Pharmasan Labs provides proprietary enzyme-linked immunosorbent assays (ELISA) that assess neurotransmitters in the urine. Below is a summary of published research supporting the accuracy and clinical use of urinary neurotransmitter testing.

**Proprietary ELISA Testing for Urinary Neurotransmitters from Pharmasan Labs is Highly Specific, Accurate, Reproducible, and Precise**

- **Highly specific**
  - No interference from endogenous urinary matrix components or common drugs (Nichkova, et al 2012; Nichkova, et al 2013)

- **Accurate and high reproducibility**
  - Validated against liquid chromatography tandem mass spectrometry (LC-MS/MS) and high-performance liquid chromatography (HPLC)
    - Statistically identical (Huisman, et al 2010)
    - Excellent correlation across reference ranges (r=0.965) (Nichkova, et al 2012)

- **Reliable reproducibility**
  - 3.9%-9.8% variation (inter- and intra-assay) (Huisman, et al 2010)

- **Baseline testing variance**
  - Shows no significant variation across 3-day to 3-week timeframe (Nichkova, et al 2012)

- **Urinary neurotransmitters reflect whole-body excretion**
  - Kidneys are not major contributors to urinary neurotransmitter pool (Eisenhofer, et al 1996)
  - Neurotransmitters are shuttled from the central to peripheral nervous system (Marc, et al 2011)

**Clinical Applicability of Urinary Neurotransmitter Testing for Assessing and Addressing Health Concerns is Well-Documented**

- **Depression**
  - “[Urinary] serotonin levels detected in depressed patients were significantly lower than in non-depressed subjects.” (Nichkova, et al 2012)
  - “Paroxetine treatment was associated with an increase in serotonin concentration in urine sampled after the first dose.” (Kotzailias, et al 2004)

- **Anxiety**
  - “Major depression is associated with a hyperactive sympathoadrenal system that can also lead to sleep disorders and anxiety.” (Maes, et al 1993)

- **Insomnia**
  - “Catecholamines and polysomnographic indices of sleep disturbance in chronic insomnia are consistent with previous studies that showed elevated urinary catecholamines in chronically stressed subjects who experience sleep disturbance…” (Vgontzas, et al 1998)

- **Fatigue**
  - “Disturbance of the [hypothalamic-pituitary-adrenal] HPA axis may be important in the pathophysiology of chronic fatigue syndrome (CFS) and fibromyalgia. Symptoms may be due to: (1) low circulating cortisol; (2) disturbance of central neurotransmitters; or (3) disturbance of the relationship between cortisol and central neurotransmitter function.” (Parker, et al 2001)
  - “A single oral dose of tyrosine (100 or 150 mg/kg) caused significant increases in urinary levels of norepinephrine (NE), epinephrine (E), dopamine (DA), 3-methoxy-4-hydroxyphenylglycol (MHPG), vanilmandelic acid (VMA), and homovanillic acid (HVA) during the first 2 hours after its ingestion; water administration failed to produce such changes.” (Alonso, et al 1982)

- **Attention Deficit-Hyperactive Disorder**
  - “Decreased [urinary] PEA [phenylethylamine] levels have been associated with symptoms of inattentiveness.” (Berry, 2004)
  - “… [urinary] PEA levels significantly increased after methylphenidate therapy in responders, whereas they did not increase in nonresponders…” (Kusaga, et al 2002)
References