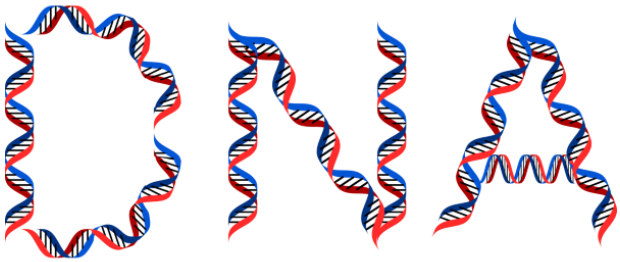
# DNA Determines Your Response to Medications: The Role of Pharmacogenetics



Betty Chaffee/ April 21, 2026/ Medication Management/ 0 comments

We all want our healthcare to fit us as individuals. An important piece is having **good communication** with our healthcare providers. But let's talk about something even more personal -- something totally unique to each one of us.

## *The role of genetics in medication effectiveness and safety*

Our DNA makes us unique. We differ from one another in eye and hair color, height, gender, physical ability and more. All of these things are determined, at least in part, by our genetic makeup. We look different from each other and respond to our environment in different ways. Why did anyone ever think that medications would work identically in everyone?

With the mapping of the human genome, it became possible to identify genetic differences in our responses to drugs. Some genetic differences may make us more likely to respond well to a particular medication. Others may make put us at higher risk of side effects. This field of study is called ***pharmacogenetics*** (AKA *pharmacogenomics*) -- "the study of how genetics affects a person's response to drugs".

## *Let's start at the beginning.*


Most medications are chemically changed (metabolized) by enzymes your body produces. Some drugs need to be changed in order to be effective. Others are changed so they can be eliminated from the body. Over the years we've learned that there are a handful of enzymes that are responsible for the majority of drug metabolism. And the enzymes we're talking about are encoded by our genes.

There are also enzymes that move (transport) drugs across membranes in the body. Sometimes the drugs are moved to make them effective. Other times they're moved so they can be eliminated. And it turns out these transport enzymes also are encoded by our genes.

Genetic testing can determine ancestry and give us interesting information about where our families came from. That same kind of testing can tell us about the enzymes that metabolize and transport drugs. And it turns out that the efficiency of these enzymes varies widely from one individual to another.

Our DNA may make our drug-metabolizing and drug-transporting enzymes work extra hard. Or our DNA might cause them to be sluggish and work slowly. Pharmacogenetic testing can help predict how we might respond to certain drugs.

## ***Here are a few examples of the ways genetics can affect drug response.***


Plavix (clopidogrel) is a medication that works to keep blood from clotting quickly. It's often used to prevent heart attacks and stroke. The ingredient in the Plavix tablet starts as an *inactive* chemical - it needs to be activated by an enzyme. A specific genetic variation causes that enzyme to work so slowly that enough of the drug doesn't get activated. The risk of another heart attack or stroke is much higher in folks with that genetic variation. Knowing about that genetic variation ahead of time allows the doctor to prescribe a different medication that's more likely to work.

There's a similar situation with some pain medications, such as codeine and tramadol, both of which are dependent on enzymes to do their job safely and effectively. Those with specific genetic variations in those enzymes can be at risk of severe side effects or of getting no benefit at all from the medications

Mental health disorders are often treated with medications. And sometimes it requires lots of trial and error to get to the right one. Genetics are part of the reason for that. Many of the medications used for mental health treatment are metabolized by the enzymes we've been talking about. Genetic variations can result in some medications being inactivated so fast they're essentially useless. Others might be inactivated so slowly they cause severe side effects. It's clear that the treatment of mental health problems is complex, and success or failure of a treatment plan isn't *only* about pharmacogenetic variations. But still, medications are a mainstay of treatment for lots of people, and knowing which medication is more likely to work can result in a shorter time to treatment success.

Omeprazole (Prilosec) is commonly-used medication for heartburn and stomach discomfort. It has to be metabolized in order to be eliminated from the body. Genetic variations in enzymes cause some people to metabolize omeprazole so rapidly that it doesn't work well. Knowing that ahead of time would allow a doctor to prescribe a more effective med.


Then there are the "statins" - drugs that reduce cholesterol to help prevent heart attack and stroke. Transporting enzymes help eliminate certain statins from the body. Genetic variations in that enzyme can make it work too slowly, keeping active drug in the body for a longer time and increasing the risk of side effects. If pharmacogenetic information were available, the safest drug could be chosen from the beginning.

These are just a few examples of the many ways pharmacogenetics can improve the way we use medications. And ongoing research continues to give us new information.

### *So what can you do to make your healthcare more personal?*

Just like genetic testing for ancestry, pharmacogenetic testing is widely available. An accompanying post explores where the test can be obtained, how it's done, how results are documented and interpreted, and what your role is in making sure your genetic makeup is taken into account by your healthcare providers.
Healthcare *can* be personal!

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