Genomics in Primary Care
How I Quit Guessing....

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Disclosures

- I receive reimbursement from testing from the 3x4 company, when I place orders for genomic tests for patients. It is considered a consultation fee that is charged to my patients.

- The *Hero's Genome* is a lifestyle medicine course that I have developed as a proprietary aspect of my practice.

- I have no financial ownership or sponsorship with any company that is discussed today.

Mary Louder, DO

- Graduated 1993 MSUCOM
- Family Medicine Residency

- Integrative, functional medicine x 26 year of the 30 years
- Boarded in Family & Integrative Medicine
- Currently private practice Direct Care model of practice

Why This is A Foundational Way For Me To Practice

- People are data with souls
- I wanted to deepen my connection in the DPR
- I wanted to have more information than community standards, good ideas and anecdotal methods. Quit Guessing.
- Patients came to me having tried so many things and they were still struggling.
- I needed clarity, and I was curious.

THE HERO'S GENOME (your story)

- Knowing the power of who you are by your own genomic blueprint can be the key to your health and wellness.
- You will learn what genomics are and how they are the blueprint of your health and wellness journey
- You will learn about YOU and why that is the most important lesson that you can learn.

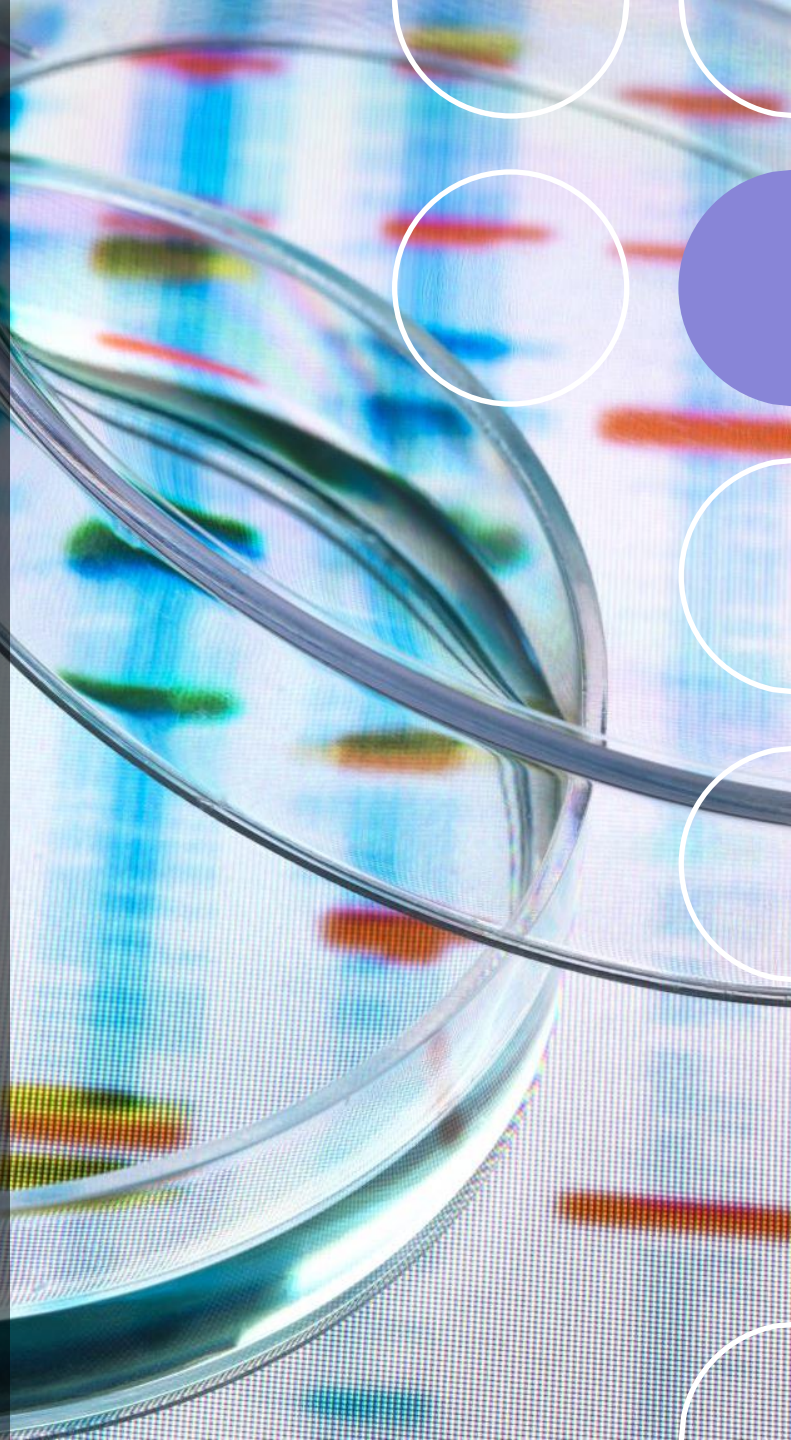
THE HERO'S JOURNEY- GENOMICS

- The study of the human genome from the basics of science of Watson and Crick who discovered the construct of the DNA molecule

- **2003 The Human Genome Project** – sequenced human DNA to understand the disease process

- **2015 – 1000 GENOMES PROJECT** – how alterations in genes lead to diseases in humans

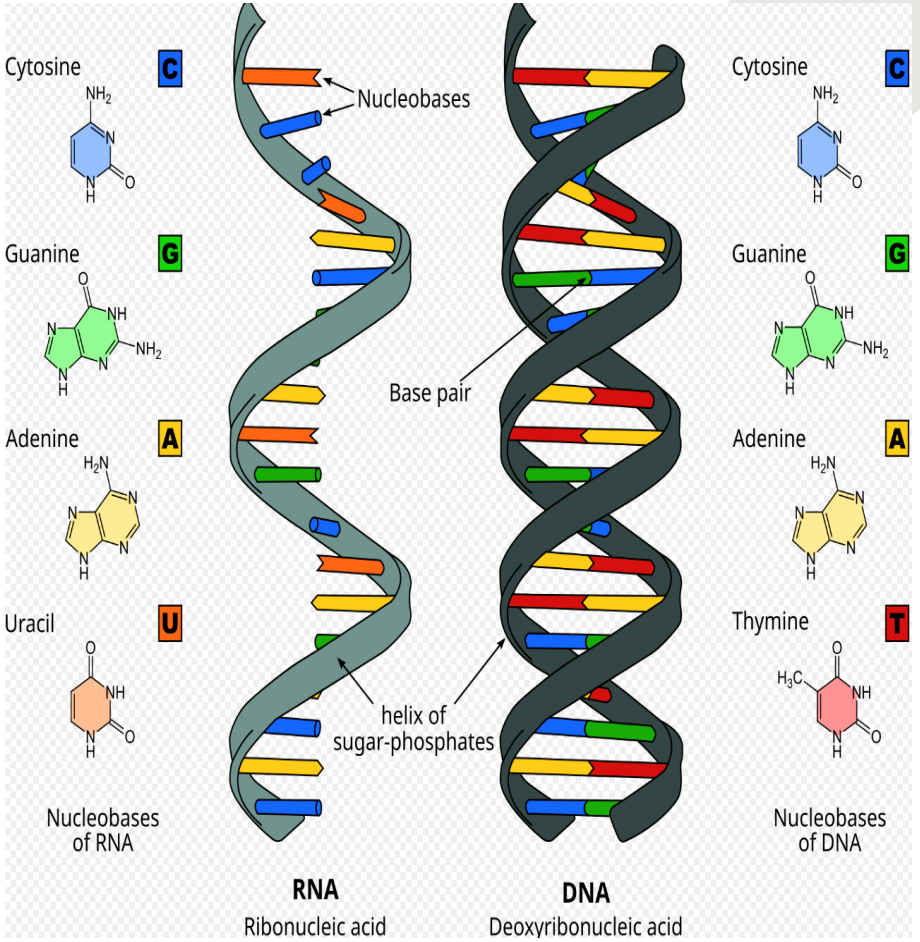
- **Precision Medicine Initiative** – using the suffix of "omics" adding this to gene to establish the science of GENOMICS



THE HUMAN GENOME

- Double stranded human genome of each cell contains 6.4 billion nucleotides Proteins are the molecules that do the work, only about 1% of the human genome sequences are designated to encode mRNA for protein coding.
- Until recently, the majority of DNA was considered “junk”. Now we know that virtually all of DNA is transcribed into RNA

(picture Wikipedia DNA nucleic acid)

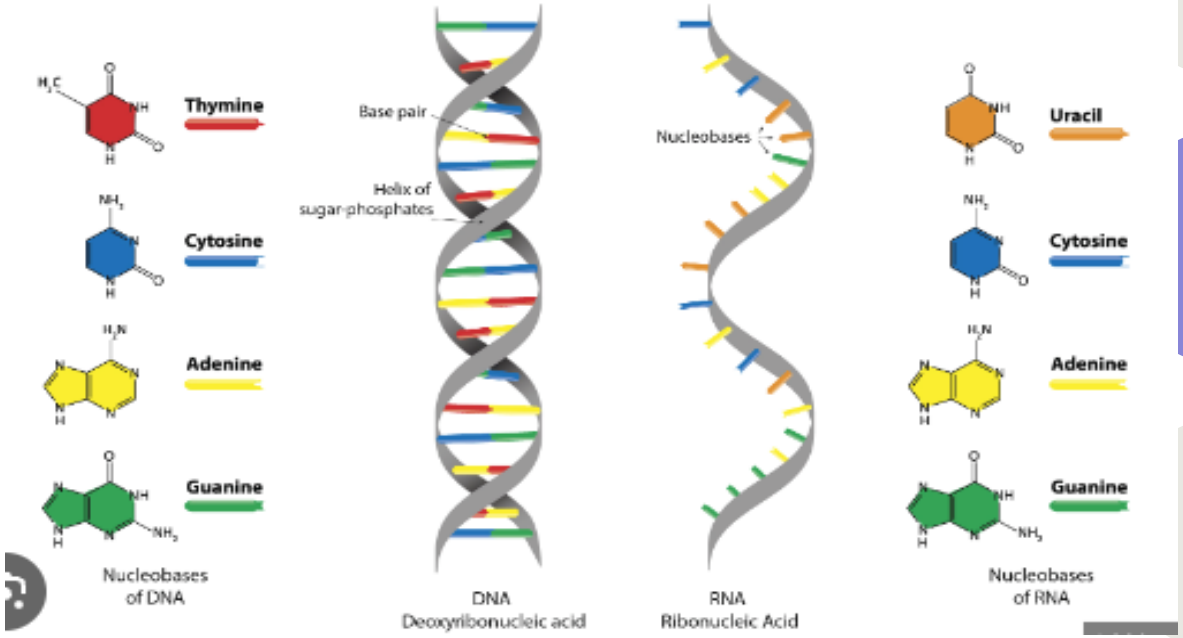


Nucleic Acids Structure and Function

- Nucleic acids are chemical compounds that are found in nature. They carry information in cells and make up genetic material. These acids are very common in all living things, where they create, encode, and store information in every living cell of every life-form on Earth.

- In turn, they send and express that information inside and outside the cell nucleus. From the inner workings of the cell to the young of a living thing, they contain and provide information via the nucleic acid sequence.

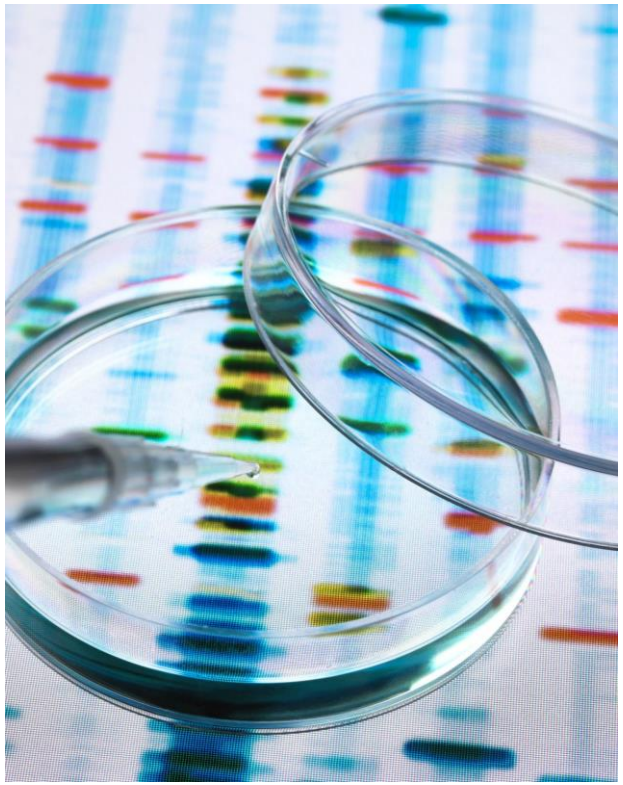
- This gives the RNA and DNA their unmistakable 'ladder-step' order of nucleotides within their molecules. Both play a crucial role in directing protein synthesis.



- **RNA (Ribonucleic Acid**) – Converting genetic information from genes into the amino acid sequence of proteins

- **DNA (Deoxyribonucleic Acid)** – genes for all living cells, inside the nucleus, double stranded, regulating the use of genetic information.

- **ANA (Artificial Nucleic Acid)** – nucleic acids analogues that have been designed and synthesized. Peptide nucleic acids are an example, the backbone of the molecule is different.



Gene nomenclature

- **PHENOTYPE** - the expression of the genotype, the patient's clinical presentation
- **CAUSAL GENES-** linked to the phenotype, risk factor expression.
- **GENOTYPE** – the persons unique DNA sequence
- **SUSCEPTIBLE GENES –** likelihood of developing a disease based upon genes

GENETIC MUTATION
3 Basic ways

- BASE SUBSTITUTION
- DELETIONS
- INSERTIONS

MUTATION EXAMPLES

1. Cystic Fibrosis (CF)

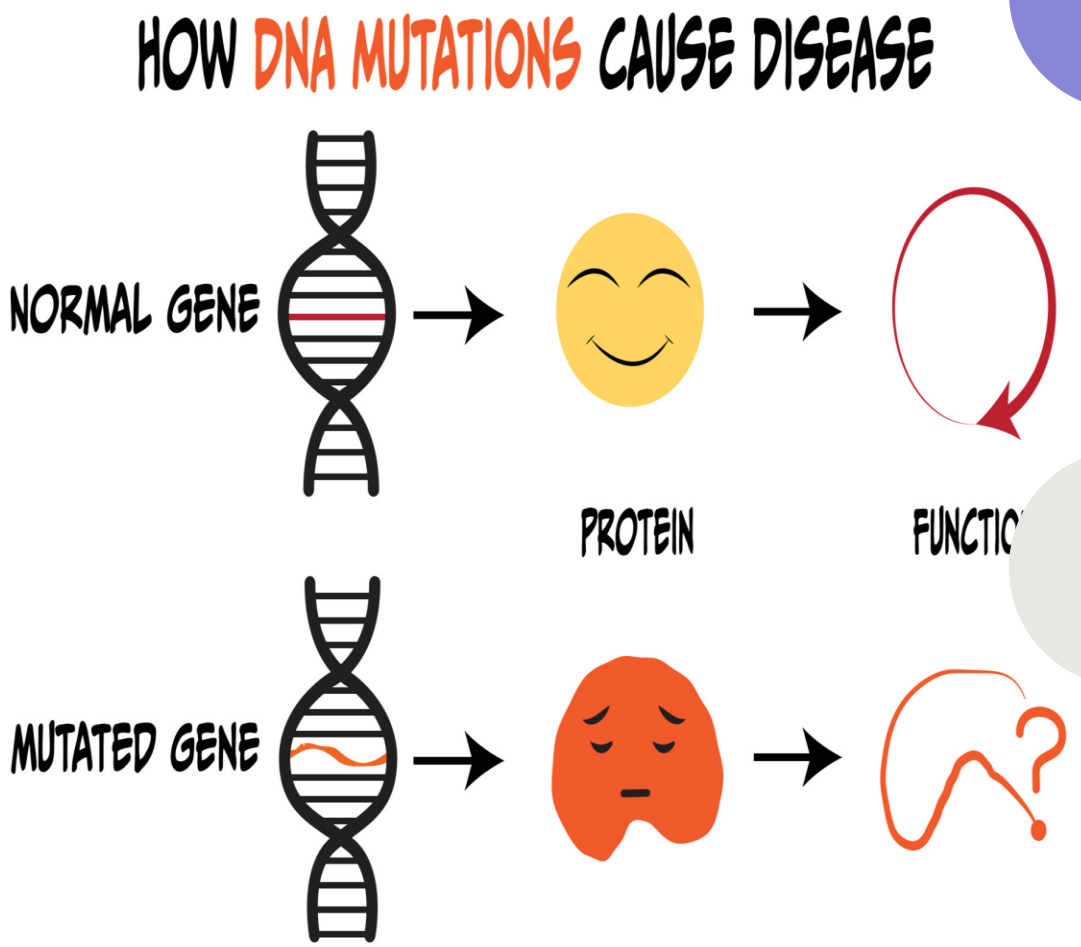
- **Gene Involved**: CFTR gene (Cystic Fibrosis Transmembrane Conductance Regulator).
- **Description**: This mutation leads to thick and sticky mucus production, affecting the lungs, pancreas, and digestive system. Symptoms include persistent cough, lung infections, and digestive difficulties.

2. Sickle Cell Anemia

- **Gene Involved**: HBB gene (Hemoglobin Subunit Beta).
- **Description**: A mutation in the HBB gene causes red blood cells to take on a sickle shape, leading to pain, fatigue, anemia, and potential organ damage due to poor oxygen transport.

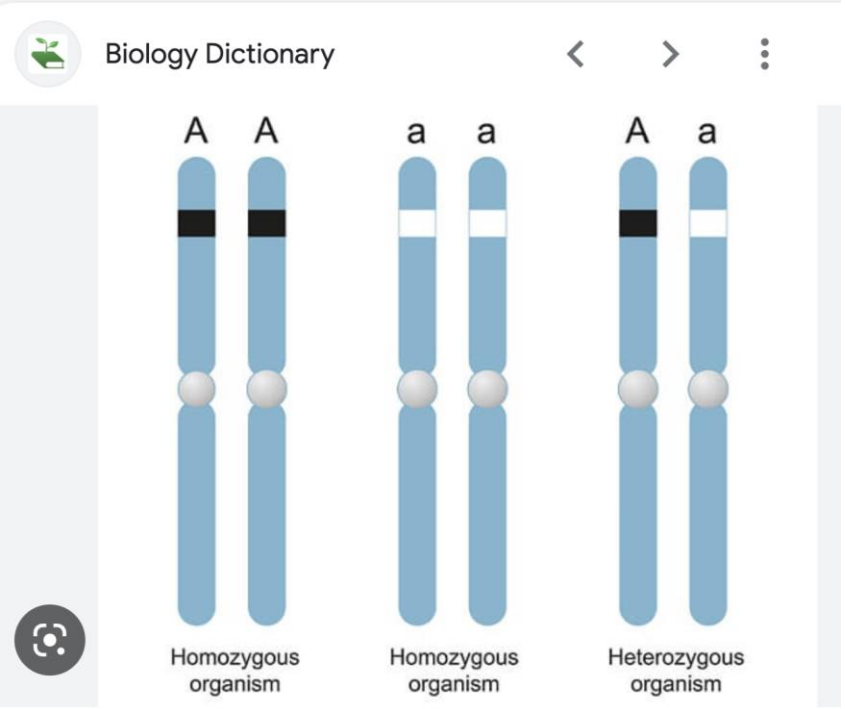
3. Huntington's Disease

- **Gene Involved**: HTT gene (Huntingtin).
- **Description**: This condition is caused by a mutation leading to abnormal repetition of the DNA sequence (CAG trinucleotide repeat). Symptoms typically include movement disorders, cognitive decline, and behavioral changes, often starting in mid-adulthood.



SNP – Single Nucleotide Polymorphisms

- At one base pair there is a change
- Alters the expression (phenotype) of your DNA
- When taken in the large picture it is called a genomic change or SNP
- NOT SET IN STONE BUT HAS EFFECTS ON BIOCHEMISTRY.
- Less intrusive also influenced by epigenetics

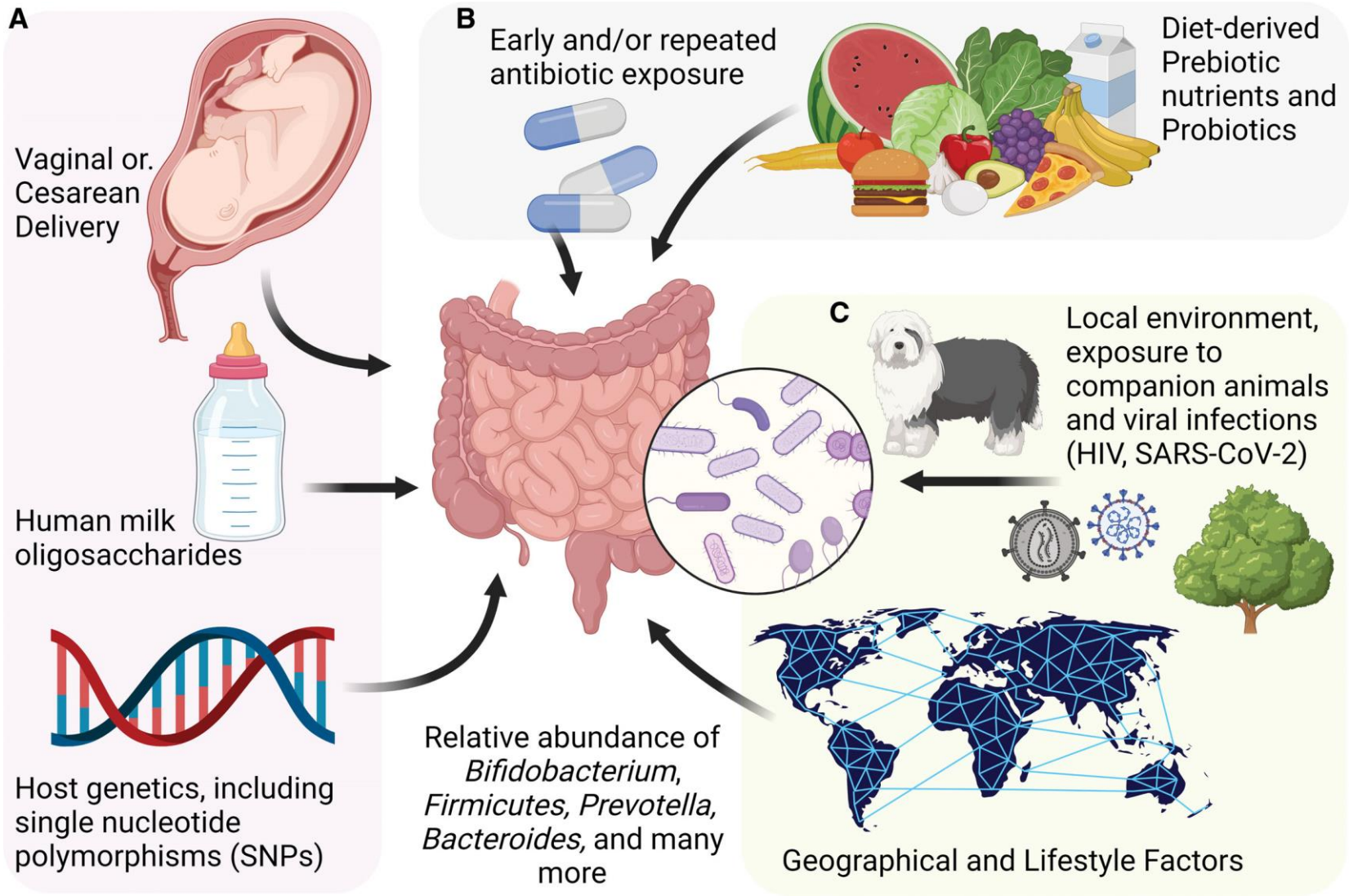


SNP
single nucleotide
polymorphisms

- Less penetrance into the genes
- Epigenetics – environmental influence on the genes
- Metabolomics – influence of the microbiome on the genes

- MICROBIOME – the community of microorganisms that live in a specific environment, such as the human body or in a part of the human body.

- BACTERIA~ VIRUSES~ FUNGI~ PROTOZOA



Gut Microbiota and Microbial Metabolism in Early Risk of Cardiometabolic Disease
(Circulation Research vol. 132, No. 12, June 2023)

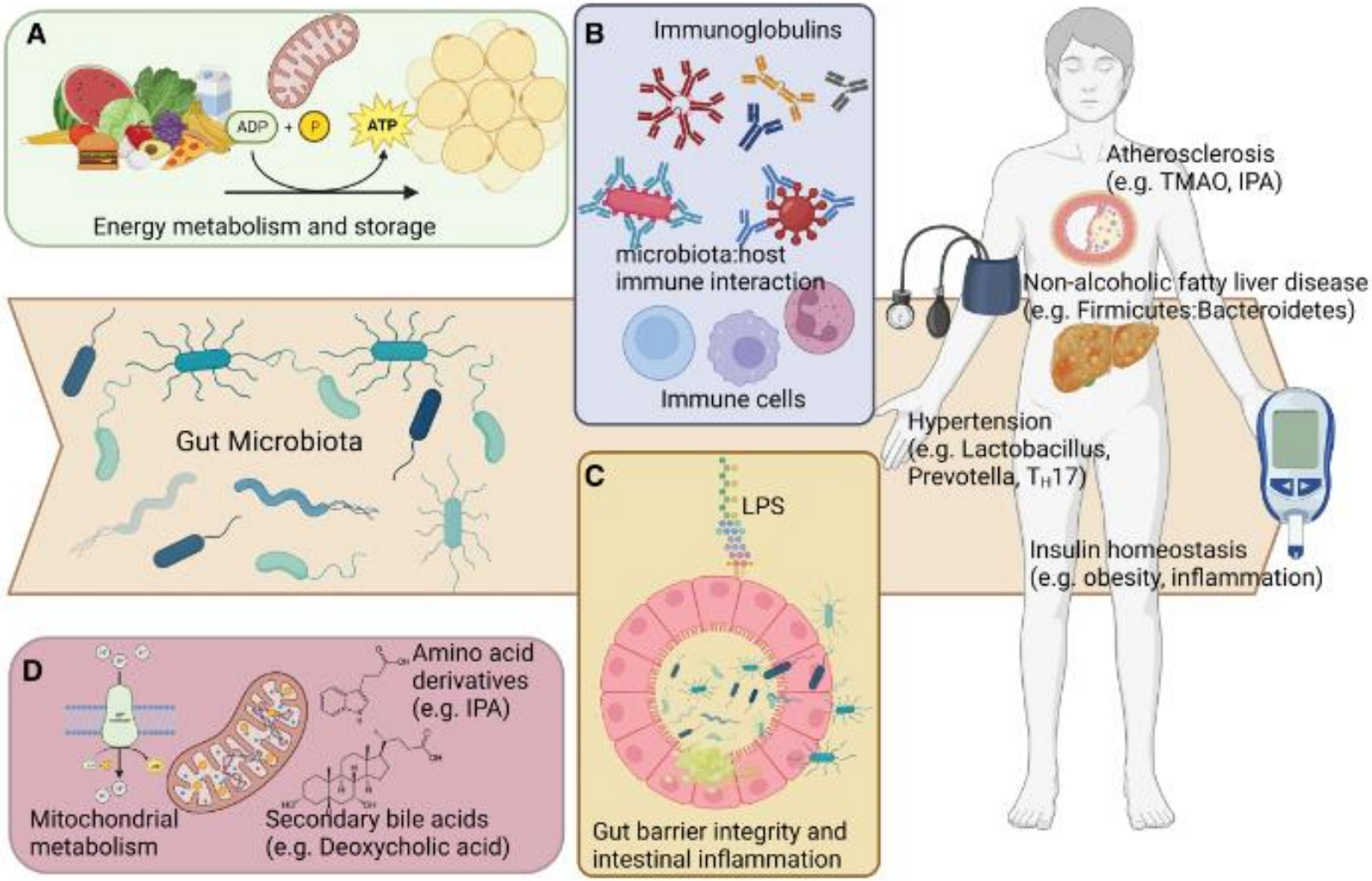


Figure 2. Mechanisms linking microbial metabolism to host physiology. Gut microbiota may cause cardiometabolic disease through diverse mechanisms including (**A**) modulation of energy and nutrient availability, (**B**) activation of immune responses, (**C**) modulation of gut barrier integrity, and (**D**) systemic effects via microbe-mediated signaling molecules. Created with BioRender.com. IPA indicates indole-3-propionic acid; LPS, lipopolysaccharide; T_H17, T helper 17; and TMAO, trimethylamine N-oxide.

ENCODE PROJECT

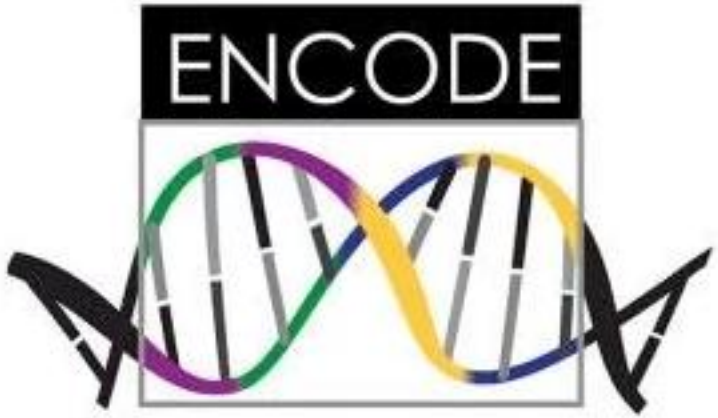
Assigns biochemical functions for 80% of the genome

- Some of the transcribed RNA is translated into protein
- the remainder performing a host of functions, affecting those sequences (genes) that encode for protein. This is its FUNCTION

- This puts the “FUN” in the functional medicine or the ”LIFE” in the Lifestyle medicine.

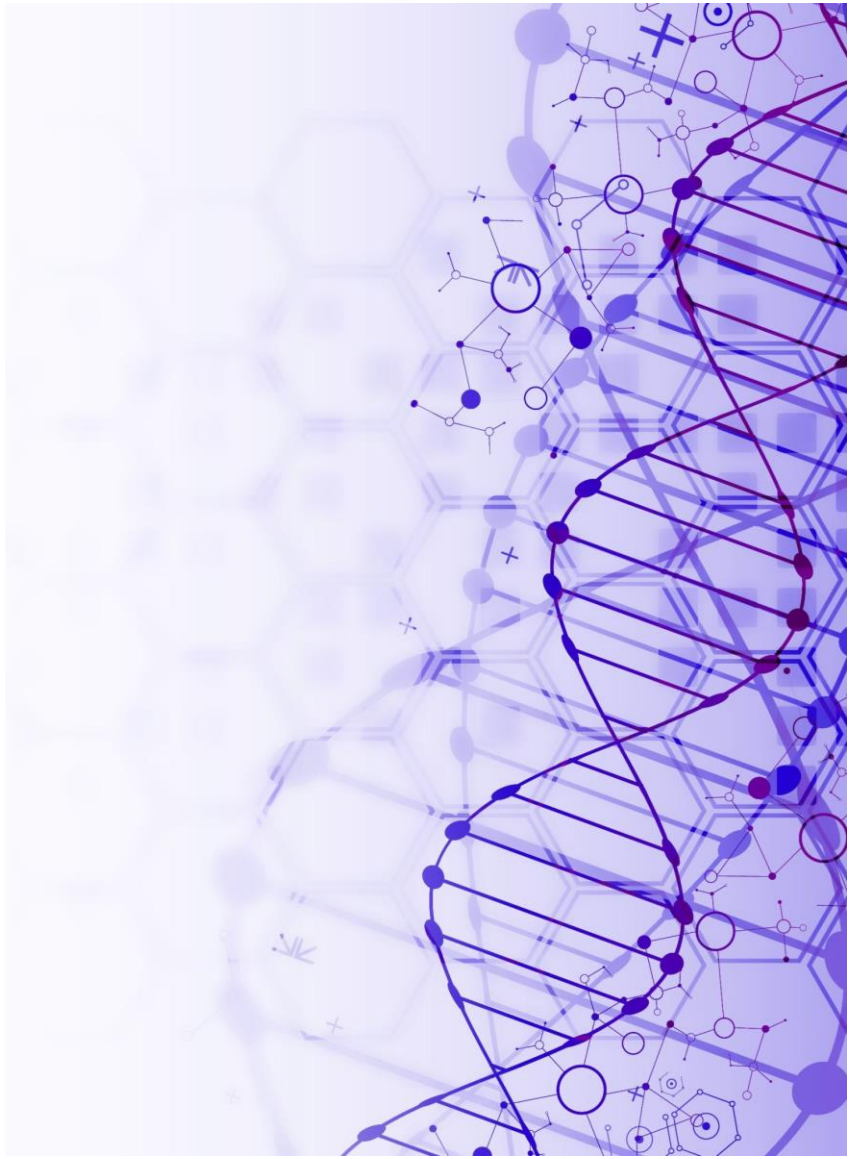
The Encyclopedia of DNA Elements is a public research project which aims to build a comprehensive parts list of functional elements of the human genome.

1. Started in 2003 >>>2012 STANFORD
2. Whole genome database
3. Research center is Stanford University.



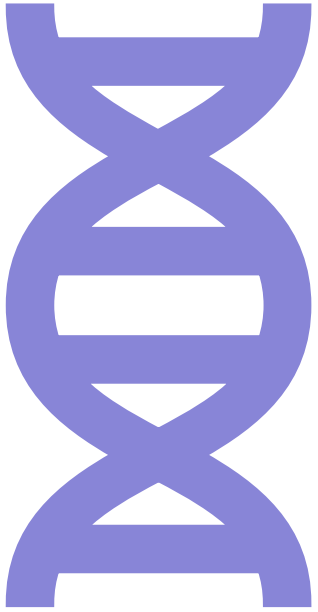
HUMAN GENOME BIODIVERSITY

- Human DNA (6 billion bases) replicates itself every few days.
- Errors are 1 error per 1 billion bases created
- These errors can accumulate over time – generations this is how we evolve.
- Currently we know that there are 3 million SNPs per genome, which account for > 80% of human phenotype variations, ie. Eye color or susceptibility to disease

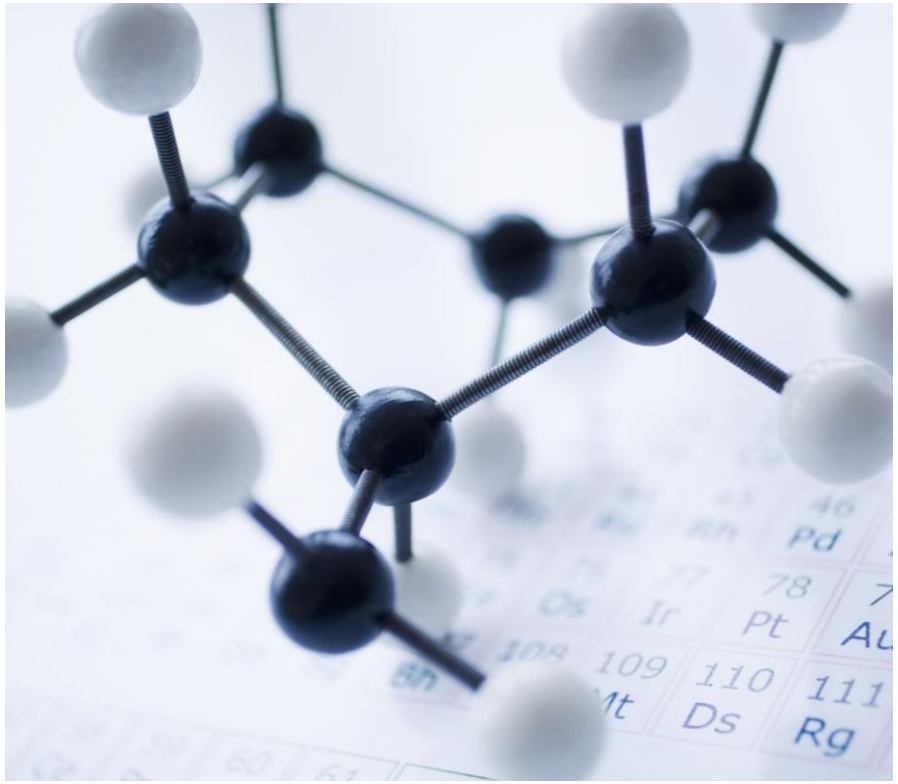


We are all uniquely different yet 99.9% alike

Human Genetic Biodiversity



- Single Nucleotide Polymorphisms (SNPs)
- Single base changes through substitution of a single base nucleotide for another. These are then passed generation to generation and referred to as SNP’s.
- Many of these SNP’s have minimal or a neutral effect.



Epigenetics

- Regulation of gene expression without changing DNA sequence by covalent modifications made to histone proteins and nucleic acids that cooperatively regulate chromatin structure.

- REVERSABLE AND DYNAMICALLY REGULATED GENE EXPRESSION

Four Main Epigenetic Mechanisms

- DNA Methylation
- Histone Modification
- Chromatin Remodeling
- Noncoding RNA

HUMAN GENOME BIODIVERSITY

- Currently we know that there are 3 million SNPs per genome, so then how does it influence DNA?

- The DNA replication creates opportunities for mutation, and the timing of DNA replication correlates with the density of SNPs across the human genome.

- The environment (EPIGENETICS) plays a role in SNP expression, depth of penetration and thus DNA replication.

GENOMIC TESTS

How to pick one

What components are important?

Is the data secure?

Are they diagnostic?

What are next steps?

Your DNA testing will do the following:

Determine risk areas. These can then be further tested with labs and imaging and consultations to more fully understand your genomic impact on your health

Exercise that is BEST 4 YOU!

Foods that are BEST 4 YOU!

Supplements that are BEST 4 YOU!

Genomic testing components

- Low penetrance genes
- Not diagnostic
- Helpful for insights of vulnerabilities
- Propensity or potential of your overall health

DIFFERENT TYPES of GENOMIC TESTING
Two examples of high utility

GENE SIGHT

- Pharmacogenomics
- Pharmacogenetics
- Psychiatric Medication focused
- Liver pathway focused
- Insurance based
- Not functional but pharmacological
- Clinical studies

3 x 4 Genomics

- Polygenomic
- SNP's
- Systems driven
- Non-insurance based
- Great for insight into structure and function
- Scientific literature and SNPedia driven – peer reviewed literature.

Gene Sight

- Used a number of times
- Patients who have failed multiple medications and remain highly symptomatic
- Side effects from multiple medications
- Fearful or polypharmacy
- Elderly – Beers Criteria
- Curious patients
- Curious physician (smile)

Fewer than **50%** of individuals with depression respond to their first medication.

Is the GeneSight test right for you?

- ✓ Has a medication failed you in the past?
- ✓ Is your current medication not working?
- ✓ Does your medication cause unwanted side effects?

What is the GeneSight Psychotropic test?

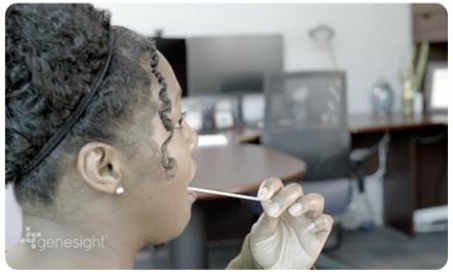
Like how your unique fingerprint unlocks your phone, the GeneSight test unlocks your genetic "fingerprint", providing insight which a clinician can use to inform your mental health medication treatment and may improve your chances of finally feeling like yourself again.

Take the next step ›

Gene sight

How does it work?

Step 1



The GeneSight test is a simple cheek swab taken in your clinician's office

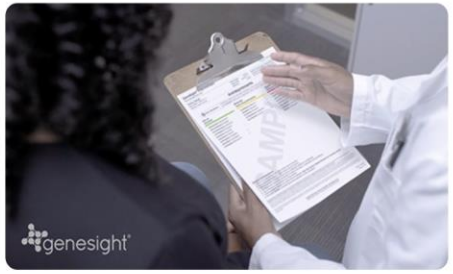
OR

can be ordered and sent by your clinician to be taken in the convenience of your home via GeneSight at Home

Step 2

The sample is sent to our lab for analysis. After we receive your sample, we send results to your clinician typically within about 2 days.

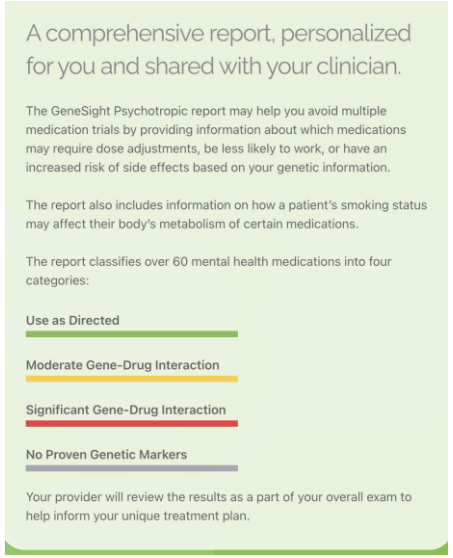
Step 3



Your clinician can review your results on the next visit. The results may be used by your healthcare provider to inform your mental health medication treatment

GENE SIGHT

- Consumer driven
- Physician driven
- Insurance may cover part – know thy policy
- Focused on liver pathways and specific classes of medications
- Easily formatted
- Has worked very well when conundrums abound



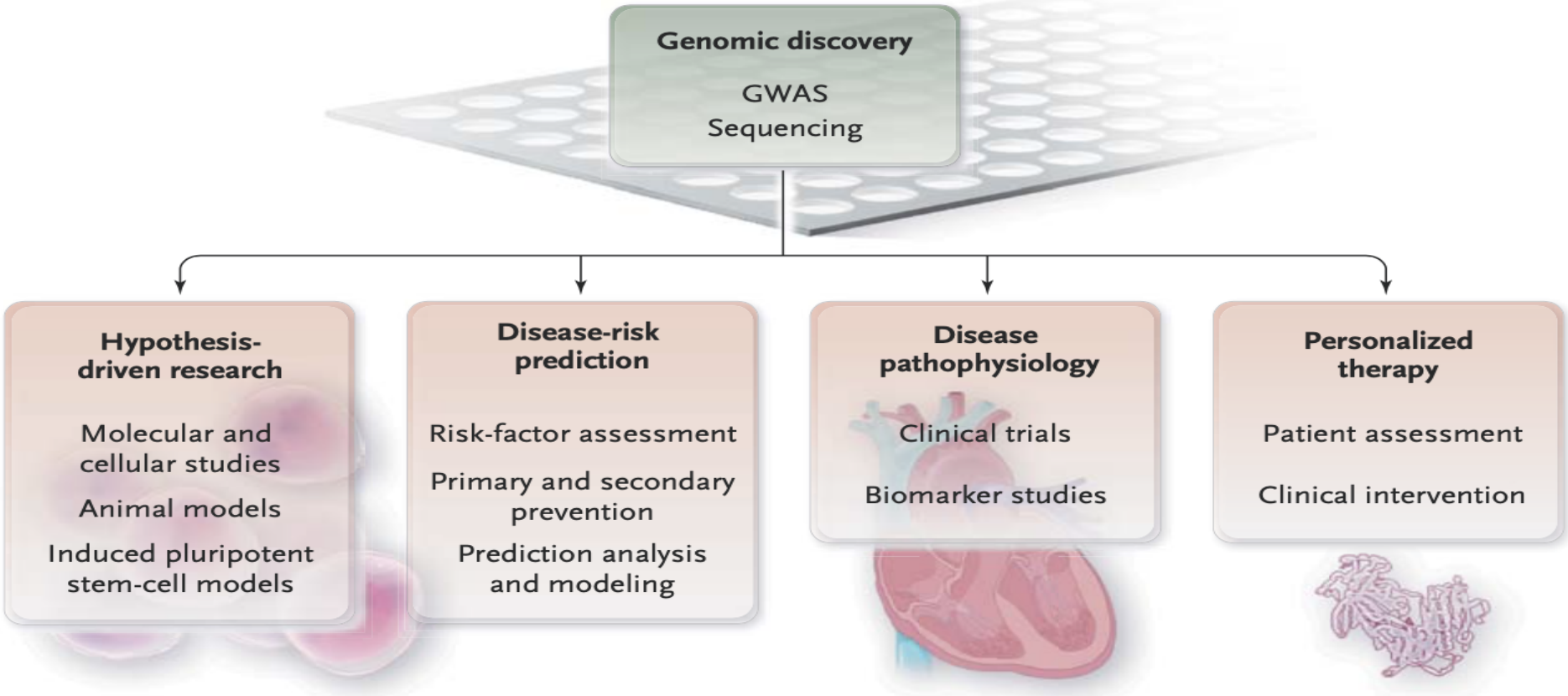


Figure 3. Investigative Pathways Leading from Gene Discovery to Clinical Application.

Genomewide association studies (GWAS) and gene sequencing represent discovery research. Findings from these studies stimulate further investigations in hypothesis-driven research and disease-risk prediction. Applications to clinical cardiovascular care will follow.

Switching to an Osteopathic Philosophy in light of GENOMICS

The human body is a functional unit, mind, body, spirit and are interconnected.

Structure and Function are inter-dependent

The human body is self-healing

OMT and treatment is based upon individualized, rational application of the above tenents

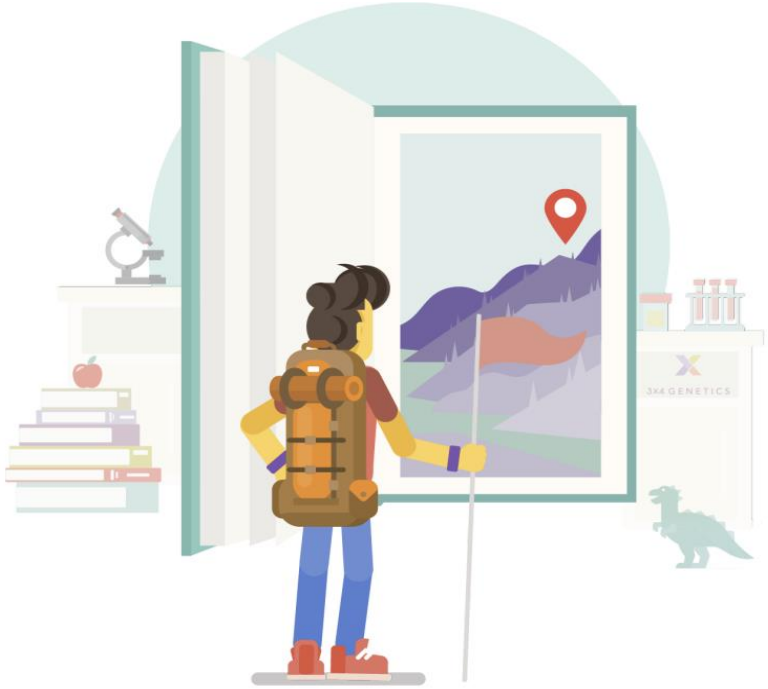
Your Genes Your Story

- Blueprint of You: Your genome is the complete set of DNA instructions that makes you unique, influencing everything from eye color to height, and even your predisposition to certain health conditions.
- Family History & Ancestry: It carries the legacy of your ancestors, revealing clues about where you come from, inherited traits, and genetic patterns that have been passed down through generations.
- Health Roadmap: Your genome can act like a predictive health guide, offering insights into potential risks for diseases, how you might respond to certain medications, and personalized strategies for well-being.

The Power of Story in Patient Care

The Patient is at the Center of the Story	Each patient's journey is unique, blending data with a personal touch – think of it as *data with a soul*.
Strengthens the Doctor-Patient Connection	Rich interactions foster trust and understanding, creating a foundation that empowers the patient.
Integrative & Functional Care	Brings *fun* into functional medicine and adds *life* to lifestyle medicine, encompassing mind, body, and spirit.
Precision in Care with Genomics	Personal genetic insights remove guesswork, leading to truly personalized treatment.

THE HERO'S GENOME



The Journey that you can choose to embark upon by using your own genomic profile to determine your steps in health and wellness.

Secondary prevention – you can recover from an illness and have improved health as well as some perspective in terms of how you got to where you did. (Disease)

The Hero's Genome

- Lab test, cheek swab with Complete Hero's Genome Modules
- Set up appointment with Dr. Louder to review your DNA report.
- Next step labs, imaging etc.

The Hero’s Journey taken from Joseph Campbell’s work

Call to Adventure – you are here

Supernatural aid and Guardians – you are not alone

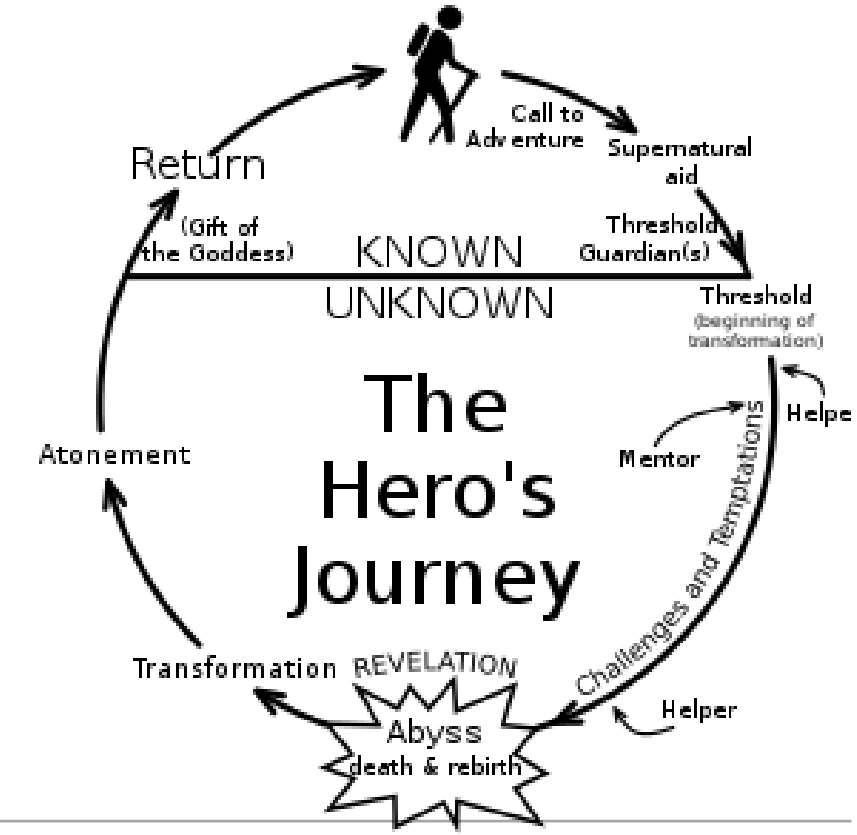
Mentor/Helper– Dr. Louder and your DNA results

Abyss – changes that you make

Transformation – what happens to you

Atonement – Becoming at one with your own self.

Return – continual renewal and of your lifestyle and enjoyment of rewards of your efforts.



Chronic Illness

- Heart Disease
- Cancer
- Chronic Lung Disease
- Stroke
- Alzheimer’s
- Diabetes
- Chronic Kidney Disease

- A condition that lasts at least a year and affects or limits daily activities or requires regular medical attention

Insurance issues with Chronic Illness and Disease

- Prior Authorization
- Rejections
- Experimental – or off label
- High deductibles
- Pharmaceutical driven
- Not holistic
- Paradigm is that there is a lot “wrong” with you as a patient
- Disempowering

Hero’s Genome

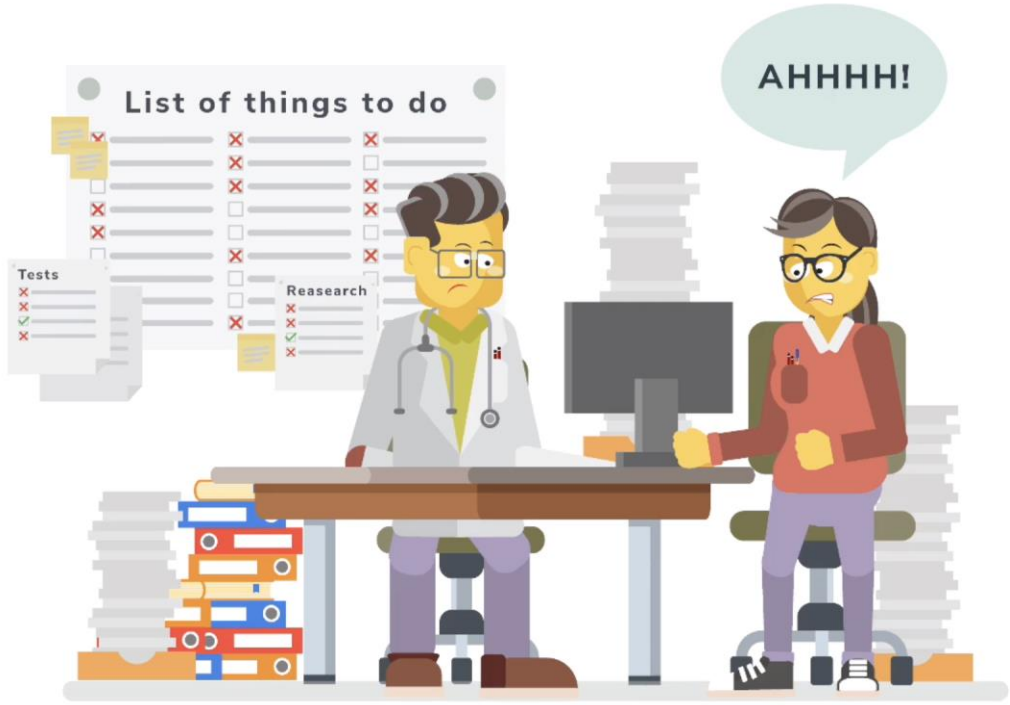
- We are traveling upriver
- We are looking for root causes
- We are identifying and repairing cellular features of the body
- This influences various systems in your body
- Then we get to symptoms – what you feel
- Then we get to signs – what your body says
- Then we look multifaceted
- ANYTHING CHRONIC HAS MULTIPLE FACETS

Standard Medical Model and Chronic Illness and Disease

- Waiting for the other shoe to drop
- Pharmaceutical driven
- One size fits all
- Conflict of interest – who does the physician actually work for?
- Customer (patient) reviews
- Once you start treatment, it does not stop
- Root causes NOT FOUND
- UPSTREAM ISSUES NOT ADDRESSED

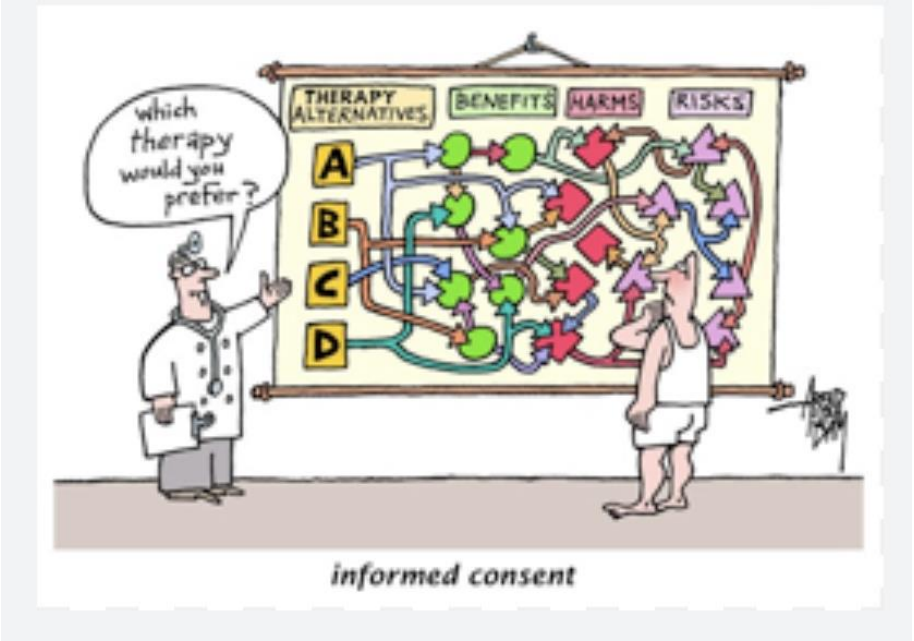
Information overload

- Where do we start?
- Are we just addressing symptoms?
- How did I get here in the first place?



Understanding Your Choices Informed Consent The Power of The DPR and Connection

- You (the patient) have autonomy
- You and the physician co-manage your care and choices
- You are the expert in your body
- The physician is the expert in medical care
- Somewhere in the middle you meet and communicate, and trust and dialog and have a relationship
- Anything can be negotiated
- Mutual trust and respect
- Transparency



The Hero’s Genome

- It is time to figure out who you are.
- You will get by with a little help from your *friends (doctor/provider/health coach)

- Using Genomic input, reporting and pattern recognition, we can discern your highest priorities for your health journey.

- You become the hero
- You become the one who makes choices
- You have information as to why
- You find root causes
- You can do/be you!

The Hero's Genome ~ The Adventure and Departure (opening of a destiny)

- Often may begin with a "blunder"
  - Diagnosis
  - Painful symptoms
  - Disability
  - Disease
  - Life altering change

  - May be preventive
    - Early on
    - Young

The Hero's Genome ~ The Refusal of the Call

- Counting the cost
- Comfort zone
- Internal resistance
- Control, fear of the unknown
- **Trapped and isolated, old issues hold you back, and choices deprive you of freedom due to their inherent restrictions, diet, exercise, rigid approach**

The Hero's Genome ~ Chronic Illness

- Identify symptoms
- Identify known diagnosis
- Identify Family History
- Identify current Lifestyle
- Identify trauma
- Identify Emotions

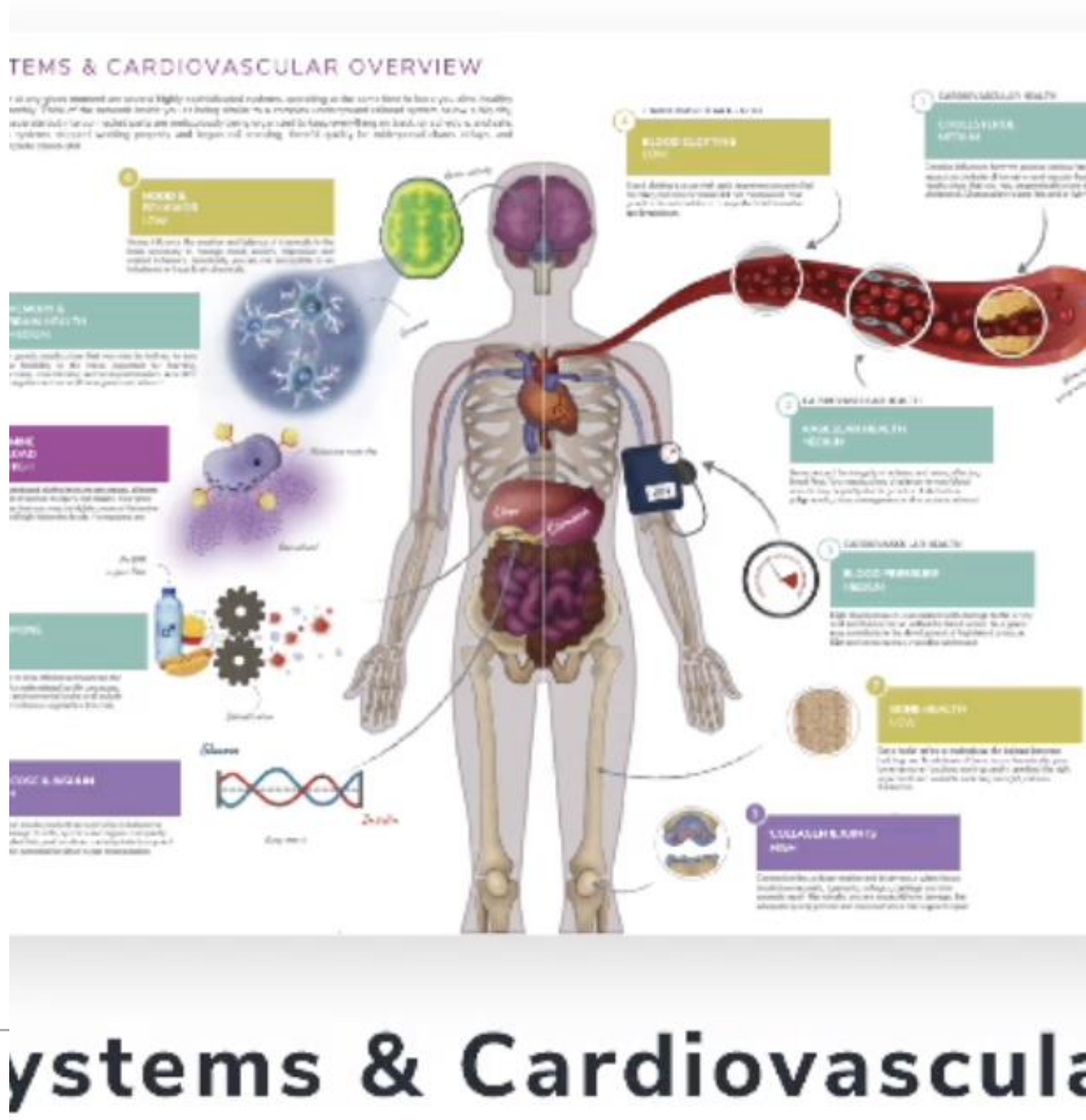
The Hero's Genome ~ The Key components

SYSTEMS OVERVIEW

We have numerous high precise and sophisticated systems operating simultaneously to keep us alive, healthy and running smoothly.

Polygenomic v. Monogenomic

“One SNP does not a disease make”

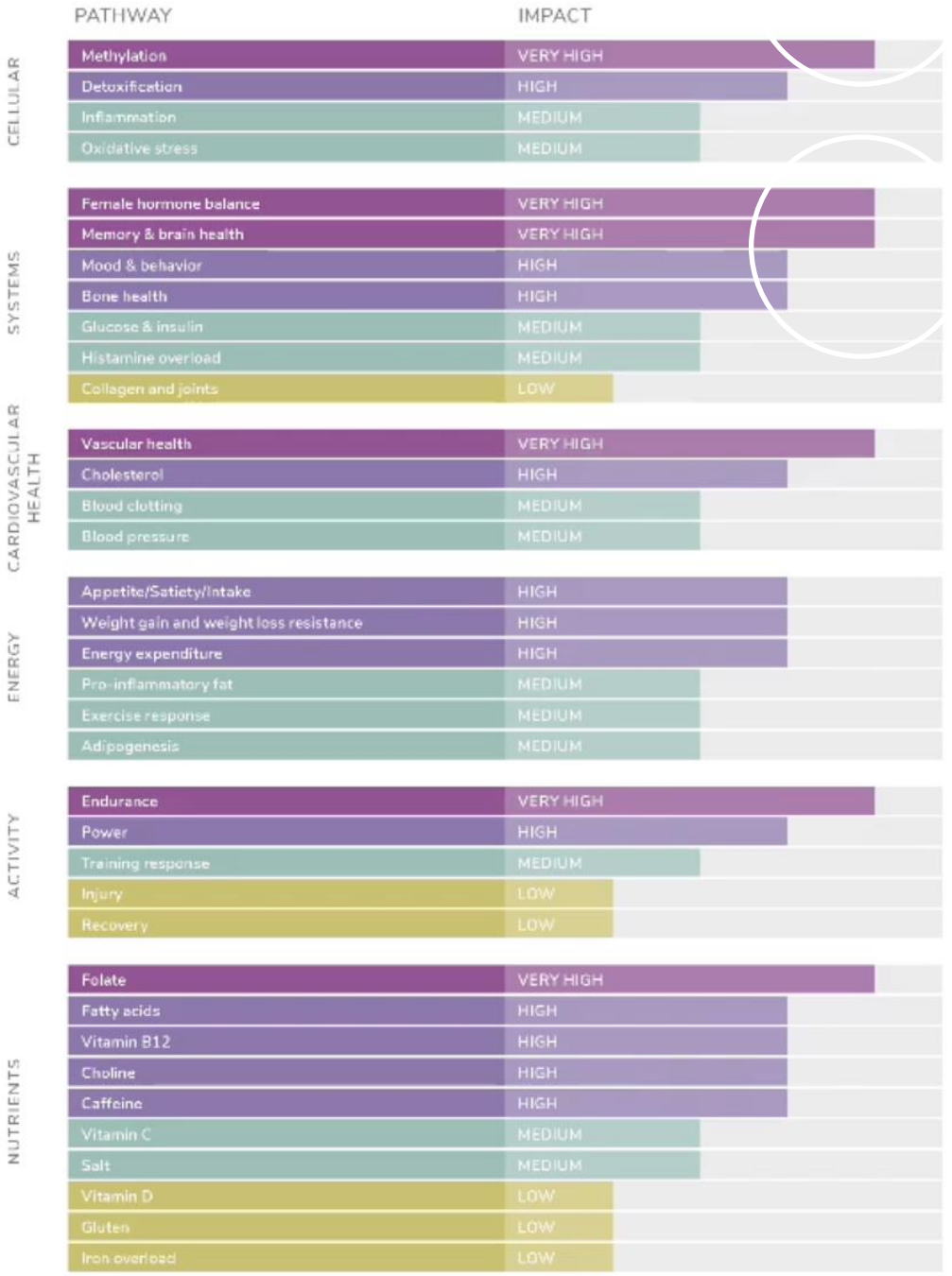


Systems overview

- Mood and Behavior
- Memory and Brain Health
- Histamine Tolerance
- Hormone Balance
- Glucose and Insulin
- Bone Health
- Collagen and Joints

- Cardiovascular
  - Blood Clotting
  - Cholesterol
  - Vascular Health
  - Blood Pressure

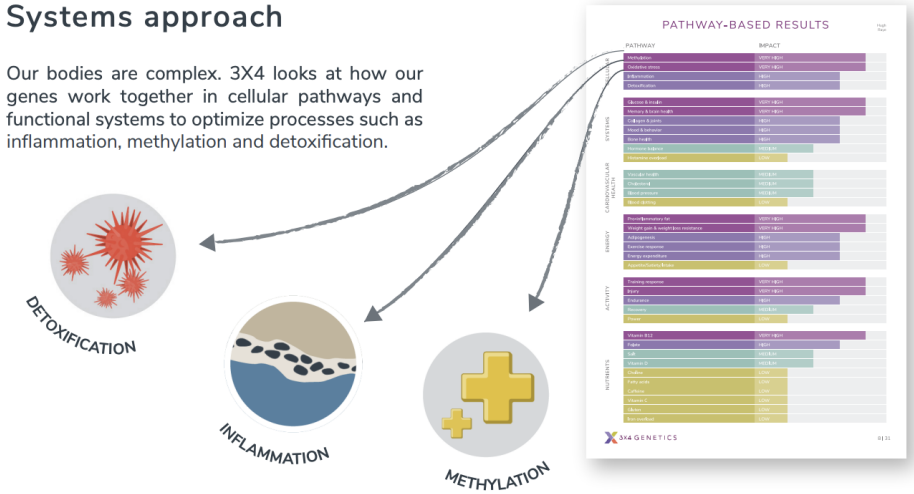
Follow the pathways Darkest color to lightest color ~ high impact to low impact



YOUR GENOME REPORT COLORS

The dark purple are the most impactful

The light green are the least impactful



The Hero's Genome Cardiovascular

- Cardiovascular
  - Inflammation
  - Cholesterol
  - Vessel health
  - Stress
  - Family hx

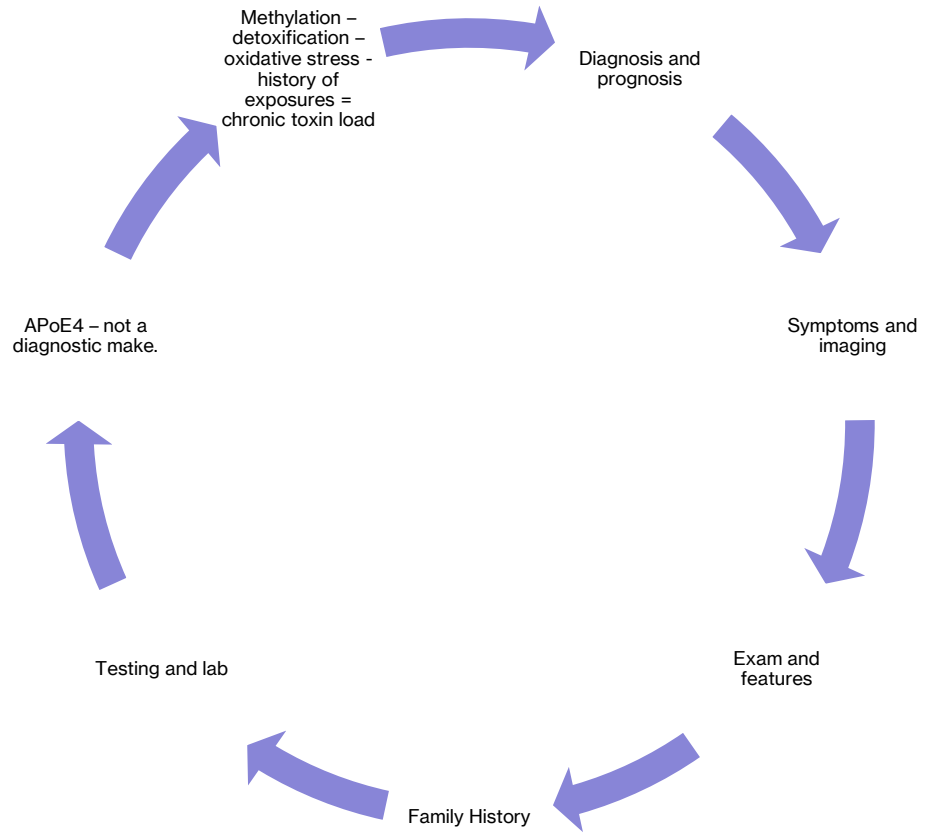
The Hero's Genome Cancer

- Cancer
  - Diagnosis and Staging
  - Treatment
  - Adjunct Therapy
  - Primary or Secondary prevention

The Hero's Genome~ Mental Health

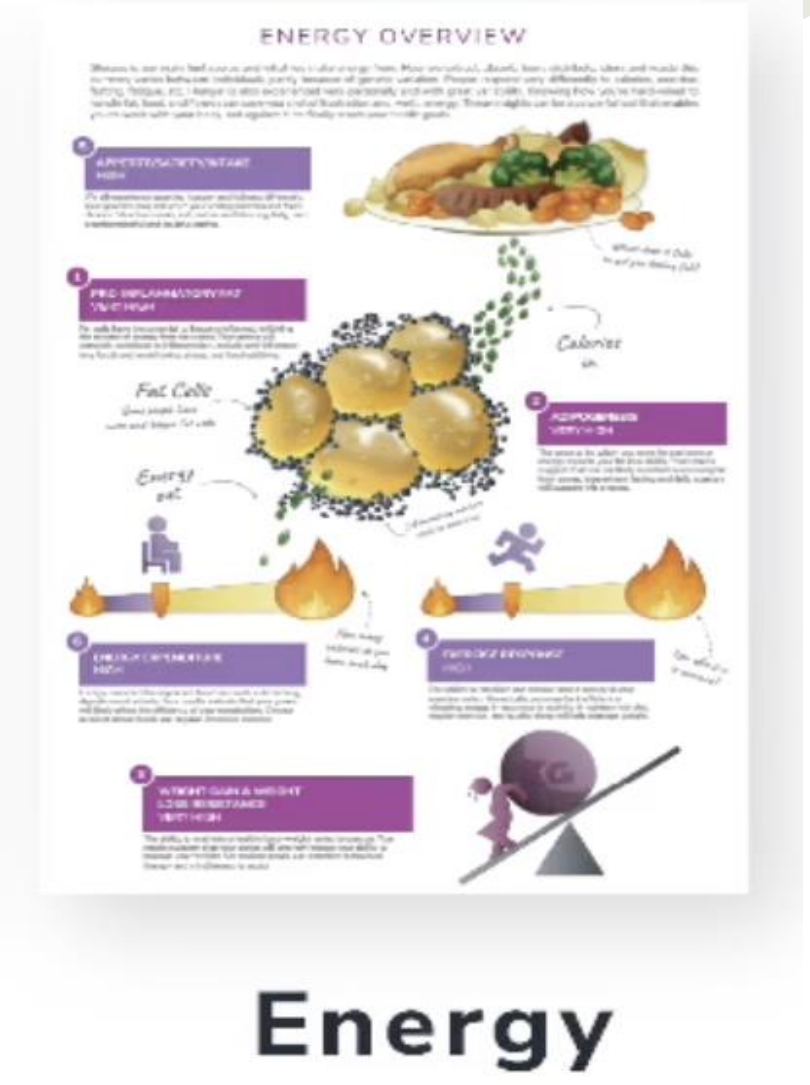
- Pathways
- Neurotransmitters
- Foods
- Trauma
- GUT Health

The Hero's Genome ~ Neurologic Disorders



ENERGY OVERVIEW

- Appetite/Satiety/Intake
- Pro-inflammatory fat
- Adipogenesis
- Energy expenditure
- Exercise Response
- Weight gain and weight loss resistance



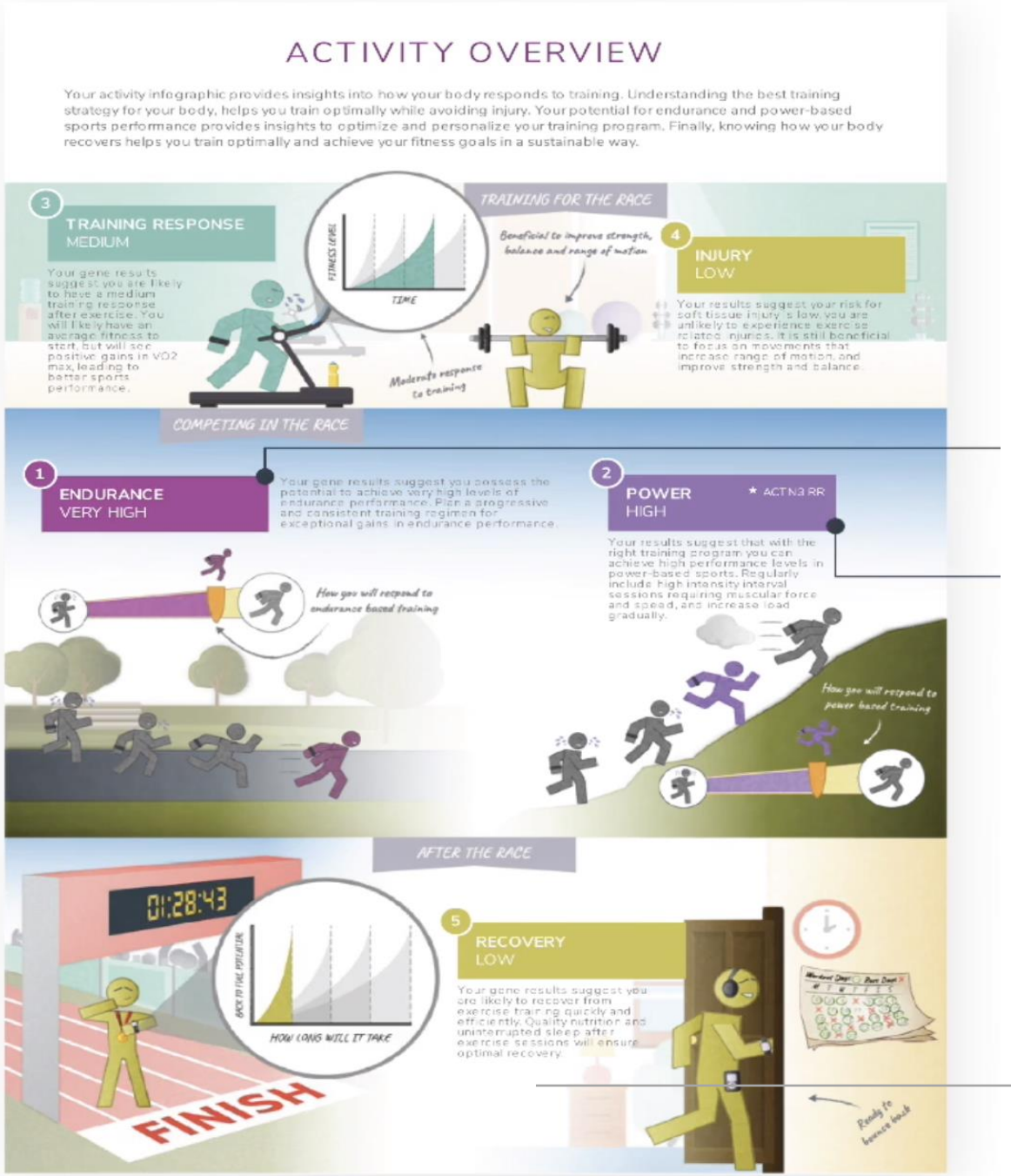
Nutrients overview

- Caffeine
- Iron Overload
- Fatty Acids
- Choline
- Folate
- Gluten
- Vitamin D
- Salt
- Vitamin C
- Vitamin B12

Nutrients

THE Hero’s Journey ~ Diabetes

- Current diagnosis
  - Metabolic syndrome
  - Type 2 or Type 1
  - Gestational
  - Associated diagnosis
  - +/- Obesity
  - Metabolic understanding



ACTIVITY and RECOVERY

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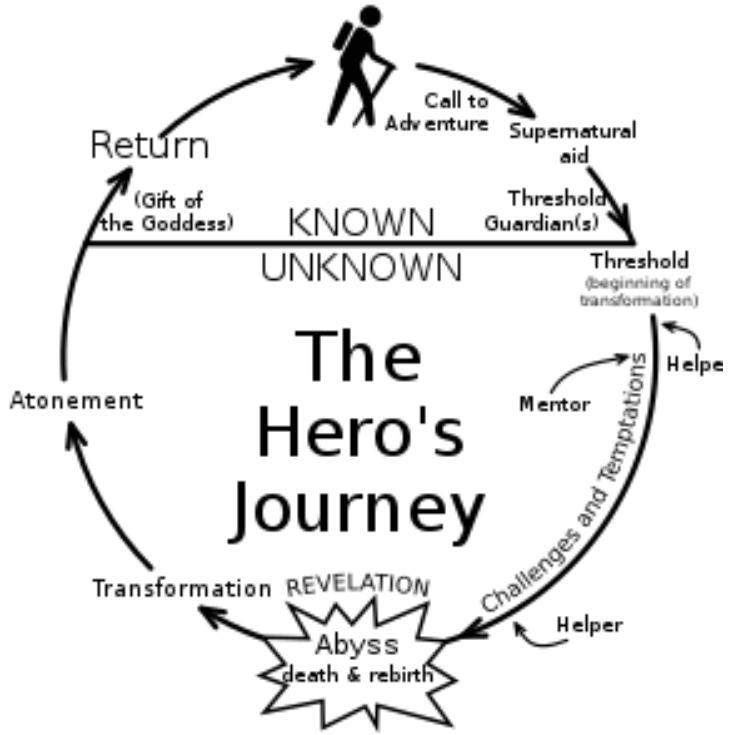
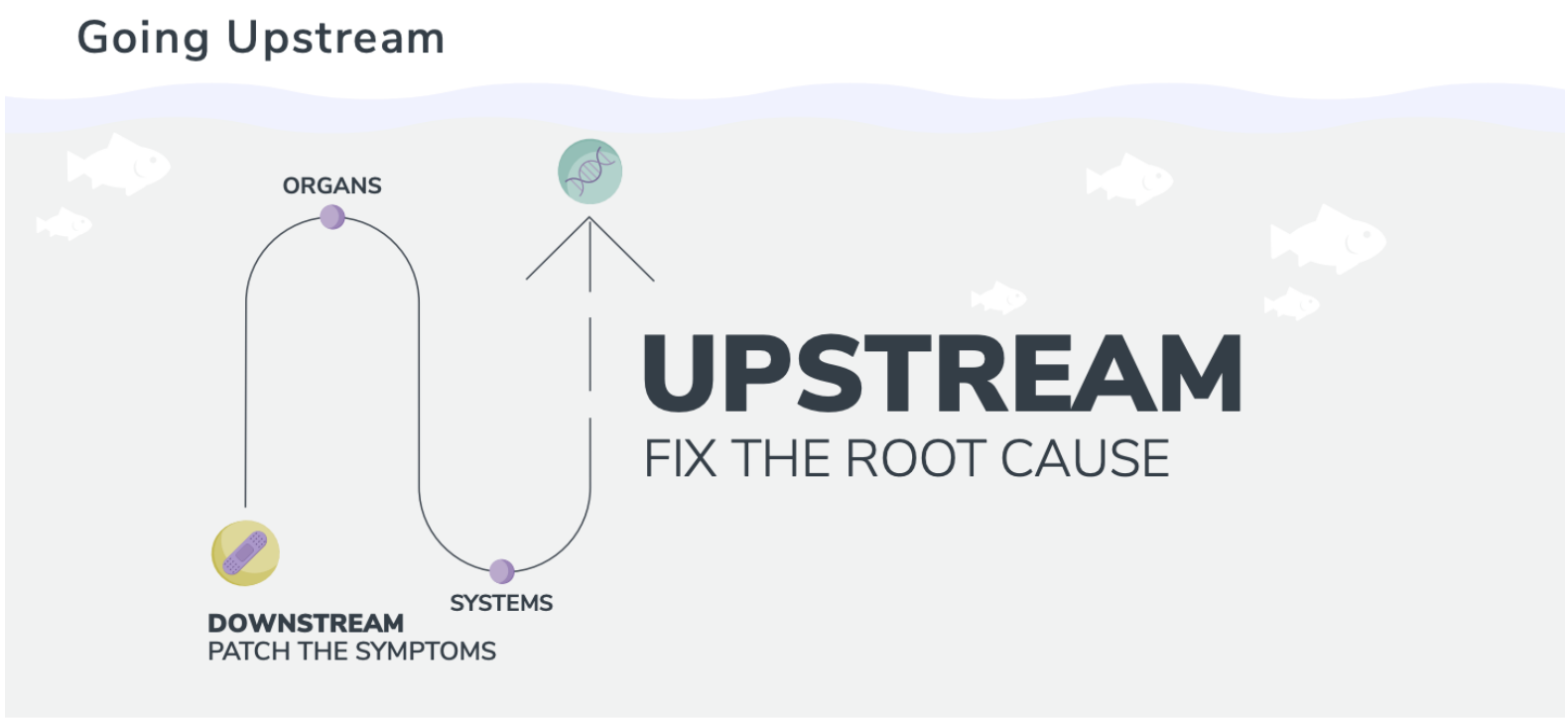
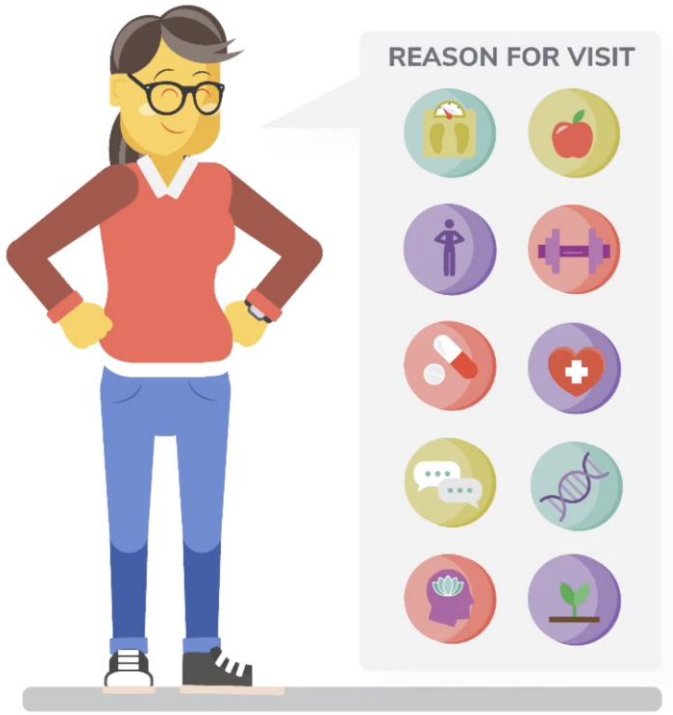
Atonement – Becoming at one with your own self.

Return – continual renewal and of your lifestyle and enjoyment of rewards of your efforts.





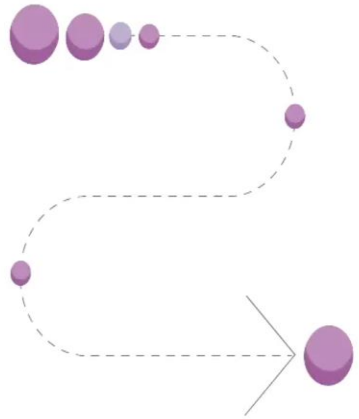


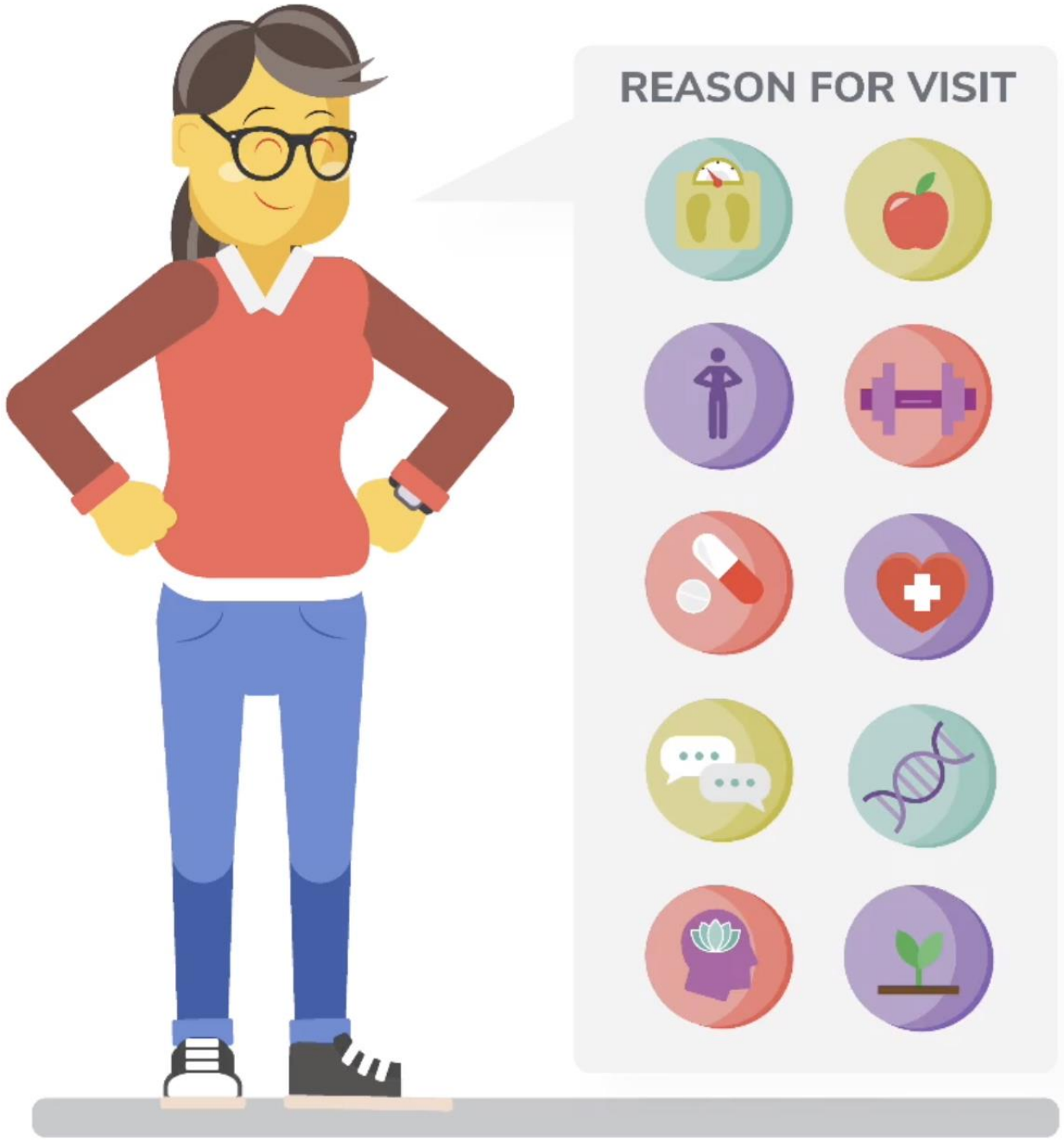
The Hero's Genome ~ Is YOUR JOURNEY TO YOUR HEALTH AND WELLNESS

Keys to remember

It's about unlocking value for a patient by giving them recommendations and help that ultimately lead to sustainable change.

Remember to follow the purple!





THE HERO'S GENOME IS ALL ABOUT YOU

Your pathways to health are right in front of you to follow for your whole life.

Know that for all the reasons that you visit your physician or health care provider, your genome and follow up plans are the best way forward for your Hero's Journey.

You do know best, because your genes say so.

You got this!

Questions???