One Size Doesn't Fit All

Genes determine the make-up of all the body's proteins, and as medicines travel through the body they interact with many of these proteins. Small, but normal, variations in your genes can produce proteins that work differently from those of your friends or relatives. This can affect how you respond—or don't respond—to different medicines. For example, certain painkillers only work when body proteins convert them from an inactive form to an active one. How well these proteins do their jobs varies considerably between people. As another example, tiny genetic differences can change how medicines called statins work to lower blood cholesterol levels.

Uncovering differences in people's genetic make-ups will help health care providers prescribe the right medicine in the right amount for each person, making medicines more effective. The payoff will be preventing unnecessary effects from the one-size-fits-all medicine dosing that is common today. A bonus of this type of research will be an increased understanding of the genes that cause or contribute to diseases such as cancer, heart disease, diabetes, depression, and asthma. Pharmacogenetic research will also help scientists figure out new and better ways to develop future medicines.

A Resource for Research

To better understand how people react differently to medicines, scientists doing pharmacogenetic research need to find normal variations among certain human genes. This can be done by collecting DNA from blood samples or cheek cells. Scientists store the information from the DNA samples in a research database. To protect the privacy of study volunteers, researchers will not match individual names or other personal information with the DNA information that is recorded in the research database.

This publication is online at http://www.nigms.nih.gov/funding/medforyou.html.

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MEDICINES FOR YOU

Studying How Your Genes Can Make a Difference

U.S. DEPARTMENT OF
HEALTH AND HUMAN SERVICES
National Institutes of Health
National Institute of General Medical Sciences

Did You Know?

- Some people get no pain relief from certain prescription painkillers.
- Certain allergy and asthma medicines work well for some people but not at all for others.
- Nearly 3 million people in the United States are at risk for overdose when given the standard amount of a medicine commonly used to prevent blood clots.
- A normally safe dose of a leukemia treatment can, in rare cases, lead to death in a child with an unusual change in just one gene.
- The National Institutes of Health is sponsoring research to understand why people can have such different reactions to medicines.

The **National Institutes of Health** aims to improve the health of all Americans through medical research that solves mysteries about how the human body normally works and how and why it doesn t work when disease or injury occurs. One goal of this research is to help improve the good effects of medicines while preventing bad reactions.

You can find more information about medicines and medicine safety at the National Library of Medicine s online health information service, MedlinePlus: http://www.nlm.nih.gov/medlineplus/medicines.html

Aren't prescribed medicines already safe and effective?
For the most part, yes. But medicines are not one-size-fits-all. While typical doses work pretty well for most people, some medicines don't work at all in certain people or the medicines can cause annoying, sometimes life-threatening, side effects.

Why do people react differently to medicines?
As medicines move through the body, they interact with thousands of molecules called proteins. Because each person is genetically unique, we all have tiny differences in the make-up and amounts of these proteins, which can affect the way medicines do their jobs.

Who pays for the study of genes and medicines?
The National Institutes of Health provides money to scientists at universities and medical centers who come up with the best plans for carrying out research on how genes cause people to respond differently to medicines.

Why should my tax dollars be spent on medical research that is not directly related to specific diseases?
Curing and preventing disease is the National Institutes of Health's highest priority. Research on how people respond differently to medicines will make current and future treatments for diseases such as cancer, heart disease, diabetes, depression, and asthma safer and more effective. A bonus of this type of research will be a better understanding of the roles many different genes play in causing or contributing to these and other diseases.

Who participates in this research?
National Institutes of Health-funded scientists across the country recruit volunteers who reflect America's rich population diversity. Research of this type relies upon studying many different people with a broad range of genetic make-ups to find the small, but normal, genetic differences among all humans.

Why should I participate in this research?
Although participating in a medical research study cannot guarantee any benefits to an individual, these important studies ensure that the best new treatments are proven to work before they make their way into the lives of large numbers of patients.

Will participating in this kind of study have any effects on my health?
Most of these research studies involve drawing a blood sample or rubbing the inside of a volunteer's cheek with a cotton swab to collect cells. Scientists get DNA—the genetic material—from these samples. There are no significant health risks associated with this type of test.

Will I need to take medicine to participate in this research?
Not usually. However, some pharmacogenetic studies may involve asking a research participant to take a medicine in addition to providing a DNA sample. People who volunteer for this type of study are fully informed of potential risks.

What happens to my DNA sample?
Scientists store the DNA information provided by your sample in a research database. Your DNA sample will only be used for the research explained to you before you agree to participate. You may also be asked if your DNA sample could be used for certain future medical research studies. That decision is entirely up to you.

What about my privacy?
The privacy of all people participating in this research is protected. Scientists will not match your name or other information with the DNA information that is recorded in the research database.

Will the researchers tell me what they learn about my DNA?
That depends on the design of the research study. The steps that make sure no one knows a DNA sample came from you mean that the scientists would not be able to provide you with specific information about your health. However, the results of the study will most likely be published in a scientific journal, advancing medical knowledge and helping many others.

Is pharmacogenetic testing available now?
Currently, most pharmacogenetic testing is done on a research basis, although more widespread testing may become available in a few years. The Food and Drug Administration is developing new rules about including pharmacogenetic information, when available, in material that health care providers use when prescribing medicines.

Medicines for You

Your lifestyle, the food you eat, and where you live and work can all affect how you respond to medicines. But your genes can also play a role. Scientists are studying how your genes, contained in your DNA, influence your response to medicines. This type of research is called pharmacogenetics or pharmacogenomics.

In recent years, scientists have found genetic variations that affect people s responses to cholesterol-lowering medicines, cancer treatments, AIDS medicines, and many other commonly used drugs. In time, this research will provide information to guide your health care provider in prescribing the correct medicine and dose for your body s needs.

Same Medicine, Different Genes, Different Effects

AIDS medicines
Allergy medicines
Anesthetics
Antibiotics
Antidepressants
Asthma medicines
Cancer medicines
Heart medicines
Heartburn treatments
Painkillers
Seizure medicines