

# The Basics of Genetics

Historically, tribes have had their own critical and important ways of understanding their connections between generations, including spiritual and cultural traditions, such as ceremonies. Today, many tribal leaders and AI/AN community members have questions about what “genetics” is and what topics are included in “genetics research.” This section includes information about the science of genetics and genetics research. Genetics research is the study of genes. A “gene” is a unit of information passed down from parents to children. Genes are molecules made up of DNA (deoxyribonucleic acid). Genes hold the instructions, or “blueprint,” for a person’s unique characteristics, including physical attributes such as hair and eye color, as well as their susceptibility or resistance to developing some diseases. However, the way genes work is influenced by many factors in a person’s environment, such as the food they eat, the place they live, and their social interactions. A person’s health and risk for many diseases are determined by a combination of genes and environmental factors. Many genes together are organized on structures called chromosomes, which is a single, long DNA molecule. Learning more about what genes are and how they work in the body may provide you with information to help decide how you personally feel about genetics and genetics research.



## Resources About the Basics of Genetics

This first section of the resource guide presents an introduction to the basics of genetics and genetics research. The resources in this section include:

[An Overview of Health Research Involving Genetics](#): This short handout was developed for tribal leaders by Dr. Wylie Burke and Dr. Rose James at the University of Washington. This handout explains the different kinds of genetics research related to health.

[Stories from American Indian and Alaska Native Communities about Genetics Research](#): This is a new collection of stories and examples explaining “genes” and “genetics research” that was written specifically for AI/AN communities by Dr. Linda Burhansstipanov (Cherokee) of Native American Cancer Research, Inc., Dr. Lynne Bemis of the University of Colorado, and Marc Strong (Sicangu Lakota). These stories help to explain basic concepts in genetics and to describe how some AI/AN communities are thinking about genetics research.

[Genetics Research and American Indian/Alaska Native Communities](#): The National Congress of American Indians Policy Research Center previously published a short paper explaining different types of genetics research and the questions tribal leaders may wish to consider regarding participation in genetics studies. That paper was authored by Dr. Puneet Sahota.

[Genetics Education for Native Americans: An In-Person Training Opportunity](#): This in-person training about genetics research for AI/AN communities is available from Native American Cancer Initiatives, Inc. This curriculum is entitled Genetics Education for Native Americans (GENA) and

was authored primarily by Dr. Linda Burhansstipanov and Dr. Lynne Bemis. It is an interactive training and has been delivered in more than 100 tribal communities, tribal colleges, and conferences. The first section of the curriculum is about how a cell works.

[Excerpt from the curriculum](#)

For more information about Genetics Education for Native Americans, please contact [Native American Cancer Research, Inc.](#)

## **Tools and Articles Online for Learning About Genetics**

There have been many educational materials developed for the general public about genetics research. Below we have included links to specific articles and websites that may be useful to tribal leaders and AI/AN community members who wish to learn more about genetics. Genes are passed down from generation to generation, and they contain instructions for how human cells work. More information about genes and how they work is available on the following websites:

[Tour of the Basics](#) - an interactive slide show on genetics from the University of Utah.

[Understanding Genetics](#) - The Tech Museum and Stanford University School of Medicine.

[Freuenrich, Craig. How DNA Works](#)

[Brain, Marshall. How Cells Work](#)

## **Family History and Disease**

Most common diseases have many factors that cause them, including genes (traits passed down in families) and environmental factors, like the diet a person eats. A family's health history includes the diseases that run in the family. If there are diseases that run in a family, some family members may also be at risk for those diseases. Learning about one's family history can help a person to be more careful about things that are in their control, such as diet, exercise, and getting regular screenings for diseases such as cancer. Excellent fact sheets on how to gather your family history and its importance to your health were developed by the Cincinnati Family History Working Group at the University of Cincinnati.

[Family History is Important to Your Health - fact sheet](#)

[Family Health History - fact sheet](#)

Specific information about common diseases, including diabetes, depression, cancer, and asthma were also developed by the Cincinnati Family History Working Group at the University of Cincinnati. Brief fact sheets on each disease explain what the disease is and what factors put a person at risk for the disease, including the role of family history.

[Family History - fact sheets](#)

## **Genes and Environment**

Genetics and environmental factors (everything from diet to social experiences) together interact to impact a person's health. Genes are expressed to different degrees, meaning that highly expressed genes are more active in determining a person's characteristics than genes which are expressed at low levels. Gene expression is regulated by many factors, including environmental impacts. The

field of epigenetics looks at how environmental factors impact the expression of genes. It is possible that the environment experienced by one generation may also affect how genes are expressed in future generations. Scientists studying epigenetics are investigating this possibility further. Another way to think about epigenetics is that genes are the “blueprint” for a person’s characteristics. Epigenetics are like the “overlay” on the “blueprint,” causing some parts to stand out more than others (that is, causing some genes to be expressed more actively than others).

[More information about epigenetics](#)

If you have further questions about genetics or genetics research, you can contact some of the authors of this resource guide.

[List of contributors with biographical and contact information](#)