Precision Genomics
Inspire a Healthier You

Immunogeno.com

October 2022 - Volume 1

Pharmacogenomics: Demystifying Precision in Medication Therapy

Convenient and affordable lab testing. High deductible insurance? No problem, we offer solutions...page 52

Your Dietary Intake and DNA-Based Dietary Recommendations...page 21

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MORE

than results

A test can change a life. That's why we're committed to a higher level of lab excellence.

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Clinical Laboratory Improvement Amendments
CLIA Certified

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Our Technologies Partners

ThermoFisher SCIENTIFIC
The world leader in serving science

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Twinkle Patel, MS | Founder & CEO

ABOUT OUR FOUNDER & CEO

Twinkle Patel has more than 21 years of clinical lab and medical informatics experience. She holds a Bachelors of Science in Microbiology and Masters degree in Medical Informatics. This gave her much insight in the healthcare industry and the ability provide consulting services to others. She has lent her expertise to leading hospital systems such as Sutter Health system, The University of Kentucky Medicine system, Indiana University, University of Chicago Medicine, Mount Sinai Health Services New York, United States Department of Veterans Affairs, Rideout Health, Sister of Charity of Leavenworth, Sentara Health System, Springhill Medical Center, University of Miami Health System and Salem Health System. Learning from those experiences, she was able to implement the best lab practices at ImmunoGenomics. Upon establishing ImmunoGenomics Lab Services, her skills were invaluable in contributing to real-time contact tracing for COVID-19 testing to various health departments across the United States.

At ImmunoGenomics we have been able to deliver more that 500,000 tests since June of 2020. Through the use of an FDA Emergency use Authorization (EUA) we have been able pioneer a non-invasive Saliva collection method that provides quick and accurate results. Through the hard work of our dedicated team ImmunoGenomics was able to expand our operations to a sister location in California. As we grow and the world changes yet again we have evolved to encompass new tests such as early detection of Cancer markers, Pharmacogenomics, and Nutrigenomics.

ImmunoGenomics continues to strive for the best patient care possible. Currently we are expanding diagnostic care in rural communities via Laboratory Outreach Program. Our budding Outreach Lab Service Program seeks to provide easier access for those in need by us getting closer to our patients through Mobile Collection Services and a Genomic based preventative health testing program. We strive to provide convenient draw services, emerging technology such as online requisitions services where both Patients and Physicians can sign orders electronically and educational seminars on lab testing is necessary to meet the needs of providers and their patients.

ABOUT OUR LAB DIRECTOR

Dr. Rosenblatt has more than 28 years of clinical and biomedical research and development experience in multiple settings, including academia, biotech, startups, and clinical practice, and he has published over 80 papers on cancer and neuronal biology, biomarker development, and clinical genomics and proteomics. Currently, he is Chief Medical Officer and Chief Scientific Officer of NX Prenatal, a prenatal diagnostics company developing assays for adverse pregnancy outcomes and conditions such as preterm birth. He is also currently President and Medical Director of Consultative Genomics, PLLC, a molecular pathology group specializing in Genomic and Proteomic clinical testing as applied to chronic disease, population health management, and personalized medicine. Recently, his lab group developed and validated a unique, saliva-based SARS-CoV-2 test and setup blood-based neutralizing antibody testing (EUA) against the RBD domain of the S1 subunit of the spike protein for determining protective immunity for previously infected or vaccinated individuals. Previously, he was Founder, Chief Scientific Officer, Chief Medical Officer, and Clinical Laboratory Director at CompanionDx CLIA/CAP/NYSDH-certified reference lab. Among other appointments, he has served as Director of the Center for Clinical Proteomics at the Brown Foundation Institute of Molecular Medicine, as well as the Director of the UT Health Science Center at Houston's Center for Clinical and Translational Sciences Proteomics Core. Dr. Rosenblatt has also served as Adjunct, Associate Professor in the Division of Oncology, Department of Internal Medicine at UT Health and the McGovern Medical School and as Associate, Adjunct Professor in the School of Health Professions at the MD Anderson Cancer Center, both in Houston.

Dr. Kevin Rosenblatt, MD PhD Lab Director

Lab Staff

Board certified in clinical chemistry and toxicological chemistry, DABCC (CC, CT) with several years of hands on experience.

Dr. Haideri PhD, DABCC (CC,TC), FAACC
Lab Technical Supervisor

Provides clinical and administrative oversight to the laboratory to ensure efficient operation and optimum resource use to maximize productivity of the organization.

Neranjala Abeywardana, MS, MB (ASCP)
Director of Lab Operations

Here at ImmunoGenomics it's my duty to make sure things run smoothly as a Lead Technologist. Validations of assays, maintenance of machines and instruments, and laboratory operations are some of the tasks I accomplish on a daily basis.

Benjamin Moore B.S
Medical Technologist

Provides value - adding insights to lab operations. Skilled in lab equipment care and validation of new assays. Seeking to deliver fast and efficient functioning of PGx testing here at Immunogenomics

Dhyani Rana B.S
Medical Technologist

Highly skilled and solution-oriented professional with experience driving laboratory operations and monitoring processes to ensure optimal performance and sustainable finacial growth.

Issis Elvir B.S
Clinical Coordinator

An exceptionally-driven professional responsible for structuring the programs, plans, and budgets. Fatima executes, monitors, controls and closes all projects at Immunogenomics.

Fatima Chaudhary B.S
Project Manager

A skilled and detail-oriented individual, David strives to ensure the lab's technical operations (software/system testing and updates) with no interruptions

David Adeyeye B.S
IT Manager

In charge of accessioning samples, primary technologist of our Salvia Now COVID panel, and Inventory Manager.

Anthony Cantu B.S
Medical Technologist

Adel Shaker MD
Medical Director

Fady Batro, B.S MB (ASCP)
Lab Technical Supervisor

Yazen Alomari B.S
Clinical Lab Scientist

Aira Discipulo B.S
Clinical Lab Scientist

Rysa Maloles
Certified Phlebotomist

Jerry Lara
Outreach Services Manager

Tanya Roman
Outreach Tech

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Our Test Menu

INFECTIOUS DISEASE TESTING

- COVID-19 & FLU
- Full Respiratory Panel
- Wound Care
- UTI (Urinary Tract Infection)
- STD (Sexually Transmitted Disease)

Genetic Testing and Consultation

- PharmacoGenomics
- NutriGenomics
- Immunodeficiency
- Cancer Risk Assessment
- Comprehensive Eye Disorders
- Comprehensive Neurology Testing
- Thyroid Genetic Testing

Full Blood Work Panel

- Mobile Collection Services available at your convenience
- Employment Drug Testing

WHY CHOOSE IMMUNOGENOMICS

Targeted Treatments Accurate Outcomes

EMR INTEGRATIONS
ACCEPTS MOST INSURANCES

PHLEBOTOMIST AVAILABLE
QUICK TURN AROUND TIME

California Location
Address: 10050 Garvey Ave., Ste. #101
El Monte, CA 91735
Phone: 626-522-1006
CLIA ID# 05D2217327

Texas Location
Address: 202 Industrial Blvd. Ste 502
Sugar Land, TX 77478
Phone: 832-500-4462
Fax: 832-376-7548
CLIA ID# 45D2187903

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Call: 832-500-4462 | **Fax:** 832-376-7548 | **Web:** www.immunogeno.com | **Email:** support@immunogeno.com

ImmunoGenomics PGx

The Future of Personalized Medicine

Principle of Procedure

Individuals with particular genotypes may find their metabolic capabilities for certain prescription drugs range from extremely slow to extremely fast; they may need to avoid or adjust to a higher or lower drug dosage in order to achieve an adequate therapeutic effect.

Other genetic markers indicate patient response or clearance through mechanisms other than metabolism. There are numerous other genes and non-coding regions (non-genes) of the genome that provide pharmacokinetic and pharmacodynamic information on an individual.
Our test analyzes evidence-based markers for genes/loci of known pharmacogenomics value that allow clinicians to gain valuable insight into an individual's ability to handle and respond to drugs based on their genetic make-up.

The pharmacogenomics panel reports genetic and pharmacologic information. Our testing and reporting is dynamic and patient-specific and focusses on the information that providers need.

scan QR code to order a test

Scan QR code to download our PGx Requisiton form

Common Drugs Impacted by Genetics

Thousands of medications are affected by genetics. Over 250 of the most commonly prescribed medications are so susceptible to these genetic-driven impacts that the **FDA has issued a warning/guidance on their** medication labels.

Drug Efficacy

90% **of prescription drugs work in only**

30–50% **of patients**

38% of therapies for depression are **ineffective**

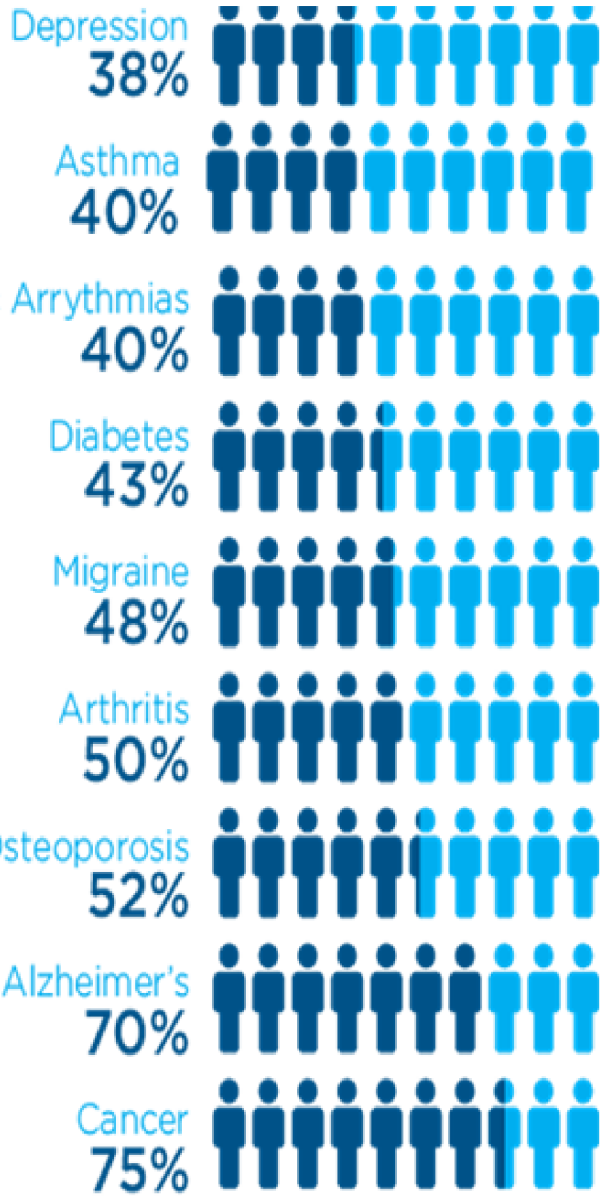
Those who remain depressed:

Up to 50%: unlikely to experience substantial improvement with the use of a different or adjunct medication

43% of therapies for diabetes are **ineffective**

75% of cancer therapies are **ineffective**

Failure Rate



Reference: https://www.pharmgkb.org/labelAnnotations

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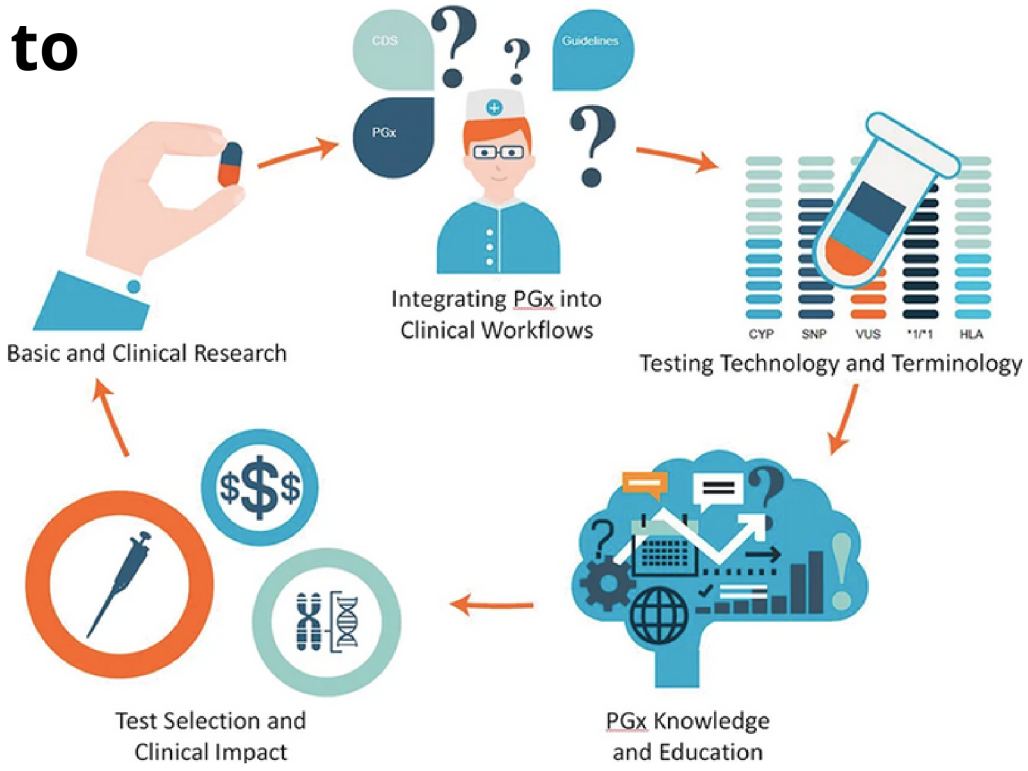
Understanding the Science

Alterations in enzyme function are categorized info four phenotypes. Knowing a patient's metabolic phenotype and its impact on drug metabolism can empower clinical treatment decisions, increase drug efficacy and reduce the risk of adverse events.

- Extensive Metabolizers (EM): carry 2 functional genes and have normal enzyme activity. Standard medication dosing is appropriate for extensive metabolizers.
- Poor Metabolizers (PM): have severely reduced or no functional capacity to metabolize substrate medications. Poor metabolizers are at risk for side effects due to toxic drug accumulation and may require lower doses.
- Intermediate Metabolizers (IM): also have a severely reduced capacity to metabolize drugs and therefore may also require modified drug doses.
- Ultra-Rapid Metabolizers (UM): typically carry multiple copies of the same gene and have elevated enzyme activity and may need increasing drug dosing or decreased drug dosing, in the case of pro-drugs, in order to offset the higher rate of metabolism.

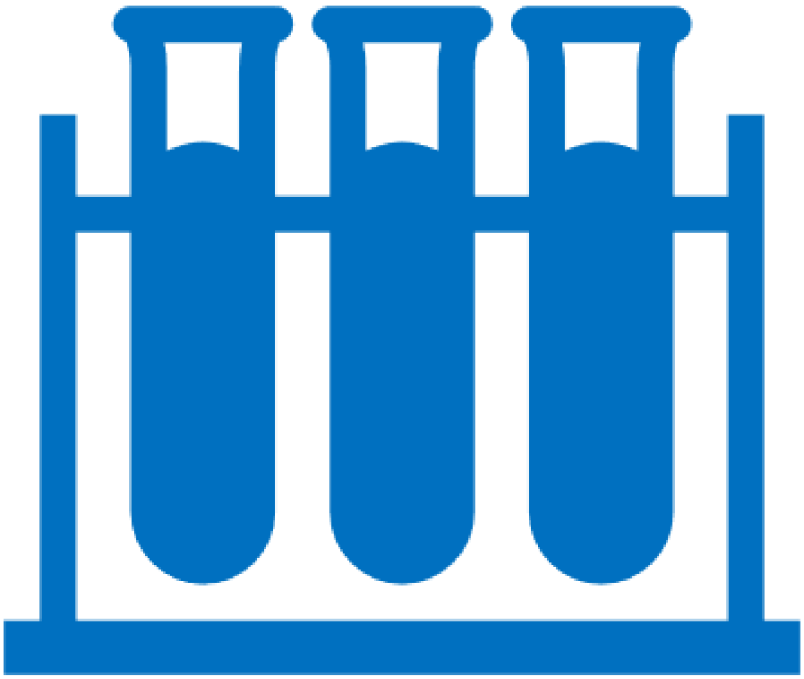
Applying it to Medicine



Specimen Source

Acceptable specimen sources are blood, extracted DNA (gDNA) and saliva.

- Peripheral Whole Blood: 3-5mL in EDTA tube (lavender top). This is our preferred specimen type;
- Extracted DNA: 1ug DNA (please indicate sample source on test request form);
- Saliva: Use DNA Genotek Oragene DNA (OG-500) kit.
- Buccal swab: Collect using Copan hDNAFree FLOQSwabs (Cat# 50E010D01) or IsoHelix RapiDri Buccal swab with self-drying pouch (Cat# RD-01) according to manufacturer's instructions.



Reference: https://www.ncbi.nlm.nih.gov/gtr/tests/593428/

Medical Necessity

- The selection of the medications in question must be derived from clinical factors and medical necessity rather than from a PGx panel.
- Once the therapeutic agents are selected, and those agents are known to have gene-drug interactions as identified above, then a PGx test may be considered reasonable and necessary when the result of that test is necessary for the physician's decision-making process regarding safely administering or dosing the drug.

https://www.cms.gov/medicare-coveragedatabase/view/lcd.aspxLCDId=38294&ver=16

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Clinical Qualification Guidelines

- The patient has a **diagnosis** for which pharmacologic therapy is reasonable and necessary, and the drug or drugs that the clinician is considering using must be reasonable and necessary for the treatment of the patient's diagnosis.

- The **clinician has made an initial personalized decision** for the patient **based** on the **patient's diagnosis**, the patient's other **medical conditions**, other **medications** the patient is taking, **professional judgement**, clinical science and basic science pertinent to the drug (e.g. mechanism of action, side effects), the patient's **past medical history** and when pertinent family history and the patient's preferences and values.

- **T**he provider performing the service must have a **record of what drug(s) is/are being considered** and for what indication(s) to ensure the test performed is **reasonable and necessary.**

Reference: https://www.cms.gov/medicare-coveragedatabase/view/lcd.aspx?LCDId=38294&ver=16

Overview of Clinical Workflow

Patient Intake form

Ship/Receive Test Kit
Return Test Kit

Registration Follow-Up

Provider Intake

Clinical Consultation

Laboratory Testing Analysis

Software Reporting Analysis

Testing Analysis Workflow

- Specimen Processing
- Sample Prep/Preamplification
- Sample Loading
- Real-Time PCR
- Analysis and Report

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Technology Testing Platforms

MassARRAY System

Testing Applications

PGx Panel
VeriDose Core Panel (Drug Metabolism)
VeriDose CYPD2D6 CNV Panel (Genotyping)
VeriDose DPYD Panel (Toxicity)

- PharmacoGenomics
- NutriGenomics
- CancerGenomics

Testing Applications

- PGx
- NutriGenomics
- Liquid Biopsy
- Tumor Profiling
- SARS-CoV-2
- Sample Integrity
- Specimen Validity
- Hereditary Genetics
- Methylation
- Chimerism
- Blood Typing

Comprehensive Panel List of Genes

- ABCB1, APOE, COMT, CYP1A2, CYP2B6, CYP2C19, CYP2C9, CYP2D6, CYP3A4, CYP3A5, DRD2, F2, F5, GLP1R (rs1042044), GLP1R (rs2300615), GLP1R (rs6923761), MTHFR (rs1801131), MTHFR (rs1801133), OPRM1, PNPLA5, SLCO1B1, SULT4A1, VKORC1

Software Reporting Analysis

PreciseQ – “Cloud Based Requisition Platform”

- The most comprehensive and agile digital health solutions for any diagnostic testing at any location.

- We enable labs to provide the best and most efficient diagnostic testing service, while boosting patient & provider satisfaction, driving costs down, and ensuring high-quality data.

GenXys – "Dynamic Reporting Analysis"

- An evidence-based platform for precision medication management —Physician Interaction with the software.
- From medication reviews to the point of prescribing, GenXys' cutting-edge medication decision support solutions enable your care team to provide high-quality, evidence-based care at reduced costs.

GenXys Health Care Systems

TreatGx – "Provider Portal"

- TreatGx, the proven and widely-adopted clinical decision support software enables personalized and evidence-based treatment options optimized for every patient. Every time.

ReviewGx - "Pharmacy Consultation Portal"

- ReviewGx, the all-in-one MTM software that enables care providers to manage all medications in one place including PGx and deprescribing insights. Efficiently.

PharmGKB annotates drug labels containing pharmacogenetic information approved by the US Food and Drug Administration (FDA)

Pain Management

Type: Anti-inflammatory Agent, Analgesic, Antipyretic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
The Nonsteroidal Antiinflammatory Drugs (NSAIDs)			
Acetic acid derivatives	Nabumetone	CYP1A2	CYP2C19, CYP3A4
	Indomethacin	CYP2C9	CYP2C19
Enolic acid (Oxicam) derivatives	Meloxicam	CYP2C9	CYP1A2, CYP3A4, CYP3A5
	Piroxicam	CYP2C9	CYP3A4, CYP3A5
	Tenoxicam	CYP2C9	
	Lornoxicam	CYP2C9	
Selective COX-2 inhibitors (Coxibs)	Etoricoxib	CYP3A4	CYP3A5, CYP2C9, CYP2D6, CYP1A2
	Parecoxib	CYP2C9	CYP3A4, CYP3A5
	Celecoxib	CYP2C9	CYP2C19
Propionic acid derivatives	Ibuprofen	CYP2C9	CYP2C19
	Flurbiprofen	CYP2C9	
	Ketoprofen	CYP3A4	CYP2C9, CYP3A5
	Fenoprofen	CYP2C9	UGT2B7
	Vicoprofen	CYP2D6	CYP3A4
	Naproxen	CYP2C9	CYP1A2
Anthranilic acid derivatives (Fenamates)	Mefenamic acid	CYP2C9	

Type: Opioid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Opioid Analgesics			
Opium alkaloids	Codeine	CYP2D6	CYP3A4, CYP3A5, OPRM1
Ethers of morphine	Dihydrocodeine	CYP3A4	CYP2D6, CYP3A5
	Ethylmorphine	CYP2D6	CYP3A4, CYP3A5
Semi-synthetic alkaloid derivatives	Hydrocodone	CYP2D6	CYP3A4, CYP3A5, OPRM1
	Oxycodone	CYP3A4	CYP3A5, CYP2D6, ABCB1, COMT
Synthetic opioids			
Anilidopiperidine derivatives	Alfentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1
	Fentanyl	CYP3A4	CYP3A5, ABCB1, OPRM1
	Sufentanil	CYP3A4	CYP3A5, OPRM1
Phenylpiperidine derivatives	Meperidine	CYP2B6	CYP3A4, CYP2C19, CYP3A5
	Ketobemidone	CYP2C9	CYP3A4, CYP3A5
Diphenylpropylamine derivatives	Dextropropoxyphene	CYP3A4	CYP3A5, Renal Excretion
	Levacetylmethadol	CYP3A4	CYP3A5
	Loperamide	CYP3A4	CYP3A5
	Methadone	CYP3A4	CYP2B6, CYP2D6, CYP3A5, ABCB1, COMT
Oripavine derivatives	Buprenorphine	CYP3A4	CYP3A5
Morphinan derivatives	Dextromethorphan	CYP2D6	CYP3A4, CYP3A5
Others	Tramadol	CYP2D6	CYP3A4, CYP2B6, CYP3A5, OPRM1, SLC22A1, COMT
	Tapentadol	CYP2C9	CYP2C19, CYP2D6
	Tilidine	CYP3A4	CYP2C19, CYP3A5
Anti-opioid	Methylnaltrexone	CYP2D6	CYP3A4, CYP3A5

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Cardiovascular

Type: Antiarrhythmic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Antiarrhythmic class Ia	Quinidine	CYP3A4, CYP2D6	CYP3A5, CYP2C9
	Procainamide	CYP2D6	NAT2
	Sparteine	CYP2D6	
	Disopyramide	CYP3A4	CYP3A5, CYP1A2, CYP2C19
Antiarrhythmic class Ib	Phenytoin	CYP2C19	CYP2C9, CYP3A4, CYP3A5, CYP2D6, ABCB1, HLA-B*1502
	Lidocaine	CYP1A2	CYP3A4, CYP3A5
	Mexiletine	CYP2D6	CYP1A2
Antiarrhythmic class Ic	Propafenone	CYP2D6	CYP3A4, CYP1A2, CYP3A5
	Flecainide	CYP2D6	
	Encainide	CYP2D6	
Antiarrhythmic class II	Carvedilol	CYP2D6	CYP2C9
	Bisoprolol	CYP2D6	CYP3A4, CYP3A5
	Metoprolol	CYP2D6	CYP3A4, CYP3A5
	Propranolol	CYP2D6	CYP1A2, CYP2C19, CYP3A4, CYP3A5
Antiarrhythmic class III	Amiodarone	CYP3A4	CYP3A5
	Dronedarone	CYP3A4	CYP3A5
	Dofetilide	Renal Excretion	CYP3A4, CYP3A5
Antiarrhythmic class IV	Diltiazem	CYP3A4	CYP2C19, CYP3A5
	Verapamil	CYP3A4	CYP3A5, ABCB1

Type:
Anticoagulant, Antiplatelet

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Blood Coagulation and Anticoagulant, and Antiplatelet Drugs			
Vitamin K antagonist	Warfarin	CYP2C9, VKORC1	CYP2C19, CYP1A2, CYP3A4, PROC, PROS1
	Acenocoumarol	CYP2C9, VKORC1	CYP2C19, CYP1A2
	Phenprocoumon	CYP2C9, VKORC1	CYP3A4
Direct factor Xa inhibitors	Rivaroxaban	CYP3A4	CYP3A5
	Apixaban	CYP3A4	CYP3A5
Antiplatelet Drugs			
ADP receptor (P2Y12) inhibitors Nucleotide/nucleo side analogs	Ticagrelor	CYP3A4	CYP3A5
ADP receptor (P2Y12) inhibitors Thienopyridines	Clopidogrel	CYP2C19	ABCB1, ABCC3
	Prasugrel	BCHE, CYP3A4	CYP2B6, CYP2C9, CYP2C19, CYP3A5, CYP2D6
Irreversible cyclooxygenase inhibitors	Aspirin	GLYAT, UGTs, Renal Excretion	CYP2C9, CYP3A4, CYP3A5
Phosphodiesterase inhibitors	Cilostazol	CYP3A4	CYP2C19, CYP3A5
Protease-activated receptor-1 (PAR-1) antagonists	Vorapaxar	CYP3A4	CYP3A5

Abbreviations: P2Y12, purinergic receptor P2Y12

Internal Medicine

Type: Modulation of Respiratory Function

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Respiratory			
Anticholinergic	Umeclidinium	CYP2D6	
	Aclidinium	CYP2D6	CYP3A4, CYP3A5
Beta2-adrenergic agonist	Arformoterol	CYP2D6	CYP2C19
	Indacaterol	CYP3A4	CYP3A5, CYP1A2, CYP2D6
	Formoterol	CYP2D6	CYP2C19, CYP2C9
	Salmeterol	CYP3A4	CYP3A5
	Vilanterol	CYP3A4	CYP3A5
Corticosteroid	Budesonide	CYP3A4	CYP3A5
	Fluticasone	CYP3A4	CYP3A5
	Mometasone	CYP3A4	CYP3A5
Phosphodiesterase inhibitor	Roflumilast	CYP3A4	CYP1A2, CYP3A5
	Theophylline	CYP1A2	
5-lipoxygenase inhibitor	Zileuton	CYP1A2	CYP2C9, CYP3A4, CYP3A5
Leukotriene receptor-1 antagonist	Montelukast	CYP3A4	CYP2C9, CYP3A5, SLCO2B1, ABCC1
	Pranlukast	CYP3A4	CYP3A5
	Zafirlukast	CYP2C9	CYP3A4, CYP3A5
Treatment of cystic fibrosis (specifics mutations in the CFTR gene)	Ivacaftor	CYP3A4	CYP3A5, CFTR

Abbreviations: CFTR, Cystic fibrosis transmembrane conductance regulator

Type: Antiemetic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Antiemetic			
Antiemetic, 5-HT3 receptor antagonist Indole derivative	Dolasetron	CYP3A4	CYP2D6, CYP3A5
	Tropisetron	CYP3A4	CYP2D6, CYP3A5
Antiemetic, 5-HT3 receptor antagonist Isoquinoline derivative	Palonosetron	CYP1A2	CYP2D6, CYP3A4, CYP3A5
Antiemetic, 5-HT3 receptor antagonist Indazole derivative	Granisetron	CYP3A4	CYP3A5
Antiemetic, 5-HT3 receptor antagonist	Ondansetron	CYP2B6	CYP1A2, CYP2D6, CYP3A4, ABCB1
Antiemetic, dopamine-receptor antagonist	Domperidone	CYP3A4	CYP3A5
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5
	Metoclopramide	CYP2D6	CYP1A2, CYB5R1, CYB5R2, CYB5R3, CYB5R4
Antiemetic, NK1 receptor antagonist	Aprepitant	CYP3A4	CYP3A5, CYP1A2, CYP2C19
Antiemetic, H1 histamine receptor antagonist	Diphenhydramine	CYP2D6	CYP3A4, CYP3A5
	Hydroxyzine	ADHs	CYP3A4, CYP3A5
	Promethazine	CYP2D6	SULTs
Cannabinoids	Dronabinol	CYP2C9	CYP2C19, CYP3A4, CYP3A5
Benzodiazepines	Midazolam	CYP3A4	CYP3A5
Anticholinergics	Scopolamine	CYP3A4	CYP3A5
Steroids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5

Abbreviations: 5-HT, Cystic fibrosis transmembrane conductance regulator

Psychiatry

Type: Antidepressant

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Antidepressants			
SSRIs	Citalopram	CYP2C19, CYP2D6	CYP3A4, CYP3A5, SLC6A4, HTR2A
	Escitalopram	CYP3A4, CYP2C19	CYP2D6, CYP3A5, SLC6A4
	Dapoxetine	CYP2D6	CYP3A4, CYP3A5, FMO1
	Fluoxetine	CYP2D6	CYP3A4, CYP2C9, CYP3A5, CYP2C19, SLC6A4, HTR2A
	Paroxetine	CYP2D6	CYP3A4, CYP1A2, CYP3A5, CYP2C9, SLC6A4, HTR2A, DRD3
	Sertraline	CYP2B6	CYP2C19, CYP2C9, CYP3A4, CYP2D6, SLC6A4
	Fluvoxamine	CYP2D6	CYP1A2, SLC6A4, HTR2A
SMSs	Vilazodone	CYP3A4	CYP3A5, CYP2C19, CYP2D6
SNRIs	Levomilnacipran	CYP3A4	CYP3A5, CYP2C19, CYP2D6
	Venlafaxine	CYP2D6	CYP2C19, CYP3A4, CYP2C9, CYP3A5, SLC6A3, SLC6A4, HTR2A
	Duloxetine	CYP2D6	CYP1A2, HTR2A
NRIs	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2
	Reboxetine	CYP3A4	CYP3A5
	Maprotiline	CYP2D6	CYP1A2
TCAs that preferentially inhibit the reuptake of serotonin	Clomipramine	CYP2D6	CYP3A4, CYP2C19, CYP1A2, CYP2C9, SLC6A4, HTR2A
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5
TCAs that preferentially inhibit the reuptake of norepinephrine	Desipramine	CYP2D6	CYP1A2, CYP2C19
	Nortriptyline	CYP2D6	CYP1A2, CYP2C19, ABCB1, SLC6A4
	Protriptyline	CYP2D6	

Type: Typical Antipsychotic

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Typical antipsychotic			
Butyrophenones	Bromperidol	CYP3A4	CYP3A5
	Droperidol	CYP3A4	CYP3A5
	Haloperidol	UGTs, CYP3A4	CYP1A2, CYP2D6, CYP3A5, SLC6A4
Phenothiazines with aliphatic side-chain	Chlorpromazine	CYP2D6	CYP1A2, CYP3A4, CYP3A5
	Levomepromazine	CYP3A4	CYP1A2, CYP3A5
	Promazine	CYP1A2	CYP3A4, CYP2C19, CYP2C9, CYP3A5
	Cyamemazine	CYP1A2	CYP3A4, CYP2C9,CYP3A5
Phenothiazines with piperazine structure	Fluphenazine	CYP2D6	
	Perphenazine	CYP2D6	
	Prochlorperazine	CYP2D6	CYP3A4, CYP3A5
	Trifluoperazine	CYP1A2	UGT1A4
Phenothiazines with piperidine structure	Thioridazine	CYP2D6	CYP1A2, CYP3A4, CYP2C19, CYP3A5
Phenothiazines used as an anti-histamine, sedative, and antiemetic	Promethazine	CYP2D6	SULTs
Diphenyl-butylpiperidine	Pimozide	CYP3A4, CYP2D6	CYP1A2, CYP3A5
Thioxanthene derivative	Thiothixene	CYP1A2	CYP3A4, CYP3A5
	Zuclopenthixol	CYP2D6	CYP3A4, CYP3A5
Tricyclics	Loxapine	CYP1A2	CYP3A4, CYP2D6, CYP3A5

Neurology

Type: Treatment of ADHD, Related Drugs

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
		Anti ADHD Stimulants	
Amphetamine	Dextroamphetamine	Renal Excretion, CYP2D6	DBH, GLYAT
	Levoamphetamine	Renal Excretion, CYP2D6	FMO3
NDRI	Dexmethylphenidate	CYP2D6	Renal Excretion
Psychostimulant	Lisdexamfetamine	Hydrolysis	CYP2D6, Renal Excretion
	Methylphenidate	CYP2D6	Renal Excretion, SLC6A2, SLC6A3, SLC6A4, DRD3
		Anti ADHD Non-stimulants	
NERI	Atomoxetine	CYP2D6	CYP2C19, CYP3A4, CYP3A5, SLC6A2
Central alpha-2 Adrenergic Agonist	Clonidine	CYP2D6	CYP1A2, CYP3A4, CYP3A5
Antidepressants	Bupropion	CYP2B6	CYP3A4, CYP2D6, CYP1A2, CYP3A5
	Imipramine	CYP1A2, CYP2D6	CYP2C19, CYP3A4, CYP3A5
	Desipramine	CYP2D6	CYP1A2, CYP2C19
	Reboxetine	CYP3A4	CYP3A5
Wakefulness-promoting agent	Modafinil	Hydrolysis, CYP2D6	CYP1A2, CYP3A4, CYP2B6, CYP3A5
	Armodafinil	CYP3A4	CYP3A5
		Anti-insomnia	
Melatonin Receptor Agonist	Ramelteon	CYP1A2	CYP2C19, CYP3A4, CYP3A5

Abbreviations: ADHD, Attention deficit hyperactivity disorder; NERI, norepinephrine reuptake inhibitor; NDRI, norepinephrine-dopamine reuptake inhibitor

Type: Anxiolytic, Hypnotic, Sedative, Anticonvulsant, Muscle Relaxant

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
		Anxiolytic, Hypnotic, Sedative, Anticonvulsant, and Muscle Relaxant	
Benzodiazepine Short-acting	Midazolam	CYP3A4	CYP3A5
	Triazolam	CYP3A4	CYP3A5
	Brotizolam	CYP3A4	CYP3A5
Benzodiazepine Intermediate-acting	Alprazolam	CYP3A4	CYP3A5
	Bromazepam	CYP1A2	CYP2D6
	Clobazam	CYP2C19	CYP3A4, CYP3A5, CYP2B6
	Flunitrazepam	CYP2C19	CYP2C9, CYP3A4, CYP3A5
	Estazolam	CYP3A4	CYP3A5
	Clonazepam	CYP3A4	CYP2C19, CYP3A5
	Quazepam	CYP3A4	CYP2C19, CYP3A5
	Lormetazepam	CYP3A4	CYP3A5
	Nitrazepam	CYP3A4	CYP3A5
	Temazepam	CYP2C19	CYP3A4, CYP3A5
Benzodiazepine Long-acting	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2
	Clorazepate	CYP3A4	CYP3A5
	Chlordiazepoxide	CYP3A4	CYP3A5
	Flurazepam	CYP3A4	CYP3A5
	Nordazepam	CYP3A4	CYP3A5
Nonbenzodiazepine hypnotic	Zolpidem	CYP3A4	CYP3A5, CYP1A2, CYP2D6
	Zaleplon	AOX1, CYP3A4	CYP3A5
	Zopiclone	CYP3A4	CYP2C9, CYP3A5
	Eszopiclone	CYP3A4	CYP3A5

Infectology

Type: Antibiotics

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Antibacterials: protein synthesis inhibitors 50S			
Amphenicols	Chloramphenicol	CYP2C9	
Lincosamides	Clindamycin	CYP3A4	CYP3A5
Antibiotic			
Macrolides	Clarithromycin	CYP3A4	CYP3A5
	Erythromycin	CYP3A4	
	Telithromycin	CYP3A4	CYP3A5
Antibacterials: nucleic acid inhibitors			
DHPS inhibitor Intermediate-acting sulfonamides	Sulfamethoxazole	Renal Excretion	NAT2, CYP2C9
Anaerobic DNA inhibitors/ Nitroimidazole	Tinidazole	CYP3A4	CYP3A5
	Ornidazole	CYP3A4	CYP3A5
DNA-dependent RNA polymerase inhibitors	Rifampicin	CYP3A4	CYP3A5, CYP2C19, RE
	Rifabutin	CYP3A4	CYP1A2, CYP3A5
Other drugs against mycobacteria	Bedaquiline	CYP3A4	CYP2C19, CYP3A5
	Pyrazinamide	AOX1, XDH	CYP1A2, CYP3A4, CYP3A5, RE

Abbreviations: DHPS, Dihydropteroate synthase

Oncology, Hematology

Type: Antineoplastic Targeted Therapy II

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Protein kinase inhibitor (non-receptor)			
EML4-ALK	Ceritinib	CYP3A4	CYP2C9, CYP3A5
	Crizotinib	CYP3A4	CYP3A5
Bruton tyrosine kinase	Ibrutinib	CYP3A4	CYP2D6, CYP3A5
Other Targeted therapy			
mTOR Inhibitors	Sirolimus	CYP3A4	CYP3A5
	Everolimus	CYP3A4	CYP3A5
Hedgehog pathway inhibitor	Vismodegib	CYP2C9	CYP3A4, CYP3A5
Hormone antagonists and related agents			
Selective estrogen receptor modulators (SERM)	Toremifene	CYP3A4	CYP2D6, CYP3A5
	Tamoxifen	CYP3A4, CYP2D6, CYP2C9	CYP3A5, CYP2B6, FMO1, CYP2C19, CYP1A2, F2, F5, ABCC2
SERD	Fulvestrant	CYP3A4	CYP3A5
Anti-androgens	Flutamide	CYP1A2	CYP3A4, CYP3A5
	Nilutamide	CYP2C19	FMO3
	Bicalutamide	CYP3A4	CYP3A5
Aromatase inhibitors	Anastrozole	CYP3A4	CYP3A5
	Letrozole	CYP3A4	CYP3A5
	Exemestane	CYP3A4	CYP3A5
Other hormone antagonists and related agents	Abiraterone	CYP3A4	CYP3A5, SULT2A1
Hematologic			
Thrombopoiesis Stimulating Agent	Eltrombopag	CYP1A2	F5, SERPINC1

Abbreviations: EML4-ALK, echinoderm microtubule associated protein like 4 – anaplastic lymphoma kinase; BRAF, proto-oncogene B-Raf; mTOR, mammalian target of rapamycin; SERD, selective estrogen receptor down-regulator.

Organ Transplantation

Type: Immunosuppressive, Immunomodulation

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Immunosuppressive			
Antimetabolite	Mycophenolate mofetil	CYP3A4	CYP3A5, UGT1A8, SLCO1B1, ABCC2, HPRT1
Calcineurin Inhibitors	Pimecrolimus	CYP3A4	CYP3A5
	Tacrolimus	CYP3A4	CYP3A5, ABCB1
	Cyclosporine	CYP3A4	CYP3A5, ABCB1, ABCC2
mTOR Inhibitors	Temsirolimus	CYP3A4	CYP3A5
	Everolimus	CYP3A4	CYP3A5
Immunomodulation			
Immunomodulator and anti-angiogenic	Pomalidomide	CYP1A2	CYP3A4, CYP2C19, CYP2D6, CYP3A5

Anesthesiology

Type: Anesthetic, Muscle Relaxant

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Intravenous agents (non-opioid)			
Barbiturates	Hexobarbital	CYP2C19	CYP2C9, CYP1A2
	Thiamylal	CYP2C9	
Benzodiazepines	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2
	Midazolam	CYP3A4	CYP3A5
Other Anesthetics	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5
Skeletal muscle relaxants			
Muscle Relaxants	Carisoprodol	CYP2C19	
	Cyclobenzaprine	CYP1A2	CYP2D6, CYP3A4, CYP3A5
	Tizanidine	CYP1A2	

Urology

Type: Treatment of Incontinence, Erectile Dysfunction, Benign Prostatic Hypertrophy

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Drugs for urinary frequency and incontinence			
Anticholinergic	Oxybutynin	CYP3A4	CYP3A5
	Tolterodine	CYP2D6, CYP3A4	CYP2C9, CYP3A5, CYP2C19
	Solifenacin	CYP3A4	CYP3A5
	Darifenacin	CYP2D6	CYP3A4, CYP3A5
Drugs used in erectile dysfunction			
Phosphodiesterase inhibitors	Sildenafil	CYP3A4	CYP2C9, CYP3A5
	Tadalafil	CYP3A4	CYP3A5
	Vardenafil	CYP3A4	CYP2C9, CYP3A5
	Avanafil	CYP3A4	CYP3A5
	Udenafil	CYP3A4	CYP3A5
Drugs used in benign prostatic hypertrophy			
Alpha-adrenoreceptor antagonists	Alfuzosin	CYP3A4	CYP3A5, Renal Excretion
	Tamsulosin	CYP3A4	CYP2D6, CYP3A5, Renal Excretion
	Silodosin	CYP3A4	UGT2B7, CYP3A5
Testosterone-5-alpha reductase inhibitors	Finasteride	CYP3A4	CYP3A5
	Dutasteride	CYP3A4	CYP3A5

Endocrinology

Type: Contraceptives, Androgens, Antiandrogens, Glucocorticoid, Thyroid

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Hormonal contraceptives			
Estrogens	Ethinylestradiol	CYP3A4, CYP2C9	CYP3A5, CYP2C19, CYP1A2
	Estradiol	CYP1A2	CYP3A4, CYP3A5
Progestogens	Desogestrel	CYP3A4, HSD3B1	CYP3A5, CYP2C9, CYP2C19
	Dienogest	CYP3A4	CYP3A5
	Mestranol	CYP2C9	
Emergency contraceptives	Levonorgestrel	CYP3A4	CYP3A5
	Ulipristal	CYP3A4	CYP1A2, CYP2D6, CYP3A5
Androgens			
3-oxoandrosten-(4) derivatives	Testosterone	CYP3A4, CYP19A1	HSD3B2, CYP3A5, UGT2B15, SULTs
Antiandrogens			
Antiandrogens	Cyproterone	CYP3A4	CYP3A5
Other sex hormones and modulators of the genital system			
Selective estrogen receptor modulators (SERMs)	Ospemifene	CYP3A4	CYP2C9, CYP3A5, CYP2C19, CYP2B6
Steroid hormone			
Glucocorticoids	Dexamethasone	CYP3A4	CYP17A1, CYP3A5
	Cortisol (hydrocortisone)	CYP3A4	CYP3A5
	Prednisone	HSD11B2	CYP3A4, CYP3A5, SLC19A1, SULTs, UGTs

Recreational Drugs

Type: Barbiturates, Benzodiazepines, Cannabinoids, Synthetic Cannabis, Dissociative Drugs

Drug Class	Generic	Primary Mechanism Involved	Other Mechanisms Involved
Amphetamines	3,4-methylenedioxy-methamphetamine (MDMA)	Renal Excretion, CYP2D6	CYP1A2, CYP3A4, CYP3A5
	Methamphetamine	CYP2D6, Renal Excretion	DBH, ACSM1, GLYAT, DRD3
Barbiturates	Amobarbital	CYP3A4	CYP3A5, CYP2B6, CYP2C9
	Phenobarbital	CYP2C19	ABCB1
Benzodiazepines	Alprazolam	CYP3A4	CYP3A5
	Clonazepam	CYP3A4	CYP2C19, CYP3A5
	Diazepam	CYP2C19, CYP3A4	CYP3A5, CYP2B6, CYP1A2
Cannabinoids & Related Drugs	Cannabidiol (CBD)	CYP3A4	CYP2C19, CYP3A5
	Delta 9-tetra hydrocannabinol (Δ9_THC)	CYP2C9	CYP2C19, CYP3A4, CYP3A5
	Cannabinol (CBN)	CYP2C9	CYP2C19, CYP3A4, CYP3A5
Synthetic Cannabis	JWH-018	CYP1A2	CYP2C9
	AM2201	CYP1A2	CYP2C9
Dissociative Drugs	Ketamine	CYP3A4	CYP2B6, CYP2C9, CYP3A5
	Phencyclidine (PCP)	CYP3A4	CYP3A5, CYP1A2
Ergoline derivatives	Lysergic acid diethylamide (LSD)	CYP3A4	CYP3A5

Medical Billing Coverage Rationale

- The use of pharmacogenetic Multi-Gene Testing versus Panels to guide therapy decisions is proven and medically necessary for antidepressant and antipsychotic medications when all the following criteria are met:
- The individual has a diagnosis of major depressive disorder or generalized anxiety disorder; and
- The individual has failed at least one prior medication to treat their condition; and
- The Multi-Gene Testing reporting focuses on relevant drugs and genes.

Medical Billing Documentation Requirements

- Benefit coverage for health services is determined by the member specific benefit plan document and applicable laws that may require coverage for a specific service. The documentation requirements outlined below are used to assess whether the member meets the clinical criteria for coverage but do not guarantee coverage of the service requested.

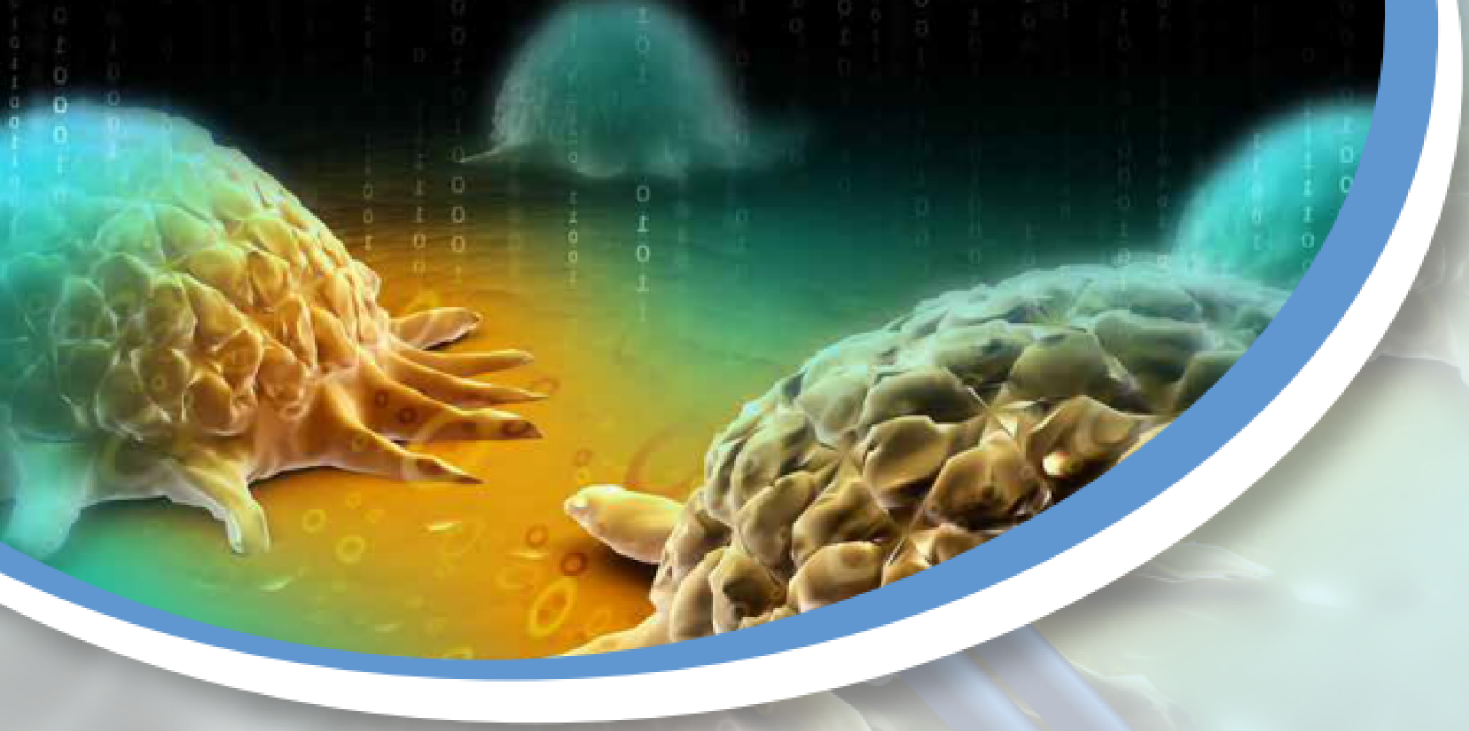
CPT Codes*	Required Clinical Information
Pharmacogenetic Testing	
0173U 0175U 81479	Medical notes documenting the following, when applicable: • Diagnosis • History of illness, including treatments tried and failed • Genes included in the Panel • Name of lab performing test and name of test, if available • Physician treatment plan based on results of genetic testing

**For code descriptions, see the Applicable Codes section.*

Medical Billing Definitions

- Multi-Gene Testing: Genetic tests that uses technologies to test multiple genes simultaneously. ✔
- Panel: A group of laboratory tests that are performed together to assess a body function or disease (Medicare, 2019 and McGraw Hill, 2002).

Our Mission, Vision and Values serve as the foundation for our organization's strategic plan. They convey the purpose, direction and underlying values of our organization. Our statements serve as powerful tool that provide our organizations with meaningful guidance.



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- Mid-age cancer risks
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COMMON SYMPTOMS

- Problems with eating
- Changes in bowel habits
- Breast changes (ie: Lump)
- Skin changes (ie: New mole)
- Difficult or painful urination
- A thickening or lump on or under the skin
- Weight gain or loss with no known reason
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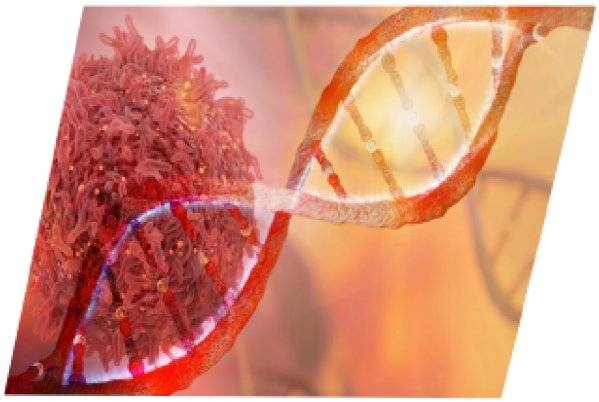
- Improves patient satisfaction



CGX / CANCER RISK SCREENING

COMMON ICD-10 CODES

Breast Cancer	
C50	Malignant neoplasm of breast
C50.1 - C50.9	Malignant neoplasm of breast (Other Quadrants)
Ovarian Cancer	
C56.9	Adenocarcinoma / Androblastoma / Arrhenoblastoma, Neoplasm ovary- malignant / Carcinoma (malignant), Cystadenocarcinoma / Cystadenoma / Dysgerminoma, Leydig cell, Sertoli cell / Tumor: Neoplasm - unspecified
Colorectal Cancer	
C7A.02	Malignant carcinoid tumors of the colon
C00-D49	Neoplasms
C15-C26	Malignant neoplasms of digestive organs
Endometrial Cancer	
C54.1	Malignant neoplasm of endometrium
C54.2	Malignant neoplasm of myometrium
C54.3	Malignant neoplasm of fundus uteri
C54.9	Malignant neoplasm of corpus uteri, unspecified
Pancreatic Cancer	
C25.9	Adenocarcinoma, Carcinoma (malignant)
Prostate Cancer	
C61	Malignant neoplasm of prostate
C63.7	Malignant neoplasm of seminal vesicle
Gastric Cancer	
C16.9	Adenocarcinoma, Carcinoma (malignant), Leather bottle stomach, Tumor
Skin Cancer	
C43 - C43.9	Malignant melanoma of skin
C43.0 - C43.9	Malignant melanoma of skin (Various regions)
C44.0 - C44.9	Other malignant neoplasms of skin (Various regions)

* Not all inclusive list

Immunogenomics LLC is a full service, national diagnostic testing laboratory with concentrations in clinical diagnostics, toxicology, genetics sequencing and molecular testing. Immunogenomics LLC is devoted to redefining diagnostic services by providing medical practitioners and their patients with exceptional customer service paired with the most advanced and informative medical analytics to assist them in making effective treatments decision.

Immunogenomics LLC fully automated laboratory utilizes state-of-the-art technologies to deliver high quality test results and service while exceeding the turnaround time requirements and demands of our physicians clients. Immunogenomics LLC currently analyzes samples for hundred of thousands of patients per year from providers and healthcare facilities all across the nation.

As our clients have trusted our laboratory with being an analytical and integral part of their patients' diagnosis and treatment process, we believe in respecting that trust with continuous dedication to customer satisfaction and support. We join our clients and physicians in their belief that patient care is and always will be the number one priority. Immunogenomics LLC personalized support and professional service continues to exceed the expectations of our valued clients, providers and facilities. More healthcare facilities and providers, in private practices, in hospitals and in long term care facilities, are placing their trust in Immunogenomics LLC; and, together we are transforming advanced diagnostic information into knowledge and superior treatment options for more and more patients every day.

NutriGenomics

The Science Behind it

One man's food is another man's poison – Lucretius Nutrition is one of the most important lifestyle factors affecting your risk for developing certain diseases and has a significant impact on overall well-being. Over the past decade, there has been growing recognition of the importance of how genes influence our nutritional status, which directly impacts our health. The human genome consists of about 25,000 genes and virtually all can exist in different forms. The variations in our genes make us unique from one another. Genetic variation determines not only the color of our eyes and hair, but how we metabolize and utilize the foods, nutrients and supplements we ingest. Nutrigenomics is the science that applies genomic information and advanced technologies to uncover the relationship between genes, nutrition and human health. The term nutrigenomics refers to both the study of how the food, beverages and supplements we consume affects our genes and how our genes can influence our body's response to what we consume. Different versions of a gene can make us respond differently to certain components in food such as the lactose in milk, the gluten in bread, the caffeine in coffee, along with carbohydrates, fats, proteins vitamins and minerals found in various foods. We are all familiar with people who are lactose intolerant or cannot eat gluten. These differences between individuals can be explained by gene variations within the population. Through science and research we have learned that genetic variations in the population and between individuals affect a wide variety of responses to key components of the human diet. For instance, some individuals may benefit from limiting their consumption of caffeine or increasing their intake of omega-3 fat, while others can follow the general recommendation for either or both. Your best diet depends on the specific variants you have for these nutrient-related genes. Understanding your genetic profile and its implications on your unique response to the foods, supplements and beverages you consume will provide you with the tools needed to make the best dietary choices.

The science of how specific genes change how we respond to dietary components enables us to use nutrition to its fullest potential to prevent, manage or improve various health issues. These personalized diets can optimize an individual's nutritional status and empower them to focus on preventing diet-related diseases or conditions. A healthy, balanced diet should provide enough energy and nutrients to support optimal health, reduce the risk of disease and maintain a healthy body weight. While general dietary recommendations might be prudent to follow, the one-sizefits-all approach to nutritional advice could limit some individuals from reaching their full potential for health and wellness. By tailoring one's nutritional needs to their genetic profile, the benefits of nutrition on health status can be maximized.

Summary of Results

Nutrient Metabolism

Dietary Component	Gene, rs Number	Risk Variant	Your Variant	Your Risk	Recommendations
Vitamin A	BCMO1, rs11645428	GG	GG	Elevated	Focus on consuming preformed sources of vitamin A.
Vitamin B_{12}	FUT2, rs601338	GG or GA	GA	Elevated	Focus on consuming bioavailable sources of vitamin B12.
Vitamin C	GSTT1, rs2266633	Del	Ins	Typical	Meet the RDA for vitamin C daily.
Vitamin D	CYP2R1, rs10741657	Algorithm	GA	Elevated	Consume 1000 IU (25 mcg) vitamin D daily.
	GC, rs2282679		GG		
Vitamin E	COMT, rs4680	GG	GA	Typical	Meet the RDA for vitamin E daily from food sources rich in vitamin E.
Folate	MTHFR, rs1801133	CT or TT	TT	Elevated	Meet the RDA for folate daily.
Choline	MTHFD1, rs2236225	Algorithm	GG	Elevated	Meet the Adequate Intake (AI) level for choline daily.
	PEMT, rs12325817		CG		
Calcium	GC, rs7041	Algorithm	TG	Elevated	Consume 1200 mg of calcium daily.
	GC, rs4588		CA		
Iron Overload	SLC17A1, rs17342717	Algorithm	CC	Low	Follow the recommendations provided in the Low Iron Status section.
	HFE, rs1800562		GG		
	HFE, rs1799945		CC		
Low Iron Status	TMPRSS6, rs4820268	Algorithm	GA	Elevated	Meet the RDA for iron and consume sources of vitamin C with iron-rich foods.
	TFR2, rs7385804		CA		

Food Intolerances and Sensitivities

Dietary Component	Gene, rs Number	Risk Variant	Your Variant	Your Risk	Recommendations
Lactose	MCM6, rs4988235	CC or CT	CT	Slightly Elevated	Limit dairy intake if you experience gastrointestinal symptoms.
Gluten	HLA, rs2395182	Algorithm	GT	Medium	Medium risk for gluten intolerance.
	HLA, rs7775228		TT		
	HLA, rs2187668		CT		
	HLA, rs4639334		GG		
	HLA, rs7454108		TT		
	HLA, rs4713586		AA		
Caffeine	ADORA2A, rs5751876	TT	CT	Typical	Follow the recommendations provided by the CYP1A2 gene section of this report.

Cardiometabolic Health

Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Caffeine	CYP1A2, rs2472300	GA or AA	AA	Elevated	Limit caffeine intake to 200 mg/day.
Whole Grains	TCF7L2, rs12255372	TT or GT	GT	Elevated	Consume most grain products as whole grains.
Sodium	ACE, rs4343	GA or AA	AA	Elevated	Limit sodium intake to the Adequate Intake level.
Omega-6 and Omega-3 Fat	FADS1, rs174547	CC or CT	TT	Typical	Meet the RDA for omega-6 LA fat and omega-3 ALA fat.
Physical Activity	LIPC, rs1800588	TT or CT	CT	Enhanced	Aim for 150 to 300 min/week of cardio and at least 2 days/week of muscle-strengthening activities.

Weight Management and Body Composition

Dietary Component	Gene, rs Number	Response Variant	Your Variant	Your Response	Recommendations
Physical Activity	FTO, rs9939609	Algorithm	AA	Enhanced	Aim for at least 30-60 mins/day of cardio activity, 6 days/ week, and muscle-strengthening activities at least 2 days/ week.
	ADRB2, rs1042713		GG		
Energy Balance	UCP1, rs1800592	GG or GA	GA	Diminished	For weight loss, aim for a daily energy deficit of 10-20% from your current energy needs plus an additional 150 kcal.
Protein	FTO, rs9939609	AA	AA	Enhanced	Consume 25-35% of energy from protein.
Total Fat	TCF7L2, rs7903146	TT	CC	Typical	Consume 20-35% of energy from fat.
Saturated Fat	APOA2, rs5082	CC	TC	Typical	Limit intake of saturated fat to no more than 10% of energy.
Saturated and Unsaturated Fat	FTO, rs9939609	TA or AA	AA	Enhanced	Limit intake of saturated fat to no more than 10% of energy. Consume at least 5% of energy from polyunsaturated fat.
Monounsaturated Fat	PPARγ2, rs1801282	GG or GC	CC	Typical	Aim for a balance of saturated, monounsaturated and polyunsaturated fats to meet your total daily fat intake.

Exercise Physiology, Fitness and Injury Risk

Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Motivation to Exercise	BDNF, rs6265	AA or AG	AA	Enhanced	You have an enhanced innate motivation to exercise.
Exercise Behavior	CYP19A1, rs2470158	Algorithm	GG	Typical	You have a typical likelihood of engaging in physical activity.
	LEPR, rs12405556		GT		
Power and Strength	ACTN3, rs1815739	TC or CC	CC	Ultra	You have a genetic advantage to excel in power sports.
Endurance	NFIA-AS2, rs1572312	Algorithm	CC	Typical	Your endurance potential is typical.
	ADRB3, rs4994		TT		
	NRF2, rs12594956		CA		
	GSTP1, rs1695		AG		
	PGC1a, rs8192678		AA		
Muscle Damage	ACTN3, rs1815739	TC or TT	CC	Typical	Meet general guidelines for warming up and cooling down.
Pain	COMT, rs4680	GG or GA	GA	Enhanced	You have an enhanced pain tolerance and therefore tend to experience less pain.
Bone Mass	WNT16, rs2707466	TC or CC	TC	Elevated	You have an elevated risk for low bone mass.
Achilles Tendon Injury	COL5A1, rs12722	CT or TT	CC	Typical	You have a typical risk for Achilles tendon injury.

Eating Habits

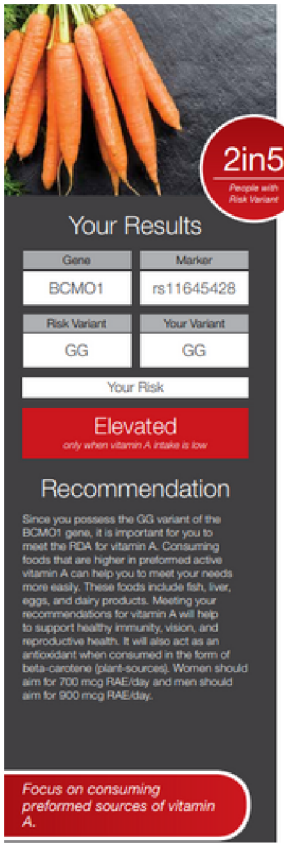
Dietary Component	Gene, rs Number	Risk/ Response Variant	Your Variant	Your Risk/ Response	Recommendations
Fat Taste Perception	CD36, rs1761667	GG or GA	AA	Typical	Your ability to sense the fatty taste of foods is typical.
Sugar Preference	GLUT2, rs5400	CT or TT	CT	Elevated	You have a high preference for sugar.
Eating between Meals	MC4R, rs17782313	CC or CT	TT	Typical	Your tendency to eat between meals is typical.

Your Dietary Intake and DNA-Based Dietary Recommendations

Dietary Component	Your estimated dietary intake per day[1]	Your DNA-based recommendations per day (for weight maintenance)[2]	Your DNA-based recommendations per day (for weight loss)[2]
Energy Balance[3]	2910 kcal	1968 kcal	1650 kcal
Carbohydrates			
Carbohydrates	243 g	148-271 g	124-227 g
Added Sugar	47 g	<25 g	<21 g
Whole Grains (proportion of grains consumed as whole grain)	~31 %	>75 %	>75 %
Protein			
Protein	118 g	123-172 g	103-144 g
Fats			
Total Fat[4]	149 g	44-77 g	37-64 g
Saturated Fat	43 g	<17-22 g	<14-18 g
Monounsaturated Fat	63 g	14-25 g	12-21 g
Polyunsaturated Fat	31 g	13-14 g	11 g
Omega-3 Alpha-Linolenic Acid (ALA)	2.3 g	1.7-2.6 g	1.5-2.2 g
Omega-6 Linoleic Acid (LA)	25 g	<10.9 g	<9.2 g

Dietary Component	Your estimated dietary intake per day[1]	Your DNA-based recommendations per day[2]
Micronutrients		
Vitamin A	1235 mcg	700 mcg
Vitamin B_{12}	4.2 mcg	2.4 mcg
Vitamin C[5]	40 mg	75 mg
Vitamin D	489 IU	1000 IU
Vitamin E	25 IU	22 IU
Folate	274 mcg	400 mcg
Choline	485 mg	425 mg
Iron[6]	11 mg	18 mg
Calcium	1248 mg	1200 mg
Sodium[7]	4372 mg	<1500 mg
Caffeine		
Caffeine	353 mg	<200 mg
Lactose		
Lactose	23 g	See section on Lactose Intolerance

1. Your current intake levels were calculated from your responses to the dietary assessment you completed online. Note that nutrient intakes reflect only those from food and beverage sources (not from supplement intakes).
2. Your DNA-based recommendations are based on the results from your DNA testing and customized recommendations in this report
3. Your total energy intake should not fall below 1200 kcal per day in order to maintain adequate intake of nutrients.
4. Total fat reflects intakes of saturated, monounsaturated, polyunsaturated, trans and other fatty acids.
5. Individuals who smoke cigarettes need an additional 35 mg of vitamin C per day.
6. If your iron overload risk is medium or high, please review the recommendations in the iron overload section of the report.
7. If you frequently sweat heavily during exercise, causing sodium losses, your sodium requirements may be higher.



Vitamin A (Beta-Carotene)

Vitamin A is a fat-soluble vitamin that is important for eye health and vision, a strong immune system and healthy reproduction. Beta-carotene is a precursor of active vitamin A (retinol) and is an antioxidant found in certain fruits and vegetables that are orange-red in color. Beta-carotene can be converted to preformed vitamin A in the body to exert its biological functions. Research shows that individuals with the GG version of the BCMO1 gene are inefficient at converting beta-carotene to preformed active vitamin A.* These individuals are considered low responders to dietary beta-carotene, so consuming enough active vitamin A can help ensure circulating levels of active vitamin A are adequate to support vision, immunity and reproductive functions. *Lietz G et al. Single nucleotide polymorphisms upstream from the b-carotene 15,15'-monoxygenase gene

Sources of Vitamin A

	High in Preformed Vitamin A	Amount (mcg RAE)
Pumpkin, canned (1/2 cup)		1010
Carrots, cooked (1/2 cup)		650
Sweet potato, boiled without skin (1/2 medium)		600
Light tuna (75g)	✓	530
Spinach, boiled (1/2 cup)		500
Butternut squash (1/2 cup)		410
Goat cheese, hard (50g)	✓	240
Eggs (2 large)	✓	220
Mackerel (75g)	✓	190

Source: Health Canada's Nutrient Value of Some Common Foods and Dietitians of Canada Food Sources of Vitamin A

BCMO1 Beta-carotene mono-oxygenase 1 (BCMO1) is an enzyme that plays a key role in the conversion of beta-carotene into the active form of vitamin A. Beta-carotene is the plant form of vitamin A. Individuals who possess the GG version of the BCMO1 gene are inefficient at converting beta-carotene into the active form of vitamin A. These individuals need to ensure they are consuming adequate amounts of vitamin A,

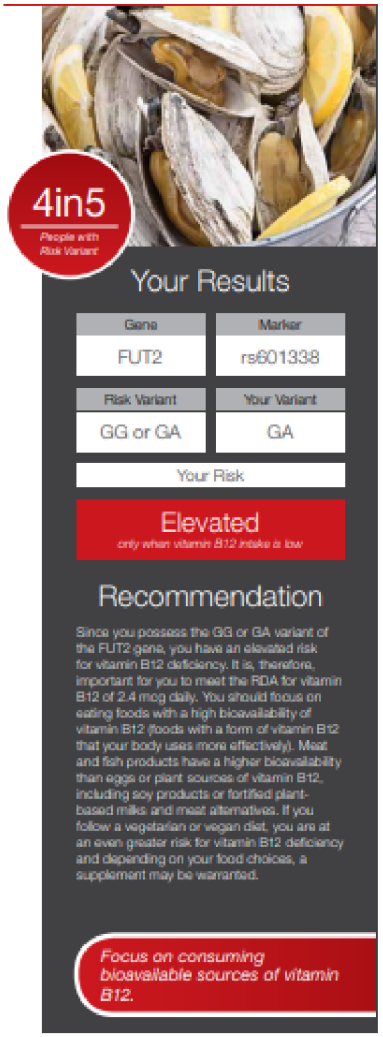
Vitamin B12

Sources of Vitamin B_{12}

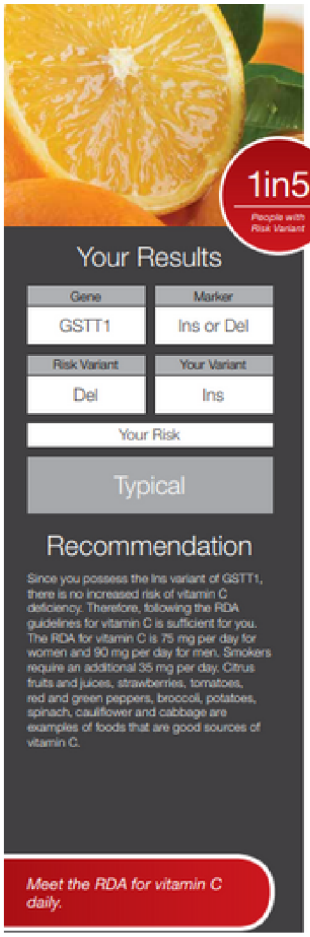
	Amount (mcg)
Clams, boiled or steamed (5 large)	59.0
Oysters, boiled or steamed (6 medium)	14.7
Atlantic herring (75g)	14.0
Fortified nutritional yeast (1 Tbsp)	3.9
Ground beef, lean (75g)	2.2
Fortified plant-based beverage (1 cup)	2.2
Atlantic salmon (75g)	2.1
Lamb (75g)	1.7
Soy 'burger' patty (1)	1.7
Eggs, hard boiled (2)	1.1

Source: Health Canada's Nutrient Value of Some Common Foods and http://nutritiondata.self.com

Vitamin B12 (cobalamin) is important for normal brain and nervous system functioning. It helps to keep blood cells healthy and prevent megaloblastic anemia, which can make you feel very weak and tired. Being deficient in vitamin B12 is also associated with pallor (pale skin) and irritability. Research shows that some individuals are at a greater risk than others for vitamin B12 deficiency based on the FUT2 gene.* Since animal products are the primary sources of vitamin B12, individuals following a vegetarian diet are at an even greater risk of vitamin B12 deficiency. *Hazra A et al. Common variants of FUT2 are associated with plasma vitamin B12 levels. Nature Genetics



FUT2 The fucosyltransferase 2 (FUT2) enzyme is encoded by the fucosyltransferase 2 gene and is involved in vitamin B12 absorption and transport between cells. Variants of this gene have been linked to low blood levels of vitamin B12 especially when consuming a vegetarian diet. However, for individuals with the risk variant, consuming adequate vitamin B12 can help reduce the risk of vitamin B12 deficiency



Vitamin C

Vitamin C is an essential nutrient and powerful antioxidant. Vitamin C also aids in the absorption of non-heme (plant) iron, and supports immune function and the formation of collagen, a protein used to make skin, connective tissue, and blood vessels, along with supporting bone and tissue repair. Low blood levels of vitamin C have been associated with an elevated risk of cardiovascular disease, type 2 diabetes and cancer. Research has shown that the amount of vitamin C absorbed into the blood can differ between people even when the same amount is consumed. Some people do not process vitamin C from the diet as efficiently as others and are at a greater risk of vitamin C deficiency. Studies have shown that the ability to process vitamin C efficiently depends on a gene called GSTT1

.* *Cahill LE et al. Functional genetic variants of glutathione S-transferase protect against serum ascorbic acid deficiency. American Journal of Clinical Nutrition. 2009;90:1411-7. Horska A et al. Vitamin C levels in blood are influenced by polymorphisms in glutathione S-transferases.

Sources of Vitamin C

	Amount (mg)
Red pepper (1 pepper)	216
Strawberries (1 cup)	96
Pineapple (1 cup)	92
Brussels sprouts (1 cup)	90
Orange juice (1 cup)	86
Broccoli (1 cup)	82
Grapefruit (1 fruit)	78
Mango (1 fruit)	75
Kiwi (1 fruit)	70

Source: TACO (UNICAMP), Canadian Nutrient File and USDA Nutrient Database

GSTT1 The GSTT1 gene produces a protein for the glutathione S-transferase enzyme family. These enzymes play a key role in the utilization of vitamin C. The GSTT1 gene can exist in one of two forms. The insertion ("Ins") form is considered functional while the deletion ("Del") form is not functional. The different versions of this gene influence the way vitamin C is utilized in the body. A deletion version of the gene results in a reduced ability to process vitamin C. This means that people who possess the deletion version (Del) will have lower blood levels of vitamin C at a given level of vitamin C intake compared to people who possess the insertion version (Ins) of the gene.

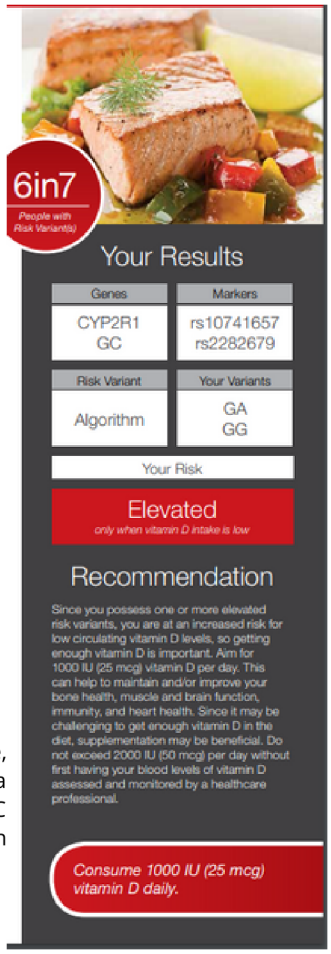
Vitamin D

Sources of Vitamin D

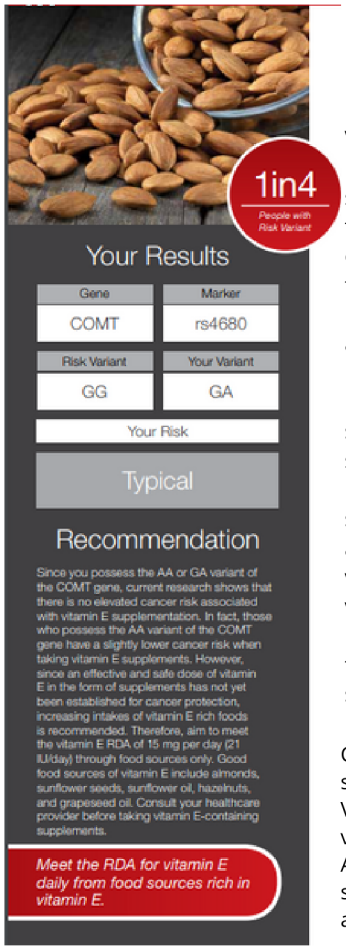
	Amount (IU)
Sockeye salmon (75g)	680
Whitefish (75g)	448
Sardines, canned in oil (1/2 can)	254
Rainbow trout (75g)	192
Smoked salmon (40g)	168
Halibut (75g)	144
Fortified plant-based beverage (1 cup)	124
Arctic char (75g)	112
Milk (1 cup)	104
Orange juice, fortified with vitamin D (1/2 cup)	50

Source: Health Canada's Nutrient Value of Some Common Foods and Canadian Nutrient File

Vitamin D is essential to calcium metabolism and promotes calcium absorption in the gut. Low levels of vitamin D are associated with decreased bone mineral density and an increased risk of fractures. Vitamin D also contributes to normal functions of most cells in the body. Vitamin D can be synthesized by the skin from UV light or it can be obtained from the diet. Low blood levels of vitamin D can result in weak, brittle bones, poor muscle function, and decreased immunity. Life-long vitamin D insufficiency has also been linked to accelerated cognitive decline, autoimmune disorders, neuro-degenerative diseases and cardiovascular disease. Vitamin D deficiency is diagnosed by measuring the most common form of vitamin D in the blood, which is 25-hydroxyvitamin D. Research shows that variations in the CYP2R1 and GC genes can affect your risk for low circulating 25-hydroxyvitamin D levels.*



CYP2R1 & GC Vitamin D 25-hydroxylase is the key enzyme that activates vitamin D from its pre-formed type, which is obtained through sun exposure and the diet. This enzyme is encoded by the CYP2R1 gene and a variant of this gene has been associated with an increased risk of low circulating levels of vitamin D. The GC gene encodes the vitamin D-binding protein, which binds vitamin D and transports it to tissues. A variant in this gene has also been associated with an increased risk of low circulating levels of vitamin D.



Vitamin E

Vitamin E is a fat-soluble antioxidant essential for building a strong immune system and supporting skin and eye health, and it may also help to reduce the risk of cardiovascular disease. Most vegetable oils, such as grapeseed, sunflower, canola and flaxseed oil, are excellent sources of vitamin E. Nuts and seeds are also great sources. Given its antioxidant properties, there has been much interest in the role for vitamin E supplementation in cancer prevention. While some studies have shown a protective effect of vitamin E supplementation on cancer risk, others have reported increased risk with higher vitamin E supplementation.* The discrepancy in findings across studies may be partly related to genetic variants that modify the risk associated with vitamin E supplementation. Scientists have reported a genetic variant in COMT may modify the risk associated with vitamin E supplementation.

Sources of Vitamin E

	Amount (mg)
Almonds (1/4 cup)	9.3
Sunflower seeds, roasted (1/4 cup)	8.5
Sunflower oil (1 Tbsp)	5.7
Hazelnuts, dry roasted (1/4 cup)	5.2
Avocado (1/2 fruit)	4.0
Peanut butter (2 Tbsp)	2.9
Peanuts, dry roasted (1/4 cup)	2.6
Flaxseed oil (1Tbsp)	2.4
Canola oil (1 Tbsp)	2.4
Halibut (75g)	2.2
Eggs (2 large)	1.0

Source: Health Canada's Nutrient Value of Some Common Foods

COMT The COMT gene produces an enzyme called catechol-O-methyltransferase, which helps detoxify both substances produced by the body and environmental compounds such as drugs and harmful toxins. Variations in the COMT gene impact the enzyme activity of COMT, and research shows that this genetic variation may modify the way individuals respond to vitamin E supplementation as it relates to risk of cancer. Among individuals with the GG variant, a slightly increased cancer risk was observed with vitamin E supplementation compared to placebo. By contrast, those with the GA variant experienced no risk or benefit, and individuals with the AA variant had a slightly reduced cancer risk following vitamin E supplementation.

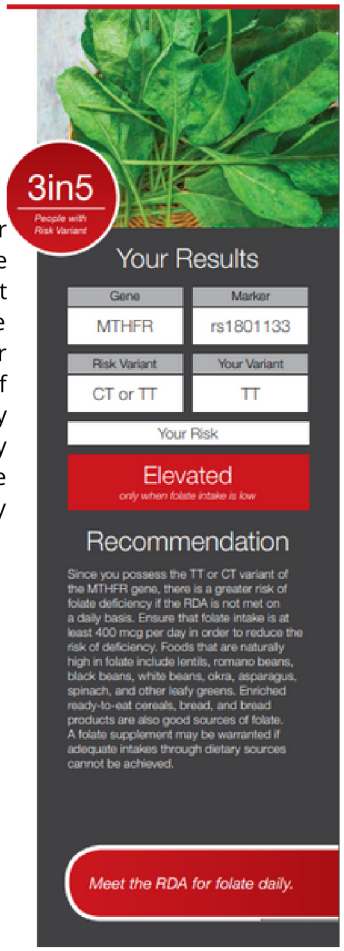
Folate

Sources of Folate

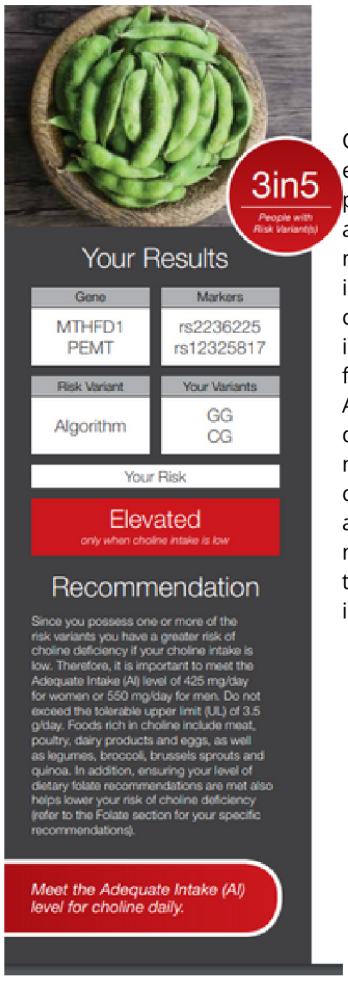
	Amount (mcg)
Lentils, cooked (3/4 cup)	265
Edamame (soybeans) (1/2 cup)	190
Spinach, cooked (1/2 cup)	130
Asparagus (6 spears)	128
Chickpeas (3/4 cup)	119
Black beans (3/4 cup)	108
Artichoke, boiled (1/2 cup)	106
Kale, raw (1 cup)	100
Avocado (1/2 fruit)	81

Source: Canadian Nutrient File and USDA Nutrient Database

Folate is a water-soluble B vitamin that is necessary for cell growth and development. Low blood levels of folate have been associated with increased risk of heart disease and stroke. Research has shown that the amount of folate absorbed into the blood can differ between individuals even when the same amount of folate is consumed. Some people do not utilize dietary folate as efficiently as others and consequently may beat a greater risk for folate deficiency. Studies* have shown that an individual's ability to process dietary folate efficiently depends on a gene called MTHFR.



MTHFR The MTHFR gene produces methylenetetrahydrofolate reductase (MTHFR), which is a vital enzyme for folate usage in the body. MTHFR converts folate obtained from the diet to an active form of the nutrient that can be used by the body at the cellular level. Variations in the MTHFR gene determine the way individuals can utilize dietary folate. Those people who have the CT or TT variant of the gene have reduced MTHFR enzyme activity and are at greater risk of folate deficiency when folate intake is low, compared to those with the CC variant.



Choline

Choline plays numerous roles in the body. This essential nutrient is involved in multiple metabolic pathways, and is needed for the production of acetylcholine, a neurotransmitter implicated in memory, mood, and muscle control. Choline is found in all cells of the body, providing a vital structural component to cell membranes. Choline can also impact early brain development and regulate the function of genes or how they are "expressed". Although some choline is produced by the body, dietary sources of choline are necessary to meet daily needs. A number of factors contribute to individual choline needs, such as estrogen levels, pregnancy and lactation, age, athletic activity, as well as dietary methionine, betaine and folate. Research also shows that variation in the MTHFD1 and PEMT genes also impact dietary choline needs.*

Sources of Choline

	Amount (mg)
Egg (1)	147
Soybeans (1/2 cup)	107
Chicken breast (85g)	72
Ground beef (85g)	72
Atlantic cod (85g)	71
Shiitake mushrooms, cooked (1/2 cup)	58
Baked potato (1 large)	57
Wheat germ (2 Tbsp)	51
Kidney beans (1/2 cup)	45

Source: National Institutes of Health

MTHFD1 & PEMT Methylene tetrahydrofolate dehydrogenase (MTHFD1) encodes an enzyme responsible for folate (also known as vitamin B9) metabolism. Choline's function is tightly linked to the metabolism of folate, as both share overlapping roles in the same metabolic pathways. Individuals who carry the A allele of the MTHFD1 gene are at higher risk of developing clinical signs of choline deficiency when choline intakes are very low in comparison to those who have the GG genotype. In addition, the phosphatidylethanolamine N-methyltransferase (PEMT) gene encodes a protein that allows the liver to produce choline. Individuals with the CG or CC variants of the PEMT gene are at a higher risk of experiencing clinical signs of choline deficiency compared to those with the GG variant if choline intake is low. Meeting the Adequate Intake (AI) for choline is especially important for individuals with the risk variants of these genes.

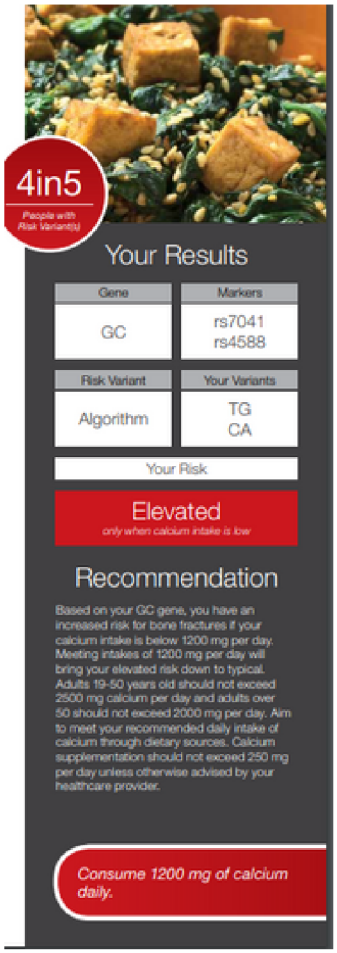
Calcium

Sources of Calcium

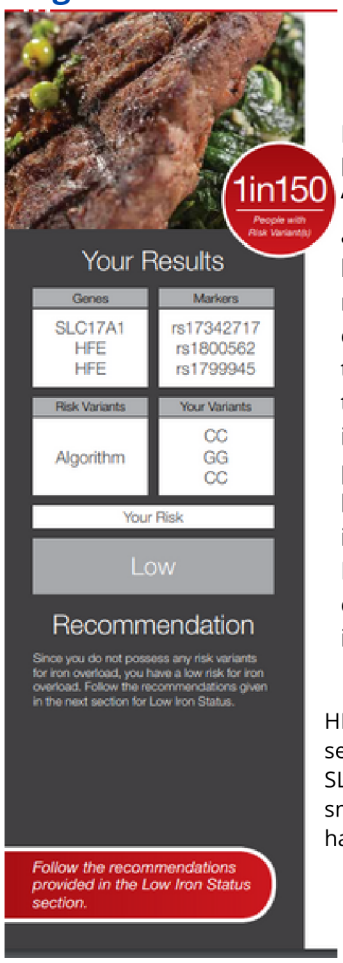
	Amount (mg)
Low-fat cheddar cheese (50g)	450
Yogurt, plain (3/4 cup)	330
Skim milk (1 cup)	325
Fortified soy or rice beverage (1 cup)	320
Tofu, firm (150g)	235
Canned salmon, with bones (75g)	210
Sardines, canned in oil (1/2 can)	200
Kefir, plain (3/4 cup)	185
Edamame (soybeans) (1/2 cup)	130
Spinach, boiled (1/2 cup)	130

Source: Health Canada's Nutrient Value of Some Common Foods

Dietary calcium is important for growth, maintenance and repair of bone tissue. It is also involved in maintenance of blood calcium levels, regulation of muscle contraction, nerve conduction, and normal blood clotting. In order to absorb calcium, we need adequate vitamin D intake (refer to the vitamin D section for your specific recommendations). Inadequate dietary calcium and vitamin D increase the risk of low bone mineral density and stress fractures. Research shows that some people do not utilize dietary calcium as efficiently as others and this may depend on variations in the GC gene.*



GC The GC gene encodes the vitamin D-binding protein, which binds vitamin D and then transports it to various tissues. Since vitamin D is needed for the absorption of calcium, this binding protein can impact calcium levels in the body and, therefore, bone fracture risk. Research shows that two variations in the GC gene are associated with an increased risk of bone fractures when calcium intake is low.



Iron Overload

Hemochromatosis is a condition where the body absorbs too much iron (i.e. iron "overload") and can result in liver disease, arthritis and heart conditions. If you have a high risk for iron overload it is important to monitor your iron intake and blood markers of iron status such as ferritin, hepcidin or transferrin saturation. There are two main types of dietary iron: heme and non-heme iron. Non-heme iron is found in certain plant products and is not absorbed as effectively as heme iron, but vitamin C can substantially increase the absorption of non-heme iron. Hereditary hemochromatosis is an iron overload condition that is linked to variations in the HFE or SLC17A1 genes.*

Sources of Iron

Sources of Heme Iron	Sources of Non-Heme Iron
Beef	Almonds
Chicken	Chickpeas
Fish	Parsley
Organ meats	Spinach
Shrimp	Tofu
Veal	White beans

HFE & SLC17A1 The human hemochromatosis protein is encoded by the HFE gene and variations in the gene sequence have been linked to iron overload. The SLC17A1 gene is located near the HFE gene and variations in SLC17A1 have also been linked to iron overload. The HFE protein functions to regulate iron uptake in the small intestine. Those with elevated risk variants need to be careful not to consume too much iron and should have their blood markers of iron monitored. This test detects approximately 95% of cases of iron overload.

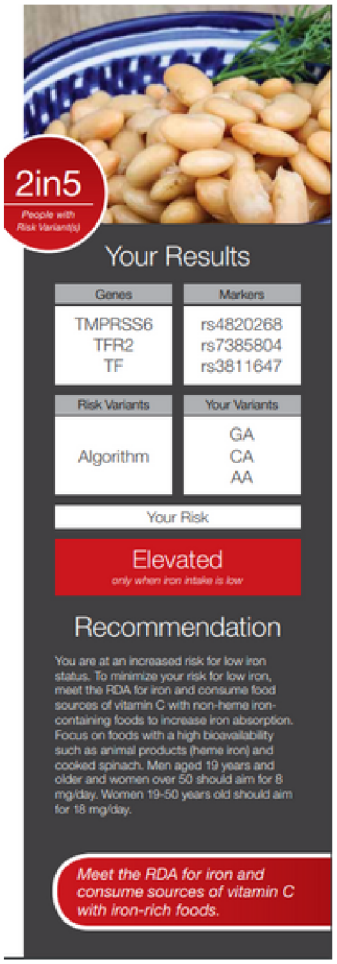
Low Iron Status

Sources of Iron

	Amount (mg)
Chicken liver (75g)	9.8
White beans, canned (1 cup)	8.0
Pumpkin seeds (2 Tbsp)	5.2
Spinach, boiled (1/2 cup)	3.4
Tofu, firm (1/2 cup)	3.0
Tahini (2 Tbsp)	2.7
Ground beef, extra lean (100g)	2.7
Chickpeas (3/4 cup)	2.4
Almonds (1/4 cup)	1.5
Lean ground chicken (75g)	1.2

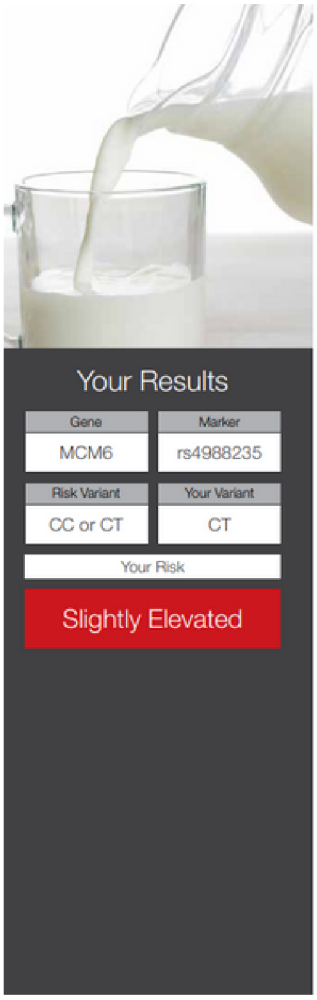
Source: Health Canada's Nutrient Value of Some Common Foods

Iron is an essential mineral and important component of hemoglobin, the substance in red blood cells that carries oxygen from your lungs to transport it throughout your body. Iron supports a strong immune system and is also necessary to maintain healthy cells, skin, hair, and nails. Low iron status is determined by measuring certain blood markers such as ferritin, hepcidin or transferrin. Low iron stores can lead to anemia, which is associated with fatigue, pale skin, weakness, shortness of breath and dizziness. Several genes can impact the risk of having low iron status including TMPRSS6, TFR2 and TF.*



TMPRSS6, TFR2 & TF The TMPRSS6 gene codes for the protein matriptase-2, which affects hepcidin levels that help to regulate iron balance. The transferrin receptor 2 (TFR2) gene codes for the TFR2 protein, which helps iron to enter into cells. The transferrin (TF) gene codes for the protein transferrin, which is mainly responsible for transferring iron in the body. Together, variations in these genes can impact the risk of low iron status.

Lactose



Lactose is a naturally occurring sugar found in dairy products. When lactose is properly digested, it is broken down into two different sugar molecules: glucose and galactose. Lactase is the enzyme needed to break down lactose. Some people do not produce any, or enough lactase. Because of this, lactose passes through the intestines undigested. When this occurs, gut bacteria in the intestines ferment the lactose, which produces gas that leads to bloating and cramps, and causes water to enter the intestine quickly leading to diarrhea. These are the uncomfortable symptoms associated with lactose intolerance. Some people who do not digest lactose cannot tolerate any dairy products, while others can tolerate small amounts of lactose. When dairy is consumed with a meal there can be minor symptoms or no symptoms at all, but consuming dairy on its own (especially fluid milk) can result in more severe symptoms.

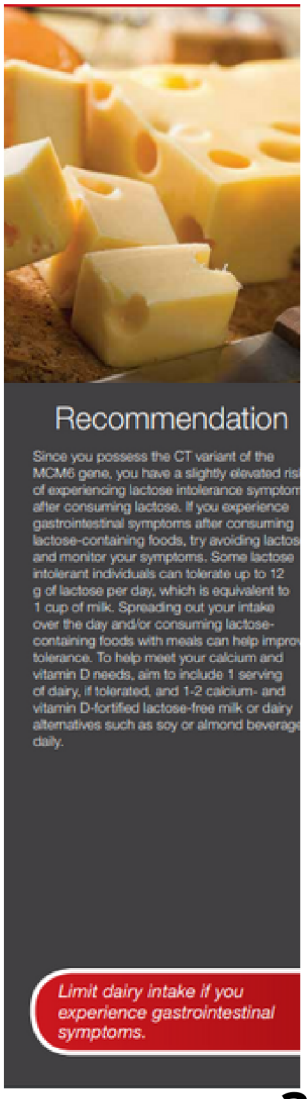
Sources of Lactose

	Amount (g)
Cow's milk (1 cup)	12
Goat's milk (1 cup)	11
Flavoured milk (1 cup)	10
Buttermilk (1 cup)	9
Yogurt (3/4 cup)	7
Frozen yogurt (1/2 cup)	5
Ice cream (1/2 cup)	5
Cottage cheese (1/2 cup)	3
Sour cream (1/4 cup)	2
Hard cheese, example: Parmesan (50g)	<1

Source: Dietitians of Canada, Food Sources of Lactose

Lactose Intolerance

Individuals who are lactose intolerant cannot digest lactose. When lactose is not digested, it can cause uncomfortable symptoms such as stomach upset, gas, bloating, and/or loose stools. These symptoms can develop as early as one hour after you consume lactose-containing products. Typically, individuals with lactose intolerance may have to consume a lactose-free or lactose-reduced diet for life or consume dairy products with a meal to reduce the impact of lactose on the gastrointestinal system. Sometimes you can train your body to produce more lactase enzyme by gradually introducing lactose into your diet. Some lactose intolerant individuals can tolerate up to 12 g of lactose per day, which is equivalent to 1 cup of milk. Spreading out your intake over the course of a day and/or consuming lactose-containing foods with meals can help improve tolerance. Your risk for lactose intolerance depends in part on the MCM6 gene. Sometimes you can develop shortterm lactose intolerance when you are sick.



Nutrition Considerations with a Lactose-Free Diet

Research shows that individuals who consume a lactose-free diet are at a greater risk of inadequate calcium and vitamin D intake compared to individuals who can tolerate lactose.* Calcium and vitamin D are important for building and maintaining strong bones and teeth. If you have lactose intolerance, you can still get enough calcium and vitamin D in the diet through lactose-free milk as well as fortified milk alternatives such as soy and almond beverages. Calcium and vitamin D are not added to all milk alternatives, so be sure to read the label to check that the products you are choosing have been "fortified with calcium and vitamin D."

MCM6

MCM6 is part of the MCM complex that helps to regulate the expression of the LCT gene, which encodes lactase, the enzyme that plays a role in breaking down lactose. Variations in this gene can impact your ability to break down lactose, impacting your risk for lactose intolerance. Individuals who possess the CC or CT variant may produce some lactase, but in limited amounts. Individuals with the CC or CT variant have been shown to be at an increased risk for low calcium intake and blood calcium levels.* This particular variant in MCM6 may not predict lactose intolerance risk for individuals who are not of European descent.

Your Results

Gene	Markers
HLA	rs2395182 rs7775228 rs2187668 rs4639334 rs7454108 rs4713586

Risk Variants	Your Variants
Algorithm	GT TT CT GG TT AA

Your Risk

Medium

Gluten

Gluten is a protein found in wheat, barley, rye and products made from these grains. Some oats also contain gluten. Many foods that contain gluten provide fibre from whole grains and can be an excellent source of vitamins and minerals. However, for some people, gluten can cause severe digestive problems leading to nutrient malabsorption, anemia and many serious health problems.

Sources of Gluten

Major Sources of Gluten	Hidden Sources of Gluten
Bread	Salad dressing
Pasta	Pudding
Cereal	Imitation crab meat
Crackers and chips	Vegan meat substitute
Oats*	Potato chips
Baked goods	French fries
Malt	Soup stock cubes
Soy sauce	Chocolate and candy
Gravy	Processed meat
Barley or wheat based-beer	Canned soup
Vinegars	Instant rice
Wheat - incl rye, spelt and barley	Ice cream

*Pure oats do not contain gluten; however, oats are often cross-contaminated with gluten-containing grains

Celiac Disease & Gluten Sensitivity

Celiac disease represents the most severe form of gluten intolerance and affects about 1% of the population. People with celiac disease require a gluten-free diet for life.* Non-celiac gluten sensitivity (NCGS) is a milder form of gluten intolerance that may affect 5% of the population. Individuals with NCGS often experience diarrhea, abdominal pain, fatigue and headaches when they consume gluten-containing foods. However, these adverse effects of gluten in individuals who do not have celiac disease are poorly understood and NCGS remains controversial.*

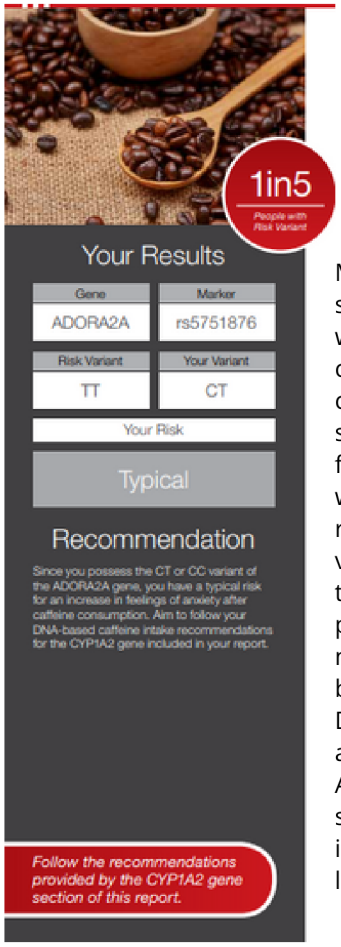
Recommendation

You have a medium risk for developing celiac disease; however, this does not mean you have celiac disease. Speak to a healthcare professional if you experience diarrhea, steatorrhea, cramps, flatulence, fatigue or joint pain while consuming gluten-containing foods, or if you have a family member with celiac disease. Major dietary sources of gluten include bread, pasta, cereal and any baked good made with wheat, barley or rye. It is not recommended that you immediately attempt to remove gluten from your diet, as eliminating gluten may interfere with the accuracy of celiac disease diagnostic tests.

Medium risk for gluten intolerance.

Nutrition Considerations when Following a Gluten-Free Diet

Gluten-free foods include all unprocessed vegetables, fruit, dairy products, meat, fish, poultry, nuts, legumes, seeds, fats and oils. Gluten-free grains include rice, quinoa, corn, buckwheat, amaranth, and millet. For individuals who need to follow a gluten-free diet, foods to avoid include any products that are made with wheat, rye, barley or triticale. Pure oats should be consumed in moderation if tolerated, while regular oats (which contain wheat) should be avoided. For the vast majority of the population, consuming a gluten-free diet is unnecessary. Processed gluten-free products often have more calories, sodium, added sugar and fat and fewer nutrients compared to their glutencontaining counterparts



Caffeine

Anxiety

Many commonly consumed foods and beverages, such as coffee, tea, soft drinks and chocolate, as well as functional beverages such as energy drinks, contain caffeine. There are also hidden sources of caffeine found in pain medications, weight loss supplements, as well as chocolate or coffee flavored beverages and food products. Caffeine is widely used to promote wakefulness and vigilance, reduce sleepiness and mitigate fatigue related to various shift-work occupations or travel across time zones. In the brain, the effects of caffeine are primarily due to its blocking action of adenosine, a neuromodulator that increases drowsiness and builds up over the day as bedtime approaches. Despite its widespread use, caffeine may cause anxiety in some people. A common variation in the ADORA2A gene contributes to the differences in subjective feelings of anxiety after caffeine ingestion,* especially in those who are habitually low caffeine consumers.**

Sources of Caffeine

	Amount (mg)
Coffee (1 cup)	100
Energy drinks (1 cup)	80
Espresso (1 shot)	85
Black tea (1 cup)	50
Green tea (1 cup)	45
Cola (1 can)	26
Chocolate, dark (40g)	27
Decaf coffee, espresso, tea (1 cup)	0-15
Herbal tea (1 cup)	0

Source: Canadian Nutrient File and USDA Nutrient Database

Cardiometabolic Health

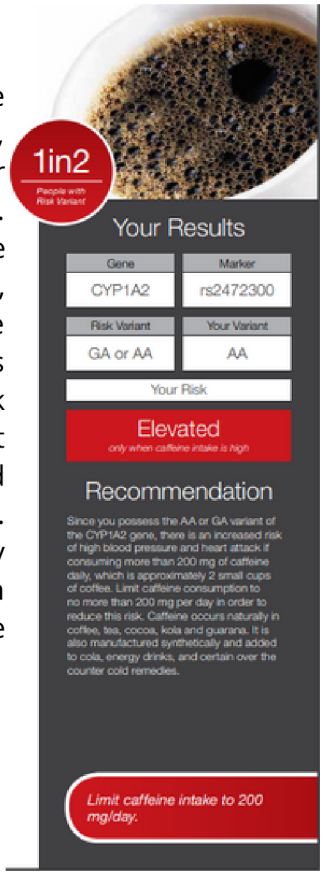
Caffeine is the most widely consumed stimulant in the world and coffee is the most significant source of caffeine, with tea, soda and chocolate also contributing to intakes. Research has shown that caffeine can influence cardiovascular health. However, the reported effects of coffee on the cardiovascular system have been inconsistent and at times have appeared contradictory. Some studies reported a link between high coffee consumption and an elevated risk of high blood pressure and heart disease, while other studies have shown no effect or even a protective effect with moderate intake. Two landmark studies* have now shown that the effect of coffee on cardiovascular disease depends on a variation in a gene called CYP1A2.

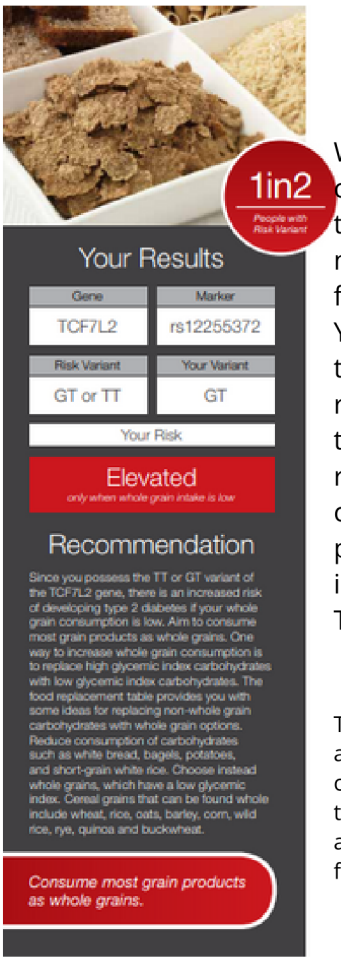
ADORA2A

The ADORA2A (adenosine A2A receptor) gene encodes one of the main receptors for adenosine. Adenosine has many functions in the body, including promoting sleep and calmness and suppressing arousal. Caffeine blocks adenosine receptors, resulting in the stimulating effects of coffee, tea, chocolate and other caffeinated food products and supplements. Individuals who possess the TT variant of the ADORA2A gene are more sensitive to the stimulating effects of caffeine and experience greater increases in feelings of anxiety after caffeine intake than do individuals with either the CT or CC variant.

CYP1A2

The CYP1A2 gene produces an enzyme called cytochrome P450 1A2 (CYP1A2), which is the main enzyme responsible for breaking down caffeine in the body. Variations in the CYP1A2 gene affect the rate at which caffeine is broken down, which determines the impact of caffeine on heart health. Individuals who possess the GA or AA variant of CYP1A2 break down caffeine more slowly and are at greater risk of high blood pressure and heart attack when caffeine intake is high. Those who have the GG variant actually have a lower risk of heart disease with moderate coffee consumption than those who consume no coffee at all.





Whole Grains

Whole grains are a low glycemic index carbohydrate that contain more fibre than refined grains. They also contain more essential micronutrients such as folic acid, magnesium and vitamin E. Years of research have demonstrated that whole grains may help reduce the risk of several diseases, particularly type 2 diabetes. Scientists have more recently shown that the benefits of consuming whole grains may be particularly important among individuals who have a variant in the TCF7L2 gene.*

Replace these foods...	with these foods..
White bread, bagels, pitas	100% whole grain bread, bagels and pitas
White rice	Brown or wild rice, quinoa
White pasta	100% whole wheat pasta or brown rice pasta
High sugar cold cereals	Oatmeal or 100% whole grain cold cereal
White flour baked goods	100% whole wheat flour baked goods

TCF7L2 The TCF7L2 gene produces a protein called transcription factor-7 like 2 (TCF7L2). This protein, in turn, affects how the body turns on or off a number of other genes. The interaction of these proteins and genes is complex, and not yet fully understood. However, the TCF7L2 gene is one of the most consistent predictors of the likelihood of developing type 2 diabetes. People who possess the high risk GT or TT variant of the gene are at greater risk of developing type 2 diabetes. Yet, recent studies have shown that consuming whole grain foods can reduce the risk of type 2 diabetes in individuals who carry the GT or TT variant of the TCF7L2 gene.

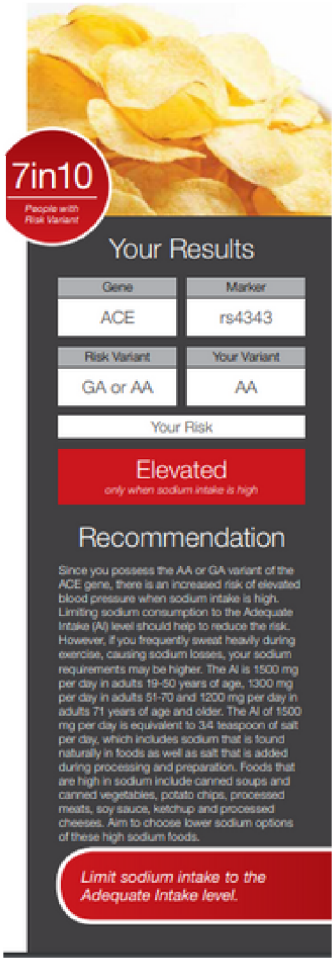
Sodium

Sodium is an essential micronutrient that regulates blood pressure and blood volume. Most people consume more sodium than the body requires. The major adverse effect of excess sodium intake is elevated blood pressure, which predisposes to hypertension and heart disease. However, some individuals do not experience as great an increase in blood pressure in response to excess sodium intake as others. Research shows that the effect of sodium intake on blood pressure is influenced by variations in a gene called ACE.*

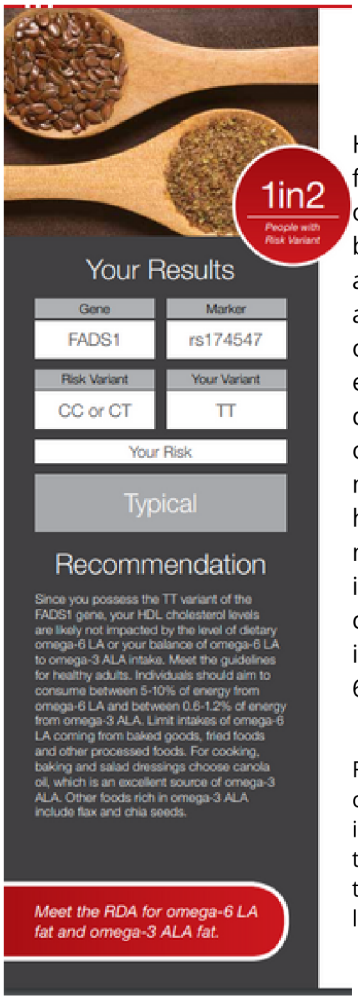
Sources of Sodium

	Amount (mg)
Ramen noodles, with flavour (1 package)	1760
Bagel with ham, egg and cheese	1260
Canned soup (1 cup)	1130
Ham (75g)	1040
Pickle (1 medium)	830
Tomato sauce, canned (1/2 cup)	650
Feta cheese (50g)	560
Chips (1 small bag)	390
Cold cereal (1 cup)	350
Bread (1 slice)	230

Source: Canadian Nutrient File and USDA Nutrient Database



ACE The ACE gene directs the body to produce the angiotensin-converting enzyme (ACE), which is known to play a role in regulating the response of blood pressure to sodium intake. Studies have shown that a person's blood pressure response to excess sodium intake is dependent on which variant of the ACE gene they possess. Those who have the GA or AA variant of the ACE gene are at a greater risk of experiencing elevated blood pressure when higher amounts of sodium are consumed than those possessing the GG variant of the gene.



Omega-6 and Omega-3 Fat

Higher consumption of polyunsaturated fats (PUFAs) is associated with reduced risk of cardiovascular disease. PUFAs include both omega-6 fat, such as linoleic acid (LA), and omega-3 fat, such as alpha-linolenic acid (ALA). Since our bodies cannot make omega-6 LA and omega-3 ALA, these essential fats must be obtained from our diets. However, consuming too much omega-6 LA and too little omega-3 ALA may have adverse health effects. Studies have shown that a gene involved in the metabolism of these PUFAs can adversely impact levels of HDL cholesterol ("good cholesterol") when dietary omega-6 LA intake is high,* or when the ratio of omega-6 LA to omega-3 ALA is too high.**

Sources of Omega-6 and Omega-3 Fats

	Omega-3 ALA (g)	Omega-6 LA (g)
Chia seeds (1 Tbsp)*	1.9	0.6
Flaxseeds (1 Tbsp)*	1.6	0.4
Canola oil (1 Tbsp)*	1.3	2.7
Walnuts (1/4 cup)	0.9	11
Edamame (1/2 cup)*	0.3	1.5
Salmon (75g)*	0.3	0.2
Sardines (75g)*	0.2	0.1
Corn oil (1 Tbsp)	0.2	7.3
Wheat germ cereal, toasted (1 Tbsp)*	0.1	0.4
Tahini (1 Tbsp)	0.1	3.5
Safflower Oil (1 Tbsp)	0.01	1.8
Sunflower Seeds (1/4 cup)	0.01	2.7
Sunflower Oil (1 Tbsp)	0.01	4

*Helps achieve a higher balance of omega-3 ALA to omega-6 LA Source: Canadian Nutrient File

FADS1 The FADS1 gene directs the production of an enzyme called fatty acid desaturase 1. This enzyme converts omega-6 LA and omega-3 ALA to longer-chain PUFAs that participate in inflammatory and immune responses. Compared to those with the TT variant, individuals who have the CC or CT variant of the gene have lower levels of HDL cholesterol when consumption of omega-6 LA is high. Among those with the CC or CT variant, increasing the proportion of dietary omega-3 ALA to omega-6 LA promotes higher levels of HDL cholesterol.

Physical Activity

for Cardiometabolic Health

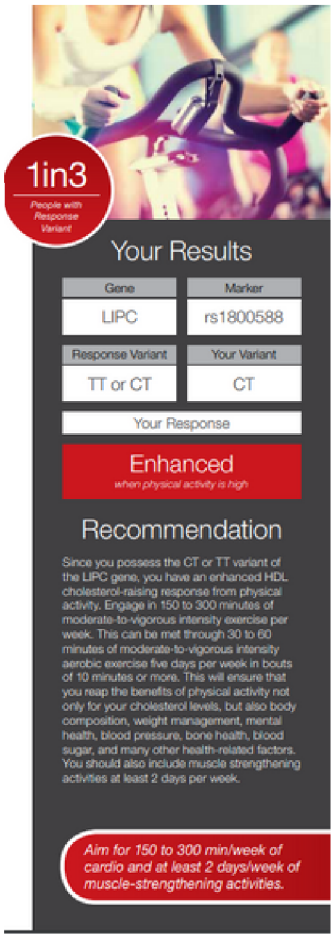
Physical activity has important benefits for mental health, physical fitness, weight maintenance and the prevention of many chronic diseases. Indeed, exercise improves the function of your heart, lungs and blood vessels, and it also has beneficial effects on blood lipids. Scientists have demonstrated that the LIPC gene influences blood levels of HDL cholesterol (the "good" cholesterol). Research also shows that physical activity raises HDL cholesterol to a greater degree among individuals who have a particular variant of the LIPC gene, compared to those who do not.*

Types of Cardiovascular Activities

Moderate-Vigorous Intensity	
Swimming	Race walking, jogging, running
Briskly walking (5 km/hour or faster)	Tennis
Biking	Water Aerobics

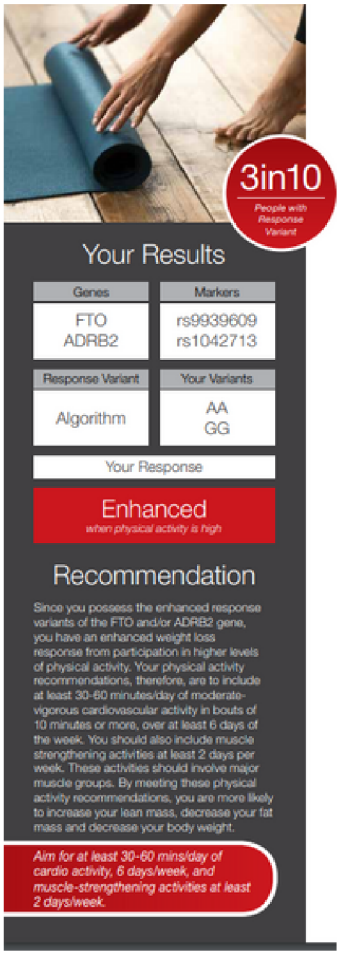
Types of Muscle-Strengthening Activities

Lifting weights	Working with resistance bands
Heavy gardening (digging, shovelling)	Push-ups
Certain types of yoga	Sit-ups



TCF7L2

The TCF7L2 gene produces a protein called transcription factor-7 like 2. This protein affects how the body turns on or off a number of other genes. Research shows that for individuals who possess the TT variant of the TCF7L2 gene, the amount of fat in the diet can significantly impact body composition (lean/muscle mass vs. fat mass) as well as the risk for being overweight or obese. Furthermore, possessing the TT variant puts you at an increased risk for insulin resistance (reduced ability to control blood sugars) when your total fat intake is high. Consuming a low-tomoderate fat intake can help facilitate weight loss in individuals with the TT variant, which can in turn help with reducing insulin resistance.



Physical Activity (cont.)

for Weight Loss

Physical activity has important benefits for mental health, physical fitness, weight maintenance and the prevention of many chronic diseases. Cardiovascular or aerobic conditioning exercises include those that elevate your heart rate for a sustained period of time, such as brisk walking, running, swimming and cycling. These aerobic exercises improve the function of your heart, lungs and blood vessels. Muscle conditioning exercises improve muscle strength and power as well as bone health and include activities such as weight-lifting or higher intensity yoga and Pilates. Most forms of physical activity are beneficial; however, some individuals can achieve greater weight loss than others based on the amount and type of physical activity they perform. Research shows that variants in the FTO gene can impact an individual's metabolic response to physical activity.* Indeed, physical activity can reduce the effects of the FTO gene on risk of overweight and obesity by as much as 75%.** In addition, a variant in the ADRB2 gene influences how much body fat you lose in response to cardiovascular exercise.***

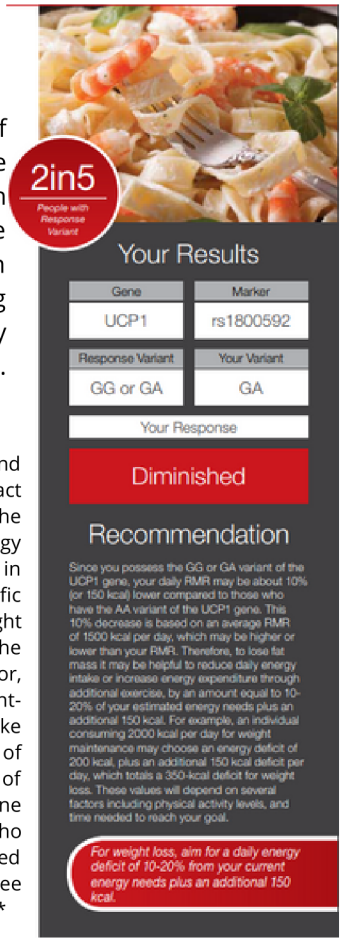
Sources of High Energy Foods

	Amount (calories)
Pizza with pepperoni and cheese (1/2 of 12")	660
Fish, battered, fried (1 piece)	590
Meat and vegetable pie (1 individual pie)	450
Mixed nuts, roasted (1/2 cup)	410
Carrot muffin (1 medium)	340
Avocado (1 fruit)	320
Cheeseburger (1)	320
Donut, chocolate covered (1)	270
French fries (20-25)	240
Croissant (1)	230

Source: Health Canada's Nutrient Value of Some Common Foods

Energy Balance

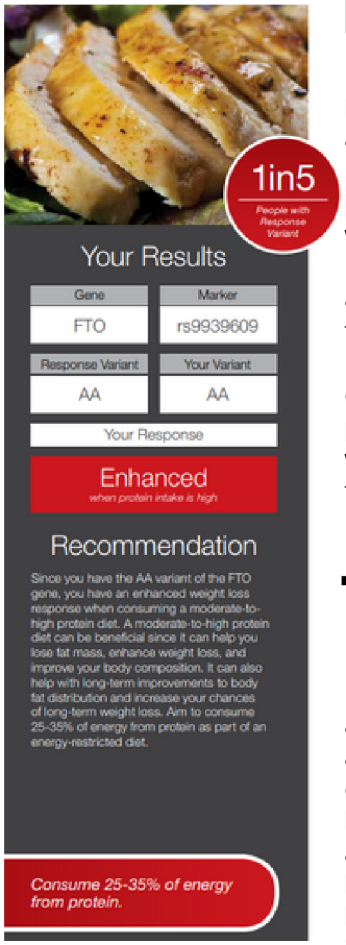
Energy is used to fuel all functions in the body. A calorie is a commonly used unit of measurement to quantify energy, which comes from the foods and beverages consumed. The body uses this energy to complete essential processes such as digestion, breathing, brain function and maintaining a normal body temperature. The energy expended during these essential processes is referred to as the Resting Metabolic Rate (RMR). Total energy output, on the other hand, is the sum of the RMR plus energy burned during physical activity. Consuming less energy and/or expending more energy can lead to weight loss. RMR can vary substantially between individuals, and can result from differences in muscle mass, weight, age and genetics. Research shows that variation in the UCP1 gene affects RMR.*



UCP1

Uncoupling protein 1 (UCP1) is found in fat tissue and is involved in metabolic processes that create energy and then release it in the form of heat. The UCP1 gene is important for regulating normal body temperature and can impact RMR. Research shows that individuals with the GG or GA variants tend to have lower RMRs compared to individuals with the AA variant. As such, they need to consume less energy to maintain regular bodily functions.

FTO & ADRB2 The FTO gene is also known as the 'fat mass and obesity-associated gene', and has been consistently shown to impact weight management and body composition. The FTO gene's role in the body is related to metabolic rate, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy intake. Current research shows that specific physical activity recommendations can substantially help with weight loss and weight maintenance in individuals with certain variants of the FTO gene.* The ADRB2 gene encodes the Beta-2-Adrenergic Receptor, which belongs to a family of molecules that are involved in the fight-or-flight response to stress and response to substances like adrenaline. ADRB2 contributes to the breakdown and mobilization of fat cells, and its activity increases during exercise. A large study of obese, sedentary individuals found that variation in the ADRB2 gene predicted fat loss in response to cardiovascular exercise. Women who carried two copies of a specific ADRB2 variant had an enhanced response to a cardiovascular exercise program, losing over three times more body fat than women who had a typical response.**, ***



Protein

Protein is an essential nutrient for muscle building, wound healing, healthy hair, skin and nails and proper immune function. Protein is best known for supporting the building and repairing of muscle tissue, which helps to build and maintain strength. Protein has also been shown to regulate appetite by filling you up and allowing you to feel more satisfied with fewer calories. For individuals at risk for overweight and obesity based on the FTO gene, a high protein diet can help with weight loss and weight maintenance over both the short-term and long-term.

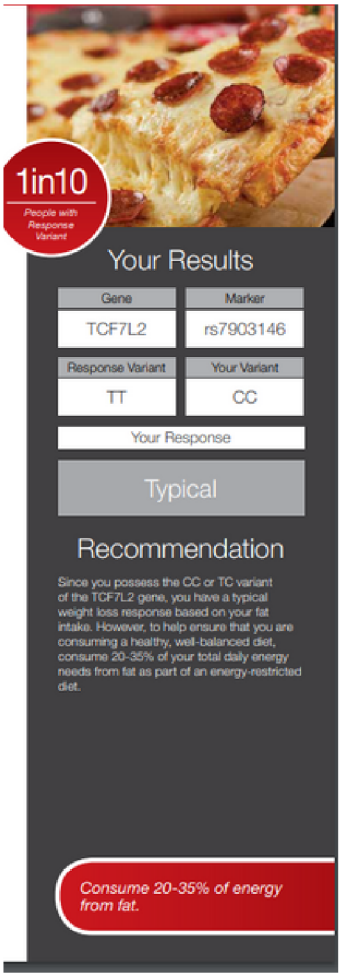
Sources of Protein

	Amount (g)
Chicken breast (75g)	25
Extra lean ground beef (75g)	23
Tofu, regular, extra firm (150g)	21
Salmon, baked (75g)	20
Cottage cheese (1/2 cup)	15
Lentils (3/4 cup)	14
Chickpeas (3/4 cup)	9
Skim milk (1 cup)	9
Almonds (1/4 cup)	8
Whole egg (1)	6

Source: Health Canada's Nutrient Value of Some Common Foods

Total Fat

Fat is an essential part of a healthy diet, and is needed for the absorption of the fat-soluble vitamins including vitamins A, D, E, and K. Each gram of fat provides more than double the amount of calories as carbohydrates or protein on a gram per gram basis. This makes fat the most energy-dense nutrient. The total amount and types of fats that you consume can affect heart health and body composition. In general, unsaturated fats are heart-healthier than saturated or trans fats. The TCF7L2 gene is involved in body weight regulation and body composition. Research shows that individuals who possess the TT variant of TCF7L2 experience greater weight loss when they consume lower-to-moderate fat diets, in comparison to when they consume higher fat diets. For those with the CC or TC variant, there is no difference in weight loss based on the amount of fat consumed, although lower total energy intakes are needed to create a calorie deficit for weight loss.*



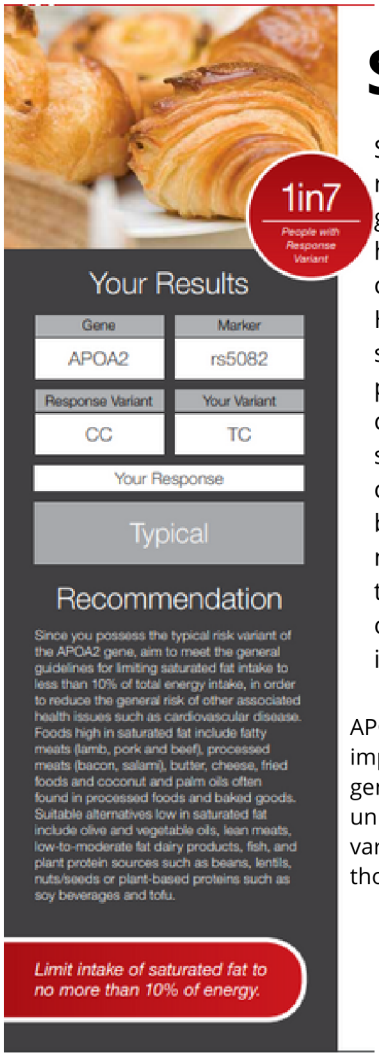
FTO

The FTO gene is also known as the 'fat mass and obesity-associated gene' since it can impact weight management and body composition. This gene's role in the body is related to your metabolism, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy or food intake. In individuals who have undergone bariatric surgery for weight loss, variation in the FTO gene can help predict their long-term weight loss success, which can have significant implications for nutrition care plans.* Research shows that in comparison to individuals with the TA or TT variant, those with the AA variant lose more body weight, including fat mass, when consuming a moderate-to-high protein diet, but not when consuming a lower protein diet.**

Sources of Fat

	Amount (g)
Bacon (75g)	32
Macadamia nuts (1/4 cup)	26
Cheddar cheese (50g)	17
Butter (1 Tbsp)	16
Olive oil (1 Tbsp)	14
Swiss cheese (50g)	14
Pistachios (1/4 cup)	14
Lean beef mince (75g)	11
Goat cheese (50g)	11
Yoghurt, 2-4% M.F. (3/4 cup)	8
Sockeye salmon (75g)	8

Source: Health Canada's Nutrient Value of Some Common Foods



Saturated Fat

Saturated fats, such as those found in red meat, processed meats and baked goods have long been associated with health conditions such as diabetes, cardiovascular disease and obesity. However, the connection between saturated fats and obesity, has been poorly understood. In the past, scientists could not explain why certain people seemed prone to obesity when consuming a diet high in saturated fats, but others were less susceptible. A number of studies* have now shown that the effect of saturated fat on obesity can be influenced by variations in a gene called APOA2.

Sources of Saturated Fat

	Amount (g)
Short ribs (75g)	11
Cheddar cheese (50g)	10
Ice cream, premium (1/2 cup)	11
Butter (1 Tbsp)	8
Salami (75g)	8
Regular ground beef, cooked (75g)	7
Cheeseburger (single patty)	6
Muffin (1 small)	5
French fries (20-25)	5
Homogenized milk (1 cup)	5

Source: Canadian Nutrient File and USDA Nutrient Database

APOA2 The APOA2 gene directs the body to produce a specific protein called apolipoprotein A-II, which plays an important role in the body's ability to utilize different kinds of fat. There are different variations in the APOA2 gene present in the human population and these different versions of the gene interact with saturated fat in unique ways to influence energy balance and ultimately the risk of obesity. Those people who have the CC variant of the gene are at a higher risk of developing obesity when consuming a diet high in saturated fats than those possessing the TT or TC variant of the gene.

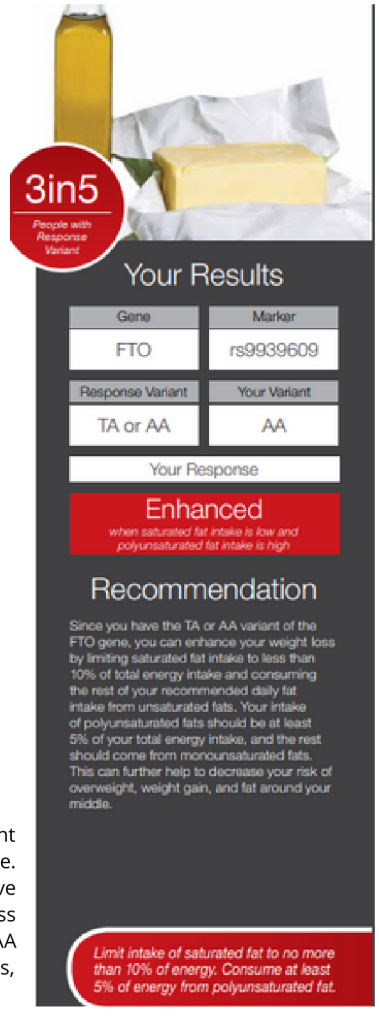
Saturated and Unsaturated Fats

There are two main types of dietary fats: saturated and unsaturated. Saturated fats are primarily found in animalderived foods such as fatty meats, cheese, butter and other whole milk dairy products as well as prepared foods such as pizza, baked goods, and many desserts. A diet high in saturated fat has long been associated with health conditions such as diabetes, cardiovascular disease and obesity. Unsaturated fats, including monounsaturated and polyunsaturated fats, such as those found in olive oil, almonds and grape seed oil, may help to decrease the risk of diabetes, cardiovascular disease and obesity. Research shows that variation in the FTO gene can impact the body's response to saturated and unsaturated fat.*

Sources of Mono and Polyunsaturated Fat

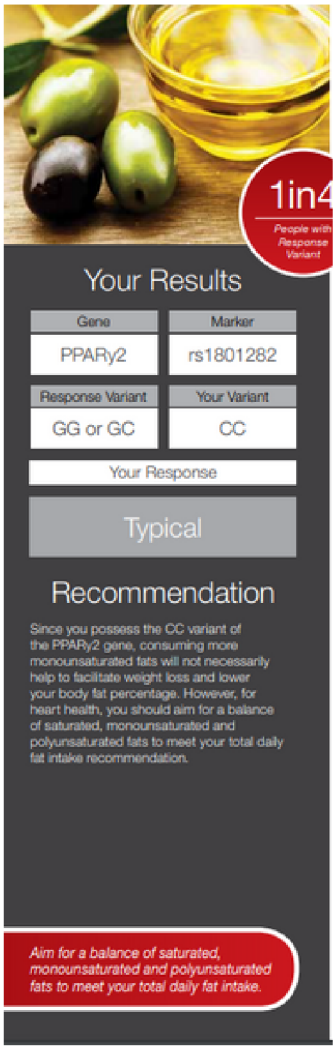
Monounsaturated Fat	Amount (g)
Macadamia nuts (1/4 cup)	20
Almond butter (2 Tbsp)	12
Olive oil (1 Tbsp)	10
Canola oil (1 Tbsp)	8
Peanut butter (2 Tbsp)	8
Polyunsaturated Fat	**Amount (g)**
Flaxseed oil (1 Tbsp)	10
Grape seed oil (1 Tbsp)	10
Sunflower oil (1 Tbsp)	9
Soybean oil (1 Tbsp)	8
Brazil nuts (1/4 cup)	7

Source: Health Canada's Nutrient Value of Some Common Foods



FTO The FTO gene is also known as the 'fat mass and obesity-associated gene' since it can impact weight management and body composition. This gene's role in the body is related to metabolic rate, energy expenditure and energy balance. It is also expressed in regions of the brain that are involved in the regulation of energy intake. In individuals who have undergone bariatric surgery for weight loss, variation in the FTO gene can help predict their long-term weight loss success, which can have significant implications for nutrition care plans.* Research shows that for individuals with the AA or TA variant, a high intake of unsaturated fat, and low intake of saturated fat in the diet can help facilitate weight loss, decrease fat stores around the abdomen and decrease the risk for obesity.*

Monounsaturated Fat



Monounsaturated fats such as those found in olive oil, almonds and avocados have been associated with reduced risk for heart disease. Monounsaturated fats can help reduce "bad" (LDL) cholesterol levels and may also help increase "good" (HDL) cholesterol. Research shows that these fats can help facilitate weight loss and lower body fat composition in some individuals based on their PPARγ2 gene.*

Sources of Monounsaturated Fat

	Amount (g)
Macadamia nuts (1/4 cup)	20
Almond butter (2 Tbsp)	12
Olive oil (1 Tbsp)	10
Canola oil (1 Tbsp)	8
Peanut butter (2 Tbsp)	8
Sesame oil (1 Tbsp)	6
Pumpkin and squash seeds, dried (1/4 cup)	5
Soybeans, boiled (3/4 cup)	3
Hummus (1/4 cup)	2

Source: Health Canada's Nutrient Value of Some Common Foods

PPARγ2 The PPARγ2 gene is involved in the formation of fat cells. This gene is mainly found in fat tissue. Because of its involvement in the formation of fat, PPARγ2 can impact weight management and body composition. Specifically, individuals who have the GG or GC variant of the gene tend to experience greater weight loss and lose more body fat, compared to those with the CC variant, when they consume a diet high in monounsaturated fats.

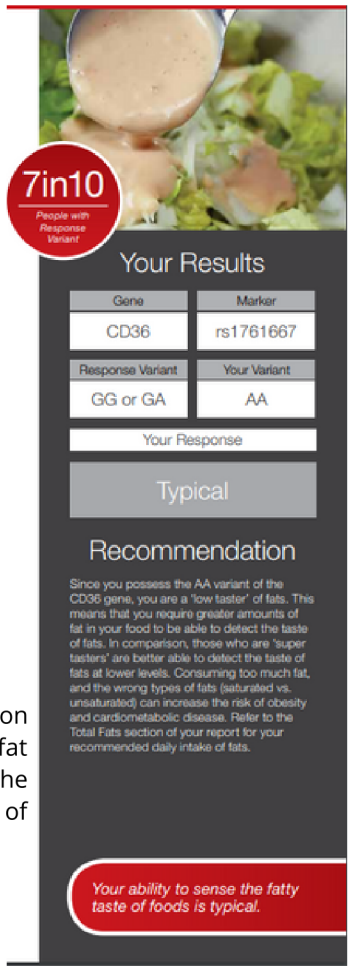
Fat Taste Perception

Food intake is largely determined by our taste perceptions and preferences for certain foods and beverages. The way that we perceive the taste of fatty foods is particularly important because our intake of fats can affect heart health and body composition. Fat is needed to absorb certain vitamins including vitamins A, D, E, and K. It provides 9 calories per gram, which is more than double the calories in a gram of protein or carbohydrate. Research shows that our preference for fatty foods can vary depending on which version of the CD36 gene we have.*

Sources of High Fat Foods

	High in Healthy (Unsaturated) Fat	Amount (g)
Cheddar cheese (50g)		17
Avocado (1/2 fruit)	✓	15
Olive oil (1 Tbsp)	✓	14
Butter (1 Tbsp)		12
Chips (20-25)		12
Hamburger (1)		12
Croissant (1)		12
Salmon (75g)	✓	9
Ice cream (1/2 cup)		8
Homogenized milk (1 cup)		8

Source: Health Canada's Nutrient Value of Some Common Foods



CD36 The cluster of differentiation 36 (CD36) gene is also known as fatty acid translocase. It is found on the surfaces of many cells, including taste bud cells in the tongue, and is involved in the transport of fat from the blood. Several studies have now linked variations in the CD36 gene to differences in the perception of the taste and texture of fats and oils. 'Super tasters' tend to be able to detect the taste of fats and oils at lower levels than 'low tasters.'

1in4
People with Risk Variant

Your Results

Gene	Marker
GLUT2	rs5400
Risk Variant	Your Variant
CT or TT	CT

Your Risk

Elevated

Recommendation

Since you possess the CT or TT variant of the GLUT2 gene, you are at an increased risk of over-consuming sugar. Be mindful of this tendency to consume sweet foods and beverages and aim to keep your intake of added sugar below 5% of your total daily energy intake. A high intake of added sugar is linked to overweight & obesity, cardiometabolic disease and dental caries risk.

You have a high preference for sugar.

Sugar Preference

Sugar intake is partly determined by our sweet taste preference and cravings for certain foods and beverages. There is considerable variability in individuals' preferences and cravings for sweet foods and beverages. There are many factors that may impact your preference for sugary foods including the age that you are first introduced to sweets, and psychological associations between consuming these foods and certain life experiences or emotions. In addition to 'pleasure-generating' signals in the brain given off in response to eating or drinking something sweet, there are specialized areas in the brain that regulate both food intake and glucose (sugar) levels in the body. Research has shown that your intake of sweet foods can be determined by a genetic variant that regulates blood glucose levels in your body. People who carry the variant associated with higher sugar intake are also at higher risk of dental caries (cavities).

Sources of High Sugar Foods

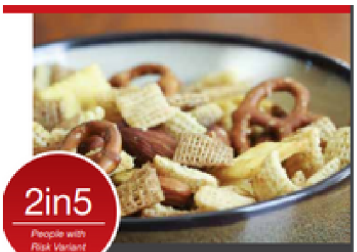
	Amount (g)
Iced cappuccino (2 cups)	56
Cola (1 can)	36
Citrus juice, frozen, diluted (1 cup)	32
Caramels (40g)	26
Milk chocolate (50g)	26
Maple syrup (2 Tbsp)	24
Jellybeans (10 beans)	20
Caramel-coated popcorn (1 cup)	20
Popsicle (75g)	10
Jam (1 Tbsp)	10

Source: Health Canada's Nutrient Value of Some Common Foods

Eating between Meals

Eating between meals (i.e. snacking) can be beneficial if snacks are healthful and the extra calories are not in excess of those needed to maintain a healthy weight. Healthy snacks can assist with regulating blood sugar levels and weight control, curb food cravings and boost energy levels. However, for many people snacking is often an unhealthy habit due to snack-food choices and/or excessive calorie intake beyond one's needs. For your overall health and wellness, it is important to manage emotional eating (psychological reasons for snacking), and focus on more healthful snacking when you feel hungry. Some reasons for emotional eating may include boredom, habit (i.e. eating in front of the television, or at certain times), stress, frustration, anxiety or loneliness. Scientists have also discovered that variations in the MC4R gene are associated with the likelihood of eating between meals, driven by the desire to eat more or less frequently, depending on your genotype.*

Replace these foods...	with these foods..
Chips	Whole wheat pita with hummus
Muffin	Whole wheat English muffin with peanut butter
Ice cream with toppings	Low-fat yogurt with fresh berries
Trail mix with added oils or sweets	Fibre-rich cereal with milk/alternative
'Veggie' chips	Fresh vegetables with low-fat dip
Pasta salad	Mixed salad topped with chickpeas
Nachos and cheese dip	Whole wheat crackers with low-fat cheese
Potato chips	Natural popcorn
Pizza slice	Half a turkey sandwich with veggies



2in5
People with Risk Variant

Your Results

Gene	Marker
MC4R	rs17782313
Risk Variant	Your Variant
CC or CT	TT

Your Risk

Typical

Recommendation

Since you possess the TT variant of the MC4R gene, you have a typical risk for eating between meals. To maintain a healthy metabolism, avoid going longer than six hours without eating during the day. Monitor and respond to hunger cues, which may include a lack of energy, mood changes, stomach growling, weakness, dizziness, or having a headache. Choose healthy snacks that are not excessive in calories.

Your tendency to eat between meals is typical.

Motivation to Exercise

1in3
People with Response Variant

Your Results

Gene	Marker
BDNF	rs6265

Response Variant	Your Variant
AA or AG	AA

Your Response

Enhanced

Implications

Since you possess the AA or AG variant of the BDNF gene, you are more likely to experience greater enjoyment and positive mood changes from exercise. You also tend to perceive your exertion level during exercise to be lower than individuals with the GG variant. These responses to exercise result in a heightened motivation to exercise and greater likelihood that you will continue to exercise regularly. Therefore, you are at a genetic advantage when it comes to motivation to begin or continue regular exercise.

You have an enhanced innate motivation to exercise.

Your attitude toward exercise and the effect it has on your mood can greatly impact your likelihood of starting or maintaining a physically active lifestyle. Research shows that individuals who possess the AA or AG variant of the BDNF gene are more likely to experience positive mood changes and exercise for enjoyment. They also perceive their effort and exertion level as lower during exercise compared to individuals who possess the GG variant.* All of these factors impact motivation to exercise. Being physically active has a multitude of benefits including improved cognitive function, and a lowered risk of many diseases, through improvements in body fat levels, blood sugars, blood pressure, blood lipid profiles, and mental health.

BDNF
The brain-derived neurotrophic factor is a protein that is encoded by the BDNF gene. This protein works in regions of the brain to influence the nervous system, musculature, and blood vessels, all of which are important to exercise. Because of the complexity of mental stamina and the psychological response to exercise, the BDNF gene is only one of many possible genetic factors that may influence responses to exercise and future exercise behavior. Nevertheless, research shows that those with the AA or AG variant of the BDNF gene derive greater enjoyment or pleasure and improvements in mood from exercise and a lower perception of effort during exercise compared to those without this variant.

1in12
People with Response Variant

Your Results

Genes	Markers
CYP19A1 LEPR	rs2470158 rs12405556

Response Variant	Your Variants
Algorithm	GG GT

Your Response

Typical

Implications

Based on your LEPR and CYP19A1 variants, you have a typical likelihood of engaging in physical activity. Set monthly SMART (specific, measurable, attainable, realistic, timely) goals and consider using mental imagery; these can further enhance your motivation. Having an exercise partner can also enhance your likelihood of participating in physical activity.

You have a typical likelihood of engaging in physical activity.

Exercise Behavior

Participating in physical activity can lower blood pressure, lower blood sugars, improve cholesterol levels, decrease depression and improve mood, among many other positive outcomes. Research shows that genetic differences influence the likelihood of engaging in physical activity. The CYP19A1 and LEPR genes have been identified as being key contributors to one's probability of participating in physical activity.*

CYP19A1 & LEPR The CYP19A1
gene helps to make the enzyme aromatase, which is involved in hormone conversion. The exact physiological pathway by which this gene impacts exercise behavior is unknown. However, current research shows that those who have the AA or GA variant of the CYP19A1 gene are more likely to exercise compared to those with the GG variant. The LEPR gene helps to make the leptin receptor protein, which helps to regulate body weight. The precise relationship between variations in the LEPR gene and exercise behavior may stem from this gene's involvement in regulating energy balance. Those who have the TT or GT variant of the LEPR gene are more likely to participate in physical activity compared to those who have the GG variant

Your Results

Gene	Marker
ACTN3	rs1815739
Response Variant	Your Variant
CC or TC	CC

Your Response

Ultra

Implications

Since you possess the CC variant of the ACTN3 gene, you have a genetic advantage to excel in strength and power-based activities. These activities are important for building and maintaining muscle mass. Aim to participate in strengthening activities at least two days per week.

You have a genetic advantage to excel in power sports.

Power and Strength

Strengthening activities, as the name implies, are activities that strengthen your muscles and bones. Research shows that muscle-building exercises can also benefit your brain, help with regulating blood sugars, improve posture and help achieve and maintain a healthy body weight. Examples of these activities include body weight exercises such as push-ups, sit-ups, and lunges as well as lifting weights, using gym machines and working with resistance bands. Some activities of daily living or household chores are also considered strengthening activities such as strenuous gardening, carrying heavy groceries or running up stairs. Research shows that the ACTN3 gene plays a major role in your genetic predisposition to excelling in strength and power-based activities.*

ACTN3

There are two types of muscle fibres: slow twitch and fast twitch. Fast twitch muscle fibres contract with greater speed and force, which are needed for short bursts of intense activities including sprinting or lifting heavy objects. Slow twitch fibres contract for longer periods and at lower intensities and are used in activities such as walking, slow running or easy cycling. The ACTN3 gene encodes the alpha-actin 3 protein, which is only expressed in fast twitch muscle fibres. Therefore, certain variations in this gene can be beneficial for exercises or activities requiring strength and power. In particular, individuals with the CC variant of ACTN3 are more likely to excel at strength-based activities. Those with the TC variant have a slightly enhanced power and strength potential.*

*Garton and North. The effect of heterozygosity for the ACTN3 null allele on human muscle performance. Med Sci Sports Exerc. 2015 [Epub ahead of print].

Endurance

Endurance activities refer to aerobic, or "cardio" exercises that cause your heart rate to increase, such as brisk walking, jogging, biking, swimming, or dancing. Your VO2 max, or maximal aerobic capacity, measures the maximum amount of oxygen that your body can process during 1 minute of exercise, and it is a marker of physical fitness. A higher VO2 max generally results in a performance advantage when it comes to endurance activities, although many factors play a role. Research shows that multiple genes impact your genetic predisposition to excelling in endurance activities.* In some of these genes, certain versions of the gene have also been shown to improve your endurance capacity in response to endurance training more effectively.**

Your Results

Genes	Markers
NFIA-AS2 ADRB3 NRF2 GSTP1 PGC1a	rs1572312 rs4994 rs12594956 rs1695 rs8192678
Response Variants	Your Variants
Algorithm	CC TT CA AG AA

Your Response

Typical

Implications

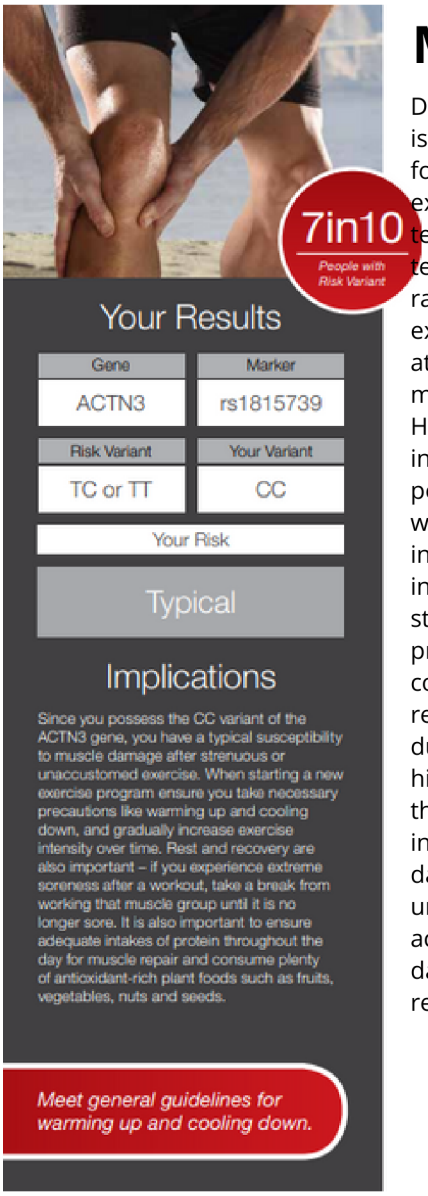
Based on your DNA, your endurance potential is typical. You may need to increase your training to a greater extent than an individual with a genetic advantage to achieve the same level of cardiovascular fitness. Aim to get at least 150 to 300 minutes of moderate-intensity exercise per week. This can be met through 30 to 60 minutes of moderate-intensity aerobic exercise five days per week, such as brisk walking or moderate intensity cycling.

Your endurance potential is typical.

NFI-AS2, ADRB3, NRF2, GSTP1 & PGC1a

NFI-AS2, ADRB3, NRF2, GSTP1 and PGC1a are all involved in physiological processes that impact your endurance abilities. Individuals with the CC variant in the NFIA-AS2 gene tend to have greater VO2 max, which is advantageous for endurance exercise. Variations in the ADRB3 gene are more common among world-class endurance athletes compared to non-athlete controls. The NRF2 gene plays an important role in the production of mitochondria, the power houses of the cell, and those with the AA variant improve their endurance in response to exercise training. Variation in the GSTP1 gene is also associated with differences in VO2 max responses to aerobic training and individuals with the GG and GA variants have greater improvements. Finally, the GG variant of the PGC1a gene is associated with improved aerobic fitness in response to endurance training. Together, these genes can predict your genetic advantage for excelling in endurance activities and sports.

Muscle Damage

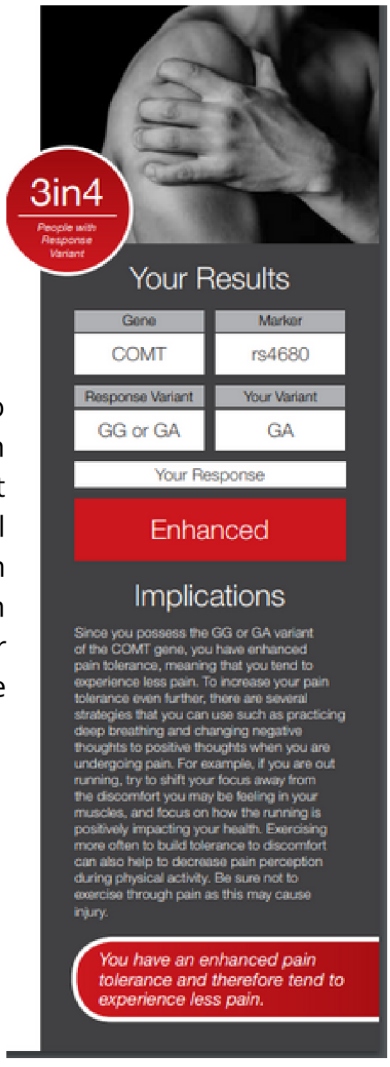


Delayed onset muscle soreness (DOMS) is commonly experienced in the days following unaccustomed or strenuous exercise, and it is characterized by tender, stiff muscles which also cause a temporary reduction in strength and range of motion. DOMS is a result of exercise-induced muscle damage, which at low levels is a positive stimulus for muscle growth and increased strength. However, excessive damage or inadequate recovery may cause persistent and unnecessary soreness which can impede strength gains and increase the risk of developing over-use injuries. DOMS is caused by oxidative stress, inflammation, and muscle protein degradation. There is considerable variability in an individual's response to muscle-damaging exercise, due to factors such as age, exercise history and genetics. Research shows that variation in the ACTN3 gene influences one's susceptibility to muscle damage after prolonged, strenuous or unaccustomed exercise.* The type of activity inducing the greatest muscle damage is most often high-intensity resistance or power-type exercise.

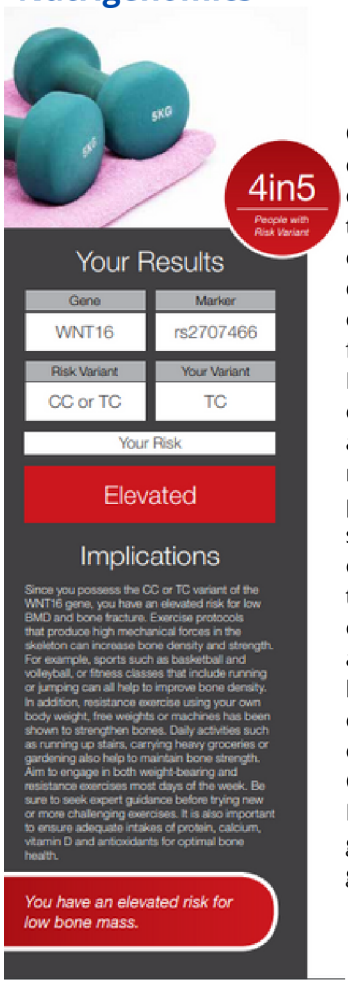
ACTN3 The ACTN3
gene encodes the alpha-actin 3 protein, which plays a key role in the contraction of fast-twitch or power-type muscle fibres during short bursts of intense activities, such as sprinting or lifting heavy objects. Genetic variation in ACTN3 affects the expression of the resulting protein in fast-twitch fibres, and individuals who carry at least one copy of the T variant produce a lower functioning ACTN3 protein that has been linked to increased risk of muscle damage. For example, a recent study showed that experienced endurance athletes with the TC or TT variant had higher levels of markers of muscle damage after a competitive marathon than individuals with the CC variant, and a similar trend was observed in a study where healthy young men performed knee extension exercises, working the quadriceps, in a laboratory setting.**

Pain

Pain is an unpleasant feeling triggered by the nervous system that can be mild to severe. Pain threshold is a term that refers to the point where you begin to feel pain that causes discomfort to the extent that it becomes difficult for you to withstand. It is a threshold at which you cannot continue to exercise at a certain intensity level due to an intolerable level of discomfort. Pain tolerance refers to the maximum amount of pain that someone can withstand. There are substantial differences in the way, or the degree to which people feel pain. Overall, men tend to have higher pain tolerances than women. Research shows that variations in the COMT gene impact how we feel and perceive pain.*



COMT
The Catechol-O-methyltransferase (COMT) gene is involved in pathways in the body that process pain signals. Because of this, researchers have studied how variations in this gene can impact our perception of pain. Studies show that the COMT gene is a significant predictor of pain tolerance. Specifically, individuals with the GG or GA variant tend to experience less pain compared to those with the AA variant.



Bone Mass

Osteoporosis and osteopenia are common bone diseases that occur more often in older adults but can develop at any age. Both involve a deterioration of tissue, resulting in low bone mineral density (BMD) and compromised bone strength. Osteoporosis can develop without any signs or symptoms and is characterized by low BMD and a high risk of bone fracture. Osteopenia is also characterized by reduced BMD and can predict later development of osteoporosis and fracture risk. Fractures are associated with hospitalization, as well as reduced mobility and independence. Our bones support us, protect our organs, and enable us to move. We also store minerals such as calcium and phosphorous in our bones, which keep them strong, and we release them into the circulation when they are needed by other tissues. Peak bone mass is reached by early adulthood, and gradually declines with age. The rate of bone loss is influenced by factors such as nutrition and exercise, with some forms of exercise slowing the rate of loss and even increasing BMD and bone strength. Genetic variation also contributes to differences in BMD levels across individuals. Research shows that a genetic variant in the WNT16 gene is associated with a greater risk of low BMD and increased risk of fracture.*

Types of Weight Bearing Activities

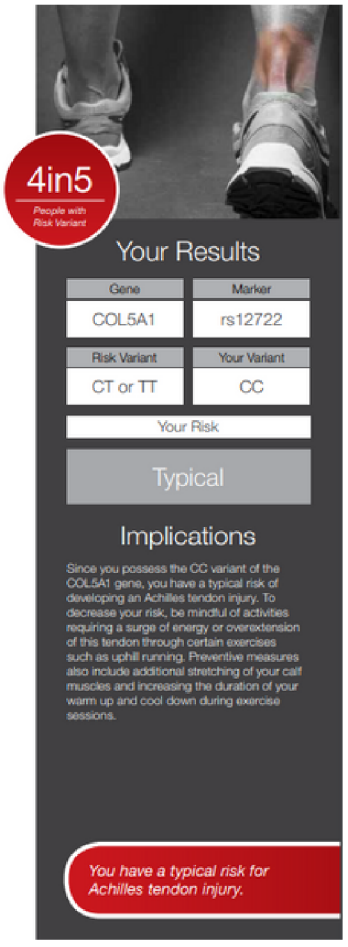
Walking	Running
Hiking/trekking	Tennis
Jogging	Team Sports

Types of Resistance Activities

Lifting weights	Working with resistance bands
Using weight machines	Push-ups
Squats	Lunges

Achilles Tendon Injury

Your Achilles tendon is one of the largest and strongest tendons in the human body. It starts at the bones in your heels and continues up to your calf muscles. This tendon gives you the ability to point your toes and extend your foot. Unfortunately, injuries to the Achilles tendon are common. They typically arise from doing exercises that require a sudden surge of energy. Symptoms of an Achilles tendon injury include extreme pain, tenderness, swelling, or stiffness along the back of your foot and above your heel. Your risk of developing an Achilles tendon injury depends in part on the COL5A1 gene.*



Dynamic Stretching Warm-up

Side lunges	Warrior pose
Heel raises	Tip-toe walking
Walking lunges with rear leg extension	Mountain climbers

Lower Leg Strengthening Exercises

Seated calf raises	Weighted toe raises
Standing calf raises	Anterior tibialis isometrics

Higher Risk Exercises for Achilles Tendon

Box jumping	Hill sprints
Plyometrics	Sled pushes

Additional Genetic Insights for Health and Wellness

The table below includes genetic markers that provide additional insights for health and wellness. These insights come from research studies on genetic variation and its association with health-related outcomes, such as the association for a genetic marker with having a higher level of a nutrient circulating in the blood. This section differs from the previous sections in the report, which focus on genetic markers that modify the way we respond to diet or exercise to impact health outcomes. Therefore, currently, no personalized diet or fitness recommendations are given for the markers in the following table. Talk to your healthcare provider about general strategies you can implement to optimize your health given these additional health-related insights

	Gene, rs Number	Gene Function	Risk/ Response Variant	Your Variant	Your Risk/ Response	Implications
Weight Management						
Maintenance of Long-Term Weight Loss	ADIPOQ, rs17300539	Adiponectin regulates fat metabolism and insulin sensitivity	AA or AG	GG	Typical	You have a typical ability to maintain weight loss in the long term.
Sleep and Lifestyle						
Short Sleep Duration	CLOCK, rs1801260	CLOCK regulates the circadian rhythm	CC or TC	TT	Typical	You have a typical risk of short sleep duration.
Alcohol Sensitivity	ALDH2, rs671	ALDH2 is involved in alcohol metabolism	AA or AG	GG	Typical	You have a typical sensitivity to the effects of drinking alcohol.
Cardiometabolic Health						
Total Cholesterol	APOA5, rs662799	APOA5 is a component of HDL	CC or TC	TT	Typical	You have a typical risk of high total cholesterol.
LDL Cholesterol	ABCG8, rs6544713	ABCG8 is involved in cholesterol transport	TT or CT	CC	Typical	You have a typical risk of high LDL cholesterol.
HDL Cholesterol	ABCA1, rs1883025	ABCA1 is involved in cholesterol transport	TT or TC	CC	Typical	You have a typical risk of low HDL cholesterol.
Triglycerides	ANGPTL3, rs10889353	ANGPTL3 is involved in regulating lipid metabolism	AA or CA	AA	Elevated	You have an increased risk of high triglycerides.
Fasting Glucose	ADCY5, rs11708067	ADCY5 is involved in insulin secretion	AA or GA	AA	Elevated	You have an increased risk for high fasting glucose.
Insulin	IRS1, rs2943641	IRS1 is involved in insulin signaling	CT or CC	CT	Elevated	You have an increased risk for high insulin concentrations.
Injury						
Rotator Cuff Injury	MMP1, rs1799750	MMP1 and MMP3 are involved in tissue remodeling	Algorithm	GG	Elevated	You have an elevated risk of having a rotator cuff injury.
	MMP3, rs3025058			DelA		

	Gene, rs Number	Gene Function	Risk/ Response Variant	Your Variant	Your Risk/ Response	Implications
Nutrients						
Magnesium	TRPM6, rs11144134	TRPM6 is a magnesium transporter	TT or CT	CT	Elevated	You have an elevated risk of low levels of magnesium.
Zinc	SLC30A3, rs11126936	SLC30A3 is a zinc transporter	CC	CC	Elevated	You have an elevated risk of low levels of zinc.
Starch	AMY1, rs4244372	AMY1 is a salivary starch enzyme	AA	AT	Typical	Your ability to metabolize starch is typical.
Vitamin E	Intergenic – rs12272004	APOA5 is a component of HDL	CC or CA	CA	Elevated	You have an elevated risk of low vitamin E levels.
Inflammation and Antioxidant Capacity						
Adiponectin	ADIPOQ, rs17366568	Adiponectin is an anti-inflammatory hormone	GA or AA	GA	Diminished	Your levels of adiponectin are likely to be diminished.
Interleukin 6	IL6, rs1800795	IL6 is an inflammation biomarker	GG or GC	GG	Elevated	Your levels of interleukin 6 are likely to be higher than normal.
Superoxide Dismutase 2	SOD2, rs4880	SOD2 is an antioxidant	TT or CT	CT	Diminished	Your SOD2 enzymatic activity, which affects antioxidant capacity, is diminished.
Nitric Oxide	NOS3, rs1799983	NOS3 is involved in producing antioxidants	GT or TT	GG	Typical	Your plasma nitric oxide levels are likely to be typical.
Eating Habits						
Hunger	NMB, rs1051168	NMB regulates eating	TT	GT	Typical	You have a typical susceptibility to hunger.

Primary Immunodeficiency

Immunodeficiency is when a part of the immune system does not work correctly. Genetic, or inherited, immunodeficiencies are called primary immunodeficiencies, whereas secondary immunodeficiencies are caused by environmental factors, such as use of certain medications or poor nutrition. People with immunodeficiency tend to get sick more often with ear infections, sinus infections, pneumonia, and skin infections. They also have longer infections that are hard to treat with regular antibiotics and may result in hospitalization. Infants may have poor weight gain and digestive problems like diarrhea.

WHAT CAUSES PRIMARY IMMUNODEFICIENCY?

Primary immunodeficiency is caused by pathogenic (disease-causing) variants in genes that help develop the immune system and keep it working. These variants may make it easier for germs to enter the body, make it more difficult for the body to identify germs, or make it so the body cannot "remember" how to fight off germs it has encountered before.

ASSOCIATED CONDITIONS

Primary immunodeficiency disorders may be isolated (occurring with no other symptoms) or as one of several features of a more complex genetic syndrome. Conditions associated with primary immunodeficiency include but are not limited to:

- Adenosine deaminase deficiency
- Agammaglobulinemia (X-linked and autosomal recessive)
- Ataxia telangiectasia
- Chronic granulomatous disease
- Immunoglobulin A deficiency
- Wiskott-Aldrich syndrome
- Hyper-IgE syndrome
- X-linked SCID (severe combined immunodeficiency)

WHO IS THIS TEST FOR?

This panel may be appropriate for anyone who has a personal or family history of frequent infections, fevers, or rash, particularly if infections do not completely clear up or keep coming require hospitalization or IV antibiotics, or are caused by an uncommon organism.

Scan QR code to download our Immunodefiency requisition form

Call: 832-500-4462 | **Fax:** 832-376-7548 | **Web:** www.immunogeno.com | **Email:** support@immunogeno.com

BENEFITS OF GENETIC TESTING

Genetic testing for Primary Immunodeficiency can:

- Establish or confirm the appropriate diagnosis
- Identify risks for additional health-related symptoms
- Assist in modifying lifestyle changes, including diet and exercise
- Result in more personalized symptom management
- Inform family members about their own risk factors
- Connect patients to relevant resources & support
- Provide options for family planning

RELATED PANEL

Comprehensive Primary Immunodeficiency NGS Panel

TEST SPECIFICATIONS

Acceptable Sample Requirements

- Buccal swab or saliva

Turnaround Time 3-5 weeks

Coverage ≥96% at 20x

Reporting
VUS, likely pathogenic, and pathogenic variants

Customization
Customizable gene list, VUS opt-out

GET CONNECTED

Primary Immunodeficiency (PI) | CDC - cdc.gov/genomics/disease/primary_immunodeficiency.htm

Immune Deficiency Foundation - primaryimmune.org/about-primary-immunodeficiencies

Primary Immunodeficiency Disease Overview - aaaai.org/Conditions-Treatments/Primary-Immunodeficiency-Disease/Primary-Immunodeficiency-Disease-Overview

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A Patient's Guide to Genetic Testing

What does a genetic test check for?

Genetic testing checks the order of one's DNA sequence (coded by the letters A, T, G, C) in specific genes linked to genetic conditions. Letters that were added, missing, or changed, are known as variants and can sometimes be harmful to one's health, increasing the risk for a genetic condition.

What are the potential results?

There are three possible results from genetic testing:

Positive

A pathogenic/likely pathogenic variant is detected in one's DNA. This type of variant is known to increase one's risk of a genetic condition. Identifying the specific gene involved can help confirm a diagnosis, inform screening and management, and reveal risk factors for an individual and/or their family.

Negative

No variation known to be associated with a genetic condition was detected in one's DNA . While a result may not show an increased risk for the condition(s) tested for, one can still be at risk for disease, especially if there is a family history.

Variant of Uncertain Significance (VUS)

A variant was detected in one's DNA, however, not enough information is known about this variant to determine whether or not it is known cause the condition(s) tested for. More research is needed to better understand this variant.

What about family members?

Children, siblings, and parents of individuals who have a variant(s) identified in genetic testing could carry the same variant(s) and benefit from testing. Regardless of whether or not a variant was identified, individuals can still be at an increased risk for a genetic condition, especially with a family history.

Do genetic test results affect health insurance or employment?

No, the Genetic Information Nondiscrimination Act (GINA) was signed into law in 2008.
It protects individuals from discrimination by an employer or a health insurance company based on genetic testing results and genetic information. GINA does not protect against life and disability insurance discrimination.
For more information on GINA, go to www.ginahelp.org.

Where can I learn more?

Medline Plus/Genetics Home Reference - medlineplus.gov/genetics/understanding
National Society of Genetic Counselors - nsgc.org

Call: 832-500-4462 | **Fax:** 832-376-7548 | **Web:** www.immunogeno.com | **Email:** support@immunogeno.com

Infectious Disease Test Menu

UTI Panel 1-3

NovaplexTM Urinary Tract Infection (UTI) Panel 1-3 and Novaplex Entero-DR Assay. RUO) is a qualitative in vitro test for the single or multiple pathogen detection (following list).

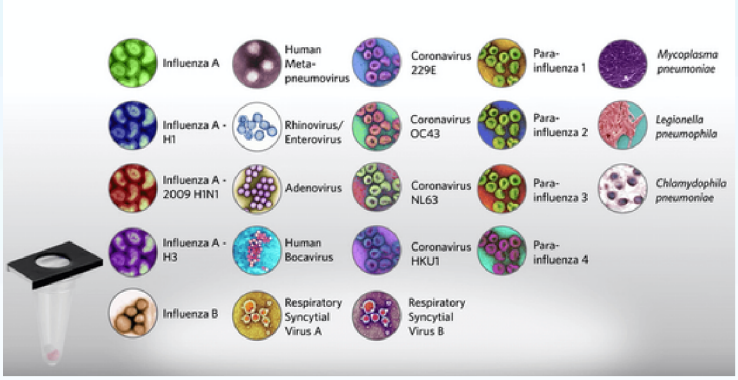
- Escherichia coli
- Pseudomonas aeruginosa
- Klebsiella pneumoniae
- Klebsiella oxytoca
- Klebsiella (Enterobacter) aerogenes
- Proteus mirabilis
- Proteus vulgaris
- Enterobacter cloacae complex
- Serratia marcescens
- Enterococcus faecalis
- Enterococcus faecium
- Staphylococcus aureus
- Streptococcus agalactiae
- Staphylococcus epidermidis
- Staphylococcus saprophyticus
- Actinobaculum schaalii
- Candida albicans
- Candida others (glabrata,tropicalis, parapsilosis, krusei)
- Acinetobacter baumannii
- Citrobacter freundii
- Citrobacter koseri
- Morganella morganii
- Providencia stuartii
- Streptococcus anginosus
- Aerococcus urinae
- Corynebacterium urealyticum
- Pantoea agglomerans
- Klebsiella pneumoniae carbapenemase (KPC)
- Verona Integron–encoded Metallo-β-Lactamase (VIM)
- New Delhi Metallo-beta-lactamase (NDM)
- Imipenemase (IMP)
- Oxacillinase-48 (OXA-48)
- [VRE]
- vanA
- vanB
- [ESBL]
- CTX-M

RPP Panel

Immunogenomics RPP panel is a qualitative in vitro test for multiple detection of following microorganisms.

- Influenza A virus (Flu A)
- Influenza B virus
- Respiratory syncytial virus A
- Respiratory syncytial virus B
- Influenza A-H1 (Flu A-H1)
- Influenza A-H1pdm09 (Flu A-H1pdm09)
- Influenza A-H3 (Flu A-H3)
- Adenovirus (AdV)
- Enterovirus (HEV)
- Parainfluenza virus 1 (PIV 1)
- Parainfluenza virus 2 (PIV 2)
- Parainfluenza virus 3 (PIV 3)
- Parainfluenza virus 4 (PIV 4)
- Metapneumovirus (MPV
- Bocavirus 1/2/3/4 (HBoV)
- Rhinovirus (HRV)
- Coronavirus NL63 (NL63)
- Coronavirus 229E (229E)
- Coronavirus OC43 (OC43)
- Mycoplasma pneumoniae (MP)
- Chlamydia pneumoniae (CP)
- Legionella pneumophila (LP)
- Haemophilus influenzae (HI)
- Streptococcus pneumoniae (SP)
- Bordetella pertussis (BP)

Bordetella parapertussis



STI Panel

Novaplex Bacterial Vaginosis

- Gardnerella vaginalis (Quantitative) (GV)
- Atopobium vaginae (Quantitative) (AV)
- Megasphaera Type 1 (Mega1)
- Bacterial vaginosis–associated bacteria 2 (BVAB2)
- Mobiluncus spp. (Mob)
- Bacteroides fragilis (BF)
- Lactobacillus spp. (Quantitative) (Lacto)

Novaplex Aerobic Vaginitis Assay

- Escherichia coli
- Staphylococcus aureus
- Enterococcus faecalis
- Streptococcus agalactiae
- Streptococcus pyogenes
- Lactobacillus spp.
- Lactobacillus reuteri/rhamnosus

COVID-19 Testing

- FDA Approved At Home Collection Test Kit for PCR Testing
- Same day result - saliva/nasal/NP

COVID-19/FLU/RSV PCR

COVID-19 Rapid Test

- Performed in-house

FREE AT HOME (OTC) COVID-19 TESTING KITS*
Get Yours Today
Your insurance will not be charged

Scan the QR code below and Sign up to receive Low Cost/Free Preventative Diagnostic Testing

COVID-19 Testing Vaccination

scan QR code to schedule a test

scan QR code to download our COVID-19 Requisition form

Call: 832-500-4462 | **Fax:** 832-376-7548 | **Web:** www.immunogeno.com | **Email:** support@immunogeno.com

Most commonly ordered tests

Afforable cash prices for all blood work are listed below

- HEMOGLOBIN $6.00
- CBC W/O DIFF,WITH PLATE $6.00
- COMPLETE BLOOD COUNT $6.00
- FOLIC ACID $14.00
- HEMOGLOBIN A1C $10.00
- BASIC METABOLIC PANEL $4.80
- LIPID PANEL $4.75
- COMP METABOLIC PANEL $6.25
- ELECTROLYTE PANEL $4.33
- HEPATIC FUNCTION PANEL $4.68
- RENAL FUNCTION TEST $4.75
- TSH $8.00
- T3 TOTAL $12.00
- T4 $6.50
- VITAMIN B-12 $12.50
- VITAMIN D, 25-HYDROXY $36
- ENVIRONMENTAL IgE PANEL WITH TOTAL IgE $120
- FOOD ALLERGY IgE PANEL WITH TOTAL IgE $120
- HIV 1/2 4TH GEN,RFLX CONF $18
- GLUCOSE $4.04
- GLUCOSE, 24 HOUR URINE $24.00
- HEPATITIS A TOTAL AB,RFLX $18.00
- INSULIN $20.00
- ALBUMIN, URINE, RANDOM $18.00
- TOTAL CHOLESTEROL/HDL $14.00
- CALCIUM $6.00
- SODIUM $6.00
- CHLORIDE $6.00
- TOTAL PROTEIN $6.00
- ALKALINE PHOSPHATASE $6.00
- ALANINE AMINOTRANSFERASE (ALT) $6.00
- ASPARTATE AMINOTRANSFERASE (AST) $6.00
- BILIRUBIN, TOTAL $6.00
- LDL DIRECT $20.00
- TRIGLYCERIDES $6.00
- BICARBONATE, URINE $16.00
- CARNITINE, FREE AND TOTAL, URINE $72.00
- UREA NITROGEN, URINE, 24 HR $18.00
- ALKALINE PHOSPHATASE $6.00
- LDH LACTATE DEHYDROGENASE $6.30
- 14-3-3n PROTEIN, SERUM $68.00
- 24HR CREATININE CLEARANCE $12.00
- ABO & RH $10.00
- ADULT FOOD III IgE PANEL $49.00
- ALBUMIN, URINE, RANDOM $18.00
- ALBUMIN,URINE,24HR QNT $20.00
- ALBUMIN/CRT RATIO,RNDM UR $30.00
- ALLERGEN,CAT EPITHELIUM $14.00
- ALLERGEN,COCKROACH,GERMAN $14.00
- ALLERGEN,DOG DANDER $14.00
- ALLERGEN,EGG WHITE IgE $14.00
- ALLERGEN,MILK $14.00
- ALLERGEN,OAK $14.00
- ALLERGEN,PEANUT $14.00
- ALLERGEN,TIMOTHY GRASS $14.00
- AMMONIA $38.00
- AMYLASE $8.00
- ANA CONFIRMATION $14.00
- ANA TITER AND PATTERN $14.00
- ANA W/O REFLEX $14.00
- ANDROSTENEDIONE $47.00
- ANTI-MULLERIAN HORMONE $350.00
- ANTI-NUCLEAR ANTIBODIES $14.00
- ARTHRITIS PROFILE $30.00
- BACT VAGINOSIS,PCR,APTIMA $112.00
- BASIC METABOLIC PANEL $4.80
- CALCULATED T7 (FTI) $20.00
- CANCER ANTIGEN 125 $24.00
- CARBAMAZEPINE,TOTAL $16.00
- CD4 (T4) ENUMERATION $40.00
- CEA $24.00
- CELIAC DISEASE PANEL $38.00
- CHLAMYDIA,TMA,SIMPLESWAB $30.00
- CHLAMYDIA,TMA,SUREPATH $30.00
- CHLAMYDIA,TMA,THINPREP $30.00
- CHLAMYDIA,TMA,URINE $30.00
- CHRG NON-IMAGED MC SP $41.00
- CHRG NON-IMAGED SP $21.00
- CK, TOTAL $8.00
- CKMB IMMUNOCHEM ASSAY $24.00
- C-REACTIVE PROTEIN $16.00
- CT/NG,TMA,SIMPLESWAB $30.00
- CT/NG,TMA,URINE $30.00
- CULTURE,BLOOD $24.00
- CULTURE,CHLAMYDIA $8.5.00
- CULTURE,FUNGUS SKIN,HAIR, $30.00
- CULTURE,GC $20.00
- CULTURE,GENITAL $20.00
- CULTURE,ROUTINE $18.00
- CULTURE,STOOL $20.00
- CULTURE,SUSCEPTIBILITY $6.00
- CULTURE,THROAT $16.00
- CULTURE,URINE $14.75
- CULTURE,URINE & SENS ALL $14.75
- CYCLIC CITRULL PEP IGG $30.00
- DHEA SULFATE $20.00
- DRUG ABUSE 11 W/ETOH,NO $54.00
- DRUG ABUSE SCRN 13,NO CON $48.00
- DRUG ABUSE SCRN 14 W/ETOH $48.00
- DRUG ABUSE SCRN 8,NO CONF $40.00
- ESTRADIOL $16.00
- ESTROGEN, FRACTIONATED $58.00
- FERRITIN $12.00
- FOLLICLE STIM HORMONE $20.00
- FREE T3 $12.00
- FREE T4 (THYROXINE) $12.00
- FSH + LH PROFILE $48.00
- GGT $4.75
- GLUCOSE, 24 HOUR URINE $24.00
- GLUCOSE,1HR POST 50GM $4.75
- GLUCOSE,2HR POST MEAL $8.00
- GONORRHEA,TMA,SIMPLESWAB $30.00
- GONORRHEA,TMA,SUREPATH $30.00
- GONORRHEA,TMA,THINPREP $30.00
- GONORRHEA,TMA,URINE $30.00
- GTT,2HR 75GM LOAD $12.00
- H PYLORI BREATH TEST $128.00
- HCG QUANTITATIVE $20.00
- HCG,QUALITATIVE,SERUM $14.00
- HDL CHOLESTEROL $14.00
- HEMATOCRIT $8.00
- HEPATITIS A TOTAL AB $16.00
- HEPATITIS A TOTAL AB,RFLX $16.00
- HEPATITIS A VIRAL AB (IGM $16.00
- HEPATITIS B CONFIRM $24.00
- HEPATITIS B SURF AB $16.00
- HEPATITIS B SURF AG $16.00
- HEPATITIS Bs AB QUANT $36.00
- HEPATITIS C ANTIBODY $16.00
- HEPATITIS C RNA BY PCR, Q $160.00
- HEPATITIS PANEL,ACUTE $30.00
- HEPATITIS PROFILE(A,B,C) $48.00
- HERPES 1 & 2 IgM $9128.00
- HERPES SIMPLEX 1 & 2 IGG $40.00
- HERPES SIMPLEX TYPE 1 IGG $20.00
- HERPES SIMPLEX TYPE 2 IGG $20.00
- HIV 1/2 CONFIRMATION $90.00
- HIV NUCLEIC ACID AMPL $160.00
- HOMOCYSTEINE $60.00
- HPV HI RISK GENOTYPE, SP $50.00
- HPV HI RISK GENOTYPE, TP $50.00
- INDICATED URINE CULTURE $12.00
- IRON+IBC+SATURATION % $20.00
- KIRBY-BAUER SUSCEPTIBILIT $6.00
- LEAD,BLOOD,VENIPUNCTURE $22.00
- LIPASE $16.00
- LITHIUM $18.00
- LUTEINIZING HORMONE $24.00
- MAGNESIUM $8.00
- MANUAL SEDRATE $6.00
- MANUAL UA W/MICRO $8.00
- MC DIABETES SCRN FAST GLU $4.75
- MC PRE-DIAB SCRN FAST GLU $4.25
- MMR & VARICELLA PROF $72
- MMR PROFILE $52
- MONO SCREEN $12.00
- MUMPS VIRUS IgG $20.00
- NICOTINE/COTININE,URINE $110.00
- NT-proBNP $78.00
- OBSTETRIC PANEL $40.00
- OCCULT BLD $12.00
- OCCULT BLOOD SCREEN (1-3) $12.00
- OVA AND PARASITES $324.00
- PAP PATH INTERP $10.00
- PAP TEST,SUREPATH,IMAGED $42.00
- PAP,SUREPATH,MC 1YR,IMAGE $42.00
- PAP,SUREPATH,MC 2YR,IMAGE $42.00
- PAP,SUREPATH,MC DIAG,IMAG $42.00
- PHENYTOIN (DILANTIN) $18.00
- PHLEB FEE,NON-CPL PT $2.00
- POLIO AB'S 1,3 $90.00
- POTASSIUM $4.04
- PREGNANCY TEST, URINE $18.00
- PROGESTERONE $18.00
- PROLACTIN $24.00
- PROTEIN, 24 HOUR URINE $18.00
- PROTHROMBIN TIME $6.00
- PROTIME & PTT $12.00
- PSA TOTAL,SCRN MEDICARE $14.99
- PSA, TOTAL $14.99
- PTH INTACT W/CALC,PHOS,CR $16.00
- PTH, INTACT $60.00
- PTT $6.00
- QUAD SCREENING W/INTERP $80.00
- RANDOM UR PROTEIN/CREAT $16.00
- REFLEX HEPATITIS A IgM $16.00
- REFLEXED RPR TITER $4.00
- REGION X (TX,OK) IgE PAN $350.00
- RHEUMATOID FACTOR $10.14
- RPR $4.00
- RUBELLA AB SCREEN $12.00
- RUBEOLA IgG ANTIBODY $20.00
- SEDIMENTATION RATE $6.00
- SERUM IRON $6.00
- SEX HORMONE BIND GLOBULIN $50.00
- SICKLE CELL RFLX ELECTRO $70.00
- SKIN OR NAIL X1 $90.00
- SKIN X 2 $180.00
- TESTOSTERONE $20.00
- TESTOSTERONE,FR/TOT W/SBG $40.00
- TEXAS REGIONAL IgE PANEL $256.00
- THINPREP PAP,IMAGED $42.00
- THYROID I PROFILE $12.20
- THYROID II PROFILE $20.55
- THYROID PEROXIDASE AB $30.00
- TRICHOMONAS URINE AMP $60.00
- TRICHOMONAS VAG SWAB AMP $52.00
- TRICHOMONAS, MALE $52.00
- TROPONIN T $50.00
- TSH REFLEX TO FREE T4 $8.00
- TSH+FREE T4 $20.00
- T-UPTAKE $4.70
- UA MICROSCOPIC & RFLX CUL $6.50
- URIC ACID $6.00
- URINALYSIS W/REFLEX MICRO $8.00
- URINALYSIS WITH MICROSCOP $8.00
- URINALYSIS,MICROSCOPIC $6.00
- VAG PATHOGENS DNA PANEL $50.00
- VALPROIC ACID (DEPAKENE) $22.00
- VARICELLA ZOSTER IGG $20.00
- VITAMIN B 12 AND FOLIC AC $26.50
- EPSTEIN BARR PANEL $76.00
- EPSTEIN BARR VCA IgM $30.00
- ASO TITER $12.00
- EPSTEIN BARR VCA IgG $28.00
- COMPLEMENT, TOTAL HEMOLYT $32.00
- IMMUNOGLOB,IgA,IgG,IgM $50.00
- COMPLEMENT C3 & C4 $40.00
- CT NG (gonorrhea/chlamydia urine $60.00
- GONORRHEA, NAAT, URINE $30.00
- CHLAM AMP URINE $30.00
- TRICH MALE $52.00
- TRICH, FEMALE URINE $52.00
- HIV 1/2 4TH GEN, RFLX CONF $18.00
- HEP B CORE AB $16.00
- HEP C ANTIBODY $16.00
- HEP C ANTIBODY $4.00
- Chlamydia Antibody Panel $88.00

Our Ethos

The Ethos of Immunogenomics is to be the best lab services provider across the nation where patients, physicians, and payers can rely on our outstanding staff and technical resources to efficiently provide diagnosis services that is unmatched in quality, convenience, and meaningful use in a informative, reliable and patient-oriented manner.

Our Priceless Values

INSPIRE | INFORMATIVE | INTEGRITY |
CARING/COMPASSION | EXCELLENCE | LISTENING| SHARING/TEAMWORK

Our Vision

The vision of Immunogenomics is to improve lab workflow with of cutting edge technology and to have knowledgeable and educated employees who focus on the Strategic Excellence Positions and Goals and how they contribute to the overall achievement of the mission of Immunogenomics

Immunogenomics is a team of dynamic individuals with a passion for change management and depth in their respective areas of expertise. Our dedicated employees bring energy, fresh ideas and pride to their work. We view Immunogenomics's culture as a competitive advantage and strive to create an environment where smart, motivated and creative people succeed. We think big and work hard. We strive for excellence in everyday interactions. We constantly push to be better.

Immunogenomics operates a CLIA certified facility and collaborates with leading platform providers including ThermoFisher, Illumina, Fluidigm, Agena, BioRad and other platforms to secure early access to advanced technologies. Our team is validating a comprehensive menu of high parameter Immuno oncology expression profiling assays to explore tumor immunobiology and identify new biomarkers and pharmacogenomics.

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