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HUMAN HEALTH
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YOU (AND YOUR GRANDKIDS) ARE WHAT YOU EAT!

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YOUNG REVIEWERS:

AARYA
AGE: 9

ANIKA
AGE: 10

APARNA
AGE: 15

OLIVIA
AGE: 10

Food is more than just fuel. On one hand, it is a way to show love and care, and it holds stories from the people around us, our ancestors, and their traditions. On the other hand, food also influences how we feel and perceive ourselves. The more we understand the ways foods can change how our bodies work, the more we can understand how our diets and our health are related. In recent years, scientists have found that foods like broccoli, green tea, peanuts, berries, and grapes can actually, change our gene activity. They have also done experiments to understand how these changes can be passed from mothers to babies, generation after generation. Thanks to computers, we have learned a lot about health, the science behind food, and nutrition education.

THE HISTORY OF FOOD, SOCIETY, AND MEDICINE

Have you ever thought about what children eat in other countries? Well, there might be some similarities, but it is definitely not the same

things you eat. The foods we eat are not just for filling our stomachs; our foods are full of stories, traditions, and beliefs (Figure 1). The moments spent gathering ingredients, preparing, and savoring dishes are part of our cultural experiences and overall wellbeing. Each culture and individual person gives food a different meaning.

Figure 1

Food plays various roles in society: **(1)** Nutrition: essential for health and bodily functions. **(2)** Toxicity: some foods can be harmful if misused or overconsumed. **(3)** Medicinal: Some foods benefit certain health conditions. **(4)** Art: used creatively in culinary arts and cultural expression. **(5)** Industry: drives economic activities through production and distribution. **(6)** Ornamental: enhances visual appeal in events and decorations. **(7)** Economics: influences trade, markets, and financial systems. **(8)** Rituals: important in cultural and spiritual ceremonies. **(9)** Social interaction: strengthens relationships and builds community through sharing and preparing food.

Here is an example: everyone loves chocolate! However, people have thought about chocolate in different ways through History. Pre-Hispanic Mesoamerican people used cacao beans in rituals. They also used it as money. Drinks and foods prepared with cacao were exclusive to important people like emperors, warriors, and priests. In Mexico, chocolate, a modern product of cacao, is still an offering for our loved ones on the Day of the Dead. In many places, people use chocolate as a symbol during rituals. Food is also an important theme in art. You may have seen paintings of feasts with many delicious treats.

And it was not only Mesoamerica, various cultures, including ancient China and India, have recognized the crucial link between food and wellbeing. Even Hippocrates, the famous "Father of Medicine", refused to accept that diseases were divine punishments. Instead, his famous words, "Let food be thy medicine and medicine be thy food", recognize the impact of food on our health. Many cultures still use food as medicine, showing how important it is in promoting wellness.

Thanks to modern scientific discoveries, scientists now know that ancient knowledge about food holds more truth than we realized. They now understand that food not only provides energy but also keeps our cells healthy. Without a balanced diet we risk various illnesses, like infections, obesity, diabetes, and heart disease. At the same time, some foods can have the opposite effect, helping us heal.

HOW CAN FOOD AFFECT OUR HEALTH?

Imagine this: two identical twins, who share the same **DNA**, grew up in different places and had different diets, habits, and hobbies. They ended up looking different from each other, and even developing different diseases. This can also happen with honeybees, who change their appearance and function in the hive depending on their environment and diet during their early lives. Why does this happen? And how?

This phenomenon can be explained by both **genetics** and **epigenetics**. Genetics is the study of the instruction manuals (genes) that tell our bodies how to grow and work. This set of instructions does not change—each person's genes remain the same throughout their life. Epigenetics, on the other hand, describes how our environments and habits can turn genes on or off, which can affect how traits and functions develop, just like with the twins and honeybees (read more about epigenetics here).

A curious scientist named Conrad Waddington wondered how traits could be influenced by more than just genes. In 1942, he came up with the term "epigenetics" even before scientists fully understood DNA. Waddington's work shows that being curious and exploring can lead to amazing discoveries, even if we do not know everything yet.

One way to think about epigenetics is through music. Think of the human genome as a musical score, in which each note and symbol represents instructions to create and conduct a unique biological symphony. Now, instead of thinking of epigenetics as changes in the score itself, think of it as the interpretation of that score by different musicians at different times and places. Why does the same song sound different when it is played by different people? Well, musicians are like **epigenetic markers**, little notes and accents that add nuances and emotions to music. In our bodies, some genes can be turned on or off by attaching or removing chemical groups such as methyl groups (molecules made of one carbon and three hydrogen atoms, CH_3) from **histones** or specific regions of DNA (Figure 2). This alters how the score is interpreted or, in other words, the way we look or the kinds of diseases that we have.

Some plant-based foods have special compounds that can change how our genes work. Green tea, for example, has substances called catechins, and soybeans and fava beans have genistein. These compounds can tell **enzymes** in our bodies what to do with our DNA. Other examples are resveratrol, found in red and blue foods like grapes; butyrate and sulforaphane from broccoli and other cruciferous vegetables; and curcumin, which is in turmeric. Such substances interact with enzymes that are involved in the way our genes are "packaged" or folded up in the DNA. Eating these foods can make our

DNA

A molecule that functions as a bookshelf holding all the instruction manuals (genes) that make you *you*.

GENETICS

The study of the instruction manuals (genes) that tell our bodies how to grow and work.

EPIGENETICS

The study of how our genes change because of our behaviors and the environments we are exposed to.

EPIGENETIC MARKERS

Special chemical tags that stick to your DNA and help decide how your genes work. They can turn genes on or off.

HISTONES

Proteins that DNA wraps around, helping to organize it inside the cell. By tightening or loosening this wrap, histones can control which genes are active or silent.

ENZYME

Special proteins that speed up chemical reactions inside your body.

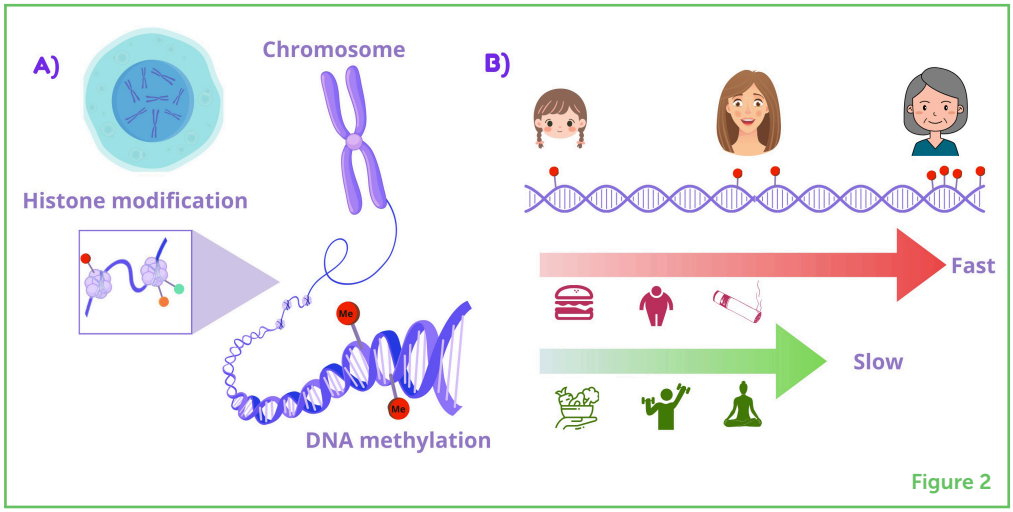

Figure 2

(A) Epigenetic mechanisms involve in certain diseases. **(B)** Over time, epigenetic marks accumulate, such as methyl groups that bind to DNA (red circles, DNA methylation). Exercise and eating habits can speed up or slow down the increase in DNA methylation.

genes work differently, showing how important foods are for healthy, functional bodies.

EPIGENOME

A collection of chemical tags that sit on DNA, telling genes when to turn on or off without changing the DNA itself. These tags help control how cells grow, develop, and respond to the environment.

Eating certain foods a lot or not at all can change our **epigenome**, and these changes can be passed from generation to generation. For example, scientists gave some mice a low-protein diet, and guess what? Their babies ended up having trouble regulating cholesterol [1]. And it is not just mice—similar things have been seen in people who experienced malnutrition, and their babies developed diseases like diabetes. So, what we eat today could shape the health of our great-great-grandkids! It is like our food choices are leaving a legacy, echoing through time.

However, if we start adopting healthier habits such as exercising regularly and eating more fruits and vegetables, we might be able to prevent these epigenetic changes and reduce the risk of getting some diseases. By making positive lifestyle choices, we can help shape a healthier future for ourselves and for generations to come.

FOOD INFORMATICS: THE PRESENT AND FUTURE OF FOOD

FOOD INFORMATICS

The study of food using computers.

After learning all this, you might be wondering what foods you should eat and how you should combine them to improve your health. Or maybe you are thinking about using food to treat illnesses. Guess what? Computers and a field called **food informatics** are helping us figure all this out! Food informatics helps us analyze food data more efficiently and discover how different foods and their components can affect human health [2]. So, the answers to these questions might be closer than we think, all thanks to the power of technology and science!

Currently, food informatics is doing some really cool things (Figure 3)! Scientists are gathering and studying big batches of information

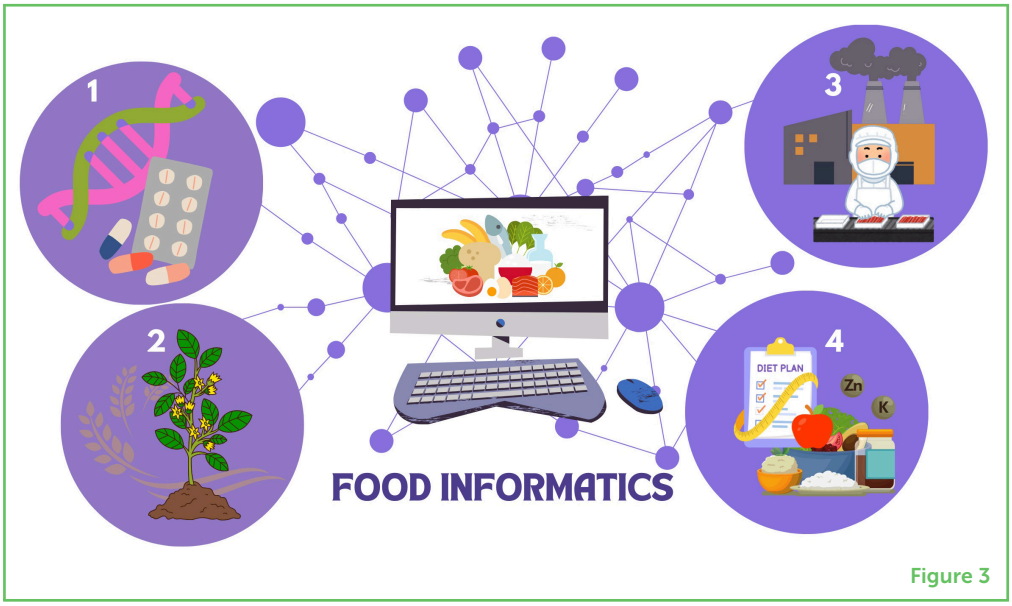

Figure 3

Uses of food informatics. **(1)** Medical: exploring food's role in health and disease prevention. **(2)** Agro-industrial: improving agricultural and food-production processes. **(3)** Food industry: enhancing manufacturing and supply chain efficiency. **(4)** Nutrition: analyzing and managing dietary practices.

about foods, genes, and how they affect our bodies. They are also discovering the mysterious connections between our senses of taste and smell and the ingredients in our meals. Have you heard about robotic noses? They are like super sniffers that can tell if our food is fresh and yummy [3]. Additionally, food informatics is important for figuring out what makes our food taste good, look nice, and stay fresh longer. In the realm of medicine, scientists are on the hunt for new molecules present in foods that not only provide nourishment but also offer health benefits and may even be used as medicines in the future.

As scientists continue to explore food informatics and epigenetics, they are finding a lot of excitement and a few tricky issues. One cool thing is that they might be able to make better guesses about what is making people sick and come up with treatments and diets that fit each person perfectly. However, there are tough things that they need to figure out. A lot of information is needed to do a really good job studying food and how it affects our bodies. So, scientists need to find ways to gather and handle all that data properly.

CONCLUSION

As you have seen, food is really important in our societies for many reasons. And as computers are becoming better and more powerful, the information scientists are learning about food and health is creating new and interesting applications in many fields. Soon, we might hear a lot more about food epigenetics on television, in supermarkets, or even in magazines due to the numerous products claiming specific health benefits based on their impact on our genes and overall health.

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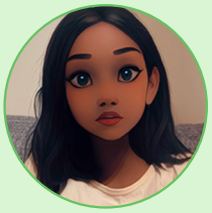
YOUNG REVIEWERS



AARYA, AGE: 9

I am a 9-year-old girl and I like to play badminton and swim. I love playing with friends and learning new things. I want to work in a rescue center for animals when I grow up.

ANIKA, AGE: 10

I am a 10-year-old girl and LOVE cats. I like to sing and dance in my free time. I like to sketch and do crafts too. I do not like slugs, snails, and bees. My favorite game is Brawl Stars and my favorite color is purple.

APARNA, AGE: 15

I am a 15-year-old girl and my interests are science, music and art! I am also a sports enthusiast who loves any type of action. Other interests include playing violin, drawing and making new friends. I love the Harry Potter book series and the movies as well. My dream is to become a neurologist one day and help find cures to diseases.

OLIVIA, AGE: 10

Hi, I am Olivia from Germany. I am a 10-year-old girl who loves reading books, playing chess, and playing the piano and violin. I am curious about nature and enjoy watching educational children's shows like "Checker Tobi". I also have lots of fun doing crazy things with my younger sister.

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I have a master's degree in chemical sciences and experience in pharmaceutical chemistry. Right now, I am pursuing a doctoral degree with a specialization in computer-aided drug design at the National Autonomous University of Mexico. My research focuses on developing new multi-target compounds for complex diseases like diabetes, while also exploring computational tools in the food sector. In my free time, I like eating a lot of different foods from around the world, traveling, and going to museums, which helps me appreciate other cultures and histories. *fer.saldivarg@gmail.com

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