DIET, NUTRITION & EXERCISE
YOUR PERSONAL GENETIC REPORT

Protected Health Information
**Personal Details**

- **Name**: PPPPP SAMPLE
- **DOB**: Jan 3, 1950
- **Sex**: Female
- **Ethnicity**: Not Reported
- **Report Date**: N/A
- **Received Date**: Jun 29, 2017

**Laboratory Info**

- **Accession #**: H4220787
- **Activation Code**: SKNIQ-TESTP
- **Specimen Type**: Buccal Swab
- **Collected Date**: Jun 1, 2017

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## YOUR MATCHING DIET

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YOUR MATCHING DIET

I should eat a variety of fruits, vegetables, whole grains, lean proteins and healthy fat. I should avoid processed foods, trans fats and added sugars.

Your diet has been selected by looking at many genetic variants associated with how people respond to the different macronutrients (proteins, fats and carbohydrates) in their food. Your genetic risk profiles for metabolic health factors were also evaluated to determine your recommended diet. Together, your genetic results suggest which one of the following diets may be best for you: "Low Fat," "Low Carb," "Mediterranean" or a "Balanced Diet." It is highly recommended to discuss any change in your diet plan with your health care provider.

RECOMMENDATIONS

- Eat a diet lower in fat instead of a low carbohydrate, Mediterranean or other diet.
- Try to tame your eating behaviors. You have a genetic variant associated with an increased food desire, and you may be willing to put in extra effort to get the foods you like. Therefore, you may have to work harder at self-control.
- You may indulge more than average on tempting foods, as you have a genetic marker associated with eating disinhibition. Reduce your exposure to foods that tempt you.
- As someone who has enhanced bitter taste perception, you may not like the taste of certain healthy vegetables, such as broccoli or leafy greens. Try recipes that mask the bitter flavors without adding too many calories.
- You are less likely to be lactose intolerant, which means you may consume dairy products and not have gastrointestinal side effects. Choose dairy products that are lower in calories, fat and added sugar.
For people with your genotype, the polyunsaturated to saturated fat ratio in your diet does not affect body weight.

Fat is an important part of any diet, and not all fats are bad. Monounsaturated fat is considered a healthy dietary fat found in avocados, olives, and some nuts, as well as oils, such as olive oil. The two possible outcomes for this test are "Increased Benefit" or "Neutral." Having an "Increased Benefit" from monounsaturated fat suggests you could benefit from eating foods containing monounsaturated fats. In general, it is best to avoid trans fats and limit saturated fat intake.

Genetic variants in two genes, ADIPOQ and PPARG, have been associated with a lower body weight in individuals when more than 13% of their calories come from monounsaturated fats. This would be equivalent to a person on an 1800 calorie diet consuming about 1 to 2 tablespoons of olive oil and a quarter cup of nuts each day as part of their total caloric intake. While the ADIPOQ study was done in a population of both men and women, the PPARG study was done only in women. There is not enough scientific evidence to support if the PPARG association is also true in men.

**YOUR RESULT**

**NEUTRAL**

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People with your genotype who eat a diet containing healthy monounsaturated fats (more than 13% of total calories) tend to have a lower body weight than those who do not.

Polyunsaturated fat is considered a healthy fat and is important for heart and brain function, as well as growth and development. Two types of polyunsaturated fats are omega-6 and omega-3 fats. Good sources of omega-6 fats include evening primrose and borage oils, as well as olives, nuts and poultry. Additionally, good sources of omega-3 fats include fish and seafood, as well as flaxseed, walnuts, hemp seeds, and dark green leafy vegetables.

The two possible outcomes in this report are "Increased Benefit" or "Neutral." Having an "Increased Benefit" from polyunsaturated fat means you should try to eat foods containing polyunsaturated fats. In general, it is best to avoid trans fats and minimize saturated fats. One study in women has shown that those with a certain genetic variant in the PPARG gene tend to have a lower body weight when they consume more polyunsaturated fats than saturated fats. This association has not been studied in men.
People with your genotype were found to have typical blood levels of an important omega-6 fat and an important omega-3 fat.

Polyunsaturated fats (PUFAs) in our diet are composed of omega-6 and omega-3 fatty acids, both of which are recommended by the American Heart Association (AHA) for good heart health. Long-chain PUFAs are provided by our diet, but can also be synthesized in our bodies starting from the precursor essential fatty acids, linoleic acid (LA, omega-6) and alpha-linolenic acid (ALA, omega-3). Both omega-6 and omega-3 fats are processed in the body by the same enzyme complex. The major dietary sources of omega-3 fatty acids include foods, such as flaxseed and walnuts, as well as fish oils and fish such as salmon. Processed foods often contain high levels of omega-6, while healthy sources of omega-6 include evening primrose and borage oils, as well as olives, nuts and poultry. Historically, the ratio of omega-6 to omega-3 fats in the diet was maintained close to a healthy 1:1, while in the current Western diet it is estimated to be about 15:1.

In recent genome-wide association studies that included over 10,000 people, it was found that those with the C/C or C/T genotypes at a variant in the FADS1 gene, which codes for one of the enzymes involved in processing omega-6 and omega-3 fats, had "Decreased" blood levels of arachidonic acid (AA), a long-chain omega-6 fat, as well as eicosapentaenoic acid (EPA), a long-chain omega-3 fat. On the other hand, those with a T/T genotype had "Typical" levels of these two omega-fats. Since both AA and EPA are precursors of biologically important metabolites, those with a "Decreased" outcome should increase their dietary intake of both omega-6 and omega-3 fatty acids. However, considering the current skewed ratio of omega-6:omega-3 fats, it is recommended that people monitor the intake of omega-6 fats from processed foods, while increasing their intake of omega-3 fats.
EATING BEHAVIOR TRAITS

SNACKING

Your genotype is not associated with extreme snacking behavior.

Snacking can be a healthy or unhealthy behavior. Snacking on balanced foods, containing healthy fats, lean protein, fiber and low glycemic index carbohydrates, in small portions, throughout the day can help control hunger cravings and reduce total caloric intake, while snacking on junk food can have negative health effects. Genetic markers associated with snacking behavior include variants in the receptor for leptin, an essential hormone for the regulation of food intake. The possible results in this report are "Typical" and "Increased." If you receive the "Increased" result, you may want to curtail the negative effects of snacking by choosing healthy snacks, eating slowly and reducing the size or calories of snacks. People with the G/G genotype in a leptin receptor (LEPR) genetic marker were more likely to show "Increased" snacking behavior. "Typical" genotypes were not associated with "Increased" snacking behavior in the same study. This association has not been studied in men.

YOUR RESULT
TYPICAL

EATING BEHAVIOR TRAITS

SATIETY - FEELING FULL

People with your genotype tend to feel full after a meal.

Satiety can be described as the feeling of fullness after you eat. The FTO (fat mass and obesity-associated) gene is known to be an important factor that predisposes a person to a healthy or unhealthy level of body weight. The two possible outcomes in this report are "Difficulty in Feeling Full" and "Typical." People who experience "Difficulty in Feeling Full" tend to eat more without feeling satisfied. To help manage this outcome, you could increase the amount of fiber in your diet and balance meals and snacks throughout the day. Examples of foods high in fiber include whole wheat bread, oatmeal, barley, lentils, black beans, artichokes, raspberries, and peas. In a 2008 study, the A/A genotype at rs9939609 in the FTO gene was associated with "Difficulty in Feeling Full." Although this study was done in children, there is preliminary data to support that the association also holds true in adults.

YOUR RESULT
TYPICAL
EATING BEHAVIOR TRAITS
EATING DISINHIBITION

Your genotype is associated with an increase in susceptibility for eating disinhibition.

Eating disinhibition describes the tendency to eat more than normal in response to a stimulus, such as a tasty food or in situations that trigger overeating (e.g., emotional stress or specific social situations). In a 2010 study, the T allele of rs1726866 was "More Likely" to be associated with eating disinhibition in women. The C/C genotype at the same marker was "Less Likely" to be associated with eating disinhibition. There is not enough scientific evidence yet to determine if this association also holds for men.

EATING BEHAVIOR TRAITS
FOOD DESIRE

Your genotype is associated with an increased desire or willingness to put forth additional effort to obtain your favorite foods.

Although there is no objective method to quantify someone’s feeling of hunger or liking for a particular type of food, behavioral scientists have devised techniques to measure an individual’s motivation to consume food and compare it with that of others. This measurement, called the reinforcing value of food, describes how much effort an individual is willing to put forth to get access to food. The reinforcing value can be determined through a series of tests in a laboratory setting. In each of those tests, the individual being tested is asked to complete a task in exchange for a small portion of his or her favorite foods. The task of the initial test is easy, so the food is not difficult to win. As the tests continue, the task gets more and more difficult until, at some point, the participant feels that the food is no longer worth the effort and decides to quit. This experiment tells us that early quitters, when compared with late quitters, are low in food reinforcement. Using this technique, a 2007 study identified a genetic component in food reinforcement. Among people who were considered obese, those who had a specific variant (T allele) of the genetic marker rs1800497 had an "Increased" likelihood to make more effort to obtain their favorite foods and eat more of them. In contrast, the C/C genotype was associated with "Typical" levels of food reinforcement.
EATING BEHAVIOR TRAITS
SWEET TOOTH

People with your genotype tend to eat an average amount of sugary foods.

Craving sweet foods is sometimes described as having a "sweet tooth." The possible outcomes in this report are "Increased" or "Typical." If your genotype shows an "Increased" likelihood to eat lots of sweets, try choosing fruit as a healthy sweet alternative to sugary foods or soda. Be sure to follow your diet as some diet plans, such as the low carbohydrate diets, significantly limit the amount of sugar you can eat. Sweet foods can include healthy foods, such as fruits, or unhealthy foods like candy and sweetened beverages. People with the C/T and T/T genotypes showed an "Increased" likelihood to eat more sweets and sugary foods, while people with the C/C genotype were more likely to have a "Typical" intake of sugary foods.
FOOD RESPONSES

CAFFEINE METABOLISM

**YOUR RESULT**

**FAST METABOLIZER**

You are likely to rapidly metabolize caffeine.

Caffeine is one of the most widely consumed stimulants in the world, and it is found in the leaves and seeds of many plants. It is also produced artificially and added to some foods. Caffeine is found in tea, coffee, chocolate, many soft drinks and energy drinks, as well as in some pain relievers and other over-the-counter medications. Caffeine is metabolized by a liver enzyme, which is encoded by the CYP1A2 gene. Variation at a marker in the CYP1A2 gene results in different levels of enzyme activity, and thus, different metabolism rates for caffeine. Therefore, the two possible genetic results in this report are “Fast Metabolizer” and “Slow Metabolizer.” If you are a “Slow Metabolizer,” then caffeine may have longer lasting stimulant effects for you. In addition to genetics, your body’s ability to metabolize caffeine also depends on other lifestyle factors. For example, how much coffee you drink, whether you smoke or whether you take hormonal birth control, may also affect your ability to metabolize caffeine. Because these and other lifestyle factors may both increase or decrease your caffeine metabolism, the most sensible advice is to make lifestyle choices that have the maximum benefit for your overall health.
FOOD RESPONSES

BITTER TASTE

You are likely to have a high sensitivity to bitter taste.

People taste things differently. Variations in the TAS2R38 gene are associated with different levels of sensitivity to a chemical called PTC, which produces a strong bitter taste. The possible results for bitter taste are "Taster," "Non-Taster," or "Inconclusive." A person described as a "Taster" may be more sensitive to bitter flavors found in foods, such as grapefruit, coffee, dark chocolate and cruciferous vegetables, such as Brussels sprouts, cabbage and kale. Being a "Taster" does not mean you do not enjoy these foods, but you may sense a stronger bitter taste compared to a "Non-Taster." In addition, tasters may need to watch their salt intake, because they may have an increased preference for salty foods, which mask the bitterness. A genetic result of "Inconclusive" means that there is not enough scientific evidence for how your genotype is associated with bitter taste sensitivity.

FOOD RESPONSES

SWEET TASTE

You are likely to have typical sensitivity to the sweet taste of sugar.

Sweet is one of the most basic tastes we can experience, and is usually found in sugar and sugary foods. The sensation of sweet taste is triggered to the brain from the taste buds. There are receptors on your tongue that are programmed by your genes to determine how you taste sweetness. A 2009 study showed that genetic variants found in the sweet taste receptors can result in "Typical" or "Decreased" sensitivity to the sweet taste of sugar. People with "Decreased" sensitivity may prefer foods with more sugar since they are less likely to taste sweetness in foods that are low sugar.
FOOD RESPONSES

LACTOSE INTOLERANCE

People with your genotype are less likely to be lactose intolerant.

Lactose intolerance is the inability to digest lactose, the sugar found in milk and milk products. This condition is caused by the lack of an enzyme called lactase. The rs4988235 variant lies close to the lactase (LCT) gene, in the MCM6 gene, and has been shown to regulate lactase levels. If you are lactose intolerant you should make sure that you are getting enough calcium from non-dairy or lactosefree sources. On the other hand, if you are not lactose intolerant, be aware that dairy products can be high in calories, fat, or both. You need to watch your intake accordingly or select low fat dairy products. People with a C/C genotype at rs4988235 are “More Likely” to be lactose intolerant, while people with other genotypes are “Less Likely”. This variant has been found to be associated with lactose intolerance in Caucasians, while other variants might play an important role in other ethnicities, including Africans and Asians.

ALCOHOL FLUSH

People with your genotype are less likely to experience alcohol flush.

Drinking alcoholic beverages is a relaxing or social activity for many, but for some it is exceedingly unpleasant due to their body's adverse reaction to alcohol. One such reaction is called alcohol flush, in which drinking even small amounts of alcohol causes a person's face to flush red and in some cases feel warm and itchy. Alcohol flush is largely attributed to genetic variation in the ALDH2 gene, which encodes an enzyme critical for proper alcohol metabolism. Those who carry the inactive version of this gene are much “More Likely” to flush and experience other negative responses to alcohol, while people with other genotypes are “Less Likely” to flush. Perhaps not surprisingly, this variant is also associated with overall reduced consumption of alcohol. In most cases, avoiding alcohol is the best remedy for those who experience alcohol flush.
EXERCISE ENDURANCE TRAINING

Endurance training may provide enhanced health benefits to people with your genotype.

Endurance training is generally used to describe exercise that is done for a longer duration with moderate intensity. Most people can benefit from a combination of endurance, high intensity and resistance exercises. Some people have genetic markers that are associated with "Enhanced Benefit" from endurance training, while others will gain "Normal Benefit." The studies that were used to calculate your result tested responses to a 20-week endurance training program. This result can be used to help tailor your exercise routine. Always consult your physician or health care provider before beginning any exercise program.

EXERCISE STRENGTH TRAINING

People with your genotype are less likely to display increased fat volume following strength training.

Strength training can be described as exercises that incorporate the use of opposing forces to build muscle. The possible outcomes in this report are "Beneficial" and "Less Beneficial." In a small study of young adult men, those with the C/G or C/C genotypes at rs7566605 were more likely to experience increased fat volume after participating in 12 weeks of resistance training, and thus strength training was "Less Beneficial". This association has not been identified in women.
Your genotype is associated with typical aerobic capacity.

Maximal oxygen uptake (VO2max) is widely used as the best measure of an individual’s cardiorespiratory fitness. VO2max is defined as the maximum volume of oxygen per unit time that an individual uses at maximum exertion. The baseline VO2max level can vary depending on age, gender, past medical history, current health and level of physical activity. However, anyone can increase their fitness and VO2max by endurance training. Elite athletes in endurance sports, such as crosscountry skiing and long-distance running, have a higher VO2max than elite athletes in power sports, such as wrestling and weightlifting. The rs8192678 SNP in the PPARGC1A gene, which is a key regulator of energy metabolism, was associated with baseline VO2max (L/min) in a study of 303 Spanish and British men. The G/G and G/A genotypes of rs8192678 were associated with "Typical" VO2max, whereas the A/A genotype was associated with a "Decreased" VO2max. This association has not been studied in women. Please remember that you can always increase your VO2max and fitness by endurance training, even if you start with a decreased aerobic capacity.

Your body is producing functional ACTN3 protein, which is associated with enhanced performance in sprinting and other power sports.

Do you have a genetic variant that is found in nearly all sprinters qualified for top-level competitions like the Olympic Games? The so-called “sprinter gene” refers to the functional version of the ACTN3 gene, which contains information for making a protein found in fast-twitch muscle fibers. The protein and the fast-twitch muscle fibers are important in generating explosive bursts of force. This is why the functional version of ACTN3 is also seen with high frequencies in other elite power-oriented athletes, such as weightlifters. About 80% of people have at least one functional copy of the ACTN3 gene, which can lead to enhanced muscle power. However, having functional ACTN3 is only one of a myriad of genetic and non-genetic factors that contribute to the success of elite athletes. The remaining 20% of people, who do not have a functional copy of ACTN3, may have less muscle power and are less likely to be world-class sprinters or weightlifters, but their chance to excel may not be affected in sports that require other types of body performance, such as endurance and nimbleness.
YOUR RESULT

EXERCISE RECOMMENDED

Your genotype is not associated with weight gain. However, exercise can still help you to maintain a healthy body weight.

Exercise is a large part of many weight loss plans, as it is a crucial tool for weight control for everyone. The possible outcomes in this report are "Exercise Strongly Recommended" and "Exercise Recommended." If your report shows "Exercise Strongly Recommended," your genotype has been shown to be associated with a tendency to be overweight, and exercise is strongly recommended for you. If your report shows "Exercise Recommended," you have one less risk factor for being overweight. However, this should not be taken as one less reason to exercise, because being physically active is beneficial to all people, regardless of genetic makeup. People with the "Exercise Strongly Recommended" outcome contain a specific variant (T allele) in the genetic marker rs1121890 of the FTO gene, which has been shown to be associated with increased body mass index (BMI) and waistline. However, a large study showed that people who have this variant could reduce their propensity to increased BMI by being physically active.

EXERCISE LOSS OF BODY FAT RESPONSE TO EXERCISE

NORMAL BENEFIT

Your genotype is associated with a typical reduction in body fat mass and percent of body fat in response to exercise.

Many people exercise to lose body fat. If you have a specific genotype in the gene LPL, you may have an "Enhanced Benefit" from exercise to lose body fat. If you have the "Normal Benefit" genotype, you will still experience fat reduction if you exercise, but it might take more effort. The study was based on women who participated in a 20-week endurance training program. This association has not been identified in men.

EXERCISE RECOMMENDATIONS

Your genetics are associated with enhanced health benefits from endurance exercises, such as mid-long distance walking, jogging or bicycling. Strength exercises, such as weight resistance, may also be helpful.

You have a genetic variant some call the "sprinter gene" that most elite power athletes also have. Thus, you may have an increased ability for sports or exercise that require fast bursts of muscle power, such as sprinting or weightlifting.

Continue a vigorous exercise regimen after losing weight. You have genes that are associated with an increased chance of gaining weight back.

If you do not exercise currently, start slow and exercise regularly. Starting too hard and too fast can lead to injury, pain or frustration.
YOUR BODY AND WEIGHT
ABILITY TO MAINTAIN HEALTHY WEIGHT

Your genetic profile indicates an average predisposition for being overweight.

Your body's weight is influenced by both genetic and environmental factors. Approximately 40 to 70% of an individual's susceptibility to being overweight is inherited. When someone reaches a body mass index (BMI) of 30 to above 40, genetic factors with strong effects are likely to be involved. There are 2 possible outcomes of this test: “Average” and “Above Average”. An “Above Average” outcome does not mean that you are overweight, it only means that you have a higher than average genetic likelihood for a high BMI.

Your genetic predisposition to maintain a healthy weight is determined from your genotypes at variants in the FTO (associated with fat mass) and MC4R (melanocortin-4 receptor) genes. The association of these genes to a healthy weight is well-established. The MC4R gene is expressed in the brain’s hunger center and is involved in regulating energy balance. Rare mutations in the MC4R gene have been shown to cause a rare, inherited form of propensity to gain fat. FTO is less well-understood, but is also believed to be important for controlling feeding behavior and energy balance. Your test result includes common variants that have been confirmed in many large genetic studies (including multiple studies of over 38000 individuals) to be associated with a predisposition for high BMI. However, as lifestyle also has a considerable impact on weight management, you can mitigate your risks by eating a proper diet, exercising and reducing stress.

YOUR BODY AND WEIGHT
WEIGHT LOSS-REGAIN

You may have difficulty keeping weight off after losing weight.

There are genes associated with the tendency to gain weight back after a person loses weight, and there are genes that protect a person from weight regain. In one study, people with the G/G genotype at a marker in the ADIPOQ gene were "More Likely to Gain Weight Back," while people with other genotypes were more likely to show "Weight Loss Maintained". It is best after losing weight to maintain a healthy diet, exercise and nutrition plan to keep the extra pounds off and support long-term health.
YOUR BODY AND WEIGHT
METABOLISM

Your genotype is associated with a normal resting metabolic rate.

Metabolism describes the way your body burns energy (calories) and tends to have a strong correlation to managing your weight. Resting metabolism is how your body burns energy while at rest. People with a "Fast" metabolism can sometimes eat more food with little exercise and not gain weight. People with a "Normal" metabolism tend to require average amounts of food intake and average amounts of exercise to maintain weight. A genetic marker in the leptin receptor (LEPR) is associated with interactions in your brain that trigger how and when you burn energy. People with a C/C genotype tend to have an increased resting metabolic rate, or "Fast" metabolism, while people with C/G or G/G genotypes are not associated with an increased resting metabolic rate; therefore, they have a "Normal" metabolism. However, having this genetic variant is only one of many other genetic and non-genetic factors that contribute towards your metabolism. Exercise is a common method of increasing your metabolism.
DISCLAIMER

This test was developed and its performance characteristics determined by Pathway Genomics Corporation. It has not been cleared or approved by the FDA. The laboratory is regulated under CLIA as qualified to perform high-complexity testing. This test is used for clinical purposes. It should not be regarded as investigational or for research.

RISKS & LIMITATIONS

RISKS

Risk of Laboratory Error

Pathway is a certified laboratory under the federal Clinical Laboratory Improvement Amendments of 1988 (CLIA) with standard and effective procedures in place for handling samples. However, laboratory error can occur, which might lead to incorrect results. Examples include, but are not limited to, a sample or DNA mislabeling or contamination, failure to obtain an interpretable report, and any other operational laboratory error. I understand that sometimes Pathway’s laboratory may need a second sample to complete my testing.

Risk of laboratory technical problems

Pathway’s CLIA-certified laboratory also has standard and effective procedures in place to protect against technical and operational problems. However, such problems may still occur and examples include, but are not limited to, failure to obtain an interpretable result for a particular SNP. Sometimes it is not possible to obtain a testing result for a particular mutation or marker due to circumstances beyond Pathway’s control, in which case it may not be possible for Pathway to conclusively report on a genetic change that might cause or be predictive of a condition. This may mean that Pathway cannot report my results for a particular health trait or other phenotype. Pathway may re-test my sample in order to obtain these results, but upon re-testing the results may still not be obtained. As with all medical laboratory testing, there is a small chance that the laboratory could report false positive or false negative results. A false positive result means that a genotype is reported as being present when it is actually not present. A false negative result means that a genotype is not reported as being present when it actually is present. A tested individual may wish to pursue further testing to verify any results.

LIMITATIONS

The purpose of this test is to provide information about how a tested individual’s genes affect their metabolism, weight, exercise, energy use, eating behavior, diet and nutritional choices. Tested individuals should not change their diet, physical activity, or any medical treatments they are currently using based on genetic testing results without consulting their personal health care provider.

Tested individuals may find that their experience is not consistent with Pathway’s selected peer-reviewed scientific research findings of relative improvement for the study group(s). The science in this area is still developing and many personal health factors affect diet and health. Since subjects in the scientific studies referenced in this report may have had personal health and other factors different from those of tested individuals, results from these studies may not be representative of the results experienced by tested individuals. Further, some recommendations may or may not be attainable, depending on the tested individual’s physical ability or other personal health factors. A limitation of this testing is that most scientific studies have been performed in Caucasian populations only. The interpretations and recommendations are done in the context of Caucasian studies, but the results may or may not be relevant to tested individuals of different or mixed ethnicities.
The association between genetic mutations and the information within this report is an active area of scientific research, and future scientific discoveries might alter our understanding of how this information is related to your diet, nutrition, and exercise.

Based on test results and other medical knowledge of the tested individual, health care providers might consider additional independent testing, or consult another health care provider or genetic counselor.

**Test Performed / Method**
Genotyping by PCR-based enrichment and next-generation sequencing.

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**Test Results Reviewed & Approved by:**
Nilesh Dharajiya, M.D.
Laboratory Director