



The Biological Component of Behavioral Health and Marijuana Use.

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Wired BioHealth™

Specializing in the biological component of behavioral health optimization and addiction recovery since 2006.

To date mental healthcare has relied entirely on an individual's ability to communicate symptoms and a practitioner's subjective interpretation of behaviors.

This **health inequity** inspired the development of the Wired BioHealth™ Panel.

Why Am I Here Today?

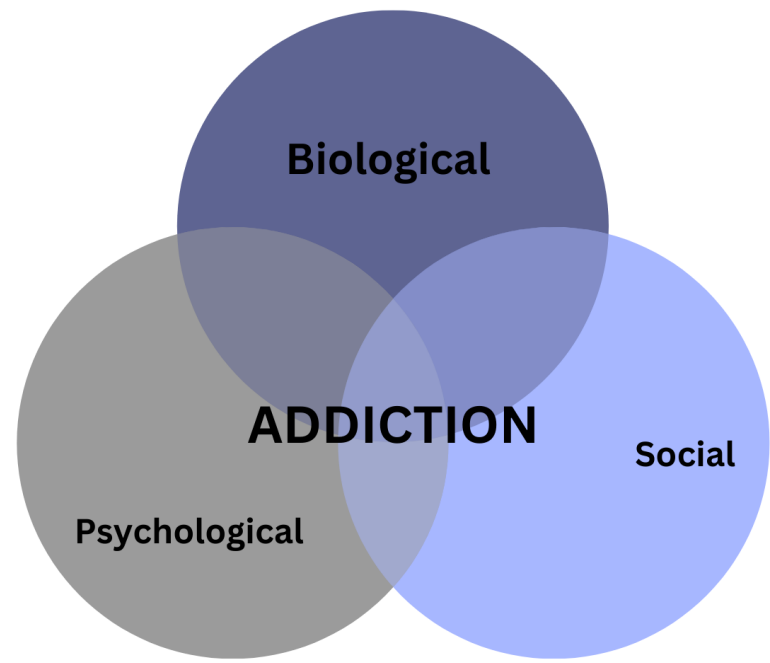
As the literature exists...

- No amount of marijuana has been proven safe to use during pregnancy.
 - American College of Obstetricians and Gynecology advises against the use of marijuana during pregnancy due to the potential adverse effect to mother and fetus.
 - Consequences in physical, emotional, and intellectual health from newborns through adulthood.
 - Users experiencing new behavioral health concerns due to evolving THC.

What more can we do?

Include Technology	Make objective behavioral health tools available to providers and mothers.
Measure the Biomarkers	Address the underlying biology that is creating a need to self medicate.
Educate Using Objectivity	Understand the biochemical pathways associated with behavioral health complexities, including addiction. Focusing less on the how and more on the why can lead to greater understanding of the cascading effect of mental health and marijuana use.
Stop Dismissing Mothers	“You’re pregnant,” becomes the answer to feelings, thoughts, cravings, impulses, etc rather than recognizing that there are measurable biomarkers that can improve the behavioral health of an expecting or new mother.

ADDICTION IS A COMPLEX DISEASE NOT A MORAL FLAW



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Disease: Any harmful deviation from the normal structural or functional state of an organism.

MENTAL HEALTH COMPLEXITIES ARE NOT WEAKNESSES

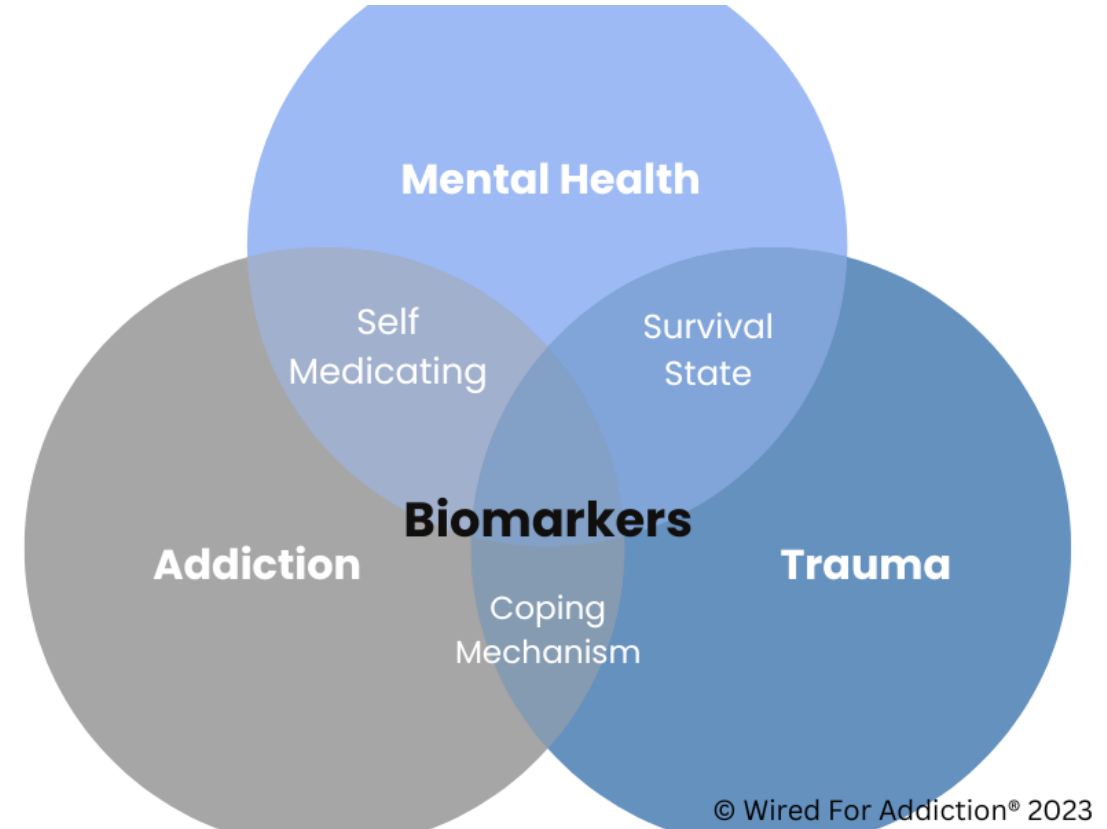
An infographic consisting of four vertical blue panels. Each panel has a circular icon at the top containing a blue DNA double helix and circuit-like lines. Below each icon is a white text box with a statistic. At the bottom of the four panels is a large, light blue double-headed arrow pointing left and right.

- 53% of Americans diagnosed with anxiety and/or depression
- 1:7 women will get a perinatal mood or anxiety disorder like postpartum depression or anxiety
- 85% of new moms will experience the postpartum blues
- 80% of individuals with <90 days of sobriety relapse

Kaiser Permanente
University of Pittsburg Medical Center
Johns Hopkins Medicine
NIDA

MENTAL HEALTH, SUBSTANCE USE DISORDERS, AND PROCESS ADDICTIONS

- According to the NIH, half of people with a substance use disorder will develop or currently have a co-occurring mental health disorder.
 - Practitioners in the field report this number to be *far greater*.
- Substance use, abuse, and dependency are often the result of self-medicating a mental health issue and/or trauma.
 - What was initially a way to manage an unwanted emotion, thought, or impulse, created its own unmanageable, co-occurring problem.
- Regardless of the form in which someone is self-medicating, they are doing so to find their perceived balance.

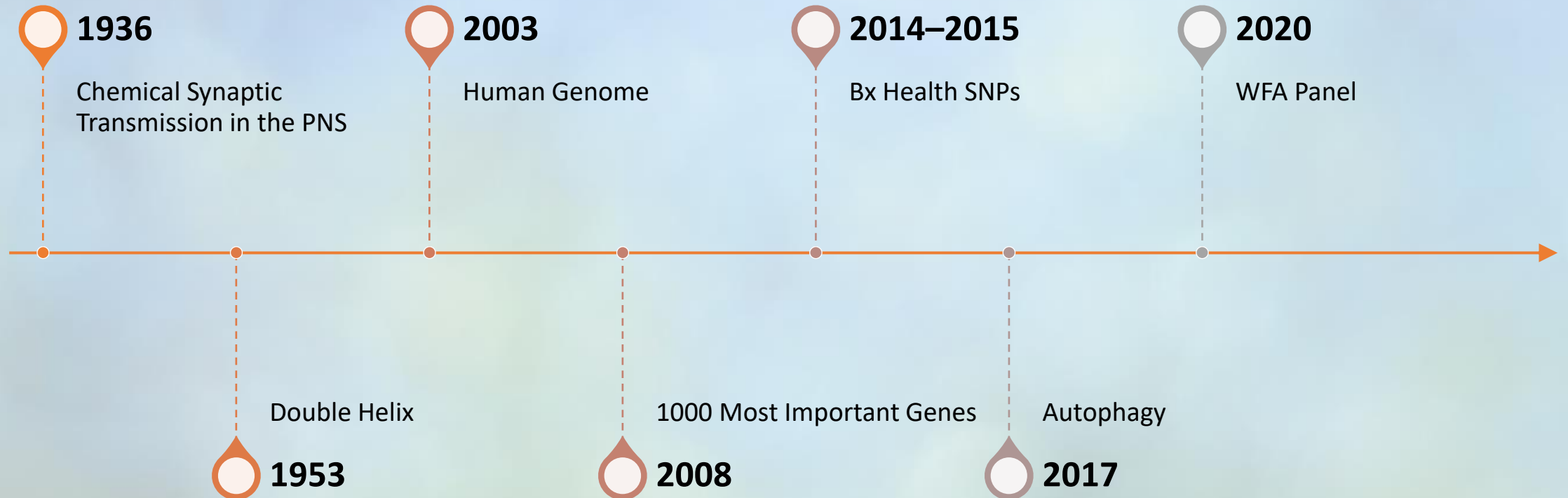




Focusing Less on
The How and
More on The
Why Through
Biomarkers



Biomarkers in Behavioral Health



Genetic Single Nucleotide Polymorphism

Previously science thought that our genes were static. We now know what we can modify the expression of our genes.

SNP is an error in genetic coding which can lead to aberrant behaviors: risk taking, impulse control, anxiety, depression, and addiction.

Ability to measure the level of the error: no clinical abnormality, heterozygous, homozygous.

Genes linked to defects in methylation, autophagy, detoxification, inflammation, neuropsych, and others.

SNPs as Biomarkers in Behavioral Health

SLC6A4

- Gene encodes the serotonin transporter, SERT
- Responsible for clearing the serotonin neurotransmitter from the synaptic space
- SERT is the target of many therapeutic drugs
- Polymorphisms are associated with increased risk of anxiety, depression, and less effective response to SSRI medications

GAD1

- Enzyme responsible for conversion of glutamic acid (a stimulant neurotransmitter) to GABA (a calming neurotransmitter)
- Deficiency of GABA from polymorphisms in this enzyme are associated with sleep disorders, "half glass empty" syndrome, dysphoria, and spasticity



Neuroscience

Neurotransmitters & Hormones

Neuroscience Biomarkers

Neurotransmitters

- Brain chemicals responsible for mood regulation, appetite, focus, sleep, pain, libido, drive...
- Reference range based on age and gender.
- Urine: bioavailable vs pathological
- Speed: Text Message

Hormones

- DHEA, sex hormones, cortisol
- Reference range based on age and gender.
- Saliva: bioavailable vs pathological
- Speed: Carrier Pigeon

Neurotransmitters as Biomarkers in Behavioral Health

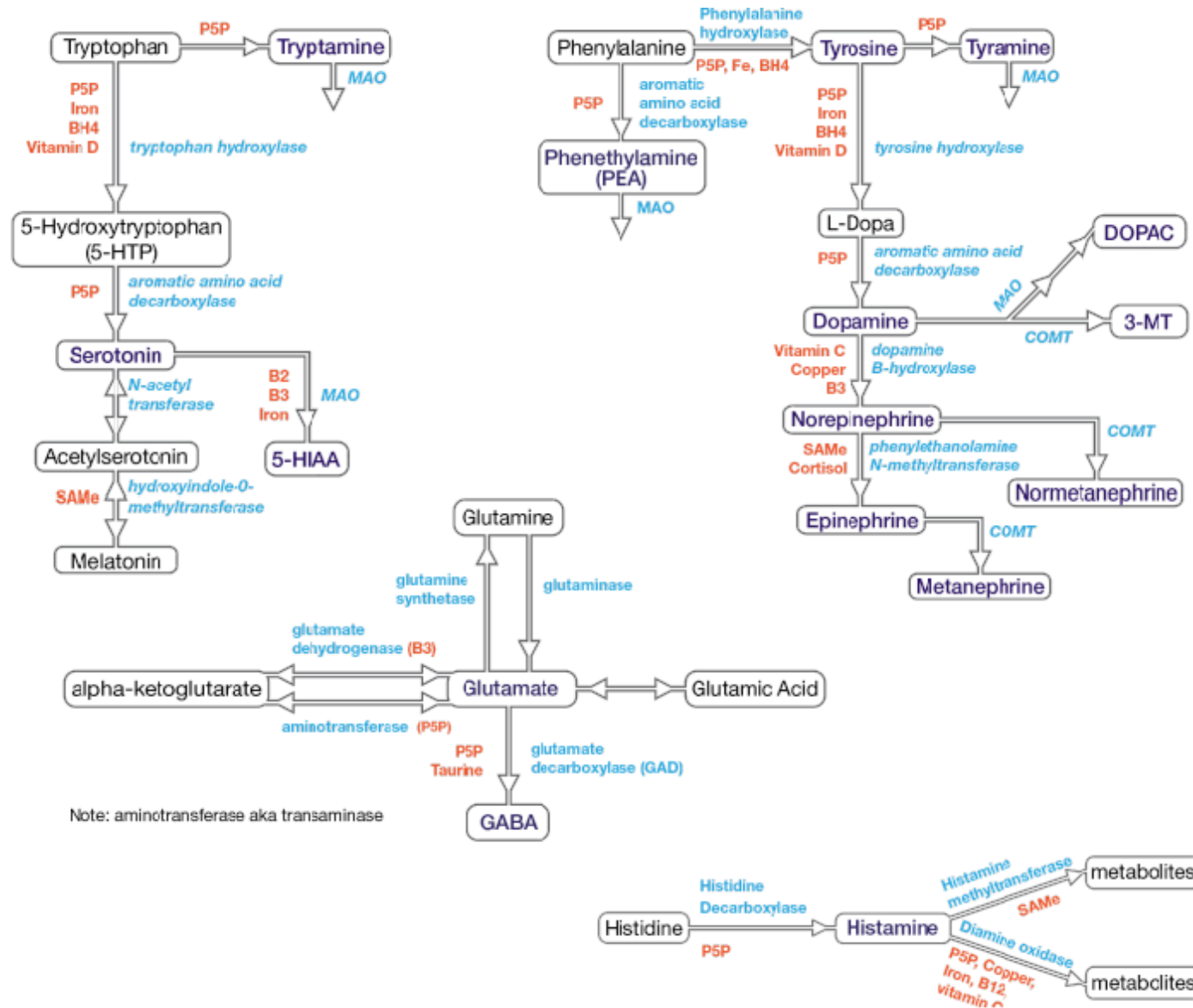
High Serotonin

- Associated with symptoms of, increased anxiety, agitation and diarrhea (IBS-like symptoms).
- Commercialized as the feel-good chemical and more is better...

Low Serotonin

- Contribute to mood concerns including anxiety, OCD, depression, anger and a sense of discontentment.
- Associated with poor sleep quality, appetite changes, chronic fatigue, rheumatoid arthritis, and over-all lassitude.

Neurotransmitter Biochemical Pathways



Biomarkers and Pregnancy

Pre-existing suboptimal physiology

- Self medicating? Using medications as prescribed?
- Family or personal history of behavioral health complexities?

Rapidly changing neuroscience biomarkers

- Androgens, Dehydroepiandrosterone, Cortisol
- Serotonin, Dopamine, Epinephrine, Norepinephrine, E:N Ratio, Glutamate, GABA, PEA, Histamine, Glycine

Activating genetic SNPs as genome interacts with the environment

- Pregnancy does not exist in a vacuum; internal and external stressors will impact physiology and clinical correlations that can create a need to self-medicate if not identified and biologically supported.

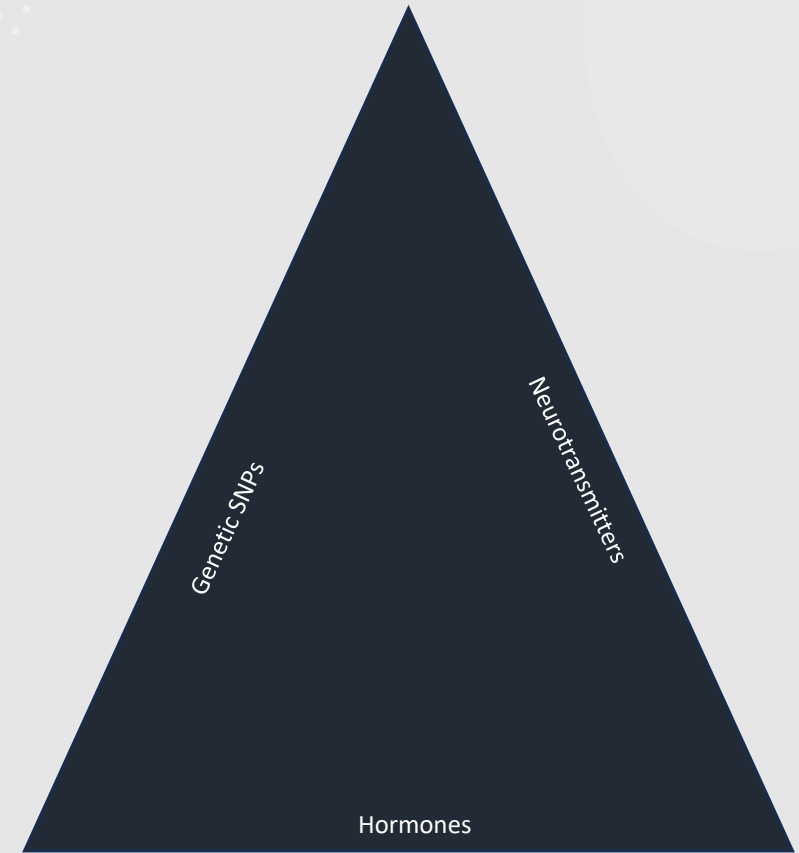
Feelings &
Behaviors Can
Be Criticized

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Objective
Biomarkers
Can't

Identify, isolate, and measure the physiological component of behavioral health complexities using a triangular relationship model.

Panel includes 85 biomarkers: 69 genes, 11 neurotransmitters, 5 hormones.



Case Study: Mother

34 YO female

- First time mom 2018
- Mother of 2 as of 2022

Health History

- Marijuana
- Alcohol
- Depression
- Anxiety
- ADHD

Sobriety Attempts

- “Tried everything”
 - Inpatient rehab
 - AA
 - Counseling
 - Therapy
 - Medications

During Pregnancy

- Anxiety, Depression, ADHD
- Marijuana use to help sleep
- Stopped drinking alcohol



Epigenetic Biomarkers:
Genetic Single Nucleotide Polymorphisms

Methylation / Folate Metabolism					
rs2071010	FOLR1	+/-	Methyltetrahydrofolate (5-MTHF)	Methyl Folate Plus™ Twice Daily	
rs651933	FOLR2	-/-			
rs1643649	DHFR	-/-			
rs6495446	MTHFS	-/-			
rs1076991	MTHFD1	+/+			
rs1801131	MTHFR A1298C	-/-			
rs1801133	MTHFR C677T	+/-			
rs1051266	SLC19A1	+/-			
Methylation / B12 Metabolism					
rs1805087	MTR	+/-	L-5-Methyl THF, Methyl Cobalamin, Nicainamide (B3), Methionine	Methylation Pro Topical™ OR Methylation Complete Fast Dissolves™ twice daily	
rs1802059	MTRR A664A	+/+	Methyl B12		
rs1801394	MTRR A66G	+/+			
rs558660	GIF	+/+	Methyl B12, Adenosyl B12		
rs526934	TCN1	+/-			
rs1801198	TCN2	+/+			

Neuroscience Biomarkers: Neurotransmitters



Order: [REDACTED]
 Test: [REDACTED]
 Client #: [REDACTED]
 Doctor: [REDACTED]


Patient: [REDACTED]
 Id: [REDACTED]
 Age: 33 DOB: [REDACTED]
 Sex: Female
 Body Mass Index (BMI): 21

Sample Collection Date/Time
 Date Collected 06/04/2022
 Collection Period 2nd morning void
 Date Received 06/07/2022
 Date Reported 06/14/2022

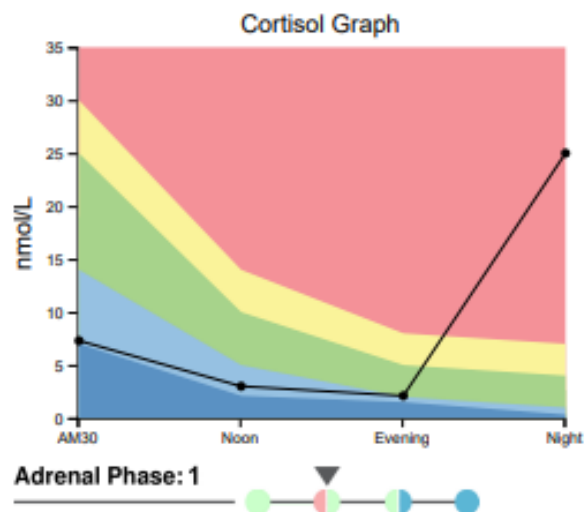
Analyte	Result	Unit per Creatinine	L	WRI	H	Reference Interval
Serotonin	89.8	µg/g		▲		60 – 125
Dopamine	220	µg/g		▲		125 – 250
Norepinephrine	28.9	µg/g		▲		22 – 50
Epinephrine	10	µg/g			▲	1.6 – 8.3
Norepinephrine / Epinephrine ratio	2.9		▲			< 13
Glutamate	18	µmol/g		▲		12.0 – 45.0
Gamma-aminobutyrate (GABA)	4.3	µmol/g			▲	2.0 – 5.6
Glycine	1071	µmol/g		▲		450 – 2200
Histamine	12	µg/g	▲			14 – 44
Phenethylamine (PEA)	21	nmol/g	▲			32 – 84
Creatinine	139	mg/dL		▲		30 – 225

- Elevated epinephrine: associated with stress response and contributory to anxiety, agitation, irritability, insomnia and hypertension
- Upper range GABA: difficulty concentrating, diminished memory, dampened mood and decreased cognitive processing as well as fatigue, decreased exercise endurance, sleepiness and an inability to feel alert
- Low histamine: digestion and appetite control, learning, memory, and mood, and may result in drowsiness.
- Low phenethylamine: depression, attention deficits and hyperactivity (ADHD), Parkinson's disease and bipolar disorder.

Neuroscience Biomarkers: Hormones

Order: ██████████  Client #: ██████ Doctor: ██████████ ██████████	Patient: ██████████ Id: ██████████ Age: 34 DOB: ██████████ Sex: Female Body Mass Index (BMI): 20.7 Menopausal Status: Pre-menopausal	Sample Collection Date/Time Date Collected 06/01/2022 AM30 06/01/2022 08:30 Noon 06/01/2022 12:30 Evening 06/01/2022 16:30 Night 06/01/2022 22:00 Date Received 06/07/2022 Date Reported 06/10/2022
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Analyte	Result	Unit	L	WRI	H	Optimal Range	Reference Interval
Cortisol AM30	7.3	nmol/L	◆			14.0–25.0	7.0–30.0
Cortisol Noon	3.0	nmol/L	◆			5.0–10.0	2.1–14.0
Cortisol Evening	2.1	nmol/L		◆		2.0–5.0	1.5–8.0
Cortisol Night	25	nmol/L			↑	1.0–4.0	0.33–7.0
DHEA*	159	pg/mL		◆			106–300



Elevated cortisol level(s) and diurnal pattern are consistent with hypothalamic pituitary axis (HPA) dysregulation.

Case Study: Child

5-year-old female

Florida
Adopted

N.A.S.

Polysubstance
APGAR Score
1 – 3 -- 5
Months of withdrawals

Behavior

Aberrant behaviors of an addict: focus, mood, sleep, pain,
relationship issues, etc.
Concern of biological family history

Test Don't Guess

- **Catechol-O-methyltransferase:** more prone to prolonged episodes of anxiety, depression, and OCD.
- **Glutamic Acid Decarboxylase:** associated with sleep disorders, "half glass empty" syndrome, dysphoria, and spasticity.
- **TPH2:** associated with psychiatric diseases such as bipolar affective disorder, anxiety, and major depression.
- **SLC6A4:** associated with increased risk of anxiety and depression and less effective response to SSRI medications.

		(-/-) No clinical abnormality	(+/-) Heterozygous result	(+/+) Homozygous result			
rsID	Gene	Genetic Result	Therapeutics Associated With Positive Result	Highly Recommended Therapeutics / Neurobiologix Formulas	Provider Discretion: As Needed Formula Recommendations	Lifestyle Recommendations	Laboratory Recommendations
Neurological / Psych							
Neurotransmitters							
rs4680★	COMT V158M	+/-					
rs769407	GAD1	-/-					
rs3827275★	GAD1	+/+					
rs6323	MAO-A	-/-					
rs1799836	MAO-B	-/-					
rs6313	HTR2	-/-					
rs1042173★	SLC6A4	+/+					
rs4570625★	TPH2	+/-					



TEST DON'T GUESS

- **Elevated Serotonin:** increased anxiety, agitation, and diarrhea (IBS-like symptoms).
- **Elevated Dopamine:** increased worry, distrust of others, decreased ability to interact socially, and is often found in patients with attention deficits and hyperactivity.
- **Low Norepinephrine:** depression and mood changes as well as fatigue, difficulty concentrating, decreased ability to stay focused on tasks, and diminished sense of personal/professional drive.
- **Upper Range Glutamate:** anxiety, poor concentration, attention deficits, hyperactive tendencies, poor sleep, and nighttime awakening.
- **Elevated GABA:** difficulty concentrating, diminished memory, dampened mood, decreased cognitive processing, fatigue, decreased exercise endurance, sleepiness, and an inability to feel alert.

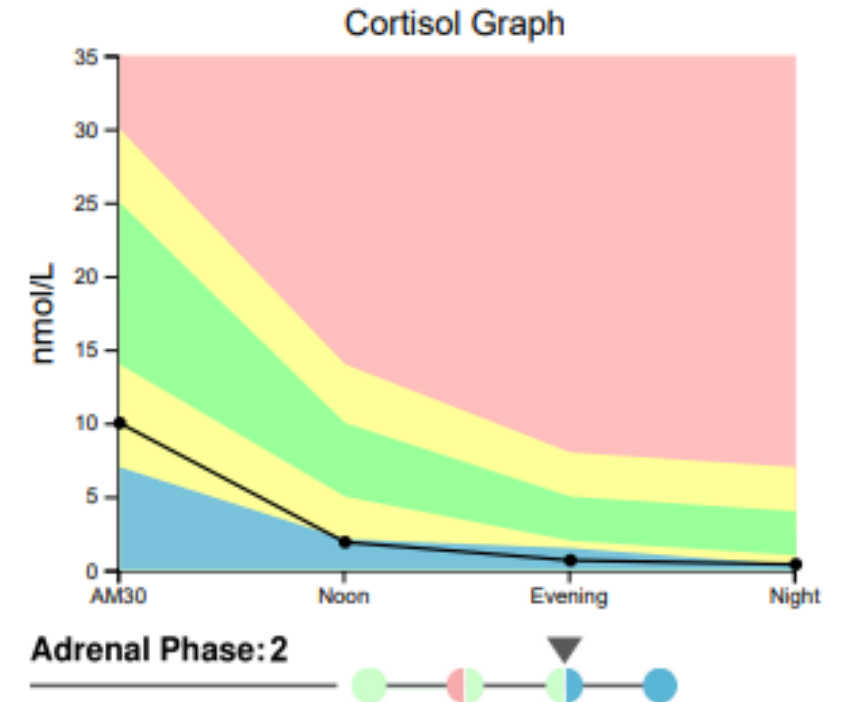
Analyte	Result	Unit per Creatinine	L	WRI	H	Reference Interval
Serotonin	240	µg/g				79 – 235
Dopamine	598	µg/g				175 – 500
Norepinephrine	28.5	µg/g				29 – 69
Epinephrine	5.9	µg/g				2.1 – 14.5
Norepinephrine / Epinephrine ratio	4.8					< 13
Glutamate	46	µmol/g				18.0 – 70.0
Gamma-aminobutyrate (GABA)	10	µmol/g				2.6 – 8.0
Glycine	1824	µmol/g				700 – 2500
Histamine	20	µg/g				14 – 51
Phenethylamine (PEA)	108	nmol/g				42 – 160
Creatinine	107	mg/dL				25 – 180

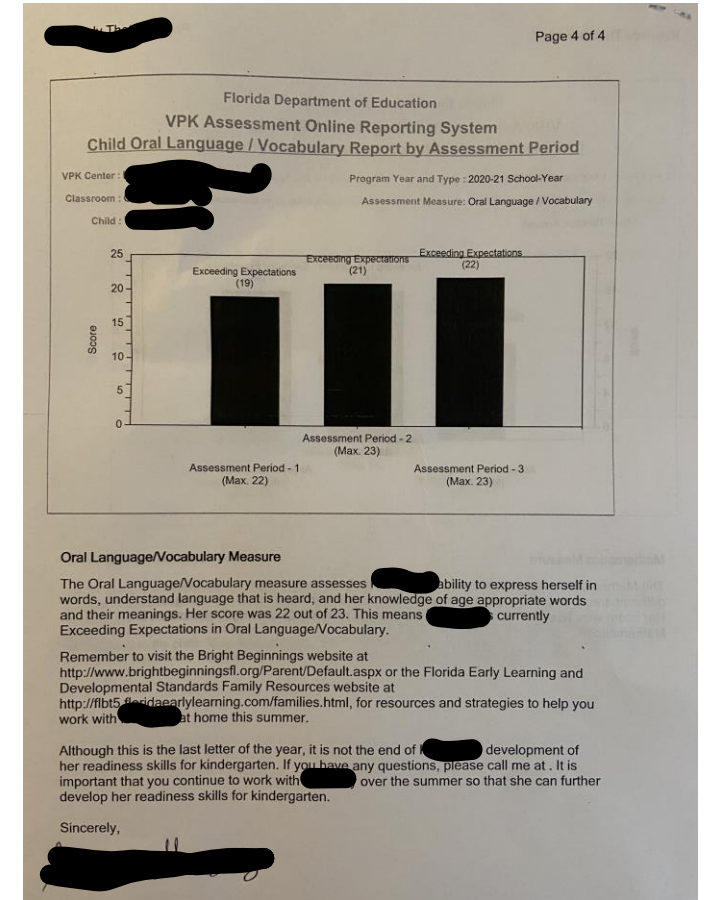
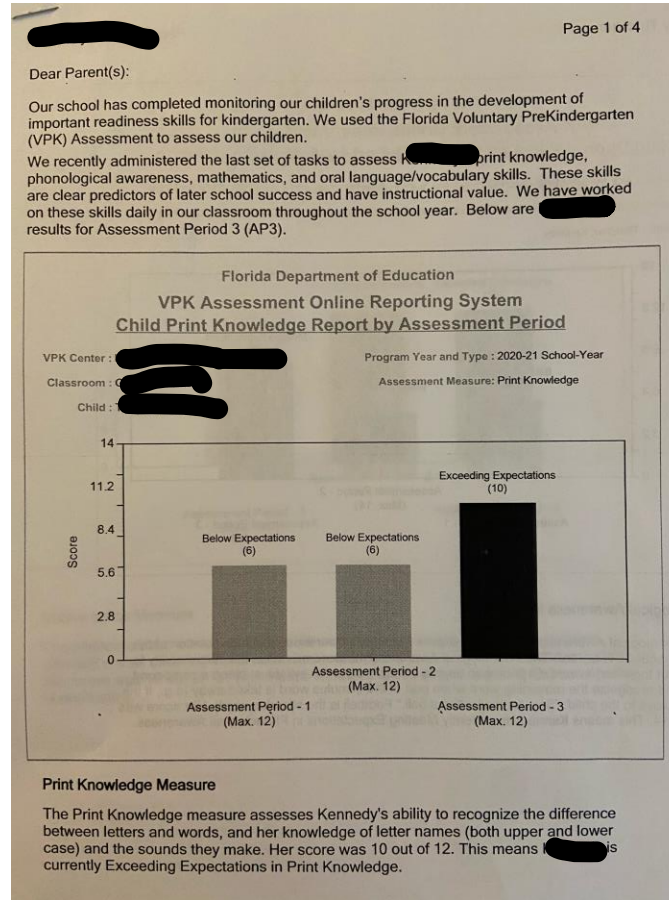
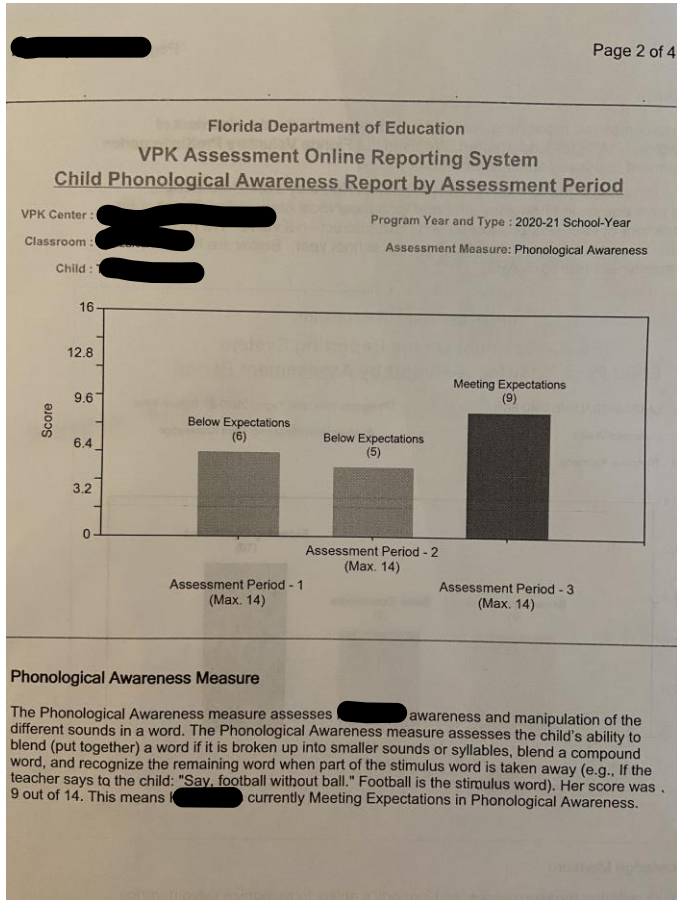


Test Don't Guess

Diurnal cortisol pattern is consistent with evolving (Phase 2) HPA axis (adrenal gland) dysfunction.

Analyte	Result	Unit	L	WRI	H	Optimal Range	Reference Interval
Cortisol AM30	10	nmol/L		◇		14.0 – 25.0	7.0 – 30.0
Cortisol Noon	1.9	nmol/L	↓			5.0 – 10.0	2.1 – 14.0
Cortisol Evening	0.66	nmol/L	↓			2.0 – 5.0	1.5 – 8.0
Cortisol Night	0.39	nmol/L		◇		1.0 – 4.0	0.33 – 7.0
DHEA*	<10	pg/mL		◇			< 220





The case study participant underwent testing & biochemical pathway support in Phase 3 of her Florida Department of Education VPK Assessment. This third-party, government standardized test objectively quantifies her learning, behavior, and cognitive improvement.

CHANGING LIVES THROUGH THE INCLUSION OF OBJECTIVE TESTING & BIOCHEMICAL PATHWAY SUPPORT



Thriving in her homelife, academic life, and piano lessons.

Went on to receive the Character Award in school for her willingness to help others and for her leadership qualities.

Behavioral Health Equity Amongst Pregnant Population & Drug Prevention Tool in Children

Pregnant Mothers

- Without testing to objectively quantify the biological component of behavioral health complexities, symptoms are easily dismissed, remain untreated, and mothers search for means to reduce symptoms.
 - Contributing factors may include history of SUD, reduced perception of harm with marijuana, fear of mental health judgement.
- Rather than self medicating to reduce anxiety, depression, lack of focus, insomnia, etc., testing can determine which biomarkers require intervention.
 - Shifts conversation from character defect, mental weakness, and moral flaw to a conversation supported by objective biological data with no room for stigma or bias.

Children

- For children born to mothers with history of use during pregnancy who are showing signing of behavioral health complexities:
 - Determining biochemical pathways requiring support rather than subjective interpretation of behavior or empirically prescribed pharmaceuticals can contribute to optimization of physiology and outcomes.
- Prevention Tool



Finishing Where We Started:
Focus Less on The How and More on
The Why Through Biomarkers

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