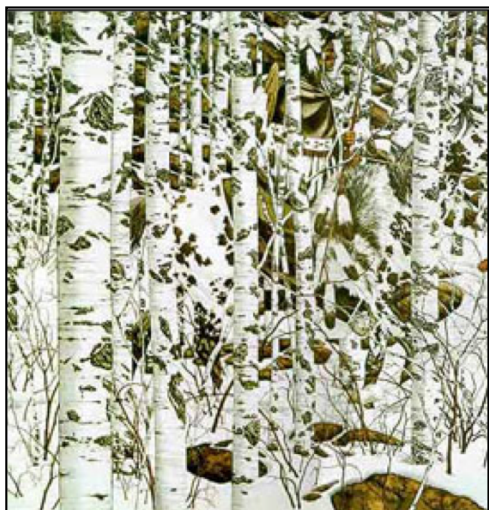


# Native American Cancer Research (NACR) Corporation: “Genetic Definitions and Explanations” Fact Sheet for Public Health Professionals and Interested Community Members



- 🥁 Genetic terminology differs from the ways our ancestors talked about heredity
- 🥁 Before agreeing or disagreeing to take part in genetic testing or studies, you need to understand some of the language
- 🥁 You are unlikely to need many of the terms in this document
- 🥁 Please do review the terms that may impact your decision about taking part in any study. Now you know, now you can.

## Genetics is not “new” information for Native Peoples



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- 🥁 Our ancestors knew how to:
  - ⌚ Grow stronger, more disease-resistant crops (e.g., corn and squash)
  - ⌚ Breed horses (Pintos, Appaloosas) so that their coloring blended with rocks, ground or aspens during the winter

### The concept of genetics is not new, but how genetics is being used today *is different*:

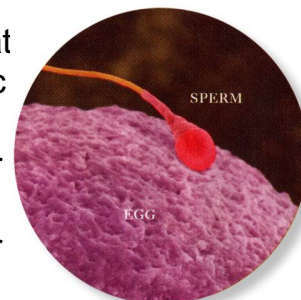
- 🥁 New words created to describe genetic science today
- 🥁 New cultural issues for protecting privacy of individual and tribal Nations today are ongoing and based on laws
- 🥁 New science that can be generated to help address common health problems (diabetes, cancer) among Natives today...
- 🥁 Those are new ideas and concepts for Native peoples.

🥁 **“Genetics”** is the study of “genes”

🥁 **“Genes”** contain the information for the body to function


- ⌚ Some genes make bones strong
- ⌚ Other genes help prevent cancer
- ⌚ A gene is a segment within a chromosome


🥁 **“Heredity”** means that the human characteristic came from the 23 chromosomes from your dad’s sperm and the 23 chromosomes from your mom’s egg.



# Words about Parts of the Cell

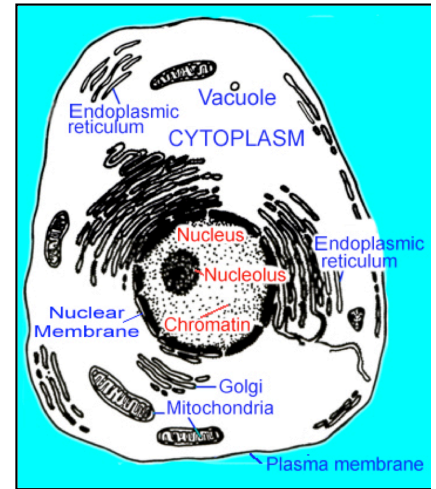
 **Cells** are the basic building blocks of the body

 **Chromosomes** are in the “nucleus” (“brains” of the cell). They are described on the next page.

 **Nucleus** is the brains of a cell and holds all of the information to make an organism

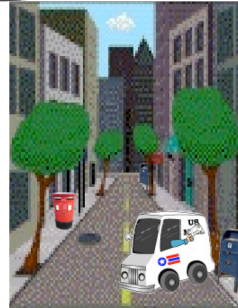
- ⊕ It is similar to the central building in a community, like the Tribal Council office, that holds all of the information about the village. The nucleus of one cell holds all the information required to reproduce the entire organism (e.g., animal, plant, or human). The nucleus contains hereditary information. “Hereditary” means information passed down between generations, from parent to child.

The nucleus is  
like the Tribal  
Council Office



 **Endoplasmic reticulum**

- ⊕ The parts of the cell talk with one another by sending messages through the endoplasmic reticulum
- ⊕ The roads and paths around the village are like the “endoplasmic reticulum”



 **Vacuoles**

- ⊕ The golgi drop off all of these messages into “Mail boxes” (or could be the post office) via the vacuoles.
- ⊕ There are many types of vacuoles (mailboxes)

 **Golgi**

- ⊕ The golgi are at the ends of the roads (endoplasmic reticulum).
- ⊕ Along the way, many messages (proteins – like the postman picking up letters) are collected by the golgi.



 **Mitochondria**

Are the power houses of the cell: they are like the Tribal electric generators.

- Mitochondria provide all of the “power” to the cell.
- Both males and females have mitochondrial DNA. In the baby most mitochondrial DNA comes from the mother and her female ancestors.



- ⊕ The vacuoles contents are dumped outside the cell as messages to other cells.

## Words about Chromosomes and their components (and functions)

🗑️ Human beings are 99.9% alike (genetically)

⊕ There are about 3 billion base pairs total in the human genome

✚ So  $0.1\% (3,000,000,000 \times 0.001) = 3,000,000$  base pairs (million)

✚ This means, 3 million base pairs differ throughout each person's genome

🗑️ **Base pairs** refers to four chemicals that are in specific sequences to create proteins that allow cells to function.; People frequently ask, “if humans, regardless of race or culture are 99.9% alike, why do we look and behave so differently from one another?”

⊕ “Bases” refer to four chemicals (abbreviated as “A”, “T”, “G” “C”) that are in a specific sequence in the person's DNA. A, T, G, and C are the building blocks of DNA. (see description of Dr. Dukepoo's bread analogy on back page please)

🗑️ **Chromosomes** are packed with thousands of genes. The genes tell our cells what to be and how to act

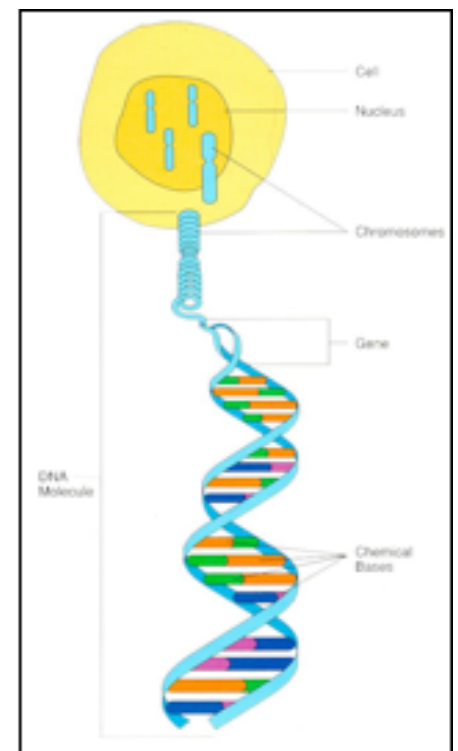
⊕ The 2 strands of DNA twist around one another and the base pairs line up. In the entwined DNA strands, an A on one strand within the chromosome always matches with T on the other strand.

⊕ Similarly, the G on one strand within the chromosome always matches with C on the other strand.

⊕ The matching of the A's and T's and the G's and C's provides information that is understood by researchers.

⊕ The A, T, G, and C are the building blocks of DNA.

⊕ The sequence of A, T, G and C's allow researchers to develop genetic tests to detect when an A, T, C, or G is in a different place in the sequence.



🗑️ **DNA** (Deoxyribonucleic Acid) molecules refer to the genetic information that is within the chromosomes

⊕ DNA is the molecule that contains the genetic code for all life forms except for a few viruses (these may be composed of RNA)

⊕ DNA consists of 2 long, twisted chains made up of nucleotides

🗑️ **Mutation** (also called Single Nucleotide Polymorphism or **SNP**, pronounced “snip”) is a change in the sequence of base pairs

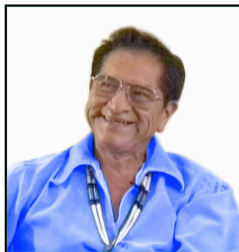
🗑️ **Genes** are copied (transcribed) into **RNA** (ribonucleic acid), which is a map for proteins

⊕ RNA is then often copied into proteins, which are the building blocks of the cell.

⊕ Proteins make up parts of cells and even help cells to communicate with one another.

⊕ Proteins act during every function in the body (sneezing, coughing, thinking)





## FrankC. Dukepoo, PhD (Laguna Pueblo; passed 1999) analogy of base pairs to bread slices

🍞 A story to describe the bases in DNA (nucleotides):

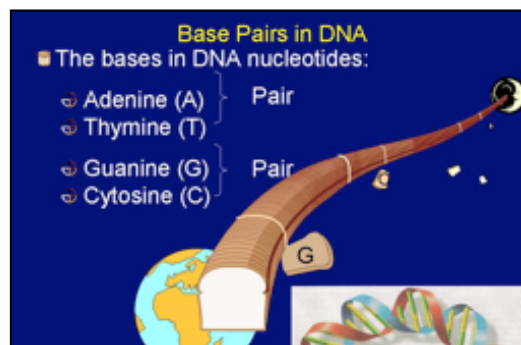
- ⊕ While shopping at the market in the bread aisle, Frank Dukepoo, PhD (Laguna Pueblo), was asked by a community member to explain genetics and base pairs.
- ⊕ He explained that the base pairs make up the human genome. There are 4 bases, or to illustrate, he used slices of bread from 4 loaves (wheat, white, pumpernickel, and rye).
- ⊕ The sequence of the slices of bread (bases) creates different proteins that are all created (coded for) from your genetic material.
- ⊕ There is so much genetic information in one cell that it would be equivalent to having loaves of bread slices from earth to the moon and back.
- ⊕ When slices of bread get out of order or are changed to other types of bread slices, they are called “mutations.”

⊕ If an alternative bread slice is placed in the sequence, then it is called a “single nucleotide polymorphism” (SNP). The SNPs may or may not change the proteins that the body needs (See SNPs later in this document for examples).

🍞 The DNA code is composed of the bases A, T, G and C. These are abbreviations for:

- ⊕ “A” for Adenine; In the bread example, A= a wheat bread
- ⊕ “T” for Thymine; In the bread example, T= a slice of white bread
- ⊕ “G” for Guanine; In the bread examples, G= a slice of pumpernickel
- ⊕ “C” for Cytosine; In the bread examples, C= a slice of rye bread

🍞 The sequence of slices of bread (to represent the base pairs) to eventually create a protein needs to be in an exact order.



### Fact Sheet & Info Partially Supported by:

Mayo Clinic's "Spirit of EAGLES Community Network Programs 2" [P.I. Kaur; U54CA153605]



National Center for Minority Health & Health Disparities [PI: Burhansstipanov, R24MD002811]



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