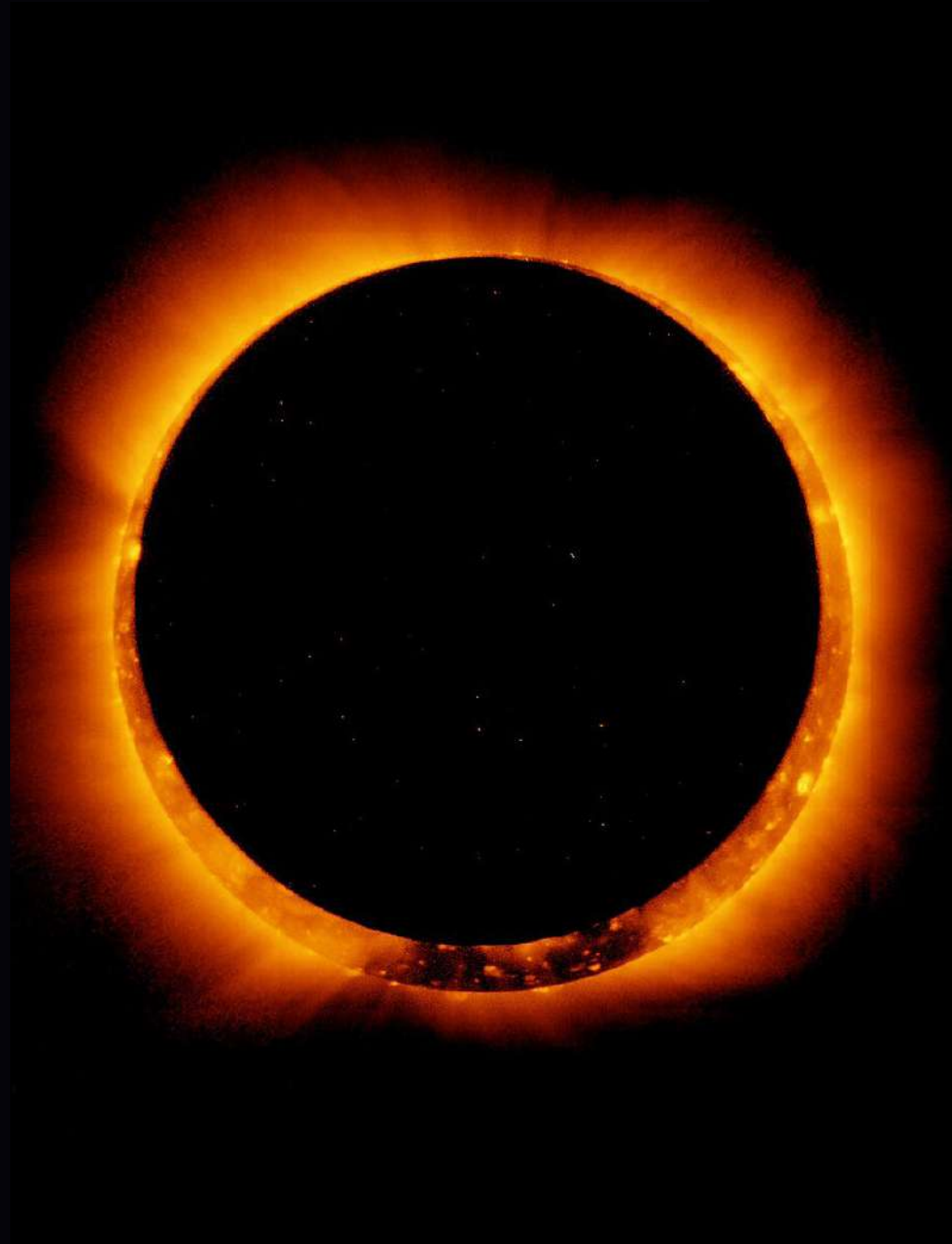




RocheS²TEM

SUSTAINABILITY · SCIENCE · TECHNOLOGY · ENGINEERING · MATHEMATICS





Bianual journal with a sustainability, sciences, technology, engineering and math productions focus from the community of Rochester School in Chía, Cundinamarca, Colombia

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FOSTERING SKILLS ACROSS ALL GRADES: A JOURNEY THROUGH MODELING, SUSTAINABILITY, AND TEAMWORK

María del Pilar Tunarroza Sierra

As we navigate the ever-evolving landscape of education, one thing remains certain: the pivotal role of STEM (Science, Technology, Engineering, and Mathematics) in shaping young minds. From the early years of Pre-Kindergarten to the culminating moments of the 12th grade, our students embark on a transformative journey where they not only acquire knowledge but also cultivate crucial skills that will propel them into a future driven by innovation and collaboration.

At our school, we design the class activities so that students emphasize on modeling, sustainability, and teamwork across all grade levels. Through engaging activities and interactive learning experiences, students are introduced to the concept of modeling—whether

it's constructing structures with blocks or creating simple representations of scientific phenomena in lower grade levels. These early encounters set the stage for their journey toward advanced modeling techniques in higher grades.

Sustainability, a core pillar of our curriculum, takes center stage as students progress through their academic years. From elementary school where they explore the basics of environmental awareness to high school where they delve deeper into understanding ecosystems and renewable energy sources, our students develop a profound appreciation for the interconnectedness between humanity and the planet. Through hands-on projects and real-world applications, they grasp the significance of sustainability,

learning to envision a world where scientific advancements harmonize with environmental preservation.

However, it is with teamwork that these skills truly flourish. Students from diverse backgrounds and varying interests converge, unified by a common goal—solving complex problems through collective effort. Whether it's engineering challenges, scientific investigations, or community outreach initiatives, teamwork becomes the catalyst for innovation and success. Students learn the art of communication, compromise, and collective problem-solving, essential skills that extend far beyond the classroom walls.

As educators, we take pride in nurturing these skills, recognizing their indispensable

value in shaping the future leaders, scientists, engineers, and innovators of tomorrow. Our commitment remains constant—to equip our students with not just academic knowledge but also values and mindset essential to help them take charge of their lives with the world on mind.

In this journey through PK to 12th grade, we witness the transformation of eager minds into capable hands ready to take good decisions that thrive on innovation, sustainability, and collective progress. We are proud of our students and teachers. This magazine contains some evidences on how our students put in practice the skills of modeling, sustainability, and teamwork, we hope you enjoy it.

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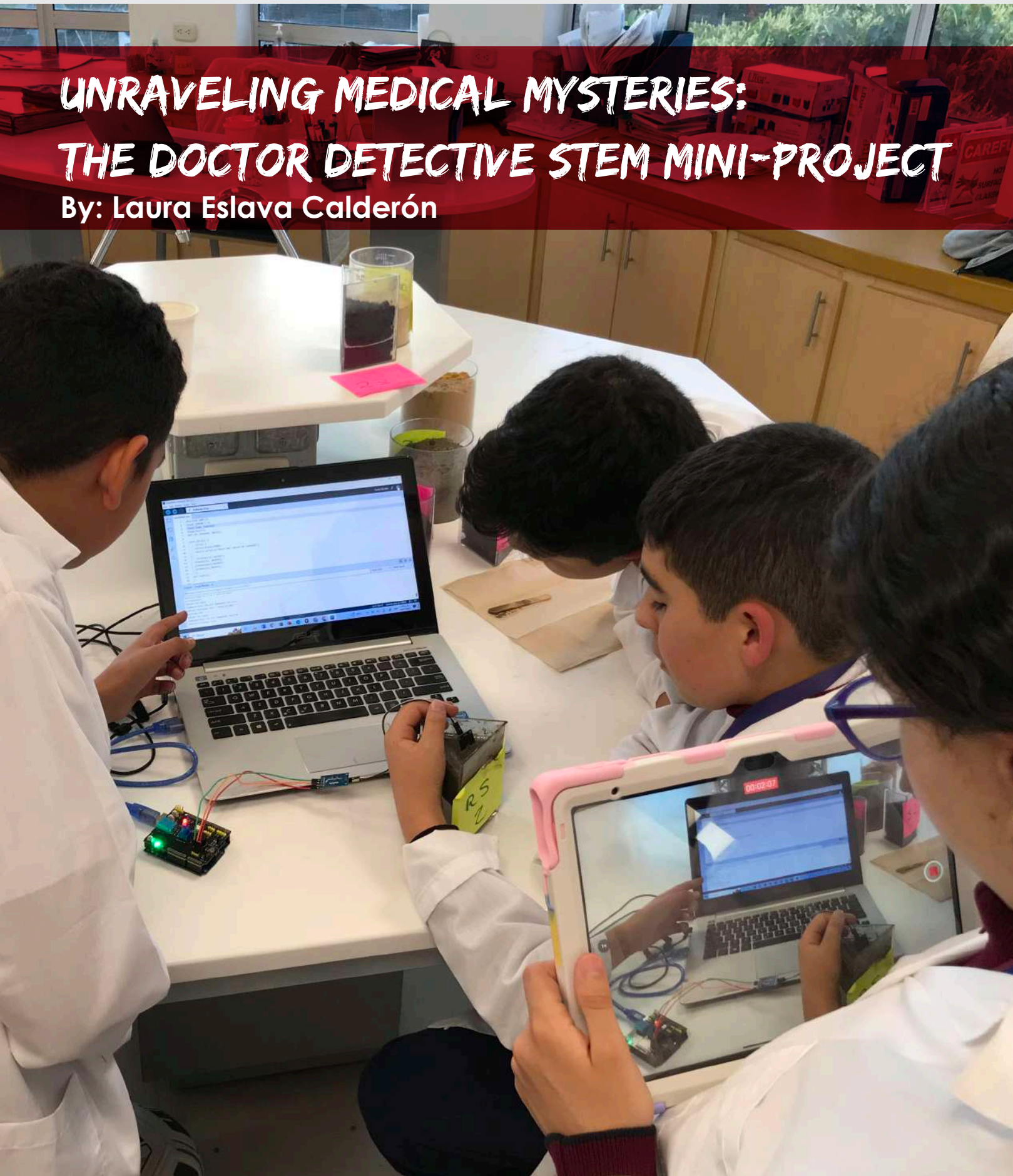


CLASS FOUNDATIONS



UNRAVELING MEDICAL MYSTERIES: THE DOCTOR DETECTIVE STEM MINI-PROJECT

By: Laura Eslava Calderón



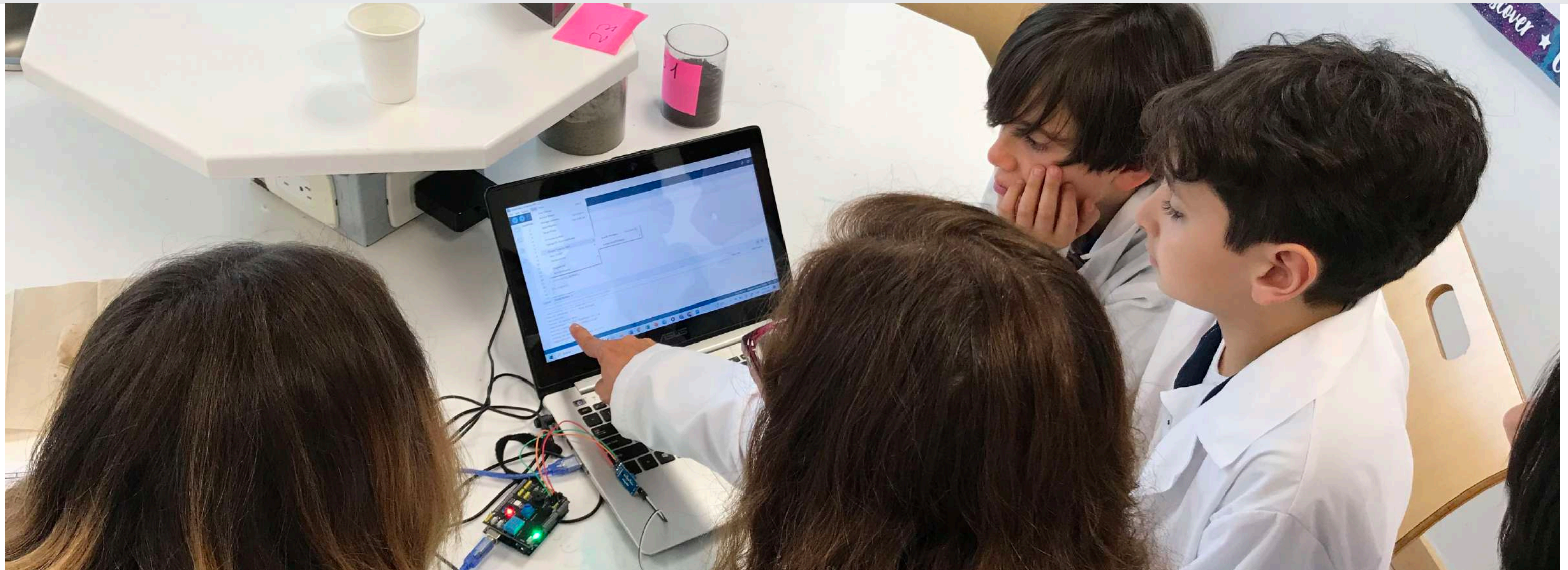
In the realm of seventh-grade scientific exploration, an initiative named “Doctor Detective” has taken center stage, bringing the intricacies of the immune and lymphatic systems to life. This mini-project not only delves into the depths of biological understanding but also instills critical scientific thinking skills in our young minds.

The Doctor Detective project challenges students to unravel medical mysteries by applying their knowledge of the immune and lymphatic systems. Armed with a list of symptoms, these budding scientists embarked on a journey akin to that of real-life medical detectives, determining diagnoses and gaining valuable insights into the functioning of our bodies.

At its core, the project serves as a bridge between theoretical knowledge and practical application, fostering a deeper understanding of the intricate mechanisms that safeguard our health. By engaging in hands-on activities related to the immune and lymphatic systems, students not only absorb textbook information but also internalize the practical implications of this knowledge.

This activity appeals directly to the multidisciplinary nature of STEM education, integrating life sciences with problem-solving skills. Students not





only deciphered the biological puzzle presented to them but also had the chance to work on their analytical and research abilities. This holistic approach to learning extends beyond the confines of a conventional classroom, preparing students for future challenges that require a synthesis of knowledge and critical thinking.

Furthermore, the Doctor Detective project encourages students to reflect on the significance of maintaining a

healthy lifestyle. As they grapple with the complexities of immune responses and lymphatic functions, they gain a newfound appreciation for the incredible resilience of their own bodies. This reflection extends beyond the classroom, inspiring a sense of responsibility towards personal well-being and fostering habits that contribute to a healthier lifestyle.

In the broader context of scientific education, the Doctor Detective project exemplifies the power of

experiential learning. It goes beyond rote memorization, inviting students to actively participate in the scientific process. This approach not only enhances their understanding of specific biological concepts but also cultivates a lifelong curiosity and appreciation for scientific inquiry.

In conclusion, the Doctor Detective STEM project undertaken by seventh-grade students is a beacon of innovation and scientific exploration. By merging

life sciences with hands-on detective work, students not only unravel medical mysteries but also cultivate essential skills for future scientific endeavors. This project stands as a testament to the transformative potential of STEM education, inspiring the next generation of scientists to think critically, inquire deeply, and take proactive steps towards safeguarding the health of both themselves and the broader community.



HOW DO DISCIPLINARY CONNECTIONS ENRICH OUR TEACHING WORK?

By: Aída Ostos

The integration of disciplinary connections plays a relevant role in enhancing the effectiveness of our teaching practices.

As educators, fostering interaction among different thematic areas provides a comprehensive and interconnected approach to learning. In this context, the synergy between chemistry, Earth science, physics, and technology takes on particular significance.

This article explores the pedagogical benefits of merging these disciplines in the context of sixth grade education, focusing on the study of soil composition using Arduino technology. By examining the relationships between variables and scientific concepts, the interconnected nature of our planet becomes evident.

This holistic approach not only encourages a deeper understanding of the material but also nurtures a sense of curiosity and critical thinking among students. Through these interdisciplinary connections, the aim is to enrich the teaching experience, providing students with a more cohesive, useful, and engaging learning environment.

Generating Disciplinary Connections

The incorporation of technology in school education for scientific subjects

is essential for cultivating curiosity and understanding of natural phenomena across different grade levels, each with certain levels of depth and focus.

This article explores the convergence of Arduino technology with key scientific concepts related to Earth sciences, particularly soil composition.

The goal is for students to recognize the importance of conducting practices with precise results that help them make decisions about how we can contribute to the care of our planet from different perspectives.

By carrying out practical experiments in the 6th-grade classroom, experiential learning is not only encouraged but also fosters the study of useful and meaningful knowledge for students, such as understanding molecular mass, soil composition, humidity, and temperature, among others.

Exploring Soil Composition

In the 6th-grade Earth, Space & Physical Science class, students have the opportunity to study the composition of the soil beneath their feet and other soil types like sand. Using temperature and humidity sensors connected to Arduino platforms, children can make precise



measurements and observe how these factors vary in different types of soil, making technology an useful strategy for obtaining data close to them.

Additionally, students manipulate other types of instruments such as microscopes to recognize particles in a more detailed form, strengthening their knowledge with more tangible activities. Identifying specific compounds present in soil samples allows students to have a greater understanding of the meaning of molecular mass, a fundamental scientific concept.

This hands-on experience enriches their understanding of the chemistry of their immediate environment, providing a valuable connection between theory and application.

Connections Between Different Disciplines: Technology, Chemistry, Physics, and Earth Science

The integration of chemistry, physics, and technology in sixth-grade education aims to be presented as an enriching and holistic approach.

By introducing concepts like molecular mass through the study of soil composition, not only are the chemical properties of materials explored, but connections are also made with students' immediate environment. By incorporating technology, specifically through the use of Arduino to measure soil temperature and humidity, many physical principles are put into practice.

Beyond data collection, students are

provided with a window into physics by exploring how these environmental factors are intrinsically linked to changes in energy.

This connection between chemistry, physics, and technology not only enriches students' understanding of the world around them but also provides practical skills and a solid foundation for future scientific studies.

The relationship between humidity, temperature, and energy changes comes to life as students monitor how these variables affect their soil environment. From the warming of the soil under sunlight to the release of energy during evaporation, children directly experience how changes in humidity and temperature trigger surprising energy transformations.

Transcending the Classroom

At the confluence of technology, soil science, and energy concepts, our 6th-grade students have discovered new ways to achieve their learning experientially and useful for later practices. The integration of Arduino not only facilitates accurate data collection but also aims to cultivate a deeper appreciation for the science that exists with us.

By inspiring curiosity and exploration, the goal is to forge a generation of young scientists passionate about discovering the secrets of the Earth.

Furthermore, interdisciplinary integration not only enriches learning in the classroom but also inspires students to take that knowledge beyond school walls.

By merging chemistry, physics, and technology in the study of soil composition, students not only gain a deep understanding of scientific concepts but also become active creators of knowledge at home.

By fostering creativity, students are encouraged to conduct practices at home that apply these concepts practically. From measuring soil moisture in their garden to designing and conducting experiments based on principles studied in class, this project is expected to inspire a scientific and creative mindset that transcends the classroom.

This approach not only reinforces learned concepts but also empowers students to explore and discover for themselves, carrying the spark of scientific discovery even beyond their school years.



**DYNAMIC MODELING IN 12TH GRADE:
ALTERNATIVE (RE)VIEW OF HIGH SCHOOL
MATHS.**

By: Guillermo Marín

As High School students approach the end of their trajectory at school, they begin thinking about what is the path to be followed in the future. Some chose to continue their formation on careers that involve strong Math skills, some chose to continue on careers that are less demanding in Math skills.

No matter what path is chosen, there is a strong need of analysis skills that allows a deep comprehension of the complexities of the phenomena that affect a person's life, a community's coexistence and harmony, a country's viability, and the world's survival. All students, regardless of their preferred path, are worthy of the tools that provides opportunities to develop these analysis skills.

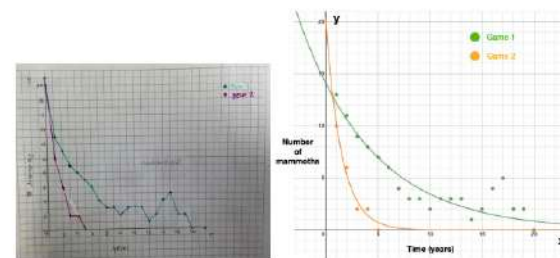
With this urgency in mind, Rochester School offers a course for Senior students that feel their future path does not demand strong Math skills. As such, Dynamic Modeling presents a combination of team games that give the chance of identifying a System's characteristics, components, and behavior, all of them presented by Dennis Meadows in his books *The Systems Thinking Playbook*, and *The Climate Change Playbook*.

Games presented here become a challenge for analysis of characteristics and prediction of behavior.



CONNECTIONS GAME

Students needed to move following instructions. Each student's movement affects everybody's in a small scale or in a big scale. How do we analyze that?



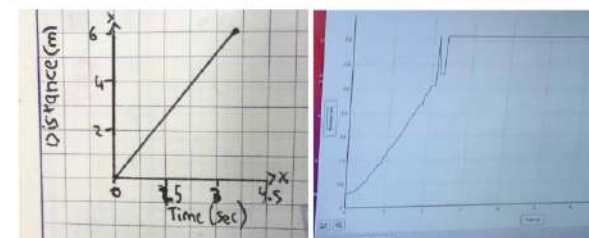
Questions Game 1
1. What do the graphs tell us about what happened to the mammoths?
- The graph shows us how the mammoth population decreases with time, it tells us that they went extinct.

MAMMOTHS GAME:

How do the relationships between the elements (Rules) affect the system? Extinction could be accelerated or retarded.

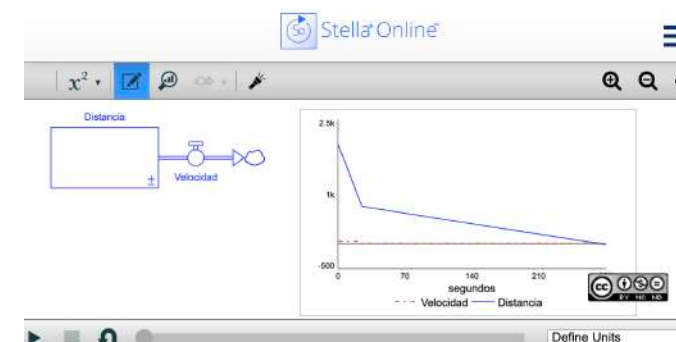
Following this phase of being aware of the complexity that a game shows and the ability to wonder how the System in the game works, students go a little deeper into describing the behavior of systems that are present in situations that go from the simplest, like walking a street, to more complex like how a medicine is taken, absorbed and eliminated from the body. All these situations are proposed by Diane Fisher in her book *The Dynamic Modeling Approach*, and modeled online with the Stella® software.

What are the keywords in the description above (about how to move) to cause the graph to be a straight line?
The keywords for how they move are slope, constant, distance, linear, and velocity.



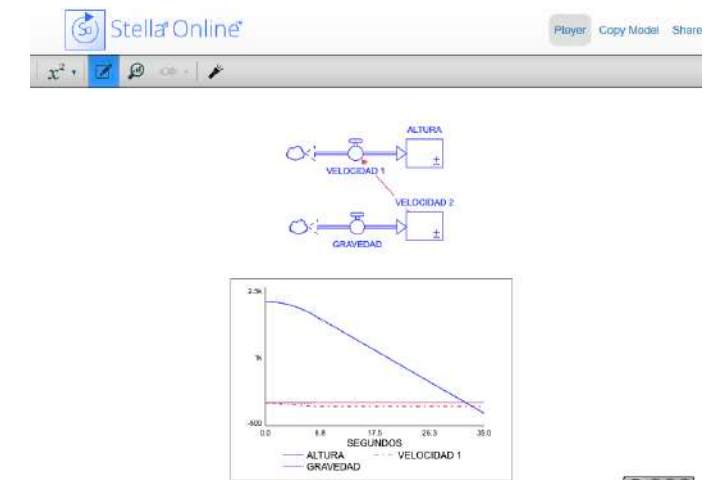
WALKING:

Students use motion sensor data to monitor movement, and used data to describe details of it.



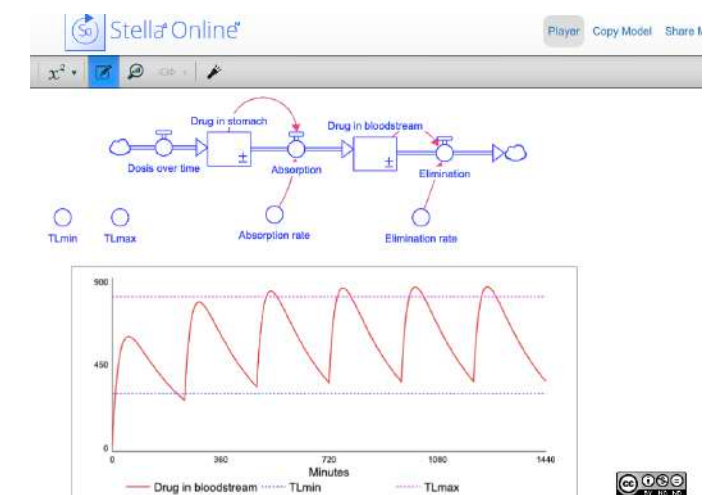
ELECTRICITY BILLS:

Students used information on electricity bill to model how in changes depending on rules with Stella® software.



JUMPING OUT OF AN AIRPLANE:

Students modeled the change in height including changing conditions over time

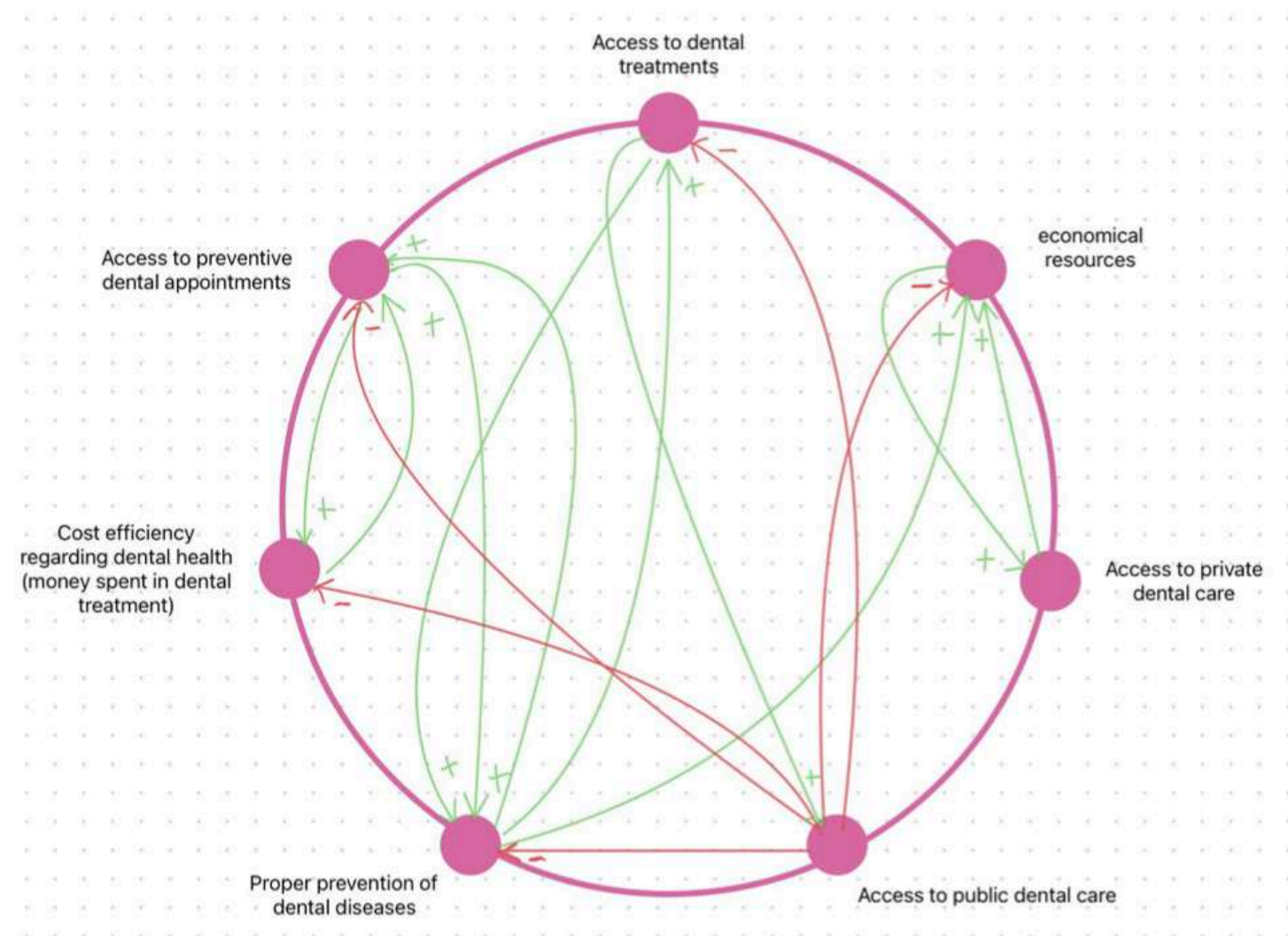


MEDICINE:

How a drug changes concentration in the blood stream.

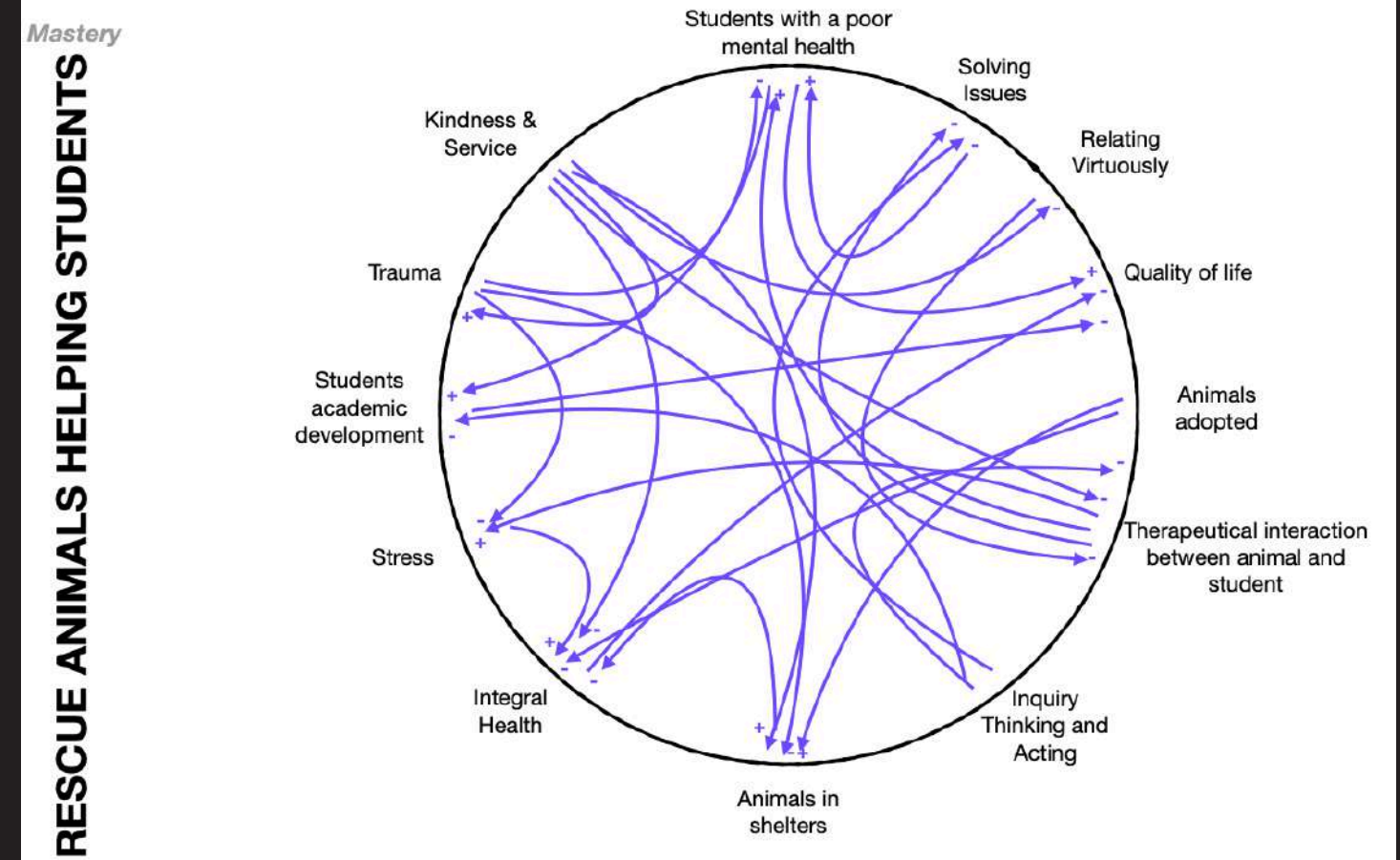
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to more complex like how a medicine is taken, absorbed and eliminated from the body. All these situations are proposed by Diane Fisher in her book *The Dynamic Modeling Approach*, and modeled online with the Stella® software.



ECONOMIC FACTORS IN DENTAL HEALTH:

Analysis of connections for Graduation project, including the role of Virtues (SHICKEL) and Useful Learning (THIS REAL) goals in Rochester School.

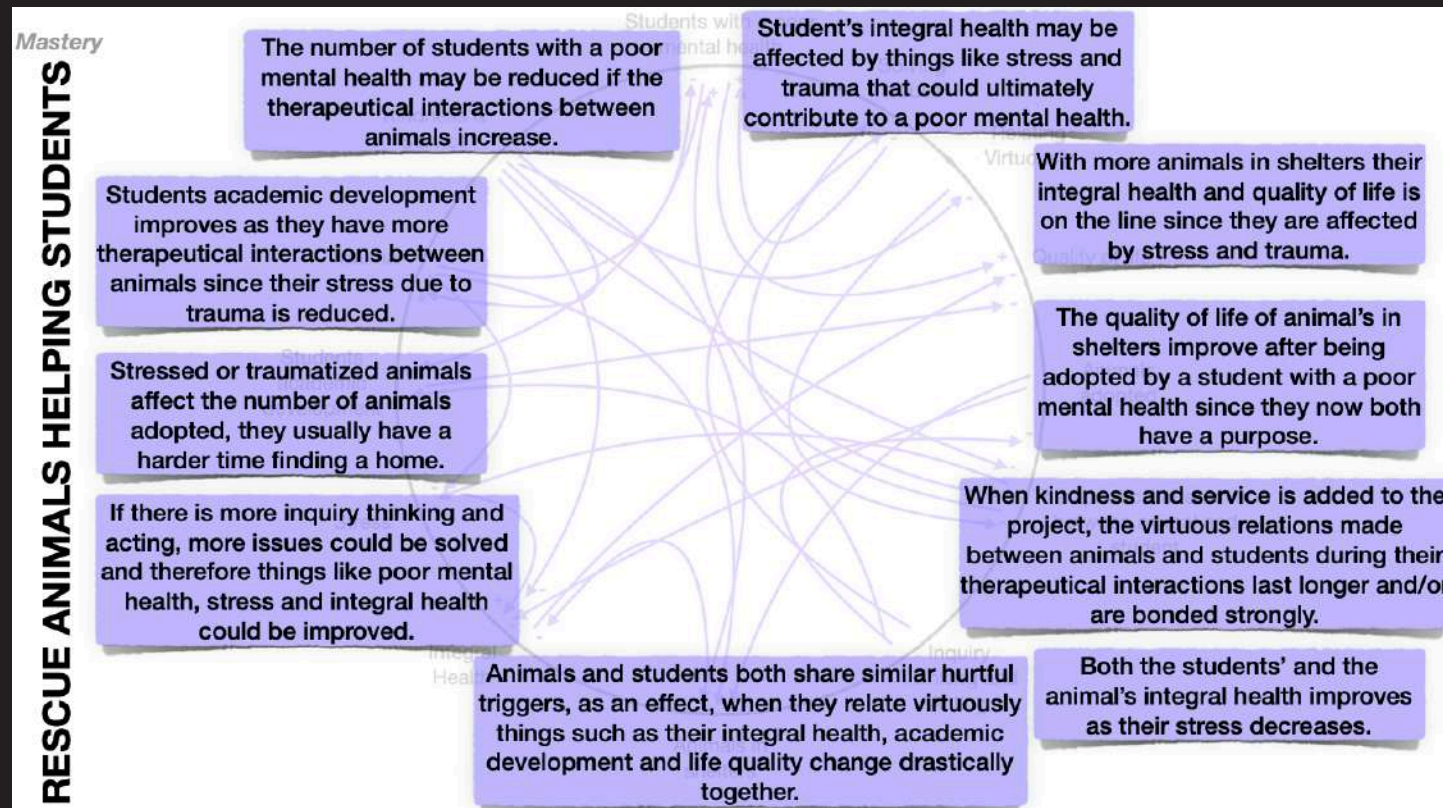


RESCUE ANIMALS - HELPING STUDENTS:

Analysis of connections for Graduation project, including the role of Virtues (SHICKEL) and Useful Learning (THIS REAL) goals in Rochester School.

GREEN GUIDE MISSION

By: Maria Juliana Rodriguez



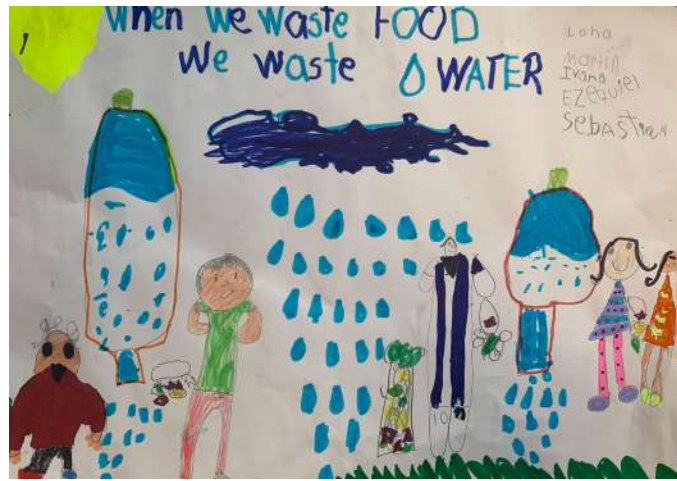
RESCUE ANIMALS - HELPING STUDENTS:

Analysis of the type of connections and how they affect the system.



First grade students visited the school's kitchen to observe how much food waste had we produce during that day. Students learn how the residues are managed. The kitchen staff explained us how many buckets they received daily, the results were outrageous, they receive about four to five collectors of food waste every day. Then Jose Juan taught us where do the organic waste goes and how it's transformed to compost. Kids were shocked to see the enormous amount of food waste of the entire school. On the collectors students found whole Foods with no bites going through this process.

As a result we decided to help our community by following one of the green guide guidelines. The green guide is one of the super hero's of the climate action program of the United Nations. One of his mission is to "Reduce waste we produce". Starting by taking care of nature and the food we eat. During first grade project class they started by gathering information to understand what is happening and the main reasons why it is occurring and the impact behind this. Using a bone fish diagram we discuss the main reason why this is happening. Starting with behavior at school and at home related to food.



Continuing with our research, the next question was: what happens when I waste food? Students to answer this question they started a campaign explaining what happens. They made a poster explaining “When we waste food we waste: love, fuel, money ,labor and water”.

Students developed a profound understanding what wasting food truly means and now they want to share this beautiful experience with you. So next time you are having a delicious meal remember that by reducing food

waste we can save money , reduce green house gases and help persevere resources for future generations.

Using our “this-real” competencies we decided to focused on mainly two : Health competence and analysis and assessment of self. Heath: Through the campaign students are also promoting a healthy sustainable diet and to reduce food waste.

Secondly invite our community to self evaluate their behavior related to food on campus and at home.





Have you ever wondered where our residues go after we discard them? Have you stopped to think why we separate residues in school as organic and inorganic into the green and grey collectors? Students in second grade have been using our school campus as a living text to understand what happens to our residues once they are discarded and what they can do to help this process work effectively.

The second graders first started by learning the difference between organic and inorganic residues and how these are separated in the green and grey collectors at school. They also examined different collectors they may have at home to separate residues. Students practiced correctly sorting out real life examples of residues produced by them on a daily basis into the green and grey collectors used in our school. They then analyzed how these collectors are used

by our community. They did this by taking pictures of the residues in different places around our campus and analyzing if the residues in them are being sorted out correctly. We found that, in general, our community separates residues correctly, though in some cases, there were a few inorganic residues placed in the green collector. As part of this project and guided by Rochester's sustainability team, second grade students visited the places in our School where the residues from the green and grey collectors go. We first visited the composting area. Students got a chance to see the food shredder used to make organic waste easier to decompose. They learned that all of the food that we do not eat, and all of the organic waste we produce is used to make compost in this area. Here, they realized that we all need to be conscious to minimize food waste. They were surprised by the smell of decomposing material and managed



to see the end product - nutrient rich soil used in the school's gardens to fertilize our plants. In our visit to the composting area we found a few pieces of plastic in the compost soil. Students realized that plastic does not degrade at the same rate as organic residues and in this way, they noticed the importance of their role of sorting out their residues properly. Continuing their guided visit, the second graders also visited the place where the inorganic residues go. We managed to see how the inorganic residues can be further categorized in order to get the most out of them - as well as keeping as many residues as possible out of landfills. They learned to classify plastic, paper, metal and general trash. Students were interested to see that there are so many ways in which we can recycle materials that they thought waste to give them a second life. Finally, students realized that there are other types of collectors around our school, where more specific

residues can be discarded. They saw where they could bring old technologic materials, old batteries, plastic caps and even saw the big plastic bottle collector in the parking lot. This activity was proposed taking into account Rochester School's institutional purpose of inspiring and educating students to take control of their lives with the world in mind. The purpose of this activity was to increase students' awareness of where our residues go, how we need to be conscious to generate the least amount of residues, and how we can sort out properly the ones we do generate in order to reduce our environmental impact. This activity helped second graders to learn a useful life lesson, promoting a sustainable learning environment. Students were engaged with the activity and enjoyed seeing new parts of their school and understanding how this everyday process works.

A wooden cutting board is the central focus, featuring several slices of grapefruit and a cluster of dark red cherries. In the foreground, a black bowl is filled with a salad of shredded chicken, green lettuce, sliced cucumbers, and a halved hard-boiled egg. The background is a soft-focus image of a tomato and a bowl of lentils.

YOU ARE WHAT YOU EAT

By: **María del Pilar Tunarroza Sierra**

Eating well has been one of the most difficult things to do lately. Everywhere we look around there's food with too much sugar, ultra processed or with genetic modifications (some benefit, some not) and every industry sells its food as the most delicious or nutritive. How can we know what to eat?

In Biology and Conservation class, students from 9th and 10th grade tried to answer this question. They started by learning about Macro and Micronutrients and where to find them in natural food. One of the macronutrients is Proteins. Students learned about the chemical composition of proteins, where to find them in food and how the body can produce some of them on its own.

Students read from books written by real medical doctors and started to understand how to change some of their eating habits to some that were more healthy. Erika Antolines, the school's nutritionist, gave a very interesting class about the importance of proteins for our wellbeing and asked a bunch of questions students had related to the effects of some food in their body.

After knowing the importance of physical health, students connected it to mental health and tried to find a balance between them in order to reach what we called at school: integral health.

They read the booklet "Definiendo la salud mental como un problema de salud pública: un nuevo rol de liderazgo para las profesiones que ayudan" by Dr. William Glasser, where they analyzed if they are close to being mentally healthy and how to improve their behavior and acting in order to feel better.

Students wanted to share this new knowledge with their family and they decided to cook a nice protein meal for them. They researched the most delicious recipes and chose the ones they thought their family would like. All students used sprouted lentils, grown in the classroom as the main protein taking into account their high nutritional value and the novelty of this food for them.

During dinner students thank their parents for always cooking for them and being aware of their health as part of the virtue of Kindness as Service. While they eat, they tell them interesting facts about proteins and pass quality time together. Students wrote a booklet themselves collecting all the information that was important for them. We leave you here with some examples of a Booklet from 10th grade. You are welcome to try new recipes from them.

Enjoy!

PROTEIN TIMES

The magazine for your cooking and healthy needs

October 2023

MACROMOLESCULES

EVERYTHING ABOUT PROTEINS

WHAT ABOUT OUR HEALTH?

PROTEIN RECIPES

1

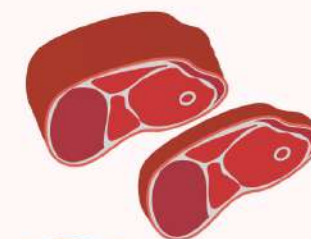
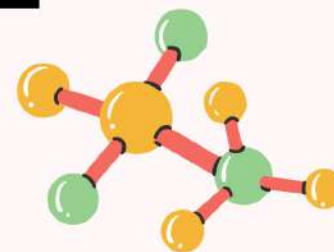
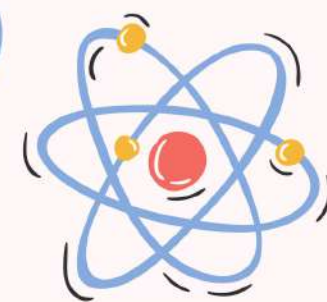
BY: Emiliano Abello

2

I N D E X

INTRODUCTION

Welcome to the first of many editions of the Protein times, this is a brief magazine which was created with the purpose to teach to people of all ages, in a simple but, in an engaging way. This magazine is based in the process of how our body creates protein and their benefits for each of us, taking into account the definition of Mental Health by William Glasser. Finally a homemade video recipe of sprout lentils germinated at home as well.



PROTEIN TIMES

EXAMPLES

Chapter 1: Macromolecules (Page 3 to 4)

A brief explanation of what macromolecules are where all the basic information of them is included. The complex and the complete research of this section would be coming soon!

Chapter 2: Everything about proteins (Page 5 to 14)

Understand what proteins are made up of, the process in which our body generates this complex molecule through a process called Protein synthesis, how to consume proteins correctly, and miscellaneous ways proteins are beneficial and their critical roles in our body.

Chapter 3: What about our health? (15 to 20)

Includes the complete but short definition of Mental Health, and ways to satisfy Mental, Emotional, Physical and Spiritual Health. As well as the association of Mental Health with protein and why we should not believe everything we see on social media with various examples used throughout the chapter.

Chapter 4: Protein recipes (21 to 23)

- Four different recipes that include a delicious well balanced meal to eat together with those special people for you as a symbol of gratefulness.
- A popular way to germinate lentils in order to create sprouts an awesome protein source meal.

Chapter 5: References (Page 24 to 25)

Chapter 6: Acknowledgments (Page 26)

Macromolecules

What are macromolecules and their structure?

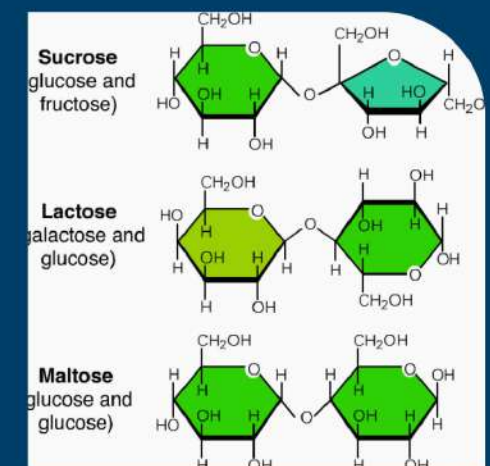
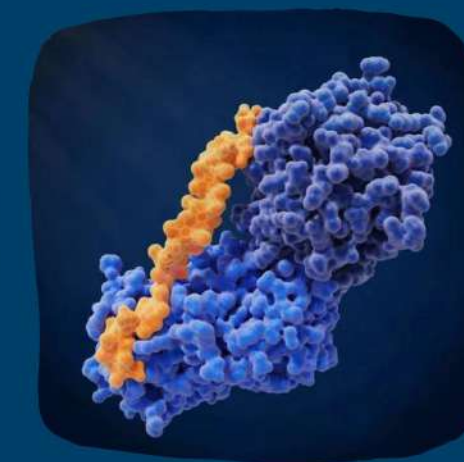
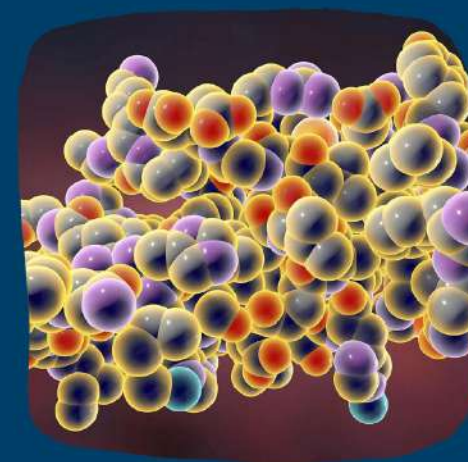
- Macromolecules are known for being a very large molecule built up from smaller chemical structures. Macromolecules are composed of thousands of covalently bonded atoms.
- One of the most common macromolecules in biochemistry are known as biopolymers (nucleic acids, proteins, and carbohydrates) and those large non-polymeric molecules such as lipids, nanogels and macrocycles.
- The 4 main components of macromolecules are proteins, carbohydrates, lipids, and nucleic acids.



Role of macromolecules in human body

- This gigantic molecules provides structural support, the ability to stock and retrieve/reclaim genetic information, and the capacity to speed biochemical reactions.

How does a macromolecule looks like?



Macromolecules

- What are macromolecules and their structure?
- Role of macromolecules in human body
- How does a macromolecule looks like?



EVERYTHING ABOUT PROTEINS

- Protein Synthesis
- Beneficial functions of protein
- How to consume proteins correctly
- Foods that contain protein

- Bad protein
- Mutations

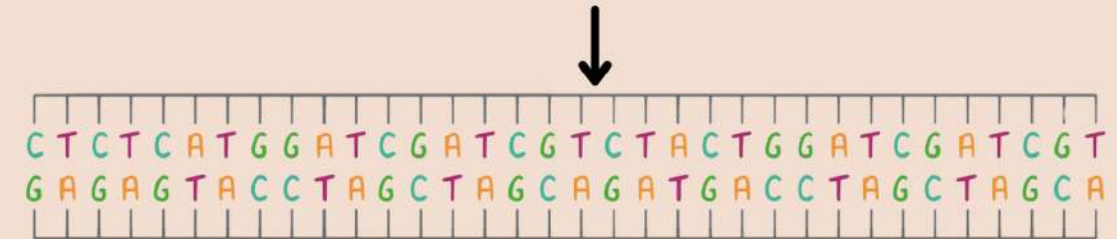
EVERYTHING ABOUT PROTEINS

Protein Synthesis

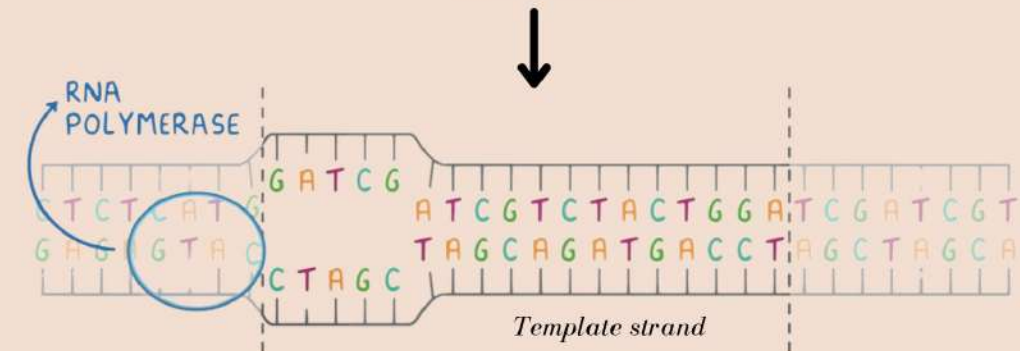
Protein synthesis is known as the process in which our body makes protein. This process is divided in 2 steps:



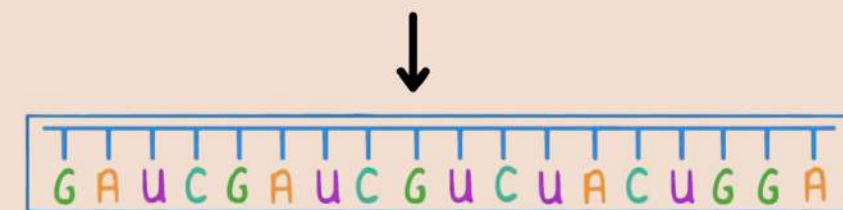
TRANSCRIPTION



The process starts with a start codon at the nucleus where we find the DNA, a double stranded gene with form of a twisted ladder. In DNA every triplet is called a codon.



Here the enzyme RNA polymerase binds to the DNA just before the gene copied later starts. This enzyme moves along the DNA template strand and reads each of the bases to make the mRNA strand, meaning mRNA's strand is complementary to one of the DNA's strand.



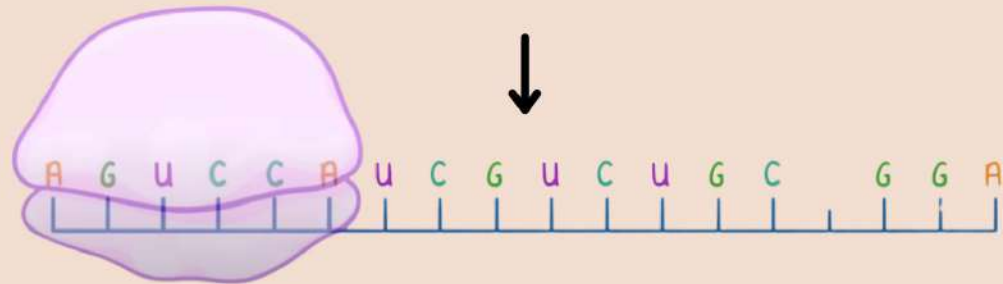
Once the enzyme detaches the DNA molecule that carries the genetic information. We all have left the mRNA strand (Messenger RNA), that is now free to leave the nucleus and goes ahead to the ribosomes to make the protein. And as in DNA every triplet in mRNA is called also a codon.

EVERYTHING ABOUT PROTEINS

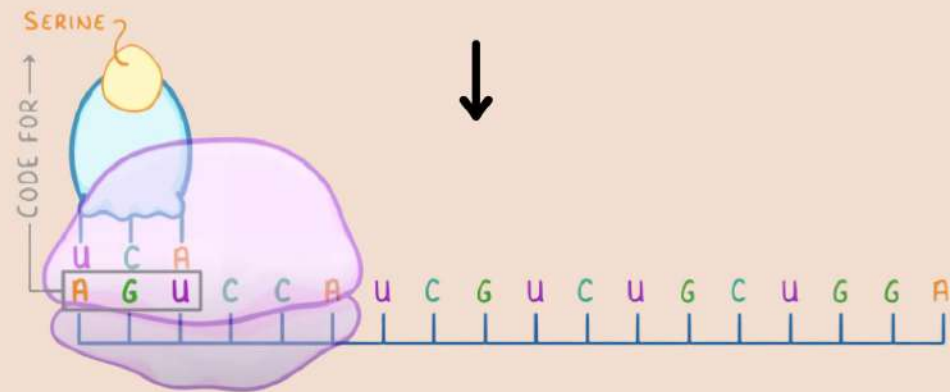
Protein Synthesis

TANSLATION

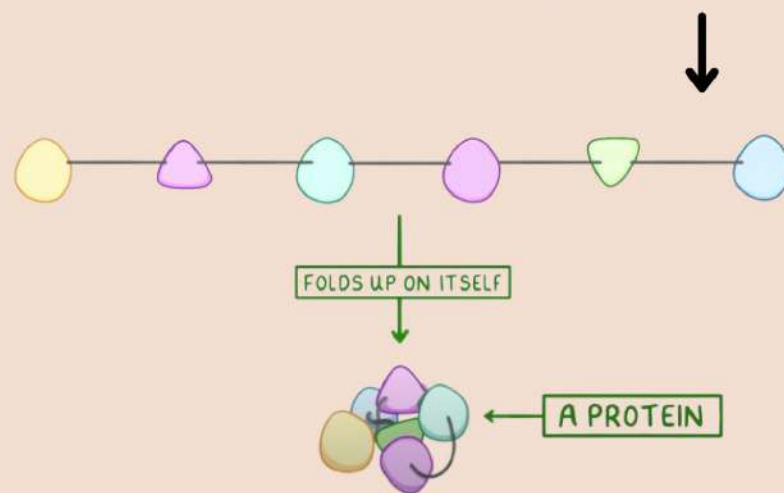
Initiation, Elongation, and Termination



The mRNA strand binds together with the ribosome



Here a molecule called tRNA (transfer RNA) comes to the ribosomes to continue the process of making protein. tRNA have an amino acid at the top and an anticodon at the bottom. As in the picture the codon of mRNA codes for the amino acid the tRNA carries. This anticodon from the tRNA is complementary to the codon of the mRNA. Once the tRNA leaves it leaves the amino acid, and a polypeptide chain is created, (chain of amino acids).



Once the chain of amino acids is completed it detaches from ribosome. Then the chain folds up on it self to form an specific protein. Here the process of protein synthesis finishes.

EVERYTHING ABOUT PROTEINS

Beneficial functions of protein in our body

Protein is a molecule that has many nutrients and components that are beneficial for our health. Its process of creation was explained in previos pages were we describe accurately and in a simple was Protein Synthesis. Now its turn to identify the different beneficial functions of proteins!

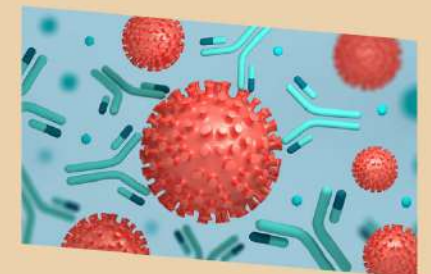
Maintain Homeostasis

- Regulate cell process
- Transmit signals like some hormones
- Coordinate processes between cells
- Transport and store atoms as well as small molecules
- Maintains pH and fluid balance
- Transports and stores nutrients like oxygen



Acts as enzymes and help fight disease

- Function as catalysts in living things
- Proteins called antibodies protect the body by binding to viruses, bacteria, and other foreign particles
- Keeps the immune system strong



Form structures in our body

- Support and protect cells
- Maintain cell shape
- Form bone, muscle and other structures
- Keratin is a structural protein
- Helps repair and build body tissue
- Gives energy to our body

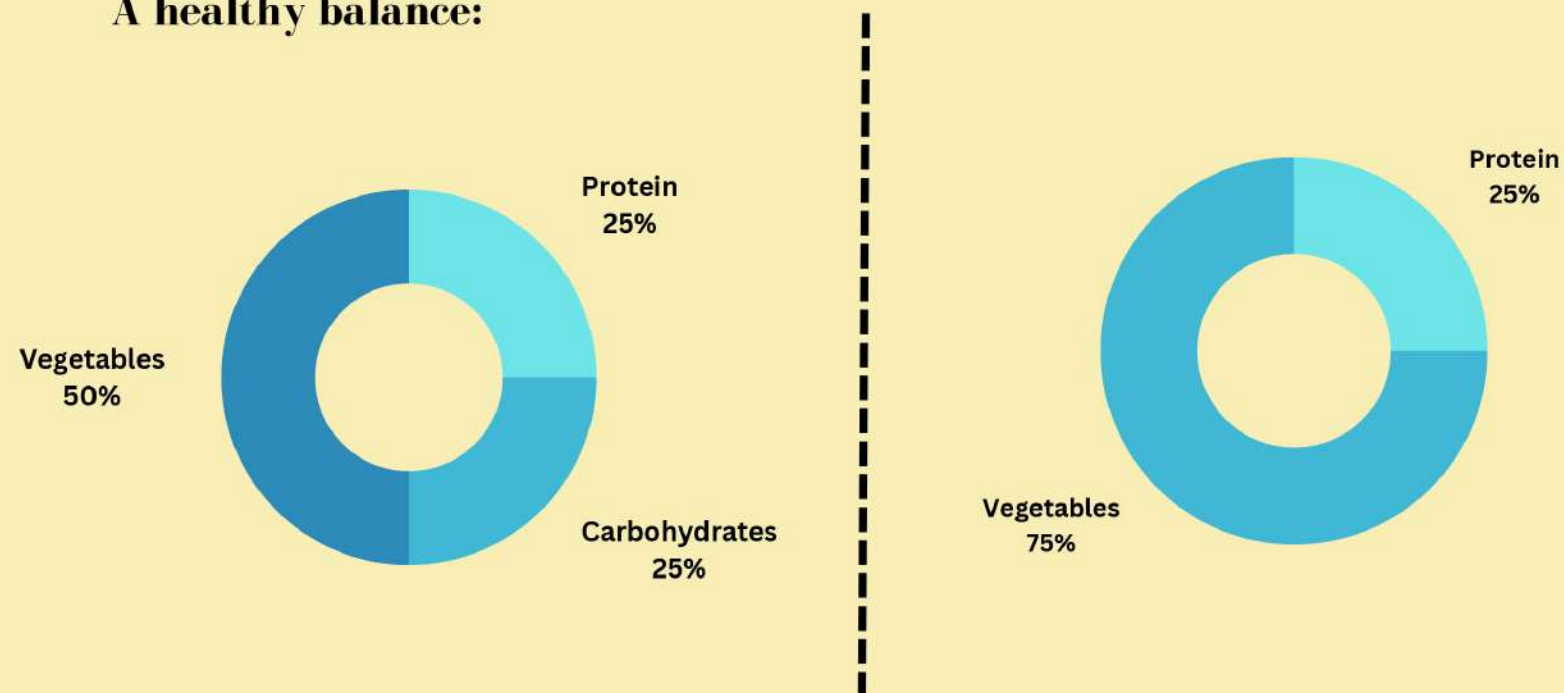


EVERYTHING ABOUT PROTEINS

How to consume proteins correctly

There is always a balance in the excess and lack of things, just as the case of proteins. Every meal we consume throughout the day must include a least a source of protein that give us energy. But how can we structure our meal in order to eat healthy and well balanced?

A healthy balance:



- Portions are not the same for people with different body, heights, etc.
- By eating too much protein you can get a condition called Amyloidosis, which affects the heart, kidneys, liver, spleen, nervous system, stomach and/or the intestines.
- In the other hand by not eating protein and a great quantity of carbohydrates you can develop some diseases called Kwashiorkor and marasmus.

EVERYTHING ABOUT PROTEINS

Foods that contain protein

Lots of food nowadays contain high amount of proteins, and many of them are unlikely to be known for that reason. In this page you will observe many of these foods that contain healthy protein and you can include in your next meal!

Lean meats:

- Beef
- Lamb
- Veal
- Pork
- Kangaroo

Legumes and beans

- All beans
- Lentils
- Chickpeas
- Split peas
- Tofu

Poultry:

- Chicken
- Turkey
- Duck
- Emu
- Goose
- Bush birds

Nuts and seeds:

- Almonds
- Pine nuts
- Walnuts
- Macadamias
- Hazelnuts
- Cashews
- Pumpkin seeds
- Sesame seeds
- Sunflower seeds

Fish and seafood:

- Fish
- Prawns
- Crab
- Lobster
- Mussels
- Oysters
- Scallops
- Clams eggs

Home products:

- Milk
- Yoghurt
- Cheese

EVERYTHING ABOUT PROTEINS

Bad protein

There are also some foods that are considered bad protein. All of these foods have something in common and is that they are unhealthy for us and can cause many dangerous diseases. As a recommendation avoid consuming the following foods:

Protein Powder and processed meats:

- Many people that develop exercise such as fitness enthusiast or also known as “gym-rats” use to eat a lot of this powder in order to increase their muscle. However there are some powder proteins that have more amount of calories than the real amount of protein, so we should not even consider them protein. Some processed meats such as bacon, hot dogs, sausages, and cold cuts must be avoided because as protein powder their fats are higher than the levels of protein causing as a result of consumption indigestion and some heat diseases.



Gluten:

It is known as a component that abounds in wheat fields and it is composed of glutenins and gliadins. This food is considered unhealthy because it is hard to digest. Some people sensitive to gluten tend to trigger a series of responses in defense against that molecule: (respiratory, mental and emotional disease, as well as anxious and depression). Gluten is found in mostly all foods that contain wheat.



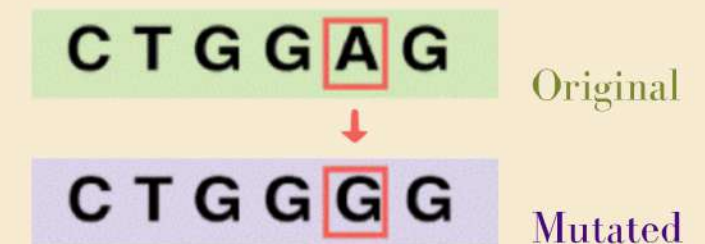
EVERYTHING ABOUT PROTEINS

Mutations

You might hear about different human and animal mutations that some of them are likely to be fake news but some people still believe in them. Nevertheless a mutation that does really exist is the protein mutation. A change in the DNA sequence of a gene is determined as a mutation. Some of these mutations can change the shape of a protein, affect the function of the protein, and affect the trait that is seen. There are three types of mutations: Substitution, Insertion, and Deletion. And these mutations can either have beneficial, harmful, and/or neutral effects in our body.

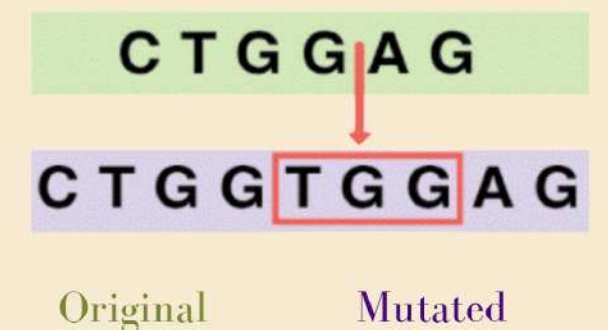
Substitution

- Change in type of amino acids
- Occurs when a base in the DNA sequence is replaced by a different base
- In substitution the amino acid may be the same as the original amino acid or it may be different



Insertion

- Occurs when one or more bases (codons) are added to the DNA sequence
- They may add extra amino acids in a protein, that changes the protein
- Insertion may change all the amino acids that follow the mutation



EVERYTHING ABOUT PROTEINS

Deletion

- Caused by the loss of one or more bases
- Deletion may remove amino acids in a protein
- May change all the amino acids that follow the mutation



EFFECTS OF MUTATION

Beneficial Effects

- Mutations might help organisms live and survive
- Lactose tolerance helps humans break down the sugar in milk into molecules that can be used as a source of energy

Harmful Effects

- Damaging change to an organism
- The red blood cell protein called hemoglobin, has a mutation that decreases a person's ability to carry oxygen
- Mutations may affect an organism survival, such as a change in the color of the skin

Neutral Effects

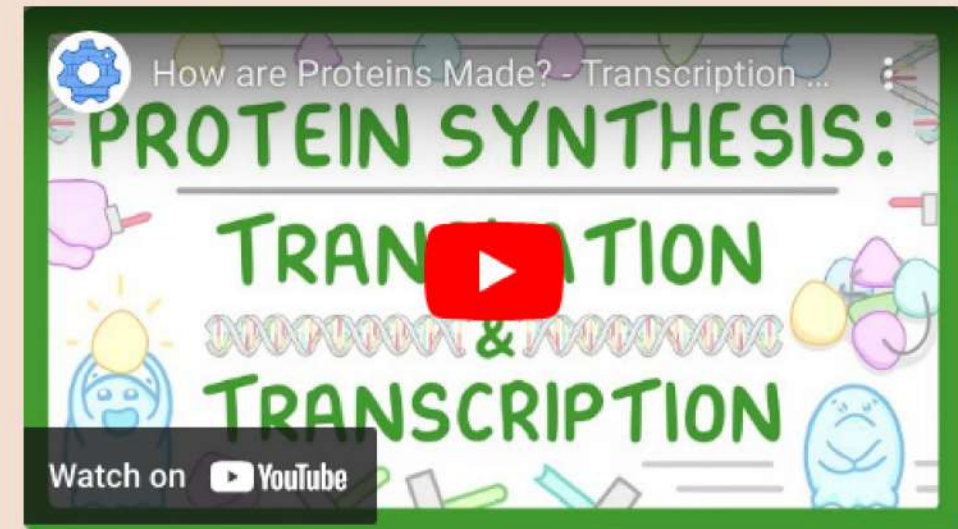
- There are not beneficial or harmful to any organism
- Such as a difference in eye color in a cat, it doesn't affect its function in any way neither its trait



EVERYTHING ABOUT PROTEINS

If you want a more detailed explanation of the topics previously explained in the section of EVERYTHING ABOUT PROTEINS feel free to watch the videos exposed below!

PROTEIN SYNTHESIS



FUNCTIONS OF PROTEINS IN THE BODY





WHAT ABOUT OUR HEALTH?

- Summary about chapter three
- What is mental Health?
- How to be healthy mentally, physically and spiritually?
- Advises and family relationships to be healthy
- Mental health and protein
- Should we believe everything we see on social media?



WHAT ABOUT OUR HEALTH?



Summary

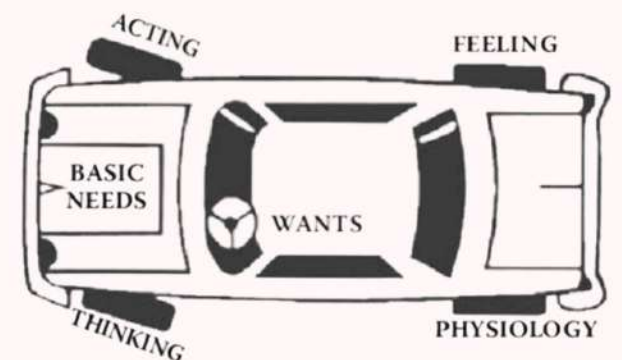
in these chapter you will observe and know about in a simple but effective and engaging way what is Mental Health according to Dr. William Glasser, some key concepts and factors associated with Mental Health, and some advises to be healthy and taking into account family relationships. Finally, the relationship protein and mental health and their influence in our body and the evaluation of the risks of believing everything we see on social media.



What is mental health?

This concept could be consideres as the ability to feel stable and in a balance with your life, by being mentally well-being. This complex theme takes into consideration our emotional, psychological, and social well-being. Meaning it affects how we feel, think and act in every situation. Mental Health is important in EVERY stage in our life because it certainly determines how we handle stress, how we relate to others, and make healthy choices, etc. By not caring about menta health and not handling stress as it should be expected, people can develop diseases that can be harmful and prejudicial for our lives, so them that not even our immune system and the antibodies our protein develop to help fight bacteria can't eliminate if first you aren't stable mentally.

Here in the total behavior car, we can only manage hoy we think and act but those feelings and phycology are not controllable.



WHAT ABOUT OUR HEALTH?

How to be healthy mentally, physically and spiritually?

In order for being healthy mentally, physically, and spiritually each of us practice and develop some activities we like and enjoy doing with company of other people that transmit positive emotions or alone. Here the 5 basics needs play a key role in our lives, where they are beneficial for us because as we practice them we become healthier mentally, physically, and spiritually. However there is need to be a balance between wants and needs. The 5 basic needs are: Love & Belonging, Power, Fun, Survival, and Freedom. Observe the diagram below to understand how to satisfy each of the 5 basics needs in order for us to me mentally, physically and spiritually healthy.



Love & Belonging

- Belonging
- Being loved
- Being respected
- Friendship
- Sharing
- Cooperation

Power

- Recognition
- Success
- Importance
- Achievement
- Skills

Fun

- Enjoyment
- Laughter
- Learning
- Change

Survival

- Health
- Relaxation
- Sexual activity
- Food
- Warmth

Freedom

- Choices
- Independence
- Freedom from
- Freedom to



WHAT ABOUT OUR HEALTH?

Advices to be healthy

Before eating anything just take a moment to remember how is that you are going to consume beneficial for your health. What we eat really influences all of our body and has either beneficial, harmful or neutral effects to it as explained in the previous chapter. As a teenager take advantage of all your capacities to be conscious of what you consume, and the daily exercise activity you perform in order to achieve those goals that seem far buy they aren't with dedication and effort.



Family and friend relationships to be healthy

In the teenage stage in our life is a stage in we direct us to what we wan to become in the future by making lots of decision, however there are certain people in which we must trust the more. Those people are our family. Had your heard the term ex-sister, or ex-father, or ex-mother? No, because that term does not exist, the family stays there from the very beginning of life until the end of everything, so you must worry about you and your family under everything because that is the base of all your emotions and the way you feel each day even before you wake up. So your family relations do matter and play a key role in your life of being healthy, since they are the primary factor that contribute to your 5 basic needs. In the other hand friends to influence in you health a lot but not at much as your family. So appreciate them all because when you loose someone you will feel bad for the rest of your life repenting on what you did.

WHAT ABOUT OUR HEALTH?

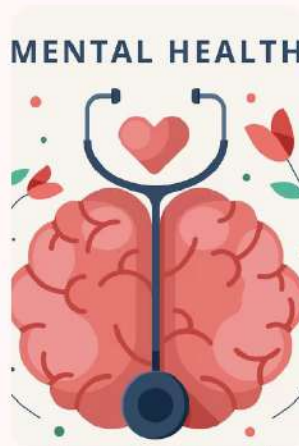
Mental health and protein

There are many ways in which we can associate this two complex concepts, but we are just going to mention three most likely to be common cases in society nowadays.

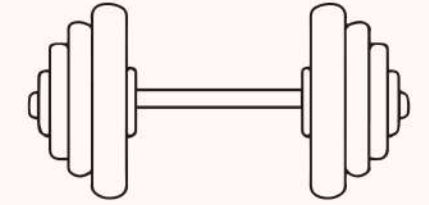
- As a result of a bad nutrition were their is no a healthy balance between and in meals, many people look either skinny or fat. As a consequences of their looks they may also decay mentally causing lots of mental issues like some type of depression.
- The same occurs otherwise when people decay mentally because any reason and develop any mental disease they are more propense to eat a lot o not to eat anything. This being very dangerous to our health and unfortunately in the worst cases generating another disease in the human body.
- When people do not eat the correct amount of protein they tend to not receive the correct amount of nutrients and components the body need to build up cells and structures on it. It also affects your mental, emotional, physical, and spiritual health, (integral health) by making you feel wimpy, in order works weaker as time passes.

Note:

“Foods rich in protein contain amino acids to help produce key neurotransmitters in preventing and treating depression and anxiety”
according to Mental Health Connecticut



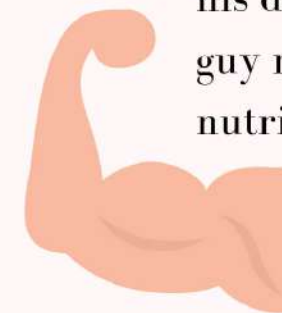
WHAT ABOUT OUR HEALTH?



Should we believe everything we see on social media?

We should never believe in everything we see in social media, in these days many artificial intelligence and app editors have been developed that are used by many people to inform make news and non-real posted thing on the different media. Some of this things include some diets not tested and certified by doctors or experts that assure that do work correctly. Many people follow thing unhealthy diets in order for build up faster muscle or for any of their need but what they don't really know is that they are actually doing damage to their own body. This things occur frequently in people from all ages. Read the example given below:

- Some guy is trying to lose weight, but he goes to the gym more than twice a week and thinks that the actual problem is the way and the quantity he is eating even though his personal nutritionist gave him the diet he must follow. As a result the guy starts to look up in *Instagram* and other social media fro diets to loose weight rapidly. For misfortune he found a diet that include just protein without any carbohydrates and very low amounts of vegetables. He starts to follow the new diet and one week later the guy starts feeling weak and is diagnosed with Osteoporosis, a disease that generates exaggerated fragility of the bones. By this moment the guy regrets completely of his decision and now is weak mentally as well. Around a year later the guy recover with help of certificated professionals and his expert nutritionist.



RECIPES

Summary of all recipes:

In all the three “draft” recipes in this section include germinated lentil sprouts, known for being a very well source of protein combined by thousands of ways in order to have a delicious meal. The three meals below include the basic steps to how to make them if some day you feel motivated to eat delicious and healthy.

PROTEIN RECIPES

- Three recipes that include homemade germinated lentil sprout
- My recipe using germinated lentil sprouts and how to germinate lentils

Ingredients

- 2 cups green lentils (rinsed)
- 6 cups water (to soak)
- 1 onion (chopped)
- 2 tomatoes (chopped)
- 1 tsp. garam masala powder
- red chili powder (as per taste)
- 1 Tbsp. turmeric powder
- 1 tsp. amchur (✓ Mango Powder)
- 1/2 tsp. cumin powder (Roasted)
- salt
- 1 lemon juice
- 1/2 tsp. chaat masala
- cilantro (to Garnish, optional)

SPROUTED GREEN LENTILS CHAAT

THIS THAT AND MORE

13 Ingredients | 3 Days | 380 Calories

[Add to Meal Planner](#)



Spicy Sprouted Lentils

19 Ingredients | 3 Days | 310 Calories

[Add to Meal Planner](#)



Ingredients

- cooked corn
- lemon juice
- olive oil
- salt
- cumin
- chili powder
- curry powder
- thyme
- herb
- 1 cup green lentils
- 3 cups water
- 1/4 cup cooked corn
- 3 Tbsp. lemon juice
- 2 Tbsp. olive oil
- 1 tsp. salt
- 1/2 tsp. cumin
- 1/2 tsp. chili powder
- 1/2 tsp. curry powder
- 1/4 cup thyme

Ingredients

- 1 Tbsp. coconut oil
- 1 yellow onion (finely chopped)
- 3 cloves garlic (minced)
- 1 Tbsp. fresh grated ginger
- 1 Tbsp. curry powder
- 15 oz. crushed tomatoes
- 14 oz. coconut milk
- 15 oz. lentils (drained and rinsed)
- 4 cups fresh spinach (chopped packed)
- chopped fresh cilantro (Optional garnish)

Indian Coconut Lentil Curry

EVERYDAY EASY EATS

★★★★★ (13)

Anik De Groof: "Very yummy. I used a combination of curry paste a..." [Read More](#)

10 Ingredients | 30 Minutes

[Add to Meal Planner](#)



MY RECIPE

What are lentil sprouts and how to germinate them?

Lentil sprouts are lentils that have been soaked in water and left out in the sun for around 3 to 6 days until they germinate correctly. These legumes can be consumed raw or cooked since both ways are completely safe and healthy to eat. When sprouted lentils go through germination, they break down some nutrients making them easier to digest since all legumes including lentils by themselves can be difficult to digest. Lentil sprouts are high in protein concentration. There are many popular traditional dishes throughout all the world where germinated lentil sprouts are included, just as the three example recipes demonstrated above.

Lentils can be germinated in 5 steps:

- **First step:** Pour dry lentils into a medium sized glass container. Fill the container with water: per each cup of lentils use 3 cups of water.
- **Second step:** Drain the water out of the container and leave the lentils in there.
- **Third step:** Rinse the lentils every 12 hours (repeat the process) for 3 to 6 days until the legume germinates completely.
- **Fourth step:** Observe for the sprouts.
- **Fifth step:** Dry and store the sprouted lentils.

Scan the QR code to watch the video of the process of creating a delicious rich in protein meal including germinated lentil sprouts to my family as a way of gratitude for everything.



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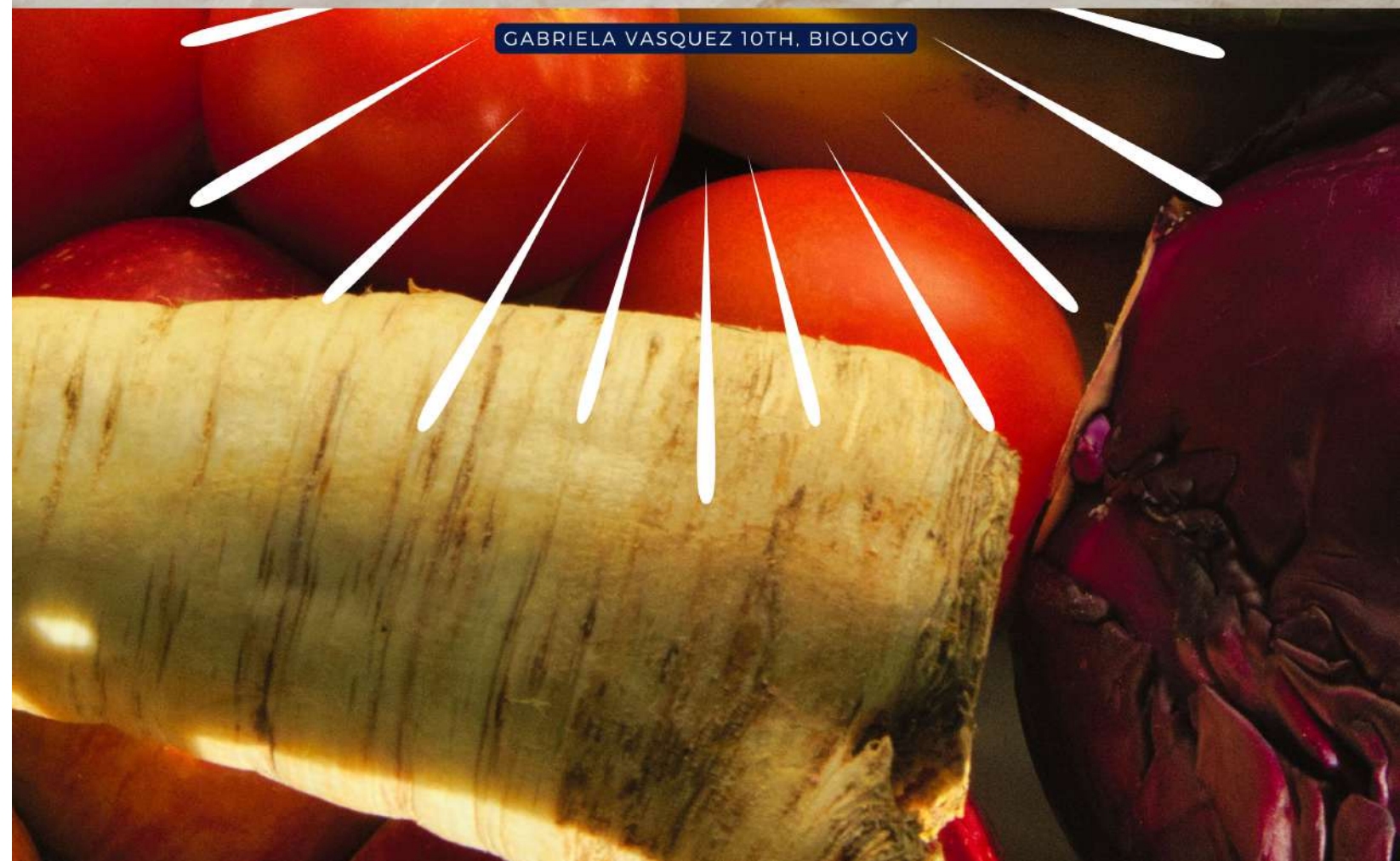
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GABRIELA VASQUEZ 10TH. BIOLOGY

YOUR PROTEIN BOOK

INDEX

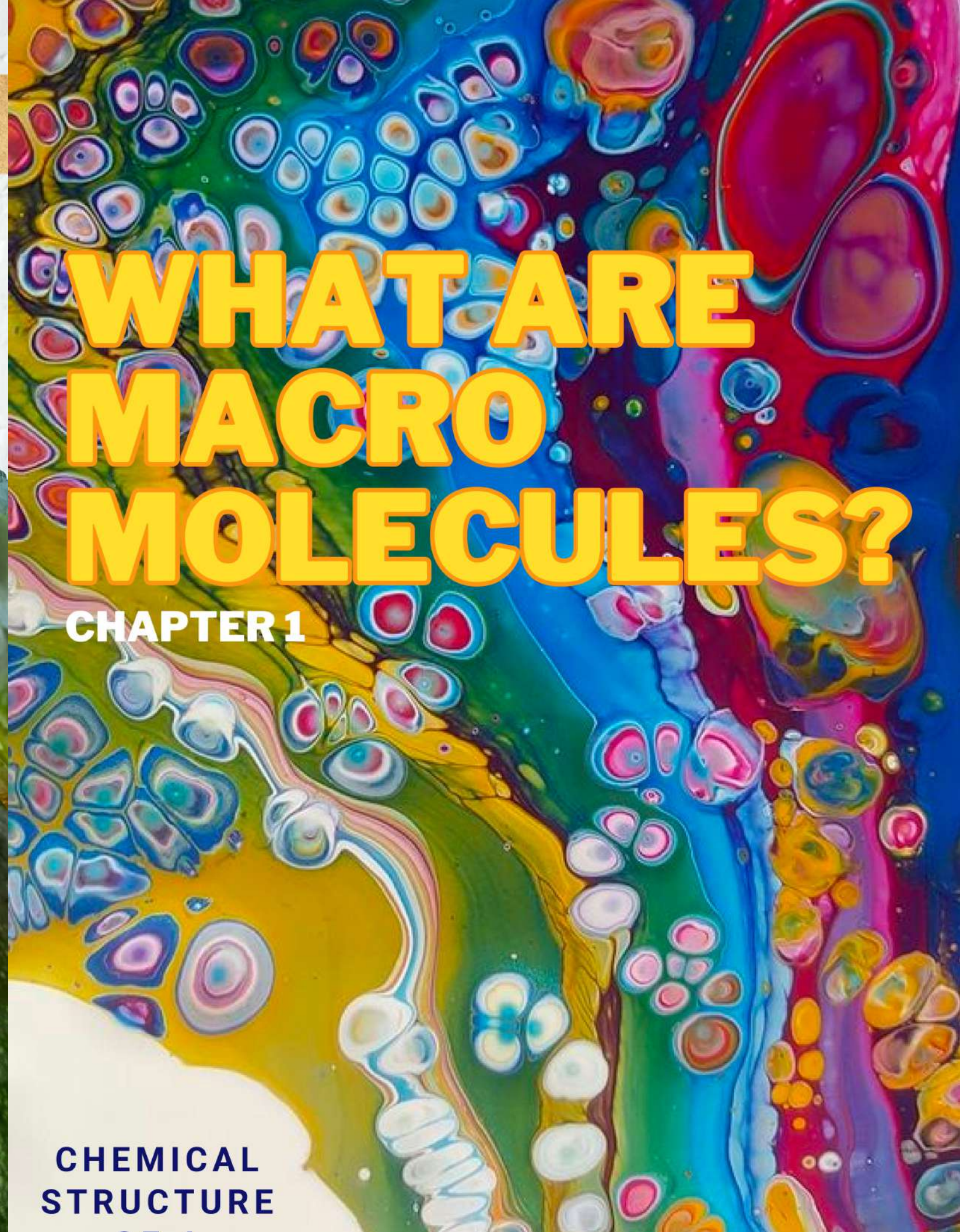
- Ch1: What are macromolecules?
- Ch2: How do my body obtain proteins?
- Ch3: What is being healthy?
- Ch4: Protein recipes



WHAT ARE MACRO MOLECULES?

CHAPTER 1

CHEMICAL
STRUCTURE



CHAPTER 1

Macromolecules are large and complex molecules made up of smaller subunits called monomers. These monomers are linked together through chemical bonds to form polymers, which are the macromolecules. Macromolecules play essential roles in various biological processes.

Proteins are one of the four major types of macromolecules found in living organisms. They are composed of amino acid monomers linked together in a specific sequence. Proteins serve numerous functions in the body, including structural support, enzymatic catalysis, transport of molecules, and regulation of cellular processes. Their diverse functions make proteins fundamental to the functioning of cells and organisms.

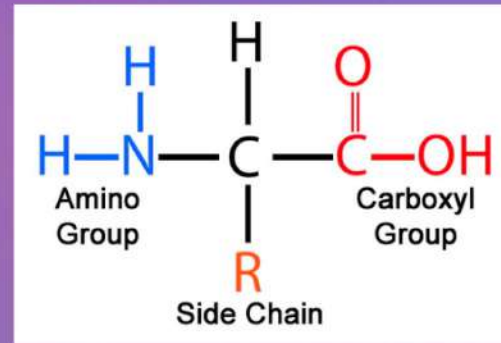


Chemical Structure Of a Protein?

is that edible...?

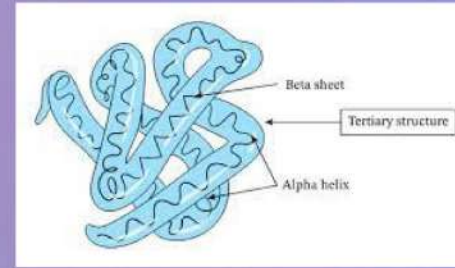
Amino Acids

- Amino acids are the building blocks of proteins.
- They consist of an amino group (-NH₂), a carboxyl group (-COOH), a hydrogen atom, and a side chain (R-group) attached to a central carbon atom.
- There are 20 different amino acids, each with a unique R-group, which gives proteins their diversity.



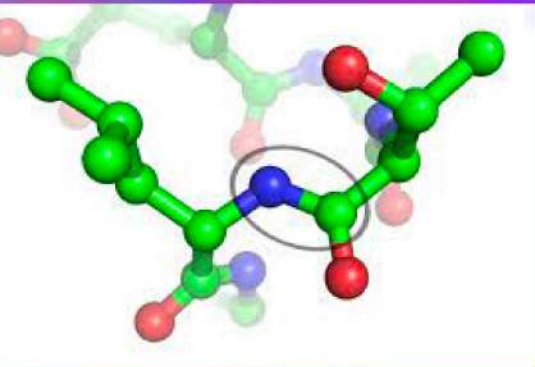
Tertiary Structure

- Tertiary structure is the overall three-dimensional shape of a single protein molecule.
- It results from interactions between amino acid side chains (R-groups), including hydrogen bonds, disulfide bonds, hydrophobic interactions, and electrostatic forces.



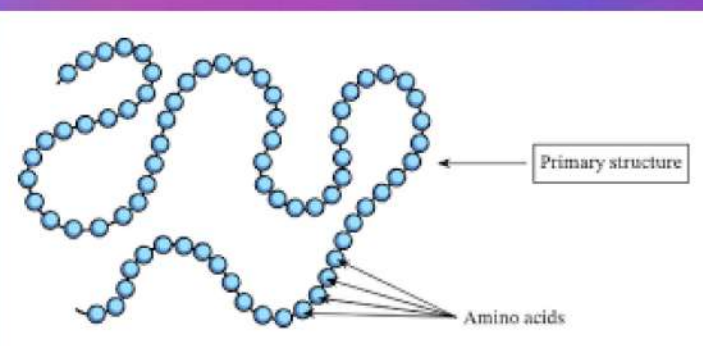
Peptide bonds

- Peptide bonds are strong covalent bonds that link amino acids together.
- They form through a dehydration synthesis reaction, where the carboxyl group of one amino acid bonds to the amino group of another amino acid, releasing a water molecule.



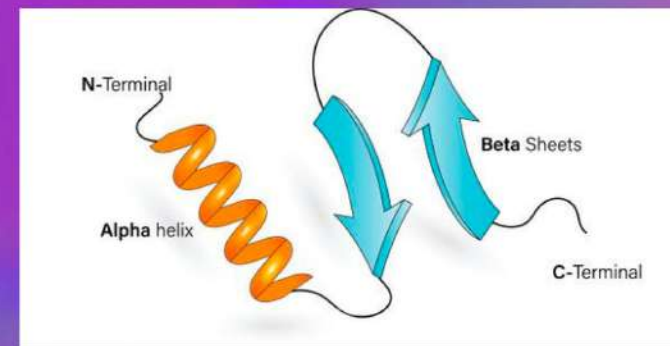
Primary Structure

- The primary structure of a protein is its specific sequence of amino acids in a linear chain.
- This sequence is determined by the genetic code.
- It is the foundation for all higher levels of protein structure.



Secondary structure

- Secondary structure refers to local folding patterns within a protein.
- Common secondary structures include alpha helices (spiral) and beta sheets (folded).
- These structures are stabilized by hydrogen bonds between amino acids.

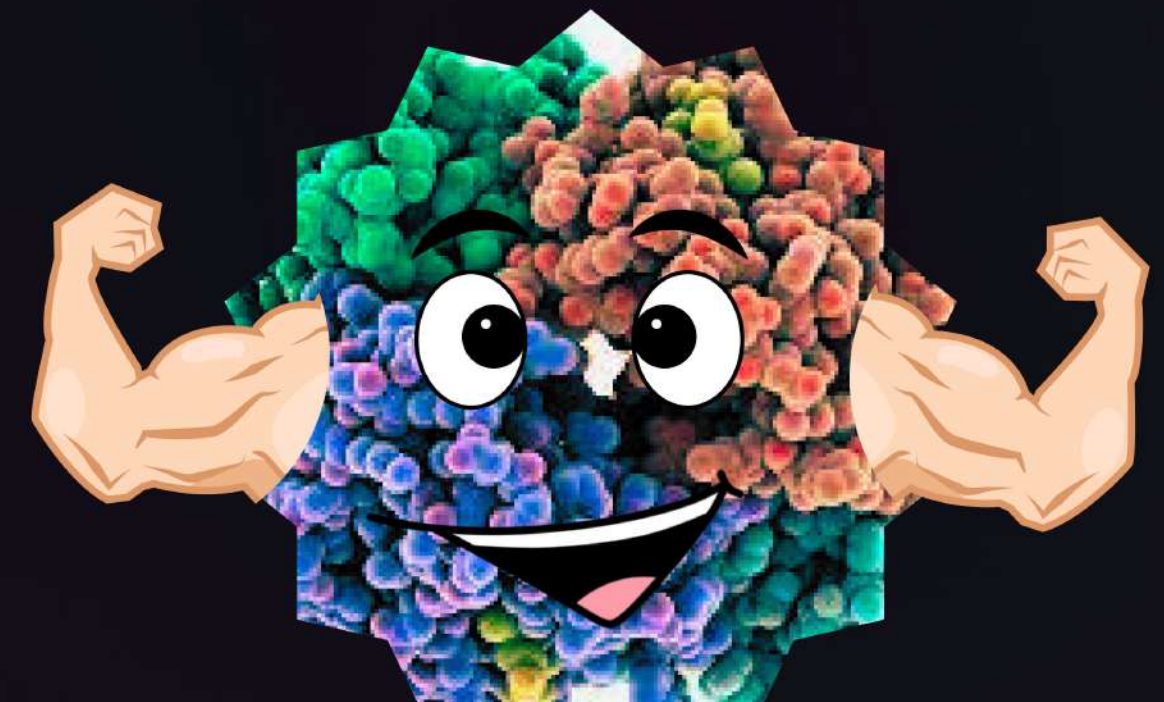


Quaternary Structure:

- Quaternary structure applies to proteins composed of multiple polypeptide chains (subunits).
- It describes the arrangement and interactions of these subunits.
- Hemoglobin, with its four subunits working together, is an example of a protein with quaternary structure.



**Our hero,
Protein!!!**



HOW DOES MY BODY

MY BODY



CHAPTER 2

OBTAIN PROTEIN?

OBTAINING PROTEINS

Protein Synthesis

The body can synthesize proteins from scratch using genetic information encoded in DNA.

This process, known as protein synthesis, occurs in every cell.

Cells transcribe DNA into RNA (transcription) and then translate RNA into proteins (translation) to build specific proteins as needed for various cellular functions.

Dietary Intake

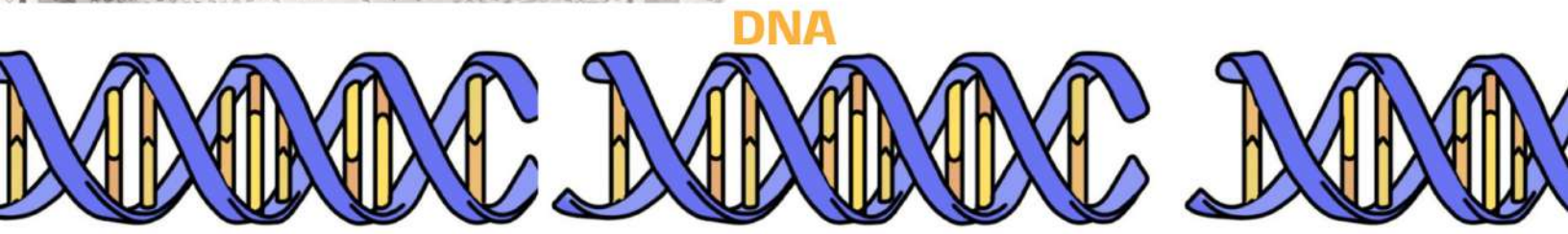
Proteins are also obtained through the diet by consuming protein-rich foods.

These dietary proteins are broken down during digestion into amino acids, which are absorbed into the bloodstream and used by cells for various purposes, including building new proteins for your body.

CHAPTER 2

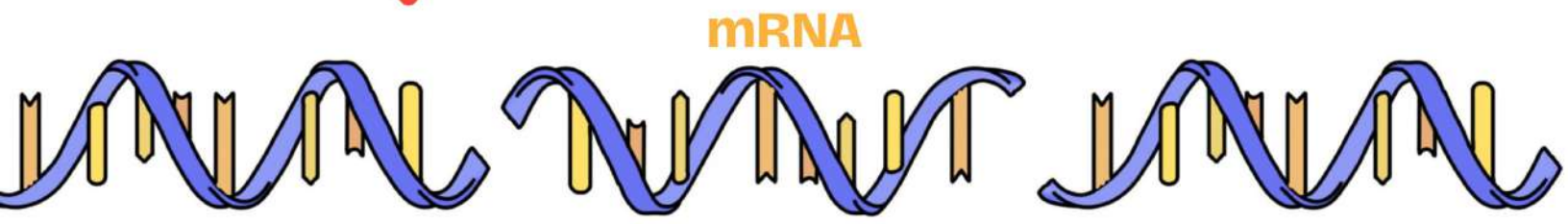
PROTEIN SYNTHESIS

cell



Transcription

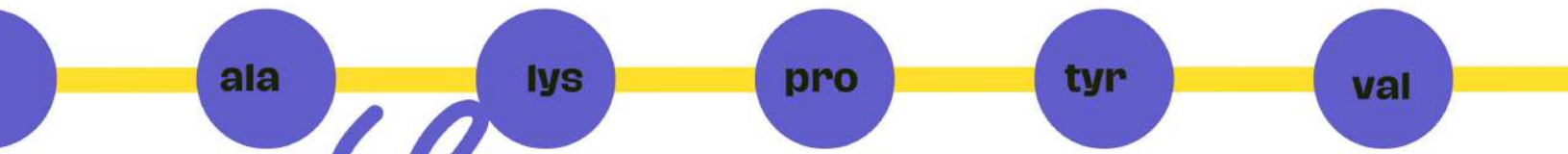
In the cell nucleus, the DNA serves as a template for creating messenger RNA (mRNA). During transcription, an enzyme called RNA polymerase reads the DNA code and synthesizes a complementary mRNA strand. This mRNA strand carries the genetic information for building a specific protein.



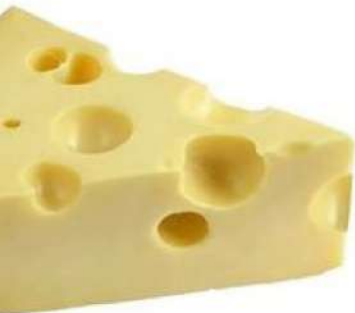
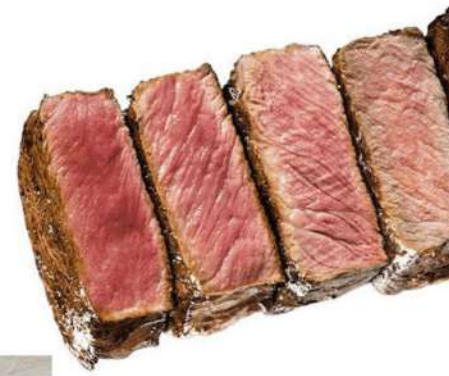
Translation

Translation takes place in the cell's cytoplasm. mRNA leaves the nucleus and attaches to ribosomes. Transfer RNA (tRNA) molecules bring the appropriate amino acids to the ribosome based on the codons (triplets of mRNA) read from the mRNA. The ribosome assembles these amino acids in the correct sequence to form a polypeptide chain, which then folds into a functional protein.

Protein



Types of Protein-Rich Foods



ANIMAL-BASED SOURCES:

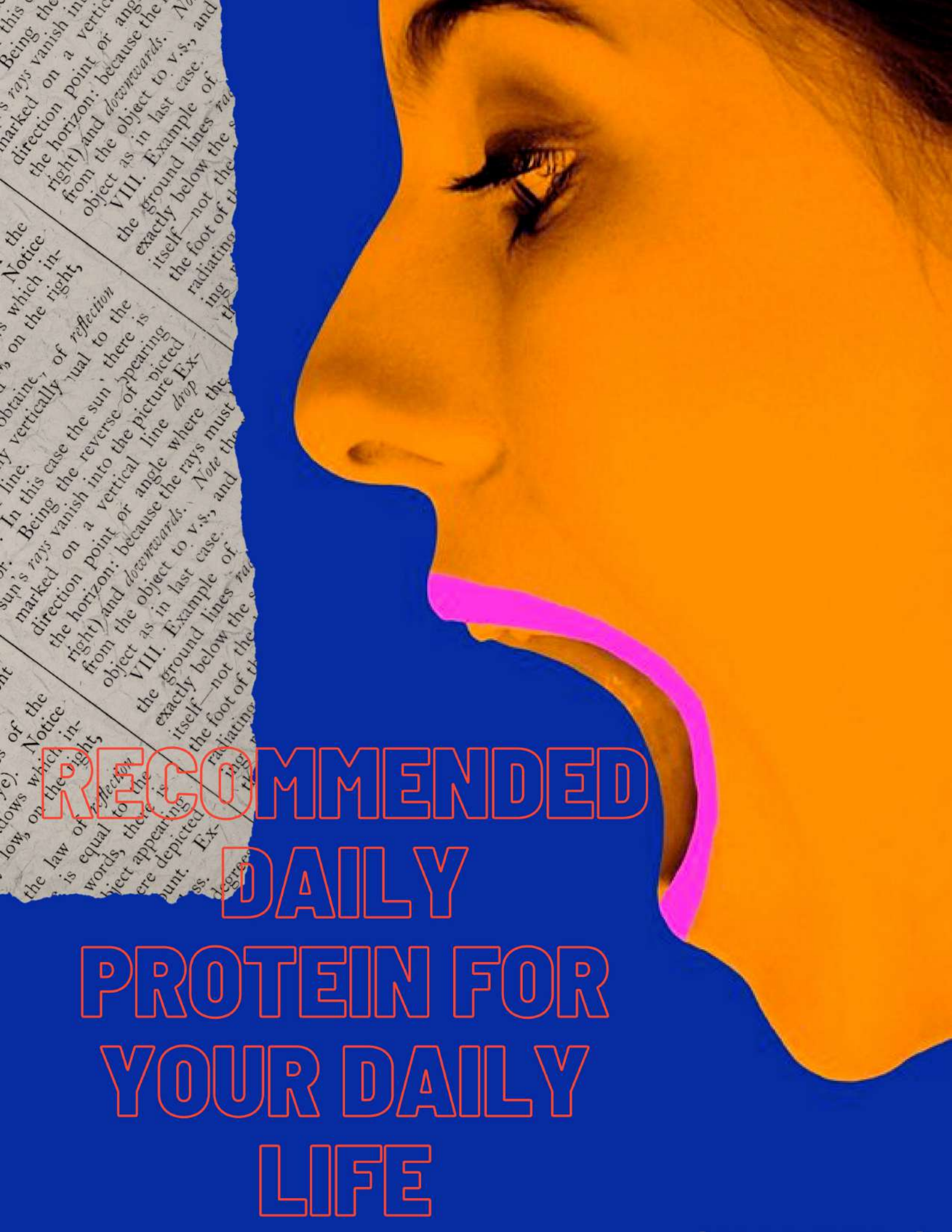
- MEATS (BEEF, CHICKEN, PORK)
- FISH (SALMON, TUNA, COD)
- DAIRY PRODUCTS (MILK, CHEESE, YOGURT)
- EGGS
- POULTRY (CHICKEN, TURKEY)



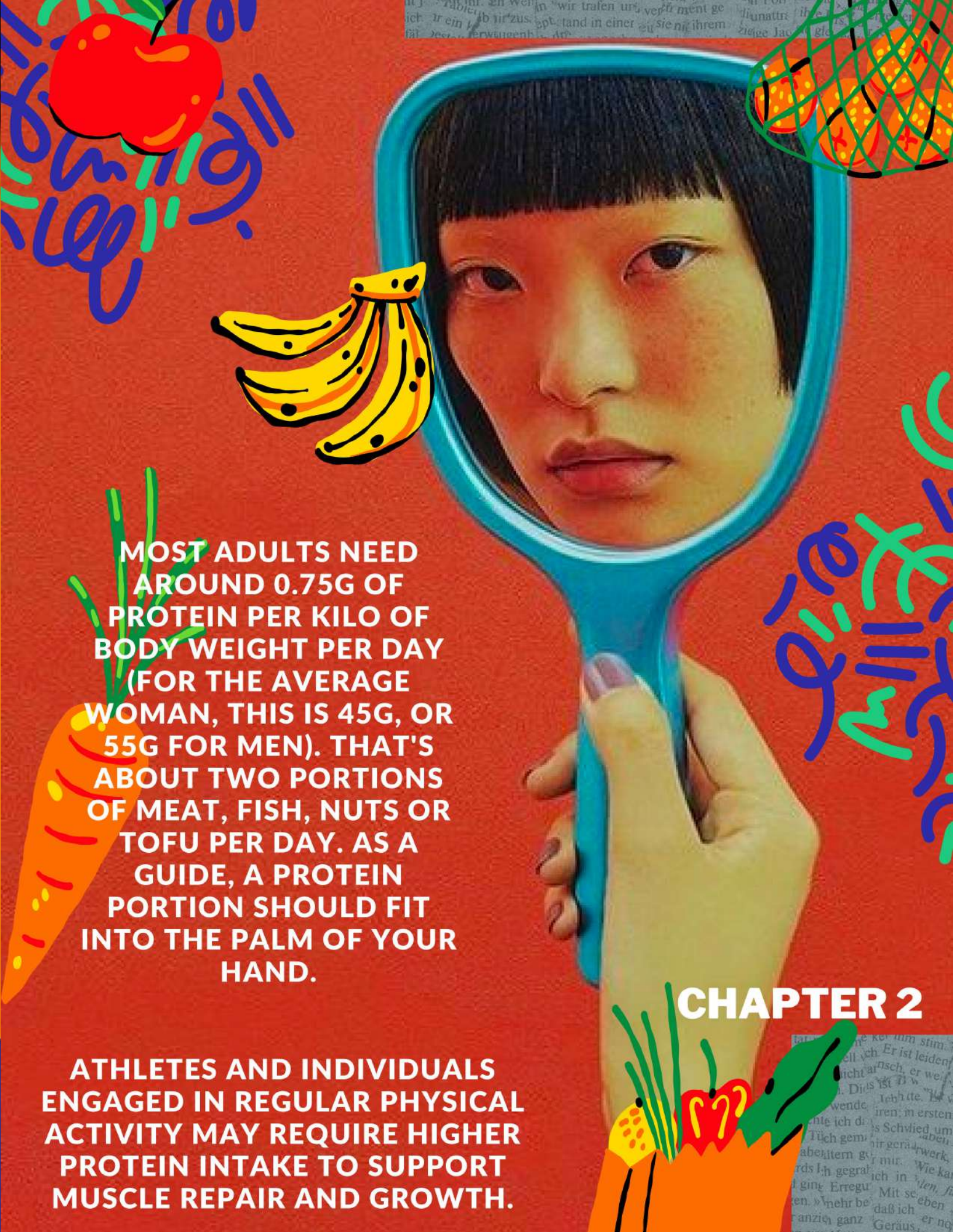
PLANT-BASED SOURCES:

- LEGUMES (BEANS, LENTILS, CHICKPEAS)
- NUTS (ALMONDS, PEANUTS, CASHEWS)
- SEEDS (CHIA SEEDS, FLAXSEEDS, PUMPKIN SEEDS)
- TOFU AND OTHER SOY PRODUCTS
- WHOLE GRAINS (QUINOA, BROWN RICE)





**RECOMMENDED
DAILY
PROTEIN FOR
YOUR DAILY
LIFE**



**MOST ADULTS NEED
AROUND 0.75G OF
PROTEIN PER KILO OF
BODY WEIGHT PER DAY
(FOR THE AVERAGE
WOMAN, THIS IS 45G, OR
55G FOR MEN). THAT'S
ABOUT TWO PORTIONS
OF MEAT, FISH, NUTS OR
TOFU PER DAY. AS A
GUIDE, A PROTEIN
PORTION SHOULD FIT
INTO THE PALM OF YOUR
HAND.**

**ATHLETES AND INDIVIDUALS
ENGAGED IN REGULAR PHYSICAL
ACTIVITY MAY REQUIRE HIGHER
PROTEIN INTAKE TO SUPPORT
MUSCLE REPAIR AND GROWTH.**

CHAPTER 2

IMPORTANCE OF BALANCED NUTRITION



CHAPTER 2

- PROTEIN IS ONE OF THE ESSENTIAL MACRONUTRIENTS, AND CONSUMING AN ADEQUATE AMOUNT IS CRUCIAL FOR OVERALL HEALTH.
- A BALANCED DIET INCLUDES A VARIETY OF FOODS FROM DIFFERENT FOOD GROUPS TO ENSURE ADEQUATE PROTEIN INTAKE ALONG WITH OTHER ESSENTIAL NUTRIENTS, VITAMINS, AND MINERALS.
- BALANCING PROTEIN INTAKE WITH CARBOHYDRATES, FATS, FIBER, VITAMINS, AND MINERALS HELPS MAINTAIN OVERALL HEALTH, SUPPORT BODILY FUNCTIONS, AND PREVENT DEFICIENCIES.



CHAPTER 2



SO...

What is being Healthy?

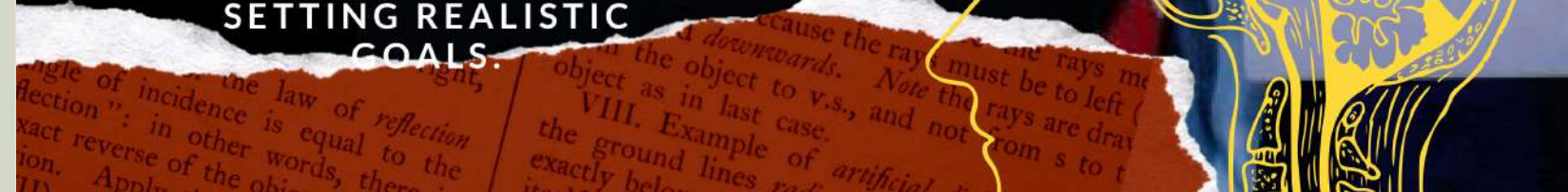
WITH WILLIAM GLASSER KNOWLEDGE

His perspective.

WILLIAM GLASSER, A PROMINENT PSYCHIATRIST, DEVELOPED A THEORY KNOWN AS REALITY THERAPY AND CHOICE THEORY. HE BELIEVED THAT MENTAL HEALTH IS ACHIEVED WHEN INDIVIDUALS MAKE CHOICES THAT LEAD TO FULFILLING AND SATISFYING LIVES.

ACCORDING TO GLASSER:

- MENTAL HEALTH IS ABOUT MAKING CHOICES THAT ALIGN WITH OUR BASIC PSYCHOLOGICAL NEEDS, SUCH AS LOVE AND BELONGING, POWER AND ACHIEVEMENT, FREEDOM AND INDEPENDENCE, AND FUN AND ENJOYMENT.
- BEING MENTALLY HEALTHY INVOLVES TAKING RESPONSIBILITY FOR OUR ACTIONS AND CHOICES, FOCUSING ON POSITIVE RELATIONSHIPS, AND SETTING REALISTIC GOALS.



WILLIAM GLASSER, M.D., SEES MENTAL, PHYSICAL, AND SPIRITUAL HEALTH AS VITAL ASPECTS OF AN INDIVIDUAL'S OVERALL WELL-BEING. HE EMPHASIZES DISTINGUISHING MENTAL HEALTH FROM MENTAL ILLNESS, DEFINING MENTAL HEALTH AS POSITIVE RELATIONSHIPS, HAPPINESS, AND A WILLINGNESS TO SUPPORT OTHERS. IT INVOLVES MINIMAL STRESS, LAUGHTER, CONSTRUCTIVE CONFLICT RESOLUTION, AND ACCEPTANCE OF DIFFERENCES. GLASSER ADVOCATES TEACHING PEOPLE TO IMPROVE MENTAL HEALTH WITHOUT LABELING THEM WITH UNNECESSARY MENTAL ILLNESSES OR PRESCRIBING DRUGS. HE VIEWS MAINTAINING MENTAL HEALTH AS A SIGNIFICANT PUBLIC HEALTH CHALLENGE AND SUGGESTS COLLABORATION BETWEEN INDIVIDUALS AND PROFESSIONALS, LIKE COUNSELORS AND PSYCHOLOGISTS, TO PROMOTE MENTAL WELL-BEING, CONTRIBUTING TO A HEALTHIER AND HAPPIER SOCIETY.



CHAPTER 3

BEING HEALTHY

1.

MENTAL HEALTH:

PRACTICE SELF-AWARENESS: UNDERSTAND YOUR EMOTIONS, THOUGHTS, AND FEELINGS.

SEEK PROFESSIONAL HELP WHEN NEEDED: DON'T HESITATE TO CONSULT A THERAPIST OR COUNSELOR IF YOU'RE FACING MENTAL HEALTH CHALLENGES.

BUILD A SUPPORT SYSTEM: MAINTAIN POSITIVE RELATIONSHIPS WITH FRIENDS AND FAMILY WHO PROVIDE EMOTIONAL SUPPORT.

DEVELOP COPING STRATEGIES: LEARN HOW TO MANAGE STRESS, PRACTICE MINDFULNESS, AND ENGAGE IN ACTIVITIES THAT BRING JOY.

1.

PHYSICAL HEALTH:

EXERCISE REGULARLY: INCORPORATE PHYSICAL ACTIVITY INTO YOUR DAILY ROUTINE TO PROMOTE CARDIOVASCULAR HEALTH, STRENGTH, AND FLEXIBILITY.

EAT A BALANCED DIET: CONSUME A VARIETY OF NUTRIENT-RICH FOODS TO MEET YOUR NUTRITIONAL NEEDS.

GET ENOUGH SLEEP: AIM FOR 7-9 HOURS OF QUALITY SLEEP PER NIGHT TO SUPPORT PHYSICAL AND MENTAL WELL-BEING.

REGULAR CHECK-UPS: VISIT HEALTHCARE PROFESSIONALS FOR PREVENTIVE CARE AND HEALTH SCREENINGS.

1.

SPIRITUAL HEALTH:

EXPLORE YOUR VALUES AND BELIEFS: REFLECT ON YOUR PURPOSE AND WHAT GIVES YOUR LIFE MEANING.

PRACTICE MINDFULNESS AND MEDITATION: THESE TECHNIQUES CAN HELP YOU CONNECT WITH YOUR INNER SELF AND FIND SPIRITUAL BALANCE.

ENGAGE IN ACTIVITIES THAT NOURISH YOUR SOUL: PURSUE HOBBIES, INTERESTS, OR PRACTICES THAT ALIGN WITH YOUR SPIRITUAL BELIEFS.



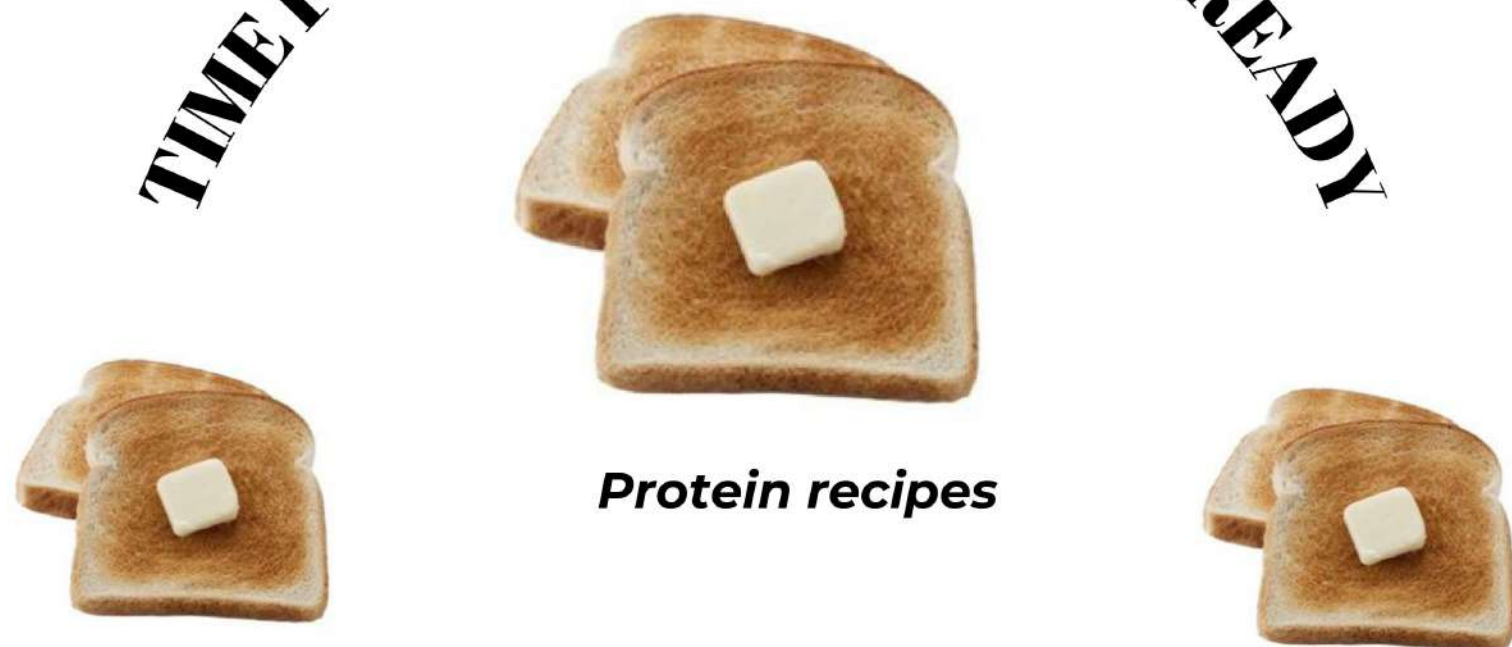
IMPORTANCE OF FAMILY AND RELATIONSHIPS:

1. HEALTHY RELATIONSHIPS WITH FAMILY AND FRIENDS ARE VITAL FOR EMOTIONAL SUPPORT AND WELL-BEING.
2. MAINTAINING STRONG CONNECTIONS CAN HELP REDUCE STRESS, INCREASE FEELINGS OF HAPPINESS, AND PROVIDE A SENSE OF BELONGING.

IMPACT OF SOCIAL MEDIA ON MENTAL HEALTH:

1. SOCIAL MEDIA CAN HAVE BOTH POSITIVE AND NEGATIVE EFFECTS ON MENTAL HEALTH.
2. IT CAN PROVIDE SOCIAL CONNECTIONS AND SUPPORT BUT MAY ALSO LEAD TO NEGATIVE CONSEQUENCES LIKE COMPARISON, CYBERBULLYING, AND EXCESSIVE SCREEN TIME.
3. IT'S ESSENTIAL TO USE SOCIAL MEDIA MINDFULLY, SET BOUNDARIES AND SEEK SUPPORT WHEN DEALING WITH ONLINE CHALLENGES.

TIME FOR COOKING, ARE YOU READY



Protein recipes


back to the horizon.
Note convergence of all lines of the
o.c.v. (centre of vision or eye). Notice
and direction of the shadows which in-
dicate that the sun is fairly low, on the right,
relative to the spectator.

from the object to
object as in last case.
VIII. Example of *artificial*
the ground lines radiate from a c




REFERENCES

info links



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Classroom, Glasser definitions on Health



Notebook notes



STUDENTS RECIPE VIDEOS





EXPLORING SPECTROPHOTOMETRIC METHODS

Ana María Campos and 12th Grade AP-Chemistry Students 2023

Exploring Spectrophotometric Methods, was an experience designed for 12th-grade AP-Chemistry students of Rochester School. This workshop aims to provide an in-depth exploration of spectroscopic methods in chemistry, offering hands-on experience and exposure to real research environments of a research laboratory, Universidad Javeriana, Facultad de Ciencias. Students were engaged with modern spectroscopy instruments, and exploring their applications in scientific research.

This workshop were designed as an immersive experience for AP-Chemistry students, igniting curiosity, and providing them with practical knowledge and exposure to the dynamic world of spectroscopy and its applications in research.

Why is this topic important for the course?

Spectrophotometry is a fascinating field of chemistry that involves the interaction of matter with electromagnetic radiation. Spectrophotometry is a branch of spectroscopy that involves measuring the intensity of light absorbed or transmitted by a substance as a function of wavelength. Introducing high school students to spectrophotometric methods can be both educational and applicable to various scientific disciplines.

Spectrophotometry is a versatile technique applicable in various scientific fields, promoting interdisciplinary learning and demonstrating the interconnectedness of different branches of science.

Workshop objectives.

Real Research Environment (Technology use, Inquiry thinking): By visiting the laboratory, students were exposed to a real research space. They observed ongoing projects, witness experiments, and interact with university students and professors. Engaging in the discussion session into the practical applications and challenges of using spectroscopy in real research scenarios.

Collaborative Learning (Relating virtuously): The workshop encourages teamwork and collaboration among students. Working together, they will conduct an experiment that starts in the AP-Chemistry class (Rochester School) and then use the spectroscopy (Universidad Javeriana) in order to interpret data, and engage in problem-solving activities related to chemistry analysis.

Networking and Discussions (Language Competence): Students had the chance to interact with university students and professors specializing in science and engineering fields. We were enjoying

conversations around career paths, academic pursuits, and the significance of spectroscopy in various fields.

Workshop Activities

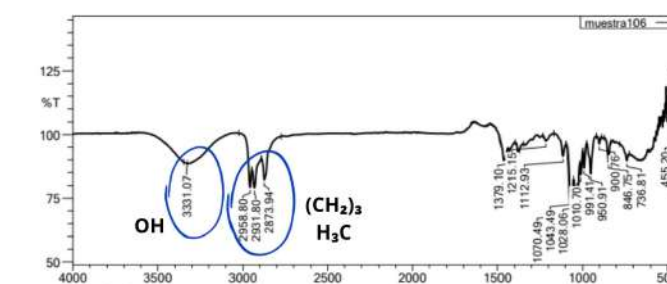
Introduction to Spectroscopy Techniques: The workshop will start with an introduction of various spectroscopic methods, including UV-Vis, IR spectroscopy, and X-Ray Diffraction. Students were engaging in spectral analysis, collecting and interpreting data using the equipment under the guidance of university researchers.

Hands-on Laboratory Experience: Students were actively involved in the university laboratory, where they will get the opportunity to see the instruments. Under the guidance of experienced professor Alejandro Perez (Universidad Javeriana) and faculty, they saw how spectral analysis is performed, collect data of some samples, and interpret results with the students.

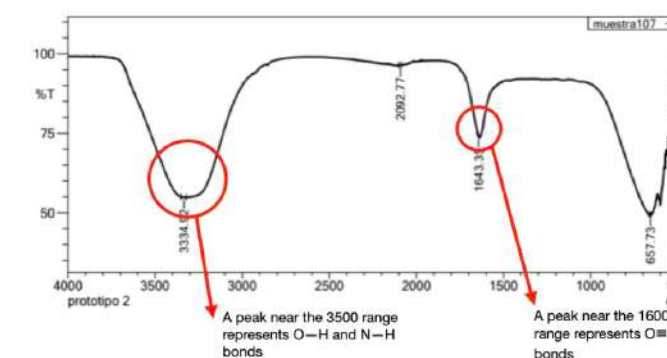
Collaborative Experimentation: Through collaborative activities, students were working in teams, conducting experiments and engaging in problem-solving tasks related to spectroscopy. This collaborative environment fosters critical thinking, teamwork, and analytical skills.

RESULTS

After the workshop during the AP-Chemistry class, students were talking about the topic, energy, chemical bonds and they were working with the IR-spectrums. They saw some signals corresponding to the chemical bonds vibrations with the IR energy.



Molecules have different vibration modes when they are exposed to the IR source of energy and as a result we can see this vibration in the spectrum. "The dancing of chemical bonds" one of the students says, what a beautiful expression for the IR-spectroscopy!

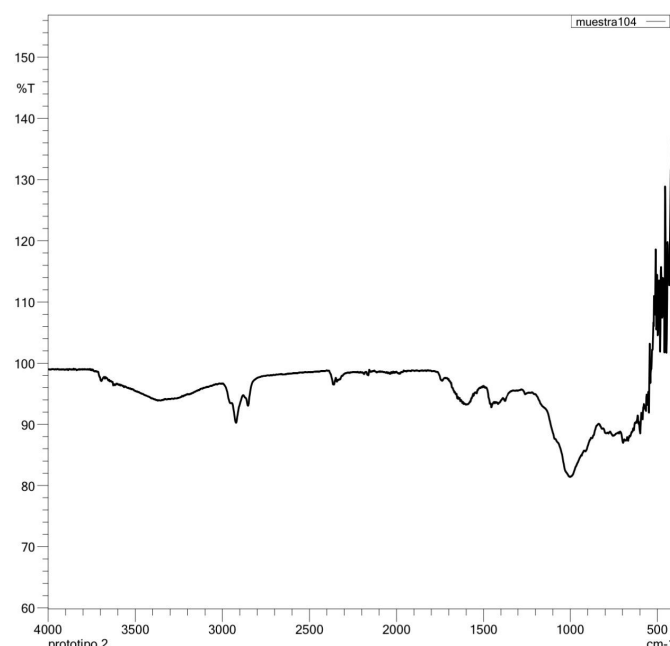


Finally the students tried to identify the chemical bonds in the samples assigned

during the workshop and did a summary about what they learned.

1. Analysis IR of Butanol:

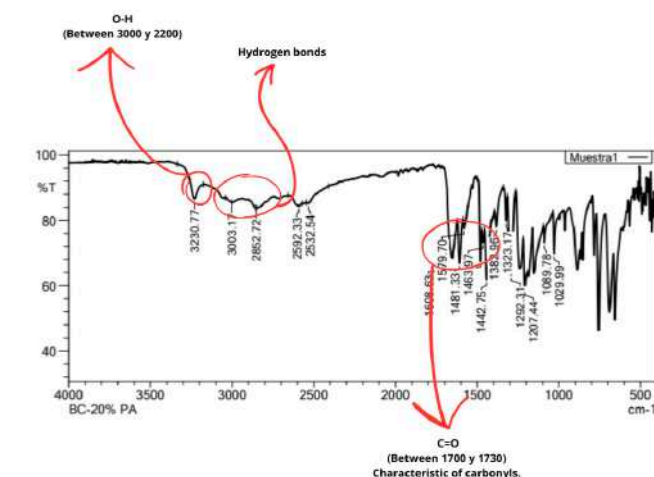
The graph shown above is the spectroscopy of Butanol, which is an organic alcohol. The formula to the substance is: $C_3H_{10}O$ or $H_3C-(CH_2)_3-OH$. Now we have to know that the most important peaks in a spectroscopy are the ones that are the most to the left. We know by the table that the peaks



that have a value near to 3300 cm^{-1} are usually the bond O-H. By looking at the table we know that CH_2 is usually between 2970 and 2915 cm^{-1} . Finally we can also find H_3C in between 2880 and 2860 .

2. Analysis of artificial insulin:

Insulin is a crucial peptide hormone in the human body that plays a key role in regulating glucose. The primary structure of insulin consists of two polypeptide chains, A and B, linked by disulfide bonds. In the IR spectrum, characteristic peaks can be observed corresponding to different functional groups within the insulin molecule. The amide I and amide II bands, centered around 1650 cm^{-1} and 1550 cm^{-1} , respectively, are indicative of the peptide backbone vibrations. Additionally, the C-H stretching vibrations in the aliphatic side chains contribute to the spectral pattern. IR analysis of insulin provides valuable insights into its molecular structure, aiding in the understanding of its biological function and potential modifications for therapeutic applications.



3. Analysis of Paraffin

This graph shows the spectroscopy of paraffin. Paraffin is a mix of saturated

hydrocarbons that are flammable, translucent, and waxy. The sample was identified while it was in a solid state. Paraffin is obtained from the distillation of petroleum or shale. It can be used for many things, especially in the cosmetic industry. The paraffin sample identified was an anti shine wipe. Since paraffins are basically hydrocarbons we can observe the C-H stretching vibrations in the aliphatic side chains contribute to the spectral pattern around 3000 cm^{-1} .

This graph shows the spectroscopy of paraffin. Paraffin is a mix of saturated hydrocarbons that are flammable, translucent, and waxy. The sample was identified while it was in a solid state. Paraffin is obtained from the distillation of petroleum or shale. It can be used for many things, especially in the cosmetic industry. The paraffin sample identified was an anti shine wipe. Since paraffins are basically hydrocarbons we can observe the C-H stretching vibrations in the aliphatic side chains contribute to the spectral pattern around 3000 cm^{-1} .

4. Analysis of Ascorbic acid

Ascorbic acid, also known as vitamin C, is an essential nutrient for humans and certain other animals, as it plays a crucial role in various physiological processes, including collagen synthesis, antioxidant defense, and the metabolism of certain neurotransmitters and hormones.

Humans cannot synthesize ascorbic acid endogenously and must obtain it through their diet to prevent vitamin C deficiency-related health issues. It is a water-soluble organic compound with the chemical formula $C_6H_8O_6$.

Its molecular structure consists of six carbon atoms, eight hydrogen atoms, and six oxygen atoms. The compound is a derivative of glucose and is classified as a polyol (sugar alcohol). In the diagram above, an infrared spectroscopy of this compound is showcased. The first bands are a result of the O-H bonds, which usually lay between the 3000 and 2200 cm^{-1} .

To the right of these vibrations, it is likely to see wide signals that represent hydrogen bonds (also located between the 3000 and 2200 cm^{-1}). Finally, between the 1725 and 1700 cm^{-1} region, an intense signal can be evidenced. This is a characteristic of the carbonyl group that corresponds to the carbonyl stretching.

References

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SIEMBRA DE INTEGRACIÓN:

Una alternativa que nos ofrece el Colegio Rochester para crear comunidad al tiempo que somos sostenibles con el ambiente.

Por: Mónica Álvarez

La siembra de árboles no es solo una actividad para reforestar nuestro entorno; es una experiencia que puede unir a familias, amigos y compañeros de una manera única y significativa. Más allá de la actividad por sí misma, esta práctica ofrece una oportunidad invaluable para crear recuerdos compartidos mientras se contribuye al bienestar del planeta. La conexión con la naturaleza, la promoción de valores sostenibles y el fomento de relaciones personales son solo algunos de los beneficios de realizar este tipo de actividades en comunidad. La siembra del grado sexto fue una alternativa atractiva y llena de propósito para aquellos que buscaban actividades que no solo divirtieran sino que también tuvieran un impacto positivo en el medio ambiente. Esta iniciativa promovida por Alejandro Patiño y Jorge Mendoza fue una experiencia enriquecedora al ser compartida con seres queridos y amigos creando una conexión más profunda entre nosotros, nuestros hijos y la naturaleza. La práctica de sembrar árboles sirve como un recordatorio tangible de la importancia de cuidar



nuestro entorno. Al participar en esta actividad de sostenibilidad, las personas no solo se convierten en testigos del proceso de crecimiento de un árbol, sino que también se vuelven partícipes activos en la preservación del medio ambiente. Este sentido de responsabilidad compartida refuerza los valores sostenibles que promueve el colegio y crea un compromiso duradero de los niños hacia la protección de nuestro planeta. En conclusión, la siembra de árboles va más allá de ser simplemente una actividad ecológica. Es una oportunidad para fortalecer relaciones, inculcar valores sostenibles y disfrutar de la naturaleza en comunidad. Al abrazar esta experiencia como una actividad del grado de nuestros hijos, contribuimos no solo a la reforestación, sino también al florecimiento de conexiones humanas y al compromiso con un futuro más verde.

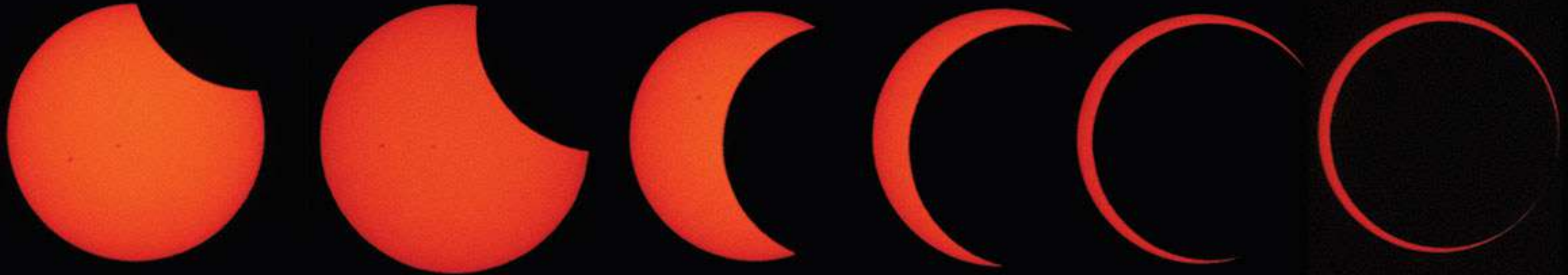
Gracias a todas las familias que hicieron parte de esta actividad, a Gloria Verástegui y Shirley Mejía por su compromiso y acompañamiento en la consecución de esta integración.



COMMUNITY CREATIVITY

ROCHESTER'S STUDENTS SEND DATA TO NASA DURING THE SOLAR ECLIPSE!

María del Pilar Tunarroza Sierra



Abstract

The Sun's energy heats our planet. Changes in solar light could cause change in the temperature, clouds and wind. What happens when the Sun is blocked by the Moon during an eclipse? Annular solar eclipse from October 14 was a great opportunity for answering that question. Rochester students collect data that will help NASA (National Aeronautics and Space Administration)

get to those conclusions. It was evident that in all sampling sites the temperature dropped during the eclipse when the moon was in front of the sun.

Objective

Collect and register temperature and cloud data in the GLOBE Observer application to be sent to NASA during the Annular Solar Eclipse from October 14.

Introduction

The students Mariana Rincón Campos (1st grade), Luis Emilio Rincón Campos (4th grade), Mariana Roa Cubillos (10th grade), María Camila Calderón Pérez (10th grade) and Diego Sierra Sánchez (10th grade), learned how to take measurements of the cloud cover and atmospheric temperature using an application call GLOBE Observer, as part of the GLOBE Program.

"The GLOBE (Global Learning and Observations to Benefit the Environment) Program is an international science and education program that focuses on promoting scientific literacy and building connections between people passionate about the environment." The GLOBE Program has NASA support and is sponsored by the National Oceanic and Atmospheric Administration (NOAA), the National Science Foundation (NSF) and the U.S. Department of State (DoS).

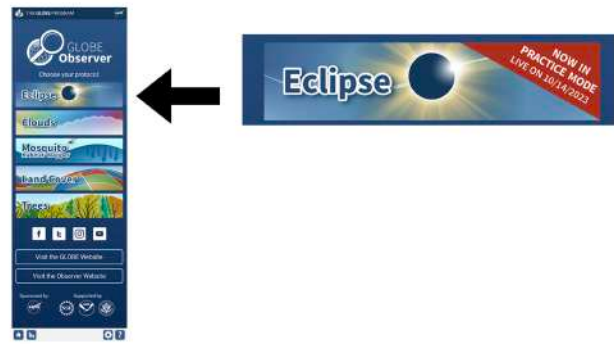


Figure 1

NASA took temperature, wind and cloud cover measurements during the Total Solar Eclipse in 2017 and want to compare those data with the past Annular Solar Eclipse from October 14. These measurements will lead to conclusions about how global warming can affect the behavior of clouds and temperature during an eclipse.

Methodology

Each student registered individually as a GLOBE student to be able to take data and practiced GLOBE's protocols of observation.

Temperature was taken using an atmospheric thermometer instrument rather than the ones we found in cell phones, since these last ones search for the closest weather station to generate the data, but a thermometer measures the temperature in the exact location you are. Temperature was taken every 10 minutes and registered on the GLOBE Observer application (Figure 1).

Cloud cover data was taken using the "Cloud Identification Chart" (Figure 2). Clouds observations were taken every 20 minutes in the GLOBE observer app including pictures of the clouds in the four cardinal directions.

Students wore the special eclipse glasses with the ISO 12312-2 international standard given directly by the Colombian Ministry of Science, Technology and Innovation which leads the GLOBE program in Colombia. Results

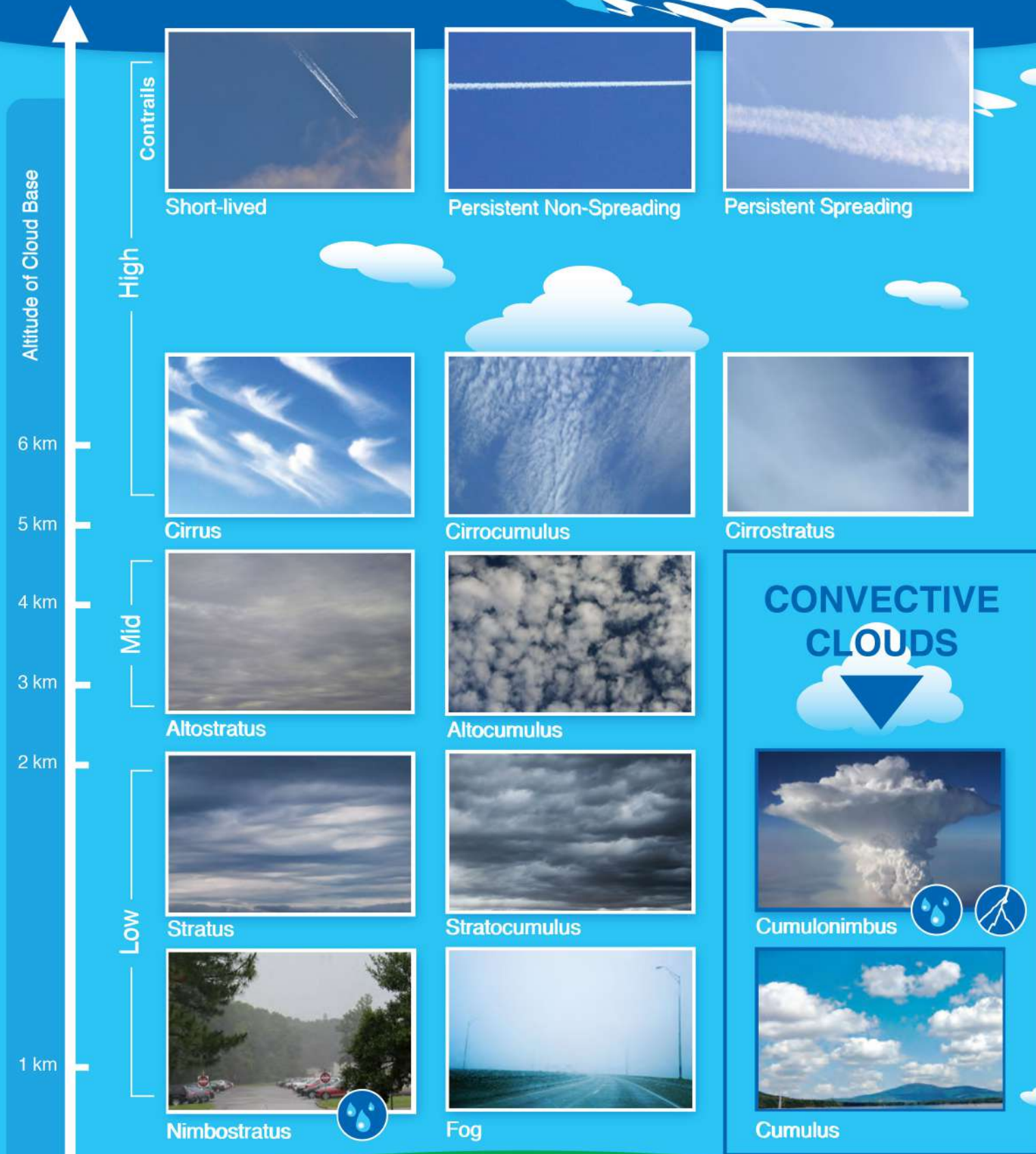
Students who were at Bogotá couldn't see the eclipse since the sky presented a cloud cover of more than 90% with stratocumulus clouds. The temperature decreased 0.5 degrees, reaching 14.5°C at 13:36.

The eclipse at the south-west of Colombia, in the Huila department, was observed completely, the sky was deep blue with no presence of clouds, and clear visibility. The temperature decreased 6.5 degrees, from 41°C to 34.5°C, during the phase of the annular eclipse where the ring of fire was shown. (Figure 3).

The eclipse at Chinauta, in Tibacuy department was observed completely, the sky was blue and clear with an isolated cloud cover, around 15%. The temperature decreased by 3 degrees

Cloud Identification Chart

Figure 2



Observation Basics

Figure 2

Cloud Type

Cirrus Contrails

Cirrostratus **Cirrus** Cirrocumulus

6000 m

Altostratus **Alto** Altocumulus

2000 m

Stratus Fog Stratocumulus **Cumulus**

Nimbostratus Cumulonimbus

Sky Color

Deep Blue Blue Light Blue

Pale Blue Milky

Look Up 45°

Sky Visibility

Unusually Clear Clear

Somewhat Hazy Very Hazy

Extremely Hazy

Look Across

Cloud Cover

Few (<10%) Isolated (10-25%)

Scattered (25-50%) Broken (50-90%)

Overcast (>90%)

Cloud Opacity

Transparent

Translucent

Opaque

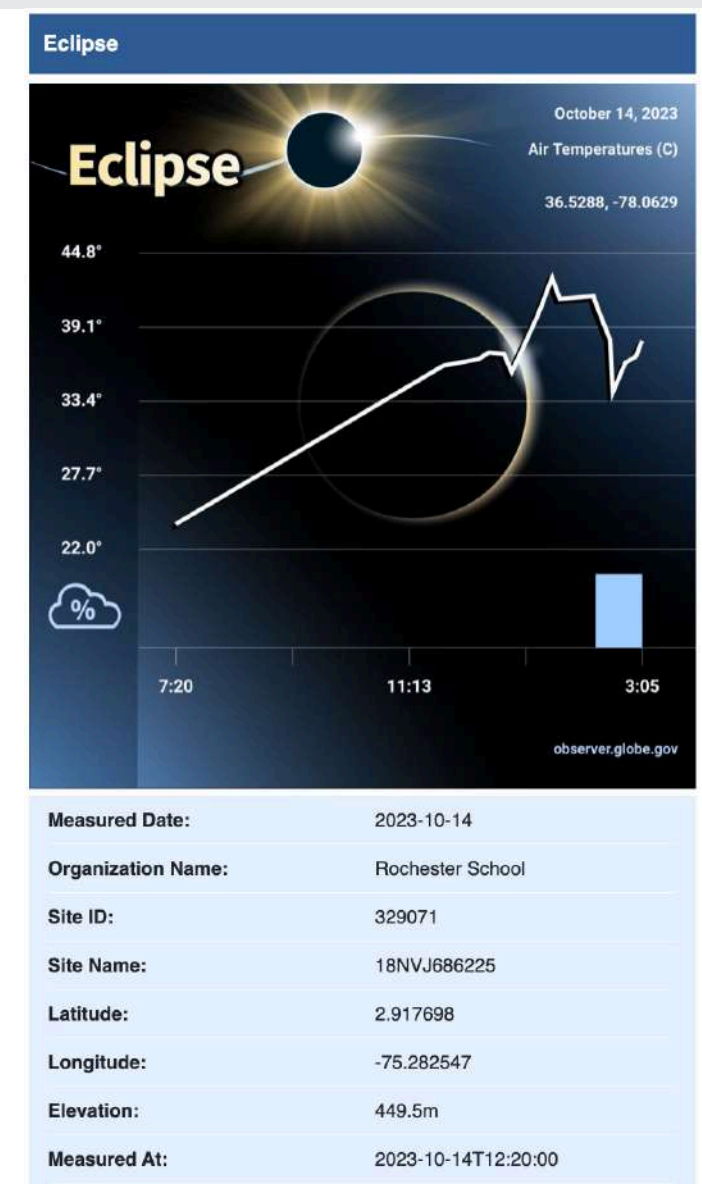


Figure 3.

reaching a temperature of 22.1°C during the phase of the annular eclipse where the ring of fire was shown. At Villa de Leyva, Boyacá department, the eclipse was not observed completely since the sky presented cloud coverage of 60%. the temperature decreased 1.5 degrees, reaching a temperature of 24.4°C during the phase of the annular eclipse where the ring of fire was shown (but not visible).

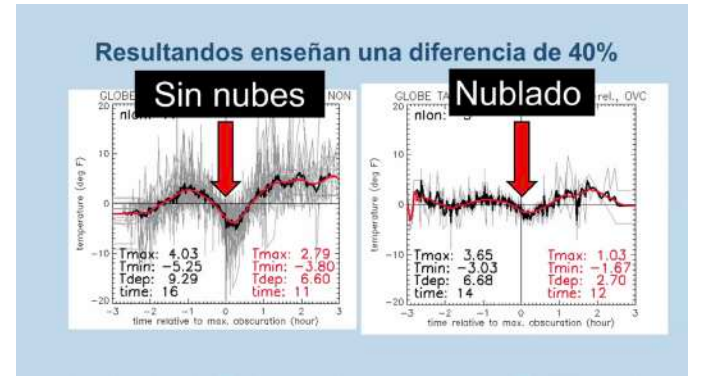


Figure 4.

Conclusions

The temperature decreased in the four places of Colombia where the data was collected during the phase of the annular eclipse where the ring of fire was shown. This decrease in temperature matches the data NASA has of the eclipse of 2017, as figure 4 shows.

There's a clear indirect relation between cloud cover percentage and the amount of degrees the temperature decreases during an eclipse. The less the clouds in the sky, the more the temperature decreases. The more clouds in the sky, the less the temperature decreases. This behavior is similar to the one registered in the 2017 eclipse.

The NASA GLOBE Clouds Team matched Rochester's cloud observation with corresponding satellite data, as informed to us by email (Figure 5). This encourages us to continue collaborating and learning with the GLOBE Program.

 **LaRC-GLOBE-Clouds@mail.nasa.gov** Inbox - Google 4 November 2023, 1:00 PM
NASA GLOBE Cloud Satellite Match [Details](#)
To: Maria del Pilar Tunarroza, Cc: LaRC-GLOBE-Clouds@mail.nasa.gov

Dear Maria Tunarroza,

The September/October/November 2023 [NASA GLOBE Clouds Quarterly Update](#) is now available!

Thank you for your NASA GLOBE cloud observation! The NASA GLOBE Clouds Team matched your cloud observation with corresponding satellite data. The satellite match is based on the time and location of your cloud report. You can learn more about how to understand your satellite match at [GLOBE Clouds Satellite Comparison](#). The link(s) below show your data. The satellite names shown correspond to the satellites that matched the time and place of your report.

[Measurement 2023-10-14 18:19:00](#) GOES-16

**Please note: Data retrieved from different satellites is processed at different speeds. You may receive multiple satellite match emails for one cloud observation. An email is sent each day a new satellite match is found.*

The GLOBE Observer mobile app has a Satellite Flyover tab. Check the tab to find when a satellite will fly over your location and to set reminder notifications.

You received this email because you participated in NASA GLOBE Clouds. Did you know you can receive emails in addition to satellite matches? To verify your NASA cloud email settings visit the GLOBE Observer app. Click on the wheel icon at the bottom of the page. Click on the blue button 'Opt-In/Opt-Out Settings' and select 'Yes' for each desired option. To stop receiving NASA satellite match emails Select 'No' under 'Receive NASA Satellite Images'.

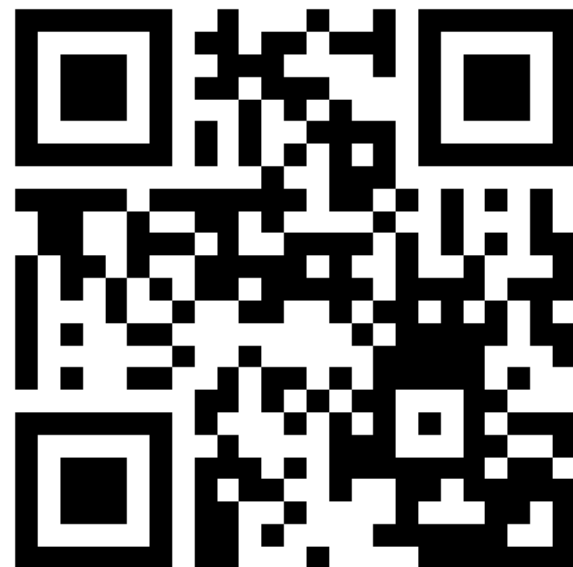
Thank you for your cloud report! We look forward to your continued observations. Your observations help NASA scientists better understand what is happening in the atmosphere from your unique point of view.

The NASA GLOBE Cloud Team
LaRC-GLOBE-Clouds@mail.nasa.gov

Acknowledgements

Ana María Campos Rosario, Chemistry High School.

Carlos Acuña Caldera, Country Coordinator at GLOBE.



SUSTAINABILITY



COLEGIO ROCHESTER, LÍDER EN ODS 7 Y 13

Por: Jorge Humberto Quintero Vélez

El Colegio Rochester ubicado en el Municipio de Chía se ha destacado desde hace más de 10 años como un referente en el ámbito educativo por la promoción de la sostenibilidad en la educación, en parte, porque cuenta con una infraestructura sostenible certificada LEED Platino (Liderazgo en Energía y Diseño Ambiental) por el Consejo de Construcción Sostenible de los EEUU. Así mismo, a través de la implementación de innovadoras iniciativas y programas, junto con el currículo en sostenibilidad con el que cuenta, ha demostrado un firme compromiso con la consecución de los Objetivos de Desarrollo Sostenible (ODS) de la ONU, con un enfoque particular en el ODS 7 (Energía Asequible y no Contaminante) y el ODS 13 (Acción por el Clima).

Contar con un campus sostenible certificado LEED tiene muchas ventajas, tales como, ofrecer espacios diseñados para brindar una ventilación y calidad de aire óptima para la salud de todos sus usuarios, uso de materiales reciclados, de origen local y con bajas emisiones de compuestos orgánicos volátiles, gestión de aguas pluviales, eficiencia hídrica, incluyendo el uso de accesorios de bajo caudal y diseño paisajístico eficiente en

el uso del agua, buena acústica lo cual es importante para la inteligibilidad del hablar y confort térmico (humedad, movimiento del aire y temperatura), entre otras características. Así mismo, un campus escolar con esta certificación se convierte a menudo en modelo para otras escuelas y edificios de la comunidad, inspirando a otros a adoptar prácticas más sostenibles. Esto se ha evidenciado en las reiteradas visitas que realizan instituciones educativas oficiales, privadas y universidades desde que la sede del colegio inició operaciones en el año 2012.

El campus del Colegio Rochester posee una eficiencia energética de 70% al 72%, logrando con ello compensar el coste de la energía y ahorros a largo plazo, además que el excedente de energía eléctrica producida se devuelve a la red, lo que ayuda a reducir el impacto medioambiental general de la institución. El colegio implementó el uso de iluminación natural y de tipo LED; estos últimos no contienen mercurio y duran mucho más que las bombillas tradicionales produciendo menos calor. También se utilizan aparatos electrónicos eficientes y de bajo consumo, y fuentes de energía renovables como paneles

solares fotovoltaicos y térmicos, buscando con ello reducir el consumo de energía, lo que supone un ahorro de costes para la institución, además de disminuir la presión sobre los servicios públicos locales. Mantener una temperatura interior estable, ayuda a la reducción del consumo de energía y su impacto ambiental, además de ofrecer beneficios a los usuarios, porque tienen mejores sistemas de ventilación, menos contaminantes y microorganismos que afectan las vías respiratorias. Estas estrategias que se relacionan con los Objetivos de Desarrollo Sostenible número 7 y 13, nos ayuda a reducir la dependencia del colegio de los combustibles fósiles y a promover el uso de energías renovables de forma más generalizada.

Por otro lado, la utilización de sistemas solares de generación eléctrica y térmica ha sido una estupenda forma de enseñar a los alumnos del colegio sobre energías renovables, desarrollo sostenible y el impacto de la actividad humana en el medio ambiente. Este tipo de tecnología sostenible se ha incorporado al currículo del colegio, donde los alumnos aprenden cómo funcionan los paneles solares, cómo se

instalan y cómo se mantienen. Así mismo, los estudiantes junto con sus profesores de Matemáticas y Ciencias Naturales, han usado los datos generados por los paneles solares para aprender sobre el uso de la energía y su conservación. A su vez, esto ha permitido organizar y celebrar el día Mundial de la Energía y mantener desde hace más de diez años, el Club Sostenible de alumnos del colegio, que se involucran en proyectos y en el aprendizaje práctico de la sostenibilidad, participando en eventos internacionales, como el más reciente reconocimiento de la Excelencia en Educación en Energía otorgado por parte de NEED (National Energy Education Development) en el 2023.

Con relación a la gestión de residuos, el Colegio Rochester desde hace más de diez años, ha puesto en marcha un programa robusto para administrar los desechos tanto inorgánicos como orgánicos, cuyo beneficio está alineado con los ODS que se relacionan con este caso de éxito. Esto se evidencia en el aporte que genera la institución al contribuir con la recuperación y aprovechamiento por parte de terceros de residuos generados en las actividades diarias. Este tipo de prácticas repercute

en la disminución de la necesidad de producir nuevos materiales, lo que a su vez reduce el consumo de energía en la fabricación y su procesamiento, así como en la reducción de emisiones de CO₂, puesto que minimiza la emisión de gases de efecto invernadero, evita la descomposición anaeróbica de residuos orgánicos y la liberación de sustancias nocivas que contribuyen al cambio climático. También cabe mencionar que la gestión de residuos en el colegio brinda la oportunidad de educar a estudiantes sobre la importancia de reducir, reciclar y reutilizar, fomentando una cultura ambiental consciente. En resumen, una gestión efectiva de residuos en el colegio no solo tiene beneficios ambientales evidentes, sino que también contribuye de manera significativa a la consecución de los ODS 7 y 13, promoviendo un entorno más sostenible y resiliente al cambio climático.

Así mismo, como parte del compromiso del Colegio Rochester de aportar positivamente disminuyendo su huella de carbono y repercutir en los Objetivos de Desarrollo Sostenible 7 y 13, además de fomentar la conciencia ambiental y la educación sobre la biodiversidad,

la institución se ha propuesto realizar siembras de árboles nativos cada mes durante cada año escolar en su zona de influencia. Los árboles absorben dióxido de carbono promoviendo un entorno más sostenible, reduciendo la dependencia de fuentes de energía no renovable, mitigando el cambio climático y preservando ecosistemas esenciales. También aportan muchos otros beneficios, como la creación de hábitats para la fauna, la reducción de la contaminación atmosférica, la mejora de la calidad del suelo y recuperación de ecosistemas afectados por actividades antrópicas. Gracias a este enfoque hemos plantado 12200 árboles nativos desde el año 2019 en zonas afectadas por actividades humanas en el Municipio de Chía, con la participación de alumnos y padres de familia, los cuales han sido parte de esta iniciativa puesta en marcha por el colegio.

En definitiva, un colegio que promueve la siembra de árboles nativos no solo cumple con su responsabilidad ambiental, sino que también contribuye significativamente a la consecución de los Objetivos de Desarrollo Sostenible.

La puesta en marcha de todas estas estrategias e iniciativas por parte del Colegio Rochester no se ha llevado a cabo de manera solitaria, logrando alianzas con diferentes actores dentro del sector gubernamental, sector privado y sociedad civil, con el propósito de promover la colaboración entre todas las partes.

Gracias a la Certificación LEED Platino, su desempeño ambiental y los proyectos sostenibles que se desarrollan, hoy en día el Colegio Rochester es reconocido en el ámbito nacional e internacional como una de las instituciones educativas líderes en el país en la ejecución de los ODS. Los alumnos aprenden habilidades importantes para el futuro y sus vidas, comprendiendo la importancia de la sostenibilidad y sabrán cómo tomar decisiones que beneficien al entorno natural. También aprenderán a colaborar con los demás y a marcar la diferencia en su comunidad. Además, desarrollarán habilidades del siglo XXI como la resolución de problemas, el pensamiento crítico y la innovación.

El beneficio a largo plazo de este caso de éxito podría llegar a tener un efecto dominó en toda la sociedad. Cuando

otras instituciones y empresas vean los beneficios de estos proyectos, podrían decidir poner en marcha iniciativas similares, lo cual podría conducir a una cultura de la sostenibilidad en la comunidad, y a su vez a una mejor calidad de vida para todos. Esperamos que este tipo de experiencias en sostenibilidad se extrapolen y se lleven a un ámbito global para que más comunidades adopten este tipo de iniciativas, y entre todos contribuyamos a disminuir la cantidad de emisiones de gases de efecto invernadero y por consiguiente el cambio climático, para aportar al Objetivo de Desarrollo Sostenible 13.





NOT AN EGG DROP CHALLENGE 10TH GRADE INTERDISCIPLINARY PROJECT

By: Matthew Reis and Rodrigo Armando

Not an Egg Drop Challenge is an interdisciplinary project between Physics and Environmental Sustainability (ES). This activity allowed students to combine their knowledge of water footprint, carbon emission, UN Sustainable Development Goals, and Newton's second law of motion. Their final product was a revised version of the classic Egg Drop Challenge.

The classic Egg Drop Challenge project is often implemented in schools' physics courses. As the name suggests, students drop an egg from the top of a building to test their parachute designs. UN Sustainable Goal 2 reports that 1 in 3 people worldwide struggle with moderate to severe food insecurity. Based on the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), 15.5 million Colombians do not have sufficient access to food and face difficulties covering their basic needs. Students at Rochester posed an insightful and thoughtful question, "How can we, as role models of sustainable development, throw eggs from the roof of a building when so many of our fellow Colombians suffer from food insecurity?". And that was when Not an Egg Drop Challenge was conceptualized.

Students in ES researched alternative products that could be used as crash test dummies instead of eggs. Students had to justify their choice using information related to water footprint and carbon emissions produced to manufacture the product. Justification was supported using numerical evidence from peer-reviewed scholarly journals. Students participated in a workshop provided by the Learning Resource Center (LRC) and learned how to use databases and search filters to find reliable resources. Students reasoned why the alternative crash test dummy material helped to achieve UN Sustainability Goals. Finally, ES students built various models from their chosen material that were tested using parachutes or landing models designed by the physics students.

Students in physics applied topics related to Newton's second law of motion, momentum, mass, and acceleration. Their final product was a parachute or landing model that could safely carry a crash test dummy from the 4th floor to the ground. Students collected data about the mass and acceleration of each test and analyzed the data. They used mathematical representations to support the claim that the total



momentum of systems is conserved when there is no net force on the system. The activity was an overall success. Students used their creativity and problem-solving skills to create a more sustainable and thoughtful version of a classic activity. Suarez (2023) states that environmental education is not just about conveying knowledge and skills to individuals but plays a crucial role in shaping the environmental consciousness of the community. Creating sustainability projects requires educators to consider cultural, social, economic, and environmental factors that shape the community (Suarez, 2023). Therefore, future improvements include collaboration with the area of social studies and economics to explore what cultural and financial aspects could

be included in future interdisciplinary projects. Lastly, the students submitted their modified sustainability lesson plan to an international professional organization that provides educators with resources, lesson plans, and activities. The expectation is that the improved sustainable lesson plan will be shared, adopted, and implemented by other educators and students who will continue to disseminate sustainable practices. Here is the link and QR code to the published lesson plan: <https://tryengineering.org/tryengineering-community-resources/not-an-egg-drop-challenge/>

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