Clinical Utility of Neurotransmitter Testing

Kate Placzek, PhD
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Today’s Presenters

David Zava, PhD

Kate Placzeck, PhD
Meet Kate Placzek, PhD

Dr. Placzek is the Senior Research Scientist at ZRT Laboratory.

She received her doctorate from Purdue University in Medicinal Chemistry and Molecular Pharmacology; and performed her postdoctoral studies at Oregon Health and Science University.

At ZRT Laboratory, Dr. Placzek is spearheading the neurotransmitter project.
Disclosure

Neurotransmitter test is not intended to diagnose, treat, cure, or prevent any disease. Statements regarding supplementation have not been evaluated by the Food and Drug Administration.
MOOD DISORDERS

- Environmental
- Psychological
- Social
- Genetic
- Spiritual
Staggering Statistics for American Adults

- 7% live with major depression
- 18% live with anxiety disorders (panic, OCD, PTSD, phobias)
  - Mood disorders are the 3rd most common cause of hospitalization for individuals aged 18-44

Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010

Top-prescribed and Top-selling Prescription Drugs in the US

- Antipsychotics
- Antidepressants
- Attention-deficit disorder drugs

Vast Individual Variability Response to Treatment of Depression

Proximal Causality of Mood Disharmony

- Thyroid hormones
- Sex steroids
- Adrenal cortisol & DHEA
- Neurotransmitters
“We have convinced ourselves that we have developed cures for mental illnesses... when in fact we know so little about the underlying neurobiology of their causes that our treatments are often a series of trials and errors.”
Benefit From Biomarkers in Psychiatry

- Objective peripheral physiological indicators
- Predict probability of onset or presence of disorder
- Stratify according to severity
- Indicate prognosis
- Track therapeutic intervention

Gururajan, et. al. (2016) Neuroscience and Biobehavioral Reviews 64
Molecular Biomarkers of Depression.
"If we consider the established criteria required for a biomarker to correspond to or indicate psychiatric symptoms, urinary neurotransmitter analysis meets these necessary requirements," Dr. Amnon Kahane.
Current Tests Offered By ZRT

Steroid Hormones & Metabolites
- Anxiety
- Mood swings
- Cravings
- PCOS
- Low libido
- Headaches
- Irritability
- PMS

Adrenals
- Changes in blood pressure
- Insomnia
- Persistent distress
- Changes in blood glucose levels
- Fatigue
- Weight fluctuations
- Low libido

Thyroid
- Insomnia
- Memory loss
- Irritability
- Headaches
- Fatigue

Heavy Metals
- Weight fluctuations
- Insomnia
- Feeling cold
- Mental fog
- Low libido
- Mood swings
- Fatigue
Neurotransmitter Testing – Complementary Addition to the Existing Profiles

- Steroid Hormones & Metabolites
  - Anxiety
  - Mood swings
  - Cravings
  - PCOS
  - Low Libido
  - Headaches
  - Irritability
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- Thyroid
  - Weight fluctuations
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  - Feeling cold
  - Mental fog
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ZRT Neurotransmitter Test

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<th>Excitatory Neurotransmitters</th>
<th>Inhibitory Neurotransmitters</th>
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<td>• Glutamate</td>
<td>• Serotonin and 5-HIAA</td>
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<td>• Histamine</td>
<td>• GABA</td>
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<tr>
<td>• PEA</td>
<td>• Glycine</td>
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<td>• Epinephrine (adrenalin) and VMA</td>
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<td>• Norepinephrine and Normetanephrine</td>
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<td>• Dopamine, DOPAC and HVA</td>
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Inhibitory Neurotransmitters

• Serotonin, generally regarded as the “happiness molecule,” contributes to the feelings of calm and well-being that eases depression and anxiety, supports sleep, and decreases appetite.

• GABA functions as the “off” switch in the brain as the major inhibitory neurotransmitter in the brain that improves mood, relieves anxiety, and promotes sleep.

• Glycine plays a dual role as a neurotransmitter and amino acid that serves as a building block to proteins, improves sleep quality, calms aggression, and serves as an anti-inflammatory agent.
Serotonin
“happiness molecule”

- Decreases anxiety
- Improves Sleep
- Modulates clotting
- Regulates cognition/learning/memory
- Stimulates gut motility
- Suppresses appetite and libido
- Controls thermoregulation and vasoconstriction/dilation
Serotonin Biosynthesis, Storage & Elimination

brain ~ 10%

storage

gut ~ 90%

metabolism

elimination
Serotonin Metabolism

![Diagram of serotonin metabolism]

- **AADC** = aromatic l-amino acid decarboxylase
- **AAMT** = arylalkylamine N-methyltransferase
- **AR** = aldehyde reductase
- **HIMT** = hydroxyindole O-methyltransferase
- **MAO** = monoamine oxidase
- **M6H** = melatonin 6 hydroxylase
- **M6ST** = melatonin 6 sulfotransferase
- **TYH** = tryptophan hydroxylase
- **MT6S** = 6-sulfatoxymelatonin
- **5-HIAA** = 5-hydroxyindole 3-acetic acid
High Serotonin in Urine Symptom Profile

- Anxiety
- Bone loss
- Carcinoid syndrome
- Celiac disease
- Diarrhea
- High blood pressure
- Hypercortisolism
- Irritability
- Low libido
Low Serotonin in Urine Symptom Profile

- Anxiety
- Depression
- Change in appetite
- Cravings
- Excessive worry
- Hot flashes
- Hunger
- Insomnia
- Low mood
- Migraines
- OCD
- Sensitivity to pain
Serotonin Support

• Cofactor support:
  – High serotonin: copper (with zinc), Acetyl Coa, SAMe
  – Low serotonin: vitamin B6

• Tryptophan, 5-HTP

• L-theanine

• Probiotics

• Bright light, diet, exercise, self-induced positive mood
# Food Sources of Tryptophan

- Avocados
- Bananas
- Beans
- Cantaloupe
- Chicken
- Corn
- Dairy
- Eggplant
- Eggs
- Fish
- Grains
- Grapefruit
- Kiwi
- Lentils
- Meats
- Nuts
- Pineapple
- Plantains
- Pork
- Rice
- Seeds
- Tomatoes
- Tuna
- Turkey
- Wheat
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GABA
the “off” switch

- Attention
- Blood flow/pressure
- Catecholamine release
- Cytokine and hormone production
- GI acid secretion
- Memory/mood/sleep
- Stress management
GABA Metabolism and Imbalance Symptoms

**HIGH GABA IN URINE**
- Anxiety
- Excessive need for sleep
- Lethargy
- Ovarian cancer

**LOW GABA IN URINE**
- Anxiety
- Inability to focus
- Low energy
- Panic attacks
- ADHD
- Tourette syndrome

\[
\text{Glutamine} \xrightarrow{GMSY, \text{Mg}, \text{Mn}} \text{Glutamate} \xrightarrow{\text{GADC}} \text{GABA}
\]

- \text{GA} = \text{glutaminase}
- \text{GADC} = \text{glutamate decarboxylase}
- \text{GMSY} = \text{glutamine synthetase}
GABA Support

- GABA
- L-theanine
- Vitamin B6
- Probiotics
- Yoga

Herbal Supplements:
- Ashwagandha
- Ginkgo biloba
- Gotu Cola
- Kava kava
- Lemon balm
- Magnolia bark
- Phellodendron bark
- Skullcap
- Valerian root

Food sources:
- Brewer’s yeast
- Dairy
- Eggs
- Fish/seafood
- Fermented foods
- Legumes
- Nuts/seeds
- Whole grains
Inhibitory Neurotransmitters

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Glycine
amino acid and neurotransmitter

- Anti-inflammatory agent
- Calms aggression
- Improves sleep quality
- Regulates locomotion
- Stabilizes blood sugar

SerHMT = serine hydroxymethyl transferase
THrA = threonine aldolase
Excitatory Neurotransmitters

- Glutamate functions as the “on” switch in the brain as the major excitatory neurotransmitter in the brain that decreases sleep, optimizes learning, memory, and mood, and improves libido.

- Histamine plays a dual role in the body as a neurotransmitter and immunomodulator that increases metabolism, promotes wakefulness, and suppresses appetite.

- PEA promotes energy, elevates mood, regulates attention, aggression, and serves as a biomarker for ADHD.

- Epinephrine and norepinephrine function as neurotransmitters and hormones that regulate the “fight or flight” response and elevate blood pressure and heart rate, stimulate wakefulness, and reduce digestive activity.

- Dopamine generally regarded as the brain’s pleasure and reward center, plays the central role in addiction, improves attention, focus, and motivation, and modulates movement control.
Glutamate
the “on” switch

- Regulates appetite
- Cognition/learning/memory
- Increases gut motility
- Improves libido
- Decreases sleep
Glutamate Metabolism

Glutamine

Glutamate

GABA

GA = glutaminase
GADC = glutamate decarboxylase
GMSY = glutamine synthetase
Glutamate Imbalance Symptoms

**HIGH GLUTAMATE IN URINE**
- Anxiety
- Autism
- Bipolar disorder
- Celiac disease
- Depression
- Hyperthyroidism
- Insomnia
- OCD
- Panic
- Stroke

**LOW GLUTAMATE IN URINE**
- Agitation
- Chronic fatigue
- Depression
- Insomnia
- Lethargy
- Migraines
Glutamate Support

• LOW GLUTAMATE:
  – L-glutamine

• HIGH GLUTAMATE:
  – GABA, L-theanine, taurine
  – Vitamin B6
  – Vitamin E
  – N-acetyl cysteine
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Histamine
neurotransmitter and immunomodulator

- Decreases sleep
- Increases metabolism
- Potent vasodilator
- Pro-inflammatory agent
- Prevents weight gain
- Stimulates gastric acid production
- Stimulates wakefulness
- Suppresses appetite
Histamine Metabolism

Histidine

Pyridoxal phosphate

HC

Histamine

SAMe

HNMT

N-methylhistamine

FAD copper

MAO

N-methylimidazole acetic acid

**HNMT** = histamine N-methyl transferase

**MAO** = monoamine oxidase
# Histamine Imbalance Symptoms

<table>
<thead>
<tr>
<th>HIGH HISTAMINE IN URINE</th>
<th>LOW HISTAMINE IN URINE</th>
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<tbody>
<tr>
<td>• Allergies</td>
<td>• Easy frustration</td>
</tr>
<tr>
<td>• Burns</td>
<td>• Lethargy</td>
</tr>
<tr>
<td>• Cystitis</td>
<td>• Low libido</td>
</tr>
<tr>
<td>• Depression</td>
<td>• Mild depression</td>
</tr>
<tr>
<td>• Flushing disorder</td>
<td>• Tension headaches</td>
</tr>
<tr>
<td>• Food allergies</td>
<td>• Weight gain</td>
</tr>
<tr>
<td>• Headaches/migraines</td>
<td></td>
</tr>
<tr>
<td>• Insomnia</td>
<td></td>
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<tr>
<td>• OCD</td>
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Histamine Support

- **LOW Histamine:**
  - Histidine

- **HIGH Histamine:**
  - Flavonoids
  - Low histamine diet
  - Antihistamines

**Herbal Supplements:**
- (flavonoids)
  - Bilberry extract
  - Citrus bioflavonoids
  - Ginko biloba
  - Grape seed extract
  - Green tea extract
  - Hawthorn extract
  - Quercetin

**Food sources:**
- Beer
- Champagne
- Cheese (aged)
- Eggplant
- Fish
- Meat
- Red wine (vinegar)
- Sauerkraut
- Spinach
Excitatory Neurotransmitters

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- Dopamine generally regarded as the brain’s pleasure and reward center, plays the central role in addiction, improves attention, focus, and motivation, and modulates movement control.
PEA promotes energy, elevates mood, regulates attention

- Biomarker for ADHD
- Inhibits dopamine, norepinephrine, and serotonin reuptake
- Regulates aggression
PEA Metabolism

Phenylalanine $\rightarrow$ Tyrosine $\rightarrow$ Phenylacetic acid $\rightarrow$ PEA $\rightarrow$ N-methyl-PEA

- AADC = aromatic L-amino acid decarboxylase
- AAAH = bipterin-dependent aromatic amino acid hydrolase
- MAO = monoamine oxidase
- PNMT = phenylethanolamine N-methyltransferase
PEA Metabolism and Imbalance Symptoms

**LOW PEA IN URINE**
- Autism
- ADHD
- Bulimia nervosa
- Depression
- Inattentiveness
- Memory issues
- Parkinson’s disease
- Tourette syndrome
- Weight control difficulties

**HIGH PEA IN URINE**
- Amphetamine
- Anxiety and insomnia
- Bipolar disorder
- Exercise
- Schizophrenia
- Postpartum period

LOW PEA IN URINE

HIGH PEA IN URINE
PEA Support

- **LOW PEA:**
  - PEA
  - Phenylalanine
  - Vitamin B6

- **HIGH PEA:**
  - SAMe

**Food Sources:**
- Beans
- Chocolate
- Cocoa nibs
- Eggs
- Natto
- Peas
Excitatory Neurotransmitters

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Epinephrine and Norepinephrine
“fight or flight”
Epinephrine and Norepinephrine Metabolism
Epinephrine and Norepinephrine HIGH Levels in Urine

- ADD
- Anxiety and depression
- Bipolar disorder
- Hyperglycemia
- Hyperinsulemia
- Obesity (norepinephrine only)
- Obstructive sleep apnea
- PTSD
- Stress
Epinephrine and Norepinephrine LOW Levels in Urine

- Alzheimer’s disease
  - Anorexia
- Attention impairment
  - Depression
  - Fatigue
  - Hypotension
  - Low mood
- Obesity (epinephrine only)
Excitatory Neurotransmitters

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- Dopamine generally regarded as the brain’s pleasure and reward center, plays the central role in addiction, improves attention, focus, and motivation, and modulates movement control.
Dopamine
“pleasure center”

• GI function
• Helps with decision making
• Improves attention
• Increases blood pressure
• Inhibits lactation
• Modulates immune function
• Promotes arousal
• Regulates sodium excretion
Dopamine Metabolism
Urinary Dopamine is Biosynthesized in the Kidneys
Dopamine Imbalance

**HIGH DOPAMINE IN URINE**

- Anxiety
- Hyperactivity
- Inability to focus
- Increased sodium intake
- Insomnia
- Mercury toxicity
- Mood swings
- Pheochromocytoma
- PTSD
- Stress

**LOW DOPAMINE IN URINE**

- Addiction
- Alzheimer’s disease
- Anorexia nervosa
- Anxiety with depression
- Apathy
- Cravings
- Fatigue
- Fibromyalgia
- Impulsivity
- Insomnia
- Low libido
- Low mood
- Memory issues
- Periodic limb movement disorder
# Catecholamine Support

## Food Sources:
- Avocados
- Bananas
- Beans
- Chocolate
- Coffee
- Hazelnuts
- Oranges
- Pineapples
- Potatoes
- Spinach
- Tea
- Tomatoes
- Wine

## LOW:
- Cofactor support

## HIGH:
- Cofactor support
- Tyramine
- Tyrosine
- Phenylalanine
When to Test?

Persistent inability to cope with stress causes failure to thrive.
NEUROTRANSMITTERS

A home-collection test to assess neurotransmitter levels that affect overall health and well-being.
WHAT THE FUTURE HOLDS

Steroid Hormones & Metabolites

Adrenals

Heavy Metals

Thyroid

Neuro transmitters

Anxiety
Mood swings
Cravings
PCOS
Low Libido
Headaches
Irritability
PMS

Changes in blood pressure
Insomnia
Persistent distress
Changes in blood glucose levels
Fatigue
Weight fluctuations
Low Libido

Insomnia
Memory loss
Irritability
Headaches
Fatigue

Weight fluctuations
Insomnia
Feeling cold
Mental fog
Low Libido
Mood swings
Fatigue
THANK YOU!

QUESTIONS

Please address any additional questions to Dr. Kate Placzek kaplaczezk@zrtlab.com