

Pharmacogenetic Testing at The Arroyos

We are pleased to announce the addition of pharmacogenetic testing to our integrated psychiatric and psychological services. The Arroyos team strives to continuously update and expand our clinical services in our ongoing commitment to providing you with superior patient care.

What is Pharmacogenetic Testing?

Pharmacogenetic testing (sometimes referred to as pharmacogenomic testing) is a simple laboratory procedure that helps your psychiatrist personalize your medication treatment based on your genetic makeup. Every person's body has an individualized way of responding to psychiatric medications based on their unique DNA. With your pharmacogenetic test results, your doctor has a deeper understanding of how your genes influence the relationship between medications and your body.

How Do My Genes Affect the Choice of My Medications?

It's common for one person to rave about the benefits of a particular drug, while another person complains about a host of side effects from the same medication. A third person finds the drug to be neither helpful nor unhelpful. How can the same medication produce such variable outcomes among different people?

One reason is because of differences in their genetic makeup. While all human beings share virtually the identical set of genes, small variations in these genes can cause the same psychiatric medication to affect people quite differently. **Pharmacodynamic genes** influence how the drug affects the body. If you have variations in these genes, this may help the doctor select medications that are a better fit for your genetic makeup. **Pharmacokinetic genes** influence how the body affects the medicine. If you have variations in these genes, this will help the doctor when giving you dosing guidelines.

What's the Next Step?

Let your Arroyos psychologist or psychiatrist know, and we will get you started and register you in our laboratory portal. If you are seeing your doctor in-person, a staff member will give you a test kit. If you are a telehealth patient, we will have a test kit sent to you. When you open the kit, simply swab the inside of your cheek with a q-tip type device, and then send the specimen into the lab. The procedure is painless and takes just a few minutes. After your insurance and any copayment are processed, a report of your results for 24 genes is prepared within a few days and uploaded into our portal. You can see a summary of this report on the second page of this handout.

Your psychiatrist will review your pharmacogenetic test results at your next visit and discuss medication options with you. Your psychologist can also provide you with psychoeducation to better understand the relationship between your genes and your experience with medications based on your test results.

What Is the Cost?

A laboratory billing representative will talk with you and let you know what type of coverage your insurance provides. Most patients pay \$325 or less after insurance coverage. The Arroyos is not involved in billing and does not receive any fees or payment for referring you for testing or processing your specimen in our portal.

GENOMIND® PROFESSIONAL PGx EXPRESS™ ANALYZES TWO TYPES OF GENES TO INFORM TREATMENT.

PHARMACODYNAMIC genes indicate the effect a drug has on the body and may inform drug candidate selection.

PHARMACOKINETIC genes indicate the effect the body has on the drug and may inform drug dosage.

The FDA requires labeling on over 260 medications to include pharmacogenetic biomarker information due to specific gene-drug associations³

INCLUDES TWO REPORT OPTIONS:

1. CORE Anxiety & Depression Report (15 Genes) Includes 15 key genes used to inform treatment decisions for anxiety and depression

	Gene	Physiological Role	Impact of Mutation	Treatment Impact
Pharmacodynamic	Serotonin Transporter (SLC6A4)	Protein responsible for reuptake of serotonin from the synapse	Associated with increased side effects or poorer response to SSRIs	Monitor for adverse events with SSRIs, or assess alternatives to SSRIs . SNRIs or other non-SSRI antidepressants may be considered if clinically indicated
	Serotonin Receptor 2A (HTR2A)	A serotonin receptor which is a target for several serotonergic drugs	Associated with response to certain antidepressants	May prompt consideration of citalopram
	Brain-derived Neurotrophic Factor (BDNF)	Important protein for proper neuronal development and neural plasticity	Impaired BDNF secretion, which may be associated with response to some antidepressants or exercise	Increased physical activity/exercise may be more beneficial for Met carriers if clinically indicated. Ethnicity dependent response to SSRIs vs SNRIs
	Methylenetetrahydrofolate Reductase (MTHFR, A1298C, C677T)	Predominant enzyme that converts folic acid/folate to its active form (methylfolate) needed for synthesis of serotonin, dopamine, and norepinephrine	Associated with variable activity and conversion of folic acid/folate to methylfolate	Supplementation with L-methylfolate may be considered if clinically indicated
	Catechol-O-Methyltransferase (COMT)	Enzyme primarily responsible for the degradation of dopamine in the frontal lobes of the brain	Altered dopamine states can have emotional/behavioral effects and impact response to dopaminergic agents or opioids	Val/Val: Dopaminergic stimulants and/or TMS/ECT may be considered if clinically indicated; Decreased sensitivity to opioids Met/Met: Assess alternatives to dopaminergic stimulants. 2nd generation antipsychotics may be considered for psychotic-related disorders if clinically indicated ; Increased sensitivity to opioids
	Melanocortin 4 Receptor (MC4R)	Receptor that plays a role in the control of food intake	Associated with differential weight gain risk with 2nd generation antipsychotics	Assess weight gain risk with 2nd generation antipsychotics ; anti-obesity therapies may be considered to mitigate weight gain if clinically indicated
	Major Histocompatibility Complex 1,A (HLA-A 31:01)	Human Leukocyte Antigen-A	Associated with risk of skin reactions to carbamazepine	Do not initiate carbamazepine
Pharmacokinetic	Major Histocompatibility Complex 1,B (HLA-B 15:02)	Human Leukocyte Antigen-B	Associated with risk of skin reactions to carbamazepine, oxcarbazepine, phenytoin, fosphenytoin and possibly lamotrigine, phenobarbital and eslicarbazepine	Do not initiate carbamazepine, oxcarbazepine, phenytoin or fosphenytoin. Caution with lamotrigine, eslicarbazepine, or phenobarbital
	Cytochrome P450 (CYP450) - CYP2D6 - CYP3A4/5 - CYP2C19 - CYP2C9 - CYP1A2 - CYP2B6 (6 separate genes)	Most psychiatric medications are metabolized by CYP450s	May influence exposure to certain psychotropic medications	Dose adjustment (an increase or decrease) may be considered
	UDP Glucuronosyltransferase (UGT2B15)	Several psychiatric medications are metabolized by UGT	May influence exposure to certain psychotropic medications	Dose adjustment (an increase or decrease) may be considered

2. FULL Mental Health Report (24 Genes) Full Mental Health Report includes 24 key genes used to inform treatment for a range of psychiatric conditions such as depression, anxiety, attention deficit hyperactivity disorder (ADHD), bipolar, substance abuse and more. **Includes all genes above as well as the following:**

	Gene	Physiological Role	Impact of Mutation	Treatment Impact
Pharmacodynamic	Serotonin Receptor 2C (5HT2C)	Receptor involved in regulation of satiety	Associated with differential weight gain risk with 2nd generation antipsychotics	Assess weight gain risk with 2nd generation antipsychotics ; Anti-obesity interventions may be considered if clinically indicated
	Alpha-2A Adrenergic Receptor (ADRA2A)	Receptor involved in norepinephrine signaling	Associated with variable response to methylphenidate	Methylphenidate may be considered if clinically indicated
	Sodium Channel (ANK3)	Protein that plays a role in sodium channel function and regulation of excitatory signaling	Associated with conditions characterized by mood instability/lability	Mood stabilizers may be considered if clinically indicated
	Calcium Channel (CACNA1C)	A subunit of the calcium channel which mediates excitatory signaling	Associated with conditions characterized by mood instability/lability	Mood stabilizers may be considered if clinically indicated
	Dopamine Receptor D2 (DRD2)	Receptor affected by dopamine in the brain	Associated with slower or poorer response to antipsychotics. Associated with small increased risk of opioid dependence in Asians	Assess dose, alternatives or adjuncts to antipsychotics. Assess non-genetic risk factors for opioid dependence
	Glutamate Receptor Kainate 1 (GRIK1)	An excitatory neurotransmitter receptor in the brain	Associated with response to topiramate for alcohol abuse	Topiramate may be considered for treatment of alcohol abuse if clinically indicated
Pharmacokinetic	µ-Opioid Receptor (OPRM1)	Opioid receptor affected by endogenous and exogenous opioids	Associated with differential opioid sensitivity. Associated with response to naltrexone for alcohol use disorder	Monitor opioid dose response. Naltrexone consideration for alcohol use disorder
	UDP Glucuronosyltransferase (UGT1A4)	Several psychiatric medications are metabolized by UGT	May influence exposure to certain psychotropic medications	Dose adjustment (an increase or decrease) may be considered
	ATP Binding Cassette B1 (ABCB1)	Protein that impacts absorption or brain penetration of certain drugs	Associated with response or sensitivity to select opioids, antipsychotics or antidepressants	Increased exposure possible for select opioids & antipsychotics, as well as citalopram, escitalopram, fluvoxamine, paroxetine, venlafaxine, amitriptyline, nortriptyline and trimipramine.