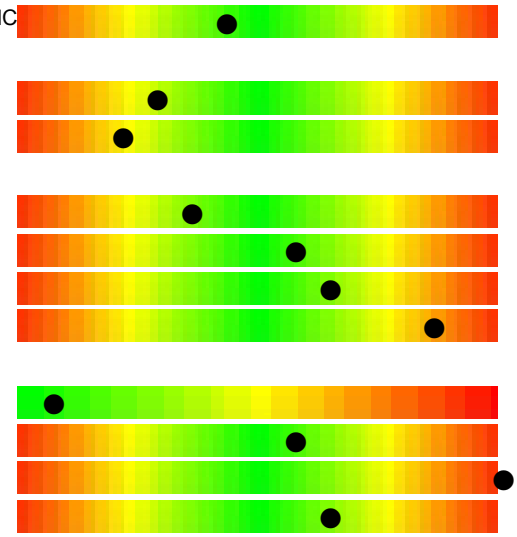
NutriPATH
Integrative Pathology Services
P: 1300 688 522
E: info@nutripath.com.au
A: PO Box 442 Ashburton VIC 3142

TEST PATIENT
Sample Test Name
Sex : F
Date Collected : 00-00-0000
111 TEST ROAD TEST SUBURB
LAB ID: 00000000 UR#:0000000

TEST PHYSICIAN
DR JOHN DOE
111 CLINIC STREET
CLINIC SUBURB VIC 3000

INTEGRATIVE MEDICINE

URINE, SPOT	Result	Range	Units
Advanced Neurotransmitter Profile			
Glycine, Urine	**78.0**	43.0 - 173	mmol/molC
Inhibitory Neurotransmitters			
SERONIN Urine	**63.6**	50.0 - 250.0	ug/gCR
GABA, Urine	**157.0**	150.0 - 700.0	ug/gCR
Excitatory Neurotansmitters			
DOPAMINE, Urine	**148.0**	100.0 - 350.0	ug/gCR
NORADRENALIN (Nor-Epinephrine)	**48.6**	13.0 - 70.0	ug/gCR
ADRENALIN (Epinephrine)	**14.9**	3.0 - 20.0	ug/gCR
GLUTAMATE Urine	***14.7* *H**	2.0 - 12.0	ug/gCR
Adrenal Adaptation Index			
Noradrenalin/Adrenalin Ratio	**3.1**	< 10.0	RATIO
Histamine, Urine	**25.0**	7.6 - 35.4	ug/gCR
PhenylEthylamine PEA	***62.8* *H**	3.6 - 38.8	ug/gCR
NorMetanephrines	**36.70**	13.40 - 44.80	ug/gCR
Optimal Ranges Table			



Biomarker	Adult Optimal Range (>11 Yrs)	
Serotonin	200 - 415	ug/gCr
GABA	600 - 1100	ug/gCr
DOPAMINE	250 - 400	ug/gCr
Noradrenaline	30 - 50	ug/gCr
Adrenaline	10 - 15	ug/gCr
Glutamate	5 - 10	ug/gCr

There are multiple factors that play roles in neurotransmitter levels (Lifestyle, receptors, meds, supplements, diet, stress, etc).
The optimal reference ranges stated above have been determined/derived statistically from historical patient data.
Historically, these levels were achieved in the majority of patients as they experienced symptom relief or improvement.

(*) Result outside normal reference range (H) Result is above upper limit of reference rang

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COMMUNICATION SYSTEM MODEL (CSM)

THE CSM AND YOUR PATIENT

The Communication System Management Model is designed to give you an analysis of neurotransmitter and adrenal hormone values and an observation of how they affect one another. This approach targets the underlying cause of chronic symptoms by addressing the root imbalance. In the next section, we will observe trends in the lab values, correlating those with the symptoms that were marked by the patient.

ADRENAL INFLUENCES

Although the patient chose to only test neurotransmitter levels, an adrenal panel is suggested should any of the following symptoms arise: allergies, symptoms of hypoglycemia (shakiness when a meal is skipped), decreased stamina, fatigue, insulin resistance (sugar cravings, fatigue, abdominal weight gain, poor sleep), decreased libido, stress, salt cravings, which are all related to low adrenal function.

INHIBITORY NEUROTRANSMITTERS

Patient indicated symptoms of ANXIETY, NERVOUSNESS, and IRRITABILITY.
These symptoms are often the result of decreased inhibitory neurotransmission and/or excess excitatory neurotransmission. Additionally, in the presence of up-regulated adrenal function, anxiety, irritability, and/or nervousness may also be present; therefore, consider assessing adrenal hormone levels. As the main inhibitory neurotransmitters, GABA, glycine, and serotonin function to promote calm and prevent over excitation. As GABA is the primary inhibitory neurotransmitter, it can be thought of as "the great balancer" of the nervous system. Also, serotonin often functions as a modulator of GABA activity. Low serotonin or depletion of GABA alone may cause anxiety. Research indicates that inositol and glycine supplementation may be beneficial for those suffering from anxiety, especially acute anxiety and panic disorders.
Avoid supporting excitatory neurotransmitter function before restoring serotonin and GABA levels. When up-regulated, thyroid hormones may also generate feelings of nervousness, irritability, and anxiety for the patient; therefore, consider a comprehensive thyroid hormone assessment.

EXCITATORY NEUROTRANSMITTERS

Patient checked FATIGUE/DECREASED STAMINA on the questionnaire.
Chronic fatigue can be caused by numerous conditions,the most common of which are
1) inadequate sleep (consider sleep pathologies),
2) low or high blood sugar,
3) hypothyroidism, and
4) adrenal fatigue,
usually demonstrated by inadequate cortisol, particularly low morning levels (87% of patients indicating fatigue of moderate or severe intensity measure low a.m. cortisol). Low stores of excitatory neurotransmitters, such as norepinephrine, epinephrine, and glutamate, can also influence energy levels.
Other reasons for fatigue involve inadequate dietary protein or B vitamins, dysregulation of mitochondrial function, anemia, depression, acute or chronic illnesses, heavy metal toxicity as well as acute and chronic environmental toxins, and

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certainly many medications.

Assessment of thyroid, iron status, blood sugar, diet and adrenal function are all warranted.

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Summary/Recommendations

Patient is in: Initial Phase

INHIBITORY NEUROTRANSMITTERS
SEROTONIN
Serotonin is within reference range. Generally regarded as the happiness molecule, serotonin has calming effects and contributes to the feelings of well-being. Serotonin elevates mood, decreases anxiety, appetite, and libido, improves sleep and memory, eases depression, and helps regulate body temperature. Most of serotonin in the human body is produced in the gastrointestinal tract, where it stimulates gut motility.

5-HIAA
5-hydroxyindoleacetic acid (5-HIAA) is high normal (>80th percentile). 5-HIAA is the primary metabolite of serotonin via the actions of monoamine oxidase and aldehyde dehydrogenase enzymes. Research shows that high urinary 5-HIAA levels are detected in men with hypogonadism (Shakir et al., 1996;Yu and Wolin, 2012). In a clinical setting, high 5-HIAA levels are associated with oxidative and immune stress.

GABA
GABA is low-normal. The brain's major inhibitory neurotransmitter, GABA functions as the "off" switch in the brain, balancing glutamate's "on" switch. GABA is essential to limiting excitation so that input signals are balanced and not overdone. Clinically, low GABA levels are implicated in in anxiety, depression, headaches, menopause symptoms, panic attacks, post-traumatic stress disorder, and sleep difficulties. Low GABA levels may also be associated with adrenal distress and HPA axis dysfunction, and disorders like attention deficit hyperactivity disorder and Tourette syndrome (Perlmutter and Loberg, 2015).

THERAPEUTIC CONSIDERATIONS: Supplementation with GABA, L-theanine, cofactor support (e.g. B6), growth hormone-releasing hormone, Ginko biloba, Ashwagandha, Kava, Valerian root, Melissa off (lemon balm), Scutellaria sinensis (skullcap), Gotu Cola, Magnolia and Phellodendron bark, and probiotics may be helpful (Alramadhan et al., 2012;Awad et al., 2007;Alexeev et al., 2012;Dhakal et al., 2012). Additionally, yoga (Streeter et al., 2012) and meditation (Guglietti et al., 2013) increase brain GABA levels. Caffeine has been found to inhibit GABA release, so avoidance may be beneficial. Progesterone's metabolite allopregnenolone interacts with the GABA receptor, so for women, menstrual cycle patterns of symptoms may be noticed (e.g. PMDD).

GLYCINE
Glycine is within normal range. Glycine plays a dual role as a neurotransmitter and a building block of proteins. Glycine serves as an anti-inflammatory agent, calms aggression, improves sleep quality, regulates locomotion, stabilizes blood sugar, and modulates excitatory signals in the brain.

EXCITATORY NEUROTRANSMITTERS
GLUTAMATE
Glutamate is elevated. The brain's major excitatory neurotransmitter glutamate (also known as glutamic acid) functions as the "on" switch in the brain. Glutamate regulates appetite, thinking (cognition), increases gut motility, optimizes learning, modulates memory, improves libido, decreases sleep and contributes to oxidative stress. Chronic stress maintains high levels of glutamate in the brain which may lead to excitotoxicity and even neuronal damage (Gold, 2015;Popoli et al., 2012). Research shows that urinary glutamate levels are high in patients with celiac disease (MARKO et

al., 1960) and with hyperthyroidism (Belanger et al., 1972). Clinically, high glutamate is suspected in anxiety, autism, bipolar disorder, depression, and impulsivity, inability to focus (racing thoughts), obsessive compulsive disorder, panic attacks, sleep difficulties, and stroke.
THERAPEUTIC CONSIDERATIONS: GABA, L-theanine, and taurine may be beneficial to counter glutamate actions. Vitamin E and N-Acetyl Cysteine (NAC) may be used to combat oxidative damage. Cofactor supplementation with vitamins B3 and B6, and magnesium and NAC may aid with glutamate metabolism.

HISTAMINE
Histamine is high-normal . Histamine is both a neurotransmitter and a modulator of the immune system that has anti-pain properties, plays a neuroprotective role in the brain, and contributes to optimal maintenance of cognition and memory. Histamine stimulates wakefulness and decreases sleep, stimulates gastric acid production, increases metabolism, suppresses appetite, and prevents weight gain. Histamine is a potent vasodilator and a pro-inflammatory agent. Research shows that urinary histamine is high in patients with burns (Johansson et al., 2012), flushing disorder (Myers et al., 1981), food allergies (Raithel et al., 2015), cystitis (el-Mansoury et al., 1994), polycythemia (Horakova et al., 1977), and pregnancy (Harrison et al., 1974). Clinically, high histamine levels are implicated in allergies, depression, headaches, migraines, OCD, schizophrenia, sensitivity to chemicals, and sleep difficulties.
THERAPEUTIC CONSIDERATIONS: Therapeutic strategies to reduce histamine levels may involve antihistamines and a low histamine diet. High histamine foods include but are not limited to beer, champagne, aged cheeses, eggplant, canned fish, fermented meat, red and white wine, sauerkraut, and spinach (Maintz and Novak, 2007). Additionally, flavonoids (green tea extract, quercetin, grape seed extract, gingko biloba, citrus bioflavonoids, bilberry extract, hawthorn extract) may be beneficial to ease the symptoms of high histamine (Murray et al., 2005).

PEA
PEA is elevated. PEA, also known as phenethylamine, promotes energy, elevates mood, and regulates attention. PEA also contributes to aggression, serves as a biomarker for ADHD, and prolongs the signaling of dopamine, norepinephrine, and serotonin. Urinary PEA levels increase after amphetamine use (Kusaga et al., 2002;Zametkin et al., 1984), exercise (Szabo et al., 2001), and in the following disorders: bipolar disorder (Karoum et al., 1982), phenylketonuria (Reynolds et al., 1978), schizophrenia (O'Reilly and Davis, 1994), postpartum period (Taylor et al., 1996), and in severe anxiety and insomnia (DeLisi et al., 1984). High PEA is suspected in the etiology of anxiety, inflammation, inability to focus (racing thoughts), sleep difficulties, and toxicity.
THERAPEUTIC CONSIDERATIONS: Methylation cofactor support to aid metabolism may be beneficial.
DOPAMINE
Dopamine is low-normal (<20th percentile). Dopamine improves attention, focus, and motivation, helps with decision making, modulates movement control, promotes lactation, increases blood pressure, urine output and sodium excretion, and allows for feelings of reward and pleasure. Additionally, the quest for dopamine stimulation plays a central role in the etiology of addiction. Dopamine also serves as the parent precursor to norepinephrine and epinephrine. Research shows that urinary dopamine levels are reduced in patients with Alzheimer's disease (Liu et al., 2011), anorexia nervosa (Van Binsbergen et al., 1991), anxiety with depression (Field et al., 2010), fibromyalgia (Riva et al., 2012), and periodic limb movement disorder (Cohrs et al., 2004).
Clinically, low dopamine is also implicated in apathy, cravings, fatigue, impulse control issues, increased sensitivity to pain, low libido, low mood, memory issues, sleep disturbances, and weight control issues.

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THERAPEUTIC CONSIDERATIONS: Supplementation with precursors (tyrosine or L-DOPA) and/or cofactors (iron, vitamin B6, tetrahydrofolate) to promote biosynthesis may be beneficial.

DOPAC
DOPAC is within reference range. DOPAC is the primary metabolite of dopamine formed via the actions of monoamine oxidase.
HVA
Homovanillic acid (HVA) is high-normal. HVA is a dopamine metabolite. Research shows that HVA is elevated in patients with anorexia nervosa (Van Binsbergen et al., 1991), lead toxicity (Tang et al., 1995), obsessive compulsive disorder (de Groot et al., 1995), and stress (Frankenhaeuser et al., 1986). Testing for lead toxicity may also be beneficial.
NOREPINEPHRINE
Norepinephrine is within reference range. Norepinephrine functions both as a neurotransmitter and a hormone, participating in the body's "fight or flight" response. Norepinephrine increases alertness, focuses attention, fine-tunes vigilance, increases blood pressure, heart rate, and blood sugar, reduces digestive activity, pain, and sleep, prevents bladder emptying, and regulates body temperature. Norepinephrine is very similar in structure and physiological effects to epinephrine. The adrenal gland produces approximately 20% of the total output with 80% produced by the sympathetic nerve fibers.
NORMETANEPHRINE
Normetanephrine is high-normal. Normetanephrine is a norepinephrine metabolite formed via the actions of
catechol-O-methyl transferase due to stress. Levels may be affected by stress, drugs, smoking, stimulating drinks (e.g. caffeine) and alcohol. Research shows that normetanephrine is elevated in patients with depression (Koslow et al., 1983) and polycystic ovarian syndrome (Garcia-Rudaz et al., 1998) and high norepinephrine.

EPINEPHRINE
Epinephrine is high-normal. Epinephrine, also called adrenalin, functions both as a neurotransmitter and a hormone, participating in the body's "fight or flight" response. Epinephrine increases alertness, focuses attention, fine-tunes vigilance, increases blood pressure, heart rate, and blood glucose, reduces digestive activity, pain and sleep, prevents bladder emptying, and regulates body temperature. The majority of catecholamines produced by the adrenal glands are epinephrine. Research shows that urinary epinephrine levels are increased in patients with attention deficit disorder (Faraone et al., 2014), anxiety and depression (Hughes et al., 2004), bipolar disorder (Koslow et al., 1983), hyperglycemia (Troisi et al., 1991), hyperinsulemia (Troisi et al., 1991), obstructive sleep apnea (Kheirandish-Gozal et al., 2013), post-traumatic stress disorder (Yehuda et al., 1992), and stress (Holzman et al., 2009;Fujiwara et al., 2004).
THERAPEUTIC CONSIDERATIONS: Testing for levels of copper and zinc may be helpful to make sure that sufficient levels of these elements are present to properly metabolize epinephrine. Consider supporting HPA axis dysfunction.

VMA
Vanillylmandelic acid (VMA) is high-normal (>80th percentile). VMA is a norepinephrine and epinephrine metabolite formed via the actions of monoamine oxidase, catechol-O-methyl transferase (COMT), and aldehyde dehydrogenase. Research shows that in rare cases, VMA is elevated in patients with adrenal lymphangioma (Hodish et al., 2015), neuroblastoma (Cangemi et al., 2012), or pheochromocytoma (Carr et al., 2013).

Retesting is an important part of this process. NT levels need to be monitored. Retesting for this patient is recommended in 9 weeks.

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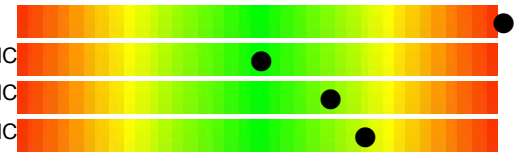
Additional Recommendations
*** It is recommended that all patients on a program to balance HPA axis function should also supplement with B complex, a multi-mineral and multi-vitamin as well as EPA/DHA.**

Disclaimers
*** These products are not intended to diagnose, treat, cure, or prevent any disease.**
***The statements above are recommendations to the clinician. All final therapeutic decisions are the responsibility of the treating physician.**
*** Please call Nutripath on 1300 688 522 with your technical and clinical questions.**
For further reading and references, please refer to Nutripath's Technical guide and Clinical guide.

DOPAC	***1.60* *H**	0.65 - 1.35	
HVA	**3.70**	2.07 - 5.53	mmol/molC
VMA	**3.50**	1.31 - 4.01	mmol/molC
5HIAA	**11.40**	1.33 - 13.53	mmol/molC



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Neuroendocrine Comments

CORTISOL
To downregulate Cortisol (If Cortisol is High): Phosphatidyl Serine, DHEA, Choline, Inositol, Adaptogenic Herbs e.g. Siberian Ginseng, Withania, Vit C, Magnesium, Vit B

To upregulate Cortisol(If Cortisol is low): Adaptogens e.g. Ginseng, Withania, assess and balance hormone imbalance, insulin sensitivity, hydrocortisone, DHEA, Magnesium, Vit B, Assess and correct hormonal balance, insulin sensitivity

DHEA
DHEA, Adaptogen e.g. Siberian Ginseng, Withania, and adrenal support e.g. ginseng, Activated B3

Methyl Cofactors
Vit B6, Activated B6, SAMe, Methionine, Folinic Acid, TMG, DMG

Melatonin
Melatonin, passionflower, Hops, Adenosine, Kava

Based on your test results, your practitioner will advise upon natural supplementation of specific formulary.

SEROTONIN (Inhibitory Neurotransmitter) LEVELS WITHIN RANGE:
Serotonin levels may be within range, however, if the patient is exhibiting symptoms you may wish to consider that the reported reference range is not optimal for this patient. Optimal Serotonin levels are levels at which serotonin can effectively counterbalance elevated excitatory neurotransmitters (esp Dopamine and Norepinephrine). Even if Serotonin is above the observed reference range but is not proportional to (or able to control) elevations in the catecholamines, then more Serotonin support is needed.

GABA (Inhibitory Neurotransmitter) LEVELS NORMAL:
GABA levels may be within normal range, however, if the patient symptoms of anxiety and insomnia, consider that the normal reference range is not optimal for this individual. Biochemical individuality is no more evident than in the CNS. For this reason, clinical observation must be valued as a primary aspect of treatment.

GLUTAMATE (Excitatory Neurotransmitter) LEVELS ELEVATED:
Glutamate levels may be elevated due to the following:
Elevated catecholamines (Dopamine, Norepinephrine, Epinephrine), High use of caffeine, Use of aspartame and monosodium glutamate (MSG), Glutamine supplementation, High levels of CNS free radical activity/Low antioxidant status, Blood brain barrier permeability, Functional estradiol deficiency.
Recommendations: Green tea, Magnesium and Potassium

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Dopaminergic Activity Comment

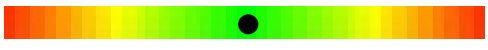
DOPAMINE METABOLISM
Dopamine is the neurotransmitter needed for assertiveness and sexual arousal, immune and autonomic nervous system function. Dopamine is important for motivation and a sense of readiness. Depleted by stress or poor sleep. Alcohol, caffeine, and sugar all seem to diminish dopamine activity in the brain. Easily oxidized; therefore eat fruits and vegetables and take antioxidants to protect dopamine-using neurons from free radical damage. Age-related cognitive decline is associated with dopamine changes in the brain. People whose hands tremble from Parkinson's disease have a diminished ability to synthesize dopamine, which is crucial to fine muscle coordination. Attention deficits are also connected to dopamine. Tyrosine or Phenylalanine is converted to L-Dopa by tyrosine hydroxylase (the rate limiting step in synthesis). L-Dopa is converted to Dopamine. COMT and MAO enzymes can degrade Dopamine. Cocaine is a powerful blocker of the dopamine transporter. Many drugs used in treating schizophrenia act as antagonists at dopamine receptors.

[DOPAC] (dihydroxyphenylacetic acid) is a metabolite of dopamine.
Dopamine is converted to DOPAC via MAO enzyme, and then DOPAC is converted to HVA via COMT enzyme.
By assessing metabolites (DOPAC, HVA) abnormalities in either COMT (catechol-O-methyl transferase) or MAO (monoamine oxidase) can be indirectly identified. This has large ramifications as COMT abnormalities are suspected in various neuropsychiatric diseases including schizophrenia.

HIGH levels of DOPAC are consistent with excessive Dopamine and adequate MAO activity and or LOW COMT enzyme activity which would be confirmed by low or low normal HVA.

[HVA] (Homovanillate) a Dopamine catabolite - is HIGH
Elevated levels of homovanillate may be due to amino acid deficiencies, the use of L-Dopa as a treatment for Parkinson's disease, copper deficiency (especially if Vit A is low), cocaine or amphetamine use or chronic depletion of Tyrosine.
Reflects the increased rate of synthesis and degradation in normal tissue.
Drugs that may have an adverse effect to the result: Aspirin.
Symptoms and Conditions: Agitation, delirium, psychosis.
Treatment: Supplement with Tyrosine 2x daily 500mg. This amino acid is essential to the synthsis of protein, catecholamines, melanin and thyroid hormones. Vitamin C and Folate are essential to its metabolism. The formation of thyroid hormone is dependent upon the absorption and sequestering of iodine which then attaches to tyrosine to form thyroxine.
Supplement with broad spectrum essential amino acids. Stop related drug use.

Adrenergic Activity Comment	Vanilmandelate is a metabolite of both epinephrine and norepinephrine.
Serotonergic Activity Comment	[5HIAA] is within range. This is the major metabolite of Serotonin.

Creatinine, Urine Spot.	**8.3**	5.0 - 11.0	mmol/L	

Tests ordered: ANEUM