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Selección Vida

Genetics
in Insurance Medicine

DNA: THE KEY TO A FAIRER INSURANCE POLICY?

Genetics is the branch of biology that studies heredity. It is responsible for understanding how genes, which are units of information encoded in DNA, as we will now see, are transmitted from parents to offspring and how they influence the characteristics of organisms.

However, heredity is not just a matter of genes. The environment also plays an important role in determining the characteristics of an organism. Nutrition, exposure to toxins, and ambient temperature are some examples of environmental factors that can influence gene expression.

PREDICTING THE FUTURE VS GENETIC DISCRIMINATION

- Genetics and insurance medicine are increasingly in the media spotlight due to factors such as:
- There are numerous reasons:
- New genomic technologies, such as CRISPR, allow for more precise and affordable genetic testing.
 - There is a growing interest in genetics and its impact on health.
 - The use of genetic information in insurance medicine raises ethical controversies.
- This intersection brings about three direct consequences:
- **Increased Awareness:** The public is now more informed about the possibilities of genetics and its implications for health and insurance.
 - **Public Debate:** A discourse is emerging, discussing the ethics surrounding the use of genetic information in insurance.
 - **Pressure on Insurance Companies:** Insurance companies are being pressured to be more transparent and responsible in their use of genetic information.

A QUICK LOOK AT THE SPANISH PRESS REVEALS THE FOLLOWING HEADLINES:

“Genetic tests could be mandatory for life insurance in some countries” (El País, 2023)	“Insurance companies use genetics to predict disease risk” (ABC, 2022)	“The controversy over genetic discrimination in insurance increases” (El Mundo, 2021)
“Genetic tests could help prevent diseases and reduce insurance costs” (La Vanguardia, 2020)	“Ethics of genetics and insurance: How far is it permissible to use genetic information?” (El Confidencial, 2019)	“CRISPR gene editing: A new challenge for insurance medicine?” (Expansión, 2018)



HEREDITARY VS GENETIC: NOT THE SAME

The term hereditary refers to any trait or characteristic that is naturally passed from parents to children through genes, meaning it is inherited in a natural way. On the other hand, the word genetic refers to something that is related to genes, which are the units of information found in DNA.

TABLE 1. HEREDITARY VS GENETIC

HEREDITARY	GENETIC
Refers to characteristics inherited from parents to children.	Refers to anything related to genes, not only what is inherited
Genetic alterations occur in germ cells (eggs and sperm) and are transmitted to offspring.	Alteration can occur in any cell of the body, in germ cells or somatic cells (rest of the body), and can be hereditary or not.
Examples: Eye color, blood type, predisposition to certain diseases	Cystic fibrosis or Down syndrome, non-inherited genetic mutations.



GENES, CHROMOSOMES, AND DNA

Genes are the fundamental units of inheritance, representing segments of DNA (deoxyribonucleic acid) that contain instructions for building proteins – molecules essential for various functions in our bodies. Each gene encodes a specific protein, such as an enzyme, hormone, antibody, or one of the thousands of proteins necessary for life.

Chromosomes are X-shaped structures located in the nucleus of cells. They contain DNA, which is made up of two long chains of nucleotides. Nucleotides are the “building blocks” of DNA and are grouped into three base pairs: adenine (A) with guanine (G), cytosine (C) with guanine (G), and thymine (T) with adenine (A). The sequence of these bases determines the genetic code.

DNA is the molecule that contains genetic information, structured as two long nucleotide chains win-

ding together to form a double helix. DNA resides in the nucleus of cells, packaged into chromosomes. The base sequence in DNA determines the genetic code.

The genetic code is a set of rules dictating how the sequence of bases in DNA translates into proteins. There are 20 different amino acids used to build proteins, and each is encoded by a triplet of bases. The genetic code is universal, meaning it is the same in all living organisms.

In recent years, there has been a lot of interest in CRISPR, known as “Clustered Regularly Interspaced Short Palindromic Repeats”. This is a gene editing tool that allows for the precise and efficient modification of DNA. It is used to correct genetic errors, develop new treatments for diseases, and conduct basic research in biology.

WHAT ARE MUTATIONS?

Mutations are changes in the DNA base sequence, the molecule containing genetic information. These changes can be of various types and have different effects on the organism.

CAUSES OF MUTATIONS:

- **Errors during DNA replication:** During cell division, DNA is copied so that each daughter cell receives a complete copy of the genome. However, this process is not perfect, and errors can occur, that lead to mutations.
- **Exposure to mutagenic agents:** Mutagenic agents are substances or factors that can damage DNA. Some examples of mutagenic agents are:
 - **Radiation:** Ionizing radiation, such as that found in X-rays and nuclear energy, can damage DNA.
 - **Chemical substances:** Some chemicals, such as benzene and asbestos, can damage DNA.
 - **Viruses:** Some viruses, like the human papillomavirus (HPV), can integrate their DNA into the host cell's DNA and cause mutations.
- **Errors in DNA repair:** DNA is constantly being damaged by environmental agents like free radicals. Cells have mechanisms to repair damaged DNA, but these mechanisms are not always perfect and can lead to errors, resulting in mutations.



WHAT ARE THE EFFECTS OF MUTATIONS?

The effects of mutations can be diverse, depending on the type of mutation, the gene affected, and the role that gene plays in the organism. Some mutations have no effect, while others can cause genetic diseases or cancer.

A. Genetic Diseases

Genetic diseases are caused by mutations in genes that are essential for the normal functioning of the organism. Some common genetic diseases are:

- **Cystic fibrosis:** It is a genetic disease that affects the lungs and other organs.
- **Hemophilia:** It is a genetic disease that affects blood clotting.
- **Duchenne muscular dystrophy:** It is a genetic disease that causes progressive muscle weakness.

B. Cancer

Cancer is a disease in which cells grow uncontrollably. Mutations in genes that control cell growth can increase the risk of developing cancer.

TYPES OF MUTATIONS:

Mutations can be classified according to their size and the type of change they produce in DNA:

1. **Point mutations:** Changes in a single DNA nucleotide.
2. **Insertion or deletion mutations:** Changes in which a nucleotide or a group of nucleotides is added or removed from DNA.
3. **Chromosomal mutations:** Changes in the structure or number of chromosomes.

GENETICS AND INSURANCE MEDICINE

Genetics plays an increasingly important role in insurance medicine, allowing insurance companies to better assess the risk of an individual developing certain diseases in the future.

BENEFITS:

- **Improves risk assessment accuracy:** It can help insurance companies more accurately determine the risk of an individual developing a particular disease, allowing them to offer more personalized policies at fairer prices.
- **Disease prevention:** It helps people identify their predisposition to certain diseases, allowing them to take preventive measures to reduce the risk of developing them.
- **Early diagnosis:** Genetic information can help identify individuals at higher risk of certain diseases, allowing early diagnosis and timely treatment.

CHALLENGES:

- **Genetic discrimination:** Insurance companies can use genetic information to customize policies and offer coverage that fits individual needs, thus promoting greater inclusion and equity in access to insurance services.
- **Privacy:** Genetic information is sensitive, and it is important to protect people's privacy.
- **Informed consent:** It is important that people understand the risks and benefits of genetic tests before undergoing them.

To Conclude, **Table 2** includes ten aspects related to human genetics that should make us reflect on the complexity of this branch of medicine.



TABLE 2. BASIC ASPECTS OF HUMAN GENETICS

	1. No two people have the same DNA Although we share 99.9% of our DNA with other humans, the small 0.1% difference is enough to create a unique genetic fingerprint.		6. Genes do not determine everything The environment also plays a significant role in people's health and development.
	2. The human genome is immense It contains around 3 billion base pairs, equivalent to 8.5 million pages of a book.		7. We have "junk" genes It is estimated that about 98% of DNA has no known function, so it is called "junk DNA".
	3. Most of our DNA does not code for proteins Only about 2% of DNA codes for proteins, while the rest has regulatory functions or its function is still unknown.		8. DNA can change throughout life Mutations in DNA can be caused by errors in DNA replication or exposure to environmental agents.
	4. We share DNA with other living beings We share about 50% of our DNA with chimpanzees and even 2% with bananas.		9. DNA can be used to solve crimes Genetic fingerprints allow identification from small DNA samples.
	5. DNA can be read and written New gene-editing technologies like CRISPR allow precise modification of DNA to correct genetic errors.		10. Genetics can help predict the future Genetic tests can determine predisposition to certain diseases, allowing preventive measures.

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The speakers are Marcos Acosta, Pedro Gargantilla, and Víctor Navarro.

SENIOR WORLD SEMINAR

Senior World Seminar On March 12th, Nacional de Reaseguros, in collaboration with the College of Actuaries of Cataluña, held a seminar on the senior world.

During this seminar, the speakers (Marcos Acosta, Pedro Gargantilla and Víctor Navarro) addressed three important perspectives affecting this group.

Firstly, they explored what is known as the Silver Economy both globally and locally, providing relevant data. This analysis highlighted the ageing of the population as a result of longer life expectancy and falling birth rates. According to the World Health Organization, it is expected that by 2030, one in six people will be 60 years of age or older, and this figure will reach 2.1 billion 20 years later, in 2050.

This demographic change presents challenges and opportunities, especially for the insurance sector.

The most common age-related pathologies, such as osteoporosis, osteoarthritis, ischaemic heart disease, renal failure, stroke and Parkinson's disease, were also discussed. Their prevalence in the population was discussed, as well as the need to carefully consider their impact on people and the appropriate way to price this type of risk, and the different products for the possible insurance of this group were presented.

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