Trichology: I Love My Hair

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The curriculum unit is recommended for:
Biology Classes, grades 9-10

Keywords: trichology, polymers, synthetic, protein, keratin, biomolecules, hair

Teaching standards: See Appendix 1 for teaching standards addressed in this unit

Synopsis:
Since the beginning of human existence, our hair has been a source of intricacy and endearment. Their designs have been symbols of status, activism, and individuality. The use of wigs dates back to ancient Egypt. Before enduring the middle passage, women braided grains of rice in their hair for sustenance. During reconstruction, women adorned tresses with feathers and fabric as a demonstration of status and individuality. Today, the debate continues concerning hair design in social and professional settings. Scholars are bombarded with opinions in and out of school concerning acceptance of their hair choices. Making connections to content and our everyday lives sparks interest and lifelong learning opportunities. As major consumers of the natural and synthetic hair industry, inclusive agency is imperative. Scientific representation in hair science should be as diverse as our global hair textures and designs. Trichology is the scientific discipline that relates to the study and research of hair. The following curriculum will provide learners with activities that provide biological and chemical connections to trichology.

I plan to teach this unit during the Spring 2022 semester to 65 students in two (2) Biology classes.

I give permission for Charlotte Teachers Institute to publish my curriculum unit in print and online. I understand that I will be credited as the author of my work.

Trichology: I Love My Hair

Introduction

School Demographics

As an African American biology teacher at Cochrane Collegiate Academy in Charlotte, North Carolina, the science of hair is fascinating and compelling. Located in Mecklenburg county, the Charlotte Metropolitan area has a population of over 2 million residents. The Census also measures what it calls the "Diversity Index," a measure of how likely it is that two people drawn at random will be from different race and ethnicity groups.[1] With a diversity index of 65, Charlotte possesses a rich and multifaceted culture. By servicing learners in grades 6-12, Cochrane Collegiate Academy provides a unique experience for middle and high schoolers. Our student population includes 58% Hispanic and 32% Black scholars. Cochrane is described as a Title 1 school, where 100 percent of learners qualify for free lunch.

iMeck is a magnet high school located in Cochrane Collegiate Academy. We provide unique opportunities for college and career, through a blended classroom experience. During the COVID-19 pandemic, iMeck learners were familiar with the use of learning management systems such as Canvas and Google Classroom. As a smaller high school, we have the opportunity to build strong student/teacher relationships, which is essential for accountability. We continue to strive for stakeholder interactions through parent involvement and local partnerships. Supporting our students to overcome academic, social, and language challenges to create opportunities in and beyond high school is a source of inspiration.

Rationale

Science and math have always been a personal source of passion and curiosity. WCollaborating with my colleagues to establish resilient, motivated citizens is an endearing experience. Becoming an educator at Cochrane a few weeks before the Covid-19 pandemic, building relationships with students has been challenging yet fulfilling. The 9th grade students that started with me at Cochrane are now 11th graders. We had the experience of learning Earth and Environmental Science and Biology together, as I changed content responsibilities in Fall 2020. Bridging the gap between science and culture is a complex task. I believe making connections through everyday experiences is a key to creating lifelong learners.

Through the North Carolina Department of Instruction's lateral entry program, I became a certified teacher in 2013. I chose to become a high school teacher because of the disparities I witnessed in the early 2000s. Growing up in Hickory, North Carolina, textile and furniture manufacturing was the source of income for most of the population until the early 2000s. As a continuing educator at the local community college, I witnessed firsthand the education gap of displaced employees due to outsourcing. The lucrative pay in the mills lured them away from

[1] Jason deBruyn, Triangle, "Charlotte Account For Most of NC's Population Growth," WUNC. WUNC North Carolina Public Radio, August 17, 2021.

high school, resulting in the lack of minimum education requirements. This experience demonstrated the importance for change management through education and career preparation programs.

As a former professional in the textile industry, I have experienced the challenges of existing in the professional sector as an African American female. I struggled with white male dominated expectations in areas such as communication, management skills, and education. To avoid hair discrimination, I chose to wear my hair relaxed with a short cut. However, in 2008, my journey with relaxers ended. In an effort to comply with professional guidelines, I wore my natural hair in a short afro. To change the culture of hair discrimination, the Creating a Respectful and Open World for Natural hair Act, or CROWN Act, has been proposed as a bill in U.S. Congress and would prohibit discrimination of hairstlyes in jobs, federally assisted programs, housing programs, and public accommodations.[2]

Instilling a sense of agency is a necessary part of the educational experience. Learners need to know their voice and culture matters. Additionally, African American and Latin people are underrepresented in the research, development, distribution, and ownership in the hair industry. Synthetic hair is and continues to grow in popularity and revenue.Consumers of African descent constitute one of the largest end-users of wigs. In terms of supply, China leads the human hair wigs and extensions market. [3] Representation is a vital part of the future safety and success of the hair industry. Creating a sense of interest in trichology throughout the high school experience gives our learners options in careers that interest and directly affect them.

For the past 8 years, biochemistry and microbiology have been challenging concepts to Biology learners to grasp. Making connections to content and our everyday lives sparks interest and lifelong learning opportunities. This curriculum will provide biochemistry content, as well as allow scholars to explore the nuances of hair as it relates to them and their families.

The curriculum unit will begin with the intricate study of hair by exploring the molecular chemistry of all living things. Hair consists of the protein keratin. Learners will discover protein and other biomolecules through an identification lab. The next part of the unit explores the importance of proteins in biology, as well as our hair. Part 1 of the trichology portion of the unit consists of identifying the content of hair (natural and synthetic), and hair treatments such as relaxers and dyes. Additionally, we will explore the importance of pH in hair applications and products. As we continue our investigation in hair, we will discover the organic and polymer chemistry of organisms, as well as hair products. Finally, our curriculum concludes with the safety and environmental impact of the hair industry.

Our learners will examine hair using culturally relevant activities and resources. The curriculum unit will provide every day connections necessary to retain content. I hope to provide an experience similar to my high school chemistry class. Investigative study of trichology will spark an increase of black and hispanic interest in scientific careers. Learners will walk away from the unit equipped with experiences that relate to our culture and personal experiences with

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[2] "I'm Not My Hair: The Criminalization of Black Hair," Center for Justice Research (Center for Justice Research, 2020), https://www.centerforjusticeresearch.org/blog/im-not-my-hair-the-criminalization-of-black-hair.

[3] "The Global Hair Wigs and Extensions Market by Revenue Is Expected to Grow at a CAGR of over 13% during the Period 2021–2026," GlobeNewswire News Room (GlobeNewswire, March 18, 2021), https://www.globenewswire.com/news-release/2021/03/18/2195251/0/en/The-global-hair-wigs-and-extensions-market-by-revenue-is-expected-to-grow-at-a-CAGR-of-over-13-during-the-period-2021-2026.html.

our hair. Class activities will reflect the direct connection of science and our hair. The goal is to spark curiosity and advocacy in the local and global hair industries.

Content Research

Biomolecules and a Common Misconception

In order to examine the study of hair, we must obtain a working background of the biochemistry of hair. All living things (organisms) are composed of the element carbon. Organic molecules are formed carbon chains, along with molecules such as oxygen, hydrogen, nitrogen, and phosphorus. There are four major organic molecules that makeup all organisms: carbohydrates, lipids (fats), proteins, and nucleic acids. Proteins are composed of smaller units called amino acids. Contrary to popular belief, proteins are not a source of energy. This is a common misconception in our biology classes. The body needs protein to maintain and replace tissues and to function and grow. Protein is not usually used for energy. However, if the body is not getting enough calories from other nutrients or from the fat stored in the body, protein is used for energy. If more protein is consumed than is needed, the body breaks the protein down and stores its components as fat.[4] By introducing the science of hair (trichology) to biology students, real life applications of the composition of proteins are developed.

Natural and Synthetic Hair

Trichology, the science of hair, includes the study of natural and synthetic hair. Just as amino acids are the building blocks (monomers) for keratin (polymer), synthetic hair is created by polymers. The natural hair market has experienced a tremendous increase in availability of hair care products and styles that promote less chemical treatments such as relaxers. Additional research and data is a vital part of trichology. However, very little data is available. Embracing our hair in our natural state has been a complicated and controversial journey. In the age of Black Lives Matter and pledges from numerous organizations to foster an atmosphere of inclusion, support to make Black hair acceptable in the workplace, school and other arenas that are traditionally deemed "professional" continues to grow.[5] With a trend of acceptance in the professional sector, many people of color are beginning to embrace their hair in its natural state, as well as explore synthetic hair options.

Whether its to create longer, thicker hair, protecting natural tresses, or individual style, synthetic hair continues to be a popular alternative today. Synthetic hair consists of polymers such as polyester and nylon. Hair extensions like Kanekalon Hair that is used to braid have also been rumored to have dangerous chemical carcinogens.[6] Synthetic hair extensions are used for

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[4] Adrienne Youdim, "Carbohydrates, Proteins, and Fats - Disorders of Nutrition," Merck Manuals Consumer Version (Merck Manuals, November 17, 2021), https://www.merckmanuals.com/home/disorders-of-nutrition/overview-of-nutrition/carbohydrates-proteins-and-fats.

[5] "I'm Not My Hair: The Criminalization of Black Hair," Center for Justice Research (Center for Justice Research, 2020), https://www.centerforjusticeresearch.org/blog/im-not-my-hair-the-criminalization-of-black-hair.

[6] Bih. "The Art of Beauty: How Black Women Are Making It Our Own." Medium. Medium, February 14, 2021. https://bih9.medium.com/black-women-in-beauty-a82612863ddd.

weaving or braiding hair to create a hairstyle that adds length and fullness to the hair. Synthetic hair is less expensive than human hair and some types are made from fibers such as Kanekalon or Toyokalon that may cause the scalp to itch if the wearer is allergic to the hair.[7] The mass production of synthetic fibers has brought concerns for sustainability and environmental issues.

Sustainability and the Environment

As future leaders and parents, our biology and other science learners must consider the impact the mass production of synthetic hair on the environment. The contents of synthetic hair is non-biodegradable. Unfortunately, this means that the global popularity of wigs and other synthetic hair sources will increase long term waste in our landfills. Our worldwide carbon footprint relies on innovative ideas and plans for reducing the environmental impact of the production and consumption of synthetic hair. The lack of research available regarding the complete life cycle of FHPs presents an opportunity to explore the potential to reduce and reuse waste within this process.[8]

Instructional Content

The unit will begin with the analysis of the 4 macromolecules. Before exploring the science of hair, students should have a working knowledge of the biomolecules existing in all organisms. A common challenge in biochemistry is the importance of objects that can not been seen with the naked eye. Therefore, microscopes are a vital part of the unit. Students will have activities where microscopes are used to investigate biomolecules as well as hair samples.

After establishing a foundation in biomolecules, students will examine proteins; their structures, and their importance for organisms. Research opportunities will be available to enhance the understanding of proteins.

Trichology is introduced by asking the learner's feedback on hair and its personal value. Students will be encouraged to explore the history of hair styles and express their thoughts of the past and present views of African American hair care and designs.

In Trichology Part 1, students will analyze chemicals and dyes of natural and synthetic hair. Additionally, we will investigate pH and its importance in hair treatments and applications. Finally, the human impact of the production of synthetic hair is researched.

Day 1: Why is Carbon Important?

Introduction Assignment: Read-Pair-Share: Article: Why is Carbon So Important in Biology?[9] After students read the article, they will discuss and agree on 4 key facts from the article. We will have a class whiteboard meeting where the students will share their facts with the class.

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[7] Linda Ray, "What Is Synthetic Hair Made of?," Our Everyday Life, February 5, 2019, https://oureverydaylife.com/what-is-synthetic-hair-made-of-12174249.html.

[8] Nicky Wilson et al., "Capturing the Life Cycle of False Hair Products to Identify Opportunities for Remanufacture," Journal of Remanufacturing (Springer Netherlands, February 11, 2019), https://link.springer.com/article/10.1007/s13243-019-0067-0.

[9] Author Biology Junction Team, "Why Is Carbon so Important in Biology? Key Element of Life on Earth," BIOLOGY JUNCTION, October 17, 2019, https://biologyjunction.com/why-is-carbon-so-important-in-biology/.

Vote for Me: Biomolecules Research: Students are divided in research groups of 3-4. Each student is given one of the four major biomolecules. A campaign must be created for their assignment of biomolecules. The electronic, video, or poster presentation must include the following points:

- Definition of a biomolecule
- The Biomolecule name (carbohydrate, lipid, protein or nucleic acid)
- The elements (from periodic table) contained in the biomolecule
- The subunit(s) (monomer(s))
- Examples and/or description of food that contains the biomolecule
- Chemically speaking, what does it look like? (Include chemical structure)
- Present an illustration of your molecule.
- And the topic that will catch your audience - Why is your candidate so special?

Presentation formats include: posters, videos, slide presentations.

Day 2: Biomolecule of the Year and Hairstory

Teams present their campaign proposals and students vote for the biomolecule of the year.

HairStory: What does your hair mean to you? Students research the history of their hair and how society has influenced the styles and society's outlook on hair for people of color.

Day 3: Trichology Part 1

Forensic scientists perform 3 major types of hair analysis: (1) testing the hair shaft for drugs or nutritional deficiencies in a person's system, (2) analyzing DNA collected from the root of the hair, and (3) viewing hair under a microscope to determine if it's from a particular person or animal. They usually study the hair's scale pattern and appearance of the medulla to identify a hair of unknown origin.[10] Students will identify hair by creating hair shaft mounts and compare human and animal hair.

Day 4: pH and Chemical Analysis

Students will compare natural and synthetic hair by creating microscopic slides of various hair shafts. After discussion pH, students will use litmus paper of various hair chemicals and products. Learners will describe the visual and tactile effect of products on natural and synthetic hair. Homework, bring a hair product from home to research.

Day 5: Hair and the Environment

Students will research ingredients in personal hair products and their effect on the environment. Additionally, we will explore synthetic hair: how its manufactured, treated, and sustainability.

[10] "Under the Microscope: Get Forensic with Hair Analysis," Carolina.com, accessed November 22, 2021, https://www.carolina.com/teacher-resources/Interactive/forensic-hair-analysis-activity/tr10879.tr.

Appendix 1: Teaching Standards

The following Biology Standards are covered in the curriculum unit:

NCES.Bio.4.1 - Understand how biological molecules are essential to the survival of living organisms.

NCES.Bio.4.1.1 - Compare the structures and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids) as related to the survival of living organisms.

NCES.Bio.4.1.2 - Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.

NCES.Bio.4.1.3 - Explain how enzymes act as catalysts for biological reactions.

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